Interreg

Co-funded by the European Union

Latvia – Lithuania

Monitoring (monitoring) services of ponds in Šilutė H. Šojaus park and Maras pond in Kuldyga city

Interreg VI-A Latvia–Lithuania Programme 2021–2027 project "Restoration of water bodies through cross-border cooperation" („Restoration of water bodies through cross-border cooperation„ acronym – „All about ponds“), Nr. LL-00049

Interim report

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Klaipėda, 2024

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Content

1. Object and tasks

H Šojaus park ponds are two small water bodies of 0.36 ha and 0.3 ha, located in a well-maintained, well-kept park with long-lived trees in the town of Šilutė near the Šyša River (Fig. 1). The large pond is equipped with a pedestrian bridge that divides the pond in half. There is also a fountain in both ponds. The ponds of H. Šojaus Park, which have no connection with the river, are connected by a narrow channel heavily overgrown with macrophytes, and are typical bodies of stagnant water, in which filamentous algae, sedges (family Lemnaceae) and duckweed (family *Ceratophyllaceae*) are abundantly grown (Fig. 2). The water clarity was relatively high (> 2 m) during the research. In the small pond, the bottom consists mostly of fallen trees on a layer of silt of varying thickness, in the larger one - silt, clay.

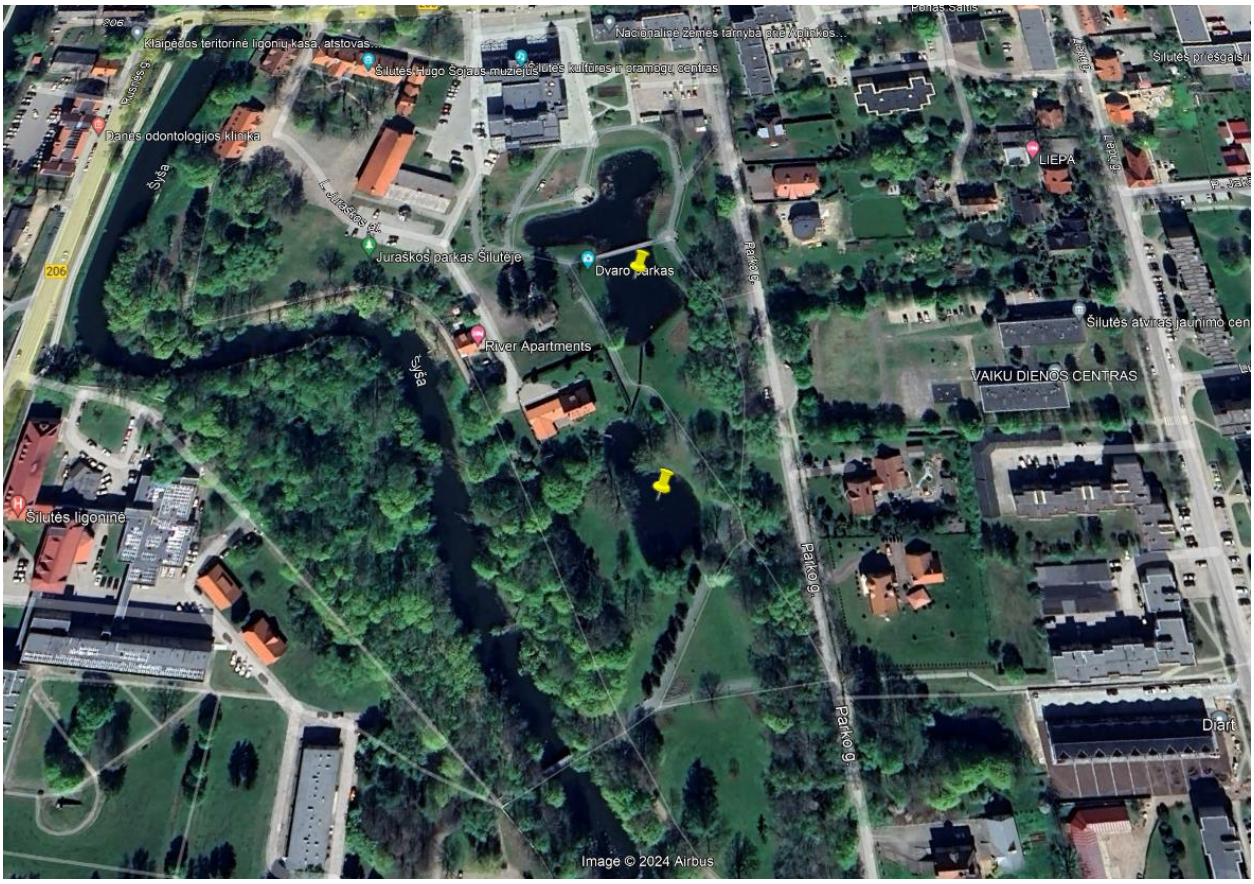

Figure 1. H. Šojaus Park ponds (source: https://maps.google.com/).

