

*-Document translated from Romanian-*

**Biodiversity study required to substantiate the Hipodrom  
Municipal Park Design Competition. Urban regeneration  
project of the Hipodrom - Municipal Park - Mures Riverbank  
Turbinei Channel**

- final report -

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## A. CHIROPTERS

### Working methodology

The assessment of the presence of bat species in the project area was carried out by recording ultrasounds with automatic recording detectors (AudioMoth), placed in 9 locations (Fig. 1.), for consecutive nights, respectively during the periods:

- 11-14.06.2022 (3 consecutive nights)
- 20-25.07.2024 (5 consecutive nights)
- 14-16.08.2024 (2 consecutive nights)

The detectors were placed near water bodies, namely the Mures and/or the Mures channel, on trees, etc. The ultrasound analysis was performed automatically, with Kaleidoscope Pro 5.4.8 (Wildlife Acoustics), using the conservative setting. The automatic analysis was followed by manual verification of all ultrasounds, to adjust automatic/atypical identification errors. In several cases, Barataud (2015) was used for accurate identification. The presence and frequency of bat species is quantified (Table 1.) by the number of passes (in front of the detector), but which does not correspond to the number of specimens, it only denotes the intensity of activity.



**Fig. 1.** Map of the location of the 9 automatic ultrasonic detectors (blue) placed during the study period (June - August), in the project area (orange).



## Description of important/assessed species

The assessment identified 10 bat species (descriptions taken from Jéré et al. 2010), namely:

- **The broad-winged bat** (*Eptesicus serotinus*)

Medium-sized, robust species with a forearm of 48.0-58.0 mm. The snout is broad and robust. The tragus is broad, and the ears are quite long. The fur on the back can be dark brown to yellowish-brown or golden-brown. On the ventral side, the fur is generally lighter gray-brown. Blackish snout and ears. The last two vertebrae are not included in the uropatagium. Summer shelters are almost exclusively in buildings, in their attics or in wall cavities. Birth colonies are rarely located at altitudes above 800m. Usually hibernate in buildings, in cracks in the attic, wall cavities; more rarely, solitary specimens, or groups of a few individuals can also be found in caves, in their cooler areas. It uses a wide variety of habitats. It hunts at the edge of forests, in parks, gardens, wooded pastures, over agricultural lands, along vegetation located on the banks of water; in many cases, in localities, it is observed hunting around lighting poles with white light.



**Fig. 2.** Broad-winged bat, hibernating (photo: Szilárd-Lehel Bücs).

- **Savii's bat** (*Hypsugo savii*)

Small species. The last vertebra or two vertebrae are not included in the uropatagium, which they exceed by 4-5 mm. Epiblema narrow, sometimes even absent. Ears, face and wing membrane black, darker than in any European species of the genus *Pipistrellus*. Dorsal fur long and dark, with light golden tips, contrasting with the white ventral fur (in adults; juveniles are more uniform, brownish or dark gray, without light-tipped hairs). Short tragus slightly widened at the top. The length of the frontal margin of the tragus is almost equal to its maximum width. Ear tip

broadly rounded. LA: 31.4-38.0mm. Tragus sometimes with two overlapping indentations at the base of the outer margin. Characteristic penis morphology, differentiating it from all representatives of the genus *Pipistrellus*: relatively small penis, with a slightly swollen distal extremity. Between the proximal and distal parts, it presents a characteristic curvature, in the form of a right angle. The upper canine (C1) and the second upper premolar (P4) come into contact. Specimens of the species take shelter in cavities of buildings, in rock crevices, cracks located in the entrance area of caves, sometimes in the structure of bridges. It hunts over pastures, meadows, water surfaces, bushes, in settlements, around lighting fixtures; it shows good adaptation to the anthropogenic environment, sometimes being frequent in large cities. It has a fast flight, sometimes at considerable heights, with much rarer changes of direction than in the case of *Pipistrellus* species.



**Fig. 3.** Specimen of *Hypsugo savii*, captured (photo: Ildikó Gönczi Vass).

- **Water bat (*Myotis daubentonii*)**

Medium-sized species. The plagiopatagus is inserted between the heel and the middle of the foot, sometimes closer to the base of the first toe. Tragus long, reaching half the length of the ear, straight or slightly curved, but never S-shaped. Fur on the dorsal side shiny brown. Tibia and uropatagium without bristles. LA: 33.1-42.0mm. Penis straight or slightly widened towards the tip. It is a species frequently found near lakes, ponds and rivers. Summer colonies take shelter in burrows, less often in buildings near water or in the structure of bridges; very rarely are birth colonies in underground shelters known. It hibernates in underground shelters (caves, mines, cellars), but also in burrows or rock cracks. A fairly flexible species in terms of the habitats used, for which the presence of forests and water is necessary, but without too high demands on them. It generally hunts close to the surface of the water (at a height of 5-40cm), catching insects on the surface of the water. Less often it hunts in forests, parks, over meadows with groups of trees.



**Fig. 4.** Water bat (*Myotis daubentonii*) (photo: Szilárd-Lehel Bücs).

- **Twilight bat** (*Nyctalus noctula*)

It is a large species, with a forearm length of 48.0–58.0 mm. The wings are long and narrow. The fur is velvety, made up of short hairs, reddish-brown in color, slightly lighter on the ventral side. In winter, the fur on the dorsal side has gray-brown shades. It uses burrows as shelters, preferring those made by woodpeckers, generally located at heights of 4–12 m. It is well adapted to the urban environment, appearing even in large cities, where the preferred shelters are cracks in the walls of apartment buildings.



**Fig. 5.** Colony of dusky bats (*Nyctalus noctula*), (photo: Dénes Dobrosi).



It can be found in almost any type of habitat. It is easy to identify, being a large species that hunts at considerable heights (generally 10–50 m). It has a very fast and direct flight. Similar to migratory birds, dusky bats can travel significant distances between summer and winter roosts. In some cases, they can migrate over distances of well over 1000 km. It hibernates in tree hollows, in cracks in buildings or bridges, but also in underground shelters or cracks in rock. It feeds on diptera, lepidoptera, hemiptera, mayflies.

- **Kuhl's Pipistrelle Bat** (*Pipistrellus kuhlii*)

It is a small species. The posterior edge of the ear has a prominent indentation. The ears are usually light brown, not blackish. There is usually a well-defined white stripe, 1–2 mm to 5 mm wide, along the plagiopatagium, between the 5th toe and the foot. The hairs on the dorsal side have a dark base and yellowish-brown or sandy tips. Some individuals have dark brown fur without light tips, resembling *P. nathusii* in coloration. The forearm length is 30.3–37.4 mm. Summer shelters are generally located in buildings, in cracks and cavities located in various parts of the constructions, but also in burrows. It hibernates in cavities located in the outer walls of buildings or in rock crevices. It is a common species in localities, hunting in parks, gardens, over water surfaces, around lighting fixtures. It is well adapted to the anthropized environment and can survive in areas where the landscape structure is strongly modified by man: agricultural lands, deforested areas. It has a fast and very agile flight. In general, it hunts at heights of 2-10m above the ground, and in some cases at much higher heights. It frequently comes out of shelters before sunset.



**Fig. 6.** Kuhl's Pipistrelle Bat (*Pipistrellus kuhlii*), (photo: Alexandra Telea).

- **Nathusius' pipistrelle** (*Pipistrellus nathusii*)

Small species, with a forearm length of 32.0–37.1 mm. The fur extends considerably over the uropatagium, exceeding half of it. The lower part of the uropatagium presents hairs along the tibia. The color of the fur on the dorsal side is dark brown or reddish-brown. Summer shelters are generally located in burrows, cracks or under the bark of trees, but also in buildings. Rarely,

specimens can also be found in the structure of bridges or in rock cracks. The shelters occupied by males during the mating season are frequently located in exposed places: alleys, bridges, tall buildings, observation towers. It hibernates in burrows, but also in cavities of buildings or rock cracks, very rarely in underground shelters. Preferred habitats are mature deciduous forests and meadow forests, but it also occurs in coniferous forests. It hunts most frequently inside or at the edge of forests and over water surfaces. It has a fast, rectilinear flight, less maneuverable than that of the pygmy bat. It frequently flies along linear landscape structures, rows of trees, hedges, watercourses, hunting at heights of 3–20 m, but also lower, above the water. The food consists of diptera, neuroptera, hemiptera, small lepidoptera.



**Fig. 7.** Nathusius' pipistrelle (*Pipistrellus nathusii*) (photo: Levente Barti).

- **Common pipistrelle** (*Pipistrellus pipistrellus*)

It is a very small species, with a forearm length of 29.2–33.5 mm. It has no hairs on the lower part of the uropatagium and along the tibia. The snout is elongated, the glandular bulbs are white, or sometimes whitish-gray. The portion of the patagium between the first joint of the fifth finger and the elbow is not divided by the rib, and the portion of the membrane above is quite short, usually not extending to the forearm. The fur is dense, but not as smooth as in the species *P. pygmaeus* and is dark brown on the back, often rusty, sometimes lighter, pale brown. The ears and muzzle are blackish in color, but some adults have a pale area around the eyes. The face and ears clearly differ from the appearance of the fur, by their dark color.



**Fig. 8.** Colony of common pipistrelle (*Pipistrellus pipistrellus*) (photo: Szilárd-Lehel Bücs).

It is a very widespread and frequently encountered species, adapting well to the anthropic environment. In summer, colonies can be found in tree hollows, in cracks, under bark, in buildings, in bridges, in cracks in walls. It hibernates in bridges or cellars of buildings, cracks in walls, in natural and artificial underground shelters. A very flexible species, it uses a wide variety of habitats. It can be observed hunting both in the center of large cities and in forests, or over water surfaces. It has a fast, agile flight, hunting around the crown of trees, along alleys, hedges, over water surfaces, around lampposts.

- **Soprano pipistrelle** (*Pipistrellus pygmaeus*)

Slightly smaller than the common pipistrelle, LA: 27.7-32.3mm. Prominent ridge between the nostrils. Viewed from behind, the snout is short and straight for about two-thirds of its length, then becomes pointed. Glandular bulbs during the breeding season yellow or orange, the rest of the year only with a tinge of yellow or orange. Ears are shorter, the length of the inner margin is 7-8mm. Skin on the face pale, not covered with hairs, especially between the eyes and ears and around the eyes. Skin of the face and ears not darker than the fur. Fur very dense and silky, on the dorsal side reddish-brown, and on the ventral side yellowish-gray. Ears lighter than in *P. pipistrellus*. As in *P. pipistrellus*, the portion of the patagium between the first joint of the fifth toe and the elbow is not divided by a rib. In addition, the portion above is also undivided in most cases and extends from the fifth toe to the forearm. The penis of adults is conspicuously yellow, during the breeding season becoming orange; the penis always without a pale median stripe. In subadults or juveniles the penis is whitish, often with a yellow tinge, but never brownish and always without a median stripe. In females the skin around the vagina is also orange, more conspicuous during the fertile period. The uropatagium is covered with dense hair in the first third. The second (F3.2) and third phalanges (F3.3) of the third toe are approximately the same size. As in *P. nathusii*, there is a space between the second and third lower incisors (I2 and I3). Main frequency around 55kHz (52-57kHz).





**Fig. 9.** The size of the Soprano pipistrelle (photo: Szilárd-Lehel Bücs).

Summer roosts are in cracks and cavities located in various parts of buildings, in spaces under the roof, or in burrows. During the mating season, exposed shelters, burrows, buildings, observation towers are occupied. In winter, hibernating specimens can be found in buildings or burrows, probably the majority of individuals hibernating in burrows. Preferred habitats are deciduous forests located in river meadows and water surfaces of any size, being much less flexible in terms of habitats used than the pygmy bat. Generally, it hunts over and around water surfaces, near vegetation, at the edge of forests, avoiding agricultural lands and meadows.

- **Gray-eared bat** (*Plecotus austriacus*)

Medium-sized species. Short first toe ( $D1 < 6.5\text{mm}$ ). First toe claw usually shorter than 2mm. Short foot (LP without claws  $< 8\text{mm}$ ). Hair on toes short and straight. Penis thickened and rounded towards the end. Dorsal fur grey, sometimes with a grey-brown tint. LA: 36.5-44.0mm. Protuberance above eye small (diameter smaller than eye). L: 14.0-16.0mm, W  $> 5.4\text{mm}$ . Summer colonies are generally in building attics, solitary specimens can be found in a variety of shelters: different parts of buildings, in the structure of bridges, in rock crevices. Most breeding colonies are located at altitudes up to 550m. Hibernates in building attics, caves, cellars, rock crevices. Being quite tolerant of cold in underground shelters, it can usually be found near the entrance. It is a characteristic species of rural areas, generally hunting in gardens and orchards, over extensively used agricultural areas, consisting of a mosaic of habitats, generally avoiding large forest massifs. It has a slow flight, generally hunting at heights of 2-5m, close to vegetation, but sometimes at heights of over 10m.



**Fig. 10.** Gray eared bat (fotografie: Szilárd-Lehel Bücs)

- **Parti-coloured bat (*Vespertilio murinus*)**

Medium-sized species. The tragus is short and widens at the top, but without becoming mushroom-shaped. Fine hairs are present on the underside of the wing, along the forearm (visible only when the wing is closed). The fur on the dorsal side is dark brown or blackish at the root, having a silvery appearance due to the white tips of the hairs. Ventrally whitish or white, clearly demarcated from the dorsal side. In the case of juvenile specimens and in some adults it is more gray. The plagiopatagium is inserted at the base of the first finger. LA: 41.0-50.3mm. Females have four mammarys. Males with a long and very thin penis. Shelters are generally in buildings, in wall cavities or behind shutters, frequently in constructions located in mountainous areas, but also in tall buildings in localities or rock crevices. It hunts over water surfaces and the vegetation around them, agricultural lands, meadows, in localities frequently around lighting fixtures. The flight is very fast and rectilinear, similar to that of *Nyctalus* species, flying at considerable heights (10-40m).



**Fig. 11.** Parti-coloured bat in hibernation (photo: Szilárd-Lehel Bücs).

All species can be considered urbanized species, being frequently present in human settlements and associated habitats. No species from Annex 2 of the Habitats Directive were identified.

### Presentation of results

Table 1. presents the details of the ultrasound recordings from June to August 2024, respectively the 10 bat species identified in the 9 fixed points with automatic ultrasound detectors. From the bats' point of view, the activity is medium to high, with an average of 288 passes / night in front of the detectors in the 10 nights, with a maximum in the upstream area of the Mures Channel (209 passes / night), followed by the Mures dead arm area and the Paraului street area (both with 144 passes / night). The highest activity of the water bat was also recorded in the upstream area of the Mures Channel, with 26 passes. The lowest value overall was recorded on the Mures Bank (only 30 passes / night), probably due to the lack of vegetation / trees, despite the presence of large water surfaces. The species diversity of the 9 points is similar, with 6-9 species out of the 10 present in each. The most urbanized species (*Hypsugo savii*, *Nyctalus noctula*, *Pipistrellus kuhlii*, *Pipistrellus pygmaeus*) are present in each point.

Although not directly investigated, the presence of hollow trees in the project area contributes to the presence of bat populations. Several species identified during the study frequently resort (e.g. *N. noctula*, *P. pygmaeus*, *M. daubentonii*) to the use of natural hollows (Dietz and Kiefer 2015) for colony formation.

The diversity observed in the project area (10 bat species out of 32 in Romania) can be considered significant, considering the degree of urbanization in the area. In comparison, the Vacaresti

Natural Park in Bucharest, with a much larger surface area (183 ha), is used as a feeding habitat and transit area for at least 8 bat species, with a very similar specific composition to the project area, and, respectively, a majority of urbanized species. The diversity and specific composition of the project area are also very similar to the proposed urban protected area in Cluj-Napoca, East Park (10 bat species, CCCL 2021).

**Table 1.** Bat activity levels based on ultrasound detector recordings, at 9 fixed points, for 10 nights during June – August 2024, in the project area. The order of the points corresponds to the west – east direction on Fig. 1.

|                                  | AM08<br>Conf.<br>Mures -<br>Channel | AM08<br>Mures<br>Channel | AM07<br>Equestrian<br>Base | AM01<br>Mures<br>Channel   | AM22<br>Paraului         | AM18<br>Mures<br>riverbanks | AM08<br>Municipal<br>Park  | AM21<br>Chamber of<br>Accounts | AM18<br>Desp. Mures -<br>Channel | Total        |
|----------------------------------|-------------------------------------|--------------------------|----------------------------|----------------------------|--------------------------|-----------------------------|----------------------------|--------------------------------|----------------------------------|--------------|
| <b>Total number of passes</b>    | N 46.54196<br>E 24.52898            | N 46.54485<br>E 24.54219 | N 46.54739<br>E 24.542532  | N 46.545643<br>E 24.548313 | N 46.54469<br>E 24.55075 | N 46.55204<br>E 24.54765    | N 46.549411<br>E 24.551387 | N 46.55267<br>E 24.55659       | N 46.558416<br>E 24.566159       |              |
| <b>No. of nights</b>             | 220                                 | 205                      | 526                        | 432                        | 289                      | 61                          | 288                        | 231                            | 628                              | <b>2880</b>  |
| <b>Passages / night</b>          | 3                                   | 2                        | 5                          | 3                          | 2                        | 2                           | 5                          | 2                              | 3                                | <b>10</b>    |
| <b>No. of species</b>            | 73.3                                | 102.5                    | 105.2                      | 144.0                      | 144.5                    | 30.5                        | 57.6                       | 115.5                          | 209.3                            | <b>288.0</b> |
| <b>Species</b>                   | 8                                   | 8                        | 8                          | 9                          | 7                        | 9                           | 6                          | 6                              | 8                                | <b>10</b>    |
| <b>Total number of passes</b>    | <b>No. of passages / species</b>    |                          |                            |                            |                          |                             |                            |                                |                                  |              |
| <i>Eptesicus serotinus</i>       | 1                                   | 1                        | -                          | 18                         | 1                        | 1                           | -                          | -                              | 2                                | <b>24</b>    |
| <i>Hypsugo savii</i>             | 2                                   | 5                        | 21                         | 9                          | 33                       | 1                           | 2                          | 25                             | 5                                | <b>103</b>   |
| <i>Myotis daubentonii</i>        | -                                   | -                        | 3                          | 4                          | -                        | -                           | -                          | 6                              | 26                               | <b>39</b>    |
| <i>Nyctalus noctula</i>          | 1                                   | 9                        | 78                         | 39                         | 61                       | 2                           | 96                         | 34                             | 64                               | <b>384</b>   |
| <i>Pipistrellus kuhlii</i>       | 29                                  | 24                       | 60                         | 51                         | 28                       | 18                          | 81                         | 3                              | 195                              | <b>489</b>   |
| <i>Pipistrellus nathusii</i>     | 48                                  | 103                      | 185                        | 71                         | 114                      | 10                          | 84                         | 145                            | 284                              | <b>1044</b>  |
| <i>Pipistrellus pipistrellus</i> | 85                                  | -                        | 3                          | 3                          | -                        | -                           | -                          | -                              | 14                               | <b>105</b>   |
| <i>Pipistrellus pygmaeus</i>     | 52                                  | 37                       | 153                        | 236                        | 51                       | 27                          | 23                         | 18                             | 38                               | <b>635</b>   |
| <i>Plecotus austriacus</i>       | -                                   | 5                        | 23                         | -                          | -                        | 1                           | -                          | -                              | -                                | <b>29</b>    |
| <i>Vespertilio murinus</i>       | 2                                   | 21                       | -                          | 1                          | 1                        | 1                           | 2                          | -                              | -                                | <b>28</b>    |



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## Conclusions/Proposals

The project area has a typical urban diversity, with 10 bat species identified to date. Water habitats play an important role in the ecology of each species identified. All species identified are urbanized species, roosting is likely in the buildings in the area (including the disused buildings in the middle of the project area, close to the Equestrian Park), as well as in hollow trees along the Mures River, the Mures Channel, and the Mures Dead Arm. For landscaping, from a bat perspective, we recommend consulting Gunnell et al. (2012) and Gunnell et al. (2013), thus increasing the possibility that the area will retain its chiropterofauna, together with the benefits of the presence of bats.

Given that several species of bats in the project area can take shelter in natural cavities, if the development removes such trees from the landscape, the impact may be negative. Thus, it is recommended to preserve **existing trees, especially hollow trees**, in the future development. In the case of cutting down hollow trees for safety reasons, compensation for the loss of natural shelters can be partially balanced by placing artificial bat houses or even complex bat towers. Since this is a relatively small area compared to the flight of bats, the placement of these houses or towers can also be carried out in areas where there are no trees / hollow trees. We note that replacing natural cavities with artificial houses must always be secondary, with the preservation of hollow trees having the main role. Preserving natural elements is most important in the case of the Dead Mures Arm, an area that should benefit from minimal intervention (e.g. just some simple paths), respectively artificial lighting that will allow safe circulation, but not extend over the water surfaces, being limited in the vertical direction (i.e. the treetops should not be illuminated). In addition, as many existing trees as possible should be preserved, as they also mask the artificial street lighting in the immediately adjacent areas.

The highest bat activity in the proposed project area was observed at the water surfaces. Thus, it is very important to preserve sections of the bank **without artificial lighting**. In general, the park design should aim for nocturnal permeability for bats, with unlit color, including unlit connections to habitats / flight routes that cross the boundaries of the design. In the case of installing lighting fixtures, they should be oriented predominantly downwards and in the opposite direction to water areas, to prevent light pollution. In the case of the need to install lighting for safety reasons, these can be in the red spectrum, red light having reduced effects on bat activity (Spoelstra et al. 2017).

As the development of the future Hippodrome Park must connect local communities to the park through alleys / access roads, exactly in this way the bats in the park **area need linear elements** (in the continuous sense, not in the straight sense), to make daily flights from shelter to feeding habitats or to transit the area during the migration period (spring and autumn). At least 2 of the identified species (*N. noctula*, *P. nathusii*) migrate considerable distances of over 1,000 km (Dietz and Kiefer 2015). Thus, the park area also becomes important as a stopover / resting / refueling area with insects. The development of the park must aim to preserve such elements in the area, as well as those elements that ensure connections to habitats that go beyond the park

boundaries. Linear elements can be rows of trees, strips of bushes or shrubs, etc. In the case of planting trees / rows of trees / bushes, they must be connected to existing elements, thus ensuring flight routes for bats and a **general permeability** of the area. Together with nocturnal permeability, preserving linear elements contributes to a functional permeability for bats. For example, the Mures Riverbank could benefit from planting more trees or bushes, thus increasing the diversity of the landscape for bats and for people. But even in this case it is recommended to avoid light pollution of the water surface, i.e. the Mures River.

In general, the project area should (1) limit light pollution and (2) retain existing vegetation as much as possible. Limiting light pollution from artificial street/path lighting would allow bats to continue to be active at night. Otherwise, habitat becomes fragmented, with bats avoiding illuminated areas (except for certain species that prefer to hunt insects that gather in the light). Retaining vegetation allows for the continuity of potential roosts (e.g., holes, tree cracks) used by bats.

In addition, artificial bat houses can be placed (on existing trees, on buildings) or "bat towers" which are free-standing structures, specially created for bats. Such structures can also have an educational role, with information panels about bats and the importance of their presence. The measures listed can contribute both to the protection of the current chiropteroфаuna and to the attraction of other bats. Artificial shelters can also serve as permanent shelters for specimens / colonies that are in danger and need to be translocated / saved.

## Photographic annex

(more photos attached to the report)



The location area of a detector at the Dead Arm of the Mures River.



Location of a detector at the confluence of the Mures River and the Mures Channel.





Location area of a detector in the upstream section of the Mures channel.



The location of a detector on the banks of the Mures River.





The location of a detector in the Municipal Park.



Detector located at the Equestrian Base.





Detector located in the Chamber of Commerce area.



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## **B. ICHTHYOFAUNA**

### **Introduction**

This report is prepared following the request of the Târgu Mures City Hall and aims to prepare a study on the ichthyofauna of the Turbinei Channel in the Municipality of Târgu Mures, Mures County. The importance of such a study is also underlined by the fact that in the specialized literature, with the exception of several publications on the ichthyofauna of the Mures in the area of the Târgu Mures locality (Banarescu 1964, Nalbant, 1995, Nagy & Imecs 2009, Nagy et al. 2023, Nagy 2023a), we did not find any reference to the ichthyofauna of the Turbinei Channel in this locality. Thus, we do not know how the ichthyofauna of this water body evolved, which, over time, went from a natural water body (being the Mures riverbed) to the name of "channel", which indicates a degraded water body. Studies in other localities (Nagy 2023b, Dénes & Kastal 2023) have demonstrated that such water bodies (which have become secondary habitats) can support high aquatic diversity.

### **Bibliographic sources**

Consulting the specialized literature in the proposed study area, we only found information regarding a wider study area (Banarescu 1964, Nalbant 1995, Nagy & Imecs 2009, Nagy et al. 2023, Nagy 2023a,b), without finding any published information referring to the ichthyofauna of the Turbinei Channel or the ichthyofauna of the Poclos stream. Most bibliographic sources refer to the ichthyofauna of the Mures River, in the area of the Târgu Mures municipality (Banarescu 1964, Nalbant 1995, Nagy et al. 2023) or the areas in its vicinity (Nagy & Imecs 2009, Nagy 2023a,b).

Given this fact, the importance of an ichthyofaunistic assessment in the study area is obvious, especially with regard to the ichthyofauna of the Turbinei Channel, which, in the past, was the minor bed of the Mures River, and today has become a heavily modified channel, with some sectors preserved in an almost natural state, and others being heavily modified, with several important fragmentations, areas with concreted banks, etc.

The most affected sector in the study area seems to be the Poclos stream, which in this area has been completely concreted, thus affecting not only the ichthyofauna of this stream, but also the image of the locality. In a very similar situation is the upstream part of the Turbinei Channel, where its banks have been covered with concrete, and the population's access to the water surface has been practically eliminated.



**Picture no. 1-2.** The bed of the Turbinei Channel (upstream area) and that of the Poclos stream without allowing public access to the water surface.



**Map no. 1.** Area studied between 1769-1773. The confluence of the Poclos stream into the Mures river is marked with a red dot.





**Map no. 2.** The area currently studied. The confluence of the Poclos stream into the Turbineci Channel (former bed of the Mures River) is marked with a red dot.

## Working methodology

The fishing procedures and equipment used depend on the water depth at the sample collection site, the target species, etc. In streams, small and medium-sized rivers, sample collection can be done by electronarcosis fishing from the bank or from the riverbed. In medium-sized and large rivers, ichthyofauna sample collection is done from a boat.

### *"Traditional" fishing with electronarcosis:*

Justification for choosing electronarcosis:

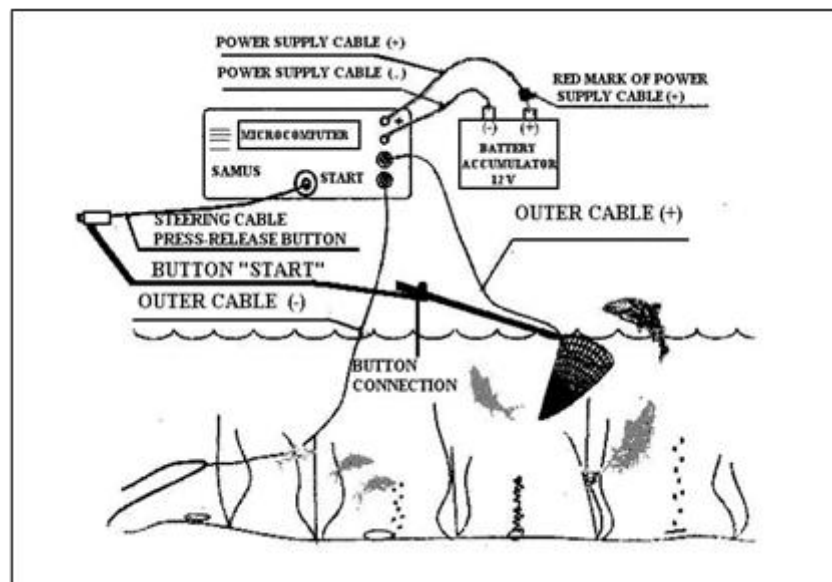
Fish have a nervous system similar to other vertebrates. In the dorsal part, the nerves, emerging from the spinal cord, follow the myomeres and enter the muscles. In the anterior part of the head, a negative charge appears which would explain why the fish are attracted to the anodes. Once entered into the electric field, the behavior of the fish will depend on the spatial positioning of the fish at the initial moment. The expected reaction is to swim involuntarily in a predictable direction (towards the anode). Electrofishing is selective according to size. Larger fish tend to be more vulnerable, due to the electrical gradient, the head-tail voltage. A large fish crosses more field lines than a small one. There is a difference between dimensional selectivity, capture efficiency and mortality. While capture efficiency increases with the length of the fish, mortality depends mainly on the response to the length and frequency of the pulses. If the electronarcosis device is well set, mortality is close to or even 0. In the case of flowing waters, the use of electronarcosis brings the best results, because no other accepted method detects almost completely the fish fauna in a collection station.

Fish sampling using electricity is carried out according to the European standard SR EN 14011. Electrofishing or electronarcosis is a fishing method that is based on the interaction between electric current and the nervous system of fish. In the case of fish, the nervous system operates on the basis of electrical impulses. Electrical impulses are transmitted from the brain

through nerves that exit the dorsal part of the spinal cord and enter the muscles. As a result of the physiology of the nervous system, a negative charge appears in the anterior part of the head in fish, which could explain why fish are attracted to anodes. Electrofishing aims to interfere with the neural transmission pathway between the central nervous system and the fish's muscles. By blocking the internal signal and overcoming it with the artificial signal, electrofishing redirects the neural signal and the muscle reaction. The effect is involuntary swimming in the direction of the anode. The orientation of the fish in the electric field determines how it is affected, with the strongest effect being when the fish is placed perpendicular to the field lines and with its head facing the anode. Fish in a continuous electric field move towards the anode and, once near it, enter a state of electronarcosis, lying on their side and thus being very easy to identify. This state is reversible and ceases one to two minutes after the fish is removed from the electric field, in some cases much more quickly.

The European standard CEN/TC 230 Water analysis establishes the method for assessing the specific composition, abundance and diversity of fish communities in rivers, lakes and coastal waters, with the aim of qualifying their ecological status. These norms standardise the methods of collecting fish, so that the results obtained by different researchers are comparable. This document presents an electrofishing method that can be used in fish identification, with the aim of characterising the species richness, composition, abundance and age structure of fish communities.

The main components of an electronarcosis device are the power supply, the control panel, the cables, the safety switches and the electrodes. Direct current (DC) or pulsed direct current (PDC) can be used for electrofishing. Alternating current is very harmful to fish, for this reason it is not used.



**Fig. no. 12.** Operation of the electronarcosis device.

All fishing equipment that generates electricity must comply with CENELEC and IEC standards and comply with current European legislation. These devices must be capable of

outputting the desired voltage and amperage throughout their operating time. Portable devices that are carried on the back during operation must meet the following conditions:

- have automatic systems to cut off the electricity when the button is pressed the switch is not pressed,
- to be light, so that they can be carried without much effort by the person carrying them
- have batteries that do not spill their contents

Taking into account the characteristics of the Turbine Channel in the study area, the collection of ichthyofauna data from the area of interest was carried out with the electronarcosis device, from the riverbed (by "wading"), as an appropriate methodology for the assessment and monitoring of fish species in the study area, with the exception of the upstream sector of the Turbine Channel and the dead arm, where the assessments were carried out from the belly, due to field conditions. All identified fish were released immediately after identification.

#### **Sample collection procedures and location:**

The sample collection location is chosen depending on the width and depth of the river, as follows:

- in small rivers, samples are fished in the riverbed
- in larger rivers, samples are collected near the banks and in the riverbed, where possible, and, if necessary, a boat is used to collect ichthyofauna data

In each case, the sample size must be large enough to include the dominant species and to encompass the complete set of species characteristic of the river in question, in order to ensure representativeness of the respective fish community (Pricope et al. 2004). Fish sample collection is carried out by a minimum of 2 people. In our case, 3 people participated in the collection of ichthyofauna data. The collection of ichthyofauna samples is standardized, thus, samples taken from similar collection points can be compared.

In addition to the above, checking catches from fishermen can provide valuable information about the presence of species that are more difficult to identify with the method described above.

#### **Constraints regarding the method presented above:**

One of the most important limitations of this method is that the range of action of the electronarcosis device is quite small (1-1.5 m). If the range of action of the electronarcosis device is increased, some of the shocked fish will not survive. For this reason, this range cannot be increased. This problem occurs in the case of any electronarcosis device and cannot be avoided.

Another limitation of this method is its use in turbid waters. In this case, shocked fish cannot be observed and collected by the evaluators. For this reason, the collection of ichthyofauna samples should be carried out, as far as possible, during a period when the water transparency is good enough to be able to observe as many of the shocked individuals as possible. Also, the high water level makes the assessments difficult, the results obtained in this case should be treated with caution.

#### **Number and size of fishing areas:**



We consider that in the project area of interest, if the assessment is carried out from the riverbed, the station length should be 100-150 m, if the ground conditions allow this.

**Collection period:**

The sampling period should be chosen according to the biology of the target species. In most cases, sampling can be carried out from spring (after the flood waters have receded) until the end of the growing season (summer-autumn), when the juveniles are large enough to be identified using electronarcosis. The ideal period for data collection is usually between July and October, which depends largely on weather conditions (for example, spring floods may still persist in July or quite cold periods may occur in October, each of which reduces the efficiency of the assessments).

The current assessments were conducted on September 3, 2024.

**Identification of specimens:**

Fish are identified based on the literature (Banarescu 1964, Gyurkó 1973, Pintér 1989, Kottelat & Freyhof 2007). All identified fish are released in the area near the identification site.

**Field form:**

The field form contains important information on which inventory reports can be prepared.

**Processing the collected data and developing the study:**

The data collected in the field were entered into OpenFishMaps databases (<https://openfishmaps.ro/>).

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## Description of Natura 2000 fish species identified in the assessed areas

*Aspius (Leuciscus) aspius*– common dace (Natura 2000 code: 1130)



A species with a fairly wide distribution in Romania, Telcean & Banarescu (2002) categorizes it among the species that have maintained their distribution area and abundance in recent years.

**Description and identification.** The body is elongated, slightly compressed laterally. The dorsal profile of the head rises smoothly, but immediately behind the head the profile rises abruptly, forming a kind of hump. The anal margin is strongly concave. The caudal is deeply hollowed, with approximately equal lobes. The scales are thin, but well fixed, with obvious striations, they cover the isthmus entirely. Usually reaches 30-40 cm, but can reach 80 cm.

**Color.** The back is dark olive, slightly blue below, the flanks are silvery, the ventral face is white. The dorsal and caudal are gray, the ventral and anal fins are colorless or pale reddish, the pectoral fins are colorless. The lips are whitish.

**Ecology and behavior:** It lives both in lowland rivers up to the hilly area, as well as in large ponds and fresh or brackish lakes, less often in the sweetened parts of the sea. A good part of the specimens in the Danube enter ponds for reproduction and retreat when the waters recede, others remain in the Danube, and others are sedentary in ponds. They ascend rivers during reproduction. The young feed initially on plankton; older young and adults feed almost exclusively on fish. Reproduction takes place in March-April, until May. They ascend rivers during reproduction. They lay their eggs on the hard bottom.

### **Distribution area:**

**Globally:** Central Europe from the Rhine to the Urals and north of the Alps and Dinaric Alps. Found in the Struma, Maritsa, northern Asia Minor and the Caucasus.

**At national level:** The Danube along its entire length and all the ponds of the floodplain and the delta. The Razelm complex, the coastal lakes Siutghiol, Tabacarie, Tasaul, Mangalia, rarely in the sweetened parts of the sea, the Tisa, Someș from Dej, the Crisul Repede from Oradea, the Mures from Ideciu de Jos (Reghin river), the Bega from the Lugoj district and its tributary Beregsau to Sacalaz, then the Subuleasa channel and the Helesta pond near Timisoara, the Timis upstream from Lugoj, the Cerna from the Baile Herculane railway station, the Jiu from Filiasi, the Olt in Tara Barsei, Vedea from the Slatina district, the Arges from Pitesti to the mouth, the Neajlovul to Comana. In Ialomita from Dridu (Urziceni river) to the mouth. Herestrau Lake near

Bucharest, Snagov and Caldarusani lakes. In Siret and Prut along their entire course in the country, in Suceava, Moldova, the Moldavian Bistrita near its mouth (Banarescu 1964).

**Protection status:**

1. Habitats Directive – Council Directive 92/43 EEC, Annex II and V.
2. Bern Convention – Law No. 13 of March 11, 1993 for the accession of Romania to the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on September 19, 1979 – Annex III.
3. Law 462/2001 on the regime of protected natural areas, conservation of natural habitats, wild flora and fauna, Annex III.
4. GEO No. 57/2007 on the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna, Annex 3.
5. IUCN - LC

***Barbus petenyi* – purple barbel/Petényi's barbel** (Natura 2000 code: 5266)



Given that the purple barbel has been divided into four species in recent decades, based on genetic characteristics, and that these species cannot be distinguished with certainty based on morphological characters, we will treat these species together. Most of the data in the literature also refer to these species together. The species is widespread in most of the country in the rivers of the mountain area and the upper part of the hilly region. Telcean and Banarescu (2002) mention it among the species that have maintained their distribution area and abundance in recent years. According to the results of the most recent genetic studies (not yet published), the species *Barbus petenyi* is present in the Mures basin.

**Description and identification:** Medium size; elongated and round body; rounded abdomen; large head; small eyes; long and prominent snout; elongated preorbita; lower semilunar mouth; fleshy lips, especially the lower one which is divided; two pairs of whiskers, one shorter at the tip of the snout and the other longer at the corners of the mouth; caudal peduncle compressed laterally; caudal deeply hollowed; scales with divergent striations on the visible side; complete lateral line weakly arched and arranged on the middle of the caudal peduncle; pharyngeal teeth

in 3 rows, sharp, bent at the tip, with an excavation at the base of the crown; short intestines; colorless or brown peritoneum. The last simple dorsal ray is thin and flexible; the insertion of the ventrals located behind the anterior end of the dorsal insertion; long, recumbent anal reaches or almost reaches (sometimes exceeds) the base of the caudal; on the back it has dark spots. At maturity it grows to a length of 15 - 20 cm.

**Habitat:** It lives exclusively in rivers and streams in the mountain region and the upper part of the hilly region; in most rivers that spring from plateau or hill areas it is absent even from their upper course which is fast. It lives both in stony, fast and cold rivers, and in some more muddy streams, which heat up strongly in summer, but only in the mountains. It shows preference especially for sections with strong current and stony bottom.

