Acta ZooBot Austria **155**, 2018, 323–336

Amphibian and reptile fauna of the Vjosa River, Albania

Thomas Frank, Enerit Saçdanaku, Michael Duda & Ferdinand Bego

Knowledge about amphibians and reptiles of the Vjosa river is missing so far, and the present work is the first report of the herpetofauna of this part of Albania, including the types of habitats in which individual species were observed. Six amphibian and eight reptile species were found at eleven sampling sites along the Vjosa river that were surveyed during several short-term expeditions conducted from 2016 to 2017. All of these 14 species are listed in the Berne Convention on the Conservation of European Wildlife and Natural Habitats as either protected or strictly protected species. Moreover, nine species are listed in the National Red List of Flora and Fauna of Albania, and eight species are listed in Appendix IV of the European Union Habitats Directive. Thus, even this very preliminary survey of the local herpetofauna clearly shows that the area of the Vjosa river is of high conservation value for amphibians and reptiles.

Frank T., Saçdanaku E., Duda M. & Bego F., 2018: Amphibien- und Reptilienfauna der Vjosa, Albanien.
Bislang gibt es keine Literatur über die Amphibien und Reptilien an der Vjosa. Vorliegende Arbeit ist die erste über die Herpetofauna dieses Teiles Albaniens, inklusive der Beschreibung der Habitattypen, in denen die Arten nachgewiesen wurden. Sechs Amphibien- und acht Reptilienarten wurden innerhalb von einigen kurzfristigen Begehungen zwischen 2016–2017 entlang der Vjosa gefunden. Alle 14 nachgewiesenen Arten gelten nach der Berner Konvention als gefährdet oder stark gefährdet, und neun Arten sind in der Roten Liste Albaniens gelistet. Diese kurzfristigen Erstbefunde zeigen bereits, dass das Gebiet entlang der Vjosa aus der Sicht der Herpetofauna sehr schutzwürdig ist.

Keywords: Amphibia, Conservation, Reptilia, Vjosa river.

Introduction

Albania boasts a high diversity of habitats and is thus able to harbour many species. To date, 16 species of amphibians (Haxhiu 1994, Szabolcs et al. 2017) and 43 species of reptiles have been detected in Albania (Bruno 1989, Haxhiu 1998, Jablonski 2011, Mizsei et al. 2017). Mainly due to the southern location, landscape heterogeneity, and habitat-scale heterogeneity of Albania, this number of species is higher than in many other, even larger, European countries (Haxhiu 1994, 1998).

The exploration of the Albanian herpetofauna started in the early 20th century, when scientists from different countries visited Albania (e.g. Kopstein & Wettstein 1920, Bolkay 1921), but was mostly halted in the second half of the century due to the political, cultural, and scientific isolation of Albania. Recent literature provides more detailed information on the systematics, distribution, and ecology of particular species or restricted regions (e.g. Farkas & Buzás 1997, Oruçi 2010a,b, Jablonski 2011). The last major updates provide a complete annotated checklist of species and distribution maps of amphibian and reptile species in Albania (Szabolcs et al. 2017, Mizsei et al. 2017).

The decline of amphibian and reptile populations has been reported worldwide and is most often linked to habitat loss and degradation, unsustainable trade, expansion of invasive species, pollution, disease, climatic processes, and synergies between these threats (Gibbons et al. 2000, Cushman 2006, Sodhi et al. 2008, Cox & Temple 2009, Todd et. al. 2010). Globally, amphibians are considered as one of the most threatened taxonomic

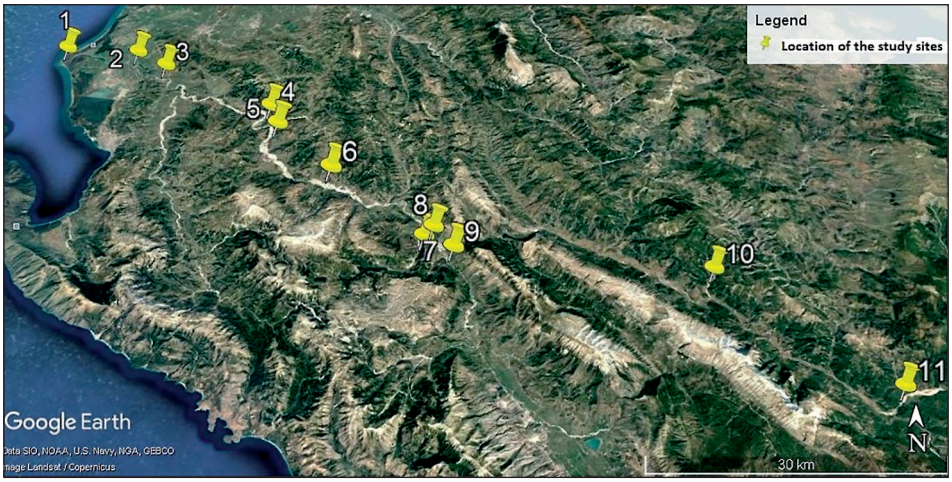

Fig. 1: Sampling sites along the Vjosa River surveyed during 2016–2017: 1. Vjosa Delta; 2. Mifoli; 3. Kashishta; 4. Poçemi; 5. Kuta; 6. Ane Vjosa; 7. Tepelena; 8. Bença; 9. Lekli; 10. Lengarica; 11. Tre Urat (Permeti). – Abb. 1: Sammelpunkte entlang der Vjosa von 2016–2017: 1. Vjosa Delta; 2. Mifoli; 3. Kashishta; 4. Poçemi; 5. Kuta; 6. Ane Vjosa; 7. Tepelena; 8. Bença; 9. Lekli; 10. Lengarica; 11. Tre Urat (Permeti).

groups (Gibbons et al. 2000, Alroy 2015), with almost half of the species continuously declining (Stuart et al. 2004). As extinction risk affects 20 % of the reptile species globally (Böhm et al. 2013), knowledge of their distribution is essential for understanding biogeographic patterns and ecological processes that are fundamental to effective conservation measures (Zachos & Habel 2011).