Figure 2 The ponds of H. Šojaus Park, large pond on the left, a small pond on the right ((photo: E. Ivanauskas and A. Skersonas).

Tasks:

1. To evaluate the water quality of the ponds before the pond cleaning works and after the end of the works using the LEŽI index method.;

2. To evaluate the water quality of the ponds before and after the pond cleaning works, using the vegetation community assessment index;

3. To assess pond biodiversity and the abundance of rare species before and after the pond cleaning works.

2. Methodology

2.1 Research on fish

Ichthyological researches in the ponds of H. Šojaus Park were carried out in accordance with the description of the procedure for researching fish resources in inland waters, approved by the Minister of the Environment of the Republic of Lithuania in 2016. October 24 by order no. D1-698 "Regarding the Minister of the Environment of the Republic of Lithuania of 2012 September 25 order no. Appendix D1-767 "Regarding the amendment to the approval of the procedure description for researching fish resources in inland waters" - Methodology for researching fish resources. Investigations are to be conducted once in 2024. in June, using selective nets according to special fishing permit No. 026 issued by the Environmental Protection Agency on June 13, 2024. Characteristics of the monitoring net: single-walled, consisting of sections of various mesh sizes, length of one section 5 m, 8 sections in the net, total length 40 m, height 3 m, section mesh sizes 14-18-22-25-30-40-50- 60 mm. In total, 1 unit was used in each pond during fishing. selective retinas. The nets were set in the evening and hauled out in the morning; nets remained in the water for about 10-12 hours.

Absolute and zoological (without tail fin) fish length, mass, and age were evaluated as empirical parameters. Species classified the fish caught during the research weighed (Q, g), the total length of the fish (L, cm), and the length without the tail fin (l, cm) were measured, and scales were taken for age determination. A ruler with an error of 1 mm was used for measurement. An electronic scale with an error of 1 g was used to weigh the catch. The age of the fish was determined from scales in the laboratory using binoculars according to the appropriate methodology (Bukelskis and Kublickas, 1988; Thoresson, 1993; Pravdin, 1966).

2.2 Macroinvertebrate research

Macroinvertebrates were sampled using a D-net. For each water body, three locations were selected and invertebrates were caught in them for 5 min. A 30*30 cm pond bottom area with sediments and plants was taken for quantitative samples.

2.3 Macrophytes

Macrophyte studies in Hugo Šojaus Park ponds should be carried out at the same time as ichthyological ones. The research was carried out under the guidance of the Minister of the Environment of the Republic of Lithuania in 2013. December 16 by order no. D1-934 approved methodology. Investigations were carried out in 3-4 transects in each studied pond, in < 1 m, 1-2 m and > 2 m depth zones. In the smallest zone, up to 1 m deep, the abundance of different macrophyte species was assessed visually, by grabbing plants with a hook only to confirm the accuracy of species identification. In the deeper zones, macrophytes were scooped out with a hook in at least 3 places in each of the zones.

All macrophytes found during the research have been identified as species. The abundance of each species in each depth zone was assessed on a 5-point scale: 1 – species very rare, 2 – rare, 3 – not rare, 4 – common, 5 – very common/dominant. Each identified species of macrophytes is assigned to ecological-morphological groups: submerged (potameida and limneida), floaters (nymphidae), free-floating plants (lemnida), and helophytes.

For the calculation of the MEI of lakes, submerged, floating and free-floating macrophytes are divided into 3 groups of indicator species: A – species sensitive to anthropogenic impact (species characteristic of reference lake communities); B – indifferent species; C - tolerant species (usually growing where there are very few or no species of group A). Following the approved methodology (Žin. 2013), the assignment of species to indicator groups was carried out by accounting for the average depth of the pond.

3. Results

This section presents the results of the research and a summary of the results.

3.1. Macroinvertebrates

3.1.1. Diversity of macroinvertebrates

Both studied ponds are abundantly covered with macrophytes. The determined species composition of invertebrates is typical for such small water bodies, where pinworms, crustaceans (Asellus), molluscs, leeches, and insect larvae predominate (Appendix. Table 1). No protected species have been identified in water bodies. According to the average abundance of macroinvertebrates, both water bodies were of similar abundance (Table 1).

