

Preliminary checklist of sailfin silversides (Teleostei: Telmatherinidae) in the Malili Lakes of Sulawesi (Indonesia), with a synopsis of systematics and threats

Vorläufige Checkliste der Sonnenstrahlfische (Teleostei: Telmatherinidae) der Maliliseen Sulawesi (Indonesien), mit einer Übersicht zu Systematik und Bedrohung

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Summary: The ancient Malili Lakes in Sulawesi harbor an adaptive radiation of sailfin silversides (Teleostei: Atheriniformes: Telmatherinidae). This radiation is characterized by local endemism either to basins of Lakes Towuti, Mahalona and Lontoa (Wawontoa) or to that of Lake Matano, and by spectacular male color polymorphisms. Based on recent surveys, we report a previously undetected diversity of steam-dwelling Telmatherinidae, inhabiting a wide range of the lake system's rivers and streams and additional adjacent catchments. We provide a preliminary checklist of Telmatherinidae in the Malili Lakes system, including surrounding catchments, and add records of three yet undescribed lacustrine *Telmatherina* from Lake Matano. Distribution patterns of Lake Matano's *Telmatherina* are provided in detail, based on eight sampling locations around the lake's shoreline. Moreover, we record an increased number of color morphs in five known *Telmatherina* and summarize color polymorphisms of the species-flock. As this radiation is used as model system to address questions concerning speciation and maintenance of color polymorphisms, we provide a summary of taxonomic, systematic, ethological and evolutionary biological knowledge regarding telmatherinids, give a brief overview about the environmental settings, and discuss the serious threats endangering this endemic ichthyofauna.

Key words: Telmatherinidae, adaptive radiation, Malili Lakes system, Sulawesi, diversity, threats

Zusammenfassung: Die Maliliseen Sulawesi beherbergen eine adaptive Radiation von Sonnenstrahlfischen (Teleostei: Atheriniformes: Telmatherinidae). Diese Radiation zeichnet sich durch lokalendemische Verbreitungsmuster einerseits in den Seen Towuti, Mahalona und Lontoa (Wawontoa) oder andererseits im Matanosee, sowie durch spektakuläre Farbpolymorphismen aus. Basierend auf kürzlich erfolgten Felderfassungen stellen wir eine bislang unbekannt Diversität bachbewohnender Telmatheriniden vor, die in weiten Bereichen der Flüssen und Bächen des Seensystems sowie angrenzenden Einzugsgebieten verbreitet ist. Wir stellen eine vorläufige Checkliste der Telmatheriniden des Maliliseen-Systems einschließlich umgebender Einzugsgebiete auf und fügen Nachweise von drei bislang unbeschriebenen lakustrinen *Telmatherina* aus dem Matanosee hinzu. Verbreitungsmuster der Manatosee-*Telmatherina* werden detailliert aufgezeigt, basierend auf acht Sammelstellen rings um die Uferzone des Sees. Außerdem weisen wir eine höhere Anzahl Farb-

morphen für fünf bekannte *Telmatherina* nach und fassen die Farbpolymorphismen des Artenschwarms zusammen. Da diese Radiation als Modellsystem dient um Fragen zu Artbildung und Aufrechterhaltung von Farbpolymorphismen nachzugehen, geben wir eine Zusammenfassung über den taxonomischen, systematischen, verhaltensbiologischen und evolutionsbiologischen Forschungsstand über Telmatheriniden sowie einen kurzen Überblick über die naturräumlichen Bedingungen und diskutieren die ernsthaften Bedrohungen, die diese endemische Fischfauna gefährden.

Schlüsselwörter: Telmatherinidae, Adaptive Radiation, Maliliseen, Sulawesi, Diversität, Bedrohung

1. Introduction

Over the last 109 years a diversity of small, atheriniform freshwater fishes has been described from the island of Sulawesi (Indonesia), accounted to the family of sailfin silversides (Atheriniformes: Telmatherinidae). Only one out of the island's 16 species is found in streams of its south-western branch, the remaining 15 are endemic to the Malili Lakes system in Central Sulawesi (Kottelat 1990a, 1991). The chance to study evolution of organismic diversity within an outstanding, compact but diverse model system characterized by different degrees of isolation, has attracted recently several research groups to this system. Apart from sailfin silversides, the endemic invertebrate radiations of crustaceans (atyid shrimps and parathelphusid crabs) and pachychilid snails (von Rintelen and Glaubrecht 2003; von Rintelen and Glaubrecht 2005; von Rintelen et al. 2004) as well as the predominantly endemic diversity of diatoms (Bramburger et al. 2004, 2006) are under investigation.

Aim of the present paper is to (1) summarize present knowledge about telmatherinid taxonomy, systematics and the Malili Lakes system and (2) to provide an overview about major patterns of diversity in the Malili Lakes sailfin-silversides radiation. It is intended as a guide to upcoming work dealing with evolutionary processes of this adaptive radiation, and to drawing attention to serious threats endangering this unique diversity. It is not aimed to serve taxonomic purposes, for which more detailed

examinations and a sophisticated concept of recognizing "species" within this obviously still radiating flock are required.

1.1. The Malili Lakes system

The Malili Lakes system is located in Central Sulawesi (the former Celebes) (fig. 1), consisting of five interconnected lakes. The three major lakes Matano, Mahalona and Towuti are large, deep ancient lakes of tectonic origin (Abendanon 1915a, b, Brooks 1950, Haffner et al. 2001). Lake Matano is with 590 m the deepest lake in Southeast Asia and the eighth deepest lake in the world (Hutchinson 1957). Geologically, it is a tectonic graben lake of the still active Matano fault zone (Ahmad 1977).

Lakes Matano, Mahalona and Towuti are arranged along a cascading chain with connecting rivers. Lake Matano is a steep-sided graben lake (Ahmad 1977), located 396 m above sea level (fig. 1). It is drained at its eastern corner by the extremely steep River Petea to L. Mahalona, descending 72 m of altitude along the river's total length of about 9.5 km (Abendanon 1915a, Kottelat 1991, own observations). According to our own ground checks and all accessible topographic maps (1: 50.000, Lembar 2213-13, 34) there is no major waterfall in River Petea. The river is located within a very steep valley and descends along a sequence of rapids, riffles, small falls, pools and backwaters until about 1 km ahead of L. Mahalona, where it becomes comparatively deep and calm. After Lake Mahalona, the flow continues as the overall wide and slow-flow-