**Ecology and reproduction:** It lives only in fresh water. Reproduction takes place in spring, sometimes extending until the end of summer. Benthopelagic. It feeds primarily on benthic aquatic invertebrates (ephemeroptera, trichoptera, gammarids, oligochaetes, etc.) less often on plants or detritus (Banarescu 1964).

**Distribution:**

**Globally:** It is present in the Danube, Dniester, Odra, Vistula and Vardar Basins and northern Poland.

**At national level:** the mountain course of all rivers that originate in the mountains (except Begheiul and Timis), starting from the trout area.

**Anthropogenic pressure factors:** Poaching, extraction of granular materials (sand, ballast, etc.) from minor riverbeds, pollution of watercourses, multiplication of dams, construction of micro-hydropower plants, logging, cutting down trees on the riverbank, decreasing river flow through capture, flood prevention and development works (placing compensation weirs, riverbed recalibration, excavations in minor riverbeds) contribute to habitat degradation, thus potentially endangering blue barbel populations.

**Protection status:**

1. Habitats Directive – Council Directive 92/43 EEC, Annex II.
2. GEO No. 57/2007 regarding the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna.
3. Law No. 13 of 1993, Annex III (by which Romania is a party to the Berne Convention).
4. According to the IUCN list, it is classified as Least Concern (LC). It is stated that the species is abundant in ideal habitats for it, but its decline is expected due to economic development.

***Romanogobio uranoscopus* – Danubian gudgeon** (Natura 2000 code: 6145)



It is an endemic species of the Danube Basin.

**Description and identification:** Body elongate, thick, cylindrical, not compressed laterally. Thickness slightly less than height. Dorsal profile slightly convex, ventral profile horizontal. Snout pointed, almost always longer than the postorbital space. Eyes looking more upwards. Mustaches much more developed than in other species of the genus. Ventrals insert exactly below the insertion of the dorsal or slightly further back. The tip of the pectorals sometimes exceeds the insertion of the ventrals, sometimes does not even touch it. Caudal deeply hollow, its lobes rounded, equal, or the lower one very slightly longer. Dorsal margin slightly hollow. Anus closer to the anal than to the ventrals. Chest and isthmus completely covered with scales.

**Color:** The dorsal side is gray-green or reddish brown; the dorsal scales have a black border. Behind the dorsal side, there are 2-3 large, very obvious blackish spots, which give a furrowed appearance. On the sides of the body, there are 7-10 large, round, rarely elongated spots. The ventral side is yellowish-white. At the base of the caudal fin, there are two very obvious white spots. On the scales of the lateral line, there are two small, weakly pronounced black dots. On the radii of the dorsal and caudal fins (rarely also of other fins), there are two rows of black spots, weaker than in *Gobio gobio*.

Dimensions: Up to 10.5 cm without caudal fin, 12.3 cm total length.

Variability: Coloration varies widely even within the same population.

**Ecology and behavior:** It lives in mountain and hill rivers, locating itself at fords and rapids, where the water has a speed of 70-115 cm/s, and the bottom is rocky. Sometimes it reaches the lowlands, but only in rapids. The fry stay in slower water, sometimes on sandy bottoms. Although many individuals are found in certain rapids, they never form true schools. The food consists of bioderma and small rheophilic invertebrates. Reproduction takes place in May-June; the eggs are deposited on stones. Sexual dimorphism is manifested only by the greater thickness of the female's body and the greater length of the paired fins in males.

**Distribution:**

**Globally:**endemic species for the Danube Basin.



**At national level:** In Romania it is present in the mountain and hill sections of all larger rivers that originate in the mountains.

**Protection status:** According to the IUCN list, it is classified as Least Concern (LC), with the specification that the species is sensitive to various pollutions and dam constructions. The species is present in the Red Book of Vertebrates of Romania, being included in the vulnerable category.

1. Habitats Directive – Council Directive 92/43 EEC, Annex II.
2. GEO No. 57/2007 regarding the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna.
3. Bern Convention – Law No. 13 of March 11, 1993 for the accession of Romania to the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on September 19, 1979 – Annex III.
4. According to the IUCN list, it is classified as Least Concern (LC), with the specification that the species is sensitive to various pollutions and dam constructions. The species is present in the Red Book of Vertebrates of Romania, being included in the **vulnerable** category.

***Romanogobio vladykovi* – The Danube whitefin gudgeon (Natura 2000 code: 5329)**



A species with a wide distribution in Romania, it is the most common of the 3 *Romanogobio* species of community importance. *Telcean & Banarescu* (2002) categorizes it among the species that have expanded their range or become more abundant in recent years.

**Description and identification:** Body and caudal peduncle relatively tall and laterally compressed. 7, exceptionally 8 rays divided dorsally. Mustaches generally reach the posterior margin of the eye. Caudal peduncle slightly laterally compressed, the minimum height being slightly greater (rarely equal) to the thickness of the peduncle at the level of the posterior end of the anal fin. Caudal deeply hollowed, its upper lobe longer than the lower one. Usually reaches up to 10 cm. It can be confused with the species *R. kesslerii*, *R. uranoscopus* and *Gobio gobio*).

**Color:** The upper side is light yellowish-gray, the dorsal side of the head is darker gray, with darker spots and stripes. On the sides 7-8, rarely 6 or up to 12 round spots, smaller than in the other species of the genus. The scales of the lateral line have two very weakly pronounced black spots. On the dorsal and caudal radii two rows of very pale black spots. Sexual dimorphism is weakly marked.

**Ecology and behavior:** It lives in the Danube and the lower reaches of rivers with sandy or clay bottoms. It is located in places with somewhat deeper water and weak current. It avoids places with faster water. It lives more solitary, sometimes in small schools. It consumes bottom fauna, especially diatoms, small mayfly larvae, and other animals in the sand. Reproduction takes place in May and June.

**Distribution area:**

**Globally:** The Danube basin from Bratislava to the mouth.

**At the national level:** The Danube from the entrance to the country to the mouth (including the Borcea branch and the three branches of the delta). It occasionally enters some ponds of the Danube: it has been reported in the Potelu pond (Oltenia), the Calarasi and Galatuiul ponds near Calarasi, then Oltina and Bugeac (in Dobrogea). The Tur River (Satu Mare district), Somes from about 10 km upstream of Satu Mare downwards, the Crasna from Acas (Carei river), the Beretau from Nusfalau (Simleu river) downstream. The Crisul Repede at Toboliu (Oradea river), the Crisul Negru at Tinca (Salonta river) and the Teuz stream, the Crisul Alb at Chisinau-Cris. The Mures from Teius, frequently only from Radna downstream, among the tributaries, only in Tarnava Mare at Blaj. In Bega from Balint (Lugoj river) downstream. In Timis from the Costeiu dam (Lugoj river), frequently from Albina (Timisoara river) downstream, in the Surgan stream at the confluence into Timis, in Poganici from Otvesti (Timisoara river) until the confluence into Timis. In Caras from Coveni (Oravita river) until the exit from the country. In Berzasca and Cerna at the confluence with the Danube. In Olt from Segarcea (T. Magurele river), in Vedea from Smardinoasa, Zimnicea district, in Arges near Bucharest, in Ialomita from Tandarei (Fetesti river), in Siret from Liesti district until the confluence into the Danube (Banarescu 1964).

**Protection status:**

1. Habitats Directive – Council Directive 92/43 EEC, Annex II.
2. Bern Convention – Law No. 13 of March 11, 1993 for the accession of Romania to the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on September 19, 1979 – Annex III.
3. Law Law 462/2001 on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna.
4. GEO no. 57/2007 regarding the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna, annex. 3.
5. IUCN – LC

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***Rhodeus (sericeus) amarus* – European bitterling** (Natura 2000 code: 5339)



A species with a wide distribution in Romania. Telcean and Banarescu (2002) categorizes it among the species that have maintained their distribution area and abundance in recent years.

**Description and identification:** The body is tall and strongly compressed laterally. The dorsal and ventral profile is convex. The mouth is small, subterminal, semilunar, its opening reaches below the nostrils. The lips are thin and entire. The peduncle is short and compressed laterally. The dorsal margin is slightly convex. The pectorals are short, rounded at the tip. The scales are large, much taller than long, persistent. The lateral line is short. It usually reaches between 30-60 mm in length without the caudal and 38-72 mm in total length. The maximum waist is 78 mm.

**Color:** The dorsal part of the body is yellowish-gray, sometimes greenish, the flanks white, without metallic luster, the dorsal and caudal gray, the other fins red. Along the posterior half of the body and the caudal peduncle a very obvious greenish stripe. During the breeding season the male acquires a particularly beautiful color: the operculum and the anterior part of the abdomen orange or pink; the stripe along the body becomes emerald green, the anal red.

**Ecology and behavior:** It lives exclusively in fresh waters. It prefers stagnant or slow waters, but it can also be found in full flow up to the mountain area of rivers. Its spread is linked to the presence of the lamellibranchiata Unio or Anodonta. Reproduction begins at the end of April and extends until August. This takes place in batches, with each female laying eggs several times during a season. With the help of the ovipositor, the eggs are laid in the gill cavity of the lamellibranchiata from the genera Unio and Anodonta. Larval development, until the resorption of the yolk sac takes place in the paleal cavity of the lamellibranchiata. The larva attaches to the host's gills with the help of outgrowths of the yolk sac. Egg hatching and larval development take 30-40 days. When it leaves the paleal cavity of the mollusks, the young measure 7-8 mm. Sexual maturity is reached at the age of one year, when the body reaches a length without the caudal fin of 30-35 mm. It feeds on filamentous and unicellular algae, remains of higher plants, and detritus; it also ingests animal organisms by chance. – Banarescu (1964).

**Distribution area:**

**Globally:** Europe from eastern France and from the Alps and Dinaric Alps to the Urals and Caucasus. It exists in Macedonia, the territory south of the Danube, between the Euxine Pontus (Black Sea), the Propontis (Sea of Marmara), the Aegean Sea, the Mesta (Nestus) River and the Morava (Margus) River, bordering on the west with Illyria and Macedonia, northern Asia Minor.

**At the national level:** It can be found in the Danube from Bazias to the mouth and most of the floodplain and delta ponds. It is absent in Razelm, abundant in Lake Tabacaria, north of Constanta, probably also in the other coastal lakes. It is found in most rivers and especially in the dead arms and ponds along them: Tisa and Iza at Sighet, Tur in Satu Mare district. In Somesul Mare at Beclean, Somesul Mic downstream of Gherla, Crasna near Carei, Beretau in Marghita district, Crisul Repede upstream of Oradea, Crisul Negru upstream of Sudrigi, Beius district, Crisul Alb upstream of Sebis until it leaves the country, then its tributary Risculita in Brad district. In the Crisurilor collector channel and in the Cefa ponds, in Mures in Toplita district, in Tarnava Mare from upstream of Blaj to the mouth. In the ponds at Zaul de Campie, Taga and Taureni in the Transylvanian Plain. In Bega in Lugoj district, Timis from Caransebes downstream, the Beregsau tributary of the Bega river, Sargan and Poganici streams (tributaries of the Timis), from the springs to the mouth. The Subuleasa channel and the Helestau pond near Timisoara. Caras from Carasova (incorporated into the city of Resita), Nera from Bozovici to the mouth. In Cerna only at the mouth. In Jiu from Targu Jiu district to the mouth, between the tributaries in Cibin, in Hartibaci and in the neighboring ponds (Sibiu district). In Vedeia and Teleorman it is absent in the upper course, very abundant in the lower one. In Arges known only at the mouth, in Dambovită near Bucharest, in Colentina and its tributaries from the springs. Frequent in Neajlov and its ponds at Comana (Giugiu river), the Sabar river near Bucharest, the ponds at Nucet (Targoviste river), all the lakes in Bucharest. In Ialomita from Dridu (Urziceni river) to the mouth, in Calmatui in the Faurei district. Frequent in the Snagov and Caldarusani lakes. In Siret and Prut on the entire Romanian section, Suceava in the Radauti district, Moldova in the Falticeni district, Bistrita Moldavian in the Piatra-Neamt district to the mouth. Milcov from Focsani, Putna from the confluence with Milcov to the mouth. Barlad and its tributaries from the source area to the mouth (Banarescu, 1964). In the river basin: Danube, Tisa, Mures, Bega, Timis, Caras, Nera, Jiu, Olt, Dambovită, Colentina, Neajlov, Ialomita, Siret, Prut (Banarescu and Banaduc, 2007).

**Protection status:**

1. Habitats Directive – Council Directive 92/43 EEC, Annex II.
2. Bern Convention – Law No. 13 of March 11, 1993 for the accession of Romania to the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on September 19, 1979 – Annex III.
3. Law 462/2001 on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna. Annex 3.
4. GEO no. 57/2007 regarding the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna. Annex 3.
5. IUCN - LC



***Cobitis elongatoides* – Danubian Spined Loach** (Natura 2000 code: 5297)



A species with a wide distribution in Romania. Telcean & Banarescu (2002) categorizes it among the species that have maintained their distribution area and abundance in recent years.

**Description and identification:** Body thick or moderately compressed laterally. Scales generally imbricated. Lateral pigmentation consists of 4 different longitudinal zones, of which the lower one is formed by obvious lateral spots. The only spot at the base of the caudal fin is black or brown. Dorsal and ventral profiles almost horizontal. The suborbital spine is located in front of and below the anterior half of the eye, with the two branches of the spine moderately divergent, the short branch is about half the length of the long branch. The two halves of the lower lip are subdivided by several furrows, generally shallow, into 3-4 lobes each. The caudal peduncle has in its posterior part a dorsal and a ventral carina, the latter more developed. The insertion of the ventral is located slightly behind that of the dorsal. The caudal fin truncate or slightly concave, the pectorals and ventrals rounded.

The scales are imbricated, suboval, with a small and eccentric focal area. The lateral line is short, generally not exceeding the pectoral. The black spot at the base of the caudal is vertical. Possible confusion with other species: The Zvarluga can be confused with the eel (*Misgurnus fossilis*), the face (*Sabanejewia balcanica*) or the barbatula (*Barbatula barbatula*). It is clearly distinguished from the barbatula by having a laterally flattened head, suborbital spines and a black spot at the base of the caudal peduncle (Banarescu 1964).

**Color:** Background yellowish-white. Small, close-set dorsal spots in variable number. The lateral pigmentation of the body consists of four 4 areas: two intermediate pigmentations, which consist of fine and close-set punctuations, the laterodorsal one of narrow spots, and the lateral pigmentation of square spots, in variable number. In many specimens, the elongated spots of the laterodorsal pigmentation unite to form an almost continuous stripe, and the lateral spots come very close to each other. At the base of the caudal fin, in the upper corner, there is a very obvious black spot. Head with small spots and an oblique stripe from the nape to the mouth (Banarescu 1964).

**Ecology and behavior:** It lives in slow-flowing waters with sandy, clayey, muddy, and rarely stony bottoms, as well as in stagnant waters, but generally avoiding very muddy ones. In ponds

it is found mainly on hard, sandy or clayey bottoms. It often buries itself completely in mud or sand. It forages mostly at night. Reproduction occurs in spring, and the eggs are adhesive. The food consists of worms, insect larvae, and algae.

**Distribution area:**

**Globally:** The Danube Basin, the upper part of the Elbe River Basin and the Oder Basin.

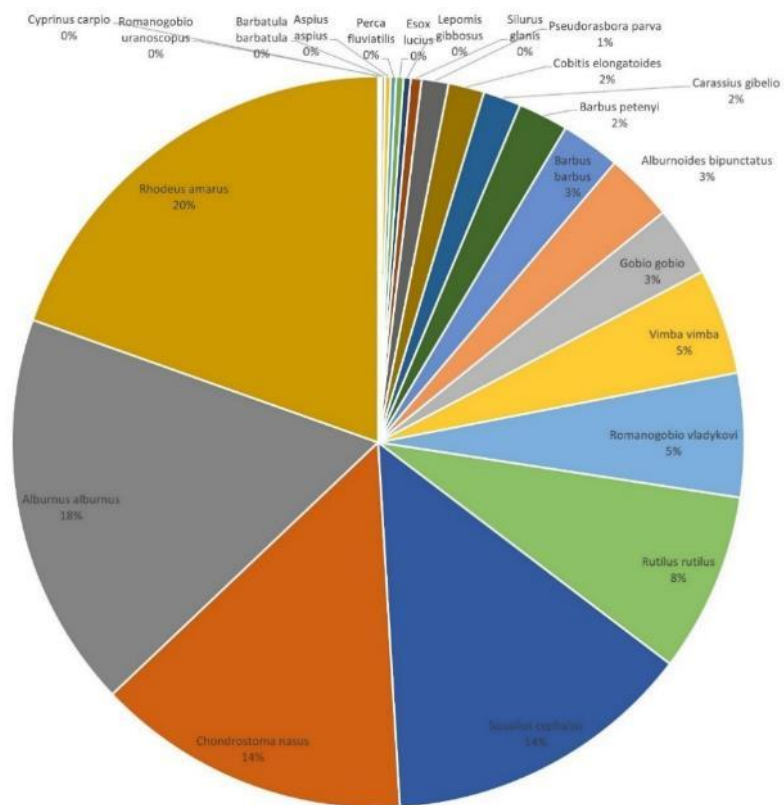
**At national level:** Present in most rivers in the country in the hilly and lowland areas.

**Protection status:**

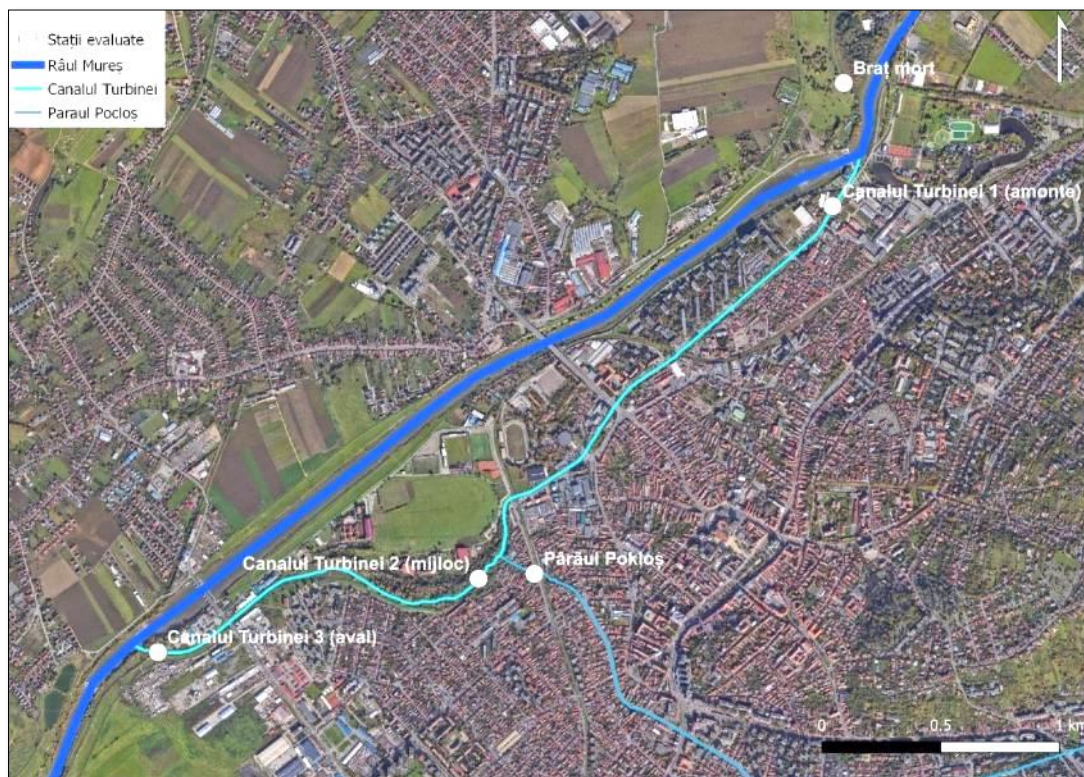
1. Habitats Directive – Council Directive 92/43 EEC, Annex II.
2. Bern Convention – Law No. 13 of March 11, 1993 for the accession of Romania to the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on September 19, 1979 – Annex 3.
3. Law Law 462/2001 on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna. Annex 3.
4. GEO no. 57/2007 regarding the regime of protected natural areas, the conservation of natural habitats, flora and wild fauna. Annex 3.
5. IUCN - LC

**Presentation of results**

During the assessments carried out on September 3, 2024, 3 sectors on the Turbinei Channel and one sector on the Poclos stream were inventoried, plus one sector on the dead arm of the Mures, located upstream of Priza Dam no. 1. The length of the sectors was 150 m each, except for the sector on the dead arm, where the vegetation and conditions in the riverbed only allowed the evaluation of a 100 m sector.



**Fig. no. 13.** Percentage composition of fish species in the Turbinei Channel.



**Map no. 3.** Location of ichthyofauna assessment stations.

During data collection, the electronarcosis apparatus was used. The methodology is described in the chapter "Description of methodologies used for data collection on ichthyofauna". A total of 1561 specimens were identified, belonging to 25 fish species, namely: *Alburnoides bipunctatus*, *Alburnus alburnus*, *Aspius aspius*, *Barbatula barbatula*, *Barbus barbus*, *Barbus petenyi*, *Carassius gibelio*, *Rhodeus amarus*, *Chondrostoma nasus*, *Cyprinus carpio*, *Gobio gobio*, *Leucaspis delineatus*, *Pseudorasbora parva*, *Romanogobio uranoscopus*, *Romanogobio vladykovi*, *Rutilus rutilus*, *Scardinius erythrophthalmus*, *Squalius cephalus*, *Tinca tinca*, *Vimba vimba*, *Cobitis elongatoides*, *Perca fluviatilis*, *Lepomis gibbosus*, *Silurus glanis* and *Esox lucius*. Of these, a total of 22 species were identified in the Turbinei Channel (Fig. no. 13). The number of identified specimens is presented in tables 2, 3, 4, 5 and 6. All identified specimens were released into the natural environment, near the place of identification.

#### **Turbinei Channel Station 1 (upstream):**

The evaluation station is located downstream of the Turbinei Channel's feeding point in the Mures River. The channel banks are concreted, the riverbed is covered by a thick layer of silt (due to the blockage of sediment transport and the clogging of the area upstream of Intake Dam No. 1, from where the Turbinei Channel is currently fed).

The most abundant species at the station was the scobar (*Chondrostoma nasus*), with an average density of 49.6 individuals/100m<sup>2</sup>, and the rarest species were the rudd (*Cobitis elongatoides*) and the perch (*Perca fluviatilis*), with an average density of 0.4 individuals/100m<sup>2</sup>, each (Table no. 2, Fig. no. 14).

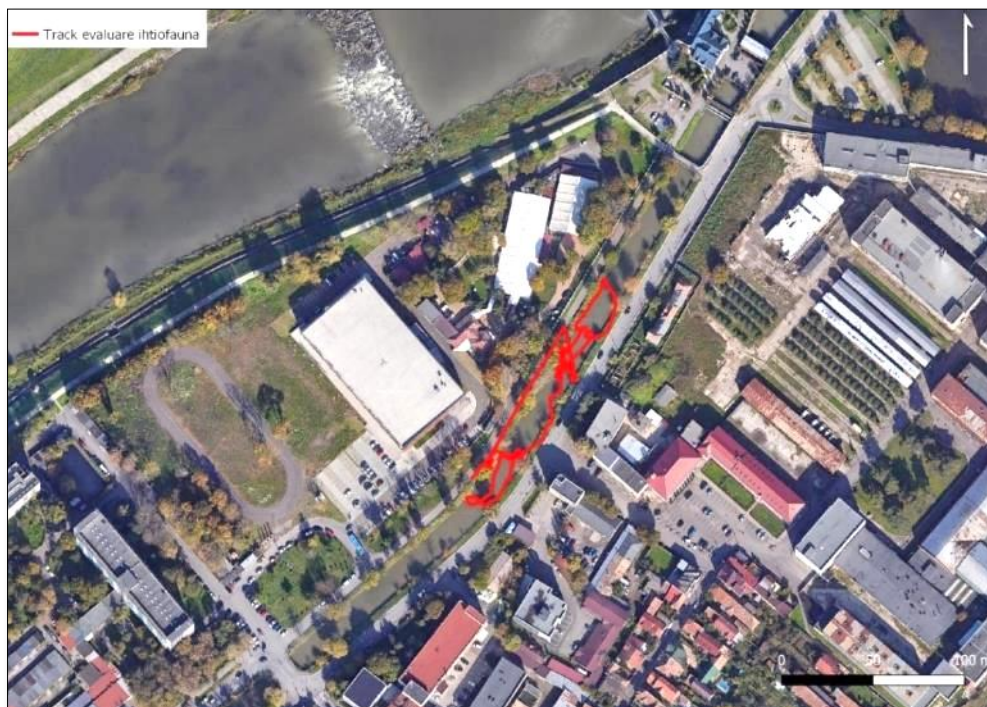


**Table no. 2.** Fish species identified at the Turbinei Channel 1 station (upstream). Natura 2000 species are **marked in bold**. Invasive species are marked in red.

| Species                             | Total number | Juvenile | Adult    | No. of specimens/100m <sup>2</sup> |
|-------------------------------------|--------------|----------|----------|------------------------------------|
| <i>Alburnoides bipunctatus</i>      | 3            |          | 3        | 1.20                               |
| <i>Alburnus alburnus</i>            | 2            |          | 2        | 0.80                               |
| <i>Carassius gibelio</i>            | 11           |          | 11       | 4.40                               |
| <i>Chondrostoma nasus</i>           | 124          | 124      |          | 49.60                              |
| <b><i>Cobitis elongatoides</i></b>  | <b>1</b>     |          | <b>1</b> | <b>0.40</b>                        |
| <i>Lepomis gibbosus</i>             | 4            | 1        | 3        | 1.60                               |
| <i>Perca fluviatilis</i>            | 1            |          | 1        | 0.40                               |
| <i>Pseudorasbora parva</i>          | 7            |          | 7        | 2.80                               |
| <b><i>Rhodeus amarus</i></b>        | <b>2</b>     |          | <b>2</b> | <b>0.80</b>                        |
| <b><i>Romanogobio vladykovi</i></b> | <b>12</b>    | <b>3</b> | <b>9</b> | <b>4.80</b>                        |
| <i>Rutilus rutilus</i>              | 7            | 1        | 6        | 2.80                               |
| <i>Squalius cephalus</i>            | 56           | 27       | 29       | 22.40                              |



**Picture no. 3.** Habitat assessed at the Turbinei Channel 1 station (upstream).



**Map no. 4.** Location of the Turbinei Channel 1 station (upstream) and the assessed area.

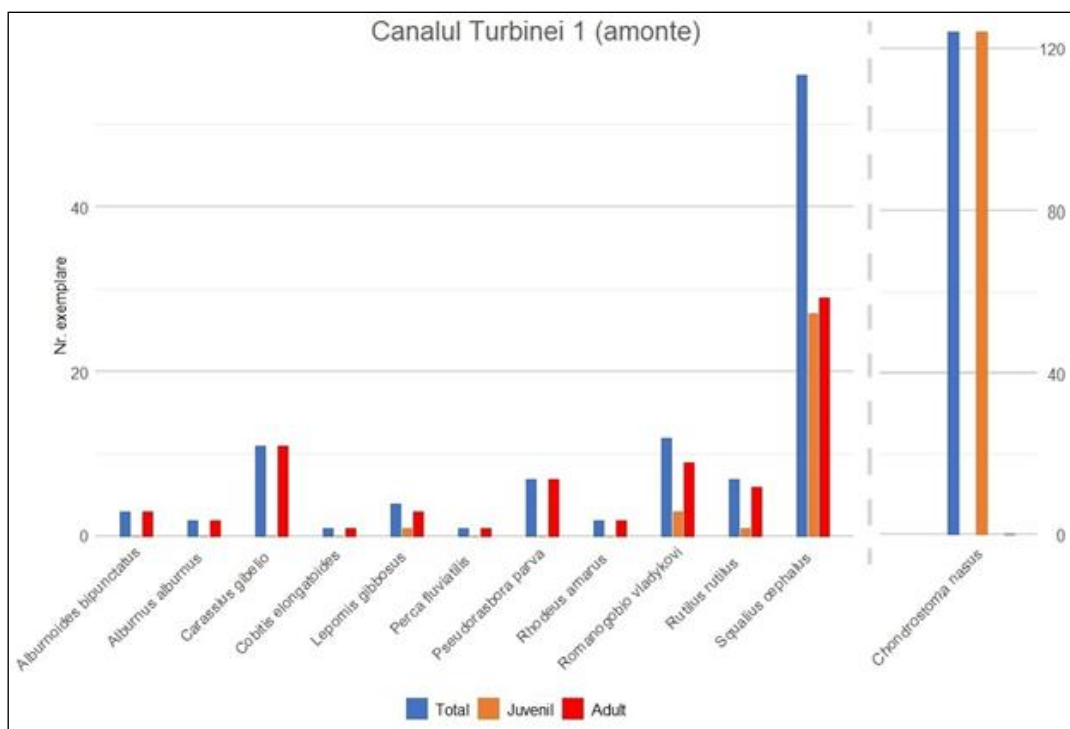


**Picture no. 4-5.** Ichthyofauna assessment activities at the Turbinei Channel 1 station (upstream).





**Picture no. 6.** A specimen of crucian carp identified at the Turbinei Channel 1 station (upstream).



**Fig. no. 14.** Composition of the ichthyofauna at the Turbinei Channel 1 station (upstream).

**Turbinei Channel Station 2 (middle):**

The evaluation station Turbinei Channel 2 (middle) is located in the area of the Romsilva Equestrian Base. The Turbinei Channel is preserved in an almost natural state in this sector, with a floodplain and a mini meadow forest. The characteristics of the riverbed and the bank in this sector most closely resemble the former minor riverbed of the Mures.

The most abundant species at the station level was the carp (*Rhodeus amarus*) with an average density of 50.89 individuals/100m<sup>2</sup>, and the rarest species was the carp (*Cyprinus carpio*), with an average density of 0.22 individuals/100m<sup>2</sup> (Table no. 3, Fig. no. 15). Even though it was not identified in this sector, according to information received from Cernea Alexandru (AJVPS Mures), tench (*Tinca tinca*) is also present here.

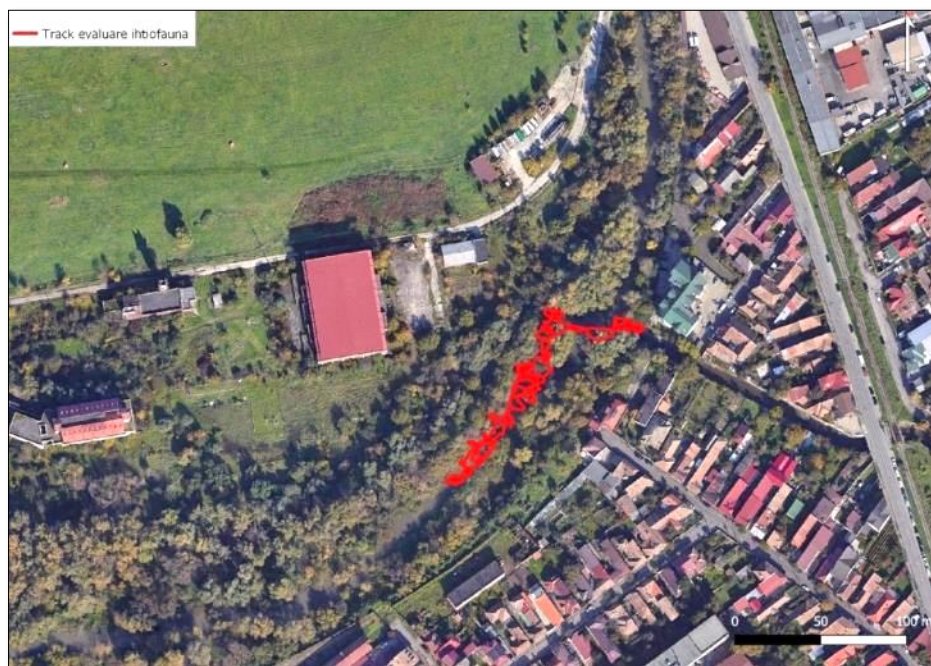
**Table No. 3.** Fish species identified at the Turbinei Channel 2 station (middle). Natura 2000 species are **marked in bold**. Invasive species are marked in red. \* - information received from fishermen.

| Species                             | Total number | Juvenile   | Adult      | No. of specimens/100m <sup>2</sup> |
|-------------------------------------|--------------|------------|------------|------------------------------------|
| <i>Alburnoides bipunctatus</i>      | 6            | 2          | 4          | 1.33                               |
| <i>Alburnus alburnus</i>            | 213          | 204        | 9          | 47.33                              |
| <b><i>Aspius aspius</i></b>         | <b>3</b>     | <b>3</b>   |            | <b>0.67</b>                        |
| <i>Barbus barbus</i>                | 3            |            | 3          | 0.67                               |
| <i>Carassius gibelio</i>            | 8            |            | 8          | 1.78                               |
| <b><i>Cobitis elongatoides</i></b>  | <b>19</b>    | <b>3</b>   | <b>16</b>  | <b>4.22</b>                        |
| <i>Cyprinus carpio</i>              | 1            |            | 1          | 0.22                               |
| <i>Esox lucius</i>                  | 4            | 2          | 2          | 0.89                               |
| <i>Gobio gobio</i>                  | 21           | 9          | 12         | 4.67                               |
| <i>Perca fluviatilis</i>            | 2            |            | 2          | 0.44                               |
| <i>Pseudorasbora parva</i>          | 8            | 1          | 7          | 1.78                               |
| <b><i>Rhodeus amarus</i></b>        | <b>229</b>   | <b>101</b> | <b>128</b> | <b>50.89</b>                       |
| <b><i>Romanogobio vladykovi</i></b> | <b>51</b>    | <b>32</b>  | <b>19</b>  | <b>11.33</b>                       |
| <i>Rutilus rutilus</i>              | 93           | 79         | 14         | 20.67                              |
| <i>Silurus glanis</i>               | 6            | 3          | 3          | 1.33                               |
| <i>Squalius cephalus</i>            | 49           | 18         | 31         | 10.89                              |
| <i>Tinca tinca</i>                  | *            |            |            | 0.00                               |
| <i>Vimba vimba</i>                  | 54           | 49         | 5          | 12.00                              |





**Picture no. 7.** Habitat assessed at the Turbinei Channel 2 station (middle).



**Map no. 5.** Location of the Turbinei Channel 2 station (middle) and the assessed area.

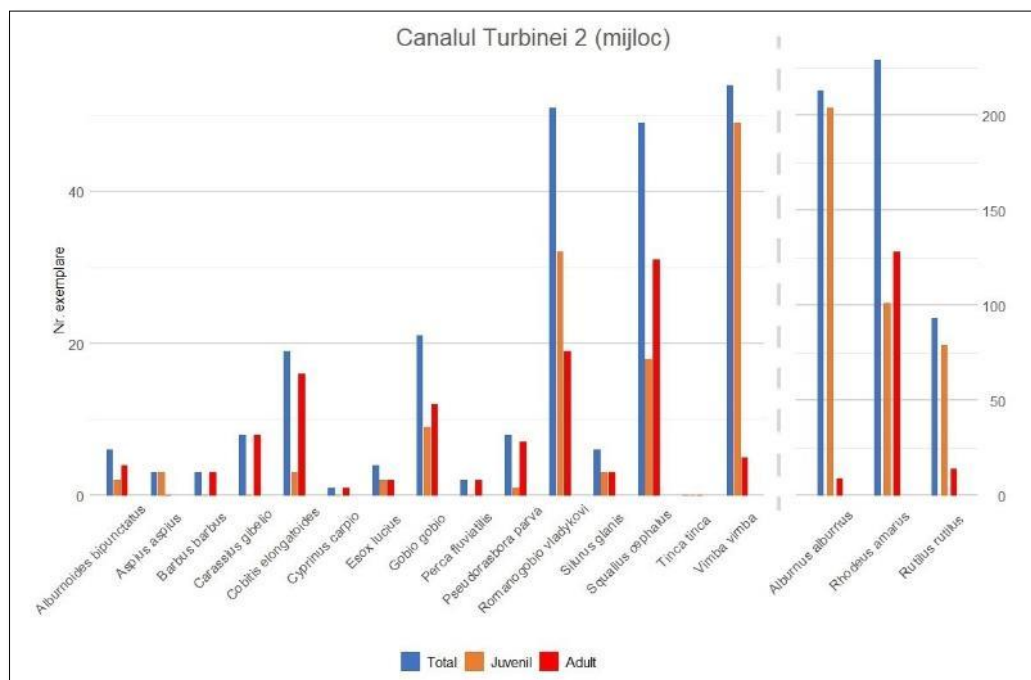


**Picture no. 8-9.** Babusca and catfish identified at the Turbinei Channel 2 station (middle)).



**Picture no. 10-11.** Specimen of common and common bream identified at the Turbinei Channel 2 station (middle).





**Fig. no. 15.** Composition of the ichthyofauna at the Turbinei Channel 2 station (middle).

#### **Turbinei Channel Station 3 (downstream):**

The Turbinei Channel 3 station (downstream) is located near the confluence of the channel with the Mures River. The banks of the channel are made of concrete, near the confluence with the Mures River, there is an impassable threshold for most fish species (Photo no. 21), and above there are over 20 concrete falls (Photo no. 22-23), making it difficult for aquatic fauna to migrate upstream. The most abundant species at the station was the common wrasse (*Squalius cephalus*), with an average density of 15.11 ex./100m<sup>2</sup>, and the rarest species was the porpoise (*Romanogobio uranoscopus*), with an average density of 0.22 ex./100m<sup>2</sup> (Table no. 4, Fig. no. 16).

**Table No. 4.** Fish species identified at the Turbinei Channel 3 station (downstream). Natura 2000 species are **marked in bold**. Invasive species are marked in red.

| Species                        | Total number | Juvenile  | Adult     | No. of specimens/100m <sup>2</sup> |
|--------------------------------|--------------|-----------|-----------|------------------------------------|
| <i>Alburnoides bipunctatus</i> | 29           | 14        | 15        | 6.44                               |
| <i>Alburnus alburnus</i>       | 6            | 2         | 4         | 1.33                               |
| <i>Barbatula barbatula</i>     | 2            | 1         | 1         | 0.44                               |
| <i>Barbus barbus</i>           | 30           | 13        | 17        | 6.67                               |
| <b><i>Barbus petenyi</i></b>   | <b>28</b>    | <b>13</b> | <b>15</b> | <b>6.22</b>                        |
| <i>Carassius gibelio</i>       | 2            | 1         | 1         | 0.44                               |
| <i>Chondrostoma nasus</i>      | 51           | 26        | 25        | 11.33                              |

|                                |    |    |    |       |
|--------------------------------|----|----|----|-------|
| <i>Gobio gobio</i>             | 18 | 11 | 7  | 4.00  |
| <i>Rhodeus amarus</i>          | 16 | 9  | 7  | 3.56  |
| <i>Romanogobio uranoscopus</i> | 1  |    | 1  | 0.22  |
| <i>Romanogobio vladykovi</i>   | 6  | 1  | 5  | 1.33  |
| <i>Squalius cephalus</i>       | 68 | 39 | 29 | 15.11 |
| <i>Vimba vimba</i>             | 5  | 5  |    | 1.11  |



**Picture no. 12.** Habitat assessed at the Turbinei Channel 3 station (downstream). Note the lack of trees and the concrete bank of the channel.

