

# POECILIID RESEARCH

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Short Note

## Law helps, but shows up rather late: The case of Biharean thermal endemic species

Gheorghe Bunea<sup>1</sup>, Ioan G. Oroian<sup>2</sup>, Alexandru Todea<sup>3</sup>

<sup>1</sup>“Bogdan Vodă” University, Cluj-Napoca, Romania; <sup>2</sup> Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania; <sup>3</sup> Department of Economics, Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania.  
Corresponding author: I. G. Oroian, neluoroian@yahoo.fr

**Abstract.** “Băile Felix” and “Băile 1 Mai” are two thermal spa resorts located in a hilly area with beach and oak tree woods, 8 km south of the municipality of Oradea and 22 km south-east of Borș. The region is a mixture of natural reservation and edifices for tourism. The thermal springs are sulphuric, calcic, sodic, and rich in bicarbonate, suitable for spa. Illegal drilling and overexploitation of geothermal and water resources have led to the aquatic natural reserve drying. Although the lake survived to a whole ice age, due to the last ten years of uncontrolled geothermal exploitation, the surface of Pețea Lake is now less than 10 square meters. The endemic species (*Scardinius racovitzai*, *Melanopsis parreyssi* and *Nymphaea lotus thermalis*) are fate to extinction. On the other side, Biharean thermal waters were the only source of feral Poeciliid fish in Romania. They were released from aquaria by hobbyists and unwanted in the reservation. However, feral populations of Poeciliid fish are good sources of information for understanding the ecology, behavior and evolution of vertebrates. The endemic species were moved temporarily into aquaria for semi natural reproduction. An international consortium, supported by The Conservationist Foundation of Saudi Prince Mohamed bin Zayed, started the project and successfully finished this work. The project was allocated 13,000 US dollars. However, the young animals and plants cannot be released in the lake because the spring is still dry. Authorities decided to limit the exploitation of the deposit of Băile 1 Mai and Băile Felix resort. Hoteliers and guesthouses will be forced to reduce the flow of drilling below 300 liters per second. Although good, this action could be pretty late.

**Key words:** Oradea, Bihor, thermal aquifer, endemic species, extinct in the wild, Poeciliid fish.

**Natural Reserve “Băile Felix”: Unique in Europe.** “Băile Felix” and “Băile 1 Mai” are two thermal spa resorts located in a hilly area with beach and oak tree woods, 8 km south of the municipality of Oradea (seat of Bihor County, Romania) and 22 km south-east of Borș (border checkpoint to Hungary). The region is a mixture of natural reservation (thermal springs, rivulets and lakes) and edifices for tourism. The thermal springs (20-48°C) are sulphuric, calcic, sodic, and rich in bicarbonate, suitable for spa.

Reserve “Băile 1 Mai” (Natura 2000 site; Fig.1) was quite small, but of a rare biodiversity and extremely high vulnerability. It was based in 1932 along the Pețea rivulet, having a length of 1.5 km (Olteanu-Cosma 1977). The thermal aquatic environment sheltered for thousands of years several species, some of which are today considered tertiary relicts and/or endemic species. Such rare species are the Petzea rudd, *Scardinius racovitzai* Müller, 1958, the thermal snail *Melanopsis parreyssi* Philippi, 1848, and *Nymphaea lotus* var. *thermalis* (D.C.) Tuza (Fig.2), a natural monument (Mag et al 2009). There are also many other invertebrates to be conserved in this particular environment (Sas-Kovács 2014; Rakosy L., personal communication).

Besides the native flora and fauna, in the last decades there was in the reservation and its neighborhoods a high diversity of exotic species: Poeciliidae (*Poecilia reticulata* Peters, 1859, *P. sphenops* Valenciennes, 1846, *Xiphophorus hellerii* Heckel, 1848), Osphronemidae (*Macropodus opercularis* Linnaeus, 1758 (Fig.3), *Trichopodus trichopterus* (Pallas, 1770), *Betta splendens* Regan, 1910), ornamental cyprinids (*Cyprinus carpio* var. *koi*; *Carassius auratus auratus* (Fig.3)), exotic chelonians (*Trachemys scripta* var. *elegans* (Fig.3)), and aquarium plants (*Miriophyllum aquaticum* (Vell.) Verdc., *Limnophila heterophylla* Benth., *Cabomba caroliniana* Gray, 1837),



Fig. 1. Reserve Băile 1 Mai, Pețea Lake, in 2008 (photo by Miruna Iacob).

