

Baltic Sea Environment Proceedings No. 126B

Salmon and Sea Trout Populations and Rivers in Sweden

HELCOM assessment of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) populations and habitats in rivers flowing to the Baltic Sea.



Helsinki Commission

Baltic Marine Environment Protection Commission

Published by:

Helsinki Commission

Katajanokanlaituri 6 B

FI-00160 Helsinki

Finland

<http://www.helcom.fi>

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For bibliographic purposes this document should be cited as:

HELCOM, 2011

Salmon and Sea Trout Populations and Rivers in Sweden – HELCOM assessment of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) populations and habitats in rivers flowing to the Baltic Sea. Balt. Sea Environ. Proc. No. 126B.

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Layout of the cover: Leena Närhi, Bitdesign, Vantaa, Finland
Cover photo: Erik Degerman

Number of pages: 110

ISSN 0357-2994

This report has been funded through a co-financing agreement between the European Union (European Commission, Directorate General for Maritime Affairs and Fisheries) and HELCOM (Overview of the state of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) populations in rivers flowing to the Baltic Sea – SI2.546540).



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1. Introduction

This Report gives a description of Swedish salmon and sea trout populations and rivers that empty into the Baltic Sea. The Report is based on the HELCOM SALAR Project that focused on the state of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) populations in rivers flowing to the Baltic Sea.

The deliveries of the HELCOM SALAR Project include a General Report on Baltic salmon and sea trout populations and rivers (BSEP 126A) as well as reports with individual descriptions of populations and rivers separately for Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Russia and Sweden (BSEP 126B). The project also prepared a GIS map of salmon rivers as well as a database compiling information on salmon and sea trout populations and rivers.

The overall ecological state of the Baltic rivers and their fish populations has deteriorated from their pristine state. This is a consequence of direct anthropogenic impacts caused by many activities in the drainage area, in the rivers and in the Baltic Sea. In the rivers, the most detrimental activities have been damming, dredging and channelizing rivers to serve for hydropower production, log driving and agricultural purposes. Also indirect impacts of human activities such as nutrient and sediment loads from agriculture, forestry and sewage sources have had negative consequences on the ecological state of the Baltic rivers.

The General Report of the HELCOM SALAR Project presents an overview, inventory and classification of Baltic rivers with salmon and/or sea trout populations. In order to improve the status of these populations, the Report recommends measures for the restoration of river habitats and waters, for the opening of passage as well as for fisheries management in rivers. Furthermore, a prioritization of Baltic salmon and sea trout populations in need of urgent actions for their recovery is included. The recommendations and prioritizations form a basis for the development of international and national programs for the planning, funding and systematic realization of these actions.

The HELCOM SALAR Project was funded through a co-financing agreement between the European Commission (DG MARE) and HELCOM. It implements fisheries actions in the strategic HELCOM Baltic Sea Action Plan to radically reduce pollution to the sea and to restore the good ecological status of the marine environment by 2021.

The Reports have been prepared in co-operation with nominated salmonid and river habitat experts of the Baltic Sea countries as mentioned on the second page. The texts concerning salmonid populations and rivers in each country have been produced by the nominated experts and edited by the project staff in the HELCOM secretariat.

The General Report, the Reports with river descriptions and the GIS map are available at www.helcom.fi and the databank as an excel file at the institutions of the nominated experts.

2. Salmon populations and rivers in Sweden

The River Alsterån

The River Alsterån is a small salmon and sea trout river flowing to the Baltic Proper.

Basic hydrological facts

River length: 127 km of which 20 km accessible for salmonids

Size of catchment area: 1,525 km²

Average flow: 11.3 m³/s

Daily lowest flow: 0.3 m³/s

Number of migration hindrances: 30 (5 contain a fish way)

Habitat and water quality in River Alsterån

River Alsterån starts from the lake Alstern that is located at an elevation of 218 m above the sea level. From here the river runs 127 km until Pataholm, where it enters the Baltic Proper at the Kalmar strait. The catchment area is dominated by forest, covering 85% of the area. Agriculture and lakes occupy 6% and 5% of the area, respectively.

The catchment area has been subject to draining and lake lowering for the benefit of agriculture and forestry. This has led to large fluctuations in the water bearing, which may have a negative impact on salmon and sea trout populations. The river has also been partly broadened and straightened. Salmon and sea trout reproduction areas (spawning and nursery areas) have therefore been given a fair status. Morphological changes can be observed at these sites. Nevertheless, the river has not been subject to a large scale clearing of boulder and debris for log driving like many other rivers in Sweden.

The river is heavily exploited for hydropower purposes: there are a total of 21 power plants within the river system. The first power plants were constructed in the beginning of the 20th century when many lakes were dammed. Until 1996 fish could not migrate further than 5 km upstream from the river mouth. Today, there are a total of five constructed fish ways that enable migration until the Hornsö power plant. Hornsö is located 20 km from the river mouth and represents a definitive migration hindrance. The fish ways have made stretches of riffles and rapids accessible for ascending salmon and sea trout, but some fish ways needs improvement.

There is no prescribed minimum flow in the river, and consequently low flows are common. However, the impact of the low flow on salmon and sea trout reproduction and migration is estimated to be small.

The river is affected by acidification and therefore extensive liming has been carried out in lakes of the river system. Nutrients from agriculture and sewage as well as forestry effluents deteriorate water quality. However, the chemical water quality (excluding mercury) and the ecological status are both rated as good.

River Alsterån according to the Water Framework Directive

The name of the water management district is Southern Baltic Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to improve existing fish ways, continue and strengthen actions to reduce nutrient load from agriculture, forestry and municipal waste; trying to raise the minimum flow; and to continue the liming operations.

Natura 2000

The river belongs to the Natura 2000 network.

The Alsterån salmon and sea trout stocks

The river Alsterån holds both a natural sea trout population and natural salmon population, but electro-fishing studies show that the salmon population is very weak. However, the river is classified as one of the two potential salmon rivers in southern Sweden.

Hybridization occurs regularly between the two species. With the current low flow, salmon reproduction is considered low in order to harbour a viable salmon population.

Salmon and sea trout population facts

Population category: 2 (salmon), 1 (sea trout)

Reproduction area: 1.6 ha

Production capacity: 4,000 smolts

Recent wild smolt production estimate: 100–200 (salmon); 900 (sea trout)

Fishing regulations in the River Alsterån

Fishing is allowed from April 1 – October 15. Minimum legal length for sea trout is 50 cm. There is a bag limit of two sea trout or salmon per day. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Fish passage in existing fish ways needs improvement.
- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- The minimum flow should be raised at hydropower plants and dams.
- Liming should be continued in the upper part of the catchment.

The River Byskeälven

The River Byskeälven is a medium-sized salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 228 km totally accessible for salmonids

Size of catchment area: 3,661.8 km²

Average flow: 40.2 m³/s

Daily lowest flow: 7.9 m³/s

Number of migration hindrances: 2 (2 contain fish ways)

Habitat and water quality in River Byskeälven

Lake Kilver is one of the source lakes of the River Byskeälven at an altitude of 362 m above the sea level. In the city of Byske, after 140 km, the river empties to the Bothnian Bay. Altitudinal differences along the way are large: there is a drop of 165 meters between the sea and Fällforsen that is located 38 km from the river mouth.

The River Byskeälven flows through a landscape that is dominated by forest (67% of the catchment area). Lakes and mires occupy 6.7% and 16.5% of the area, respectively. Salmon production is highest in the forested areas. The spring flood, occurring during the first half of May, is intense and influences the bank vegetation. Instead of shrubs and trees, the banks grow herbs and grasses.

The river landscape is affected by the past timber cutting and dredging. The river was used for log driving until the end of the 1960s. Almost 60% of the stream length has been used for timber floating. Most of the affected areas have been restored, by replacement of stones and boulders, in order to improve reproduction success of fish species utilising these habitats.

The River Byskeälven has not been harnessed for hydropower production, because the Swedish Environmental Code prohibits construction of power plants in the river. However, there is a natural partial migration hindrance (water fall) at Fällforsen. Two fish-ladders, one along each bank, have been built to aid fish migration upstream, although fish could pass also before the construction of these fish ways. In addition to Fällforsen, there are a total of 45 road culverts that are at least partially blocking migration, especially in the tributaries.

Both the chemical water quality (excluding mercury) and the ecological status are rated as good. Liming has been carried out in two tributaries in order to reduce acidification effects.

River Byskeälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good

Hydrologic & morphological status: Fair–Good depending on location

No official water management plan is established, but the probable main measure in the water management plan is continued restoration of riffles and rapids that have suffered from dredging.

Natura 2000

The main river belongs to the Natura 2000 network.

The Byskeälven salmon and sea trout stocks

The river harbours wild strains of both salmon and sea trout, and no releases have been carried out in the past 10 years.

While many other Swedish salmon rivers showed a declining salmon population trend during the 1980s, the Byskeälven population seemed to be more stable.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 560 ha (salmon), 530 ha (sea trout)

Production capacity: 121,000 smolts (salmon)

Recent wild smolt production estimate: 109,000 (salmon); 1,500 (sea trout)

Fishing regulations in the River Byskeälven

Open season is from June 10 – August 31. The Minimum legal length for salmon is 50 cm, and there is a bag limit of one salmon per fisher per day. During August only salmon of 50–63 cm may be landed. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of the river is in good state and focus should be on maintaining the good habitat and fisheries management. Continued restoration of the river bed is required in some areas.

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Dalälven

The River Dalälven is a large former salmon and sea trout river flowing to the Bothnian Sea.

Basic hydrological facts

River length: 542 km of which 9 km is accessible for salmonids

Size of catchment area: 28,954 km²

Average flow: 348 m³/s

Daily lowest flow: 43.3 m³/s

Number of migration hindrances: 64 along the main river

Habitat and water quality in River Dalälven

The river Dalälven starts from the Scandinavian Mountain Range, in the north of Dalarna, and reaches the Bothnian Sea in the northern Upland. Forest covers 73%, mires 10.3%, lakes 6.5%, and mountains 3.5% of the catchment area. Mountains and mires characterize the upper part of the catchment area, but towards the coast forest becomes dominant.

The river has been extensively harnessed for hydroelectric power production, and there are a total of 42 power plants. The first power plant, Älvkarleby, located 9 kilometres upstream from the river mouth, is especially problematic. It prevents fish from entering the rest of the river because there is no fish ladder at this point. Many riffles and rapids upstream of Älvkarleby have been dredged due to timber floating. Previously, spawners were transported upstream the lowest 2–3 dams. In order to prevent outbreaks of diseases threatening fish hatcheries located downstream, this has been discontinued.

According to Swedish Water Court decision the power companies are obliged to release a certain number of reared fish to the river annually. This decision is an attempt to maintain a sufficient population size for commercial and recreational fishing.

Water quality (excluding mercury) in Dalälven is rated as good, whereas the ecological status is rated as only “fair–poor” due to flow regulations and morphological changes. At the main reproduction area the chemical water quality is improving because the chemical outflow from industry has decreased.

River Dalälven according to the Water Framework Directive

The name of the water management district is Bothnian Sea River District and the river type is a large forest river.

Ecological status: Fair – Poor

Biological status: Fair

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable actions concern reduction of industrial effluents and nutrients.

Natura 2000

The river does not belong to the Natura 2000 network.

The Dalälven salmon stock

Salmon reproduces naturally only in a small part of the river, at Kungsådran at Älvkarleby. The stock is not self-sustaining. It is dependent on large quantities and continuous releases of reared fish. 250,000 smolts of the Dalälven-strain are released annually.

Salmon and sea trout population facts

Population category: 5 (salmon), 7 (sea trout)

Reproduction area: 4 ha (salmon)

Production capacity: 2,000 (salmon)

Recent wild smolt production estimate: A few hundred (salmon); 1,000 (sea trout)

Fishing regulations in the River Dalälven

Fishing is open from January 1 – September 30. Fishing of three salmon and/or sea trout is allowed per fisher per day. Minimum size for salmon is 50 cm and for trout 45 cm. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The feasibility of establishing fish ways through the lowermost dams of the river must be investigated.
- Riffles and rapids should be restored if made accessible with new fish ways or if transport of spawners upstream of the 2–3 lowest situated dams will be resumed.

The River Emån

The Emån is a medium-sized salmon and sea trout river flowing to the Baltic Proper.

Basic hydrological facts

River length: 229 km of which 45 km accessible for salmonids
Size of catchment area: 4,471 km²
Average flow: 29.5 m³/s
Daily lowest flow: 0.8 m³/s
Number of migration hindrances: 38 (8 contain a fish way)

Habitat and water quality in River Emån

At an altitude of 300 m above the sea level, a few lakes give rise to the River Emån. After 240 km the river empties to the Kalmar Strait of the Baltic Proper. The river is divided into two water ways, River Emån and River Solgenån. The largest tributaries connected to Emån are Rivers Gnyltån, Pauliströmsån, Silverån and Gårdvedaån.

Pine forest and mires dominate the catchment area in its upper part, whereas the lower part is characterized by cultivated plains and deciduous forest. There are as many as 848 lakes in the area (5.5% of the catchment area), while forest is the dominant land type (73% of the area). Agricultural land and mires make up for 13% and 1.5% of the area, respectively. Agriculture is concentrated to the areas around lakes, plains and valleys. The Swedish Environmental Code prohibits the construction of new power plants in the catchment area.

The catchment area has been subject to draining and lake lowering for the benefit of agriculture and forestry. This has led to large fluctuations in the water bearing which has a negative impact on salmon and sea trout populations. The river has also been used for log driving and has for that purpose been subject to clearing of boulders and debris. Approximately a half of the river length has been cleared or straightened.

The water quality is affected by nutrient load from agriculture and sewage as well as by effluents from forestry. Acidification is strong in the upper parts of the catchment area and extensive liming has been carried out in lakes, wetlands and tributaries connected to the main river. The river water shows elevated levels of cadmium, lead, and nickel.

There are as many as 240 migration obstacles in the river and 150 of them are definite. 38 of these obstacles are significant migration hindrances for salmon and/or sea trout. The power plant constructions started in the early 20th century. Today there are 22 hydropower plants in the river. The power plants of Emsfors and Karlshammar, situated at 5 km and 8 km from the river mouth respectively, are equipped with fish ways. Recently the dam at Emsfors has been eliminated. Salmon reproduces mainly downstream of Emsfors, but also areas upstream are used.

Both the chemical status (excluding mercury) and the ecological status of the water quality are rated as good. Restoration works have been undertaken in the straightened and broadened parts of the reproduction areas.



Figure 1. Rivers Emån, Alsterån, Mörrumsån and Helge Å.

River Emån according to the Water Framework Directive

The name of the water management district is Southern Baltic Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (except mercury)

Hydrologic & morphological status: Good–Fair (depending on location)

No official water management plan is established, but probable main measures in the water management plan are improving the water quality by decreasing nutrient and sediment load from forestry, agriculture and sewage; continued liming; improving the low flow conditions by hydrological restoration of the watershed.

Natura 2000

The main river belongs to the Natura 2000 network.

The Emån salmon and sea trout stocks

The river harbours unique strains of both salmon and sea trout and no releases have been carried out in the past 10 years. The sea trout population is in poor condition, but the salmon population is considered to be self-sustaining.

Annual smolt production could be increased with restoration of river beds and construction of new fish ways. Both the salmon and sea trout populations suffer from occurrences of low flow events and preventing these events would aid fish to expand their reproduction areas.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 21.7 ha (salmon)

Production capacity: 14,000 smolts (salmon)

Recent wild smolt production estimate: 2,500 (salmon); 3,000 (sea trout)

Fishing regulations in the River Emån

Open season is from March 1 – September 30. The minimum legal length for salmon and trout is 60 cm (raised from national legislation that only requires 50 cm). There is a bag limit of 1 to 3 salmon or trout per fisher per day (depending on fishing area).

There is no weekly closure for fishing in the river. Net fishing is not allowed. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of Emån is in need of recovery. The exact cause of the situation is not known and hence all actions that will improve the habitat and increase the number of spawners are needed.

- Spawning grounds of salmon and sea trout, including rapids and riffles, should be further restored.
- Decreasing entry of nutrients, sediment and effluents is also essential for improving the water quality. An effective riparian protection zone should be established along agricultural lands by the river.
- Further draining in the catchment area should be prevented.
- Low flow conditions should be stopped by restoring wetlands, e.g. by filling old, unnecessary ditches and re-meandering of channelized parts
- Liming must continue in acidified parts.
- Down-stream passage of smolts and kelts must be improved at power plants.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Fylleån

The River Fylleån is a small salmon and sea trout river flowing to the Kattegat.

Basic hydrological facts

River length: 65 km of which 26 km accessible for salmonids
 Size of catchment area: 393.8 km²
 Average flow: 7.7 m³/s
 Daily lowest flow: 0.09 m³/s
 Number of migration hindrances: 5 (all contain fish ways)

Habitat and water quality in River Fylleån

The River Fylleån starts from a mire-rich region at the small village of Lidhult and runs for almost 65 kilometres to the sea where it drains into Laholmsbukten between Rivers Nissan and Genevadsån. The catchment area is dominated by forest and mires, occupying 53.5% and 19.5% of the area, respectively. Agriculture becomes more widespread towards the sea and covers a total of about 15% of the catchment area. The small portion of lakes, 3% of the catchment area, causes large fluctuations in the water-bearing. Flat terrain surrounding the river is regularly flooded in times of high water levels. The river is protected from further hydropower exploitation through the Swedish Environmental Code.

The river is used for hydroelectric power production and there are a total of four power plants in the river. The power plants at Fyllinge kvarn, Marbäcks bruk and Linebergsmöllan are equipped with fish ways. There is a natural salmon and sea trout migration hindrance at Tolarpsfallen which may be a definite block for ascending salmon in case of low flow.

Acidification is strong in the whole river system and extensive liming operations have been ongoing since 1982 in the source lakes and wetlands. Water is used for irrigation in the lower parts of the river. During the low flow season this affects salmon reproduction negatively in terms of migration and smolt production. The lower parts of the river are also negatively affected by nutrient and sediment load from agriculture and morphological changes can be observed at these locations. Some parts of the river suffer from continuity problems (e.g. the tributary Trönningeån). The water quality (excluding mercury) and the ecological status of the river are both good.

River Fylleån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures in the water management plan are improving the water quality by decreasing nutrient load from agriculture, private sewage drains and sewage treatment plants, and by the establishment of buffer zones; prevention of the occurrence of extreme low flow conditions by decreasing irrigation; and increased liming operations.

Natura 2000

The river belongs to the Natura 2000 network and is protected within Ramsar.

The Fylleån salmon stock

The river harbours a genetically unique salmon strain. The population has a low introgression of genes from other strains. Salmon was near extinction in the 1980s due to acidification, overfishing, migration hindrances and pollution. Thanks to liming and reared fish releases of the original strain, the salmon population somewhat recovered and the abundance has increased since the mid-1980s.

There are no fish farms in the river. The ectoparasite *Gyrodactylus salaris* is observed in the river but only in low densities.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 17.8 ha (salmon); 22.5 ha (sea trout)

Production capacity: 17,800 smolts (salmon)

Recent wild smolt production estimate: 11,000 (mean of 2005–2009) (salmon); 1,500 (sea trout)

Fishing regulations in the River Fylleån

Fishing for salmon is allowed from March 1 – September 30. Minimum legal length for salmon and sea trout is 45 cm. There is a large protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river. The fish way at Marbäck will be improved during 2011-2012.

- An effective riparian protection zone should be established along agricultural lands by the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- Liming should be maintained and eventually increased.
- The occurrence of extreme low flow conditions should be prevented by limiting irrigation, and by restoring the wetlands in the catchment.

The River Genevadsån

The River Genevadsån along with its tributaries Alslövsån, Vessingeån and Brostorpsån is a small salmon and sea trout river flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 37 km of which 30 km accessible for salmonids

Size of catchment area: 224.1 km²

Average flow: 3.3 m³/s

Daily lowest flow: 0.07 m³/s

Number of migration hindrances: 6 (at least one of the main river dams contains a fish way)

Habitat and water quality in River Genevadsån

The River Genevadsån springs from several small water courses and form one larger. The largest of the headwaters originates from a large mire-mosaic at an elevation of 160 m above the sea level. The main stem, River Genevadsån, starts by the small village of Genevad at the crossing where the tributaries Alslövsån, Vessingeån and Brostorpsån meet. From here the river flows about 5 km until it empties into Laholmbukten in Kattegat.

The catchment area is dominated by mires and forest in the upper part, occupying a total of 15.5% and 44.5% of the catchment area respectively. Towards the river mouth the scenery changes gradually into an agriculture dominated landscape. 31.5% of the catchment area is cultivated. Lakes take up only 0.9% of the catchment area which brings large fluctuations to the water level.

There are a total of 6 small power plants in the river and they all lack a prescribed minimum flow. Salmon can migrate 15 kilometres from the river mouth until the mill of Bölarp at the tributary Vessingeån and 20 kilometres in the tributary Brostorpsån. Fish ways have been constructed at Tönnersa kvarn (Genevadsån), at Öringe mölla (Brostorpsån) and at Lindome kvarn (Alslövsån).

Acidification is strong in the whole river system, and extensive liming operations are ongoing since 1987. The river is also affected, mainly in the lower part, by nutrient and sediment load from agriculture, and morphological changes in the water course are perceivable. During the low flow season the river suffers from continuity problems and from water usage for irrigation, both of which have a negative impact on salmon migration and smolt production. Pollution from a sugar manufacturer has caused several fish deaths in the river during the 20th century.

Water quality (excluding mercury) is good within the whole system. The ecological status varies from good to fair depending on the area.

River Genevadsån and the tributaries according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agriculture river.

Ecological status of the main river and its tributaries: Fair (Genevadsån), Fair–Good (Alslövsån), Fair–Good (Vessingeån), Fair (Brostorpsån)
Biological status: No information
Physical & chemical status: Good (excluding mercury)
Hydrologic & morphological status: Good–Fair depending on location

No official water management plan is established, but probable main measures in the water management plan are improving the water quality by decreasing nutrient load from agriculture, and the establishment of buffer zones; prevention of the occurrence of extreme low flow conditions by decreasing irrigation; establishment of prescribed minimum flow; continued liming operations.

Natura 2000

The river does not belong to the Natura 2000 network.

The Genevadsån salmon stock

The river harbours a genetically unique salmon strain, which has a low introgression of genes from other strains. Fish farming is not practiced in the river, but occurrences of the ectoparasite *Gyrodactylus salaris* have been recorded.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)
Reproduction area: 0.1 ha (main river), 3.1 ha (Alslövsån), 2.4 ha (Vessingeån), 8.0 ha (Brostorpsån) (salmon)
Production capacity: 20,865 (salmon)
Recent wild smolt production estimate: 10,900 (mean of 2005–2009) (salmon)

Fishing regulations in the River Genevadsån

Minimum legal length for salmon and sea trout is 45 cm. Net fishing is prohibited. There is a large protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- Liming operations should be continued, and eventually increased.

- The occurrence of extreme low flow conditions should be prevented by decreasing irrigation and restoring wetlands.
- A prescribed minimum flow must be established at all power plants.

The River Gideälven

The River Gideälven is a medium-sized salmon and sea trout river flowing to the Bothnian Sea.

