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Bulgaria's Amphibians and Reptiles

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Summary

Due to Bulgaria's geographic location and varied relief, its herpetofauna is among the richest in Europe. At present, 52 species of amphibians and reptiles are found on Bulgarian territory and in adjacent continental waters. Of these, 48 species are permanent residents. Two species of poisonous snakes, *Vipera aspis* and *Vipera ursinii,* are considered extinct from the Bulgarian fauna. Specimens of two other species, the sea turtles *Chelonia mydas* and *Caretta caretta,* have been found on occasion along the Bulgarian Black Sea coast. They do not permanently inhabit the Black Sea, but are rare "guests."

The Bulgarian herpetofauna can be divided into three groups on the basis of its zoogeography.

1. Northern European and European species whose distribution extends south into Bulgaria. This group includes species such as *Triturus alpestris, Rana temporaria, Zootoca vivipara,* and *Vipera berus,* which in Bulgaria are almost entirely localized in the mountains.

2. Middle and southern European species, including *Salamandra salamandra, Bufo bufo, Coronella austrica, Natrix natrix, Emys orbicularis,* which are found throughout Bulgaria.

3. Mediterranean and Near East species such as *Ophisops elegans, Eryx jaculus, Elaphe situla, Coluber rubriceps,* and *Mauremys caspica,* which penetrate only the hottest, low elevation areas of southern Bulgaria.

Anthropogenic pressures on the Bulgarian herpetofauna fall into two basic categories: (1) changes in and destruction of the landscape, including the clearing of forests, the replacement of native forests with coniferous plantations, drainage of ponds and wetlands, pollution of rivers, changes or corrections in river flows or currents, environmental degradation due to modern farming techniques, and the general standardization of the landscape; and (2) direct destruction of herpetofauna populations, particularly of species that are of commercial value and that are subject to poaching.

The most endangered species are those whose distribution is sporadic, especially species with Mediterranean or Near Eastern distribution (i.e., located in low-lying southern Bulgaria). Some of the commercially exploited species - the two types of dry land tortoises - and those used in terrariums (including some rare Mediterranean snakes with limited or scant distribution in Bulgaria) are highly endangered.

The extensive agricultural areas of northern Bulgaria are poorest in herpetofauna. The high mountain areas, above 2,000 meters in elevation, are also poor in herpetofauna. The southern portions of the Strouma River valley, the southeastern section of the Maritsa valley, the eastern Rhodopes, and the narrow strip of the Black Sea coast southeast of Bourgas are the areas richest in herpetofauna. Mediterranean and Near Eastern species penetrate these regions and exist alongside southern and central European species. There are places in these areas where, in the space of several square kilometers, 28-31 species of amphibians and reptiles can be found.

The Bulgarian herpetofauna is protected from destruction by special Order No: 729/1986 of the Ministry of Environment. It protects 31 species. For 13 species, this order protects against not only damage, injury, or elimination, but against the actual capture of specimens as well. Fourteen amphibian and reptile species are included in the Bulgarian *Red Data Book* (Beshkov, 1985). Twenty-two species of the Bulgarian herpetofauna are included in the register of the Balkan Convention (1979); fourteen of these species are protected by the previously mentioned MOE order, while five are

listed in the Bulgarian *Red Data Book.* One marshy area, near Botevgrad, 63 km northeast of Sofia, is under special protection as an area used in the reproductive cycle of an interesting migratory population of *Rana temporaria.*

The Bulgarian public's awareness of the protected status of amphibians and reptiles, and of the legislative acts protecting the herpetofauna, is extremely unsatisfactory.

Historic Overview of Herpetological Research in Bulgaria

Hristovitsch (1892) published the first scientific studies of the Bulgarian herpetofauna. Important early studies of the species composition, distribution, morphology, and biology of amphibians and reptiles were conducted by the founder of Bulgarian herpetology, Vasil T. Kovachev (1866-1926) (1894, 1903, 1905, 1905, 1906, 1910, 1910, 1912, 1917). He assembled the first collection of Bulgarian amphibians and reptiles, which was subsequently housed in his native Russe. Schischkov (1914) described the discovery of two species new to the Bulgarian herpetofauna (*Triturus alpestris* and *Typhlops vermicularis*). Buresch (1929) added two more species, *Eryx jaculus* and *Malpolon monspessulanus.* From 1924-1942, Dr. Ivan Buresch and his assistant Jordan Zonkov, working at the Royal Natural History Museum in Sofia, conducted an intensive study of the distribution of amphibians and reptiles in Bulgaria and the Balkan Peninsula and compiled a very rich collection of representatives of these two groups. The results of their studies are published in five works (Buresch and Zonkow, 1932, 1933, 1934, 1941, 1942) that remain the foundation of Bulgarian herpetology.

During the 1930s, many important European herpetologists visited Bulgaria at the invitation of Buresch. Their publications (Cyren, 1933, 1941; Lankes, 1932; Mueller 1933, 1934, 1940; Stepanek, 1934, 1937, 1937; Werner, 1936) expanded our knowledge of the species composition, distribution, subspecies status, etc., of the Bulgarian herpetofauna. During this period, studies of northern Bulgaria and southern Dobrudzha, which at that time was temporarily incorporated in Romania, were also published (Bacescu, 1934; Calinescu, 1924, 1931; Lankes, 1932; Lepsi, 1927; Mueller, 1927).

