

## **AMPHIBIA AND REPTILIA OF ŠTOJ PLAIN (ULCINJ, MONTENEGRO)**

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There are 20 good and certain species of amphibians and reptiles in the Štoj Plain. Most populations are composed of atypical forms, distinctly polymorphous in many characters.

**Key words:** Amphibia, Reptilia, morphology, biodiversity, ecosystem vulnerability.

### INTRODUCTION

Štoj Plain is situated in the most southern part of Montenegro and is surrounded by water. To the north the boundaries are the complex of basins of the Ulcinj salt pans (former Zogajsko Blato), to the east the boundary is the Bojana River, to the south the Adriatic Sea, and to the west Milena Bay (former mouth of the Bojana River to the Adriatic Sea).

The creation of the Štoj Plain dates to late Pleistocene and early Holocene. The causes of its origin are: positive epeirogenous movements, accumulation of alluvial sediments of the Bojana and Drim Rivers, and deposition of material brought by sea currents (Radulović 1983a, 1983b; Mirković *et al.* 1985; Živaljević 1989; Geomorfološka karta Crne Gore

1:100.000 2000). Since the beginning of its formation, the Štoj Plain has been characterized by low altitude, increased salinity of substrate (Pedološka karta 1966; Fušić 2000), increased natural radioactivity of the substrate (Vukotić *et al.* 1998), high level of underground water, high air humidity, high mean yearly temperatures and pronounced macro- and microgeographic (physical) isolations.

The southern part is composed mostly of moving marine sand or sand poorly bound with weak vegetation, while the northern part is made of swamp-like alluvium (Pedološka karta 1966).

Until 1995, Štoj Plan included several different types of habitats inhabited by amphibians and reptiles. Their distribution from south toward the north was as follows:

- moving marine sand, without vegetation or with herbaceous vegetation; this belt is 12-13 km long and about 500 m wide; it includes several artificial ponds (in the open) which are either devoid of vegetation or overgrown; water in all ponds is brackish and weakly radioactive; the artificial ponds are separated by brush, woodland stands, pastures or fields with various agricultural cultures;

- fields under grass or some agricultural culture in the urban part; the substrate is connected marine sand;

- belt of oak forests with deep ponds and swamps (the substrate is swamp alluvium) crisscrossed by grassy meadows which originated as places of logging or dried parts of swamps; the water in the marshes is brackish and weakly radioactive; there is a sharp boundary between the urbanized part and the oak forests, represented by the local concrete road stretching in direction East-West;

- channels and basins of Ulcinj saltpans are the northernmost belt of Štoj Plain, with weak vegetation;

- belt zone of thick oak forests and grassy fields at the east, near the mouth of the Bojana River into the sea and upstream.

The whole Štoj Plain is divided into Donji and Gornji Štoj (Lower and Upper Štoj). There are no further demarcations apart from these two areas. Therefore in this paper the localities were cited according to the habitats or the most prominent objects in the vicinity of the site where the specimen was observed or collected. All the studied sites were at the altitude of -1 to +3 m. The herpetofauna of Štoj Plain was insufficiently studied and there were only some preliminary contributions (Jovanović 1986, 1995).

## MATERIAL AND METHODS

This paper was based on results of studying several hundred specimens of amphibians and reptiles from Štoj Plain, collected at more than 50 localities in the months of March, May, June, July, August, September and November, continuously from 1984 to 1995. During these 11 years the studied area was about 15 km<sup>2</sup>. Amphibians and reptiles were collected in all habitat types at Štoj Plain, at various times of day and year.

They were collected by bare hands or with fishing nets. The number of collected specimens was minimal. Juvenile reptiles were not collected. Most collected specimens were macerated in a solution of NaOH in order to prepare the osteological specimens, while a smaller number is kept in jars with 73% ethanol. All the osteological specimens cited in this paper are stored in the *Osteological collection of amphibians and reptiles* at the Natural History Museum in Belgrade. These specimens were collected by Miodrag Jovanović, Luka Čaće, Jelena Jovanović and Nikola Zdravković.

