Pelophylax ridibundus (PALLAS, 1771) winter activity in thermal sulphurous water in Dobroudja (SE Romania)

Winter activity in amphibian species, while normally absent in regions where freezing occurs, can however, be present wherever a favorable microclimate exists that ensures temperatures suitable for amphibian activity and feeding. Sometimes amphibians become active during warm spells in winter – e.g., JABLONSKI 2013 for *Lissotriton vulgaris* (LINNAEUS, 1758), and literature quoted therein for other species; the authors observed the same for *Bufo* (*Bufotes*) *viridis* LAURENTI, 1768 (IFTIME & IFTIME, unpublished data). In other circumstances, amphibians can be active and even reproduce regularly throughout the winter, irrespective of the air temperature, in thermal surface water microhabitats, which are quite numerous in Western Romania (see, e.g., COVACIU-MARCOV et al. 2006; SAS et al. 2010; COVACIU-MARCOV et al. 2011; BOGDAN et al. 2011; SAS et al. 2012), showing their capacity for thermal acclimation (cf. DUELLMANN & TRUEB 1994).

The electrolyte contents and concentration of the water they live in is another limiting factor for amphibians, with some able to withstand greater concentrations of dissolved substances than others. Thus, some amphibians can breed in brackish or saline water; others in sulphurous waters, rich in hydrogen sulphide (H_2S) – see, e.g., IFTIME & IFTIME (2012), and literature quoted therein. The combination of thermal and sulphurous water as an amphibian habitat is also sometimes found e. g., ORUÇI (2010).

Here, the authors report the case of a few individuals of *Pelophylax ridibundus* (PALLAS, 1771), found active throughout the winter of 2014-15 in a habitat consisting of a pipe discharging mesothermal sulphurous water to the sea. The discharge pipe runs through the beach at Cap Aurora (43°50' 54.189" N and 028°36'10.6956" E), a tourist resort, and is open in several points, which are constructed to allow visitation and are similar to small fountain-like structures, covered with movable concrete lids. The general mineralization of sulphurous waters in this region, which belong to a larger hydrothermal system that also feeds the well-known Movile cave (MUSCHIOL et al. 2015) is high, but variable (see SÂRBU & POPA 1992; FLOT et al. 2014 for mineralization and H_2S content). While the water in the mesothermal sulphurous pool in proximity emerges from the ground at a temperature around 24 °C, that in the discharge pipe in winter varied narrowly from 11 to 13 °C. The discharge pipe also contained various live insect larvae and adults, but also dead crabs that penetrated through the discharge in the nearby sea and died (possibly because of inadequate water chemistry, although they can be seen around natural sulphurous springs in the sea). In early summer, *B. viridis* was present in the same habitat, possibly having bred successfully (metamorphs were coming out of the visitation points) – this being the only amphibian found here besides *P. ridibundus*.

In this microhabitat the authors found cold season active *P. ridibundus*, probably three specimens of which one was more readily observable, during visits in November 29, 2014 (air temperature ca. 4 °C), January 3, 2015 (air temperature ca. 0 °C but following a cold spell reaching -10 °C) and February 11, 2015 (air temperature ca. 1 °C). In all instances, frogs were sitting at the surface in the open points but immediately reacted to intrusion by diving into the water and into the horizontal pipe, away from the accessible visitation structure. The observations could not be continued in the 2015-16 cold season: the water level in the discharge pipes was much lower in December 1, 2015, which may be due to a light eustatic variation in the sea level (as, e. g., described by BONDAR 2007, but in the opposite sense) that could have led to a retreat of the sea and therefore making water buildup impossible in the visitation structures (which were isostatic with the sea, but saturated with thermal water).

The present observation of non-hibernating *P. ridibundus* is the first for southeast Romania, well away from the sites of earlier reports in the west of the country. It confirms that this species is among the most adaptable to thermal microhabitats (comp. discussion in COVACIU-MARCOV et al. 2006; DUELLMANN & TRUEB 1994). However, in

the present case, the water temperature is lower than in most other thermal habitats of non-wintering amphibians, falling in the range where *P. ridibundus* no longer hibernates, but cannot breed through the winter (COVACIU-MARCOV et al. 2006; BOGDAN et al. 2011). This illustrates the adaptability of *P. ridibundus* and its readiness to occupy what would appear to be marginal habitats, but which offer the opportunity for all-year activity.

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