Basic hydrological facts

River length: 239 km of which 8.8 km accessible for salmonids

Size of catchment area: 3,441.8 km²

Average flow: 35.9 m³/s

Daily lowest flow: 4.34 m³/s

Number of migration hindrances: 10 (at least one contains a fish way)

Habitat and water quality in River Gideälven

River Gideälven springs from its sources in Arasjöfjällen in South-Eastern Lapland, from where it runs for 239 km and drains into Degerfjärden in the Bothnian Sea. The river is considered a typical forest river with forest occupying 82% of the catchment area. Mires and lakes cover 10% and 5.4% of the drainage basin, respectively. Agriculture is practiced only in approximately 1% of the catchment area and it is concentrated to its lower part.

The river is heavily harnessed for hydropower production. Salmon may pass the power plant of Gideåbacka through a fish way and ascend further upstream until the power plant of Gidböle that presents a definite migration hindrance 8.8 km from the mouth.

Water quality (excluding mercury) is rated as good within the whole river system whereas the ecological status is rated as fair due to water regulation and effects from the past timber floating activity.

River Gideälven according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair

Biological status: Poor

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures in the water management plan are continued liming operations and restoration of riffles and rapids that suffered from dredging due to timber floating.

Natura 2000

The river does not belong to the Natura 2000 network.

The Gideälven salmon stock

In Gideälven, there is some natural reproduction of salmon but the stock consists mainly of reared fish that are released on a continued basis. The salmon stock is hence not self-sustaining. 6,000 smolts of the Skellefte-strain are released annually according to a Swedish Water Court decision.

Salmon and sea trout population facts

Population category: 5 (salmon), 4 (sea trout)

Reproduction area: 0.4 ha (sea trout)

Production capacity: No information

Recent wild smolt production estimate: Insignificant (salmon); 400 (sea trout)

Fishing regulations in the River Gideälven

Gillnet fishing is prohibited from Saturdays at 12:00 until Sundays at 18:00 from January 1 – August 31, and from Thursdays at 18:00 until Sundays at 18:00 from September 1 – December 31. Angling is allowed throughout the year. No bag limit exists. There is no area protected from fishing in the estuary, which means that coastal fishing pressure may be high.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Liming of tributaries and lakes in the catchment area should be continued.
- Restoration of areas cleared for timber floating should be continued.
- It may be reconsidered if fish ways should be built and management procedures initiated to establish a wild population of salmon again.

The River Göta älv

The River Göta älv, with the tributaries Säveån, Grönån, Mölndalsån, Lärjeån, Västerlandaån and Brattorpsån is a large salmon and sea trout river flowing to Skagerrak.

Basic hydrological facts (main river)

River length: 756 km of which 80 km accessible for salmonids

Size of catchment area: 50,115 km²

Average flow: 565 m³/s

Daily lowest flow: 44.5 m³/s

Number of migration hindrances: 3 in the main river (1 contains a fish way)

Habitat and water quality in River Göta älv

The River Göta älv together with its tributaries has the largest catchment area in Sweden. The river springs from sources in the mountain regions in Norway and from the County of Härjedalen in Sweden. From Lake Vänern, the Göta älv runs past Trollhättan, Lilla Edet and Ale until Kungälv where it divides into two branches: Göta älv and Nordre älv. There are several Nature reserves

along the way. The largest island within the river is Hisingen that is located between Göta älv, Nordre älv and Kattegat. The landscape of the catchment area is dominated by forest (57%), and agricultural area takes up 11% of it. Including the large Lake Vänern, lakes cover up to 18% of the catchment area. Mountains and mires characterize the upper parts of the river and occupy a total of 7.5% of the catchment area.

Säveån, Grönån, Lärjeån, Västerlandaån and Brattorpsån have all been subject to channelling for agricultural purposes. In the main stem all reproduction areas have been destroyed as a result of power plant construction. Göta älv also suffers from nutrient load from agricultural land surrounding the river.

The river system is heavily exploited for hydropower production purposes. Construction of the hydropower plants began in the end of the 1800s, during the industrialization era. In the main stem there are currently a total of three power plants downstream of Lake Vänern. The tributary Säveån holds as many as 19 power plants and salmon may only migrate as far as to the power plant at Hedefors. Prior to the construction of the power plant at Lilla Edet in 1918 salmon and sea trout could migrate freely up to the natural migration hindrance at Trollhättefallen, 80 km from the river mouth. Today there are two fish ways, one at each bank, at Lilla Edet and fish may again reach Trollhättefallen. These fish ways also allows migration to the tributary Brattorpsån. One of these fishways will probably be removed in the future.

There are two fish farms in the river downstream of Lake Vänern. One of them is almost exclusively producing salmon smolts to be released in rivers Göta älv and Mölndalsån. Habitat restoration has been undertaken at Jonsered in River Säveån. Restoration work will be continued in this large tributary.

Water quality (excluding mercury) within the whole system is good. Ecological status is fair within all the tributaries but has not been evaluated for the main river itself. Salmon reproduction habitat varies between different parts of the river system. In the main stem the habitat quality is poor due to channelization for navigation. In the tributaries Säveån, Grönån, Västerlandaån and Brattorpsån habitat status is good whereas in Mölndalsån and Lärjeån it is considered only fair.

River Göta älv and its tributaries according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a large forest river.

Ecological status: Not classified (Göta älv), Fair (Säveån, Grönån, Mölndalsån, Lärjeån, Västerlandaån and Brattorpsån)

Biological status: Good–Fair (depending on location)

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor (Göta älv), Fair (Möndalsån, Lärjeån)

Good (Säveån, Grönån, Västerlandaån, Brattorpsån)

No official water management plan is established, but probable main measures are continued liming operation in all tributaries; a yearly compensatory stocking of 30,000 salmon smolts; establishment of a protected zone along the river, and improving old fish ways and constructing a new in Säveån.

Natura 2000

The tributaries Lärjeån, Brattorpsån and Säveån belong to the Natura 2000 network.

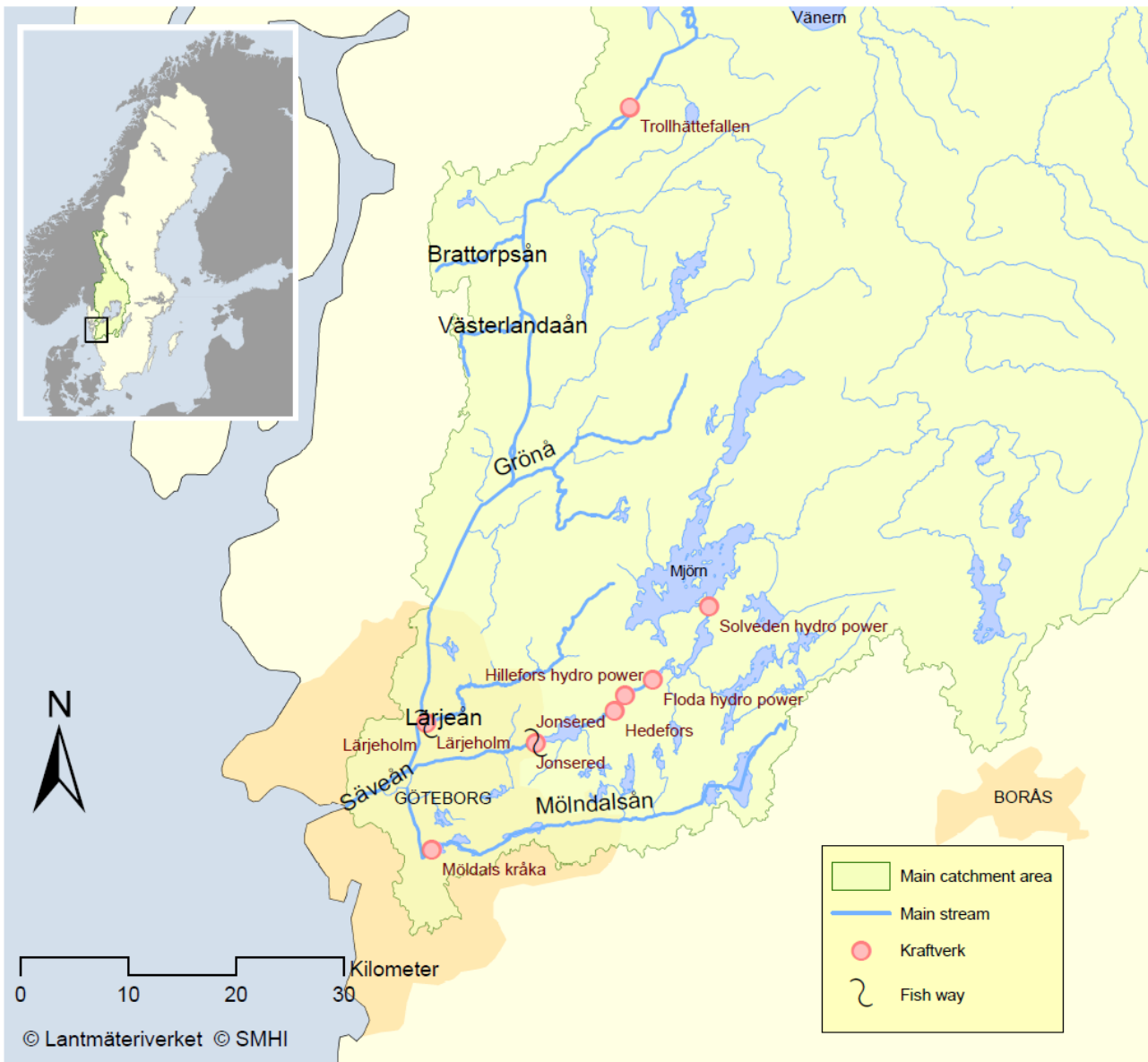


Figure 2. Göta älv tributaries Brattorpsån, Västerlandaån, Grönå, Lärjeån, Sävån and Möldalsån.

The Göta älv salmon and sea trout stocks

The main river stem does not hold a natural reproducing salmon stock. Wild salmon reside in the tributaries Mölndalsån, Säveån, Lärjeån, Solbergaån, Grönån, Västerlandaån, Brattorpsån, Sollumsån, Sannerbybäcken and Sköldsån. The stock in Säveån and Grönån is considered to be of the original strain.

Both the salmon and sea trout stocks in the main stem are dependent on the yearly stockings. About 35,000 salmon annually, reared from the Säveån strain, according to a recent Water Court decision. Habitat restoration in Säveån that started in 2007 is estimated to increase the smolt production by 300 salmon annually.

The ectoparasite *Gyrodactylus* has been found in the river 1989, but has not been observed after 1997.

Salmon and sea trout population facts

Population category: 7 (main river), 1 (Säveån, Grönån, Lärjeån, Västerlandaån and Brattorpsån), 2 (Mölndalsån); 3 (sea trout)

Reproduction area: 17.23 ha (salmon); 0 ha (sea trout)

Production capacity: 12,900 smolts (salmon)

Recent wild smolt production estimate: 2,900 (mean of 2005–2009) (salmon); 0 (sea trout)

Fishing regulations in the River Göta älv

According to national legislation the minimum size of salmon and sea trout in rivers of the Kattegatt region is 45 cm. In addition to the rules set by the Swedish government, a wide variety of fishing rules applies to the different sections of the river and its tributaries. Especially in the river Säveån the rules are strict with e.g. daily and annual bag-limits. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

Some of the tributaries have weak salmon populations. The system is complex with large and small tributaries, with good or poor stocks. Focussing on the original stocks of category 1 the following actions are recommended.

- A fish way should be built at Hedefors in Säveån to expand the salmon habitat.
- Down-stream passage should be enhanced at all power plants, also with regard to eel.
- Continued river restoration is required, especially in River Säveån.
- The effects of stocking on wild populations must be monitored.
- Liming should be continued in all tributaries.
- An effective riparian protection zone should be established along agricultural lands by the river.

The recommendations in the general report of the HELCOM SALAR project in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Helgeån

The River Helgeån with the tributaries Almaån, Vramsån and Bivarödsån is a medium-sized salmon river flowing to the Baltic Proper.

Basic hydrological facts (main river)

River length: 202 km of which 34 km accessible for salmonids

Size of catchment area: 4,724.5 km²

Average flow: 46.4 m³/s

Daily lowest flow: 3.3 m³/s

Number of migration hindrances: 27 (0 contain a fish way in main river)

Habitat and water quality in River Helgeån

The River Helgeån springs from a number of small lakes in the southern part of the county of Kronoberg. In the city of Åhus it drains into Hanöbukten in the Baltic Proper. The catchment area is mainly covered by forest and agriculture land, which make up for 56% and 21% of the area, respectively. Mires cover 7% and lakes 9% of the drainage basin.

Morphological changes are extensive in most stretches of the river as a result of its exploitation for hydropower usage. There are a total of 18 power plants in the river. To improve the efficiency of power plants many water courses have been channelized and cleared, and regulation occur in several lakes. Water usage for agricultural irrigation is widespread during summer months, which causes extreme low flow events that affect salmon and sea trout negatively. The changes have had a negative impact on both flora and fauna in the region.

Water quality (excluding mercury) is good within the whole system. Ecological status is fair in the main stem and in the tributary Almaån, but poor in the tributary Bivarödsån. Reproduction habitat status varies between different parts of the river system. In the main stem the status is fair and within the tributaries it is good. Smaller water courses in the northern part are affected by acidification and the river has been subject to liming since 1982. The buffering capacity is high in the southern agricultural intense areas because of lime-rich soils. These parts of the river are, however, affected by high nitrogen and phosphorous loads. The river was also affected by industrial pollutants in the 1960s. There are fish farms for rearing rainbow trout, brown trout, salmon (Mörrum strain) and the original sea trout strain in the river.

Restoration efforts have been made in the river e.g. by the removal of migration obstacles.

River Helgeån and its tributaries according to the Water Framework Directive

The name of the water management district is Southern Baltic Sea River Basin District and the river type is a medium-sized agriculture river.

Ecological status: Fair (Helgeån), Fair (Almaån), Poor (Bivarödsån)

Biological status: Fair

Physical & chemical status: Good

Hydrologic & morphological status: Fair (Helgeån), Good (Almaån, Bivarödsån)

No official water management plan is established, but probable main measures are continued and strengthened actions to reduce nutrient load from agriculture, and continued liming operations. The efficiency of fish ways in the tributaries should be checked.

Natura 2000

The main river belongs to the Natura 2000 network.

River Helgeån salmon stock

Pollution in the 1960s almost resulted in the extinction of the sea trout and the salmon populations. However, a fragment of the sea trout population survived in a tributary and some individuals were used to rear fish to be released in Helgeån. In 1975–1987 a total of 79 000 sea trout fry were released, and currently the population is regarded as self-sustaining.

The natural salmon stock went extinct during the same period, and the current salmon population originates from the River Mörrumsån. In 1995–1997 a total of about 20,000 smolts were released in the tributaries of Helgeån. This was followed by further releases in 2005–2008 when 305,000 parr were released in the river. However, the salmon population is just considered to be self-sustaining at the moment in the main river, but is certainly self-sustaining in some of the tributaries.

Salmon and sea trout population facts

Population category: 3 (salmon), 1 (sea trout)

Reproduction area: 4.7 ha (salmon)

Production capacity: 3,200 (salmon)

Recent wild smolt production estimate: No information

Fishing regulations in the River Helgeån

The fishing season for salmon is March 1 – May 14. Fishing of sea trout is allowed March 1 – September 30. Minimum legal sizes are 50 cm for sea trout and 60 cm for salmon. Fishing is only allowed with a fishing license. There is a bag limit of 3 salmon or trout per day. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The efficiency of the fish ways needs to be checked.
- An effective riparian protection zone should be established along the river to improve water quality by decreasing nutrient and sediment input from forestry and agriculture.

- Liming should be continued.
- The occurrence of extreme low flow conditions should be prevented by regulation of the usage of water for irrigation purposes, and by restoring wetlands.

The River Himleån

The River Himleån with its tributary Stenån is a small salmon and sea trout river flowing to Kattegat.

Basic hydrological facts (main river)

River length: 38 km of which 27 km accessible for salmonids

Size of catchment area: 208 km²

Average flow: 2.7 m³/s

Daily lowest flow: 0.06 m³/s

Number of migration hindrances: 1

Habitat and water quality in River Himleån

The River Himleån springs from the Lakes Nösslingesjöarna, Stora Neden and Lilla Neden (77 m above the sea level) near Rolfstorp and runs for 38 km just north of the city of Varberg. The uppermost part flows through a nutrient poor forested area and transcends the lower agriculturally dominated areas. The catchment area is dominated by agricultural and open land (50 %) and forest (36.5 %). Lakes occupy only 2.8 % of the catchment area.

Typically the annually lowest flow season is during the summer months. The river has been heavily channelized to gain land for agricultural use. Recurrent clearing of shrubs, bushes and debris in-stream and along the banks further impair the river as a suitable habitat for salmon and sea trout.

The last migration hindrance below lake Stora Neden in River Himleån was eliminated in 2007, which allowed salmonids to access all of the existing habitat area (6.6 ha). The entire river below Lake Stora Neden with its tributaries is now accessible for salmon and sea trout. Above the lake there are no reproduction areas, and one migration obstacle is left in the form of a dam at the outlet. Extensive restoration work has been undertaken in River Himleån during 1989–2010. This included among other things, restoration of the meandering of the river, fish ways, tearing down dams, planting of alder along banks. Other migration hindrances such as culverts have also been replaced. After further restoration from 2010 to 2011 the available habitat for salmon will be 8 ha, and an additional 4 ha for sea trout.

Water quality (excluding mercury) is good. The ecological quality is set to fair due to problems with nutrient load from the surrounding agriculture. The upper third of the river is affected by acidification and further liming operations are required to maintain the water quality. Increased buffer zones would further improve the ecological quality.

River Himleån and its tributary according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Fair (main river), Good (Stenån)

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good (main river), Fair (Stenån)

No official water management plan is established, but probable main measures are to continue and strengthen actions to reduce nutrient load from agriculture, continue efforts to restore habitats, restoration of wetlands, continued liming operations, increased buffer zones, and re-meandering of main channel along 3 km.

Natura 2000

The river does not belong to the Natura 2000 network.

River Himleån salmon and sea trout stocks

The River Himleån is one of the most productive waters in the County of Halland. From only 2,500 smolts, the annual smolt production increased to around 4,600 in the beginning of the 21st century. Both salmon and sea trout reproduce along the main river and in the tributary Stenån.

The salmon population is stressed by the occurrence of the ectoparasite *Gyrodactylus salaris*. The parasite was first discovered in 2004 and a research programme has been initiated to study survival of salmon parr.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 8 ha (salmon); 7 ha (sea trout)

Production capacity: 16,000 (salmon)

Recent wild smolt production estimate: 13,100 (mean of 2005–2009) (salmon); 5,000 (sea trout)

Fishing regulations in the River Himleån

According to national legislation minimum size of salmon and sea trout in rivers of the Kattegatt region is 45 cm. Fishing is operated by a local fishing association. During the past years salmon fishing within the river has been prohibited. For the last ten years only two salmon has been landed. There is a large protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of the river is in a good state, but there are still issues that need attention.

- Spawning grounds should be further restored.
- An effective riparian protection zone should be established along the river to improve water quality thorough decreasing nutrient and sediment input from forestry and agriculture. The clearing of debris and shrubs along the banks should be discontinued.

- Re-meandering of 3 km of the main stem would provide large areas of potential habitats for salmon.
- Liming should be continued.
- The occurrence of extreme low flow conditions should be prevented by regulation of the usage of water for irrigation purposes, and restoration of wetlands.

The recommendations in the general report of the HELCOM SALAR project in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Hörnån

The River Hörnån is a small potential salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 74 km of which 46 km accessible for salmonids
 Size of catchment area: 392 km²
 Average flow: 4.2 m³/s
 Daily lowest flow: 0.2 m³/s
 Number of migration hindrances: 2 (1 contains a fish way)

Habitat and water quality in River Hörnån

The River Hörnån springs from Lake Bastuträsk located 65 kilometres from the coast and 175 m above the sea level. The catchment area is dominated by forests (82%) while mires and agriculture/open land each occupy 7% of the area. Lakes cover only 2.5% of the catchment area. Whereas the upper part is characterized by mires, the lower part of the river is mainly mixed forest and agriculture land.

There was a dam at Hörnforsen about 2 km from the river mouth. This migration hindrance was removed in 2002. Until 2002 fish could not ascend more than 40 km up the river where this old sawmill dam effectively prevented fish from migrating further upstream.

There is no wild salmon production in the river. Sea trout, however utilizes the river for reproduction. The river is acidified and a liming programme was commenced in 1993. This programme covers the liming of the four most important tributaries and the main river. Water quality (excluding mercury) is good within the whole river and the ecological status is also good. Riffles and rapids were dredged for timber floating, but they have recently been almost fully restored to improve reproduction success of fish species utilising these habitats.

River Hörnån according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a small forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (except for mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are the final restoration of riffles and rapids that have suffered from dredging due to timber floating; and continued liming efforts.

Natura 2000

The main river does not belong to the Natura 2000 network.

River Hörnån salmon and sea trout stocks

Electrofishing surveys have shown that salmon parr are very sparse some years, and most of the years there are no salmon at all. As no historical evidence existed suggesting that the river had ever held a salmon population, it was decided not to initiate a salmon reintroduction program in the river. Today there is no self-sustaining salmon population in the river.

There have been some supplemental releases of hatchery reared sea trout in the 1990s and since 2003 a programme to re-establish a viable sea trout population was set in action. During 2003 – 2007 a total of 100,000 fry, 14,000 0+ fry, and 100 smolts originating from the rivers Lögdeälven and Öreälven were released every year.

Salmon and sea trout population facts

Population category: 6 (salmon); 3 (sea trout)

Reproduction area: 15 ha (salmon)

Production capacity: 2,730–4,100 smolts (salmon)

Recent wild smolt production estimate: No information

Fishing regulations in the River Hörnån

A maximum of one salmon and two sea trout landed per day and fisher is maintained. The legal size of both species is 50 cm.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

- Some additional restoration of riffles and rapids suffering from the effects of dredging due to timber floating is required.
- Liming should be continued.

The River Indalsälven

The River Indalsälven is a large salmon and sea trout river flowing to the Bothnian Sea.

Basic hydrological facts (main river)

River length: 430 km of which 10 km accessible for salmonids

Size of catchment area: 26,726.5km²

Average flow: 455.3 m³/s

Daily lowest flow: 56.77 m³/s

Number of migration hindrances: 25 (0 contain a fish way)

Habitat and water quality in River Indalsälven

The River Indalsälven originates in the Scandinavian mountain range and runs for 430 km to the river mouth in the Bothnian Sea, 20 km north-east of the town of Sundsvall. The largest tributaries in the river are Kallströmmen, Långan, Hårkan and Ammerån. The catchment area is characterized by mountains and mires in its upper parts, occupying 17.5% and 8% of the area, respectively. Towards the coast the nature surrounding the river becomes dominated by forest, occupying a total of 60% of the catchment area. Lakes cover 9% of the area.

The river has been extensively harnessed for hydroelectric power production and there are a total of 25 power plants in the river, completely blocking salmon from reaching reproduction areas. Flow problems due to water regulation have large negative impacts on salmonid reproduction and migration in the river.

According to a Water Court decision the owners of the power plants are obliged to release fish to maintain the commercial and recreational fishing in the sea. Stocking of reared fish is done annually. The power plant closest to the mouth, 10 km from the coast, lacks a fish way and therefore represents a definite migration hindrance for salmon and sea trout in the river.