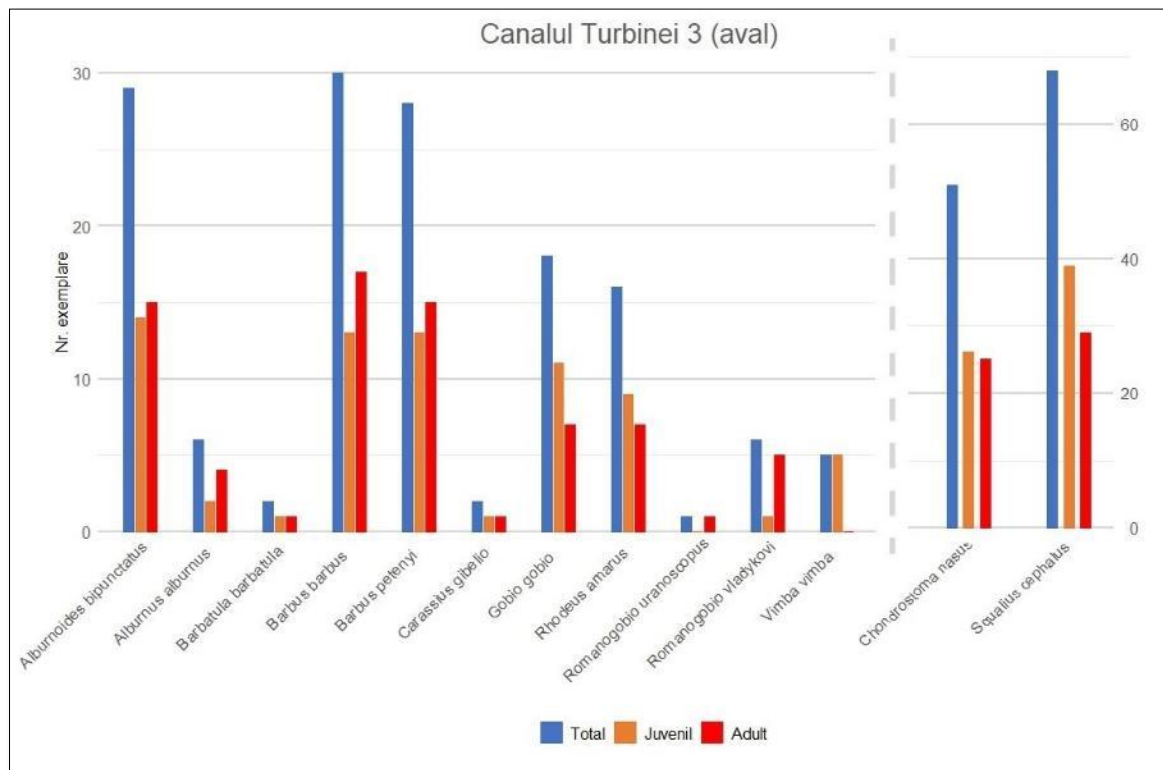




**Map no. 6.** Location of the Turbinei Channel 3 station (downstream) and the assessed area.



**Picture no. 13-14.** Scobar (left) and Danubian longbarbel gudgeon (right) identified at the Turbinei Channel 3 station (downstream).



**Fig. no. 16.** Composition of the ichthyofauna at the Turbinei Channel 3 station (downstream).

### Poclos Stream Station:

The assessment station is located upstream of the confluence of the Poclos stream with the Turbinei Channel bed. Both banks are made of concrete walls, the stream bed is made of concrete, without providing hiding places for fish species. The only place of refuge is under the bridge on Somnului Street, where a deeper area has been preserved, which offers refuge to fish, even in periods of low flow.

The most abundant species at the station was the common goby (*Gobio gobio*) with an average density of 85.33 individuals/100m<sup>2</sup>, and the rarest species was the scaly goby (*Cobitis elongatoides*), with an average density of 0.67 individuals/100m<sup>2</sup> (Table no. 5, Fig. no. 17).

**Table no. 5.** Fish species identified at the Poclos stream station. Natura 2000 species are **marked in bold**. Invasive species are marked in red.

| Species                            | Total number | Juvenile | Adult     | No. of specimens/100m <sup>2</sup> |
|------------------------------------|--------------|----------|-----------|------------------------------------|
| <i>Carassius gibelio</i>           | 5            | 1        | 4         | 3.33                               |
| <b><i>Cobitis elongatoides</i></b> | <b>1</b>     |          | <b>1</b>  | <b>0.67</b>                        |
| <i>Gobio gobio</i>                 | 128          | 31       | 97        | 85.33                              |
| <i>Pseudorasbora parva</i>         | 20           | 3        | 17        | 13.33                              |
| <b><i>Rhodeus amarus</i></b>       | <b>33</b>    | <b>4</b> | <b>29</b> | <b>22.00</b>                       |
| <i>Squalius cephalus</i>           | 3            | 2        | 1         | 2.00                               |



**Picture no. 15.** Habitat assessed at the Poclos stream station level.



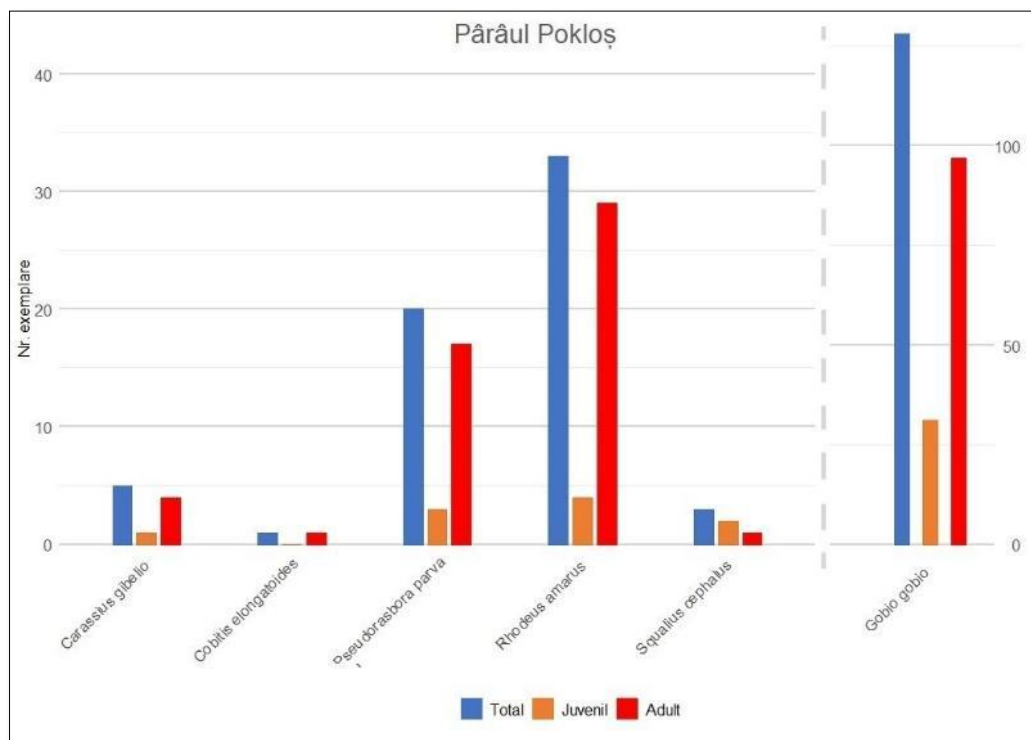


**Map no. 7.** Location of the Poclos stream station and the assessed area.



**Picture no. 16-17.** Wild boar – Natura 2000 species – (left) and invasive species (white carp and crucian carp) on the right, identified at the Poclos stream station. In the image on the right, in addition to the crucian carp and white carp, you can also see the common porcupine and the wild boar.





**Fig. no. 17.** Composition of the ichthyofauna at the Poclos stream station.

### Dead Arm Station:

The station is located on the dead arm of the Mures River, on its right side, upstream of the intake dam no. 1. It is a stagnant habitat that offers the possibility of maintaining some stagnophilous fish species. Given the small number of habitats of this type, special emphasis must be placed on the conservation of this area.

The most abundant species at the station was the roach (*Rhodeus amarus*), with an average density of 35.5 individuals/100m<sup>2</sup>, and the rarest species were the pike (*Esox lucius*), the tench (*Tinca tinca*), and the bream (*Vimba vimba*), with an average density of 0.5 individuals/100m<sup>2</sup>, each (Table 6, Fig. 18). It is worth highlighting the presence of the three species that prefer stagnant habitats with submerged vegetation (*Tinca tinca*, *Leucaspis delineatus* and *Scardinius erythrophthalmus*). These species have become very rare in recent decades due to the fact that these stagnant habitats with submerged vegetation and clean water have disappeared from most areas of the country, as a result of the drying up of floodplains of rivers, but also due to the transformation of these habitats into fishing lakes.

**Table No. 6.** Fish species identified at the Dead Arm station. Natura 2000 species are marked in bold. Invasive species are marked in red.

| Species            | Total number | Juvenile | Adult | No. of specimens/100m <sup>2</sup> |
|--------------------|--------------|----------|-------|------------------------------------|
| <i>Esox lucius</i> | 1            | 1        |       | 0.50                               |

|                                    |           |           |           |              |
|------------------------------------|-----------|-----------|-----------|--------------|
| <i>Lepomis gibbosus</i>            | 2         |           | 2         | 1.00         |
| <i>Leucaspius delineatus</i>       | 3         | 1         | 2         | 1.50         |
| <b><i>Rhodeus amarus</i></b>       | <b>71</b> | <b>30</b> | <b>41</b> | <b>35.50</b> |
| <i>Rutilus rutilus</i>             | 28        | 10        | 18        | 14.00        |
| <i>Scardinius erythrophthalmus</i> | 2         | 1         | 1         | 1.00         |
| <i>Tinca tinca</i>                 | 1         | 1         |           | 0.50         |
| <i>Vimba vimba</i>                 | 1         | 1         |           | 0.50         |



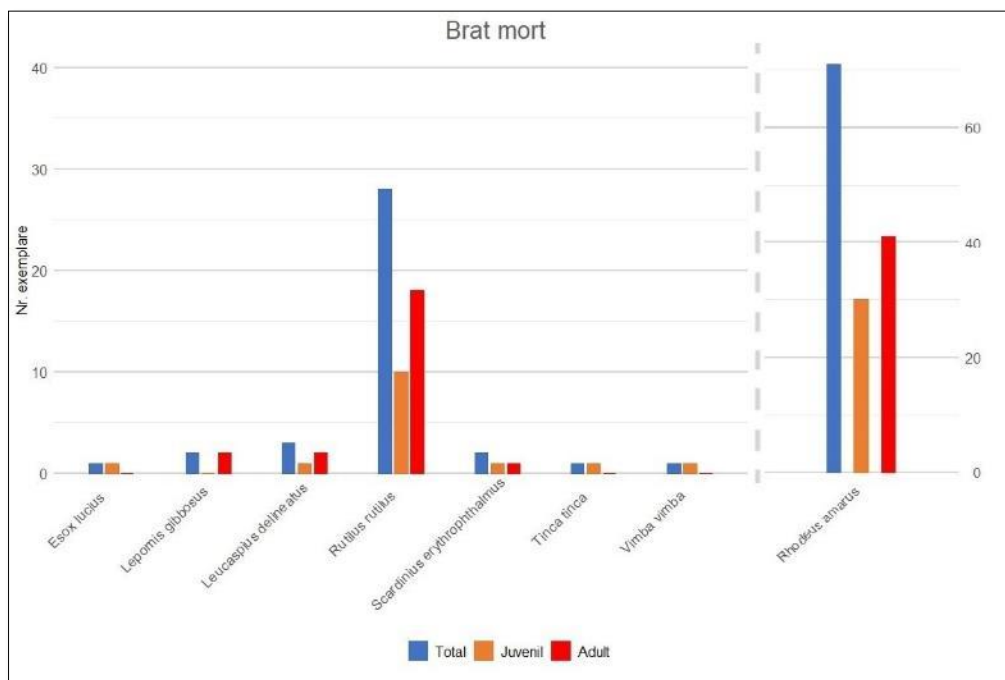
**Picture no. 18.** The habitat assessed at the Dead Arm station.



**Map no. 8.** Location of the Dead Arm station and the assessed area.



**Picture no. 19-20.** Rare stagnophilous species, identified at the Dead Arm station: tench (left) and scaly (right).



**Fig. no. 18.** Composition of the ichthyofauna at the Dead Arm station.

### Interpretation of results:

The Turbinei Channel was once the minor riverbed of the Mures River (Map no. 1 and 2). Some well-preserved sections of it (for example, the section located in the area of the Romsilva Equestrian Base) still show the characteristics of a natural riverbed. The high number of fish species identified in the Turbinei Channel (22 fish species of which 6 are Natura 2000 fish species – Fig. no. 13) indicates both that some sections, even if quite short, have been preserved in an almost natural state, and that this channel still has a direct connection with the Mures River (it is fed by it). Even though it is an urbanized habitat along almost its entire length, this channel offers refuge for several rare natural elements.

Based on a single assessment, we cannot draw final conclusions about its ichthyofauna. For example, the tench (*Tinca tinca*) was identified by us only in the dead arm, located upstream of the intake dam no. 1, but we have information with supporting photographs from the AJVPS Mures, that this species is also present in the Turbinei Channel. The same is true of the eel (*Misgurnus fossilis*), which has not been identified at the moment, but it is present both in the dead arm of the Mures and in the Turbinei Channel, but, due to the fact that this species takes refuge vertically, its identification is very difficult. In addition to the species identified and mentioned above, there may be other fish species living in the Turbinei Channel. In order to collect data on their presence and abundance, regular monitoring of the ichthyofauna is needed. In order to identify all fish species in this habitat, repeated monitoring would be needed over several years.

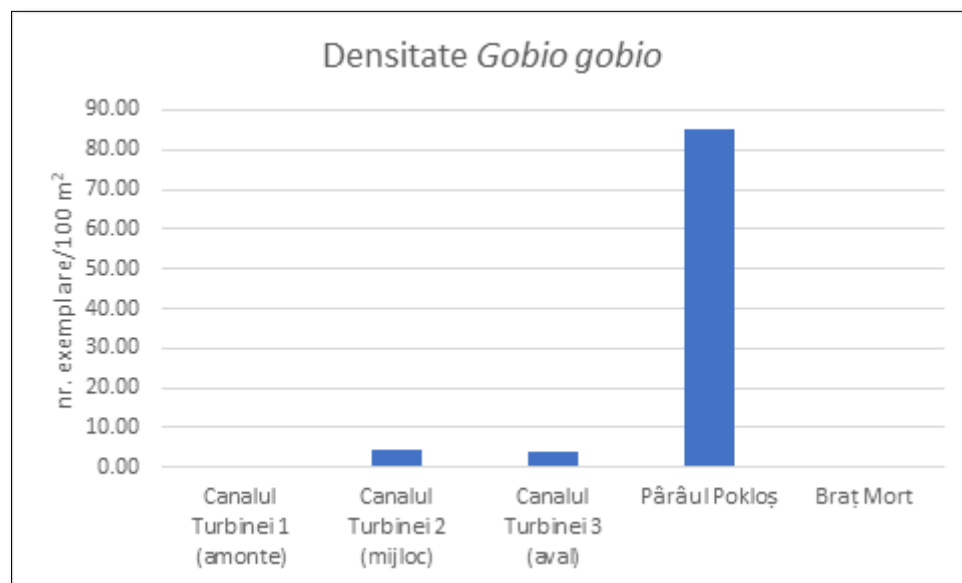
Given the current fragmentations that interrupt the longitudinal connectivity of this channel in several places (Map no. 10), at the moment the Turbinei Channel cannot function as



a bypass channel to bypass the two intake dams (no. 1 and 2) on the Mures River. By removing these fragmentations and/or restoring longitudinal connectivity at the level of that fragmentation element that cannot be eliminated, it is possible to reach a situation in which the Turbinei Channel functions as a bypass/bypass channel for the two major fragmentations on the Mures River (intake dam no. 1 and 2). This also requires the reconfiguration of the rockfall threshold in the minor bed of the Mures River, located downstream of intake dam no. 2, in order to increase the attractiveness of the channel.

The identification of 22 fish species in the Turbinei Channel underlines the quality of this urban habitat. Given that this channel is fed by the Mures River, from where more fish species have been reported than those currently reported in the Turbinei Channel (Nalbant 1995, Nagy et al. 2023, Nagy 2023a, Nagy 2023b), the presence of these species in the channel is very likely, but at a reduced density.

The presence of the 6 Natura 2000 fish species (of community interest) in the Turbinei Channel underlines the importance of this urban habitat, especially if we take into account the fact that in Romania there are many protected areas designated (among others) for the protection of fish species, which do not provide habitat for the 6 Natura 2000 fish species. However, traces of urbanization are also confirmed by the composition of the ichthyofauna, especially in the composition of the ichthyofauna of the Poclos stream, a tributary of the Turbinei Channel.



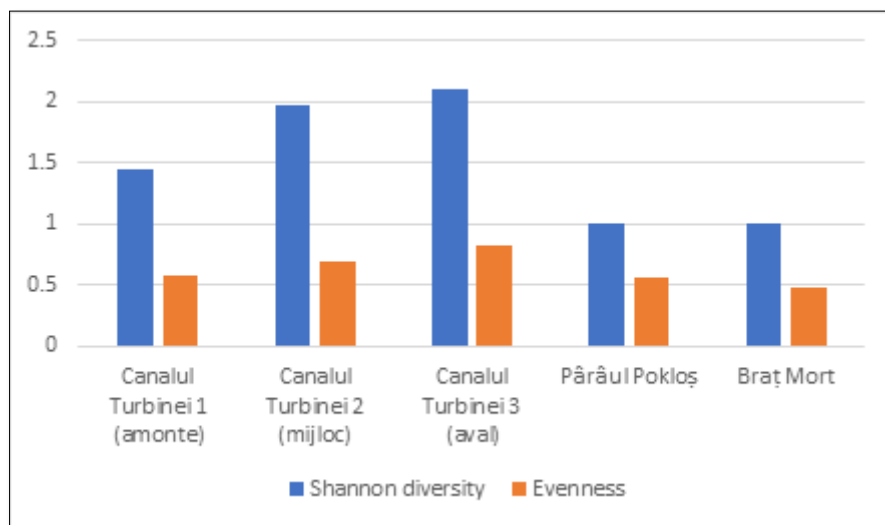
**Fig. no. 19.** Density of the *Gobio gobio* species at the evaluated stations.

The presence of three invasive fish species, as well as the relatively high abundance of the chub or the gudgeon (both species tolerate pollution quite well, see Machala et al. 2001, Dragun et al. 2012, Knapensi et al. 2004) at some assessment stations, indicate an advanced degree of anthropization of this channel, but especially of the Poclos tributary. If we take into account the fact that the common porpoise adapts quite well and resists major water pollution,

then we understand why the density of the species is highest at the assessment station located on the Poclos stream (Fig. no. 19). Very likely, the largest source of pollution feeding the Turbinei Channel is the Poclos stream. Thus, with the increase in pollution of the channel, the density of the common porpoise also increases, which adapts much better to unfavorable conditions than the other species. At the station located on the Poclos stream, the species was present in a very high density (85.33 ex./100 m<sup>2</sup>), missing from station 1 (upstream), where the water quality is identical to that of the Mures (the channel being fed from the Mures river a few tens of meters upstream) and appearing at the stations located downstream of the confluence with the Poclos stream.

If we look at the data collected at the most upstream station (Turbinei Channel Station 1 upstream), we can see that the most abundant species is the common sculpin (49.6 ex./100m<sup>2</sup>), which seems paradoxical, considering that in this sector the channel bed is covered by a thick layer of silt, a totally unfavorable habitat for the common sculpin (Banarescu 1964, Harka & Sallai 2007). The high abundance of the common sculpin is explained by the fact that this sector is very close to the feeding area of the Mures River channel, and, due to the presence of the intake dam no. 1 on the Mures River, the common sculpins in the area upstream of the dam try to find ideal habitats or migrate downstream of this dam through the Turbinei Channel bed, this being the only access to the downstream areas.

Both the Shannon diversity index and the Evenness index (which quantifies how numerically equal a species community is) look very similar (Fig. no. 20). The highest species diversity, according to the Shannon index, is found at the Turbinei Channel 3 station (downstream), even though this is not the sector preserved in the best natural state. This result is explained by the positive impact of the Mures River on this sector located just upstream of the confluence with the Mures River. Even though near the confluence with the Mures River there is an impassable threshold for most fish species, under appropriate flow conditions, some species can cross this threshold, positively influencing the diversity of this area. The Evenness index looks very similar, reaching the highest value near the confluence with the Mures River.



**Fig. no. 20.** Shannon diversity index and evenness index at the level of the five evaluated stations.

At present, rheophilic species such as *Zingel streber* or *Romanogobio kesslerii*, which are present in the Mures River both upstream and downstream of Targu Mures (Nagy et al. 2023), have not been identified in the Turbinei Channel. Given that other rheophilic fish species have been identified (e.g. *Barbus petenyi*, *Chondrostoma nasus*), the lack of sand porcupine and small fusar can most likely be explained by the presence of fragmentation near the confluence of the Turbinei Channel with the Mures River. This assumption is also supported by the identification of a single specimen of the wading porcupine (*Romanogobio uranoscopus*), another rheophilic species with a reduced ability to overcome obstacles. Most likely, most of the specimens of these species were blocked in their upstream migration by fragmentation at the confluence with the Mures River (Map no. 10, Photo no. 21).

The dead arm of the Mures River, located on its right side, upstream of the intake dam no. 1, is preserved in an acceptable natural state, providing habitat for some rare stagnophilous species (Table no. 6, Fig. no. 18). In recent years, this habitat has been particularly affected by the cutting of old trees on its banks, thus leading to the loss of natural characteristics specific to habitats of this type. The presence of the red mullet (rheophilous species) in this habitat indicates that this dead arm still has a direct connection with the Mures River.

The presence of more sensitive fish species (*Romanogobio uranoscopus*, *Tinca tinca*, *Leucaspis delineatus*, etc.), even if in much lower quantities, indicates the ecological potential of these natural aquatic habitats in urban areas. It is very important that, in the future, the (re)development activities of the Turbinei Channel be carried out using green techniques and using local materials, without the use of concrete and without unclogging activities of the riverbed (possibly with some unclogging activities in the sector between the threshold of the Electrica micro-hydropower plant and the feeding area of the Mures River of the channel). Also, in order to ensure the most optimal conditions for aquatic communities, it is proposed that the



flow of the Turbinei Channel follow the flow of the Mures River, thus ensuring natural fluctuations in the flow.

To have a more realistic picture of the aquatic communities in the Turbinei Channel, it is welcome to conduct a study on benthic macro-invertebrate communities, which can provide us with additional information about the state of the studied aquatic habitat (see Dénes & Kastal 2023).

## **Conclusions/Proposals:**

### **Renaturation of the Turbinei Channel bank and removal of concrete areas**

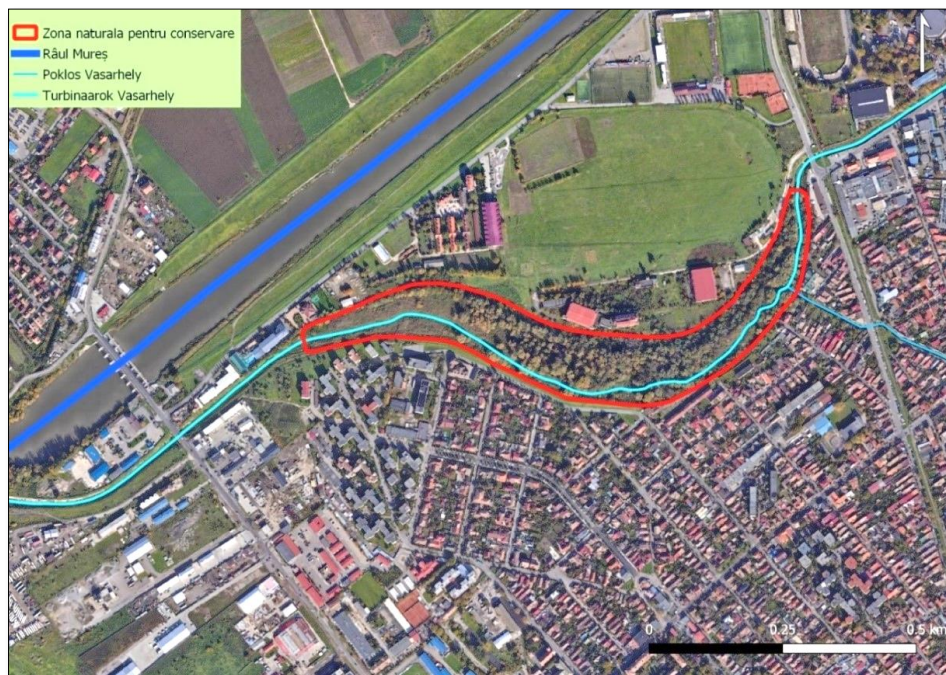
Since it is a body of water located within a locality, it is desirable to arrange its shore in such a way that the population has access to the water surface. For this, it is necessary to use solutions based on nature and without the use of concrete, possibly using it in those situations when alternative solutions cannot be implemented. Thus, this body of water and the areas in its vicinity can become favorable areas both for aquatic fauna (its minor riverbed), and a place of rest or recreation for the inhabitants of the municipality, thus improving the quality of life in the locality.

### **Avoiding channel clogging**

At present, especially the upstream part of the Turbinei Channel is quite clogged, due to the alluvium brought from the area of their deposition, located upstream of the intake dam no. 1. Solutions must be found to unclog and then avoid clogging of the area located at the mouth of the Turbinei Channel supply. If it is desired to unclog the bed of the Turbinei Channel, such works must be carried out only in its upstream part, where the banks are concreted. Under no circumstances can unclogging activities be carried out on the natural sector located in the vicinity of the Romsilva Equestrian Center (Map no. 9), these interventions destroying the natural character of that area.

### **Preservation of natural areas:**

The sector in the vicinity of the Romsilva Equestrian Center (a sector that has been preserved in an almost natural state) must be preserved as much as possible in its current state, by preserving the floodplain and the meadow forest that has been preserved along this sector. At present, this is the sector where the most fish species have been identified (18 species).



**Map no. 9.** Natural area proposed for conservation.

### **Elimination or significant reduction of pollution**

Given the advanced degree of anthropization, especially of the Poclos tributary, it is proposed to eliminate or significantly reduce pollution at the level of this tributary, but also of the Turbinei Channel. In addition to the positive impact that this will have on aquatic communities, it will also have a positive effect on the inhabitants of the municipality, especially if this is combined with facilitating access to the channel's water surface.

### **Elimination of existing fragmentations on the Turbinei Channel and its possible use as a bypass channel**

Currently, there are two significant dams on the Mures River (within the municipality of Targu Mures) that interrupt the longitudinal connectivity of the river, blocking the migration of fish species and the transport of sediments. To facilitate the migration of fish species, the Turbinei Channel, which bypasses these two dams, could be used as a bypass channel. For this, it is necessary to eliminate all existing fragmentations from this channel. Currently, there are several fragmentations at the level of this channel. Also, in order to increase the attractiveness of the Turbinei Channel, it is necessary to reconfigure the rockfill threshold, located downstream of the intake dam no. 2, on the Mures River. The scope of this study does not allow for a detailed technical description of the solutions to restore longitudinal connectivity at the level of this channel. However, we propose summary solutions in order to restore it.





**Map no. 10.** Fragmentations in the project area of interest.

#### **Fragmentation near the confluence with the Mures River:**

Before the confluence with the Mures River (the downstream part of the channel), there is a significant fragmentation on the Turbinei Channel (Photo no. 21), which affects the migration of fish species upstream and makes it impossible for this channel to function as a bypass channel to bypass the two intake dams on the Mures River. The high diversity of fish species that was observed on this sector (Fig. no. 9) indicates that, in case of ideal flows, some fish species can cross this barrier. However, most likely, most of the fish specimens that would ascend from the Mures River into the Turbinei Channel are stopped by the presence of this fragmentation. This fragmentation needs to be eliminated.





**Picture no. 21.** Fragmentation near the confluence of the Turbinei Channel with the Mures River.



**Picture no. 22.** Too long section, with very fast water, near the confluence of the Turbinei Channel with the Mures River.



**Picture no. 23.** The same section, seen from upstream, at high flow and very high water velocity.

After the threshold shown in picture no. 21, there is a sector where the water speed is slow and the fish species can rest. After this, there is the sector shown in pictures no. 22 and 23,

where the water speed is high (in some periods of the year very high), and the steps can only be crossed by some of the fish species that want to move upstream. Being a very long sector, the fish consume a lot of energy while crossing this sector, without having areas with slow-flowing water (resting area), so, very likely, a large part of these species fail to cross this sector.

In the sector presented above, it is necessary to include resting areas (for example, by creating resting pools on the left bank), with slower flowing water, to ensure the possibility of resting during the crossing. Crossing this sector requires considerable effort and can take several days, thus this sector constitutes an obstacle for most fish species. Photo no. 24 shows a specimen of weakened blue barbel, identified in the middle of this sector. During the assessments, several weakened specimens were identified in this sector.



**Picture no. 24:** Weakened purple barbel, identified in the very fast-flowing water section near the confluence of the Turbinei Channel with the Mures River.

#### **Fragmentation at the Barajului street crossing level:**

At the level of the crossing of Barajului Street over the Turbinei Channel, there is a weir (actually, it is made up of 3 different parts) that blocks the migration of fish species upstream. It is proposed to eliminate this fragmentation.



**Picture no. 25.** Fragmentation at Barajului street level.



**Picture no. 26.** The same fragmentation, at a higher water flow rate.

**Non-permanent fragmentation upstream of the confluence with the Poclos stream:**

During the assessments, this objective did not constitute real fragmentation, but, according to fishermen, in certain periods, this fragmentation is reinforced, in such a way that it blocks the free migration of fish species. It is proposed to completely eliminate this fragmentation.





**Picture no. 27.** Non-permanent fragmentation upstream of the confluence with the Poclos stream.

#### **Fragmentation at the Insulei street crossing level**

It is a small-scale fragmentation that at certain flows can block the upstream migration of fish species. In fact, this constitutes a real fragmentation for most of the year. It is proposed to eliminate it.



**Picture no. 28.** Fragmentation at the level of the Insulai street. In the background, fragmentation at the level of the railway can be seen.



**Picture no. 29.** The same threshold at a high-water flow becomes passable for certain fish species.

#### **Fragmentation at the railway crossing level**

The concrete tubes placed under the CFR bridge constitute a barrier for most fish species. The very fast speed of the water in these tubes, as well as its shallow depth at lower water levels, make upstream crossing impossible for most fish species. This fragmentation needs to be eliminated.



**Picture no. 30.** Fragmentation at the CFR bridge level.





**Picture no. 31.** The same fragmentation, at a higher water flow rate.

#### **MHC Electrica Fragmentation:**

It is the most important fragmentation on the course of the Turbinei Channel, being impassable for all fish species.

It is proposed to eliminate it. If its elimination is not feasible, it is proposed to place a fish ladder with vertical slats, where the level difference between the basins does not exceed 0.1 m. It should be noted that the elimination of this barrier would have a more positive impact on the ichthyofauna than the placement of a fish ladder. Also, sediment transport must be ensured at the level of this fragmentation.



**Picture no. 32.** Fragmentation from MHC Electrica.



**Possible fragmentation at the level of the weir at the Turbinei Channel feed (confluence with the Mures River, upstream):**

Given that it is not possible to see whether this dam constitutes a fragmentation or not (it is covered by the constructions belonging to SGA Mures), it is proposed to verify the situation together with SGA Mures representatives.



**Picture no. 33.** The weir area on the upstream side of the Turbinei Channel (SGA headquarters area)).

**Renaturation of the riverbed and banks along the Poclos stream:**

Currently, the bed and banks of the Poclos stream are concreted, without providing adequate refuge, shelter, reproduction, feeding, or wintering habitats for fish species. Over 99% of the specimens found in the Poclos stream were identified at the level of the only refuge site with deeper water, located under the bridge on Somnului Street. The arrangement of the stream bed in such a way as to include both deeper areas and areas with stones and boulders of various sizes, combined in the stream bed, could have been carried out when arranging this channel, involving low costs. Changing the conditions at the moment can be carried out involving quite high costs. To avoid such situations, it is much more efficient to find solutions in the design phase. In the long term, it is proposed to renature the riverbed, by removing concrete (where feasible), redeveloping the banks and planting native trees, specific to the site (*Alnus sp.*, *Fraxinus sp.*, *Salix sp.*, *Populus sp.*, etc.), which will provide both shade for the riverbed and food and shelter habitat for several species of fish, but will also serve as a recreational habitat for the municipality's residents, thus improving the quality of life in the locality.

**Dead arm:**

This is an important natural habitat that provides refuge for some rare stagnophilous fish species, for this reason special attention should be paid to the conservation of this habitat. Unclogging activities can only be carried out in its upstream part, thus reducing the negative impact of these works on the fauna of the dead arm. If the upstream area of the dead arm is unclogged (see map no. 11), this will be done in such a way that the depth of this area is deeper (by approximately 1 m) than the current depth of the area that will not be unclogged (the area preserved in the best natural condition) in order to preserve the water and in case of a decrease in the water level in the Mures River (for example, due to works carried out at the level of the intake dam no. 1).

The current form of water retention in the dead arm is suitable to maintain the desired water level in this dead arm. There is no need to place weirs.



**Map no. 11.** Possible area for unclogging.

### **Planting native trees in areas without tree vegetation of the channel (and the dead arm) and facilitating population access to the water surface:**

At present, especially on the upstream side of the Turbinei Channel, the banks of the channel are concreted and, for the most part, are devoid of tree vegetation. It is necessary to arrange the bank in such a way that at least on one of the banks of the channel the population's access to the water surface is facilitated, as well as to plant some native trees, specific to the place (*Alnus* sp., *Fraxinus* sp., *Salix* sp., *Populus* sp. etc.), which will provide both shading of the riverbed and food and shelter habitat for several species of fish, also serving as a recreational habitat for the locals of the municipality. It is also proposed to plant some native trees on the right bank of the dead arm and to preserve the existing trees.

### **Monitoring**

Any intervention on the Turbinei Channel may have an impact on its ichthyofauna. This can be positive or negative, depending on the nature of the works and, in particular, on the solutions chosen. For this reason, monitoring the works and their results is very important. The present study can be seen as a baseline on the situation of the ichthyofauna of the Turbinei Channel. Monitoring studies should be carried out with methods identical or very similar to those used in the current assessment.

In order to use the Turbinei Channel as a bypass channel to bypass Intake Dams 1 and 2 on the Mures River, it is necessary to eliminate the existing fragmentations or, if this is not feasible, to restore longitudinal connectivity at the level of those fragmentations. In order to establish its functionality (as a bypass channel), it is necessary to monitor it. For this, it is proposed to mark fish species with PIT Tags (chips) and to place reading antennas both at the entrance to the Turbinei Channel and at its exit. Depending on the solutions found at the level of fragmentations on this channel, it will be necessary to monitor each fragmentation that will not be eliminated (placing reading antennas both downstream of these fragmentations and upstream). Increased attention should be paid to fragmentation at the level of the MHC Electrica weir.

### **Non-technical summary, conclusions**

A total of 1561 specimens were identified in the project area of interest, comprising 25 fish species, of which 6 species are of community interest. 22 fish species were present in the Turbinei Channel. All identified specimens were released into the natural environment near the location of identification.

The Turbinei Channel was once the minor riverbed of the Mures River. Some well-preserved sections of it still present the characteristics of a natural riverbed. The conservation of these sections must be a priority in the urban regeneration of the area. The high number of fish species identified in the Turbinei Channel indicates that, although it is an urbanized habitat along most of its length, this channel offers refuge for several rare natural elements. The effects of urbanization are also present in the studied area, with pollution-resistant species (*Gobio gobio*, *Squalius cephalus*) being present in a fairly high density in certain surveyed sections.

It should be noted that it is impossible to identify all the species present in a single assessment. In order to have a more realistic picture of the composition of the ichthyofauna, assessments/monitoring over several years are necessary.

If the Turbinei Channel is chosen as a bypass channel to bypass Intake Dams 1 and 2 on the Mures River, interventions are necessary to eliminate the barriers identified in the Turbinei Channel bed, and, after these are carried out, it is necessary to monitor the functionality of this "bypass channel". For this, it is proposed to mark fish species with PIT Tags (chips) and to place reading antennas both at the entrance to the Turbinei Channel and at its exit. Depending on the solutions found at the level of fragmentations on this channel, monitoring will be necessary at the level of each fragmentation that cannot be eliminated. Increased attention must be paid to fragmentation at the level of the Electrica weir.



The dead arm on the right bank of the Mures River, upstream of the intake dam no. 1, is an important natural habitat that provides refuge for some rare stagnophilous fish species. For this reason, special attention must be paid to the conservation of this habitat.

In order to raise awareness among locals and improve the quality of life in the locality, it is advisable to ensure access to the water surface for locals in as many places as possible. At the same time, it is proposed that the bank of the Turbinei Channel be accessible to the general public, along its entire length. It is also very important to pay special attention to the Poclos tributary, which is currently very polluted. All households and commercial companies, institutions in the municipality, must be connected to a functional sewage system.

Even if at the moment the word "channel" in the name of this water body indicates a degraded habitat, the current conditions found suggest more the origin of this water body, which was not long ago part of the Mures riverbed. Thus, the interventions carried out on this water body must also aim at its original functions, ensuring an optimal habitat for both aquatic communities and the locals of the municipality (for example, a recreation area).

