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THE OTOLITHS OF THE TELEOSTEAN FISH *ANTIGONIA CAPROS* AND THEIR TAXONOMIC SIGNIFICANCE

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With 2 plates

ABSTRACT

The sacculiths of *Antigonia capros* Lowe, are described and the correct taxonomic position of the family ANTIGONIIDAE is established on their evidence.

INTRODUCTION

In the Spring of 1966 Mr. G. E. MAUL, Museu Municipal do Funchal, Madeira, obtained three specimens of *Antigonia capros* Lowe, of which one was sent to the Author for extraction of the otoliths. Only the sacculiths (sagittae) were removed so that the mutilation of the fish should be kept to a minimum for these are the only otoliths of diagnostic value, the utriculith (lapillus) and lagenalith (asteriscus) contributing little or no additional supporting evidence. The fish, which weighed 122 grammes and measured 131 mm. standard length, was eventually returned to Mr. MAUL for preservation in the museum collections (MMF Reg. No. 21979).

DESCRIPTION OF OTOLITHS

Order ***Beryciformes***
Suborder ***Berycoidei***
Family ***Antigoniidae*** Jordan & Fowler, 1902: 521.
Genus ***Antigonia*** Lowe, 1843: 85.
Type Species: ***Antigonia capros*** Lowe, 1843: 85.

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Antigonia capros Lowe.

Pl. 1 figs. 1 a, b. 2 a, b. Pl. 2 fig. 1.

Dimensions: Left sacculith Length 8.61 mm. Width 9.76 mm.
Right sacculith Length 8.77 mm. Width 9.92 mm.

Rather high, oval sacculiths, somewhat produced to truncated points posteriorly. Short dorsal rim, prominently notched anteriorly and sloping gently towards the posterior rim with which it forms a gently rounded angle. A second, much smaller notch is present near the posterior end of the dorsal rim. Obtuse, irregularly undulant posterior rim. Very deep ventral rim, the posterior edge prominently but irregularly undulant while the anterior edge is finely denticulated. Oblique anterior rim which is prominently notched at its junction with the ventral rim. Outer face slightly convex with indistinct radial ridges on the dorsal half and a shallow groove from the centre to the anterior notch. Faint, concentric growth lines indicate that this fish was about six years old and is a mature example. Inner face slightly convex with a wide, median sulcus set slightly above the mid-line. Sulcus consisting of a wide, moderately deep rather pyriform, fairly long ostium which is somewhat diagonally set and a shallower, wide, slightly undulant cauda with a slight upward trend posteriorly. Crista superior continuous and undivided with a shallow depression above it but a marked acute angle on the crista inferior at the junction of ostium and cauda. Prominent rostrum, antirostrum and excisura present. No colliculi.

TAXONOMIC SIGNIFICANCE

In 1950 WEILER described an otolith from the Middle Miocene of Rumania (218, pl. 2 figs. 7 a, b) as *Otolithus (Monocentridarum) altus*, remarking on its apparent relationship to various berycoid genera but later, after studying sacculiths of *Antigonia capros*, he considered that the fossil form represented an ancestral form of *Antigonia* and accordingly referred it to this genus (WEILER, 1959: 99), including the genus within the CAPROIDAE.

In the present paper the writer will demonstrate that a study of the otoliths clearly reveals that the ANTIGONIIDAE are closely related to the BERYCIDAE. No osteological or morphological evidence other than that of the otoliths is offered apart from a mention of the presence of bony idgesr

on the frontal areas in both the BERYCIDAE and ANTIGONIIDAE, a feature which is considered significant by some ichthylogists. Both families have ctenoid scales as further evidence of their affinity.

