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Good news from newts: distribution, population size, and dynamics of two protected newt species in the Jiu Gorge National Park, Romania

Severus-Daniel Covaciu-Marcov[1]✉, Denisa-Marina Pop[2], Felicia-Nicoleta Sucea[3], George-Adelin Ile[4,5], Alfred-Ştefan Cicort-Lucaciu[1] and Sára Ferenţi[1]

[1]University of Oradea, Faculty of Informatics and Sciences, Department of Biology, Oradea, Romania; [2]Dent AS MED Oradea, DiaSer Laboratory, Oradea, Romania; [3]Jiu Gorge National Park; Bumbeşti-Jiu, Romania; [4]Technological High School "Toma Socolescu", Ploieşti, Romania; [5]National Military College "Dimitrie Cantemir" Breaza, Breaza de Sus 105400, Romania;
✉***Corresponding author, E-mail:*** ***severcovaciu1@gmail.com***

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Abstract. Long-time monitoring studies recently indicated that newts are in decline in many regions. Motivated by the above-mentioned, in the year 2019, we started monitoring the newt populations from the Jiu Gorge National Park (JGNP) in the Romanian Carpathians, 10 years after the previous study on the same topic. Compared with other areas where newts are in decline, we identified new distribution locations of the two newt species which are present in the park. Also, the previously known populations have greatly increased. Thus, the *Lissotriton vulgaris* population increased 2.58 times in 10 years, and the *Triturus cristatus* increased 1.80 times in 10 years. At the same time, in areas from JGNP affected by human activities in the past (abandoned quarry and areas adjacent to the railway), the newts extended their range in the last years and occupied artificial aquatic habitats. In the case of the populations from the natural habitat, the temporal dynamics and the ratio between sexes and species followed the same evolution as in the case of other populations from Romania. The increase of newt populations from JGNP in the last 10 years was most probably a consequence of the reduced human pressure, corroborated with the large surface occupied by native forests in the

park. Thus, in natural areas, probably the best management measures for both newt species are not represented by direct (invasive) human interventions but by the conservation of the natural habitats used by the newts. A protected area should maintain the conservation status at least at the present level, and if the region is natural, this fact will maintain and also increase the newt and probably other amphibian populations.

Keywords: *Triturus cristatus*, *Lissotriton vulgaris*, habitats, forests, Carpathian Mountains, natural protected area.

Introduction

Newt decline is a well-known fact, as it was documented in numerous regions (see Denoël, 2012). Usually, this is a consequence of habitat alteration (e.g., Ficetola and De Bernardi, 2004; Arntzen *et al.*, 2017; Cupşa *et al*., 2020),. Nevertheless, recent data have shown that newt decline also occurs in stable habitats (Falaschi *et al.*, 2022). Thus, in northern Italy, in the case of two newt species, the population reduction was between 57% and 63% and was caused in the first place by invasive fish and crayfish (Falaschi *et al.*, 2022). Besides these, there are other studies that document reductions in newt populations (e.g., Griffiths *et al.*, 2010; Samraoi *et al.*, 2012; Arntzen *et al.*, 2017; Sinsch *et al.*, 2018; von Bülow and Kupfer, 2019). Nevertheless, newts decline seems to be more documented in Western Europe (see Denoël, 2012). Unlike this, in Romania, there are numerous distribution records of newts (see Cogălniceanu *et al.*, 2013), even recent ones (e.g., Bogdan *et al.*, 2013, 2014; Bondar *et al.*, 2018; Cupşa *et al.*, 2020). Besides these, there are also several studies regarding the effective of some newt populations in western Romania, populations which generally seem larger and stable (Cicort-Lucaciu *et al.*, 2009, 2010, 2011; Bogdan *et al.*, 2012; Dobre *et al.*, 2009). But these studies only present the status of some populations at a certain moment, without having any comparison base in the past, in the conditions in which the decline of newts was registered in studies that aimed longer time periods (e.g., Arntzen and Thorpe, 1999; Arntzen *et al.*, 2017; von Bülow and Kupfer, 2019; Falaschi *et al.*, 2022). A region in Romania with some data regarding the effective of two newt species populations is the Jiu Gorge National Park - JGNP (Dobre *et al.*, 2009). Nevertheless, the status of newts in JGNP does not seem exactly favorable, as in the region, only one habitat is able to sustain a large newt population because of the extremely steep relief, which, as a consequence, is unfavorable to aquatic habitats (Covaciu-Marcov *et al.*, 2009). Thus, in the year 2009, in that habitat were present 89 *Triturus cristatus* (Laurenti, 1768) individuals and 486 *Lissotriton vulgaris* (Linnaeus, 1758)

