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POPULATION DYNAMICS OF *Lissotriton montandoni* AND *Triturus cristatus* SPECIES IN TWO AQUATIC HABITATS

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Abstract: *We studied the dynamics of the number of individuals for Lissotriton montandoni and Triturus cristatus populations in two low altitude habitats. The populations were in their aquatic phase in two permanent habitats, one natural and the other one man-made. We observed quantitative differences between the two populations, given by the size and aquatic affinity of the species. The length of the reproductive period of the populations was reduced to at least half in the artificial habitat, though this is also a permanent one. Triturus cristatus population was the most affected by the high level of pollution in the habitat. Within all four populations taken into study, male specimens proved to have a higher affinity for aquatic environment. Females have a higher percentage just before, and immediately after the peak of aquatic phase, while the males' higher affinity is observed at the begining and towards the end of this phase. The size of the populations in the natural habitat is of 115 specimens for L. montandoni, and 52 specimens for T. cristatus. In the artificial habitat, there were 28 L. montandoni, and 34 T. cristatus specimens. Sex ratio (M/F) in the natural habitat is 54.78 / 45.21 for L. montandoni, and 34.61 / 65.38 for T. cristatus. In the artificial habitat sex ratio is 3 / 1 for L. montandoni, and 1 / 1 for T. cristatus.*

Key words: *population dynamics, sex ratio, newt, size of population, Romania*

INTRODUCTION

Lisotriton montandoni is endemic to some regions in the Carpathians and Sudetes Mountains, at altitudes starting with 120m, untill about 2000m

(Arntzen et al, 2008a). This species is commonly found in Romania at altitudes ranging between 500m and 1500m (Cogălniceanu et al, 2000). Recent studies reported the presence of some low altitude populations at altitudes of about 200m, north of Somes River, in the area where Oaş Mountains meet the plain (Covaciu-Marcovet al. 2004, 2007). Human activities are more intense in these low altitude areas, thus the effect of anthropogenic factor is higher.

We decided to focus on *L. montandoni* and *T. cristatus* populations from two habitats located in this region, driven by the fact that these species are protected by national and international legislation (BERN 1979, C.D. 2006/105/E.C., O.U.G. 57/2007). We studied the dynamics of the number of individuals during the aquatic phase of newts, which enabled us to asess the size of populations, and sex ratio as well. Similar studies in Romania are scarce (Cicort-Lucaciu et al. 2008, 2009, Dobre et al. 2009), and were carried out for *L. vulgaris*, *T. cristatus,* and *T. dobrogicus* species. In this regard, this study is the first of this kind for *L. montandoni* species.

MATERIALS AND METHODS

Field studies were carried out with a periodicity of two weeks, between March and May, 2007. After capturing all the newts present in the two habitats, we noted the species and sex for every individual.

The habitats are represented by two permanent ponds located in the proximity of Turț Băi, at an altitude of approximately 250m, and about 0.5 km distance apart. The first one is an artificial habitat, formed by the accumulation of water into an excavation for a mining pipeline (Fig. 1.a).

This pond is about 2m in length, 1m in width, and 1.5m in depth. The water's turbidity is constant and high. The aquatic and pond-side vegetation is very poor.

There is a coniferous plantation close to the pond. The second habitat is a natural one, and is actually the ponding zone of a stream, located at the base of a slope (Fig. 1.b).

This pond is 13m long and 2m wide, with a maximum depth of 1m, lying by the line of a beech natural forest.

The pond's substrate is covered by a thick layer of decomposing leaves, sheltering a rich benthic fauna (Cupşa et al. 2008). The shores are populated by amphibious vegetation.

In this paper we focused on the length of the aquatic phase of newts, size of populations, sex ratio, and also, on the number of specimens present in the habitats with regard to their period, species and sex. The

presence of the population in the habitat at a certain date was defined based on the amount from the effective population of the captured number of specimens at that date.

a **b**

Fig. 1. Habitats located in Turț Băi region.
(a – artificial habitat, b – natural habitat)

The population's presence in the habitat during the reproductive period is showed as the amount (P) from the effective population (n) of the average number of specimens (N/t) counted in all of the studied periods. Due to the fact that '*t*' is variable, we adapted the formula (with a range of $100/t \leq P \leq 100$) for the range of $0 \leq P' \leq 100$.

$$P = \frac{N}{n \times t} \times 100 \text{, where } P \in \left[\frac{100}{t}, 100\right]$$

$$P' = \frac{N - n}{n \times (t - 1)} \times 100 \text{, where } P' \in [0, 100]$$

RESULTS AND DISCUSSIONS

The high level of water pollution, indicated by its constant turbidity and reddish color, made the artificial habitat inappropriate for the reproduction of amphibians. We noted five more amphibian species reproducing in the natural habitat: *Rana dalmatina*, *Rana temporaria*, *Bufo bufo, Bombina variegata*, and *Hyla arborea*. From these species, only *R. temporaria* and

B. variegata were present in the artificial habitat. The water pollution also had a negative effect on the newt populations. In comparison to the newt populations from the natural habitat, the ones from the artificial habitat had the reproduction period shortened at about a half (Table 1). This difference is also caused by the natural and permanent character of the other habitat, which proved to provide better conditions than even the habitats located in Prunişor - Arad County, and Comandă – Gorj County (Cicort-Lucaciu et al. 2009, Dobre et al. 2009). This could be the only explanation for the fact that the populations from the natural habitat from Turț Băi were encountered in the pond with the entire effective in two consecutive field study periods (over 90%).