Tuleschkov (1959) published the first work devoted entirely to the ecology of the herpetofauna. Beshkov (1959, 1965) announced the discovery of *Telescopus fallax* and *Rana esculenta* in Bulgaria. Beshkov also published a series of works on the geographic and altitudinal distribution, biology, and subspecies status of a number of species, and the extent of range overlap for several species of frogs. These works also included studies of the effects on the amphibians and reptiles of industrial pollution from a copper manufacturing plant; discussions of the problems involved in tortoise protection; and the section on herpetofauna for the Bulgarian *Red Data Book* (Beshkov, 1961, 1966, 1970, 1970, 1972, 1973, 1974, 1975, 1975, 1976, 1977, 1978, 1981, 1984, 1985, 1986, 1987).

Beshkov and additional authors also published works on the biology of *Salamandra salamandra;* the distribution of the Bulgarian herpetofauna; the various groups of vertebrates that serve as snake food sources; the population of *Bombina variegata;* the unusually large reproductive migration of the *Rana temporaria* population; the reproductive biology of *Bufo bufo;* and the debate concerning the occurrence of *Vipera aspis* in Bulgaria (Beshkov and Zoncev, 1963; Beshkov and Beron, 1964; Bechkov et al., 1967; Beshkov and Nankinov, 1979; Beshkov and Jameson, 1980; Beshkov and Gerasimov, 1980; Beshkov and Dushkov, 1981; Beshkov and Angelova, 1981; Beshkov et al., 1986; Buresch and Beshkov, 1965).

Bartoschik and Beshkov (1979) announced the discovery of *Coluber rubriceps* in Bulgaria, while Bartoschik et al. (1981) studied the morphology and distribution of this species in Bulgaria.

Other important contributions to the study of Bulgarian herpetofauna published during the 1960s, 1970s, and 1980s include: Bischoff, 1969; Chlebicki, 1985, 1985; Geissler, 1981, 1982; Geissler and Bruhl, 1980; Hartkopf et al., 1974; Kabisch, 1966, 1966, 1972; Noellert, 1983, 1980, 1981; Noellert, and Ritter, 1986, 1986; Obst and Geissler, 1982; Peters, 1962, 1963; Rehak, 1986; and Sura, 1981. Many popular articles, dealing primarily with the conservation and biology of protected species, were also published by Bulgarian herpetologists and qualified amateurs. A great many of these articles contain original research.

The helminthofauna of the Bulgarian amphibians and reptiles has been studied by D. Bojkov and G. Buchvarov. The venom of snakes, especially of *Vipera ammodytes,* has also been investigated,

primarily by P. Manahilov and associates. Karyological studies have been undertaken by P. Belcheva and P. Popov. Immunology has been explored by B. Botev, V. Vulchanov, and associates. Mlynarski and Beshkov have published on tortoise fossils. The works of these authors have not been included in the bibliography as they do not directly relate to the matters at hand.

Herpetological research in Bulgaria is currently conducted by the Institute of Zoology of the Bulgarian Academy of Sciences. Research focuses primarily on ecological problems and on the protection of the herpetofauna. Research is also conducted in part by the Ecology and Zoology faculties of the Department of Biology at Sofia University, where almost every year one or two students present diploma work on herpetology.

Gaps in Current Knowledge

For the purposes of this report, the main gaps in our knowledge of Bulgaria's amphibians and reptiles involve:

1. Knowledge of the basic population parameters of the majority of species. This is particularly true for the rare species with limited distribution - species that most need protection. Major indicators, including population numbers and density, age structure, mortality, fertility, and survival rates, are lacking. For only a few of the most common species is there relatively complete information.

2. Knowledge of the species distributions of the herpetofauna in Bulgaria. The only parts of the country that are relatively well known are those that are richest in species, the area around Sofia, and several areas where herpetologists have worked in the past (including, for example, Russe, where Kovachev worked, and areas surveyed by the Royal Natural History Museum, which collected specimens in the 1920s and 1930s). The lowland regions of Bulgaria, in particular, have been visited only incidentally by herpetologists, and so little information is available for these areas. Thus, in these areas only a few of the most common species have been recorded.

3. Knowledge of the numbers and distribution of species in the recent and more distant past. Herpetological studies in Bulgaria started at the end of the 19th century and the beginning of the 20th. However, data on historic changes in the populations of the species are almost completely lacking. This absence of data makes the tracing of population trends difficult. Information from chronicles, travelogues, or other historical works is extremely rare, and it is difficult to determine which species are being referred to.

4. Knowledge of the methods poachers use to gather, conceal, and export protected species. From 1986-1989, four groups of foreign poachers were captured, as well as several dozen local inhabitants, primarily for destroying tortoises. We have knowledge of dozens of other cases where poachers have managed to leave the country prior to the arrival of conservation groups working to protect the rare species.

Current Status

Areas Requiring Further Investigation

Bulgaria does not have large unexplored areas in which particularly interesting complexes of amphibians and reptiles could be expected to be found. The relatively lesser known areas, and those which are poorest in herpetofauna are: the Bulgarian Danube region; the land along the former Yugoslavian border; an area forming a 90° angle whose apogee is Sofia, opening to the west; the area known as the "Ludogorieto" or "Wild Forest"; the areas around the towns of Razgrad and Turgovisht; and the eastern-most sections of the Stara Planina Mountains.

The localized areas where rare amphibians and reptiles are found are of special interest and deserve greater attention. The search for such areas continues presently.

Species Richness

With its 52 species of amphibians and reptiles, Bulgaria's herpetofauna ranks (along with Greece, Turkey, Macedonia, Albania, France, and Spain) among the most diverse in Europe. Compared to Northern or Central Europe, Bulgaria has a high degree of species diversity. This degree of diversity is also very high given Bulgaria's limited size (111,000 km^2). Including subspecies, the total number of Bulgarian herpetofauna taxa is 70.