The genus *Antigonia* was established by LOWE (1843. 85) and he proposed the family name CAPROIDAE to include nis new species *Antigonia capros* with the species *Capros aper*. GÜNTHER (1880; 449) placed the family among the CARANGIDAE. JORDAN and FOWLER (1902: 521) proposed the family name of ANTIGONIIDAE as being more appropriate for the genus *Antigonia*. STARKS (1903: 565) related the family ANTIGONIIDAE to the chaetodonts on the evidence of certain osteological characters and REGAN (1923: 204) included it in his Series CAPRIFORMES, citing various characters which suggested possible affinities with the ZEIDAE, CHAETODONTIDAE and other fish families whose salient feature was their compressed, deep-bodied, circular shape. BARNARD (1925: 380) and FROST (1927: 443) followed REGAN (1910; 481) in including the family ANTIGONIIDAE in the division ZEOMORPHI while BERG (1958: 243) followed JORDAN'S classification. BERRY (1959: 205) summarised the earlier works on the subject and remarked on the doubtful affinities of the family.

There is no doubt that the superficial morphology of fishes, as with all other vertebrates, may be changed with comparative ease so that some forms may evolve into quite atypical forms which simulate other groups although unrelated to them. The variation in the shape and number of finspines is usually considered as highly significant in taxonomic considerations and yet, by the whim of a changed chromosome, these characters may alter markedly. Even in *Homo sapiens* a variation in the number of digits is not uncommon. On the other hand, the otoliths, developing in the shelter of the brain cavity, have not been subjected to strong environmental selection pressures and so have evolved comparatively slowly. No doubt for this reason Eocene otoliths (after a lapse of perhaps 40 million years) are found in many cases to be hardly distinguishable from those of living genera. This slow rate of evolution of the otoliths has, it seems, preserved important ancestral features substantially unmodified through long periods of time. Undoubtedly a study of otoliths, usually ignored by ichthyologists, would resolve many of the problems of classification which have arisen in the study of the teleosts.

The figured series of berycoid otoliths clearly show where the affinities of *Antigonia* lie. For example, the sacculith of *Beryx decadactylus* Cu-

vier, (Pl. 1 fig. 3, pl. 2 fig. 2), although triangular in outline, shows similar rostral features, notches in the dorsal rim and a sulcus with the same characters apart from a variation in the dimensions of the ostium. Again, in the sacculiths of *Trachichthodes affinis* Günther, (Pl. 1 fig. 4, pl. 2 fig. 3) the overall characters of the sulcus, notched dorsal rim and rostral area link it closely with *Antigonia* despite the different peripheral outlines. An even closer relationship is demonstrable with sacculiths of the MONOCENTRIDAE. In *Monocentris japonicus* Houttuyn, (Pl. 1 fig. 5, pl. 2 fig. 4) the width of the otolith is greater than the length, as in *Antigonia capros* and although peripheral outlines and rostral areas are dissimilar the sulcus is remarkably similar in the two cases while in *Cleidopus gloriamaris* De Vis, (Pl. 1 figs. 6 a, b, pl. 2 fig. 5) the resemblace is even more marked as these sacculiths are produced posteriorly, the dorsal rim is notched and the sulcus is almost identical in each case, thus showing that the ANTIGONIIDAE are closely related to the BERYCIDAE.

An examination of the sacculiths of the CAPROIDAE and ZEIDAE demonstrates little, if any, resemblance to those of the ANTIGONIIDAE except, perhaps, a vague similarity in the peripheral contours for otoliths of the CAPROIDAE and ZEIDAE are relatively considerably smaller and are highly specialised in character. In those of *Capros aper* Linnaeus, (Pl. 1 figs. 7 a, b, 8 a, b, pl. 2 figs. 6 a, b) the sulcus consists of a long straight cauda with a very small, hardly distinguishable ostium, features which are completely different from those of *Antigonia*. Also, the outer faces are quite dissimilar. However, the otoliths of *Capros* show a close affinity with those of *Cyttus novaeseelandiae* Waite, (Pl. 1 figs. 9 a, b, pl. 2 figs. 7 a, b) particularly in the outer faces while the inner face does not suggest any relationship to the ANTIGONIIDAE. The specialised form of the sacculith of *Zeus faber* Linnaeus, (Pl. 1 fig. 10, pl. 2 fig. 8) suggests that this genus is referable to the CYTTIDAE for it is probable that the separated lobes of the dorsal area evolved from the dorsal crenulations seen in *Cyttus* while the ventral area became modified into two extended lobes. The sacculith of *Lampris*, with its deep ostium, figured by FROST (1927: 439, pl. 8 fig. 14), although highly specialised, may indicate a berycoid origin. Only the lagenaliths of *Lampris regius* Bonnaterre, (Pl. 1 figs. 11, 12, pl. 2 figs. 9 a, b) are represented in the author's collections for no sacculiths were found in the auditory capsules although they might well bave been destroyed by post mortem changes owing to their extreme fragility.

