

CONTRIBUTION TO THE FAUNISTIC RESEARCH AND
CONSERVATION OF THE HERPETOFAUNA OF NORTHERN
KRESNA GORGE AND SOME ADJACENT AREAS

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Abstract: Due to its species richness, Kresna Gorge is relatively well investigated in herpetological aspect. However, almost all of the researchers concentrate their efforts in the well-known biodiversity hot spots situated in the middle and the southern parts of the area, thus leaving the northern parts almost unexplored.

Most of the locations of the researched species presented in this work are newly identified, since the areas of investigation remained out of the scope of the majority of scientists.

In addition the research presents some of the conservation measures in the area, taken by the non-governmental organization Fund for Wild Flora and Fauna (FWFF), which directly affected the prosperity of the researched species populations. The identified nature conservation benefits and possible fails of these measures were evaluated.

INTRODUCTION

Information on the herpetofauna in the Kresna Gorge could be found in the general works of Buresh and Tzonkov (1933, 1934, 1941, 1942) and especially in the researches of Beshkov (1961, 1970, 1972, 1974, 1975, 1977, 1985, 1986). In recent years the investigations were intensified during the projects for mapping

and monitoring of Natura 2000 areas in Bulgaria. New faunistic information, concerning the area in general was also published recently (Stoyanov et al. 2011; Pulev et al. 2015).

This research presents information of the observations of 7 amphibian species (*Salamandra salamandra*, *Bombina variegata*, *Bufo bufo*, *Hyla arborea*, *Rana dalmatina*, *Rana graeca*, *Pelophylax ridibundus*,) and 10 reptilian species (*Testudo hermanni*, *Testudo graeca*, *Emys orbicularis*, *Lacerta viridis*, *Podarcis erhardii*, *Dolichophis caspius*, *Platycephalus najadum*, *Zamenis longissimus*, *Natrix natrix*, *Natrix tessellata*) in the northern Kresna Gorge and some adjacent areas, gathered during five years of field work. When available, additional information concerning population ecology, habitat preferences and behavior of the species as well as identified treating factors were included.

Most of the locations of the researched species are new and unpublished, since the areas of investigations remained out of the scope of the majority of scientists.

MATERIALS AND METHODS

Herpetological information was gathered mainly in the period 2011 - 2016. In relation with the reintroduction activities for the Griffon vulture (*Gyps fulvus*), the researched area was frequently visited (3 - 5 days for a week, or over 1040 days for the whole period). Most of the observations were concentrated in the zones, where the reintroduction work was mainly executed (figure 1). The observed individuals were identified and geographic coordinates were taken (using GPS equipment in the field or Google Earth software after the field work). Additional data concerning the behavior, habitat preferences, predatory tactics, etc. was also collected when available. During the work in the area, some conservation measures affecting the reptiles and amphibians were also taken. The observed results of these measures were described and commented in the next section.