Rare Species

Nearly all the species that are classified as rare or very rare in Bulgaria are classified as common or numerous through their entire ranges. Only *Coluber rubriceps* is universally classified as rare, for its numbers are minuscule and its habitats rare.

Vipera aspis balcanica can also be added to the very rare taxa. Buresch and Zonkow (1934) caught only two specimens in Bulgaria, the last in 1933. This taxon has not been found outside of Bulgaria.

In general, the incidence of rare reptile and amphibian species in Bulgaria is considered low.

Endemism

Bulgaria has no endemic species of amphibians and reptiles. Bulgaria does however have five endemic subspecies:

1. *Cyrodactylus kotschyi rumelicus* (Mueller, 1940). Near Plovdiv.

2. *Vipera aspis balcanica* (Buresch and Zonkow, 1934). A type specimen from near the town of Harmanlie in southeastern Thrace.

3. *Coluber rubriceps thracius* (Rehak, 1986). From the southern portion of the Black Sea coast.

4. *Ophisaurus apodus thracius* (Obst, 1978). Also from the southern portion of the Black Sea coast; probably occurs also along the European section of Turkey, and perhaps in eastern (or throughout all of) Greece.

5. *Salamandra salamandra beshkovi* (Obst, 1981). From the region near the town of Sandanski. Its taxonomic status is unclear.

Endemism among the Bulgarian amphibians and reptiles is judged to be low, especially when compared to that of the Greek herpetofauna and, in particular, the island endemics.

Important Ecosystems and Unique Habitats

It stands to reason that the most important habitats for the protection of species diversity are located in areas where the greatest number of species can dwell (see maps).

The regions that are high in species diversity are so rated due to the high incidence of rare, threatened, or protected species. They share, almost without exception, the Mediterranean and South European pattern of distribution. In Bulgaria, all of these species are encountered within relatively tiny areas. Some species occupy only .1% - 3% of the territory of Bulgaria. Thus, for many species (even those that are more widely distributed) the most important habitats are located within extremely small areas, serving to support a single population, usually for reproduction. Consequently, they are places of high population density. Given that much research has yet to be done, it may be that only an insignificant proportion of these areas is known. A description of the areas that have been studied is provided at the end of this report.

The maps show that the three "corridors" where the Mediterranean climatic influence is strongest - the Strouma River valley, the Maritsa River valley and the eastern Rhodope Mountains, and the southernmost portion of the Black Sea coast (south of Bourgas) - are richest in species diversity.

At these three locations can be found not only species that are distributed throughout Bulgaria (e.g., *Bombina variegata, Rana ridibunda, Rana dalmatina, Bufo bufo, Bufo viridis, Hyla arborea, Podarcis muralis, Anguis fragilis, Natrix natrix, Natrix tessellata, Colubera jugolaris, Vipera ammodytes, Emys orbicularis*), but also the Mediterranean species, such as *Pelobates Syriacus, Rana graeca, Mauremys caspica, Ophisaurus apodus, Cyrodactylus kotschyi, Ophisops elegans, Typhlops vermicularis, Eryx jaculus, Coluber najadum, Coluber rubriceps, Elaphe situla, Elaphe quatuorlineata quatuorlineata, Malpolon monspessulanus, Telescopus fallax,* and others. Only the northern European and Euro-Siberian species (*Rana temporaria, Triturus alpestris, Zootoca vivipara, Vipera berus*) are missing from these three corridors. The northern European and Euro-Siberian species occur almost exclusively in the high mountains.

Several of the Mediterranean species (*Typhlops vermicularis, Mauremys caspica, Cyrtodactylus kotschyi, Malpolon monspessulanus*) are found in all three corridors. Others (*Coluber najadum, Eryx jaculus,* etc.) occur in only two. Still others (*Telescopus fallax, Coluber rubriceps, Ophisops elegans,* etc.) are found in only one.

Since most of the Mediterranean species inhabiting these corridors are terrestrial reptiles not directly dependent on aquatic habitats (the exceptions being *Mauremys caspica* and *Pelobates syriacus*), we can conclude that the most important habitats for the protection of species diversity are those located slightly above sea level (from 0-800 m a.s.l.). Research in the Strouma River valley near the town of Kresna has shown that most of the Mediterranean species occur on slopes up to an elevation of 450-600 m a.s.l. On rare occasions they reach altitudes of 700-800 m a.s.l. Those species that are widely distributed throughout the country and northern Europe settle on the higher altitude slopes.

Based on our current understanding, the best hypothetical terrain for protection would have the following qualities: an altitude of up to 500 m a.s.l.; southeastern to southern and southwestern exposure; a highly defined microrelief with crags, cliffs, and ridges, especially of volcanic rocks, calcareous limestone, or scree; mixed vegetation dominated by grass and shrubs; protection from temperature inversions; adequate moisture in the ravines or glens, or permanent water sources; and a lack of deep valley slopes.

Current observations indicate that the three Mediterranean corridors, which possess all or at least some of these qualities, are the richest and most interesting in terms of their herpetofauna. This type of terrain is found: along the Strouma valley, predominantly in the lower portion of the slopes enclosing the Petrich-Sandanski vale, which sharply narrows on its northern end; upon the volcanic hill Kojuha and at Pchelina; in the southern portion of the Kresna gorge; in the Maritsa valley and the eastern Rhodopes; on the southern slopes of Sakara, Svilengrad, and Ivailovgrad; and on the hillsides and low mountain ranges. As to the Black Sea coast, this type of terrain is found on the eastern slopes of Strandzhja Mountain and along a narrow band, 5 to 10 km wide, along the sea shore.

The sites recommended for protection are specified at the end of this report.

