

Ecomorphological diversity of goatfishes from the Great Reef of Toliara (Madagascar)

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Goatfishes (*Mullidae*) are widely distributed in temperate, subtropical and tropical marine waters. Main target of artisanal fisheries, this fish family groups 88 species. The majority of these species are found over sand and around reefs at depths of 5-200 m. Co-occurring goatfish species sometimes partition their environment on the basis of water depth and substratum type. Even if goatfishes are generally considered as benthic carnivores, no ecomorphological studies tested the hypothesis of a segregation of species along the trophic axis. The main aims of this study were (1) to characterize the isotopic niches of six species of goatfishes from the Great Reef of Toliara (Madagascar), (2) to understand their resources partitioning and (3) to reveal the potential links between their trophic ecology and the morphology of their cephalic region. Along this work, morphometrics and stable isotope analyses were combined to address these points. Isotopic signatures of nitrogen ($d^{15}N$) confirmed that all species belong to the same trophic level. Variation along carbon and sulfur axes suggested that *Mulloidichthys flavolineatus* and *Parupeneus barberinus* differ in their trophic ecology from the other species. Isotopic variation seemed rather similar among species suggesting no difference in their levels of trophic diversity. Regular morphometrics and landmark-based geometric morphometric methods revealed large morphological variation among studied goatfishes. Length of hyoid barbles, size of the adductor mandibulae muscle, shape of the opercular bones, shape of the head profile and insertions of pectoral fins are main traits varying among species. The length of the rostral region and barbels are certainly key parameters for species distinction but could also explain ecological diversity. Accordingly, with significant linear relationships between isotopic values and morphological traits, we hypothesize that the variation in the head morphology of goatfishes could be linked to differences in their feeding behaviour. Indeed, *Parupeneus macronemus* possesses the most elongated head and the longest hyoid barbels which could allow him the target of animal preys deeply buried in sand. This ecomorphological study combining stable isotopes and morphometrics helped to demonstrate an unexpected level of trophic partitioning among sympatric species of goatfishes.

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