Ref.: Contract between UCODEP - building a human world and Dr. Vesna Sidorovska on the Investigation of Amphibians & Reptiles, within the frames of the Project “Environmental Protection, Economic Development and Promotion of Eco/Sustainable Tourism in the National Park Mavrovo”.

Draft Final Report

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Study on Assessment and Evaluation of Amphibians & Reptiles within the Protected Area National Park Mavrovo

Skopje, August, 2010

Contents

Executive Summary

The Balkans with Macedonia in its central part, contain some of the most extreme environments, and boast the additional diversity of their cave and lake environments which is unsurpassed in other parts. Certainly, compared to other temperate regions on Europe, it is quite outstanding. Coupled with the importance of the geographic location in a transitional zone open to a variety of floral and faunal influences, it is not surprising the notion that the Balkans are indeed the centre of European biodiversity (Reed et al., 2004).

In the case of the National Park Mavrovo, due to its unique natural values, in the year 1949, the forest belt around the Mavrovsko Pole, encompassing an area of 11,750 ha has been proclaimed as a National Park. In the year 1952, the boundaries of the Park have been widened for several times, encompassing an area of 73,088 ha, including the mountains Korab and Deshat.

The National Park Mavrovo is situated in the mountainous region of the north-west part of the country. It is with elongated shape, extending into a North-South direction, following the border line with Albania westwardly. Besides the two mountain massifs Korab and Bistra, within the current boundaries of the Park are included parts of the Shar Planina Massif, as well as almost the whole watershed of the Radika River. The sides of the mountains at their higher altitudes are mostly steep, rocky and to a great extent bare, thus resembling the mountains of the Dinaric Alps. This, and the presence of associated deep valleys, makes the area difficult to access. From the standpoint of regional designations, the Mountains included in the NP Mavovo belong to the westernmost part of the Western-Macedonian Mountain Zone. Regarding its morphogenesis, the origin of the mountains is related to radial tectonic movements that took place in the Tertiary Period, when these mountain massifs actually developed.

The Amphibians and Reptiles within the confines of the National Park Mavrovo are quite well represented, dominantly by Northern species, while the Mediterranean species are less represented. The unique value of the territory of the National Park Mavrovo, concerning the herpetofauna is mostly related to the Northern species as Ultimate Southern Frontier of their distribution range. In addition in the Park are present the core populations of these species on National Level.

Among the all-terrestrial vertebrates, the Amphibians and Reptiles are the best biological indicators in assessing the status of environmental conditions of certain area. Amphibians and Reptiles are particularly vulnerable groups; most are confined to small territories or home ranges, within which they have little ability to escape from land development, or even short-term changes. This vulnerability is considerably exacerbated in the more temperate parts, or in the high mountains, where these animals spend up to 6 months or more in hibernation/torpor.

Notwithstanding the fact that numerous data on Amphibians and Reptiles for the territory of the Protected Area National Park Mavrovo have been published, they are still only scarcely investigated. Fragmentary investigations have been conducted by Klaptocz (1910), Kopstein & Wettstein (1920), Fejervary (1922), Karaman (1922, 1928, 1931), Bolkay (1924), Wolterstorff (1925), Cyren (1941), Dimovski (1964), Pozzi (1966), Krivokapic (1969), Tovornik & Brelih (1980), Petkovski, Sidorovska & Dzukic (2001) and Sterijovski, Stamatovski & Tokov (2003).

The classification of species, presented in this report follows the most contemporary publications on the taxonomy of Amphibians & Reptiles: Biserkov (2007), Bohme & Kuhler (2005), Carranza et al. (2006), De Lapparent de Broin et al. (2006), Nagy et al. (2004), Utiger et al. (2002).

Based upon a literature review, unpublished data of the author of this report, analysis of the Museum collections, as well as field investigations conducted in the frames of this project, in

total, within the confines of the Protected Area National Park Mavrovo, presence of 35 species of herpetofauna has been ascertained, which is 74.5% of the total number of Amphibian and Reptile Species on National Level, represented by 47 species.

The Evaluation of Amphibians and Reptiles has been conducted in accordance with the EU Habitats Directive (Directive 92/43/EEC), the IUCN Red List of Globally Threatened Species (2010), the IUCN European Red List of Threatened Species (2010), Species Richness, Species Heterogeneity and Geographical Distribution/Endemism.

Amphibians and Reptiles, according to the IUCN Red List of Globally Threatened Species (2010), are regarded as the least endangered. However, on a national level, including the Protected Area National Park Mavrovo a considerable reduction in the populations of most of the species has been recorded.

A general characteristic for the Amphibians of the Protected Area National Park Mavrovo is its high degree of species diversity. Within the territory of the Protected Area National Park Mavrovo 11 Amphibian species have been recorded, which is 73.3% of the total number of species on National Level, represented by 15 species.

Amphibians of Boreal (Taiga) or Siberian Origin within the Protected Area National Park Mavrovo are represented by the following species: Alpine Newt (*Ichthyosaura alpestris*), Common Frog (*Rana temporaria*) and Common Toad (*Bufo bufo*).

Amphibians of Broadleaved Arboreal Origin represented by Holo-Mediterranean Elements that have widely expanded their range up to Central Europe to the North include the following species: Fire Salamander (*Salamandra salamandra*), Marsh Frog (*Pelophylax ridibundus*), Common Tree Frog (*Hyla arborea*), Agile Frog (*Rana dalmatina*) and Green Toad (*Pseudepidalea viridis*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species on appropriate habitats reaches high altitudes.

Amphibians of Broadleaved Arboreal Origin represented by Ponto (Eastern)-Mediterranean Elements with distribution range mainly restricted to the Balkan Peninsula encompass the following species: Macedonian Crested Newt (*Triturus macedonicus*) and Balkan Stream Frog (*Rana graeca*).

The Complex of Eremial (Steppes-Desert) Faunal Elements within the territory of the National Park Mavrovo includes the species: Balkan Yellow-belied Toad (*Bombina scabra*) with origin of the Ponto-Caspian Steppes Region.

From the Oreo-Tundral (Arctic-Mountain) Complex of Faunal Elements, none amphibian species is present.

Habitats Directive provide a strict legal protection for six species (Annex IV), while the species Macedonian Crested Newt (*Triturus macedonicus*) and the Balkan Yellow-belied Toad (*Bombina scabra*) are included in the list of Annex II, which means that the species are of community interest whose conservation requires designation of special areas of conservation.

None of the 11 amphibian species present within the territory of the Protected Area National Park Mavrovo is included in the three IUCN categories of Threatened Species on European Scale.

None of the 11 amphibian species present within the territory of the Protected Area National Park Mavrovo is included in the three IUCN categories of Globally Threatened Species.

The amphibians Macedonian Crested Newt (*Triturus macedonicus*), Balkan Yellow-belied Toad (*Bombina scabra*) and Balkan Stream Frog (*Rana graeca*) are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers wetland ecosystems with disjunctive distribution only within certain parts of the Balkan Peninsula.

The number of hitherto recorded Reptiles for the territory of the Protected Area National Park Mavrovo is 24 species, which is 75% of the total number of species on National Level, represented by 32 species.

Reptiles of Boreal (Taiga) or Siberian Origin within the Protected Area National Park Mavrovo are represented by the following species: Viviparous Lizard (*Zootoca vivipara*), and Adder (*Vipera berus*).

Reptiles of Broadleaved Arboreal Origin represented by Holo-Mediterranean Elements that have widely expanded their range up to Central Europe to the North and include the following species: European Pond Terrapin (*Emys orbicularis*), Slow Worm (*Anguis fragilis*), Common Wall Lizard (*Podarcis muralis*), Sand Lizard (*Lacerta agilis*), Green Lizard (*Lacerta viridis*), Grass Snake (*Natrix natrix*), Aesculapian Snake (*Zamenis longissimus*), and Smooth Snake (*Coronella austriaca*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species on appropriate habitats reaches high altitudes.

Reptiles of the Complex of Species of Broadleaved Arboreal Origin represented by Ponto (Eastern)-Mediterranean Elements that have widened its range to the Circum-Mediterranean Region include the species Montpellier Snake (*Malpolon monspessulanus*).

Another group of reptiles of this Complex includes species whose core distribution range is mainly restricted to the Balkan Peninsula: Hermann's Tortoise (*Eurotestudo hermanni*), Snake-eyed Skink (*Ablepharus kitaibelii*), Kotschy's Gecko (*Mediodactylus kotschyi*), Balkan Green Lizard (*Lacerta trilineata*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Balkan Whip Snake (*Hierophis gemonensis*) and Dahl's Whip Snake (*Platyceps najadum*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species is mainly restricted to the lower altitudes, mainly in the Oak forest belt.

The Complex of Eremial Faunal Elements that includes species of Ponto-Caspian Steppes Origin encompasses the following species: Balkan Wall Lizard (*Podarcis tauricus*), Large Whip Snake (*Dolichophis caspius*), Orsini's Viper (*Vipera ursinii*) and Dice Snake (*Natrix tessellata*).

The origin of the species Erhard's Wall Lizard (*Podarcis erhardii*) and Nose-horned Viper (*Vipera ammodytes*) comes from the Aegean-Anatolian Semi Deserts.

None reptilian species is included in the Complex of Oreo-Tundral (Arctic-Mountain) Faunal Elements, therefore no presence of such elements on the territory of the Protected Area National Park Mavrovo too, which is quite understandable, since this group are cold-blood animals.

Habitats Directive provides a strict legal protection for 18 species (Annex IV), while the species: Hermann's Tortoise (*Eurotestudo hermanni*), European Pond Terrapin (*Emys orbicularis*) and Orsini's Viper (*Vipera ursinii*) are also included in Annex II (Animal and plant species of community interest whose conservation requires the designation of special areas of conservation).

The Species Orsini's Viper (*Vipera ursinii*), present within the territory of the Protected Area National Park Mavrovo is included in the European Red List of Threatened Species within the category Vulnerable (VU). In addition, the species: Hermann's Tortoise (*Eurotestudo hermanni*) and European Pond Terrapin (*Emys orbicularis*) are listed in the Category Near Threatened (NT) which is close to qualify the species as Vulnerable (VU).

The Species Orsini's Viper (*Vipera ursinii*) is included in the IUCN Red List of Globally Threatened Species under the category Endangered (EN), while the species European Pond Terrapin (*Emys orbicularis*) under the category Vulnerable (VU). In addition, the species Hermann's Tortoise (*Eurotestudo hermanni*) is listed in the Category Near Threatened (NT) which is close to qualify the species as Vulnerable (VU) on a Global Scale.

The Reptiles: Hermann's Tortoise (*Eurotestudo hermanni boettgeri*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Balkan Green Lizard (*Lacerta trilineata*), Erhard's Wall Lizard

(*Podarcis erhardii*) and Balkan Wall Lizard (*Podarcis tauricus*) are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers habitat types with disjunctive distribution.

From a Global point of view, it is confirmed that the living world of the Planet Earth is faced with the sixth phase of mass extinction (Wake & Vredenburg, 2008). The process of extinction has shown most vigorous effects on the Amphibians and Reptiles, since they are particularly vulnerable groups.

In the case of the Protected Area National Park Mavrovo, on the basis of our field investigations on the status of Amphibians and Reptiles, several human activities that have negative impact on the populations of Amphibians and Reptiles have been recorded.

Indirect threats are related with human activities in the wider area: construction of artificial lakes i.e. Mavrovsko Ezero and Lukovo Pole, transfer of water resources from one watershed (Radika River Watershed) to another Watershed (Vardar River Watershed), development of mass tourism (especially for 8th of September when big mass of humans are visiting the highest peak Golem Korab), development of tourist infrastructure, development of local road infrastructure.

Besides the migration corridors important for the Pan-European Ecological Network, within the territory of the protected Area National Park Mavrovo, several local migration corridors exist, which are not less important for the Park itself, but also on National and European Level. These migration corridors relate the amphibians with their breeding and hibernation sites. Twice a year, in spring and autumn appears mass movement of amphibians and reptiles in certain directions, so called migration corridors that have been established through the millennia. The spring migration of the amphibians to the breeding aquatic sites is especially powerful. This mass migration is of explosive character, carried out into a period between 3 and 14 days, therefore looks like a torrent that could not be stopped, even a mass casualties on the roads, when they cut off the migration corridor.

Such local migration corridors have been recorded on certain sites within the Park, including: the local ring road around the Lake Mavrovsko Ezero, and along the local road Mala Reka-Selce-Tresonche. However, the most impressive is the migration corridor that is cut-off by the local road Strezimir-Lukovo Pole, which constraint the movement of the amphibians from the surrounding area to the rivers Radika, Adzina Reka and Crn Kamen. Only during a short monitoring period (June 09, 2010) on this portion of the road have been recorded more than 100 live specimens and 42 road casualty specimens of Common Toad (*Bufo bufo*). Such a big casualties on a extremely low frequency road, should be an alarm to the Management Body of the Park to undertake immideate actions to prevent the future casualties.

On the Korab, Bistra and Deshat Mountains a unique hydrological complex of mountain glacial lakes and temporary pools are present. These aquatic biotopes are primarily breeding sites for rare European species of amphibians whose populations are existing at the ultimate southern range of the species, mainly concerning the Alpine Newt (*Ichthyosaura alpestris*) and the Common Frog (*Rana temporaria*), as well as the Balkan Endemic Species Macedonian Crested Newt (*Triturus macedonicus*). Even with the only three above mentioned species, excluding the other zoological and botanical rarities, these small aquatic ecosystems deserve strict protection.

In this case we shall be focused on the Glacial Lake Lokuf, situated on the Deshat Mountain. The glacial lake Lokuf is the lowermost glacial lake in the Republic of Macedonia (1,574 m asl), which is in the phase of the process of natural succession into a peat bog.

Unfortunately, just close to the lake shore a Sheep-Farm has been constructed, which is directly situated within the primary watershed of the glacial lake, incongruous with the level of protection of this area. It is not only a violation of the virgin nature and visual landscape, but primarily it has negative impact on the natural processes in the lake itself. Namely, with the run-off and snow melting waters a huge amount of Nitrogen and Phosphorus nutrients enter

the lake waters that accelerate the process of eutrophication of the lake and its succession into a peat bog.

The water capture from mountain streams that is conducted through pipelines into the Lake Mavrovsko Ezero is widely present within the boundaries of the National Park Mavrovo. In accordance with the Macedonian Law on Nature Protection concerning the Biological Minimum of Water Habitats (Article 56), Paragraph (1) says: "For the purposes of protecting the survival of the natural wealth and conserving the biological and landscape diversity in the water habitats, partition of the waterways in a way contributing to habitat degradation, reduction of the quantity of water below the biological minimum, drying, and encumbering of the springs, swamps and other water habitats, shall be prohibited". However, concerning the water extraction from mountain streams in the National Park Mavrovo, the law has not been implemented properly, since in certain cases the whole quantity of water of the mountain streams is captured, leaving dry stream bed, as it is the case with the waters of Adzina Reka.

Such actions cause vigorous negative impact not only to the populations of Amphibians, mainly for the Balkan Stream Frog (*Rana graeca*) and the Fire Salamander (*Salamandra salamandra*), but also desiccation of the spawning sites of the endemic Stream Trout Radichka Pastrmka (*Salmo farioides*) and the core natural habitat of the Globally Threatened Species Stone Crayfish (*Austropotamobius torrentium*) as well as to other numerous animal species that are closely related to such habitat types.

A major portion of Direct Threats to Amphibians and Reptiles is related to prejudices concerning these two groups of animals as a consequence of long term tradition and inadequate knowledge of the local population treating them as harmful and dangerous animals that results in killing the animals in most of the accidental encounters, especially with the snakes. Finally, it should not be neglected the illegal, unregistered, collecting of all species of Amphibians and Reptiles, connected with commercial, hobbyst or even semi scientific reasons. Across the territory of the Park a whole teams of illegal collectors, amateurs, students and experts are roaming collecting series of specimens of rare species. Protected Areas, like National Parks, especially the most worthy areas, should be excluded of such activities.

The preliminary results of the analyses made on the basis of the field investigations, the construction and maintaining of Dam and Artificial Lake on the locality Dolno Lukovo Pole will not cause significant negative impact on the population status of Amphibians and Reptiles in the wider area. On the opposite, certain species of Amphibians, like: Common Toad (*Bufo bufo*), Green Toad (*Pseudepidalea viridis*), Yellow-belied Toad (*Bombina scabra*), Common Tree Frog (*Hyla arborea*), Marsh Frog (*Pelophylax ridibundus*) and Common Frog (*Rana temporaria*), as well as the aquatic reptiles: Grass Snake (*Natrix natrix*) and Dice Snake (*Natrix tessellata*) will increase their populations, while other species or Reptiles, like: Sand lizard (*Lacerta agilis*), Smooth Snake (*Coronella austriaca*), Adder (*Vipera berus*) and Orsini's Viper (*Vipera ursinii*) will have conditions to retreat safely in the surrounding habitats.

The Amphibians and Reptiles play an important role as insect and rodent predators and as valuable prey for various birds of prey and carnivorous mammals. Successful management of wildlife areas for protection of Amphibians and Reptiles should introduce Protection Measures that will take into consideration all stages of their life history. Protection measures have to provide access to food, shelter, migration corridors as well as hibernation, aestivation, breeding, and nesting sites.

Management practices commonly used to manipulate the structure and composition of vegetation can exert immediate, short-term, and long-term effects on herpetological assemblages. Prescribed fire, mowing, grazing, and forest thinning are examples of disturbance techniques. The best method for avoiding herpetological mortality due to site management is to conduct any treatment outside of herpetological activity periods. In general, the Amphibians and Reptiles hibernate from mid-October through March and are least impacted by management during this time period. If management is to occur within the

herpetological active season, several different approaches may be taken to minimize impacts.

Amphibians and Reptiles are most active when air temperatures are between 10-26,6 ^{0}C and after rain or flood events. Therefore, a suitable time to conduct management is during the hottest part of the day, during a dry spell, or on unseasonably cool days.

The highest potential for mortality due to site management occurs during spring and fall migrations to and from breeding or wintering habitats. Becoming familiar with the migratory behaviour of Amphibians and Reptiles known to occur within the management area is critical in formulating a management plan that will reduce the chances for management during mass herpetological movement.

Due to the weak dispersal capabilities of many Amphibian and Reptile Species, emigration of animals during and immigration of animals post-management is most successful for sites within 200 meters of suitable untreated habitat. It is therefore advised that a site be managed on a rotational basis with no more than ¼ of the site impacted in any given year.

Some of the typical Mediterranean reptile species have been recorded exclusively at the ultimate age of Park's Boundary downstream the Radika River Valley, or immediately outside the borders of the Park, on its southern edge. In order to encircle the biodiversity richness and heterogeneity of the Park with the Complex of Mediterranean faunal and floral elements, it is highly recommending alteration of the current boundary, that is, its widening downstream the River Radika, from the locality Boshkov Most, up to the artificial lake Debarsko Ezero and the settlement Dolno Kosovrasti. In that way, the main biocoridor for undisturbed penetration of Mediterranian faunal elements from the Adriatic Sea Area upstream along the River Drim up to the territory of the National Park Mavrovo will be protected. In that manner we shall mention the following Mediterranean Reptile Species: Hermann's Tortoise (*Eurotestudo hermanni boettgeri*), Kotschy's Gecko (*Mediodactylus kotschyi*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Montpellier Snake (*Malpolon monspessulanus*), Large Whip Snake (*Dolichophis caspius*), Balkan Whip Snake (*Hierophis gemonensis*) and Dahl's Whip Snake (*Platyceps najadum dahlii*).

In addition, the boundary of the Park should be extended on the Mountain Krchin that will encompass not only the mountain peaks Rudina and Crvena Plocha, but also southwestwardly up to Debarska Banja.

On the Korab, Bistra and Deshat Mountains a unique hydrological complex of mountain glacial lakes and temporary rain and snow melting pools are present. These aquatic biotopes are primary breeding sites for rare northern species of amphibians whose populations exist at the ultimate southern range of the species. The natural, small aquatic habitats are exclusively significant for the Amphibians. Maintenance of functions of such aquatic habitats is great challenge. The conservation and improvement of status of the existing aquatic habitats is of special significance for the Amphibians, since they represent unique sites for breeding and development of their larval stage, as an early phase within their life history.

On the Korab Mountain such unique complex of small aquatic ecosystems represents is present on the locality Kobilino Pole. On the Deshat Mountain, the Glacial Lake Lokuf, the Glacial Lake Barite and the temporary pool Suva Bara. On the Bistra Mountain, the main complex of temporary pools is situated on the right side of the local soil road Toni Voda-Tri Bari, including the locality Tri Bari itself.

All these small aquatic ecosystems should be included in Zone of Strict Protection, following the instructions given in the Chapter on Management/Protection Measures.

Concerning the conservation of Amphibians and Reptiles, the most important localities for zoning of the Protected Area National Park Mavrovo are included in the high-mountain belt of Korab, Bistra and Deshat Mountains.

On the Korab Mountain the most important area for Amphibians and Reptiles is the locality Kobilino Pole with the surrounding mountain peaks. In the grassland ecosystem of this area the core population on National Level of the Viviparous Lizard (*Zootoca vivipara*) is maintaining. In the temporary pools of Kobilino Pole the largest population on National Level of the Common Frog (*Rana temporaria*) is also present. Besides the Amphibians and Reptiles, until 2001, the largest population of the Balkan Chamois (*Rupicapra rupicapra balcanica*) counting more than 1,000 specimens, was present on this area. The Balkan Chamois is Balkan endemic subspecies and the core population was surviving on the locality Kobilino Pole and the surrounding mountain peaks. After the extinction of the core population, the subspecies is faced with complete extinction. Therefore, the Management Body of the Park should undertake immediate restoration measures for reintroduction of small population from the locality Brzovec and proclaim the area as Zone of Strict Protection.

On the Bistra Mountain, the high-mountain belt on the section between the Mountain Peaks Golem Brzovec and Mal Brzovec, should be included in the Zone under Strict Protection, since this is the core zone for the population of the Globally Threatened Species Orsini's Viper (*Vipera ursinii*).

On the Deshat Mountain, the high-mountain belt over 1,900 m asl should be also included in the Zone under Strict Protection.

The borders of the areas that are proposing as strictly protected zones were set down with their optimum surface, which gives possibilities for certain reduction during the process of synchronizing of the Zones of Strict Protection, with the proposals of experts on the other thematic issues.

During the process of development of Long-term Monitoring Programme for the Protected Area National Park Mavrovo, the following key Amphibian and Reptile Species are recommending to be included for monitoring:

- Alpine Newt (*Ichthyosaura alpestris*): monitoring on the stability of the breeding centres on the localities: Toni Voda, Chaushica, Tri Bari, Kobilino Pole, Lokuf and Barite.
- Balkan Stream Frog (*Rana graeca*): monitoring of the population status on transect lines along the Mountain Stream over the Hotel Makpetrol in Mavrovo, Rosochka Reka near Selce and Bunetska Reka near Bogdevo.
- Common Frog (*Rana temporaria*): monitoring on the stability of the breeding centres on the localities: Toni Voda, Chaushica, Kobilino Pole.
- Slow Worm (*Anguis fragilis*): monitoring of the population status on transect line along the Valley of the Mountain Streams Mala Reka, Rosochka Reka and Tresonechka Reka.
- Sand Lizard (*Lacerta agilis*): Monitoring of Population Status and Trend in the Grassland Ecosystems on the locality Toni Voda-Ski Lifts.
- Viviparous Lizard (*Zootoca vivipara*): Monitoring of Population Status and Trend in the Wet Grassland Ecosystems on the locality Kobilino Pole.
- Orsini's Viper (*Vipera ursinii macrops*): Monitoring of Population Status and Trend in the Dry Grassland Ecosystems on the localities Golem Brzovec-Mal Brzovec and Kobilino Pole.

The original intent of the IUCN Protected Area Management Categories system was to create a common understanding of protected areas, both within and between countries.

The established categories are recognized by international bodies such as the United Nations and by many national governments as the global standard for defining and establishing protected areas. As such, these categories are increasingly being incorporated into government legislation.

The Convention on Biological Diversity (CBD) Program of Work on Protected Areas “recognizes the value of a single international classification system for protected areas and the benefit of providing information that is comparable across countries and regions.”

If we take into consideration the above already mentioned statement that the Convention on Biological Diversity (CBD) Program of Work on Protected Areas “recognizes the value of a single international classification system for protected areas” of which the Republic of Macedonia is a signatory country, than it is obviously clear the necessity for further adaptation of the Law on Nature Protection concerning the classification of the Protected Areas in accordance with the IUCN criteria.

Notwithstanding the fact that the National legislation is in urgent need of further harmonization with the IUCN Criteria and EU Directives, if we follow the National and International criteria for choosing a new category for the Protected Area Mavrovo, as most appropriate, we highly recommend the Category II (National Park).

1. Introduction

A unique set of geological, climatic and anthropogenic factors have combined to make the Balkans one of the most biologically intriguing and valuable areas in the Northern Hemisphere. It is now widely appreciated that the Balkans does represent a significant "sump" for, at least, European biodiversity. Despite this, there is still little understanding of the Balkan fauna above the level of simple species description. The extremely high level of endemism in the Balkans compared to other parts of Europe is perhaps the most striking element of comparative patterns of biodiversity (Griffiths, 1998).

The Balkans with Macedonia in its central part, contain some of the most extreme environments, and boast the additional diversity of their cave and lake environments which is unsurpassed in other parts. Certainly, compared to other temperate regions on Europe, it is quite outstanding. Coupled with the importance of the geographic location in a transitional zone open to a variety of floral and faunal influences, it is not surprising the notion that the Balkans are indeed the centre of European biodiversity (Reed et al., 2004).

In the case of the National Park Mavrovo, due to its unique natural values, in the year 1949, the forest belt around the Mavrovsko Pole, encompassing an area of 11,750 ha has been proclaimed as a National Park. In the year 1952, the boundaries of the Park have been widened for several times, encompassing an area of 73,088 ha, including the mountains Korab and Deshat.

The National Park Mavrovo is situated in the mountainous region of the north-west part of the country. It is with elongated shape, extending into a North-South direction, following the border line with Albania westwardly. Besides the two mountain massifs Korab and Bistra, within the current boundaries of the Park are included parts of the Shar Planina Massif, as well as almost the whole watershed of the Radika River. The sides of the mountains at their higher altitudes are mostly steep, rocky and to a great extent bare, thus resembling the mountains of the Dinaric Alps. This, and the presence of associated deep valleys, makes the area difficult to access. From the standpoint of regional designations, the Mountains included in the NP Mavovo belong to the westernmost part of the Western-Macedonian Mountain Zone. Regarding its morphogenesis, the origin of the mountains is related to radial tectonic movements that took place in the Tertiary Period, when these mountain massifs actually developed.

From a topographical standpoint, the mountains are divided in two massifs: Korab Massif, in the west (composed of Korab, Deshat and Krchin Mountains) and Bistra Mountain Massif in the east.

The Korab Mountain is of elongated shape, extending into a North-South direction, along the border line with Albania. To the east border it descends with steep sides to the Radika River Valley and westwardly to the Crni Drim Valley. The northern border continues in the Shar Planina Massif, while to the South it continues into the Deshat Mountain. The analysis of the structural elements of the terrain clearly shows the orogenic phase of its morpho-tectonic evolution. Within the Alpine Orogeny (Late Mesozoic), the most significant influence on the tectonic movements that created the morphology of the terrains of the whole Protected Area National Park Mavrovo has happened. This process has been a part of the wider formation of the mountain massifs within the Mediterranean-type geo-syncline. The definite shape has been developed during the Tertiary Geological Period. The basic rocks are composed of Paleozoic Schist, while the mountain peaks of Mesozoic Limestone Rocks. The highest part of the Korab massif is represented by a wide, level area (Kobilino Pole) with 16 clearly distinguished peaks over 2,000 m, including the highest mountain peak in the Republic of Macedonia: Golem Korab (2,764 m). During the glacial period, only the highest parts of the Korab Mountain have been affected by intensive glaciations, which left deep traces in the relief. Remnants from that period include a number of cirques, the most impressive of which

are situated in the headwaters zone of the rivers: Shtirovica, Dlaboka Reka, Ribnica and Zhirovnica. In the cirques of the River Ribnica, four glacial lakes are present.

The Deshat Mountain encompasses the medium portion of the Korab Massif. To the North, its border continues into the Korab Mountain, while to the South into the Krchin Mountain. The mountain ridge extends into a North-South direction, with six mountain peaks higher than 2,000 m, of which most prominent are Velivar (2,375 m) and Golem Krchin (2,345 m). During the glacial period, only the highest parts of the Deshat Mountain have been affected by intensive glaciations, which left deep traces in the relief. Remnants from the glacial period on the Deshat Mountain are also present into a form of cirques, the most impressive of which is the Glacial Lake Lokuf.

