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# A new barbeled dragonfish (Teleostei: Stomiiformes: Stomiidae) from the Miocene of Torricella Peligna, Italy: *Abruzzoichthys erminioi* gen. & sp. nov.

GIORGIO CARNEVALE

**Key words:** Teleostei, Stomiiformes, Stomiidae, *Abruzzoichthys erminioi*, Miocene, Torricella Peligna, Italy

## ABSTRACT

*Abruzzoichthys erminioi*, new genus and species, is described, based on a single specimen from the Middle Miocene of Torricella Peligna, Abruzzo, Italy. *Abruzzoichthys* has a unique combination of characters and is considered to be most closely related to the genera *Astronesthes* and *Borostomias*. Stomiid fishes are extremely rare in the fossil record. Previously, only six taxa have been included or tentatively accepted in the Stomiidae. The new taxon represents the seventh member of this family in the fossil record.

## RIASSUNTO

*Abruzzoichthys erminioi*, nuovo genere, nuova specie, viene descritto sulla base di un singolo esemplare del Miocene medio di Torricella Peligna, Abruzzo, Italia. *Abruzzoichthys* presenta una combinazione unica di caratteri ed è

qui considerato strettamente imparentato con i generi *Astronesthes* e *Borostomias*. Gli stomiidi sono estremamente rari nel record fossile. Soltanto sei taxa possono essere inclusi o provvisoriamente accettati nel registro fossile della famiglia Stomiidae. Il nuovo taxon qui descritto rappresenta il settimo componente di questa famiglia nel record fossile.

## ZUSAMMENFASSUNG

*Abruzzoichthys erminioi*, nov. gen., nov. sp., aus dem mittleren Miozän von Torricella Peligna (Abruzzo, Italien) wird anhand eines Exemplares beschrieben. *Abruzzoichthys* weist eine einzigartige Merkmalskombination auf und wird hier als nahe verwandt mit den Gattungen *Astronesthes* und *Borostomias* betrachtet. Die Stomiidae sind fossil extrem selten und mit nur sechs Taxa vertreten. Das hier beschriebene neue Taxon stellt den siebten fossilen Vertreter dieser Familie dar.

## 1. Introduction

In 1999 Erminio Di Carlo, curator of the Museo Geo-Paleontologico dell'Alto Aventino of Palena, collected a few fossil fishes from a quarry near the town of Torricella Peligna (Fig. 1), in the Abruzzo Apennines (Central Italy), where Miocene sediments outcrop. Di Carlo made them available to me for identification and study in 2001. Among the specimens, there is an elongate articulated skeleton with a well preserved cranial region. This specimen was prepared at the Dipartimento di Scienze della Terra of the University of Pisa, and previously unexposed parts were brought to light. The Miocene fossil described below was determined to be a stomiid, and was subsequently compared to other stomiids in order to understand their relationships. This fossil is of great interest because it represents a new genus and species of a family characterized by a scanty fossil record.

Stomiids (barbeled dragonfishes) are a large group of primarily mesopelagic fishes (Parin 1984) with more than 230 species (Nelson 1994). These fishes, which are characterized by an amazing disparity, and are traditionally (Greenwood et al. 1966; Regan 1923; Weitzman 1974) placed in six families (*Astronesthidae*, *Chauliodontidae*, *Idiacanthidae*, *Malacosteidae*, *Melanostomiidae*, and *Stomiidae*), have recently been included in the single family Stomiidae (Fink 1984, 1985). Members of this family are among the most specialized predators of the oceanic ecosystems (Marshall 1954; Tchernavin 1953). Recent studies (Sutton & Hopkins 1996) demonstrate that stomiids are the dominant mesopelagic upper-trophic level predatory fishes with a key role in the transfer of energy in these ecosystems.

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Fig. 1. Sketch map of Italy showing the Torricella Peligna location.

## 2. Systematic Paleontology

Subdivision Teleostei *sensu* PATTERSON & ROSEN 1977  
 Order Stomiiformes *sensu* HAROLD & WEITZMAN 1996  
 Infraorder Photichthya *sensu* HAROLD & WEITZMAN 1996  
 Family Stomiidae *sensu* FINK 1985  
 Genus *Abruzzoichthys* new genus

### *Abruzzoichthys erminioi* new species

**Holotype:** Museo Geo-Paleontologico dell'Alto Aventino (MGPA), Palena (CH), Central Italy, MGPA TOR002. Nearly complete skeleton, approximately 284 mm SL (standard length). The central portion of the axial skeleton is mainly preserved as impression. The location of dorsal and anal fins is unclear.

