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New data about the biodiversity of “Pârâul Pețea” natural reserve in Băile 1 Mai, northwestern Romania

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Abstract. During a qualitative faunistic survey in the „Pârâul Pețea” natural reserve, a total of 83 species were observed, out of which 17 are protected and 3 are invasive. 10 Odonata species are recorded for the first time in the reserve, including the rare *Pyrhosoma nymphula* and southern elements which may indicate climate warming. The recent decrease in the thermal spring flow in the reserve and its impact on the fauna and the survival of the ecosystem are briefly discussed.

Introduction

The „Pârâul Pețea” natural reserve is situated at 9 km southeast from Oradea, has a total length of ca. 1 km and a surface of 10,86 ha, and belongs to IUCN category IV, according to Romanian law OUG 57/2007. The reserve is enclosed in the Natura 2000 site „Lacul Pețea”, which follows the course of Pețea rivulet from its origin to the entrance in Oradea (ca. 5 km). The site encloses also Băile 1 Mai spa, with Lake Pețea and its underwater thermal spring.

The following endemic, protected taxa were cited in the reserve: *Nymphaea lotus* var. *thermalis*, the only tropical plant vegetating spontaneously in the temperate area, *Melanopsis parreyssii* (Philippi 1847) and *Scardinius racovitzai*.

According to Annex II of the European Council Directive 92/43/CEE, the habitat is listed as Transylvanian thermal water covered with lotus (31A0*), and the following protected species are listed: *Emys orbicularis*, *Bombina bombina*, *B. variegata*, *Triturus cristatus*, *Cobitis taenia*, *Sabanejewia aurata*, *Callimorpha quadripunctaria*, *Drobacia banatica*, *Unio crassus*. The species protected by national law and quoted in the reserve are: *Hyla arborea*, *Pelobates fuscus*, *Rana dalmatina*, *R. ridibunda*, *Triturus vulgaris*, *Lacerta agilis*, *L. viridis*, *Natrix natrix*, *N. tessellata*, *Vipera berus*.

Following a tendency in the decrease of water level in the reserve in recent years, possibly because of excessive extraction of thermal water, in December 2011 the underwater thermal spring has ceased temporarily its flow. The custodian of the reserve (Țării Crișurilor Museum) tried to ensure the survival of the ecosystem by pumping thermal water from a nearby drilling. Therefore, the impact of the dramatically low level of the lake and of the decrease in water temperature on the fauna of the reserve was of special interest.

Material and methods

A qualitative survey of the biodiversity in the reserve, aimed mainly at Odonata, Gerromorpha and Nepomorpha, was carried on weekly during March-September 2012, and implied observations, photographs, capturing and collecting with entomological or mesh nets. When collecting was not necessary, the captured individuals were released at the same spot. The animals were determined based on their morphological features according to the available literature (Cârdei & Bulimar 1965, Poisson 1957) and using a digital microscope Aigo GE-5 when necessary. The protection status of the species was verified in legislation and literature (Tatole & al. 2009).

Results and discussion

The presence of the following species was documented in the reserve for the studied period of time:

Class Gastropoda

Fam. Melanopsidae

Melanopsis parreyssii (Philippi 1847) - IUCN Red List CR, critically endangered, endemic for Lake Peșea, abundant in the past; introduced with limited success in Hungary: Lake Malom in Budapest, and Körösladány; may be affected by habitat

destruction and pollution; in Dec. 2011 the thermal spring ceased temporarily its activity, therefore an aquarium with 20 individuals was set up in the museum for reintroduction of the species if necessary.

Fam. Helicidae

Drobacia banatica (Rossmässler 1838) - IUCN Red List DD, data deficient; Pleistocene relic, strictly protected species in the EU, protected by national law, rare, hygrophilic, occurs in woods in Romania, Hungary and Ukraine, was introduced in Germany; endangered by deforestation, loss of riparian vegetation, drainage.

Class Bivalvia

Order Unionoida

Fam. Unionidae

Unio crassus Philipsson 1788 - IUCN LR/nt, near threatened; protected by national law; occurs in slow flowing waters, needs clean and well oxygenated water, sandy or moderately muddy substrate, affected by high concentrations of organic substances, therefore being an indicator of environment quality; may be affected by pollution, changes in water level, and the invasive species *Sinanodonta woodiana*, which has 2-3 generations, while *U. crassus* has only one.

Sinanodonta woodiana (Lea 1834) - Eastern Asian invasive species.