individuals (Dobre *et al.*, 2009). Due to the rarity of aquatic habitats, newts in JGNP ended up using even artificial habitats such as the settling ponds of a stone quarry (Ile and Sucea, 2018). Even if it is considered that the occurrence pattern of *T. cristatus* can be indicated by the aspect of the terrestrial habitats (Gustafson *et al.*, 2011), this fact is probably true in areas with numerous aquatic habitats available to the newts, which is not the case in JGNP (Covaciu-Marcov *et al.*, 2009). In JGNP, there are numerous terrestrial habitats favorable for the newts as a consequence of the large surface occupied by natural, deciduous forests (Theme no.11.RA/2004). Nevertheless, this fact had no influence upon the aquatic habitats, which are rare because of the relief (Covaciu-Marcov *et al.*, 2009), and newts need both (e.g., Müllner, 2011; Denoël and Lehmann, 2006; Denoël and Ficetola, 2008; Gustafson *et al.*, 2011). Moreover, in the last years, the droughts narrowed the few aquatic habitats available to the newts; therefore, in the JGNP, *T. cristatus* ended up frequently consuming *L. vulgaris* individuals (Sucea *et al.*, 2014). This was even worsened by the fact that the last years were warmer and drier in southern Romania (e.g., Bogdan and Marinică, 2010; Marinică and Marinică, 2012; Pravalie *et al.*, 2014). Thus, we hypothesized that the drought further negatively affected the newts in JGNP in the time since the previous studies (Covaciu-Marcov *et al.*, 2009; Dobre *et al.,* 2009). Knowing that newts are declining (e.g., Denoël, 2012; Arntzen *et al.*, 2017; von Bülow and Kupfer, 2019; Falaschi *et al.*, 2022), that JGNP is a natural protected area and that newts are protected (Law 49 / 2011), we aimed to monitor the newts in JGNP 10 years after the previous study from the region (Dobre *et al.*, 2009). For this, in the year 2019 we studied the newts in JGNP with the following objectives: **1.** identifying potential new distribution records, **2.** monitoring the populations in the habitat which was previously investigated with the same methods (Dobre *et al.*, 2009).

Material and Methods

The fieldwork was made in the warm season of the year 2019. Thus, starting with March and until October, we made each month a field trip in JGNP. In spring, the activity took two days, but subsequently, only one day was enough in the field. The studied region is situated in south-western Romania, in the western part of the Southern Carpathians, as JGNP is a mountainous area covered with extensive, mainly beech, forest (Theme no.11.RA/2004).

Because our study had two objectives, the methods that we used differed according to them. When we aimed to record new distribution records of newts in JGNP, we made transects through different areas of the park that we considered suitable for newts' aquatic habitats, especially for

T. cristatus, which is related to larger aquatic habitats (e.g., Fuhn, 1960; Skei *et al.*, 2006). The same method was used in the case of the herpetofauna in other protected areas in Romania (e.g., Covaciu-Marcov *et al.*, 2009, 2020). Because the alpine newt was previously recorded only in a very small area of JGNP, at altitudes above 1100 meters (Covaciu-Marcov *et al.*, 2009), this species was not especially searched, but it wasn't either identified in any habitat. If we encountered suitable aquatic habitats, newts were directly observed in the case of clear and shallow waters without being captured. In deeper and more turbid waters, newts were captured with a round net mounted on a two-meter-long metal handle; this dip net was used in other studies (e.g., Covaciu-Marcov *et al.*, 2020; Cupşa *et al.*, 2020). Newts were released in their habitats immediately after their capture.