Knowledge about amphibians and reptiles of the Vjosa River is very scarce; the only published information is that of Oruci (2010b) on amphibians of thermal waters of Benja along the Lengarica stream, a tributary of Vjosa River, with only two species recorded (*Rana balcanica* (*Pelophylax kurtmuelleri*) and *Rana graeca*).Therefore, with this study, we aim to fill gaps in our knowledge by providing the most recent records of different amphibian and reptile species along the Vjosa River including their conservation status and potential threats.

Material and Methods

Semi-aquatic and terrestrial amphibians and reptiles reported here were found in habitats that are connected with the river Vjosa and were visited during several short-term expeditions conducted from 2016 to 2017. Therefore, the species described below can only be seen as an incomplete selection of the species expected to occur alongside the Vjosa River. Nevertheless, these preliminary data already provide a good insight into the local specifics of the herpetofauna of the project area.

Data on amphibian and reptile species were primarily collected through transect campaigns at the eleven sites (Fig. 1) along the Vjosa River during 2016–2017 (March, April, June, September), not following a given sampling protocol.

The identification of the species observed was conducted based on their morphology, according to the newest field guides to the amphibians and reptiles of Europe (Arnold & Ovenden 2002, Speybroeck et al. 2016). Specimens were left in the field and neither collected nor brought to the laboratory.

Results and Discussion

Six species of amphibians and eight species of reptiles (14 species in total) were recorded (Tab. 1).

Tab. 1: Records of amphibian and reptile species present in the eleven sampling sites surveyed along the Vjosa river during 2016–2017. – Tab.1: Amphibien- und Reptiliennachweis 2016–2017 in den elf Sammelstandorten an der Vjosa.

Species	Vjosa Delta Vjosa	Mifoli	Kashishta	Poçemi	Kuta	Ane Vjosa	Tepelena	Bença	Lekli	Lengarica	Tre Urat
AMPHIBIANS											
1. *Bufo bufo*										+	
2. *Bufotes viridis*					+						
3. *Bombina variegata*										+	
4. *Rana graeca*					+			+		+	+
5. *Pelophylax kurtmuelleri*			+		+		+		+	+	+
6. *Pelophylax shqipericus*					+						
REPTILES											
1. *Testudo hermanni*					+	+					
2. *Emys orbicularis*	+			+	+						
3. *Mauremys rivulata*					+						
4. *Pseudopus apodus*					+						
5. *Podarcis muralis*			+								+
6. *Podarcis tauricus*		+			+	+					
7. *Natrix natrix*					+						
8. *Natrix tessellata*										+	
Total species	**1**	**1**	**2**	**1**	**10**	**2**	**1**	**1**	**1**	**5**	**3**

Amphibia

Bufo bufo (Linnaeus, 1758)

The common toad (*Bufo bufo*) is one of the most widespread species in Albania among the anuran species that can be found from coastal to mountainous areas (>2000 m a.s.l) (Haxhiu 1994). It is found in a very wide array of habitats varying from fairly dry maquis, steppes, or dunes to humid marshes, forests, or alpine meadows. It is not uncommon near human habitation, such as gardens, city parks, and ponds. Breeding occurs in an equally wide array of places, but somewhat larger, deep waters with plenty of sun are preferred, such as large ponds, lakeshores, stagnant parts of rivers, or river floodplains (Speybroeck et al. 2016). During our surveys, we observed *B. bufo* in only one site (Lengarica), which is a small river flowing into the Vjosa (Fig. 1). We observed spawning activities of the com-

mon toad along the river in March, April and June 2016 and 2017, as well as some adult individuals.

There are generally no major threats to this widespread and common species. Populations might be locally impacted through deforestation, drainage of wetlands, pollution, agricultural intensification, urbanisation, desertification, mortality on roads (migrating animals), and persecution. *B. bufo* is a protected species listed on Appendix III of the Berne Convention (1972) and in the National Red List of Flora and Fauna of Albania (2013).

Bufotes viridis (Laurenti, 1768)

Being a pioneer species, *Bufotes viridis* requires new and astatic water-bodies as spawning habitats (Heckes & Gruber 2003). Such habitats primarily occur in dynamic floodplains that periodically form temporary shallow waterbodies. Such primary waterbodies have largely disappeared from Central Europe. Thus, pioneer species usually depend on secondary habitats and are forced to adapt to substitute habitats when their original habitats have been destroyed. In a conservation programme for *B. viridis* and *B. calamita* at the Isar river in Bavaria, Pellkofer et al. (2010) listed several factors threatening toad populations. Among the most important factors were ageing of the spawning habitats leading to dense growth of vegetation, re-cultivation and abandonment of gravel pits and abandonment of extensively used ponds, frequent drying-out events at spawning habitats during summer, the increased shading of waterbodies due to the growth of bushes and trees, and introduction of predatory fish. Many of these threatening factors are characteristic of secondary habitats. However, at the highly dynamic Vjosa river we could observe *B. viridis* in its natural habitat. We found it at gravel banks, often below abundantly occurring deposits of woody debris (Fig. 3). Likewise, Schmidt & Indermaur (2014) observed *B. viridis* below wood deposits at the pristine Tagliamento river in Italy – also a natural habitat. They mention the importance of these structures for hunting and hiding, and suggest the establishment of large woody debris as a conservation measure at degraded river systems which cannot provide these important resources any longer.