Problems Relating to the Protection of the Bulgarian Herpetofauna

Certain specific problems related to the protection of Bulgaria's reptiles and amphibians cannot be addressed in other sections of this report.

A large portion of the Bulgarian herpetofauna - primarily the central European species, many of which have a Mediterranean-type distribution pattern - do not require protection measures, at least for the present. Some of these species have nevertheless been placed under protection with the adoption of Order No: 729/1986. They are: *Triturus cristatus, Triturus vulgaris, Bufo viridis, Hyla arborea, Rana graeca, Zootoca vivipara,* and *Anguis fragilis.* Other species, such as *Bombina variegata, Rana dalmatina, Rana temporaria, Ablepharus kitaibeli, Lacerta trilineata, Lacerta viridis, Podarcis muralis, Podearcis erhardi, Lacerta taurica, Zootoca praticola, Natrix natrix,* and *Natrix tessellata* are not protected by this order.

The populations of these species, both protected and unprotected, are generally healthy. These species are not used for commercial purposes, and the effects of collection by terrarium enthusiasts are insignificant. Most of these species are distributed country-wide. Those species that are more limited in distribution, such as *Rana graeca, Zootoca vivipara, Podarcis erhardi,* and *Rana temporaria,*

have high and stable population number. The two *Natrix* species and *Anguis fragilis* are widely hunted due to the traditional prejudice against snakes.

The remaining species in the Bulgarian herpetofauna require, to a greater or lesser extent, protection measures. In the descriptions that follow, species protected by Order No: 729 are marked with an asterisk (*), while those included in the *Red Data Book* of Bulgaria are marked with an exclamation point (!).

* *Salamandra salamandra*

Still frequently encountered in wooded areas throughout almost all of the Bulgarian mountains. The highest numbers have been reported along the northern slope on Kom Peak in the western Stara Planina Mountains: 84 specimens on a 4-4.5 km route, at 700-1600 m above sea level. The territory of this species is declining due to the clearing of old deciduous broad-leaved forests, predominantly beech forests. These areas are often reforested with conifers or left as vacant land. *Salamandra salamandra* is commonly destroyed by unknowledgeable locals or tourists.

*! *Triturus alpestris*

A rare relict species, with sporadic distribution in some of the Bulgarian mountains. In Bulgaria this species is an ice age relict whose populations are entirely isolated from one other. Measures to protect the Alpine Newt must include preservation of the original conditions of all the ponds it inhabits. Its wetland meadow habitat in the Petrohan Pass in the western Stara Planina Mountains faced complete destruction as a result of drainage. In 1987, a small pond was dug out with a bulldozer in this area, and a population was successfully established. The habitat underneath Bogdan Peak at Sredna Gora is entirely gone, the ponds in this area having dried up as a result of the clearing of the surrounding beech forest. A habitat on the Yakuruda fishing lake, located 2,185 m a.s.l. in the Rila Mountains, has also been destroyed, having been transformed by a dam with an extremely variable waterline.

Bombina bombina

A relatively rare species whose southern limit of distribution traverses Bulgaria. This species is directly enangered. It has become extinct in the areas along the Danube. In Thrace, it has disappeared due to the drainage of the marshes or pollution by petroleum products. Special measures for its protection are not yet necessary.

* *Pelobates fuscus*

Distributed predominantly in northern Bulgaria, it is also found south of the Stara Planina Mountains and (in insignificant numbers) at several locations around Sofia. In the future some of these locations may require protection, especially the quarry lakes near the village of Dolni Bogrov (some ornithologists have also recommended that this become a protected reserve due to the marsh birds that visit the area).

*! *Pelobates syriacus*

Found primarily in southern Bulgaria. Although it is not an endangered species, its richest and most famous location - the wetland across from the Kresna train station in the Strouma River valley - is highly endangered by its transformation into the town's garbage dump.

From 1969-1980, the numbers of this species along the Black Sea coast southeast of Bourgas were drastically reduced due to increased use of insecticides against mosquitos and destruction of their food sources by construction of tourist complexes. In 1991, it was determined that the populations of this frog had recovered to 1964-66 levels.

* *Bufo bufo*

Frequently encountered, particularly along the lower mountains. Some populations are endangered as a result of exploitation for their skin secretion (which is unlawful). The Valeka company in Ahtopol,

southeast of Bourgas, raises these frogs for commercial purposes. Their unsympathetic appearance often leads to their destruction, especially during their reproductive period, by children.

Rana ridibunda

The most commonly encountered frog in Bulgaria. It is quite numerous and unaffected by pressures from the human population. It is used commercially as a food source and is exported. Domestic consumption ranges from 6-8 tons annually. Exports, which began in 1959, reached record totals (281 tons) in 1971. Today 15-18 tons are exported annually, primarily to France. Though the species cannot be said to be endangered in Bulgaria, the great reserves found in the major ponds have been greatly reduced due to exploitation, pollution, and the drainage of ponds. A major reason for the reduced export trade is the low wholesale price offered to the frog gatherers in the last 2 to 3 years.

Every spring, the Ministry of Environment determines the period during which frog hunting is forbidden (to allow the frogs to for reproduce) and sets a quota for export quantities. A 2-3 year temporary halt is required for populations in exploited areas to reestablish or replenish their numbers. In certain regions - for example, Plovdiv, Pasardzhol, and Yambol - the frog resources have been exhausted. In other areas the frogs are not captured at all.

** *Testudo graeca and Testudo hermanni*

These two tortoise species are widespread, but their numbers are rapidly declining, especially in lowland regions subject to intensive agriculture. They are also traditionally used for food, for "medicinal treatments," and as live souvenirs, gathered by Bulgarians and foreigners alike in the low mountain areas and along the Black sea coast. Areas in Bulgaria that have tortoises are shown on Map 1 with a scaled rating. The map is based on a written questionnaire sent in the years 1976- 1979 to all inhabited areas of the country, and on surveys of their abundance in territories near 111 villages.