Water quality (excluding mercury) is rated as good whereas the ecological status is classified as fair-poor due to flow regulations and morphological changes. The river was used for timber floating and hence the riffles and rapids have been dredged.

River Indalsälven according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a large mountain river.

Ecological status: Poor

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measures are continued liming operations in tributaries and upper parts and establishment of fish ways.

Natura 2000

The tributaries (Ammerån, Hårkan and parts of Långan) belong to the Natura 2000 network, but the main river does not.

The Indalsälven salmon stock

The River Indalsälven has no salmon reproduction. Because of significant migratory hindrances the stock is dependent on large continuous releases of reared fish. Sea trout occur in some tributaries close to the coast.

Salmon and sea trout population facts

Population category: 7 (salmon and sea trout)
Reproduction area: 0 ha (salmon); No information (sea trout)
Production capacity: 0 (salmon); No information (sea trout)
Recent wild smolt production estimate: 0 (sea trout)

Fishing regulations in the River Indalsälven

Fishing is allowed May 15 – October 15. Minimum legal size for salmon is 50 cm and 40 cm for sea trout. There is a bag limit of three sea trout per angler per day, but no bag limit for salmon has been set.

Specific actions for the development of the salmonid populations

- The feasibility of establishing fish ways through the lowermost dams of the river must be investigated, although no salmon reproduction areas are probably left because of dams. Establishing fish ways in this river has lower priority than in other totally blocked salmon rivers in Sweden, e.g. rivers Ängermanälven, Ljusnan, Skellefteälven and Dalälven.
- Liming operations in the catchments needs to be continued.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Kalixälven

The River Kalixälven is a large salmon and sea trout river flowing to the Bothnian Bay. It has three main tributaries: Ängesån, Tärendöälven and Kaitumälven.

Basic hydrological facts (main river)

River length: 461 km of which 323 km accessible for salmonids
Size of catchment area: 18,130 km²
Average flow: 295 m³/s
Daily lowest flow: 32 m³/s
Number of migration hindrances: 2 (with fish ways)

Habitat and water quality in River Kalixälven

The River Kalixälven starts in the alpine regions of Kebnekaise and empties into the Bothnian Bay at the city of Kalix, about 460 km from its source. The catchment area is characterized by the alpine region and by large forested areas, and has a low population density. In its uppermost parts the river landscape is dominated by bare fjelds (13% of the catchment area) and mires (18% of the

catchment area). On the way to the outlet, the scenery gradually becomes dominated by forest (63% of the catchment area). 4% of the catchment area is covered by lakes.

The River Kalixälven is one of the four National Rivers in Sweden. This means that according to the Swedish Environmental Code, construction of power plants is prohibited in its catchment area. Kalixälven is hence one of the few unharnessed salmon rivers in the Baltic area.

The river was used for log driving until the end of 1970s. Log driving was especially intense in the tributary Ängesån, which is an important salmon reproduction area. Restoration work has been undertaken in parts of the main river and in Ängesån.

The lowest flow occurs just before the spring flood, from May to June, when the water flow usually peaks. Ice may clog the river locally and cause water levels to rise several meters. Nutrients and sediments enter the river mainly from point sources, forestry and peat mining. Agriculture is a minor source. The increased nutrient load may result in the growth of macro-vegetation, and could also possibly affect mid- and late summer conditions of salmon parr and spawners to some extent.

During high flows effluents from mining activities may end up in the river. The effluents may potentially negatively affect reproductive success of salmon. On the whole, however, the chemical and biological status of the river is good. There are two fish ways built at natural waterfalls, one at Jockfall and the other one at Linafallet. Salmon has always been able to pass Jockfall, but it has been a difficult passage. Thereby the productive area of the river for salmon has increased beyond natural barriers.

River Kalixälven and its tributaries according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a large forest river.

Ecological status: Good

Biological status: High

Physical & chemical status: Good (also tributaries)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures according to the water management plan are to continue and strengthen the actions to reduce nutrient load from forestry and municipal waste; to maintain and increase water pollution control in peat mining; and to restore riffles and rapids that have suffered from dredging due to timber floating.

Natura 2000

The main river and its tributaries belong to the Natura 2000 network.

The Kalixälven salmon stock

Electro-fishing surveys and counts in a fish ladder in Jockfall show that the salmon stock in this river is in a good state. The stock in this river is one of very few in the Baltic region that is expected to probably achieve at least 75 % of the potential production level in 2010.



Figure 3. Kalixälven and Råneälven.

Fishing regulations in the River Kalixälven

In the main river, the fishing season for salmon is January 1 – August 31. Minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon per fisher per day. There is no weekly closure for fishing in the river.

Sea trout fishing is forbidden during the period of September 15 – October 14. Minimum legal length for sea trout is 50 cm as of 2011. No bag limit for sea trout exists, but it will probably be implemented.

Fishing with gill nets, fish traps, long line, scissors and other such equipment is prohibited. Fishing with fine-mesh nets in lakes along the river is allowed for perch and whitefish. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 2,570 ha (including the tributaries) (salmon and sea trout)

Production capacity: 812,000 (salmon)

Recent wild smolt production estimate: 695,000 smolts (salmon); 1,250 (sea trout)

Specific actions for the development of the salmonid populations

The salmon stock of the river is in a good state and focus should be on maintaining the good habitat and fisheries management.

- A ban on sea trout fishing in the river would help the poor status of the trout population.
- Further river restoration efforts are required.
- The potential impact of mine effluents should be investigated.

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Kungsbackaån

The River Kungsbackaån is a small salmon and sea trout river in western Sweden flowing to Kattegat.

Basic hydrological facts

River length: 44 km of which 23 km accessible for salmonids

Size of catchment area: 301.9 km²

Average flow: 5 m³/s

Daily lowest flow: 0.12 m³/s

Number of migration hindrances: 2 (both contain a fish way)

Habitat and water quality in River Kungsbackaån

The river Kungsbackaån originates from several lakes in the forested mountain region in the western Sweden. From the elevation of approximately 150 m above the sea level, the river runs for 44 km to connect with the Kungsbackafjorden. The river flows through the valleys in a forest-dominated landscape (53% of the catchment area is forest), and is also surrounded by some

agricultural areas (11% of the catchment area). Lakes occupy 6% of the catchment area. The river Lillån is the main tributary of Kungsbackaån.

Water quality (excluding mercury and nutrients) of the River Kungsbackaån is good. The ecological status is only fair due to problems caused by eutrophication, acidification, and morphological changes. The upper parts of the catchment area are strongly acidified and extensive liming has been carried out since 1983. The lower parts of the river are affected by the nutrient load from agriculture. Migration hindrances, channelizing, dams, and morphological changes are a current problem to salmonids in the river Kungsbackaån.

Until recently salmon could migrate freely up to the dam at Ålgårdsbacka which presented a definite migration hindrance. Today a fish way has been constructed at Ålgårdsbacka, allowing salmon to migrate further upstream. Downstream of Ålgårdsbacka, at Alafors Mill, salmon may pass via a temporary fish way that was built in 1997. In 2010 the Alafors Mill was bought by the government and the dam will be removed. This will allow fish to pass the site freely.

The River Kungsbackaån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small forest river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to continue and strengthen actions to reduce nutrient load from agriculture; to increase buffer zones; restore wetlands, and to continue the liming operations.

Natura 2000

The river itself does not belong to the Natura 2000 network. But Kungsbackafjorden, where the river drains, is protected within the network.

The Kungsbackaån salmon stock

Kungsbackaån salmon was on the verge of extinction due to pollution and acidification in the mid-1950s. To compensate for this, stocking from the Rolfsån strain was conducted from 1983 to 1986. Thanks to the stockings, salmon has since then been annually caught in electro-fishing. The current salmon stock hence to some extent originates from the Rolfsån strain.

The reproduction area could be increased by 0.1 ha after habitat restoration. In 1999 the annual salmon production was estimated to be 5,150 smolts. The number could be increased to 6,250 if restoration measures are undertaken. Low water flow through Ålgårdsbacka and Alafors (according to water court decision) have limited smolt production previously.

Salmon population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 4.4 ha (salmon), 0.5 ha (sea trout)

Production capacity: 3,300 smolts (salmon)

Recent wild smolt production estimate: 1,200 (mean of 2005-2009) (salmon)

Fishing regulations in the River Kungsbackaån

Fishing season is from April 1 – September 30. Minimum legal size is 45 cm for salmon, and 45 cm for sea trout. Fishing is allowed from land only, and is limited to one rod per angler.

Specific actions for the development of the salmonid populations

The salmon sock in the Kungsbackaån is in need of recovery inspite of restoration work, new fish ways and liming operations. Continued and further actions are required.

- Liming must be continued, and perhaps increased
- An effective riparian protection zone should be established along agricultural lands by the river.
- Hitherto not restored salmon habitats should be restored.
- The hydrological situation needs improvement by restoration of wetlands and strict control of irrigation.
- The effect of fishing pressure in the river on the spawning stock may need to be investigated.

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Kågeälven

The River Kågeälven is a small salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 96 km of which 33.8 km accessible for salmonids

Size of catchment area: 909.3 km²

Average flow: 9.8 m³/s

Daily lowest flow: 0.7 m³/s

Number of migration hindrances: 4

Habitat and water quality in River Kågeälven

The river Kågeälven runs through a forest-dominated landscape (forest covers 83% of the catchment area). Mires and agriculture occupy 8.6% and 2.5% of the catchment area, respectively. 2.5% of the area is covered by lakes. There are two large waterfalls within the river, one at Storfallet (30 km up the river) and the other one at Slybergforsen. From the falls the river flows through a flat landscape and drains into the Bothnian Bay at Kåge population center.

There is a natural salmonid migration obstacle at the waterfall Storfallet preventing fish to ascend further upstream. There are no power stations in the river. Like most rivers in northern Sweden, the river Kågeälven was also used for timber floating purposes in the past, and its rapids and riffles have been cleared from stones and boulders. Restoration has been undertaken in the main stream.

The river water is affected by effluents coming from a mine in one of the tributaries. The effluents have caused the turbidity to increase and copper, lead and zinc levels to rise. However, the river

water quality (excluding mercury) is good, but the ecological status is only fair due to clearing for timber floating. Parts of the river have been restored but some work remains to be done.

River Kågeälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a small forest river.

Ecological status: Fair

Biological status: Fair

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to continue restoration of riffles and rapids that have suffered from dredging due to timber floating.

Natura 2000

The river does not belong to the Natura 2000 network.

River Kågeälven salmon and sea trout stocks

There is natural reproduction of both salmon and sea trout in the river although it has only been classified as a potential salmon river. Until and including 2004 there have been large continuous releases of reared fish as a part of a reintroduction program for salmonids. There have been no releases of fish since 2007. The salmon population is small. As a salmon generation has now passed since the last releases and there are signs of good annual reproduction of salmon, the river could be re-classified from “potential” to “wild” salmon river.

Salmon and sea trout population facts

Population category: 2 (salmon), 4 (sea trout)

Reproduction area: 38.6 ha (salmon and sea trout)

Production capacity: No information

Recent wild smolt production estimate: No information (salmon), 500 (sea trout)

Fishing regulations in the River Kågeälven

Fishing in the tributaries is banned. There is a closed season for angling from September 15 – October 14. Open fishing season for salmon starts on June 19 and continues until August 31. Any salmon caught outside this period must be released. Minimum legal length for salmon is 60 cm and 50 cm for sea trout. There is a bag limit of 1 salmon or sea trout per fisher per day. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

As stocking stopped in 2007 a wild salmon population is successively being established. This should be carefully monitored, whereas other actions may wait, especially since fishing is strictly regulated.

- The river bed habitat in tributaries should be checked to see if further restoration is required.

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Lagan

The River Lagan is a medium-sized salmon and sea trout river flowing to Kattegat.

Basic hydrological facts (main river)

River length: 232 km of which 9 km accessible for salmon

Size of catchment area: 6,451.8 km²

Average flow: 76.7 m³/s

Daily lowest flow: 0.4 m³/s

Number of migration hindrances: 31 (4 in the tributary Smedjeån contain a fish way)

Habitat and water quality in River Lagan

The River Lagan is the second largest river on the Swedish west coast after the Göta älv. Its main salmon tributary is Smedjeån. River Lagan springs from sources just south of the city of Jönköping, at an elevation of 337 m above the sea level. The catchment area is dominated by forest (60%) and agriculture land occupies 12% of the area. Lakes cover approximately 8% of the catchment area.

The river has been heavily exploited by commercial fisheries for a long time, and the history of salmon fishing in the river reaches far back.

There are rapids and waterfalls at Majenfors, Bassalt, Knäred, Skogaby, Karsefors and Laholm, which are all harnessed for hydropower production. Today salmon can ascend only 9 kilometres until the dams at Laholm. This stretch does not however contribute to the salmon production in the main stem, as all reproduction areas were lost with the construction of the Laholm power plant in 1932. In the tributary Smedjeån, salmon may today ascend 29 km until the mill at Oxhult. In order to get there they must pass four fish ways.

Water usage for irrigation during the low flow season impedes salmon reproduction and migration in Smedjeån. The salmon and sea trout populations suffer from the lack of established minimum flow in the main river and in Smedjeån. Also, Smedjeån is repeatedly dredged to maintain a straight channel in the lower part of the agricultural areas.

Water quality (excluding mercury) in the river is good while ecological status is only fair. The main river and tributaries are highly affected by acidification and extensive liming operations have been ongoing since the late 1970s. Smedjeån is affected by nutrient load from the surrounding farm land which can result in low oxygen levels.

River Lagan and its tributary according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair (Lagan); Good (Smedjeån)

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor (Lagan); Fair (Smedjeån)

No official water management plan is established, but probable main measures are to alter water regulation, restore salmonid habitats, continue liming operations, to establish a riparian buffer zone area and to stop channelization of the tributary Smedjeån.

Natura 2000

The river does not belong to the Natura 2000 network.

The Lagan salmon stock

The River Lagan harbours a natural self-sustaining population of salmon only in the tributary Smedjeån. The main river salmon stock is maintained by voluminous compensatory stocking of hatchery-reared smolts of the Lagan strain. Stocking has been ongoing since the 1930s. Each year almost 190,000 smolts are released according to a Water Court decision. Smolts are reared at fish farms within the river.

The salmon reproduction area in tributaries amounts to 8.8 ha which could be increased by 1.08 ha if necessary restoration measures are taken. High abundance of the ectoparasite *Gyrodactylus salaris* on salmon was found in 1997.

Salmon and sea trout population facts

Population category: 7 (main river), 4 (Smedjeån); 1 (sea trout)

Reproduction area: 0 ha (main river), 6.9 ha (Smedjeån), 1.9 ha (other tributaries) (salmon); 0.88 ha (sea trout)

Production capacity: 8,815 smolts (salmon)

Recent wild smolt production estimate: 5,200 (mean of 2005–2009) (salmon); 1,250 (sea trout)

Fishing regulations in the river Lagan

Open season for salmon and sea trout starts on March 1 and continues until October 14. There is a minimum legal size of 45 cm for both salmon and sea trout. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

As the main stem (Lagan) is totally blocked actions are to be taken in the tributary Smedjeån.

- Water use for irrigation should be reduced and wetlands restored to improve summer low flow.
- An effective riparian protection zone should be established along agricultural lands by the

- river.
- Liming should be continued, and eventually increased.
- Habitat restoration work should be undertaken.
- The continuous channelization of river Smedjeån for draining of agricultural areas should be phased out.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Ljungan

The river Ljungan is a large salmon and sea trout river flowing to the Bothnian Sea.

Basic hydrological facts

River length: 399 km of which 19 km accessible for salmonids
Size of catchment area: 12,851.1 km²
Average flow: 137.6 m³/s
Daily lowest flow: 19.1 m³/s
Number of migration hindrances: 22 (none contain a fish way)

River Ljungan habitat and water quality

The river Ljungan springs from the mountain regions in the county of Härjedalen and runs for 399 kilometres to the river mouth in the Bothnian Sea. The largest tributary in the river is Gimån. The catchment area is characterized by forest, mountains and mires, occupying 78%, 5% and 6% of the area, respectively. Lakes cover 7.5 % of the catchment area.

The river has been extensively harnessed for hydropower and there are a total of 14 power plants in the river. The river is protected from establishment of new power plants through the Swedish Environmental Code in the lower parts downstream from the power plant at Viforsen.

Even though heavily exploited for hydroelectric power salmon and sea trout reproduce in the lower parts of the river. Salmon may ascend 19 km from the mouth until the power plant at Viforsen, which presents a definite migration hindrance. Previously salmon reached far inland.

The water quality (excluding mercury) is rated as good, whereas the ecological status is classified as poor due to flow regulations and morphological changes. Parts of the river are affected by acidification and liming operations have been carried out. The river was used for timber floating and hence the riffles and rapids have been dredged. But today the river downstream of Viforsen is fully restored. Forestry and peat mining are the main sources of nutrients, humus and sediment load.



Figure 4. Rivers Ljungan and Indalsälven.

River Ljungan according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a large forest river.

Ecological status: Poor

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are continued liming operations; establishment of fish ways; improved water level regulation; i.e. avoidance of large unnatural flow variations.

Natura 2000

The main river upstream from Lake Storsjön belongs to the Natura 2000 network as well as the tributary Gimån upstream from Lake Holmsjön.

The Ljungan salmon stock

The salmon stock is genetically unique and considered to be self-sustaining. However, there have been annual stocking of 30,000 smolts of the original strain, but no releases have been made during the past ten years.

Due to water regulation, the discharge varies considerably, which affects the salmon population negatively. There are several hatcheries in the river, for rainbow trout and brown trout, but only two are located in the lower parts.

Salmon and sea trout population facts

Population category: 3 (salmon and sea trout)

Reproduction area: 17 ha (salmon); 8.8 ha (sea trout)

Production capacity: 1,000 smolts (salmon)

Recent wild smolt production estimate: 1,320 (salmon); 4,400 (sea trout)

Fishing regulations in the river Ljungan

Open season is January 1 – October 14. The minimum legal length for salmon is 50 cm and 40 cm for sea trout. There is a bag limit of 1 salmon per fisher per day. There is no weekly closure for fishing in the river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock is in good state and focus should be on maintaining the good habitat and fisheries management.

- Liming operations in tributaries should be continued.
- A minimum flow should be prescribed at each power plant and a common regulation plan must be implemented to lessen unnatural flow variations.
- The feasibility of establishing a fish way at Viforsen and upstream dams must be investigated.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Ljusnan

The River Ljusnan is a large former salmon and sea trout river flowing to the Bothnian Sea.

Basic hydrological facts

River length: 443 km of which 0.5 km accessible for salmonids

Size of catchment area: 19,828.1 km²

Average flow: 230 m³/s

Daily lowest flow: 28.61 m³/s

Number of migration hindrances: 21 (0 contain a fish way)

Habitat and water quality in River Ljusnan

The River Ljusnan springs from sources in the Scandinavian mountain range and runs for 443 kilometres to the river mouth in the Bothnian Sea. The largest tributary in the river is Voxnan. The upper part of the catchment area is characterized by mountains and mires, occupying 5% and 11% of the area respectively. As the river makes its way to the coast the nature surrounding it gradually changes into a forest-dominated landscape. 60% of the catchment area is covered by forest. Lakes make up for 5% of the area and the spring flood typically occurs in May.

The river has been extensively harnessed for hydroelectric power production and there are a total of 22 power plants in the main river and 11 in the tributary Voxnan. These power plants completely block salmon from reaching reproduction areas. According to a Water Court decision the owners of the power plants are obliged to release fish to maintain the population for commercial and recreational fishing purposes in the sea. Stocking of reared fish is done annually. The power plant, Ljusnefors, located at the river mouth lacks a fish way and therefore represents a definite migration hindrance for salmon and sea trout in the river. There is no prescribed minimum flow through the power plants except for Ljusnefors.

In the 1970s, the river was heavily affected by nutrients, humus and sediment load from forestry, peat mining and sewage. Since then water quality has improved a great deal and effluents from forestry have decreased by 95% which has resulted in increased oxygen-saturation in the river. There are several hatcheries and fish farms in the river which are a vital source of income to the area. The river was also used for timber floating in the past, and hence the riffles and rapids have been dredged. About 400 lakes in the upper catchment area have been subject to liming.

Water quality (excluding mercury) is rated as good whereas the ecological status is classified as poor due to flow regulations and morphological changes. The lower part of the river, thanks to lime-rich bedrock, is not affected by acidification.

River Ljusnan according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a large mountain river.

Ecological status: Poor

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measures are to establish fish ways in the lower parts, achieve increased/minimum flow through power plants; habitat restoration. Liming operations in the headwaters in the mountain range must continue.

Natura 2000

Parts of the main river (from Hede to Lake Svegsjön) and the tributary Voxnan belong to the Natura 2000 network.

The Ljusnan salmon and sea trout stocks

The River Ljusnan is considered to have no natural reproduction. With significant migratory hindrances the stock is dependent on large continuous releases of reared fish. The stocking material is of the Ljusnan-strain. According to a Water Court decision approximately 200,000 salmon and 50,000 sea trout smolts are released annually.

Salmon and sea trout population facts

Population category: 7 (salmon and sea trout)

Reproduction area: 0 ha (salmon), 0.5 ha (sea trout)

Production capacity: No information

Recent wild smolt production estimate: 0 (salmon and sea trout)

Fishing regulations in the River Ljusnan

Open season for salmon is from June 1 until August 31. Fishing for sea trout is allowed year round. Minimum legal length for salmon is 50 cm and 45 cm for sea trout. There is a bag limit of 3 fish per license. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

In a recent research project it has been suggested that the lower dams and power plants should be taken away, and instead the power plant at the upper limit of the salmon habitat should be improved allowing a larger proportion of flow to pass the turbines.

- If fish ways are established, also habitats should be restored to allow for reproduction of salmonids.
- The flow should be increased or a minimum flow should be set at the power plants.
- Liming is not required for salmon production today, but may be of importance if fish ways are constructed.

The recommendations in the general report of the HELCOM SALAR project concerning

accessibility and river fisheries management are applicable for this river.

The River Luleälven

The River Luleälven is a former salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 461 km of which 21 km accessible for salmonids

Size of catchment area: 25,263 km²

Average flow: 506.5 m³/s

Daily lowest flow: 63.17 m³/s

Number of migration hindrances: 47 (2 contain a fish way, but upstream of salmon region)

Habitat and water quality in River Luleälven

From the border of Sweden and Norway, the river Luleälven runs for about 460 km and enters the Bothnian Bay at the city of Luleå. The river bears the second largest amount of water in Sweden after Göta älv. The largest tributaries of Luleälven are Lilla Luleälven, Vietasättno and Bodträskån.

Luleälven is heavily harnessed for hydroelectric purposes. There are a total of 15 hydroelectric power plants and 32 reservoirs in the river. There are about 190 dams in the river; most of them are remains from the log driving era. 14 migration hindrances are regarded as definite. Today salmon can only migrate to the first dam at the city of Boden, 21 km from the sea. There are some fish ways in the catchment upstream, but beyond the reach of salmon and sea trout.

Today the hydropower dams have drowned upstream areas of salmon habitat. Like most Swedish rivers, Luleälven was used for log driving and hence its riffles and rapids have been dredged and cleared from stones and boulders.

