Coalition Clean Baltic

REPORT

Potential Dam-barrier objects for removal/mitigation to support wild Baltic salmonid populations in Estonia

Credit picture: M. Kesler

March 2021

CCB report – Potential Dam-barrier objects for removal/mitigation to support wild Baltic salmonid populations in Estonia

Table of Contents

I Introduction

Estonia has totally about 1000 dams and barriers in Estonian river systems and 75 % of those are unpassable to fish. Furthermore 40 % of those dams pose a major threat to riverine fish fauna. Many of these are historical and are today without purpose or usage. Many are obsolete weirs and partly broken/demolished barriers, which should be removed with priority when it is barriers that prevent migrating fish and aquatic fauna.

Estonia has so far a few examples where you have removed or taking mitigation measures to support salmonid migration in rivers with dams/barriers that prevent migration. Seventeen dams have been demolished and, ninety fish-passes have been constructed so far in Estonian rivers.

Estonia has so far been able to use EU cohesion fund to finance dam removal and fish pass construction. Estonia's River Basin Management Plans for 2016-2021 do specify the work to be done to promote the migration and spawning of salmonids, in general during the 2016-2021 period the planned measures were carried out to a limited degree. The future tasks are aimed for evaluation of the feasibility of such work and direct effort to open fish passage at key dams.

The Fisheries administration in Estonia have unfortunately not initiated any serious work or activities to strengthen and support migration of salmonids to important upstream salmonid spawning areas in past years. Only some examples exist.

Estonia has developed policy ambitions to promote the three remaining native wild salmon populations in Estonian rivers, but more concrete plans to buy out dams and land in wild salmon rivers are necessary, including dam removals for free salmon migration. For wild sea-trout river populations is needed an evaluation of various populations and an action programme for protection, including removal of barriers, where needed, and habitat restoration measures.

Beaver dams

In Estonia the total number of beaver dams is estimated to be about 13 000. A typical small trout stream holds 4-5 beaver dams, of which on average 1-2 dams are impassable and depending on the location can pose a threat for important salmonid populations. Beaver is less of a problem in larger rivers.

Estonia has listed river sections of special importance for salmon, sea-trout and grayling where beaver dams can be a threat to endangered/threatened/native salmonid stocks of high value. Beaver population removal or temporary beaver dam opening during Sea trout migration period are irregularly organized by recreational anglers. This activity is also favoured by fisheries officials.

River stretches, where beaver dams are recommended to be removed, should be documented and marked on maps. Administrations implementing current WFD River District Management Plans should also allocate resources for actions/programmes to remove beaver dams, with start in river basins with salmonid populations of high value.

Financing of dam/barrier removals

The best example in BSR where EU Cohesion Funds have been used for dam removal can be found in Estonia. In lower part of Pärnu river a 150 m wide and 4,5 m high dam was constructed in 1977, which prevented upstream migration of salmon, seatrout, vimba etc. In 2019 the dam

was removed in a big project with a total budget of 15 million Euro, where 85% was paid via EU Cohesion Funds and the rest via Estonian state budget. Pärnu river, that drains 20% of the Estonian territory, opened the main stream with another 100 km, and reached 144 km length. When Sindi dam was removed, another 2 small dams in the river basin were also removed. Future studies of salmonid migration in Pärnu river basin will consider the need for more dam removals.

Estonia has had a very cleaver policy how to use EU Cohesion Funds for infrastructure projects. A dam removal in the size of Sindi dam with a total budget of 15 mill Euro, would probably never happened, if only national budget resources would be used.

To support native salmonid populations in Estonian rivers, there is a need for financial mechanisms to provide financing for dam removal and construction of fauna-passages that could be used by different public organizations and NGO's, e.g. anglers clubs, and municipalities etc.

