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Data on Population Dynamics of Three Syntopic Newt Species from Western Romania

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Abstract. We studied the population dynamics of three syntopic newt species [*Mesotriton alpestris* (Laurenti, 1768), *Lissotriton vulgaris* (Linnaeus, 1758) and *Triturus cristatus* (Laurenti, 1768)] in Zarand Mountains (Arad County, Romania). *M. alpestris* had the shortest aquatic phase, approximately two months, out of which the nuptial display was 2-3 weeks long. *L. vulgaris* and *T. cristatus* spent three months in the habitat, having a nuptial display of 2-3 weeks for *L. vulgaris,* and of 4-5 weeks for *T. cristatus*. *M. alpestris* had the highest degree of reproductive synchronization, while this was the lowest at *T. cristatus.* Males from all three species had a higher affinity for the aquatic habitat than females. The population size was estimated at 769 for *L. vulgaris*, 588 for *T. cristatus*, and 294 for *M. alpestris.* Balanced sex ratio was observed in the peak of breeding activity for all species.

Keywords: Salamandridae, aquatic phase, population dynamics, population size, sex ratio.

Introduction

There are five newt species in Romania: *Lissotriton vulgaris, Lissotriton montandoni, Mesotriton alpestris, Triturus cristatus, Triturus dobrogicus* (COGĂLNICEAU *et al*., 2000). The conservation status of these five species is governed by the Government Emergency Ordinance 57/2007, which transposed into Romanian legislation the Birds Directive and Habitats Directive (O.U.G. 57/2007). The size of a population is an important parameter in assessing the conservation status of plant and animal species, as well as in the management of Natura 2000 network sites. There are few studies on newt population dynamics in Romania (CICORT-LUCACIU *et al*., 2008, 2009, 2010; DOBRE *et al*., 2009). The present study focuses on the dynamics of the number of individuals during repopulation (entering in the aquatic habitat) and depopulation (leaving the aquatic habitat) of an aquatic habitat from western Romania, used for reproduction by three newt species (*L. vulgaris, T. cristatus, M. alpestris*). Based on this data, we could then determine the size of the populations and sex-ratio. According to IUCN red list, all these three species are considered least concern (IUCN, 2011).

Material and methods

The study was carried out in the spring of 2006, when we went on field at four times: on the 9th of April, the 6th of May, the 20th of May, and on the 17th of June. On each occasion we tried to capture all newts

present in the habitat. Newts were captured using nets with a round metal frame, fixed to the end of long metal rods. We noted the species, gender and age class (juvenile or adult) for each captured individual, followed by their release into the natural environment. Adults and juveniles were determined based on the presence (adults) or the absence (juveniles) of the secondary sexual characteristics (see in: KARLSSON *et al*., 2007). Elimination of individuals was the method used in order to assess population size (see in: COGĂLNICEANU, 1997), counting the individuals present in the habitat. The highest value within the four counts was considered to be the size of a population (juveniles were not included). The number of males and females recorded at a certain time allowed to calculate sex ratio. We observed the dynamics of the number of newts in the habitat during their aquatic phase. A population's presence in the habitat at a certain moment was expressed as the percentage of the number of individuals captured at that time, considered to the size of the population.

The habitat is located at an altitude of 450 m in Zarand Mountains, upstream from Madrigesti locality (46°10'01''N/ 22°14'52''E). A county road is interposed between the habitat and a valley. The habitat is a quasi-permanent pond, formed between a road and a slope covered by beech forest. It is fed by a small spring and by rain fall, with a maximum length of 12 m, and a maximum width of 3-4 m. One of its sides is touching the edge of the forest, here the substrate being covered by leaves. Above this deposit of leaves, the water level is 30-40 cm deep and there is no aquatic vegetation. *Typha* sp. clusters are present in the middle of the pond. The deepest regions (approximately 1 m) do not present vegetation. The bank near the forest is steeper, with large clumps of *Juncus* sp. The bank close to the road is completely devoid of aquatic vegetation, being flooded in spring. The most relevant anthropogenic factor affecting this habitat is bathing of cattle from nearby households. On the other side of the road, close to this habitat, there is a group of four small ponds, with sizes of about 2-4 m^2. Unlike the main habitat, these are temporary ones, without aquatic vegetation.

Results

Out of the three newt populations, only *M. alpestris* was not present in all four field work periods. The aquatic phase of this species was approximately one month shorter than that of the other two species. In the first two periods, *L. vulgaris* populated only the banks. It was only in the third period (20th May) when we observed individuals from this species to be distributed throughout the habitat, and to form reproduction pairs. Moreover, in the first two periods of field work (9th April, 6th May), some individuals inhabited the small ponds, where no individuals from the other two species were present. In the second period (6th May), numerous newts were migrating from the small ponds into the large pond. In this period we found newts as victims of road traffic. Unlike *L. vulgaris*, *T. cristatus* inhabited the pond in a relatively uniform manner from the beginning of its aquatic phase. Breeding pairs of this species were observed starting from the second period (6th May) of the field work. The situation is different in case of *M. alpestris*. They also formed breeding pairs in the second period of work, but the pairs did not last until the third period. *M. alpestris* was found in the deepest regions of the habitat.

