BALTCF project 051S17 „Freshwater health control through Black Stork perspective"

Assessment of Black Stork (*Ciconia nigra*) feeding streams 2020-2021

REPORT

KOTKAKLUBI

BaltCF

Eagle Club

2021

Contents

Summary

During the inventory, 21 observers described a total of 1,187 sections of rivers, brooks or ditches located on approximately one hundred watercourses. From the collected questionnaires, a map layer was created in MapInfo format "Streams data", with the locations of the starting point of the section, where all the data collected during the project are gathered. List of data describe the characteristics of evaluated sections and give recommendations for improving the ecological condition. The supplementary files are on the map layer "Streams endpoints" with the coordinates of the endpoint of the assessed sections and a linking index, and the "Streams drainage" map layer describing the inflows of land improvement systems. The questionnaire is attached to the report (Appendix 1).

Introduction

The number of black storks has been decreasing in Estonia for decades, and the population of the species has reached a critical status (30-60 pairs). There are various reasons for the decrease in numbers, but one of the important factors is the lack of food during the breeding season and when the fledglings become capable to fly in the late summer dry season.

The main reason for the black stork's lack of food in the summer is the decrease in the quality of rivers and brooks, which results mainly from the straightening of natural watercourses that took place in the last century, the extensive drainage of wetlands, and the construction and reconstruction of state-funded drainage systems that continue until now.

The main negative impact of drainage systems stems from their narrow focus on increasing the productivity of forest and farmland and it does not consider the accompanying effects on aquatic and terrestrial communities and (endangered) species in the drained area. A well-functioning and well-maintained drainage network reduces the value of the drainage system itself as a habitat for aquatic life. Lowering the groundwater level affects all communities within the area of the drainage system and the processes taking place there (for example, when draining peat soils, carbon emissions increase). Due to sediments and nutrient washout, erosion and changes in the water regime, the condition of the water bodies to which the water from the drainage network is directed, also deteriorates. Estonia is one of the countries in the world most affected by forest drainage, and the resulting negative effects on life and the environment must be significantly reduced in the nearest future.

The aim of this project was to describe the watercourses on the black stork feeding areas and evaluate their suitability to the black stork's prey-species. We also propose solutions how to improve the condition of watercourses and black stork feeding grounds, considering the habitat demands and needs of the black stork and its main food objects.

Methods and measurable factors

The selection of the water bodies to be assessed was mainly based on the distribution of the black stork in Estonia, whose population density is higher in Saaremaa, the southern part of Pärnu County and the Karula region of Southern Estonia, as well as data on birds previously equipped with transmitters and then visiting feeding areas. In addition, the size of the water body was considered (smaller water bodies with shallower water are suitable for the black stork to feed on) and their point of entry (preferably the sea). The points described in Southern Estonia are mostly located in the sub-basin of the Mustjõgi River flowing into the Gulf of Livonia, the water bodies described in Central Estonia reach the Baltic Sea through Lake Peipsi and the Narva River.

A questionnaire was prepared to describe the water bodies and the observers could fill it on site digitally with a tablet or phone or later at home, in the KoBoToolbox environment (https://kf.kobotoolbox.org/) or with the KoboCollect app. The collected dataset with photos is currently available in this environment and available to the project coordinator. The form of the questionnaire used for the inventory is presented in Appendix 1 of this report.

When describing water bodies, the coordinates of the beginning and endpoint of the described section, the name of the river and the observer were fixed. At the starting point, a photo was taken, later a second photo of the most characteristic place on the described section was added to the form. The width of the stream bed, average water depth, flow velocity, water transparency, presence of suspended solids and sediments were evaluated. The naturalness of the habitats on the shores, the height of the shores, the occurrence of shallows, the bottom substrate of the shore and the river were described. Also, the vegetation present in the water, the hiddenness of the river bottom, the number of depths, the presence of (clear-) cuts on the riverbanks, the quantity of debris in the water and its origin. The naturalness of the completed section (whether the river flows in a natural bed or has been straightened and deepened etc), the restoration potential of the water body and the accessibility to the black stork were evaluated. Fish, mammals, and water-related bird species encountered during the assessment were also recorded. In the last part, each section was given recommendations that could improve the ecological status of the watercourse. Several different recommendations could be made for each section. With the form, you could also describe old rivers, ditches flowing into the water body, and pollution, if any. All other observations could be added in free form, for example of beaver activity and its impact.

Results

Areas and observers

As part of the assessment, 21 observers described a total of 1,187 sections of watercourses located on approximately one hundred water bodies. An overview of the location of the described water bodies is presented in Figure 1.