Tortoise consumption among the Bulgarian population is shown on Map 2. In 1981, Order No: 128 was issued by the MOE, providing complete protection of the land tortoises over the entire territory of the country, effective over all seasons. In 1985, the Institute of Zoology and the MOE issued a poster calling for the protection of tortoises and disseminating the text of the protection order. From 1986 to 1989, some 7,000 posters were distributed and posted at around 3,000 sites in the country.

Order No: 729/1986 placed the tortoises under a still tighter protection regime. The order not only forbid their destruction, but deemed their capture an "indismissable offense." This has allowed sanctions to be imposed when poachers are caught, even if the tortoises are immediately released. Restaurants that specialized in cooking tortoise have shut down. Information about the tortoises' protected status, as well as their uselessness for "medicinal treatments," was also broadcast on radio and television. Many poachers were heavily fined, and this fact too was broadcast. All of this resulted in a drastic reduction in the destruction of tortoises, while live capturing has become social stigmatized. Unfortunately, tortoise protection work has declined in the last few years due to a shortage of finances and a general lack of respect for the law on the part of most Bulgarians.

* *Emys orbicularis*

This species is not as acutely endangered as the tortoises. It has suffered eradication throughout much of its traditional range due to the drainage of marshes, corrections or changes in the river channels and basins, and capture by terrarium enthusiasts. However, it has reestablished itself along newly built microdams, ponds, and fish farms. This species is not used for food or "medicinal treatments." Many turtles, however, are destroyed when they are caught by line or captured by the nets of fishermen. Special measures for their protection will need to be undertaken in the near future.

*! *Mauremys caspica*

Extremely limited in distribution. A number of the inhabited ponds were destroyed in the Petrich-Sandanski plain, near the volcanic hill Kojuha, as a result of a land reclamation project. These ponds had in fact been created several decades earlier as part of a land improvement program. Another of its habitats, near the village of Slaveevo in the Ivailovgrad area, is heavily polluted with petroleum

products emitted by the Ivailovgrad metals plant. The Karchovia Sazluk wetland, near Svilengrad, has been drained almost entirely. However, the species has retained significant numbers within a 1 km distance of the neighboring floodplain created by the local river.

In the years 1974 to 1979, Bulgarian and foreign tourists completely destroyed the population of two species of marsh turtles that inhabited the little river that flows into the Black Sea along Ahtopol's northern beach. Meanwhile, in the artificially created carp ponds near Levunova and Lebnitsa, not too far from Sandanski, numerous populations of *Mauremys caspica* have been observed breeding in man-made ponds, microdams, and water-filled sand quarries. Others have been observed in Svilengrad, in the village of Mandritsa, and near Ivailovgrad, as well as other places. The total number of this species in Bulgaria is estimated at between 600 and 1000 (Beshkov, 1987).

* *Cyrodactylus kotschyi*

In Bulgaria, this species almost always inhabits human habitats. "Wild" populations have been observed in the Sozopol and Primorsko regions. The species is directly endangered. Foreign poachers have been observed on many occasions capturing these lizards. In one 3-hour nocturnal observation period near the village of Kulata, by the Greek border along the Strouma River valley, nearly 70 individuals were seen.

Lacerata gilis

This species is neither hunted nor captured. Although it is still commonly encountered in the mountains in western Bulgaria, this species should be carefully monitored, as it has virtually disappeared around Sofia in the past 30 years. The reasons are unclear.

*! *Ophisops elegans*

Found in Bulgaria in a small area near the village of Mandritsa, in the eastern Rhodope Mountains. Their occurrence near the village of Mesek in the Svilengrad area has not been reconfirmed during several visits over the last 15 years. Their numbers near the village of Mandritsa are satisfactory. Anthropogenic pressures on this lizard and its habitats do not exist at this time.

*! *Ophisaurus apodus*

Under heavy anthropogenic pressure. This species is directly destroyed due to its snake-like form and is also captured by foreign poachers (14 individuals were seized from a Czechoslovakian collector near Sozopol in 1987). Its presence along the Strouma River valley, noted in 1916, has not been reconfirmed. Neither have they been reconfirmed in the last 25 years in former habitat south of Russe. Along the Black Sea coast, the tourist invasion has considerably reduced the territory inhabited by this species. This is particularly true of the 2-3 km zone that runs along the coast. The status of the species is good in Sakhar, the eastern Rhodopes, the neighboring hillsides in Thrace, and in locations at Strandzha Mountain.

*! *Typhlops vermicularis*

Because of its hidden, underground existence, this species is considered very rare, and is included in the Bulgarian Red Data Book. Nocturnal studies conducted over the past 10 years indicate that its numbers in known habitats, and in many newly discovered locations, are very high. There is no danger of this species disappearing from the Bulgarian herpetofauna. Unfortunately, though, its most interesting location was destroyed by urbanization. This site was near mineral hot water springs, near the village Varbara, Pazardzhik. It represented the northern limit of this species on the Balkan Peninsula, and existed only because of the specific temperature conditions of the land around the hot spring.

*! *Eryx jaculus*

The status of this species is of great concern. Its northernmost location, near the village of Tatari, Svishtov, has been destroyed as a result of reforestation of its hill habitat with acacias nearly 35-40

years ago. Some populations in southern Bulgaria (near the village Lillyanovo, Sandanski, and Nadezhden, Harmanli) have been seriously damaged by foreign and Bulgarian collectors. In the remaining habitats, the species' numbers are meager. In a number of localities its survival is threatened by the capture technique of turning over stones or rocks. This can in a short time destroy a large portion of its population.

