

Mesozoic halecostomes and the early radiation of teleosts

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Abstract

An evaluation of the knowledge of advanced actinopterygians during the last 150 years reveals notable progress in the understanding of halecomorphs and teleosts, especially progress in the last 30 years. The unnatural taxon Holostei prevailed during most of the 20th century, and only recently, have taxa such as Halecostomi, Halecomorphi and Teleostei (which include part of the holosteans) been recognized as monophyletic units. New taxa, such as the Halecomorphi with the †Parasemionotiformes at the base, and the Teleosteomorpha including the stem-group teleosts (e.g., †aspidorhynchiforms, †pachycormiforms) and “true” teleosts have been put forward. Despite the progress, groups such as †Parasemionotiformes, †Caturioidea, †Ionoscopiformes, †Pachycormiformes and †Pholidophoriformes’ still need major revisions to clarify their contents and phylogenetic relationships. Although there is apparently no doubt regarding the monophyly of the main teleostean lineages, e.g., the Elopomorpha, Osteoglossomorpha and Clupeocephala, their phylogenetic relationships remain unresolved. Three hypotheses have currently been put forward regarding the phylogenetic position of elopomorphs versus osteoglossomorphs and more advanced teleosts, the clupeocephalans. These hypotheses are strongly biased by the selection of taxa, e.g., Recent forms or fossil plus Recent forms. The sister group of Teleostei is still unresolved. Possible sister groups are the amiids, lepisosteids, *Dapedium*, pycnodontiforms, pachycormiforms and aspidorhynchiforms. Their relative positions in the cladogram changes when different outgroups are used. The living sister group (*Amia* or *Lepisosteus*) of Teleostei is similarly still unknown.

The Teleostei, the largest group of vertebrates today, had a modest beginning, presumably in the Late Triassic. They underwent an extraordinary radiation throughout the Mesozoic, especially during the Late Jurassic when several of the modern teleostean lineages made their entrance in the history of fishes. Interestingly, none of the Jurassic genera have been recovered in the Early Cretaceous. All Late Triassic and Jurassic teleostean genera had, apparently, a reduced geographical distribution and lived a few millions years to be replaced by new fishes.

Introduction

The name Actinopterygii, which appears to have a clear content today, was coined by COPE in 1887 to include the living ray-finned fishes, the chondrosteans, holosteans, and teleosteans sensu MÜLLER (1844). The actinopterygians, as the name indicates, are ray-finned fishes whose paired fins do not possess a symmetrical axis. COPE (1887) grouped the ray-finned fishes in three major subdivisions to distinguish them from the Crossopterygii of HUXLEY (1861), a classification that was adopted later by WOODWARD (1891) and most subsequent workers until the late 1960s. Then HENNIG’s (1966) ideas brought a new approach to systematics, and influenced immensely the present understanding of actinopterygians.

Numerous features have been proposed to support the monophyly of Actinopterygii (see for instance ROSEN et al. 1981, PATTERSON 1982, LAUDER & LIEM 1983, GARDINER 1984, GARDINER & SCHAEFFER 1989, SCHULTZE & CUMBAA 2001, ZHU & SCHULTZE 2001). Most hypotheses of actinopterygian interrelationships are based on primitive members of the group (e.g., GARDINER & SCHAEFFER 1989, TAVERNE 1997, DIETZE 2000, LUND & POPLIN 2002). Exceptions are the phylogenetic hypotheses of COATES (1999) who included *Amia* and *Lepisosteus* together with some basal actinopterygians, and CLOUTIER & ARRATIA (2004) who include many basal actinopterygians and several advances ones. On the other hand, a few phylogenetic hypotheses only dealing with several advanced actinopterygian taxa (e.g., BRITO 1997, ARRATIA 1999) have been proposed. This results in a dichotomy of actinopterygian

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