Conservation of the endangered endemic parthenogenetic lizards in Armenia

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Acknowledgment

We would like to express our heartfelt gratitude to the Rufford Small Grants for their generous support of our project focused on the conservation of endemic and endangered parthenogenetic rock lizards. This support is of profound importance, not only for our conservation efforts but for Armenia and Yerevan State University as well. For Armenia, a country rich in biodiversity, the preservation of these unique and endangered lizard species is crucial. By supporting our project, the Rufford Small Grants are actively contributing to the protection of Armenia's natural heritage and its ecological health. We are especially grateful to the reviewers of the project, Prof. Marine Arakelyan - Head of the Department of Biology YSU, Prof. David Tarkhnishvili, Dean, School of Natural Sciences and Medicine, Ilia State University, Georgia, Karen A. Ghazaryan Dean Yerevan State University, Faculty of Biology. The experience gained through this project, made possible by the Rufford Small Grants, not only enriches our educational programs but also provides our students with valuable hands-on experience in the field of conservation.

INTRODUCTION

Caucasian rock lizards of the genus Darevskia (Lacertidae) are the first group of terrestrial vertebrates, in which true parthenogenesis was discovered (Darevsky 1958). Armenia is the distribution range of three unique and endemic parthenogenetic lizard species:

D. rostombekowi is classified as "Endangered" according to the International Union for Conservation of Nature (IUCN) criteria and included in the Red Book of Armenia (2010). It is also listed as "endangered" (EN) in the IUCN Red List (Ananjeva, Aghasyan, 2009). Protected areas such as the national parks of "Dilijan" and "Sevan" serve as crucial habitats for its conservation.

D. dahli, a species teetering on the edge of endangerment according to the Red Book of Armenia and labeled "Near Threatened" by the IUCN, finds its stronghold in the northeastern reaches of Armenia and the southern fringes of Georgia.

D. unisexualis, residing in the "Vulnerable" category according to the IUCN and similarly labeled "Near Threatened" in the Red Book of Armenia.

During the project, the following objectives were fully or partially achieved:

ACTIVITY	STATUS
Fieldwork survey for determining presence/absence of lizard in their area	Finished
Estimation lizards' population density	Finished
Identifying new sites using maps	Established, ongoing
Develop the actions plan for each target plan	Established, ongoing
Preparing the detailed maps of endangered species with sites which need in protection for presentation to related authorities	Established, ongoing
Presentations and posters in social media	Finished
Installing the information boards in Zoo, near to monasteries, and near to tourist attractive sites about parthenogenetic lizards	Finished
Lectures in Yerevan State Universities, Public center of Biodiversity in Yerevan and local schools	Finished

D.dahli *D.rostombekowi* *D.unisexualis*



EDUCATION AND SOCIAL ACTIVATES

This report outlines our efforts at Yerevan State University (YSU) to enhance awareness of biodiversity, specifically regarding lizard conservation in Armenia, through proactive educational initiatives and collaborations. We organized seminars targeting students and schoolchildren to share insights about our research, which effectively inspired curiosity about lizards within Armenia's ecosystems. Our participation in prominent events, including the **STARMUS VI Festival** and an **EXPO** at YSU, allowed us to showcase our findings to a broader audience and engage in meaningful discussions surrounding ecological conservation. Additionally, we secured approval from the **Ministry of Enviromental Protection** to establish an educational stand in Dilijan National Park to further promote lizard conservation efforts, complemented by the design of a themed educational poster. Our collaboration with **Yerevan Zoo** aims to create a dedicated corner for rock lizard conservation, enhancing public education. Collectively, these initiatives seek to bridge the gap between scientific research and community engagement, fostering a robust understanding of Armenia's unique biodiversity and encouraging conservation efforts.

https://www.facebook.com/dilijannationalpark/posts/572597588652782?ref=embed_post

https://www.facebook.com/RuzannaPetrosyan258/posts/8639996339411556?ref=embed_post

https://www.facebook.com/ysu.am/posts/1016446030514412?ref=embed_post

Education


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In the Yerevan Zoo

RESEARCH ACTIVITIES

According to the scientific literature, there are about 14 populations of *Darevskia rostombekowi* in Armenia (Table 1). Our thorough investigation of these localities revealed the presence of this species only in eight habitats. *D. rostombekowi* has been preserved in the regions of Tavush, Lori, and Gegharkunik on several small isolated islands. Population counts showed a low number of individuals in these populations.

Table 1.
Number of lizard habitats near major cities in Northern Armenia and Lake Sevan.

Source of data	Dilijan	Spitak	Ijevan-Noemberyan	Sevan lake	Total
Literature	4	3	6	1	14
Field research 2015	3	2	2	1	8

The results of data processing using MaxEnt showed that the most suitable regions for the distribution of this species are in northern and northwestern Armenia. Some regions in eastern Armenia and Syunik province were also identified as areas suitable for *D. rostombekowi* habitat, however, the species' range does not extend to these areas. Figure 1 shows that red indicates complete habitat suitability, green represents possible habitats, and blue indicates the absence of necessary biotopes. Analysis of MaxEnt results showed that the most suitable areas for *D. rostombekowi* habitat coincided with those areas where data on the species' distribution are available.