## RESULTS

### Faunistic list

#### Amphibia

##### *Caudata*

##### *Salamandridae*

##### 1. *Triturus carnifex* ssp.

Donji Štoj – with gills, forest swamp, March 23<sup>rd</sup>-26<sup>th</sup> 1987; with gills, forest ponds, August 20<sup>th</sup> – September 17<sup>th</sup> 1985 and July 27<sup>th</sup>-28<sup>th</sup> 1989; adults, forest swamp, 2 ♂, March 23<sup>rd</sup>-26<sup>th</sup> 1987; adults, forest, under a rotten tree stump, 6 individuals, July 3<sup>rd</sup> 1992; adults, pond “near the school”, 6 ♂ and 5 ♀, March 26<sup>th</sup> 1987.

##### 2. *Lissotriton vulgaris graecus* (Wolterstorff, 1905)

Donji Štoj – with gills, forest pond, July 28<sup>th</sup> 1989; with gills, pond “near the school”, March 25<sup>th</sup> 1987; neotenic, pond “near the school”, July 17<sup>th</sup> 1987 and August 4<sup>th</sup> 1987; adults, pond “near the school”, March 25<sup>th</sup> 1987; female with eggs, pond “near the school”, November 30<sup>th</sup> 1989.

Gornji Štoj – with gills, pond “near the highway”, July 14<sup>th</sup> 1989.

## **Anura**

### **Bufonidae**

3. *Bufo bufo* ssp. (?*spinosus*)

Gornji Štoj – grassy field, under a pile of rocks, August 1985; grassy field, under rotten logs, August 5<sup>th</sup> 1990.

4. *Epidalea viridis* ssp.

Donji Štoj – settlement, July 24<sup>th</sup> 1989; settlement, three specimens, August 1990.

### **Hylidae**

5. *Hyla arborea arborea* (Linnaeus, 1758)

Donji Štoj – settlement, two specimens, 1995; November 30<sup>th</sup> 1989.

### **Ranidae**

6. *Pelophylax* sp. Fitzinger 1843

Štoj Plain – ponds, marshes, high grass, forest, August 1984; March 6<sup>th</sup> 1987; August 4<sup>th</sup>-8<sup>th</sup> 1987; (several specimens) July 7<sup>th</sup> 1989; (2 specimens) June 15<sup>th</sup> 1989; (several specimens) July 19<sup>th</sup>-22<sup>nd</sup> 1989; July 21<sup>st</sup> 1989; July 1989; July 22<sup>nd</sup> 1990; July 29<sup>th</sup> 1990; August 8<sup>th</sup> 1990; (several specimens) August 1990.

7. *Rana dalmatina* Fitzinger in Bonaparte, 1838

Donji Štoj – young adult, forest, July 23<sup>rd</sup> 1989; adult, forest, July 29<sup>th</sup> 1988, June 28<sup>th</sup> 1992, July 1992 and June 1994.

## **Reptilia**

### **Chelonia**

#### **Emydidae**

8. *Emys orbicularis* ssp.

Donji Štoj – forest swamp, adult, March 25<sup>th</sup> 1987.

Gornji Štoj – pond, two specimens, July 14<sup>th</sup> 1989; pond ♀, June 1989; pond, ♀, June 1990, July 29<sup>th</sup> 1992 and July 1993;

#### **Testudinidae**

9. *Testudo hermanni* (?)*hercegoviensis*.

Donji and Gornji Štoj – adults, terrain under vegetation, August 1984, August 6<sup>th</sup> 1987, July 1990, August 1990, 1990, June 1993, July 1993.

**Squamata****Sauria****Anguinae**

10. *Anguis fragilis* ssp. Linnaeus, 1758.

Donji Štoj – August 1993; swamp forest, under a rotten tree stump, July 3<sup>rd</sup> 1992; forest besides the seashore, inside a rotten log, July 31<sup>st</sup> 1992.

Gornji Štoj – field, under hay, July 18<sup>th</sup> 1989;

11. *Pseudopus apodus* (Pallas, 1775)

Donji and Gornji Štoj – all sites with sparse vegetation, August 4<sup>th</sup> 1987, July 18<sup>th</sup> 1989 and August 2<sup>nd</sup> 1991.

**Lacertidae**

12. *Lacerta trilineata* Bedriaga, 1886.

Donji Štoj, thorn bushes, August 1991.

13. *Lacerta viridis* (Laurenti, 1768)

Donji i Gornji Štoj - observed on thorn bushes and banks of River Bojana.

14. *Podarcis melisellensis* (?) *fiumana* Werner, 1891.

