Evaporative water loss in amphibians

Evaporativni gubitak vode kod vodozemaca

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Introduction

In the era of increasingly frequent heat waves and long drought periods, water availability is a problem for all organisms, especially amphibians whose life functions are closely related to humid habitats. Evaporative water loss (EWL) is the process of losing water by evaporation from the body surface into the surrounding air, and is expressed as the mass of water that evaporates from the body surface over time (mg cm^{-2} h^{-1}).[1] EWL is one of the most important physiological processes in amphibians due to their extremely permeable skin, and is closely related to the ecological adaptations of individual species.[2] Most amphibians are considered "typical" with relatively high EWL values (e.g. aquatic, semi-aquatic, fossorial species, toads), while "atypical" species are characterized by low EWL (arboreal species).[3,4] The aim of this study was to determine the intensity of evaporative water loss in semi-aquatic water frogs (genus *Pelophylax*) from Stara Drava, Višnjevac (Osijek). The genus *Pelophylax* (family *Ranidae*) is characterized by frequent hybridization between species and complicated species determination.[5] The individuals were exposed to dry conditions, during which their mass was measured, based on which EWL values were determined.

Materials and methods

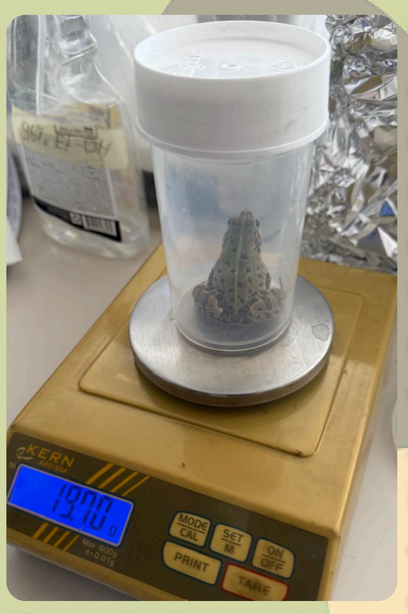


Figure 2. Frog weighing using a digital scale

Ten *Pelophylax* individuals were caught at Stara Drava, Višnjevac using a fishing net and by hand. Morphometric parameters and mass of the frogs were measured in the field. The frogs were placed in marked containers with 2-3 cm deep water where they spent 44 hours. After this hydration phase, the individuals were placed in new containers, which were placed in chambers, each containing 100 grams of silica gel taped to the lid as the main desiccant (Figure 1.).

The individuals were then weighed every 15 minutes over a period of 4 hours (Figure 2.), after which they were returned to the wild. The recorded mass loss was used to obtain the frogs' EWL. The surface-area-specific EWL was calculated using the estimated body surface area of the individuals. The program *jamovi* (Version 2.6) was used for statistical analysis of the results.



Figure 1. Chambers containing silica gel. The chambers were wrapped in aluminium foil to achieve constant temperature of 25 ° C

Conclusion

The obtained results indicate that species of the genus *Pelophylax* have characteristics of "typical" amphibians, species that do not own specific physiological adaptations to reduce evaporative water loss but maintain water balance primarily by being constantly directly connected to humid and aquatic habitats. The results confirm the importance of EWL as one of the fundamental physiological processes that shapes the biology and ecology of anurans and amphibians in general. In the context of current climate change and frequent dry periods, knowledge of the process of EWL may be important for understanding future changes in the distribution, activity, and survival of amphibian populations.





Results

Initial body mass of individuals ranged from 5.07 g to 39.77 g, and body length (SVL) between 69 mm and 34 mm. After 4 hours in desiccating conditions, the individuals with the lowest initial mass had the highest percentage of lost body mass (Figure 3.).

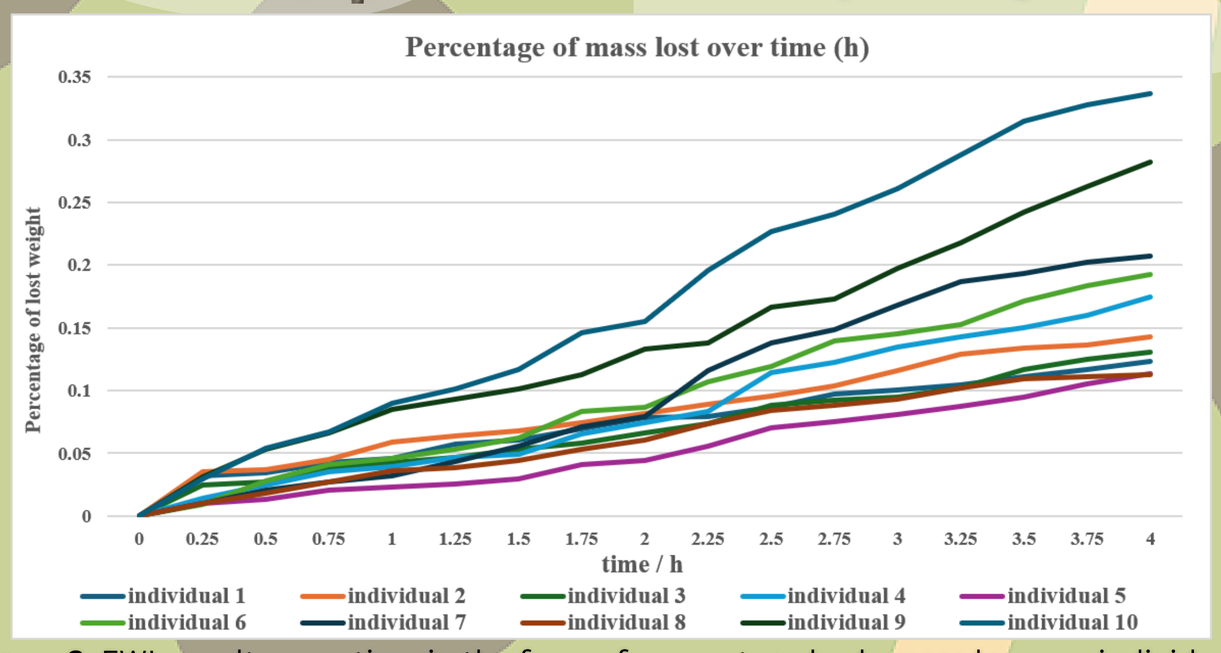


Figure 3. EWL results over time in the form of percentage body mass loss per individual. Maximal mass loss percentage of 33.7% was recorded in individual 10 (the smallest individual), while the minimal of 11.26% was recorded in individual 8.

A significant negative correlation was established between the initial mass and the percentage of lost mass using Pearson's correlation analysis (r = -0.736; p = 0.015), meaning that smaller individuals lose higher water percentages and vice versa. The average surface-area-specific EWL of measured individuals (Table 1.) was 20.13 mg cm^{-2} h^{-1}.

Table 1. Evaporative water loss per unit of body surface in individuals of the genus *Pelophylax* (mg cm^{-2} h^{-1})

Individual number	1	2	3	4	5	6	7	8	9	10
EWL (mg cm^{-2} h^{-1})	22.99	20.44	17.08	18.66	14.68	21.74	17.18	20.34	23.56	24.62





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