The Bistra Mountain is situated between the Kichevo Valley to the east and the Radika River Valley to the west. The northern border goes along the Lake Mavrovsko Ezero and the valley of Mavrovska Reka, while the southern border along the valleys of the rivers Mala Reka, Garska Reka and Jamska Reka. The surface geological structure of the Bistra Mountain is mainly limestone. In its final phase of development the Bistra Mountain had been covered by limestone layers of 10-400 m thickness. Later, with tectonic movements the limestone layers have been split and crumbled. Erosion of the karstic material has left deep traces in the rock, forming all kinds of relief: crevices, funnel-shaped vertical shafts (vrtachi), depressions and karstic fields. The vertical shafts are most numerous on the locality Sultanica. The karstic fields are the highest form of surface karstic relief. They are deep, enclosed or semi-enclosed depressions. There are several such karstic fields within the confines of the National Park Mavrovo: Tonivoda, Govedarnik, Bardash, Sultanica, Solomunica, Suvo Pole and Tri Bari. Of the underground karstic features, several caves have are present on the Bistra Mountain. The largest of them are: Alilica, Kalina Dupka and Sharkova Dupka. During the glacial period, only the highest parts of the Bistra Mountain have been affected by intensive glaciations, which left deep traces in the relief. Remnants from that period include a number of cirques.

The Amphibians and Reptiles within the confines of the National Park Mavrovo are quite well represented, dominantly by Northern species, while the Mediterranean species are less represented. The unique value of the territory of the National Park Mavrovo, concerning the herpetofauna is mostly related to the Northern species as Ultimate Southern Frontier of their distribution range. In addition in the Park are present the core populations of these species on National Level.

Among the all-terrestrial vertebrates, the Amphibians and Reptiles are the best biological indicators in assessing the status of environmental conditions of certain area. Amphibians and Reptiles are particularly vulnerable groups; most are confined to small territories or home ranges, within which they have little ability to escape from land development, or even short-term changes. This vulnerability is considerably exacerbated in the more temperate parts, or in the high mountains, where these animals spend up to 6 months or more in hibernation/torpor.

It is essential therefore that theirs key habitats are clearly identified and protected against loss or adverse change. While the public and political interest in nature conservation is increasing, that for amphibians and reptiles has tended to remain in the shadow of the more popular groups such as flowering plants, butterflies, birds, and mammals. As a consequence, their overall decline has largely gone unnoticed and certainly not addressed, while minimal use has been made of their significance as indicator species for many important habitats.

2. State of the Art

Notwithstanding the fact that numerous data on Amphibians and Reptiles for the territory of the Protected Area National Park Mavrovo have been published, they are still only scarcely investigated. Fragmentary investigations have been conducted by Klaptocz (1910), Kopstein & Wettstein (1920), Fejervary (1922), Karaman (1922, 1928, 1931), Bolkay (1924), Wolterstorff (1925), Cyren (1941), Dimovski (1964), Pozzi (1966), Krivokapic (1969), Tovornik & Brelih (1980), Petkovski, Sidorovska & Dzukic (2001) and Sterijovski, Stamatovski & Tokov (2003).

The last decades brought major changes both in the number of species and in the reappraisal of the amphibian's and reptilian's systematics, world wide. This situation is due to perfecting of available tools: techniques of molecular and behavioural analysis, data processing, larger geographic cover and a larger number of researchers. The result is an explosion of publications and taxonomic reappraisal that determines instability of nomenclature and it creates a chaotic situation in legislation and conservation. These taxonomic modifications are necessary, it keeps up with our increased capacity of knowledge, but they are probably not final (Arntzen & Bauer 1997, Kuzmin & Tarkhnishvili 2000, Cogalniceanu & Hartel, 2009).

The existing taxonomy of amphibians and reptiles in Europe is thus rather chaotic, so drastic in fact that longstanding efforts to create a standard system of classification have been practically undermined (Dubois, 1998). It is not a question of waiting for verification of taxon names by the relevant commission of the General Assembly of the International Union of Biological Sciences but, rather, that "revisions" are being instantly placed on the internet, thus giving rise to an avalanche of different Latin names for each specific taxon.

By citing the genus of the species in parenthesis, we have endeavoured to maintain continuity with names that have been legitimate for decades.

The classification of species, presented in this report follows the most contemporary publications on the taxonomy of Amphibians & Reptiles: Biserkov (2007), Bohme & Kuhler (2005), Carranza et al. (2006), De Lapparent de Broin et al. (2006), Nagy et al. (2004), Utiger et al. (2002).

In order to obtain an overall perspective on the batracho- and herpetofauna of the Protected Area National Park Mavrovo, numerous localities have been taken in recognition and investigation from the lowest altitudes at the Radika Valley of about 600 m asl to the almost highest mountain belt (Kobilino Pole) of about 2,300-2,400 m asl, as well as various habitat types, including aquatic and terrestrial. Concerning the elaboration of the results of the field investigations, including the distribution of each species within the territory of the Protected Area, detailed analysis with strict finding sites are given in this report.

The list of species present in the Protected Area National Park Mavrovo has been prepared on the basis of historical published records, unpublished data of the author of this report, scientific collections of the Macedonian Museum of Natural History and related institutions in the neighbouring countries, as well as on the basis of data collected during the field investigations conducted by the consultant on Amphibians & Reptiles for the purposes of this project.

3. Biology and the Area of finding of Amphibians and Reptiles in NP Mavrovo

3.1. Assessment of Amphibians

Based upon a literature review, unpublished data of the author of this report, analysis of the Museum collections, as well as field investigations conducted within the frames of this project, in total, presence of 11 amphibian species has been ascertained for the territory of the Protected Area National Park Mavrovo, which is 73.3% of the total Macedonian amphibian fauna (15 species).

Taxonomic survey of Amphibians recorded in the Protected Area National Park Mavrovo

Taxonomic Group / Species		English Common Name	Macedonian Common Name
Order Caudata (Tailed Amphibians: Salamanders and Newts); (Opashesti Vodozemci: Dozhdovnici i Mrmorci)			
Family Salamandridae (Typical Salamanders and Newts); (Vistinski Dozhdovnici i Mrmorci)			
1.	*Salamandra salamandra*	Fire Salamander	Sharen Dozhdovnik
2.	*Triturus macedonicus*	Macedonian Crested Newt	Makedonski Mrmorec
3.	*Ichthyosaura alpestris*	Alpine Newt	Planinski Mrmorec
Order Anura (Tailless Amphibians: Frogs and Toads); (Bezopashesti Vodozemci: Zhabi)			
Family Bombinatoridae (Fire-bellied Toads); (Ogneni Zhabi)			
4.	*Bombina scabra*	Yellow-belied Toad	Zholt Mukach
Family Bufonidae (Typical Toads); (Krastavi Zhabi)			
5.	*Bufo bufo*	Common Toad	Golema Krastava Zhaba
6.	*Pseudepidalea viridis*	Green Toad	Zelena Krastava Zhaba
Family Hylidae (Tree Frogs); (Lisni Zhabi, Drvjarki)			
7.	*Hyla arborea*	Common Tree Frog	Gatalinka
Family Ranidae (Typical Frogs); (Vodni Zhabi)			
8.	*Rana dalmatina*	Agile Frog	Gorska Zhaba
9.	*Rana graeca*	Balkan Stream Frog	Potochna Zhaba
10.	*Rana temporaria*	Common Frog	Planinska Zhaba
11.	*Pelophylax ridibundus*	Marsh Frog	Obichna Ezerska Zhaba

3.1.1. Order Caudata (Tailed Amphibians):

Salamandra salamandra - Fire Salamander

The range of the species covers most of the West, Central and South Europe. This species is present most often in deciduous forest regions (rarely evergreen), particularly those below 800 m asl. The Fire Salamander is active exclusively during the night, except after periods of rainfall. The period of mating for the Fire Salamander is in autumn, and after 6-8 months (next spring) females most usually give birth to 8-70 larvae, which are often deposited in cool and clean water, both flowing and still. Larvae live mainly on the bottom of the water body and may over-winter, though often they metamorphose in about 2-4 months. Sexual maturity of Fire Salamander is reached in about 2-3 years. The adult animals over-winter in groups or separately in the holes of other animals, caves or cracks in the rocks.

Fire Salamander (*Salamandra salamandra*)

***Former Records*:** Bistra (Vlainica), 00/00/2000-2003, leg. Sterijovski (15 specimens), Sterijovski et al. 2003; Valley of Radika River (Monastery Sveti Jovan Bigorski), 17/09/1978, (1 specimen), Dzukic (BISS**) Database, unpublished data; Deshat (Rostushe), 03/10/1974, (1 specimen), Dzukic (BISS**) Database, unpublished data; Mavrovo (no precise locality), 20/06/1964 (1 specimen), 1,300 m asl, MMNH* Database, unpublished data; Korab (Adzhina Reka), 19/09/1996, (1 specimen), Dzukic (BISS**) Database, unpublished data.

***Current Records*:** Mavrovo (Upstream of the hotel Makpetrol), 07/06/2010, 1,275 m asl, N: 41. 64593, E: 020. 74383; Deshat (cross-road Vele Brdo - Bitushe), 10/06/2010, 894 m asl,. N: 41. 61443, E: 020. 59436; Nichpurska Planina Mountain (mountain stream before the village Bogdevo), 12/08/2010, 1,499 m asl, (larvae in a stream pools), N: 41.74455, E: 020.71013.

Triturus macedonicus (*Triturus carnifex macedonicus*) - Macedonian Crested Newt

Macedonian Crested Newt is South-Western Balkan endemic species. It is described by Karaman (1922) on the basis of material collected along the shoreline of Lake Ohrid. It is mainly lowland species most frequent at altitudes of 1,000 m. The species is closely associated with temporary and small stagnant aquatic biotopes during the spawning season. Females usually lay their eggs singly, attaching them to aquatic vegetation and often using their hind feet to wrap leaves round them. The laying period is often fairly extended being spread over several days or weeks. Afterwards, it leaves the aquatic environment, but never stays too far. On land the Macedonian Crested Newt are secretive and nocturnal, and usually only found when turning stones, logs, dead bark and vegetation in damp places.

Macedonian Crested Newt (*Triturus macedonicus*)

***Former Records*:** Bistra (Toni Voda), 16/05/1999, 1,700 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. 2003; Mavrovsko Ezero (temporary pool not far of the lake shore), 16/09/1978, (2 specimens), Dzukic (BISS**) Database, unpublished data; Bistra (no precise locality), 27/05/1984, leg. Petkovski (2 specimens), MMNH* Database, unpublished data; Mavrovo (Leunovo) 17/06/1982, leg. Cingovski (1 specimen), MMNH Database, unpublished data; Mavrovo (no precise locality: below fallen dead (rotten / decay) Beech Stem), 03/07/1982, leg. Petkovski (1 specimen), MMNH* Database, unpublished data.

***Current Records*:** Deshat (Glacial Lake Lokuf), 10/06/2010, 1,574 m asl, N: 41.63548; E: 020. 56219; Deshat (Barite: small glacial lakes), 10/06/2010, 1,793 m asl, N: 41. 63566; E: 020. 54607.

MMNH*: Macedonian Museum of Natural History, Scientific Collection of Amphibians & Reptiles.
BISS**: Biological Institute Sinisha Stankovic, Scientific Collection of Amphibians & Reptiles.

Ichthyosaura alpestris - Alpine Newt

The Alpine Newt is more widely distributed than its name suggests. Its distribution ranges from north, central and east France eastwards to extreme western Ukraine and Romania, and from southern Denmark south to Greece and northern Italy. Isolated populations exist in southern Italy (Calabria), north-west Spain (Cantabrian Mountains) and central Spain (Guadarrama Mountains, were possibly introduced). The Alpine Newt is a medium-sized newt (about 12 cm in length, including tail), usually identifiable by distinctive coloring: dark above, with uniform deep yellow to red belly. It is very aquatic species, and nearly always found in or quite near water. Alpine Newt is common in cold, almost plantless pools, lakes and slow-flowing streams in mountain regions, often above the tree-line.

It is strictly mountain species in the southern parts of the range, were it may occur at 2,500 m in the Alps and Albania (Arnold, 2002). On land, Alpine Newt is usually found in very cool, moist places. It breeds early in spring, and mature females laying around 250 eggs in a season, but sometimes as many as 530. Newly metamorphosed newts are 3-5 cm long and often have an orange stripe on the back. They mature in 2-4 years, but neotenous populations tending to take longer.

Alpine Newt (*Ichthyosaura alpestris*)

***Former Records*:** Korab (Fusha Korabit), 27/07/1918, leg. Penther (2 specimens), Kopstein & Wettstein (1920); Korab (Fusha Pechinec), 27/07/1918, leg. Penther (6 specimens), Kopstein & Wettstein (1920); Korab, 22/08/1918, leg. Ebner (6 specimens), Kopstein & Wettstein (1920); Korab, 25/08/1917, 1,800 m asl, leg. Csiki (8 specimens), Fejervary (1922); Korab, 22/07/1918, 1,800 m asl, leg. Csiki (27 specimens), Fejervary (1922); Korab, 23/07/1918, 2,200 m asl, leg. Csiki (9 specimens), Fejervary (1922); Korab (North Albania), 00/00/1925, leg. Ebner (1 specimen), Wolterstorf (1925); Bistra (Toni Voda), 13/07/2003, 1,800 m asl, leg. Sterijovski (10 specimens), Sterijovski et al. (2003); Lukovo Pole, 23-29/07/1995, sight record, Dzukic (BISS) Database, unpublished data; Mavrovsko Ezero

(temporary pool not far from the lake shore), 16/09/1978, (1 specimen), Dzukic (BISS) Database, unpublished data; Bistra (no precise locality), 06/07/1978, MMNH Database (3 specimens), unpublished data; Bistra (no precise locality), 27/05/1984, leg. Petkovski (1 specimen), MMNH Database, unpublished data; Deshat (Lower Glacial Lake), 1,800 m asl, leg. Petkovski, MMNH Database, unpublished data.

***Current Records*:** Bistra (temporary pools after the pass on the local road Mavrovo-Galicnik), 08/06/2010, 1,689 m asl, (adult specimens, mass presence), N: 41.64322, E: 020.69552; Bistra (Temporary Pool -1, near the locality Toni Voda), 08/06/2010, 1,681 m asl, (adult specimens, mass presence), N: 41.64277, E: 020.69769; Bistra (temporary pool - 2, near the locality Toni Voda), 08/06/2010, 1,685 m asl, (adult specimens - mass presence), N: 41.64288, E: 020. 69855; Bistra (Spring and Headwaters of the Toni Voda Stream), 08/06/2010, 1,680 m asl, (adult specimens - mass presence), N: 41.64460; E: 020.70033; Bistra (Temporary Pool along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,683 m asl, N: 41.63675, E: 020.70534; Bistra (Temporary Pool nearby the locality Dolna Cherkezica), 08/06/2010, 1,701 m asl, N: 41.61891, E: 020.74063; Bistra (Temporary Pool nearby the mountain soil road Toni Voda - Lazaropole, after the cross to the locality Chavkarnik), 08/06/2010, 1689 m asl, N: 41.61779, E: 020.75480; Bistra (Second temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, N: 41.58805, E: 020.78492; Bistra (Fourth temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, N: 41.58805, E. 020.78492; Bistra (Temporary Pool below the locality Tri Bari), 08/06/2010, 1,922 m asl (adult specimens - mass presence), N: 41.59151, E: 020.78955; Korab (Scattered temporary pools on the locality Mid Lukovo Pole - Summer Military Post), 09/06/2010, 1,641 m asl, N: 41.85293, E: 020.63835; Korab (Dolno Lukovo Pole - temporary pool nearby the influence of two mountain streams), 09/06/2010, 1,526 m asl, N: 41.85271, E: 020.62277; Deshat (Glacial Lake Lokuf), 10/06/2010, 1,574 m asl, (mass presence of adult specimens), N: 41.63548, E: 020.56219; Deshat (Small Glacial Lake – Barite), 10/06/2010, 1,793 m asl (adult and neotenous specimens), N: 41.63566, E: 020.54607; Bistra (Temporary Pool aside the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,690 m asl, N: 41.63446, E: 020.70572; Bistra (Stream Pool aside the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,692 m asl, N: 41.63344, E: 020.70519; Bistra (Stream Pool aside the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,705 m asl, N: 41.63252, E: 020.70596. Korab (Kobilino Pole, stream pool below small waterfall), 13/08/2010, 2,304 m asl, (adult specimens), N: 41.78131 E: 020.56448.

3.1.2. Order Anura (Tailless Amphibians)

Bombina scabra (*Bombina variegata scabra*) - Yellow-bellied Toad

The distribution of the subspecies "*scabra*" is limited exclusively to the Balkans. It is a distinctly aquatic and sociable amphibian, found in sunny, shallow and often temporary waters. Its spawning sites are pools in open forest terrain and near forest edges, but also in various stagnant waters. The species is exceptionally rare above the forest zone (Sidorovska et al., 2006). This toad is largely diurnal species, except for the mating period, when it can be active also through the night. The breeding season starts from end of March until May-June. The adults hibernate away from water.

Yellow-bellied Toad (*Bombina scabra*)

***Former Records*:** Korab, 22/07/1918, 1,800 m asl, leg. Csiki (1 specimens), Fejervary (1922); Bistra (Koritnik), 10/07/2003, 1,600 m asl, leg. Sterijovski (4 specimens), Sterijovski et al. (2003); Bistra (Koritnik - small temporary pool on the road), 10/07/2003, 1,600 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Small temporary pool below the Shkrka Peak), 15/07/2003, 1,550 m asl, leg. Sterijovski (3 specimens), Sterijovski et al. (2003); Korab (Lukovo Pole), 23-29/07/1995, Dzukic (BISS) Database, (sight records), unpublished data; Mavrovo (no precise locality), 15/06/1972, leg. Bogoevski, MMNH Database (3 specimens), unpublished data; Korab (Strezimir - over the House of the former Border Military Post), 17/09/1996, (2 specimens), Dzukic (BISS) Database, unpublished data; Korab (Mountain Stream Kara Mustafa, wetland area), 18/09/1996, (1 specimen), Dzukic (BISS) database, unpublished data.

***Current Records*:** Bistra (Mavrovo - Upstream of the hotel Makpetrol, small temporary pools along the mountain stream), 07/06/2010, 1,279 m asl, (tadpoles), N: 41.64762, E: 020.74175; Bistra (temporary pools after the pass on the local road Mavrovo-Galicnik),

08/06/2010, 1,685 m asl, (10 breeding pairs in amplexus), N: 41.64282, E: 020.69430; Bistra (Temporary Pool, near the locality Toni Voda), 08/06/2010, 1,689 m asl, (tadpole specimens), N: 41.64322, E: 020.69552; Bistra (Temporary Pool, near the locality Toni Voda), 08/06/2010, 1,681 m asl, (adult specimens), N: 41.64277, E: 020.69769; Bistra (temporary pool, in the neighborhood of the locality Toni Voda), 08/06/2010, 1,685 m asl, (several adult breeding specimens), N: 41.64288, E: 020. 69855; Bistra (Spring and Headwaters of the Toni Voda Stream), 08/06/2010, 1,680 m asl, (frequent adult specimens), N: 41.64460; E: 020.70033; Bistra (Temporary Pool along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,683 m asl, (adult specimens), N: 41.63675, E: 020.70534; Bistra (Temporary Pool on the right side of the road Toni Voda - Lazaropole, after the cross to the locality Chavkarnik), 08/06/2010, 1689 m asl, (several adult specimens), N: 41.61779, E: 020.75480; Bistra (Fourth temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, (breeding specimens), N: 41.58805, E: 020.78492; Bistra (Temporary Pool at the Locality Chirilevec), 08/06/2010, 1,741 m asl, (breeding specimens), N: 41.57228, E: 020.79393; Korab (small rain pools on the mountain soil road Strezimir- Kobilino Pole), 09/06/2010, 1,738 m asl, (adult specimens), N: 41.77655, E: 020.61465; Bistra (Temporary Pool aside the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,690 m asl, (adult specimens), N: 41.63446, E: 020.70572; Bistra (Stream Pool on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,689 m asl, (several adult specimens), N: 41.63639, E: 020.70549; Bistra (Stream Pool on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,693 m asl, (several adult specimens), N: 41.63408, E: 020.70541; Radika Valley (pool below a fountain on the road to the village Adjievci), 12/06/2010, 747 m asl, (5 adult specimens), N: 41.58771, E: 020.61589; Temporary Pool beside the local road Debar-Banjishte, 12/06/2010, 649 m asl (several adult specimens), N: 41.54176, E: 020.51490. Nichpurska Planina Mountain (Vrben-Bogdevo, small water pools aside the road), 12/08/2010, 1,385 m asl, (2 specimens), N: 41.72504, E: 020.72222; Korab (Kobilino Pole, small temporary pool, over the former Summer Military Post), 13/08/2010, 2,138 m asl, (several adult specimens), N: 41.77981, E: 020.57951; Korab (Kobilino Pole, temporary snow melting pool), 13/08/2010, 2,178 m asl, (adult specimen), N: 41.78111, E: 020.57797.

Bufo bufo (*Bufo bufo spinosus*) - Common Toad

The distribution of the subspecies *"spinosus"* is limited to the Mediterranean region (Gasc et al. 1997). In terms of habitat types and vertical distribution, this toad is one of the most distinctive of the ubiquitous European amphibians. Most frequently, the species is found within the forest belt. It is mainly nocturnal species, hiding by day, usually in one particular spot. Migration towards the breeding ponds often begins in the autumn, but the final journey is made in the spring (from March to May), when large numbers of toads can be seen moving at night. Newly metamorphosed toads are very small (just 7-12 mm) and are quite diurnal in their first months.

Common Toad (*Bufo bufo*)

***Former Records*:** Bistra (in the vicinity of the village Lazaropole), 08/07/2003, 1,337 m asl, leg. Sterijovski (1 specimens), Sterijovski et al. (2003); Korab (Strezimir-Nichpur Mountain Stream), 18/09/1996, sight records, Dzukic (BISS) Database, unpublished data.

***Current Records*:** Mavrovo (parking of hotel Alpina), 07/06/2010, 1,257 m asl, (adult female), N: 41.65088, E: 020.73476; Mavrovo (on the road in the village), 07/06/2010, 1,229 m asl, (adult female), N: 41.65691, E: 020.73478; Mavrovo (on the road along the lake), 07/06/2010, 1,247 m asl, (subadult specimen), N: 41.67398, E: 020.74948; Mavrovo (on the road along the lake), 07/06/2010, 1,245 m asl, (female), N: 41.67545, E: 020.75053; Mavrovo (on the road along the lake), 07/06/2010, 1,253 m asl, (road casualty), N: 41.68008, E: 020.77155; Bistra (temporary pools after the pass on the right side of the local road Mavrovo-Galicnik), 08/06/2010, 1,685 m asl, (tadpoles), N: 41.64282, E: 020.69430; Bistra (Temporary Pool nearby the locality Dolna Cherkezica), 08/06/2010, 1,701 m asl, (tadpoles), N: 41.61891, E: 020.74063; Bistra (Temporary Pool on the right side of the road Toni Voda - Lazaropole, after the cross to the locality Chavkarnik), 08/06/2010, 1689 m asl, (tadpoles), N: 41.61779, E: 020.75480; Bistra (Fourth temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, (rows of egg strings), N: 41.58805, E: 020.78492; Korab (section of the local mountain soil road from the Police Border Post at Strezimir up to the Dolno Lukovo Pole at the influence of two mountain streams), 09/06/2010, (1,396 - 1526 m asl), (N: 41.81484, E:

020.64052 - N: 41.85271, E: 020.62277), altogether 42 road casualties and 9 live specimens; Deshat (Barite - Small Glacial Lake), 10/06/2010, 1,793 m asl (breeding pairs in amplexus), N: 41.63566, E: 020.54607; Bistra (Stream Pool on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,689 m asl, (tadpoles), N: 41.63639, E: 020.70549; Radika Valley (local road), 12/06/2010, 675 m asl, (breeding pair in amplexus - road casualty), N: 41.59487, E: 020.61509; Radika Valley (local road to villages Janche and Prisojnica), 12/06/2010, 649 m asl, (road casualty specimen), N: 41.58968, E: 020.62135; Radika - Mala Reka Valley (local asphalt road to the village Lazaropole), 12/06/2010, 614 m asl, (road casualty specimen), N: 41.34937, E: 020.61616; Mala Reka Valley (local asphalt road to the village Lazaropole), 12/06/2010, 649 m asl, (road casualty specimen), N: 41.54319, E: 020.62661; Bistra (village Selce – in front of the NP Mountain House), 12/06/2010, 1,010 m asl, (1 adult specimen), N: 41.57022, E: 020.71392. Bistra (Nikiforovo-Mavrovo), 12/08/2010, 1,252 m asl, (road casualty specimen), N: 41.65713, E: 020.73717; Nichpurska Planina Mountain (mountain stream before the village Bogdevo), 12/08/2010, 1,499 m asl, (larvae in a stream pools), N: 41.74455, E: 020.71013; Korab (Kobilino Pole, small temporary pool, over the former Summer Military Post), 13/08/2010, 2,138 m asl, (tadpoles), N: 41.77981, E: 020.57951; Korab (Kobilino Pole, temporary pool), 13/08/2010, 2,184 m asl, (tadpoles), N: 41.78108, E: 020.57784; Korab (Kobilino Pole, glacial lake below the former Summer Military Post), 13/08/2010, 2,070 m asl, (tadpoles), N: 41.77764, E: 020.58017.

Pseudepidalea (*Bufo*) *viridis* - Green Toad

The Green Toad is Central to South-eastern Europe species. Typical habitats are cultivated steppes, although it does not avoid forest complexes either. This species shows substantial ecological plasticity. The Green Toad is mainly nocturnal species, although sometimes active by day, especially in spring. The breeding period begins from March to May. As spawning sites, it prefers shallow temporary waters. This species hibernate on land. It is predominantly a lowland species, with an average vertical distribution of up to 1,000 m asl (Arnold, 2002). Its maximal altitude in Europe reaches 2,400 m asl (Mt. Korab - Nollert & Nollert, 1992).

Green Toad (*Pseudepidalea viridis*)

***Former Records*:** Bistra (in the vicinity of the village Lazaropole), 11/07/2003, 1,400 m asl, Sterijovski et al. (2003); Korab (no precise locality), 00/00/1992, 2,400 m asl, (no number of specimens), Nollert & Nollert (1992).

***Current Records*:** Bistra (Second temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, (several specimens in the pool), N: 41.58805, E: 020.78492; Bistra (Fourth temporary pool on the locality Tri Bari), 08/06/2010, 1934 m asl, (egg stripes), N: 41.58805, E. 020.78492; Radika Valley (Kosovrasti Spa), 12/06/2010, 580 m asl, (road casualty specimen), N: 41.55347, E: 020.58150.

Hyla arborea - Tree Frog

In Central Europe, this frog inhabits areas from 600 to 800 m asl, while in the more southern regions, including the Balkan Peninsula it reaches much higher altitudes, of up to 2300 m (Arnold, 2002). It prefers habitats with dense vegetation, either shrubs and trees or muddy terrains. The Tree Frog is mainly nocturnal and crepuscular species, but sometimes active by day, especially when conditions are warm and humid. It spawns in quiet temporary waters. The breeding period starts from March to May. The Tree Frog hibernates on land.

Tree Frog (*Hyla arborea*)

***Former Records*:** Korab (Lukovo Pole), 23-29/07/1995, (sight records), Dzukic (BISS) Database, unpublished data.

***Current Records*:** Lake Mavrovsko Ezero, 07/06/2010, 1,249 m asl, (more specimens - sound records), N: 41.67986, E: 020.77188.

Rana dalmatina - Agile Frog

The species is widely distributed in Europe, except the most northern parts and the Iberian Peninsula. Prefers bright, relatively dry, deciduous forests consisting predominantly of oak, but it also tolerates beech, birch and chestnut forest. It is also often found in riparian forests, along rivers and streams. Agile Frog is mainly crepuscular or nocturnal species, but sometimes also seen during the day. It is not connected with water biotopes, except for the breeding season (end of February until April). It spawns in permanent and semi-permanent still waters. The Agile Frog usually hibernates in water, very rare on land.

Agile Frog (*Rana dalmatina*)

***Former Records*:** Bistra (Mavrovo), 16/06/1972, leg. Bogoevski (MMNH Database), (1 adult specimen), unpublished data.

***Current Records*:** Bistra (Mavrovo - Upstream of the hotel Makpetrol, small temporary pools along the mountain stream), 07/06/2010, 1,275 m asl, (subadult), N: 41.64593, E: 020.74383; Bistra (Leunovo Village), 07/06/2010, 1,230 m asl, (road casualty specimen), N: 41.69469, E: 020.80362; Radika - Mala Reka Valley, 12/06/2010, 614 m asl, (adult specimen), N: 41.34937, E: 020.61616.

Rana graeca - Balkan Stream Frog

Endemic species, limited to the Balkan Peninsula. Nearly always associated with cool running waters, and most often found in mountain areas up to 2000 m. The Balkan Stream Frog is typically encountered in, or near permanent mountain streams with rocky beds. The species is active by day and night. The breeding period starts from April until beginning of June. It prefers hills and mountains up to 2,000 m asl. Within these areas it is found almost exclusively along cold, running waters.