Class Arachnida

Order Araneae

Fam. Tetragnathidae

Tetragnatha extensa (L. 1758)

Fam. Thomisidae

Misumena vatia (Clerck 1757)

Fam. Araneidae

Argiope bruennichi (Scopoli 1772)

Order Odonata**Suborder Zygoptera****Fam. Calopterygidae**

Calopteryx splendens (Harris 1780) - common, prefers slow running waters with open surfaces, is very sensitive to pollution and needs healthy emergent plants for oviposition (Szállassy 2008).

C. virgo (L. 1758) - the first documented occurrence in the reserve.

Fam. Coenagrionidae

Coenagrion puella (L. 1758) - common species, occurs also in eutrophic waters, yet is sensitive to pollution (Szállassy 2008); abundant.

C. pulchellum (Vander Linden 1825) - common, prefers stagnant waters (Szállassy 2008).

Erythromma viridulum (Charpentier 1840) - Pontic-Mediterranean species, first occurrence in the reserve.

Ischnura elegans (Vander Linden 1820) - common, very adaptable, tolerant to pollution (Szállassy 2008); abundant.

I. pumilio (Charpentier 1825)

Pyrrhosoma nymphula (Sulzer 1776) - this species is very rare in Romania; first occurrence in the reserve.

Fam. Lestidae

Sympecma fusca (Vander Linden 1820) - Mediterranean and Central-European species.

Fam. Platycnemididae

- *Platycnemis pennipes* (Pallas 1771) - common, prefers running waters, is vulnerable to the destruction of riparian habitats and pollution (Szállassy 2008); abundant.

Suborder Anisoptera**Fam. Aeshnidae**

Aeshna affinis Vander Linden 1823 - common, prefers stagnant waters, is sensitive to pollution (Szállassy 2008); first documented occurrence in the reserve.

A. cyanea (Müller 1764)

A. isosceles (Müller 1767)

Anax imperator Leach 1815 - relatively frequent, prefers stagnant waters, may be eliminated by habitat destruction, especially of aquatic plants serving as support for larvae during metamorphosis (Szállassy 2008); first documented occurrence in the reserve.

A. parthenope (Sélys 1839) - first documented occurrence in the reserve.

Brachytron pratense (Müller 1764) - first documented occurrence in the reserve.

Fam. Libellulidae

Crocothemis erythraea (Brullé 1832) - African species expanding in Europe due to climate change (Kalkman & al. 2010), first documented occurrence in the reserve, abundant.

Libellula depressa L. 1758 - abundant in the reserve; common species, prefers small stagnant waters with open surfaces, but may occur also in semi-polluted habitats, is less abundant in the last stage of lakes, its apparition is encouraged by elimination of the riparian vegetation (Szállassy 2008).

L. fulva Müller 1764 - rare, prefers waters with high organic content, emerging vegetation and riparian shrubs; may be threatened by excessive shadow from the trees on the shore and also by high water temperature, low oxygen levels and pollution (Szállassy 2008).

Orthetrum albistylum Sélys 1848 - relatively frequent, prefers stagnant waters (Szállassy 2008).

O. brunneum (Fonscolombe 1837) - Mediterranean origin.

O. coerulescens (Fabricius 1798)

Sympetrum meridionale (Sélys 1841) - first documented occurrence in the reserve.

S. sanguineum (Müller 1764) - common (Szállassy 2008).

S. striolatum (Charpentier 1840) - first documented occurrence in the reserve.

S. vulgatum (L. 1758) - common, prefers stagnant waters (Szállassy 2008).

Order Hemiptera

Suborder Heteroptera

Most semiaquatic species found in the reserve belong to the ecological group favored by shallow waters, a fact which may be related to the decrease in the spring flow and the level of the thermal lake observed mostly after December 2011.

Infraorder Gerromorpha

Fam. Gerridae

Aquarius paludum (Fabricius 1794) - prefers shallow waters (Hufnagel & al. 1999).

Gerris (*s. str.*) *argentatus* Schummel 1832 - common, shore species, prefers relatively deeper waters (Hufnagel & al. 1999, Ilie 2006).

G. (s. str.) lacustris (L. 1758) - prefers shallow waters, tolerant species; dominant in habitats with shore vegetation and heavy anthropic impact (Hufnagel & al. 1999, Oloşutean & Ilie 2010).

G. (Gerriselloides) lateralis Schummel 1832

Limnoporus rufoscutellatus (Latreille 1807) - prefers shallow waters, the species is rare in Hungary (Hufnagel & al. 1999).