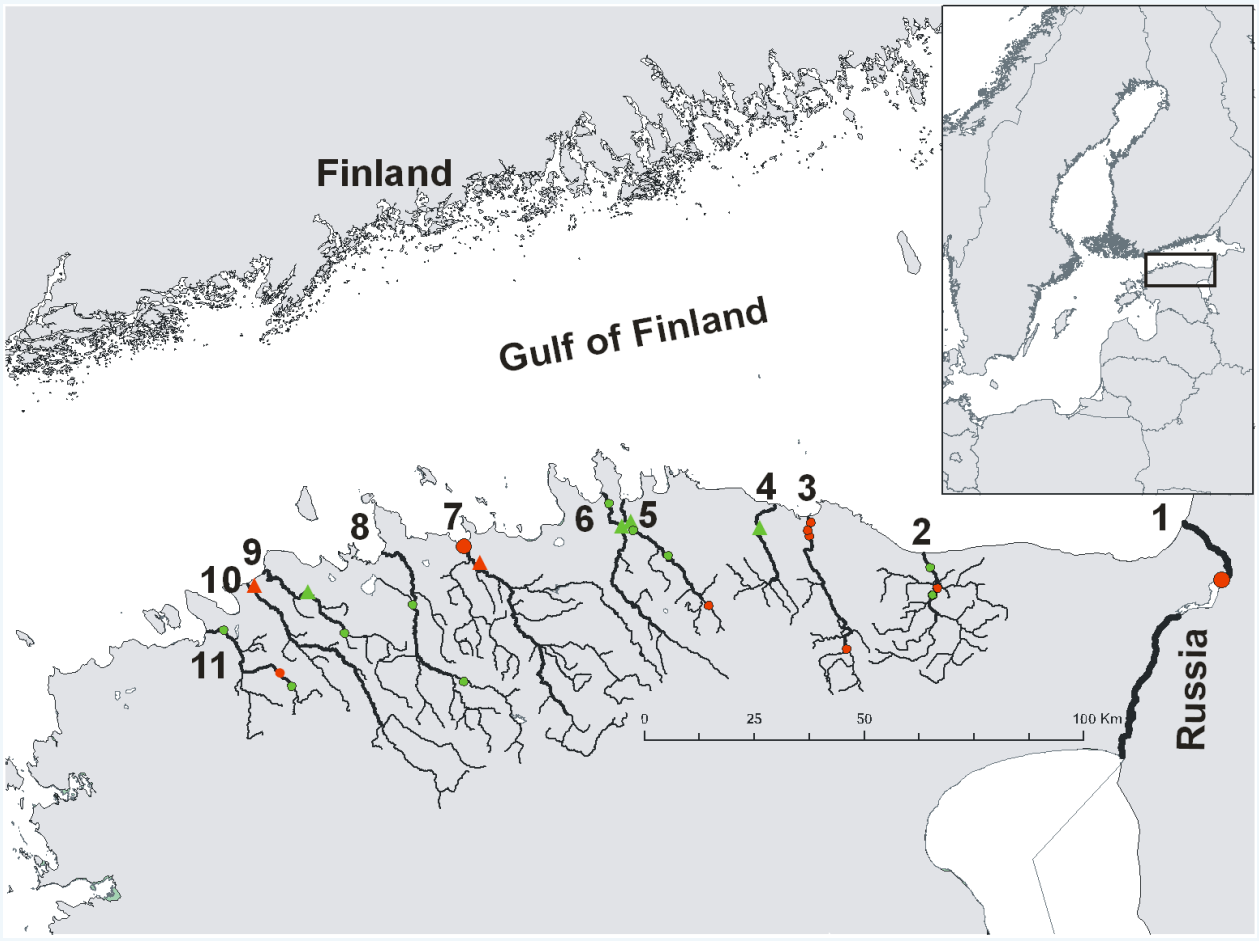


Figure 1. Overview of historical salmon bearing river in North Estonia. 1. Narva; 2. Purtse; 3. Kunda; 4. Selja; 5. Loobu; 6. Valgejõgi; 7. Jägala; 8. Pirita; 9. Vääna; 10. Keila; 11. Vasalemma. Circles mark for manmade obstacles, triangles mark for natural waterfalls. Red symbols are unpassable and green are at least partially passable for salmon.

II Kunda river – 3 dams

River Kunda is 82.2 km long and has a 535.9 km2 catchment area. Average discharge is 4.26 m3/s, maximum is 50 m3/s and absolute minimum is 1.1 m3/s. Source elevation the river is 90 m. The lowermost accessible part of the river holds wild native salmon and sea trout populations. Resident trout is widespread throughout the watershed. River also has a river lamprey, grayling and noble grayfish populations. Lower 14.5 km long part of the river is Natura 2000 area. According to the present best available knowledge, available reproduction area suitable for salmon and sea trout below the lowermost hydroelectric power station is 2.1 ha. Reproduction area between the first and second hydroelectric power stations is 0.3 ha, if the lowermost dam is removed, the reproduction area would increase to about 0.5 ha. There is about 0.5 ha of reproduction areas between the second hydroelectric power station and old Kunda manor mill. Main river upstream from the old Kunda manor mill has about 16 ha of reproduction areas suitable for salmon and sea trout. There is no information about the reproduction areas suitable for sea trout in tributaries and uppermost part of the main river. More detailed habitat inventory of the entire river basin is recommended. It is evident that the restoration of salmon population (and all other anadromous species) necessitates a free passage in all 3 dams on the lower river Kunda.

Salmon in River Kunda is one of only 3 remaining native populations in Gulf of Finland and thus particularly valuable. Salmon parr density at the lower part of the river is monitored since 1982 (Figure 2). Parr density has been on a precarious level up to a year 2015, since then the density has increased many folds and is now considered at or near the carrying capacity. Thus the size of the accessible spawning and rearing areas is most limiting factor for the size of the salmon population.