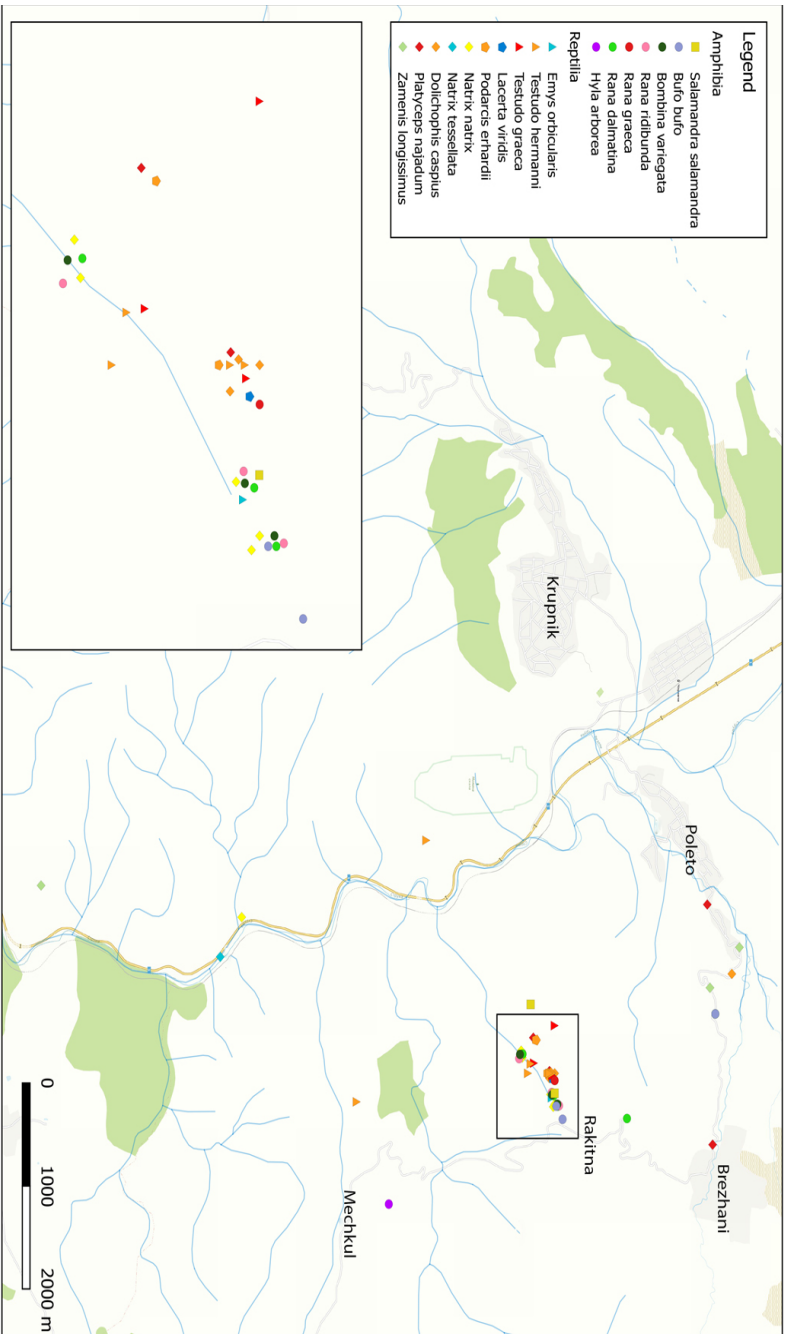


Figure 1. Map of the species observations in the researched area. The core zone with the majority of identified locations is presented in large-scale.

RESULTS AND DISCUSSION

I. Species

During the present research, we observed the following species of amphibians and reptiles in the investigated area (see also table 1):

1. Fire salamander (*Salamandra salamandra*) - in the autumn of 2014, single individuals were observed active near the dry stone walls of Nature conservation center Vila Fauna (NCCVF) of FWFF.

2. Yellow-bellied toad (*Bombina variegata*) - the species was regularly observed in suitable sites during the whole investigation period. The main locations for the toad in the area were the artificial water pools, made for the domestic animals near the NCCVF, where high concentration of individuals was found (up to 200 ind.).

3. Common toad (*Bufo bufo*) - single individuals were observed in the vicinity of NCCVF and Rakitna village. We identified a water-holding concrete structure (c.3 sq. meters area and c. 2,5 meters high), situated partially into the ground. The common toad was observed to overwinter successfully in the structure, but probably in general this site plays a role of ecological trap for several species of amphibians and at least one reptile.

4. Common tree frog (*Hyla arborea* complex) - single observation of young individuals (body length up to 1 cm.) at small artificial pond.

5. Agile frog (*Rana dalmatina*) - observed regularly during 2010 - 2015 in water tanks (including new build tanks during the research period) for cattle near NCCVF. Agile frogs were also identified in the water holding concrete basin, mentioned in the species information for *Bufo bufo*.

6. Greek stream frog (*Rana graeca*) - one subad. The individual was observed in artificially created pool, built to support amphibian reproduction near the NCCVF.