Donji Štoj – settlement, March 25<sup>th</sup> 1987; forest swamp, July 28<sup>th</sup> 1987; settlement, ♀ with 4 eggs in her stomach, July 4<sup>th</sup> 1989; settlement, lizards mating, July 9<sup>th</sup> 1989; field 100 m from the sea, July 9<sup>th</sup> 1989; inside a rotten fallen tree on a field, three eggs, August 5<sup>th</sup> 1990.

15. *Podarcis muralis* ssp.

Donji Štoj – forest, in trees, July 1989; August 1990.

16. ?*Lacerta sicula*

Donji Štoj – settlement, August 1988.

**Serpentes****Colubridae**

17. *Natrix natrix* (Linnaeus, 1758)

Donji Štoj – forest swamps, August 8<sup>th</sup> 1987; ♀ with 11 eggs, July 21<sup>st</sup> 1989; 1990; August 1991; July 28<sup>th</sup> 1992,

Gornji Štoj – pond, July 14<sup>th</sup> 1989;

18. *Natrix tessellata* (Laurenti, 1768)

Donji Štoj – forest swamp, August 8<sup>th</sup> 1987.

19. *Dolichophis caspius* (Gmelin, 1789)

Donji Štoj – swamp forests and their edges, August 4<sup>th</sup> 1987;

Gornji Štoj – sand road near the forest, June 24<sup>th</sup> 1993.

20. *Zamenis longissimus* (Laurenti, 1768)

Donji Štoj – settlement, part of body, 1989.

21. *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827)

Gornji Štoj – highway, August 1988; August 1990; July 1992.

*Viperidae*

22. *Vipera ammodytes* ssp.

Donji Štoj – swamp forest, August 5<sup>th</sup> 1986, July 28<sup>th</sup> 1988; bushes, July 1992.

## DISCUSSION

Studies of herpetofauna of the Štoj Plain were performed in the period 1984-1995. Studies of collected specimens resulted in the identification of 6 good and certain species of amphibians and 14 good and certain species of reptiles.

During a prolonged period of time, the pessimal abiogenic factors induced certain types of selective pressure on amphibians and reptiles of Štoj Plain, inducing the appearance of diverse, specific adaptations. The adaptive processes to the conditions of Štoj Plain are still ongoing in these vertebrates. The unpolished adaptations are the cause of larger phenotype polymorphism in their populations and morphological (osteological) specificities.

*Triturus carnifex* ssp. lives at the bottom of ponds and marshes, in the basins with muddy bottoms, at -1 m of altitude. These basins were more than 1000 m from the sea coast. They were recorded in the ponds until mid-September. The body length of two ♂ collected in March 1987 were 66.3 mm and 66.5 mm. The length from the top of the snout to the end of the tail was about 116 mm. The length of forelimbs was 66% of the distance

between the front legs and hind legs. The body lengths of gill-bearing juveniles were 43-60 mm.

*Lissotriton vulgaris graecus* inhabits the bottoms of all ponds from -1 to 0 m above sea level, at a distance of more than 1000 m from the sea coast. They were recorded both in forest ponds and the ponds in open areas. They were very rare in ponds with sandy bottoms. The length between the top of the snout and end of the tail (without the filament) was 53 cm in the longest ♂ and 51 cm in the longest female. In the longest non-metamorphosed specimen, that length was more than 60 mm. The mean value of total length in non-metamorphosed specimens (calculated on a sample of 37 measured individuals) was 5.7 cm. The neotenic larvae had fingers about twice as long as in larvae of the same age that were going to metamorphose and in adults. One female with eggs was recorded in late November in a pond where the temperature was about 6°C. In some of the ponds there were both *Triturus carnifex* ssp. and *Lissotriton vulgaris graecus* living in sympatric conditions. *Lissotriton vulgaris graecus* has a wider distribution at the Štoj Plain than *Triturus carnifex* ssp.

*Salamandra atra* Laurenti, 1768 was not recorded at the Štoj Plain; it was recorded by mistake in the paper at the Seventh congress of biologists of Yugoslavia (Jovanović 1986).