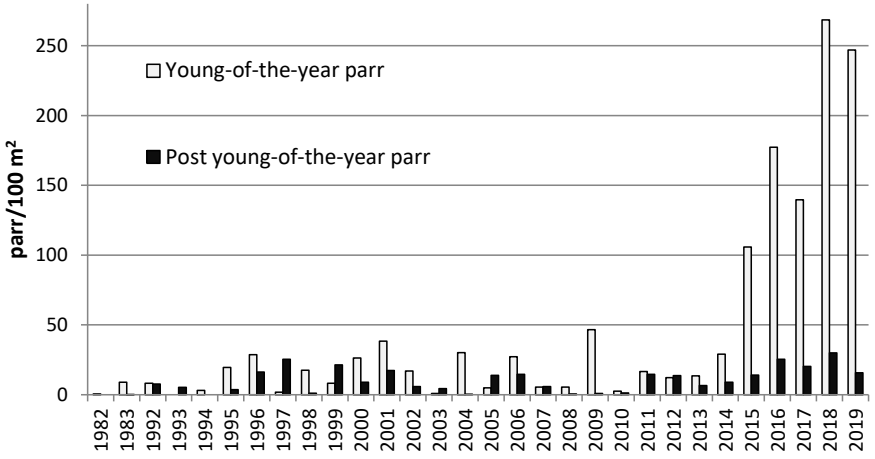
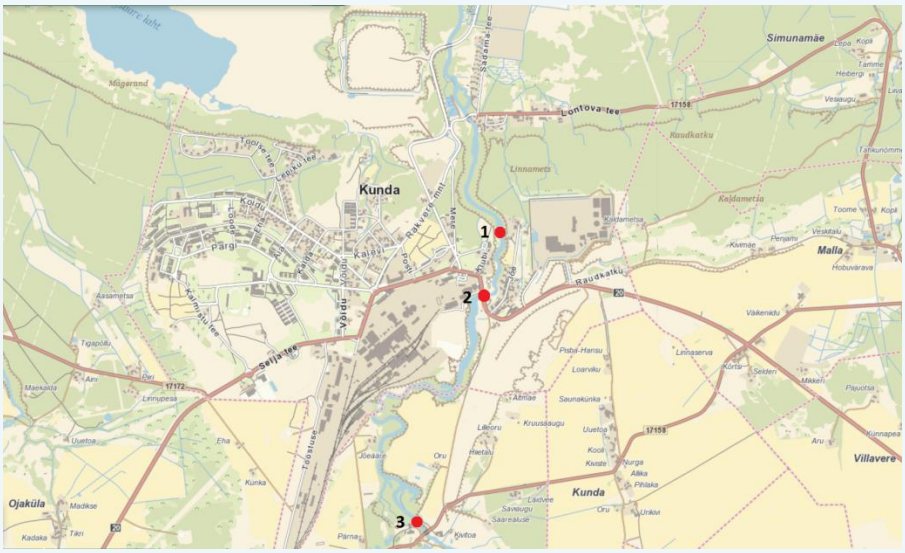


Figure 2. Salmon parr density (individual per 100 m2) in the accessible part of River Kunda.



Map 1. Three dams on the lower river Kunda. Nr. 1. Lower Kunda hydroelectric power station, nr. 2. Kunda second Hydro hydroelectric power station and nr. 3. Old Kunda manor mill.

1. Lower Kunda hydroelectric power station (part of Retrout project).

The hydroelectric power station was built in 1893 and it is cultural heritage site. Presently the power station is not operational and it has no water permit. Designed height of the dam is 9.3 m, however the wooden parts are gone and the height as it presently stands is approximately 6.5 m (Photo 1 and 2). The dam is located 2.3 km from the river mouth and it is migration obstacle for all fish. The private company owns the dam and wishes to restore the power station and produce electricity. Local county also supports the plan. However it is unlikely that the dam gets a water permit as it is not able to meet many environmental requirements. The environmental inspectorate issued a decree to fully open the spill gate and to remove the impounded lake. This would restore the spawning areas that are presently flooded, however fish can pass the spill gate only in low numbers and only during in optimal conditions. Long term solution is to remove part of the dam to provide satisfactory fish passage and to retain culturally valuable features of the dam as much as possible. In INTERREG RETROUT project, three alternatives to provide free passage were devised. The construction of a new river channel around the left side of the dam, while retaining all of the cultural values was estimated to cost 2 666 862 euros. The demolition of the concrete body of the dam was estimated to cost 1 038 147 euros. In this alternative cultural values are only partially kept. Third alternative was demolition of all parts of the dam and the estimated cost was 1 125 234 euros. None of the cultural values would be kept in this alternative.

Photo 1. Lower Kunda hydroelectric power station. Note that the upper wooden parts of the dam are missing and all water is (M. Kesler 29.09.2016).

Photo 2. View downstream from the lower Kunda hydropower station (M. Kesler 09.06.2019).

2. Kunda second Hydro hydroelectric power station

The hydroelectric plant was built in 1870 and rebuilt in 2003. The height is 6.4 m and it is located 2.8 km from the river mouth. The dam has no water permit and therefore not operational. A Fish elevator was built in 2013 to provide passage to fish, however it is considered not adequate (Photo 3). The private company owns the dam and wishes to restore the power station and produce electricity again. Local county also supports the plan. Long term objective is to remove at least part of the dam to guarantee good passage (both upstream and downstream) to fish and at least partially restore the salmon spawning areas at the impounded part of the river. Presently there are no cost estimates of such work.

Photo 3. Kunda second Hydro hydroelectric power station has a fish lift that is considered not to provide sufficient passage.