Bufotes viridis is considered a strongly declining amphibian from Central, Southeastern, and Eastern Europe (Dufresnes et. al. 2011). For example, when comparing the historic with the current situation of this species in Switzerland, its populations were reported to have declined dramatically (Grossenbacher 2003). Based on its Europe-wide decline of populations, *B. viridis* is a strictly protected species listed in Appendix II of the Berne Convention (1979), and also listed in Appendix IV of the European Union Habitats Directive (1992), and in the National Red List of Flora and Fauna of Albania (2013).

Bombina variegata (Linnaeus, 1758)

The yellow-bellied toad (*B. variegata*) is a small aquatic toad with a flattened body and brightly coloured underside (typically yellow or orange with blue-grey or blackish markings), and back grey, brown, yellowish or even olive, with prominent warts, often ending with black, spiny points (Arnold & Ovenden 2002). It is a common species in Albania, often found in hilly and mountainous regions and rarely in coastal areas (Haxhiu 1994). It is a very aquatic and sociable species, i.e. many animals being found together in small areas of water. It can be found in open, often sunny, shallow, and often temporary water that may have little vegetation: small ponds, drainage ditches, pools near and around lakes, clay pits, drinking troughs, flooded tyre tracks, streams, etc. It is a lively, active

toad, often seen floating with its legs spread on the surface of the water (Speybroeck et al. 2016). During our surveys it was observed in Lengarica river in June and September 2017.

At a global scale, the species appears not to be significantly threatened. Populations of this species might be locally threatened by the loss of suitable habitat due to urbanisation, road construction, industry (including oil extraction and transportation), and discharge of pollutants into wetlands. *B. variegata* is a strictly protected species listed in Appendix II of the Berne Convention (1979), and also listed in Appendices II and IV of the Habitats Directive (1992), as well as in the National Red List of Flora and Fauna of Albania (2013).

Pelophylax kurtmuelleri (Gayda, 1940)

The Balkan water frog (*P. kurtmuelleri*) belongs to the genus *Pelophylax* (water frogs), which consists of approximately 20 species that are native to the wider Eurasian continent. While water frogs are among the best-known and most characteristic amphibian species, they are notoriously difficult to distinguish. Variability within each species is considerable (Speybroeck et al. 2016). *P. kurtmuelleri* is native to Albania and Greece, but sometimes not regarded as distinct from the marsh frog (*Pelophylax ridibundus*), which is distributed all over Central and Eastern Europe including the Balkan Peninsula (Arnold & Ovenden 2002). In a recent genetic study (analysing DNA of the species), Dufresnes et al. (2017) identified three distinct *Pelophylax* species, two of which were: Balkan's frog (*P. kurtmuelleri*), native to Greece and Albania, and its sister species the Eurasian marsh frog (*P. ridibundus*), widely distributed throughout Eastern and Central Europe.

Fig. 2: An aberrant individual of *Pelophylax spp*. with partial amelanism found on Tre Urat (Permeti) (Photo: Enerit Sacdanaku). – Abb. 2: Ein unüblich gefärbtes Individuum von *Pelophylax spp*., nachgewiesen in Tre Urat (Permeti) (Foto: Enerit Sacdanaku).

Pelophylax species are highly aquatic, sun-loving frogs which can be found in a wide variety of generally well-vegetated and sunny waterbodies. The Balkan water frog can be found in swamps, ditches, marshes, and along the edges of slow-flowing rivers. It prefers water with heavily vegetated margins, reeds, and floating water weeds (Arnold & Ovenden 2002). We observed it in such habitats at six sites out of eleven (Kashishta, Tepelena, Lekli, Kuta,

Lengarica, and Tre Urat), making it the most widespread species among all species observed during our survey. An interesting finding during our expedition was a strange specimen of *Pelophylax* spp. with a partial yellow coloration on the back side, observed at Tre Urat (Permeti) (40.08308333N; 20.61515E; date: 27.09.2017) in a little stream by the riverside (Fig. 2). This is a rare phenomenon occurring in some of the anuran species described as "amelanism". In the absence of melanin, xanthophores and iridophores establish the pigmentation pattern, and this usually results in a pale yellowish colour of the skin (Pabijan et al. 2004). When this is expressed uniformly throughout the body, the individuals are defined as "xantici". The phenomenon can also be present on only a few portions of skin, as in our case (Fig. 2). This is the first report of such an aberrant individual of *Pelophylax* spp. for Albania; based on the existing literature no similar case has been reported previously.

This species is threatened in its native range by drainage of wetland habitats and aquatic pollution of many waterways caused by agrochemicals and industrial (including mining) contaminants. In northern parts of its native range (e.g. Shkodra lake) it is significantly threatened by overcollection for commercial purposes. The species is additionally threatened by accidental introductions of commercially transported non-native water frogs. However, it remains abundant in many places.