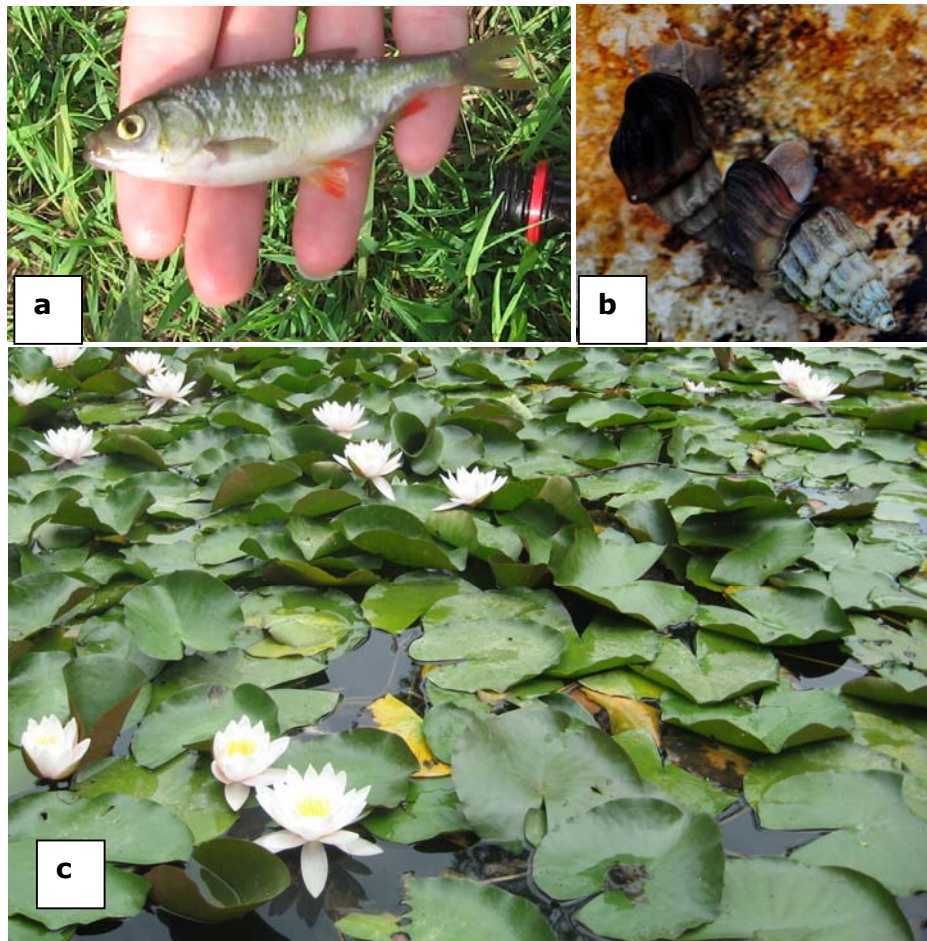


Fig. 2. Species to be conserved at "Băile 1 Mai" and "Băile Felix": *Scardinius racovitzai* (a) (photo: Miruna Iacob), *Melanopsis parreyssi* (b) (photo: Peter Lengyel), and *Nymphaea lotus* var. *thermalis* (c) (photo: Miruna Iacob).

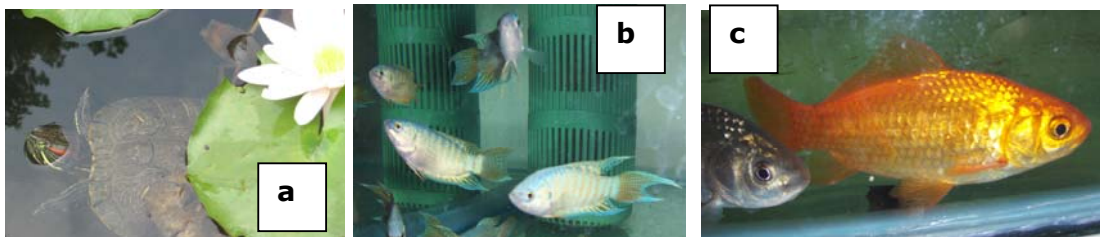


Fig. 3. Non-native species from Biharean thermal springs: *T. scripta* var. *elegans* (a) *M. opercularis* (b) and *C. auratus aratus* (c).

*Ceratopteris thalictroides* (L.) Brongn, *Najas guadelupensis* (Spreng.) Magnus) (Iacob & Petrescu-Mag 2008; Petrescu-Mag et al 2008; Mag et al 2009). However, most of the above mentioned exotic species are unwanted in the reservation and detrimental to the native biodiversity (Olteanu-Cosma 1977; Bud et al 2006; Mag et al 2009; Petrescu-Mag et al 2013).