All toads *Bufo bufo* ssp. (?*spinosus*) were recorded in daytime, with an air temperature of about 35°C. These sites were 50-100 m from the closest wood stands, 150-300 m from the closest permanent ponds and about 500-800 m from the sea coast. The altitude of these localities was 0 to +1 m above sea level. Each of the collected specimens had three longitudinal darker stripes on the back. There were numerous smaller and larger warts with sharp spines on the reddish-brown skin. Most spiny warts were around the parotid glands, at the lateral sides of the body and on the ventral side of the neck. The dimensions of the collected toad were: body length 72 mm; head length 27.4 mm; head width 25 mm; length of parotid glands 15 mm; width of parotid glands 5 mm; inter-orbital distance 5.7 mm; length of the forelimb, from the wrist to the chest 40 mm; length from the tip of the longest finger to the wrist 15 mm; length of hind limb from ankle to cloaca 53.6 mm; length of foot from the tip of longest toe to the heel 40.2 mm. According to the external morphology, zoogeography and zoecological characteristics, these toads are close to the subspecies *spinosus*. According to Lange (1973), body size and the number of sharp spines in the skin of toad *B. bufo spinosus* increase from north to south of their range. Dimensions of all three toads from the Štoj Plain are smaller than expected for *B. bufo spinosus* in this part of Europe.

Green Toads, *Epidalea viridis* ssp., were recorded only in the settlement, in household yards. The localities were about 1 m above sea level,

about 1000 m away from the sea coast and 200-500 m from the closest permanent ponds. All the observed specimens were lighter in color than those in Serbia, smaller and with numerous red warts on the skin.

European Tree Frog *Hyla arborea arborea* is one of the commonest and most abundant anurans and amphibians in general at the Štoj Plain. It is present in all places with better-developed vegetation and higher air humidity, on reeds and bushes around the ponds and certain forest swamps, as well in the yards of the houses. It shuns the sparse vegetation on sandy substrate. The closest recorded distance from the sea coast was 200-300 m. It was recorded at altitudes of -1 m to +3m above sea level. During the night these amphibians climb the house walls and approach light bulbs in order to catch insects. They reach the abundance maximum once every 5 or 6 years. According to measurements performed on five specimens, the body is 3.65 times longer than the head, while the tibia is 0.98 times longer than the femur.

The taxonomy of frogs from the genus *Pelophylax* Fitzinger 1843 at the Štoj Plain is complex and still unresolved. There are two clearly distinct morphotypes, two phenotypes, two ecotypes and two ethological types. **Morphotypes according to Radovanović (1951):** I. Length of hind legs and size of knobs at the first toe as in *Pelophylax ridibundus*. II. Length of hind legs and size of knobs at the first toe as in *Pelophylax lessone*. It should be noted that in the dark swamp forests the recorded individuals were almost exclusively small, while larger individuals were most commonly recorded in the open areas. **Phenotypes (ibid):** I. Dorsal side green, grayish green or brownish green, or the anterior part is green and posterior part grayish, without or with only a very small number of darker markings. There are no dark markings on the head. The ventral side of the body is quite pale or grayish with more or less distinct darker markings. The hind legs are greenish-grey with dark markings (forms with dominant characters of *R. lessone*). II. Dorsal side of body is dark green with many dark brown markings. There is a light green medio-dorsal stripe. In many cases there is one additional longitudinal green stripe on each side of the body toward the flanks. The tympanums on the head are very dark. There is a dark stripe leading from the edge of the upper eyelid toward the shoulder. There is another dark stripe from the front angle of the eyelid toward the nostrils and the top of the snout, while a white stripe is present above the upper lip. The inner sides of thighs and the outer side of the abdomen are yellowish-orange (untypical *Pelophylax ridibundus* or hybrids *Pelophylax ridibundus/ Pelophylax lessone*). **Ecotypes:** I. Frogs that spend most of their time in the pond, on the pond bank or in the swamp, moving no further than 3-5 m from it (as in *Pelophylax ridibundus*). II. Frogs that spend most of their time away from the ponds and swamps, even 100 or

more meters away (as in *Pelophylax lessone*). **Ethological types:** I. Frogs that, when scared, immediately jump into the water basin and stay on its bottom for a longer period of time. They mostly inhabit ponds with sparsely developed vegetation (as in *Pelophylax ridibundus*). II. Frogs that, when scared, even if they are at the edge of a pond, jump into the vegetation, further away from the pond, in order to hide. If they are forced to jump into water, they stay near the surface and climb to dry land very soon. They were observed in the vicinity of ponds overgrown in thick vegetation (as in *Pelophylax lessone*).