Fam. Mesoveliidae

Mesovelia thermalis Horváth 1915 - the reserve is its only habitat in Romania; it lives in the shore area of ponds on the floating vegetation; the association of

Mesovelgia sp. with Nymphaeion is due to the abundance of vegetation in that stage of the lakes; eats mainly Ostracods coming to the water surface and tiny insects fallen on the water, inserts its eggs in the stems of semiaquatic plants; the nymphs hatch in 7-19 days depending on temperature, has only four instars, total development takes 12-32 days (Gagiu 2004), the first adults emerge in May-June, has probably 3-4 generations, overwinters probably as egg; almost all published, collected and observed individuals in the reserve are apterous, therefore the population has limited spreading ability; habitat key factors are: thermal water, partly covered riparian aquatic habitat, undisturbed and not polluted, and the presence of tiny arthropods as prey; another European species, *M. furcata* Mulsant & Rey 1852, prefers relatively deeper waters (Hufnagel & al. 1999).

Fam. Veliidae

Microvelia (s. str.) *reticulata* (Burmeister 1835) - prefers relatively deeper waters and the presence of algae in their microhabitat (Hufnagel & al. 1999).

M. (Picaultia) pygmaea (Dufour 1833) - prefers shallow waters (Hufnagel & al. 1999).

Infraorder Nepomorpha

Fam. Naucoridae

Ilyocoris cimicoides (L. 1758) - common species, prefers deeper waters, with abundant vegetation (Hufnagel & al. 1999, Ilie 2006); only one specimen found.

Fam. Corixidae

Micronecta (Dichaetonecta) pusilla (Horváth 1895) - prefers shallow waters, is influenced by the surrounding terrestrial habitat; the thermal ecological form *M. pusilla episcopalis* (Horváth 1916) was not found (Hufnagel & al. 1999, Wróblewski 1960).

Sigara sp. - prefers deeper waters; only two individuals found.

Superfamily Pentatomoidea

Fam. Pentatomidae

Graphosoma lineatum (L. 1758)

Order Coleoptera**Fam. Cleridae**

Trichodes apiarius (L. 1758)

Fam. Scarabaeidae

Trichius fasciatus (L. 1758)

Cetonia aurata (L. 1758)

Fam. Cerambycidae

Dorcadion (Carinatodorcadion) aethiops Scopoli 1763

Fam. Lucanidae

Lucanus cervus (L. 1758) - strictly protected species in the EU, needs maintaining the old or fallen trees.

Dorcus parallelipipedus (L. 1758)

Fam. Coccinellidae

Harmonia axyridis (Pallas 1773) - Asian invasive species, apparently reproducing in the reserve; f. *spectabilis* observed; the first occurrence was in 2011 (Gagliu 2011).

Order Lepidoptera**Fam. Nymphalidae**

Inachis io (L. 1758)

Polygonia c-album (L. 1758)

Fam. Sphingidae

Proserpinus proserpina (Pallas 1772) - IUCN Red List DD, data deficient; strictly protected species in the EU.

Fam. Pieridae

Anthocharis cardamines (L. 1758)

Fam. Papilionidae

Iphiclides podalirius (L. 1758) - on the right bank of the rivulet; this species is an indicator of a relatively well preserved habitat with xerothermic pastures and sylvo-steppe vegetation.

Fam. Lycaenidae

Lycaena phlaeas (L. 1761)

Class Actinopterygii**Order Cypriniformes****Fam. Cyprinidae**

Scardinius racovitzai Müller 1958 - IUCN Red List CR, critically endangered, endemic for Lake Pețea, prefers thermal, shallow waters with muddy substrate and dense vegetation, optimal temperature 28-34 °C., reproduction in February-March, maturity at 2 years for females and one year for males, may be affected by organic pollution and low, colder water caused by excessive extraction of thermal water; in Dec. 2011 the thermal spring ceased temporarily its activity, therefore a 450 l. aquarium with 25 individuals was set up in the museum for reintroduction of the species if necessary; protected by national law.

Rhodeus amarus (Bloch 1782) - protected by national law; may be affected by draining, pollution and the loss of local Unionids needed for reproduction.

Gobio gobio (L. 1758)

Cyprinus carpio L. 1758 - the wild populations are vulnerable, but many are hybridized with domesticated or Asian, introduced subspecies.

Fam. Cobitidae

Cobitis elongatoides Băcescu & R. Mayer 1969 - protected by national law; ben-

thic, in stagnant or slow running waters, may be affected by pollution and drainings.