It has even been suggested that the BRAMIDAE might be related to the ANTIGONIIDAE but a study of the sacculiths of *Brama raii* Bloch, (Pl. 1 figs. 13, 14, pl. 2 figs. 10, 11) shows that this surmise is untenable and demonstrates a close relationship with the SERIOLIDAE, the otoliths of which, incidentally, indicate a marked affinity with the SCOMBRIDAE s. s

The sacculiths of the chaetodonts, such as *Chaetodon hoefleri* Steindachner, (Pl. 2 fig. 12) indicate that this group is quite unrelated to the ANTIGONIIDAE and any superficial resemblances are probably fortuitous. However, these otoliths, which are distinctly percoid in character, form a composite group with those of the EPHIPPIDAE, DREPANIDAE, SCATOPHAGIDAE and POMACANTHIDAE.

CONCLUSIONS

The importance of otoliths in determining the taxonomic position of doubtful groups of teleosts is exemplified in the case of the ANTIGONIIDAE which are here demonstrated to be closely related to the Berycidae. The conclusion is drawn that in many cases the superficial characters of fishes are of secondary importance for the morphological and osteological features, considered alone, may result in questionable and often erroneous conclusions.

ACKNOWLEDGEMENTS

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PLATE 1

1 a, b. *Antigonia capros* Lowe. Right sacculith, inner and outer faces. × 2.4. — 2 a, b. *Antigonia capros* Lowe. Left sacculith, inner and outer faces. × 2.4. — 3. *Beryx decadactylus* Cuvier & Valenciennes. Left sacculith, inner face, × 1.8. — 4. *Trachichthodes affinis* Günther. Right sacculith, inner face. × 2.4. — 5. *Monocentris japonicus* Houttuyn. Left sacculith, inner face. × 2.4. — 6 a, b. *Cleidopus gloriamaris* De Vis. Left sacculith, inner and outer faces. × 3. — 7 a, b. *Capros aper* Linnaeus. Right sacculith, inner and outer faces, × 3.5. — 8 a, b. *Capros aper* Linnaeus. Left sacculith, inner and outer faces. × 3.5. — 9 a, b. *Cyttus novaeseelandiae* Waite. Right sacculith, inner and outer faces. × 8.2. — 10. *Zeus faber* Linnaeus. Right sacculith, inner face. × 9.4. — 11. *Lampris regius* Bonnaterre. Left lagenalith, inner face. × 11.7. — 12. *Lampris regius* Bonnaterre. Right lagenalith, outer face, × 11.7. — 13. *Brama raii* Bloch & Schneider. Right sacculith, inner face. × 4.1. — 14. *Brama raii* Bloch & Schneider. Left sacculith, outer face. × 4.1.