It is a protected species listed on Appendix III of the Berne Convention (1979).

Pelophylax shqipericus (Hotz, Uzzell, Guenther, Tunner & Heppich, 1987)

The Albanian pool frog (*P. shqipericus*) is another water frog belonging to the genus *Pelophylax*. It is endemic to the Balkan Peninsula and native to Albania and Montenegro, where it inhabits freshwater marshes, swamps, ditches, and densely vegetated shorelines of lakes and rivers (Jablonski 2011). Recently, this species was first reported for Italy where it does not occur naturally, but unfortunately it was likely introduced through international water frog trade (Domeneghetti et al. 2013). At the Vjosa river basin we observed this frog in several bigger water bodies.

Pelophylax shqipericus is an endangered species and known populations are currently in decline. Significant threats are pollution and drainage of wetlands, and a more direct threat is the collection of the species for commercial purposes (Gratwicke et al. 2010). *Pelophylax shqipericus* is listed as an endangered species on the IUCN Red List of Threatened Species since 2004 (Uzzel & Isailovic 2009). Moreover, it is a protected species listed in Appendix III of the Berne Convention on the Conservation of European Wildlife and Natural Habitats (1979). Populations in Albania and Montenegro are diminishing due to a variety of factors. Its habitat is being fragmented by the draining of wetlands for infrastructure and farming, and the quality of its remaining habitat is declining through pollution from agricultural and industrial run-off. The northernmost part of its range is Shkodra Lake. Although Shkodra Lake is a protected site on both the Albanian and Montenegrin sides, and is recognised as an important wetland by the Ramsar Convention, there is still a significant amount of collection of amphibians that occurs at the lake for the pet trade and food industry, contributing significantly to the decline of populations.

Rana graeca (Boulenger, 1891)

The Greek stream frog (*R. graeca*) is endemic to the Balkan Peninsula (Džukić & Kalezić 2004). Its distribution ranges from Greece in the south, to parts of Bulgaria, Albania, and

Macedonia through Montenegro, Serbia, and Bosnia Herzegovina in the north (Asimakopoulos 1997). Its natural habitats are deciduous forests, temperate grasslands, perennial and intermittent rivers, springs, and pastures (Šukalo et al. 2015). We observed *R. graeca* in four (Kuta, Bença, Lengarica and Tre Urat) out of eleven sites visited (Fig. 3).

Rana graeca is a protected species listed in Appendix III of the Berne Convention on the Conservation of European Wildlife and Natural Habitats (1979). In Serbia it is among the most vulnerable anurans (Vukov et al. 2015), and it is also listed in the National Red List of Flora and Fauna of Albania (2013).

Fig. 3: *Rana graeca* (adult) observed in the area of Tre Urat, Permeti (Photo: Enerit Sacdanaku). – Abb. 3: *Rana graeca* (adult) aus der Region Tre Urat, Permeti (Foto: Enerit Sacdanaku).

Reptilia

Testudo hermanni (Gmelin, 1789)

Hermann's tortoise (*T. hermanni*) occurs throughout Southern Europe. The Western population (*T. h. hermanni*) occurs in Eastern Spain, Southern France, the Balearic islands, Corsica, Sardinia, Sicily, and South and Central Italy (Tuscany). The Eastern population (*T. h. boettgeri*) inhabits Serbia, Kosovo, Macedonia, Romania, Bulgaria, Albania, Turkey, and Greece, while *T. h. hercegovinensis* populates the coasts of Bosnia and Herzegovina, Croatia, and Montenegro. This tortoise prefers patchy landscapes equipped with shrubs, various kinds of pastures, and sparse herbaceous and grassy vegetation (Couturier et al. 2014, Popgeorgiev et al. 2014), and can frequently be encountered in areas of traditional agriculture, provided it is not too mechanised (Bertolero et al. 2011). Such conditions are fulfilled in the study region at Vjosa River where we observed this species in exactly such habitats at two sites (1. Kuta – three individuals: 40.46715 N; 19.75301667 E; 2. Ane Vjosa: one individual: 40.3886 N; 19.85813333 E) out of eleven (Fig. 4).

An investigation of *T. hermanni* in a traditionally managed rural landscape in Romania revealed its small home range combined with short-distance movements (Rozylowicz & Popescu 2013). As these tortoises have a low ability to recolonise areas

Fig. 4: *Testudo hermanni boettgeri* (adult) observed in the area of Kuta (Photo: Enerit Sacdanaku). – Abb. 4: *Testudo hermanni boettgeri* (adult) aus der Region Kuta (Foto: Enerit Sacdanaku).

Fig. 5: *Emys orbicularis* (Photo: Wolfram Graf). – Abb. 5: *Emys orbicularis* (Foto: Wolfram Graf).

Fig. 6: *Mauremys rivulata* (subadult) observed in the area of Kuta, Vjosa river (Photo: Enerit Sacdanaku). – Abb. 6: *Mauremys rivulata* (subadult) aus der Region Kuta an der Vjosa (Photo: Enerit Sacdanaku).

Fig. 7: *Podarcis tauricus ionicus* (adult) observed in Ane Vjosa, Vjosa river (Photo: Enerit Sacdanaku). – Abb. 7: *Podarcis tauricus ionicus* (adult) in Ane Vjosa (Photo: Enerit Sacdanaku).

which they formerly occupied (Badiane et al. 2017), based on their restricted dispersal capability, heterogeneously structured landscapes characterised by small parcels occurring in the Vjosa study region help to sustain local populations of *T. hermanni*.