Table 1.

Dynamics of the number of specimens

Species	Gender	March 16 2007	March 30 2007	April 15 2007	April 28 2007	May 10 2007	May 25 2007	Total
L. montandoni (artificial habitat)	M	-	11	21	10	-	-	42
	F	-	1	7	5	-	-	13
	total	-	12	**28**	15	-	-	**55**
T. cristatus (artficial habitat)	M	-	6	17	-	-	-	23
	F	-	2	17	-	-	-	19
	total	-	8	**34**	-	-	-	**42**
L. montandoni (natural habitat)	M	30	46	63	59	31	5	234
	F	23	38	52	52	22	1	188
	total	53	84	**115**	111	53	6	**422**
T. cristatus (natural habitat)	M	5	9	18	16	17	9	74
	F	8	21	34	33	20	20	136
	total	13	30	**52**	49	37	29	**210**

Regarding the presence of populations in the natural habitat, it is easy to observe that *T. cristatus* has a higher value compared to *L. montandoni* (Table 2), and also than *L. vulgaris* congener species (Cicort-Lucaciu et al. 2009). The explanation would be that *T. cristatus* has a higher affinity for aquatic environment, especially illustrated by its trophic behavior (Cicort-Lucaciu et al. 2009, Covaciu-Marcov et al. 2010). In general, *Triturus* species have this higher aquatic affinity compared to *Lissotriton* species (Cicort-Lucaciu et al. 2008). Previous studies report some cases in which the crested and Dobrudjan newt renounced at the terrestrial phase (Fuhn 1960, Arntzen et al. 2008b). However, *T. cristatus* has a much lower presence compared to *L. montandoni* in the artificial habitat (Table 2). This

indicates that *T. cristatus* is more sensitive to the pollution of reproductive habitat, fact proven mostly by the shortening of the aquatic phase of this population (Table 1). Arntzen et al. describes *T. cristatus* as a species which is not flexible to the habitat's changes (Arntzen et al. 2008c), though sometimes it can use artificial habitats for reproduction (Arntzen et al. 2008c, Covaciu-Marcov et al. 2007, Cogălniceanu et al. 2000).

Table 2.

The amount (P') from the effective of the population of the average number of counted specimens

Species	Natural habitat			Artificial habitat		
	Males	Females	Total	Males	Females	Total
Lissotriton montandoni	54.28	52.30	53.39	50.00	42.85	48.21
Triturus cristatus	62.22	60.00	60.76	35.29	11.76	23.52

The size of the populations in the natural habitat is of 115 *L. montandoni* and 52 *T. cristatus* specimens, while 28 *L. montandoni* and 34 *T. cristatus* specimens were present in the artificial habitat (Table 1). The populational effectives from the artificial pond are more reduced, probably due to the fact that it is an artificial habitat, and also, due to its smaller size and high level of pollution.

Almost half of the *L. montandoni* population was present in the natural habitat at the begining of their aquatic phase (early March). On the other hand, only a quarter of the *T. cristatus* population was present (Table 3). The earlier entrance of *L. montandoni* in the habitat happened probably because of its smaller size, enabling these specimens to inhabit the shallow areas of water, reaching the necessary minimum temperature much faster. At the end of the aquatic phase (May), there were more *T. cristatus* specimens present (Table 3). On the 25th of May we registered more than half of the *T. cristatus* population, while only a very small percentage (5.2%) of *L. montandoni* specimens were present. This proves again the higher affinity of *T. cristatus* for aquatic environment.

Male specimens were present in a higher number at the beginning of the aquatic phase compared to females (Table 3). We observed the same pattern during studies of other populations (Cicort-Lucaciu et al. 2008, 2009, and other unpublished data), comprising populations from all newt species present in Romania (*Mesotriton alpestris*, *L. montandoni*, *L. vulgaris*, *T. cristatus,* and *T. dobrogicus*). There are also other reports about *L. vulgaris* and *T. cristatus* males entering the aquatic environment

before females (Cogălniceanu et al. 2000, Jalbă 2008). Jalbă (2008) describes this behavior as a competition for territory between the males.

The individuals' dynamics expressed in percentage points out another important aspect, which is the repopulation and depopulation in phases of the natural habitat (Table 3). The percentage of females is higher right before and immediately after the peak of the aquatic phase, while males dominate at the begining and at the end of this phase (Fig.2).

Table 3.