* *Coluber jugularis*

This species is extremely numerous in Bulgaria. However, its number have been drastically reduced in the extensive agricultural plains of northern Bulgaria and Thrace. Many are destroyed not only through traditional means, but by being run over on the roads.

*! *Coluber rubriceps*

Seriously endangered as a result of poaching by foreign and domestic collectors. Its dwelling sites are tiny and consequently are inhabited by very few individuals. From the publications of foreign specialists, it is apparent that tens of individual specimens have been made available by "collectors" prior to, and subsequent to, the publication of the Bulgarian *Red Data Book* and Order No:729/1986. We do not recommend territorial protection as this would precisely pinpoint their dwelling sites for the poachers. Perhaps some form of on-site control of the snake hunting process might be more effective.

*! *Elaphe quatuorlineata quatuorlineata*

Extremely endangered species. It inhabits only about 3% of the Bulgarian territory, and these areas are heavily populated. As a large and slow-moving snake, it is frequently destroyed by local people. In the Petrich-Sandanski valleys, it has been drastically reduced in number, and is now found mainly along the lower slopes of the surrounding mountains. It is also found in isolated island-like habitats, such as the volcanic hillside Kojuha.

* *Elaphe quatuorlineata sauromates*

Also of concern. At the end of the last century this snake was very commonly found in northern Bulgaria. During the past 40 years, only 2 have been found in northern Bulgaria. The primary cause of its catastrophic reduction is the radical transformation of the landscape due to collectivized farming. No territories or refuges survived for this readily noticeable snake to use. Conditions are similar with the northern Thracian plain: 3 known occurrences in the Assenovgrad area during the last 31 years! The situation is somewhat better in the eastern Rhodopes, Sakkar, the Derven heights, and at Strandzha Mountain. In these areas, no particular changes in its numbers appear to have occurred over the past decades. It is taken by foreign poachers. Six specimens were found captured by citizens of the former German Democratic Republic in 1986.

*! *Elaphe situla*

An extremely common species along the Strouma River valley, even though it is an object of poaching and of destruction by local residents. One individual was reported near Assenovgrad (southeast of Plovdiv) nearly 100 years ago, but its occurrence in this region has remained unconfirmed since then. The species has been greatly reduced in the Sozopol area (south of Bourgas) as a result of direct destruction and urbanization of its terrain in connection with the tourist invasion. According to information from foreign colleagues, a Czechoslovakian citizen dug up a winter hibernating site and captured several tens of Elaphe situla nearly 4-5 years ago. Protection of the Sozopol population is very difficult, and a solution to the situation is hard to imagine.

*! *Elaphe longissima*

Very commonly encountered throughout Bulgaria. It is included in the Bulgarian *Red Data Book* due to its inclusion in the European *Red Data Book.* Destruction or reduction of old deciduous forests and the hollowed-out trees where they lay their eggs are potential dangers. This species is also frequently destroyed by local people or tourists due to traditional prejudices. It is most endangered in regions with intensive farming and in the mountain foothills, where forests are most commonly being cleared.

* *Coronella austriaca*

Commonly encountered. Parts of its range have been destroyed by human activities. Conversely, other terrains, perhaps larger in size, have become hospitable to its existence. This is mainly a result of clearing of the deciduous broad-leaved forests. There are no direct dangers to its existence in the country or over large.

* *Malpalon monospessulanus*

Greatly increased in numbers in the Strouma River valley, where it was unknown prior to 1960. From 1961 to 1970, 4-5 individuals were found; 13 were found from 1971-80, during which time extensive research was undertaken. From 1982 to 1990, 30-32 individuals were located using no more intensive methods. This radical increase in numbers is probably due to global-scale phenomena (possibly increased aridity and xerophilization of the vegetation due to global warming). No apparent changes in numbers have occurred in the remaining portion of the Bulgarian segment of its range. Observations, however, have been infrequent.

*! *Telescopus fallax*

Considered an extremely rare species since its status was first determined in 1953. Nocturnal research conducted along the Strouma River valley has shown that, under appropriate conditions, this snake is not especially rare. During the past 5 years, 12 or 13 individuals have been captured. Nearly 10 other young specimens have been run over on the roads along a frequently visited segment of the Kresna gorge. This species, like *Malpolon monspessulanus,* is probably increasing its numbers along the Strouma River valley.

Vipera ammodytes

Widely distributed throughout Bulgaria. During the last 3 years, it has become an object of increased attention by snake catchers, who sell the specimens to snake farms for the extraction of poison for export. Hunting has seriously injured the populations in its richest habitats - namely, the southeastern quarter of the country, as well as the Petrich and Sandanski region, northwest Bulgaria (Belogradchik), the Iskar gorge north of Sofia, and the southern slopes of Sredna Gora in Stara Zagora. Poaching or capture has taken place not only during the hot months, but through the autumn, winter, and early spring. Poachers have dug up their winter refuges, converting them into essentially open traps, useless as hibernating grounds in subsequent years. In March 1991, the MOE issued an order banning the capture of this species through excavation of its winter habitats, as well as trade and exchange, in the period between 30 September and 30 April. An annual quota of 2,000- 3,000 individuals was also instituted. The establishment of new snake farms can be undertaken only after approval of the conditions for their breeding by the regional inspectors for environmental protection.