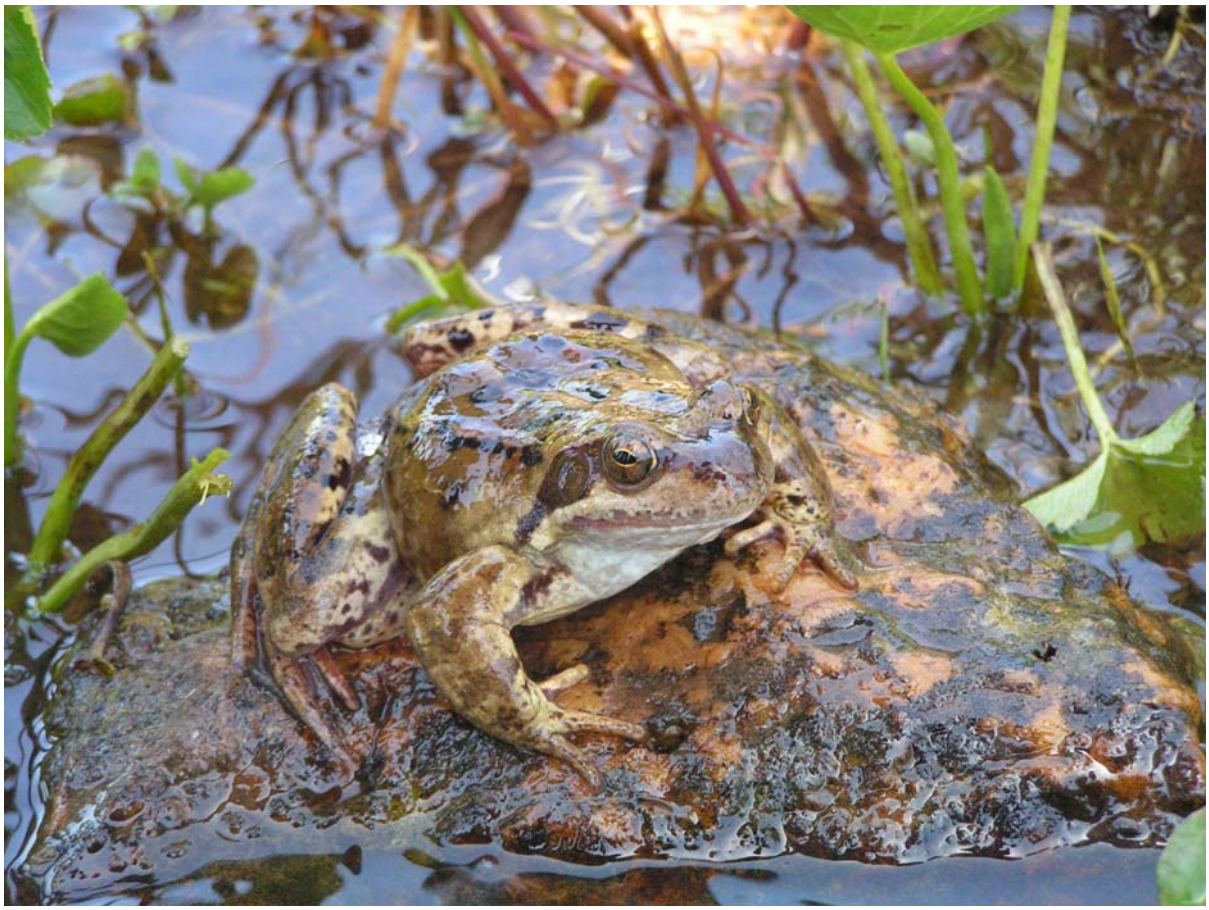
Balkan Stream Frog (*Rana graeca*)

***Former Records*:** Mavrovo (Mavrovska/Vrbenska Reka River), 00/00/1928, 1,000 m asl, leg. Karaman, N: 41^0 42' 664", E: 20^0 43' 264"; Mavrovo (Mavrovska Reka River), 00/00/1928, 1,100 m asl, leg. Karaman, N: 41^0 42' 667", E: 20^0 43' 2380", Karaman (1928); Bistra (neighborhood of the village Lazaropole), 10/07/2003, 1,337 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Alilica), 12/07/2003, 1,650 m asl, leg. Sterijovski (3 specimens), Sterijovski et al. (2003); Bistra (Mavrovo), 16/06/1972, leg. Bogoevski (MMNH Database), (1 adult specimen), unpublished data.

***Current Records*:** Bistra (Mavrovo - Upstream of the hotel Makpetrol, small temporary pools along the mountain stream), 07/06/2010, 1,266 m asl, (juvenile specimens), N: 41.64697, E: 020.74249; Bistra (Mavrovo - Upstream of the hotel Makpetrol, along the mountain stream), 07/06/2010, 1,285 m asl, (adult specimen), N: 41.64568, E: 020.74419; Bistra (Mavrovo - Upstream of the hotel Makpetrol, along the mountain stream), 07/06/2010, 1,289 m asl, (adult specimen), N: 41.64527, E: 020.74483; Bistra (Leunovo – on the road), 07/06/2010, 1,230 m asl, (adult specimen), N: 41.69469, E: 020.80362; Korab (Dolno Lukovo Pole - influence of two mountain streams, at the stream bank), 09/06/2010, 1,526 m asl, N: 41.85271, E: 020.62277; Radika - Mala Reka Valley (local asphalt road to the village Lazaropole), 12/06/2010, 614 m asl, (road casualty specimen), N: 41.34937, E: 020.61616; Mala Reka Valley (local asphalt road to the village Lazaropole), 12/06/2010, 649 m asl, (road casualty specimen), N: 41.54319, E: 020.62661; Nichpurska Planina Mountain (mountain stream before the village Bogdevo), 12/08/2010, 1,499 m asl, (2 juvenile specimens), N: 41.74455, E: 020.71013.

Rana temporaria - Common Frog

The Common Frog is widely distributed throughout Europe, but it is absent from Portugal, most of Spain, much of Italy and the South Balkans. It is usually robustly built frog, with relatively short hind limbs and closely spaced dorsolateral folds. The Common Frog is extremely variable in color. On the back it is grey, brown, olive, yellow or red, usually with dark blotches (sometimes these are orange or red), and often with a dark ^ - shaped mark between the shoulders. Underside is white, yellow or even orange, typically marbled, or spotted with darker pigment. In the north of the range, this frog is largely terrestrial and is often only found in water during the breeding season or hibernation.
In contrast, in the south of the range, it may stop close to ponds and streams and is frequently confined to the mountains. It is often found at high altitudes, even up to the snow line, and occurs up to nearly 3,000 m in Pyrenees and to nearly 2,800 m in Southern Alps. In early spring, large numbers of frogs are traveling at night to the breeding waters, although they are also active in the day once they arrive. Females lay one or two clumps of spawn, containing a total of 700-4,500 eggs, which are deposited over vegetation in shallow water. Newly metamorphosed frogs are 1-1.5 cm long, and became sexually mature at 2-3 years at a length of about 5-6 cm.



Common Frog (*Rana temporaria*)

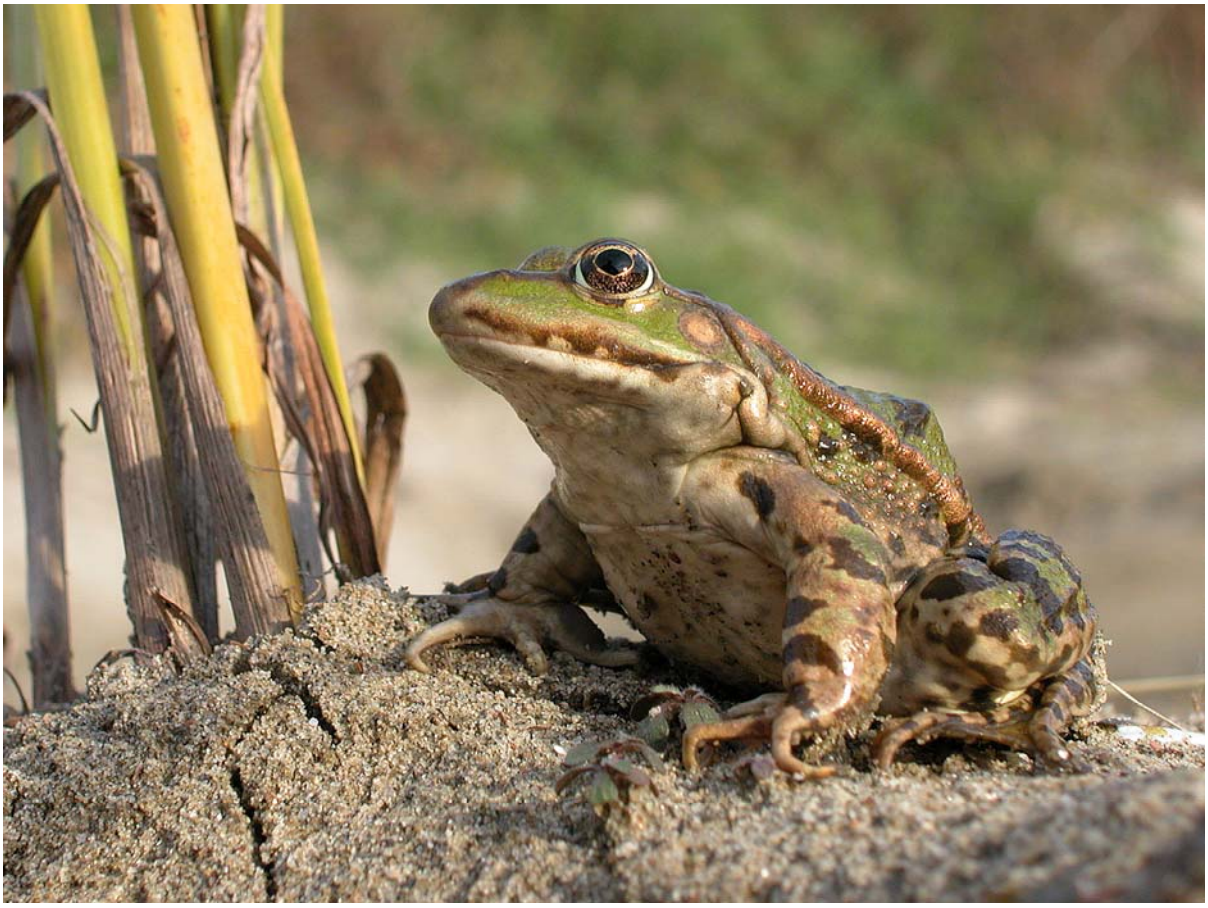
***Former Records*:** Korab (no precise locality), 01/08/1918, leg. Penther (2 adult specimens), Kopstein & Wettstein (1920); Korab (no precise locality), 25/08/1917, 1,900 m asl, leg. Csiki (2 adult specimens), Fejervary (1922); Korab (no precise locality), 22/07/1918, 1,800 m asl, leg. Csiki (1 adult and 1 subadult specimen), Fejervary (1922); Korab (no precise locality), 23/07/1918, 2,200 m asl, leg. Csiki (7 adult and 3 subadult specimens), Fejervary (1922); Bistra (Tri Bari), 13/07/2003, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Korab (Lukovo Pole), 23 -

29/07/1995, (mass presence, sight records), Dzukic (BISS) Database, unpublished data; Bistra (no precise locality), 06/07/1978, leg. Petkovski (4 specimens), MMNH Database, unpublished data; Korab (lake below Kobilino Pole), 16/09/1996, sight record (abundant population), Dzukic (BISS) Database, unpublished data; Korab (Kobilino Pole), 16/09/1996, 2,100 - 2,300 m asl, sight record (1 adult specimen), Dzukic (BISS) Database, unpublished data; Korab (Proyfel Waterfall), 17/09/1996, sight record, Dzukic (BISS) Database, unpublished data; Korab (Dlaboka Reka), 17/09/1996, sight record, Dzukic (BISS) Database, unpublished data; Korab (Kabash), 17/09/1996, sight record, Dzukic (BISS) Database, unpublished data; Korab (Kobilino Pole - Mala Vraca), 17/09/1996, sight record, Dzukic (BISS) Database, (approximately 5 adult specimens per each pool), unpublished data; Korab (Strezimir - Belandza), 18/09/1996, Dzukic (BISS) Database, (2 adult specimens), unpublished data; Korab (Kjos Alija), 18/09/1996, sight record, Dzukic (BISS) Database, unpublished data; Korab (Kara Mustafa River), 18/09/1996, sight record, Dzukic (BISS) Database, unpublished data.

***Current Records*:** Bistra (temporary pools after the pass on the local road Mavrovo-Galicnik), 08/06/2010, 1,689 m asl, (tadpoles), N: 41.64322, E: 020.69552; Bistra (Temporary Pool -1, near the locality Toni Voda), 08/06/2010, 1,681 m asl, (tadpoles), N: 41.64277, E: 020.69769; Bistra (Spring and Headwaters of the Toni Voda Stream), 08/06/2010, 1,680 m asl, (adult specimens - rare), N: 41.64460; E: 020.70033; Bistra (Temporary Pool along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,683 m asl, (tadpoles), N: 41.63675, E: 020.70534; Bistra (Temporary Pool along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,690 m asl, (tadpoles), N: 41.63446, E: 020.70572; Bistra (Temporary Pool nearby the locality Dolna Cherkezica), 08/06/2010, 1,701 m asl, (tadpoles), N: 41.61891, E: 020.74063; Bistra (Temporary Pool at the Locality Chirilevec), 08/06/2010, 1,741 m asl, (tadpoles), N: 41.57228, E: 020.79393; Korab (small rain pools on the mountain soil road Strezimir- Kobilino Pole), 09/06/2010, 1,738 m asl, (adult specimens), N: 41.77655, E: 020.61465; Korab (Scattered temporary pools and mountain stream on the locality Mid Lukovo Pole - Summer Military Post), 09/06/2010, 1,641 m asl, (several adult specimens and tadpoles), N: 41.85293, E: 020.63835; Korab (Dolno Lukovo Pole - influence of two mountain streams, at the stream bank), 09/06/2010, 1,526 m asl, (several specimens), N: 41.85271, E: 020.62277; Bistra (Temporary Pool aside the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,690 m asl, (2 adult specimens, 1 subadult specimen and tadpoles), N: 41.63446, E: 020.70572; Bistra (Stream Pool on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,689 m asl, (tadpoles), N: 41.63639, E: 020.70549; Bistra (Stream on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,689 m asl, (adult specimen on the stream bank), N: 41.63408, E: 020.70541; Korab (Kobilino Pole, small temporary pool, over the former Summer Military Post), 13/08/2010, 2,138 m asl, (adult specimens and tadpoles), N: 41.77981, E: 020.57951; Korab (Kobilino Pole, small temporary pool, over the former Summer Military Post), 13/08/2010, 2,158 m asl, (adult specimens), N: 41.78037, E: 020.57882; Korab (Kobilino Pole, temporary pool), 13/08/2010, 2,184 m asl, (adult specimens and tadpoles), N: 41.78108, E: 020.57784; Korab (Kobilino Pole, temporary pool), 13/08/2010, 2,207 m asl, (adult specimens), N: 41.78189, E: 020.57630; Korab (Kobilino Pole, mountain stream), 13/08/2010, 2,265 m asl, (adult specimens), N: 41.78173, E: 020.56936; Korab (Kobilino Pole, grassland ecosystem), 13/08/2010, 2,298 m asl, (3 adult specimens), N: 41.78097, E: 020.56669; Korab (Kobilino Pole, glacial lake below the peak Golem Korab), 13/08/2010, 2,337 m asl, (adult specimens), N: 41.78162, E: 020.56011; Korab (Kobilino Pole, mountain stream below the glacial lake), 13/08/2010, 2,323 m asl, (adult specimens), N: 41.78262, E: 020.56139; Korab (Kobilino Pole, temporary pool beside the mountain stream), 13/08/2010, 2,304 m asl, (adult specimens), N: 41.78240, E: 020.56272; Korab (Kobilino Pole, temporary pools beside the mountain stream), 13/08/2010, 2,293 m asl, (tadpoles), N: 41.78171, E: 020.56407; Korab (Kobilino Pole, stream pool below small waterfall), 13/08/2010, 2,304 m asl, (adult specimens), N: 41.78131 E: 020.56448; Korab (Kobilino Pole, glacial lake below the former Summer Military Post), 13/08/2010, 2,070 m asl, (adult specimens and tadpoles), N: 41.77764, E: 020.58017.

Pelophylax (*Rana*) *ridibundus* - Marsh or Lake Frog

The range of the species covers Central and Eastern Europe, including the Balkan Peninsula. It is closely associated with still and slow-flowing waters, overgrown with rich aquatic vegetation. Usually gregarious, diurnal and very aquatic species, but also it can be active at night, especially in the more southern part of its range. The breeding period is in April-May. The Lake Frog hibernates in water bodies.



Marsh or Lake Frog (*Pelophylax ridibundus*)

***Former records*:** Radika Valley (Boshkov Most), leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Radika Valley (2 km upstream of Boshkov Most), leg. Sterijovski (1 specimen), Sterijovski et al. (2003).

***Current Records*:** Bistra (Mavrovo - Upstream of the hotel Makpetrol, along the mountain stream), 07/06/2010, 1,275 m asl, (subadult specimen), N: 41.64593, E: 020.74383; Bistra (Mavrovo - Upstream of the hotel Makpetrol, along the mountain stream), 07/06/2010, 1,285 m asl, (adult specimen), N: 41.64566, E: 020.74419; Lake Mavrovsko Ezero, 07/06/2010, 1,229 m asl, (more specimens - sound records), N: 41.65691, E: 020.73478; Lake Mavrovsko Ezero, 07/06/2010, 1,238 m asl, (more specimens - sound records), N: 41.66119, E: 020.72967; Lake Mavrovsko Ezero, 07/06/2010, 1,253 m asl, (more specimens - sound records), N: 41.68008, E: 020.77155; Lake Mavrovsko Ezero, 07/06/2010, 1,249 m asl, (more specimens - sound records), N: 41.67986, E: 020.77188; Deshat (Glacial Lake Lokuf), 10/06/2010, 1,574 m asl, (mass presence of adult specimens), N: 41.63548, E: 020.56219; Bistra (Mountain fountain (spring) before the pass on the local road Mavrovo - Galichnik), 11/06/2010, 1,527 m asl, (adult specimen), N: 41.66270, E: 020.71423; Temporary Pool beside the local road Debar-Banjishte, 12/06/2010, 649 m asl (several adult specimens), N: 41.54176, E: 020.51490. Radika Valley (Kosovrasti Spa), 12/06/2010, 580 m asl, (road casualty specimen), N: 41.55347, E: 020.58150.

3.2. Assessment of Reptiles

Within the territory of the Protected Area National Park Mavrovo, presence of 24 reptilian species has been ascertained, which is 75% of the total number of Reptile Species on National Level, represented by 32 species.

Taxonomic survey of Reptiles recorded in the Protected Area National Park Mavrovo

Taxonomic Group / Species		English Common Name	Macedonian Common Name
Order Testudines (Tortoises and Terrapins); (Zhelki)			
Family Testudinidae (Tortoises); (Suvozemni Zhelki)			
6.	*Eurotestudo hermanni boettgeri*	Hermann's Tortoise	Ridska Zhelka
Family Emydidae (Terrapins); (Blatni Zhelki)			
7.	*Emys orbicularis* *	European Pond Terrapin	Blatna Zhelka
Order Squamata (Scaled Reptiles); (Lushpesti Vlechugi)			
Suborder Sauria (Lizards); (Gushterici)			
Family Gekkonidae (Geckos); (Gekoni)			
8.	*Mediodactylus kotschyi*	Kotschy's Gecko	Balkanski Gekon
Family Scincidae (Skinks); (Skinkovi)			
9.	*Ablepharus kitaibelii* *	Snake-eyed Skink	Kratkonogo Gushterche
Family Anguidae (Slow Worms and Glass Lizards); (Slepoci i Zmijogushteri)			
10.	*Anguis fragilis*	Slow Worm	Slepok
Family Lacertidae (Lacertid Lizards); (Vistinski Gushteri)			
6.	*Algyroides nigropunctatus*	Dalmatian Algyroides	Lushpesta Gushterica
7.	*Lacerta viridis*	Green Lizard	Zelen Gushter
8.	*Lacerta trilineata*	Balkan Green Lizard	Golem Zelen Gushter
9.	*Lacerta agilis*	Sand Lizard	Planinska Gushterica
10.	*Zootoca vivipara*	Viviparous Lizard	Zhivorodna Gushterica
11.	*Podarcis muralis*	Common Wall Lizard	Skalesta Gushterica
12.	*Podarcis tauricus*	Balkan Wall Lizard	Polska Gushterica
13.	*Podarcis erhardii*	Erhard's Wall Lizard	Makedonska Gushterica
Suborder Serpentes (Snakes); (Zmii)			
Family Colubridae (Typical Snakes); (Smokovi)			
14.	*Malpolon monspessulanus*	Montpellier Snake	Dlabochelen Smok
15.	*Dolichophis caspius*	Large Whip Snake	Zholt smok
16.	*Hierophis gemonensis*	Balkan Whip Snake	Balkanski Smok
17.	*Platyceps najadum dahlii*	Dahl's Whip Snake	Dzitka
18.	*Zamenis longissimus*	Aesculapian Snake	Eskulapov Smok
19.	*Natrix natrix*	Grass Snake	Beloushka
20.	*Natrix tessellata*	Dice Snake	Ribarka
21.	*Coronella austriaca*	Smooth Snake	Planinski Smok
Family Viperidae (Vipers); (Zmii Otrovnici)			
22.	*Vipera ammodytes*	Nose-horned Viper	Poskok
23.	*Vipera berus bosniensis*	Adder	Sharka
24.	*Vipera ursinii macrops*	Orsini's Viper	Ostroglava Sharka

* Species not yet recorded, but most likely to be present within the territory of the Park.

3.2.1. Order Testudines (Terrapins and Tortoises):

***Eurotestudo* (*Testudo*) *hermanni* [*Eurotestudo hermanni boettgeri*] - Herman's Tortoise**

Mediterranean species restricted mainly to the Balkan Peninsula and partly on the Apennine Peninsula including Sardinia and Corsica. On the territory of Macedonia, the Herman's Tortoise is represented by the subspecies “boettgeri” that is Balkan endemic. It is found in a variety of habitats including lush meadows, cultivated land, scrub-covered hillsides, light woodland etc. The Herman’s Tortoise occurs up to 600 m asl in the western part of its range and up to 1500 m asl in South-eastern Europe. Herman's Tortoise is active by day. In spring and autumn is active through all day, but in summer only in the morning and in the evening. The copulation is during April and May, and the eggs are incubated after 2-3 months. The species hibernates on land in burrows deep from 40-90 cm. Males mature in 8-12 years, and females in 11-13 years.

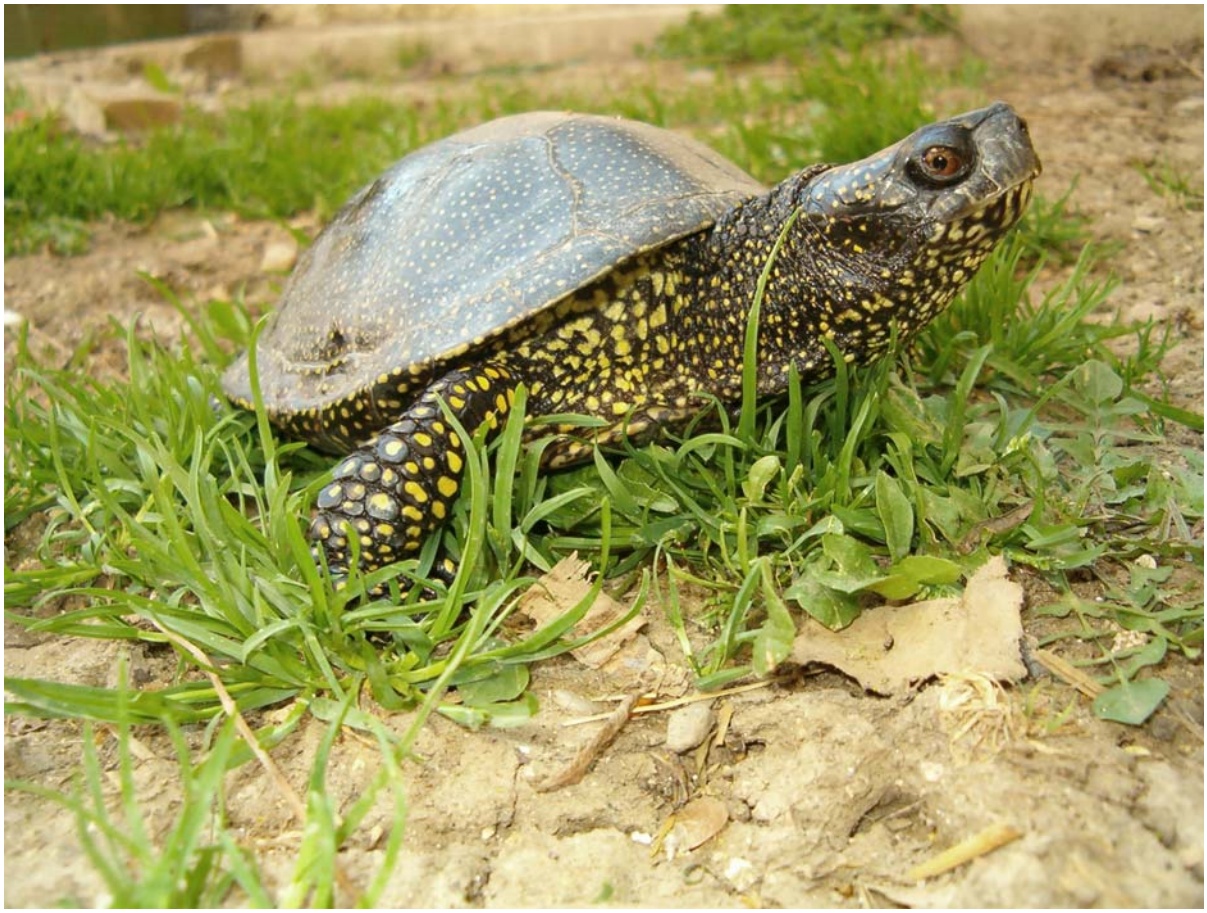
Herman's Tortoise (*Eurotestudo hermanni*)

***Former Records*:** Bistra (Rosochka Reka River Valley near the village Rosoki), 14/07/2010, 800 m asl, leg. Sterijoski (1 specimen), Sterijovski et al. (2003). Bistra (Rosochka Reka River Valley near the village Rosoki), 16/07/2010, 800 m asl, leg. Sterijoski (1 specimen), Sterijovski et al. (2003).

***Current Records*:** Radika Valley (Kosovrasti Spa - Debar), 12/06/2010, 633 m asl (road casualty specimen), N: 41.51851, E: 020.56110; Radika Valley (Kosovrasti Spa), 12/06/2010, 580 m asl, (live specimen), N: 41.55347, E: 020.58150.

Emys orbicularis - European Pond Terrapin

The species is distributed in most of Europe, except Northern and Central parts. The European Pond Terrapin is usually found in still or slow moving waters with growth of aquatic plants and overhanging vegetation, including ponds, lakes, rivers, canals, bogs and ditches. The breeding period is in spring, and the eggs are burrowed on the shore of the wetlands. The incubation period is from 65 to 100 days depends of the temperature. The sexual maturity on males is between 6-12 years, and for females between 14-18 years. The European Pond Terrapin mainly hibernate in water, rare on land.



European Pond Terrapin (*Emys orbicularis*)

***Former Records*:** The species has not been hitherto recorded for the territory of the Protected Area National Park Mavrovo. Notwithstanding the fact that the European Pond Terrapin has not yet been recorded, it is most likely the species to be present within the territory of the Park.

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area,

3.2.2. Order Squamata (Scaled Reptiles)
3.2.2.1. Suborder Sauria (Lizards)

Mediodactylus kotschyi - Kotschy's Gecko

The European distribution range is limited to South and East Balkans north to Albania, central and east Greece, Macedonia, south and east Bulgaria and many Ionian and Aegean islands. This species is typically found in rather dry rocky or stony places, on dry-stone walls, outsides of houses, cliffs and sometimes tree-boles. This lizard does not enter houses very often but tends to be associated with people. Kotschy's Gecko usually habits on low altitudes.

Kotschy's Gecko (*Mediodactylus kotschyi*)

***Former Records*:** The species has not been hitherto recorded for the territory of the Protected Area National Park Mavrovo. Notwithstanding the fact that the Kotschy's Gecko has not yet been recorded, it is most likely the species to be present within the territory of the Park.

***Current Records*:** Debar (Banjishte Spa or Debarski Banji Spa), 12/06/2010, 879 m asl, (live specimens have been recorded by local citizens on the walls of old houses), N: 41.55796, E: 020.52967.

Ablepharus kitaibelii - Snake-eyed Skink

The range of the species in Europe is restricted to the South and East Balkans. This is mainly lowland species closely related with the oak forest belt. This species tend to be active mainly in the spring and autumn, and after rain. The Snake-eyed Skink is not particularly agile, but can retreat effectively into its dense habitat.

Snake-eyed Skink (*Ablepharus kitaibelii*)

***Former Records*:** The species has not been hitherto recorded for the territory of the Protected Area National Park Mavrovo. Notwithstanding the fact that the Snake-eyed Skink has not yet been recorded, it is most likely the species to be present within the territory of the Park.

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area. However, the species should be expected in open Oak Forests along the Radika River and its tributaries, especially on the area around the village Selce.

Anguis fragilis (*Anguis graeca*) - Slow Worm

The range of the species covers almost the whole mainland of Europe except the most northern and most southern parts. The Slow Worm prefers well vegetated habitats with extensive ground cover in rather dump, but not wet situations, tending to disappear in periods of hot dry weather. The species is usually slow moving and secretive, and most likely to be encountered abroad at evening or after rain, and may be active in quite cool conditions around 15 ^{0} C.