3. Old Kunda manor mill (part of Retrout project)

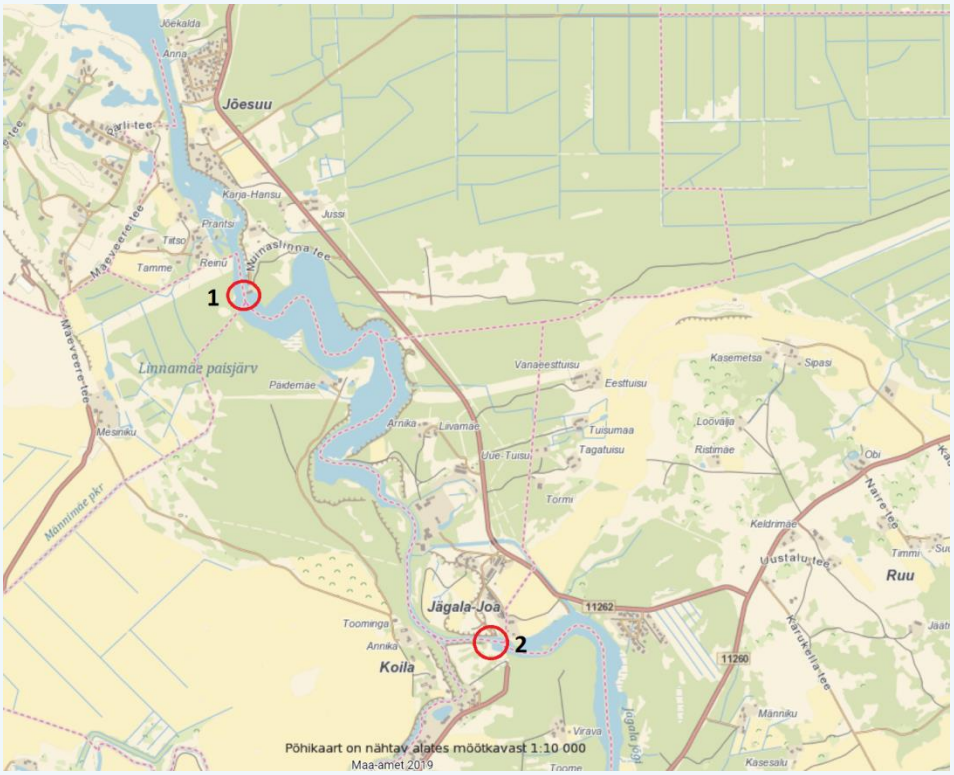
The mill was built in 1870 and the original height was 2.7 m. Only the concrete lower part of the dam remains and the bottom spill gate is open (Photo 4). All water flows through the spill gate during low flow periods, however it is still a migration obstacle. The dam has no water permit and negotiations over the solution with the dam owner (private company) and the Ministry of the Environment are ongoing. Environmental agencies long term coal is to remove the dam. Estimated cost of the dam removal is 104 148 euros.

Photo 4. Old Kunda manor mill has no function, is very bad technical condition and is a migration obstacle for fish. The best option is to demolish it (26.07.2019 M. Kesler).

III Jägala river - Linnamäe HPP

River Jägala is 119 km long and has a 1481.3 km2 catchment area. Average discharge is 7.24 m3/s, maximum is 111 m3/s and absolute minimum is 0.67 m3/s. Source elevation is 82 m. The lowermost accessible 1.5 km long part of the river has only marginal spawning areas for salmon and seatrout (Map 2). Therefore the wild recruitment of salmon is marginal. Resident brown trout is widespread throughout the watershed. Weak population of grayling inhabits mid-section of the river. Lower 4.7 km long part up to the Jägala-Joa waterfall of the river is Natura 2000 area. According to the present best available knowledge, historical reproduction area suitable for salmon and sea trout existed from the present location of the Linnamäe dam up to the Jägala-Joa waterfall and in the tributary river Jõelähtme. It is estimated that historically there has been about 7.6 ha of spawning areas available for salmon and sea trout. Before the construction of the Linnamäe dam the river Jägala was well known salmon river. The Jägala-Joa waterfall is 7 m high and a natural migration obstacle for all migratory fish.

There has been a decade's long period when the water quality in river Jägala was poor and therefore possibility to restore a salmon population (and other anadromous fish populations) was unrealistic. Presently however the water quality has improved substantially and lack of habitat because of the Linnamäe dam is the principle factor.



Map 2. 1. Indicates the location of the Linnamäe hydroelectric power station and 2 indicates the location of the Jägala-Joa waterfall.

Linnamäe hydroelectric power station was built in 1924 and it is cultural heritage site. The dam was deliberately partially destroyed in 1941 and was restored in 2002. Since then it is operational hydroelectric power station with a capacity of 1.1 MW. The height is 11.8 m and (Photo 5) and it is located 1.5 km from the river mouth. The private company owns the dam and wishes to continue to produce electricity. Local county also supports this plan. However the dam has a temporary water permit and an obligation to ensure the good status of Jägala Natura 2000 areas conservation values. The main values are river habitat and salmon. The Linnamäe dam was declared to be culturally valuable site in 2016. The future of the Linnamäe dam is a source of heated debate between the dam owners, county, cultural heritage experts and environmental agencies. Long term solution is to remove part of the dam to provide satisfactory fish passage and to retain culturally valuable features of the dam as much as possible. The construction of a new river channel around the left side of the dam, while retaining all of the cultural values was estimated to cost 6 777 045 euros. The demolition of the

concrete body of the dam was estimated to cost 2 169 750 euros. In this alternative cultural values are only partially kept. Third alternative is demolition of all parts of the dam and the estimated cost is 2 391 246 euros. None of the cultural values would be kept in this alternative.

Photo 5. Linnamäe dam on river Jägala is the principal cause for the lack of migratory fish in the river.