Table 1. Average abundance of macroinvertebrate taxa (ind./sq.m) in the studied water bodies

	H Šojaus large pond	**H. Šojaus small pond**
Taxa	**Abundance, ind./sq.m.**	
Oligochaeta	68	64
Erpobdella sp.	48	11
Asellus aquaticus	33	45
Caenis sp.	33	30
Chironomidae	37	52
Valvata sp.	107	78
Others	38	49
Total	365	328

3.2. Macrophytes

The presented Figure 2 shows the transects where plant research was carried out in Hugo Šojaus ponds. Aquatic plant species richness was found to be very low, so the Macrophyte Benchmark Index (MEI) was not calculated. According to the order of the Minister of the Environment of the Republic of Lithuania "On the approval of the methodology for determining the condition of surface water bodies" of point 9 "Requirements for calculating the MEI of the transect:" , for the requirement of subsection 9.2: "9.2. for water bodies with an average depth of <3 m, − the total amount of plants ≥35 and Nymphaea, Nuphar species make up <80% of the total

amount of plants;", the MEI index was not calculated due to the insufficient number of aquatic macrophyte species in both ponds of Hugo Šojaus Park. However, their relative abundance in the pond and the relative vegetation of the shores with aquatic plants were evaluated.

Table 2. Aquatic plant species and their relative abundance/overgrowth were identified in Hugo Šojaus Park ponds.

	Relative abundance (overgrowth) %	
The species	Large pond	Small pond
LYMNEIDS		
Flowering plants		
Elodea canadensis	1	10
POTAMEIDS		
Flowering plants		
Potamogeton lucens	-	3
Ceratophyllum demersum	96	80
FLOAT LEAVES AND FLOATERS (NYMPHEIDS, PLEUSTOPHYTES)		
Flowering plants		
Nuphar lutea	-	3
Potamogeton natans	2	28
SHORELINE PLANTS		
Typha latifolia	-	3
Schoenoplectus lacustris	-	2
Schoenoplectus tabernaemontani	3	
Phragmites australis	95	60

During the research, aquatic plant species and their total relative abundance were discovered and determined in the research transects in the ponds of H. Šojaus Park. The detected species of aquatic plants are typical for this type of water bodies and are very common, compared to eutrophicated small water bodies of a similar type, the number of species is even small, usually only a few species of aquatic plants dominate in similar type of water bodies. The ponds of H. Šojaus Park are heavily overgrown with aquatic vegetation, but aquatic macrophytes are also covered (especially in the large pond) by filamentous spirogyra algae. Decomposition of decaying spirogyra algae requires a lot of oxygen, so when there is a large amount of it in the water, it can become deoxygenated, which would partly explain the low diversity of fish species and their relatively low abundance (especially in the large pond).

Figure 2. Locations of macrophyte research transects in H Šojaus park ponds. (map from www.maps.lt)

3.2. Fish abundance and biomass

During ichthyological research, 5 species of fish were caught in the ponds of H. Šojaus Park in 2024. In both ponds: tench (*Tinca tinca*), roach (*Rutilus rutilus*), rude (*Scardinius erythrophthalmus*), and silver bream (*Blicca bjoerkna*) were caught, and only in the larger pond was caught one individual of silver crucian carp (*Carassius gibelio*) (Table 3). The total biomass of fish in the large pond was determined to be 70.218 kg/ha, the density was 1638 units/ha, in the smaller pond – 39.5 kg/ha and the abundance was 294 ind./ha. Although the species composition is not high in such small reservoirs, none of the predatory fish species (perch or pike) were identified or observed in the ponds, and sunbleak (*Leucaspius delineates*), which is often found in this type of reservoir, was not observed.

In both ponds, predatory fish were not detected or their abundance was extremely low, which indicates a distorted composition of the fish community.

Table 3. Fish species caught in the ponds of H. Šojaus Park during the study and their calculated biomass (B, kg/ha), density (units/ha).

Species	H. Šojaus large pond		H. Šojaus small pond	
	B(kg/ha)	N(units/ha)	B(kg/ha)	N(units/ha)
Tench	37.6	54	31.5	31
Roach	3.9	90	4.3	93
Rude	19.5	1458	3.4	155
Silver bream	0.3	18	0.3	15.5
Crucian carp	8.9	18	-	-
Viso	***70.2***	***1638***	***39.5***	***294***

According to their hydro morphological parameters, both H. Šojaus Park ponds are classified as shallow, often mixed water bodies with an average depth of <3 meters (Table 4). The lake fish index - EŽI (Virbickas, 2016) was used to assess the ecological condition.