Percentage dynamics of the number of specimens

Species	Sex	March 16 2007	March 30 2007	April 15 2007	April 28 2007	May 10 2007	May 25 2007
Lissotriton montandoni (artificial habitat)	M	-	52.38	100	47.61	-	-
	F	-	14.28	100	71.42	-	-
	total	-	42.85	100	53.57	-	-
Triturus cristatus (artficial habitat)	M	-	35.29	100	0	-	-
	F	-	11.76	100	0	-	-
	total	-	23.52	100	0	-	-
Lissotriton montandoni (natural habitat)	M	47.61	73.01	100	93.65	49.20	7.93
	F	44.23	73.07	100	100	42.3	1.92
	total	46.08	73.04	100	96.52	46.08	5.21
Triturus cristatus (natural habitat)	M	27.77	50	100	88.88	94.44	50
	F	23.52	61.76	100	97.05	58.82	58.82
	total	25	57.69	100	94.23	71.15	55.79

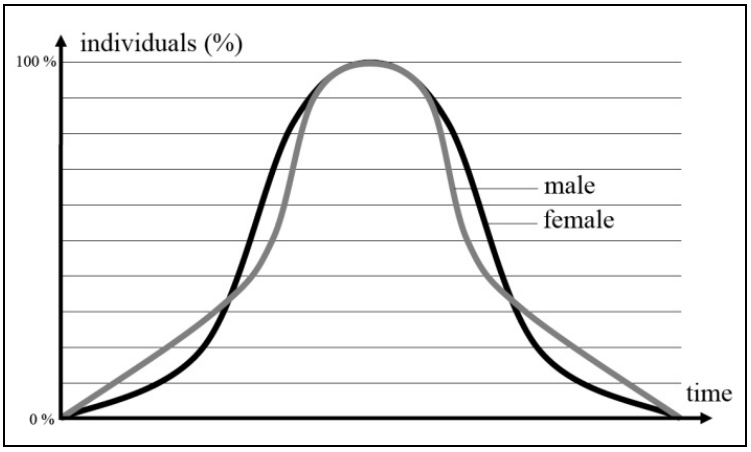

Fig. 2. Phases of repopulation and depopulation in the natural habitat.

The most probable reason for this is that females have a lower affinity for aquatic environment, confirmed by the higher number of males in the habitat (Table 2).

Sex-ratio (males/females) in the natural habitat is 54,78 / 45,21 for *L. montandoni,* and 34,61 / 65,38 for *T. cristatus* species (Table 4). Within the artifcial habitat, sex-ratio is 3/1 for *L. montandoni* and 1/1 for *T. cristatus* (Table 4).

Table 4.

Sex-ratio (M/F) and the evolution of the ratio between the individuals of the two sexes

Species	March 16 2007	March 30 2007	April 15 2007	April 28 2007	May 10 2007	May 25 2007
L. montandoni (natural habitat)	56.60 / 43.39	54.76 / 45.23	**54.78 / 45.21**	52.67 / 47.32	58.49 / 41.50	83.33 / 16.66
T. cristatus (natural habitat)	38.46 / 61.53	30 / 70	**34.61 / 65.38**	32.65 / 67.34	45.94 / 54.05	31.03 / 68.96
L. montandoni (artificial habitat)	-	91.66 / 8.33	**75 / 25**	66.66 / 33.33	-	-
T. cristatus (artficial habitat)	-	75 / 25	**50 / 50**	-	-	-

CONCLUSIONS

The reproductive phase of newts was reduced to almost half in the artificial habitat, as a result of high level of pollution.

Considering that the larger habitat is a natural and permanent one, the size of specimens and their aquatic affinity are the only factors that have a limiting effect on the aquatic phase of newts. The size of the species was the decessive factor to dictate the beginning of the aquatic phase. *L. montandoni*, a species with smaller size, was this way favoured, being able to populate the shallow areas with higher temperatures in the pond. The affinity for aquatic environment was the factor to determine the end of the aquatic phase. Thus, *T. cristatus* left the water habitat after *L. montandoni* specimens.

Males proved to have a higher affinity for aquatic environment within all the four populations taken into study. This is the reason why repopulation and depopulation of the natural habitat occured in two phases. Female specimens register a higher percentage right before and immediately after the peak of the aquatic phase, while males dominate at the begining and at

the end of this phase. This higher affinity for water led to faster repopulation of the two habitats by the male individuals at the beginning of the aquatic phase.

The size of the populations in the natural habitat is of 115 specimens for *L. montandoni*, and 52 specimens for *T. cristatus*. In the artificial habitat, only 28 *L. montandoni* and 34 *T. cristatus* specimens were present. The values of the sex-ratio (Males / Females) of the populations from the natural habitat are 54.78 / 45.21 for *L. montandoni*, and 34.61 / 65.38 for *T. cristatus*. In the artificial habitat, the values of the sex ratio were 3 / 1 for *L. montandoni*, and 1 / 1 for *T. cristatus* populations.

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