The evaluation of the population size of *T. cristatus* and *L. vulgaris* took place firstly in the habitat from Comandă, which is considered the only one from JGNP that shelters large populations of both species (Covaciu-Marcov *et al.*, 2009; Dobre *et al.*, 2009). This is the most important (relatively permanent) aquatic habitat available for newts in JGNP; thus, it was repeatedly described previously (Covaciu-Marcov *et al.*, 2009; Dobre *et al.*, 2009; Sucea *et al.*, 2014). The size of this habitat varied depending on the rainfall regime, both between different years and in the case of the studied year seasons. Just like in the past (Dobre *et al.* 2009), the water depth reached an average of 40-50 de cm, rarely reaching 1 m; the length of the habitat was 7-10 m at its spring maximum after the snow melt, and the width was of 4-5m. The water surface reduced a lot during the warm season. The other habitats had smaller surfaces and depths, as they generally dried up faster. With the exception of the Meri quarry settling ponds which is a permanent habitat, the other was temporary and artificial habitats, which modifies from year to year. Thus, at Meri railroad station, the old habitat had a length of 3 m, a width of 1 m, and a depth of 30-40 de cm, with a lot of mud in the substratum and alders on the shores. The new habitat from Meri railroad station has a surface of more m^2, but it reached a depth of only 10-20 cm. In Vulcan Pass, the habitat was a puddle formed in wheel tracks on a mountain peak, without aquatic vegetation, with turbid water with only 20 depths. The habitats from the Meri Quarry settling ponds were also previously described (Ile and Sucea, 2018), as they are two artificial basins with 9 m length and 6 m wide and a half a meter depth, with a lot of mud in the substratum. In the Meri Quarry technological area, there were more puddles with a diameter between 1 and 6 m^2, and a depth of 30-40 cm, with crushed stones on the bottom and without vegetation, as they were described previously (Covaciu-Marcov and Sucea 2021). Finally, in the Meri quarry extraction area there were two ponds of 6 - 7 m in length, 2 - 3 m in width, and 30 - 40 cm in depth with rocky substratum and with no aquatic vegetation.

Population parameters (population size, sex ratio, etc.) were studied after capturing all individuals from the habitat at the time of the study, as in other cases (Cicort-Lucaciu *et al.*, 2009, 2010, 2011; Dobre *et al.*, 2009). The newts were captured with two dip nets, identical to the one described above. Each time, the nets were operated by the same two people, both from the shore and from the water. Similar methods of capturing newts were previously used, both in Romania (e.g., Covaciu-Marcov *et al.*, 2020; Cupşa *et al.*, 2020) and in other regions (Vuorio *et al.*, 2013). Each month we allocated an hour for capturing newts, time that was roughly sufficient to generally investigate the entire habitat. Subsequently, all newts captured during the study hour were determined, numbered, and their sex was established. After that, all newts were released into the habitat. During the summer, we monitored the presence of larvae. Also, in the case of other, smaller aquatic habitats from JGNP, we counted the newts and their sex.

Results

During 2019, we identified 10 amphibian species (including two newt species) in several distribution locations in JGNP (Tab. 1). Among newts, *T. cristatus* was the most widespread species, and among Anurans, *Bombina variegata* (Linnaeus, 1758) and *Rana dalmatina* Bonaparte, 1840 were the most widespread species (Tab. 1). The abandoned areas (at least at the time of the study) belonging to Meri quarry sheltered a high number of amphibian species (nine).

Table 1. Amphibian species observed in the investigated habitats in JGNP

	Comandă	**Vulcan Pass**	**Meri railroad station - old**	**Meri railroad station - new**	**Meri quarry - settling ponds**	**Meri quarry - technological area**	**Meri quarry - extraction area**
Salamandra salamandra (Linnaeus, 1758)	-	-	X	-	X	-	-
Lissotriton vulgaris (Linnaeus, 1758)	X	-	X	X	X	X	X
Triturus cristatus (Laurenti, 1768)	X	X	X	X	X	X	X

	Comandă	**Vulcan Pass**	**Meri railroad station - old**	**Meri railroad station - new**	**Meri quarry - settling ponds**	**Meri quarry - technological area**	**Meri quarry - extraction area**
Bombina variegata (Linnaeus, 1758)	X	-	X	-	X	X	X
Hyla arborea (Linnaeus, 1758)	-	-	-	-	-	X	-
Bufo bufo (Linnaeus, 1758)	X	-	-	-	X	X	X
Bufotes viridis (Laurenti, 1768)	-	-	-	-	X	X	-
Rana dalmatina Bonaparte, 1840	X	-	X	X	X	X	-
Rana temporaria Linnaeus, 1758	x	-	X	-	X	X	-
Pelophylax ridibundus (Pallas, 1771)	-	-	-	-	X	X	X
Total no. of species	6	1	6	3	9	9	5