Testudo hermanni is listed in the National Red List of Flora and Fauna of Albania (2013), and is a strictly protected species listed in Appendix II of the Berne Convention on the Conservation of European Wildlife and Natural Habitats (1979).

Emys orbicularis (Linnaeus, 1758)

The European pond turtle (*E. orbicularis*) occurs in Southern and Central Europe, Western Asia, and Northern Africa. In the early post-glacial period, it had a much wider distribution, reaching as far north as southern Sweden. *Emys orbicularis* prefers to live in wetlands surrounded by a natural and wooded landscape. Specimens are also found in upland environments (Ficetola & Bernardi 2006). *Emys orbicularis* is usually considered semi-aquatic, as it can occasionally travel up to 4000 metres away from the nearest water resources. It is widespread in Albania, where it occurs in plains and hilly zones up to

an altitude of 1000 metres. It occurs in various watery surroundings such as swamps, canals, pools, streams, water reservoirs, freshwater lakes, as well as in brackish ponds (Lezha, Shengjin) near the sea. It prefers places rich in aquatic plants (Haxhiu 1998). At the Vjosa River system the species was observed in a similar such habitat at three sites (Delta of Vjosa, Pocem and Kute) out of eleven (Fig. 5). In Poçemi it was found in a small macrophyte-rich pond at the margin of the floodplain, which would be destroyed by the planned hydropower plant at Poçemi.

This turtle has a patchy distribution in most countries even though it is widely distributed in Europe. *Emys orbicularis* is regarded as the most endangered reptile in France, and in Switzerland it was extinct at the beginning of the twentieth century and reintroduced in 2010 (Perrot 2016). Habitat loss through long-term drainage has necessitated higher mobility between ponds, leading to increased energy-expenditure and also an increased risk of road mortality (Owen-Jones et al. 2016). Additionally, Trakimas & Sidaravicius (2008) describe habitat fragmentation by traffic as a potential negative impact. Moreover, habitat pollution and the spread of invasive turtle species are further threats to the endurance of *E. orbicularis* (Krizmanić et al. 2015). None of the aforementioned threats occur in the Vjosa area, thus making this pristine ecosystem the most likely area to ensure the species' survival. This is significant, as *E. orbicularis* is listed in the National Red List of Flora and Fauna of Albania (2013). It is a strictly protected species listed in Appendix II of the Berne Convention (1979), and also listed in Appendices II and IV of the Habitats Directive (1992).

Mauremys rivulata (Valenciennes, 1833)

The Balkan terrapin (*M. rivulata*) occurs in the Southern Balkan region, Eastern Adriatic coast from South Croatia and Montenegro southwards, Albania, South Macedonia, South Bulgaria, Turkish Thrace, and Greece, including many Ionian and Aegean islands, and Crete (Speybroeck et al. 2016). It is common in Western Albania in the low and hilly regions which belong to the hilly and lowland Mediterranean climatic region. It lives in watery surroundings with or without swamps, canals, pools, or streams, as well as in brackish water (Butrinti, Shengjini) near the sea. It is abundant in the Southern zone (Saranda), but very rare in the Northern zone (Lezha, Shkodra) (Haxhiu 1998). We observed three individuals of *M. rivulata* (one subadult and two juveniles) in the area of Kuta (40.47243333 N; 19.7552 E) in small water bodies (freshwater channel but very little water remaining because of the summer droughts) covered by dense vegetation near the Vjosa River (Fig. 6). This is the first record of *M. rivulata* in this area (Kuta, Vjosa River).

Several populations of this species have experienced severe declines during the last decades due to anthropogenic pressure throughout its range. *Mauremys rivulata* has dense populations in some areas, but natural wetlands are gravely endangered in the Mediterranean area, as well as in the Middle East. Habitat loss is the main threat to survival of the species. Many aquatic habitats are either drained or canalised due to the ever-growing demand for water, especially in island habitats in the Mediterranean region (Rifai & Mantziou 2005). Fragmentation and habitat destruction is a growing threat for many aquatic animals that cannot easily move to another suitable habitat. Habitat destruction has increased in recent decades due to urban development. Habitats are often destroyed to construct roads, settlements, and hotels. The Balkan terrapin is a species which, although semi-aquatic, cannot move for very long distances in order to find a new habitat. If a small pond re-

mains near their original habitat, turtles remain there instead of searching for a new habitat. Often, however, these remaining pools have no suitable nesting sites around them; thus, in the long term, these populations could become extirpated (Mantziou 2000, Rifai & Mantziou 2005).

M. rivulata is a strictly protected species listed in Appendix II of the Berne Convention (1979), and also listed in Appendices II and IV of the Habitats Directive (1992), as well as in the National Red List of Flora and Fauna of Albania (2013).

Pseudopus apodus (Pallas, 1775)

Pseudopos apodus has a wide distribution and populates the Balkan Peninsula and Asia Minor and Central Asia. It was formerly more widespread and its distribution also spanned Germany, as was reported from Pliocene sediments. It preferentially inhabits open dry and warm habitats, e.g. short grassland or sparsely wooded hills up to 2300 metres (Speybroeck et al. 2016). Moreover, it can be observed in cultural landscapes such as vineyards or stone walls. In Albania it occurs in fields and hilly regions from the seashore to an altitude of about 600 m (Kruje), from Hani i Hotit (north) to Konispol (south). It also enters the Central area of Albania through the valleys of the rivers and through the hilly Mediterranean zone (Haxhiu 1998).