Export of *Vipera ammodytes* is permitted with an agreement from the MOE. At present there are 40 regulated snake farms, along with 20-25 unregulated ones. Fortunately, this business has not produced the expected income, and many practitioners have gone bankrupt. During the next 3-4 years, capture of this species is expected to decline. It is anticipated that this will allow the populations to reestablish themselves in the most heavily exploited areas. Concurrently, in areas where the snakes are less numerous and where capture has not taken place, the snakes have maintained their numbers. As a result of human activities, especially on the lower mountain slopes, new areas conducive to *Vipera ammodytes* are being created through the clearing of ancient forests, erosion of the terrain, degradation of pastures, and so forth.

Vipera berus

Confined almost exclusively to the high mountains. It is not subject to poaching. The decline of tourism over the last 3-4 years has reduced the number of destroyed specimens. Special measures are unnecessary at present.

!! *Vipera aspis* and *Vipera ursinii*

Listed in the Bulgarian *Red Data Book* as extinct species.

Impact of Human Aactivity

1. Human Activities With Negative Impacts

a. Intensive farming in the plains, which entails the creation of large monoculture tracts and homogenization of the landscape, has a very negative impact in particular on the two species o*f Testudo, Elapha quatuorlineata sauromates, Elaphe longissima,* and *Coluber jugularis.* This trend also affects *Bufo bufo, Hyla arborea, Ablepharus kitaibeli, Anguis fragilis, Lacerta viridis, Lacerta trilineata, Lacerta taurica, Coronella austriaca,* and *Vipera ammodytes.*

b. The cutting of broad-leaved deciduous forests and their replacement with conifers, combined with the creation of clearings, eroded lands, and other open areas, has a heavy negative impact on *Salamandra salamandra, Bufo bufo, Rana dalmatina, Zootoca praticola, Elaphe longissima,* the two species of the genus *Testudo* (in particular), *Anguis fragilis,* and others.

c. Drainage or pollution of ponds and the correction of river courses have an unfavorable impact on all amphibians, and in particular on *Triturus alpestris. Bombina variegata, Rana esculenta, Rana temporaria,* and *Rana graeca,* due to the character and location of their habitats, have also been affected by these factors, though to a somewhat lesser degree. Among reptiles, the negative impacts have been definitive for the two species of the genus *Natrix* and *Mauremys caspica.*

d. Actual destruction, instigated by local residents due to traditional prejudices, has an unfavorable impact on the populations of *Salamandra salamandra, Bufo bufo, Anguis fragilis, Ophisaurus apodus,* as well as all species of snakes. *Emys orbicularis* and *Mauremys caspica* are frequently destroyed by fishermen, who catch them with lines or capture them in nets.

e. Commercial use affects most heavily the populations of both types of tortoises of the genus *Testudo* and, to a lesser degree, *Vipera ammodytes.* The populations of *Rana ridibunda* are also heavily impacted. They, however, can reestablish themselves quickly - within a 2-3 year period following the cessation of commercial exploitation.

2. Human Activities With Positive Impacts

a. The clearing and replacement of the old-growth deciduous broad-leaved forests has created new dwelling sites for both species of the genus *Testudo.* Other species that have benefitted from this trend are: *Ablepharus kitaibeli, Ophisaurus apodus, Podarcis muralis, Podarcis erhardi, Lacerta agilis, Lacerta viridis, Lacerta trilineata, Lacerta taurica, Ophisops elegans, Eryx jaculus, Coluber jugularis, Coluber najadum, Elaphe situla, Coronella austriaca, Malpolon monspessulanus, Telescopus fallax,* and *Vipera ammodytes.*

b. The uncovering of rocky surfaces and the breaking up of rocks during road construction, quarrying work, etc., can have a beneficial impact on some species, especially on the plains and in grassy or forested areas. Species that settle in these places are: *Podarcis muralis, Podarcis erhardi, Lacerata viridis, Lacerata trilineata, Ophisops elegans,* and at times *Coluber jugularis* and *Coronella austriaca.*

c. The creation of new ponds, pools, or flooded areas near fish farms, microdams, and potable water sources has a positive impact. All species of amphibians, with the exception of *Salamandra salamandra* and *Rana graeca,* settle and reproduce in these aquatic habitats. Nearly 70-75% of the ponds inhabited by one or more species of amphibians within a 20 km radius of Sofia have been man-made. This includes ponds created by U.S. bombs dropped during World War II. *Emys orbicularis* and *Mauremys caspica* also settle in these artificially created ponds. They nearly compensate for the destruction of the species due to the drainage and pollution of the natural ponds. The same is true of both species of the genus *Natrix.*

In general, it can be stated that human activity has increased the area inhabited by the xerophilous species, predominantly reptiles with Mediterranean and southern European distributions. At the same time, human activity has limited the moisture-loving forest species, primarily those with central

European distributions. The destruction of natural ponds has been compensated to a great extent by the creation of artificial ones.

Known Dangers

Aside from the well known dangers to the global biosphere that have resulted from human activity, the following represent concrete dangers to the Bulgarian herpetofaouna:

- Continued denudation of the country's forest lands, especially the reduction in area of the deciduous, broad-leaved forests. In the previous section, we have clarified which species are endangered and which enlarge their range as a result of clearing.

- Further drainage and pollution of ponds. We can expect that the creation of new ponds will be drastically reduced under the new economic conditions, but no reduction in pollution is foreseen.

- Increased interest in rare, interesting, or beautiful amphibians and reptiles by Bulgarian and foreign terrarium enthusiasts and traders in pets. The number of Bulgarian terrarium enthusiasts is rapidly increasing, and hundreds of animals are captured for domestic breeding. This includes species cited in Order No: 729. There now exists a Bulgarian company that, with an MOE permit, exports hundreds of unthreatened amphibians and reptiles to pet stores in Great Britain. This is a dangerous precedent and directs attention to this type of a business, which without doubt would eventually attempt to export illegally some rare or endangered species that are in demand by foreign pet store owners. The sums of money they offer are extremely attractive to our poachers.