**Locality and horizon:** The material described here originates from Madonna delle Rose, near the town of Torricella Peligna, Abruzzo, Central Italy. The fossil was collected in organic-rich pelagic laminites of the Tufillo structural Unit (Patacca et al. 1992). The fossiliferous layers date back to the Middle Miocene (Carnevale et al. 2001), Serravallian (*Dentoglobigerina altispira altispira* planktonic foraminiferal Zone of Foresi et al. 1998; MN6 calcareous nannofossil Zone of Fornaciari et al. 1996).

**Diagnosis:** *Abruzzoichthys* differs from other stomiids in the following combination of characters: body scaleless, elongated body with head length 10,7 SL, advanced position of pelvic fin (~23,6 SL), upper jaw length 8,8 SL, presence of parasphenethmoid, maxilla edentulous, type 1 mode of tooth attachment

Table 1. Counts and measurements for *Abruzzoichthys erminioi* gen. & sp. nov. Except for standard length and total length, all measurements are as percentage of standard length. Counts and measurements were made following mainly the methodology indicated by Gibbs (1969) and Gibbs & McKinney (1988).

Pectoral fin rays	8
Vertebrae	66
Premaxillary teeth	4
Mandibular teeth	9
Standard length	284
Total length	302
Head length	10,7
Prepectoral length	9,2
Prepelvic length	23,6
Upper jaw length	8,8
Premaxilla length	4,5
Maximum body depth	8,4

(Fink 1981), presence of an accessory neural arch, dorsal prezygapophyses of the first four centra enlarged, presence of (at least) 15 supraneurals, posttemporal discoid in outline, location of dorsal and anal fins, at least partially, at the same level of the body.

**Etymology:** Generic name: *Abruzzo*, referring to the Abruzzo region where the type locality is; and *ichthys*, a fish (in Greek).

Specific name: *erminioi*, in honor of the curator of the Museo Geo-paleontologico dell'Alto Aventino, Erminio Di Carlo, who greatly contributed to the knowledge of paleontology of Abruzzo.

## 3. Description

Counts and measurements for the only known specimen of *Abruzzoichthys erminioi* gen. & sp. nov. are summarized in Tables 1 and 2. The specimen approaches 302 mm TL (total length). It appears to be an adult based on the heavy ossification of most skeletal elements. The body outline is well preserved on the specimen, but the central portion of the axial skeleton is present only as impression (Fig. 2). Among stomiids, the general proportions of *Abruzzoichthys erminioi* gen. & sp. nov. resemble those of *Eustomias*, *Flagellostomias*, *Leplostomias*, *Melanostomias*, and *Thysanactis*. Superficial resemblance between these taxa is due to relative size and shape, but they strongly differ in osteology and placement of pelvic fin.

The general outline of the neurocranium is clearly recognizable in the available specimen (Fig. 3) and greatly resembles that of *Astronesthes* in its structure (cf. Weitzman 1967a). The braincase is very small. The sutures of the skull roof bones are difficult to determine. The skull roof is extensively pitted on its dorsal surface. The skull roof consists of supraethmoid, lateral ethmoids, frontals, parietals, sphenotics, pterotics and supraoccipital. The frontals are the largest bones of the skull roof. The dorsal surface of these bones is strongly ornamented. Below the supraethmoid and lateral ethmoids lies the vomer.

Table 2. Comparison of some morphometric and meristic features between *Abruzzoichthys* gen. nov. and other stomiids. Morphometric features are as percentage of standard length. Data from Gibbs 1964a, 1964b, 1969; Gibbs et al. 1983; Gibbs & Mc Kinney 1988; Kawaguchi & Moser 1984; Morrow 1964a, 1964b, 1964c; Morrow & Gibbs 1964.