Table 4. Criteria for classifying lakes, ponds, and quarries into types ≤3

Types of water bodies in the category of lakes				
Criteria:	**Poly Polymictic**		**S Stratified**	**GS Deep stratified**
Average depth (m)	≤3	>3	>3	*n**
Maximum depth (m)	*n**	<11	11-30	>30

* „*n*“ - criterion is not used

Table 5. Fish indices and their change limits in condition classes.

Types of lakes	Indicators	Benchmark value	Status classes				
			V.good	Good	Average	Bad	V.bad
1 (POLY)	Silver bream Q% [1]	1.5	<4	4-10	11-18	19-25	>25
	Benthivor_Sp Q% [2]	10	<20	20-34	35-46	47-60	>60 (0)
	Perch N% [3]	30	>25	25-18	17-10	9-5	<5
	Obligatory species [4]	6	6	5	4	<4	<4
	Non-native Translocated species Q%[5]	0	-	-	<1	1-5	>5

Description of EŽI indicators:

1 Silver bream Q% - relative biomass of silver breams;
2 Benthivor_Sp Q% - relative biomass of silver breams, common breams, and ruff;
3 Perch N% – relative abundance of perches;
4 Obligatory species: POLY lakes - Bleak, Rude, Pike, Tench, Perch, Roach;
5 Non-native Translocated species Q% - Total relative biomass (%) of individuals of pikeperch, crucian carp, carp, and other non-native species in the fish community;

Table 6. Values of indicators (except for obligatory species and relative biomass of non-native-translocated species) transformed to the EKS scale ("1" - l. good condition, "0" - l. bad condition).

Types of lakes	**Indicators**	(Maximal value)	**Status classes**				
			V.good	**Good**	**Average**	**Bad**	**V.bad**
1 (POLY)	Silver bream Q%_EKS	(30)	1.0-0.913	0.912-0.702	0.701-0.421	0.420-0.175	0.175-0.0
	Benthivor_Sp Q%_EKS	(70)	1.0-0.834	0.833-0.600	0.599-0.400	0.399-0.167	0.166-0.0
	Perch N%_EKS		1.0-0.834	0.833-0.600	0.599-0.333	0.332-0.167	0.166-0.0

The transformation of the indicators presented in Table 6 into the ecological quality ratio (EKS) is carried out according to the formulas below.

Silver bream Q% ir Benthivor_Sp Q% indicators:

EKS = (X-Xmax)/(Xet-Xmax), kur X – set value, Xet – reference value (Table 7), Xmax – theoretical maximum value;

Indicator EKS at the value of >1 or <0 (negative value; indicators of group 1), the value of the indicator is equated to "1" or "0", respectively.

Table 7. EKS value of obligatory species depends on the number of obligate species found in the lake.

Lake type		Number of obligatory species			
	1 (POLY)	6	5	4	<4
Obligatory species EKS		1	-	0,2	0

Note: if one of the obligate fish species is not caught during the survey, but it is known that it lives in the lake, it is added to the other species when determining the EKS indicator of the obligate fish species.

Table 8. Relative biomass (Q%) EKS values of non-native and translocated species

Relative biomass (Q%) indicator of individuals of non-native and translocated species				
Q%	0%, or only 1 individual in the catch per CPUE	<1%	1-5%	≥5%
EKS	- (indicator not used)*	0,5	0,2	0

* - The indicator is used only when more than 1 individual is caught during the standardized fishing effort with 8 selective nets.

The Lake Fish Index (EŽI) is the average of all indicators in the EKS. The change limits of the EŽI index in different condition classes are presented in Table 9. The same EŽI classification system as for lakes is used to determine the ecological potential of ponds.

Table 9. Ecological status/potential classes of lakes according to EŽI values

Types of lakes	**Ecological status classes**				
	V.good	**Good**	**Average**	**Bad**	**V.bad**
1-3	1,00-0,87	0,86-0,61	0,60-0,37	0,36-0,18	0,17-0,00

Table 10. Fish indicators, reference values, ecological quality ratio, and their condition in the studied ponds were determined.