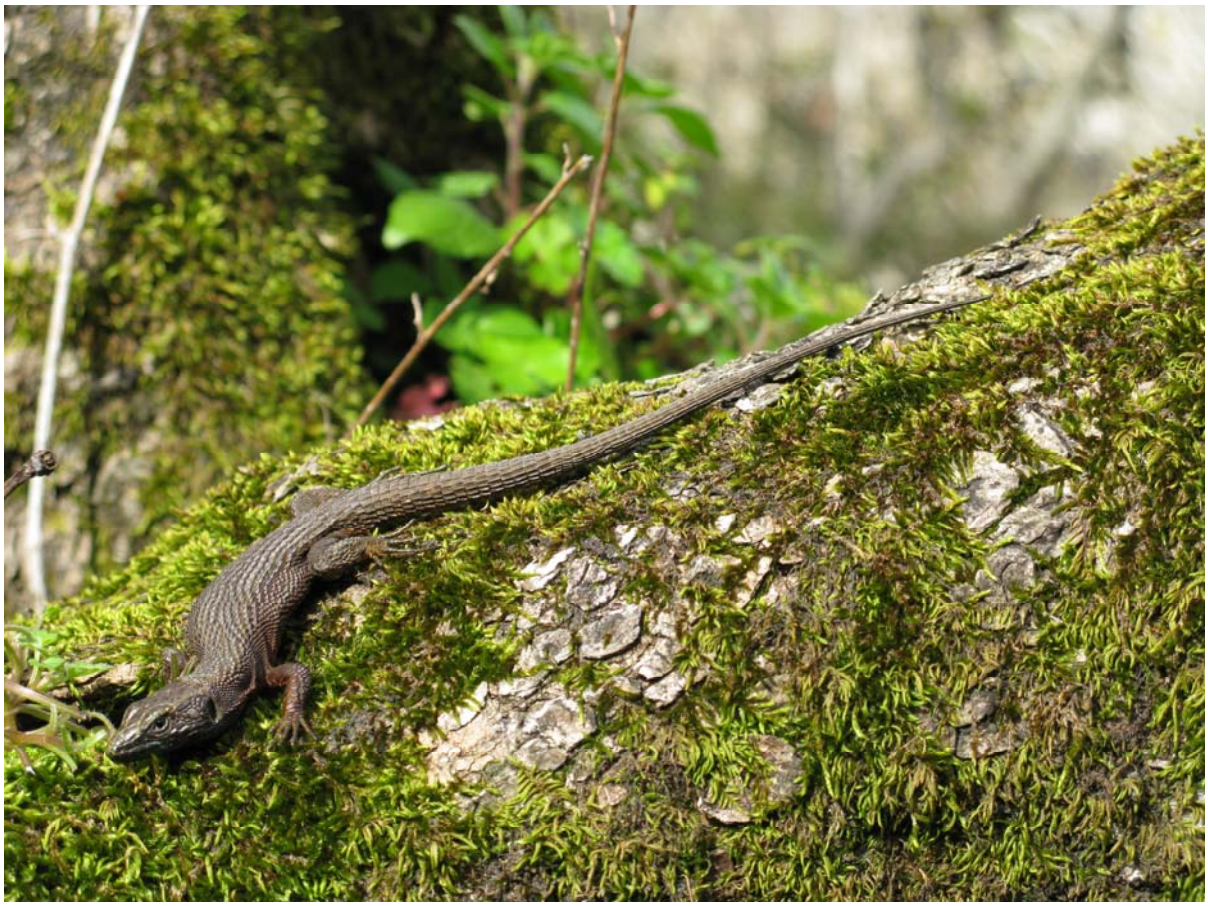
Slow Worm (*Anguis fragilis*)

***Former Records*:** Korab (Lukovo Pole), 23-29/07/1995, sight record, Dzukic (BISS) Database, unpublished data; Korab (Strezimir, Military Camp), 18/09/1996, Dzukic (BISS) Database, (1 juvenile specimen), unpublished data.

***Current Records*:** Deshat Mountain, 10/06/2010, 894 m asl, (road casualty specimen), N: 41.61443, E: 020.59436; Radika Valley (Monastery Sveti Jovan Bigorski), 12/06/2010, 767 m asl, (2 road casualty specimens), N: 41.61993, E: 020.60936; Bistra (Selce Village, close to the NP Mountain House), 12/06/2010, 1,010 m asl, (road casualty specimen), N: 41.57022, E: 020.71392; Bistra (local road to Selce Village), 12/06/2010, 779 m asl, (road casualty specimen), N: 41.53805, E: 020.66116.

Algyroides nigropunctatus - Dalmatian Algyroides

The distribution range of Dalmatian Algyroides cover East Adriatic coastal region: extreme north-east Italy and adjoining western Slovenia, west and south Croatia, west Bosnia, Albania and adjoining areas of Serbia and Macedonia, north-west Greece as far as the Gulf of Corinth and the Ionian islands. This relatively small dark lizard can be easily distinguished from other small lacertas by rough appearance of back scales and sombre coloring above. Typically it is dark grey-brown to reddish-brown above, often with scattered black spots. Adult males have an intense blue throat, and the belly is orange to red, the color often extending onto flanks. The Dalmatian Algyroides inhabits a wide variety of habitats, but usually open woods, degraded scrubs, walls, bushes between fields and olive groves, found up to 700 m and exceptionally to 1,200 m in the south of its range. Tends to prefer shady or partly shaded areas and may be rather secretive.



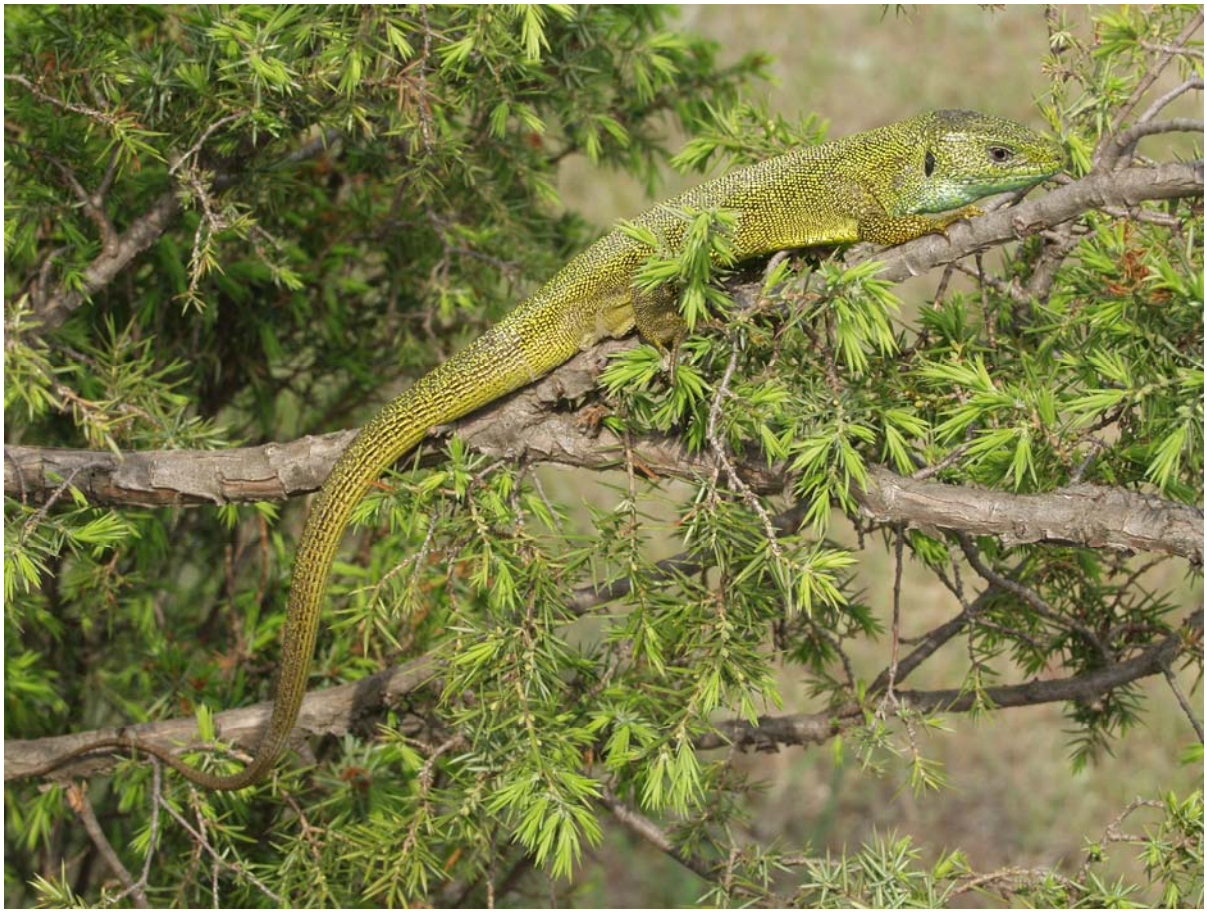
Dalmatian Algyroides (*Algyroides nigropunctatus*)

***Former Records*:** Debar-Jablanica (no precise locality), 16/07/1918, leg. Ebner (1 specimen), Kopstein & Wettstein (1920).

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area. However, the species is expected to be recorded in the Canyon of the River Radika in its lower flow.

Lacerta viridis - Green Lizard

The species is distributed mainly in the Southern part of Europe. Typically found in and around dense bushy vegetation with good exposure to sun. The Green Lizard hunts and climbs in dense vegetation, but comes out to bask, especially in the morning and evening. When pressed it takes refuge in bushes, rodent burrows, crevices etc.



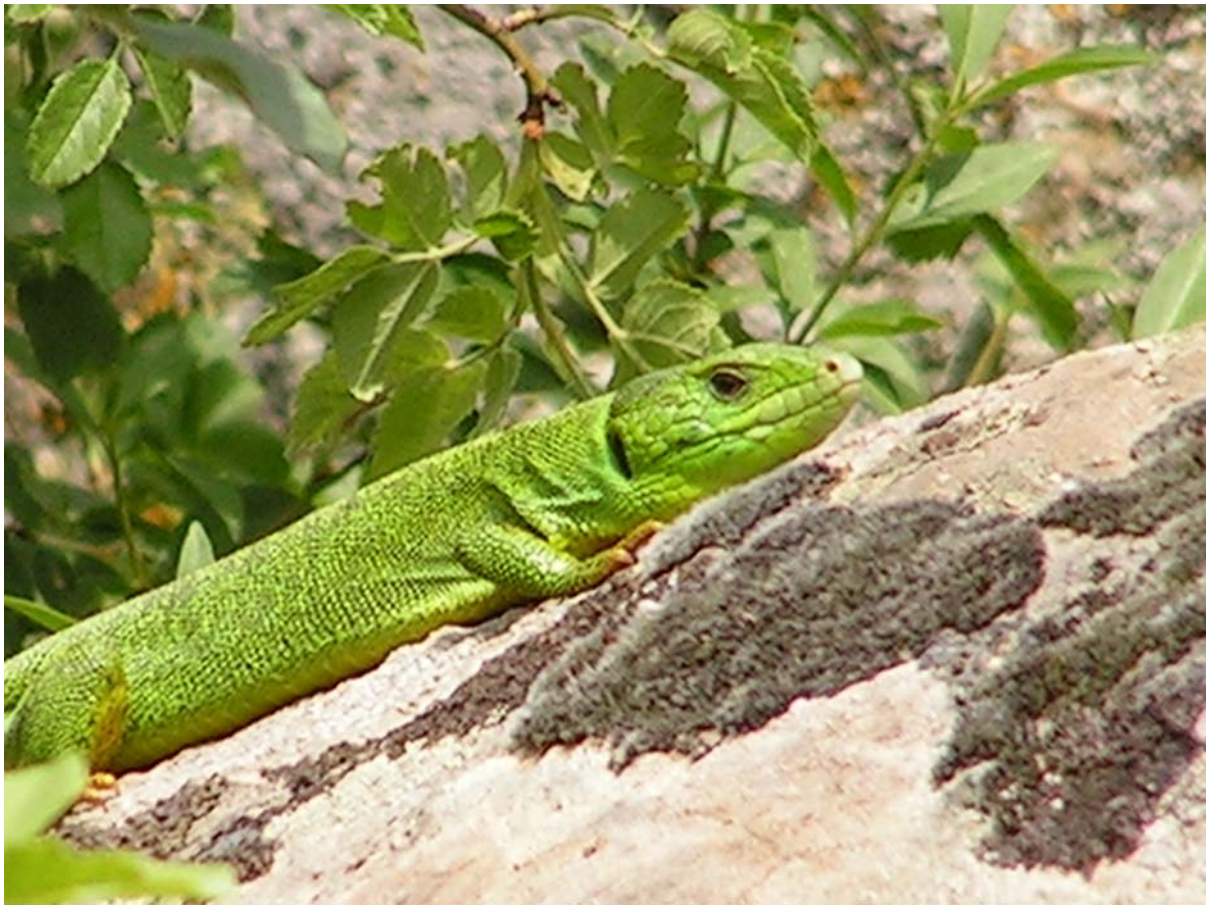
Green Lizard (*Lacerta viridis*)

***Former Records*:** Mavrovo (Djonovica), 06/06/1959, 800 m asl, (1 specimen), Tovornik & Brelih (1980); Bistra (below the Ship Farm Shkrka), 17/07/2003, 1,700 m asl, leg. Sterijovski (3 specimens), Sterijovski et al. (2003).

***Current Records*:** Mavrovo (close to the dam on Lake Mavrovo), 07/06/2010, 1,243 m asl, (road casualty specimen), N: 41.6970, E: 020.74693; Deshat Mountain, 10/06/2010, 894 m asl, (road casualty specimen), N: 41.61443, E: 020.59436; Mavrovo (on the local road around the Lake Mavrovo), 12/06/2010, 1,243 m asl, (live specimen), N: 41.6970, E: 020.74693; Radika Valley (Mavrovo - Debar Road), 12/06/2010, 789 m asl, (live specimen), N: 41.66570, E: 020.59834; Radika Valley (local road to the village Boletin), 12/06/2010, 742 m asl, (live specimen), N: 41.65541, E: 020.59997; Radika Valley (local road to the village Tresonche), 12/06/2010, 751 m asl, (live specimen on the bank of the river), N: 41.53697, E: 020.65816; Radika Valley (local road to Selce, fountain Bela Vodica), 12/06/2010, 927 m asl, (live specimen), N: 41.56444, E: 020.70370; Radika Valley (local road to Selce, after the fountain Bela Vodica), 12/06/2010, 832 m asl, (live specimen), N: 41.54343, E: 020.67595; Radika Valley (local road to the village Selce), 12/06/2010, 779 m asl, (live specimen), N: 41.53805, E: 020.66116.

Lacerta trilineata - Balkan Green Lizard

The species range in Europe is restricted to the Balkan Peninsula. This lizard tends to be found in warmer, drier places, and is largely confined with areas with a Mediterranean climate. The Balkan Green Lizard is daily active species and can be also active through warmest hour in a day. The length of the adult individuals (from snout to vent) is up to 16 cm, or more, and tail is twice body length or more. In areas where the Balkan Green Lizard occurs syntopically with the Green Lizard (like in the Protected Area NP Mavrovo) on moister habitats and at higher altitudes, it is often replaced by the Green Lizard. Within the borders of the Pilot Protected Area, the species occupies lower altitudes in the oak belt, usually appearing on clearings overgrown with bushes, on altitudes up to 1100 m asl.



Balkan Green Lizard (*Lacerta trilineata*)

***Former Records*:** Bistra (Lazaropole), 11/07/2003, 1450 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Tresonche), 12/07/2003, 850-900 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Bistra (Boshkov Most-Tresonche), 12/07/2003, 700 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003).

***Current Records*:** Radika Valley (asphalt road Mavrovo – Debar, after the Monastery Sveti Jovan Bigorski), 12/06/2010, 694 m asl, (road casualty specimen), N: 41.60875, E: 020.60872; Radika Valley (on the cross to the villages Janche and Adjievci), 12/06/2010, 669 m asl, (live specimen), N: 41.58994, E: 020.61910; Radika Valley (on the local road to the village Janche), 12/06/2010, 649 m asl, (road casualty specimen), N: 41.58968, E: 020.62135; Radika Valley (close to the mouth of Mala Reka), 12/06/2010, 649 m asl, (live specimen), N: 41.54319, E: 020.62661.

Lacerta agilis - Sand Lizard

The distribution range of the Sand Lizard covers most of Europe, north to southern and north-west England and southern Scandinavia, but it is rare or absent in much of west and south-east France, and from Italy, European Turkey, most of Greece and nearly all of the Iberian Peninsula. This is a short-legged, stocky lizard with a very short deep head (especially in males) and usually a distinct band of narrowed scales along the mid-back. The coloring is extremely variable, usually a dark band of series of marks along center of back that is often complex and may contain darker blotches, a light central streak (often broken up) and light spots. The Sand Lizard occurs up to 2000 m in south of the range, but it is a lowland species in north of range. It is largely a ground lizard and, in many areas lives in a wide variety of usually fairly dry habitats. In southern regions it is partly mountain species and occurs in upland pastures and alpine situations. Males threaten and fight each other vigorously in the breeding season and guard their mates after copulation. Females lay 4-14 eggs (often 5-6, and more in large animals), which in north and central Europe are buried in sandy ground exposed to the sun. Males often mature at 2 years (sometimes 1), and females at 3 at around 7-8 cm length from snout to vent.

Sand Lizard (*Lacerta agilis*)

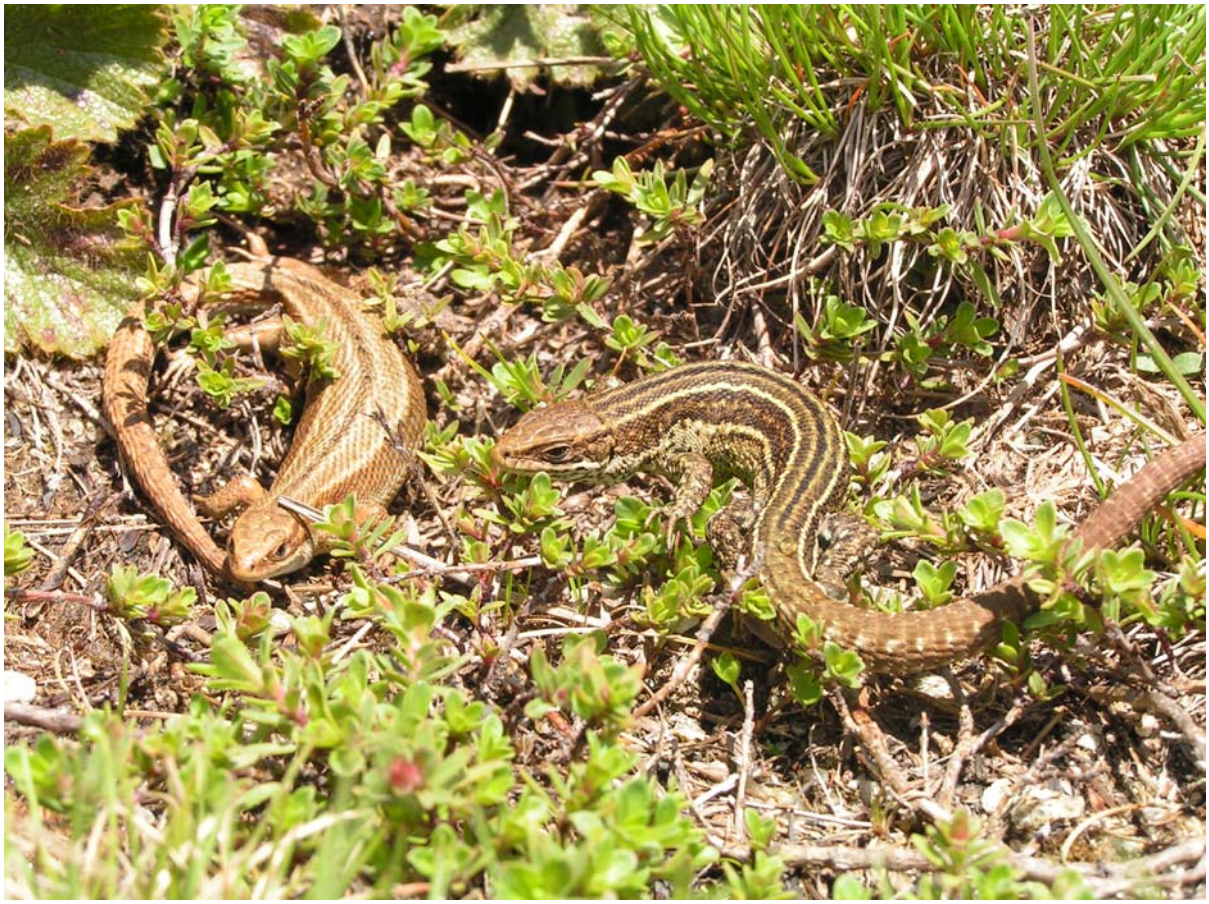
***Former Records*:** Korab (no precise locality), 26/07/1918, 1,800 m asl, leg. Csiki, (1 adult specimen), Fejervary (1922); Shajna-Globochica, 00/00/1918, (1 adult specimen), Bolkay (1924); Korab (Military post Ujedinjenje), 1,700 m asl, leg. Micevski (7 specimens), Dimovski (1964); Bistra (Maskarovec), 09/07/2003, 1,650 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Koritnik), 10/07/2003, 1,556-1,650 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Bistra (Plocha), 13/07/2003, 1,900 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Golem Brzovec-Mal Brzovec),

17/07/2003, 1,800-1,900 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Deshat (no precise locality), 26/09/1987, 2,000 m asl, leg. Petkovski (1 specimen, MMNH-R-672), unpublished data; Bistra (Plocha), 23/07/1985, leg. Sovkovski (2 specimens, MMNH-R-565-566), unpublished data; Stogovo (Sheep Farm over Jamska Reka River), 24/07/1985, 2,000 m asl, leg. Sovkovski (1 specimen, MMNH-R-567), unpublished data; Bistra (no precise locality), 30/06/1984, 2,000 m asl, leg. Petkovski (2 specimens, MMNH-R-530-531), unpublished data; Bistra (Chulavec over Lazaropole), 30/06/1984, 1,700 m asl, leg. Petkovski (3 specimens, MMNH-R-503-505), unpublished data; Bistra (no precise locality), 06/07/1978, leg. Petkovski (4 specimens, MMNH-R-437-440), unpublished data; Bistra (no precise locality), 30/06/1976, leg. Bogoevski (1 specimen, MMNH-R-422), unpublished data.

***Current Records*:** Bistra (mountain meadow in the vicinity of the Spring and Headwaters of Toni Voda Stream), 08/06/2010, 1,680 m asl, (adult specimen), N: 41.64460; E: 020.70033; Bistra (mountain pasture in the vicinity of a Temporary Pool along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,690 m asl, (female and juvenile specimens), N: 41.63446, E: 020.70572; Bistra (mountain pasture along the section of the road Toni Voda - Ski lift), 08/06/2010, 1,677 m asl, (subadult specimen), N: 41.63516, E: 020.70636; Bistra (mountain pasture), 08/06/2010, 1,985 m asl, (adult specimen), N: 41.57912, E: 020.75579; Korab (mountain soil road Strezimir- Kobilino Pole), 09/06/2010, 1,804 m asl, (female and juvenile specimens), N: 41.79639, E: 020.61224; Korab (mountain grassland ecosystem at Mid Lukovo Pole - Summer Military Post), 09/06/2010, 1,641 m asl, (several adult specimens), N: 41.85293, E: 020.63835; Deshat (Bitushe - Glacial Lake Lokuf), 10/06/2010, 1,483 m asl, (adult pregnant female), N: 41.63198, E: 020.56646; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,690 m asl, (adult specimen), N: 41.63446, E: 020.70572; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole), 11/06/2010, 1,703 m asl, (subadult specimen), N: 41.63486, E: 020.70534; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole, along mountain stream), 11/06/2010, 1,689 m asl, (adult female), N: 41.63639, E: 020.70549; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole, along mountain stream), 11/06/2010, 1,689 m asl, (subadult), N: 41.63408, E: 020.70541; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole, along mountain stream), 11/06/2010, 1,692 m asl, (adult specimen), N: 41.63344, E: 020.70519; Bistra (grassland ecosystem on the right side of the mountain soil road Toni Voda - Lazaropole, along mountain stream), 11/06/2010, 1,705 m asl, (adult specimen), N: 41.63252, E: 020.70569; Bistra (grassland ecosystem on the right side of the local asphalt road Mavrovo - Galichnik, after the mountain pass), 11/06/2010, 1,694 m asl, (subadult specimen), N: 41.64262, E: 020.68418.

Zootoca vivipara - Viviparous Lizard

The range of the Viviparous Lizard covers most of Europe, including Arctic Scandinavia, Britain and Ireland, but it is absent from the Mediterranean area: extends south to north Spain, north Italy and Macedonia, and south-west Bulgaria. This is a long-bodied, almost unflattened, short-legged lizard with a small rather rounded head and thick neck and tail. Pattern is very variable: most animals are basically brown, but may be gray or olive. Females usually have dark sides and a vertebral stripe. Viviparous Lizard is essentially a ground-dwelling lizard, although it may climb occasionally, especially in vegetation. Requires a fairly humid environment and is typically found among grass or other dense herbaceous plants. In most places, the Viviparous Lizard gives birth to 3-11 (often 7-8) fully formed young. In Spain and adjoining south-west France, this lizard usually lays a single clutch 1-13 (average 5-7) eggs, which may sometimes be deposited communally and develop quickly, in about 4-5 weeks.



Viviparous Lizard (*Zootoca vivipara*)

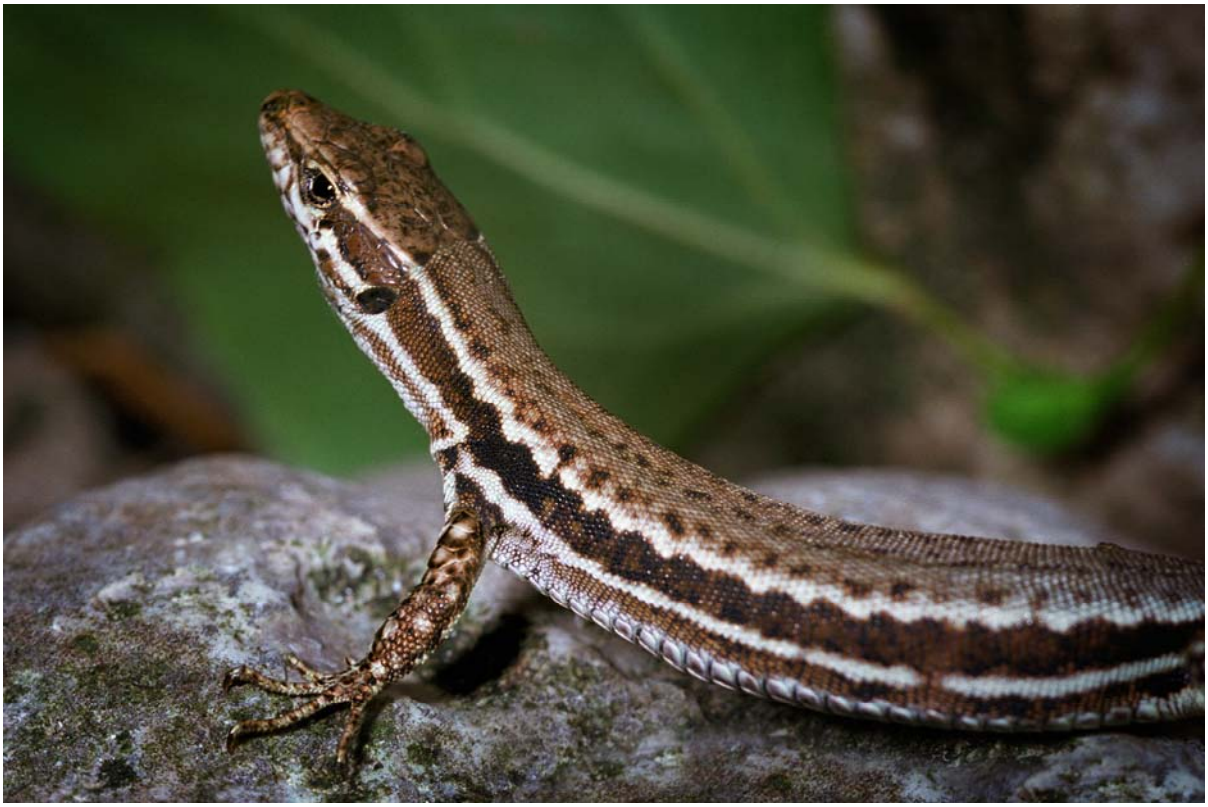
***Former Records*:** Korab (Fusha Korabit), 27/07/1918, leg. Zerny (1 specimen), Kopstein & Wettstein (1920); Korab (no precise locality), 23/07/1918, leg. Csiki (3 specimens), Fejervary (1922); Korab (Kobilino Pole, Nistrovsko Bachilo), leg. Micevski (no number of specimens), Dimovski (1964); Shar Planina, Korab, Rudoka (general distribution), Pozzi (1966); Bistra (Tonivoda-Medenica), 00/04/2003, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Korab (Lukovo Pole), 23-29/07/1995, Dzukic (BISS) Database, (several specimens), unpublished data; Korab (Kobilino Pole), 16/09/1996, Dzukic (BISS) Database (sight records), unpublished data.