Parts of the catchment area are occupied by large scale and intense forestry. Forestry activities bring nutrients, humus and sediment to the river. Nutrients and pollutants also reach the river from the iron and steel industry, sawmills, the municipal sewage treatment plants and fish farming. However, because the catchment area is sparsely populated in the upper–middle part of the river, the load from sewage is minute in these areas.

Water quality in the river is good, but the ecological status is classified as poor.

River Luleälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a large mountain river.

Ecological status: Poor

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measures are to allow anadromous fish to pass the lowermost dams (today these dams are blocking access to the river); and to restore tributaries with running water sections.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Luleälven salmon stock

There is no wild production of salmon in Luleälven anymore. The stock is maintained as reared, with the brood stock annually sampled from returning spawners. 525,404 reared smolts were released in the river in 2009.

Salmon and sea trout population facts

Population category: 7 (salmon and sea trout)

Reproduction area: 0 ha (salmon and sea trout)

Production capacity: No information

Recent wild smolt production estimate: 0 (salmon and sea trout)

Fishing regulations in the River Luleälven

Sport fishing is allowed all year. Legal size is 55 cm for salmon and 50 cm for trout. No bag limit exists as fish are stocked.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility are applicable for this river.

- The feasibility of establishing fish ways through the lowermost dams of the river must be investigated.
- If fish ways are established, also habitats should be restored to allow for reproduction.
- The flow should be increased or a minimum flow should be set at the power plants.

The River Löftaån

The River Löftaån is a small salmon and sea trout river flowing to the Kattegat.

Basic hydrological facts

River length: 31 km of which 15 km accessible for salmonids

Size of catchment area: 309 km²

Average flow: 2.3 m³/s

Daily lowest flow: 0.05 m³/s

Number of migration hindrances: 2(1 contains a fish way)

Habitat and water quality in River Löftaån

The River Löftaån starts from three source lakes, Lakes Skärsjön, Store Rammsjö and Lövsjö, located at an elevation from 70 to 100 m above the sea level. The river runs through its course in a south-western direction and empties into Kattegat. The landscape of the catchment area is dominated by forest (36%) and agriculture (26%). Lakes cover only 2% of the catchment area.

There is an area with rapids and riffles at Håfors, approximately 15 km upstream from the mouth. This area is a definite migration hindrance for salmon and sea trout. There is no hydropower production in the river anymore. Previously there was a power plant at Stuv that gained a fish way in 1992 to allow passage of ascending fish.

The upper parts of the river are affected by acidification and extensive liming operations have been taking place since 1991 in Lake Store Rammsjö. Water quality (excluding mercury) is good within the river. Ecological status is only fair due to problems with eutrophication.

River Löftaån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Fair

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are that the water quality should be improved by decreasing nutrient and sediment load from agriculture, preferably by proper buffer zones along the river; liming operations should be continued; buffer zones to provide shade, leaf litter and large woody debris should be increased. Wetlands should be restored to improve the summer flow situation.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Löftaån salmon stock

Electro-fishing results show that the river harbours high densities of salmon parr despite an abundance of pike and eel. It is however unclear whether or not this river has held a unique salmon strain earlier. This river is regarded to be almost too small to harbour a viable salmon population with the prevailing declination (slope) of 0.13%. During dry summers the salmon population suffers from low discharge and warm water.

There is evidence of the occurrence of the ectoparasite *Gyrodactylus salaris*.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 1 ha (salmon)

Production capacity: 6,000 smolts (salmon)

Recent wild smolt production estimate: 250 (mean of 2005-2009) (salmon)

Fishing regulations in the River Löftaån

According to national legislation minimum size of salmon and sea trout in rivers of the Kattegatt region is 45 cm. There is no fishing of salmon in the river. Fishing for sea trout is considered good. There is a small protected area in the sea just outside the river mouth. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock in Löftaån is in need of recovery and actions are urgently required.

- Wetlands should be restored to improve the summer flow situation.
- An effective protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture. This riparian zone should also provide shade.
- Liming should be continued.

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Lögdeälven

The River Lögdeälven is a medium-sized salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 204 km of which 100 km accessible for salmonids

Size of catchment area: 1,602.2 km²

Average flow: 18.5 m³/s

Daily lowest flow: 1.7 m³/s

Number of migration hindrances: 0

Habitat and water quality in River Lögdeälven

The River Lögdeälven originates 526 m above the sea level and runs for 204 kilometres to the river mouth at Nordmalingsfjärden where it enters the Bothnian Bay. The river is considered as a typical forest river, forest occupying 82% of the catchment area. Mires and lakes cover 12.5% and 3.8% of the area, respectively. Agriculture is practiced in approximately 1% of the catchment area and it is concentrated to the lower part near the coast. Lögdeälven is one of the few salmon rivers in the Baltic Sea area with no hydropower production, and it is protected from construction of power stations through the Swedish Environmental Code.

Riffles and rapids were dredged for timber floating in the past but have been partly restored to improve reproduction success of fish species utilising these habitats. There is a natural migration hindrance for salmonids at the waterfall Fällforsen that is located 45 kilometres upstream from the river mouth. In 1992 a fish way was constructed at the waterfall, and today salmon and sea trout ascend as far as to the lake Storlögdasjön, which makes 100 kilometres of the river accessible for the fish. Fish could in fact migrate upstream of the lake as no migration obstacles exist. Supplemental stocking has been done upstream of the Fällforsen waterfall in the past.

Both water quality (excluding mercury) and the ecological status are rated as good. The river is partly affected by acid precipitation and liming has been carried out to counteract acidification.

River Lögdeälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are continued liming operations; and restoration of riffles and rapids from dredging due to timber floating.

Natura 2000

The whole river system belongs to the Natura 2000 network.

The Lögdeälven salmon and sea trout stocks

The river holds wild self-sustaining stocks of both salmon and sea trout. The salmon stock is genetically unique. Sea trout reproduces also in the tributaries in the lower part of the river.

Salmon and sea trout population facts

Population category: 3 (salmon and sea trout)

Reproduction area: 104 ha (salmon); 95 ha (sea trout)

Production capacity: 15,000 smolts (salmon)

Recent wild smolt production estimate: 10,000 (salmon); 500 (sea trout)

Fishing regulations in the River Lögdeälven

Open season is from January 1 to April 30 and from June 19 to August 31. The Minimum legal length for salmon is 50 cm and 40 cm for sea trout. There is a bag limit of 1 salmon per fisher per day. There is no weekly closure for fishing in the river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

- Liming of tributaries and lakes in the catchment area should be continued
- Further restoration is required of reproduction areas cleared for timber floating purposes.

The River Moälven

The River Moälven is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Sea.

Basic hydrological facts (main river)

River length: 135 km of which 28 km are accessible for salmonids

Size of catchment area: 2,307 km²

Average flow: 26 m³/s

Daily lowest flow: 2.3 m³/s

Number of migration hindrances: 5 (2 contain a fish way)

Habitat and water quality in River Moälven

The River Moälven is considered a natural river system and has, only marginally, been harnessed for hydropower production. But, the main river has a definitive migration obstacle at the dam at Edet. Downstream of this dam 4 km of the main river is left without water. The main tributary is river Södra Anundsjöån. The river runs through a forest dominated landscape to the Bothnian Sea at the city of Örnsköldsvik. The catchment area is occupied mainly by forest (80.5% of the area). Agriculture (2.3% of the catchment area) is concentrated to the lower parts of the river, and lakes cover 4% of the catchment area.

There are a total of three hydropower plants in the river system. In the tributary Södra Anundsjöån salmon may only migrate 2 kilometres until the power plant at Sörflärke. The river has also been used for log driving and large stretches of it have been cleared of boulders and stones. Liming has been started in the river due to acidification. Extensive restoration of the river bed has been undertaken.

Water quality is good within the entire system. In the main stem the ecological status is poor at the reproduction sites and fair close to the river mouth. In the tributary Södra Anundsjöån the ecological status is fair close to the river outlet but varies from poor to fair at the main reproduction areas.

River Moälven and its tributary according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Poor/Fair (Moälven); Fair/Poor–Fair (Södra Anundsjöan).

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to restore riffles and rapids from dredging due to timber floating, to continue liming operations and investigate feasibility of establishing new fishways.

Natura 2000

The main river belongs to the Natura 2000 network.

The Moälven salmon stock

The river harbours a weak salmon population. The river is considered to have possibilities for natural reproduction and potential of becoming self-sustaining. However, as reproduction area in the river is small, natural reproduction is low.

The stock is not considered self-sustaining and salmon of the Lögde-strain are released yearly according to a Water Court decision. In the 1990s, salmon from the River Byskeälven was released into the Moälven, but only to a minor extent. Extensive restoration efforts have been made during 2006–2009 through an EU Life-project.

Salmon population facts

Population category: 6

Reproduction area: 6–8 ha

Production capacity: 1,800–4,800 smolts

Recent wild smolt production estimate: No information

Fishing regulations in the River Moälven

Fishing for salmon and sea trout is allowed from January 1 – August 30. The minimum legal size is 50 cm for both species. There is a bag limit of one salmon or sea trout per angler per day. Gillnetting in the river is banned. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The feasibility of constructing a fish way at Edet (Norra Anundsjöån) should be evaluated. Large reproduction areas would then be accessible for salmon, as well as the long stretch of dry river bed below the dam.

- Restoration of cleared stretches that are possible reproduction areas should commence.
- Liming should be continued.

The River Mörrumsån

The River Mörrumsån is a medium-sized salmon and sea trout river flowing to the Baltic Proper.

Basic hydrological facts

River length: 186 km of which 31 km accessible for salmonids
 Size of catchment area: 3,369.1 km²
 Average flow: 27.5 m³/s
 Daily lowest flow: 5.3 m³/s
 Number of migration hindrances: 35 (5 contain a fish way)

Habitat and water quality in River Mörrumsån

The River Mörrumsån is one of the major rivers in southern Sweden and springs from sources in the counties of Jönköping and Kronoberg. Lake Vrånge, 286 m above the sea level, is considered to be the central headwater lake from which the river flows for 186 km until Mörrum where it enters the Baltic Proper. On its way to the sea the river passes through several large lakes, for instance Lake Helgasjön and Lake Åsnen situated at approximately 100–200 m above the sea level.

The catchment area is characterized by pine forest and mires in its upper part while the lower part is dominated by cultivated plains and deciduous forest. Forest occupies as much as 64% of the catchment area whereas agricultural land, mires and lakes make up for 11%, 2.5% and 7.4% of it, respectively. Agriculture is concentrated on areas around the lakes, plains and valleys. The river holds several natural rapid areas unharnessed for power production.

The river is used for hydropower production and there are a total of 24 power plants in the river system. Four power plants are situated in the main river in areas with salmon reproduction. The catchment area is protected from construction of new power plants through the Swedish Environmental Code. The first power plants were constructed in the beginning of the 20th century and many lakes and parts of the river were dammed. The catchment area has been subject to draining and lake lowering for the benefit of agriculture and forestry. This has led to large fluctuations in the water bearing which has a negative impact on the salmon and sea trout populations. The river has also been used for log driving and has for that purpose been subject to clearing of boulders and debris. The water is also affected by nutrient load from agriculture and sewage as well as by effluents from forestry.

Restoration work has been undertaken to improve water and habitat quality, for instance in the form of construction of sewage treatment plants, improved flow regulation and construction of fish ways. Thanks to the new fish ways, salmon may migrate as far as to the power plant at Fridafors.

Both chemical status (excluding mercury) and ecological status are good. Acidification is strong in the upper part of the catchment area and in tributaries in the lower part, and extensive liming has been carried out in lakes and wetlands connected to the main river and in the tributaries.

River Mörrumsån according to the Water Framework Directive

The name of the water management district is Southern Baltic Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures in the water management plan are to continue and strengthen actions to reduce nutrient load from agriculture, forestry and municipal waste and to continue liming. Efforts to reduce pesticides are also required in certain areas of the catchment.

Natura 2000

The main river belongs to the Natura 2000 network.

The Mörrumsån salmon and sea trout stocks

The river harbours wild self-sustaining stocks of both salmon and sea trout. Improving the river habitat for salmon reproduction may increase the productivity through increased survival of eggs and juveniles. Since 2004, when two new fish ways were installed to allow ascending salmon and sea trout to pass the power plants at Hemsjö, the suitable reproduction areas have increased by 50 %.

The salmon stock has been subject to stocking of hatchery reared individuals of the original strain in the past (until 1993). The production of both salmon and sea trout has been impaired in the later years, without the exact cause being known.

River Mörrum is proposed as a salmon Index river and work has begun with establishing a smolt trap at Marieberg dam. At Marieberg ascending spawners have been counted already for many years.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 66 ha (salmon and sea trout)

Production capacity: 80,000 smolts (salmon)

Recent wild smolt production estimate: 46,000 (salmon); 15,000 (sea trout)

Fishing regulations in the River Mörrumsån

The open season is from March 1 to September 30. The minimum legal length for salmon is 50 cm. There is no weekly closure for fishing in the river. Recreational fishing is allowed only with fishing license. Using worm as bait is prohibited. Net fishing is not allowed. A rule has been introduced that requires salmonids that are hooked outside the mouth to be released. There is a large protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The cause of the decrease in number of spawners must be investigated.
- The water quality should be improved by decreasing nutrient and sediment load from forestry, agriculture and sewage.
- An effective riparian protection zone should be established along agricultural lands by the river.
- Summer low flow conditions must be improved by restoration of wetlands, e.g. filling old, unnecessary ditches. New draining activities in the catchment area must be prevented.
- Liming must commence.
- Down-stream passage of smolts and kelts must be improved at power plants.

The River Nissan

The River Nissan with its tributary Sennan is a medium-sized salmon and sea trout river flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 186 km of which 22 km accessible for salmonids

Size of catchment area: 2,685.7km²

Average flow: 41 m³/s

Daily lowest flow: 1.71 m³/s

Number of migration hindrances: 14 (4 contain a fish way)

Habitat and water quality in River Nissan

The River Nissan starts from a mire-rich region northwest of the town of Jönköping and runs for almost 200 km and drains into Laholmsbukten at the town of Halmstad. Its main salmon tributary is Sennan. The catchment area is dominated by forest and mires, occupying 72 % and 9 % of the area, respectively. As the river runs towards the sea, agriculture becomes more widespread. It covers a total of 8 % of the catchment area. Lakes make up for 4.5 % of the area. The tributary Sennan connects to the main river 15 km from the outlet to the sea.

The river is heavily harnessed for hydropower production and there are a total of 14 power plants within the river. Salmon used to be able to migrate freely for 110 km up to a natural migration hindrance at Nissafors. Today, salmon may ascend only 22 km until the power plant at Oskarsström. The 10 km-stretch between Oskarsström and Åled is today the only section considered suitable for salmon reproduction. The power plants Slottsmöllan and Sperlingsholm, located downstream from Oskarsström, are equipped with fish ways. In the tributary Sennan there are two fish ways, one at Sennerdal and the other one at the Årnilt mill.

Both the chemical and the ecological status are rated as good but habitat quality is only fair due to channelling and water regulation. Acidification is strong throughout the entire river and extensive liming operations are ongoing in the main river since the 1970s and in Sennan since 1984.

River Nissan and its tributaries according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures in the water management plan are restoration to establish spawning habitat and continued liming operations. Further, load from upstream paper mills and communities must be reduced.

Natura 2000

The river does not belong to the Natura 2000 network.

The Nissan/Sennan salmon stock

Prior to hydropower exploitation the annual smolt production was estimated to be about 50,000. The combination of water regulation, industrial pollution and waste from urban communities drove the salmon population extinct in around 1920. Thanks to the construction of sewage treatment plants, liming and large releases of hatchery reared fish, the river has now resurrected as a salmon river.

The original strain is extinct and replaced by salmon mostly of other origin. Releases of salmon started in 1979 and salmon from rivers Lagan, Fylleån, Ätran and Rolfsån have been used. The total reproduction area for salmon and sea trout amounts to 13.2 hectares and could be increased to 16.9 hectares if restoration measures were undertaken. There are at least two rainbow trout farms in the river. The salmon population is stressed by the occurrence of the ectoparasite *Gyrodactylus salaris*.

Salmon and sea trout population facts

Population category: 5 (Nissan), 1 (Sennan) (salmon); 1 (sea trout)

Reproduction area: 10.9 ha (salmon), 4.8 ha (sea trout)

Production capacity: 8,175 (salmon)

Recent wild smolt production estimate: 2,600 (mean of 2005-2009) (salmon); 1,500 (sea trout)

Fishing regulations in the River Nissan

The fishing season is from March 1 – September 30. Minimum legal size for salmon and sea trout is 45. There is a bag limit of three salmon per angler per day. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of Nissan is in need of recovery inspite of restoration work, improved fish ways and liming operations Continued and further actions are required.

- Spawning habitats should be restored in the main river.

- Liming should be continued, and possibly increased.
- The function of the fish ways in the main river may need further improvement.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Piteälven

The River Piteälven is a large salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts (main river)

River length: 402 km of which 85 km accessible for salmonids
 Size of catchment area: 11,285 km²
 Average flow: 168 m³/s
 Daily lowest flow: 27 m³/s
 Number of migration hindrances: 3 (2 contain a fish way)

Habitat and water quality in River Piteälven

The River Piteälven springs from two large lakes, Mavasjaure and Pieskehaure, in the alpine region of southern Lapland near the Norwegian border. Its main salmon tributary is Varjisån. On its journey to the Bothnian Bay, the river Piteälven runs through several large lakes, e.g. Tjeggelvas and Vuolvojaure, and empties into the Svenbyfjärden Bay near Piteå. The catchment area is dominated by forest (68%). Lakes, mires and mountains occupy 7.5%, 9% and 14% of the area, respectively. The spring flood occurs in May-June. The strong and intense spring flood makes a distinct impression on the vegetation where herbs and grasses dominate the banks rather than shrubs and trees.

The river can be divided into three different regions. The uppermost stretch from Mavasjaure until Lake Tjeggelvas is a pure mountain region river. Between Lake Tjeggelvas and Storforsen the river changes into a forest river. The last stretch from Storforsen to the municipality of Piteå at the Bothnian Bay is regarded as a coastal river. There are relatively few tributaries in the river, of which Varjisån and Abmoälven are among the largest.

The first migration obstacle is at Sikfors. The Sikfors power station, 40 km from the river mouth, was built in 1911 and is still in operation. There is a fish way at this location, and in 1998 also a fish counter was installed. 38 km above Sikfors a natural migration obstacle in the form of a waterfall at Fällfors had a fish way built in the 1970s. The rapids of Storforsen, 85 km from the river mouth, represent a natural migration hindrance. Here fish may ascend further in the river system through the tributary Varjisån. The River Piteälven is one of four National Rivers in Sweden and hence the catchment area of the river is protected from construction of new power stations through the Swedish Environmental Code.

The river is affected by anthropogenic disturbances mainly through the clearing and channelling of streams for forestry purposes. The river was used for log driving until 1979 and although extensive restoration has been undertaken, large parts of the river remain yet to be restored.

The water quality (excluding mercury) is rated as good both in Piteälven and Varjisån whereas the ecological status is rated as fair. To obtain higher ecological rating further restoration of potential salmon habitat is needed.

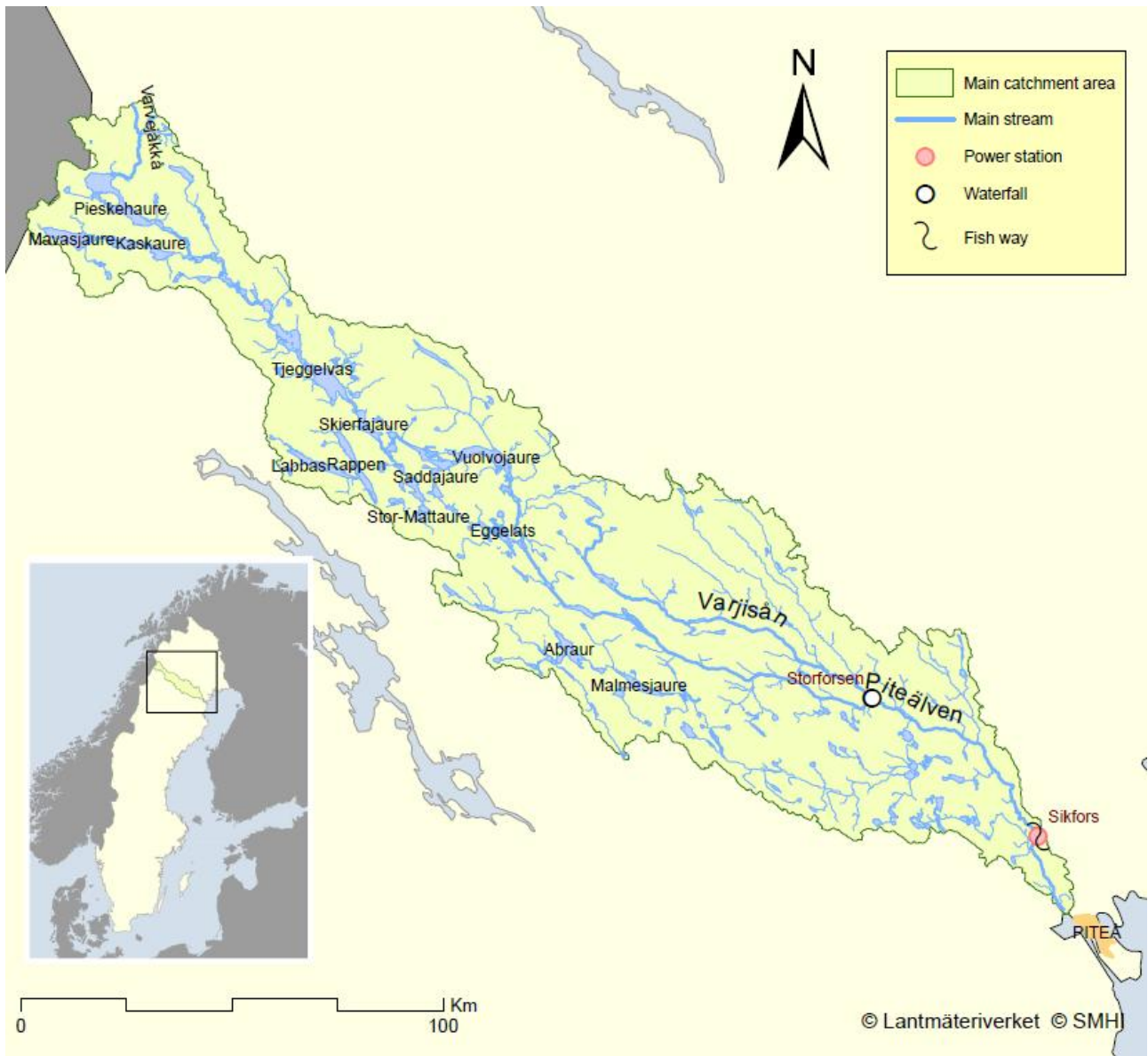


Figure 5. River Piteälven

River Piteälven and its tributary according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a large forest river.

Ecological status: Fair

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measures are to continue the restoration of riffles and rapids from dredging due to timber floating and to improve downstream migration survival in passing the Sikfors power plant.

Natura 2000

The main river belongs to the Natura 2000 network.