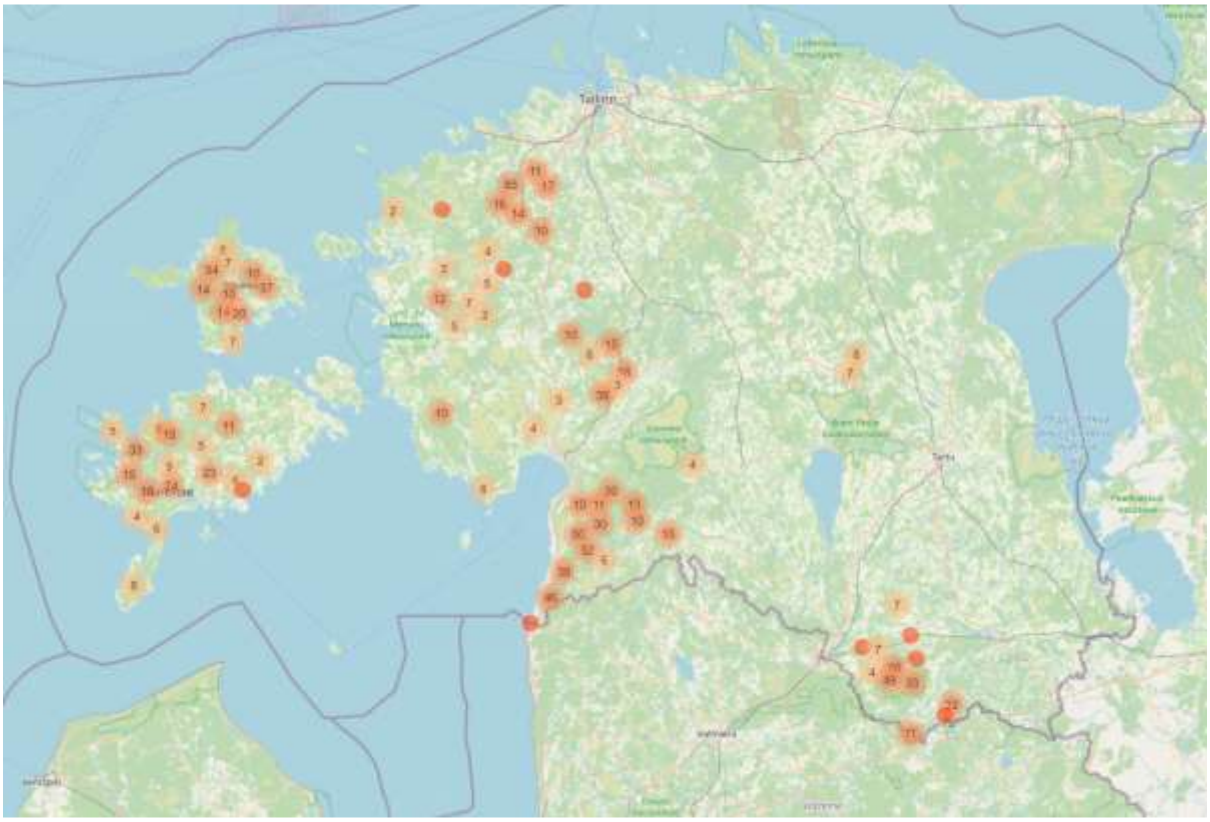


Figure 1. Location of evaluated rivers and brooks.

The list of evaluated watercourses (except unnamed streams) with the numbers of sections described in them is presented in the following Table 1.

Table 1. Monitored waterbodies and the number of sections described.

Nimi	Arv	Nimi	Arv	Nimi	Arv	Nimi	Arv
Munalaskme oja, Ha	35	Kõnnu jõgi, Pä	10	Laane oja, Vi	4	Tabra oja, Lä	1
Uru oja, Ra	35	Pihla jõgi, Hi	10	Lõve jõgi, Sa	4	Õeruma oja, Lä	1
Ura jõgi, Pä	33	Suuremõisa jõgi, H	10	Möldri jõgi, Sa	4	Armijõe lisaharu	7
Kloostri jõgi, Ha	32	Vaemla jõgi, Hi	10	Nurtu jõgi, Ra	4	Tülli peakraav	7
Lemmejõgi, Pä	31	Tirtsi jõgi, Sa	9	Pähkla jõgi, Sa	4	Tammela peakraav	7
Laanemetsa oja, Va	29	Kadaka oja, Pä	8	Ristioja, Sa	4	Tulimurru peakraav	7
Vasalemma jõgi, Ha	25	Kidaste jõgi, Hi	8	Tolkuse oja, Pä	4	Maidema kraav	7
Luguse jõgi, Hi	23	Männiku jõgi, Pä	8	Vesiku jõgi, Sa	4	Rebasselja peakraav	5
Pähni jõgi, Võ	23	Vedruka oja, Sa	8	Ahelo jõgi/Ahli oja, V	3	Kraav Koobassaare3	5
Arumetsa jõgi, Pä	20	Arakaoja, Pä	7	Elbu oja, Pä	3	Kraav Koobassaare7	4
Sauga, Pä	20	Biitmani oja, Pä	7	Haiba oja, Ha	3	Oja	4
Häädemeeste jõgi, P	17	Nepste oja, Pä	7	Kasari jõgi, Pä	3	Hingu oja vanajõgi	4
Põduste jõgi, Sa	17	Nuutri jõgi, Hi	7	Pikknurme jõgi, Jõ	3	Paope jõkke suubuv kraa	3
Rannametsa jõgi, Pä	16	Paope jõgi, Hi	7	Punabe jõgi. Sa	3	Kraav Koobassaare5	3
Armijõgi, Hi	14	Ristiküla pkr, Pä	7	Rae oja, Pä	3	Kraav (2704088)	3
Aude oja, Ha	12	Vardi jõgi, Vi	7	Seljamäe oja, Ha	3	Kraav (2691175)	3
Loode oja, Pä	12	Kivioja, Pä	6	Surju oja, Pä	3	Pihla jõkke suubuv kraav	1
Lähkma jõgi, Pä	12	Korju jõgi, Pä	6	Ärnu jõgi, Võ	3	Hingu vanajõe kraav	1
Neitsi oja, Pä	12	Sutesoo oja, Pä	6	Paadrema jõgi, Pä	2	Hingu oja vanajõgi	1
Valdimurru oja, Pä	12	Timmkanal, Pä	6	Ridalepa oja, Lä	2	Armi jõe vana säng	1
Hingu oja, Ha	11	Liivi jõgi, Lä	5	Riguldi jõgi, Lä	2	Vilivalla peakraav	1
Jausa jõgi, Hi	11	Rogense oja, Pä	5	Hundioja, Jõ	1		
Karisöödi oja, Võ	11	Vanajõgi, Hi	5	Ikla jõgi, Pä	1		
Pühajõgi, Sa	11	Õngu jõgi, Hi	5	Rägina pkr, Lä	1		

They participated in the inventory of waterbodies: Camilo André Ferreira Carneiro, Tarmo Evestus, Indrek Hiiesalu, Tauno Jürgenstein, Iti Jürjendal, Katrin Kaldma, Eliise Kara, Jürgen Karvak, Gennadi Kotsur, Kristiina Kübarsepp, Triin Leetmaa, Raul Melsas, Kaire Nellis, Rein Nellis, Maarja Nõmm, Selve Pitsal, Liina Remm, Gunnar Sein, Siim Tamme, Henn Timm, Terje Volke.