The Agile Frog *Rana dalmatina* is relatively rare at Štoj Plain.

*Emys orbicularis* ssp. are common in all ponds of the Štoj Plain that either have higher, thicker vegetation or are situated in the immediate vicinity of forests, with an altitude of -1 m do +1 m. According to Fritz (1992, 1994), the Štoj Plain is inhabited by *Emys oricularis hellenica* (*Valenciennes*).

*Testudo hermanni* (?) *hercegoviensis* is very common in the study area, most often recorded around the forest edges, at forest glades and in fields overgrown with low vegetation. It is very rare on moving marine sand without vegetation. The latitudes of the localities where it was recorded were between 0 m and +1m. About 100 specimens of these tortoises were studied during the 11 years of research and the following results were obtained: in about 15 % of individuals the supracaudal plate is undivided (as in *Testudo graeca*), in about 10% of individuals the length of medial line between the third pair of plates on the plastron is shorter than the corresponding length between the fifth pair of plates (as in *Testudo hermanni boettgeri*), about 2-3% of individuals have strongly developed warts on the posterior sides of thighs; they are mostly darker in color than tortoises from Serbia. All these characteristics are freely and independently combined in various individuals. According to literature data (Fritz *et al.* 2006), Štoj Plain is the region of contact between two subspecies of Hermann's Tortoise: *Testudo hermanni hercegoviensis*, which inhabits the northwestern coast of Adriatic Sea, from Istria to southern Montenegro, and *Testudo hermanni boettgeri* present in the South (Albania, Greece) and East (Serbia).

The sample of studied sexually mature individuals of *Anguis fragilis* in the study area included 14 individuals. The minimal body length (without tail) varied from 16 to 17 cm. They were recorded at altitudes of about 1 m above sea level, almost exclusively in sites with vegetation. They were extremely rare on marine sand. One inactive specimen was recorded under the bark of a rotten tree in the immediate vicinity of a coiled *Natrix natrix persa*, and another just beside the anthill of big black ants. The snake and the ants were completely indifferent toward these two slowworms. All the

studied slowworm specimens from the Štoj Plain had poorly visible but open ear canals, which is the morphological characteristic of subspecies *Anguis fragilis colchicus* Nordmann, 1840 (Džukić 1987) and they lacked the blue spots on the body characteristic of the subspecies *Anguis fragilis fragilis* Linnaeus, 1758 (ibid). According to Džukić (ibid), the Štoj Plain is inhabited by *Anguis fragilis colchicus* (Nordman, 1840). From the phenotype standpoint, none of the studied slowworms was typical of *Anguis fragilis colchicus* Nordmann, which would be expected according to the literature data (ibid).

*Pseudopus apodus* is rare at the Štoj Plain. It was recorded only at sunny places with sparser vegetation. It is very rare on sandy substrate. The altitude of the localities where it was recorded was 0 m to +3 m. The glass lizards become roadkill on the highway leading almost parallel to the sea coast (about 600-700 m north from it) more often than other reptile species. The highway almost perfectly divides the Štoj Plain into the southern part with marine sand, mostly loosely or poorly connected with vegetation, and the northern part with mostly marsh alluvium (Pedološka karta Crne Gore 1:50.000, 2000). It is obvious that this traffic line cuts through certain lines of circadian migrations of *P. apodus*. A similar number of casualties was recorded at a local road parallel to the highway and coastline but even more toward north. These lizards die on the roads mostly in morning hours or at dusk. All the recorded individuals were shorter than 1 m.

*Lacerta trilineata* is a rare lizard of the Štoj Plain. The altitudes where it was recorded were between 0 m and 3 m.

*Lacerta viridis*. The Green Lizard is relatively rare in this area. It was most commonly observed in thick thorny bush close to open areas, or in vegetation by the shore of Bojana River. An almost completely black specimen was observed once. All the lizards were about 30 cm long and none was collected.

