

COMPARATIVE MORPHOLOGY BETWEEN EXTINCT AND EXTANT FORMS PROVIDES EVIDENCE FOR EARLIER RADIATION IN ISTIOPHORID BILLFISHES (TELEOSTEI, ISTIOPHORIFORMES)

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Billfishes include some of the largest pelagic teleostean species, but several aspects about their morphology, paleobiology and evolution remains ambiguous. Their fossil record is very fragmentary and mostly represented by rostral and skull remains. Here, we present a comparative study of the caudal vertebral morphology of extant istiophorid species and we use this information to describe two fossil vertebrae from the Gatun and Chagres formations, both from the late Miocene of Panama. The caudal vertebra from the Gatun Fm. is characterized by the presence of a lateral apophysis and accordingly identified as *Makaira* sp., while the vertebra from the Río Indio Member of Chagres Fm. lacks this structure and its morphology indicates a different genus. The estimated total length of the *Makaira* sp. specimen from Gatun Fm. is about 5.18 m, the largest size calculated for a marlin, while the Río Indio specimen was about 2.56 m long. The phylogenetic analysis conducted here demonstrates that crown istiophorids lack lateral apophyses on the caudal vertebrae. Loss of this feature most likely evolved in the Pliocene when crown istiophorids diverged from its closest relative. However, the fossil vertebra from Río Indio proves that the lateral apophysis already had been lost in some istiophorids during the late Miocene, ~8.3 – 7.1 Ma. Our results highlight that both *Makaira* ssp. and taxa lacking the lateral apophysis already occurred during the late Miocene, indicating that the radiation of crown istiophorids most likely occurred earlier.