Indicators	**Set value**		**Ecological quality ratio**		**Reference value**	**Status class**	
	Large pond	Small pond	Large pond	Small pond		Large pond	Small pond
Silver bream Q%_EKS	0.46	0.63	**1**	**1**	1.5	**V.good**	**V.good**
Benthivor_Sp Q%	0.46	0.63	**1**	**1**	10	**V.good**	**V.good**
Perch N%	0	0	**0**	**0**	30	**V.bad**	**V.bad**
Obligatory species	3	3	**0.5**	**0.5**	6	**Average**	**Average**
Non-native Translocated species Q%	12.7	0	**0**	**1**	0	**V.bad**	**V.good**
EŽI			**0.5**	**0.7**	**-**	**Average**	**Good**

The EŽI value of the ponds of H. Šojaus was determined to be 0.5 in the large pond, and 0.7 in the small pond, and the ecological condition is assessed as average and good, respectively. (Table 10). This value of the EHI indicator and the evaluation of the ecological condition was determined by the fact that the abundance of silver bream was found in the reservoirs, which led to a high value of the indicator. Accordingly, a low abundance of fish in the *benthivor* group was also determined, due to which the indicator also received the maximum value. In both ponds, perch was not captured (presumably the ponds are completely absent of them), which resulted in minimal indicator values. In both ponds, 3 obligate fish species were also caught (roach, rude, and tench),

which is why the indicator got an average value. Among the non-native, translocated fish species, crucian carp was caught only in the large pond, and its relative biomass was very significant, so this indicator took a minimum value in the large pond and a maximum in the small pond.

Both ponds are very similar in their species composition, only crucian carp were caught in the larger one, which is why the value of the EŽI index is lower in it. Larger differences are observed in the composition of the fish population; in the large pond, small roaches make up about 90% of the total abundance of fish, in the small pond, the relative abundance of small roaches makes up about 50%, which indicates a very strong eutrophication in the reservoir.

4. Conclusions

1. Small bristle worms, crustaceans (Asellus), molluscs, leeches, and insect larvae predominate in the studied ponds, and the determined species composition of invertebrates is typical for such small water bodies.
2. Due to the low abundance of water macrophyte species, the reference index of macrophytes was not calculated, and both pools are heavily covered by filamentous algae of the *spirogyra* genus.
3. *Ceratophyllum demersum*, dominates the large pond, other aquatic macrophytes are found episodically or form small, local meadows. The small pond is also dominated by *Ceratophyllum demersum*, but a significant part of the pond is also covered by *Potamogeton natans* and *Elodea canadensis*. The species diversity of aquatic macrophytes is very poor (especially in large pond).
4. During ichthyological research, 5 species of fish were caught in the ponds, but no predatory fish were caught. The total biomass of fish in the large pond was determined to be 70.2 kg/ha, the abundance was 1638 units/ha, in the small pond it was 39.5 kg/ha, the abundance was 294 units/ha.
5. The indicator of the ecological condition of the Hugo Šojaus Park ponds was determined according to the indicators of the EŽI index: **0.5** in the large and **0.7** in the small, and the condition is assessed as **average** and **good**, respectively.
6. We recommend interpreting the obtained estimates with caution, as all these indices are created for Lithuanian lakes. There is no specific index for assessing the ecological status of relatively small stagnant water bodies, due to the low species abundance and sensitivity of the body, and a relatively small change can have large consequences for the values of the indices.
7. No protected species were identified during the investigation. All species of plants, macrophytes and macroinvertebrates found during the research are often found, and the H. Šojaus park ponds

themselves are artificial and strongly affected by human activities, so restrictions on pond cleaning should not be applied.

8. H. Cleaning of the ponds of Šojaus Park - cleaning the shores, and removal of silt, and debris, will improve the ecological condition of the ponds, especially in the larger pond since it is more overgrown and has lower biodiversity.

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Appendix Table 1 Composition of macroinvertebrate species in the studied water bodies (+ - detected taxon in a quantitative or qualitative sample, 0 - species not detected)

Taxa	Kuldygas Maras pond	H. Šojaus large pond	H. Šojaus small pond
Worms			
Planaria	0	+	+
Oligochaeta	+	+	+
Leeches			
Glosiphonia sp.	+	0	0
Erpobdella sp.	+	+	+
Crustaceans			
Asellus aquaticus	+	+	+
Insects			
Caenis sp.	+	+	+
Ceratopogonidae	+	+	0
Cloeon sp.	+	+	+
Chironomidae	+	+	+
Nymphula sp.	+	0	+
Sympetrum sp.	+	0	+
Coenagrion sp.	+	0	+
Leptoceridae	0	+	+
Sialis sp.	+	0	+
Dytiscidae larvae	0	0	+
Gyrinus sp.	0	0	+
Molluscs			
Valvata sp.	+	+	+
Pisidium sp.	+	0	0
Sphaerium sp	0	0	+
Physa sp.	+	0	0
Anadonta sp.	+	+	+
Radix	+	+	+