Genus	Vertebrae	Pectoral fin rays	Great depth	Head length	Prepelvic length	Upper jaw length
<i>Abruzzoichthys</i>	66	8	8.4	10.7 ca.	23.6	8.8
<i>Aristostomias</i>	44–56	3–17	14–21	22–33	52–59	–
<i>Astronesthes</i>	46–63	8	9–25	14–31	42–52	17–25
<i>Bathophilus</i>	38–45	1–37	9–44	17–42	41–57	–
<i>Borostomias</i>	53–55	7	7–17	18–27	51–58	16–24
<i>Chauliodus</i>	51–62	12–13	5–12	10–16	38–47	–
<i>Chirostomias</i>	54–55	6	11–15	17–19	56–58	–
<i>Echiostoma</i>	57–59	1+3	12	15	59	–
<i>Eustomias</i>	56–69	0–13	5–11	9–17	49–63	9–13
<i>Flagellostomias</i>	65	1+8–9+II	6–7	11–12	60–61	–
<i>Grammatostomias</i>	50–56	4–11	10–12	15–18	44–46	–
<i>Heterophotus</i>	66	7	15–21	22–24	59–65	18–19
<i>Idiacanthus</i>	79–85	0	3–5	6–8	34–38	–
<i>Leptostomias</i>	77–80	9–11	5–8	8–12	61–65	–
<i>Malacosteus</i>	49	3–5	13–14	28	55	–
<i>Melanostomias</i>	50–57	5	9–15	11–17	61–68	12–14
<i>Neonesthes</i>	53	8	12–17	18–23	39–45	14–20
<i>Opostomias</i>	60	1+4	–	–	–	–
<i>Pachystomias</i>	48	5–6	13	24	53	–
<i>Photonectes</i>	49–64	0–3	6–17	11–21	51–65	–
<i>Photostomias</i>	52–58	0	9–10	20–22	43–47	–
<i>Rhadinesthes</i>	67	7	8	19	45	17
<i>Stomias</i>	64–164	6–7	3–11	5–14	55–76	–
<i>Tactostoma</i>	80–82	0	–	–	–	–
<i>Thysanactis</i>	61	1+10.11	8–11	11–14	60	–
<i>Trigonolampa</i>	61–62	5	12–15	17–18	48–53	–

Posterior to and sutured to this bone is the parasphenoid which forms the ventral part of the skull. Interposed between the lateral ethmoids and the parasphenoid is the parasphenethmoid. The basisphenoid, the pterosphenoid, and the prootic were also still present and clearly visible. Most of the otic and occipital regions of the neurocranium are obscured by the overlying hyomandibula. The infraorbital bone was not preserved in the examined specimen.

The oral jaws are intact. The overall morphology closely approaches that of *Astronesthes* (cf. Weitzman 1967a). The premaxilla is a large and strong bone bearing four robust fang-like canine teeth with slightly sagittate tips. The maxilla is an elongate, edentulous bone, with a smooth ventral surface. A single supramaxilla is present. Of the lower jaw the dentary and the articular are visible. The dentary bears three robust fang-like canine teeth, and the original existence of nine other teeth is testified by circular traces of attachment bone. Premaxilla, and dentary are slightly pitted. Both the premaxillary and the dentary teeth are fully ankylosed to the attachment bone (type 1 mode of tooth attachment).

The suspensorium of *Abruzzoichthys erminioi* gen. & sp. nov. is incompletely preserved. It is minimally composed of the hyomandibula, quadrate, symplectic, metapterygoid, and palatine. The ectopterygoid was probably lost or hidden beneath surrounding bones. The anterior part of the palatine is visible. The hyomandibula is the larger bone of the suspensorium.

This bone bears an expanded bony lamella anteriorly, and lacks the anterior hyomandibular spine. The dorsal portion of this bone articulates with the pterotic and possibly with the prootic. The opercle articular process is short. The hyomandibula articulates with the metapterygoid anteroventrally. The joint between the symplectic and hyomandibular is at a level with the joint between the quadrate and metapterygoid. The quadrate is still present. The articular head of this bone is thick and well developed. The metapterygoid is visible, but partially covered by disarticulated fragments of the branchial and hyoid skeleton. There are no traces of a mesopterygoid. This bone was probably poorly ossified or totally cartilaginous and consequently not prone to fossilization. A similar condition is also observed in *Astronesthes* and *Neonesthes* (see Weitzman 1967a). Alternatively, as in *Aristostomias*, *Bathophilus*, *Eustomias*, *Grammatostomias*, *Idiacanthus*, *Malacosteus*, *Pachystomias*, *Photostomias*, *Tactostoma*, and *Thysanactis* (see Fink 1985), the mesopterygoid was originally absent in *Abruzzoichthys erminioi* gen. & sp. nov.

The opercle is a quadrangular thin bone with thickened ridges along its anterior and dorsal border. The subopercle and the interopercle are moderately well preserved. The preopercle is a narrow, subtubular bone. The lateral sensory pores of this bone are clearly visible. From a functional point of view, this bone, in association with hyomandibula, symplectic, quadrate and pterygoids, was part of the suspensorium.



Fig. 2. *Abruzzoichthys erminioi* gen. & sp. nov. Photograph of the holotype, MGPA TOR002, 284 mm SL, Middle Miocene of Torricella Peligna. Scale bar 60 mm.