Overview of inventories

Within the scope of this project, water bodies and their sections suitable for black stork feeding were chosen, which is why 80 percent of the described sections had an average water depth suitable for black stork feeding (0.03-0.7 m; Figure 2). The average channel width of sections with suitable water depth was 2.8 meters, the average width of deeper (>0.7 m) sections (n=149) was 5.2 meters (among the latter there were also several beaver flood areas with a width of 10-20 m).

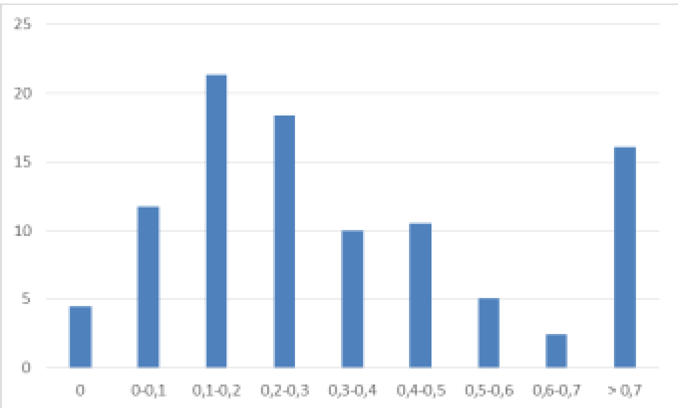


Figure 2. Water depth in the described waterbodies (n=947).

Water bodies with a depth suitable for feeding the black stork were on average 1.7-4.7 meters wide, as the width of the body of water increased, the depth of the water found there increased (Figure 3).

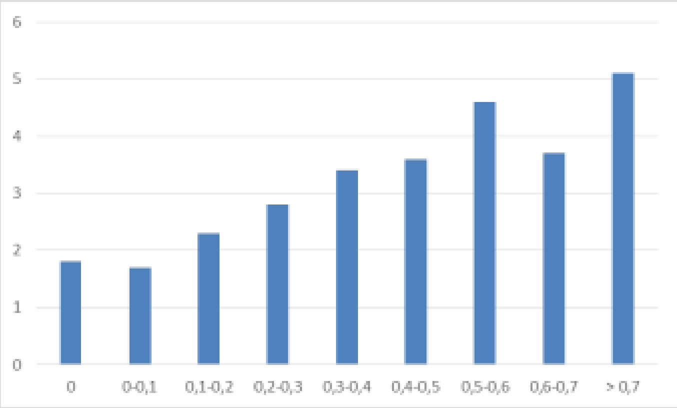


Figure 3. The average depth of the described watercourses by water depth class in meters (n=921).

The water level of water bodies and other parameters (content of suspended solids, transparency, etc.) depend on the amount of precipitation, which in turn depends on the season, which is why the time distribution of the inventory by year is presented in the following figure. The majority, i.e. 83 percent, of the water body sections were assessed during the (methodically best time) low water period, between June and September (Figure 4).

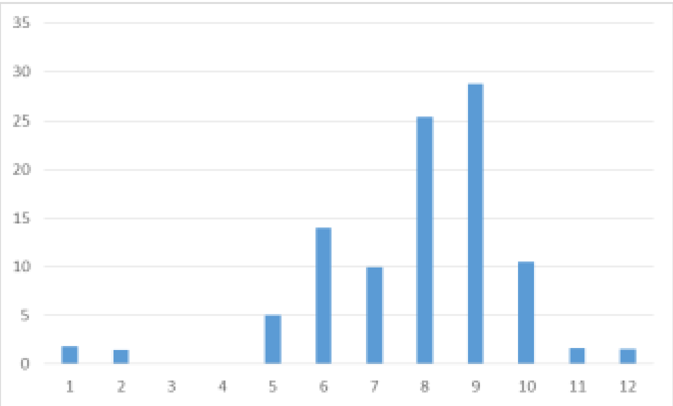


Figure 4. Time distribution of the inventory of water bodies by month (%, n=959).

The flow rate of the studied water bodies could be assessed on a three-point scale (if there was water in them; Figure 5) and several values could be given if the flow rate varied in different parts of the section. Overall, standing water accounted for 25 percent of the ratings, slow current 45 percent, and fast current 30 percent. Four percent of the total sample were dry at the time of description, they are not considered when describing water-related parameters.

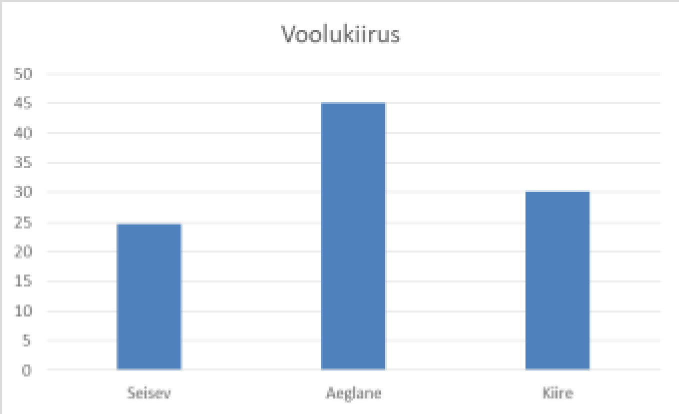


Figure 5. Flow rate in described water bodies (n=761). From left to right: still; slow; fast.