The largest newt populations in JGNP are still present in the habitat at Comandă; the other habitats in JGNP shelter a much lower number of newts (Tab. 2). Nevertheless, also in most of the other habitats, newt populations seem viable, a fact indicated by the presence of larvae (Tab. 2). In the habitat from Comandă, the maximum number of newts was registered on 20 April 2019, when in the habitat, 1419 newts from both species were present (Tab. 3). Most of them were *L. vulgaris* (1258); *T. cristatus* was represented by 161 individuals. Compared to April, in March and May, the number of newts present in the habitat was lower (Tab. 3). Nevertheless, the fact that in May, a high number of newts were present in the water compared to March indicated that their reproduction period had not been finished yet. The reproduction peak, indicated by the maximum number of individuals present in the water,

was registered in April. In June, newts from both species were still present in the water in high numbers. Because of the very high number of larvae (which are very sensitive), we did not capture newts in that month but just observed them from the shoreline. Nevertheless, judging by the large number of individuals observed from the shores compared with the ones observed in the previous month in the same way, in June, approximately 400-500 newts from both species were still present in the water. Adults from both newt species were observed in very small numbers (few individuals) both in June and July. Newts` larvae were encountered in the habitat from Comandă between June and August. In August, the water level was very low, and in September and October, the pond dried out completely.

Table 2. Newt population size in the investigated habitats in JGNP in 2019 (data from 2009 after Dobre *et al.,* 2009)

	Comandă		**Vulcan Pass**	**Meri railroad station - old**	**Meri railroad station - new**	**Meri quarry – settling ponds**	**Meri quarry – technological area**	**Meri quarry – extraction area**
	2009	2019						
L. vulgaris	486	1258	-	12	39	16	1	3
T. cristatus	89	161	1	10	2	10	8	30

In the case of both newt species, in the habitat from Comandă in March, males were more numerous than females, but subsequently, in the case of both species, the sex ratio turned in favor of females (Tab. 3). In the case of *L. vulgaris*, the decrease in the number of individuals of both sexes present in the water was faster than in the case of *T. cristatus*. Unlike this natural habitat with large populations, in the other habitats that are artificial by origin and generally recently colonized by newts, the sex ratio presented higher and random differences between periods (Tab. 3). At Comandă, in the natural habitat, the sex ratio was approximately equal in the case of both species (Tab. 3). In the artificial habitats, this ratio was different, and also differed between the habitats (Tab. 3).

Table 3. Population size and sex ratio dynamics of newts in the investigated ponds in JGNP in 2019 (III – X : March – October, M – males, F – females, J – juveniles, L – larvae, -- – not investigated because of the presence of larvae in the pond, *with italic* – visual investigation).