***Current Records*:** Korab (Kobilino Pole, nearby small temporary pool over the former Summer Military Post), 13/08/2010, 2,138 m asl, (adult specimen), N: 41.77981, E: 020.57951; Korab (Kobilino Pole, mountain pasture), 13/08/2010, 2,202 m asl, (adult

specimen), N: 41.78150, E: 020.57685; Korab (Kobilino Pole, grassland ecosystem along mountain stream), 13/08/2010, 2,263 m asl, (adult specimen), N: 41.78211, E: 020.57009; Korab (Kobilino Pole, grassland ecosystem around the Glacial Lake), 13/08/2010, 2,337 m asl, (several adult specimens), N: 41.78162, E: 020.56011; Korab (Kobilino Pole, grassland ecosystem in wetland area around the numerous temporary pools along the mountain stream), 13/08/2010, 2,293 m asl, (numerous adult specimens), N: 41.78171, E: 020.56407.

Podarcis muralis - Common Wall Lizard

The range of the species covers most mainland of Europe except the most northern parts. In the southern part of its distribution it occurs in the mountain areas up to 2500 m. This lizard is typically found in rather humid, semi-shaded places. In general, Common Wall Lizard is very active, alert and usually more adventurous than its relatives from the same genera. Males are territorial and dominant ones, and may defend territory of about 25 m^2.



Common Wall Lizard (*Podarcis muralis*)

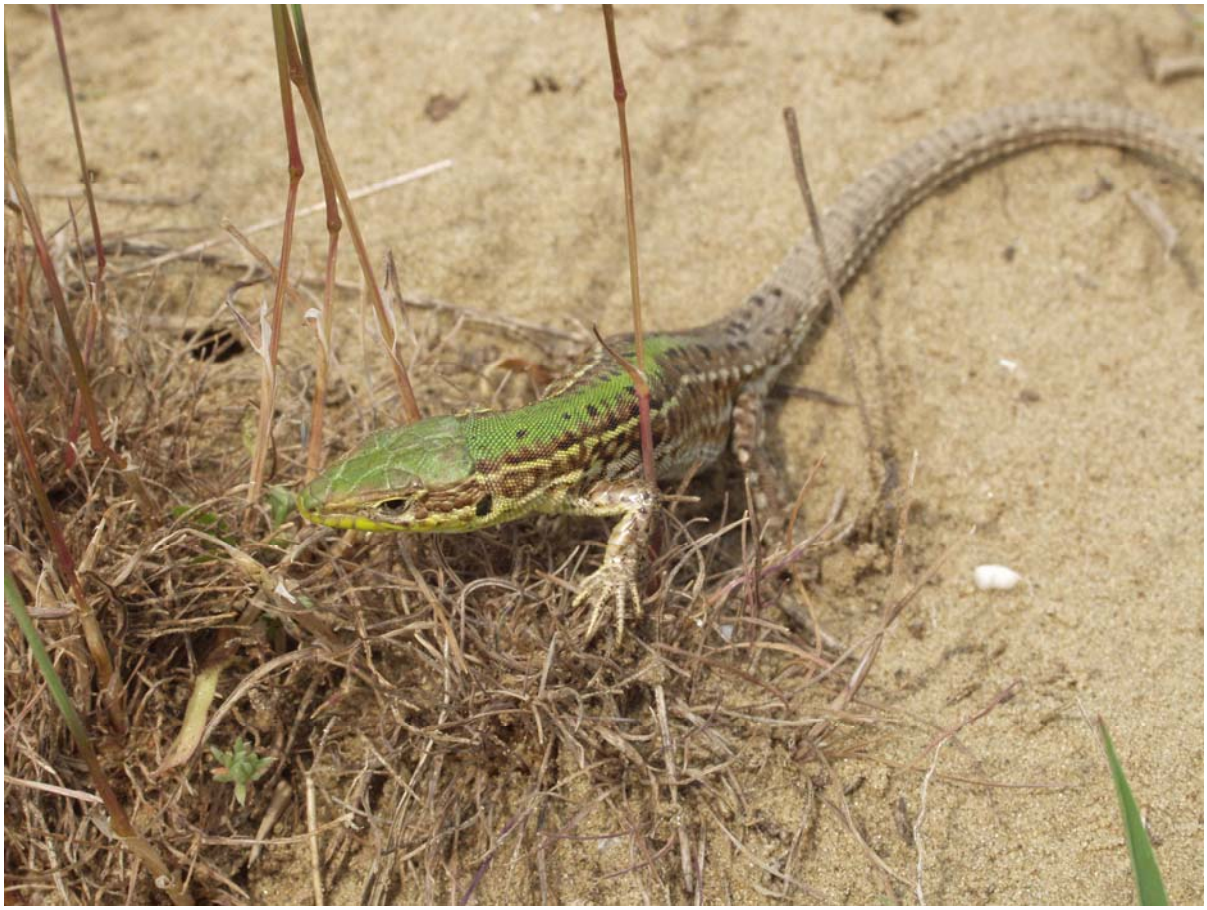
***Former Records*:** Jablanica-Debar (no precise locality), 16/08/1918, leg. Ebner (1 specimen), Kopstein & Wettstein (1920); Jablanica-Pishkopeja (no precise locality), 18/08/1918, leg. Ebner (1 specimen), Kopstein & Wettstein (1920); Gostivar-Kichevo (no precise locality), Karaman (1922); Gostivar-Kichevo (Bukovik), Karaman (1922); Gostivar-Kichevo (no precise locality), following Karaman (1922), Bolkay (1924); Kichevo-Ohrid (no precise locality), following Karaman (1922), Bolkay (1924); Gostivar-Kichevo (no precise locality), following Karaman (1922), Karaman (1928); Kichevo-Ohrid (no precise locality), following Karaman (1922), Karaman (1928); Gostivar-Debar (Rostushe), 00/00/1928, leg. Karaman (no number of specimens), N: $41^0$36'543", E: $20^0$36'289", Karaman (1928); Crni Drim River (along the river), Pozzi (1966); Kichevo (no precise locality), 07/06/1959, 650 m asl, (8 specimens), Tovarnik & Brelih (1980); Mavrovo (Djonovica), 06/06/1959, 800 m asl, (6 specimens), Tovarnik & Brelih (1980); Bistra (Lazaropole-Tresonche), 12/07/2003, 1,047 m

asl, leg. Sterijovski (3 specimens), Sterijovski et al. (2003); Bistra (Lazaropole-Rosochka Reka River), 16/07/2003, 800 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Bistra (Koritnik), 17/07/2003, 1,700 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Debar (along the river), 04/08/1968, leg. Grupche, Dimovski et Bogoevski (6 specimens, MMNH-R-333-338), unpublished data.

***Current Records*:** Mavrovo (courtyard of the NP Main Office), 07/06/2010, 1,301 m asl (several live specimens), N: 41.70216, E: 020.75675; Bistra (Mavrovo - Upstream of the hotel Makpetrol, along the mountain stream), 07/06/2010, 1,285 m asl, (adult specimen), N: 41.64568, E: 020.74419; Bistra (Mavrovo – local asphalt road around the Lake Mavrovo, close to the Lake Dam), 09/06/2010, 1,243 m asl, (live adult specimen), N: 41.69700, E: 020.74693; Deshat (local road Velebrdo - Bitushe), 10/06/2010, 894 m asl, (live adult specimens), N: 41.61443, E: 020.59436; Deshat (fountain at the Glacial Lake Lokuf), 10/06/2010, 1,583 m asl, (live adult specimen), N: 41.63467, E: 020.56202; Radika Valley (local asphalt road Mavrovo - Debar), 12/06/2010, 789 m asl, (live juvenile specimen), N: 41.66570, E: 020.59834; Radika Valley (local asphalt road Mavrovo – Debar, near the Monastery Sveti Jovan Bigorski), 12/06/2010, 694 m asl, (road casualty specimen), N: 41.60875, E: 020.60872; Radika Valley (local asphalt road Mavrovo - Debar), 12/06/2010, 678 m asl, (road casualty specimen), N: 41.60376, E: 020.60785; Radika Valley (local asphalt road to village Janche), 12/06/2010, 649 m asl, (road casualty specimen), N: 41.58968, E: 020.62135; Mala Reka Valley (local asphalt road to Lazaropole), 12/06/2010, 614 m asl, (live specimen), N: 41.34937, E: 020.61616; Rosochka Reka Valley (local asphalt road to Tresonche), 12/06/2010, 751 m asl, (live specimen), N: 41.53697, E: 020.65816; Rosochka Reka Valley (local asphalt road to Tresonche), 12/06/2010, 806 m asl, (the species is quite frequent and abundant along the river), N: 41.54221, E: 020.67189; Rosochka Reka Valley (local asphalt road to Tresonche), 12/06/2010, 885 m asl, (several live specimens), N: 41.55847, E: 020.69121; Rosochka Reka Valley (local asphalt road to Tresonche, fountain Bela Vodica), 12/06/2010, 927 m asl, (several live specimens around the fountain), N: 41.56444, E: 020.70370.

Podarcis tauricus - Balkan Wall Lizard

The range in Europe is restricted to the Balkan Peninsula but not East Adriatic area north of Albania. Typically found on flattish dry ground with at least some covering of grass. This lizard is very conspicuous when basking on stones, open ground, but coloring hides it well when hunting in vegetations and adapts through the year, changing as the summer advances. Takes refuge in holes in ground, in bushy plants and sometimes under stone.



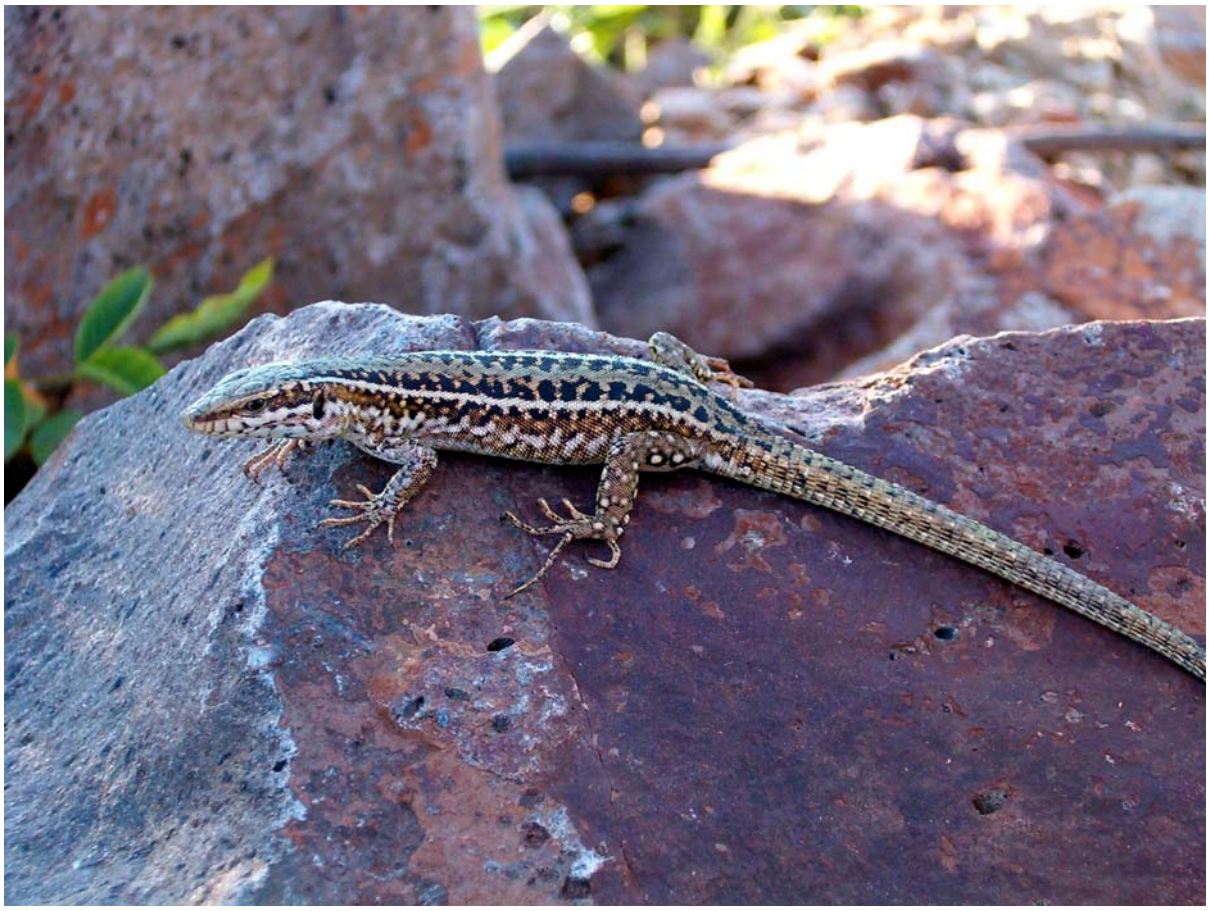
Balkan Wall Lizard (*Podarcis tauricus*)

***Former Records*:** Globochica Dam, 13/05/1982, leg. Petkovski (2 specimens, MMNH-R-468-469), unpublished data; Bistra (no precise locality), 04/10/1978, leg. Bogoevski (4 specimens, MMNH-R-428-431), unpublished data;

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area.

Podarcis erhardii (*Podarcis erhardii riveti*) - Erhard's Wall lizard

The species range is restricted to South Balkans, north to Albania, Macedonia and South Bulgaria, and it is Balkan endemic. The subspecies “riveti” is registered for the whole territory of Macedonia. The Erhard’s Wall Lizard is mainly lowland species, with vertical distribution up to 1000 m asl. On mainland is found in often stony or rocky places, usually with low, dense, bushy vegetation. This lizard hibernate close to the surface of land, and because of that, it can be seen sometimes in winter days when daily temperatures are higher.



Erhard's Wall lizard (*Podarcis erhardii*)

***Former Records*:** Jablanica (south of Debar), following Wettstein, Karaman (1922); Peshkopeja (north of Debar), following Wettstein, Karaman (1922); Jablanica-Debar, 16/08/1918, leg. Ebner (no number of specimens), Bolkay (1924); Debar-Peshkopeja, 18/08/1918, leg. Ebner (no number of specimens), Bolkay (1924); Kichevo, 07/06/1959, 650 m asl, leg. Tovarnik (29 specimens), Tovarnik & Brelih (1980); Mavrovo (Djonovica), 06/06/1959, 800 m asl, leg. Tovarnik (4 specimens), Tovarnik & Brelih (1980); Crni Drim Valley, 04/08/1968, leg. Grupche, Dimovski et Bogoevski (12 specimens, MMNH-R-321-332), unpublished data; Crni Drim Valley (Globochica Dam), 13/05/1982, leg. Petkovski (3 specimens, MMNH-R-465-467), unpublished data; Kichevo (Oslomej), 15/09/1981, leg. Stankovic (2 specimens, MMNH-R-574-575), unpublished data; Mavrovo (beech forest), 00/00/0000, 1,350 m asl, leg. (no data), (1 specimen, MMNH-R-613), unpublished data.

***Current Records*:** Bistra (local asphalt road Mavrovo - Galichnik, before the pass), 08/06/2010, 1378 m asl, (male and female, live specimens), N: 41.66579, E: 020.72531; Bistra (Bunec-Leunovo), 12/08/2010, 1,249 m asl, (road casualty specimen), N: 41.72784, E: 020.79962.

3.2.2.2. Suborder Ophidia (Snakes)

Malpolon monspessulanus - Montpellier Snake

The distribution range of the species covers Iberian Peninsula (except part of north), France (Mediterranean coast), Italy (Liguria and Trentino only), East Adriatic Coast, South Balkan Peninsula, north to Albania, Macedonia and Southern Bulgaria, and a few Greek islands. The Montpellier Snake is an aggressive, agile and mainly terrestrial snake. It is most usually found in warm, dry Mediterranean habitats, nearly always with some plant cover in which it often hides. Prefers often rocky or sandy terrain with bushy vegetation, but is also encountered on arable land and open woods. The food of this snake includes a large proportion of lizards, other snakes and mammals, as well as occasional birds (especially young of ground-dwelling species).

Montpellier Snake (*Malpolon monspessulanus*)

***Former Records*:** The species has not been hitherto recorded for the territory of the Protected Area National Park Mavrovo.

***Current Records*:** Debar (local asphalt road Debar - Banjishte Spa or Debarski Banji Spa), 12/06/2010, 803 m asl, (adult male - road casualty specimen), N: 41.55285, E: 020.52504.

Dolichophis (*Coluber*) *caspius* - Large Whip Snake

The main distribution range of the species is in the South and East Balkans. This snake is diurnal, swift and largely terrestrial species, living in dry, open habitats with some vegetation. Often basks on roads and usually is killed by traffic. This snake is highly aggressive and frequently not very inclined to retreat. Strikes repeatedly when approached and bites readily and fiercely when handled. The Large Whip Snake may climb 5-7 m up bushes and trees when hunting.

Large Whip Snake (*Dolichophis caspius*)

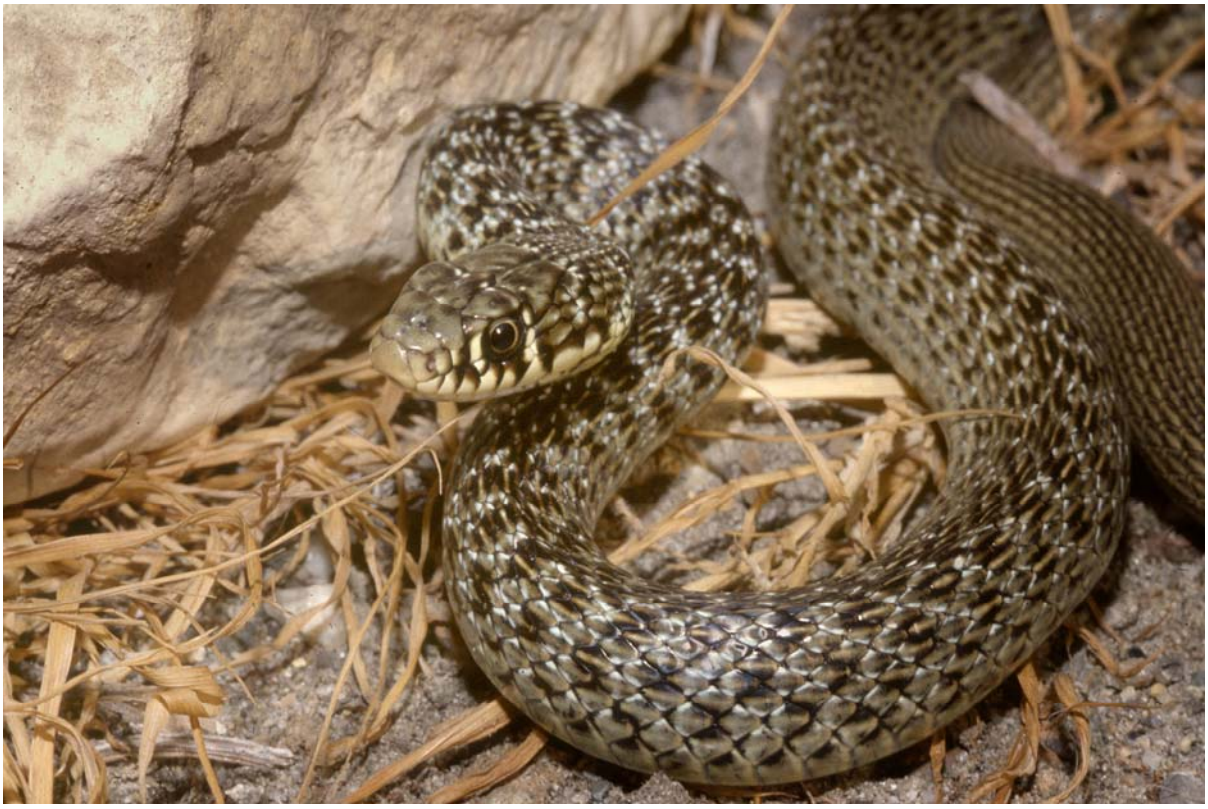
***Former Records*:** Bistra (Tresonche), 16/07/2003, leg. Sterijovski (1 specimen), Sterijovski et al. (2003);

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area.

Hierophis (*Coluber*) *gemonensis* - Balkan Whip Snake

The range of the species is restricted to the East Adriatic coastal area. The NP Mavrovo and the NP Galicica are the most eastern and deepest land range of the species. Occurs in dry stony places and open woods, shrub areas and on road banks. This snake is diurnal and terrestrial, although sometimes climbs on bushes. Bites fiercely when handled.

On the territory of the National Park Mavrovo, the species has not yet been recorded, but it has been recorded just outside the southern border of the Park. Within the field investigations on this project, presence of the Balkan Whip Snake has been confirmed for the same localities.



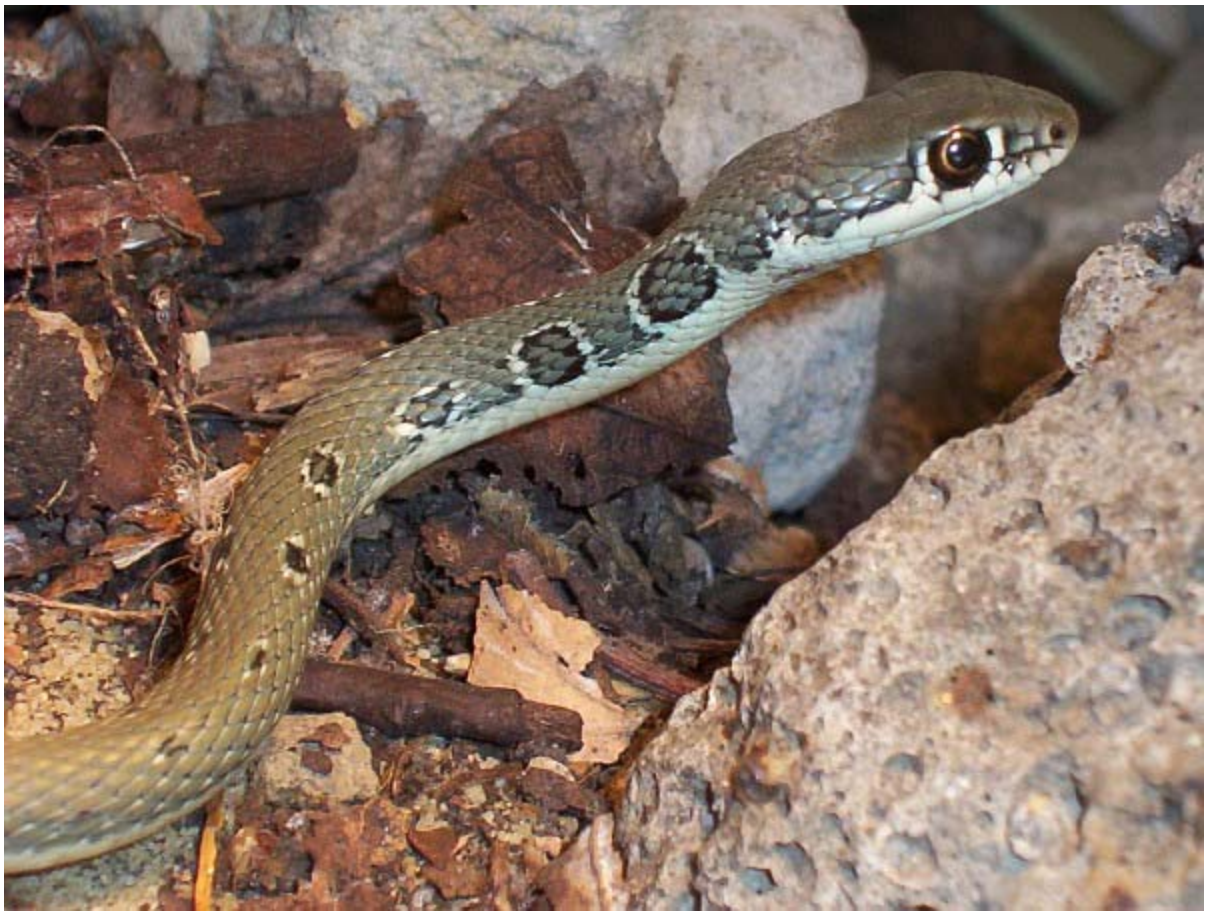
Balkan Whip Snake (*Hierophis gemonensis*)

***Former Records*:** Debar (Debarski Banji), 24/08/1999, 650 m asl, (2 juvenile specimens, MMNH Database), Petkovski et al. (2001).

***Current Records*:** Debar (local asphalt road Debar - Banjishte Spa or Debarski Banji Spa, near the Spa), 12/06/2010, 879 m asl, (road casualty adult specimen), N: 41.55796, E: 020.52967.

Platyceps (*Coluber*) *najadum dahlii* - Dahl's Whip Snake

The distribution range is mainly on South Balkans: from mainland Greece, north to coastal Croatia, Macedonia and extreme South Bulgaria. The Dahl's Whip Snake is diurnal species and mainly terrestrial in dry, often stony habitats, usually with bushes and some dense grassy vegetation in which it climbs. The snake feeds mainly on small lizards, especially lacertids, but known to also take grasshoppers and other invertebrates, rarely small mammals.



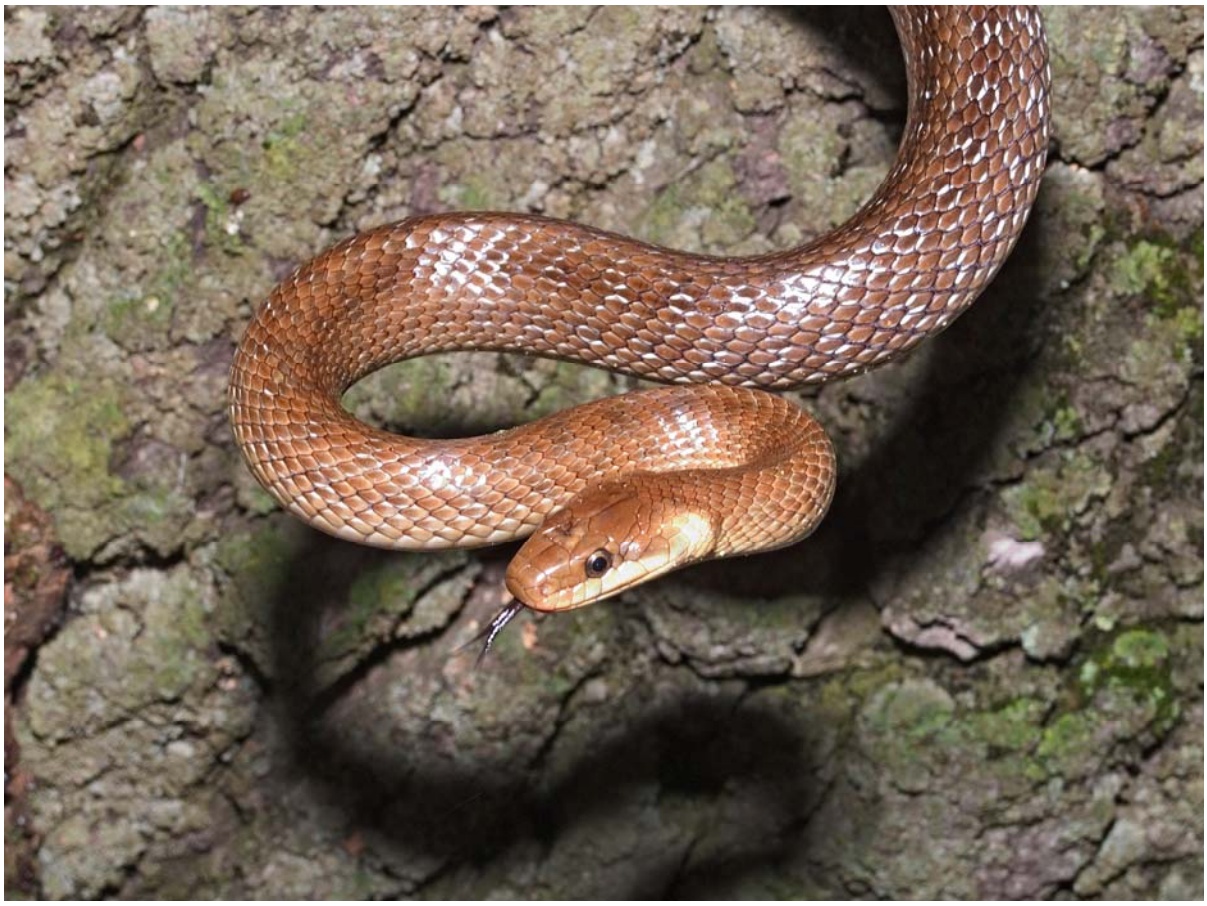
Dahl's Whip Snake (*Platyceps najadum*)

***Former Records*:** Upper flow of River Treska and Kichevo, (no precise locality), Karaman (1931).

***Current Records*:** During the field investigations conducted within the frames of this Project, presence of the species has not been recorded on the territory of the Protected Area.