In terms of water transparency, the described water bodies were rather clear and suitable for the black stork due to this characteristic. More than half a meter of water was visible in 64 percent of the water bodies, 34 percent of the water bodies had lower transparency during the inventory (Figure 6).

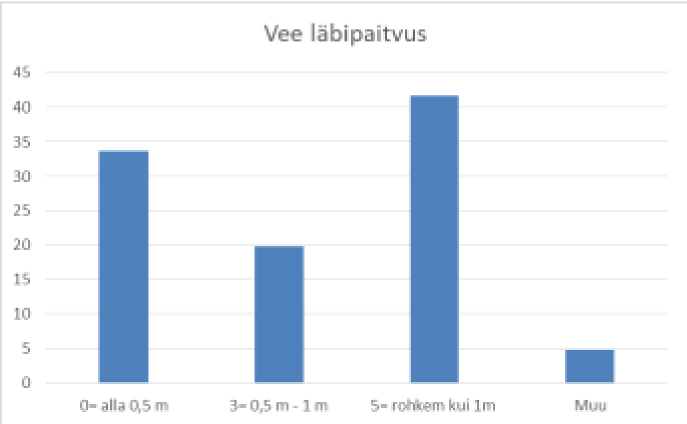


Figure 6. Water transparency in the described water bodies (n=927). 0= less than 0.5m; 3= 0.5-1m; 5= more than 1m; other.

In terms of the content of suspended solids (under normal conditions), the described waterbodies are rather poor, the content of suspended solids was high in one fifth of the waterbodies (21%), in the remaining water bodies it was low (61%) or absent altogether (18%; Figure 7).

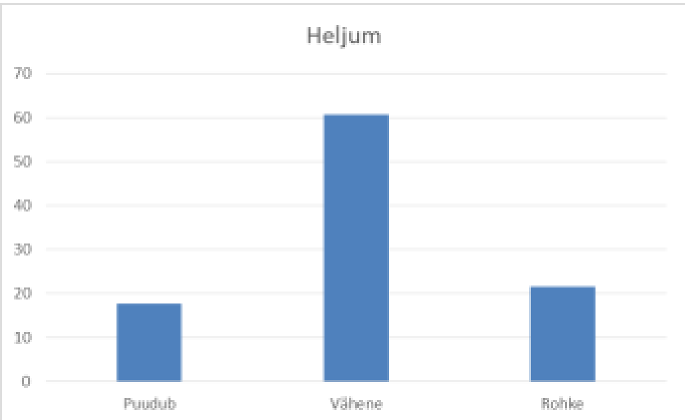


Figure 7. The content of suspended solids in the described waterbodies under normal water conditions (n=891). From left to right: missing, somewhat, a lot.

The banks of the water bodies were mostly high (64%; Figure 8), the visible soil on the banks was mainly soil (n=762; 42%) and sand (n=423; 23%), there were less gravel, stony and clay bank sections (Figure 9).

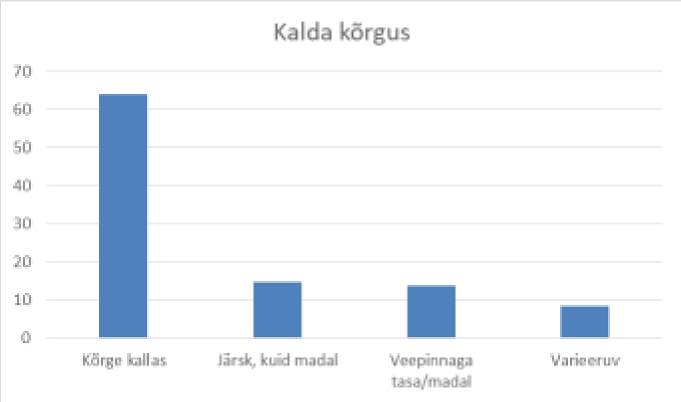


Figure 8. Height of the riverbanks in the described water bodies at normal water level (n=969). From left to right: high banks, steep but low, even with the water, variable.

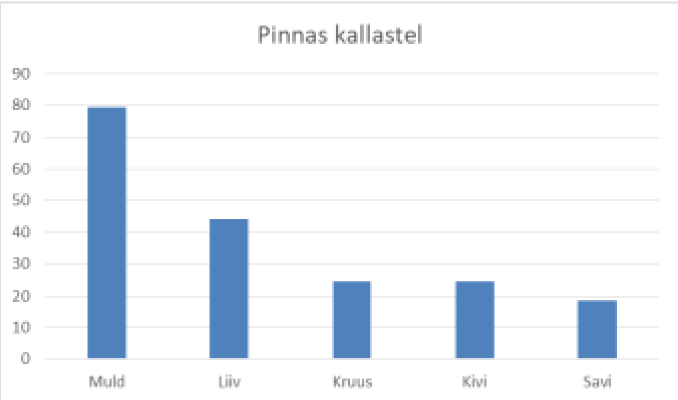


Figure 9. Visible soil on the banks of the described water bodies (n=1830). From left to right: soil, sand, gravel, stones, glay.

During the inventory, the level of naturalness of the habitats found on the banks of the described water bodies was also assessed. Mostly, the described water bodies were in natural (40%) or mostly natural habitats (30%). Non-natural habitats/surroundings were moderately present in nearly 14 percent of the sections, and non-natural surroundings were predominant in nearly 14 percent of the sections as well (Figure 10).

Figure 10. The level of naturalness of habitats found on the banks of water bodies (n=940). 0= natural, 1= dominantly natural, 3= moderately non-natural banks, 4= non-natural areas are dominating.

Almost 2/3 of the described sections were straightened and deepened, but according to the observers, about a third of them (21 percent of all sections) had started to recover their natural appearance. 26 percent of the described sections flowed in a completely natural bed or a bed with a natural appearance changed a very long time ago (Figure 11).