IV Udria brook – one old dam

Udria brook is located at north eastern Estonia and it flows to the Gulf of Finland 10 km to the west from the river Narva. The brook is just 5 km long and has a catchment area of 15.1 km2. The habitat and fish fauna was studied in 2006. The brook has about 30 m total elevation and most of it (over 25 m) is located on the lower 1.4 km long part. This lower part is also the only part that has natural riverbed, rest of the brook is dredged. The brook has relatively high

summer base flow due to many springs. The lower 1.4 km long part of the brook is very suitable for sea trout spawning and parr rearing (Photo 6 and 7). The brook has a dam 320 m from the sea, it is 1.9 m high and unpassable for all fish (Photo 8). In 2006, the trout parr density below the dam was 59 parr/100 m2 and no trout was found upstream from the dam. River lamprey, three-spined stickleback, nine-spined stickleback and minnow also inhabit the river. Based on the size of the habitat in the brook, it was estimated that the part downstream from the dam could potentially produce 150 sea trout smolts annually and the upstream part could produce about 500 smolts annually. The dam has no water permit or any use, therefore removing it is best option and easy to do.

Map 3. Lower part of the Udria brook. Red dot indicates the location of the dam.

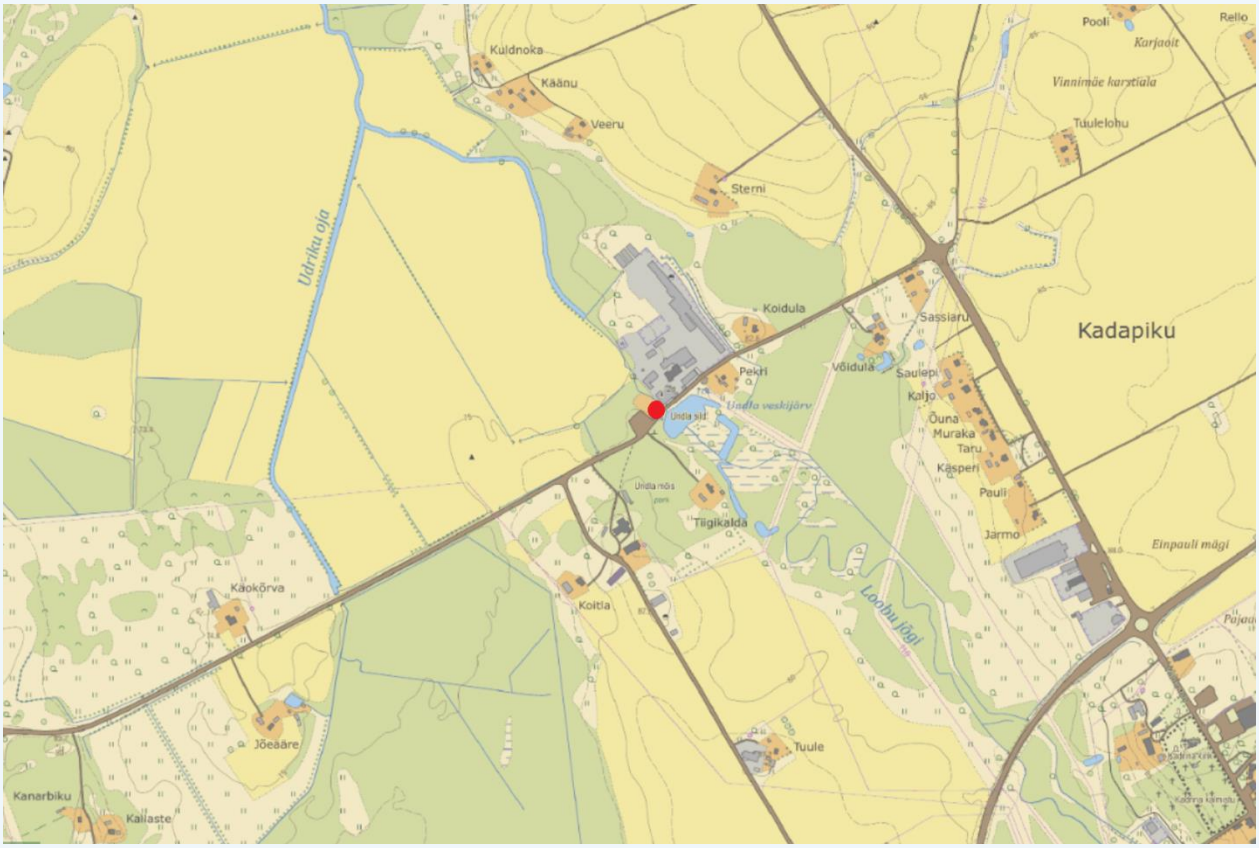
Photo 6. Outlet of the Udria book.

Photo 7. Typical habitat of the Udria brook. Bottom is naturally dominated by gravel that is suitable for sea trout spawning.

Photo 8. The 1.9 m high dam on Udria brook prevents access to about 75% of the potential sea trout spawning areas.

V Loobu river - Undla dam

River Loobu is 66.5 km long and has a 314 km2 catchment area. Average discharge is 1.97 m3/s, maximum is 17.5 m3/s and absolute minimum is 0.6 m3/s. Source elevation is 90 m. The lowermost 10 km long part of the river has salmon, seatrout and grayling (Map 1). The Joaveski falls and a dam with a fish pass (10 km from the sea) are difficult for fish to pass. Resident brown trout is widespread throughout the entire watershed. It is estimated that present potential sea trout smolt production if the entire river is 15800. Undla dam is the last definite migration obstacle in the upper r. Loobu. The upstream areas are suitable only for the sea trout and the smolt production potential of this area is estimated to be about 600. The potential smolt production would increase further if the dam is removed.



Map 4. Map of the upper r. Loobu. Red dot indicates the location of the Undla dam.