### Economic Interests against Conservation

**Oradea Triassic Aquifer: Geothermal Energy.** The Oradea aquifer was identified during 1963 and 1964 by the drills no 4005 and 4006. Then, between 1965 and 1988, it was researched from geological and hydrodynamical point of view, using twelve wells (Haiduc et al 2008; see also in Petrescu-Mag et al 2009). The Oradea aquifer is located in

Triassic limestone and dolomites, at 2200-3400 meters depth; the surface of the geothermal perimeter is about 113 km<sup>2</sup>. The aquifer was exploited by twelve wells, from which eleven wells were used as production wells and one for the reinjection of the waste geothermal water. The Oradea aquifer had a natural recharging with the outflow in the perimeter of Băile Felix and Băile 1 Mai. The geothermal water from the Oradea Triassic aquifer has temperatures between 70 and 105°C, the values are decreasing from the West (105°C) to the East (70°C). The average temperature of the eleven production wells is about 90°C (Țenu 1981; Coșuț 1986). The energetic potential of the twelve wells was about 150000 Gcal/year and the annual quantity of geothermal energy supplied for consumers was around 60000 Gcal (Bococi 2005; Petrescu-Mag et al 2009).

**Spa for Tourists.** Over one hundred years, around Oradea town, drillings were made and geothermal waters were exploited for therapeutical purposes. The soothing effect of the waters on articular and muscular pain and on various rheumatic neuralgias accounts for the fame of cures in the resort for the treatment of inflammatory rheumatic diseases (rheumatic polyarthrititis, rheumatoid spondylitis, conditions after acute articular rheumatism), degenerative and articular rheumatic diseases, central and/or peripheral neurological disorders, gynecological or endocrine diseases, post-traumatic conditions etc. At present, the modern medical base has at its disposal various facilities for procedures involving electrotherapy, hydrotherapy, aerosols, massage, paraffin packing and other water treatments.

Concerning the water chemistry, the last data available (Petrescu-Mag et al 2009) shown that the content of sulphate ion was about 350-900 mgL<sup>-1</sup>, and 190-300 mgL<sup>-1</sup> for the bicarbonate ion. The calcium content for hot waters was about 140-300 mgL<sup>-1</sup>, and for magnesium was about 40-75 mgL<sup>-1</sup>. The sodium content was relatively low: 7 mgL<sup>-1</sup> up to 117 mgL<sup>-1</sup>, as the level of ammonia ion (0.1-4 mgL<sup>-1</sup>). Like most of the geothermal fluids of meteoric origin, Bihorean geothermal fluids had low chlorine content (19-50 mgL<sup>-1</sup>).

**The Result.** Illegal drilling and overexploitation of geothermal and water resources have led to drying (see Fig.4). Although the lake survived to a whole ice age, due to the last ten years of uncontrolled geothermal exploitation, the present surface of Pețea Lake is less than 10 square meters, while endemic species are fate to extinction.



Fig. 4. The present state of the natural reserve Pețea Lake "Băile 1 Mai". Source: Cristian Horgoș, Bihor Online.

**The Poeciliid Fish Have Disappeared From the Map of Romania.** Bihorean thermal waters were the only source of feral Poeciliid fish in Romania (Fig.5). Their origin is surely aquarium (see Mag et al 2009 and explanations therein). Besides Poeciliids and other aquarium fish there were many attempts by Bihorean farmers to introduce new exotic species for aquaculture (Bud et al 2004). Fortunately, they were not able to survive in the wild. It is generally accepted that exotic species are detrimental to biodiversity because they compete with the native species for food and spawning places (Gavriloaie & Rusu 2010; Gavriloaie et al 2010; Hărșan & Petrescu-Mag 2008). However, feral populations of Poeciliid fish are good sources of information for understanding the ecology, behavior and evolution of vertebrates (Petrescu-Mag 2008; Lozinsky 2009; Miller et al 2010; Păsărin & Petrescu-Mag 2011).



Fig. 5. Other non-native fish: *P. reticulata* (a), *P. sphenops* (b) and *X. hellerii* (c).

**What about Endemic Species?** Endemic species were moved into aquaria for semi natural reproduction. An international consortium, funded by The Conservationist Foundation of Saudi Prince Mohamed bin Zayed, started the project and successfully finished this work. The project was allocated 13,000 US dollars. However, the young animals and plants cannot be released in the lake because the spring is still dry.

**Finally, the Law Shows Up.** Authorities decided to limit the exploitation of the deposit of Băile 1 Mai and Băile Felix resort. Hoteliers and guesthouses will be forced to reduce the flow of drilling below 300 liters per second (Digi24, <http://www.digi24.ro>).

**Final Remarks.** Although the scientist could reproduce the endemic species in laboratory and aquaria, the animals lost their home. To cut the long story short: "extinct in the wild". Paradoxically, we like to release exotic aquarium fish in the wild and, finally, host the native wildlife in aquaria.

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Authors:

Gheorghe Bunea, "Bogdan Vodă" University, 26A Grigore Alexandrescu Street, Cluj-Napoca, Romania.

Ioan G. Oroian, Department of Environment and Plant Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine, 3-5 Calea Mănăștur Street, Cluj-Napoca 400372, Romania, e-mail: neluoroian@yahoo.fr

Alexandru Todea, Department of Economics, Faculty of Horticulture, University of Agricultural Sciences and Veterinary Medicine, 3-5 Calea Mănăștur Street, Cluj-Napoca 400372, Romania.

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