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## C. FLORA – HABITATS

The assessment of flora and habitats in the area of the Urban Regeneration Project of the Hipodrom – Municipal Park – Mures Riverbank – Turbinei Channel followed the approach of the **Biotope Area Factor (BAF)**. BAF is a tool developed in the 1990s in Germany to facilitate the integration of green policies into urban planning. BAF measures the absorptive properties of urban surfaces, i.e. the permeability of surfaces to water (rainfall), air, and vegetation colonization.

BAF is calculated by relating surfaces with different permeabilities to the total area studied: ***BAF = effective ecological area x Ecological Value Factor per m<sup>2</sup> of surface (EVF)/total area***, where the ecological factor per m<sup>2</sup> value varies between 0 and 1, depending on the permeability of the surfaces, according to the table below:

| Surface type   | Ecological Value Factor per m <sup>2</sup> of surface (EVF) | Examples   |
|--|---|--|
| Sealed surfaces  | 0   | The surface is impermeable to air and water, there is no vegetation (concrete, asphalt, paving on solid substrate).                                  |
| Partially sealed surfaces  | 0.1   | The surface is permeable to air and water, there is no vegetation (paving and mosaic on a sand or gravel substrate).                                 |
| Semi-open surfaces   | 0.2   | The surface is permeable to air and water, with water infiltration, but without vegetation (sand, gravel, pavements with high water infiltration).   |
| Green areas  | 0.4   | The surface is permeable to air and water, with water infiltration, and with vegetation (vegetated sidewalk, wooden cubes, ecological/grass paving). |
| Vegetated surfaces, not connected to the ground, with low substrate thickness    | 0.5   | Vegetated areas, not connected to the ground, with a substrate thickness between 20 - 40 cm.   |
| Vegetated surfaces, not connected to the ground, with medium substrate thickness | 0.6   | Vegetated areas, not connected to the ground, with substrate thickness between 41 - 80 cm.   |



|   |     |   |
|---|-----|---|
| Vegetated surfaces, not connected to the ground, with high substrate thickness  | 0.7 | Vegetated areas, not connected to the ground, with substrate thickness between 81 - 150 cm.   |
| Vegetated surfaces, not connected to the ground, with very high substrate thickness   | 0.9 | Vegetated areas, not connected to the ground, with substrate thickness greater than 150 cm.   |
| Areas with vegetation connected to the ground   | 1   | Vegetation connected to the ground, suitable for the development of flora and fauna.  |
| Rainwater infiltration per m <sup>2</sup> of roof   | 0.2 | Rainwater infiltration to replenish groundwater, in areas with existing vegetation.   |
| Water surfaces  | 0.5 | Water surfaces fed by rainwater. By establishing vegetation the BAF can be increased to 0.6.  |
| Vertical green areas connected to the ground  | 0.5 | Vertical green surfaces, with vegetation rooted in the soil, absorbing nutrients and water directly from the soil through the roots.  |
| Vertical green areas not connected to the ground  | 0.7 | Vertical or horizontal vegetation on walls, without direct connection to the ground, in planting pots and with artificial irrigation.   |
| Extensive green roofs   | 0.5 | Natural looking roofs, with substrate thickness below 20 cm, without artificial irrigation. With water retention systems the BAF can increase to 0.6 (only in the case of extensive green roofs). |
| Semi-intensive green roofs  | 0.7 | Mix of extensive and intensive green roofs, with substrate thickness between 15 - 50 cm (depending on planting), usually combined with artificial irrigation.                                     |
| Intensive green roofs   | 0.8 | Green roofs designed similarly to green spaces on the ground, with substrate thickness over 50 cm, usually with artificial irrigation.  |
| If the green volume is lower than that possible for the substrate thickness, the BAF can be reduced by 0.1 in the case of green roofs and surfaces with vegetation not connected to the ground. |     |   |

For areas with vegetation connected to the ground, the BAF can be reduced by even 0.5 if there is no suitable green volume.

Because we are increasingly faced with climate change issues in urban areas: heat islands (generated by densely built-up areas), poor air quality (due to fine particles and exhaust fumes), low accessibility to cool areas (shaded and adjacent to water bodies), flooding due to lack of rainwater infiltration on sealed surfaces, the use of the BAF tool offers a flexible approach in implementing greening policies, by incorporating them into urban planning.

First used in Berlin in 1994, different minimum BAF values were developed for different types of built-up areas (e.g. min. 0.6 (60% permeability) for residential areas), the use of BAF in urban planning, through different policies and collaborative adaptations, has spread to several metropolises (Malmö, Seoul, Singapore, Paris, Montréal).

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*Senate Department for Urban Mobility, Transport, Climate Action and the Environment Berlin*

*(<https://www.berlin.de/sen/uvk/en/nature-and-green/landscape-planning/>,*

*<https://www.berlin.de/sen/uvk/en/nature-and-green/landscape-planning/baf-biotope-area-factor/calculating-the-baf/>)*

Complementary to the BAF approach, urban tree inventory can form the basis of diversity indicators, and, at the same time, indicate valuable specimens from the point of view of greening the project area. An urban tree inventory initiative is represented by the UTree project of the Pando Association (<https://www.pando.ro/project/utree/>). Following a more simplified approach, by inventorying the trees in the project area, the location and species of the trees were recorded, contributing to a more complete inventory in the public spaces in this area. In small areas, inventory was not possible due to fences and limited access to private properties.

Natural/semi-natural plant habitats of conservation importance were identified and defined according to Donita et al. *Habitats in Romania* (2005), and, where applicable, the Natura 2000 correspondence was also indicated, according to Gafta and Mountford *Interpretation Manual of Natura2000 Habitats in Romania* (2008).

## Working methodology

Stages of the working methodology:

I. GIS preparation stage: At this stage, the project area boundary was processed in vector format (in the QuantumGIS 3.22.9 program). The parts of the project area were delimited, according to the documentation:

1. Turbinei Channel
2. Municipal Park
3. Hippodrome

4. The Dead Arm of the Mures River

5. The banks of the Mures River

6. Poclos River

These parts were further divided to delimit the areas with different permeability following the BAF approach. The delimitation of these areas was based on information from satellite images (Google Maps – Satellite Layer), and Google Street View. In the attribution table, columns were created to indicate the parts of the studied area, to enter the EVF indices, to add any descriptions, respectively a column to calculate the areas of the polygons.

II. Field validation stage: In this stage, the studied areas were visited to verify and correct the surface types assumed in the previous stage. GPS points were recorded (using the Etrex Legend HCx GPS device), and the surfaces were documented with photographs and field notes.

III. Tree inventory stage: The tree inventory was carried out using the Observado mobile phone application, which allows the recording of coordinates, tree species, number of specimens, as well as documentation through photos. Trees in public spaces, their species, and, in several cases, photos were recorded. The data recorded in the application is uploaded to a server, from which the table with coordinates and data was subsequently downloaded, from which the distribution map of trees in public spaces was generated.

IV. Data processing stage: Based on the information collected on the ground, the map of surfaces with different permeabilities was corrected and adjusted, and maps with the different EVF values were generated for the 6 parts of the project.

The tree inventory was visualized on the map, indicating the species. A list of tree species was drawn up, with the number of specimens belonging to each species, distributed across the 6 project areas.

BAF was calculated, both at the level of the 6 project areas and in relation to the entire studied area.

V. In the case of the semi-natural area of Bratului Mort, the identified characteristic species and their abundance were recorded on the Braun-Blanquet scale (1951) (i.e. a 7-step scale: r: very rare species, present thread by thread, +: abundance below 1%, 1: abundance of 5-10%, 2: abundance of 10-25%, 3: abundance of 25-50%, 4: abundance of 50-75%, 5: abundance over 75%). Based on this information, the habitats and habitat fragments present in the area were identified, according to Donita et al. *Habitats in Romania* (2005), and the Natura 2000 correspondence was indicated, according to Gafta and Mountford *Manual for the interpretation of Natura2000 habitats in Romania* (2008).

## **Description of important/assessed species and habitats**

No flora species of community interest or protected at national level were identified within the studied area.

The importance of maintaining urban trees is emphasized. They, especially older ones, have a multiple beneficial role. First of all, they provide shade and a cooler microclimate, which is



extremely necessary in the context of heat islands in densely built urban areas. They contribute significantly to both reducing air pollution and reducing noise. Last but not least, they provide shelter and habitat for numerous animals (birds, bats, insects).

The already installed urban tree and shrub vegetation represents a natural value with high conservation importance, because they are already acclimatized (they dry out much more difficult than newly planted saplings), older trees have thicker trunks (difficult to break by irresponsible people) and provide shade for the development of the newly installed vegetation and for the city population (newly planted trees need several years to develop a sufficient canopy to provide significant shade). Thus, in each phase of the project, special attention must be paid to maintaining the existing trees and shrubs within the perimeter of the studied area.

**The Dead Arm of the Mures River Area**, between the beginning of the Matei Ene entrance and the Târgu-Mureș Stallion Depot, over a length of approximately 1200 m, the area with the closest appearance to the natural one of the watercourse is encountered and represents the surface with a high natural value compared to all other areas in the project area. In this area the watercourse bed is not developed, the substrate is the natural one, consisting of sediments, and the undeveloped banks are covered by dense and structured vegetation, characteristic of natural riparian habitats.

The banks are covered by willow galleries, representing the plant association **Salicetum albae-fragilis Issler 1926 em Soó 1957, and the habitat R4405 Daco-Getic forests of black poplar (*Populus nigra*) with *Rubus caesius*** (Natura 2000 correspondence: 91E0\*Alluvial forests of *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)). The 5-7 m high canopy layer is predominantly formed by white willow (*Salix alba*), to which are added in lower abundances elm (*Ulmus laevis*) and walnut (*Juglans regia*), and achieve varying covers of 60-90%. The shrub layer is also dense, with a high abundance of American maple (*Acer negundo*), an invasive non-native species, but the characteristic native species of meadow forests are also found in significant abundance: black elder (*Sambucus nigra*), dogwood (*Cornus sanguinea*), cherry (*Prunus cerasifera*), soft sedge (*Euonymus europaeus*), willow (*Salix triandra*). The grassy layer is dense and varied, due to the presence of microhabitats with different degrees of coverage or waterlogging, from hygrophilous species to ruderal nitrophilous species characteristic of these habitats: various species of sedges (*Carex riparia*, *Scirpus sylvaticus*), rushes (*Typha latifolia*), soft rushes (*Juncus effusus*), reeds (*Phragmites australis*), tall hygrophilous dicotyledons (*Lythrum salicaria*, *Butomus umbellatus*), in areas without water, blackberries (*Rubus caesius*) and other nitrophilous species (*Galium aparine*, *Urtica dioica*, *Glechoma hederacea*) predominate. There is also no lack of lianas (*Calystegia sepium*, *Clematis vitalba*, *Humulus lupulus*). Allochthonous herbaceous species with an invasive character are present with a lower abundance (among these, *Sorghum halepense*, *Phytolacca americana*, *Reynoutria* sp. were observed).

Especially at the two ends of the area, where the canopy cover is lower, **reed beds have formed (the *Scirpo-Phragmitetum* W. Koch 1926 association, representing the R5309 Danubian communities habitat clumps with *Phragmites australis* and *Schoenoplectus lacustris*).**

The most important anthropogenic pressures identified in the area are (household) waste and tree pruning.

*Aspects from the Dead Arm of the Mures area, with high natural value:*















**Tree inventory** - resulted in a total number of 929 trees (possibly shrubs) across the entire project area, including spontaneous trees and shrubs.

*Identified species and the number of specimens belonging to different species, compared to the total number of trees*

| <i>Species<br/>(scientific name)</i> | <i>Species<br/>(popular name)</i> | <i>No. of<br/>specimens in<br/>the project area</i> | <i>Mentions</i>        |
|--------------------------------------|-----------------------------------|---|------------------------|
| <i>Tilia platyphyllos</i>            | large-leaved lime tree            | 92  |                        |
| <i>Acer negundo</i>                  | american maple                    | 91  | invasive alien species |
| <i>Robinia pseudoacacia</i>          | acacia                            | 80  | invasive alien species |
| <i>Juglans regia</i>                 | walnut                            | 79  |                        |
| <i>Populus nigra</i>                 | black poplar                      | 73  |                        |
| <i>Prunus cerasifera</i>             | wax cherry                        | 59  |                        |
| <i>Acer platanoides</i>              | field maple                       | 57  |                        |
| <i>Tilia cordata</i>                 | lime tree                         | 47  |                        |
| <i>Fraxinus excelsior</i>            | ash                               | 45  |                        |

|                                      |                   |    |                               |
|--------------------------------------|-------------------|----|-------------------------------|
| <i>Acer pseudoplatanus</i>           | mountain sycamore | 44 |                               |
| <i>Ulmus laevis</i>                  | elm               | 40 |                               |
| <i>Aesculus hippocastanum</i>        | horse chestnut    | 22 | non-native ornamental species |
| <i>Thuja occidentalis</i>            | thuja             | 19 | non-native ornamental species |
| <i>Picea abies</i>                   | spruce            | 16 |                               |
| <i>Prunus cerasus</i>                | cherry            | 12 |                               |
| <i>Quercus robur</i>                 | oak               | 11 |                               |
| <i>Spiraea sp.</i>                   | garland           | 10 |                               |
| <i>Rhus typhina</i>                  | castor            | 9  | non-native ornamental species |
| <i>Salix alba</i>                    | white willow      | 9  |                               |
| <i>Philadelphus sp.</i>              | mock-orange       | 8  | non-native ornamental species |
| <i>Taxus baccata</i>                 | yew               | 8  |                               |
| <i>Betula pendula</i>                | birch             | 7  |                               |
| <i>Forsythia sp.</i>                 | golden shower     | 7  | non-native ornamental species |
| <i>Carpinus betulus</i>              | hornbeam          | 6  |                               |
| <i>Gleditsia triacanthos</i>         | glade             | 6  | invasive alien species        |
| <i>Morus sp.</i>                     | mulberry tree     | 6  |                               |
| <i>Malus pumila</i>                  | ornamental apple  | 5  | non-native ornamental species |
| <i>Pinus nigra</i>                   | black pine        | 5  | non-area-specific species     |
| <i>Malus domestica</i>               | apple             | 4  |                               |
| <i>Platanus occidentalis</i>         | turntable         | 4  | non-native ornamental species |
| <i>Prunus spinosa</i>                | loft              | 4  |                               |
| <i>Sophora japonica</i>              | japanese acacia   | 4  | non-native ornamental species |
| <i>Acer platanoides</i><br>'crimson' | ornamental maple  | 3  | ornamental species            |
| <i>Catalpa bignonioides</i>          | catalpa           | 3  | non-native ornamental species |
| <i>Liriodendron sp.</i>              | tulip tree        | 3  | non-native ornamental species |
| <i>Rosa canina</i>                   | dog rose          | 3  |                               |
| <i>Sambucus nigra</i>                | black elderberry  | 3  |                               |



|                               |                        |   |                               |
|-------------------------------|------------------------|---|-------------------------------|
| <i>Syringa vulgaris</i>       | common lilac           | 3 |                               |
| <i>Tamarix sp.</i>            | red sea buckthorn      | 3 | non-area-specific species     |
| <i>Acer campestre</i>         | maple                  | 2 |                               |
| <i>Cornus sanguinea</i>       | dogwood                | 2 |                               |
| <i>Fraxinus pennsylvanica</i> | american ash           | 2 | non-native species            |
| <i>Juniperus sabina</i>       | savin juniper          | 2 |                               |
| <i>Thuja orientalis</i>       | platycladus            | 2 | non-native ornamental species |
| <i>Acer tataricum</i>         | tatar maple            | 1 |                               |
| <i>Ailanthus altissima</i>    | tree of heaven         | 1 | invasive alien species        |
| <i>Crataegus monogyna</i>     | common hawthorn        | 1 |                               |
| <i>Elaeagnos angustifolia</i> | Russian olive          | 1 | invasive alien species        |
| <i>Laburnum anagyroides</i>   | common laburnum        | 1 | non-native ornamental species |
| <i>Pinus sylvestris</i>       | Scots pine             | 1 | non-area-specific species     |
| <i>Populus tremula</i>        | quaking aspen          | 1 |                               |
| <i>Pyrus pyraeaster</i>       | European wild pearhair | 1 |                               |
| <i>Ulmus pumila</i>           | Siberian elm           | 1 | non-native species            |

Tree distribution:

### 1. Canalul Turbinei

|                              |                          |                         |                        |                      |
|------------------------------|--------------------------|-------------------------|------------------------|----------------------|
| ● Acer campestre             | ● Crataegus monogyna     | ● Malus pumila          | ● Prunus cerasus       | ● Tamarix sp.        |
| ● Acer negundo               | ● Elaeagnus angustifolia | ● Morus nigra           | ● Prunus spinosa       | ● Taxus baccata      |
| ● Acer platanoides           | ● Fallopia sp.           | ● Morus sp.             | ● Pyrus pyrastra       | ● Thuja occidentalis |
| ● Acer platanoides 'crimson' | ● Forsythia sp.          | ● Philadelphus sp.      | ● Quercus robur        | ● Thuja orientalis   |
| ● Acer pseudoplatanus        | ● Fraxinus excelsior     | ● Picea abies           | ● Rhus typhina         | ● Tilia cordata      |
| ● Acer tataricum             | ● Fraxinus pennsylvanica | ● Pinus nigra           | ● Robinia pseudoacacia | ● Tilia platyphyllos |
| ● Aesculus hippocastanum     | ● Gleditsia triacanthos  | ● Pinus sylvestris      | ● Rosa canina          | ● Tilia platyphyllos |
| ● Ailanthus altissima        | ● Juglans regia          | ● Platanus occidentalis | ● Salix alba           | ● Ulmus laevis       |
| ● Betula pendula             | ● Juniperus sabina       | ● Populus nigra         | ● Sambucus nigra       | ● Ulmus pumila       |
| ● Carpinus betulus           | ● Laburnum anagyroides   | ● Populus nigra italica | ● Sophora japonica     |                      |
| ● Catalpa bignonioides       | ● Liriodendron sp.       | ● Populus tremula       | ● Spiraea sp.          |                      |
| ● Cornus sanguinea           | ● Malus domestica        | ● Prunus cerasifera     | ● Syringa vulgaris     |                      |







### 3. Hipodrom

|                            |                        |                      |                       |                      |                    |
|----------------------------|------------------------|----------------------|-----------------------|----------------------|--------------------|
| Acer campestre             | Catalpa bignonioides   | Juniperus sabina     | Pinus sylvestris      | Rhus typhina         | Thuja occidentalis |
| Acer negundo               | Cornus sanguinea       | Laburnum anagyroides | Platanus occidentalis | Robinia pseudoacacia | Thuja orientalis   |
| Acer platanoides           | Crataegus monogyna     | Liriodendron sp.     | Populus nigra         | Rosa canina          | Tilia cordata      |
| Acer platanoides 'crimson' | Elaeagnus angustifolia | Malus domestica      | Populus nigra italica | Salix alba           | Tilia platyphyllos |
| Acer pseudoplatanus        | Fallopia sp.           | Malus pumila         | Populus tremula       | Sambucus nigra       | Tilia pityphylos   |
| Acer tataricum             | Forsythia sp.          | Morus nigra          | Prunus cerasifera     | Sophora japonica     | Ulmus laevis       |
| Aesculus hippocastanum     | Fraxinus excelsior     | Morus sp.            | Prunus cerasus        | Spiraea sp.          | Ulmus pumila       |
| Ailanthus altissima        | Fraxinus pennsylvanica | Philadelphus sp.     | Prunus spinosa        | Syringa vulgaris     |                    |
| Betula pendula             | Gleditsia triacanthos  | Picea abies          | Pyrus pyraeaster      | Tamarix sp.          |                    |
| Carpinus betulus           | Juglans regia          | Pinus nigra          | Quercus robur         | Taxus baccata        |                    |





The coordinates of the inventoried trees and shrubs can be found in Annex 1, in wgs84 projection (EPSG:4326).

## Results presentation

According to the methods presented in Chapter I., the BAF value was calculated for each of the 6 parts of the project. Given the semi-natural character of the Mures Dead Arm area, presented in detail in Chapter III, this area was excluded from the calculations, as the high value of this area would have resulted in the BAF value being biased in the increasing direction of the area. The BAF values at the level of the project parts, respectively, regarding the entire project area, are presented in the following table (the related calculations can be found in Annex 2.):

|   | <i>Project parts</i>  | <i>Area (sqm)</i> | <i>Sum of polygon areas x EVF</i> | <i>BAF</i>  | <i>Mentions</i>   |
|---|---|-------------------|-----------------------------------|-------------|---|
| 1 | <b>Turbinei Channel</b>   | 66865.13          | 26937.76                          | <b>0.4</b>  | Concrete riverbed, with narrow strips of green spaces and paved roads on both sides.  |
| 2 | <b>Municipal Park</b>   | 92890.24          | 41689.82                          | <b>0.44</b> | Park with asphalt sports fields, respectively abandoned stadium, playground.  |
| 3 | <b>Hippodrome</b>   | 267493.04         | 209589.23                         | <b>0.78</b> | Area with large areas of grassy vegetation, used for riding and walking, sports fields and adjacent parking lots.   |
| 4 | <b>The Dead Arm of the Mures River</b>                          | 61744.16          | 51032.37                          | <b>0.82</b> | The area mainly contains areas with spontaneous vegetation on the bank with a dammed portion, in the peripheral area of the city, with areas restricted by roads, and with the watercourse bed partially covered with concrete slabs. |
|   | <b>Dead Arm of the Mures River - Area of high natural value</b> |                   |                                   | <b>1</b>    | Area with natural vegetation, habitats with high natural value.   |
| 5 | <b>The banks of the Mures River</b>                             | 69208.4           | 69208.4                           | <b>1</b>    | The banks of the Mures River, the green area between the riverbed and the dam.  |



|              |                     |           |           |             |   |
|--------------|---------------------|-----------|-----------|-------------|---|
| <b>6</b>     | <b>Poclos River</b> | 4576.22   | 2115.82   | <b>0.46</b> | Small area, with a concrete riverbed and a patch of green space next to the road and railway. |
| <b>Total</b> |                     | 562777.22 | 400573.43 | <b>0.71</b> |   |

*Map of areas with different EVF values in parts of the project*













## Conclusions/Proposals

- A large part of the surface of the **Mures Dead Arm constitutes an area of high natural value**. Although some low anthropogenic pressures are observed, the area can be considered an almost natural island, presenting a complex structure, dominated by spontaneous species, devoid of significant anthropogenic influences and interventions. **In this area, only limited developments are recommended, with exclusive ecological education purposes, made only from natural materials (wood, stone, clay), to raise awareness of natural values**. In the case of planning developments, attention will be paid to not allowing the BAF value (of 1) to decrease at all by covering new surfaces with paving stones.
- Most urban trees are found on permeable surfaces that are far too limited in terms of canopy coverage. Even in the Municipal Park, the pavements and ecological pavements extend to the base of the tree trunks. Although relatively many specimens of trees and shrubs have been identified, they are often grouped in rows of trees, many show signs of excessive pruning or are young specimens. Native species are poorly represented, of the 53 species identified, 23 are non-native or non-specific to the area (some even invasive).

- The BAF values are relatively low, even in the case of the Municipal Park, which, theoretically, represents a green, recreational area at the city level. The areas with high BAF are the peripheral ones, the banks of the Mures River and the surface of the hippodrome covered with periodically mowed grassy vegetation.
- Approaches to consider in defining the goals of green areas, in general:
- **BAF increases** at the level of each studied area (by changing impermeable and semi-permeable pavements into permeable surfaces, not only for water and air, but also vegetation. Where this is not possible, impermeable surfaces could be changed to semi-permeable surfaces).
- **Exclusion of decrease in BAF value** following the arrangements at the level of each part of the project.
- Searching for suitable solutions to modify the vertical and concrete bank of the Turbinei Channel into a terraced bank, with aquatic vegetation and access to water for the townspeople (especially since fishing is currently practiced in the area).
- Looking for ways to set up green walls in buildings (e.g. the Multipurpose Hall), also investments in reducing energy consumption at the Municipal Park and the Multipurpose Hall (reducing energy consumption through photovoltaic panels and smart energy use technologies).
- Increasing floristic and especially arboreal diversity, by planting autochthonous, native species, characteristic of natural habitats in the hilly areas of Transylvania.
- Exclusion of cutting down trees with a trunk diameter greater than 5 cm, to ensure the development of old trees over time.
- Increasing permeable surfaces around existing tree trunks and professionally performing crown trimming to ensure healthier and richer crown development.
- **Planning spaces reserved for nature**, and spaces presenting nature-based solutions: small Miyawaki forests, rain gardens, small temporary or permanent ponds with natural substrate pools (not sealed with artificial materials), with substrate and aquatic vegetation consisting of native plants, dead wood trunks preserved for xylophagous insects, areas with trees for burrows (including artificial burrows) and reserved for nesting bird colonies.
- Paths made of natural materials (wood, stone, brick) without a concrete base.
- Including spaces reserved for dog walking, possibly for a dog agility track.
- Searching for feasible and suitable solutions to eliminate barriers in the watercourse: reducing concrete surfaces in the riverbed, eliminating pipe-shaped straits around bridges.



## D. AVIFANUNA

### Working methodology

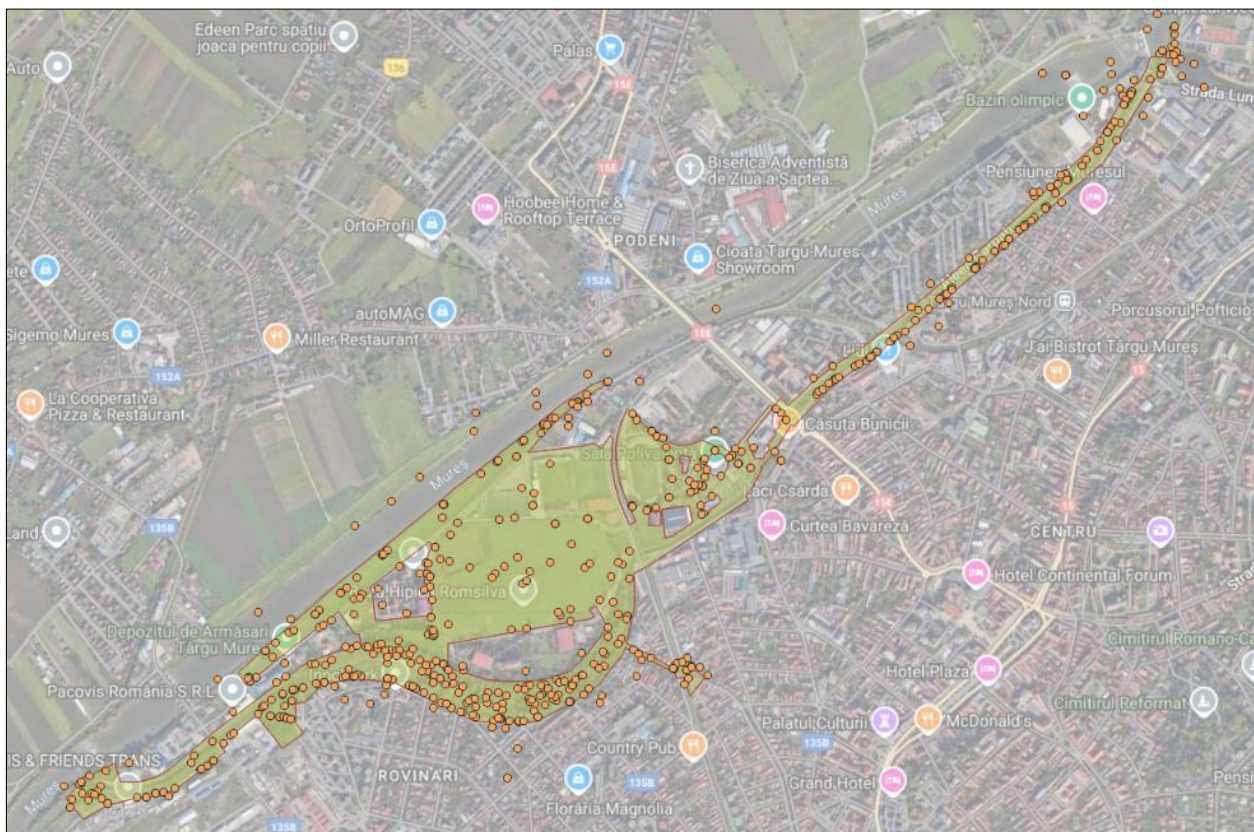
The trips were made in the morning, as birds are more active during this period, and the observation rate is higher.

During these field trips, all species observed both acoustically and visually were noted. The OpenBiomaps mobile application was used to collect data, which allows each observation to be mapped. Thus, in addition to species counts, the results of the censuses also represent a detailed distribution map of all species in the project area.

The birds were observed using binoculars based on specific songs/sounds.

The field inventory was carried out as follows:

- ✓ May 30, 2024 – complete exploration of the study area
- ✓ June 20, 2024 - complete exploration of the study area
- ✓ July 5, 2024 - complete exploration of the study area
- ✓ July 22, 2024 – detailed inventory/mapping of the meadow forest in the "Ritz" area
- ✓ July 31, 2024 - complete exploration of the study area
- ✓ September 3, 2024 – kayaking along the Turbinei Channel in the "Ritz" area
- ✓ October 16, 2024 – kayaking of the section of the Mures River included in the project to inventory/evaluate the waterfront
- ✓ December 11, 2024 – search for larger bird nests



**Map no. 12** – Bird observations collected during field trips (Light green area – project area, yellow dots – bird observations)

### Description of species of community interest

Given the relatively large number of bird species observed and the fact that these are mostly common, urbanized species (pigeon, sparrow, crow, pheasant, etc.), in this study we present only species of European conservation interest (Natura2000 species).

Little Egret (*Egretta garzetta*) Species Code – EUNIS, EUNIS Code – 1016, Natura 2000 Code A026

#### Species description

It is a medium-sized heron species, which shows reduced sexual dimorphism, the male being slightly larger than the female. The little egret has an elegant body, with a long and thin neck, black legs with yellow toes in strong contrast, and a black, dagger-shaped beak, the base of the beak sometimes being yellow. In the nuptial plumage it shows two very long and elegant white feathers, which start from the nape. The body length is 55 - 65 cm, the wingspan is 86 - 104 cm, and the weight is 280 - 710 g.

#### Critical periods

It requires special attention during the nesting period and raising chicks.



A summer guest in our country, it arrives at the beginning of April from its wintering grounds. It places its nest, built of branches and reeds, on willows and sometimes in reeds or dense shoots near ponds. Both parents participate in building the nest. Nests in colonies are placed at a distance of 1-4 m from each other (sometimes this distance is even less than 1 m). The female lays 3-4 greenish eggs between the second half of May and the first half of June. The size of an egg is 46.54 x 33.67 mm. Incubation, which lasts 21-25 days, is provided by both parents. The chicks remain in the nest for about 30 days and leave it before they can fly, climbing with great skill among the branches. They continue to be fed by their parents until they are 40 days old, when they become independent.

It hunts by lurking or moving carefully in shallow waters. It feeds on fish up to 10 cm long, amphibians and other small aquatic animals (especially insects and mollusks). During nesting, the parents travel between 7 and 13 km from the colony daily to feed.

#### *Habitat requirements*

It prefers marshy areas, deltas and ponds, with clusters of trees necessary for nesting. It is the quietest species of egrets. It nests in mixed colonies, along with other species of herons and cormorants. The maximum known longevity is 22 years and 4 months.

White stork (*Stork stork*) Species Code – EUNIS - EUNIS Code – 969, Natura 2000 Code A031

#### *Species description*

It is a large bird species. The sexes have identical coloration. The plumage is generally white, with black wing tips (flight feathers). The legs and beak are deep red (blackish in juveniles). The body length is 95-110 cm and it has an average weight of 2400-4400 g. The wingspan is between 180-218 cm.

#### *Critical periods*

It requires special attention during the nesting period and raising chicks.

It arrives at the beginning of March from its wintering grounds. The nest, most often placed on medium-voltage power poles, but also on the roofs of houses, is made of branches fixed with earth. The nest can reach impressive dimensions by adding material every year (1.5 m in diameter, 1-2 m in height and weighing 40 kg). The inside is lined with moss and plant debris. Usually, the male brings the materials, and the female places them and fits them in the nest. Often, many pairs of field sparrows (or black-faced sparrows, *Passer hispaniolensis*, in the stork nests in Dobrogea).

The female lays 3-4 eggs between the beginning of April and the second half of May. The average size of the eggs is 73.6 x 52.54 mm. Incubation is provided by both parents. At night, only the female sits on the eggs. After 33-34 days, the chicks hatch and are fed by the parents in the nest for 53-55 days.

#### *Habitat requirements*

The white stork is a species characteristic of wet grasslands and marshy areas. Adults have a similar appearance and are distinguished from the black stork by the white color of the head and neck. It feeds on frogs, mice, insects, moles, baby birds and rabbits, snails, snakes and lizards.

The white stork is, along with the swallow, the species that interacts the most with the human population, being present in most localities in our country, except for mountainous areas. Being a species accustomed to human presence, it uses medium-voltage network poles and house roofs as a support for its nest. Typically, the stork pair returns to the nest occupied in previous years.



Little Blue Gull (*Alcedo atthis*) Species Code – EUNIS - EUNIS Code – 855, Natura 2000 Code A229

#### *Species description*



A small, brightly colored bird species with an unmistakable appearance. The sexes are very similar. The head and back are blue with metallic reflections (lighter in the central part of the back) and the ventral side is orange; the goiter is white. The male has a completely black beak, and the female has a reddish base. The body length is 17-99 cm, the wingspan is 24-28 cm, and the weight is 34-46 grams.

*Critical periods*

Requires special attention during nesting and chick raising

It is a monogamous and territorial species, requiring a daily food intake equivalent to 60% of its body weight, which implies the control of a territory of 1-3.5 km along the watercourse. The nuptial ritual is initiated by the male, who follows the female and offers her food. Both sexes contribute to building the nest on the banks of the water, in galleries approximately 1 m long. At the end of these, a wider and round chamber is dug, in which the female lays her eggs in April-May. The 6-7 eggs are incubated in turn by both parents. The size of an egg is 22 x 19 mm.

The incubation period is 19-21 days, being provided by both sexes during the day, with the female incubating at night. The chicks remain in the nest for 24-27 days and, as they grow, come to the edge of the tunnel to be fed. In favorable conditions, the species can have two or even three clutches per year.

The main food of the species is small freshwater fish, aquatic insects and marine fish. Less often it also consumes crustaceans, mollusks, terrestrial insects or amphibians. It usually dives headfirst to catch prey, launching itself from ambush sites represented by the branches of bushes or trees hanging above the water. It can be observed attacking even after briefly flying in place above the water. The maximum known longevity in the wild is 21 years, but only a quarter of adults live more than one season.

*Habitat requirements*

The species breeds in the western Palearctic at both high and mid latitudes, being widespread in continental and oceanic climates, in temperate, boreal and steppe regions, wherever it finds clear, unfrozen water, preferably still or slowly flowing, with small fish and sufficient hiding places. During the breeding season it prefers fresh water to salt or brackish water. Preferred nesting habitats are streams, small rivers and channels with steep and sandy banks in which it digs its nest.



Common tern (*Sterna hirundo*) EUNIS Code – 1282, Natura 2000 Code A193

*Species description*

It is a medium-sized species of tern. The sexes are similar. In adults in summer plumage, the dorsal part of the head is black, the chest and belly are white, and the back is gray. In winter plumage, the black on the head is less intense and the forehead becomes white. The legs are red. The bill is red with a black tip, and in winter plumage it is black. Juveniles have a marbled dorsal color, with shades of brown in the first year; ventrally they are white. The body length is 34 - 37 cm, the wingspan is 70 - 80 cm, and the weight is 97 - 146 grams.

*Critical periods*

Requires special attention during nesting and chick raising

The clutch, laid in the latter part of May and June, is usually made up of 2-3 eggs, with an average size of 41.1 x 30.4 mm. Incubation lasts around 22-28 days and is provided by both partners. The species is very aggressive near the nest or chicks, so it can attack large predator species. The chicks leave the nest a few days after hatching and are cared for by the adults until they become flightless, at around 27-30 days.

To feed, it dives after detecting prey, from 1-6 m high to a depth of 50 cm. It hovers in place, flapping its wings in pursuit of prey. It feeds at a distance of up to 5-10 km from the colony. Its diet mainly includes small fish, but it also captures small crustaceans, annelids, mollusks, and insects.



#### *Habitat requirements*

The pond tern is characteristic of coastal wetlands, but also of inland freshwater lakes. It nests on sandy beaches or islands, on sand dunes inside ponds, sometimes on plant debris or floating vegetation.

Field fescue (*Anthus campestris*) EUNIS code –882

#### *Species description*

A species of small songbird, with a relatively uniform gray color, fine streaks on the sides of the chest, a light-colored abdomen, a long tail, and pinkish legs. The sexes are similar. Juveniles have plumage similar to adults, being much more streaked on the head, chest, and back. The body length is 15.5–18 cm, and the weight is 17–32 g.



#### *Critical periods*

Requires special attention during nesting and chick raising

It begins to sing in April and becomes silent in early July. During the nuptial ritual, it rises up to 30 m, singing, and describes circles or undulating flights. It is a territorial and monogamous species. Outside the nesting period the partners are solitary. In the central and southern part of Europe, the laying of eggs takes place from mid-May to July. The nest is placed in a shallow scrape, usually under plants, being built by the female from plant matter and lined with hairs or wool. It usually has one clutch per year (occasionally two) which consists of 3-6 eggs measuring 21.2 x 15.3 mm and which are incubated mainly by the female, for 13-14 days. During this period the male may frequently change the female to incubate. The chicks leave the nest after about 12-14 days, but are still fed by their parents for another 7-10 days, until they can fly. They become independent at 4-5 weeks.

It feeds on the ground, predominantly on insects (*Orthoptera*, *Isoptera*, *Odonata*, *Mantodea*, *Coleoptera*), or other invertebrates (*Mollusca*), as well as seeds; less often, it can also consume small vertebrates (reptiles). The maximum known longevity is five years. It spends most of its time on the ground. Similar to the codobats, it swings its tail

#### *Habitat requirements*

The species prefers dry, but not arid, soil in areas located at mid-latitudes, from the shores of the Mediterranean Sea and steppes to temperate regions. It avoids steep and rocky terrain, high and low vegetation. Preferred habitats are more widespread in areas of sunny continental plains, but locally their habitat also reaches altitudes of 2,600 m in Armenia. In Germany, it breeds on sandy arable land and on sandy banks of rivers, lakes; similar habitats are occupied in other regions of western Europe. In northwestern Africa, it colonizes dry slopes and plateaus up to an altitude of 2,400 m, being an abundant species in the Atlas Mountains above the tree line, up to an altitude of 3,000 m. Other references include sand dunes in coastal regions, dry riverbeds, roadsides, vineyards, and dry hills. In winter, in Africa, the preference for arid soil is accentuated; thus, the species is common in coastal areas, steppes, Acacia scrub, and in the bare areas of the transition zone between dry savannas and desert, even on the edge of the desert; it is frequently associated with cattle herds.