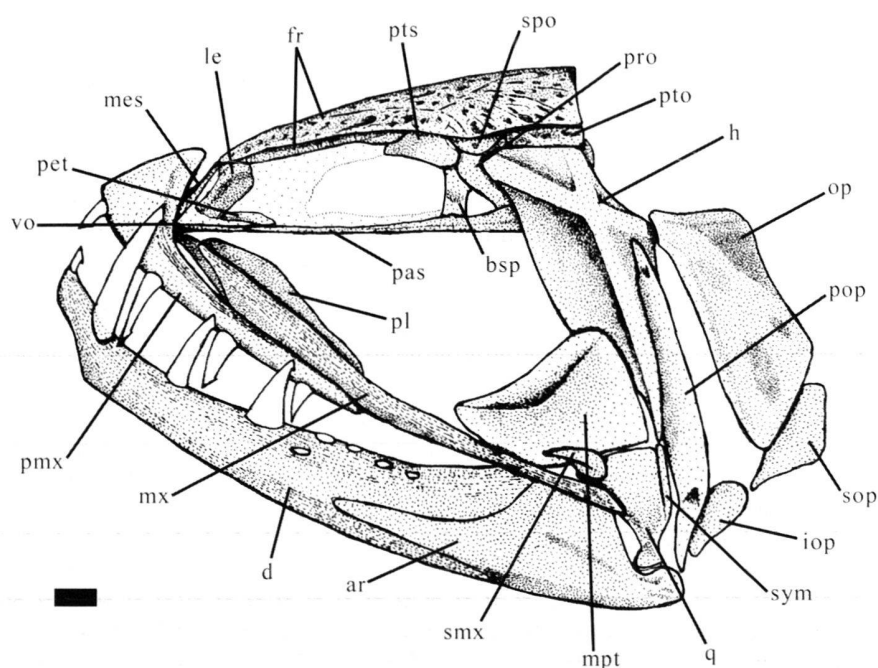


Fig. 3. *Abruzzoichthys erminioi* gen. & sp. nov. Reconstruction of the head. Scale bar 1mm. ar, articular; bsp, basisphenoid; d, dentary; fr, frontal; h, hyomandibula; iop, interopercle; le, lateral ethmoid; mes, mesethmoid; mtp, metapterygoid; mx, maxilla; op, opercle; pas, parasphenoid; pet, parasphenethmoid; pl, palatine; pmx, premaxilla; pop, preopercle; pro, prootic; pto, pterotic; pts, pterosphenoid; q, quadrate; smx, supramaxilla; sop, subopercle; spo, sphenotic; sym, symplectic; vo, vomer.

As other stomiids, *Abruzzoichthys erminioi* gen. & sp. nov. lacks gill rakers. An element of the branchial arch, possibly a ceratobranchial, was partially preserved. This bone bears some gill teeth showing the type 3 mode of tooth attachment. These teeth appear to be very similar to those of *Diplophos taenia* figured in Fink (1981). Of the hyoid apparatus, only few frag-

ments of the ceratohyal and three branchiostegal rays are recognizable.

The vertebral column has at least 66 vertebrae. Only the first 24 and the last eight centra are preserved as bone, while the remaining are preserved almost as impression only. There is a wide space between the first vertebra and the occiput. An-

terior to the first vertebra is an accessory neural arch. The first 26 (27) and the last nine vertebral centra are compressed anteroposteriorly and nearly subsquare in shape, while the others are more elongated. All centra bear neural arches. The neural arches have a single foramen for a spinal nerve. With the exception of the first three (or four), the centra bear paired, not fused, neural spines. The centra bear some lateral fossae. Each centrum has well developed dorsal prezygapophyses that overlap the centrum behind it. The dorsal prezygapophyses of the first four vertebrae are enlarged, but not into hoods as in *Astronesthes*. Each of the preserved precaudal centra ventrally bears two small autogenous parapophyses. Each parapophysis articulates with a rib. Dorsally to the rib there is a thin autogenous epipleural which articulates on the parapophysis. Twenty pairs of ribs and epipleurals are preserved starting from the sixth centrum. At least the vertebrae comprised from the seventh to the 24<sup>th</sup> have elongated epineurals that are fused to the bases of the neural arches. The epineurals bifurcate into two branches, extending for the length of four vertebrae. Fifteen slender, rod-like supraneurals were preserved. The anteriormost supraneural is similar to the others in shape, and is located adjacent to the neural spines of the fifth vertebra. Each caudal vertebra has paired, not fused, haemal arches and spines.

Of the pelvic fin, only the anterior part of the pelvic bones was preserved. The pelvic fin is more advanced in position with respect to the other stomiids, originating at the level of the 19<sup>th</sup> vertebra. The pelvic bone consists of a flattened bony plate with a thickened anterior process and an expanded medial plate.