The Piteälven salmon and sea trout stocks

The River Piteälven with the tributary Varjisån hold natural reproducing wild strains of both salmon and sea trout. No releases have been made in the river during the past seven years. Mortality at the passing downstream of the power plant has, through tagging experiments, been estimated to be approximately 20 % for both salmon and sea trout.

Sea trout migrate far up the tributary Varjisån to reproduce.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 452 ha (salmon)

Production capacity: No information

Recent wild smolt production estimate: 30,000 (salmon); 1,000 (sea trout)

Fishing regulations in the River Piteälven

The open season is from June 19 – August 31 in the main river. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon or sea trout per fisher per day. There is no weekly closure for fishing in the river. Gillnetting is not allowed for salmon and trout, and may only be carried out in lakes along the main river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of Piteälven is in good state and focus should be on maintaining the good habitat and fisheries management. The restoration of the river bed should be continued.

- Down-stream passage of smolts and kelts must be improved at Sikfors power plant.
- Fishing of sea trout may need to decrease in the river.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Rickleån

The River Rickleån is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts (main river)

River length: 147 km of which 41 accessible for salmonids
Size of catchment area: 1,649 km²
Average flow: 16 m³/s
Daily lowest flow: 2.7 m³/s
Number of migration hindrances: 8

Habitat and water quality in River Rickleån

The River Rickleån flows into the Bothnian Bay approximately 50 km north of the town of Umeå, Sweden. The river runs through a landscape dominated by forest, mostly spruce and pine, (74.8% of the catchment area). Lakes and mires occupy 8.9% and 10.2%, respectively, of the catchment area. The river itself consists of three tributaries, Sikån, Risån and Tallån emptying into Lake Bygdeträsket, regulated by a dam. From here, the Rickleån proper flows to the sea, with five power stations along its course.

In addition to being regulated, this system suffers from a previous anthropogenic disturbance with heavy metal pollution in its lower reaches. As a result of the steep gradient, the river has little floodplain and a minimum of sinuosity in the upper parts, but a high sinuosity close to the sea. Previously, salmon could not ascend further upstream than the power plant at Robertsfors, 15 km from the mouth, but during 2002 three fish ways opened and doubled the available reproduction area for salmon.

The upper parts of the river have been dredged for timber floating. No modifications, for timber floating purposes, have been made in the lower parts of the river where timber instead was loaded onto trains for transport to the sea. Hence, the lowermost portion of river Rickleån has a high habitat quality.

Both water quality (excluding mercury) and the ecological status are rated as good. Parts of the river are affected by acid precipitation and liming has been carried out with the purpose of reducing acidification.

River Rickleån according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to continue restoration of riffles and rapids from dredging due to timber floating. Also monitoring the effectiveness of the new fish ways and improving survival of downstream migrating fish passing the power plants are necessary.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Rickleån salmon stock

The salmon almost disappeared from the river at two points during the 20th century due to heavy metal pollution. The river holds a weak, but increasing, population that has been supplemented by stocking. No releases have been carried out in the past 10 years.

Production estimates from the 1990s was lower than 1,000 smolts per year. The production has increased since the construction of fish ways at Robertsfors.

Salmon population facts

Population category: 3 (salmon), 4 (sea trout)

Reproduction area: 15 ha (salmon), 30 ha (sea trout)

Production capacity: 6,000 smolts (salmon)

Recent wild smolt production estimate: 600 (salmon); 1,000 (sea trout)

Fishing regulations in the River Rickleån

The open season for salmon is from June 19 – August 31. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon or trout per fisher per day. There is no weekly closure for fishing in the river. Gillnetting is not allowed for salmon and trout, and may only be carried out in lakes along the main river. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

River Rickleån salmon stock is in need of urgent actions for its recovery.

- Restoration of riffles and rapids upstream of Robertsfors should be continued.
- Down-stream passage of smolts and kelts must be improved at power plants.
- Water regulation at power plants and dams needs to be improved in order to avoid short-time variations.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Rolfsån

The River Rolfsån is a small salmon and sea trout river in south western Sweden flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 91 km of which 10 km accessible for salmonids

Size of catchment area: 694 km²

Average flow: 12 m³/s

Daily lowest flow: 0.16 m³/s

Number of migration hindrances: 10 (at least 2 contain a fish way)

Habitat and water quality in River Rolfsån

The Rolfsån river system flows into Kungsbackafjorden in Kattegat. Its catchment area is dominated by forest (67%), and agricultural land covers 11% of it. The Rolfsån flows through farmland and has areas with rapids and fast flowing waters. Lakes occupy 8% of the catchment area, and lake Lygnern (3,276 ha) makes up for a half of this 8%.

The Rolfsån river system is dominated by river Storån (comprising the tributaries Nolån and Sörån). The river Rolfsån is actually only the lowest 9 kilometres of the river.

There are a total of 10 power plants in the river which affect the salmon and sea trout populations negatively. Prior to 1918 salmon was able to migrate freely but with the construction of the power plant at Ålgårda (10 km from the river mouth) salmon was deprived of the possibility to migrate to spawning grounds further up the river. The utilization of water for power production has, in addition to flooded spawning areas, led to irregular water flow which may harm salmon and sea trout populations in the river.

Only the lowest 10 km is available for salmon (to the power plant at Ålgårda) and no more than 3.5 km is considered suitable as reproduction area. Above Ålgårda new fish ways have been built; a dam at Bosgården was demolished and a new fish passage was built there in 2009. Also, a new fish way was constructed at Apelnäs. This means that when a fish way will be established at Ålgårda, salmon and sea trout will be able to more than double their reproduction areas.

Both the chemical status (excluding mercury) and the ecological status is rated as good. Acidification is strong in the upper parts of the catchment area and extensive liming has been carried out since 1978.

River Rolfsån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to construct fish ways at power plants and the demolition of dams that are not in use. Also, continued liming actions and habitat restoration are needed, as well as stopping the clearing of debris (LWD in-stream). Also an increase in minimum water flow at two of the power plants is necessary.

Natura 2000

The main river does not belong to the Natura 2000 network, but Kungsbackafjorden (into which the river drains) does.

The Rolfsån salmon stock

The salmon stock in Rolfsån is genetically unique and is considered worth preserving. The strain is unaffected by elements of exogenous genes and the river is protected from introduction of other strains.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 3.1 ha (salmon and sea trout)

Production capacity: 3,100 smolts (salmon)

Recent wild smolt production estimate: 2,000 (mean of 2005-2009) (salmon)

The salmon and sea trout stocks were at a high level in the 19th century but with the construction of power plants stocks drastically decreased. Since then efforts have been made to strengthen stocks by the means of construction of fish ways and habitat restoration. The salmon population is in addition threatened by acidification and eutrophication. Salmon is also affected by gill net fisheries in the lower parts of Rolfsån.

Suitable reproduction areas amount to only 3.1 ha and could be increased by substantially if a fish way is built at Ålgårda. In 2008 twelve adult salmon were released in Storån and electrofishing has shown that these individuals were able to reproduce. Also in 2009 spawners were moved to Storån, above the migration stop at Ålgårda.

Fishing regulations in the River Rolfsån

The minimum legal size for salmon and sea trout is 45 cm. Fishing for salmon and sea trout is prohibited in Kungsbackafjorden, an estuary area shared with the river Kungsbackaån. Rolfsån is the only salmon river on the Swedish west coast with gillnet fishing for salmon and trout.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Work is in progress to allow passage of trout and salmon at Ålgårda.
- Liming should be continued, and eventually increased.
- Fishing with gillnets in the river should be stopped until the salmon population has recovered.

The River Råneälven

The River Råneälven is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts (main river)

River length: 217 km totally accessible for salmonids

Size of catchment area: 4,207 km²

Average flow: 44.2 m³/s

Daily lowest flow: 7.8 m³/s

Number of migration hindrances: 14 in the catchment (0 contain a fish way)

Habitat and water quality in River Råneälven

The river is greatly diversified: the upper part flows calmly through the landscape with the surrounding areas dominated by wetlands, and the middle part of the river is characterized by strong currents, rapids and riffles. The lower portion of the river flows through a flat landscape dominated by large lakes connected by shorter rapids. The spring flood, which occurs during the first half of May, is in the upper parts of Råneälven remarkably intense as a result of the absence of lakes. The intensity in the spring flood makes a distinct impression on the vegetation where herbs and grasses dominate rather than shrubs and trees. The catchment area is dominated by forest (71%) and mires (24%). Lakes occupy 3.5% of the catchment area.

The river is unexploited for hydropower purposes. Riffles and rapids were used for timber floating up until 1965. Extensive restoration works have been undertaken in parts of the river since the midst of the 1990s to improve reproduction success of fish species utilising these habitats. However, large parts of the river remain to be restored. Major parts of the river are affected by increased loads of sediment, humus and nutrients from extensive forestry in the area. 38% of all culverts in the catchment area, in tributaries, are regarded as migration hindrances.

The water quality (excluding mercury) is rated as good whereas the ecological status is rated as fair. To obtain higher ecological rating further restoration of potential salmon habitats is needed.

River Råneälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to start actions to reduce humus and nutrient load from forestry, replace or modify all culverts regarded as migration hindrances, in the area. There are also continued efforts to restore riffles and rapids from dredging due to timber floating.

Natura 2000

The main river belongs to the Natura 2000 network.

The Råneälven salmon stock

Råneälven harbours a weak wild salmon population. During the past years there has, however, been a tendency towards a stronger population.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 384 ha (salmon and sea trout)

Production capacity: 29,000 smolts (salmon)

Recent wild smolt production estimate: 34,000 (salmon); 1,000 (sea trout)

Fishing regulations in the River Råneälven

The open season starts on June 19. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon per fisher per day. There is no weekly closure of fishing in the river. Gillnetting is not allowed for salmon and trout, and may only be carried out in lakes along the main river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of the river is in good state and focus should be on maintaining the good habitat and fisheries management.

- By establishing riparian buffer zones humus and nutrient load from forestry could be reduced.
- Large areas of riffles and rapids should be restored.
- Fishing of sea trout may need to decrease in the river.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Rönne å

The River Rönne å with its tributaries Pinnån, Bäljane å, Käglean and Rössjöholmsån is a small salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 114 km of which 38 km accessible for salmonids

Size of catchment area: 1,897 km²

Average flow: 23.5 m³/s

Daily lowest flow: 1.2 m³/s

Number of migration hindrances: 14 (0 contain a fish way in main river)

Habitat and water quality in River Rönne å and its tributaries

The river Rönne å springs from Lakes Östra Ringsjön, Västra Ringsjön and Sätöftasjön 53 metres above the sea level and 83 kilometres from the coast, and drains into Skälderviken at the city of Ängelholm. The river flows through a diverse landscape where the upper part is dominated by forest and the lower part is characterized by agriculture land. The middle parts hold both forest and agricultural land. Forest and agriculture occupy 45 % and 32.5 % of the catchment area, respectively. Lakes cover only 3.5 % of the drainage basin. The tributaries are all characterized by forest in the upper part and agricultural land in the lower part of the catchment area.

The river is harnessed for hydropower production and there are a total of three power plants in the main river located upstream of the tributaries. The utilization of water for power production and for the extensive irrigation has a negative impact on the salmon and sea trout populations in the river. The water is also affected by nutrient load from agriculture, private sewage drains and humus from forests.

Salmon used to be able to migrate 40 km from the mouth to Herrevad kloster (monastery), but today there is a definite migration hindrance in the main stem at the dam at Stackarp/Klippan, 38 km from the coast. Salmon may migrate freely throughout the entire Rössjöholmsån and Bäljane å, but in the tributary Pinnån salmon may not ascend further than 15 kilometres.

Water quality (excluding mercury) is classified as good and the ecological status is rated as poor in Rönne å, fair in the tributaries Pinnån and Bäljane å, and good in Rössjöholmsån. The fair and poor status is given due to problems with eutrophication, continuity, morphological changes and flow regulation. Most areas are unaffected by acidification, but some areas in the upper part of the river system are, and liming in these areas is ongoing.



Figure 6. Rivers Nissan, Fylleån, Genevadsån, Smedjeån, Stensån, Sännan and Rönne å.

River Rönne å with its tributaries according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Poor (Rönne å), Fair (Pinnån), Fair (Bäljane å) and Good (Rössjöholmsån)

Biological status: Good–Poor

Physical & chemical status: Good (excluding mercury) (the entire river system)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to continue and strengthen actions to reduce nutrient load from agriculture, forestry and private sewage drains. There are also actions to remove migration hindrances, to restore salmon habitats, to prevent extreme low flow and to continue liming.

Natura 2000

The catchment area holds a total of four Natura 2000 areas protected for its freshwater values.

The Rönne å salmon stock

The river holds unique strains of salmon and sea trout and the stocks of both species are considered to be self-sustaining. However, salmon of the Lagan strain has been introduced and genetic analysis should be conducted in order to establish the level of genetic introgression.

There are 27 ha of habitat suitable for salmon reproduction which could be increased by 2–4 ha with the elimination of existing migration hindrances in the main stem. Fish farms for rearing of rainbow trout exist upstream from the migration hindrance in Pinnån.

A high abundance of the ectoparasite *Gyrodactylus salaris* was found in salmon in 1997.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 0.5 ha in main river, 27 ha in the entire system (salmon and sea trout)

Production capacity: 27,000smolts (salmon)

Recent wild smolt production estimate: 9,500 (mean of 2005–2009) (salmon); 4,890 (sea trout)

Fishing regulations in the River Rönne å

Fishing season opens on March 1 and continues until September 14th. The minimum legal size for salmon and sea trout is 45 cm. There is a bag limit of 3 salmon fish per angler per day. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon populations of the river system are in need of recovery, inspite of restoration work, new fish ways and liming operations. Continued and further actions are required.

- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from agriculture.
- The extreme low flow conditions in tributaries should be avoided by restoration of wetlands.
- Liming should be continued.
- Salmon reproduction habitats should be further restored.
- Water regulation downstream of power plants may need to be evaluated.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Sangisälven

The River Sangisälven is a medium-sized potential salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts

River length: 109 km of which 30 km are accessible for salmonids

Size of catchment area: 1,230 km²

Average flow: 12.9 m³/s

Daily lowest flow: 0.6 m³/s

Number of migration hindrances: 3 (0 contain a fish way)

Habitat and water quality in River Sangisälven

The catchment area is dominated by forest (73%) and wetlands (18%). Lakes occupy only 5% of the catchment area. Sangisälven used to be a salmon river but the population has probably never been strong.

Like most Swedish rivers, the river Sangisälven was used for log driving and hence the riffles and rapids have been dredged and cleared from stones and boulders. Log driving was carried out until the 1960s and following this, some restoration works have been undertaken. However, only 9 km of a total of 230 km has been restored and large parts of the river remain to be restored. In the 1980s, large ditching and excavations in the tributary of Korpikå lead to extensive transport of fine particles and humic matter.

There are two dams that are regarded as definite migration hindrances in the river. One is the power plant at Taipele, 30 km from the river mouth, where fish may migrate through an old watercourse at high water. There is a total of 25 dams or remains of dams in the river system. The river is heavily channelized upstream of the power plant. In addition, there are a total of 51 culverts regarded as migration hindrances in the river system, but these are located mainly in the tributaries.

Water quality is good whereas ecological status is set to fair due to the fact that the river is strongly affected by dredging from foresting activities. The level of nutrients is naturally high in the areas

around Lake Mieköjärvi and could in combination with agriculture, forestry or fish farming lead to eutrophication of the water. There is a potential risk of natural acidification originating from acid sulphate rich soils in the catchment area.

River Sangisälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measure is to continue restoration of the river channel, riffles and rapids from straightening and dredging due to timber floating. There are also measures required for the replacement or modification of all culverts, regarded as migration hindrances, in the area.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Sangisälven salmon stock

Currently there is no self-sustaining salmon stock in the river. When the Salmon Action Plan was started up it was decided that no restoration program for salmon would be implemented in this river, due to small reproduction areas. Instead sea trout is in the focus of management.

Salmon and sea trout population facts

Population category: 6 (salmon); 1 (sea trout)

Reproduction area: 6.1 ha (salmon and sea trout)

Production capacity: No information

Recent wild smolt production estimate: 100 (sea trout)

Fishing regulations in the River Sangisälven

There is no fishing for salmon, but some for sea trout. Gillnetting is not allowed for salmon and trout, and may only be carried out in lakes along the main river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river. The river channel, riffles and rapids should be further restored.

The River Skellefteälven

The River Skellefteälven was a large salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts

River length: 440 km of which 22 km are accessible for salmonids

Size of catchment area: 11,726 km²

Average flow: 162 m³/s

Daily lowest flow: 20 m³/s

Number of migration hindrances: 19 (5 contain a fish way, but not accessible for salmon)

Habitat and water quality in River Skellefteälven

The river Skellefteälven originates in Lake Ikesjaure and drains three large lakes on its way to the Bothnian Bay near the town of Skellefteå. The largest tributaries in the river are Malån, Petikån, Finnforsån, Bjurån and Klintforsån. The river flows through a landscape dominated by forest (60% of the catchment area). Mire and mountain regions occupy 10% and 15% of the catchment area, respectively. The river has been extensively harnessed for hydropower and there are a total of 17 power plants in the river completely blocking salmon from reaching reproduction areas.

There are no reproduction areas remaining due to the construction of the many power plants, and the migrating fish cannot pass the first dam. According to a Water Court decision the owners of the power plants are obliged to release fish to maintain the population for commercial and recreational fisheries purposes. Stocking of reared fish is done on an annual basis.

The water quality (excluding mercury) is rated as good whereas the ecological status is classified as poor due to flow regulations and morphological changes.

River Skellefteälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Poor

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measure is to allow reproduction of wild salmon in the river by establishing fish ways.

Natura 2000

The main river does not belong to the Natura 2000 network, but some of its tributaries do.

The Skellefteälven salmon stock

River Skellefteälven is a river with no natural reproduction and the population is maintained by the means of continuous releases of hatchery reared fish. It is the original Skellefteälven strain that is used in the salmon stocking program. In 2008 and 2009 around 180,000 salmon smolts and around 7,000 sea trout smolts were released annually.

Due to the extensive modifications caused by the construction of power plants there are significant migratory hindrances in the river and reproductive areas are extremely limited below the first dam.

Salmon population facts

Population category: 7
Reproduction area: 0 ha
Production capacity: No information
Recent smolt production estimate: No information

Fishing regulations in the River Skellefteälven

Fishing for salmon is allowed during September 16 – March 15 between 06:00 am and 20:00 pm; March 16 – May 15 between 04:00 am and 20:00 pm; May 16 – August 15 between 04:00 am and 24:00 pm; and August 16 – September 15 between 04:00 am and 22:00 pm.

From September 15 – October 14 fishing for sea trout is banned. Angling is allowed with sports fishing methods only, from boat or from land.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The feasibility of establishing fish ways through the lowermost dams of the river must be investigated.
- Potential reproduction areas need to be mapped before further actions are taken.

The River Stensån

The River Stensån is a small salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts

River length: 47 km of which 25 km accessible for salmonids
Size of catchment area: 284 km²
Average flow: 4.2 m³/s
Daily lowest flow: 0.05 m³/s
Number of migration hindrances: 67 (one contains a fish way)

Habitat and water quality in River Stensån

The river Stensån springs from sources in the horst Hallandsåsen. The upper part of the catchment

area is dominated by forest (46%) and the lower part by agricultural land (26%). Lakes occupy only 1.1% of the catchment area.

The river is subject to small scale regulation, without established minimum flow. The main stem has been channelized and water usage for irrigation is extensive during the summer months. High water temperature during warm summer months may negatively affect the survival rate of young salmon and sea trout. There are a total of 67 migration hindrances in the river, of which 52 are manmade - such as dams and culverts. 18 of the manmade hindrances are regarded as definite for ascending fish while there are 6 natural hindrances considered definite. Many of the manmade obstacles are dams from small-scale sawmills, mills and industrial manufacturing.

Both the water quality (excluding mercury) and the ecological status are considered fair. The upper forested parts of the river are highly affected by acidification and extensive liming has been ongoing since 1985. The main threats to salmon and sea trout in the lower part of the river are eutrophication from agriculture and the morphological changes of the water course. The river is also affected from leachate water originating from the ongoing railroad tunnelling project at Hallandsåsen.

River Stensån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Fair

Biological status: Good

Physical & chemical status: Fair (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to improve water quality by decreasing the nutrient load from agriculture through establishing of buffer zones along the river. For promoting fish migration a fish way in Örebäcken and by the mill at Stackarp are necessary. Restoration of possible reproduction areas and continued liming operations are needed. Furthermore the water regulation at power plants needs to be improved.

Natura 2000

The river does not belong to the Natura 2000 network.

The Stensån salmon stock

The river holds a genetically unique strain of salmon, and both the salmon and the sea trout populations are considered self-sustaining. The strains are regarded to be of national interest according to the Swedish Environmental Code. There has been no release of exogenous genes into the river. Electro-fishing surveys have shown a high abundance of salmon in the river.

High abundances of the ectoparasite *Gyrodactylus salaris* was found on salmon in 1997.

Salmon population facts

Population category: 1

Reproduction area: 12.5 ha

Production capacity: 18,660 smolts

Recent wild smolt production estimate: 15,800 (mean of 2005-2009)

Fishing regulations in the River Stensån

Fishing season is open from March 1 – September 30. The minimum legal size for both salmon and sea trout is 45 cm. There is a bag limit of 3 salmon/ sea trout per angler per day. There is a large protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock of Stensån is in good state and focus should be on maintaining the good habitat and fisheries management.

- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- Possible reproduction areas should be restored.
- Liming should be continued, and eventually increased.
- The water regulation at power plants needs to be improved to avoid low summer flow.
- New fish ways are required at Stackarp and in Örebäcken.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Suseån

The River Suseån with the tributary Mostorpsån is a small salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 52 km of which 35 km accessible for salmonids
Size of catchment area: 450 km²
Average flow: 7.4 m³/s
Daily lowest flow: 0.20 m³/s
Number of migration hindrances: No information (4 contain a fish way)

Habitat and water quality in River Suseån

The River Suseån starts where the tributaries Mostorpsån and Slissån meet and it then flows for approximately 20 kilometres and enters the sea 8 km south of the Ätran outlet. The catchment area is dominated by forest (54 %), and agriculture occupies 26 % of the area. Lakes make up for only 1 % of the area. Salmon may reach as far up in the river as Sämbs mölla and to the dam at Kvibille in Slissån, 34 km and 35 km from the outlet.

The water quality (excluding mercury) is good within the whole river while the ecological status is set to fair due to the following reasons; the river is affected by intense agriculture through channelling activities and nutrient load. The river is also affected by acidification in the whole upper parts of the river system and extensive liming has been ongoing since 1985. Water usage during low flow season affects salmon reproduction negatively both with regard to migration and smolt production. Nutrient load, channelling, acidification and irrigation have together had a strong negative impact on the salmon population. Low water level during dry summers also affects the salmon population negatively.