Reddish warbler (*Lanius collurio*) EUNIS Code – 1098, Natura 2000 Code A338

#### *Species description*

It is a small-sized species of shrike. Sexual dimorphism is more pronounced than in other shrike species. The male has a gray head, a reddish-brown back, and a white chest with pinkish hues; the black band around the eyes, characteristic of shrike species, is narrow and ends in the beak area. In the female, the colors are more muted, the head is gray, brown on the shoulders and wings, light gray with fine striations on the sides; the band around the eyes is smaller and dark brown. The body length is 16-18 cm, and it has an average weight of 23-34 g. The wingspan is between 24-27 cm.



#### *Critical periods*

Requires special attention during nesting and chick raising

The female usually lays 4-6 eggs in late May and early June, which are about 22 x 17 mm in size. The eggs are dull, with gray spots on a greenish, yellowish, or pink background. It is a species with great variability in the shape and color of the eggs. Incubation lasts about 13-15 days and is provided by the female, who is fed throughout this time by the male. The chicks are fed by both parents and become flightless after 14-15 days. A single clutch is laid per year.

Its diet consists almost exclusively of large insects. It lurks on a branch, facing a wide-open area, from where it dives for prey that it captures in flight. When it has the opportunity, it also consumes lizards, rodents, or even small mammals. It is used to robbing the nests of small songbirds, stealing their chicks. It has the habit of fixing the surplus of captured prey in the thorns of shrubs, to use on rainy days, when food is less available.

#### *Habitat requirements*

The reddish warbler is characteristic of open agricultural areas of pastures, with many bushes and brambles. It is found up to a maximum altitude of 1,700 m.



## Results presentation

In total, 710 observations were collected and 2820 birds were observed, belonging to 72 species, and 57 nests were found (**Map no. 12 and 13, Table no. 7 and 8**).

**Table No. 7**– Bird species identified in the different project areas. Note: Total WMC – data collected within this project in 2024; BD Milvus – observations from the project area according to the Milvus Group database from 2004-2024; **nest.** – nesting; **fe.** – feeding; **p.** – pairs; **i.** – individuals; \* - written species are species of community interest (listed in Annex 1 of the Birds Directive)

| No. | Species name                      |                   |                      | Total WMC (2024) | BD Milvus (2004-2024) | Observation  | Turbinei Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |     | Ritz area |     | Poclos |     |
|-----|-----------------------------------|-------------------|----------------------|------------------|-----------------------|--|------------------|-----|----------------|-----|------------|-----|------------------------------|-----|-----------|-----|--------|-----|
|     |                                   |                   |                      |                  |                       |  | nest.            | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe. | nest.     | fe. | nest.  | fe. |
| 1   | <i>Accipiter gentilis</i>         | Goshawk           | Héja                 | -                | 1                     | rare, occasional, irrelevant observation               |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 2   | <i>Accipiter nisus</i>            | Bird-watching owl | Karvaly              | 1                | 49                    | occasionally, can appear anywhere                      |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 3   | <i>Acrocephalus arundinaceus</i>  | Large lake        | Nádirigó             | 14               | 13                    | nesting reed warbler                                   |                  |     |                |     |            |     | 3 - 6 p                      |     | 2 - 4 p   |     |        |     |
| 4   | <i>Acrocephalus palustris</i>     | Swamp lark        | Énekes nádiposzáta   | 10               | 33                    | aquatic nesting species                                |                  |     |                |     | 0 - 1 p    |     | 1 p                          |     | 4 - 5 p   |     |        |     |
| 5   | <i>Acrocephalus schoenobaenus</i> | Small hut         | Foltos nádiposzáta   | 10               | 3                     | aquatic nesting species                                |                  |     |                |     |            |     | 2 - 3 p                      |     | 1 - 2 p   |     |        |     |
| 6   | <i>Acrocephalus scirpaceus</i>    | Reed hut          | Cserregő nádiposzáta | -                | 3                     | rare species of reed                                   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 7   | <i>Actitis hypoleucos</i>         | Mountain whistler | Billegető cankó      | -                | 9                     | occasionally may appear along the waters               |                  |     |                |     |            |     | 1 - 2 i                      |     |           |     |        |     |
| 8   | <i>Aegithalos caudatus</i>        | Codified tit      | Őszapó               | 5                | 496                   | occasionally, it can appear anywhere in larger numbers |                  |     |                |     |            |     |                              |     | 5 - 20 i  |     |        |     |
| 9   | <i>Aix galericulata</i>           | Mandarin duck     | Mandarinréce         | -                | 6                     | rare, occasional, irrelevant observation               |                  |     |                |     |            |     |                              |     |           |     |        |     |

| No. | Species name              |                  |                     | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbinei Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |     | Ritz area |     | Poclos |     |
|-----|---------------------------|------------------|---------------------|------------------|-----------------------|---|------------------|-----|----------------|-----|------------|-----|------------------------------|-----|-----------|-----|--------|-----|
|     |                           |                  |                     |                  |                       |   | nest.            | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe. | nest.     | fe. | nest.  | fe. |
| 10  | <i>Alauda arvensis</i>    | Eurasian skylark | Mezei pacsirta      | -                | 5                     | occasionally, it may appear in the Hippodrome area and the banks of the Mures River |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 11  | <i>Alcedo atthis*</i>     | Blue gull        | Jégmadár            | 8                | 42                    | It can appear anywhere along the waters.  | 1 - 2 i          |     |                |     |            |     | 1 - 2 i                      |     | 1 - 2 p   |     |        |     |
| 12  | <i>Anas crecca</i>        | Little duck      | Csörgő réce         | -                | 31                    | occasionally may appear along the waters  |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 13  | <i>Anas platyrhynchos</i> | Big duck         | Tökés réce          | 157              | 614                   | Common species in aquatic habitats.   | 20 - 30 i        |     |                |     |            |     | 10 - 15 i                    |     | 15 - 20 i |     |        |     |
| 14  | <i>Anser albifrons</i>    | Large shrike     | Nagy lilik          | -                | 123                   | only in the passage above the city  |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 15  | <i>Anthus campestris*</i> | Tawny pipit      | parlagi pityer      | 1                | -                     | rare plain species  |                  |     |                |     |            |     | 0 - 1 p                      |     |           |     |        |     |
| 16  | <i>Anthus cervinus</i>    | Reddish stripe   | Rozsdástorkú pityer | -                | 1                     | rare species in passage   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 17  | <i>Anthus pratensis</i>   | Meadow pipit     | Réti pityer         | -                | 27                    | rare species in passage   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 18  | <i>Anthus spinoletta</i>  | Mountain strip   | Havasi pityer       | -                | 1                     | rare species in passage   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 19  | <i>Anthus trivialis</i>   | Forest strip     | Erdei pityer        | -                | 10                    | rare species in passage   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 20  | <i>Apus apus</i>          | Black thorn      | Sarlósfecske        | -                | 453                   | Anthropized species in areas with tall buildings.                                   |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 21  | <i>Ardea alba*</i>        | Great egret      | Nagy kócsag         | -                | 1                     | It may occasionally appear in the Mures riverbank area.                             |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 22  | <i>Ardea cinerea</i>      | Grey heron       | Szürke gém          | 1                | 21                    | It may occasionally appear in the Mures/Ritz riverbank area.                        |                  |     |                |     |            |     |                              |     | 1 - 2 i   |     |        |     |
| 23  | <i>Ardea purpurea</i>     | Red heron        | Vörös gém           | -                | 1                     | only in the passage above the city  |                  |     |                |     |            |     |                              |     |           |     |        |     |

| No. | Species name                      |                        |                   | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbine Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |          | Ritz area |     | Poclos |         |
|-----|-----------------------------------|------------------------|-------------------|------------------|-----------------------|---|-----------------|-----|----------------|-----|------------|-----|------------------------------|----------|-----------|-----|--------|---------|
|     |                                   |                        |                   |                  |                       |   | nest.           | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe.      | nest.     | fe. | nest.  | fe.     |
| 24  | <i>Asio otus</i>                  | Forest tuft            | Erdei fülesbagoly | -                | 196                   | can nest in parks, the Alley area.                                    |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 25  | <i>Athene noctua</i>              | Little owl             | Kuvik             | 1                | 72                    | rare species in rural areas   |                 |     |                |     |            |     |                              |          | 0 - 1 p   |     |        |         |
| 26  | <i>Bombycilla garrulus</i>        | Bohemian waxwing       | Csonttollú        | -                | 22                    | rare winter guest   |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 27  | <i>Buteo buteo</i>                | Common shrew           | Egerészölyv       | 10               | 69                    | the most common species of raptor.                                    |                 |     |                |     | 1 - 4 i    |     |                              |          | 1 p       |     |        |         |
| 28  | <i>Carduelis carduelis</i>        | Goldfinch              | Tengelic          | 47               | 642                   | Common anthropized species, it can appear anywhere.                   | 5 - 15 i        |     | 1 - 5 i        |     | 5 - 10 i   |     |                              | 5 - 10 i | 1 - 5 i   |     |        | 1 - 5 i |
| 29  | <i>Charadrius dubius</i>          | Small collared plunder | Kis lile          | -                | 1                     | rare aquatic species in passage                                       |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 30  | <i>Chloris chloris</i>            | greenfinch             | Zöldike           | 34               | 469                   | Common anthropized species, it can appear anywhere.                   | 5 - 10 i        |     | 1 - 5 i        |     |            |     | 1 - 5 i                      |          | 1 - 5 i   |     |        |         |
| 31  | <i>Chroicocephalus ridibundus</i> | Laughing gull          | Dankasirály       | 5                | 509                   | occasionally may appear along the waters                              |                 |     |                |     |            |     | 1 - 5 i                      |          |           |     |        |         |
| 32  | <i>Ciconia ciconia</i>            | White stork            | Fehér gólya       | 2                | 25                    | Are you stuck somewhere?  |                 |     |                |     | 2 i        | 2 i |                              |          |           |     |        |         |
| 33  | <i>Cinclus cinclus</i>            | Black-headed gull      | Vízirigó          | -                | 2                     | rare, may occur along watercourses in winter                          |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 34  | <i>Circus aeruginosus</i>         | Reed beds              | Barna rétihéja    | -                | 5                     | occasionally, in passing  |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 35  | <i>Circus cyaneus*</i>            | Erete venice           | Kékes rétihéja    | -                | 4                     | occasionally, in winter it may appear on the banks of the Mures River |                 |     |                |     |            |     |                              |          |           |     |        |         |
| 36  | <i>Clanga pomarina*</i>           | Lesser spotted eagle   | Békászó sas       | -                | 5                     | rare sighting, only in passage over the city                          |                 |     |                |     |            |     |                              |          |           |     |        |         |



| No. | Species name                         |                 |                 | Total WMC (2024) | BD Milvus (2004-2024) | Observation  | Turbine Channel |            | Municipal Park |     | Hippodrome |            | The banks of the Mures River |           | Ritz area |          | Poclos |         |
|-----|--------------------------------------|-----------------|-----------------|------------------|-----------------------|--|-----------------|------------|----------------|-----|------------|------------|------------------------------|-----------|-----------|----------|--------|---------|
|     |                                      |                 |                 |                  |                       |  | nest.           | fe.        | nest.          | fe. | nest.      | fe.        | nest.                        | fe.       | nest.     | fe.      | nest.  | fe.     |
| 37  | <i>Coccothraustes coccothraustes</i> | Bullfinch       | Meggyvágó       | 3                | 84                    | Relatively common species, in small numbers, it can appear anywhere. |                 |            |                |     |            |            |                              |           |           | 1 - 5 i  |        |         |
| 38  | <i>Coloeus monedula</i>              | Western jackdaw | Csóka           | 401              | 37474                 | Common, anthropized species.   | 20 - 60 i       |            | 5 - 10 i       |     |            | 10 - 100 i |                              | 1 - 10 i  |           | 5 - 10 i |        |         |
| 39  | <i>Columba livia forma domestica</i> | Domestic pigeon | Parlagi galamb  | 487              | 662                   | Common, anthropized species.   |                 | 50 - 200 i | 5 - 10 i       |     | 25 - 50 i  |            |                              | 10 - 40 i |           |          |        | 1 - 5 i |
| 40  | <i>Columba palumbus</i>              | Collared dove   | Örvös galamb    | 1                | 9                     | Common species can appear anywhere.                                  |                 |            |                |     |            |            |                              | 1 - 2 i   |           |          |        |         |
| 41  | <i>Coracias garrulus</i>             | Roller          | Szalakóta       | -                | 1                     | rare, occasional, irrelevant observation                             |                 |            |                |     |            |            |                              |           |           |          |        |         |
| 42  | <i>Corvus corax</i>                  | Raven           | Holló           | 7                | 365                   | Relatively common species, accustomed to anthropogenic impact.       |                 |            |                |     |            |            | 3 - 5 i                      |           | 1 p       |          |        |         |
| 43  | <i>Corvus cornix</i>                 | Maned crow      | Dolmányos varjú | 30               | 2910                  | Common, anthropized species.   | 5 - 15 i        |            |                |     |            | 1 - 5 i    |                              |           | 2 - 3 p   |          |        | 1 - 5 i |
| 44  | <i>Corvus frugilegus</i>             | Sowing crow     | Vetési varjú    | 362              | 871                   | Common, anthropized species.   | 15 - 30 i       |            | 20 - 30 i      |     |            | 80 - 200 i |                              | 10 - 15 i |           | 5 - 8 i  |        |         |
| 45  | <i>Corvus spec.</i>                  | Crow spec.      | Varjú faj       | 261              | 5012                  |  |                 |            |                |     |            |            |                              |           |           |          |        |         |
| 46  | <i>Coturnix coturnix</i>             | Quail           | Fürj            | -                | 8                     | occasionally, in passing   |                 |            |                |     |            |            |                              |           |           |          |        |         |
| 47  | <i>Crex crex*</i>                    | Field crystal   | Haris           | -                | 3                     | Rare observation, Hippodrome area (haylands)                         |                 |            |                |     |            |            |                              |           |           |          |        |         |
| 48  | <i>Cuculus canorus</i>               | Cuckoo          | Kakukk          | 2                | 26                    | common species   |                 |            |                |     |            |            | 0 - 1 p                      |           | 0 - 1 p   |          |        |         |
| 49  | <i>Cyanistes caeruleus</i>           | Blue tit        | Kék cinege      | 13               | 219                   | common species in gardens/parks/forests.                             | 1 - 3 p         |            | 1 - 2 p        |     |            |            | 1 - 5 i                      |           | 1 - 2 p   |          |        |         |
| 50  | <i>Cygnus olor</i>                   | Summer swan     | Bütykös hattyú  | -                | 2                     | casual observation   |                 |            |                |     |            |            |                              |           |           |          |        |         |

| No. | Species name                        |  |                                    | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbinei Channel |     | Municipal Park |     | Hippodrome |         | The banks of the Mures River |         | Ritz area |           | Poclos |     |
|-----|-------------------------------------|--|------------------------------------|------------------|-----------------------|---|------------------|-----|----------------|-----|------------|---------|------------------------------|---------|-----------|-----------|--------|-----|
|     |                                     |  |                                    |                  |                       |   | nest.            | fe. | nest.          | fe. | nest.      | fe.     | nest.                        | fe.     | nest.     | fe.       | nest.  | fe. |
| 51  | <i>Delichon urbicum</i>             | Homemade slaw                                | Molnárfecske                       | 55               | 408                   | nesting species   |                  |     |                |     |            |         |                              |         | 10 - 20 p | 25 - 50 i |        |     |
| 52  | <i>Dendrocopos major</i>            | Great spotted woodpecker                     | Nagy fakopáncs                     | 9                | 88                    | species nesting in areas with old trees   | 1 - 2 p          |     | 1 p            |     | 0 - 1 p    |         |                              |         | 1 p       |           |        |     |
| 53  | <i>Dendrocopos major / syriacus</i> | Great Spotted Woodpecker / Garden Woodpecker | Nagy fakopáncs / Balkáni fakopáncs | 4                | 2                     |   |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 54  | <i>Dendrocopos spec.</i>            | Speckled Woodpecker                          | Tarka harkály spec.                | -                | 2                     |   |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 55  | <i>Dendrocopos syriacus*</i>        | Garden woodpeckers                           | Balkáni fakopáncs                  | -                | 282                   | species nesting in areas with old trees   |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 56  | <i>Dryobates minor</i>              | Lesser Spotted Woodpecker                    | Kis fakopáncs                      | 1                | 1                     |   |                  |     |                |     |            |         |                              |         | 1 p       |           |        |     |
| 57  | <i>Egretta garzetta*</i>            | Little egret                                 | Kis kócsag                         | 2                | 10                    | rare aquatic species, can appear in the Ritz area and the banks of the Mures River. |                  |     |                |     |            |         |                              | 2 - 4 i |           |           |        |     |
| 58  | <i>Emberiza calandra</i>            | Gray bream                                   | Sordély                            | -                | 4                     | common species in agricultural areas  |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 59  | <i>Emberiza citrinella</i>          | Yellow briquette                             | Citromsármány                      | -                | 14                    | common species in agricultural areas  |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 60  | <i>Erithacus rubecula</i>           | robin  | Vörösbegy                          | 9                | 34                    | common species in gardens/parks/forests.  | 1 - 2 p          |     | 1 - 2 p        |     |            |         |                              |         | 2 - 4 p   |           |        |     |
| 61  | <i>Falco peregrinus</i>             | Peregrine falcon                             | Vándorsólyom                       | -                | 9                     | common species in gardens/parks/forests.  |                  |     |                |     |            |         |                              |         |           |           |        |     |
| 62  | <i>Falco subbuteo</i>               | The swallow hawk                             | Kabasólyom                         | 1                | 53                    | rare species, partially anthropized   |                  |     |                |     | 0 - 1 p    | 1 - 2 i |                              |         |           |           |        |     |

| No. | Species name                    |                     |                   | Total WMC (2024) | BD Milvus (2004-2024) | Observation                                     | Turbine Channel |           | Municipal Park |          | Hippodrome |           | The banks of the Mures River |           | Ritz area |          | Poclos |         |
|-----|---------------------------------|---------------------|-------------------|------------------|-----------------------|---|-----------------|-----------|----------------|----------|------------|-----------|------------------------------|-----------|-----------|----------|--------|---------|
|     |                                 |                     |                   |                  |                       |   | nest.           | fe.       | nest.          | fe.      | nest.      | fe.       | nest.                        | fe.       | nest.     | fe.      | nest.  | fe.     |
| 63  | <i>Falco tinnunculus</i>        | Red kite            | Vörös vércse      | 6                | 235                   | common species of raptor                        |                 |           |                |          | 1 p        |           | 0 - 1 p                      |           |           |          |        |         |
| 64  | <i>Ficedula albicollis*</i>     | Collared flycatcher | Örvös légykapó    | -                | 1                     | rare observation, in passing                    |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 65  | <i>Ficedula hypoleuca</i>       | Black flycatcher    | Kormos légykapó   | -                | 9                     | rare, occasional observation                    |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 66  | <i>Ficedula parva*</i>          | Small flycatcher    | Kis légykapó      | -                | 1                     | rare observation, in passing                    |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 67  | <i>Fringilla coelebs</i>        | Finch               | Erdei pinty       | 3                | 342                   | common species in gardens/parks/forests.        | 1 - 3 p         |           |                |          |            |           |                              |           |           |          |        |         |
| 68  | <i>Fringilla montifringilla</i> | Winter finch        | Fenyőpinty        | -                | 13                    | winter guest, can appear anywhere               |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 69  | <i>Galerida cristata</i>        | Crested grebe       | Búbospacsirta     | -                | 12                    | relatively common species in open habitats      |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 70  | <i>Gallinula chloropus</i>      | Pond hen            | Vízityúk          | 8                | 10                    | common aquatic species                          |                 |           |                |          |            | 0 - 1 p   |                              | 1 p       |           |          |        |         |
| 71  | <i>Garrulus glandarius</i>      | Jay                 | Szajkó            | 12               | 617                   | common species in gardens/parks/forests.        | 2 - 3 p         |           |                |          |            |           | 0 - 1 i                      | 2 - 3 p   |           |          |        |         |
| 72  | <i>Hippolais icterina</i>       | Icterine warbler    | Kerti geze        | -                | 17                    | rare forest/park species                        |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 73  | <i>Hirundo rustica</i>          | Barn Swallow        | Füsti fecske      | 234              | 1154                  | common nesting species                          |                 | 50 - 70 i |                | 5 - 10 i | > 10 p     | 30 - 50 i |                              | 15 - 25 i |           | 5 - 10 i |        | 1 - 5 i |
| 74  | <i>Jynx torquilla</i>           | Twisted Head        | Nyaktekercs       | -                | 3                     | rare species of woodpecker                      |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 75  | <i>Lanius collurio*</i>         | Reddish shrike      | Tövisszűrő gébics | 3                | 1                     | rare species nesting in agricultural areas/bush |                 |           |                |          |            |           | 1 p                          |           | 1 p       |          |        |         |
| 76  | <i>Lanius excubitor</i>         | Big shrike          | Nagy őrgébics     | -                | 1                     | rare winter guest in open habitats              |                 |           |                |          |            |           |                              |           |           |          |        |         |
| 77  | <i>Larus cachinnans</i>         | Black-headed gull   | Sztyeppi sirály   | -                | 10                    | may appear along the waters                     |                 |           |                |          |            |           |                              |           |           |          |        |         |



| No. | Species name                            |  |                                    | Total WMC (2024) | BD Milvus (2004-2024) | Observation                           | Turbinei Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |         | Ritz area |         | Poclos  |     |
|-----|---|--|------------------------------------|------------------|-----------------------|---------------------------------------|------------------|-----|----------------|-----|------------|-----|------------------------------|---------|-----------|---------|---------|-----|
|     |   |  |                                    |                  |                       |                                       | nest.            | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe.     | nest.     | fe.     | nest.   | fe. |
| 78  | <i>Larus cachinnans / michahellis</i>   | Black-legged Kite / Yellow-legged Kite             | Sztyeppi sirály / Sárgalábú sirály | 14               | 42                    | may appear along the waters           |                  |     |                |     |            |     |                              | 3 - 8 i |           | 1 - 3 i |         |     |
| 79  | <i>Larus canus*</i>                     | Grey gull  | Viharsirály                        | -                | 1                     | rare winter guest, along the waters   |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 80  | <i>Larus michahellis</i>                | Yellow-legged gull                                 | Sárgalábú sirály                   | -                | 462                   | may appear along the waters           |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 81  | <i>Linaria cannabina</i>                | Linnet   | Kenderike                          | -                | 40                    | Common species can appear anywhere.   |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 82  | <i>Locustella luscinioides</i>          | Reed sedge   | Nádi tücsökmadár                   | 2                | 5                     | characteristic species of reedbeds    |                  |     |                |     |            |     |                              |         | 1 - 2 p   |         |         |     |
| 83  | <i>Loxia curvirostra</i>                | Red crossbill                                      | Keresztesőrű                       | -                | 18                    | occasional, irrelevant observations   |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 84  | <i>Luscinia luscinia</i>                | Nightingales of the nightingales                   | Nagy fülemüle                      | -                | 7                     | common species in parks/orchards      |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 85  | <i>Luscinia megarhynchos</i>            | Red-headed nightingale                             | Fülemüle                           | 1                | 9                     | common species in parks/orchards      |                  |     |                |     |            |     |                              |         | 1 - 3 p   |         |         |     |
| 86  | <i>Luscinia megarhynchos / luscinia</i> | Red-breasted Nightingale / Nightingale of the Lair | Fülemüle / Nagy fülemüle           | 4                | 1                     |                                       |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 87  | <i>Merops apiaster</i>                  | Prigoria   | Gyurgyalag                         | -                | 47                    | rare species, occasional observations |                  |     |                |     |            |     |                              |         |           |         |         |     |
| 88  | <i>Motacilla alba</i>                   | White-tailed deer                                  | Barázdabillegető                   | 11               | 249                   | common species along the waters       | 3 - 5 p          |     |                |     | 1 - 2 p    |     | 1 - 2 p                      |         | 1 - 2 p   |         | 1 - 2 p |     |

| No. | Species name                        |                               |                          | Total WMC (2024) | BD Milvus (2004-2024) | Observation                              | Turbine Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |         | Ritz area |          | Poclos  |         |
|-----|-------------------------------------|-------------------------------|--------------------------|------------------|-----------------------|--|-----------------|-----|----------------|-----|------------|-----|------------------------------|---------|-----------|----------|---------|---------|
|     |                                     |                               |                          |                  |                       |  | nest.           | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe.     | nest.     | fe.      | nest.   | fe.     |
| 89  | <i>Motacilla cinerea</i>            | Mountaineering                | Hegyi billegető          | -                | 21                    | rare species, in migration               |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 90  | <i>Motacilla flava</i>              | Yellow-bellied toad           | Sárga billegető          | -                | 5                     | common species of agricultural habitats  |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 91  | <i>Muscicapa striata</i>            | Gray flycatcher               | Szürke légykapó          | -                | 48                    | relatively rare species in forests       |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 92  | <i>Nycticorax nycticorax</i> *      | Night heron                   | Bakcsó                   | 1                | 21                    | rare aquatic species                     |                 |     |                |     |            |     | 1 - 2 i                      |         |           |          |         |         |
| 93  | <i>Oriolus oriolus</i>              | Oriole                        | Sárgarigó                | 7                | 9                     | charismatic species in orchards/forests  |                 |     |                |     |            |     |                              |         | 2 - 3 p   |          |         |         |
| 94  | <i>Otus scops</i>                   | Scops owl                     | Füleskuvik               | -                | 40                    | occasional species in parks/orchards     |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 95  | <i>Panurus biarmicus</i>            | Reed tit                      | Barkóscinege             | -                | 1                     | rare species of reed                     |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 96  | <i>Parus major</i>                  | Great tit                     | Szécinege                | 58               | 2349                  | common species in gardens/parks/forests. | 3 - 5 p         |     | 2 - 4 p        |     | 1 - 2 p    |     | 1 - 2 p                      | 1 - 5 i | 3 - 5 p   |          | 1 - 3 i |         |
| 97  | <i>Passer domesticus</i>            | House sparrow                 | Házi veréb               | 223              | 4127                  | Common, anthropized species.             | 15 - 25 p       |     | 2 - 3 p        |     | 10 - 20 i  |     |                              | 3 - 5 i |           | 5 - 10 i |         | 3 - 5 i |
| 98  | <i>Passer montanus</i>              | Field sparrow                 | Mezei veréb              | 29               | 1254                  | Common, anthropized species.             | 5 - 10 i        |     | 5 - 10 i       |     | 10 - 20 i  |     |                              |         |           |          |         | 2 - 5 i |
| 99  | <i>Passer montanus / domesticus</i> | Field Sparrow / House Sparrow | Mezei veréb / Házi veréb | 29               |                       |  |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 100 | <i>Pastor roseus</i>                | Rosy starling                 | Pásztormadár             | -                | 1                     | very rare species                        |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 101 | <i>Periparus ater</i>               | Coal tit                      | Fenyvescinege            | -                | 264                   | common species of fir                    |                 |     |                |     |            |     |                              |         |           |          |         |         |
| 102 | <i>Pernis apivorus</i> *            | Honey Buzzard                 | Darázsölyv               | -                | 5                     | rare species, in migration               |                 |     |                |     |            |     |                              |         |           |          |         |         |

| No. | Species name                   |                    |                   | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbine Channel |         | Municipal Park |     | Hippodrome |         | The banks of the Mures River |         | Ritz area |         | Poclos  |     |
|-----|--------------------------------|--------------------|-------------------|------------------|-----------------------|---|-----------------|---------|----------------|-----|------------|---------|------------------------------|---------|-----------|---------|---------|-----|
|     |                                |                    |                   |                  |                       |   | nest.           | fe.     | nest.          | fe. | nest.      | fe.     | nest.                        | fe.     | nest.     | fe.     | nest.   | fe. |
| 103 | <i>Phalacrocorax carbo</i>     | Great cormorant    | Kárókatona        | 4                | 383                   | common aquatic species                              |                 |         |                |     |            |         |                              | 1 - 5 i |           | 1 - 2 i |         |     |
| 104 | <i>Phasianus colchicus</i>     | Pheasant           | Fácán             | 3                | 24                    | common species in agricultural habitats             |                 |         |                |     |            | 1 - 2 i |                              |         |           | 1 i     |         |     |
| 105 | <i>Phoenicurus ochruros</i>    | Black redstart     | Házi rozsdafarkú  | 12               | 641                   | common, anthropized species, can appear anywhere    | 3 - 5 p         |         | 2 - 3 p        |     | 1 - 2 p    |         |                              |         | 2 - 3 p   |         | 2 - 3 p |     |
| 106 | <i>Phoenicurus phoenicurus</i> | Forest grove       | Kerti rozsdafarkú | 4                | 10                    | relatively common species in gardens/parks/forests. | 1 - 2 p         |         |                |     |            |         | 1 p                          |         | 1 - 2 p   |         |         |     |
| 107 | <i>Phylloscopus collybita</i>  | Small nit          | Csilpcsalpfüzi ke | -                | 117                   | common species in gardens/parks/forests.            |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 108 | <i>Phylloscopus sibilatrix</i> | Wood warbler       | Sisegő füzike     | -                | 34                    | relatively common species in the forest.            |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 109 | <i>Phylloscopus trochilus</i>  | Willow warbler     | Fitiszfüzike      | -                | 53                    | occasionally in migration                           |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 110 | <i>Pica pica</i>               | Magpie             | Szarka            | 20               | 133                   | anthropized species, common everywhere              |                 | 3 - 5 i |                |     |            | 1 - 2 i |                              | 2 - 3 i | 2 - 3 p   |         |         |     |
| 111 | <i>Picus canus*</i>            | Gray sedge         | Hamvas küllő      | -                | 2                     | rare species in gardens/parks/forests.              |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 112 | <i>Podiceps cristatus</i>      | Crested grebe      | Búbos vöcsök      | -                | 2                     | common aquatic species on ponds                     |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 113 | <i>Poecile palustris</i>       | Marsh tit          | Barátcinege       | -                | 182                   | relatively common species in gardens/parks/forests. |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 114 | <i>Prunella modularis</i>      | Forest mistletoe   | Erdei szürkebegy  | -                | 1                     | occasionally in migration                           |                 |         |                |     |            |         |                              |         |           |         |         |     |
| 115 | <i>Pyrrhula pyrrhula</i>       | Eurasian Bullfinch | Süvöltő           | 1                | 1                     | winter guest, can appear anywhere                   |                 |         |                |     |            |         |                              |         |           | 1 - 2 i |         |     |
| 116 | <i>Rallus aquaticus</i>        | Pond snail         | Guvat             | -                | 1                     | rare species of reed                                |                 |         |                |     |            |         |                              |         |           |         |         |     |



| No. | Species name                 |                        |                    | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbinei Channel |          | Municipal Park |         | Hippodrome |         | The banks of the Mures River |           | Ritz area |     | Poclos |         |
|-----|------------------------------|------------------------|--------------------|------------------|-----------------------|---|------------------|----------|----------------|---------|------------|---------|------------------------------|-----------|-----------|-----|--------|---------|
|     |                              |                        |                    |                  |                       |   | nest.            | fe.      | nest.          | fe.     | nest.      | fe.     | nest.                        | fe.       | nest.     | fe. | nest.  | fe.     |
| 117 | <i>Regulus ignicapilla</i>   | Eyebrowed awl          | Tüzesfejű királyka | -                | 4                     | occasionally in migration                           |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 118 | <i>Regulus regulus</i>       | Yellow-headed gull     | Sárgafejű királyka | -                | 108                   | relatively common species in forests/parks.         |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 119 | <i>Remiz pendulinus</i>      | Eurasian penduline tit | Függőcinege        | 1                | 0                     | rare species in riparian habitats                   |                  |          |                |         |            |         |                              |           | 0 - 1 p   |     |        |         |
| 120 | <i>Riparia riparia</i>       | Shore swallow          | Partifecske        | -                | 230                   | occasionally above water                            |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 121 | <i>Saxicola rubetra</i>      | Great thornbush        | Rozsdás csuk       | -                | 1                     | relatively common species in open habitats          |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 122 | <i>Saxicola rubicola</i>     | Black bramble          | Cigány csuk        | 2                | -                     | relatively common species in open habitats          |                  |          |                |         |            |         | 2 - 3 p                      |           |           |     |        |         |
| 123 | <i>Scolopax rusticola</i>    | Forest sitar           | Erdei szalonka     | -                | 1                     | occasional sighting, rare forest species            |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 124 | <i>Serinus serinus</i>       | Canaras                | Csicsörke          | 8                | 393                   | relatively common species in human settlements      | 1 - 2 p          |          | 2 - 3 p        |         | 2 - 3 p    |         |                              |           |           |     |        |         |
| 125 | <i>Sitta europaea</i>        | Nuthatch               | Csuszka            | -                | 469                   | relatively common species in gardens/parks/forests. |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 126 | <i>Spatula querquedula</i>   | Quacking duck          | Bőjtű réce         | -                | 5                     | occasionally in passage along the waters            |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 127 | <i>Spinus spinus</i>         | Siskin                 | Csíz               | -                | 842                   | common winter guest, can appear anywhere            |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 128 | <i>Sterna hirundo</i> *      | Common tern            | Küszvágó csér      | 3                | 23                    | relatively rare, along the Mures River              |                  |          |                |         |            |         | 2 - 5 i                      |           |           |     |        |         |
| 129 | <i>Streptopelia decaocto</i> | Eurasian collared dove | Balkáni gerle      | 26               | 1970                  | anthropized species, common everywhere              | 3 - 5 p          |          | 1 - 3 p        |         | 1 - 2 p    |         | 3 - 5 i                      | 1 - 3 p   |           |     |        | 1 - 2 i |
| 130 | <i>Strix aluco</i>           | Tawny owl              | Macskabagoly       | -                | 6                     | common species in forests                           |                  |          |                |         |            |         |                              |           |           |     |        |         |
| 131 | <i>Sturnus vulgaris</i>      | Starling               | Seregély           | 76               | 2122                  | anthropized species, common everywhere              |                  | 5 - 15 i |                | 1 - 5 i |            | 1 - 5 i |                              | 30 - 60 i |           |     |        |         |

| No. | Species name                     |                         |               | Total WMC (2024) | BD Milvus (2004-2024) | Observation   | Turbine Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |          | Ritz area |         | Poclos |         |
|-----|----------------------------------|-------------------------|---------------|------------------|-----------------------|---|-----------------|-----|----------------|-----|------------|-----|------------------------------|----------|-----------|---------|--------|---------|
|     |                                  |                         |               |                  |                       |   | nest.           | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe.      | nest.     | fe.     | nest.  | fe.     |
| 132 | <i>Sylvia atricapilla</i>        | Black-headed woodpecker | Barátposzáta  | 18               | 277                   | common species in gardens/parks/forests.                            | 2 - 5 p         |     | 1 - 2 p        |     | 2 - 5 p    |     |                              |          | 3 - 5 p   |         |        |         |
| 133 | <i>Sylvia borin</i>              | Garden warbler          | Kerti poszáta | -                | 2                     | relatively common species in gardens/parks/forests.                 |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 134 | <i>Sylvia communis</i>           | Whitethroat             | Mezei poszáta | 2                | 7                     | common species in agricultural/bush areas.                          |                 |     |                |     | 1 - 2 p    |     | 1 - 2 p                      |          |           |         |        |         |
| 135 | <i>Sylvia curruca</i>            | Garden warbler          | Kis poszáta   | 2                | 224                   | common species in gardens/parks/forests.                            | 1 - 2p          |     | 1 - 2 p        |     |            |     |                              |          |           |         |        |         |
| 136 | <i>Tachybaptus ruficollis</i>    | Little Grebe            | Kis vöcsök    | 1                | 29                    | relatively common aquatic species, may occur in the Ritz/Mures area |                 |     |                |     |            |     |                              |          |           | 1 - 2 i |        |         |
| 137 | <i>Thalasseus sandvicensis</i> * | Sandwich tern           | Kenti csér    | -                | 4                     | rare species in migration   |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 138 | <i>Tringa erythropus</i>         | Spotted Redshank        | Füstös cankó  | -                | 1                     | aquatic species, occasionally in passage                            |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 139 | <i>Tringa nebularia</i>          | Common greenshank       | Szürke cankó  | -                | 1                     | aquatic species, occasionally in passage                            |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 140 | <i>Tringa ochropus</i>           | Green sandpiper         | Erdei cankó   | -                | 2                     | aquatic species, occasionally in passage                            |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 141 | <i>Troglodytes troglodytes</i>   | Wren                    | Ökörszem      | 3                | 37                    | common winter guest, can appear anywhere                            |                 |     |                |     |            |     |                              |          |           | 3 - 5 i |        |         |
| 142 | <i>Turdus iliacus</i>            | Redwing                 | Szőlőrigó     | -                | 12                    | rare winter guest   |                 |     |                |     |            |     |                              |          |           |         |        |         |
| 143 | <i>Turdus merula</i>             | Common blackbird        | Fekete rigó   | 23               | 1703                  | common species in gardens/parks/forests.                            |                 |     | 2 - 3 p        |     |            |     |                              | 1 - 2 i  | 2 - 4 p   |         |        | 1 - 2 i |
| 144 | <i>Turdus philomelos</i>         | Song thrush             | Énekes rigó   | -                | 24                    | common species in gardens/parks/forests.                            | 3 - 5 p         |     |                |     |            |     |                              |          |           |         |        |         |
| 145 | <i>Turdus pilaris</i>            | British Thrush          | Fenyőrigó     | 3                | 99                    | common winter guest, can appear anywhere                            |                 |     |                |     |            |     |                              | 3 - 10 i |           |         |        |         |

| No. | Species name             |                 |             | Total WMC (2024) | BD Milvus (2004-2024) | Observation                                 | Turbinei Channel |     | Municipal Park |     | Hippodrome |     | The banks of the Mures River |     | Ritz area |     | Poclos |     |
|-----|--------------------------|-----------------|-------------|------------------|-----------------------|---|------------------|-----|----------------|-----|------------|-----|------------------------------|-----|-----------|-----|--------|-----|
|     |                          |                 |             |                  |                       |   | nest.            | fe. | nest.          | fe. | nest.      | fe. | nest.                        | fe. | nest.     | fe. | nest.  | fe. |
| 146 | <i>Turdus viscivorus</i> | Mistle Thrush   | Léprigó     | -                | 2                     | common winter guest, can appear anywhere    |                  |     |                |     |            |     |                              |     |           |     |        |     |
| 147 | <i>Upupa epops</i>       | Eurasian hoopoe | Búbos banka | -                | 1                     | characteristic species of mosaic landscapes |                  |     |                |     |            |     |                              |     |           |     |        |     |



**Table no. 8** – Nests identified in the project area

| No.          | GPS point | No. of nests | Area             | Species         | Observations                                 |
|--------------|-----------|--------------|------------------|-----------------|--|
| 1            | Alea1     | 1            | Carpati area     | crow            | outside the project perimeter                |
| 2            | Alea2-3   | 2            | Carpati area     | crow            | outside the project perimeter                |
| 4            | Alea4     | 2            | Carpati area     | crow            | outside the project perimeter                |
| 5            | Alea5     | 2            | Carpati area     | crow            | outside the project perimeter                |
| 6            | Alea6-8   | 3            | Carpati area     | crow            | outside the project perimeter                |
| 7            | Alea9-13  | 5            | Carpati area     | crow            | outside the project perimeter                |
| 2            | Alea14-15 | 2            | Carpati area     | crow            |  |
| 8            | Kokos     | 1            | Cocosul de Aur   | maned crow*     | outside the project perimeter                |
| 9            | Park 1    | 1            | Parcul municipal | jay*            |  |
| 10           | Park2-13  | 12           | Municipal park   | crow            |  |
| 11           | Park14-16 | 3            | Municipal park   | crow            |  |
| 12           | Park17-19 | 3            | Municipal park   | crow            |  |
| 13           | Park20-26 | 7            | Municipal park   | crow            |  |
| 24           | Turb1     | 1            | Electrica        | jay             |  |
| 25           | Turb2-3   | 2            | Insulei str.     | magpie          |  |
| 18           | Ritz1     | 1            | Ritz             | common shrew    | buzzard's or raven's nest                    |
| 19           | Ritz2     | 1            | Ritz             | raven / buzzard | the replacement nest of the buzzard or raven |
| 20           | Ritz3     | 1            | Ritz             | magpie*         |  |
| 21           | Ritz4     | 1            | Ritz             | magpie*         |  |
| 22           | Ritz5     | 1            | Ritz             | magpie*         |  |
| 23           | Ritz6     | 1            | Ritz             | magpie*         |  |
| 14           | Ritz7     | 1            | Ritz             | magpie*         |  |
| 15           | Ritz8     | 1            | Ritz             | jay*            |  |
| 16           | Ritz9     | 1            | Ritz             | jay*            |  |
| 17           | Ritz10    | 1            | Ritz             | jay*            |  |
| <b>TOTAL</b> |           | <b>57</b>    |                  |                 |  |



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**Map no. 13** – Nests identified in the project area



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**Poza. nr. 34.** – Colony of carrion crows in the municipal park



**Picture no. 35-36.** – The nest of the common shrew and raven in the meadow forest in the "Ritz" area



**Picture no. 37** – Magpie/jay nest in the meadow forest in the "Ritz" area

### **Conclusions / Proposals**

The avifauna of the studied area was as expected, mostly presenting a wide range of species and a degree of diversity suitable for an urban area with a relatively mosaic landscape: gardens, watercourses, parks, old trees, etc.