Class Amphibia**Order Anura****Fam. Ranidae**

Rana dalmatina Bonaparte 1840 - strictly protected species in the EU; occurs mainly in forests, reproduction in March, may be affected by pollution, drainings, and introduction of coniferous trees in deciduous forests.

Class Reptilia**Order Testudines****Fam. Emydidae**

Emys orbicularis (L. 1758) - IUCN Red List NT, near threatened; strictly protected species in the EU; rare, in stagnant or slow running waters, with shore vegetation, may be affected by habitat destruction, illegal collecting, destruction of clutches by out of control domestic animals, and the introduction of invasive species like *Trachemys scripta*.

Trachemys scripta elegans (Wied-Neuwied 1839) - Nearctic, invasive species, first observed in the reserve in September 2012, possibly reproducing; may have been introduced by irresponsible pet owners or may have escaped from a nearby ornamental, open air pool in Băile Felix spa, which is housing dozens of *T. scripta elegans*, *T. scripta scripta* and *Chrysemys picta* individuals.

Order Squamata**Fam. Lacertidae**

Lacerta agilis argus (Laurenti 1758) - strictly protected species in the EU.

Suborder Serpentes**Fam. Colubridae**

Natrix tessellata (Laurenti 1768) - strictly protected species in the EU; may be affected by habitat destruction, pollution, road traffic and killings by ignorant people.

N. natrix (L. 1758)

Zamenis longissimus (Laurenti 1768) - strictly protected species in the EU; two individuals observed: a killed adult and a sub-adult (70 cm, 210 g).

Class Aves

Order Coraciiformes

Fam. Alcedinidae

Alcedo atthis (L. 1758) - protected by national law; territorial species, lives near clean waters with abundant riparian vegetation, nests in a gallery dug out in the shore; bioindicator of a good condition of the ecosystem, may be affected by degradation or fragmentation of habitats, disturbances during the reproduction interval and pollution.

Order Piciformes

Fam. Picidae

Picus canus Gmelin 1788 (protected by national law) or *P. viridis* L. 1758 (strictly protected by national law).

Order Anseriformes

Fam. Anatidae

Anas platyrhynchos L. 1758 - occurs in shallow waters, max. 1 m deep.

Order Gruiformes

Fam. Rallidae

Gallinula chloropus (L. 1758)

Order Galliformes

Fam. Phasianidae

Phasianus colchicus L. 1758

Order Passeriformes

Fam. Acrocephalidae

Acrocephalus arundinaceus (L. 1758)

Fam. Aegithalidae

Aegithalos caudatus (L. 1758)

Fam. Corvidae

Pica pica (L. 1758) - large distribution area, including urban areas.

Garrulus glandarius (L. 1758) - occurs in mixed forests, recently also in urban areas because of habitat destruction.

Order Cuculiformes**Fam. Cuculidae**

Cuculus canorus L. 1758

Order Pelecaniformes**Fam. Ardeidae**

Nycticorax nycticorax (L. 1758) - protected by national law.

Order Falconiformes**Fam. Falconidae**

Falco tinnunculus (L. 1758) - strictly protected by national law.

Class Mammalia**Order Soricomorpha****Fam. Talpidae**

Talpa europaea L. 1758.

Conclusions

Of the 83 species observed, 17 have a certain degree of protection status, and 3 are invasive. 26 Odonata species were recorded (10 Zygoptera and 16 Anisoptera), and 10 of them were observed for the first time in the reserve, when

compared to the only other faunistical reports for the area (Lehrer & Bulimar 1979, Mancu 2012), including *Pyrrhosoma nymphula*, which is rare in Romania.

The presence and probable establishment of 3 Mediterranean and one African species may be linked to a trend of climate warming in Europe. The influence of climate warming on damselfly and dragonfly distribution can be seen also in the area of Belarus and Poland through the expansion of Mediterranean species (Buczyński & Moroz 2008). Though, the well represented *L. fulva*, a species affected by higher water temperature, may be correlated with the recent, dramatic decrease in the thermal spring flow.

A similar correlation occurs from the dominance of semiaquatic Hemiptera species preferring shallow waters over those preferring deeper waters. Therefore, should legal measures not be taken by the authorized institutions, the survival of the ecosystem in the „Pârâul Pețea” reserve seems extremely problematic, when taking into account the recent cease of the thermal spring flow, the surrounding anthropic pressure and the three invasive species recently observed.

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