Figure 11. The level of naturalness of the flow bed (n=913). 1= straightened, 3= straightened, but partly recovered, 5= natural conditions.

As most of the watercourses had been straightened, as expected, there were few depths in them where the aquatic life could find shelter during low water periods. Deeper places were absent in most of the described water bodies (40%) or they were present only a few times (29%). They were moderately present in 17 percent of the sections and abundant in only a few sections with the most natural appearance (3%; Figure 12).

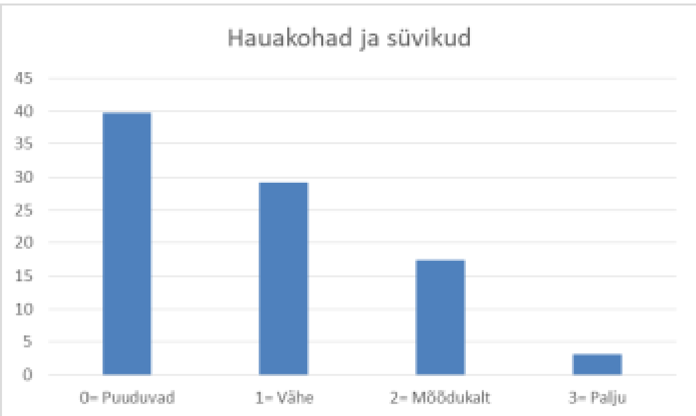


Figure 12. Occurrence of depths in the described sections of the water body (n=856). 0= absent, 1= few, 2= moderately, 3= a lot.

The bottom substrate of the water bodies was soft in a third of the sections (muddy or peaty, 33%). The remaining sections (2/3) were suitable for the black stork to feed on: 28 percent had variable bottom sections, 19 percent and 17 percent were mostly sandy and rocky sections, respectively (Figure 13).

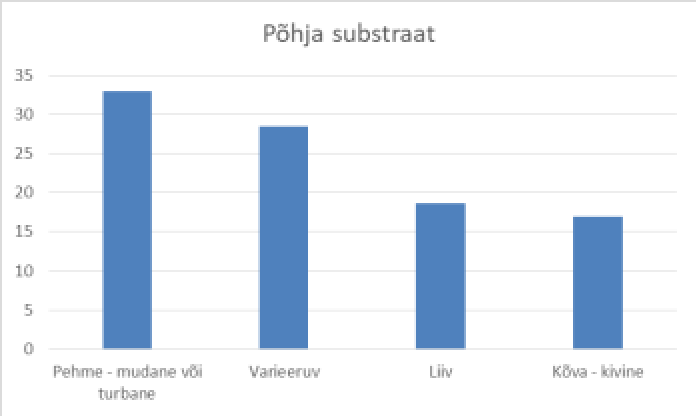


Figure 13. The nature of the bottom substrate (n=929). From left to right: soft, variable, sand, hard.

According to the amount of sediment accumulated in the riverbed, the water bodies were roughly divided into two according to visual assessment - in more than half of the sections there was rather little (52%) or no sediment (5%), in the remaining sections (43%) there was rather a lot of sediment (Figure 14).

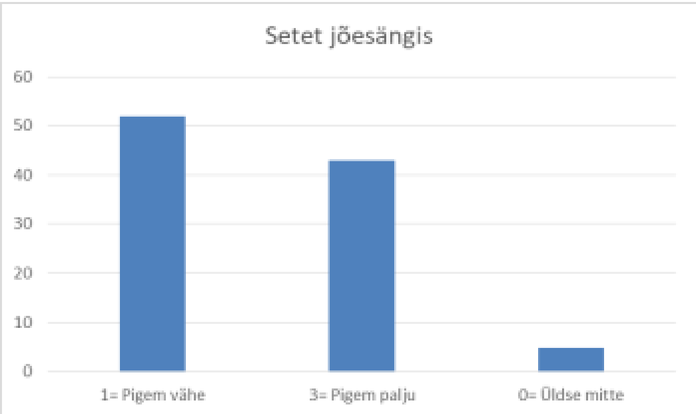


Figure 14. The amount of sediment accumulated in the stream bed (n=956). 1= rather small amount, 3= rather a lot, 0= not at all.

The sediments that have reached to the rivers and brooks depend to a large extent on the condition and characteristics of the drainage systems. Within the scope of this assessment, a total of 670 ditches or other inflows were recorded. Of the inflowing ditches and branches, 24 percent were dry and 76 percent were not. According to observers, 28 percent of inflowing ditches worsened the condition of the watercourse. Sediment was mainly noted in or near the mouth of the ditch, in many cases the water in the ditches was suspended or turbid, or some type of pollution was suspected. About one of the ditches that flows into the Ura River, the application also wrote: "A perfect solution, a reconstructed ditch that ends in a sediment pond, followed by an unconstructed section of approx. 100 m, clear water reaches the river."

The shadowiness of the water surface was assessed on a six-step scale. Most of the sections (48 percent in total) were completely or at least 2/3 covered (Figure 15). 33 percent was partially shadowed (shadow 1/2-1/3), and 21 percent of the sections had little or no shadowing woody vegetation.

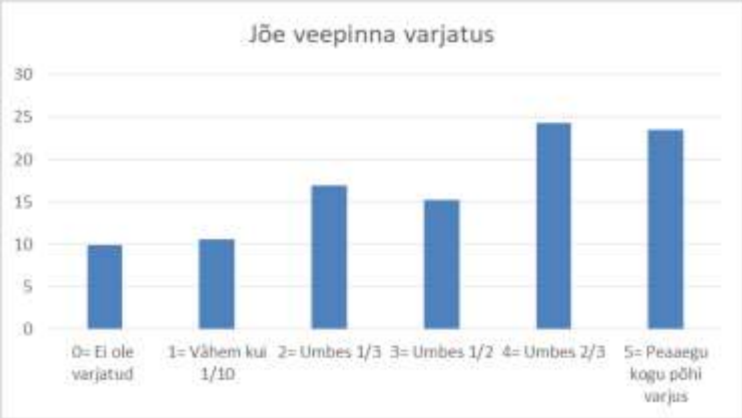


Figure 15. Shadowiness of the water surface of the stream sections (n=964). 0= no shadow, 5= almost full shadow.