*Podarcis melisellensis* (?) *fiumana*. It belongs to the group of commonest reptiles of the Štoj Plain. Fourteen specimens were collected. They were recorded only in open habitats (bound marine sand) – at the grassy fields, on sparse rocks, in yards and on house walls. It was found on sand 20-30 m away from the sea coast. Two eggs of this species were excavated from soil in one back yard in early August 1987, from a depth of about 10cm. One of them contained a moving embryo. Three additional eggs were discovered in early August 1990 under a fallen, semi-rotten oak tree on a grassy meadow. Their mean length was 12.4 mm and mean width was 9.3 mm. All three eggs were incubated but only one young hatched on August 31<sup>st</sup> 1990. Cannibalism was recorded in adult individuals. According to Boulenger (1920), there are differences in morphology and phlo-

dosis between the lizards from Štoj and those from Dalmatia (and its outback).

*Podarcis muralis ssp.* was recorded on certain larger, partially sun-drenched oak trees at the edges of swamp trees in the Štoj Plain. The coloration of recorded adults resembles the species *Podarcis muralis*. The juveniles had a melanistic body and tail, while their heads were gray. These are arguably the most cautious lizards of Southeastern Europe. They would hide upon the tree at the slightest movement which they could notice at a distance of 4-5 m. According to pholidosis they were determined (by Dr Georg Džukić) as *Podarcis muralis albanica* Bolkay 1919, although they have certain characteristics distinguishing them from the specimens from Albania and Ohrid (Bolkay 1928). The most important difference in the pholidosis of *Podarcis muralis ssp.* from Štoj and *Podarcis muralis albanica* from Albania and Ohrid is the number of abdominal plates. The average number of these plates is 28.3 in lizards *Podarcis muralis ssp.* from Štoj and 26 in *Podarcis muralis albanica* from Albania and Ohrid (Bolkay 1928). *Podarcis muralis ssp.* from Štoj also differs from *Podarcis muralis albanica* from Albania and Ohrid by the length ratio of head and body.

*Lacerta sicula*. Only a single, very much damaged specimen was collected, so the taxonomic determination could not be performed to the full extent.

*Natrix natrix* is distributed at ponds, marshes and their vicinity. These snakes are more common in water basins overgrown with thick vegetation. Two subspecies were recorded: *Natrix natrix natrix* and *Natrix natrix persa*. *N. natrix natrix* is rare and comprises 10-20% of the total population of Grass Snakes in this area. Their dorsal side is grayish-green, while the ventral side is yellow in the front (1/4 or 1/3 of total length) and dark or almost black in the rear part. One almost completely black individual was observed in the forest swamp. Most snakes of this subspecies were shorter than 100 cm but longer than *N. natrix persa*. *Natrix natrix persa* comprises most of the Grass Snake population at Štoj – 80-90%. The color of the dorsal side is more variable, from very dark to light. The longitudinal light stripes are always prominent and whole, without interruptions. Besides the longitudinal light stripes there may also be some pronounced darker blotches on the flanks. On the ventral side they are usually darker than *N. natrix natrix* and the body length is also shorter. The body cavity of a female *N. natrix persa* collected on June 21<sup>st</sup> 1989 contained 11 eggs and a semi-digested *Anguis fragilis* about 12-13 cm in length.

At the Štoj Plain, the Dice Snake *Natrix tessellata* (Laurenti, 1768) is much less common than the Grass Snakes. Only four individuals were observed in 11 years of study. The maximum length of these snakes was about 80cm. Two individuals were observed sunbathing on bushes, 70-80

cm above ground. It was noted that they are distinctively faster moving than *Natrix natrix*. The other two individuals were recorded in a pond with very little water, together with 6 smaller *Natrix natrix persa*. All these snakes were rolling and crawling over each other. One specimen was collected. Its dorsal side was grayish-green with less distinctive darker pattern. The ventral side had an intense orange-red color. At the Štoj Plain these snakes predominantly feed on small fish from the genus *Gambusia*, which are very abundant in ponds and swamps. *Gambusia* were introduced to waters of Štoj several decades ago, as a natural enemy of malaria-carrying mosquitoes (their larvae).

*Dolichophis caspius* belongs to the group of rare reptiles of the Štoj Plain. In 11 years only three specimens were observed, and one of them (130 cm long) was collected and macerated. The stomach contents included a half-digested *Ophisaurus apodus* about 40 cm long.

*Zamenis longissimus* is a rare type of snake and during our studies only part of the body was recorded as roadkill on the highway. The altitudes of the localities were about +1 m.

At the highway passing through Štoj we recorded the roadkill remains of a specimen of *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827). The species was determined according to the preserved body vertebrae as presented in the identification guide by Szyndlar (1984, 1991).