Habitat	Month	*L. vulgaris*				*T. cristatus*				Habitat	Month	*L. vulgaris*				*T. cristatus*			
		M	**F**	**J**	**L**	**M**	**F**	**J**	**L**			**M**	**F**	**J**	**L**	**M**	**F**	**J**	**L**
Comandă	III	517	327	-	-	71	42	-	-	Meri quarry – settling ponds	III	7	9	-	-	3	2	-	-
	IV	612	646	-	-	72	89	9	-		IV	8	5	-	-	-	9	1	-
	V	395	583	-	-	63	87	-	-		V	5	1	-	-	-	2	-	-
	VI	--	--	--	x	--	--	--	x		VI	*1*	--	--	x	--	*2*	--	x
	VII	*10*		--	x	*5*		--	x		VII	*1*	--	--	*2*	--	*2*	--	*4*
	VIII	--	--	--	x	--	--	--	x		VIII	--	--	--	*2*	*1*	--	--	x
	IX	pond dried out									IX	--	--	--	*2*	*1*	--	--	--
	X										X	-	-	-	-	-	-	-	-
Meri railroad station – old	III	7	2	-	-	6	1	-	-	Meri quarry – technological area	III	-	-	-	-	-	-	-	-
	IV	6	6	-	-	2	2	-	-		IV	-	1	-	-	-	5	1	-
	V	1	1	-	-	4	6	-	-		V	-	-	-	-	*8*			
	VI	--	--	--	x	--	--	--	x		VI	--	--	--	--	--	--	--	x
	VII	-	-	-	*5*	-	-	-	-		VII	-	-	-	-	-	-	-	-
	VIII	-	-	-	-	-	-	-	-		VIII	-	-	-	-	-	-	-	-
	IX	pond dried out									IX	pond dried out							
	X										X	-	-	-	-	-	-	-	-
Meri railroad station – new	III	17	22	-	-	1	-	-	-	Meri quarry – extraction area	III	-	-	-	-	-	-	-	-
	IV	13	12	-	-	1	1	-	-		IV	*2*	*1*	-	-	*30*			
	V	--	--	--	x	--	--	--	--		V	*2*				*6*			
	VI	--	--	--	x	--	--	--	--		VI	--	--	--	x	--	--	--	x
	VII	-	-	-	-	-	-	-	-		VII	-	-	-	-	-	-	-	-
	VIII	pond dried out									VIII	-	-	-	-	-	-	-	-
	IX										IX	pond dried out							
	X										X	-	-	-	-	-	-	-	-

Discussion

Although numerous recent studies clearly indicated that newts are in an obvious decline (e.g., Denoël, 2012; Samraoi *et al.*, 2012; Arntzen *et al.*, 2017; von Bülow and Kupfer, 2019; Falaschi *et al.*, 2022), our results indicated that in JGNP both species register important increases in their populations. Thus, in the habitat from Comandă, *T. cristatus* population increased by 1.80 times in 10 years, and *L. vulgaris* population increased by 2.58 in the same time interval, compared with the previous data (Dobre *et al.*, 2009). Not only the previously known populations have increased, but the two newt species were also identified in new locations in JGNP, a fact that increases even more their number in the park. The new distribution records are situated both in the close vicinity of

areas where the presence of the species was previously established, like the Meri quarry and the railway station (Covaciu-Marcov *et al.*, 2009; Ile and Sucea, 2018), as well as several kilometers from them. The favorable evolution of the newts in JGNP could be a consequence of the reduced and constant human impact that manifests in most of the park surface. At the same time, JGNP is covered almost completely by forests (Theme no.11.RA/2004), habitats that are extremely important for newts in their terrestrial phase (e.g., Müllner, 2001; Gustafson *et al.*, 2011). Thus, except for the areas surrounding the European road, which was recently modernized, and a gas pipeline that was installed near the limit of the park, JGNP experienced little human activity with disturbing potential in the 10 years that passed since the previous study (Dobre *et al.*, 2009). Nevertheless, in the year 2022, the Meri quarry resumed activity, and obviously, that had a negative impact on the newts in its area. Our results from JGNP seem to indicate that in regions with no increase in human activity (regions where habitats were not destroyed, fragmented, etc.), the newt populations can increase by themselves without any special management measures. The new distribution records highlight once again that JGNP still shelters unexplored habitats, a fact already indicated in the case of other terrestrial (Sucea, 2019) and aquatic species (Sucea *et al.*, 2022).

Although some of the new distribution records are only partially new, as newts were not searched in those regions previously (Covaciu-Marcov *et al.*, 2009), in other cases, the newts expanded their range between studies. Thus, in May 2019, *T. cristatus* was identified in Vulcan Pass, in the immediate vicinity of the JGNP limit (but with a few tens of meters off limits), at an altitude of 1428 m, but that region was not included in the previous study (Covaciu-Marcov *et al.*, 2009). Nevertheless, in the Vulcan Pass, we identified only one female at an altitude near the maximum altitude reached by this species in Romania (Cogălniceanu *et al.*, 2013). Probably, the female accidentally reached that habitat as it was the only newt present in it. The habitat was represented by a puddle formed in wheel tracks on a forest road on the top of the mountain. Moreover, the water level was low, and the puddle was totally devoid of vegetation, while *T. cristatus* prefers deep aquatic habitats with vegetation (e.g., Fuhn, 1960; Skei *et al.*, 2006). Thus, either in the region, there are other more suitable habitats for newts, or the encountered individual was a relict of former populations.