7. Marsh frog (*Pelophilax ridibundus*) - regular observations in the cattle water holders and the concrete structure near NCCVF.

8. European pond terrapin (*Emys orbicularis*) - observed twice in one of the cattle water holders and in the stream nearby.

9. Hermans tortoise (*Testudo hermanni*) - observed regularly in the area between NCCVF and the vultures feeding site. The tortoises were observed to eat mulberries regularly near the center. An interesting observation was made of a dead individual pierced by a sharp rock, probably after Golden eagle attempt to break the shell by throwing from the air.

10. Spur-thighed tortoise (*Testudo graeca*) - observations similar to the previous species. Egg laying was observed on 17.06.2015.

11. Green lizard (*Lacerta viridis*) - observed regularly in the whole area between NCCVF and the vulture feeding station. The species also inhabited the dry stone walls of the center and was observed basking in close proximity to *Podarcis erhardii*.

12. Erhard's Wall lizard (*Podarcis erhardii*) - similarly to the previous species, the Erhard's wall lizard was observed regularly in the same areas during the research period. The most favorable habitats were the rocky slopes with groups of *Quercus* and the dry stone walls of NCCVF, where at least 5 individuals at once were observed regularly. We observed winter activity of the species - active ad. individuals were registered on the dry-stone walls on 28.12.2015 and near the road to the vulture feeding site on 21.02.2015.

13. Caspian whip snake (*Dolichophis caspius*) - single individuals were observed in close proximity to NCCVF. Dead whip snakes were found on the road between Poletto village and town of Brejani and one was killed by the locals near NCCVF.

14. Dahl's whip snake (*Platyceps najadum*) - observed in several sites in the researched area. Most regular observations were made in the dry stone walls of NCCVF.

15. Aesculapian snake (*Zamenis longissimus*) - several individuals were found killed on the roads in the area. On 03.05.2015 a juvenile albinistic individual was observed near Poletto village.

16. Dice snake (*Natrix tessellata*) - one individual was observed on 25.04.2010 near the Struma River.

17. Grass snake (*Natrix natrix*) - during the research period, many observations were made in and around artificial water bodies, including the concrete structure and the cattle water tank near NCCVF. On 25.04.2015 a middle-sized individual was observed in attempts to ingest large edible frog in the newly build by FWFF cattle water tank. Later the species was observed several times at the same site.

Table 1. Amphibian and reptile observations in the researched area

Date	Species	Coordinates	Altitude	Comments
Amphibia				
17.04.2010	<i>Salamandra salamandra</i>	41°50'49" N 23°10'38" E	679	1 ind. drowned in cattle water pool (one <i>Bombina variegata</i> is trying to copulate with it).
2010 – 2015	<i>Salamandra salamandra</i>	41°50'41" N 23°10'0" E	720	On the way to feeding station and between villages of Stara Kresna and Senokos. Spring, during rainfalls.
2010 – 2015	<i>Bombina variegata</i>	41°50'49" N 23°10'38" E	679	In cattle water pool, over 200 ind. During the active season. The number increased after we managed to keep water in the pool during the whole year.
17.04.2010	<i>Bombina variegata</i>	41°50'49" N 23°10'38" E	679	Two ind. trying to copulate with <i>Salamandra salamandra</i> (and attempts for copulation with <i>Pelophilax ridibundus</i> on 26.03.2014).
2014 – 2015	<i>Bombina variegata</i>	41°50'37" N 23°10'21" E	648	New build cattle water pool. Few individuals in the first year (2014) and up to 25 in 2015.
2010 – 2015	<i>Bombina variegata</i>	41°50'51" N 23°10'42" E	680	Several individuals are constantly present in the concrete structure.
2010 – 2015	<i>Bombina variegata</i>	41°50'51" N 23°10'42" E	679	Along the stream close to NCCVF.
2013-2015	<i>Bufo bufo</i>	41°50'51" N 23°10'42" E	679	Two ind. trapped and overwintered in the concrete structure. Singing males observed near the same place.
2014 – 2015	<i>Bufo bufo</i>	41°50'53" N 23°10'48" E	682	Meadow flooded in spring. Multiple observations of eggs (At least six copulating pairs on 20.02.2016).
20.09.2015 г.	<i>Bufo bufo</i>	41°51'50" N 23°10'4" E	511	The road between the villages Poletto and Brejani. Active on the roads during heavy rains (last observation of 5 ind. during rain on 20.09.2015).
2010 – 2015	<i>Rana dalmatina</i>	41°50'49" N 23°10'38" E, 41°50'37" N 23°10'21" E, 41°50'51" N 23°10'42" E	679	The cattle pools and the concrete structure. Multiple observations.