Zamenis (*Elaphe*) *longissimus* - Aesculapian Snake

The range covers mainly the Mediterranean part of Europe, excluding the Iberian Peninsula. Mainly diurnal species that enjoys sun, most frequent on clearings of the oak and beech belt. Moves rather deliberately but is very adept climber in bushes and trees, even ascending tall vertical trunks. Frequently bites and voids the malodorous contents of cloacal glands when handled. Males can travel quite long distances in breeding season, sometimes up to 2 km. Most females appear to reproduce every year (May-June), producing 5 -11 elongate eggs. These may be laid in holes including ones in trees and in soil.



Aesculapian Snake (*Zamenis longissimus*)

***Former Records*:** Jablanica-Debar (no precise locality), Kopstein & Wettstein (1920); Bistra (Lazaropole), 14/07/2003, 1337 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Debar (Golem Papradnik), 04/06/1985, leg. Darovski Limche (2 specimens, MMNH-R-561-562), unpublished data; Mavrovi Anovi, 00/05/1939, 1 specimen (MMNH-R-27), unpublished data.

***Current Records*:** Bistra (forest belt below the NP Mountain House at the locality Brzovec), 08/06/2010, 1,534 m asl, (live specimen), N: 41.57922; E: 020.74683; Deshat (local road Velebrdo - Bitushe), 10/06/2010, 894 m asl, (road casualty, adult specimens), N: 41.61443, E: 020.59436. Radika Valley (asphalt road Mavrovo - Debar, before the cross to the village Zhirovnica), 12/06/2010, 819 m asl, (road casualty specimen), N: 41.66736, E: 020.63459; Bistra (Rosochka Reka Valley, local asphalt road to Tresonche, near the NP mountrain house at the village Selce), 12/06/2010, 1,010 m asl, (live specimen), N: 41.57022, E: 020.71392.

Natrix natrix (*Natrix natrix natrix; Natrix natrix persa*) - Grass Snake

The range of the species covers nearly whole Europe. Over most of its range it is a snake of damp places, such as moist meadows and woods, but in Southern Europe where it may reach altitudes, more than 2000 m, usually occurs near water bodies. Within the Protected Area National Park Mavrovo, both subspecies are present *N.n. natrix* and *N.n.persa*, and they are distributed almost equally. When disturbed, the Grass Snake often hisses and strikes with mouth closed, but rarely bites. Frequently voids foul-smelling contents of anal glands when handled, and may feign death, lying on back with mouth open and tongue hanging out. The copulation began from end of April until beginning of June. The places for hibernation are sometimes 2 km far from the summer habitats.

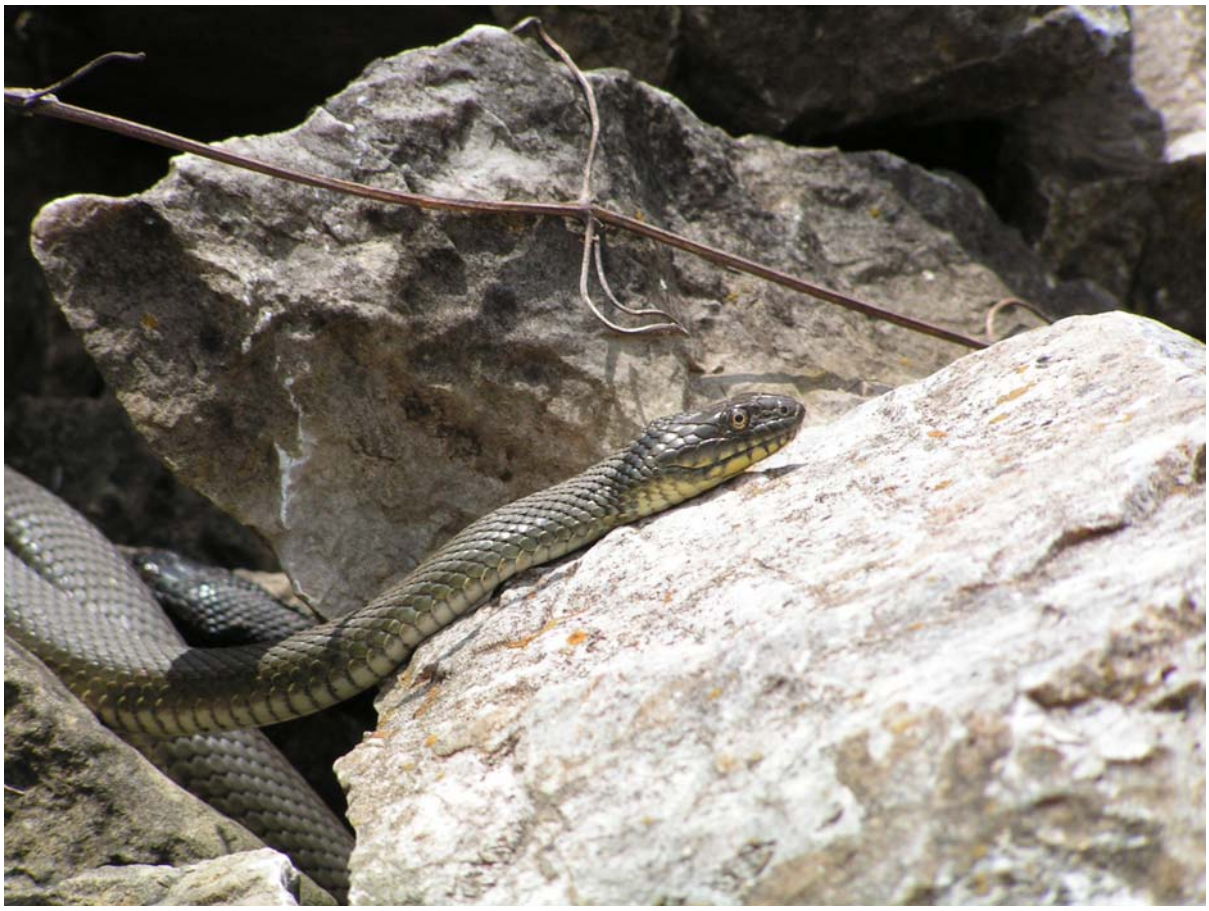
Grass Snake (*Natrix natrix*)

***Former Records*:** Bistra (Rosochka Reka River Valley), 16/07/2003, 850 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Deshat (Lower Glacial Lake-Barite), 26/09/1987, 2,000 m asl, leg. Petkovski (1 specimen, MMNH-R-671), unpublished data.

***Current Records*:** Radika Valley (asphalt road Mavrovo - Debar, after the Monastery Sveti Jovan Bigorski), 12/06/2010, 678 m asl, (road casualty specimen), N: 41.60376, E: 020.60785; Radika Valley (asphalt road Mavrovo - Debar, near the Kosovrasti Spa), 12/06/2010, 603 m asl, (road casualty specimen), N: 41.53211, E: 020.58044; Lake Mavrovo (on the road near the Church), 13/06/2010, 1257 m asl, (road casualty specimen), N: 41.66291, E: 020.73083; Korab (Kobilino Pole, temporary pool), 13/08/2010, 2,207 m asl, (adult specimen), N: 41.78189, E: 020.57630.

Natrix tessellata - Dice Snake

The range of the species is restricted to the most of Balkan Peninsula and Italy. The Dice Snake is extremely aquatic species spending much of its time in the water. It forages actively, searching under stones and weed for hidden prey but also occasionally hunts from ambush, lying with the body and tail largely buried among stones and weed and striking at passing prey. Like other Water Snakes, rarely bites but may empty contents of cloacal glands if handled. The copulation period begin on May-June (depend on the temperature).



Dice Snake (*Natrix tessellata*)

***Former Records*:** Bistra (Rosochka Reka), 16/07/2003, 860 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); River Treska (near the village Drugovo), 27/05/2005, 639 m asl, sight view (Sidorovska), road casualty specimen, N: 41^{0}28'3996", E: 20^{0}55'0695", unpublished data.

***Current Records*:** Radika Valley (asphalt road Mavrovo - Debar, near the Kosovrasti Spa), 12/06/2010, 603 m asl, (road casualty specimen), N: 41.53211, E: 020.58044.

Coronella austriaca - Smooth Snake

The range of the species covers most of Europe. In the Northern parts it is lowland species, while in the most Southern parts of Europe it is restricted to the mountain zone. This species is diurnal although rather secretive snake found in a variety of usually dry sunny habitats. It avoids extreme heat and is often active in the cooler parts of the day, in warm cloudy conditions and even at night during warm weather. Often basks under cover, beneath vegetation or discarded pieces of metal. Rather slow-moving and phlegmatic but bites readily when handled and voids smelly contents of anal glands. Mating often takes place in the spring (April-May), but it may mate again in summer (August-September), and than the young being carried through hibernation to be borne after the mother emerges from it (spring).

Smooth Snake (*Coronella austriaca*)

***Former Records*:** Bistra (Lazaropele), 08/07/2003, 1,337 m asl, leg Sterijovski (2 specimens), Sterijovski et al. (2003); Bistra (below the Mountain Peak Golem Brzovec), 17/07/2003, 1,900 m asl, leg Sterijovski (1 specimen), Sterijovski et al. (2003); Cer-Kichevo (no precise locality), 16/09/1981, leg. Cingovski (1 specimen, MMNH-R-450), unpublished data; Bistra (Lazaropole), 00/06/1987, leg. Kiril Simeonov (1 specimen, MMNH-R-670), unpublished data; Bistra (Lazaropole), 28/09/1987, leg. Angelovski (1 specimen, MMNH-R-719), unpublished data.

***Current Records*:** Bistra (below the NP Mountain House at Brzovec, tall grassland with juniper bushes), 08/06/2010, 1,623 m asl, N: 41.57922; E: 020.74683.

Vipera ammodytes (*Vipera ammodytes meridionalis*) - Nose-horned Viper

The main range of the species is on the Balkan Peninsula. The subspecies "*meridionalis*" occupies the territory of Albania, Macedonia, Greece, the southern parts of Serbia, Montenegro and Asia Minor. It is typical snake for dry rocky slopes with some vegetation and woods exposed to sun. Mainly lowland species, that regularly occurs on elevations up to 1200 m, while exceptions have been recorded, like in the Protected Area National Park Mavrovo, where it climbs much higher. The Nose-horned Viper occasionally climbs in bushes, and also on rock faces where it may be seen working its way along crevices looking for lizards. Generally encountered by day, but said to be sometimes nocturnal in warmer parts of range. This is a slow rather phlegmatic snake that is not very irascible, although when disturbed it hisses loudly. This snake is more dangerous than any other widespread European Viper and caused regular human deaths before modern treatment was available.

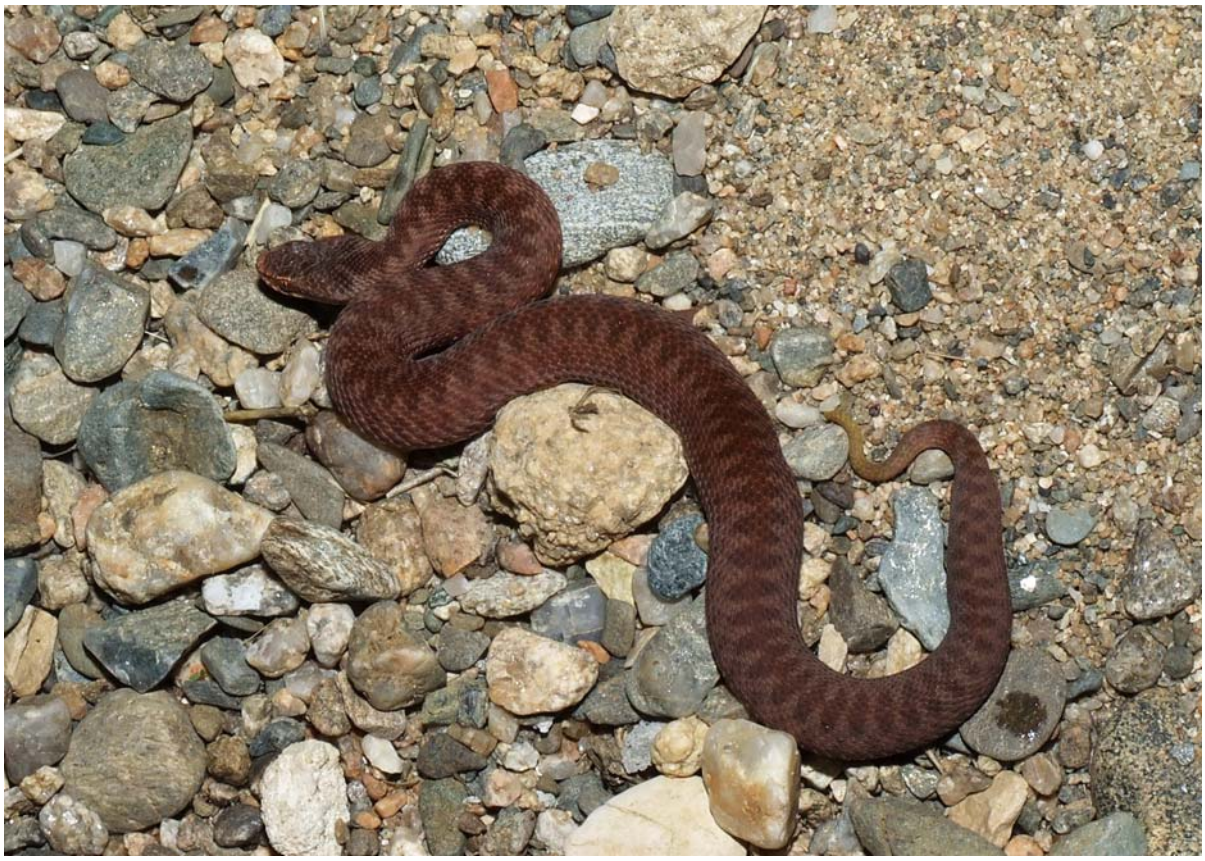
Nose-horned Viper (*Vipera ammodytes*)

***Former Records*:** Bistra (Tresonche), 09/07/2003, 950 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Bistra (Tresonche), 16/07/2003, 950 m asl, leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Debar (no precise locality), 12/04/1978, 1 specimen (MMNH-R-423), unpublished data; Korab (Strezimir Military Post), 16/09/1996, 1,550 m asl, killed specimen, Dzukic (BISS) Database, unpublished data; Korab (Lower Lukovo Pole), 16/09/1996, 3 killed specimens (Vlado Irakliev observations), Dzukic (BISS) Database, unpublished data.

***Current Records*:** Bistra (local asphalt road Mavrovo - Galichnik, before the mountain pass, into a Beech Forest clearing), 08/06/2010, 1378 m asl, (live adult specimen), N: 41.66579, E: 020.72531; Bistra (below the NP Mountain House at Brzovec, calcareous rocks on southern exposition), 08/06/2010, 1,534 m asl, N: 41.57922; E: 020.74683; Korab (mountain soil road Trnica - Lukovo Pole), 09/06/2010, 1,406 m asl, (road casualty specimen), N: 41.81706, E: 020.64324; Deshat (local road Velebrdo - Bitushe), 10/06/2010, 894 m asl, (road casualty, adult specimens), N: 41.61443, E: 020.59436. Bistra (Nikiforovo-Mavrovo), 12/08/2010, 1,235 m asl, (road casualty specimen, 66 cm in length), N: 41.67290, E: 020.74791.

Vipera berus bosniensis - Adder

The Adder occurs over much of Europe, extending north to beyond the Arctic Circle and south to northern France, north Italy, north Albania, northern Greece and west European Turkey. Adults are usually long up to 65 cm, including tail, exceptionally almost 90 cm. Females tend to be larger than males. Most Adders have a clearly marked dark, zig-zag vertebral stripe. In rare cases, the vertebral stripe is straight-edged, broken up, faint, or even absent. Colouring varies according to sex: many males are very contrasting especially in spring, often being whitish or pale gray with intense black markings. Females are frequently brownish or reddish with dark brown markings. Young animals are often reddish. The adder occurs in wide variety of habitats, particularly in north of the range. In the south, it is more restricted, and usually encountered in mountain areas, were it occurs in highlands. Adults feed mainly on small mammals, although birds, lizards and frogs may also be taken. Males leave hibernation earlier than females, and go to breeding areas first. A male often remains with a particular female for some time, copulating repeatedly, and 3-18 young are produced which may mature in 3-4 years.



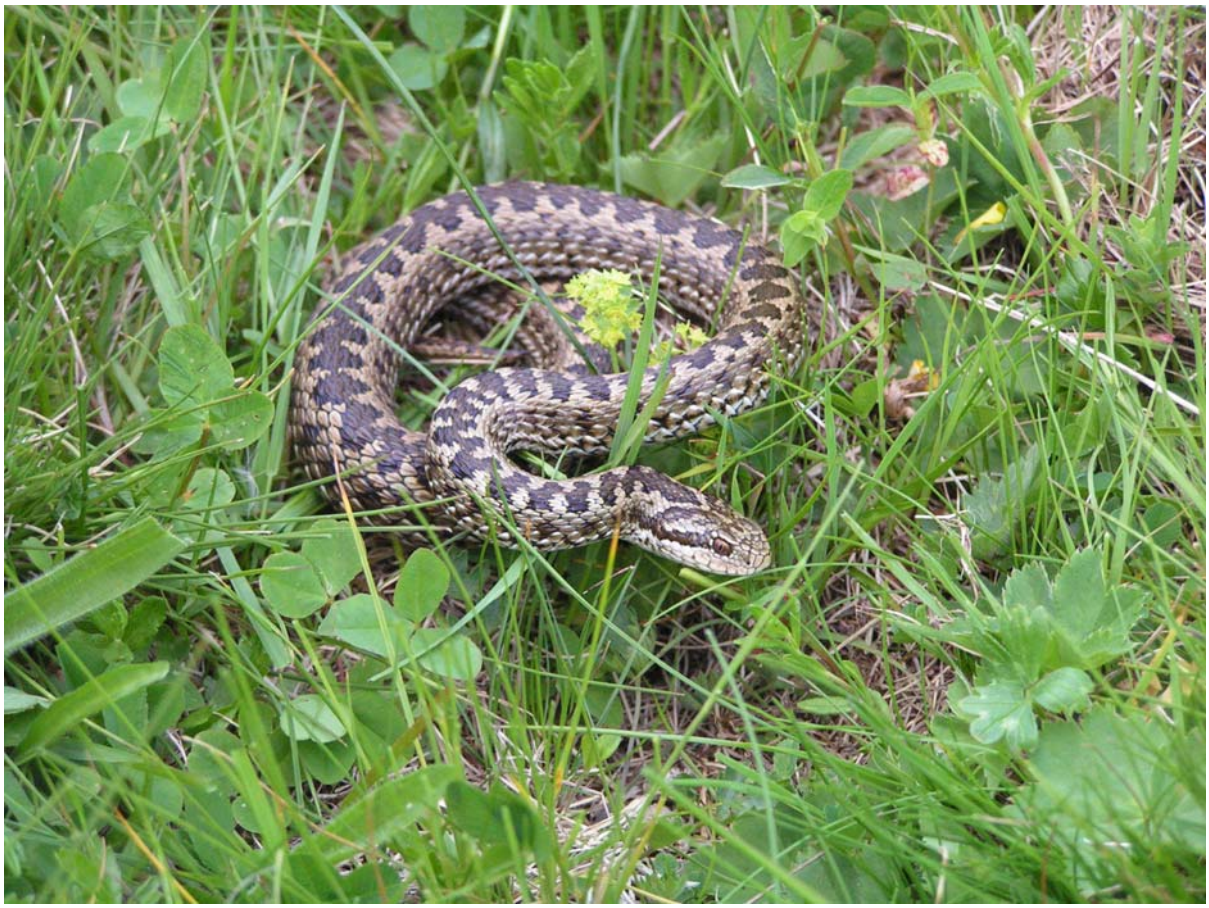
Adder (*Vipera berus bosniensis*)

***Former Records*:** Korab (Fusha Korabit), 23/07/1918, 2 adult specimens, Kopstein & Wettstein (1920); Korab (Kobilino Pole - Nistrovsko Bachilo Sheep Farm), 2,200 m asl, leg. Micevski (no number of collected specimens), Dimovski (1964); Bistra (Golem Brzovec), 17/07/2003, 1,900 m asl, leg. Sterijovski (2 specimens), Sterijovski et al. (2003); Korab (Lukovo Pole), 23-29/07/1995, (1 specimen), Dzukic (BISS) Database, unpublished data; Korab (Lukovo Pole), 25/03/1983, leg. Petkovski (3 specimens, MMNH-R-637-639), unpublished data; Korab (Kobilino Pole), 16/09/1996, (observations data of the guide Vehbi), Dzukic (BISS) Data Base, unpublished data.

***Current Records*:** Bistra (Tri Bari - Brzovec), 08/06/2010, 2014 m asl, (cast-off snakeskin), N: 41.57865; E:020.75825.

Vipera ursinii macrops - Orsini's Viper

The distribution range of Orsini's Viper is discontinuous. In Europe it occurs in isolated, often quite small populations in south-east France, central Italy, west Balkans (west Croatia, west Bosnia, north Albania and adjoining Montenegro and Macedonia), north Greece, Hungary, Romania, Moldavia, Ukraine and southern Russia. Adults are usually less than 50 cm in length, including tail, and rarely over 60 cm. The females tend to be larger than males. The Orsini's Viper is the smallest European viper. It differs from the Adder in smaller adult size, in having a narrower head with more tapering snout, and the several features of head scaling. The pattern is often not very variable: tends to be grayish, pale brown, or yellowish, with a dark zig-zag dorsal stripe that is usually edged with black and may be occasionally broken into spots. *Vipera ursinii ursinii, Vipera ursinii macrops* and *Vipera ursinii graeca* are mountain forms, occurring above 1,000 m and extending in some cases to 2,700 m. They live on well drained hillsides with some vegetation, or more commonly on high, often dry meadows. Unlike other vipers, Orsini's Viper is usually quite docile and almost never bites.



Orsini's Viper (*Vipera ursinii*)

***Former Records*:** Korab (no precise locality), 27/07/1918, 1,750 m asl, leg. Csiki, (1 specimen), Fejervary (1922); Korab (Kobilino Pole-Nistrovsko Bachilo Sheep Farm), 2,200 m asl, leg. Micevski (2 specimens), Dimovski (1964); Bistra (no precise locality and date), leg. Sterijovski (1 specimen), Sterijovski et al. (2003); Korab (Lukovo Pole), 23-29/07/1995, (1 specimen), Dzukic (BISS) Database, unpublished data.

***Current Records*:** Bistra (over the NP Mountain House at the locality Brzovec), 08/06/2010, 1883 m asl, (live collected specimen), N: 41.57952; E:020.74555; Korab (Kobilino Pole, grassland ecosystem nearby a temporary pool), 13/08/2010, 2,207 m asl, (adult specimen), N: 41.78189, E: 020.57630.

4. Evaluation of Amphibians & Reptiles

4.1. Introduction

The Evaluation of Amphibians and Reptiles has been conducted in accordance with the EU Habitats Directive (Directive 92/43/EEC), the IUCN Red List of Globally Threatened Species (2010), the IUCN European Red List of Threatened Species (2010), Species Richness, Species Heterogeneity and Geographical Distribution/Endemism.

Amphibians and Reptiles, according to the IUCN Red List of Globally Threatened Species (2010), are regarded as the least endangered. However, on a national level, including the Protected Area National Park Mavrovo a considerable reduction in the populations of most of the species has been recorded.

4.2. Methodology

4.2.1. Species Richness

A general characteristic for the Amphibians & Reptiles of the Protected Area National Park Mavrovo is its high degree of species diversity.

4.2.2. Species Heterogeneity

Besides the species richness, another most striking feature of the Amphibians & Reptiles of the Protected Area National Park Mavrovo is its heterogeneity. The complex zoogeographical structure, with herpetological elements of various origins and zoogeographical affiliations is manifested, coupled by a high degree of relict and regional endemic forms.

4.2.3. Legal Protection

Since in Macedonia the by- law documents on Legal Protection of Wild Animal and Plant Species, under the Habitats Directive and Birds Directive are already into Administrative Procedure for adoption, the Evaluation of Amphibians and Reptiles under Legal Protection has been made in accordance with the Habitats Directive.

Habitats Directive (Directive 92/43/EEC). The Habitats Directive (Directive 92/43/EEC), adopted in 1992, is a Community legislative instrument in the field of nature conservation that establishes a common framework for the conservation of wild animal and plant species and natural habitats of Community importance.

Annex I. Natural and semi-natural habitat types of community interest whose conservation requires the designation of special areas of conservation.
Annex II. Animal and plant species of community interest whose conservation requires the designation of special areas of conservation.
Annex IV. Animal and plant species of community interest in need of strict protection.
Annex V. Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures.

Only Annexes II and IV are used in the present report as a selection criterion for "evaluation".

4.2.4. Conservation Status

The IUCN Red List of Globally Threatened Species (2010). The Red List distinguishes nine hierarchically related Red List Categories. The present IUCN criteria are based on estimates of rates of decline and extinction risk as well as rarity.

All taxa listed as Critically Endangered (CR), Endangered EN) and Vulnerable (VU) are qualified as Threatened. The category Data Deficient (DD) is not a threatened category, although it indicates a need to obtain more information on a taxon to obtain the appropriate listing. The old IUCN category Lower Risk (LR) in (IUCN 1994) is replaced by Near Threatened (NT), which is close to qualifying for Vulnerable but not Threatened.

The IUCN European Red List of Threatened Species (2009). The IUCN European Red List of Threatened Species is based on the same criteria like the Global Red List, but the estimates of rates of decline, the extinction risk and rarity are restricted exclusively to the European populations of the species.

Geographical Distribution/Endemism. For the evaluation of the geographic distribution of species, the degree to which species are characteristic on Local and National level is consider as the most important criterion. Species for which the geographical distribution is restricted to a certain area are included in the category of "Endemic Species". Therefore, the definition of endemism is scale dependent. Within the scope of the present report, endemism is defined at the Local (Protected Area), National (Macedonia) and Regional Scale (Balkan Peninsula).

4.3. Evaluation of Amphibians

Amphibians under Strict Legal Protection, Globally Threatened and Endemic Species

Taxonomic Group / Species		English Common Name	92/43/EEC	IUCN	Endemism
Order Caudata (Tailed Amphibians: Salamanders and Newts); (Opashesti Vodozemci: Dozhdovnici i Mrmorci)					
Family Salamandridae (Typical Salamanders and Newts); (Vistinski Dozhdovnici i Mrmorci)					
1.	*Triturus macedonicus*	Macedonian Crested Newt	II/IV	-	SW Balkans
Order Anura (Tailless Amphibians: Frogs and Toads); (Bezopashesti Vodozemci: Zhabi)					
Family Bombinatoridae (Fire-bellied Toads); (Ogneni Zhabi)					
2.	*Bombina scabra*	Balkan Yellow-belied Toad	II/IV	-	Balkans
Family Bufonidae (Typical Toads); (Krastavi Zhabi)					
3.	*Pseudepidalea viridis*	Green Toad	IV	-	-
Family Hylidae (Tree Frogs); (Lisni Zhabi, Drvjarki)					
4.	*Hyla arborea*	Common Tree Frog	IV	-	-
Family Ranidae (Typical Frogs); (Vodni Zhabi)					
5.	*Rana dalmatina*	Agile Frog	IV	-	-
6.	*Rana graeca*	Balkan Stream Frog	IV	-	Balkans

4.3.1. Species Richness

A general characteristic for the Amphibians of the Protected Area National Park Mavrovo is its high degree of species diversity. Within the territory of the Protected Area National Park Mavrovo 11 Amphibian species have been recorded, which is 73.3% of the total number of species on National Level, represented by 15 species.

4.3.2. Species Heterogeneity

Amphibians of Boreal (Taiga) or Siberian Origin within the Protected Area National Park Mavrovo are represented by the following species: Alpine Newt (*Ichthyosaura alpestris*), Common Frog (*Rana temporaria*) and Common Toad (*Bufo bufo*).

Amphibians of Broadleaved Arboreal Origin represented by Holo-Mediterranean Elements that have widely expanded their range up to Central Europe to the North include the following species: Fire Salamander (*Salamandra salamandra*), Marsh Frog (*Pelophylax ridibundus*), Common Tree Frog (*Hyla arborea*), Agile Frog (*Rana dalmatina*) and Green Toad (*Pseudepidalea viridis*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species on appropriate habitats reaches high altitudes.

Amphibians of Broadleaved Arboreal Origin represented by Ponto (Eastern)-Mediterranean Elements with distribution range mainly restricted to the Balkan Peninsula encompass the following species: Macedonian Crested Newt (*Triturus macedonicus*) and Balkan Stream Frog (*Rana graeca*).

The Complex of Eremial (Steppes-Desert) Faunal Elements within the territory of the National Park Mavrovo includes the species: Balkan Yellow-belied Toad (*Bombina scabra*) with origin of the Ponto-Caspian Steppes Region.

From the Oreo-Tundral (Arctic-Mountain) Complex of Faunal Elements, none amphibian species is present.

4.3.3. Legal Protection

Habitats Directive provide a strict legal protection for six species (Annex IV), while the species Macedonian Crested Newt (*Triturus macedonicus*) and the Balkan Yellow-belied Toad (*Bombina scabra*) are included in the list of Annex II, which means that the species are of community interest whose conservation requires designation of special areas of conservation.

4.3.4. Conservation Status

The European Red List of Threatened Species (2009)

None of the 11 amphibian species present within the territory of the Protected Area National Park Mavrovo is included in the three IUCN categories of Threatened Species on European Scale.