The pectoral fin consists of 8 elongated rays. The radials are completely covered by the cleithrum. The extrascapular is mostly missing. The posttemporal is a massive, nearly discoid bone which forks into two arms (Fig. 4). Just beneath the posttemporal is the supracleithrum which overlaps the spine-like process of the cleithrum. The cleithrum is large and elongate, with a thickening on its anterodorsal margin. Of the other bones that originally compose the pectoral girdle, only a little part of the coracoid is still present, but poorly preserved.

The caudal fin is deeply forked, and contains 33 rays, with 20 branched. The caudal skeleton is well preserved (Fig. 5). The first four caudal vertebrae show modified structures for caudal fin support. As in other stomiids, *Abruzzoichthys erminioi* gen. & sp. nov., has five hypurals. These bones articulate to the terminal vertebra. A well developed parahypural is clearly visible. The first uroneural (=stegural; see e.g. Arratia & Schultze 1992) appears to be partially fused to the terminal vertebra. Dorsal to the first uroneural is a single epural. A second uroneural lies laterally to the dorsal process of the first uroneural.

The dorsal fin is mostly missing. Only three pterygiophores were preserved with bone and six further are observable as impression. The pterygiophores consist of separate proximal, middle and distal radials. Also the anal fin is mostly missing. Seven elements of this fin are preserved only as impressions.

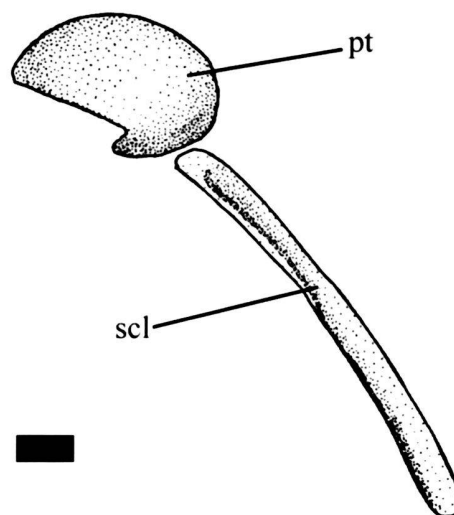


Fig. 4. *Abruzzoichthys erminioi* gen. & sp. nov. Posttemporal and supracleithrum. Scale bar 1 mm. pt, posttemporal; scl, supracleithrum.

Unfortunately, the position of insertion of these fins is not clear. The visible elements of these two fins are located more or less at the same level in the posterior third of the body.

There are no traces of squamation on the fossil, thus, I suspect that the body of *Abruzzoichthys erminioi* gen. & sp. nov. was originally scaleless.

Two pigmented rows along the ventral part of the body probably represent the remains of the original photophores series.

#### 4. Systematic notes

In their study on stomiiform relationships, Fink & Weitzman (1982) extended the diagnosis elaborated by Rosen (1973). Following Rosen (1973), the stomiiforms share the presence of a modified alignment of the second and third pharyngobranchials and a particular morphology of the second epibranchial. Fink & Weitzman (1982) listed eight synapomorphies of Stomiiformes, including: (1) a particular photophore structure (see also Bassot 1966), (2) type 3 mode of tooth attachment, (3) presence of a medial division of adductor mandibulae muscle which is subdivided into two sections, one inserting dorsally directly onto the maxilla and the other onto the primordial ligament, (4) a premaxillary-rostrodermethmoid ligament extending from the dorsolateral aspect of the ethmoid to the contralateral premaxilla, or both the contralateral and ipsilateral premaxillae, (5) a single termination of the second epibranchial articulating with the second and third pharyngobranchials, (6) posterior branchiostegal rays larger than anterior ones, (7) some branchiostegal articulating with ventral hypohyals, and (8) rete mirabilia and associated blood vessels located at the posterior of the gas bladder. More re-



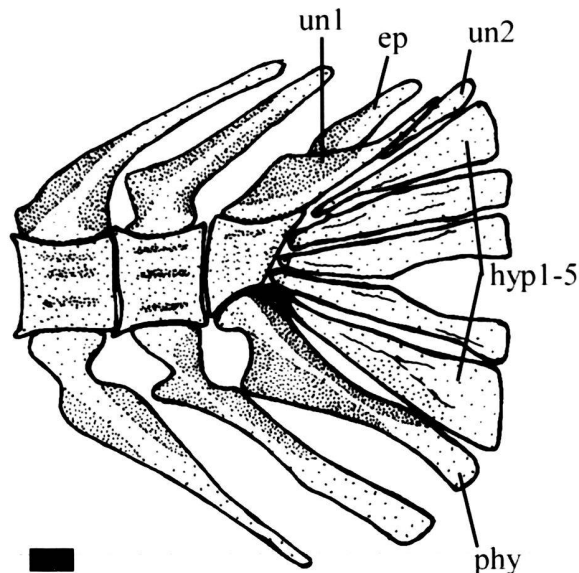


Fig. 5. *Abruzzoichthys erminioi* gen. & sp. nov. Caudal skeleton. Scale bar 1 mm. ep, epural; hyp, hypural; phy, parahypural; un, uroneural.