20.09.2015 г.	<i>Rana dalmatina</i>	41°51'50" N 23°10'4" E	511	Several individuals on the road between Poletto and Brejani.
2015 spring	<i>Rana dalmatina</i>	41°51'17" N 23°10'48" E	676	Small temporary pond in wet meadow. Many ind. and larv. in early spring.
2010 – 2015	<i>Rana ridibunda</i>	41°50'49" N 23°10'38" E, 41°50'37" N 23°10'21" E, 41°50'51" N 23°10'42" E	679	Multiple observations in the cattle pools and the concrete structure.
24.05.2014 г.	<i>Rana graeca</i>	41°50'50" N 23°10'32" E	690	In the artificially made pool along the stream near NCCVF.
5.07.2015 г.	<i>Hyla arborea</i>	41°49'48" N 23°11'24" E	716	Several juv. in artificial pool. Some were still with tale.
Reptilia				
2013	<i>Emys orbicularis</i>	41°50'49" N 23°10'38" E	679	Two observations - in cattle water pool and in the nearby stream.
2010 – 2015	<i>Testudo hermanni</i>	41°50'2" N 23°8'51" E	481	Pierced over sharp rock, probably thrown by Golden eagle.
2010 – 2015	<i>Testudo hermanni</i>	41°50'49" N 23°10'29" E	693	Feeding with mulberries.
2010 – 2015	<i>Testudo hermanni</i>	41°50'41" N 23°10'25" E	659	Feeding with mulberries.
24.03.2014 г.	<i>Testudo hermanni</i>	41°49'36" N 23°10'41" E	675	Dead.
11.06.2015 г.	<i>Testudo hermanni</i>	41°50'48" N 23°10'29" E	686	Observations of egg laying.
2014 – 2015	<i>Testudo hermanni</i>	41°50'40" N 23°10'29" E	690	Many holes.
2014 – 2015	<i>Testudo hermanni</i>		690	Multiple observations in the whole area.
17.06.2015 г.	<i>Testudo graeca</i>	41°50'50" N 23°10'38" E	685	Observations of egg laying.
2010 – 2015	<i>Testudo graeca</i>	41°50'49" N 23°10'29" E	693	Feeding with mulberries.
2010 – 2015	<i>Testudo graeca</i>	41°50'41" N 23°10'25" E	693	Feeding with mulberries.
2010 – 2015	<i>Lacerta viridis</i>			Multiple observations in the whole area.
2010 – 2015	<i>Podarcis erhardii</i>	41°50'48" N 23°10'29" E	686	Dry-stone walls of NCCVF (including winter activity).
2010 – 2015	<i>Podarcis erhardii</i>	41°50'43" N 23°10'15" E	684	Rocky terrains along the road to vulture feeding station (including winter activity).

