

SUBTERRANEAN AQUATIC FAUNA: BIODIVERSITY, BIOLOGY, ECOLOGY AND CONSERVATION

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Pimelodella kronei (photo A. Camargo)



R. enfernada (photo A. Camargo)

Due to their distinctive characteristics, subterranean ecosystems are of a major scientific interest. Regarding conservation, their intrinsic fragility and vulnerability are a matter of concern. Subterranean communities include species living exclusively in hypogean habitats (troglobites). As a result of the evolution through isolation under a peculiar selective regime, characterized by permanent darkness and food limitation, troglobites generally present autapomorphies such as reduction of eyes and melanic pigmentation (classical troglomorphies), and other morphological, physiological and behavioral specializations.

In Brazil, systematic studies on the cave fauna began in the early 1980's. Since then, there was a rapid progress in the knowledge of hypogean ecosystems and particular rate, but there are still important gaps. A most serious problem is the taxonomic impediment and the paucity of biological and ecological data for several groups.

Brazil distinguishes worldwide by its remarkably rich and diversified subterranean ichthyofauna, with a great potential for research on aquatic Biospeleology. Having as basis faunistic inventories in different Brazilian karst areas, this project encompasses several aspects of the biology and ecology of subterranean fishes and other aquatic troglobites, some new and some in a higher level of detail and methodological sophistication. For fieldwork aiming to faunistic surveying, natural history and population ecology of selected fish species, several karst areas in the States of Bahia, Minas Gerais, Goiás, Mato Grosso, Mato Grosso do Sul and São Paulo, besides non-karst areas in Amazônia, were chosen. Specimens brought alive to the laboratory are used for behavioral (including chronobiological) and physiological studies, and preserved specimens for taxonomic (morphological and molecular systematics), anatomical (brain) and biological (diet, reproduction).

The detection of "hotspots" of subterranean biodiversity and detailed studies on specific rate are important steps for effective conservation actions, especially needed in the case of the fragile subterranean ecosystems and their troglobitic species.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

After three years of surveying, the confirmed number of troglomorphic fishes raised from 18 to 24, including the first record of troglobitic species for the family Callichthyidae and the trichomycterid *Glaphyropoma* and *Copionon*. As well, the number of troglophilic populations was significantly increased. Ichthyofaunistic surveys in surface water bodies, carried out for comparative purposes, helped to establish the troglobitic *versus* troglophilic status of subterranean populations, also contributing to the knowledge of the ichthyofauna in poorly known areas.

In addition to the description of new troglobitic species, morphological, cytogenetic and molecular taxonomic studies have been carried out for rate such as the Amazonian *Phreatobius* catfishes, the new *Rhamdiopsis* catfish from Chapada Diamantina,



Santana cave (photo A.L. Guil)

and the catfishes of the genera *Pimelodella* and *Rhamdia*. Data on distribution, allied to these taxonomic studies have been the basis for the evolution and subterranean populations differentiation hypothesis.

Techniques of individual identification using permanent tags were used in long-term population studies, encompassing several annual cycles, thus allowing for the detection of annual patterns. The duration of this project has being fundamental for this. Studies on the heptapterids *Rhamdia enfernada* (Bahia), *Pimelodella spelaea* (Goiás) and *Pimelodella kronei* (São Paulo) are in progress. Visual censuses were applied to fishes with sizes insufficient for identification and/or with low population densities. Previously studied species could be monitored. The data obtained are the basis for efficient conservation actions.

Studies on the locomotor rhythmicity were carried out for eight species, which showed different degrees of reduction in time control mechanisms, apparently correlated with their degree of troglomorphy. Other behaviors focused include the reaction to light, hiding habits and agonistic interactions. As observed for morphological characters, behavioral specializations have a mosaic distribution in the studied species, revealing interesting and complex evolutionary patterns.

Physiological studies revealed the complexity of pigmentation reduction mechanisms in troglobitic fishes, which includes changes in the response to hormones (detailed study in progress) and loss of melanin production, caused by different mechanisms.

Collections of terrestrial invertebrates also resulted in the discovery of new and interesting troglobitic species. Some of these species have already been described.

MAIN PUBLICATIONS

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