The other new distribution records of newts in JGNP were situated in the vicinity of some previously known habitats, in areas where the newts' presence was already established (Covaciu-Marcov *et al.*, 2009; Ile and Sucea, 2018). First, this is the case of the Meri quarry, where although newts were not mentioned in the past (Covaciu-Marcov *et al.*, 2009), they were recently

encountered in the settling ponds (Ile and Sucea, 2018). In 2019, both newt species were recorded in the settling ponds and in other abandoned areas in the quarry. Thus, newts were identified in several large puddles, with little vegetation in the technological areas of the quarry, where the crushed stone was loaded in trucks, but also at approximately 1 km upstream, in an area where the stone was recently exploited. Probably, the presence of newts in different areas of the quarry has the same explanation as previously in the case of the settling ponds (Ile and Sucea, 2018). Thus, the newts present in the area occupied different suitable habitats for a period after the cessation of human activity, coming from the neighboring natural areas (Ile and Sucea, 2018). At least in the case of *T. cristatus*, juveniles remain in the close vicinity of the aquatic habitat (Jarvis, 2016), but the adults were observed moving even over 1.5 km during the breeding season (Haubrock and Altrichter, 2016). Thus, they can move easily during a single year between different aquatic habitats from the Meri area. Probably, the human impact that existed in the region over time changed the number, type, and position of the habitat, as well as the newt population size. Probably, even in 2019 the newts moved often between those habitats, a fact indicated by the sex ratio different from the one registered at Comandă, by the shorter length of the aquatic period compared with Comandă, and also by the reduced number of individuals. Also, in other regions, the expansion of the newt population was related to the creation of new aquatic habitats, which newts usually colonize in only a few years (Arntzen and Teunis, 1993; Glesener *et al.*, 2022).

During the study, the Meri quarry was not in operation; thus, the entire range of habitats from the quarry was practically available to the newts. Nevertheless, in the year 2022, the quarry activity partially resumed a fact that surely had a negative impact on newts. The same fact was observed in the vicinity of the Meri railway station, where besides the previously known habitat (Covaciu-Marcov *et al.*, 2009), we identified a new habitat also resulted from human activities. The new habitat was less deep and completely exposed to the sun, thus drying faster. The new habitat was populated almost exclusively by *L. vulgaris*. Both the quarry and the railway station from Meri offer relatively flat areas in a region where the steep slopes are the cause of the rarity of aquatic habitats available for newts (Covaciu-Marcov *et al.*, 2009). The quarry and the railway leveled the ground, which made possible the formation of aquatic habitats subsequently used by newts. Therefore, the data from JGNP confirms the fact that abandoned quarries could be valuable for different amphibian species (e.g., Wirga and Majtyka, 2015; Caballero-Diaz *et al.*, 2020; Kettermann and Fartmann, 2023), including newts (e.g., Arnzen and Teunis, 1993; Arntzen and Thorpe, 1999). However, quarries replaced different

natural habitats, whose value for biodiversity is unknown (and virtually impossible to be known). Indeed, the quarry offers habitats for newts, but what if, before, on the slopes that were replaced by the quarry, there were good habitats for plants, insects, or reptiles? Thus, the high number of records regarding the value of quarries for biodiversity (e.g., Wirga and Majtyka, 2015; Caballero-Diaz *et al.*, 2020; Kettermann and Fartmann, 2023) should rather be considered a result of the high number of such artificial habitats that appeared in the landscape. The situation of newts in JGNP is a particular one because of the relief (Covaciu-Marcov *et al.*, 2009), and even this apparently favorable trend could be reversed as a consequence of resuming the quarry activity.