Most of the species are common species, accustomed to human disturbance and the landscape. Several species, although considered common, were observed only in small numbers and only in some places. It should be noted that these species are generalists and can occur practically anywhere in the project area, the fact that they were observed in the respective location is only coincidental. Details about the probabilities and possible locations of the birds' appearance are in the "Observations" column of **Table no. 7**.

A large part of the species (including those of community interest) that appear in the Milvus database, but were not observed by our team in 2024, are birds with occasional occurrence, especially during the migration period, when they can be observed almost anywhere. (These species have few observations (<50), even in a 20-year period.

The bird species that were observed by us in 2024, found in the Milvus database, appear in populations of less than 50 individuals, are relatively rare species (including those of



community interest), especially in urban environments, with a regular appearance / nesting in the project area.

The fact that some nesting species (e.g., reed warblers) were regularly observed during the breeding season by our team but appear in small numbers (<50) in the Milvus Group database over a 20-year period, shows us that these data are not based on standardized, systematic methodologies covering the entire project area, but are rather occasional observations. Of course, these are valuable data, but they present gaps in some locations relevant to the project.

#### *"Ritz" area*

The meadow forest in this area presents a natural and diverse forest habitat that provides nesting sites for many bird species. Made up of mature trees, it ensures the presence of woodpeckers, as well as nesting sites for species associated with burrows (titties, bats, etc.).

The diversity of the area is increased by aquatic habitats, such as reedbeds, running water, flooded forest areas, and marshy habitats. Thus, this area is one of the most valuable natural areas in the city of Târgu Mureș that must be protected under all circumstances. As can be found in **Table no. 7**, most species were observed here, some being observed only here (e.g. sandpiper, nightingales, the buzzard nests only here, etc.). In this portion of the Turbinei Channel, reedbed species (*Acrocephalus sp.*, *Locustella sp.*) and the blue tern (*Alcedo atthis*), a species of community interest nesting in this area, are concentrated.

The area also provides feeding habitat for other species: gulls, swallows, etc.

#### *Hippodrome Area*

It is an open area with a large area of semi-natural grassy habitat, regularly mowed, which provides a feeding area for many species of birds. It is partially surrounded by tree and shrub alignments that provide a resting/shelter/lurking place for species that feed, sometimes in large numbers. It is mostly used by swallows (*Hirundo rustica*), various crow species (*Corvus sp.*), starlings (*Sturnus vulgaris*).

Due to the extensive meadow, it is the most frequently visited area for feeding and by the raptor species that nest nearby: the red kestrel (*Falco tinnunculus*) and the common buzzard (*Buteo buteo*).

This area is also sometimes visited by species of community interest associated with grassy habitats, with a pair of white storks (*Ciconia ciconia*) being observed feeding in this area. In 2021, Milvus Group experts observed three specimens of corncrake (*Crex crex*), a species characteristic of wet meadows.

Based on the above, we can say that the meadows in the Hippodrome area represent an important feeding area for many birds, which must be maintained at least partially at this stage.

#### *Municipal Park*

It has a strong anthropogenic impact due to buildings and large concrete/asphalt/paved surfaces. The main importance of this area is the presence of old trees that provide nesting sites for woodpeckers and other species associated with burrows (titties, etc.).



The crow colony consisting of approximately 25-30 nests is important from the point of view of other species that occasionally nest in crow nests and can be present in urban environments: Eurasian hawk (*Asio otus*), red kestrel (*Falco tinnunculus*), and kestrel (*Falco subbuteo*).

#### *Poclos area*

Area with a small surface area and low importance for birds. The species present are typical of urbanized areas with gardens: mountain thrushes (*Phoenicurus ochruros*), blackbirds (*Turdus merula*), tits (*Parus sp.*), sparrows (*Passer sp.*), various finches, etc. The density of these species is low due to the small surface area and high disturbance.

The stream's water attracts birds for watering (crows, pigeons, etc.) and, in small numbers, some species associated with aquatic habitats, such as wagtails (*Motacilla alba*) and mallards (*Anas platyrhynchos*).

#### *The banks of the Mures River*

It is a grassy area with reedbeds along much of the bank. It provides nesting grounds for reedbed-associated bird species, such as the great reed warbler (*Acrocephalus arundinaceus*) and, to a lesser extent, the lesser reed warbler (*A. schoenobaenus*) and the marsh warbler (*A. palustris*).

The meadow on the shore has the same feeding role for birds as the one in the Hippodrome area, the species composition is similar.

The Mures River itself provides a feeding/shelter for aquatic species along the entire length of the sector included in the project: mallards (*Anas platyrhynchos*), gulls (*Larus sp.*), cormorants (*Phalacrocorax carbo*), grey heron (*Ardea cinerea*).

The area is also frequented by aquatic species of community interest that nest along the Mures River, upstream and downstream of Târgu Mureș: little egret (*Egretta garzetta*), little tern (*Sterna hirundo*), night heron (*Nycticorax nycticorax*) and little tern, which very likely nests in the area included in the project (*Alcedo atthis*).

During the winter in this area of the Mures River, sometimes clusters of aquatic birds consisting of several hundred individuals can appear, with large ducks dominating.

#### *Turbinei Channel*

The Turbinei Channel itself, without the "Ritz" area and the confluence with the Mures River, is a straight channel, with concrete edges, with an asphalt road on both sides. Thus, it has low diversity and importance.

Mallard (*Anas platyrhynchos*) is present in larger numbers (20-30 individuals in this section). During the field trips in 2024, no other aquatic bird species were observed.

The alignments of trees and bushes on the bank provide resting, nesting and feeding places for common, urbanized species (cuckoos, blackbirds, crows, sparrows, woodpeckers, finches, etc.).

Due to the presence of trees, bushes, the river, the natural, unconcreted bank and the lower disturbance, the confluence area with the Mures presents characteristics described in the Ritz and Mures riverbank areas.

#### *Nests*

The most important nests identified are in the "Ritz" area, a **nest of a common buzzard** (*Buteo buteo*) and a **raven** (*Corvus corax*). These nests must be preserved and protected.

**The crow colony** (approximately 25-30 nests) in the Municipal Park is important from the point of view of other species that do not build their own nests and, occasionally, nest in crow nests and can be present in urban environments: wood grouse (*Asio otus*), red kestrel (*Falco tinnunculus*), common falcon (*Falco subbuteo*). To avoid conflicts between crows and these species, their nesting period does not coincide with that of crows.

Although sometimes during the nesting period (early spring) the presence of crows is noisy and dirty, outside this period the colony is mostly deserted, so it is not noisy/dirty. For example, during the summer, when most people visit green and recreational areas.

For the reasons listed above, this colony should not be destroyed, driven away. We must emphasize that if the colony is disturbed/destroyed, the birds are driven away, there is a high chance that they will actually disperse in the area, nesting in several locations, thus causing a negative impact (noise, dirt), cumulatively greater on the population.

In the area of Carpati Alley, near the Turbinei Channel, several groups of 2-5 nests of crows grouped together were identified, but these are outside the project. Only two nests (Alea14-15) are found within the project perimeter.

Apart from the nests of carrion crows, several **medium-sized nests** have been identified, such as: jay (*Garrulus glandarius*), jackdaw (*Corvus cornix*), magpie (*Pica pica*). Similar to small songbirds, these species build new nests every year (the main reasons are to avoid parasites and nest predators). It is important to keep these unused nests, because, in some cases, they can provide nesting sites for other species that do not build their own nests (wood thrush, red kite, kestrel).

The presence of **woodpecker cavities** is only possible in trees of a certain size/thickness/age. Woodpeckers also make a new cavity every year, thus providing new breeding sites for species that nest in cavities but cannot hollow out trees. These species in urban environments can be: tits (*Parus sp.*), muscari (*Ficedula sp.*), starlings (*Sturnus vulgaris*), nuthatch (*Sitta europea*), owls (little hawk – *Strix aluco*, scops – *Otus scops*), hoopoe (*Upupa epops*), various species of bats, etc.

For these reasons, protecting old trees, regardless of location, is essential for biodiversity conservation. (It is almost as important to protect younger trees, as old trees will eventually die and localities will need to be cut down for safety reasons, with the young trees of today becoming the mature/old trees of tomorrow.)

Some cavities are very visible and easy to locate, but most are very difficult/impossible to notice (at high altitude in the dense canopy of the tree). For the reasons previously presented,

the exact number and location of cavities is not important, as they have a dynamic over time (old branches break, new cavities are created, etc.). Protecting old trees in sufficient numbers ensures a relatively constant number of cavities, independent of their short-term dynamics.

Most **nests of small songbirds** are also very difficult to find, locate because, in most cases, they are well hidden in dense vegetation and/or at high heights in the treetops. Identifying all nests is practically impossible. Songbirds, similar to woodpeckers, in order to avoid parasitism and predators, build a new nest annually. Thus, the effort made to find these nests would be in vain. These nests are built during the vegetation period, when the trees/bushes are already green, so the currently used nests are very difficult to find. During the winter period, some nests can be found more easily, but these will certainly not be used the following year. As in the case of woodpeckers, to protect local avifauna, it is necessary to protect habitats, suitable vegetation, trees, and bushes on a larger scale and in the long term. This can ensure stable nest and species dynamics. (It is important to have enough surplus nesting sites because once a nest is built in a good location, that location will be occupied by the abandoned and unused nest until it is freed up again by nest destruction. Thus, a good nesting site can be occupied by an abandoned nest for many years.)

### **Proposals for the conservation/improvement of conditions for avifauna**

To maintain or even improve the current biodiversity of avifauna, we recommend taking and complying with the following measures:

- ✓ Maintaining/protecting old trees (and younger trees in general)
- ✓ Maintaining at least 70% of the area of semi-natural grassy habitats in the Hippodrome area
- ✓ Manual cleaning of the waste area. It is particularly important to avoid the use of machinery for cleaning, as it causes significant habitat destruction.
- ✓ Installation of artificial bird holes (type A, B, C, and D holes: for details, consult an ornithologist specialist during the construction phase of the project)
- ✓ During winter, bird feeders can be placed (for details, consult an ornithologist during the construction phase of the project)
- ✓ Planting trees and bushes (only native, natural species) on the banks of the Mures River, to increase the naturalness and diversity of habitats in this area (also, trees can provide shady, pleasant places for people).
- ✓ Leaving a strip of natural vegetation with a minimum width of 20 m along the bank of the Mures River where no construction will take place.
- ✓ Do not destroy the nests of carrion crows, do not disturb the nesting birds.
- ✓ Establishment of a thematic trail in the meadow forest in the "Ritz" area:
  - placement of information boards about local natural values
  - to install wooden walkways in floodplain areas/aquatic habitats, to avoid habitat destruction and limit access only to them
  - avoiding nighttime lighting of this area



- restricting access to the area at night (total closure of the area)
- installing surveillance cameras to avoid intentional destruction/vandalism

### **Bibliographic sources**

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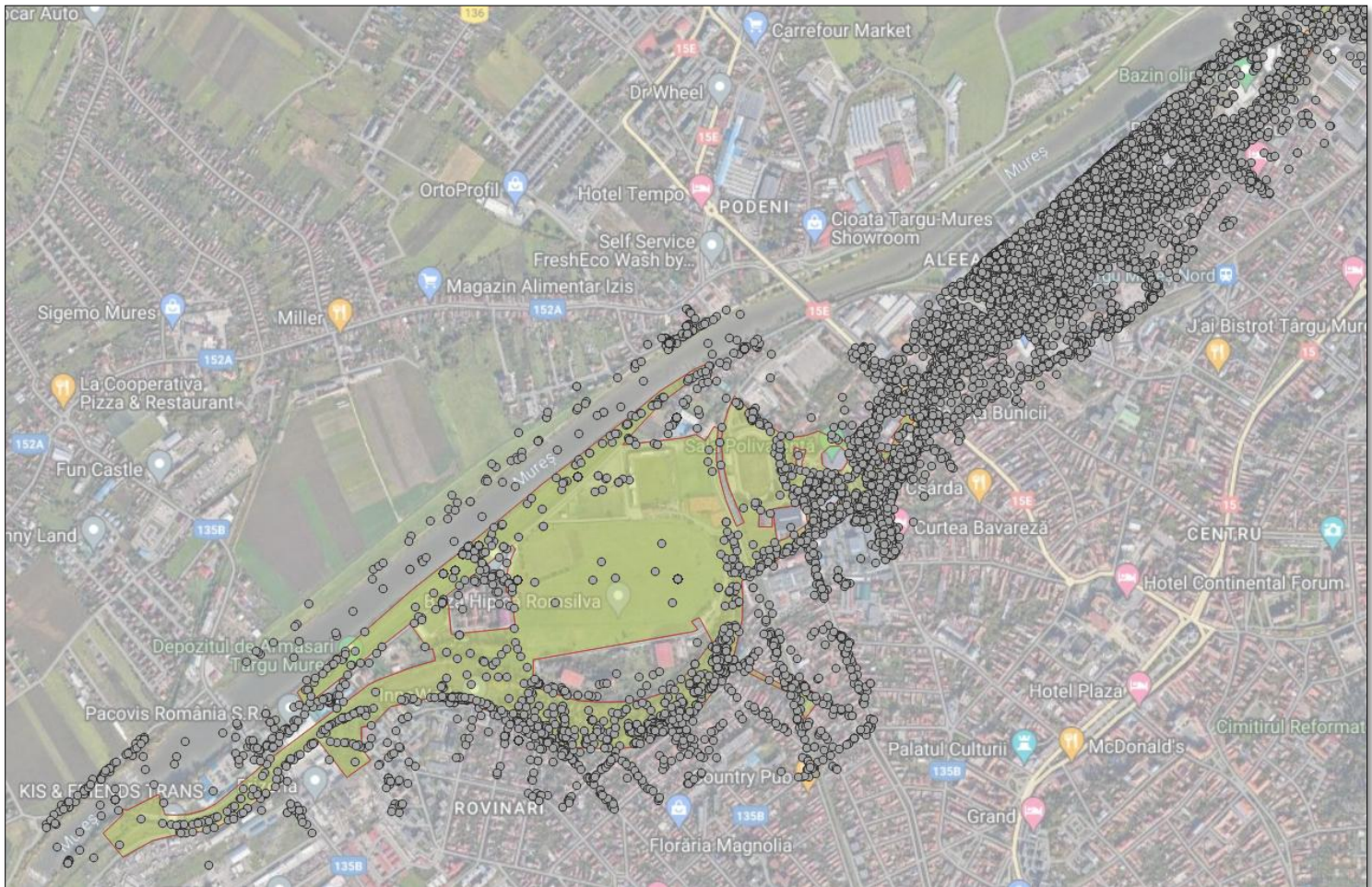
In Târgu Mureș is the headquarters of one of the largest environmental protection associations, the Association for the Protection of Birds and Nature "Milvus Group", founded in 1991. Since its establishment, it has carried out bird census activities/campaigns in Targu Mures.

In 2023, he initiated a local bird species inventory project in Târgu Mureș. The ultimate goal of these programs is to create an atlas of the city's birds for the interested public.

This database is partially public, available online: <https://openbirdmaps.ro/map/>.

Here in the study area, including a perimeter of 150 m, there are over 15,000 point observations, well located on the map, from the period 2005-2024 (*Map no. 1*).

This source of information is of superior quality both qualitatively and quantitatively and was used to compare/complement the own data collected within this project.



**Map no. 14** – Observations from the project area (light green) according to the database of the "Milvus Group" Association, available on: <https://openbirdmaps.ro/map/>.

## E. AMPHIBIANS AND REPTILES

### Working methodology

*Inventory, mapping and assessment of the conservation status of aquatic habitats used by amphibian and reptile species*

Amphibians are a group of animals with a complex lifestyle. The reproduction of these species is closely linked to the presence and quality of water bodies. Some species, such as springtails (*Bombina* sp.), are closely linked to the presence of water bodies, for example, small, temporary ponds. These species spend their entire annual activity period in these aquatic habitats, so this is where they reproduce, feed, etc. Newts and most species of native frogs, for example, crested newts (*Triturus* sp.) and brown frogs (*Rana* sp.), have an annual aquatic and terrestrial cycle. They enter an aquatic phase in the spring, which also represents a morphological change, and reproduce only in aquatic habitats. The period spent in the aquatic habitat depends on the

species, the weather, the physical characteristics of the waters, etc. After reproduction, they leave the water and become terrestrial and, in general, nocturnal. Larval development of all amphibian species occurs only in water, so the lack of aquatic habitats for reproduction leads to local extinction of amphibians. Larval preferences and resistance to the physical, chemical and structural characteristics of aquatic habitats and threat factors differ, determining the compositional structure of species and their abundance.

Some snake species, such as water snakes (*Natrix* sp.), and the water turtle (*Emys orbicularis*) have a semi-aquatic lifestyle, so transects along aquatic habitats also target these species.

To inventory and map the target amphibian and reptile species, we identified and inventoried the habitats favorable to these two groups of animals. This identification was achieved by walking transects in the different habitat types on the site.

The transect method is a widely known and used method for the inventory of species and their habitats. With this method we use well-defined units (e.g. the area covered by the transects, etc.), which are usually randomly arranged in the target area. The data obtained by observation along the transects result in data sets on the diversity, distribution and relative abundance of the target species and the structure and quality of the habitats occupied by them. These data can be used to compare the diversity, distribution and relative abundance of species in different habitat types, along an altitudinal gradient, a distance from a negative factor, etc. From the distribution obtained we can deduce the relationship between the occupied habitats and the ecology of the targeted species. The repeatability of the inventory act is a strong point of the method. Inventory data taken at different times of the year or annually can reveal changes in the presence and structure of communities, so it is a method often used to monitor changes in communities over time.

Most amphibians prefer temporary, stagnant waters for reproduction. These water bodies are often small, and their identification is possible only by linearly walking through the target area. After identifying the habitats, we noted the following data: the type of aquatic habitat (spring, stream, channel, ditch, temporary pond, mudflat, fish pond, pond of unknown origin, natural lake, reservoir, dead branch, swamp, floodplain, etc.) and the characteristics of the aquatic habitat, for example, surface area and depth. Each temporary water was photographed for the presence and condition of vegetation, water quality, etc. In the case of flowing waters (e.g. the Mures River), we made a similar transect along the watercourse to identify the sections used for reproduction or annual activity.

*Inventory, mapping and assessment of the conservation status of terrestrial habitats occupied by amphibians and reptiles*

Transects planned for the identification and mapping of aquatic habitats were used in parallel to inventory, map and identify the conservation status of terrestrial habitats. The survival and continuity of amphibian populations that also have a terrestrial lifestyle also depend on the presence and condition of terrestrial habitats. Terrestrial habitats are usually located in the vicinity of aquatic ones, up to 1-5 km away from them – this distance being the maximum



migration or dispersal distance of native aquatic and semi-aquatic amphibian and reptile species. After leaving the waters, terrestrial habitats are the main occupied habitats. Terrestrial hibernation areas are another vital territory for amphibians and reptiles. These can be identified based on the migration preceding the breeding season and the annual terrestrial activity of the species. Amphibians transect terrestrial habitats to aquatic habitats, so the condition of green corridors is another important point in the protection of populations. All reptile species depend on the presence and condition of terrestrial habitats.

*Inventory, mapping and assessment of the conservation status of amphibian species during the breeding season*

During the breeding season for caudates (newts) and for anuran (frogs) we followed the diurnal aquatic visual transect method and/or the diurnal aquatic active linear transect method. In the case of caudates, the number of observed specimens is counted/estimated, in the case of frogs, in addition to the number of breeding specimens, the number of eggs laid is also counted/estimated. According to the specialized literature, in the case of frog species, the number of eggs laid corresponds to the number of females in reproduction. Based on the sex ratio, the size of the reproductive population can be estimated.

In the case of small aquatic habitats, with characteristics that allow counting the specimens present without using a sock (such as clean water, vegetation) rare, etc.), we used the diurnal aquatic visual linear transect method. In aquatic habitats with low water transparency and dense vegetation, we used the stocking. Thus, we followed the diurnal aquatic active linear transect method. In each case, the number of specimens/broods is counted/estimated on an area of 1-2 m<sup>2</sup>, if possible. The number of sampling points depended on the size of the wet habitat. These methods can also be used to evaluate reproductive success, for example, counting and evaluating the number of larvae in the period preceding the reproductive period.

*Inventory, mapping and assessment of the conservation status of amphibian species during the terrestrial period and reptile species*

Hibernation, migration, and terrestrial activity of amphibians are closely related to terrestrial habitats. Thus, their inventory was also carried out in this type of habitat. In parallel, we followed the inventory and mapping of reptile species. In the case of specimens encountered on transects, we used the diurnal terrestrial visual transect method.

*Field service delivery schedule*

The complex lifestyle of amphibians, with aquatic and terrestrial periods, influences the detectability of species in different ways. Most species are easy to encounter during the breeding season, due to crowding and, in the case of amphibians, also the song of the males. In the terrestrial phase, they spread to adjacent terrestrial habitats, become partially nocturnal and have a cryptic lifestyle, become less active, defend themselves by homochromy, etc. Eggs and larvae are easy to detect, metamorphs leaving the water simultaneously are an easy phenomenon to document, but, later, juveniles are almost impossible to track.

Monitoring changes in amphibian communities can only be done by inventorying common, easily detectable species. Rare species are difficult to detect because of their rarity. The difficulty in detecting relatively common species is due to the cryptic lifestyle they follow. These rare observations lead to an inconsistent data set that is difficult to interpret.

In order to increase the detectability of the species, the inventory period was carried out throughout the contract. The reproductive activity of different species, in addition to the specificity caused by the ecology of the species, (for example, some have an early reproduction compared to other species), is also influenced by weather, precipitation, temperature, altitude, etc., thus, the reproduction period cannot be estimated accurately. According to the data in the literature and based on field knowledge, the reproduction of the species will take place in the first stage in the period March-June. The species leave the water starting from March-May. The metamorphs leave the water starting from June until the end of the season, depending on the ecology of the species, weather, precipitation, altitude, etc., so the reproductive success will be similar in the second part of the period.

### Description of important/assessed species

These species were chosen based on their presence in the city of Targu Mures and its vicinity, according to the specialized literature and the OpenHerpMaps database.

#### **Crested newt - *Triturus cristatus***

Species Code – EUNIS 814

##### *Species description*

**Morphology.** It is the largest species of newt in Romania, reaching up to 16 cm. The body is robust and oval in section, the head is wide, with a rounded snout, devoid of longitudinal grooves. The gular fold is well pronounced. The limbs are long and strong, when they stretch along the body - the posterior ones towards the anterior ones - the fingers touch. The length of the tail is less than or equal to that of the body and ends



pointed. The integument is rough both dorsally and ventrally. Males are smaller than females, have longer limbs, during the breeding season, they have a high and serrated dorsal crest that starts between the eyes, is missing near the cloaca, and then continues with the caudal crest, equally well developed, but less serrated; this is also developed on the ventral side of the tail. The cloaca of males is swollen and dark in color. Females have a mid-dorsal groove instead of a crest, and the caudal crests are very poorly developed.

*Color.* Males during the breeding season have a background color, dorsally and laterally, dark brown with black spots to olive-earthy, sometimes with reddish-brown shades; white dots appear laterally and latero-ventrally, which cluster on the head and on the goiter, and can form white vermiculations. The goiter is colored from yellow to black, frequently with white spots; the ventral part is yellow or yellow-orange with irregular black spots; the cloaca is black. On the sides of the tail there is a wide, pearly-white, shiny stripe. The color of the female is similar to that of the male, with small differences: the cloaca and the ventral edge of the tail are yellow or yellow-orange, and the pearly stripe on the tail is missing.

*Natural environment*

*Habitat.* It is widespread in wooded areas, glades, parks, gardens; it prefers large and deep stagnant waters, with submerged and marshy vegetation, and in our country it is found from the plains to 1000-1400 m altitude. It is common in ponds and lakes, ditches, puddles, artificial basins, even irrigation channels or smooth-flowing waters, especially if there is aquatic vegetation in which it can hide and fish are absent. It is not very demanding on water quality, but the larvae have higher needs in this regard; it adapts with difficulty to urban or suburban habitats.

*Biology*

*Activity.* It is a predominantly aquatic and nocturnal newt, but can also be active during the day; when environmental conditions become unsuitable, it retreats to land near the pond, being only active at night. It is generally found in water between March and June, and then on land near the water, hiding under stones, under foliage, under fallen logs, in holes in the ground. Isolated specimens can remain in the water throughout the year. The migration and colonization power refers to distances of up to 1 km. Despite its large size, it moves quickly, both in aquatic and terrestrial environments.

*Reproduction.* Due to their large size, they do not reproduce in small temporary ponds, but only in permanent ones. Reproduction takes place in March-April; nuptial games take place in the same way as in other species of newts. Fertilization is internal, without amplexus and is carried out by means of a spermatophore. The transfer of the spermatophore takes place following a complex sexual parade, during which the partners do not touch each other, the stimulation of the female and the synchronization of movements for the successful transfer of the spermatophore being carried out through a series of visual, olfactory and mechanical signals. Females lay a single egg or groups of 2-3, which they attach to submerged vegetation, more precisely they are wrapped in the leaves of the plants; in total, between 60 and 200 eggs are laid, these being large in size, 2-4 mm and white in color, but some do not develop due to chromosomal mutations. The larvae are large (8-10 mm at hatching) with a high dorsal crest that continues with a caudal filament up to 6 mm long and have a variable color, from dark brown to light gray, with large black spots. Embryogenesis lasts between 12-20 days, and larval development around 2.5-3 months; many larvae hibernate at this stage. After hatching, the larvae have a benthic lifestyle (they are found on aquatic plants or on the substrate), and become pelagic after the development of the caudal filament and fingers. Cases of neoteny are also encountered, sexual maturity being reached after the first 2-3 years of life in the case of males, when the body length reaches 12-13 cm; females require more time.

*Defense.* If captured, they can make a sharp sound; their skin secretes a toxic white substance with a specific odor. Sometimes, they can take a specific defensive position: they expose their



aposematic colors of the abdomen by twisting their body and rolling their tail; the position is maintained with their eyes closed and without breathing for several seconds.

*Critical periods.* Periods of drought, when water surfaces are reduced, in spring and summer, when larval development takes place.

*Habitat requirements*

*Habitat.* It is widespread in wooded areas, glades, parks, gardens; it prefers large and deep stagnant waters, with submerged and marshy vegetation, and in our country it is found from the plains to 1000-1400 m altitude. It is common in ponds and lakes, ditches, puddles, artificial basins, even irrigation channels or smooth-flowing waters, especially if there is aquatic vegetation in which it can hide and fish are absent. It is not very demanding on water quality, but the larvae have higher needs in this regard; it adapts with difficulty to urban or suburban habitats.

*Feeding.* Adults are voracious, with seasonal plasticity; they consume earthworms, insects and their larvae, gastropod mollusks, microcrustaceans, tadpoles and smaller newts (especially *T. vulgaris*), depending on the aquatic or terrestrial stage they are in; sometimes cases of cannibalism are encountered. Larvae feed on microcrustaceans (daphnia, copepods) and insects, the selectivity of food also depending on ontogenetic development.

**Common newt – *Lissotriton vulgaris* (*Triturus vulgaris*)**

Species Code – EUNIS10599

*Species description*

*Morphology.* The adult is about 70 mm long. The dorsal crest of the male in rut is generally short (2-4 mm), with a straight or slightly wavy or scalloped edge; the crest begins only in the occipital region and is streaked with black and yellow. The dorsal crest usually gradually increases in height in anteroposterior direction,



reaching its maximum height above the cloaca. The lower edge of the caudal crest is straight and unstriated. On the sides of the back, the integumentary edges are well expressed. The tail usually ends in a sharp filament, having an integumentary edge or with a black filament, without an edge. Usually, the toes of the hind legs of the male in rut have well-developed webs on both sides of the phalanges. Females often have an unspotted goiter and abdomen, as in *Triturus helveticus*.

*Color.* In males, the background is generally yellowish, sometimes brownish, with very intense round black spots on the back and flanks. The head has 7 black stripes: on the upper jaw, on the eyes, in the supraocular region, and an unpaired stripe between the supraocular stripes. On the abdomen there are round black spots, usually with a bright orange-red median stripe (sometimes missing); longitudinal blue and red stripes are observed on the infracaudal edge; the flanks have golden reflections. Females have a generally light-yellow color, with lateral edges on the back and a median dorsal edge; small black dots appear on the back and flanks; sometimes with a dark

serrated line along the edges of the back. On the head, between the upper jaw and the eyes, up to the parotoids, a yellow stripe is observed that sometimes extends to the cloaca, separating the flanks from the abdomen. The abdomen and goiter are very often uniform, light yellow or pinkish-yellow without spots.

*Description of its natural environment*

*Habitat.* It is present in the hill and mountain area, between 300-1200 m altitude, in and near ponds or lakes with or without vegetation, even in calcareous waters and especially in clear limnocrène ponds. In the spring for reproduction, it chooses a wide variety of water types in different types of habitats. It usually prefers shallow, well-sunlit, clean, vegetated waters, from stagnant, permanent or temporary ones, to smooth-flowing ones. It prefers waters devoid of fish. During the terrestrial period, the common newt also has habitat preferences, needing shelter and feeding areas, so the presence of stones, cracks and dead wood near the reproduction habitats is very important, especially since the dispersal capacity is reduced, being located in the range of 1 - 1000 m.

*Biology*

It enters the water in early spring (mid-February - early March) for reproduction, after which the adults quickly leave the aquatic environment; sometimes, it can remain aquatic throughout the active period. In the aquatic environment, it is present more in the water mass, it is active both day and night, while in the terrestrial environment it is nocturnal. The larvae are benthic and diurnal.

*Reproduction.* Mating takes place in the spring, starting in March and can last until later, in June. The male courts the female, bringing her into a state of sexual receptivity through a specific nuptial dance, after which he deposits the spermatophore on the bottom of the water, which is immediately taken up by the female, who follows him. Fertilization is internal. The female will lay 60-300 eggs, one by one on the leaves of aquatic plants: the egg, covered in an adhesive substance, is deposited on the leaf, after which the female folds the leaf around it with her hind limbs, to protect it. The larvae appear after 1-3 weeks, are 6-7 mm long when hatched, have a high dorsal ridge and a dorsal coloration of light brown to yellow, with brown dots, and a ventral coloration of silvery-white; metamorphosis usually occurs in the same year, they can rarely overwinter in the larval stage. Sexual maturity is reached after 2-3 years in males and up to 7 years in females.

*Defense.* If caught, they can emit a soft scream and secrete toxic substances produced by their skin glands. In the aquatic phase, in case of danger, they take refuge in nearby aquatic vegetation.

*Critical periods*

The spring and summer months are when reproduction and metamorphosis occur. The dry periods, when water surfaces are reduced, are in the spring and summer, when larval development occurs.

*Habitat requirements*

*Habitat.* It is present in the hill and mountain area, between 300-1200 m altitude, in and near ponds or lakes with or without vegetation, even in calcareous waters and especially in clear limnocrène ponds. In the spring for reproduction, it chooses a wide variety of water types in different types of habitats. It usually prefers shallow, well-sunlit, clean, vegetated waters, from stagnant, permanent or temporary ones, to smooth-flowing ones. It prefers waters devoid of fish.

During the terrestrial period, the common newt also has habitat preferences, needing shelter and feeding areas, so the presence of stones, cracks and dead wood near the reproduction habitats is very important, especially since the dispersal capacity is reduced, being located in the range of 1-1000 m.

**Feeding.** It is an opportunistic and generalist feeder, feeding on a wide variety of invertebrates, such as earthworms, crustaceans, gastropods, spiders, mites, springtails, coleoptera, diptera, lepidoptera, as well as eggs or larvae of small amphibians. Freshly metamorphosed juveniles feed on land. Males and females sometimes have different capture strategies, the former in the aquatic environment being more skilled in obtaining food due to their dorsal ridge. Cannibalism is widespread in females that spend more time in the abundant vegetation near the shore to lay their eggs; they are oophages, sometimes even consuming their own hatchlings. The larvae, at first, feed on the egg yolk, then on microcrustaceans; as they develop, they consume larger prey, usually aquatic mollusks and insects.

### **Yellow-bellied toad - *Bombina variegata***

Species Code – EUNIS 638/1193

#### *Species description*

**Morphology.** Habitus is stronger and stockier than *B. bombina*, in general, the average length of adults rarely exceeds 5 cm. Head wider than long, rounded snout with circular, immobile tongue, adherent to the floor of the mouth. Large eyes with cordiform pupils, eardrum not visible. If the legs are bent at right angles to the body axis, the tibiotarsal joints touch, and the tibia is equal to the femur. The skin thickness is on average 296.6



microns, greater than in *B. bombina*, due to the fact that it is more terrestrial. The skin is warty, being covered with large, sharp warts, surrounded by numerous, smaller warts. The warts have spines. Males generally have a shorter body than females. Their forelimbs are thicker, and during mating dark nuptial calluses appear on the inner side of the fingers and arm. The male does not have vocal sacs.

**Color.** Dorsally it is dark gray, earthy or olive spotted with black. It usually has a pair of light spots between the shoulders and a single spot in the middle of the back. Ventrally it is marbled, with yellow spots on a black or dark gray background, very rarely with white dots. The yellow spots are most often united and occupy over 50% of the ventral coloration (unlike *B. bombina* in which the dark pigment predominates). The spots are also present on the limbs; there is a palmar spot that extends from the first finger to the tip, the tips of the fingers being always yellow.



### *Natural environment*

**Habitat:** *B. variegata* occupies hilly, hilly and mountainous regions, from 150 m to almost 2000 m (in the Retezat Mountains). There is an ecological separation of the two species, *B. bombina* occupying the lowlands exclusively. It is less pretentious in its choice of habitat, being found in temporary or permanent ponds and puddles, both clean and polluted, even with high concentrations of hydrogen sulfide or salts ([www.amphibiaweb.org](http://www.amphibiaweb.org)), with or without vegetation, swamps, streams with a smoother flow, springs, including in the water collected in wheel tracks. It is among the first amphibian species to occupy areas damaged by human activities. During periods of drought, it hides in wet places until the rains restore the ponds.

### *Biology*

**Activity.** Eurytopic species, it has a diurnal and nocturnal lifestyle. It is both aquatic and terrestrial, capturing prey through grassy vegetation. We often find it floating on the surface of the water in full sun, and when it senses danger, it quickly sinks into the mud or swims quickly to another location. It is an active and sociable frog, many specimens being found together in small water areas, in certain favorable locations, the density reaching one specimen per 0.02 m<sup>2</sup>.

**Reproduction.** It usually prefers temporary ponds, with a low density of predators and competitors, shallow, sunny and consequently with a higher average temperature that allows a faster metamorphosis. It is an opportunistic species, reproduction taking place when conditions allow it. In rainy years, favorable for reproduction, a pair can lay hundreds of eggs, disseminated in time and space, utilizing any water source for reproduction and thus ensuring good survival conditions for the larvae. Individuals are most often suitable for reproduction after two to three winters. Reproduction generally begins later than in the species *B. bombina*, usually in May and extends throughout the active season. The ponds used for reproduction are numerically dominated by males. It is a territorial species, the stronger males occupying deeper places with less vegetation, therefore more secure in terms of completing metamorphosis. The territory is marked by sound and concentric waves made with the forelimbs, and the territory can have a radius of 0.5-0.75 m. Males do not sing in sync. The frequency of the sounds emitted is higher than in *B. bombina* (580 Hz) and their rate is higher (95/min). Mating is done by lumbar amplex. The eggs protected by their gelatinous shell are laid in small piles or isolated, fixed to aquatic plants or are allowed to fall to the bottom. The clutch contains 45-100 eggs deposited in portions. Metamorphosis lasts around 61 – 63 days, at an average temperature of 20°C. The larvae are around 6 – 7 mm when hatching and can reach up to 45 mm. They differ from *B. bombina* larvae in that they lack the light longitudinal stripes and have a shorter, finely reticulated tail with small dark spots. At the same time and in the same locations, the species can be observed in various stages of reproduction, from adults in amplexus, to eggs and tadpoles undergoing metamorphosis.