The IUCN Red List of Globally Threatened Species (2010)

None of the 11 amphibian species present within the territory of the Protected Area National Park Mavrovo is included in the three IUCN categories of Globally Threatened Species.

Geographical Distribution/Endemism

The amphibians Macedonian Crested Newt (*Triturus macedonicus*), Balkan Yellow-belied Toad (*Bombina scabra*) and Balkan Stream Frog (*Rana graeca*) are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers wetland ecosystems with disjunctive distribution only within certain parts of the Balkan Peninsula.

4.4. Evaluation of Reptiles

Reptiles under Strict Legal Protection, Globally Threatened and Endemic Species

Taxonomic Group / Species		English Common Name	92/43/EEC	IUCN	Endemism
Order Testudines (Tortoises and Terrapins); (Zhelki)					
Family Testudinidae (Tortoises); (Suvozemni Zhelki)					
1.	*Eurotestudo hermanni boettgeri*	Hermann's Tortoise	II/IV	NT/NT	Balkans
Family Emydidae (Terrapins); (Blatni Zhelki)					
2.	*Emys orbicularis*	European Pond Terrapin	II/IV	NT/VU	-
Order Squamata (Scaled Reptiles); (Lushpesti Vlechugi)					
Suborder Sauria (Lizards); (Gushterici)					
Family Gekkonidae (Geckos); (Gekoni)					
3.	*Mediodactylus kotschyi*	Kotschy's Gecko	IV	-	-
Family Scincidae (Skinks); (Skinkovi)					
4.	*Ablepharus kitaibelii*	Snake-eyed Skink	IV	-	-
Family Lacertidae (Lacertid Lizards); (Vistinski Gushteri)					
5.	*Algyroides nigropunctatus*	Dalmatian Algyroides	IV	-	Balkans
6.	*Lacerta viridis*	Green Lizard	IV	-	-
7.	*Lacerta trilineata*	Balkan Green Lizard	IV	-	Balkans
8.	*Lacerta agilis*	Sand Lizard	IV	-	
9.	*Podarcis muralis*	Common Wall Lizard	IV	-	-
10.	Podarcis tauricus	Balkan Wall Lizard	IV	-	Balkans
11.	*Podarcis erhardii*	Erhard's Wall Lizard	IV	-	Balkans
Suborder Serpentes (Snakes); (Zmii)					
Family Colubridae (Typical Snakes); (Smokovi)					
12.	*Dolichophis caspius*	Large Whip Snake	IV	-	-
13.	*Platyceps najadum dahlii*	Dahl's Whip Snake	IV	-	-
14.	*Zamenis longissimus*	Aesculapian Snake	IV	-	-
15.	*Natrix tessellata*	Dice Snake	IV	-	-
16.	*Coronella austriaca*	Smooth Snake	IV	-	-
Family Viperidae (Vipers); (Zmii Otrovnici)					
17.	*Vipera ammodytes*	Nose-horned Viper	IV	-	-
18.	*Vipera ursinii macrops*	Orsini's Viper	II/IV	VU/EN	-

4.4.1. Species Richness

The number of hitherto recorded Reptiles for the territory of the Protected Area National Park Mavrovo is 24 species, which is 75% of the total number of species on National Level, represented by 32 species.

4.4.2. Species Heterogeneity

Reptiles of Boreal (Taiga) or Siberian Origin within the Protected Area National Park Mavrovo are represented by the following species: Viviparous Lizard (*Zootoca vivipara*), and Adder (*Vipera berus*).

Reptiles of Broadleaved Arboreal Origin represented by Holo-Mediterranean Elements that have widely expanded their range up to Central Europe to the North and include the following species: European Pond Terrapin (*Emys orbicularis*), Slow Worm (*Anguis fragilis*), Common Wall Lizard (*Podarcis muralis*), Sand Lizard (*Lacerta agilis*), Green Lizard (*Lacerta viridis*), Grass Snake (*Natrix natrix*), Aesculapian Snake (*Zamenis longissimus*), and Smooth Snake (*Coronella austriaca*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species on appropriate habitats reaches high altitudes.

Reptiles of the Complex of Species of Broadleaved Arboreal Origin represented by Ponto (Eastern)-Mediterranean Elements that have widened its range to the Circum-Mediterranean Region include the species Montpellier Snake (*Malpolon monspessulanus*).

Another group of reptiles of this Complex includes species whose core distribution range is mainly restricted to the Balkan Peninsula: Hermann's Tortoise (*Eurotestudo hermanni*), Snake-eyed Skink (*Ablepharus kitaibelii*), Kotschy's Gecko (*Mediodactylus kotschyi*), Balkan Green Lizard (*Lacerta trilineata*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Balkan Whip Snake (*Hierophis gemonensis*) and Dahl's Whip Snake (*Platyceps najadum*). Within the territory of the Protected Area National Park Mavrovo the vertical distribution of these species is mainly restricted to the lower altitudes, mainly in the Oak forest belt.

The Complex of Eremial Faunal Elements that includes species of Ponto-Caspian Steppes Origin encompasses the following species: Balkan Wall Lizard (*Podarcis tauricus*), Large Whip Snake (*Dolichophis caspius*), Orsini's Viper (*Vipera ursinii*) and Dice Snake (*Natrix tessellata*).

The origin of the species Erhard's Wall Lizard (*Podarcis erhardii*) and Nose-horned Viper (*Vipera ammodytes*) comes from the Aegean-Anatolian Semi Deserts.

None reptilian species is included in the Complex of Oreo-Tundral (Arctic-Mountain) Faunal Elements, therefore no presence of such elements on the territory of the Protected Area National Park Mavrovo too, which is quite understandable, since this group are cold-blood animals.

4.4.3. Legal Protection

Habitats Directive provides a strict legal protection for 18 species (Annex IV), while the species: Hermann's Tortoise (*Eurotestudo hermanni*), European Pond Terrapin (*Emys orbicularis*) and Orsini's Viper (*Vipera ursinii*) are also included in Annex II (Animal and plant species of community interest whose conservation requires the designation of special areas of conservation).

4.4.4. Conservation Status

The European Red List of Threatened Species (2009)

The Species Orsini's Viper (*Vipera ursinii*), present within the territory of the Protected Area National Park Mavrovo is included in the European Red List of Threatened Species within the category Vulnerable (VU). In addition, the species: Hermann's Tortoise (*Eurotestudo hermanni*) and European Pond Terrapin (*Emys orbicularis*) are listed in the Category Near Threatened (NT) which is close to qualify the species as Vulnerable (VU).

The IUCN Red List of Globally Threatened Species (2010)

The Species Orsini's Viper (*Vipera ursinii*) is included in the IUCN Red List of Globally Threatened Species under the category Endangered (EN), while the species European Pond Terrapin (*Emys orbicularis*) under the category Vulnerable (VU). In addition, the species Hermann's Tortoise (*Eurotestudo hermanni*) is listed in the Category Near Threatened (NT) which is close to qualify the species as Vulnerable (VU) on a Global Scale.

Geographical Distribution/Endemism

The Reptiles: Hermann's Tortoise (*Eurotestudo hermanni boettgeri*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Balkan Green Lizard (*Lacerta trilineata*), Erhard's Wall Lizard (*Podarcis erhardii*) and Balkan Wall Lizard (*Podarcis tauricus*) are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers habitat types with disjunctive distribution.

5. Threats to Amphibians and Reptiles

5.1. Introduction

From a Global point of view, it is confirmed that the living world of the Planet Earth is faced with the sixth phase of mass extinction (Wake & Vredenburg, 2008). The process of extinction has shown most vigorous effects on the Amphibians and Reptiles, since they are particularly vulnerable groups.

At present, ecologists estimate that less than one tenth of 1% of naturally occurring species is directly exploited by humans (Wilson, 1988). It is therefore argued that the major threat to the loss of species is not caused by direct human exploitation of species, but the habitat alteration and destruction that results from the expansion of human populations and human activities. Habitat change by humans is caused directly through land-use changes, urbanization, infrastructure development and industrialization, and indirectly through environmental effects caused by the use and extraction of resources from the environment, and the discharge of various wastes to air, soil and water. These include global climate changes due to fossil-fuel burning and the emission of greenhouse and ozone depleting gases.

In the case of the Protected Area National Park Mavrovo, on the basis of our field investigations on the status of Amphibians and Reptiles, several human activities that have negative impact on their populations have been recorded.

5.2. Indirect Threats to Amphibians and Reptiles

Indirect threats are related with human activities in the wider area: construction of artificial lakes i.e. Mavrovsko Ezero and Lukovo Pole, transfer of water resources from one watershed (Radika River Watershed) to another Watershed (Vardar River Watershed), development of mass tourism (especially for 8th of September when big mass of humans are visiting the highest peak Golem Korab), development of tourist infrastructure, development of local road infrastructure.

5.3. Direct Threats to Amphibians and Reptiles

5.3.1. Cut-off of the Migration Corridors

Besides the migration corridors important for the Pan-European Ecological Network, within the territory of the protected Area National Park Mavrovo, several local migration corridors exist, which are not less important for the Park itself, but also on National and European Level. These migration corridors relate the amphibians with their breeding and hibernation sites. Twice a year, in spring and autumn appears mass movement of amphibians and reptiles in certain directions, so called migration corridors that have been established through the millennia. The spring migration of the amphibians to the breeding aquatic sites is especially powerful. This mass migration is of explosive character, carried out into a period between 3 and 14 days, therefore looks like a torrent that could not be stopped, even a mass casualties on the roads, when they cut-off the migration corridor.

Such local migration corridors have been recorded on certain sites within the Park, including: the local ring road around the Lake Mavrovsko Ezero, and along the local road Mala Reka-Selce-Tresonche. However, the most impressive is the migration corridor that is cut-off by the local road Strezimir-Lukovo Pole, which constraint the movement of the amphibians from the surrounding area to the rivers Radika, Adzina Reka and Crn Kamen. Only during a short monitoring period (June 09, 2010) on this portion of the road have been recorded more than 100 live specimens and 42 road casualty specimens of Common Toad (*Bufo bufo*). Such a

big casualties on an extremely low frequency road should be an alarm to the Management Body of the Park to undertake immediate actions to prevent the future casualties.

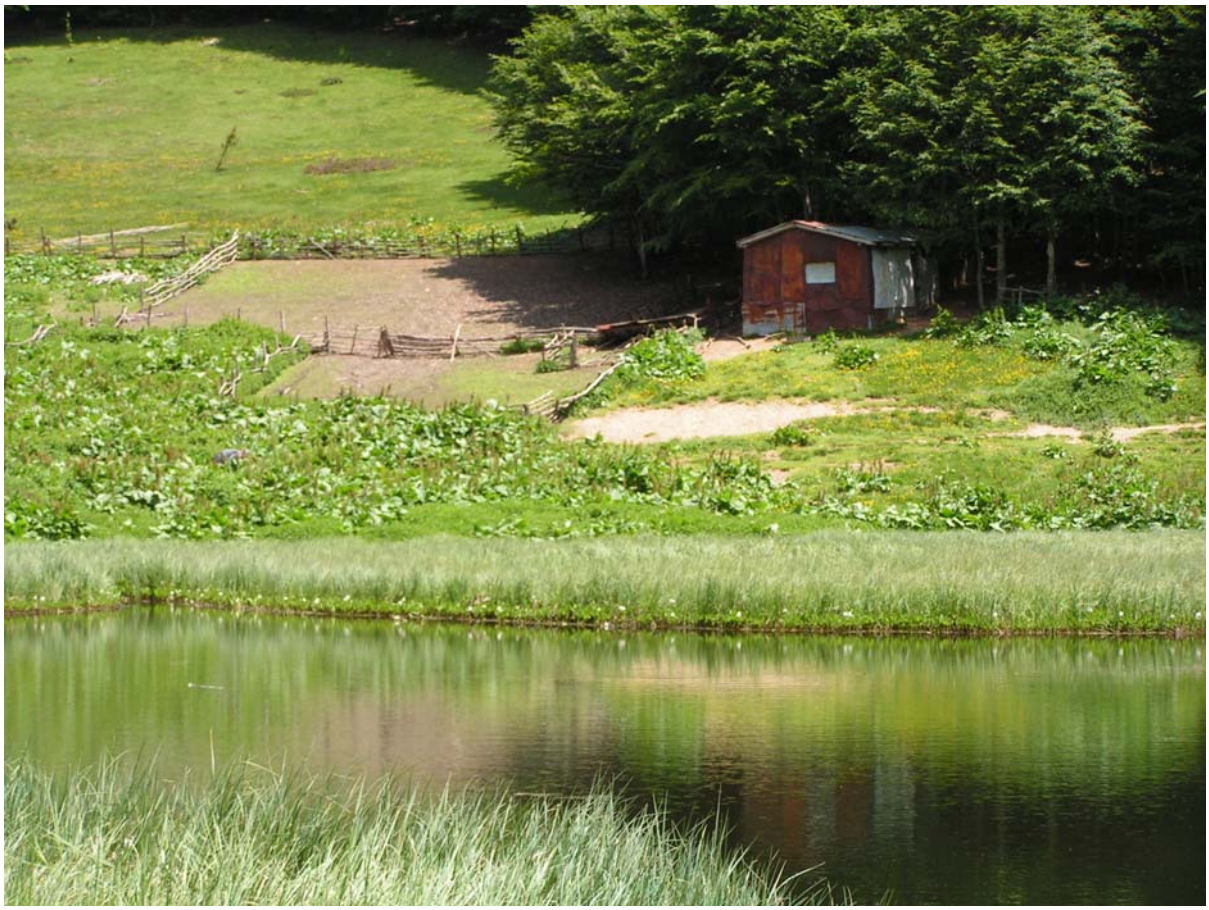
Common Toad (*Bufo bufo*), road casualty specimens on the local road Strezimir-Lukovo Pole

5.3.2. Eutrophication of Glacial Lakes and Temporary Pools

On the Korab, Bistra and Deshat Mountains a unique hydrological complex of mountain glacial lakes and temporary pools are present. These aquatic biotopes are primarily breeding sites for rare European species of amphibians whose populations are existing at the ultimate southern range of the species, mainly concerning the Alpine Newt (*Ichthyosaura alpestris*) and the Common Frog (*Rana temporaria*), as well as the Balkan Endemic Species Macedonian Crested Newt (*Triturus macedonicus*). Even with the only three above mentioned species, excluding the other zoological and botanical rarities, these small aquatic ecosystems deserve strict protection.

In this case we shall be focused on the Glacial Lake Lokuf, situated on the Deshat Mountain. The glacial lake Lokuf is the lowermost glacial lake in the Republic of Macedonia (1,574 m asl), which is in the phase of the process of natural succession into a peat bog.

Unfortunately, just close to the lake shore a Sheep-Farm has been constructed, which is directly situated within the primary watershed of the glacial lake, incongruous with the level of protection of this area. It is not only a violation of the virgin nature and visual landscape, but primarily it has negative impact on the natural processes in the lake itself. Namely, with the run-off and snow melting waters a huge amount of Nitrogen and Phosphorus nutrients enter the lake waters that accelerate the process of eutrophication of the lake and its succession into a peat bog.



Glacial Lake Lokuf with a Sheep Farm

5.3.3. Water capture/extraction from Mountain Streams

The water capture from mountain streams that is conducted through pipelines into the Lake Mavrovsko Ezero is widely present within the boundaries of the National Park Mavrovo. In accordance with the Macedonian Law on Nature Protection concerning the Biological Minimum of Water Habitats (Article 56), Paragraph (1) says: "For the purposes of protecting the survival of the natural wealth and conserving the biological and landscape diversity in the water habitats, partition of the waterways in a way contributing to habitat degradation, reduction of the quantity of water below the biological minimum, drying, and encumbering of the springs, swamps and other water habitats, shall be prohibited". However, concerning the water extraction from mountain streams in the National Park Mavrovo, the law has not been implemented properly, since in certain cases the whole quantity of water of the mountain streams is captured, leaving dry stream bed, as it is the case with the waters of Adzina Reka (see photo bellow).

Water capture in the upper flow of Adzina Reka

Such actions cause vigorous negative impact not only to the populations of Amphibians, mainly for the Balkan Stream Frog (*Rana graeca*) and the Fire Salamander (*Salamandra salamandra*), but also desiccation of the spawning sites of the endemic Stream Trout Radichka Pastrmka (*Salmo farioides*) and the core natural habitat of the Globally Threatened Species Stone Crayfish (*Austropotamobius torrentium*) as well as to other numerous animal species that are closely related to such habitat types.

River bed of Adzina Reka after the water capture

5.3.4. Prejudices and Illegal Collection

A major portion of Direct Threats to Amphibians and Reptiles is related to prejudices concerning these two groups of animals as a consequence of long term tradition and inadequate knowledge of the local population treating them as harmful and dangerous animals that results in killing the animals in most of the accidental encounters, especially with the snakes. Finally, it should not be neglected the illegal, unregistered, collecting of all species of Amphibians and Reptiles, connected with commercial, hobbyst or even semi scientific reasons. Across the territory of the Park a whole teams of illegal collectors, amateurs, students and experts are roaming collecting series of specimens of rare species. Protected Areas, like National Parks, especially the most worthy areas, should be excluded of such activities.

5.4. Impact on Amphibians & Reptiles by the Construction of Dam and Artificial Lake on the locality Dolno Lukovo Pole

The preliminary results of the analyses made on the basis of the field investigations, the construction and maintaining of Dam and Artificial Lake on the locality Dolno Lukovo Pole will not cause significant negative impact on the population status of Amphibians and Reptiles in the wider area. On the opposite, certain species of Amphibians, like: Common Toad (*Bufo bufo*), Green Toad (*Pseudepidalea viridis*), Yellow-belied Toad (*Bombina scabra*), Common Tree Frog (*Hyla arborea*), Marsh Frog (*Pelophylax ridibundus*) and Common Frog (*Rana temporaria*), as well as the aquatic reptiles: Grass Snake (*Natrix natrix*) and Dice Snake (*Natrix tessellata*) will increase their populations, while other species or Reptiles, like: Sand lizard (*Lacerta agilis*), Smooth Snake (*Coronella austriaca*), Adder (*Vipera berus*) and Orsini's Viper (*Vipera ursinii*) will have conditions to retreat safely in the surrounding habitats.

Dolno Lukovo Pole, locality where is planning construction of artificial lake

6. Ways for Effective Protection of Amphibians and Reptiles in NP Mavrovo

The Amphibians and Reptiles play an important role as insect and rodent predators and as valuable prey for various birds of prey and carnivorous mammals. Successful management of wildlife areas for protection of Amphibians and Reptiles should introduce Protection Measures that will take into consideration all stages of their life history. Protection measures have to provide access to food, shelter, migration corridors as well as hibernation, aestivation, breeding, and nesting sites.

6.1. General Management

Management practices commonly used to manipulate the structure and composition of vegetation can exert immediate, short-term, and long-term effects on herpetological assemblages. Prescribed fire, mowing, grazing, and forest thinning are examples of disturbance techniques. The best method for avoiding herpetological mortality due to site management is to conduct any treatment outside of herpetological activity periods. In general, the Amphibians and Reptiles hibernate from mid-October through March and are least impacted by management during this time period. If management is to occur within the herpetological active season, several different approaches may be taken to minimize impacts:

Amphibians and Reptiles are most active when air temperatures are between 10-26.6 ^{0} C and after rain or flood events. Therefore, a suitable time to conduct management is during the hottest part of the day, during a dry spell, or on unseasonably cool days.

The highest potential for mortality due to site management occurs during spring and fall migrations to and from breeding or wintering habitats. Becoming familiar with the migratory behaviour of Amphibians and Reptiles known to occur within the management area is critical in formulating a management plan that will reduce the chances for management during mass herpetological movement.

Due to the weak dispersal capabilities of many Amphibian and Reptile Species, emigration of animals during and immigration of animals post-management is most successful for sites within 200 meters of suitable untreated habitat. It is therefore advised that a site be managed on a rotational basis with no more than ¼ of the site impacted in any given year.

6.2 Prescribed Fires

Prescribed fires will be probably used to reduce the presence of unwanted, juniper bushes to maintain the traditional landscape of mountain pastures, as well as to encourage oak and/or beech dominance in woodlands and native vegetation in wetlands/temporary pools. To a certain degree, Amphibians & Reptiles have physiological and/or behavioral strategies for surviving events of fire. Examples of fire avoidance include the fossorial behavior of salamanders and toads and the use of mammal burrows by the snakes. Several studies on the effects of prescribed fire have shown negative *immediate* impacts on Amphibian & Reptile communities, but upon further study it was found that the communities responded positively over the *long-term* with increased species richness on sites where burns had occurred within the past decade.

Amphibians & Reptiles most sensitive to the effects of fire are those whose habitat requirements include significant amounts of leaf litter normally consumed during a burn. Salamander species that fall into this category may not return to a burned site until litter has accumulated for several years after a burn. In such situations, it may be wise to create fire-

breaks to protect these vital habitat components. As with all disturbances, frequency will determine whether a given species will persist or expire on a site; therefore, fire intervals of 3-7 years or greater have been recommended in order to maintain a healthy plant and herpetological community.

6.3. Mowing

Mowing is a common management technique used to manipulate vegetation, especially on sites where fire may not be feasible. Amphibians & Reptiles may be run over by a mower or killed by the mowers blades; instances found to cause mortality of Amphibians & Reptiles if conducted during peak foraging times or during migrations. Increasing the deck height of a mower to 20-25 cm will reduce the potential for Amphibians & Reptiles run-ins with blades.

When possible, begin mowing at the center of a treatment area, progressively mowing out from the center to allow wildlife to flee in all directions and not become trapped to one side. To reduce the area impacted by the mower tires, effort should be made to follow the outermost tire track of a previous pass, which will reduce animal mortality and soil compaction. Cover objects, logs, or other potential refugia should be avoided and left undisturbed while mowing.

6.4. Grazing

If managed properly, grazing can improve grassland habitats for Amphibians & Reptiles by maintaining evenness in the vegetative community and by providing basking areas. Prescribed grazing and flash grazing are examples of suitable grazing practices whose intensity and frequency can be set to achieve the maximum benefit for cattle and wildlife.

6.5. Management of Woodlands

Woodlands are vertically stratified into vegetative zones including the forest floor, shrub, sub-canopy and canopy, providing structural complexity for Amphibians and Reptiles to exploit. Promoting structural and species diversity within the forest plant community can be accomplished through manipulation of the forest canopy, by using prescribed fires.

Forest management strategies for reptiles differ from those for amphibians. Amphibians prefer forests with dense canopy cover that promotes a shaded, cool, moist environment with sparse forest floor vegetation and a high amount of litter.

Drier, more open woodland habitats are generally preferred by Reptiles. Forest openings as well as walking paths and roadways promote warmer, drier forest conditions by allowing air flow, a consideration that should be addressed if such openings are expected to be part of a management plan. Managing habitat for reptiles may include tree harvesting (thinning, regeneration cuts, clear cuts, selective cuts) every 10-20 years to open the forest canopy or by introducing prescribed fire. Woodland areas visited by tortoises may be enhanced by the establishment of fruiting species such as wild raspberry, blackberry, plum, strawberry, and grape which constitute a large part of the tortoise diet during part of the year.

6.6. Management of Wetlands

Creating ponds and pools are effective ways to create wetlands or to restore the natural hydrology of a site that has been manipulated in the past. Restorations requiring little excavation with very gradual side slopes (5% optimal) will maximize the shallow wetland habitats (15-20 cm) that are the most attractive to a broad range of Amphibians.

Wetlands constructed for Amphibians should be placed in a mosaic pattern with wetlands of varying shape, depth, and proximity to each other to provide needed habitat throughout time and space. Diverse water regimes should be included with a minimum hydro-period of 3 months and shallow ephemeral pools no further than 300 meters from a permanent water source to provide Amphibians with water during drought periods. Water levels should not be manipulated during the breeding or hibernation seasons, a practice that may result in the desiccation and death of hibernating amphibians or amphibian eggs and larvae.

Fishes should not be introduced into natural or restored habitats that do not or did not naturally house these habitats. Predatory fish will eat amphibian eggs, larvae, and adults; therefore, most amphibians require wetlands devoid of these predators.

To improve the vegetative quality of an existing wetland, mowing, prescribed burns, or light disking may be used. For newly restored wetlands, leaving the site rough rather than smoothing it out adds complexity to the wetlands bottom structure resulting in variable water depths, chemistry, and aspect which improves the site's ability to house numerous plant species. The use of aquatic herbicides and pesticides within wetlands is discouraged, due to the potential for negative impacts on a wide range of non-target species, including amphibians. Emergent wetland, sedge, and wet meadow habitats with 50-80% vegetative cover offer optimal shelter, food, foraging habitat, and egg attachment sites for most Amphibians; whereas, wetlands with sparse plant, algal, and periphyton communities house minimal food resources for tadpoles with herbaceous diets. Urban, industrial, and agricultural pollutants (nutrients, pesticides, heavy metals, organo-chemicals, sediment, etc.) pose serious risks to Amphibian communities; therefore, potential sources of pollutants should be identified and addressed in a wetland management plan prior to restoration.

6.7. Core Habitat, Corridors, and Buffers

In most recent studies on riparian dependant Amphibians, it was suggested that habitat should, at a minimum, be protected within a 300-meter radius from the edge of a wetland; an area termed as **"core habitat"**. The establishment of core habitat is essential to the survival of riparian Amphibians that require upland habitat for foraging, nesting, aestivation, and hibernation. It is also suggested that a 50-meter buffer zone be created adjacent to core habitat and land use zones. The creation of a **"buffer zone"** will reduce off-site impacts on core habitat and amphibian contact with unfriendly land use. Buffer zones are used to protect core habitat from pollutants such as nutrients, pesticides and sediments, and from physical impacts such as encroachment. The desired width of a buffer zone is dependant upon topography, adjacent land use, and the home ranges of the amphibians and reptiles present. It is generally recommended that buffer zones be a minimum of 50-meters wide.

Amphibians and Reptiles require "**corridors"** to facilitate everyday home range movements, seasonal and breeding migrations, dispersal, and range shifts in response to environmental and climatic changes. Corridors connecting fragments of isolated habitat provide a safe and friendly passageway allowing for immigration and emigration of animals aiding gene flow and decreasing the chance of local herpetological extinction events. It has been found that wetland areas adjoined by forest have greater herpetological diversity and have higher colonization rates after restoration than isolated wetlands without corridors. Suitable corridors can be constructed by planting grasses, trees, and shrubs in wide strips connecting two habitats isolated by barriers.

6.8. Microhabitats

Microhabitats are very small, specialized habitats located within larger habitats. Constructing various microhabitats within any management area will improve habitat quality for a number of Amphibians and Reptiles and other wildlife.

6.8.1. Cover Objects

Cover objects can be logs, rocks, boards, etc. placed out in the open, along forested edges, or partially in or underwater. It is very important that cover objects be scattered along the length of corridors to protect migrating amphibians from desiccation. Large objects such as slabs of limestone, and logs are suitable cover objects that are inexpensive and easy to provide.

Cover objects have a dual purpose in providing above ground basking platforms and below ground shelter from the midday sun. Cover objects also concentrate invertebrates and become an important feeding area for insectivorous Amphibians and Reptiles. The development of suitable conditions (temperature, humidity, etc.) under cover objects may take a considerable amount of time; therefore, disturbance of such habitat should not occur.

6.8.2. Nesting Sites

Traditional nesting sites may be scarce or have unique characteristics that can not be recreated; hence, the disturbance of known nesting sites should be avoided at all costs. Amphibian breeding ponds should be monitored for water quality to determine whether the site provides a safe environment for developing eggs, larvae and aquatic adults. Many amphibian species attach eggs to submerged vegetation and debris, habitat attributes that should be provided if not naturally present.

6.8.3. Den Sites

Dead den trees, logs, and snags should be included in the management plan to provide shelter and nesting sites for Amphibians and Reptiles. Optimally, a minimum of five den trees/logs/snags per 1ha should be provided to benefit herpetological and other wildlife alike.

7. Important Areas for Amphibians & Reptiles with Recommendations for Zoning

7.1. Alteration of the Current Boundaries of the Park

Some of the typical Mediterranean reptile species have been recorded exclusively at the ultimate age of Park's Boundary downsream the Radika River Valley, or immediately outside the borders of the Park, on its southern edge. In order to encircle the biodiversity richness and heterogeneity of the Park with the Complex of Mediterranean faunal and floral elements, it is highly recommending alteration of the current boundary, that is, its widening downstream the River Radika, from the locality Boshkov Most, up to the artificial lake Debarsko Ezero and the settlement Dolno Kosovrasti. In that way, the main biocoridor for undisturbed penetration of Mediterranian faunal elements from the Adriatic Sea Area upstream along the River Drim up to the territory of the National Park Mavrovo will be protected. In that manner we shall mention the following Mediterranean Reptile Species: Hermann's Tortoise (*Eurotestudo hermanni boettgeri*), Kotschy's Gecko (*Mediodactylus kotschyi*), Dalmatian Algyroides (*Algyroides nigropunctatus*), Montpellier Snake (*Malpolon monspessulanus*), Large Whip Snake (*Dolichophis caspius*), Balkan Whip Snake (*Hierophis gemonensis*) and Dahl's Whip Snake (*Platyceps najadum dahlii*).

In addition, the boundary of the Park should be extended on the Mountain Krchin that will encompass not only the mountain peaks Rudina and Crvena Plocha, but also southwestwardly up to Debarska Banja.