Composto e impresso na Tipografia Eco do Funchal


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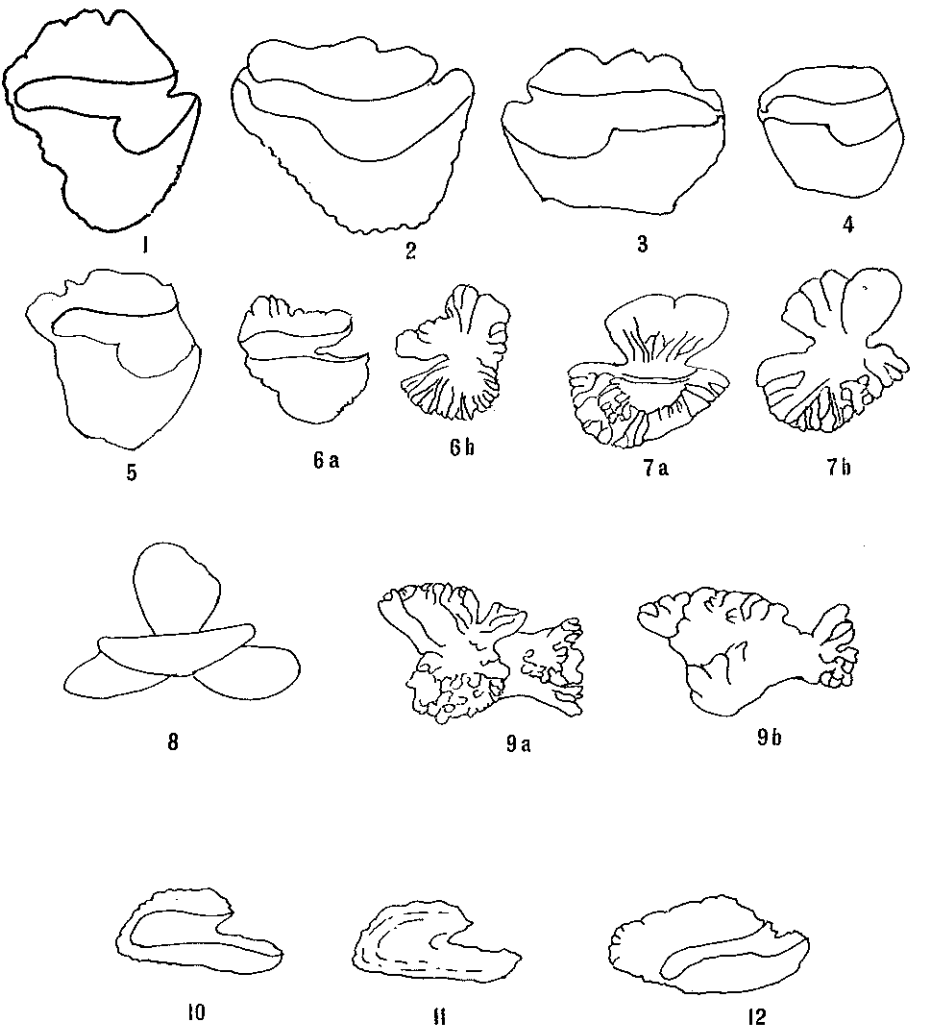

PLATE 2

1. *Antigonia capros* Lowe. Left sacculith, inner face. × 2.9. — 2. *Beryx decadactylus* Cuvier & Valenciennes. Left sacculith, inner face. × 2.1. — 3. *Trachichthodes affinis* Günther. Right sacculith, inner face. × 2.1. — 4. *Monocentris japonicus* Houttuyn. Left sacculith, inner face. × 2.1. — 5. *Cleidopus gloriamaris* De Vis. Left sacculith, inner face. × 2.1. — 6 a, b. *Capros aper* Linnaeus. Left sacculith, inner and outer faces. × 4.3. — 7 a, b. *Cyttus novaeseelandiae* Waite. Left sacculith, inner and outer faces. × 8.6. — 8. *Zeus faber* Linnaeus Right sacculith, inner face. × 10. — 9 a, b. *Lampris regius* Bonnaterre. Left and right sacculiths, inner and outer faces. × 14.3. — 10. *Brama raii* Bloch & Schneider. Left sacculith, inner face. × 5. — 11. *Brama raii* Bloch & Schneider. Right sacculith, outer face. × 5. — 12. *Chaetodon hoefleri* Steindachner. Left sacculith, inner face. × 4.3.