cently, Harold & Weitzman (1996) criticize the validity of the character (5) as a stomiiform derived condition because a similar condition is also observed in myctophyforms (Paxton 1972). It is not possible to examine *Abruzzoichthys erminioi* gen. & sp. nov. for many of the characters listed here because they refer to soft parts, and some of the osteological features diagnostic of Stomiiformes were not preserved on the specimen. Furthermore, *Abruzzoichthys erminioi* gen. & sp. nov. has the type 1 mode of tooth attachment. This mode of tooth attachment was also observed by Fink (1981) in other stomiiforms, such as *Argyropelecus*, *Astronesthes*, *Bathophilus*, *Borostomias*, *Chauliodus*, *Cyclothone*, *Diplophos*, *Ichthyococcus*, *Leptostomias*, *Malacosteus*, *Melanostomias*, *Neonesthes*, *Photostomias* and *Stomias*, and represents a primitive condition for teleosts. Moreover, the gill teeth of *Abruzzoichthys erminioi* show the type 3 mode of tooth attachment.

The placement of *Abruzzoichthys erminioi* gen. & sp. nov. in the Stomiidae is well supported. Fink (1984, 1985) provides a cladistic analysis of the Stomiidae and proposes six shared derived characters which diagnose the family. Among these characters, three (presence of two main bodies of the geniohyoideus muscle, a portion of the adductor mandibulae inserting on the postorbital photophore, and presence of a mental barbel associated with the hyoid apparatus) correspond to soft anatomy, and the remaining refer to osteology, including: presence of a single infraorbital bone, lack of gill rakers in adults, and lack of hypural 6. Of the synapomorphies based on osteological characters, only two, lack of gill rakers in adults and lack of hypural 6 were clearly preserved. As suggested above, there are no traces of first infraorbital bone on the fossil. This bone was probably a very delicate structure that had few possi-

bilities to fossilize. Inclusion of *Abruzzoichthys erminioi* gen. & sp. nov. in the Stomiidae is also supported by a wide range of other features, such as the shape of the body, the osteology of the head, the structure of the axial skeleton, the morphology of the caudal skeleton, the absence of scales, and the form of the teeth.

## 5. Paleobiological remarks

The tooth morphology and the shape of the head of *Abruzzoichthys erminioi* gen. & sp. nov. both resemble those of *Astronesthes* and *Borostomias*. The teeth are comparable to those of many *Astronesthes* species (see Weitzman 1967a). The osteology of the head and the robustness of the teeth suggest that *Abruzzoichthys erminioi* gen. & sp. nov. may have had a piscivorous feeding mode. This feeding mode is typical of stomiids, which are included by Gartner et al. (1997) in the micronektivorous pelagic trophic guild, and more precisely in the piscivorous subguild.

The presence of a stomiid in the deposit of Torricella Peligna is consistent with the inferred mesopelagic habitat (Carnevale et al. 2001). Several other taxa that are recovered from these deposit are typical of this environment. These include the Gonostomatidae, Myctophidae, Paralepididae, Sternoptychidae and other stomiiforms (Carnevale et al. 2001).

## 6. The relationships of *Abruzzoichthys* gen. nov.

A phylogenetic analysis of Stomiidae including *Abruzzoichthys* gen. nov. is beyond the scope of this study. Fink (1985) describes several diagnostic characters of Stomiidae based on soft anatomy. These features have very little possibilities to preserve, and thus, it is difficult to place fossils within the phylogeny of Fink (1985). Regardless, several osteological characters of *Abruzzoichthys* gen. nov. appear relevant for the understanding of its affinities within the Stomiidae. The osteology and the overall morphology of the head appear to be very similar to those of the primitive stomiid genera *Astronesthes* and *Borostomias*. In the phylogenetic interpretation of Fink (1985), these genera are strictly related and form an unresolved node. Many other characters of *Abruzzoichthys* gen. nov. are perfectly comparable to those of these two genera, and particularly of *Astronesthes*. The presence of the parasphenethmoid in *Abruzzoichthys* gen. nov. is of great relevance in order to evaluate its relationships. This character in fact, has been found only in *Astronesthes* and *Borostomias* among teleosts. The morphology of premaxilla and mandible greatly resembles those of the *Astronesthes* species. The form of the teeth and the mode of tooth attachment are similar to those observed in *Astronesthes*. A number of other characters, including morphology of parapophysis, enlargement of dorsal prezygapophysis of anterior vertebrae, elevated number of supraneurals, reduction of mesopterygoid, morphology of the hyomandibula, morphology of the caudal skeleton, number of pectoral fin rays (see Kawaguchi & Moser 1984), and morphol-