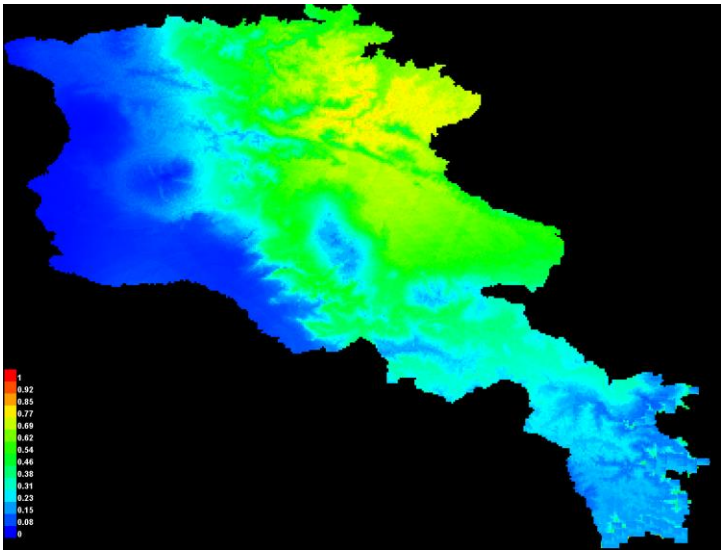

Figure 1. The model of *D. rostombekowi* distribution in Armenia created using MaxEnt software.

The population at Lake Sevan occupies a small area of 4-5 hectares, located approximately 2 km from the lake, in the vicinity of Lake Sevan. The second population is located directly in Dilijan city.
In both populations, *D. rostombekowi* shared its habitat with sympatric species of rock lizards: *D. unisexualis* in the "Sevan" population and *D. dahli* and *D. armeniaca* in the "Dilijan" population.

In the "Sevan" population, during route counts (3 days, 4 routes each, 1 km long), 352 individuals of *D. rostombekowi* and 345 individuals of *D. unisexualis* were recorded, while in Dilijan only 43 individuals of *D. rostombekowi*, 81 individuals of *D. dahli*, and 12 individuals of *D. armeniaca* were counted. In both populations, *D. rostombekowi* showed a significant overlap in spatial and ecological niches with sympatric species of rock lizards. To count *D. rostombekowi* in the "Sevan" population, 4 routes, each 1 km long, were selected. The abundance of the two lizard species on the 4 routes, there were no significant differences in habitat preferences, and the two parthenogenetic species coexisted well together.

Table 2. Density of two lizard species in the "Sevan" population.

		D.rostombekowi	***D.unisexualis***
Date	**Routes**		
18 June	1	87	97
	2	80	45
	3	44	48
	4	21	30
	Total	*232*	*220*
19 June	1	50	54
	2	75	87
	3	66	81
	4	54	65
	Total	*245*	*278*
14 September	1	64	30
	2	52	32
	3	12	11
	4	7	5
	Total	*135*	*78*

To estimate the population size of *D. rostombekowi* in the Dilijan population, four 1 km routes were also selected (Table 3). As shown in Table 3 regarding the distribution of the three syntopic species of rock lizards, *D. dahli* was the most abundant on all routes, while *D. rostombekowi* ranked second in terms of abundance, and *D. armeniaca* was the least abundant.

It is interesting to note that, similar to the Sevan population, *D. rostombekowi* remains active for a longer period in the autumn, while *D. dahli* and *D. armeniaca* go into hibernation earlier.

Table 3. Population structure of two lizard species along the route in the Dilijan population.

		D.rostombekowi	*D.dahli*	*D.armeniaca*
Date	Route			
20-June	1	17	25	3
	2	2	9	3
	3	4	12	0
	4	1	5	0
	Total	24	51	6
21- June	1	0	0	0
	2	15	26	4
	3	2	8	0
	4	4	3	0
	Total	21	37	4
22- June	1	16	32	3
	2	6	19	2
	3	1	0	0
	4	0	0	0
	Total	23	51	5
16-Spetember	1	10	5	4
	2	16	8	5
	3	14	7	6
	4	5	3	2
	Total	45	23	17

Comparison of two populations of *D. rostombekowi* revealed a significant difference in population density (t-value = 6.50, $p < 0.0001$): the population density from the shore of Lake Sevan was significantly higher than that of the "Dilijan" population.

On average, the "Sevan" population had 59 individuals of *D. rostombekowi* per 1 km or 295 lizards per 1 ha and 65 individuals of *D. unisexualis* per 1 km or 325 lizards per 1 ha. In the "Dilijan" population, the mean number of *D. rostombekowi* was 7 lizards per 1 km or 35 lizards per 1 ha, 10 lizards of *D. dahli* per 1 km or 50 individuals per 1 ha, and 2 lizards of *D. armeniaca* or 10 individuals per 1 ha.

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