Undla mill has been rebuilt several times however the construction year is not known. Presently the dam has no function and it has no water permit. It is located 49.6 km from the river mouth and is 2.2 m high. It is not culturally valuable and has no recreational value since the impounded lake is mostly filled with sediments. The dam is part of the bridge construction and therefore it may not be possible to entirely remove it. The road and the bridge with the dam belong to Estonian Road Administration. The upper wooden part of the dam is in a very bad condition and most of the water flows under the wooden construction (Photo 9). Otherwise the wooden parts of the dam should be very easy to remove.

Photo 9. View to Undla dam at r. Loobu. Note that all water flows underneath the upper wooden components of the dam. The dam is located beneath a bridge and that may complicate the full removal of the dam.

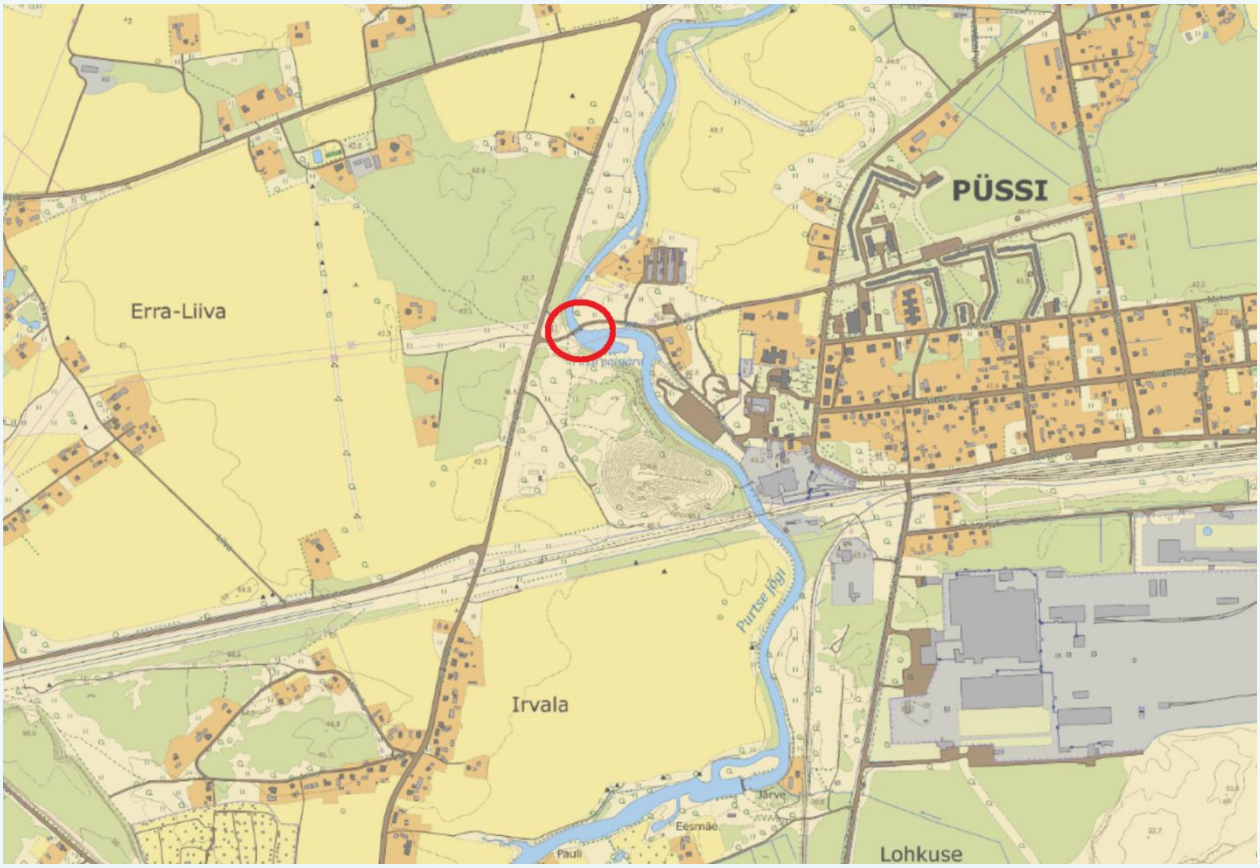
Photo 10. View to the upper part of the Undla dam.

VI Purtse river - Püssi dam

River Purtse is 57.2 km long and has 810 km2 catchment area. Average discharge is 6.77m3/s and absolute minimum is 0.47m3/s. Source elevation is 72 m. The r. Purtse is located at the center of North Estonia's oil shale mining and processing industry. The pollution (mostly phenols and oil) from the industry caused the extinction of the original salmonid populations in the 1960s. Furthermore the mining has caused major changes in the hydrological regime of the river. Presently over 60 % of the annual runoff flows freely from closed mines or is pumped from the active mines. The water quality started to improve in early 2000s and salmon, sea trout and more recently grayling have reappeared. The lowermost dam on the river is the Sillaoru dam (4.5 km from the sea) and a natural like fish pass was built to it in 2014. It is known that at least some of the salmon and sea trout ascend the pass. The second dam (without any passage possibility) is Püssi dam.

The 1.5 m high Püssi dam was built in 1970s to provide water for a plywood factory (Photo 11). The dam has water permit, however the plywood factory is closed and the there is no need to for the dam. So far the company is reluctant to give up the right to abstract water and operate the dam. The company has an obligation to ensure fish passage and the renewal on the water permit necessitates the plant to provide passage. Most cost effective option for the future would be the dam removal and reconstruction of the water uptake facility, if that is still necessary.