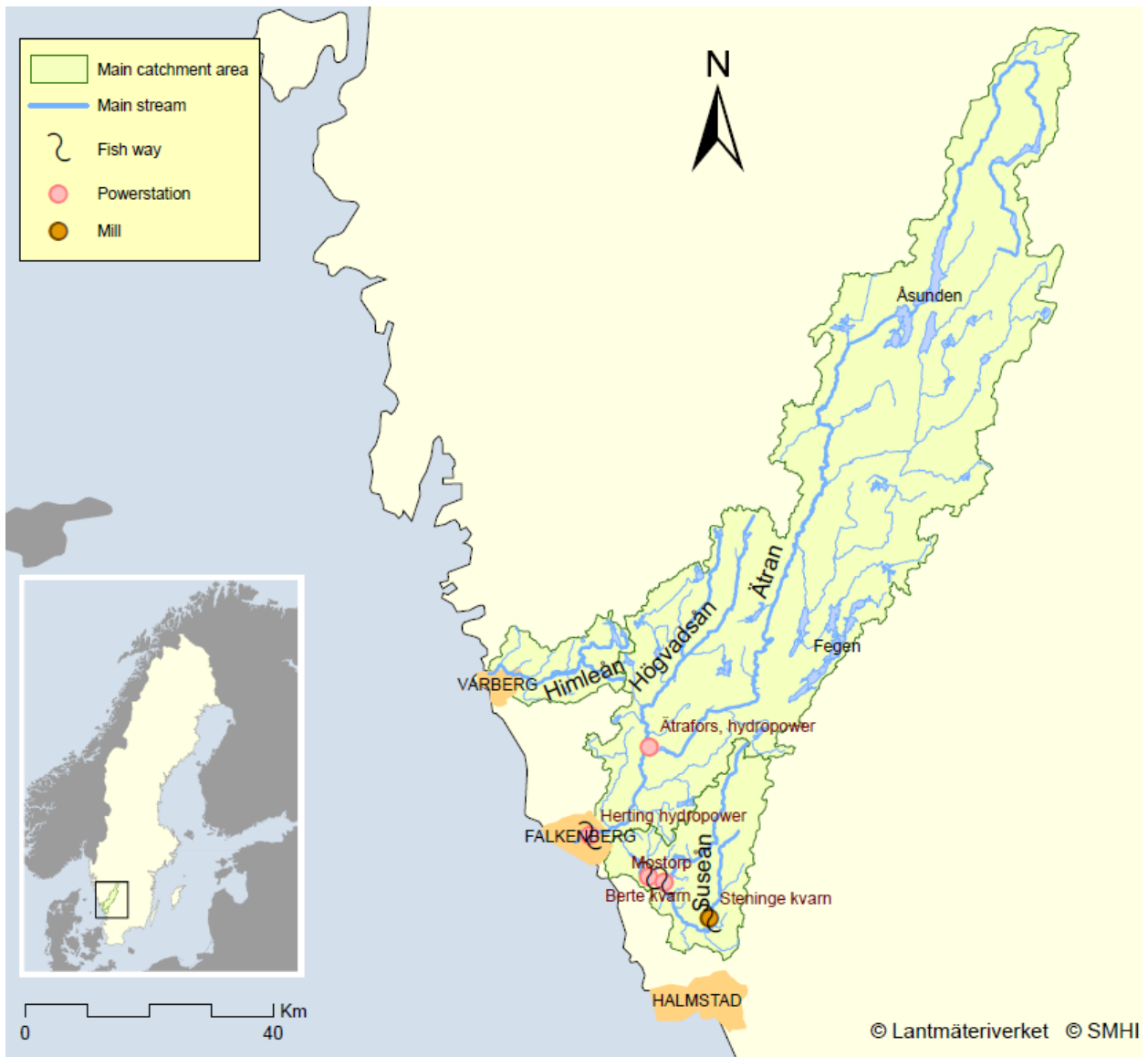


Figure 7. Rivers Suseån, Ätran, Himleån and Högvadsån.

River Suseån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural land river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to improve water quality by decreasing the nutrient and sediment load from agriculture through establishing of buffer zones. The occurrence of extreme low flow conditions should be prevented by regulating the usage of water for irrigation purposes. Restoration of possible reproduction areas and continued liming operations are needed.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Suseån salmon stock

The salmon population in the River Suseån used to be regarded as a strain unique for this river, but it may have considerable proportion of the genome from the Åtran-strain. The stock has been supplemented by stockings of salmon originating from river Åtran. The genetic background should be investigated. The population is stressed by the occurrence of the ectoparasite *Gyrodactylus salaris*.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 9.5 ha (salmon); 8 ha (sea trout)

Production capacity: 9,500 smolts (salmon)

Recent wild smolt production estimate: 7,200 (mean of 2005-2009) (salmon); 1,000 (sea trout)

Fishing regulations in the River Suseån

All fishing in the river is carried out by a private club. No fishing permits are sold to the public. Legal size for salmon and trout are 45 cm according to national legislation. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- The occurrence of extreme low flow conditions should be prevented by regulation for the usage of water for irrigation purposes, as well as restoration of wetlands.

- Restoration of possible reproduction areas should be undertaken.
- Liming should be continued.
- Down-stream passage of smolts and kelts must be improved at power plants.

The River Sävarån

The River Sävarån is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts

River length: 142 km of which 75 km accessible for salmonids
 Size of catchment area: 1,161 km²
 Average flow: 12.3 m³/s
 Daily lowest flow: 0.7 m³/s
 Number of migration hindrances: 3 (1 contain a fish way)

Habitat and water quality in River Sävarån

The river Sävarån springs from the lake Lossmeträsket, 261 m above the sea level, and runs through the lakes Storsävarträsket and Lillsävarträsket to the bay of Sävarfjärden in the Bothnian Bay. The river runs through a flat landscape dominated by forest (76% of the catchment area) and mires (14% of the catchment area). Lakes cover 6% of the catchment area. The areas surrounding the river have a diversified appearance with many lakes, bogs and mountains. The water level in the river varies about 3 metres and large areas are flooded regularly which creates good conditions for widespread wet meadows and deciduous march forests.

Like most Swedish rivers, Sävarån was used for log driving and it was hence largely excavated. Most of the river has now been restored by the means of dam destruction and restoration of salmonid spawning grounds.

River Sävarån and its tributaries occupy a region susceptible to acidification, which lead to a near extinction of the salmon and sea trout populations. Extensive liming and stocking have lead to the strong populations. Water quality (excluding mercury) is good in the river but the ecological status is set to fair due to the impact from clearing for timber floating and acidification.

In 1998, a fish-ladder was constructed at Krokbäcksfallet 40 km upstream of the mouth.

River Sävarån according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to continue the restoration of riffles and rapids from dredging due to timber floating and to continue liming of tributaries.

Natura 2000

Parts of the main river belong to the Natura 2000 network.

The Sävarån salmon and sea trout stocks

Both the salmon and the sea trout stock have been supplemented by voluminous stocking during the last 20 years. The stocking material is primarily of the Byskeälven strain, but also some of, Ume/Vindelälven- and Öreälven-origin.

Despite the large scale stocking made in the river there are signs that the original salmon population have survived. Both the salmon and sea trout populations can be genetically identified and separated from adjacent populations. The level of genetic variation is comparable with that of other populations in the Bothnian Bay.

Salmon and sea trout population facts

Population category: 3 (salmon); 1 (sea trout)

Reproduction area: 21 ha (salmon and sea trout)

Production capacity: 6,000 smolts (salmon)

Recent wild smolt production estimate: 4,000(salmon); 1,000 (sea trout)

Fishing regulations in the River Sävarån

The open seasons for salmon fishing in the main river are January 1 – April 30 and June 19 – August 31. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon or sea trout per fisher per day. No weekly closure for fishing in the river applies, and recreational fishing is only allowed with a fishing license. Gillnetting is not allowed for salmon and trout, and may only be carried out in lakes along the main river. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Liming should be continued in the tributaries.
- River habitat of the upper parts of the river should be restored.

The River Testeboån

The River Testeboån is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Sea.

Basic hydrological facts

River length: 113 km of which 21 km accessible for salmonids

Size of catchment area: 1,112 km²

Average flow: 12.1 m³/s

Daily lowest flow: 1.2 m³/s

Number of migration hindrances: 8 (2 contain a fish way)

Habitat and water quality in River Testeboån

The river Testeboån starts where rivers Bresiljeån and Kölsjöån meet, and flows into the Bothnian Sea at the town of Gävle. The catchment area is dominated by forest (83%). Lakes and mires occupy 6% and 4.5% of the area, respectively.

The river has been harnessed for centuries, first for the iron industry, with mills and saw-mills, and today for hydropower production. The river has also been used for timber floating and many stretches of it have been channelized and cleared from stones and boulders. Restoration work to restore habitat, by the means of replacement of stones and boulders, has been undertaken downstream of Oslättfors.

The power plant closest to the mouth (at 2 km from the coast) is equipped with a fish way. Yet, the fish migration is affected because the water bearing through the fish way is often too low to attract fish. Also downstream movement of smolts and kelts may be impeded. A dam 3 km further up the river was demolished in 2005 in order to improve habitat conditions of salmon and sea trout. There is a definite migration hindrance by the power plant at Nyhammar 21 km from the mouth.

The water quality (excluding mercury) in the river is good whereas the ecological status is set to fair due to the morphological changes of the water course. Parts of the wetlands in the upper part of the catchment area are acidified and have consequently been subject to liming operations.

River Testeboån according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures in the water management plan are to improve existing fish ways and establish new fish ways, also for downstream moving fish. Also restorations of areas that have been dredged and cleared for timber floating and continued liming operations are important.

Natura 2000

Parts of the main river belong to the Natura 2000 network.

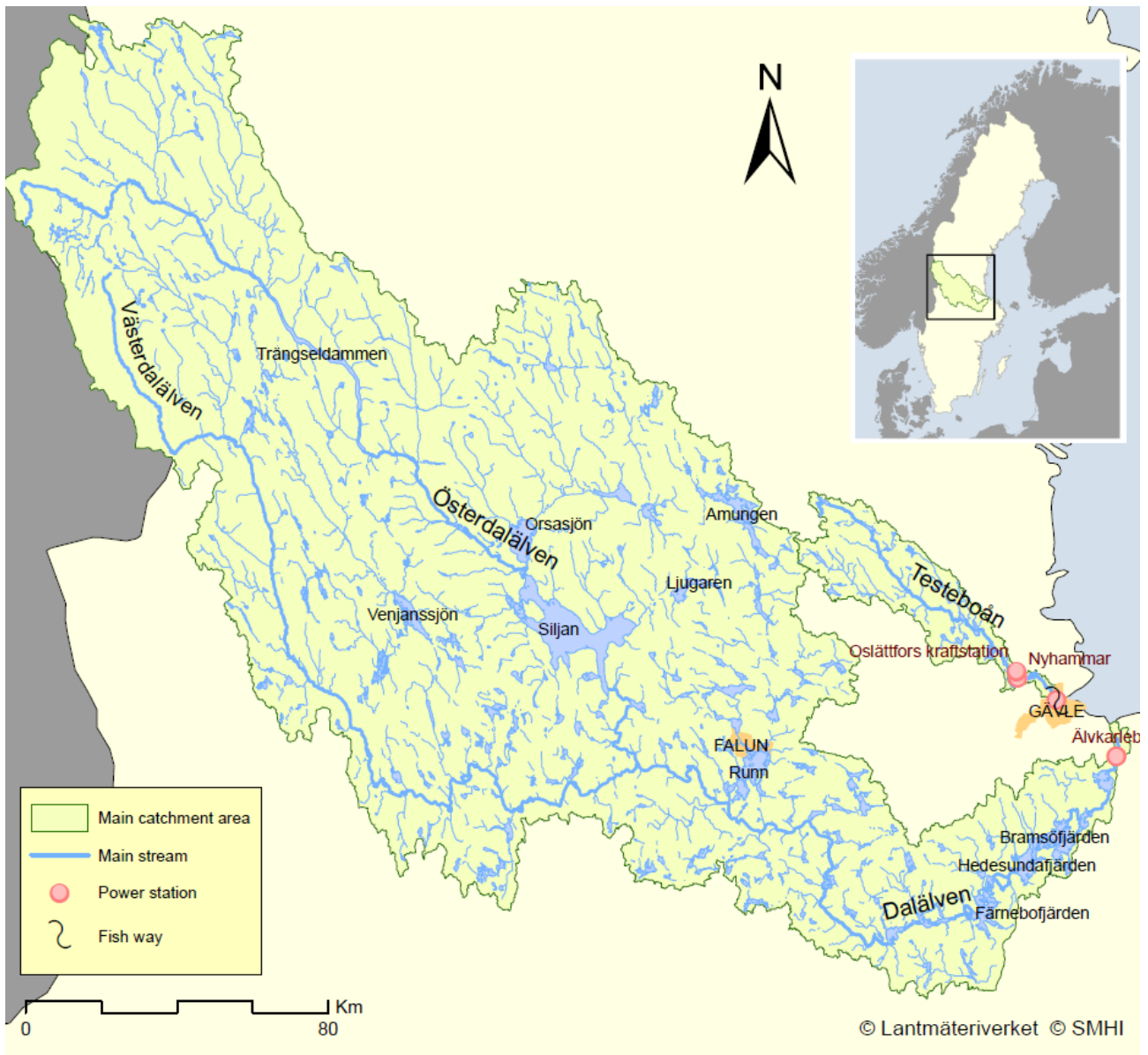


Figure 8. Rivers Testeboån and Dalälven.

The Testeboån salmon stock

The natural salmon stock has been eliminated at some stage after the 1960s. The river is considered to have natural reproduction, albeit weak, and the population has been maintained by large continuous releases of reared fish. Extensive restoration work has been carried out, and still continues in this river. Actions undertaken to restore the river as a salmon river have mainly focused on habitat restoration, removal of migration hindrances and releases of eggs.

Salmon and sea trout population facts

Population category: 3 (salmon); 2 (sea trout)
Reproduction area: 7.7 ha (salmon)
Production capacity: No information
Recent wild smolt production estimate: 2,100–4,200 (salmon)

Fishing regulations in the River Testeboån

The salmon and sea trout stocks in the river are protected from fishing since 2002. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Areas that have been dredged and cleared for timber floating should be restored.
- Liming should be continued.
- Fish passage up-stream at the lowermost power plant needs to be improved.
- Down-stream passage of smolts and kelts must be improved.

The River Tornionjoki/Torneälven

The River Tornionjoki is a salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 522
Size of catchment area: 40,131 km²
Average flow: 383
Daily lowest flow: 76
Number of migration hindrances: 0

Habitat and water quality in River Tornionjoki

The Tornionjoki river system is the largest unregulated river system in the Western Europe, and it is connected to the adjacent River Kalixälven through a natural bifurcation. It is also one of the world's largest spawning rivers of Atlantic salmon and the largest producer of wild salmon in the Baltic Sea. The river Tornionjoki flows to the Bothnian Bay along the national border between Finland and Sweden. It starts and form the Swedish mountain lake Torneträsk from where it flows down to the national border and confluences with River Muonionjoki. The headwaters are located near the Norwegian border in the Swedish and Finnish Lapland. The headwater sources form three

main rivers: Torneälven, Lainioälven and Muonionjoki. After flowing 240 km as separate rivers, there is a confluence at about 200 km from the sea. River Tornionjoki has several tributaries.

The River Tornionjoki catchment area is the northernmost of the Baltic Sea catchment river basins. The catchment covers sparsely populated terrain ranging from the southern boreal zone in its lower reaches to the headwater subarctic zone 400 to 500 meters above the sea level. Lakes cover only 4.6% of the catchment area and therefore the river flow varies a lot seasonally. Discharge is the lowest from December to May, when the river is frozen. During the spring thaw in May-June the discharge rate peaks to 1,000–2,000 m³/s.

There are thousands of hectares (hundreds of km) of rapids and riffles in the river system. Most riffles and rapids of the tributaries in the lower and middle reaches have been dredged for timber floating in the 1940s and 1950s, but they have been restored to improve reproduction success of fish species utilising these habitats.

There is one small hydropower plant with a dam in the main river Torneälven (Sweden), but the power station blocks only a small side channel of an island and it does not impede fish migration. Two tributaries (one in Sweden, one in Finland) on the lower catchment are regulated by hydropower plants. Salmon or sea trout are not known to have occurred in these tributaries. There are no natural migration obstacles in the river system.

Only minor anthropogenic disturbances are evident in river water quality, which is predominantly excellent on the rivers of the upper catchment, but slightly deteriorates downstream. The water quality has hardly any negative effects on salmon reproduction, but it may affect sea trout reproduction in a few spawning tributaries with the highest anthropogenic disturbances. Forestry, agriculture and municipal waste are the main sources of nutrient and sediment load. Large mines are planned in the middle part of the catchment area. The poor control of effluents from the mines is a potential threat for the water quality in the future.

River Tornionjoki according to the Water Framework Directive

The name of the water management district is Torne River Basin District and the river type changes along the river. The main types are: a very large peat land river, a large mineral land river (most salmon spawning areas), and a medium-sized mineral/peat land river (most sea trout spawning areas).

Ecological status: Good–Excellent

Biological status: Good–Excellent

Physical & chemical status: Good–Excellent

Hydrologic & morphological status: No information

The main measures in the water management plan are to continue and strengthen actions to reduce nutrient and sediment load from agriculture, forestry and municipal waste.

Natura 2000

The main rivers and lakes belong to the Natura 2000 network.

The Tornionjoki/Torneälven salmon and sea trout stocks

River Tornionjoki supports original wild salmon and sea trout stocks. Salmon spawn and parr occur in the swiftly flowing sections of the main stream, in the headwaters and in the major tributaries

from the lowermost riffles up to 400–500 km from the sea. Spawning areas of sea trout are concentrated on the small-medium sized tributaries of the middle reach, but some juvenile trout are also found elsewhere, e.g. in the main rivers.

There are clear indications of sub-population structure for sea trout, and each spawning tributary supposedly holds a distinct sea trout population. Genetic studies have found some indications of sub-population structure also for salmon. However, the within-river genetic variability of salmon is poorly known.

The salmon stock was supplemented by voluminous stocking of hatchery-reared parr and smolts from the early 1980s until 2002. Frequent stocking of sea trout started in the early 1990s and it has been continued thus far. Stocking activities have been concentrated on the border river and the Finnish tributaries.

During the second half of the last century the Tornionjoki salmon and sea trout stocks declined and the years with the overall lowest abundance date back to the 1980s. In the late 1980s the annual run of wild smolts was 50,000–100,000 salmon. Since then, the salmon stock has recovered mainly by a sudden sharp rise in the late 1990s, as a result of which the annual smolt run rose to 500,000–700,000 salmon in the early 2000s. In the recent years the salmon abundance has further increased and the smolt run exceeded the level of one million salmon in 2008 for the first time. The counting of spawning run in 2009 indicates that currently 30,000–40,000 salmon spawners ascend the river.

Parr densities of sea trout have shown improvement in some periods after the 1980s. However, annual smolt run seems to be low, i.e. 10,000–20,000 trout smolts. Monitoring data indicates that several historical trout spawning tributaries have extremely low abundance and in some years possibly no sea trout reproduction at all.

Salmon and sea trout population facts

Population category: 1 (salmon), 3 (sea trout)

Reproduction area: 4,997 ha

Production capacity: 1.318 million smolts

Recent wild smolt production estimate: 1.18 million smolts (salmon 2009); 10,000–20,000 (sea trout)

Fishing regulations in the River Tornionjoki/ Torneälven

In the new border agreement between Finland and Sweden that come into force in October 2010, all fishery in the border river (agreement area) is forbidden from September 15 – December 15 with the exception of lamprey fishing. Fishing for salmon and sea trout with rod is allowed from June 1 – August 31. During this time it is forbidden to fish salmon and trout between Sunday 19:00 (Finnish time) and Monday 19:00. There is also a bag limit of one salmon or trout per fisher per day and the minimum legal length for salmon and trout is 50 cm. Salmon and trout fishing by traditional gillnet fishing methods and by a hoopnet ('lippu') is allowed during some days in June and July on the listed sites in the border river.

In the Swedish rivers Torneälven, Lainioälven and in some Swedish tributaries salmon fishing is forbidden during the whole year with exception the following exceptions. Salmon and trout fishing with rod is only prohibited from September 1 – December 31. It is also forbidden to fish with gillnet and trapnets which is higher than 1.5 meter and mesh size larger than 60 mm from May 1 - June 20 and September 1 – December 31 and also from Thursday 18:00 to Sunday 18:00 from July 1 - August 31. Dip net fishing is prohibited from May 1 – June 15. Minimum legal length for salmon is

50 cm. There is a bag limit of one salmon per fishermen and day. Recreational fishing is only allowed with a fishing license.

Specific actions for the development of the salmonid populations

In some spawning tributaries of sea trout, the water quality should be improved by establishing effective protection zones along the agriculture land by the river. The occurrence of extreme low flow conditions should be prevented by filling old, unnecessary ditches and by strict permission policy for any digging of new ditches (draining for forestry, agriculture or peat mining).

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

The River Tvååkersån

The River Tvååkersån is a small salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts

River length: 22 km of which 9 km accessible for salmonids

Size of catchment area: 92 km²

Average flow: 1.3 m³/s

Daily lowest flow: 0.02 m³/s

Number of migration hindrances: 1 (0 contain a fish way)

Habitat and water quality in River Tvååkersån

The river Tvååkersån is fed by several lakes originating in beech forests at a height of approx. 50 m above the sea level. The river flows through a landscape dominated by agriculture areas (53% of the catchment area) and has on that account been heavily channelized to gain land for agricultural use. Forest and lakes occupy 18% and 9% of the catchment area, respectively. The annual lowest flow season is typically in the summer, when there is stress by water withdrawal for irrigation purposes. The water usage during low flow season affects salmon reproduction negatively regarding both migration and smolt production.

The water quality (excluding mercury and nutrients) is good, but the nutrient levels are quite high. The ecological status is rated as fair due to problems with eutrophication, flow regulation, morphological changes and continuity. Liming started in the 1990s as a result of problems with acidification in the upper part of the river. Effluents from private sewage drains and agriculture increases the nutrient load which may negatively affect mid- and late summer conditions of salmonid parr and spawners. Channelization in the 1930s has reduced the possible salmonid spawning area and recent clearing has further impaired smolt production.

River Tvååkersån according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Fair

Biological status: Fair

Physical & chemical status: Good (excluding mercury and nutrients)

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to continue and strengthen actions to reduce nutrient load from agriculture and private waste as well as the restoration of potential reproduction areas.

Natura 2000

The main river belongs to the Natura 2000 network.

The Tvååkersån salmon stock

The river is small: it is on the verge of being able to sustain a salmon population. The salmon production will always be small, but the population must be maintained to preserve biodiversity. No genetic analyses have, however, been made to establish whether or not the salmon stock in Tvååkersån is unique for the river.

Tvååkersån salmon reproduces only along the main river up to Strömman Power plant. The reproduction area for both salmon and sea trout could be increased to 20,000 m² with restoration work. The drop height (25 m) and normal water bearing during low flow season is considered to be too low for the river to harbour a stable salmon stock.

There has been stocking of rainbow trout in the river. Rainbow trout stocking is now prohibited to avoid spreading of the ectoparasite *Gyrodactylus salaris* and the small fish farm is closed.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 1.2 ha (salmon and sea trout)

Production capacity: 900 smolts (salmon)

Recent wild smolt production estimate: 300 smolts (mean of 2005–2009) (salmon); 1,250 (sea trout)

Fishing regulations in the River Tvååkersån

Normally very little fishing is carried out in this small river. No general rules are set but national legislation applies with e.g. legal size of 45 cm for salmon and trout. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

River Tvååkersån is in need of recovery and actions are hence urgently required.

