

# Sperm competition, sexual selection and the diverse reproductive biology of Osteoglossiformes

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## Funding information

National Science Foundation, Grant/Award Numbers: DGE-1848739, IOS-1644965

## Abstract

Osteoglossiformes are an order of “bony tongue” fish considered the most primitive living order of teleosts. This review seeks to consolidate known hypotheses and identify gaps in the literature regarding the adaptive significance of diverse reproductive traits and behaviour of osteoglossiforms within the context of sperm competition and the wider lens of sexual selection. Many of the unusual traits observed in osteoglossiforms indicate low levels of sperm competition; most species have unpaired gonads, and mormyroids are the only known vertebrate species with aflageolate sperm. Several osteoglossiform families have reproductive anatomy associated with internal fertilization but perform external fertilization, which may be representative of the evolutionary transition from external to internal fertilization and putative trade-offs between sperm competition and the environment. They also employ every type of parental care seen in vertebrates. Geographically widespread and basally situated within teleosts, osteoglossiforms present an effective study system for understanding how sperm competition and sexual selection have shaped the evolution of teleost reproductive behaviour, sperm and gonad morphology, fertilization strategies, courtship and paternal care, and sexual conflict. The authors suggest that the patterns seen in osteoglossiform reproduction are a microcosm of teleost reproductive diversity, potentially signifying the genetic plasticity that contributed to the adaptive radiation of teleost fishes.

## KEYWORDS

adaptation, fish, natural selection, reproduction, sexual selection, sperm competition

## 1 | INTRODUCTION

The approximately 26,000 known species of teleost fish occupy a wide range of aquatic habitats (Froese & Pauly, 2019) and exhibit a remarkable array of reproductive strategies (Helfman et al., 2009). It is presently unclear which factors contribute to the evolution of such numerous reproductive strategies within teleosts (Smith & Wootton, 2016). The basally situated Osteoglossiformes (“bony tongue”) are a microcosm of teleost reproductive diversity. They exhibit variation in reproductive anatomy, gamete morphology and reproductive behaviour, all suggesting flexibility early in teleost evolution (Figure 1). Osteoglossiforms are distributed worldwide and are

comprised of five families: Osteoglossidae (15 species in South America, Africa, Asia and Australia), Notopteridae (10 species in Africa and Southeast Asia), Pantodontidae (one species in Africa), and two families of weakly electric fish, Mormyridae (>200 species, Africa) and Gymnarchidae (one species, Africa). In accordance with osteoglossiforms’ cosmopolitan distribution and their ancestral position within teleosts, insights into the evolution of their reproductive diversity may lead to a new understanding about the factors underlying the evolution of reproduction in teleosts (Figure 2).

Several reviews have considered osteoglossiform reproductive behaviour (Britz, 2004; Hopkins, 1986; Karino, 2009; Kolm, 2009; Yanwitsal, 2013) and sperm morphology (Jamieson, 1991;

# Sperm Competition And Sexual Selection

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