Photo 11. View to the Püssi dam on r. Purtse.



Map. 5. The location of the Püssi dam is marked with a red circle, the dam is also part of the bridge.

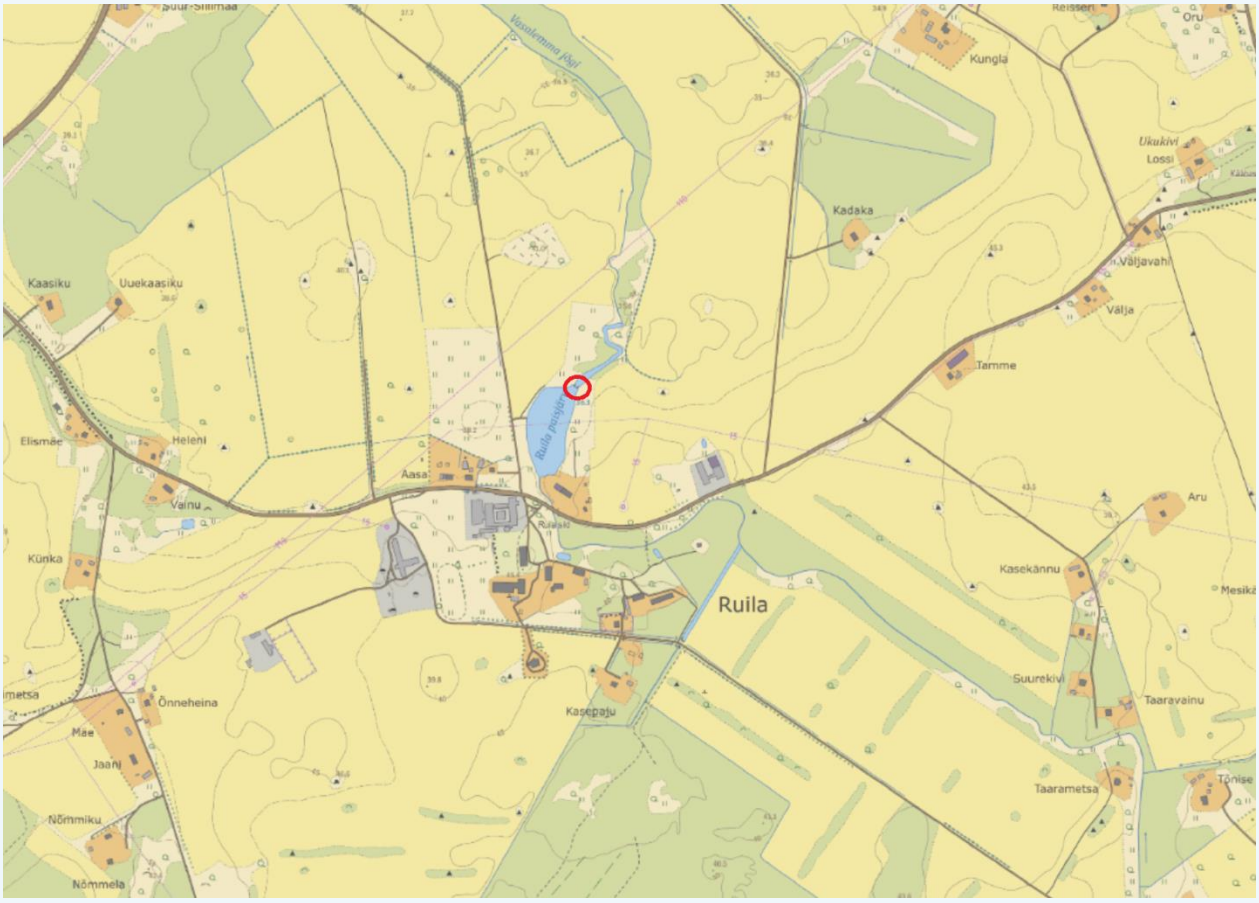
VII Vasalemma river - Ruila dam

River Vasalemma is 63.5 km long and has 395 km2 catchment area. Average discharge is 3.49m3/s and absolute minimum is 0.18m3/s. Source elevation is 50 m. The river has native salmon and sea tout populations. Resident brown trout is common throughout the watershed. In the past 2 m high Vanaveski dam located 4.5 km from the sea blocked fish migration to the most of the river. Vanaveski dam was opened in 2018 and most of the river became accessible to migratory fish. Next 1 m high weir (Laitse) is located 31 km from the sea and artificial rapid to provide passage was built to it in 2015. Presently fish are able to migrate up to Ruila dam. The upstream area has potential only for sea trout.

The Ruila dam is 1.6 m high and is located 32.5 km from the sea. The dam was built in 1984 as a part of irrigation system. The dam no longer serves that function and it has no water permit. The dam is not a culturally valuable. However it forms a 1.4 ha pond that for the locals may be seen as a valuable landscape element. Local municipality owns the dam and is presently

reluctant to completely remove the dam, however the burden of maintaining and providing fish passage in the future is not desired either. Dam removal cost calculation is not available.

Foto 12. Presently the 1.6 m Ruila dam is the first definite migration obstacle for fish (G. Lauringson, 29.07.2013).



Map 6. The location of the Ruila dam is marked with a red circle.