As most of the sections were shadowed (Figure 15), many sections also lacked aquatic vegetation (30%) or had little cover (30%). One-third to one-half of the bottom of the water body was covered by vegetation in 25 percent of the sections, 15 percent of the sections were mostly or completely vegetated (Figure 16).

Figure 16. The coverage of aquatic vegetation in the assessed sections (n=946). 0= missing, 5= almost everywhere.

Moss growing in water were also found in few of the described sections: mosses were not observed in 66 percent of the cases. Moss was present to a small extent in 17 percent of the sections and abundantly in almost a tenth of the sections covered (9%). Due to deep or muddy water, the assessment was not given in 4 percent of the cases (Figure 17).

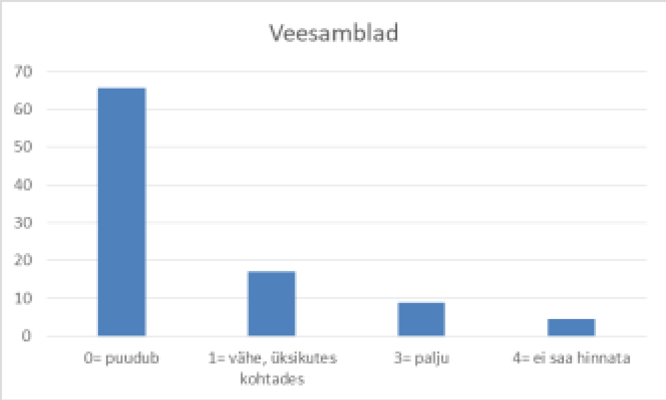


Figure 17. Occurrence of aquatic mosses in the described sections (n=920). 0= missing, 1= some, 2= a lot, 4= impossible to say.

Reed was present in almost 2/3 of the inventoried sections, although in 21 percent of these sections the species was rather random (occurred in 1/10 of the sections). 24 percent of the sections were completely or mostly full of reeds, 35 percent of the sections were not reedy (Figure 18).

Figure 18. The presence of riparian reeds in the described sections (n=935). 0= missing, 5= almost everywhere.

The amount of wood accumulated in the stream bed was assessed on a four-step scale. In most cases, there was little (46%) or moderate (25%) debris, but there were also sections where debris was absent (15%) or abundant (10%; Figure 19).

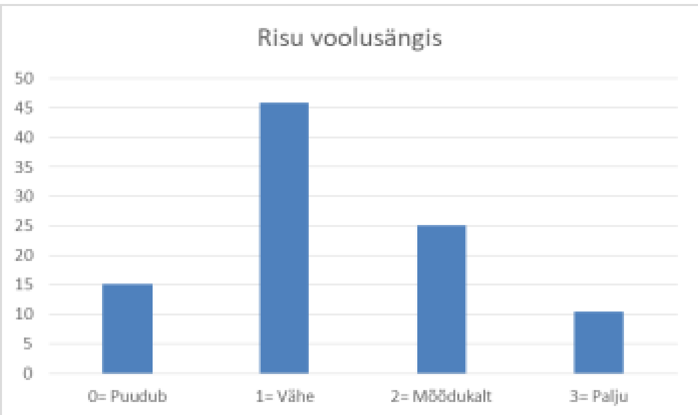


Figure 19. The presence of debris in the described sections (n=926). 0= missing, 1= not much, 2= moderate, 3= a lot.

The wood present in the water bodies was mostly of natural origin (77%), logging waste was found in 23 percent of the studied sections (Figure 20).

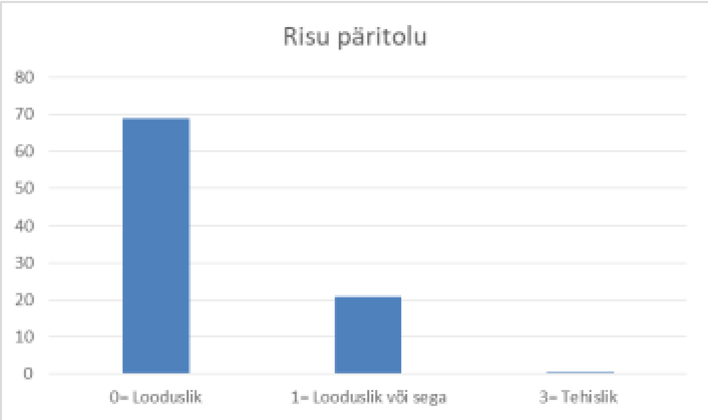


Figure 20. The origin of debris in described sections (n=862). 0= natural, 1= mixed, 3= not natural

Observers of water bodies assessed the accessibility of the water body from the point of view of the black stork - whether the water body is accessible from above or approached from the riverbanks, whether the stork can walk and fly along the stream or ditch. According to this evaluation, 14 percent of the sections were inaccessible to black storks, 30 percent were partially (1/3) open. The remaining 56 percent of the water bodies were open to birds from half to the whole extent (Figure 21).

Figure 21. Black stork access to the described sections (n=987). 0= missing, 2= half of the section is accessible, 4= accessible along the whole section.

During the inventory, the presence of various water-related species was also fixed. In total, different species were seen on 677 occasions (Figure 22). In most places, the black stork preys were seen - fish and amphibians (21% of observations in total). The third place was taken by the beaver, whose impact on water ecosystems is great and traces of activity are easy to see (15%). The fourth largest group was fish-eating birds - gray heron and kingfisher - were observed a total of 77 times (9%). Mallard ducks and otter and/or some traces of activity were seen, black stork was detected four times (Figure 22).