On the 20th of May we recorded the peak for the number of individuals of *L. vulgaris* and *T. cristatus*, while for *M. alpestris* the peak number was on the 6th of May (Table 1). The peak periods are the same considering gender, and also, age of individuals. Therefore, the size of the surveyed populations was 769 for *L. vulgaris*, 588 for *T. cristatus*, and 294 for *M. alpestris*.

The relative abundance of the individuals differs between the periods. For *T. cristatus* the relative abundance was low in the first period (Table 2). For *M. alpestris* this value is high, including the last period (Table 2), this species leaving the water in a short interval. Sex ratio was 0.96 for *L. vulgaris*, 0.73 for *T. cristatus*, and 0.71 for *M. alpestris* (Table 3).

Table 1. *Number of individuals captured in the study periods. The maximum numbers are given as the population sizes (juveniles were not considered – see the text).*

Species	Gender / Age class	9 April	6 May	20 May	17 June
Lissotriton vulgaris	males	81	108	377	121
	females	75	88	392	131
	adults	156	196	769*	252
	juveniles	-	-	5	-
Triturus cristatus	males	29	73	249	73
	females	32	61	339	111
	adults	61	134	588*	184
	juveniles	1	-	9	4
Mesotriton alpestris	males	28	122	102	-
	females	36	172	124	-
	adults	64	294*	226	-
	juveniles	-	-	-	-

* population size

Table 2. *Relative abundance of individuals in the four study periods. (100% was considered the recorded peaks for the number of individuals – see Table 1)*

Species	Gender	9 April	6 May	20 May	17 June
Lissotriton vulgaris	males	21.48%	28.64%	100%	32.09%
	females	19.13%	22.44%	100%	33.41%
	total	20.30%	25.54%	100%	32.75%
Triturus cristatus	males	11.64%	29.31%	100%	29.31%
	females	9.43%	17.99%	100%	32.74%
	total	10.53%	23.65%	100%	31.02%
Mesotriton alpestris	males	22.95%	100%	83.60%	-
	females	20.93%	100%	72.09%	-
	total	21.94%	100%	77.84%	-

Table 3. *Sex ratios (males/females) in different study periods and marked with asterisk for the whole population*

Species	9 April	6 May	20 May	17 June
Lissotriton vulgaris	1.08	1.23	0.96*	0.92
Triturus cristatus	0.91	1.20	0.73*	0.66
Mesotriton alpestris	0.78	0.71*	0.82	

Discussion

M. alpestris had a more synchronous reproduction than *L. vulgaris* and *T. cristatus*. Out of the latter two, the reproduction of *T. cristatus* was the most asynchronous, this being the only species which formed pairs for reproduction during two field work periods. It seems that *L. vulgaris* was affected by the low temperatures in the deeper regions of the habitat, recorded at the beginning of the aquatic phase and so populated only the banks. The larger size of *T. cristatus* did not allow them to occupy the marginal areas of the habitat, unlike *L. vulgaris*. The preference of *L. vulgaris* for areas immediately next to

the bank was previously reported, as well (GHIRA, 2007). In these regions, the water is not so deep and heats up easier. Later this period, *L. vulgaris* had a uniform distribution, with individuals forming pairs only during a single period of work, similarly to *M. alpestris*. However, there is a difference between the populations of the two species in this regard, given the fact that similar to *T. cristatus, L. vulgaris* had a longer aquatic phase.

M. alpestris had the shortest aquatic phase. This is probably a consequence of the temporary character of the small habitats characteristic to the mountain regions in Romania in which this species is frequently found (STRUGARIU *et al*., 2006; GHERGHEL *et al*., 2008; SOS *et al*., 2008; COVACIU-MARCOV *et al*., 2009 a, b). Nevertheless, a study undertaken in the Apennines Mountains (FASOLA & CANOVA, 1992) reports that out of the syntopic populations from these three species, *M. alpestris* was the only one present in water throughout the year. Such cases were reported in Romania as well (COGĂLNICEANU *et al*., 2000). Those populations inhabit high altitude lakes, where the surface is covered with ice for a longer time of the year.

L. vulgaris population had the highest number of individuals. This was reported in other cases as well, comparing with *T. cristatus* (CICORT-LUCACIU *et al*., 2009; DOBRE *et al*., 2009) or with *T. dobrogicus* (CICORT-LUCACIU *et al*., 2008). A decreasing body size during speciation is a process of specialization to use food and habitat (JOLY & GIACOMA, 1992). The smaller size is an advantage for *L. vulgaris*, allowing a higher number of individuals within a limited space. Considering the reports about the habitats populated by *L. montandoni* and *T. cristatus*, we observe that this rule is generally valid within syntopic *Lissotriton* and *Triturus* populations (CICORT-LUCACIU *et al*., 2010). Generally the number of *Triturus karelinii* populations is nearly always lower than that of the coexisting newt species (MERMER *et al*., 2008), underlining the influence of the larger size of the crested newts. Furthermore, southern crested newts prefer relatively deeper waters for breeding, compared to other newt species (TARKHNISHVILI & GOKHELASHVILI, 1999; MERMER *et al*., 2008), this preference being valid also in the case of *T. cristatus* population from Madrigesti. However, there are cases in which crested newts are more numerous that other newt species to which they co-habitate with (ŠIZLING & ZAVADIL, 2001).