7.2. Important Aquatic (Wetland) Habitats

As we have already pointed out in Chapter 3, on the Korab, Bistra and Deshat Mountains a unique hydrological complex of mountain glacial lakes and temporary rain and snow melting pools are present. These aquatic biotopes are primary breeding sites for rare northern species of amphibians whose populations exist at the ultimate southern range of the species. The natural, small aquatic habitats are exclusively significant for the Amphibians. Maintenance of functions of such aquatic habitats is great challenge. The conservation and improvement of status of the existing aquatic habitats is of special significance for the Amphibians, since they represent unique sites for breeding and development of their larval stage, as an early phase within their life history.

On the Korab Mountain such unique complex of small aquatic ecosystems is present on the locality Kobilino Pole. On the Deshat Mountain, the Glacial Lake Lokuf, the Glacial Lake Barite and the temporary pool Suva Bara. On the Bistra Mountain, the main complex of temporary pools is situated on the right side of the local soil road Toni Voda-Tri Bari, including the locality Tri Bari itself.

All these small aquatic ecosystems should be included in Zone of Strict Protection, following the instructions given in the Chapter on Management/Protection Measures.

7.3. Important Terrestrial Habitats

Concerning the conservation of Amphibians and Reptiles, the most important localities for zoning of the Protected Area National Park Mavrovo are included in the high-mountain belt of Korab, Bistra and Deshat Mountains.

On the Korab Mountain the most important area for Amphibians and Reptiles is the locality Kobilino Pole with the surrounding mountain peaks. In the grassland ecosystem of this area

the core population on National Level of the Viviparous Lizard (*Zootoca vivipara*) is maintaining. In the temporary pools of Kobilino Pole the largest population on National Level of the Common Frog (*Rana temporaria*) is also present. Besides the Amphibians and Reptiles, until 2001, the largest population of the Balkan Chamois (*Rupicapra rupicapra balcanica*) counting more than 1,000 specimens, was present on this area. The Balkan Chamois is Balkan endemic subspecies and the core population was surviving on the locality Kobilino Pole and the surrounding mountain peaks. After the extinction of the core population, the subspecies is faced with complete extinction. Therefore, the Management Body of the Park should undertake immediate restoration measures for reintroduction of small population from the locality Brzovec and proclaim the area as Zone of Strict Protection.

On the Bistra Mountain, the high-mountain belt on the section between the Mountain Peaks Golem Brzovec and Mal Brzovec, should be included in the Zone under Strict Protection, since this is the core zone for the population of the Globally Threatened Species Orsini's Viper (*Vipera ursinii*).

On the Deshat Mountain, the high-mountain belt over 1,900 m asl should be also included in the Zone under Strict Protection.

The borders of the areas that are proposing as strictly protected zones were set down with their optimum surface, which gives possibilities for certain reduction during the process of synchronizing of the Zones of Strict Protection, with the proposals of experts on the other thematic issues.

8. Long-term Monitoring Program for Amphibians and Reptiles in NP Mavrovo

8.1. Key Amphibian and Reptile Species that are recommending for Long Term Monitoring

During the process of development of Long-term Monitoring Programme for the Protected Area National Park Mavrovo, the following key Amphibian and Reptile Species are recommending to be included for monitoring:

- Alpine Newt (*Ichthyosaura alpestris*): monitoring on the stability of the breeding centres on the localities: Toni Voda, Chaushica, Tri Bari, Kobilino Pole, Lokuf and Barite.
- Balkan Stream Frog (*Rana graeca*): monitoring of the population status on transect lines along the Mountain Stream over the Hotel Makpetrol in Mavrovo, Rosochka Reka near Selce and Bunetska Reka near Bogdevo.
- Common Frog (*Rana temporaria*): monitoring on the stability of the breeding centres on the localities: Toni Voda, Chaushica, Kobilino Pole.
- Slow Worm (*Anguis fragilis*): monitoring of the population status on transect line along the Valley of the Mountain Streams Mala Reka, Rosochka Reka and Tresonechka Reka.
- Sand lizard (*Lacerta agilis*): Monitoring of Population Status and Trend in the Grassland Ecosystems on the locality Toni Voda-Ski Lifts.
- Viviparous Lizard (*Zootoca vivipara*): Monitoring of Population Status and Trend in the Wet Grassland Ecosystems on the locality Kobilino Pole.
- Orsini's Viper (*Vipera ursinii macrops*): Monitoring of Population Status and Trend in the Dry Grassland Ecosystems on the localities Golem Brzovec-Mal Brzovec and Kobilino Pole.

8.2. Monitoring Methodology

Terrestrial environments host a range of amphibian and reptile species for some or all of their life stages. The diversity of species and life history strategies in these two vertebrate classes is phenomenal, making it simultaneously critical and impossible to represent them easily with a few multiple species survey protocols. Many species are highly specialized, and it is expected that an effective monitoring program will need to combine core and supplemental survey methods with species, specific survey efforts to obtain detections to make inferences about species diversity and species of concern.

Amphibian and Reptile Visual Encounter Surveys (ARVES) are a standard method for terrestrial herpetofauna inventories (Campbell and Christman, 1982; Corn and Bury, 1990; Crump and Scott, 1994; Heyer et al., 1994). Several survey techniques exist to inventory and monitor multiple amphibian and reptile species (e.g., pitfall traps, funnel traps, cover-boards, visual encounter searches, transects), each with its own inherent biases with regard to the species detected, applicability across habitat types, and assumptions (Heyer et al., 1994).

Certainly the use of multiple survey techniques will effect a more complete characterization of any fauna, including herpetofaunal communities (Corn and Bury, 1990; Morrison et al., 1995; Clawson et al., 1997). However, given the option of selecting just one survey method, visual encounter surveys have the broadest utility with regard to effectiveness across all habitat conditions and ease of implementation (Crosswhite et al., 1999). They also have

some important additional benefits: (1) they are low impact on site conditions compared to other standard methods requiring digging or debris clearing (e.g., pitfalls and cover boards); (2) they pose virtually no threat to the well-being of individual animals; and (3) they are effective in a diversity of environments, including both terrestrial and aquatic ecosystems. Therefore, ARVES is a favorable core method for surveying amphibians and reptiles.

Amphibian and reptile visual encounter surveys can have a low probability of detection for many species, depending on the ecosystem and search effort. The search effort prescribed here reflects a moderate intensity search effort per unit area, which may be augmented with additional search effort or with secondary methods as deemed necessary and appropriate for the Protected Area NP Mavrovo to increase the number and breadth of species detected. The exact timing of surveys will also need to be determined and specified in the Monitoring plan.

8.2.1. Sampling Design

The 10 ha sampling hexagon serves as the primary sampling unit (PSU) for the ARVES.

The size of the sample unit was selected to suit the detection of a broad array of vertebrate taxa (small and large-bodied) and co-locate amphibian and reptile surveys with surveys for other taxa. The sample unit is a relatively large survey area when compared to studies using similar types of visual encounter surveys for identifying herpetofaunal assemblages (Clawson et al. 1997, Smith and Petranka 2000).

However, such a large area is likely to encompass a variety of microhabitats and possibly multiple habitat types increasing the probability of detecting a more representative assemblage of species associated with each monitoring point.

Two observers systematically survey for individuals and sign by traversing the sampling hexagon (Crump and Scott, 1994), with one observer searching each half of the hexagon.

Observers follow the transect line that loops through the hexagon at a 50 m spacing. The length of each route on each half of the sample unit is approximately 1200 m, for a total of 2400 m. These transects are also used for terrestrial visual encounter surveys conducted during the summer season. One of the six points of the hexagon is randomly selected as the start point for the first visit, and then the second visit randomly selects from all but the point opposite the point selected for the first visit so that the second visit is along a different route than the first visit. Observers use the flag lines and distance markers along the centerline and perimeter of the hexagon and compass bearings (checked periodically) to walk the transect lines.

8.2.2. Data Collection

Two observers simultaneously search throughout the 10 ha sampling hexagon for 4 hours, or a total of 8 person-hours. Eight person-hours per survey reflect a balance between reasonable coverage of the sample unit and the ability of observers to maintain their concentration. Surveys are conducted generally between 10:00 and 18:00 hours, targeting times of day when ectotherms are expected to be active and visible. However, in hot parts of the day, many species are most active and/or visible early in the morning, at dusk, or at night. Nocturnal sampling is more dangerous and less feasible than daytime sampling, but it should be use as a secondary survey method because of its high effectiveness for detecting some species.

The sampling unit is visited a minimum of twice per non-winter season (spring and fall) for a total of 4 visits per year to maximize the number of species detected and facilitate the calculation of within and among season probability of detection. If funding allows, additional visits would increase the number of species detected, the probability of detection for individual species, and the precision of estimates of proportion of points occupied.

Observers search within 1 m on either side of the transect line, but can leave transect to investigate high quality habitats (e.g., logs, seeps, riparian areas, talus, areas of high density of natural cover objects) within 10 m on either side of the transect line. Aquatic habitats, such as ponds, streams, and bogs located within the sample unit are not surveyed as part of this protocol – they are surveyed as part of the aquatic visual encounter survey.

Observers search surfaces, vegetation, turn over objects such as logs and rocks, and look in crevices in rocks and bark, replacing all surface objects after examining the ground beneath (Crump and Scott, 1994). Observers pace themselves, focusing on the most fruitful habitat components (e.g. under logs, rocks, bark) while leaving enough time to move along the transect line. Observers need to move along the transect line at an average pace of approximately 50 m every 10 minutes.

Observers note only presence of individuals or sign, and identify the detection to the most specific taxonomic level possible. Animals are captured only when necessary to confirm identification, however in areas with high species richness and difficult to distinguish species, it is recommended that observers capture individuals to confirm identification. Voucher specimens may be needed to confirm identification of rare species that are difficult to identify. Time used for species identification and data recording is not included in the total search time.

The following information is recorded for every detection: observer, time, search time elapsed, species, detection type (e.g., visual, auditory, capture, sign), age class of captures (adult/subadult/juvenile), snout-vent length, substrate type (e.g., rock, log, bare ground), and location along the transect. Use rubber gloves when handling amphibians to reduce the risk of transmitting harmful chemicals or disease (e.g., fungus) to the animal. If plastic bags are used to temporarily contain the animal, the bag must not be reused for another amphibian. The detection of rare species should be documented by taking a picture of the individual, being careful to display the diagnostic characteristics of the species. All mortalities are collected, properly stored, reported to the field crew leader, and provided to a Natural History Museum.

8.2.3. Quality Control and Assurance

The nature of the data collected by this protocol makes quantification of management quality objectives difficult. Examination of collected data will not reveal missed detections or misidentifications of data collected by observation without photo record.

Data quality rests largely with a strong training and testing program prior to data collection. Digital pictures provide a valuable tool for verifying questionable field identifications. In addition, the field crew leader should rotate working with each field crew member to check on their techniques and field identification. If during this checkup crew members are missing detections, additional training should be given before that crew member participates in data collection. Additionally, observers should be rotated among sites, such that each site is visited by a different crew each visit to reduce the potential effects of observer bias on detection estimates.

8.2.4. Supplemental Survey Methods

Supplemental survey methods consist primarily of augmentation of the ARVES to increase detection probabilities for species well detected with this method, and pitfall traps and cover-boards, which are likely to detect species not as readily detected with ARVES.

Nocturnal auditory amphibian counts are a potential supplemental survey in some areas, but not all. Supplemental survey methods should be selected to increase the number and array of species detected relative to species readily detected by the ARVES survey method. Species expected to occur in the Protected Area National park Mavrovo that may be detected by secondary methods need to be identified in monitoring plans and included in training materials.

9. Protection Regime

The original intent of the IUCN Protected Area Management Categories system was to create a common understanding of protected areas, both within and between countries.

The established categories are recognized by international bodies such as the United Nations and by many national governments as the global standard for defining and establishing protected areas. As such, these categories are increasingly being incorporated into government legislation.

The Convention on Biological Diversity (CBD) Program of Work on Protected Areas "recognizes the value of a single international classification system for protected areas and the benefit of providing information that is comparable across countries and regions."

9.1. Current Protection/Management Category of the Protected Area National Park Mavrovo

9.1.1. IUCN Criteria

The Protected Area National Park Mavrovo currently belongs to Category II, "National Park," which defines a natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

The Primary Protection/Management Objective of National Park is: To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.

How does the management objective relate to the category: The category should be based on the Primary Management Objective(s) of the Protected Area. The Primary Management Objective should apply to at least three-quarters of the Protected Area.

Attributes defining Primary Management Objectives for a National Park are:

Conservation Management: Management activities aimed at preserving habitats, ecosystems and species in the most natural state possible or at recovering this situation (restoration).

Public Management: Foster and manage public use, with a view to inspirational, educational, cultural and recreational uses. Promote recreational and tourism activities that are in line with essential qualities of these areas.

Socio-Economic Development and Use of Natural Resources: Promote socio-economic development and bring benefits for the local population.

Research and Monitoring: Facilitate the conduct of scientific research and environmental monitoring activities.

Primary Protection/Management Objective of the Categories of Protected Areas in accordance with the IUCN criteria:

I: Strict protection (Ia - Strict Nature Reserve; Ib - Wilderness Area).

II: Ecosystem conservation and protection (National Park).

III: Conservation of natural features (Natural Monument).

IV: Conservation through active management (Habitat/Species Management Area).

V: Landscape conservation and recreation (Protected Landscape)

VI: Sustainable use of natural resources (Managed Resource Protected Area)

Category Ia. Protected Area included in Category Ia defines a strictly protected area as one set aside to safeguard biodiversity and also possibly geological/geomorphologic features, where human visitation, use, and impacts are strictly controlled in order to ensure conservation goals are met. Such protected areas can serve as indispensable reference sites for scientific research and monitoring.

The Primary Protection/Management Objective of Category Ia is to conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geo-diversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.

Category Ib. Protected Areas of the Category Ib will generally be larger unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.

These are Protected Areas less strictly protected from human visitation than category Ia. Although not usually subject to mass tourism they may be open to limited numbers of people, which is not the case in Category Ia.

The Primary Protection/Management Objective of the Category Ib is to protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.

Category II. Protected Areas included in Category II are generally large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational, visitor opportunities and mass tourism.

Category II protected areas usually combine ecosystem protection with recreation, ьхицх ape subject to zoning.

The Primary Protection/Management Objective of Category II is to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.

Category III. Protected Areas of Category III are generally quite small protected areas that are set aside to protect a specific natural monument, which can be a specific landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove or a single stem. They often have high visitor value.

Category III protected areas are generally centred on a particular natural feature, so that the primary focus of management is on maintaining this feature.

Category IV. Category IV protected areas protect fragments of ecosystems or habitats, which often require continual management intervention to maintain. Typical example of Category IV is the Protected Area Ezerani, where the characteristic habitat types, as well as the populations of animal and plant species of the Wetland Ecosystem are highly reduced, as a consequence of rapid climate change and unsustainable human activities. In the case of Ezerani, without management interventions, there is no possibility to maintain the remaining highly fragmented habitat types and reduced populations of animal and plant species, in order to achieve their restoration.

Category IV protected areas aim to protect particular species or habitats and management reflects this priority.

In general, category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats.

Category V. Protected Areas of Category V represent areas where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

Category V protected areas are generally cultural landscapes, i.e. natural landscapes that have been altered by humans over hundreds or even thousands of years and that rely on continuing intervention to maintain their qualities including biodiversity. Many category V protected areas contain permanent human settlements.

The Primary Protection/Management Objective of Category V is to protect and sustain important landscapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.

Category VI. Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

Category VI protected areas contain usually large natural areas where biodiversity conservation is linked with sustainable use of natural resources.

However large category VI protected areas may contain category Ia areas within their boundaries as part of management zoning.

The Primary Protection/Management Objective of Category VI is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

9.1.2. National Legislation

The Macedonian Law on Nature Protection ("Official Gazette of RM" No. 67/04) includes six categories of protected areas as follows:

Categories of Protected Areas, Categorization of Protected Areas
Article 66

(1) Categories of natural heritage, within the meaning of this Law shall be:
1. Strict Nature Reserve;
2. National Park;
3. Natural Monument;
4. Nature Park;
5. Protected Landscape;
6. Multipurpose Area.

In accordance with the Macedonian Law on Nature Protection, Category II, "National Park" should fulfill the following criteria and purposes:

Category of National Park
Article 72
The National Park shall be a large, mainly unchanged area of land or water with particular multiple natural values, which encompasses one or more, preserved or insignificantly changed ecosystems, primarily designed for the conservation of the original natural, cultural and spiritual wealth.
(2) The National Park shall be intended for scientific-research, cultural, pedagogic-educational and tourist-recreational purposes.

Management Plan of National Park
Article 73
(1) The public institution-National Park shall adopt a Management Plan for the National Park, upon a prior approval by the body of the public administration responsible for the execution of the works in the field of nature protection.
(2) The Management Plan of the National Park shall prescribe specific measures and activities for the protection of the characteristic natural values and the original state thereof, owing to which it had acquired the status of protected natural heritage.

Manner of National Park Management
Article 74
The National Park shall be managed on its whole territory in an integrated manner that shall provide the following:
1. Protection of the natural areas of national and international importance for cultural, scientific, educational, tourist and recreational purposes.
2. Stability of the environmental processes and diversity through sustainable conservation of the representative physical and geographical regions, biocenosis, genetic resources and species in an authentic state.
3. Creation of conditions for tourism development in accordance with the principle of sustainable development.
4. Achievement of cultural, scientific, educational and recreational objectives, which at the same time maintains the natural state of the area.

Prohibited Activities in National Park
Article 75
(1) It shall be prohibited to carry out activities, which endanger the authenticity of the nature in the national park, as well as lighting fire on the territory of national park, except at specially determined places defined by the National Park Management Plan.
(2) Tourist-recreational activities shall be allowed in the national park, as well as extensive agricultural activities and fishery performed in a way that does not endanger the survival of the species and their natural balance, in accordance with the provisions of this Law.

Zoning in the Protected Areas
Zone of strict protection
Article 104
(1) Zone of strict protection shall be part of the protected area of highest interest for protection, characterized by authentic, unchanged ecosystem characteristics, or slightly changed as a result of the traditional management practices.
(2) Within the strict protection zone it shall be distinguished:
1. Authentically natural areas, with no human interventions at all.
2. Areas with limited intervention, where the traditional manner of management is still present and serves the maintaining of the natural values of the zone.

(3) Scientific research activities shall be allowed in the strict protection zone, unless they are in contradiction with the primary objectives of the protection of the area.
(4) The entity responsible for the natural heritage management shall provide for constant monitoring for the purpose of maintaining the characteristics of the strict protection zone.

Zone for active management
Article 105
(1) Zone for active management shall be a zone of high interest for the protection, in which some major management interventions are needed for the purpose of restoration, revitalization or rehabilitation of the habitats, ecosystems and other elements of the landscape.
(2) Within the zone for active management, management activities may be carried out with regard to:
1. Manipulation with habitats; and
2. Manipulation with species.

(3) It shall be allowed to carry out economic activities that have no adverse impact on the primary objective of the protection in the zone for active management, such as ecotourism or traditional extensive agriculture.
(4) The successful management of this zone, as well as the further permanent maintenance thereof, may lead to the zone acquiring characteristics of a strict protection zone.

Zone for sustainable use
Article 106
(1) The zone for sustainable use shall be a significant part of the protected area with no high values for protection, with infrastructure facilities, objects of cultural heritage, types of forest plantations that are not characteristic for the area, as well as inhabited places with the surrounding agriculture land.
(2) Long-term undertaking of interventions and measures may lead to it acquiring the characteristics of zone for active management.

Buffer zone
Article 107
(1) Buffer zone in principle shall be an area outside the natural heritage and shall have the role to protect the zones referred to in articles 104, 105 and 106 of this Law, with an interest in protection against the threats coming from outside of the natural heritage area.

(2) When economic activities are carried out within the frames of the buffer zone, the measures for protection provided for by this Law shall be applied.
(3) A buffer zone shall also be established within the frames of the protected area between the zones the regime of protection and management of which exclude each other.

9.2. Discussion

The current Macedonian Law on Nature Protection, at the time when it was adopted, represented a radically positive change concerning the nature protection. However, in recent conditions, when Republic of Macedonia is adapting its National Legislation with the EU Legislation and the ratified International Conventions, an urgent need of harmonizing the Law on Nature Protection with the EU directives and regulations has arised, because of the following reasons:

- The protection of species and natural habitats in the current law is based on the specifications of the Bern Convention, under which are working the countries of the Council of Europe and not the EU members. Consequently, the Macedonian Law on Nature Protection should be adapted with the EU Directives: Directive 92/43/EEC and Directive 79/409/EEC, without which, between the others, could not be establish the Natura 2000 network of protected areas, that works exclusively on the basis of these two directives. In addition, the Law should be adapted with the Council Regulation (EC) No. 338/97, as well as with the Commission Regulation (EC) No. 1808/2001. The adaptation of the Law on Nature Protection with these Directives and Regulations will cause appropriate changes in the Law on Hunting and the Law on Fishing.
- The Categories of Protected Areas in the current Law on Nature Protection by its title mainly follow the IUCN criteria. However, concerning the Primary Protection/Management Objective, as well as the Other Objectives, certain categories are highly deviated. That is the reason for disparate opinions and recommendations on certain issues between the national consultants that follow the National Legislation and the International Consultants, whose conclusions and recommendations are based on the IUCN criteria and the EU legislation.

If we take into consideration the above already mentioned statement that the Convention on Biological Diversity (CBD) Program of Work on Protected Areas “recognizes the value of a single international classification system for protected areas” of which the Republic of Macedonia is a signatory country, than it is obviously clear the necessity for further adaptation of the Law on Nature Protection concerning the classification of the Protected Areas in accordance with the IUCN criteria.

Notwithstanding the fact that the National legislation is in urgent need of further harmonization with the IUCN Criteria and EU Directives, if we follow the National and International criteria for choosing a new category for the Protected Area Mavrovo, as most appropriate, we highly recommend the Category II (National Park).

10. Conclusions

Species Richness

Notwithstanding the fact that the entire territory of the Protected Area National Park Mavrovo encompasses an area of 730.88 km^2, which is 2.84 % of the territory of the Republic of Macedonia (25.713 km^2), a huge portion of herpetological diversity is concentrated within this area represented by 35 species (11 species of Amphibia and 24 species of Reptilia) that covers 74.5% of the total number of Amphibian and Reptile Species on National Level, represented by 47 species.

Simple comparative analysis shows that the concentration of Herpetological Species Richness in the National Park Mavrovo is 26 times higher than the mean Herpetological Species Richness on National Level.

Species Heterogeneity

Besides the species richness, another most striking feature of the Amphibians & Reptiles of the Protected Area National Park Mavrovo is its heterogeneity. The complex zoogeographical structure, with herpetological elements of various origins and zoogeographical affiliations is manifested, coupled by a high degree of relict and regional endemic forms.

Legal protection

Habitats Directive provide a strict legal protection for six amphibian species (Annex IV), while the species Macedonian Crested Newt (*Triturus macedonicus*) and the Balkan Yellow-belied Toad (*Bombina scabra*) are included in the list of Annex II, which means that the species are of community interest whose conservation requires designation of special areas of conservation.

Habitats Directive provides a strict legal protection for 18 reptilian species (Annex IV), while the species: Hermann's Tortoise (*Eurotestudo hermanni*), European Pond Terrapin (*Emys orbicularis*) and Orsini's Viper (*Vipera ursinii*) are also included in Annex II (Animal and plant species of community interest whose conservation requires the designation of special areas of conservation).

Conservation Status

None of the 11 amphibian species present within the territory of the Protected Area National Park Mavrovo is included in the three IUCN categories of Threatened Species on European Scale, as well as in the three IUCN categories of Globally Threatened Species.

Three amphibian species are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers wetland ecosystems with disjunctive distribution only within certain parts of the Balkan Peninsula.

The Species Orsini's Viper (*Vipera ursinii*), present within the territory of the Protected Area National Park Mavrovo is included in the European Red List of Threatened Species within the category Vulnerable (VU). In addition, the species: Hermann's Tortoise (*Eurotestudo hermanni*) and European Pond Terrapin (*Emys orbicularis*) are listed in the Category Near Threatened (NT) which is close to qualifying the species as Vulnerable (VU).

The Species Orsini's Viper (*Vipera ursinii*) is also included in the IUCN Red List of Globally Threatened Species under the category Endangered (EN), while the species European Pond Terrapin (*Emys orbicularis*) under the category Vulnerable (VU). In addition, the species

Hermann's Tortoise (*Eurotestudo hermanni*) is listed in the Category Near Threatened (NT) which is close to qualifying the species as Vulnerable (VU) on a Global Scale.

Five reptilian species are endemic to the Balkans, vulnerable to extinction due to their restricted range size that covers habitat types with disjunctive distribution.

Threats to Amphibians and Reptiles

In the case of the Protected Area National Park Mavrovo, on the basis of our field investigations on the status of Amphibians and Reptiles, several human activities that have negative impact on their populations have been recorded.

Indirect threats are related with human activities in the wider area: construction of artificial lakes i.e. Mavrovsko Ezero and Lukovo Pole, transfer of water resources from one watershed (Radika River Watershed) to another Watershed (Vardar River Watershed), development of mass tourism (especially for 8th of September when big mass of humans are visiting the highest peak Golem Korab), development of touristic infrastructure, development of local road infrastructure.

Direct threats to Amphibians and Reptiles are related with cut-off of the migration corridors, eutrophication of the glacial lakes and temporary pools, water extraction from mountain streams, traditional prejudices of the local population and illegal collection.

Threats to Amphibians and Reptiles by the construction of dam and artificial lake on the locality Dolno Lukovo Pole

The preliminary results of the analyses made on the basis of the field investigations, the construction and maintaining of Dam and Artificial Lake on the locality Dolno Lukovo Pole will not cause significant negative impact on the population status of Amphibians and Reptiles in the wider area.

Ways for Effective Protection of Amphibians and Reptiles

The Amphibians and Reptiles play an important role as insect and rodent predators and as valuable prey for various birds of prey and carnivorous mammals. Successful management of wildlife areas for protection of Amphibians and Reptiles should introduce Protection Measures that will take into consideration all stages of their life history. Protection measures have to provide access to food, shelter, migration corridors as well as hibernation, aestivation, breeding, and nesting sites.

Management practices commonly used to manipulate the structure and composition of vegetation can exert immediate, short-term, and long-term effects on herpetological assemblages. Prescribed fire, mowing, grazing, and forest thinning are examples of disturbance techniques. The best method for avoiding herpetological mortality due to site management is to conduct any treatment outside of herpetological activity periods. In general, the Amphibians and Reptiles hibernate from mid-October through March and are least impacted by management during this time period. If management is to occur within the herpetological active season, several different approaches may be taken to minimize impacts.

Zoning of the Park

In order to encircle the biodiversity richness and heterogeneity of the Park with the Complex of Mediterranean faunal and floral elements, it is highly recommending alteration of the current boundary, that is, its widening downstream the River Radika, from the locality Boshkov Most, up to the artificial lake Debarsko Ezero and the settlement Dolno Kosovrasti.

In addition, the boundary of the Park should be extended on the Mountain Krchin that will encompass not only the mountain peaks Rudina and Crvena Plocha, but also southwestwardly up to Debarska Banja.

Concerning the conservation of Amphibians and Reptiles, the most important localities for zoning of the Protected Area National Park Mavrovo are included in the high-mountain belt of Korab, Bistra and Deshat Mountains.

On the Korab Mountain a unique complex of small aquatic ecosystems is present on the locality Kobilino Pole. On the Deshat Mountain, the Glacial Lake Lokuf, the Glacial Lake Barite and the temporary pool Suva Bara. On the Bistra Mountain, the main complex of temporary pools is situated on the right side of the local soil road Toni Voda-Tri Bari, including the locality Tri Bari itself. All these small aquatic ecosystems should be included in Zone of Strict Protection, following the instructions given in the Chapter on Management/Protection Measures.

Concerning the terrestrial habitats, on the Korab Mountain the most important area for Amphibians and Reptiles is the locality Kobilino Pole with the surrounding mountain peaks. On the Bistra Mountain, the high-mountain belt on the section between the Mountain Peaks Golem Brzovec and Mal Brzovec should be included in the Zone under Strict Protection. On the Deshat Mountain, the high-mountain belt over 1,900 m asl should be also included in the Zone under Strict Protection.

The borders of the areas that are proposing as strictly protected zones were set down with their optimum surface, which gives possibilities for certain reduction during the process of synchronizing of the Zones of Strict Protection, with the proposals of experts on the other thematic issues.

Long-term Monitoring Program for Amphibians and Reptiles

During the process of development of Long-term Monitoring Programme for the Protected Area National Park Mavrovo, the following key Amphibian and Reptile Species are recommending to be included for monitoring: Alpine Newt (*Ichthyosaura alpestris*), Balkan Stream Frog (*Rana graeca*), Common Frog (*Rana temporaria*), Slow Worm (*Anguis fragilis*), Sand lizard (*Lacerta agilis*), Viviparous Lizard (*Zootoca vivipara*) and Orsini's Viper (*Vipera ursinii macrops*).

Protection Regime

Notwithstanding the fact that the National legislation is in urgent need of further harmonization with the IUCN Criteria and EU Directives, if we follow the National and International criteria for choosing a new category for the Protected Area Mavrovo, as most appropriate, we highly recommend the Category II (National Park).

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