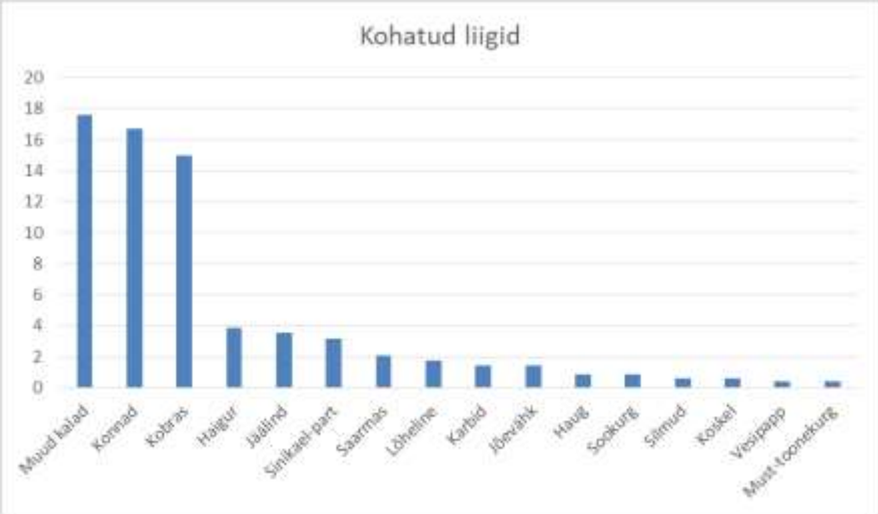


Figure 22. Overview of water-related species fixed during the inventory (n=677).

To the evaluated sections a summary assessment of their naturalness and restoration potential of the section was given on 390 occasions (Figure 23). It was found that 11 percent of the sections were in a natural state (rating 5), 31 percent were slightly damaged (rating 4), on average 22 percent of the evaluated sections were damaged (3). The remaining 36 percent of water bodies are in an even worse state (ratings 0, 1 and 2; Figure 23).

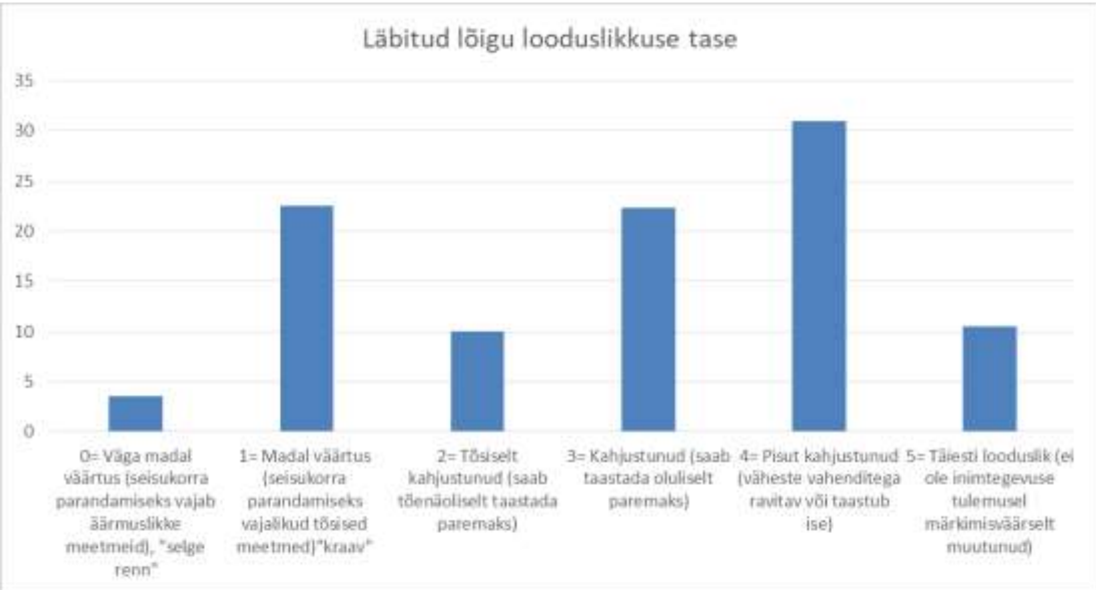


Figure 23. The level of natural conditions and restoration potential of the monitored sections (n=390). 0= very low, needs extreme measures; 1= low, needs strong measures; 2= damaged, but perhaps possible to make better; 3= damaged, but can improve, 4= slightly damaged, with a few resources gets better or recovers on its own; 5= natural, unaltered by human activity.

Restoration recommendations for monitored watercourses

From the restoration recommendations of this inventory, the largest part of described sections where, according to the observers, these where it is necessary to remove excess brush from the banks of the to ensure sufficient access for the black stork (301 sections). Since the water bodies and their sections that are better suited for the black stork were preferentially chosen for description, a lot of such water bodies were also found, in order to improve and maintain their condition it is best not to touch them (208 sections, table 2, figure 24 and 25).

Table 2. Recommendations for improving the condition of the inventoried sections (n=1520).

Proposals for habitat restoration/reviving	n	%
1= not to touch	277	18
2= add deflectors (boulders, wood)	208	13
3= add boulders or big stones (diversifies the variability of structure and depth)	224	14
4= graveling (adding gravel to create new spawning beds)	46	3
5= removing or opening fish barriers (including beaver dams) not block the movement of fish	144	9
6= removing underwood from the banks to the extent necessary to allow access to the black stork	301	19
7= reforestation of banks (for shading)	70	4
8= sediment traps for ditches	61	4
9= removal of sediment, dredging (removal of a large amount of new sediment - mud and sand)	75	5
10= something else	114	7

Since 2/3 of the described watercourses were straightened, it was recommended to add large boulders to the watercourses in 224 sections and flow deflectors in 208 sections to increase the structure and depth variability of the streambed.