- Urbanization, construction, and other anthropogenic changes in the habitats of the species with sporadic distributions. At the same time, the present and forthcoming restitution of private lands offers some limited optimism. The process might prove to be a boon to some species, principally the lizards and, to a lesser extent, the snakes. This would result from the subdivision of the land into smaller segments, and the presumable creation of borders, amongst which shrubs, individual trees, stone fences, or other small structures with beneficial building materials may be placed. Such a landscape is, from a conservation standpoint, preferable to the monocultures inherited from collectivization.

Important Areas for Biodiversity

This section identifies areas that are important for the protection of herpetofaunal biodiversity, as well as particular places that are important for the existence of specific populations. It is recommended that these areas receive greater attention in future protection efforts.

The following territories contain the greatest diversity of species:

1. The volcanic hill Kojuha, between the towns of Petrich and Sandanski in the Strouma River valley. This area is presently protected, but is under heavy human pressure from construction activities, quarry mining, land reclamation projects, and increasing travel (which entails an increase in poaching). A total of 26 species - 7 amphibian species and 19 reptile species - exist in this area. Seven of these are listed in the Bulgarian *Red Data Book,* while 16 are protected by Order No: 729/1986 of the MOE. Kojuha also supports a large number of other Mediterranean plants and animals, and is the single Bulgarian site for many. Its protection should focus on their preservation.

2. The characteristic terrain found along the southern end of the Kresna gorge in the Strouma River valley. We propose that the present Tissata Reserve be maintained as an important appropriate habitat for the herpetofauna. Although it was established primarily for the population of *Juniperus excelsa* and other rare Mediterranean vegetation, it is also inhabited by 7 species of amphibians and 18 species of reptiles. Of these, 5 are listed in the Bulgarian *Red Data Book,* and 16 are protected by Order No: 729/1986. The Tissata Reserve is relatively free of human impact (although it is used illegally for grazing goats) and its protection would create far fewer obstacles than the protection of Kojuha.

3. Protection of the Ropotamo-Maslen Nos area along the Black Sea coast east of Sozopol. The exact borders and status of this area are presently being determined. The territory has a rich variety of plants and animals. Thirty-one species of the examined groups - 8 amphibians and 23 reptiles - are found within it. Of these, 6 species are included in the Bulgarian *Red Data Book,* while 19 species are protected by Order No:729/1986. The northernmost habitat of *Coluber rubriceps,* which in Europe is found only in the narrow band of sea coast south of Sozopol, is found there.

The following territories are important for the existence of the specified populations and also deserve special attention.

1. The marshy plain along the Petrohan Prohod, in the western Stara Planina Mountains, with an altitude of 1380-1400 m a.s.l. The one relict population of *Triturus alpestris* in the Stara Planina survives here, and is artificially supported by a specially made pond constructed in 1987. At the same place live the remaining 3 components of the high mountain herpetological complex - *Rana temporaria, Zootoca vivipara,* and *Vipera berus.* Protection of this location would not affect any special interest.

2. The protected area around the Muhalnitsa wetland south of Botevgrad, 63 km northeast of Sofia. It is protected by Order No: 328/8.5.1992 issued by the MOE. The protected area includes 1.9 hectares of land. Several hundred sexually mature *Rana temporaria* arrive at this tiny (in terms of size and depth) swamp in the late winter and early spring, descending from the high mountain of the neighboring Bilo Planina to reproduce. After a 7-25 day stay, they return to the high areas of the mountain. The distance travelled ranges from 4.5 to 10.5 km, with vertical migrations between 450-950 m a.s.l.

This is the largest periodic migration yet observed in the amphibian world. It has been explained as a result of the coming of the end of the "Vurm" glacial period and the warming of the climate. During this period, the ancestors of all the other populations of this species in the Balkan peninsula have retreated to the high mountains. However, the ancestors of the population at the place in question adapted by climbing up the mountain, which lacks ponds appropriate for reproduction. Consequently, every year, the frogs have returned to reproduce at the original birth place, in the plain, of their ancestors. To protect this site, the requirements in the order issued for its protection need to be strictly followed.

3. The swamp across from the Kresna train station in the Strouma River valley, used by *Pelobates syriacus* for reproduction. It is located 70-100 m away from the train station. Several hundred individuals of the above mentioned species use it as their reproductive grounds. During the past two years it has become a dumping ground, and there is an immediate danger that the richest Bulgarian population of this species will disappear. Measures for cleaning up this habitat need to focus on the restoration of the site to its condition prior to its pollution with waste.

General Recommendations

As general measures to protect the species diversity of the Bulgarian herpetofauna, we recommend:

1. A wide-ranging campaign to inform the public of the protected status of the rare and endangered species, with particular attention paid to the lack of danger from snakes and the direct practical use of these species (for example, *Bufo viridis*). It should include a message about the importance of biodiversity and ecosystems.

2. Wide-spread communication of the official acts issued for the protection of species and habitats. At present, the Bulgarian population is virtually uninformed as to which species are protected and which collection activities are permitted or prohibited. All the poachers that have been caught have excused themselves by citing their lack of knowledge of the law, and the fact that the protection acts have not been popularized.

3. Mutual cooperation among environmental protection organizations and personnel - the regional inspectors for the protection of the environment, non-governmental organizations, outdoor enthusiasts, mayors and other municipal officials, national forest rangers, customs officials, police, and so forth - for rapid response to poaching and other destructive acts. Perhaps the best solution would be the

creation of a "green police." A "green tele-phone hotline" should be established, and its number advertised, to alert officials of violations.

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