**Defense.** In the skin there are glands that secrete toxic polypeptides from the bombesin class, and as a warning measure there is the aposematic coloration of the abdomen. When attacked, the animal takes a certain posture called the “unken reflex”, just like in *B. bombina*. Also, if the attack continues, it can secrete excess toxic, irritating substances, with the appearance of white foam.

**Critical periods.** The spring and summer months, when reproduction and metamorphosis take place, as well as periods of drought, when aquatic surfaces shrink.

### *Habitat requirements*

*Habitat.* *B. variegata* occupies hilly, hilly and mountainous regions, from 150 m to almost 2000 m (in the Retezat Mountains). There is an ecological separation of the two species, *B. bombina* occupying the lowlands exclusively. It is less pretentious in its choice of habitat, being found in temporary or permanent ponds and puddles, both clean and polluted, even with high concentrations of hydrogen sulfide or salts, with or without vegetation, swamps, streams with a smoother flow, springs, including in the water collected in wheel tracks. It is among the first amphibian species to occupy areas damaged by human activities. During periods of drought it hides in wet places until the rains restore the ponds.

*Feeding.* In the larval stage, the species is phytophagous. Here too, cases of necrophagy are sometimes encountered. Adults consume both aquatic animals (Crustaceans-Amphipods, Gastropods, Diptera larvae) and terrestrial animals (Hymenoptera, Homoptera, Heteroptera, Coleoptera). *B. variegata* often hunts in terrestrial environments, so a higher proportion of terrestrial prey is observed. Feeding on small vertebrates, such as tadpoles, has also been observed.

### European green toad - *Bufo viridis* (*Bufo viridis*)

Species Code – EUNIS 1201

#### *Species description*

Massive species, with a stocky body, with a head wider than long. The pupil is horizontal, and the eardrum distinct. The fingers of the forelimbs are short and rounded at the end, the third finger being the longest, the 2nd and 4th being equal. The hind limb is relatively long, the tibiotarsal joint of the extended limb reaching the eye, or between the eye and nostril, in males, and between the shoulder and eye, in females. At right angles to the body axis, the bent limbs touch or slightly overlap. The fingers of the



hind limbs are not very long, the interdigital membrane joining the fingers up to half of the longest finger. It has 2 metatarsal tubercles, one internal, oval and prominent and one external, smaller, oval or round. On the inner side of the tarsus it has a well-marked integumentary fold, of a horny nature, which is used for digging. On the dorsal side of the body, the skin is covered with numerous verrucosities. From the lumbar region to the tip of the mouth, a row of larger verrucosities is highlighted. The parotoid glands are large and pear-shaped (pyriform), slightly converging towards the base. The ventral side is granular. The male differs from the female by its smaller size than that of the females, strong forelimbs, the appearance of nuptial calluses during the reproductive period, more developed interdigital membranes and a large, internal vocal sac, positioned subjugular. The dorsal side is slightly variable, but characteristic of the species. On a yellowish-white, gray-green or yellowish background with pink shades, large, irregular spots of green or olive color appear. The ventral color is dirty-white, with or without darker spots. The color of the iris is greenish-yellow vermiculated with black.

*Critical periods.* The spring/summer months in which reproduction and postembryonic development and metamorphosis occur.

*Habitat requirements.* The green toad is a terrestrial species, being more widespread than *Bufo bufo*. It can be found from sea level to an altitude of 1700 meters. It is a crepuscular-nocturnal species, after sunset or when the slope is no longer exposed to the sun, it comes out for food, but it can also be diurnal in the semi-adult stages. During the day it hides in underground rodent galleries or in its own galleries, in rock crevices, under stones, tree trunks, leaves or grass bushes. It feeds on invertebrates such as insects, millipedes, spiders, snails, earthworms, beetles, ants. It moves faster and jumps more easily than *Bufo bufo*.

### European tree frog - *Hyla arborea*

Species Code – EUNIS 710

#### *Species description*



*Morphology.* Adults reach 5-7 cm in length. The characteristic green color of the species can change to brown or even become spotted. The pupil is horizontal. The fingers with adhesive discs are an adaptation to arboreal life. The fold above the eardrum and across the chest and the dark lateral stripes, from the nose to the base of the femur, which end in curls, are characteristic of the species.

*Biology*

*Activity.* It is specialized for arboreal life. It is aquatic only during the breeding season. After breeding, it usually leaves the water on the side with dense and tall vegetation. This side is also preferred by juveniles, especially if it is sunny and with high humidity. It also occupies agricultural crops. In the terrestrial phase, it is active crepuscular-nocturnal, but it often bathes in open places, being a thermophilic species. It defends itself through homochromism.



*Feeding.* They prefer flying insects; tadpoles consume algae, but they also attack tadpoles or amphibian eggs.

*Reproduction.* The breeding areas can be spotted from 2-3 km away by following the crepuscular-nocturnal chorus of the males. In fact, the males call all year round, regardless of the time of day. The females lay their eggs in small piles attached to vegetation or various objects. The number of eggs can reach 10,000.

*Critical periods.* The spring and summer months when reproduction and metamorphosis take place.

*Habitat requirements.* In spring, for breeding, it chooses stagnant, temporary or permanent, shallow bodies of water with vegetation. In the case of larger waters, it prefers areas near the shore. After breeding, it usually leaves the water on the side with dense and tall vegetation. It prefers waters devoid of fish. During the terrestrial period, the frog also has habitat preferences, needing shelter and feeding areas, so the presence of tall vegetation, bushes, shrubs, reeds, etc., near the breeding habitats is very important, especially since the dispersal capacity is reduced, being located in the range of 1-1500 m.

**Agile Frog - *Rana dalmatina***

Species Code – EUNIS 778

*Species description*

*Morphology.* Adults have a slender, elegant body of medium size (up to 9 cm, but usually smaller). On the head: the snout is pointed, the posterior part of the tongue is free and forked; the eardrum is large and well-defined, being positioned immediately behind the eye; the pupil is horizontal. The subarticular tubercles are large and prominent. The hind limb is very long, the tibiotarsal joint exceeds the tip of the snout when it is stretched forward, parallel to the spine. When the animal is at rest, with the hind limbs located perpendicular to the axis of the body, the tibiotarsal joints overlap over a



large portion. The fingers are provided with an interdigital membrane. The metatarsal tubercle is small, oval. Males differ from females by: smaller body size, better developed forelimbs, with two small, dark nuptial calluses on the inner side of the first toe during the breeding season; also at that time, the interdigital membrane becomes smoky, better developed, with an almost straight edge. The male has no vocal sacs. The integument is smooth, with few prominent glands. Dorso-laterally, there are two obvious integumentary ridges.

*Color.* Dorsal: brown color predominates, similar to dry forest foliage; there are variations: earthy-gray, brownish-pink, dark brown, etc. On the head, the two dark brown temporal spots are evident; they start from the tip of the snout, continue over the eyes, and end at the insertion of the forelimbs. Between this brown band and the upper lip, also darker colored, there is a light band, which thins out when it reaches the temporal area. Dorsal median, a slightly less obvious, lighter band sometimes appears; the dorso-lateral edges are also lighter; sometimes a ^-shaped sign may appear between the shoulders. Ventrally, they are yellowish-white; in females, red marbling appears in the region of the rump and chest. During the mating season, males become darker in color, reaching shades of dark earth. The transverse bands on the hind limbs are evident: three on the femur, three on the tibia, and four on the rest of the leg. On the inner side, the thighs have a yellowish or sometimes deep yellow color.

*Description of its natural environment*

*Habitat.* Deciduous forests, meadows, bushes, from 0 to 900 m altitude. It is not dependent on a certain degree of humidity, preferring more xerophilic habitats. It is abundant in forests in the hilly and mountainous areas.

*Biology.* Terrestrial species, active in the early part of the day and at dusk; actively hunts invertebrates in forest litter, meadows, etc.

*Reproduction.* Mating takes place at night in March-April, sometimes even February, depending on temperature and altitude. Males are territorial, singing while sitting on the bottom of the breeding pond. The amplexus is axillary. The clutch (500-1800 eggs) is laid at night in a single pile usually fixed to submerged plants; the eggs do not float on the surface of the water and require about 3 weeks to hatch. Metamorphosis lasts about 2 and a half months, from June to early August. Sometimes tadpoles overwinter in this stage.

*Defense.* Passive, through homochromia, and active, through jumps that can reach up to 2 m.

*Critical periods.* The larval period and especially the period after the metamorphs emerge from the aquatic environment.

*Habitat requirements*

*Habitat.* Deciduous forests, meadows, bushes, from 0 to 900 m altitude. It is not dependent on a certain degree of humidity, preferring more xerophilic habitats. It is abundant in forests in the hilly and mountainous areas.

*Feeding.* Adults consume insects, earthworms, spiders, millipedes, etc.



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**Marsh frog – *Pelophylax ridibundus* (*Rana ridibunda*)**

Species Code – EUNIS 786

*Species description*

*Morphology.* Length up to 15-17 cm. Number of eggs: up to 16,000. Larvae at hatching: 4-9 mm, at metamorphosis: 40-50 mm. Juvenile after metamorphosis: 15-35 mm. Sexual maturity: in the 2nd-3rd year. Lifespan: 5-10 years. Longevity: over 12 years.

*Color.* With variable coloration from green to brown. The thighs are black with small white spots, and the vocal sacs are gray.

*Description of its natural environment*

*Habitat.* Altitude: 0-1200 m (300 m). From the lowlands to the hilly areas; it also occurs in the mountainous areas.

*Biology.* Aquatic all year round. It hunts and basks on the water's edge or on floating vegetation, being a thermophilic species. In warm periods, it is more active in the morning and evening. It hibernates in water, rarely on land. In the thermal waters of the north-west of the country it is active all year round.

*Reproduction.* It breeds and sings both day and night. The song of the males can be heard from miles away, but is difficult to distinguish from the song of *Pelophylax kl. esculentus*. The female lays her eggs in large clusters, which float on the surface of the water.

*Defense.* It protects itself through homochromism. Frightened, it dives into the water and hides in the mud.

*Critical periods.* The larval period and especially the period after metamorphosis.

*Habitat requirements*

*Habitat.* It prefers large, stagnant or smoothly flowing waters, with or without vegetation, but also appears in small, temporary waters, which it encounters in its pioneer habitat.

*Feeding.* It feeds on invertebrates, small amphibians, reptiles, mammals and even birds.



**Field lizard - *Lacerta agilis***

Species Code – EUNIS 713

*Species description*

**Morphology.** Relatively large shape (total length exceeds 20 cm); The head is pyramidal, robust, with a rounded snout at the tip, the body is stocky, the limbs are short, the tail is shorter than twice the length of the trunk (from the tip of the snout to the cloacal slit). On the head, the tympanum is oval; the collar is formed by 7-12 scales with a serrated edge. The dorsal scales (8-16 rows) are keeled, well differentiated from the dorso-lateral scales, which are not keeled. The caudal scales are long and keeled, except for those in the anterior third of the ventral part.



The ventral scales are arranged in 6 longitudinal rows. The anal plate is bordered by a single row of small plates; femoral pores, 10-15 in number. Differences between males and females: females are larger in size; the head of males is wider and higher; Their trunk is shorter, but their tail is longer; in females, it is the opposite: they have a longer trunk and a shorter tail. The femoral pores are more developed in males than in females, and the base of the tail is thicker.

**Color.** There is a pronounced sexual dichromism. The dorsal and sometimes dorso-lateral coloration of males is brown or tan: in the dorsal median, there is a wide band formed by an alternation of small transverse bands, darker and lighter; this is usually bordered dorso-laterally by two continuous bands much lighter in color; sometimes a white vertebral line, complete or interrupted, may appear. The general pattern is also continued on the tail. Laterally, males have dark brown ocellar spots on a light brown or green background. The ventral coloration and sometimes the coloration of the flanks is green spotted with small black spots. Females have a light brown or brownish background color. Dorsally, there is the same coloration as in males, with the difference that it is lighter in color. The flanks are never green; ventrally, they are yellowish-white or greenish-white spotted or not spotted with black. Juveniles have ocelli on the flanks, and the background coloration is like that of females.

#### *Description of its natural environment*

**Habitat.** In our country, it is found from the plains to approximately 1400 m altitude, in open, sunny habitats (meadows with or without bushes, clearings, forest edges, slopes, etc.). It needs warmth and a certain degree of humidity and does not necessarily require shelters (rocks, scree, bushes). It is rarely observed in forests, and only in rare ones, with southern exposure and with grassy areas.

**Biology.** Diurnal, active in the morning, after a period of sunshine, and in the afternoon, when the temperature is no longer so high. It moves quite slowly, due to its legs that are too short for its stocky body. Unlike other lizards, it is a poor climber, but it is a good digger, digging its own galleries to shelter, lay eggs, or hibernate. These can reach several tens of cm in length. It defends a small territory; in suitable habitats, high densities of up to 300 individuals/hectare can be found.

**Reproduction.** Mating takes place from late April to early June, depending on altitude. Males emerge from hibernation first and, after molting, begin to fight for the female; sometimes this results in injuries or the tail of one of the combatants breaking. During mating, the male first

grabs the female by the base of the tail, and then by the sacral area, after which he inserts one of the two hemipenises into her cloaca. In both sexes, multiple matings can occur during the same reproductive season. Females lay up to 14 small eggs (9 x 14 mm), white or slightly yellowish, in the soil; the incubation period varies between 7-9 weeks. Juveniles are 2-3.5 cm long at hatching, and reach sexual maturity after 2 (males) or 3 (females) years. In lowland areas, with higher temperatures, there may be two reproductive periods.

*Defense.* Its homochromic color protects it quite well; in case of danger, it hides in the grass or in rodent holes; it is not very agile, as its Latin name suggests, being the slowest of all the lizard species in our country.

*Critical periods.* When mowing hayfields, and after the eggs hatch and the juveniles emerge

#### *Habitat requirements*

*Habitat.* In our country, it is found from the plains to approximately 1400 m altitude, in open, sunny habitats (meadows with or without bushes, clearings, forest edges, slopes, etc.). It needs warmth and a certain degree of humidity and does not necessarily require shelters (rocks, scree, bushes). It is rarely observed in forests, and only in rare ones, with southern exposure and with grassy areas.

*Feeding.* It feeds on insects (orthopterans, coleopterans, lepidopterans, diptera), spiders, earthworms, gastropods.

### **European pond turtle - *Emys orbicularis***

Species Code – EUNIS 678

#### *Species description*

*Morphology.* It is a turtle with a beveled shell, and juveniles have a keeled shell. It rarely reaches even 30 cm, but only females, males reach up to 20 cm. It is greenish-black with yellow spots or stripes. The limbs are flattened, the fingers have interdigital membranes, which help it swim.



#### *Natural environment*

*Habitat.* It occurs from the plains to the hilly area, between altitudes of 0-800 m. In the mountainous area, it can climb into the valleys with a warm climate. Aquatic all year round, it leaves the water for breeding purposes or in case of deterioration of aquatic habitats. It prefers large, permanent, stagnant, or slightly flowing water basins, but it often also appears in temporary waters. The genus *Emys* is part of the turtle family Emydidae, also known as the “New World water turtles”. Most members of this family are of American origin. Even the European water turtle is native to North America. The species migrated to the Asian continent on the Bering “strip” (today: the Bering Strait) and later reached Europe.

#### *Biology*

*Activity.* During the warm period, it is active especially in the early morning and evening, often even at night. It chooses microhabitats with dense vegetation. It is faithful to sunny places - trees fallen into the water, stones, points on the shore without vegetation. Omnivorous, it feeds on



invertebrates, vertebrates (amphibians, fish), and plants. It generally hibernates in water. A shy species, it takes refuge in the water when frightened.

*Reproduction.* Males often migrate between water bodies to find mates. Females are faithful to their spawning grounds, which are sloping, sunny areas with loose, sandy soil. The number of eggs laid is between 2-20. Juveniles hatch with dimensions of 23-33 mm. Males reach sexual maturity at around 6 years of age, females over 15 years of age.

*Critical periods.* The period of egg development, hatching, and adults migrating for reproduction and spawning.

*Habitat requirements*

*Habitat.* In the case of water turtles, protection areas must include aquatic habitats (feeding, basking, breeding, hibernation, etc.) as well as terrestrial habitats (basking, spawning, migration routes, etc.). In the case of populations living in the vicinity of running waters, protection of the entire watercourse, even outside the protection area, is equally important. Upstream pollution sources must be stopped or reduced and continuously monitored.

**Other species of amphibians and reptiles with possible presence in the study area:**

**Common toad - *Bufo bufo***

Species Code – EUNIS 10579

**Common spadefoot toad - *Pelobates fuscus***

Species Code – EUNIS 753

**Edible frog - *Pelophylax kl. esculentus* (*Rana esculenta*)**

Species Code – EUNIS 779

**Smooth snake - *Coronella austriaca***

Species Code – EUNIS 663

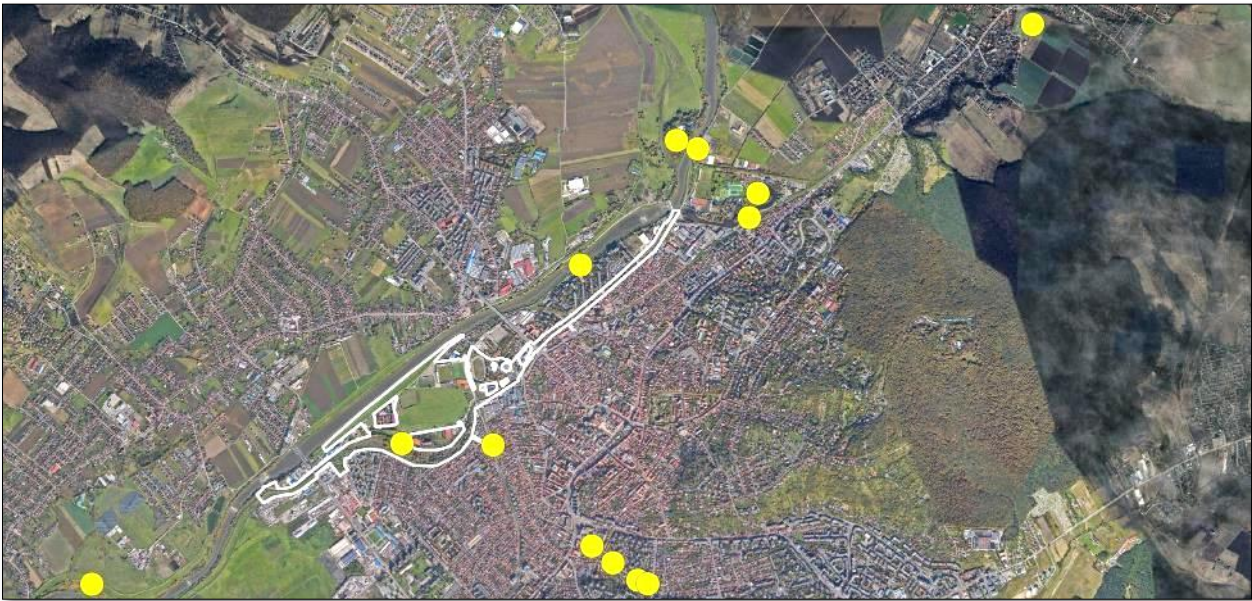
**Grass snake – *Natrix natrix***

Species Code – EUNIS 10667

**Presentation of results - Inventory of species and other elements that constitute the evaluation criteria (e.g., wetland areas, presence and number of dens, presence and number of nests of key species, etc.)**

Despite favorable habitats, during the inventory period we only identified the presence of the species *Pelophylax ridibundus*. However, the presence of other species is very likely in the target area of the study, even if in reduced numbers. The absence or reduced number of other species may be the result of the proximity of the city and human activities in the area, past and present.

The following shows you the distribution of the species identified in the target area, as well as the species likely to be present in the area.

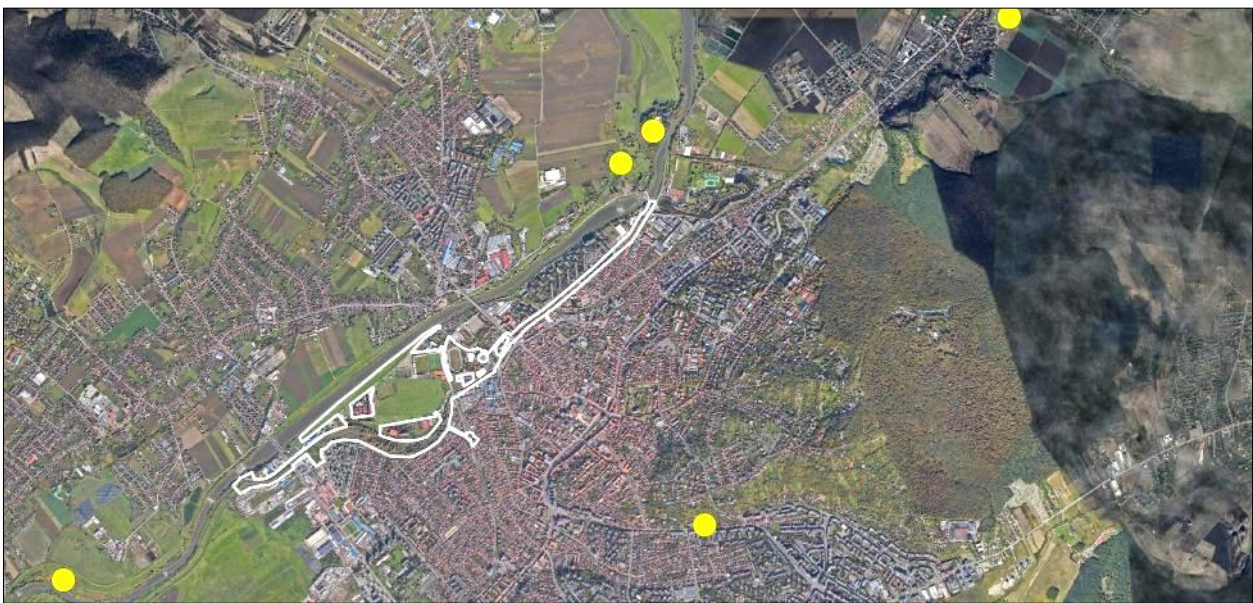


**Map no. 15.** Distribution of the large pond frog (*Pelophylax ridibundus*) in the target study area and its vicinity.





**Map no. 16.** The presence of the crested newt (*Triturus cristatus*) in the area.

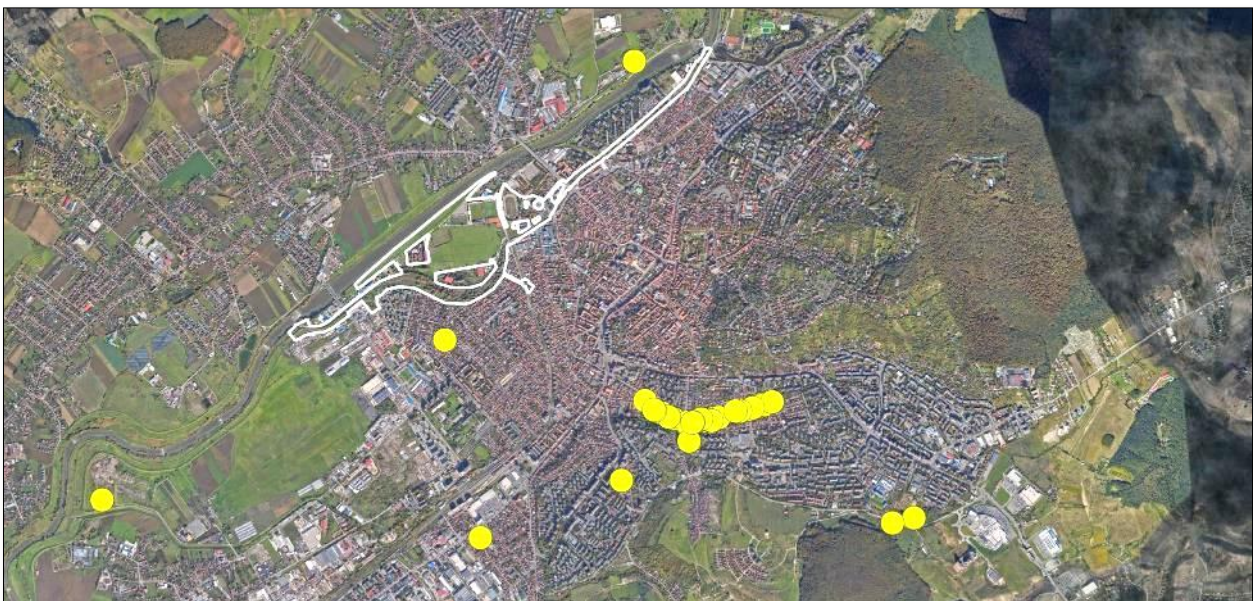


**Map no. 17.** The presence of the Transylvanian common newt (*Lissotriton vulgaris ampelensis*) in the area.





**Map no. 18.** The presence of the yellow-bellied toad (*Bombina variegata*) in the area.



**Map no. 19.** The presence of the green toad (*Bufotes viridis*) in the area.





**Map no. 20.** The presence of the tree frog (*Hyla arborea*) in the area.



**Map no. 21.** The presence of the red forest frog (*Rana dalmatina*) in the area.





**Map no. 22.** The presence of the field lizard (*Lacerta agilis*) in the area.

### Conclusions / Proposals

Structurally, the aquatic and terrestrial habitats in the study area appear to be favorable for more amphibian and reptile species than those observed. However, the characteristic favorable breeding habitats used by most amphibian species, which breed in temporary wet habitats, such as shallow ponds, are missing. Also, deep or rapid waters, especially with fish, are often avoided due to predators and strong currents. Thus, the reduced number of favorable breeding habitats directly leads to a smaller number of species, respectively, of specimens. Also, the closed area without insolation is not preferred by reptiles with a semi-aquatic lifestyle, such as water turtles (*Emys orbicularis*) or water snakes.

The low number of species (one) and the low number of specimens indicate the unfavourability of these habitats in their current state, as a likely result of the high urbanization in the area. The large pond frog (*Pelophylax ridibundus*) prefers aquatic habitats with permanent water, large in size, with deep water, even flowing, such as the Mures River. Its presence is expected in such types of habitats of large rivers. However, its low number nevertheless indicates that the area is not favourable for this species either. Most likely, the water quality is the factor that keeps this species at a low number, which often appears in relatively large numbers, where it encounters favourable conditions. This pollution may be the cause of the lack of other amphibian species, which, even in the absence of preferred breeding habitats (those with shallow water), can also choose other types of aquatic habitats, even artificial ones (such as toads, *Bufotes* or *Bufo*, or red toads, *Rana* sp. etc.).

As a proposal, the area should be maintained in this state, because structurally it still seems to be natural, but it must be sanitized on a large scale. The sources of pollution that affect the water quality must be identified and stopped. The most advisable thing is to remove the mud,

which may contain chemical elements of pollution and will probably maintain the pollution of the area in the long term.

After sanitation, the creation of elements (dams, semi-artificial or natural aquatic habitats, such as ponds resulting from beaver activity), which could maintain the water depth low, below 30 cm, being beneficial for attracting amphibian and reptile species. These areas can be created along the proposed "park", in the shore areas, where the wet habitat continues into a terrestrial habitat, without the risk of causing injury to species on the roads in the vicinity, if they were to leave the aquatic habitat. Some species could appear naturally, being present in the city or its vicinity or are already there, but in small numbers and with a currently low detectability. The presence of fallen trees in the water (due to beaver activity or other natural causes) would also make the area more attractive for water turtles.

To maintain a low pressure of human presence in the area, from the point of view of the protection of amphibians and reptiles, any structure built to facilitate human access must be of the suspended type. The construction of pontoons would facilitate human access to the river or the active branch, as well as the observation of the fauna in the area.

In conclusion, sources of pollution must be stopped and sanitized areas, to increase water quality. The integration of shallow water areas would lead to an increase in the biodiversity of the area and the emergence of new species or an increase in the number of amphibian and reptile species present in the area. Maintaining fallen trees in the water will have the same effect. This compartmentalization with shallow water areas can be carried out in parallel with the water sanitation system, where several basins could help recirculate water contaminated by surface or groundwater wastewater from the city, which currently flows directly, unfiltered, into the Mures River. Thus, these waters would be included in a natural system with natural water cleaning processes, a process often used in other cities around the world.

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## F. BEAVER PRESENCE IN THE "RITZ" AREA

In the meadow forest in the Ritz area, there is an active colony of beavers (*Castor fiber*). The traces, the trees felled / gnawed by beavers, are visible everywhere (**Photos no. 38-45**). This area is not only occasionally used by the species, the family having the den (fortress/burrow) built on the bank of the channel (**Photo no. 44**). Also, the activity of beavers can be observed on the bank of the Mures, within the project perimeter (**Photo no. 45**).

We consider that the presence of the species in the area is very beneficial to biodiversity, contributing significantly to the recreation of the meadow forest habitat, by building dams (**Photo no. 38**), raising the water level, and slowing down the water flow speed. These mechanisms lead to the creation of a habitat and aquatic/marsh vegetation that creates a place for feeding, shelter, and reproduction for both fish and amphibians, as well as for birds.

### *Species description:*

The European beaver is the largest rodent mammal in Europe. It is a semi-aquatic animal with multiple anatomical adaptations that allow it to successfully explore the aquatic environment. Its thick fur protects it in the aquatic and terrestrial environments from extreme temperatures. The fine hair of the fur is soft, wavy, and extremely dense and can reach 2 - 3 cm in length, while the guard hair is strong, thick, and long, reaching 5 - 6 cm in length. The color of the guard hair varies from black to gray, while the fine hair is reddish-brown. In water, the hydrodynamic body is propelled by the power of the hind limbs and tail. The fingers of the hind limbs are webbed, being especially adapted for swimming. A particularity is the presence of the "double claw" on the second finger of the hind limbs, used for daily grooming of the fur.

The head is strong, medium-sized, covered with hair. The ears, small, are located on the upper part. The nose, short and leathery, has a pair of nostrils adapted to life both in water and on land. The beaver's skull is massive. The incisors are large, covered on the outer surface by a hard, bright orange enamel, have an open root, and are continuously growing. The interior is composed of white dentine, softer and which wears down faster than enamel, favoring the formation of a cutting edge. The sense of hearing and smell are well developed, but the vision is poor. The tail is used for swimming, for maintaining balance while moving on land and for the alarm signal. It is the place of storage of fat for the winter and the organ of heat exchange. It is a strictly herbivorous species, feeding mainly on woody vegetation in winter (it prefers soft-core species such as willow and poplar, with a diameter of less than 10 cm), which it collects in large quantities in autumn and stores in water. During the summer it prefers herbaceous plants if they are available (it consumes aquatic vegetation, shoots, twigs, bark, leaves, buds, roots, and crop plants if agricultural land is nearby). It is monogamous, it reproduces once a year (only one pair of adults/colony). It reproduces in early spring (January-February), the gestation period lasts 60-128 days, and it can have up to 6 young, but generally 1-3 young/year. The chicks are fed with milk until they are 6 weeks old, during which time they are cared for only by the female, and after the age of 6 weeks to 3 months, food (twigs and soft bark) is brought to the chicks by

subadults in the colony. Family members in the colony help raise and care for the chicks. The chicks disperse at the age of 1.5 -2 years, and they reach sexual maturity on average at the age of 3 years. It can live 10-17 years, but in the natural environment, it rarely exceeds 7-8 years.

*Protection status:*

The *Castor fiber* species is included in Annex II of the Habitats Directive, respectively Annex 3 of GEO no. 57/2007, which includes species of wild fauna and flora of community interest, whose conservation requires the declaration of Special Areas of Conservation (SAC) forming the Natura 2000 Network. The species is also included in the list of species of Annex IV of the Habitats Directive, respectively Annex 4A of GEO no. 57/2007, as a **species of community interest requiring strict protection**. Among the obligations arising from the Habitats Directive are: maintaining the favorable conservation status of the beaver population, monitoring, and periodic reporting to the European Commission on the conservation status of the species. Also, the *Castor fiber* species is included in Annex II (Strictly protected fauna species) of the Convention on the Conservation of European Wildlife and Natural Habitats, adopted in Bern on 19 September 1979, to which Romania acceded by Law no. 13/1993. In order to ensure the protection regime of wild fauna species of hunting interest, taking into account the provisions of EU legislation and international conventions in the field of nature protection, Law no. 407/2006 on hunting and the protection of hunting resources, with subsequent amendments and completions, imposes restrictions on the conduct of hunting activities, the *Castor fiber* species being included in Annex 2 of this law, as a species of hunting interest for which hunting is prohibited. In order to reduce human-beaver conflicts and control the population, in Romania the competent authorities may issue derogations from strict protection measures based on the provisions of art. 16 of the Habitats Directive. Compensation payments are granted for the damage caused by this species, for which a uniform award procedure has been established at national level. Conservation status - The assessment of the conservation status of all wild mammals in Europe, initiated in 2005, in accordance with the IUCN guidelines for assessing the conservation status of species at regional level, includes the *Castor fiber* species in the category of species not threatened with extinction (LC- Least Concern) (Temple and Terry 2007, Vié et al., 2009).

### Conclusions / Proposals:

To maintain/improve the current state of naturalness of the meadow forest, we recommend the following:

- ✓ Avoiding any form of disturbance of beavers
- ✓ Partial restriction of human access to areas frequented by beavers to avoid/minimize disturbance (also during the day)
- ✓ Restricting access to the area at night (total closure of the area)
- ✓ Trees can be protected from beavers by wrapping the trunk with wire mesh, from the ground to a height of about 1 meter.