25.04.2010 г.	<i>Natrix tessellata</i>	41°48'45" N 23°9'40" E	253	Close to Struma river.
2.10.2014 г.	<i>Natrix natrix</i>	41°50'50" N 23°10'42" E	680	Near the concrete structure.
2010 – 2015	<i>Natrix natrix</i>	41°50'50" N 23°10'42" E	680	Several individuals in the concrete structure.
2013	<i>Natrix natrix</i>	41°50'49" N 23°10'38" E	681	One ind. in cattle water pool.
25.04.2015 г.	<i>Natrix natrix</i>	41°50'37" N 23°10'21" E	660	One individual observed several times to hunt in the new build cattle pool (including with caught edible frog).
24.03.2014 г.	<i>Natrix natrix</i>	41°48'53" N 23° 9'23" E	278	
2010 – 2015	<i>Natrix natrix</i>			Multiple observations in artificial pools in the area and along Struma river.
29.05.2014 г.	<i>Platyceps najadum</i>	41°50'42" N 23°10'14" E	688	Also observed in the same place in 2013.
30.07.2014 г.	<i>Platyceps najadum</i>	41°50'48" N 23°10'29" E	689	Dry stone walls of NCCVF.
2014 autumn	<i>Platyceps najadum</i>	41°51'49" N 23°10'59" E	553	
2015 summer	<i>Platyceps najadum</i>	41°51'47" N 23°9'18" E	368	Killed on the road.
10.05.2015 г.	<i>Dolichophis caspius</i>	41°50'50" N 23°10'29" E	697	Adult. ind. hiding regularly in disposed construction waste.
10.05.2015 г.	<i>Dolichophis caspius</i>	41°50'48" N 23°10'31" E	678	Juv. ind. (45 cm.) near NCCVF.
2015	<i>Dolichophis caspius</i>	41°51'50" N 23°9'58" E	420	Four killed ind. Between Poletto and Brejani (summer).
2011	<i>Dolichophis caspius</i>	41°50'48" N 23°10'31" E	690	Killed by locals during construction work of NCCVF (2011).
10.04.2015 г.	<i>Zamenis longissimus</i>	41°47'38" N 23°9'10" E	476	
14.05.2015 г.	<i>Zamenis longissimus</i>	41°51'48" N 23°9'53" E	495	Killed on the road (and at least two more killed in 2015).
3.05.2015 г.	<i>Zamenis longissimus</i>	41°51'59" N 23°9'36" E	396	Juv. ind. crossing road.

II. Threats and conservation measures

During the research period, we identified the human attitude and activities as a main threatening factor for the herpetofauna in the area. Some amphibian species and snakes were found killed on the roads, as mainly for the latter this could be often classified as a result of deliberate actions. Snakes were also killed by the locals during construction works around NCCVF.

In the period of the present study, the following conservation activities were taken and evaluated for the amphibian and reptile species in the area:

1. Building of artificial water bodies was recognized as the most effective measure for the support of the populations of *Bombina variegata*, *Rana dalmatina*, *Rana graeca*, *Pelophylax ridibundus* and partially *Natrix natrix* (Figure 2). These species were observed in the cattle water tanks, including the new build by FWFF, where the process of inhabiting was short - within the same active season (Figure 2). As some of the streams in the area are drying during summer, the establishment of larger pools along them is an effective way to provide the amphibians with more places suitable for reproduction. After the building of such pool in the early spring of 2014, a Greek stream frog was observed there for the first time in the area within the same active season.



Figure 2. Water source used by the domestic animals and inhabited by amphibians, including over 200 ind. of *Bombina variegata*.



Figure 3. Construction of water source with pool for cattle, inhabited by *Rana dalmatina* within the same season.

2. Construction of dry stone walls was identified as an effective measure in support of amphibians and reptiles. The walls were deliberately made without using cement, in order to preserve the suitable spaces between the stones (Langton and Burton, 1998). During the research five species were observed in the new build walls of NCCVF (*Salamandra salamandra*, *Lacerta viridis*, *Podarcis erhardii*, *Dolichophis caspius*, *Platyceps najadum*), where suitable shelters and basking places were provided (Figure 3).



Figure 4. The new build dry stone walls of Vila Fauna became a suitable reptile habitat, for example for *Platyceps najadum*.

3. Working with the local community for building of positive attitude to reptiles was identified as very important factor in the conservation of these taxons, especially for the snakes. In many cases, snakes were found killed on the roads and also around the NCCVF during construction works, conducted by the locals. One of the main tools for neutralizing of this problem was to develop the concept of specialized tourism based on biodiversity, as a source of economic income for the local community.

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