There is an evident difference in the behaviour of males and females in the case of populations where the process of populating the habitat takes an evolution in time before reaching the peak number (*L. vulgaris* and *T. cristatus*). Males dominate females numerically at the beginning of the aquatic period, although females dominate males considering the structure of the population. Reproducing adults are, in general, faithful to the same aquatic habitat every year (JOLY & MIAUD, 1989). However, juveniles inhabit other aquatic habitats besides the one they originate from (BELL, 1977; GILL, 1978a; JOLY & MIAUD, 1989; LANGTON *et al*., 2001). Therefore, when determining the size of population we did not take into account the number of juveniles. The difficulty of counting the juveniles was previously signalled (ARNTZEN & TEUNIS, 1993). Still, captured juveniles provide some information about the species' behaviour. We only found juveniles from species with a longer aquatic phase (*L. vulgaris* and *T. cristatus*). Probably this is a consequence of shorter aquatic phase for *M. alpestris*. The highest number of both adults and juveniles was recorded on the 20th of May. This was the case with both populations from this study, as well as with some *L. vulgaris* and *T. dobrogicus* populations from Western Plain (CICORT-LUCACIU *et al*., 2008).

There are no big differences between *L. vulgaris* and *T. cristatus* with regard to leaving the habitat. Studies from Oas Mountains, Romania also report the size of *T. cristatus* as a limiting factor when repopulating the habitat (CICORT-LUCACIU *et al*., 2010). In the beginning of the aquatic period the males` relative abundance was higher than the females`. A previous study mentions that males from syntopic *L.*

vulgaris and *L. helveticus* populations entered the water before females (HARRISON *et al*., 1983). The same study reports *L. helveticus* females leaving the water at a significantly later point. This behaviour was also observed while comparing values of sex ratio at the beginning and at the end of the aquatic phase (ARNTZEN, 2002). It was found that sex ratio is in favour of males at the beginning of the aquatic phase, and of females at the end of it. However, another study reports *T. cristatus* males to be in the water before females, and leaving the water after females (VERRELL & HALLIDAY, 1985). Other studies from north-western Romania also describe that newt populations follow this rule in the beginning of their aquatic phase (CICORT-LUCACIU *et al*., 2008, 2009, 2010). Considering *M. alpestris,* the percentage of individuals present in the habitat at the moment of our last count was too high to reflect the behaviour of depopulating the habitat.

The time spent in water without having a reproductive activity may be extended under favorable feeding conditions. Feeding studies indicate that, from the three species in question, *T. cristatus* had the highest feeding activity (e.g. COVACIU-MARCOV *et al*., 2010). So, we can consider that this species has the highest affinity to the aquatic habitat, in other cases it spending more time in water than *L. vulgaris* (GRIFFITHS & MYLOTTE, 1987). This was the only species present in the habitat in August as well, with a few individuals. A study in the Apennines reports that *T. cristatus* remained in water 3 to 4 months after the end of the reproductive period, while *L. vulgaris* used the aquatic habitat exclusively for reproduction (FASOLA & CANOVA, 1992). The relation between the relative abundance of individuals and the population size shows that males had higher presence in the habitat than females. Their affinity to the aquatic environment is probably a consequence of the presence of dorsal crest, which helps mobility in the water.

Sex ratio is approximately equal in the case of all three newt species. However, females were more numerous than males considering the structure of all three newt populations. There are previous studies which report an almost balanced sex ratio for newts (e.g. HAGSTROM, 1979; ARNTZEN, 2002; JOHNSON, 2002; MERMER *et al*., 2008). Whenever there is a slight difference, females are more numerous (e.g. HARRISON *et al*., 1983; KARLSSON *et al*., 2007, MERMER *et al*., 2008, ÇIÇEK & AYAZ, 2011). In very rare cases males outnumber females (GILL, 1978b). Several factors are known to favour females in sex ratio. The number of females increases when the temperature drops below optimum (WALLACE & WALLACE, 2000). Another study mentions that mortality of *L. vulgaris* males during winter is higher than that of females (BELL, 1977). Out of 15 newt populations previously studied in Romania (CICORT-LUCACIU *et al*., 2008, 2009, 2010; DOBRE *et al*., 2009), 10 had of approximately balanced sex ratios. In three cases, the sex ratio was female biased (CICORT-LUCACIU *et al*., 2008, 2010), while in two populations sex ratio was male biased (DOBRE *et al*., 2009; CICORT-LUCACIU *et al*., 2010).

In conclusion, the newts form Madrigesti behave in the aquatic period, following the rules established previously in the case of other populations from Romania (CICORT-LUCACIU *et al*., 2008, 2009, 2010). *L. vulgaris* has the largest population and *M. alpestris* has the shortest aquatic period. These results show the uniformity of the factors that act upon the newts in the aquatic period indifferent of the geographical region.

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