VIII Altja brook - Oanda dam

Altja brook is 17 km long and its catchment area is 46 km2. Its elevation at the source is 55 m. Sea trout regularly spawns on the lower 4.4 km section up to the Oandu dam. The Oandu dam forms a 3.5 ha lake and may be seen as esthetical landscape element. No trout occur upstream from the lake. Stream section up stream of the lake has suitable trout spawning and rearing areas the exact size of those areas is not known

The Oandu dam was built in 1975 to the old mill site for recreational purposes. The dam has no water permit and it is not culturally valuable. The lake has some limited recreational value. The designed height was over 4 m, earth embankment of the dam has eroded and the water level is kept at 2-3 m level during past decade. The dam has several private owners and has no water permit. The concrete regulator is built just in front of the embankment that has a culvert. The embankment also acts as a road. Therefore there is almost no room to build a fish pass. Most sensible is to remove the regulator and to smooth the stream bottom below the culverts for easier passage. Dam removal cost calculation is not available.

Map 7. The location of the Onadu dam on Altja brook.

Photo 13. Oandu dam regulator, note that the designed water level is at least one 1 m higher than it is presently maintained.

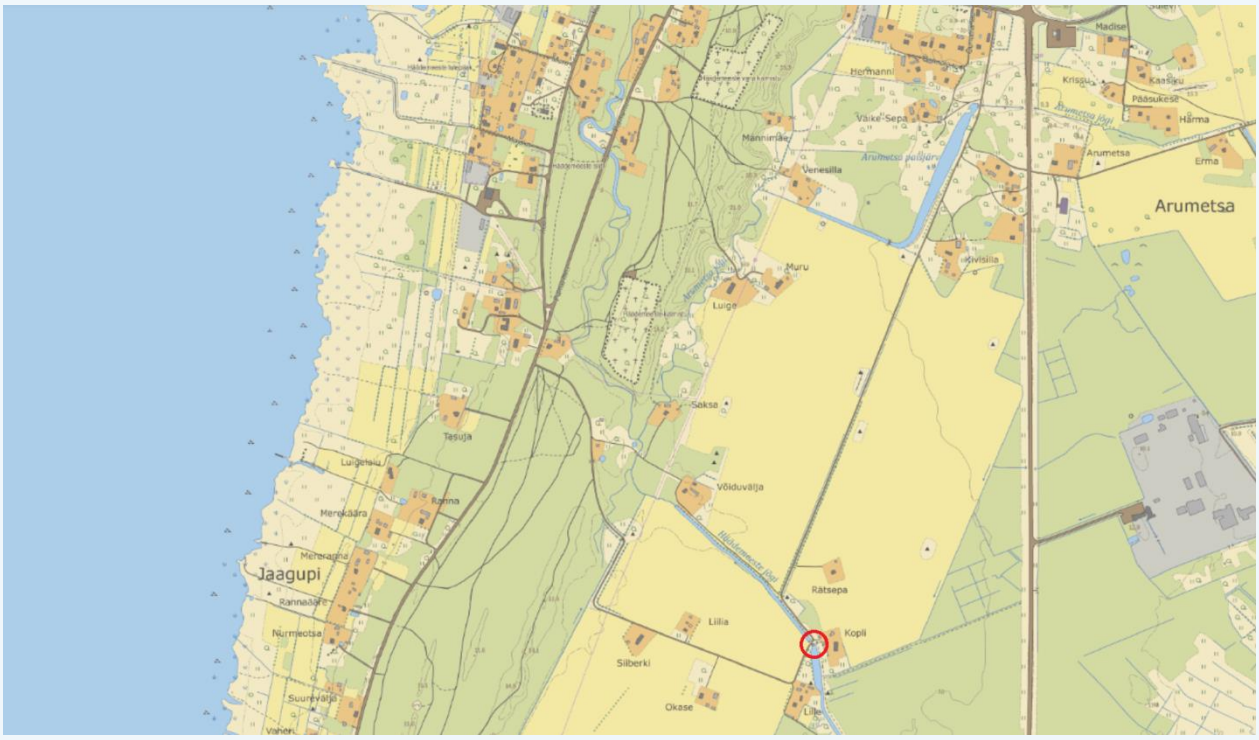
Photo 14. The two culverts below the regulator are in a steep angle and somewhat difficult to pass.

IX Häädemeeste river - Kopli dam

Häädemeeste river is 15.1 km long and its catchment area is 67.7 km2. Its elevation at the source is 48 m. Sea trout regularly spawns on the lower 4.4 km long part. Small resident trout population also exists upstream of the Kopli dam. The river has about 2.5 hectares of sea trout spawning areas and conservative potential smolt production estimate is 1400. About 55% of those areas are located upstream of the Kopli dam.

The construction year of the Kopli dam is not known. The dam was part of irrigation system; however it is no longer in use. Presently the dam less than 1 m high and does not need a water permit because the river is not designated as salmonid bearing river. Nevertheless it is still impassable to fish. The dam is in front of a culvert and is owned by the local municipality. It is has no cultural or recreational value. The dam is maintained by nearby household. The household is fears that the further lowering of the water level at the dam will affect the water

level in their well. Most sensible solution is to completely remove the dam and assisting the nearby household with their water supply issues.



Map. 8. Location Of the Kopli dam on Häädemeeste river is marked with a red circle.

Photo 15. The Kopli dam as a simple metal frame that holds wooden blanks. Removing this structure is very easy.

Coalition Clean Baltic

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Published in 2021