

Biodiversity and habitat specialization of coral-dwelling gobies (Pisces: Gobiidae) in the Red Sea (September 2005 - August 2008)



This research project is funded by the Austrian Academy of Sciences (APART) and will deal with the biodiversity of obligatory coral-associated gobiid fishes in the entire Red Sea. Ecological, molecular genetic and morphological investigations will be carried out.

Introduction

Gobiid fish represent the most diverse marine fish family and comprise almost 2000 species, including the smallest fish species known. Within the genera *Bryaninops*, *Gobiodon*, *Paragobiodon* and *Pleurosicya*, highly specialized species inhabit hydrozoan, antipatharian and especially scleractinian corals. These highly specialised coral reef fish are very sensitive to ecosystem alterations and highly affected by local or global, anthropogenic and/or natural causes of reef degradation (Munday et al., 2004). Furthermore, they play an important role in tropical food webs (Depczynski & Bellwood, 2003). First data on the taxonomy and ecology of these gobiids in the Red Sea were recorded in the course of my studies from 2003 to 2005. During those investigations, 21 species from the genera *Gobiodon*, *Paragobiodon*, *Eviota*, *Bryaninops*, *Pleurosicya*, *Priolepis* and *Trimma* were identified and found to depend

on live corals to different degrees. At least 3 species of *Gobiodon* were new for the Red Sea (Herler & Hilgers, 2005); their uncertain affiliations to Indo-Pacific species required taxonomic investigations, which are still ongoing (Herler, unpublished data). In addition, about 15 species of *Acropora* (~ 30 % of all Red Sea species) were sampled, identified and confirmed by Dr. Carden Wallace (MTQ, Australia) after the collecting and export was permitted by the EEAA and the CITES management authority, Egypt. The microhabitat choice of *Gobiodon* spp. was revealed by a master student's work (Markus Dirnwöber, 2004-2005).

The proposed recent study is designed to extend this first research project at several levels. Long-term monitoring will reveal population dynamics and will be accompanied by non-invasive field experiments. Investigations at different regions of the Red Sea are proposed to compare local versus regional biodiversity and to test different hypotheses of reef fish biodiversity, e.g.: 1) species compositions are coincidental and vary over space and time; 2) niche segregation is distinct and all species can co-exist within a single reef, and local populations remain relatively constant. Highly live-coral-dependent gobiid species will be the focus of this study. Niche segregations, host fidelity and life-style flexibility of the specialized species of *Bryaninops*, *Gobiodon*, *Paragobiodon* and *Pleurosicya* will be examined in addition to a series of (eco-)morphological investigations. Hypotheses on the life-style evolution of these most specialized reef fishes, their speciation processes and predictions on their future development should be established and proved. Molecular genetic and morphological phylogenies are to be constructed to shed light on the origin of the Red Sea species and the evolution of their microhabitat choice. Evaluation of their host fidelity and monitoring of populations at different reefs will help determine the effects of certain reef ecosystem alterations: e.g. regional *Acanthaster* outbreaks destroy large *Acropora* tables in fore reef zones, or local effect deteriorate branching corals in general.

Main objectives of the proposed research

- 1.) Examination of regional and local biodiversity of coral-associated gobiid fish in the entire Red Sea
- 2.) Investigation of gobiid host specificity, niche overlap
- 3.) Long-term observations on population fluctuations
- 4.) Investigations of gobiid fish dependence on live coral coverage and coral assemblage types
- 5.) Examination of adaptive traits in the eco-morphology of fish
- 6.) Establishment of phylogenetics of Red Sea *Gobiodon* based on morphology and molecular genetics

Master theses currently supervised:

Simone Niedermüller: Interactions between coral-feeding and coral-inhabiting reef fishes – an etho-ecological study of chaetodontid feeding behaviour and gobiid microhabitat selection

Lucie Schiemer: Influence of live coral cover on the assemblage and abundance of coral-associated gobiid fishes in the northern Red Sea

References

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Herler J. & Hilgers H. (2005): A synopsis of coral and coral-rock associated gobies (Pisces: Gobiidae) from the Gulf of Aqaba, northern Red Sea. *aqua, Journal of Ichthyology and Aquatic Biology*, 10 (3): 103-132.

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