ogy of pelvic bones, suggest strong affinities to *Astronesthes* (Fink 1985; Weitzman 1967a). *Abruzzoichthys* gen. nov. differs from *Astronesthes* by the presence of an accessory neural arch. This character is considered primitive for teleosts (Fink & Fink 1981) and has been found in primitive stomiiformes (Patterson & Johnson 1995). Within Stomiidae a bony accessory neural arch is present in *Borostomias*, *Heterophotus*, *Neonesthes*, and *Stomias*. In comparing *Abruzzoichthys* gen. nov. to *Astronesthes* and *Borostomias*, it is interesting to note that *Abruzzoichthys* is more elongated. Elongation of the body, that is typical of certain stomiids (*Echiostoma*, *Flagellostomias*, *Idiacanthus*, *Melanostomias*), has been found also in *Astronesthes* (= *Cryptostomias*) *psychrolutes* and *Astronesthes kreffti* (Gibbs & Weitzman 1965; Gibbs & McKinney 1988), but the dimension and general proportions of the body of *Abruzzoichthys* gen. nov. could be considered as apomorphic for the genus (see Tab. 2). *Abruzzoichthys* gen. nov. can be distinguished from other 'astronesthids' by the morphology of the posttemporal and by the relative position of dorsal and anal fin. The posttemporal of *Abruzzoichthys* is a discoid and strongly ossified bone. A similar shape of the posttemporal was also observed in *Chauliodus*, but poorly ossified. Although the dorsal and anal fins of *Abruzzoichthys* gen. nov. are poorly preserved, they are located, at least for half of their length, at the same level of the body. A similar condition can be considered unique within 'astronesthids'. Only some *Astronesthes* species, in fact, (*Astronesthes indicus*, *Astronesthes leucopogon*, *Astronesthes macropogon*, *Astronesthes micropogon*, and *Astronesthes niger*; see e.g. Gibbs 1984, 1986), have their anal fin origin beneath the end of the dorsal fin base. *Abruzzoichthys* gen. nov. has many autapomorphies that easily distinguish it from 'astronesthids' and more generally from all other stomiids. The first of these autapomorphic characters is the possession of an edentulous maxilla. The maxilla of all other stomiids (see Fink 1985; Weitzman 1967a), and more generally of stomiiforms (see Fink & Weitzman 1982; Weitzman 1967b, 1974) has a well definite series of teeth. Thus, the edentulous condition of the maxilla of *Abruzzoichthys* gen. nov. must be considered as derived. *Abruzzoichthys* gen. nov. can also be diagnosed by the unusual advanced insertion of the pelvic fin (~23,6 SL; Tab. 2). A transposed position of the pelvic fin has arisen several times within teleosts (see e.g. Parenti & Song 1996). As suggested by Winterbottom (1974), as the pelvic fin migrates through segments, it is composed of the mesenchymal elements of those segments. However, conclusive phylogenetic placement of the fossil must await the discovery of additional material.

## 7. The fossil record of Stomiidae

Although the Stomiidae are relatively abundant in recent oceanic ecosystems, the fossil record of this family appears really scarce. Until now only a few specimens have been collected in ichthyoliferous sedimentary rocks of the world. A brief review of the fossil record of stomiids was provided by Fink