- An effective riparian protection zone should be established along the river to improve water

- quality through decreasing nutrient and sediment input from forestry and agriculture.
- The occurrence of extreme low flow conditions should be prevented by regulation of the usage of water for irrigation purposes, as well as wetland restoration.
- Possible reproduction areas should be restored.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Törlan

The River Törlan is a small salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts

River length: 20 km totally accessible for salmonids
Size of catchment area: 72 km²
Average flow: 1.225 m³/s
Daily lowest flow: 0.02 m³/s
Number of migration hindrances: 0

Habitat and water quality in River Törlan

The river is about 20 km long and is fed by Lake Lyngsjö, which is surrounded by beech forests at low elevation. The river flows through a landscape dominated by agriculture (53% of the catchment area) while forest and lakes occupy 18% and 0.7% of the area, respectively. Typically the annual lowest flow occurs during the summer months. The river has been heavily channelized to gain land for agricultural use. Recurrent clearing of shrubs, bushes and debris in-stream and along the banks further impairs the river as a suitable habitat for salmon and sea trout.

The water quality (excluding mercury) is fair, and the ecological status is also rated as fair due to problems with eutrophication. There is only a slight acidification of the water and therefore no liming has been done. Problems with eutrophication are on the other hand severe, especially with nitrogen. Water usage during low flow season affects salmon reproduction and migration negatively.

River Törlan according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a small agricultural river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Fair

Hydrologic & morphological status: Fair

No official water management plan is established, but probable main measures are to continue and strengthen actions to reduce nutrient load from agriculture and private waste. Restoration of potential reproduction areas and river re-meandering.

Natura 2000

The river does not belong to the Natura 2000 network.

The Törlan salmon stock

The salmon stock is regarded as weak within the river and the population has not been the subject of stocking efforts. But, there are no indications of a genetically unique stock in the river. Spawners may have come from nearby larger River Ätran.

Salmon have access to the whole river, but utilizes only the 3 km closest to the mouth. The upper parts of the river are too small and have low flow.

The reproduction area for sea trout could be increased by 1.7–2.28 hectares if measures to restore habitats are taken. Although regarded as a weak population, salmon parr is caught every year in electro-fishing surveys.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 0.9 ha (salmon); 1.7 ha (sea trout)

Production capacity: 225 smolts (salmon)

Recent wild smolt production estimate: 120 (mean of 2005–2009) (salmon); 1,250 (sea trout)

Fishing regulations in the River Törlan

There is very little fishing for salmon or sea trout in this small river. No general rules are set but national legislation applies with e.g. legal size of 45 cm for salmon and trout. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning river fisheries management are applicable for this river.

- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from forestry and agriculture.
- The occurrence of extreme low flow conditions should be prevented by regulation of the usage of water for irrigation purposes, as well as wetland restoration.
- Possible reproduction areas should be restored.

The Rivers Umeälven/Vindelälven

The River Umeälven/Vindelälven system is a large salmon and sea trout river flowing to the Bothnian Bay.

Basic hydrological facts

River length: 467 km of which 47 km accessible for salmonids (Umeälven); 453 km totally accessible for salmonids (Vindelälven)

Size of catchment area: 26,783 km² (Umeälven); 12,630 km² (Vindelälven)

Average flow: 443 m³/s (Umeälven); 190 m³/s (Vindelälven)

Daily lowest flow: 23.61 m³/s (Umeälven); 0.2 m³/s (Vindelälven)

Number of migration hindrances: 18 (Umeälven [1 contains a fish way]); 0 (Vindelälven)

Habitat and water quality in Rivers Umeälven/Vindelälven

The River Umeälven and its large tributary Vindelälven are among the largest rivers in northern Sweden. River Vindelälven flows in parallel and joins to the Umeälven 47 km before the outlet to the Bothnian Bay. The tributary Vindelälven is one of four National Rivers in Sweden. The catchment area of the river Vindelälven is protected from construction of power stations through the Swedish Environmental Code. In the upper part Vindelälven runs through Lake Storvindeln, a lake with a natural variation in water level of about 5 metres. It stretches in a south-eastern direction from its source, the lake Överuman at the Norwegian border within the Scandinavian mountain range.

On its course the river passes through Lake Storuman and eventually drains into the Bothnian Bay on the east coast of Sweden at the village of Holmsund, just adjacent to the city of Umeå.

The river Umeälven has been extensively harnessed for hydropower production and there are a total of 18 power plants in the main river and its tributaries, but none in Vindelälven. The river runs through a landscape dominated by forest (65% of the catchment area) while mires and lakes each occupy 7.5% of the catchment area. Mountains cover as much as 18% of the catchment area.

Like most of the rivers in northern Sweden, the rivers were used for log driving. These activities ceased in 1967 and restoration work has been undertaken to enhance reproduction success in these areas.

Salmon and sea trout may pass the fish way at the power plant at Stornorrfor (22 km from the mouth) and ascend to the reproduction areas in the tributary Vindelälven. A new improved fish-ladder for migrating fish will open in 2010 at Stornorrfor. Umeälven have lost most of its spawning and nursery habitats due to construction of power plants and logging activities. All or almost all reproduction areas are located within the catchment area of the tributary Vindelälven.

Water quality (excluding mercury) in river Umeälven is classified as good but the ecological status is set to fair due to extensive flow regulation and morphological changes made to the river. Both

the water quality (excluding mercury) and the ecological status is classified as good in the Vindelälven tributary.

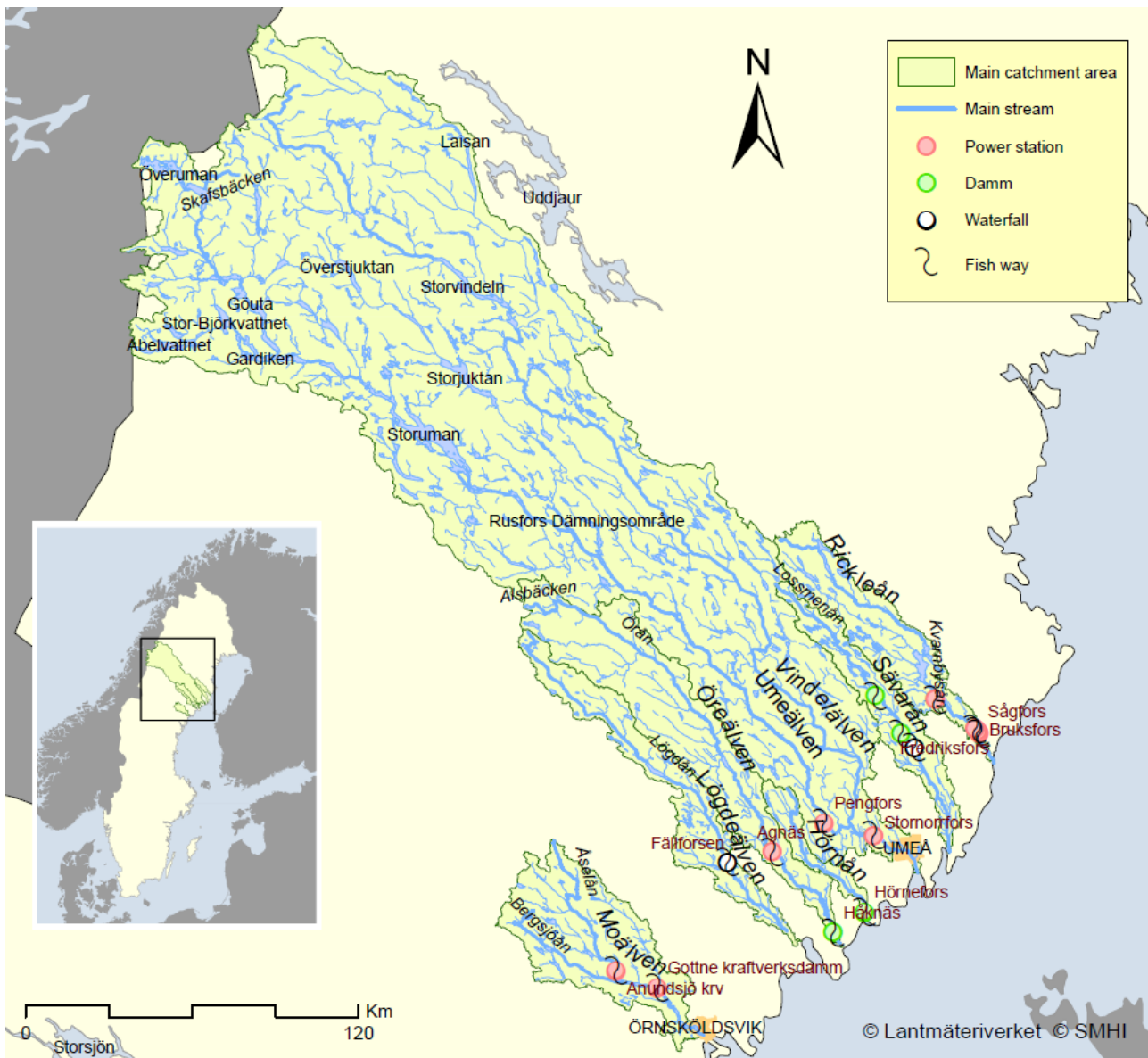


Figure 9. Rivers Rickleån, Sävarån, Vindelälven, Umeälven, Hörnån, Öreälven, Lögdeälven and Moälven.

River Umeälven and its tributary Vindelälven according to the water framework directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a large mountain river.

Ecological status: Fair/Poor (Umeälven), Good (Vindelälven)
Biological status: Good–Poor
Physical & chemical status: Poor (Umeälven), Good (Vindelälven)
Hydrologic & morphological status: Poor (Umeälven), Good (Vindelälven)

No official water management plan is established, but probable main measures in the water management plan are to improve down-stream passage at Storforsen, further restoration of the habitat in Vindelälven.

Natura 2000

The lower part of River Umeälven and the entire river of Vindelälven belong to the Natura 2000 network.

The Umeälven/Vindelälven salmon stock

Hatchery reared smolts, of the original Umeälven strain, are released yearly into the river Umeälven according to a Water Court decision. These stockings are a compensation for the lost production caused by the hydropower plants. 144,951 and 90,844 salmon smolts were released in 2008 and 2009, respectively. The wild smolt production stems from the tributary Vindelälven, since there is no production of salmon in the main river, Umeälven.

Salmon and sea trout population facts

Population category: 7 (Umeälven), 1 (Vindelälven) (salmon); 5 (Umeälven), 1 (Vindelälven) (sea trout)
Reproduction area: 1,242 ha (Vindelälven) (salmon); 1,000 ha (Vindelälven) (sea trout)
Production capacity: 158,000 smolts (salmon)
Recent wild smolt production estimate: 86,000 (salmon); 2,000 (sea trout)

Fishing regulations in the River Umeälven/Vindelälven

Fishing regulation may vary between different parts of the river due to different management organisations, although national legislation forms the basis. The open season for salmon fishing is from the June 19 – August 31. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon per fisher per day. No weekly closure for fishing in the river applies. Fishing with nets is not allowed for salmon and trout. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The River Vindelälven requires further habitat restoration. Especially spawning areas and areas for young-of-the-year salmon parr should be restored.
- Down-stream passage of smolts and kelts must be improved at power plants.
- The feasibility of establishing fish ways through the lowermost dams of the branch River Umeälven, which today lacks salmon, should be investigated.
- Fishing of sea trout may need to decrease in the river.

The River Viskan

The River Viskan with its tributaries Surtan, Lillån and Hornån is a medium-sized salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts (main river)

River length: 142 km of which 50 km accessible for salmonids
 Size of catchment area: 2,202 km²
 Average flow: 35.5 m³/s
 Daily lowest flow: 0.98 m³/s
 Number of migration hindrances: No information (2 contain a fish way)

Habitat and water quality in River Viskan

The river Viskan is one of the largest rivers in the county of Halland. It starts from Lake Tolken near the city of Ulricehamn and runs through vast forested areas and agricultural land on its way to Åskloster, just north of the city of Varberg. From the source to the sea the river falls 200 m and turns turbid on its way to the sea. The suspended sediment originates from clay rich soils in the catchment area. 66% of the catchment area is occupied by forest. Agricultural land and open land occupy 15.5% and 7%, respectively, whereas lakes make up for 5.5% of the area.

The main river and tributaries are all affected to a large extent by water regulation due to hydropower production. Water level may shift rapidly from high to low, and parts of the river are almost completely drained. This has a negative influence on the salmon and sea trout populations. Large parts of the river bed of the lower catchment area are dredged repeatedly to increase run-off in order to gain agricultural land along the river. Viskan has suffered from pollution from industries and conurbations for several decades.

Water quality (excluding mercury) is good within the main river as well as in the described tributaries. The ecological status is classified as follows: in the main river it is fair near the outlet and from good to fair on the reproduction areas. In Surtan the status is good near the outlet and fair on the reproduction areas. In Lillån and Hornån the ecological status is fair both in reproduction areas and near the outlet.

The main problems in areas rated as fair are related to eutrophication and continuity. The areas surrounding Lakes Fävren, Mäsen and Oklängen are prone to acidification and extensive liming operations have been undertaken. Habitat restoration is planned to be undertaken in tributaries to River Viskan.

River Viskan according to the Water Framework Directive

The name of the water management district is Skagerrak and Kattegat River Basin District and the river type is a medium-sized forest river.

Ecological status: Fair–Good (see text)

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Fair (Viskan), Good (Tributaries)

No official water management plan is established, but probable actions are altered water regulation, elimination of migration obstacles, habitat restoration, increased buffer zones and continued liming operations.

Natura 2000

The main river does not belong to the Natura 2000 network.

The Viskan salmon stock

The river holds wild strains with natural production of both salmon and sea trout and no fish have been released in the past 10 years.

The annual smolt production capacity was, in 1999, estimated to be 9,000 in Viskan; 8,000 in Surtan; 300 in Lillån and 2,000 in Hornån. Other small tributaries also contribute. The reproduction area could be increased to 25.5 ha with continued restoration efforts.

Salmon population facts

Population category: 1

Reproduction area: 16.1 ha

Production capacity: 24,100 smolts

Recent wild smolt production estimate: 14,300 (mean of 2005-2009)

Fishing regulations in the River Viskan

The fishing season for salmon and sea trout is April 1 – September 30. The minimum legal size is 45 cm for salmon and sea trout. Fishing license applies only to fishing with rod. Use of bait from other waters is prohibited. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Habitats should be further restored, especially in tributaries.
- An effective riparian protection zone should be established along the river to improve water quality through decreasing nutrient and sediment input from agriculture.
- Liming should be continued.
- An altered water regulation scheme is required, especially in river Hornån.
- A stop to dredging of the river bed for gaining agricultural land is necessary.

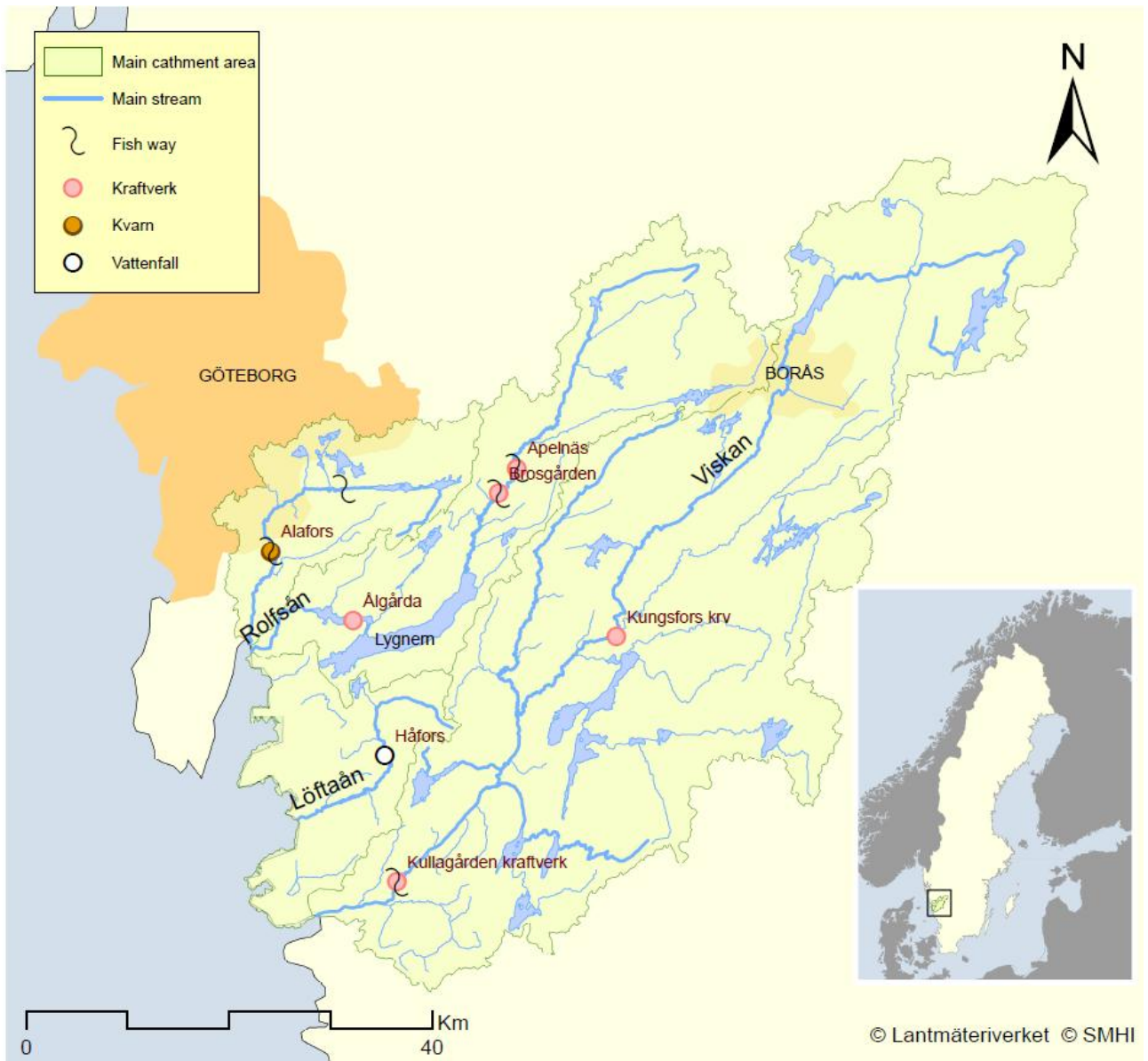


Figure 10. Rivers Rolsån, Löftaån and Viskan.

The River Åbyälven

The River Åbyälven is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Bay.

Basic hydrological facts

River length: 175 km totally accessible for salmonids
Size of catchment area: 1,344 km²
Average flow: 15.2 m³/s
Daily lowest flow: 1.1 m³/s
Number of migration hindrances: 1 (it contains a fish way)

Habitat and water quality in River Åbyälven

The river Åbyälven runs for its 175 kilometres through forests and wetlands to the coastal lowlands, where it empties to the Bothnian Bay. From the source, Lake Övre Kikkejaure, to the river mouth the landscape is dominated by forest (75.9% of the catchment area). Lakes and mires occupy 5.2% and 17.3% of the catchment area, respectively. Rapids and riffles are abundant in the river, especially in the lower part.

The river is, with the exception of the power plant at Hednäs, unexploited for hydro power production. The catchment area of the river is protected from construction of new power stations through the Swedish Environmental Code. Until 1996 salmon could not ascend further than the power plant at Hednäs, but following the constructions of fishways salmon may now reach the source areas of the river.

The river was used for log driving until 1968, and has since then been partially restored to improve reproduction success of species utilising these habitats. Both the water quality (excluding mercury) and the ecological status are rated as good. Liming has been carried out in two tributaries in order to reduce acidification.

River Åbyälven according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are the continue restoration of riffles and rapids from dredging due to timber floating and to secure safe downstream migration at the power plant. Continued liming is also important.

Natura 2000

Parts of the main river belong to the Natura 2000 network.

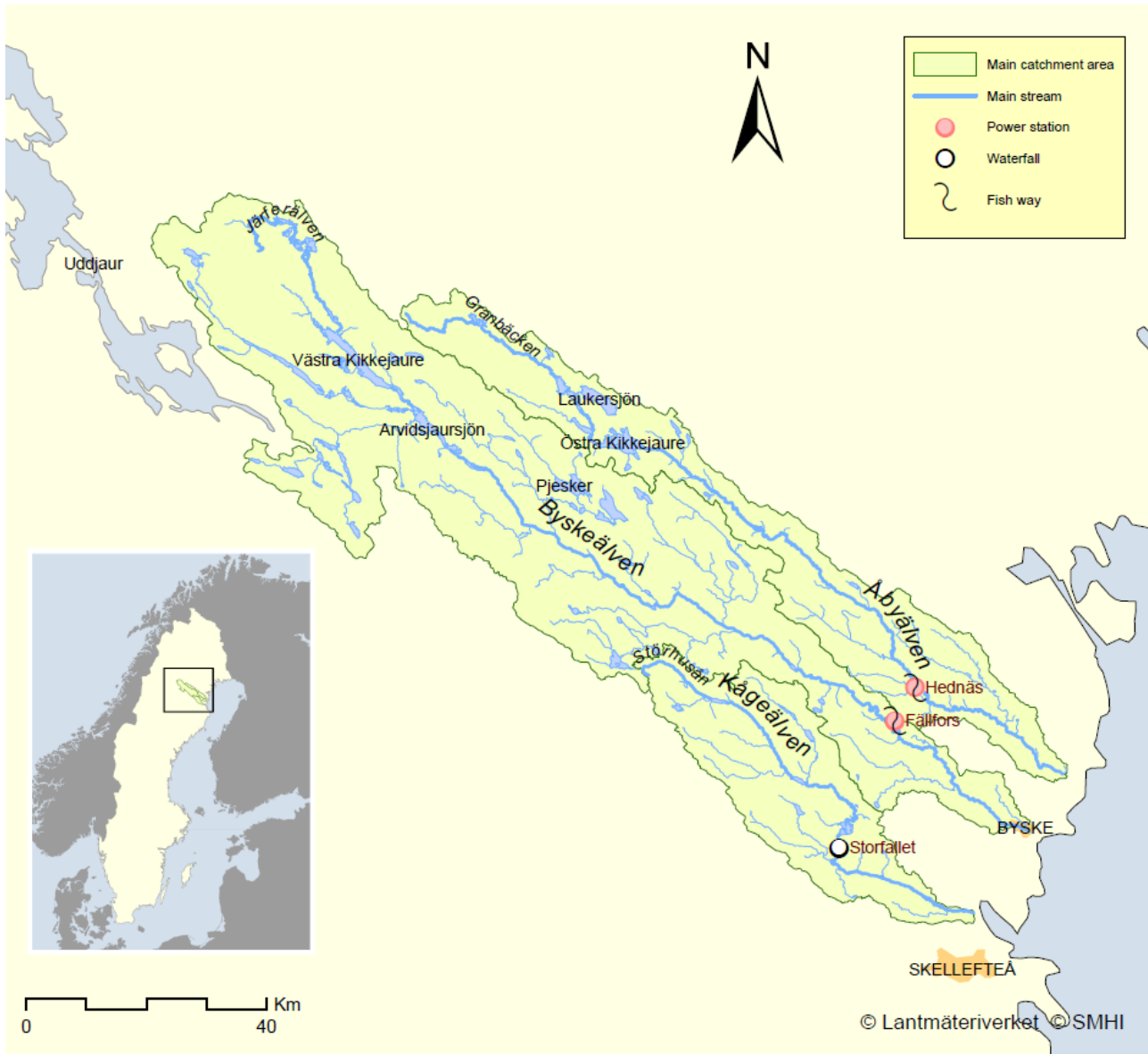


Figure 11. Rivers Åbyälven, Byskeälven and Kågeälven.