- ✓ Manual cleaning of the waste area. It is particularly important to avoid using machinery for cleaning, as it can cause significant habitat destruction!
- ✓ Establishment of a thematic trail in the meadow forest in the "Ritz" area:
  - placement of information boards about local natural values, including the life of beavers
  - installing a wooden walkway in floodplains/aquatic habitats, to avoid habitat and dam destruction, and limiting access to this path only
  - avoiding nighttime lighting of this area
  - installing surveillance cameras to avoid intentional destruction/vandalism

**Bibliography:** Action plan for the national conservation of the Eurasian beaver population (*Castor fiber*), Brasov, 2020. (Source: [apepaduri.gov.ro](http://apepaduri.gov.ro))



**Picture no. 38** – Beaver dam in the meadow forest in the "Ritz" area





**Picture no. 39** – Old beaver tracks (fallen tree)



**Picture no. 40** – Old beaver tracks (rotten tree trunk)



**Picture no. 41** – Old beaver tracks (fallen tree)





**Picture no. 42** – Fresh beaver tracks (fallen tree)



**Picture no. 43** – Fresh beaver tracks (fallen trees)



**Picture no. 44** – Active beaver habitat (fortress)





**Picture no. 45** – Fresh beaver tracks (rotten tree) on the banks of the Mures River (Insulei Street)

## ANNEX NO. 1 – BIRD SPECIES DISTRIBUTION MAPS



Distribution map of the Great reed warbler (*Acrocephalus arundinaceus* – nádírigó)





Distribution map of the Swamp reed warbler (*Acrocephalus palustris* – énekes nádiposzáta)





Distribution map of the little reed warbler (*Acrocephalus schoenobaenus* –foltos nádiposzáta)

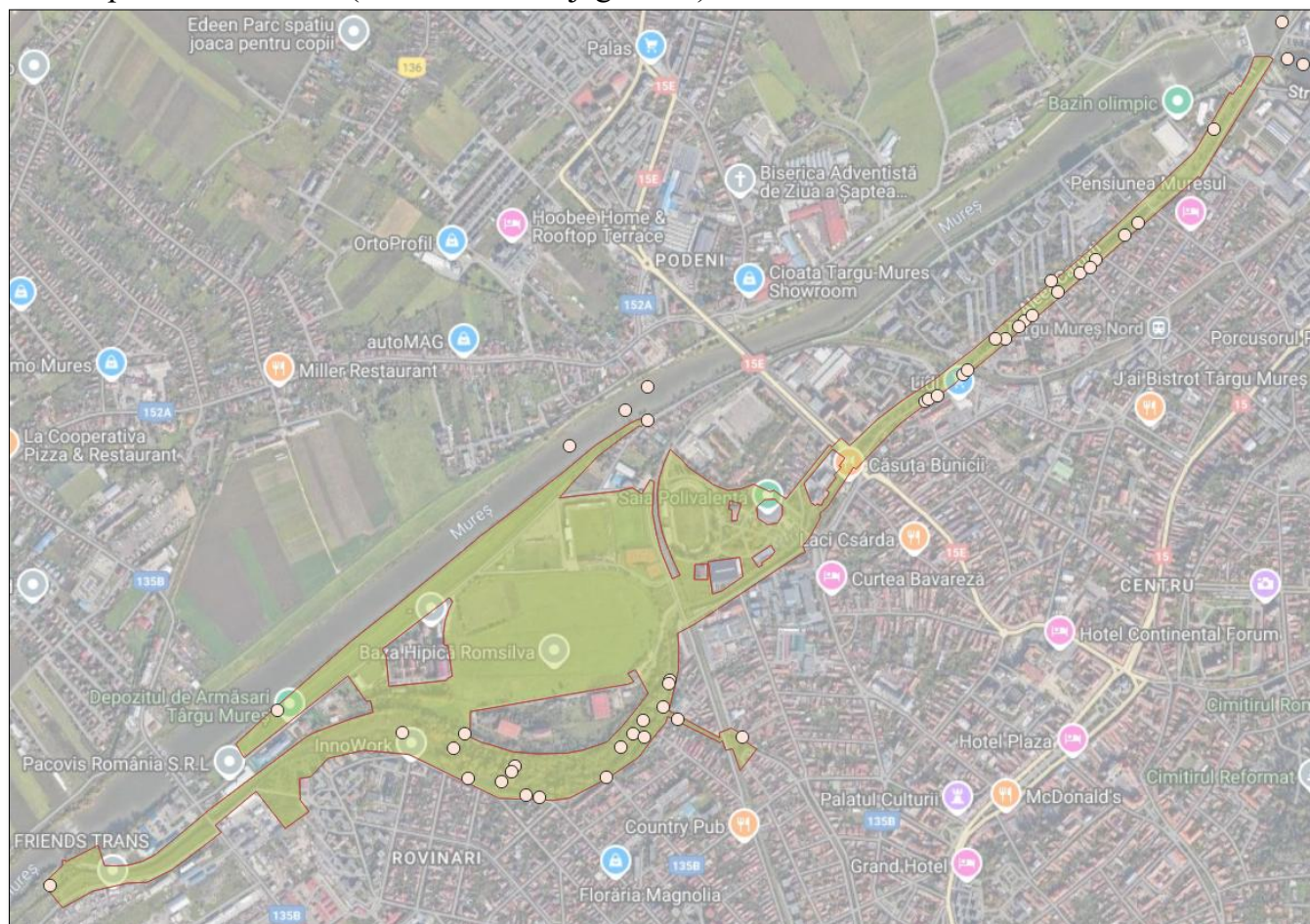




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Distribution map of the blue tern (*Alcedo atthis* – jégmadár)



Distribution map of mallard (*Anas platyrhynchos* – tőkés réce)





Distribution map of the owl (*Athene noctua* – kuvik)





Distribution map of the house swallow (*Delichon urbicum*– molnárfecske)





Distribution map of woodpeckers (*Dendrocopus sp.*)





Distribution map of the red-backed shrike (*Lanius collurio* – tövisszúró gébics)

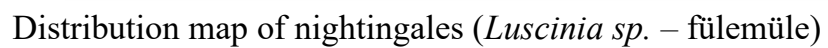




Distribution map of the reed louse (*Locustella luscinioides* – nádi tücsökmadár)



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Distribution map of the oriole (*Oriolus oriolus* – sárgarigó)





Distribution map of the pond tern (*Sterna hirundo* – kűszvágó csér)



## ANNEX NO. 2 – LIST OF TREES IN THE PROJECT AREA

| no. | species                       | xcoord      | ycoord      | no. | species                      | xcoord    | ycoord    |
|-----|-------------------------------|-------------|-------------|-----|------------------------------|-----------|-----------|
| 1   | <i>Tilia cordata</i>          | 24.55850762 | 46.55379174 | 206 | <i>Tilia platyphyllos</i>    | 24.555654 | 46.552356 |
| 2   | <i>Sophora japonica</i>       | 24.55870743 | 46.55390975 | 207 | <i>Tilia platyphyllos</i>    | 24.55557  | 46.552317 |
| 3   | <i>Tilia platyphyllos</i>     | 24.55879428 | 46.5539596  | 208 | <i>Tilia cordata</i>         | 24.555485 | 46.552271 |
| 4   | <i>Fraxinus excelsior</i>     | 24.55883245 | 46.55398375 | 209 | <i>Juglans regia</i>         | 24.5554   | 46.552226 |
| 5   | <i>Fraxinus pennsylvanica</i> | 24.55889867 | 46.55401803 | 210 | <i>Tilia cordata</i>         | 24.555351 | 46.552199 |
| 6   | <i>Acer pseudoplatanus</i>    | 24.55919935 | 46.55419875 | 211 | <i>Tilia platyphyllos</i>    | 24.555324 | 46.552184 |
| 7   | <i>Acer pseudoplatanus</i>    | 24.55925232 | 46.55422796 | 212 | <i>Tilia platyphyllos</i>    | 24.555256 | 46.552144 |
| 8   | <i>Acer pseudoplatanus</i>    | 24.55932087 | 46.55426691 | 213 | <i>Tilia cordata</i>         | 24.555133 | 46.552061 |
| 9   | <i>Fraxinus excelsior</i>     | 24.55948445 | 46.55436661 | 214 | <i>Tilia platyphyllos</i>    | 24.554839 | 46.551856 |
| 10  | <i>Tilia platyphyllos</i>     | 24.55949613 | 46.55437129 | 215 | <i>Tilia platyphyllos</i>    | 24.554634 | 46.551713 |
| 11  | <i>Tilia platyphyllos</i>     | 24.55969166 | 46.55448891 | 216 | <i>Taxus baccata</i>         | 24.553865 | 46.551488 |
| 12  | <i>Fraxinus excelsior</i>     | 24.55979136 | 46.55454967 | 217 | <i>Taxus baccata</i>         | 24.553954 | 46.55142  |
| 13  | <i>Acer pseudoplatanus</i>    | 24.55989652 | 46.55460498 | 218 | <i>Tilia cordata</i>         | 24.553958 | 46.551447 |
| 14  | <i>Tilia cordata</i>          | 24.55995651 | 46.55464237 | 219 | <i>Tilia cordata</i>         | 24.554035 | 46.5514   |
| 15  | <i>Tilia cordata</i>          | 24.56003207 | 46.55468911 | 220 | <i>Tilia cordata</i>         | 24.554111 | 46.551358 |
| 16  | <i>Tilia cordata</i>          | 24.56007179 | 46.55471326 | 221 | <i>Tilia platyphyllos</i>    | 24.554229 | 46.551306 |
| 17  | <i>Acer pseudoplatanus</i>    | 24.56011152 | 46.55473818 | 222 | <i>Taxus baccata</i>         | 24.554113 | 46.551269 |
| 18  | <i>Tilia cordata</i>          | 24.5602642  | 46.55483205 | 223 | <i>Tilia platyphyllos</i>    | 24.554186 | 46.55125  |
| 19  | <i>Tilia cordata</i>          | 24.56040441 | 46.55490917 | 224 | <i>Acer pseudoplatanus</i>   | 24.554168 | 46.551246 |
| 20  | <i>Tilia cordata</i>          | 24.56044803 | 46.55493643 | 225 | <i>Tilia platyphyllos</i>    | 24.554191 | 46.551189 |
| 21  | <i>Acer campestre</i>         | 24.56084063 | 46.555167   | 226 | <i>Tilia platyphyllos</i>    | 24.554138 | 46.551165 |
| 22  | <i>Acer pseudoplatanus</i>    | 24.56091464 | 46.55521141 | 227 | <i>Acer negundo</i>          | 24.55422  | 46.551108 |
| 23  | <i>Fraxinus excelsior</i>     | 24.56095748 | 46.55523555 | 228 | <i>Tilia platyphyllos</i>    | 24.554241 | 46.551131 |
| 24  | <i>Acer campestre</i>         | 24.5612566  | 46.5554116  | 229 | <i>Acer negundo</i>          | 24.554268 | 46.55116  |
| 25  | <i>Tilia cordata</i>          | 24.561302   | 46.555439   | 230 | <i>Acer pseudoplatanus</i>   | 24.554289 | 46.551187 |
| 26  | <i>Tilia cordata</i>          | 24.561368   | 46.55547625 | 231 | <i>Tilia cordata</i>         | 24.554306 | 46.551205 |
| 27  | <i>Tilia cordata</i>          | 24.561548   | 46.555588   | 232 | <i>Acer negundo</i>          | 24.554329 | 46.551238 |
| 28  | <i>Acer pseudoplatanus</i>    | 24.56166322 | 46.55565386 | 233 | <i>Tilia platyphyllos</i>    | 24.552781 | 46.550802 |
| 29  | <i>Tilia cordata</i>          | 24.56195612 | 46.55582601 | 234 | <i>Tilia platyphyllos</i>    | 24.552654 | 46.550696 |
| 30  | <i>Tilia cordata</i>          | 24.562027   | 46.55586496 | 235 | <i>Tilia cordata</i>         | 24.552601 | 46.550651 |
| 31  | <i>Fraxinus excelsior</i>     | 24.56206361 | 46.55588755 | 236 | <i>Tilia cordata</i>         | 24.552426 | 46.550494 |
| 32  | <i>Fraxinus excelsior</i>     | 24.56215008 | 46.55593585 | 237 | <i>Tilia cordata</i>         | 24.553206 | 46.549513 |
| 33  | <i>Tilia cordata</i>          | 24.56219604 | 46.55596155 | 238 | <i>Robinia pseudoacacia</i>  | 24.552091 | 46.549122 |
| 34  | <i>Tilia cordata</i>          | 24.56227238 | 46.55600595 | 239 | <i>Acer platanoides</i>      | 24.552161 | 46.549174 |
| 35  | <i>Tilia cordata</i>          | 24.56230821 | 46.55603088 | 240 | <i>Acer negundo</i>          | 24.552362 | 46.549255 |
| 36  | <i>Tilia cordata</i>          | 24.56239779 | 46.55608229 | 241 | <i>Acer platanoides</i>      | 24.552426 | 46.549297 |
| 37  | <i>Tilia cordata</i>          | 24.5624492  | 46.55610956 | 242 | <i>Acer platanoides</i>      | 24.552486 | 46.549354 |
| 38  | <i>Tilia cordata</i>          | 24.56252554 | 46.55615552 | 243 | <i>Populus nigra italica</i> | 24.552473 | 46.549329 |
| 39  | <i>Tilia cordata</i>          | 24.56265407 | 46.55623107 | 244 | <i>Populus nigra italica</i> | 24.552624 | 46.549426 |
| 40  | <i>Tilia cordata</i>          | 24.56269847 | 46.55625912 | 245 | <i>Picea abies</i>           | 24.552082 | 46.549567 |
| 41  | <i>Tilia cordata</i>          | 24.56283401 | 46.55633818 | 246 | <i>Picea abies</i>           | 24.552126 | 46.549589 |
| 42  | <i>Acer pseudoplatanus</i>    | 24.56286517 | 46.55635571 | 247 | <i>Picea abies</i>           | 24.552061 | 46.549616 |
| 43  | <i>Tilia cordata</i>          | 24.56305407 | 46.55646749 | 248 | <i>Betula pendula</i>        | 24.551992 | 46.549638 |
| 44  | <i>Tilia cordata</i>          | 24.56315845 | 46.55652202 | 249 | <i>Betula pendula</i>        | 24.551955 | 46.549661 |
| 45  | <i>Fraxinus excelsior</i>     | 24.56375982 | 46.55688891 | 250 | <i>Picea abies</i>           | 24.551995 | 46.549788 |

| no. | species                           | xcoord      | ycoord      | no. | species                      | xcoord    | ycoord    |
|-----|-----------------------------------|-------------|-------------|-----|------------------------------|-----------|-----------|
| 46  | <i>Acer pseudoplatanus</i>        | 24.56384784 | 46.55693721 | 251 | <i>Tilia cordata</i>         | 24.552175 | 46.549746 |
| 47  | <i>Fraxinus pennsylvanica</i>     | 24.56391249 | 46.5569746  | 252 | <i>Acer platanoides</i>      | 24.552217 | 46.549717 |
| 48  | <i>Acer platanoides 'crimson'</i> | 24.56438883 | 46.55739602 | 253 | <i>Taxus baccata</i>         | 24.552364 | 46.549592 |
| 49  | <i>Prunus cerasifera</i>          | 24.56428289 | 46.55731657 | 254 | <i>Juniperus sabina</i>      | 24.552397 | 46.549873 |
| 50  | <i>Prunus cerasifera</i>          | 24.56404025 | 46.55734539 | 255 | <i>Acer platanoides</i>      | 24.551227 | 46.550162 |
| 51  | <i>Malus pumila</i>               | 24.564194   | 46.557354   | 256 | <i>Acer platanoides</i>      | 24.551266 | 46.550198 |
| 52  | <i>Malus pumila</i>               | 24.564169   | 46.557369   | 257 | <i>Fraxinus excelsior</i>    | 24.551362 | 46.550285 |
| 53  | <i>Prunus cerasifera</i>          | 24.564182   | 46.557392   | 258 | <i>Acer negundo</i>          | 24.551432 | 46.550345 |
| 54  | <i>Liriodendron sp.</i>           | 24.56431    | 46.557423   | 259 | <i>Acer negundo</i>          | 24.551485 | 46.550391 |
| 55  | <i>Acer platanoides</i>           | 24.564379   | 46.557472   | 260 | <i>Prunus cerasifera</i>     | 24.551504 | 46.550407 |
| 56  | <i>Prunus cerasifera</i>          | 24.56432574 | 46.55755883 | 261 | <i>Fraxinus excelsior</i>    | 24.551519 | 46.55042  |
| 57  | <i>Betula pendula</i>             | 24.564434   | 46.557529   | 262 | <i>Prunus cerasifera</i>     | 24.551561 | 46.550459 |
| 58  | <i>Betula pendula</i>             | 24.56443285 | 46.55757441 | 263 | <i>Acer platanoides</i>      | 24.551549 | 46.550444 |
| 59  | <i>Acer platanoides</i>           | 24.56451619 | 46.55759544 | 264 | <i>Robinia pseudoacacia</i>  | 24.551734 | 46.55053  |
| 60  | <i>Prunus cerasifera</i>          | 24.56459838 | 46.55753701 | 265 | <i>Acer negundo</i>          | 24.551811 | 46.550526 |
| 61  | <i>Prunus cerasifera</i>          | 24.56454541 | 46.55756506 | 266 | <i>Prunus cerasifera</i>     | 24.551845 | 46.550506 |
| 62  | <i>Malus pumila</i>               | 24.5645532  | 46.55752377 | 267 | <i>Acer negundo</i>          | 24.551829 | 46.550496 |
| 63  | <i>Malus pumila</i>               | 24.564548   | 46.557476   | 268 | <i>Acer negundo</i>          | 24.551925 | 46.550498 |
| 64  | <i>Acer platanoides 'crimson'</i> | 24.56451619 | 46.55745055 | 269 | <i>Robinia pseudoacacia</i>  | 24.551923 | 46.550498 |
| 65  | <i>Acer platanoides 'crimson'</i> | 24.56459487 | 46.55741082 | 270 | <i>Acer negundo</i>          | 24.55188  | 46.550478 |
| 66  | <i>Acer platanoides</i>           | 24.564636   | 46.557419   | 271 | <i>Picea abies</i>           | 24.552219 | 46.55025  |
| 67  | <i>Acer pseudoplatanus</i>        | 24.56450724 | 46.55736798 | 272 | <i>Picea abies</i>           | 24.552259 | 46.550016 |
| 68  | <i>Prunus cerasifera</i>          | 24.5644235  | 46.55732514 | 273 | <i>Philadelphus sp.</i>      | 24.552453 | 46.550071 |
| 69  | <i>Liriodendron sp.</i>           | 24.564318   | 46.557247   | 274 | <i>Morus sp.</i>             | 24.552465 | 46.550037 |
| 70  | <i>Liriodendron sp.</i>           | 24.564236   | 46.55722    | 275 | <i>Acer negundo</i>          | 24.552561 | 46.550038 |
| 71  | <i>Gleditschia triacanthos</i>    | 24.56428913 | 46.55705951 | 276 | <i>Spiraea sp.</i>           | 24.552618 | 46.54998  |
| 72  | <i>Acer negundo</i>               | 24.56452048 | 46.55719972 | 277 | <i>Spiraea sp.</i>           | 24.552713 | 46.549966 |
| 73  | <i>Fraxinus excelsior</i>         | 24.56457423 | 46.55723088 | 278 | <i>Philadelphus sp.</i>      | 24.552747 | 46.549892 |
| 74  | <i>Acer negundo</i>               | 24.56463421 | 46.5572636  | 279 | <i>Acer negundo</i>          | 24.552925 | 46.549709 |
| 75  | <i>Fraxinus excelsior</i>         | 24.5646568  | 46.55727762 | 280 | <i>Populus nigra italica</i> | 24.552947 | 46.549732 |
| 76  | <i>Fraxinus excelsior</i>         | 24.564859   | 46.5574     | 281 | <i>Populus nigra italica</i> | 24.552963 | 46.549758 |
| 77  | <i>Prunus cerasifera</i>          | 24.56493801 | 46.55743809 | 282 | <i>Populus nigra italica</i> | 24.552982 | 46.549789 |
| 78  | <i>Fraxinus excelsior</i>         | 24.56509925 | 46.55754286 | 283 | <i>Populus nigra italica</i> | 24.553005 | 46.549823 |
| 79  | <i>Fraxinus excelsior</i>         | 24.565063   | 46.557514   | 284 | <i>Populus nigra italica</i> | 24.553011 | 46.549869 |
| 80  | <i>Fraxinus excelsior</i>         | 24.565035   | 46.557499   | 285 | <i>Prunus cerasifera</i>     | 24.553039 | 46.549896 |
| 81  | <i>Acer platanoides</i>           | 24.56482545 | 46.55760264 | 286 | <i>Populus nigra italica</i> | 24.553033 | 46.549911 |
| 82  | <i>Populus nigra</i>              | 24.56498007 | 46.55757986 | 287 | <i>Prunus cerasifera</i>     | 24.553043 | 46.549934 |
| 83  | <i>Acer negundo</i>               | 24.56487919 | 46.55763565 | 288 | <i>Populus nigra italica</i> | 24.553045 | 46.549961 |
| 84  | <i>Juglans regia</i>              | 24.5649604  | 46.55768268 | 289 | <i>Populus nigra italica</i> | 24.553062 | 46.550022 |
| 85  | <i>Acer platanoides</i>           | 24.56498611 | 46.55769612 | 290 | <i>Populus nigra italica</i> | 24.553087 | 46.550079 |
| 86  | <i>Populus nigra</i>              | 24.56543655 | 46.55775318 | 291 | <i>Juniperus sabina</i>      | 24.552807 | 46.550029 |
| 87  | <i>Populus nigra</i>              | 24.565222   | 46.557625   | 292 | <i>Prunus cerasifera</i>     | 24.552728 | 46.550044 |
| 88  | <i>Acer negundo</i>               | 24.56506381 | 46.55774695 | 293 | <i>Spiraea sp.</i>           | 24.552698 | 46.550064 |
| 89  | <i>Acer platanoides</i>           | 24.56511873 | 46.55777324 | 294 | <i>Juglans regia</i>         | 24.5527   | 46.550083 |
| 90  | <i>Prunus cerasifera</i>          | 24.56513509 | 46.55778317 | 295 | <i>Taxus baccata</i>         | 24.552567 | 46.550165 |
| 91  | <i>Acer negundo</i>               | 24.56517793 | 46.55780693 | 296 | <i>Sambucus nigra</i>        | 24.552588 | 46.550176 |
| 92  | <i>Acer platanoides</i>           | 24.56521454 | 46.5578303  | 297 | <i>Picea abies</i>           | 24.552594 | 46.550196 |

| no. | species                       | xcoord      | ycoord      | no. | species                       | xcoord    | ycoord    |
|-----|-------------------------------|-------------|-------------|-----|-------------------------------|-----------|-----------|
| 93  | <i>Acer negundo</i>           | 24.56524881 | 46.55785133 | 298 | <i>Prunus cerasus</i>         | 24.55255  | 46.55018  |
| 94  | <i>Acer platanoides</i>       | 24.5652714  | 46.55786223 | 299 | <i>Philadelphus sp.</i>       | 24.552632 | 46.550264 |
| 95  | <i>Acer platanoides</i>       | 24.56530393 | 46.5578784  | 300 | <i>Thuja occidentalis</i>     | 24.55242  | 46.55026  |
| 96  | <i>Acer negundo</i>           | 24.5653345  | 46.55790118 | 301 | <i>Philadelphus sp.</i>       | 24.552394 | 46.550234 |
| 97  | <i>Acer negundo</i>           | 24.56537033 | 46.55792533 | 302 | <i>Forsythia sp.</i>          | 24.552398 | 46.550218 |
| 98  | <i>Acer negundo</i>           | 24.56540694 | 46.55795026 | 303 | <i>Spiraea sp.</i>            | 24.552464 | 46.550241 |
| 99  | <i>Acer platanoides</i>       | 24.56545914 | 46.55798609 | 304 | <i>Taxus baccata</i>          | 24.552537 | 46.550264 |
| 100 | <i>Acer negundo</i>           | 24.56544434 | 46.55797674 | 305 | <i>Prunus cerasus</i>         | 24.55251  | 46.550291 |
| 101 | <i>Fraxinus excelsior</i>     | 24.56553859 | 46.55783108 | 306 | <i>Betula pendula</i>         | 24.552461 | 46.550302 |
| 102 | <i>Acer platanoides</i>       | 24.565512   | 46.558022   | 307 | <i>Betula pendula</i>         | 24.552493 | 46.550321 |
| 103 | <i>Fraxinus excelsior</i>     | 24.56565388 | 46.55794169 | 308 | <i>Prunus cerasus</i>         | 24.552611 | 46.550337 |
| 104 | <i>Acer negundo</i>           | 24.56571542 | 46.55798998 | 309 | <i>Prunus cerasus</i>         | 24.552587 | 46.550382 |
| 105 | <i>Acer negundo</i>           | 24.56581454 | 46.55809982 | 310 | <i>Spiraea sp.</i>            | 24.552634 | 46.550417 |
| 106 | <i>Fraxinus excelsior</i>     | 24.56584141 | 46.55814539 | 311 | <i>Tamarix sp.</i>            | 24.552613 | 46.550459 |
| 107 | <i>Acer negundo</i>           | 24.56599195 | 46.55830702 | 312 | <i>Fallopia sp.</i>           | 24.553495 | 46.551237 |
| 108 | <i>Fraxinus excelsior</i>     | 24.56596313 | 46.55827197 | 313 | <i>Acer pseudoplatanus</i>    | 24.553538 | 46.55127  |
| 109 | <i>Fraxinus excelsior</i>     | 24.56593353 | 46.55823069 | 314 | <i>Acer pseudoplatanus</i>    | 24.553641 | 46.551371 |
| 110 | <i>Aesculus hippocastanum</i> | 24.56578319 | 46.55823692 | 315 | <i>Acer pseudoplatanus</i>    | 24.553739 | 46.551451 |
| 111 | <i>Acer platanoides</i>       | 24.56577929 | 46.55830702 | 316 | <i>Acer pseudoplatanus</i>    | 24.553769 | 46.551458 |
| 112 | <i>Robinia pseudoacacia</i>   | 24.56576917 | 46.55836701 | 317 | <i>Fallopia sp.</i>           | 24.553743 | 46.551438 |
| 113 | <i>Acer platanoides</i>       | 24.5657606  | 46.55841141 | 318 | <i>Populus nigra</i>          | 24.549966 | 46.550015 |
| 114 | <i>Acer platanoides</i>       | 24.56574969 | 46.55848151 | 319 | <i>Populus nigra</i>          | 24.550032 | 46.549746 |
| 115 | <i>Acer platanoides</i>       | 24.56586712 | 46.55845444 | 320 | <i>Populus nigra</i>          | 24.550054 | 46.54961  |
| 116 | <i>Acer platanoides</i>       | 24.56590451 | 46.55846613 | 321 | <i>Quercus robur</i>          | 24.550278 | 46.549445 |
| 117 | <i>Acer negundo</i>           | 24.565861   | 46.558422   | 322 | <i>Aesculus hippocastanum</i> | 24.550417 | 46.549578 |
| 118 | <i>Acer platanoides</i>       | 24.56587296 | 46.55838901 | 323 | <i>Acer platanoides</i>       | 24.550573 | 46.549537 |
| 119 | <i>Acer negundo</i>           | 24.565922   | 46.558388   | 324 | <i>Tilia platyphyllos</i>     | 24.550766 | 46.549608 |
| 120 | <i>Acer negundo</i>           | 24.566063   | 46.558384   | 325 | <i>Tilia platyphyllos</i>     | 24.550672 | 46.549625 |
| 121 | <i>Robinia pseudoacacia</i>   | 24.565975   | 46.558403   | 326 | <i>Tilia platyphyllos</i>     | 24.550608 | 46.54962  |
| 122 | <i>Robinia pseudoacacia</i>   | 24.565994   | 46.558437   | 327 | <i>Tilia platyphyllos</i>     | 24.550505 | 46.549648 |
| 123 | <i>Robinia pseudoacacia</i>   | 24.56601785 | 46.55845036 | 328 | <i>Tilia platyphyllos</i>     | 24.550424 | 46.549662 |
| 124 | <i>Robinia pseudoacacia</i>   | 24.56602778 | 46.55846321 | 329 | <i>Tilia platyphyllos</i>     | 24.550541 | 46.549696 |
| 125 | <i>Acer negundo</i>           | 24.566095   | 46.558399   | 330 | <i>Tilia platyphyllos</i>     | 24.550625 | 46.549683 |
| 126 | <i>Fraxinus excelsior</i>     | 24.566147   | 46.558495   | 331 | <i>Tilia platyphyllos</i>     | 24.550739 | 46.549665 |
| 127 | <i>Fraxinus excelsior</i>     | 24.56608445 | 46.55852981 | 332 | <i>Tilia platyphyllos</i>     | 24.550809 | 46.549653 |
| 128 | <i>Fraxinus excelsior</i>     | 24.56643499 | 46.55882017 | 333 | <i>Acer platanoides</i>       | 24.550927 | 46.549619 |
| 129 | <i>Juglans regia</i>          | 24.56650042 | 46.5588821  | 334 | <i>Quercus robur</i>          | 24.551012 | 46.549713 |
| 130 | <i>Tamarix sp.</i>            | 24.56642389 | 46.55891423 | 335 | <i>Aesculus hippocastanum</i> | 24.551098 | 46.549572 |
| 131 | <i>Fraxinus excelsior</i>     | 24.56657871 | 46.55897557 | 336 | <i>Quercus robur</i>          | 24.551195 | 46.54967  |
| 132 | <i>Acer negundo</i>           | 24.5667271  | 46.55914383 | 337 | <i>Aesculus hippocastanum</i> | 24.551871 | 46.549595 |
| 133 | <i>Tamarix sp.</i>            | 24.56667803 | 46.55920109 | 338 | <i>Aesculus hippocastanum</i> | 24.551746 | 46.549626 |
| 134 | <i>Forsythia sp.</i>          | 24.5667493  | 46.55928521 | 339 | <i>Acer platanoides</i>       | 24.551725 | 46.549718 |
| 135 | <i>Fraxinus excelsior</i>     | 24.566849   | 46.559277   | 340 | <i>Fraxinus excelsior</i>     | 24.551515 | 46.549724 |
| 136 | <i>Forsythia sp.</i>          | 24.56679838 | 46.55933663 | 341 | <i>Aesculus hippocastanum</i> | 24.551385 | 46.549812 |
| 137 | <i>Fraxinus excelsior</i>     | 24.56691288 | 46.55935532 | 342 | <i>Carpinus betulus</i>       | 24.551527 | 46.549604 |
| 138 | <i>Forsythia sp.</i>          | 24.56683109 | 46.55938336 | 343 | <i>Quercus robur</i>          | 24.55158  | 46.549494 |
| 139 | <i>Juglans regia</i>          | 24.56697949 | 46.55943244 | 344 | <i>Acer platanoides</i>       | 24.551343 | 46.549531 |



| no. | species                    | xcoord      | ycoord      | no. | species                       | xcoord    | ycoord    |
|-----|----------------------------|-------------|-------------|-----|-------------------------------|-----------|-----------|
| 140 | <i>Spiraea sp.</i>         | 24.56451658 | 46.55758609 | 345 | <i>Acer platanoides</i>       | 24.551273 | 46.549533 |
| 141 | <i>Acer platanoides</i>    | 24.56483976 | 46.55761053 | 346 | <i>Aesculus hippocastanum</i> | 24.551229 | 46.549453 |
| 142 | <i>Acer platanoides</i>    | 24.56485174 | 46.55761871 | 347 | <i>Acer platanoides</i>       | 24.551128 | 46.549468 |
| 143 | <i>Acer platanoides</i>    | 24.56509068 | 46.5577598  | 348 | <i>Tilia platyphyllos</i>     | 24.551006 | 46.549501 |
| 144 | <i>Acer negundo</i>        | 24.55483421 | 46.55142232 | 349 | <i>Acer pseudoplatanus</i>    | 24.550994 | 46.549403 |
| 145 | <i>Acer negundo</i>        | 24.55494992 | 46.55142355 | 350 | <i>Thuja orientalis</i>       | 24.551285 | 46.549096 |
| 146 | <i>Acer negundo</i>        | 24.55489264 | 46.55147895 | 351 | <i>Aesculus hippocastanum</i> | 24.551228 | 46.54918  |
| 147 | <i>Acer negundo</i>        | 24.55498131 | 46.55145617 | 352 | <i>Acer platanoides</i>       | 24.551276 | 46.54927  |
| 148 | <i>Acer negundo</i>        | 24.55502686 | 46.55149987 | 353 | <i>Acer platanoides</i>       | 24.551268 | 46.549225 |
| 149 | <i>Acer negundo</i>        | 24.55496162 | 46.55155034 | 354 | <i>Aesculus hippocastanum</i> | 24.551265 | 46.549369 |
| 150 | <i>Acer negundo</i>        | 24.55509164 | 46.55156695 | 355 | <i>Ulmus laevis</i>           | 24.5514   | 46.549362 |
| 151 | <i>Acer negundo</i>        | 24.55502964 | 46.55161995 | 356 | <i>Aesculus hippocastanum</i> | 24.551529 | 46.549351 |
| 152 | <i>Juglans regia</i>       | 24.55507064 | 46.55164695 | 357 | <i>Sophora japonica</i>       | 24.551476 | 46.549424 |
| 153 | <i>Acer negundo</i>        | 24.55512903 | 46.55159527 | 358 | <i>Sophora japonica</i>       | 24.551649 | 46.549428 |
| 154 | <i>Acer negundo</i>        | 24.55516534 | 46.55162051 | 359 | <i>Platanus occidentalis</i>  | 24.551598 | 46.549394 |
| 155 | <i>Prunus cerasifera</i>   | 24.55512841 | 46.55169313 | 360 | <i>Sophora japonica</i>       | 24.551738 | 46.549423 |
| 156 | <i>Acer negundo</i>        | 24.55514811 | 46.55171098 | 361 | <i>Acer platanoides</i>       | 24.551824 | 46.549421 |
| 157 | <i>Acer negundo</i>        | 24.55522997 | 46.55177068 | 362 | <i>Acer negundo</i>           | 24.560187 | 46.554448 |
| 158 | <i>Prunus cerasifera</i>   | 24.5553069  | 46.55182177 | 363 | <i>Fallopia sp.</i>           | 24.560106 | 46.554412 |
| 159 | <i>Acer negundo</i>        | 24.55535429 | 46.55185377 | 364 | <i>Tilia cordata</i>          | 24.559899 | 46.554291 |
| 160 | <i>Acer negundo</i>        | 24.55541153 | 46.5518944  | 365 | <i>Fallopia sp.</i>           | 24.559722 | 46.554175 |
| 161 | <i>Acer negundo</i>        | 24.55544292 | 46.55191655 | 366 | <i>Juglans regia</i>          | 24.559629 | 46.554126 |
| 162 | <i>Acer negundo</i>        | 24.55570143 | 46.5520655  | 367 | <i>Prunus cerasus</i>         | 24.559293 | 46.553935 |
| 163 | <i>Acer negundo</i>        | 24.55593954 | 46.55213059 | 368 | <i>Acer negundo</i>           | 24.559197 | 46.553875 |
| 164 | <i>Acer negundo</i>        | 24.55603194 | 46.55222737 | 369 | <i>Salix alba</i>             | 24.559171 | 46.553847 |
| 165 | <i>Tilia cordata</i>       | 24.55619997 | 46.55230369 | 370 | <i>Prunus cerasifera</i>      | 24.559135 | 46.553831 |
| 166 | <i>Acer negundo</i>        | 24.5562769  | 46.55234185 | 371 | <i>Robinia pseudoacacia</i>   | 24.559118 | 46.55381  |
| 167 | <i>Prunus cerasifera</i>   | 24.5563993  | 46.55239682 | 372 | <i>Salix alba</i>             | 24.55903  | 46.553756 |
| 168 | <i>Acer pseudoplatanus</i> | 24.55641869 | 46.55236358 | 373 | <i>Salix alba</i>             | 24.558937 | 46.553712 |
| 169 | <i>Tilia cordata</i>       | 24.55646585 | 46.55242494 | 374 | <i>Acer negundo</i>           | 24.55881  | 46.553638 |
| 170 | <i>Acer negundo</i>        | 24.55652309 | 46.55245264 | 375 | <i>Juglans regia</i>          | 24.558685 | 46.553568 |
| 171 | <i>Acer negundo</i>        | 24.55665419 | 46.55250957 | 376 | <i>Acer negundo</i>           | 24.558565 | 46.553497 |
| 172 | <i>Prunus cerasifera</i>   | 24.55672066 | 46.55253727 | 377 | <i>Prunus cerasifera</i>      | 24.558485 | 46.553449 |
| 173 | <i>Sambucus nigra</i>      | 24.55689238 | 46.55257235 | 378 | <i>Prunus cerasifera</i>      | 24.558441 | 46.553421 |
| 174 | <i>Juglans regia</i>       | 24.55695454 | 46.55259389 | 379 | <i>Prunus cerasifera</i>      | 24.558201 | 46.553299 |
| 175 | <i>Populus nigra</i>       | 24.55691146 | 46.55262836 | 380 | <i>Aesculus hippocastanum</i> | 24.551711 | 46.549636 |
| 176 | <i>Acer negundo</i>        | 24.55702533 | 46.55267575 | 381 | <i>Quercus robur</i>          | 24.550236 | 46.549396 |
| 177 | <i>Juglans regia</i>       | 24.55710534 | 46.55266406 | 382 | <i>Acer platanoides</i>       | 24.551354 | 46.549506 |
| 178 | <i>Juglans regia</i>       | 24.55717364 | 46.55275295 | 383 | <i>Acer platanoides</i>       | 24.551391 | 46.549502 |
| 179 | <i>Juglans regia</i>       | 24.55731706 | 46.55276192 | 384 | <i>Acer platanoides</i>       | 24.551425 | 46.549527 |
| 180 | <i>Acer negundo</i>        | 24.55732864 | 46.55280995 | 385 |                               | 24.551393 | 46.549145 |
| 181 | <i>Juglans regia</i>       | 24.55739523 | 46.55279454 | 386 |                               | 24.551574 | 46.549227 |
| 182 | <i>Malus domestica</i>     | 24.55740261 | 46.55285485 | 387 |                               | 24.551691 | 46.549279 |
| 183 | <i>Acer negundo</i>        | 24.55748664 | 46.55287495 | 388 |                               | 24.551651 | 46.54926  |
| 184 | <i>Acer negundo</i>        | 24.55767958 | 46.55297733 | 389 | <i>Picea abies</i>            | 24.55193  | 46.54979  |
| 185 | <i>Populus nigra</i>       | 24.55794055 | 46.55313551 | 390 | <i>Populus nigra</i>          | 24.550037 | 46.549709 |
| 186 | <i>Prunus cerasifera</i>   | 24.55788884 | 46.55310105 | 391 | <i>Populus nigra</i>          | 24.55001  | 46.549783 |

| no. | species                     | xcoord      | ycoord      | no. | species                   | xcoord    | ycoord    |
|-----|-----------------------------|-------------|-------------|-----|---------------------------|-----------|-----------|
| 187 | <i>Populus nigra</i>        | 24.55775652 | 46.55304381 | 392 | <i>Philadelphus sp.</i>   | 24.552805 | 46.550029 |
| 188 | <i>Quercus robur</i>        | 24.55768543 | 46.55313274 | 393 | <i>Philadelphus sp.</i>   | 24.55257  | 46.550018 |
| 189 | <i>Populus nigra</i>        | 24.55774605 | 46.55318352 | 394 | <i>Forsythia sp.</i>      | 24.55261  | 46.549944 |
| 190 | <i>Tilia platyphyllos</i>   | 24.5575331  | 46.55321953 | 395 | <i>Forsythia sp.</i>      | 24.552582 | 46.54993  |
| 191 | <i>Tilia cordata</i>        | 24.55742046 | 46.55316598 | 396 | <i>Spiraea sp.</i>        | 24.552729 | 46.549943 |
| 192 | <i>Tilia platyphyllos</i>   | 24.55734538 | 46.55313028 | 397 | <i>Forsythia sp.</i>      | 24.552405 | 46.550224 |
| 193 | <i>Fraxinus excelsior</i>   | 24.55696378 | 46.55295179 | 398 | <i>Philadelphus sp.</i>   | 24.552402 | 46.55024  |
| 194 | <i>Tilia cordata</i>        | 24.55690284 | 46.55292533 | 399 | <i>Thuja occidentalis</i> | 24.552387 | 46.550255 |
| 195 | <i>Tilia cordata</i>        | 24.5567896  | 46.5528724  | 400 | <i>Thuja occidentalis</i> | 24.552408 | 46.550277 |
| 196 | <i>Tilia cordata</i>        | 24.5566505  | 46.55281023 | 401 | <i>Thuja occidentalis</i> | 24.552359 | 46.550259 |
| 197 | <i>Tilia platyphyllos</i>   | 24.55658772 | 46.55278192 | 402 | <i>Thuja occidentalis</i> | 24.552412 | 46.550301 |
| 198 | <i>Robinia pseudoacacia</i> | 24.55653356 | 46.55275545 | 403 | <i>Thuja occidentalis</i> | 24.552385 | 46.55027  |
| 199 | <i>Robinia pseudoacacia</i> | 24.55648124 | 46.55273268 | 404 | <i>Taxus baccata</i>      | 24.552536 | 46.550248 |
| 200 | <i>Prunus cerasifera</i>    | 24.55642154 | 46.55270314 | 405 | <i>Philadelphus sp.</i>   | 24.552627 | 46.550251 |
| 201 | <i>Acer tataricum</i>       | 24.55638215 | 46.55268714 | 406 | <i>Acer negundo</i>       | 24.555025 | 46.551495 |
| 202 | <i>Tilia cordata</i>        | 24.55631321 | 46.55265513 | 407 | <i>Acer negundo</i>       | 24.555032 | 46.551505 |
| 203 | <i>Tilia platyphyllos</i>   | 24.55588792 | 46.55246248 | 408 | <i>Acer negundo</i>       | 24.55502  | 46.551493 |
| 204 | <i>Tilia platyphyllos</i>   | 24.55581098 | 46.55242925 | 409 | <i>Acer negundo</i>       | 24.555088 | 46.551561 |
| 205 | <i>Tilia platyphyllos</i>   | 24.55573282 | 46.5523917  | 410 | <i>Acer negundo</i>       | 24.555083 | 46.551556 |



### ANNEX NO. 3 – PHOTOGRAPHS



Green area behind the apartment buildings in the Rovinari neighborhood (Photo: Miholcsa Tamás)



The "Ritz" area in the Rovinari neighborhood, image on the left side of the Turbinei Channel – contains precious aquatic habitats for birds, supports an important avifaunal diversity at the urban level (Photo: Miholcsa Tamás)





The confluence of the Turbinei Channel with the Mures River (Photo: Miholcsa Tamás)



Green area behind the hippodrome, in the background the meadow forest of the Ritz Area, (Photo: Miholcsa Tamás)





Mures channel area.



Mures confluence area – Mures channel.





Upstream area of the Turbinei Channel