In the study area at the Vjosa, this species was observed in an area characterised by dry grassland sparsely covered with shrubs, a habitat that would be flooded by the planned hydropower plant at Poçemi.

Pseudopos apodus is a strictly protected species listed in Appendix II of the Berne Convention (1979), in Annex IV of the European Union Habitats Directive (1992), and in the National Red List of Flora and Fauna of Albania (2013).

Podarcis muralis (Laurenti, 1768)

The common wall lizard (*P. muralis*) is the most common species in Albania compared to all other species of the family Lacertidae. It occurs everywhere in Albania, from the seashore up to an altitude of about 2000 metres. It occupies a wide range of sunny habitats. It can be found on rocks, stony places, walls of houses, torrents, along railways and roads, in wood and trees, in garden fences, fields etc. (Haxhiu 1998). We observed it at two sites by the river bank in Tre Urat (40.08098333 N; 20.61345 E) and Kashishta (40.59483333N; 19.53978333E). There generally appear to be no major threats to this adaptable and widespread species.

Populations are locally threatened in parts of its range, including those on islands or in mountains (for example through the development of alpine tourism in the Central Mountains of Spain). This species is listed in Appendix II of the Berne Convention (1979) and in Annex IV of the European Union Habitats Directive (1992).

Podarcis tauricus (Pallas, 1814)

The Balkan wall lizard (*P. tauricus*) is quite common in Albania. It prefers plains, hilly zones and valleys, and rarely occurs as high as 1000 metres. It lives in surroundings full of plants, in meadows, gardens, orchards, near woods, riversides, streams, and in sandy seashore zones (Haxhiu 1998). We observed it in such habitats by the riverside at three

sites: Mifoli (40.6359N; 19.45671667E), Kuta (40.47093333N; 19.75435N), and Ane Vjosa (40.38881667N; 19.85736667E) (Fig. 7).

This species is locally threatened in parts of its range by habitat loss through agricultural intensification and pollution (largely from the use of agrochemicals), but overall it is not at significant risk. It is a strictly protected species listed in Appendix II of the Berne Convention (1992), in Annex IV of the European Union Habitats Directive (1992), and in the National Red List of Flora and Fauna of Albania (2013).

Natrix natrix (Linnaeus, 1758)

The grass snake (*N. natrix*) is common all over Albania from the seashore up to an altitude of 1700 metres (Lura Lake), probably even higher. It lives in various watery surroundings such as swamps, lakes, reservoirs, rivers, streams, pools, as well as in gardens, near houses, and in open woods. The most common subspecies in Albania is *N. n. persa* (Haxhiu 1998). We observed it in a small pool by the riverside covered by dense vegetation at one site, Kuta (40.47536667N; 19.75425E).

It is locally threatened in parts of its range by water pollution impacting prey populations (mainly amphibians), drainage of wetland habitats and general intensification of agricultural practice. It is a protected species listed in Appendix III of the Berne Convention.

Natrix tessellata (Laurenti, 1768)

The dice snake (*N. tessellata*) is distributed all over Albania, living in fresh water and sometimes also in brackish water of bays and lakes. It is more commonly found in lakes (Ohrid, Prespa, Shkodra) rather than streams or rivers (Haxhiu 1998). We observed it in Lengarica river in April and September 2017 (both adult and juveniles).

It appears not to be globally threatened. It is threatened by loss or modification of wetland habitats in parts of its range, for example through river channelisation and lakeshore development. This species is considered to be threatened in a number of Western and Central European range states. It is often killed by road traffic, particularly during the mating season. It is a strictly protected species listed in Appendix II of the Berne Convention (1979) and in Annex IV of the European Union Habitats Directive (1992).

Literature

Alroy J., 2015: Current extinction rates of reptiles and amphibians. Proceedings of the National Academy of Sciences America 112, 13003–13008.

Arnold N. & Ovenden D., 2002: A Field Guide to the Reptiles and Amphibians of Britain and Europe, 2nd Edition. London, UK, Harper Collins Publishers, pp. 288.

Asimakopoulos B., 1997: *Rana graeca*. In: Gasc J.-P., Cabela A., Crnobrnja-Isailović J., Dolmen D., Grossenbacher K., Haffner P., Lescure J., Martens H., Martinez Rica J.P., Maurin H., Oliveira M.E., Sofianidou T.S., Veith M. & Zuiderwijk A. (Eds.), Atlas of Amphibians and Reptiles in Europe. Societas Europea Herpetologica and Museum National d' Historie Naturelle, Paris, pp. 141.

Badiane A., Matos C. & Santos X., 2017: Uncovering environmental, land-use and fire effects on the distribution of a low-dispersal species, the Hermann's tortoise *Testudo hermanni*. Amphibia-Reptilia 38, 67–77.

Berne Convention, 1979: Berne convention on the conservation of European wildlife and natural habitats 1979. (http:// conventions.coe.int/treaty/en/Treaties/Html/104.htm).

Bertolero A., Cheylan M., Hailey A., Livoreil B. & Willemsen R.E., 2011: *Testudo hermanni* (Gmelin 1789) – Hermann`s Tortoise. In: Rhodin A.G.J., Pritchard P.C.H., van Dijk P.P., Saumure R.A., Buhlmann K.A., Iverson J.B. & Mittermeier R.A. (Eds.). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Projectof the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs 5, 059.1–059.20.