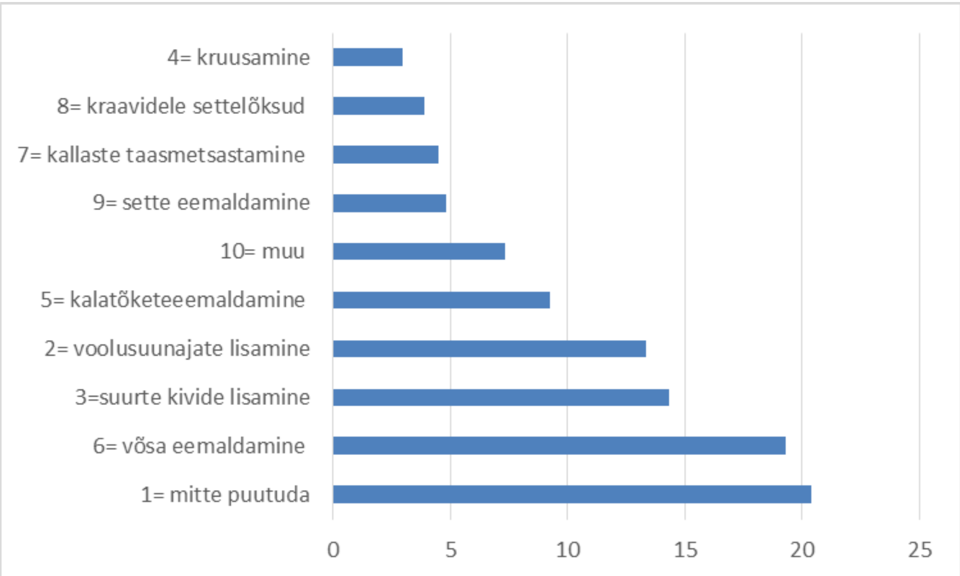
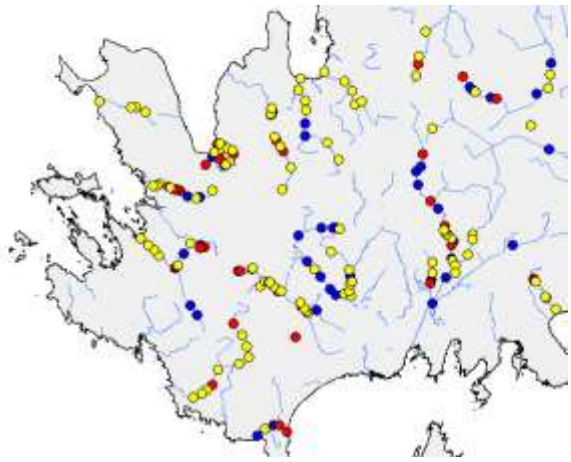


Figure 24. Ranking of recommendations for improving the condition of inventoried water bodies (percentage). For the explanation of numbers see Table 2.

The fifth major improvement measure is the removal of obstacles to fish migration, which needs to be addressed in 144 inventoried sections of the water body. This includes both natural debris blockages, beaver dams and man-made dams, water regulators and other impeding structures. The removal of accumulated sediments was recommended in 75 cases and the establishment of sediment traps on drainages in 61 cases. In 70 sections, it was considered necessary to reforest the banks of the water body. It was recommended to add spawning beds in 46 sections of salmon rivers (table 2, figure 24 and 25).

Other recommendations mostly specified previous choices or described other factors and the local situation. Of the various recommendations, the need to clean up tree trunks that fell over the river, debris in the riverbed, cutting waste and storm debris was mentioned. The conditions of the water body around influence of beaver dams were also described and the need for beaver extermination was assessed. In addition, mowing banks and reeds, digging depths, closing ditches, reducing the effects of cattle grazing and erosion, opening obstacles and adding flow deflectors to make variabilities were also suggested as restoration measures.



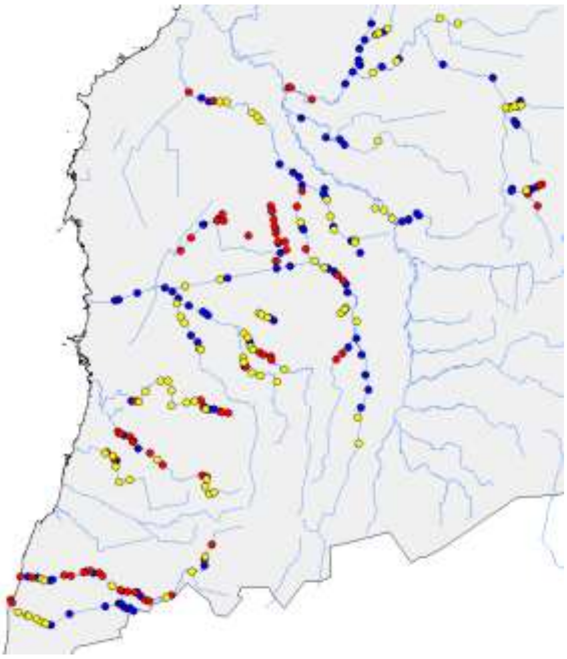


Figure 25. Sections of described waterbodies that do not need to be restored (red dots) and sections that need to be cleared from brush (yellow dots) in the western part of Saaremaa Island (above) and the southern part of Pärnu County (right). Blue dots – do not fall in either group.

In several cases, it was found that it does not make sense to restore a given section, either because of its naturally altered but ecologically good condition (e.g., beaver floodings) or because of its very poor condition (e.g. ditches that are without water for most of the year).