(1985). Weitzman (1967b, 1974) commented about the fossil stomiiforms. Carroll (1988) lists four fossil taxa belonging to the Stomiidae, sensu Fink (1985): *Chauliodus*, *Eostomias*, *Pronotacanthus*, and *Protostomias*. The fossil *Chauliodus* reported by Carroll (1988) refers to *Chauliodus eximius* from the Miocene of California. This species was first described by Jordan (1925) as *Eostomias eximius*. David (1943) recognized the specimen as a member of the genus *Chauliodus* and changed the name to *Chauliodus eximius*. In the same paper David (1943) described a new taxon, *Chauliodus barbatus frazeri*, also from the Miocene diatomaceous deposits of California. In his redescription of the fossil *Chauliodus*, Crane (1966) established that David's *Chauliodus barbatus frazeri* has to be considered as junior synonym of *Chauliodus eximius*. As commented above, the genus *Eostomias* is now considered a junior synonym of *Chauliodus*. The genus *Pronotacanthus* was erected by Woodward (1901), who considered it as a notacanthid. Arambourg (1943, 1954) included this genus in the family Stomiidae. Fink (1985) rejected the conclusion that *Pronotacanthus* was a stomiid and more generally a stomiiform. I agree with Fink's suggestion, because of the evident absence of any diagnostic feature to place this genus in the Stomiidae. The genus *Protostomias* was originally described by Arambourg (1943) from the Cretaceous (Cenomanian) of Morocco, and then included in the family Protostomiatidae (Arambourg 1954). This taxon was successively reported also from the Cretaceous of Italy (Sorbini 1976) and Russia (Bannikov et al. 1984). In agreement with Fink (1985), I reject the inclusion of *Protostomias* in the Stomiidae or related groups. Several characters, such as possession of large infraorbital bones, elongate premaxilla, gill rakers, and enlarged coronoid process of the mandible, indicate that *Protostomias* is not a stomiid, and probably not a stomiiform. There are some other fossil stomiids or putative stomiids that are absent in the catalogue of Carroll (1988). Daniltshenko (1962) described *Astronesthes praeivius* from the Middle Eocene (Lutetian) of Dabaxanskaya Formation, Georgia. This species was based on two incomplete skeletons nearly 100 mm TL. The specimens have recently been reviewed by Prokofiev (2001) and included in the new genus *Azemiolestes*. There are several characters diagnostic of Stomiidae that have been found in this species, including lack of gill rakers, body scaleless, and oral jaws teeth. Although the specimens show a questionable character (presence of hypural 6), I provisionally accept the placement of the genus *Azemiolestes* in the family Stomiidae. According to Fink (1985) and Weitzman (1974), the Oligocene *Astronesthes simus*, described by Arambourg (1967), does not appear to be a stomiid because of the presence of gill rakers. Fink & Fink (1986) reported the existence of a single specimen of *Stomias affinis* from the Upper Miocene of California. Few specimens referred to *Chauliodus* cf. *macouni* were described by Ohe (1993) from the Middle Miocene of the Yamami Formation, Aichi Prefecture, Central Japan. In the Neogene fossil record of the Mediterranean there are two other fossils clearly belonging to the Stomiidae. A single specimen of *Chauliodus sloani* from



the Upper Pliocene sapropels of Vrica, Southern Italy was described by Landini & Menesini (1978), and a further specimen has recently been found by Sorbini (1999) from the Upper Pliocene deposits of Stuni, Southern Italy. Sorbini (1999) also reports a single specimen of *Stomias boa* from the same deposit. In summary, the fossil record of the Stomiidae consists of six taxa, ranging from the Middle Eocene to the Upper Pliocene. Four of these taxa are still living (*Chauliodus* cf. *macouni*, *Chauliodus sloani*, *Stomias affinis*, *Stomias boa*), whereas the remaining two (*Azemiolestes praeivius*, *Chauliodus eximius*) are extinct. *Abruzzoichthys erminioi* represents the seventh record of the Stomiidae.

## 8. Summary

A new genus and species of barbeled dragonfish (family Stomiidae) is described: *Abruzzoichthys erminioi* gen. & sp. nov. It is one of the best preserved fossil stomiids known, although so far it is only known by a single specimen. The placement of the specimen is justified by the presence of two synapomorphies of the Stomiidae: lack of gill rakers, and lack of hypural 6. *Abruzzoichthys* gen. nov. is described as a new genus because of the possession of several autapomorphic characters within the Stomiidae, such as a strongly advanced position of pelvic fin, and an edentulous maxilla. Several features suggest close relationships with basal stomiids, and in particular with the 'astronesthid' genera *Astronesthes* and *Borostomias*. These are: morphology of the head, presence of parasphenethmoid, type 1 mode of tooth attachment, elevated number of supraneurals, and osteology of caudal skeleton. Based on the morphology of the head I consider *Abruzzoichthys* gen. nov. as a piscivorous fish. This feeding mode is commonly found within stomiids. Stomiidae have a poor fossil record ranging from the Middle Eocene to Late Pliocene. In this study, only six species have been placed or provisionally retained in this family: *Azemiolestes praeivius*, *Chauliodus eximius*, *Chauliodus* cf. *macouni*, *Chauliodus sloani*, *Stomias affinis*, and *Stomias boa*. *Abruzzoichthys erminioi* gen. & sp. nov. is considered the seventh taxon in the fossil record of Stomiidae.

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