Böhm M., Collen C., Baillie J.E.M., Bowles P., Chanson J., Cox N., Hammerson G., Hoffmann M., Livingstone S.R., Ram M. et al., 2013: The conservation status of the world's reptiles. Biological Conservation 157, 373- 385.

Bolkay S.J., 1921: Über pflanzen- und gesteinsliebende Lacerten. Blätter für Aquarien- und Terrarien-Kunde 32, 181–184.

Bruno S., 1989: Introduction to a study of the herpetofauna of Albania. British Herpetological Society Bulletin 29.

Couturier T., Besnard A., Bertolero A., Bosc V., Astruc G. & Cheylan M., 2014: Factors determining the abundance and occurrence of Hermann's tortoise *Testudo hermanni* in France and Spain: fire regime and landscape changes as the main drivers. Biological Conservation 170, 177–187.

Cox N.A. & Temple H.J., 2009: European Red List of Reptiles. Office for Official Publications of the European Communities, Luxembourg.

Cushman S.A., 2006: Effects of habitat loss and fragmentation on amphibians: a review and prospectus. Biological Conservation 128, 231–240.

Domeneghetti D., Bruni G., Fasola M. & Bellati A., 2013: Discovery of alien water frogs (gen. *Pelophylax*) in Umbria, with first report of *P. shqipericus* for Italy. Acta Herpetologica 8, 171–176.

Dufresnes C., Betto-Colliard C., Perrin N. & Stöck M., 2011: Thirteen polymorphic microsatellite markers for the European green toad *Bufotes viridis viridis*, a declining amphibian species. Conservation Genetics Research 3, 311–313.

Dufresnes C., Denoël M., di Santo L. & Dubey S., 2017: Multiple uprising invasions of P*elophylax* water frogs, potentially inducing a new hybridogenetic complex. Scientific Reports 7: 6506.

Džukić G. & Kalezić M.L., 2004: The Biodiversity of Amphibians and Reptiles in the Balkan Peninsula. In: Griffiths, H.I., Kryštufek, B. & Reed, J.M. (Eds.), Balkan Biodiversity Pattern and Process in the European Hotspot. Kluwer Academic Publishers, Netherlands, pp. 167–192.

Farkas B. & Buzás B., 1997: Herpetologische Beobachtungen in den Nordalbanischen Alpen. Herpetofauna 19, 10–18.

Ficetola G.F. & De Bernardi F., 2006: Is the European pond turtle *Emys orbicularis* strictly aquatic and carnivorous?. Amphibia-Reptilia 27, 445–447.

Gibbons J.W., Scott D.E., Ryan T.J., Buhlmann K.A., Tuberville T.D., Metts B.S., Greene J.L., Mills T., Leiden Y., Poppy S. & Winne C.T., 2000: The global decline of reptiles, déjá vu amphibians. BioScience 50, 653–666.

Gratwicke B. Evans, M. J., Jenkins P. T., Kusrini M. D., Moore R. D., Sevin J. & Wildt D.E., 2010: Is the international frog legs trade a potential vector for deadly amphibian pathogens? Frontiers in Ecology and the Environment 8, 438–442.

Grossenbacher K., 2003: Die Wechselkröte (*Bufotes viridis*) in der Schweiz: historische und aktuelle Situation. Mertensiella 14, 147–152.

Habitats Directive (1992): Habitats directive – council directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

Haxhiu I., 1994: The herpetofauna of Albania: amphibia: species composition, distribution, habitats. Zoologisches Jahrbuch für Systematik 121, 109–115.

Haxhiu I., 1998: The reptiles of Albania: species compositions, distribution, habitats. Bonner Zoologische Beiträge 48, 35–37.

Heckes U. & Gruber H.-J., 2003: Verbreitung und Bestandssituation der Wechselkröte (*Bufotes viridis* Laurenti, 1768) in Bayern. Mertensiella 14, 130–146.

Jablonski D., 2011: Reptiles and amphibians of Albania with new records and notes on occurrence and distribution. Acta Societatis Zoologicae Bohemicae 75, 231.

Kopstein F. & Wettstein O., 1920: Reptilien und Amphibien aus Albanien. Verhandlungen der Zoologisch Botanischen Gesellschaft Österreich 70, 387–457.

Krizmanić I., Urošević A., Simović A., Krstić M., Jović D., Ajtić R., Anđelković M., Slijepčević M., Đorđević S., Golubović A., Žikić V. & Džukić G., 2015: Updated distribution of the European pond turtle *Emys orbicularis* (LINNAEUS, 1758) and its conservation issues in Serbia. Archives of Biological Science Belgrade 67, 1043–1053.

Mantziou G., 2000: Ecology, distribution and differentiation of *Mauremys caspica* (Testudines: Bataguridae) in Crete. M.Sc. Thesis, University of Crete.

Mizsei E., Jablonski D., Végvári Z., Lengye S. & Szabolcs M., 2017: Distribution and diversity of reptiles in Albania: a novel database from a Mediterranean hotspot. Amphibia-Reptilia 38, 157–173.

National Red List of Flora and Fauna of Albania, 2013: Ministerial Order No. 1280, 20.11.2013.

Oruçi S., 2010a: Data on geographical distribution and habitats of the marginated tortoise (*Testudo marginata* Schoepff, 1792) in Albania. Natura Montenegrina 9, 495- 498.