Compared with the previous studies regarding newt populations from Romania (Cicort-Lucaciu *et al.*, 2009, 2010, 2011; Bogdan *et al.*, 2012), it seems that the habitat from Comandă sheltered in 2019 the second largest *L. vulgaris* and *T. cristatus* populations known in the country, after the ones from Măru, in Banat region (Bogdan *et al.*, 2012). Probably the same explanations as in Măru is also true in JGNP; thus, the reduced number of available aquatic habitats attracts a large number of newts in a small area (Bogdan *et al.*, 2012). At the same time, the ratio between the two species was the one previously registered, as *L. vulgaris* was generally more numerous than *T. cristatus* (Cicort-Lucaciu *et al.*, 2009, 2011; Dobre *et al.*, 2009; Bogdan *et al.*, 2012). Although, at Comandă *T. cristatus* consumed in certain situations numerous *L. vulgaris* individuals (Sucea *et al.*, 2014), the *L. vulgaris* population from this habitat increased more compared to the *T. cristatus* population. Regarding the sex ratio, in the case of both species, their temporal dynamic was, at Comandă, similar to the one described previously, with the prevalence of males at the beginning of the aquatic season and a subsequent increase in female percentage abundance (e.g., Cicort-Lucaciu *et al.*, 2011; Bogdan *et al.*, 2012). Unlike Comandă, in artificial habitats, this dynamic was no longer observed. This fact indicates either the importance of large aquatic habitats for newts or the fact that artificial aquatic habitats from JGNP were only recently populated by newts, and the populations from those habitats are not yet stabilized. In the case of other crested newt species, it was proven that even aquatic habitats of the same type offer different conditions to the newts, but the larger ones offer more stable conditions (Lukanov *et al.*, 2021). Also, in other cases, the breeding period (the aquatic phase) of newts was shorter in artificial habitats compared with natural habitats (Cicort-Lucaciu *et al.*, 2010).

For newts, the importance of forests with rich herbaceous vegetation in the substrate close to their aquatic habitats was previously indicated, at least in the case of *T. cristatus* (Vuorio *et al.*, 2013). But forests are generally preferred by both species rather than grassy areas (Müllner, 2001). JGNP is a region with

numerous forests (Theme no.11.RA/2004), many of them being native with a rich and diverse litter fauna, even if there are many recoveries and plantations (Cicort-Lucaciu *et al.*, 2020). Although it is considered that the distribution of *T. cristatus* could be indicated by the aspect of the surrounding terrestrial habitats (Gustafson *et al.*, 2011), in JGNP, they are generally favorable to newts and occupies most of the park. Thus, the above-mentioned (Gustafson *et al.*, 2011) is probably valid in regions with numerous aquatic habitats available for newts, which is not the case in JGNP, where the steep slopes make them very rare (Covaciu-Marcov *et al.*, 2009). Thus, in JGNP, newts frequently use, in large numbers, different artificial aquatic habitats left behind by human activities in the quarry and in the railway vicinity. At the same time, in JGNP, forests are usually native, deciduous forests (Theme no.11.RA/2004), and at least for *T. cristatus* coniferous plantations was proved to be unfavorable (Gustafson *et al.*, 2011), a fact repeatedly indicated also in JGNP for different animal groups (Covaciu-Marcov *et al.*, 2009; Tomescu *et al.*, 2011; Cicort-Lucaciu *et al.*, 2020). Thus, in JGNP, the newt's distribution is rather indicated by the presence of aquatic habitats. We agree that *T. cristatus* management should focus to a greater extent on terrestrial habitats (Gustafson *et al.*, 2011), which in this case are represented by the forested areas from JGNP surrounding the aquatic habitats. Thus, JGNP should be preserved in the future as much as possible as it is nowadays, a fact that will guarantee that 10 years later, the newts will still be present here in large numbers. At a small scale, it is difficult to stop the climatic changes which will negatively affect amphibians in the future (e.g., McMenamian *et al.*, 2008; Cohen *et al.*, 2019; Souza *et al.*, 2023), but we can try to preserve habitats at least at their present status. Thus, in similar situations, the best management measure seems to be non-intervention (at least directly) because there were cases when pond restoration caused the decline of some newt populations (Sinsch *et al.*, 2018).

Although our study targeted newts in the first place, almost all amphibian species previously recorded in JGNP (Covaciu-Marcov *et al.*, 2009) were identified in the studied habitats, and in some cases, they were identified in new distribution locations. Thus, it is relevant that new results can be brought, even regarding the geographical distribution from an area considered a sampling effort hot spot (Cogălniceanu *et al.*, 2013). This fact highlights the necessity of future studies, even in regions considered to be well studied, and even more in areas not so well known, under the conditions in which in Romania, even nowadays, many regions have only a few amphibian records (Cogălniceanu *et al.*, 2013), although nothing explain their absence from the region, except for the absence of appropriate studies.

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