*Vipera ammodytes* ssp. is a relatively common snake at Štoj Plain. It was observed only in areas with thicker vegetation. It was absent in sand-covered areas. These snakes were observed both on ground and in trees. In the Štoj area this snake climbs trees to heights of over 3 m. The captured specimen was kept in a cloth bag and it ate one smaller *Rana dalmatina* and several *Hyla arborea* over the course of several days.

## CONCLUSIONS

There were 20 good and certain species of amphibians and reptiles recorded in the studied part of the Štoj Plain.

The recorded number of species at the Štoj Plain is about 2.5 times smaller than the number of amphibian and reptilian species recorded in the vicinity of Skadar Lake (51 species) according to Crnobrnja-Isailović, Džukić (1997). Therefore the herpetofauna of Štoj Plain may be considered a reduced and partially altered herpetofauna of the vicinity of Skadar Lake, i.e. its derivative.

The causes of decreased diversity of herpetofauna of Štoj when compared to diversity in the vicinity of Skadar Lake are definitively the

pessimistic abiotic factors present in the area – increased salinity of land water, very low altitude, primarily sand-based substrate, high level of underground water and lack of stony areas. The increased salinity of land water (marshes and ponds) almost completely disables survival of stenohaline amphibians that live in the surrounding areas. Due to the very low altitude of the terrain, underground waters cover almost 50% of the Štoj Plain during the greater part of the year. The high level of underground water causes significantly lower soil temperature than expected. The lower temperatures of soil and water in ponds and marshes lead to the prolongation and deceleration of development of reptilian and amphibian embryos in eggs. Additionally, the reptile eggs at the Štoj Plain are developing in a more anaerobic substrate, due to the increased amount of capillary water in sandy soil, caused by the increased level of underground water.

The ecosystems of the Štoj Plain occupy small surface areas and as such are extremely vulnerable. The high-speed urbanization of this area, draining of swamps and ponds, cutting down of forests and continuous anthropogenic pollution are having a pronounced negative impact on local herpetofauna. These changes in the ecosystem are causing the disappearance of certain species, as evidenced by the information on the presence of the turtle *Mauremys rivulata* (oral report by Dr Đorđe Mirić) which was not recorded during the many years of research, as well as the species *Elaphe quatorlineata* and *Zamenis situla* (reported in conversation with local natives). These data support the arguments for the necessity to protect the whole area of the Štoj Plain and all of its fauna and flora in a maximally quick and reliable manner (if it is not too late already).

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## ВОДОЗЕМЦИ И ГМИЗАВЦИ ШТОЈСКЕ РАВНИЦЕ (УЛЦИЊ, ЦРНА ГОРА)

МИОДРАГ ЈОВАНОВИЋ

### РЕЗИМЕ

У проучаваном делу Штојске равнице нађено је 20 добрих и сигурних врста водоземаца и гмизаваца. Жабе рода *Pelophylax* нису могле бити јасно специјски одређене до нивоа врста. Постојање гуштера *Lacerta sicula* у Штојској равници није са сигурношћу утврђено.

Херпетофауна Штојске равнице је вероватно настала од оне из околине Скадарског језера која је реком Бојаном могла да се прошири до овог дела обале Јадранског мора.

Узроци смањеног диверзитета херпетофауне Штојске равнице у односу на ону из околине Скадарског језера су сигурно пеисимални абиогени фактори - повећана заслањеност воде у барама и мочварама, веома мала надморска висина, пешчана подлога, висок ниво подземних вода због кога је подлога хладнија и више анаеробна.

Остеолошка истраживања, за разлику од морфолошких, показала су да код појединих врста водоземаца и гмизаваца Штојске равнице постоје веће разлике у односу на исте таксоне из Србије до чега је дошло током процеса лаганог акумулирања нових мутација у ситуаци-

ји недостатка интензивнијег генетичког мешања са полулацијама ван ове територије.

Екосистеми овог подручја заузимају мале површине и као такви су изузетно рањиви. Максимално брза урбанизација овог подручја, исушивање мочвара и бара, сеча шума, загађивања свих врста изразито негативно делују на херпетофауну Штојске равнице. Брзина којом се уништава природа у овом делу Црне Горе фантастична је и може се очима пратити из сата у сат. Зато постоји апсолутна неопходност да се простор Штојске равнице максимално заштити што је могуће хитније.