Oruçi S., 2010b: Bio-Ecological Data on Amphibians of Thermal Water of Permeti Area (South Albania). Art.267, pp.1–3. in: BAlWOIS Conference Proceedings 2010, Ohrid,. Republic of Macedonia, 25–29 May, 2010.

Owen-Jones Z., Priol P., Thienpont S., MARC Cheylan M., Sauret G., Coic C. & Besnard A., 2016: The contrasting effects of short- and long-term habitat drainage on the population dynamics of freshwater turtles in a human-dominated landscape. Freshwater Biology 61, 121–132.

Pabijan M., Czarniewska E. & Berger L., 2004: Amelanistic phenotypes in Western Palearctic water frogs from Poland (Anura: Ranidae: Rana). Herpetozoa 17, 127–134.

Pellkofer B., Späth J. & Zahn A., 2010: Kreuz- und Wechselkröte (*Bufotes calamita* und *B. viridis*) im Unteren Isartal – Bestandssituation und Artenhilfsprogramm. Zeitschrift für Feldherpetologie 17, 61–76.

Perrot J., 2016: Dans la peau d'une tortue. La Salamandre 235, 20–45.

Popgeorgiev G., Tzankov N., Kornilev Y., Plachiyski D., Naumov B. & Stoyanov A., 2014: Changes in agri-environmental practices pose a threat to the herpetofauna: a case study from Besaparski Ridove special protection area (Natura 2000), Southern Bulgaria. Acta Zoologica Bulgarica, Supplement 5, 157–169.

Rifai L. & Mantziou G., 2005: L'Emyde caspienne de l'ouest, *Mauremys rivulata*. Manouria 29, 33–36.

Rozylowicz L. & Popescu V.D., 2013: Habitat selection and movement ecology of eastern Hermann's tortoises in a rural Romanian landscape. European Journal of Wildlife Research 59, 47–55.

Szabolcs M., Mizsei E., Jablonski D., Vági B., Mester B., Végvári Z. & Lengyel S., 2017: Distribution and diversity of amphibians in Albania: new data and foundations of a comprehensive database. Amphibia-Reptilia 38, 435–448.

Schmidt B.R. & Indermaur L., 2014: Die Lebensweise der Erdkröte und der Wechselkröte in der Wildflussaue des Tagliamento. Zeitschrift für Feldherpetologie 21, 121–132.

Sodhi N.S., Bickford D., Diesmos A.C., Lee T.M., Koh L.P., Brook B.W., Sekercioglu C.H. & Bradshaw C.J.A., 2008: Measuring the meltdown: drivers of global amphibian extinction and decline. Plos One 3, e1636.

Speybroeck J., Beukema W., Bok B., Voort Van Der J. & Velikov I., 2016: Field Guide to Amphibians and Reptiles of Britain and Europe. Bloomsbury, London/New York, 432 pp.

Stuart S.N., Chanson J.S., Cox N.A., Young B.E., Rodrigues A.N.S.L., Fischman D.L. & Waller R.W., 2004: Status and trends of amphibian declines and extinctions worldwide. Science 306, 1783–1786.

Šukalo G., Dmitrović D., Filipović S., Kovacević M., Đordević S. & Tomović L., 2015: New findings of the Greek frog, *Rana graeca* Boulenger, 1891 (Anura: Ranidae) in the north-western Bosnia and Herzegovina. Ecologica Montenegrina 2, 74–77.

Todd B.D., Willson J.D. & Gibbons J.W., 2010: The Global Status of Reptiles and Causes of their Decline. In: Sparling, D.W., Linder, G., Bishop, C.A. & Krest, S. (Eds.), Ecotoxicology of Amphibians and Reptiles, CRC Press, Boca Raton, pp. 47–67.

Trakimas G. & Sidaravicius J., 2008: Road mortality threatens small northern populations of the European pond turtle, *Emys orbicularis*. Acta Herpetologica 161–166.

Uzzel T. & Isailovic J.C., 2009: *Pelophylax shqipericus*. IUCN Red List of Threatened Species. Version 2013.1.

Vukov T.D., Tomović L., Krizmanić I., Labus N., Jović D., Džukić G. & Kalezić M.L., 2015: Conservation issues of Serbian amphibians identified from distributional, life history and ecological data. Applied Zoology 67, 105–116.

Zachos F.E. & Habel J.C., 2011: Biodiversity Hotspots – Distribution and Protection of Conservation Priority Areas. Springer, Berlin-Heidelberg.

Received: 2018 06 21

Addresses:

Univ.-Prof. Dr. Thomas Frank, Institute of Zoology, University of Natural Resources and Life Sciences Vienna, Gregor-Mendel-Straße 33, A-1180 Vienna, Austria.
E-mail: thomas.frank@boku.ac.at

Dr. Enerit Saçdanaku, Research Center for Flora and Fauna, Faculty of Natural Sciences, University of Tirana, Albania. E-mail: enerit.sacdanaku@fshn.edu.al

Dr. Michael Duda, 3rd Zoological Department, Museum of Natural History Vienna, Burgring 7, A-1010 Vienna, Austria. E-mail: michael.duda@nhm-wien.ac.at

Univ.-Prof. Dr. Ferdinand Bego, Department of Biology, Faculty of Natural Sciences, University of Tirana, Albania. E-mail: ferdinand.bego@fshn.edu.al