The Åbyälven salmon stock

Åbyälven holds a weak but natural strain. The salmon population has shown a stable increase during the latest years.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)
Reproduction area: 84 ha (salmon), 80 ha (sea trout)
Production capacity: 13,000 smolts (salmon)
Recent wild smolt production estimate: 11,000 (salmon); 500 (sea trout)

Fishing regulations in the River Ångermanälven

The open season for salmon is from January 1 – August 31. The minimum legal length for salmon is 50 cm and 40-50 cm for sea trout, depending on location. The banned season for fishing for sea trout stretches from September 1 – October 15. There is a bag limit of 1 salmon and 5 sea trout per fisher per day. No weekly closure for fishing in the river applies. Fishing with nets in the river is not allowed for salmon and trout. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmon and sea trout stocks

The salmon stock of the river is in good state and focus should be on maintaining the good habitat and fisheries management.

- Liming in the tributaries should be continued.
- Further habitat restoration is required.
- Down-stream migration of smolts and kelts must be secured at the power plant.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

The River Ångermanälven

The River Ångermanälven was a large salmon and sea trout river in northern Sweden flowing to the Bothnian Sea.

Basic hydrological facts

River length: 463 km of which 70 km accessible for salmonids
Size of catchment area: 31,864 km²
Average flow: 500 m³/s
Daily lowest flow: 62.36 m³/s
Number of migration hindrances: 19 (0 contain a fish way)

Habitat and water quality in River Ångermanälven

The river Ångermanälven is one of Sweden's longest rivers. This large forest river springs from a source in the Scandinavian mountain range, in the southern parts of the Swedish province of

Lapland and empties into the Baltic Sea near the town of Kramfors. The rivers Vojmán, Fjällsjöälven and Faxälven are its main tributaries. The catchment area in the upper parts is characterized by mountains and mires occupying 11.5% and 9% of the area, respectively. Towards the coast the nature surrounding the river changes and becomes dominated by forest (69% of the catchment area). Lakes cover 8% of the drainage basin.

The river is heavily harnessed for hydropower production and there is a total of 17 power plants in the main river. The power plant at Sollefteå closest to the mouth, at 70 kilometres, lacks a fish way and therefore represents a definite migration hindrance for salmon and trout in the river. There are no remaining reproduction areas in the main river as a result of the water regulation. The tributaries Fjällsjöälven and Faxälven hold 11 and 13 power plants, respectively. In Faxälven a small reproduction area is still available.

Riffles and rapids were dredged for timber floating but have been partly restored to improve reproduction success of fish species utilising these habitats. The water quality (excluding mercury) is rated as good while the ecological status is rated as fair. Parts of the river are affected by acidification and liming has been carried out in these areas. The river is highly affected by water regulation as well as from clearing and channelling for timber floating.

River Ångermanälven according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a large forest river.

Ecological status: Fair

Biological status: No information

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Poor

No official water management plan is established, but probable main measures in the water management plan are to continue liming in tributaries and to open up the main river with fish ways.

Natura 2000

The river does not belong to the Natura 2000 network.

The Ångermanälven salmon stock

The river is considered to have no natural salmon reproduction. With significant migratory hindrances the stock is dependent of large continuous releases of reared fish. The stocking material is of the Ångerman-strain. According to a Water Court decision about 200,000 smolts are released annually.

In 2010 a project has been launched to do an analysis of costs and salmon production if a fish way is established at Sollefteå, the first power plant 70 km from the mouth.

Salmon and sea trout population facts

Population category: 7 (salmon and sea trout)

Reproduction area: 0 ha (salmon and sea trout)

Production capacity: 0 (salmon and sea trout)

Recent wild smolt production estimate: 0 (salmon and sea trout)

Fishing regulations in the River Ängermanälven

The open season for salmon fishing is from the 19th of June to the 31st of August. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon (male) per fisher per day. There is no weekly closure for fishing in the river.

Gillnetting is prohibited from Saturdays at 12:00 until Sundays at 18:00 starting January 1 – August 31 and from Thursdays at 18:00 until Sundays at 18:00 September 1 – December 31. Angling is allowed throughout the year.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- The feasibility of establishing fish ways through the lowermost dams of the river must be investigated. A project started in December 2010.
- Liming should be continued.

The River Ätran

The River Ätran with its tributaries Högvadsån and Fagerredsån is a medium-sized salmon and sea trout river in south-western Sweden flowing to the Kattegat.

Basic hydrological facts

River length: 243 km of which 26 km (60km in Fagerredsån) accessible for salmonids
Size of catchment area: 3,342 km²
Average flow: 51 m³/s
Daily lowest flow: 2.25 m³/s
Number of migration hindrances: 2(1 fish way in the main river)

Habitat and water quality in River Ätran

The river is fed by Lake Lönnern and flows through Lake Åsunden and through a narrow valley to Falkenberg. The river passes through a series of rapids which have been harnessed for hydropower production. The catchment area of the river is dominated by forest (57%) and agriculture areas (17%). Lakes make up for only 6% of the catchment area. The catchment area of the tributary Högvadsån is 85% forest and mires.

The river has since long been heavily exploited by commercial and recreational fishing. The history of the salmon fishing in the river reaches far back. In the 18th century it was one of the most important sources of income in the area. Salmon used to be able to migrate freely 31 km up the river to a natural migration hindrance at Yngeredsfors, which salmon could pass only at high water. Today salmon may migrate to the power plant at Ätrafors, 26 km from the river mouth. Close to the mouth in the city of Falkenberg, salmon must pass a power plant (Herting). A fish way of denil-type has been functioning well here since 1945. The dam and part of the power plant will be taken away, making the existing fish way unnecessary.

In Högvadsån salmon may migrate freely 50 km up the river to the dam at Lia, where they may pass through a fish way and continue for another 10 km to the power plant at Älvsered. This upper

section is today only utilised by a few spawners.

Both the chemical status (excluding mercury) and the ecological status are good. Acidification is strong in the upper parts of the catchment area and extensive liming has been carried out in lakes, wetlands and tributaries connected to the main river.

River Ätran and its tributaries according to the Water Framework Directive

The name of the water management district is Bothnian Bay River Basin District and the river type is a medium-sized forest river.

Ecological status: Good

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are to continue liming and to improve the functioning of fish ways. The lowest dam will be taken away.

Natura 2000

The tributary Högvadsån is protected within the Natura 2000 network.

The Ätran salmon stock

The Ätran with the tributary Högvadsån has a unique salmon stock that probably is virtually unaffected from elements of exogenous genes, although stocking was carried out previously. Ätran is chosen as an index river by the Swedish Board of Fisheries.

Ätran salmon reproduces along the main river and in the tributaries Högvadsån, Fagerredsån and Hjärtaredsån. Extensive electro-fishing surveys are carried out in the river. The number of salmon increased significantly following the extensive liming but showed a rapid decrease during the 1990s, possibly due to a combination of outbreak of the ectoparasite *Gyrodactylus salaris*, drought, lower survival rate at sea and periodically high levels of aluminium.

Stocking has been carried out from 1965 until 1985. In 1923 stocking was made even with Baltic salmon from the River Indalsälven. Being the only Index River at the west coast of Sweden research on salmon is focused to this river.

Salmon and sea trout population facts

Population category: 1 (salmon and sea trout)

Reproduction area: 54.9 ha (salmon); 27 ha (sea trout)

Production capacity: 54,870 smolts (salmon)

Recent wild smolt production estimate: 27,500 (mean of 2005-2009) (salmon); 1,500 (sea trout)

Fishing regulations in the River Ätran

The open season for fishing varies depending on the river location, but in general it is between the April 1 and September 30. Fishing hours are 5 am – 11 pm. Minimum legal length for salmon and

sea trout is 45 cm. There is a bag limit of two anadromous fish (salmon or sea trout) per fisher per day.

Only fly and spinning rods are allowed. Legal baits are spoons, devons, wobblers, (tube) flies, jigs and shrimps. No other kinds of baits are allowed. Snagging is banned according to Swedish law. There is a protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

- Liming should be continued, and might need to be increased in tributaries.
- Habitats may need to be restored in tributaries.
- Fishing in the river may impact the number of spawners to a high extent. This needs to be evaluated.
- The effect of the ectoparasite *Gyrodactylus salaris* on salmon production must be monitored carefully.

The River Öreälven

The River Öreälven is a medium-sized salmon and sea trout river in northern Sweden flowing to the Bothnian Sea.

Basic hydrological facts

River length: 240 km of which 70 km accessible for salmonids

Size of catchment area: 3,001 km²

Average flow: 34 m³/s

Daily lowest flow: 1.7 m³/s

Number of migration hindrances: 3 (2 fishways)

Habitat and water quality in River Öreälven

The river Öreälven starts from Lakes Alsträsket and Stor-Arasjön in a low alpine region, comprised of areas with forest and mires. The river varies a lot along its length with several waterfalls, rapids and rifts as well as calmer meandering parts in the areas closer to the mouth in the bay of Örefjärden in the Bothnian Sea. The river mouth is characterized by an extensive delta with sand islands and cut off bays. The catchment area is dominated by forests 80% and mires 13.5%. Lakes cover only 2.3% of the catchment area.

The river was used for timber floating until the 1970s and hence riffles and rapids were dredged, but these have now been restored to improve reproduction success of salmon and sea trout.

There are a total of three power plants in the river. At Agnäs approx. 50 km up the river there is a power plant equipped with a fish ladder. A fish way at Laxforsen (Torrböle) helps salmon and trout to pass a difficult passage. Near the river mouth there was a dam equipped with a fish pass at Håknäs (6.9 km from the mouth). This dam has been demolished. Thanks to these measures salmon is able to migrate 70 km up the river where the water fall at Storfors is a definite hindrance. The river including its tributaries is protected against further construction of power plants through the Swedish Environmental Code. There is one hatchery in the river, rearing sea trout. Some of the

tributaries, regarded as important sea trout reproduction areas, have been subject to liming.

The water quality (excluding mercury) is considered good in the whole river whereas the ecological status is set to good near the outlet, but is regarded as fair on the reproduction areas due to flow regulation and continuity problems.

River Öreälven according to the Water Framework Directive

The name of the water management district is Bothnian Sea River Basin District and the river type is a medium-sized forest river.

Ecological status: Good (near outlet), Fair (reproduction areas)

Biological status: Good

Physical & chemical status: Good (excluding mercury)

Hydrologic & morphological status: Good

No official water management plan is established, but probable main measures are measures to decrease flow regulation downstream dams and to continue liming.

Natura 2000

The main river belongs to the Natura 2000 network.

The Öreälven salmon stock

River Öreälven holds an original salmon stock. However, the production of salmon is only 25 % of what is expected. The reason for this is not known.

Salmon and sea trout population facts

Population category: 3 (salmon); 1 (sea trout)

Reproduction area: 105 ha (salmon); 100 ha (sea trout)

Production capacity: 16,000 smolts (salmon)

Recent wild smolt production estimate: 4,000 (salmon); 500 (sea trout)

Fishing regulations in the River Öreälven

The open season for salmon fishing is from June 19 – August 31. The minimum legal length for salmon is 50 cm. There is a bag limit of 1 salmon (male) per fisher per day. There is no weekly closure for fishing in the river. There is a small protected area from fishing in the estuary to allow migratory fish to pass.

Specific actions for the development of the salmonid populations

The salmon stock in Öreälven is in need of recovery, in spite of restoration work and liming operations. Continued and further actions are required.

- Primarily the cause of the low stock status must be investigated.
- Liming should be continued, and eventually increased.

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for this river.

3. Sea trout populations and rivers in Sweden

Sea trout rivers of Main Basin and the Sound

Basic hydrological facts (median for all rivers)

River length: 17 km
Size of catchment area: 44 km²
Average flow: 0.4 m³/s
Daily lowest flow: No information
Number of migration hindrances: No information

Habitat and water quality in the Swedish sea trout rivers flowing to the Main Basin and the Sound

Totally 172 sea trout populations were reported from the Main Basin including the Sound. Among these are four salmon rivers. Only seven rivers are tributaries to larger rivers.

The water quality is affected by eutrophication in several rivers, but generally not to such an extent that sea trout production is affected. A major problem is natural summer drought that is strengthened by draining of wetlands and water withdrawal for irrigation. Liming is carried out in some (21%) rivers in order to reduce acidification effects.

The rivers and streams are generally blocked by several dams, both active hydropower dams and old unused dams. At dams for hydropower production fish ways are built or planned in the lower reaches of the rivers, but not so frequently in the upper reaches. Many of the smaller streams have road culverts that are regarded as partial or total migration obstacles. Several fishways have been installed in the coastal rivers, often with recorded improved trout production. To lessen the outflow of nitrogen to the sea artificial dams have been built in the watercourses, leading to migration obstacles for fish.

The draining of the landscape along with irrigation for farming leads to extreme low flows during summer, especially in warm and dry periods. In some regions small trout streams may even be completely dry some years, especially on the island of Öland. Acidification is still a problem in some areas. The impact of forestry and agriculture is pronounced in the smaller rivers, leading to increased bed load and nutrient load. Implementing of riparian buffer zones would address this problem, and also decrease insolation leading to lower water temperatures in summer.

Swedish Main Basin and Sound rivers according to the Water Framework Directive

The name of the water management district is Northern & Southern Baltic Sea River Basin District and the river types are small streams draining to the sea.

Ecological status: Generally Fair (20% Good, 14% Poor)

Biological status: Generally Good

Physical & chemical status: Generally Good/Fair

Hydrologic & morphological status: Good/Fair (41% Good)

The main measures in the water management plan are to restore stream habitat and hydrology, to establish fish ways at power plants and dams, to decrease net fishing in shallow coastal waters and to establish riparian buffer zones.

Natura 2000

Twelve of the rivers are more or less totally included in Natura 2000 network. Among these are Rivers Mörrumsån, Emån and Alsterån, which all hold salmon populations together with sea trout.

The sea trout stocks of the Swedish rivers flowing to the Main Basin and the Sound

99% of the sea trout stocks are self-sustaining and 84% are classified as category 1 rivers. Stocking of smolts is not common, but is undertaken annually close to River Åvaån (Stockholm) and in rivers Marströmmen, Ljungbyån and Mörrumsån. In general all stocks are small, due to the small river size, especially southern rivers. The southern stocks are of good status, whereas stocks on the east coast have somewhat lower status, but are in general satisfactory.

Sea trout population facts

Population category: 1 (84% of the rivers)

Reproduction area: No information

Production capacity: No information

Recent wild smolt production estimate: No information

Fishing regulations in the Swedish Main Basin and Sound rivers

The minimum size of trout is 50 cm. In the coastal zone drift-lines, drift-nets and anchored nets or lines are not allowed. Fishing for trout is prohibited in the sea 15 September – 31 of December.

Most rivers have areas that are protected from fishing at the mouth from September 1 – December 31, in order to protect migrating spawners in the estuary. In the Sound area there are 18 large protected areas at river mouths. In the main Baltic there are 52 such areas. As a general rule the smaller streams draining into the sea always have as a minimum a protected zone of 200 m radius from the mouth during this period. Net fishing is prohibited in most rivers. All stocked sea trout are fin-clipped.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for these rivers.

- Landscape hydrology must be restored by re-meandering straightened channels, re-establishing wetlands and restoration of lowered lakes. Straight ditches must be removed or blocked.
- Effective riparian buffer zones must be established throughout the catchments to lessen the load of nutrients and sediment.
- A strict regulation of water withdrawal for irrigation purposes is required in most lowland streams (agricultural areas).
- Continued river bed restoration is required in several streams; most urgent is the re-establishment of large structures (boulders, logs) and spawning beds.
- Re-meandering of straightened channels should be allowed, and preferably initiated by establishing large structures along shores allowing for free meandering of the river within the river channel.
- Liming of acidified waters will be required for several decades in especially south-western Sweden.
- Opening of fish ways through dams are also required. When possible technical fish-ladders should be avoided and nature-like by-pass channels used instead.

Sea trout rivers of the Bothnian Bay

Basic hydrological facts (median for all rivers)

River length: 53 km

Size of catchment area: 320 km²

Average flow: 4.6 m³/s

Daily lowest flow: No information

Number of migration hindrances: No information

Habitat and water quality in the sea trout rivers flowing to the Bothnian Bay

Sea trout spawn both in shallow areas along the banks in the large salmon rivers of the region, but also in tributaries. Few of the smaller (catchment area <100 km²) streams that drain directly in the sea hold sea trout populations of any significance. This is due to low slope of the coastal area resulting in too low water velocity. In total 13 larger salmon rivers and 46 smaller streams are included in the HELCOM database. Of these smaller streams 80% are tributaries of the larger rivers.

Generally the water quality is good in the main rivers and tributaries. Liming has been carried out in some tributaries in order to reduce acidification effects. In total 40% of the catchments benefit from liming operations. The air-transported acid load has decreased substantially and most liming operations in the region will cease.

Fishways are lacking at several hydropower dams. Some large rivers, as Luleälven and Skellefteälven, are completely blocked by dams at the mouth. To compensate for the loss of trout and salmon habitat stocking is carried out, successively with decreasing success.

Even though the tributaries are often unexploited for hydropower purposes, there are some that are blocked by dams. In some cases these are remnants of the timber floating period. Even these small tributaries were used for log driving until the end of the 1960s. Some parts of the affected areas have been restored to improve reproduction success of salmon and trout. Many of the smaller streams have road culverts regarded as partial or total migration obstacles.

Swedish Bothnian Bay rivers according to the Water Framework Directive

The name of the water management district is Bothnian Bay River District and the river types are mainly tributaries to large salmon rivers.

Ecological status: Generally Good/Fair (Good 42%, Poor 17%)

Biological status: Generally Good

Physical & chemical status: Good

Hydrologic & morphological status: Good/Fair (48% Good)

The main measures in the water management plan are to decrease fishing of trout in the coastal fishery, to continue the restoration of riffles and rapids from dredging due to timber floating and to establish fish ways at power plants and dams.

Natura 2000

Several tributaries of River Kalixälven belong to the Natura 2000 network. Remaining Natura2000-rivers normally are protected only along the main river, i.e. not including tributaries.

The sea trout stocks of the Swedish Bothnian Bay rivers

In general all stocks are very small and the situation for the trout populations is critical. In spite of this 88% of stocks are classed as category 1 and 95% as self-sustaining, although on a low level.

Sea trout population facts

Population category: 1 (88% of the rivers)

Reproduction area: No information

Production capacity: No information

Recent wild smolt production estimate: No information

Fishing regulations in the Swedish Bothnian Bay rivers

In the coastal zone and fresh waters the minimum size is 50 cm. In the coastal zone drift-lines, drift-nets and anchored nets or lines are not allowed.

Fishing for trout in the sea is prohibited from October 1st – December 31st. Fishing with nets in the coastal zone at the depth of 0–3 m is prohibited in the spring, autumn and winter.

Some large salmon rivers have large protected areas from fishing from September 1st – December 31st to protect migrating spawners in the estuary. As a general rule all rivers and streams draining into the sea have a protected zone of 200 m radius from the mouth during this period.

No trout may be fished during the spawning season. Net fishing is only allowed in lake-like habitats in certain rivers, and salmon and trout may not be caught. All stocked sea trout are fin-clipped.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for these rivers.

- Landscape hydrology must be restored by re-establishing wetlands. Straight ditches must

- be removed or blocked.
- Effective riparian buffer zones must be established throughout the catchments to lessen the load of nutrients and sediment.
- Continued river bed restoration is required in several streams; most urgent is the re-establishment of large structures (boulders, logs) and spawning beds.
- Opening of fish ways through dams are also required. When possible technical fish-ladders should be avoided and nature-like by-pass channels used instead.
- Fishing pressure on sea trout in the rivers is generally too high and must decrease.

Sea trout rivers of the Bothnian Sea

80% of the Swedish sea trout rivers flowing to the Bothnian Sea are wild, category 1 rivers.

Basic hydrological facts (median for all rivers)

River length: 20 km

Size of catchment area: 70 km²

Average flow: 0.7 m³/s

Daily lowest flow: No information

Number of migration hindrances: No information

Habitat and water quality in the sea trout rivers flowing to the Bothnian Sea

Sea trout spawn both in shallow areas along the banks in the salmon rivers of the region, but also in tributaries and in smaller rivers emptying on the coast. In total 11 salmon rivers and 73 smaller streams with sea trout are included in the HELCOM database. Of these smaller streams only 23% are tributaries of the larger rivers. This region has more trout populations in smaller rivers draining directly to the sea than the Bothnian Bay region. In three of the former salmon rivers, Ångermanälven, Ljusnan and Indalsälven, dams block all access to spawning areas and instead stocking of fin-clipped smolts of salmon and sea trout is undertaken annually. Generally the water quality is good in the main rivers and tributaries. Forestry, and at low altitude agriculture, affect water quality mainly by sediment load. Liming is carried out in several (75%) rivers or their tributaries with positive effects on trout reproduction.

Many of the watercourses are blocked by dams or have road culverts regarded as partial or total migration obstacles. Even small rivers and streams were used for log driving. Large parts of the affected areas have been restored to improve reproduction of salmon and trout.

Swedish Bothnian Sea rivers according to the Water Framework Directive

The name of the water management district is Bothnian Sea River District and the river types are mainly small coastal rivers and some larger salmon rivers.

Ecological status: Generally Good/Fair (Good 37%, Poor 23%)

Biological status: Generally Good

Physical & chemical status: Good

Hydrologic & morphological status: Good/Fair (42% Good)

The main measures in the water management plan are to decrease fishing of trout in the coastal fishery, to continue restoration of riffles and rapids from dredging due to timber floating and to establish fish ways at power plants and dams.

Natura 2000

The salmon river Moälven with its tributaries and with good trout populations belongs to the Natura 2000 network. Also the main stems of the rivers Testeboån and Enångersån belong to the Natura 2000 network.

The sea trout stocks of the Swedish Bothnian Sea rivers

In general all stocks are stable in the northern part, and improving in the southern part. Overall the status may be regarded as satisfactory with 80% classed as category 1, and 95% of stocks self-sustaining. Stocking of smolts is carried out in nine rivers.

Sea trout population facts

Population category: 1 (80% of the rivers)

Reproduction area: No information

Production capacity: No information

Recent wild smolt production estimate: No information

Fishing regulations in the Swedish Bothnian Sea rivers

In the coastal zone the minimum size of trout is 40 cm, being the lowest minimum size for this species in the Baltic. In the coastal zone drift-lines, drift-nets and anchored nets or lines are not allowed. No trout may be fished in the sea during the spawning season, i.e. October 1 –December 31.

Some rivers have large protected areas from fishing during September 1 – December 31 to protect migrating spawners in the estuary. As a general rule all rivers and streams draining into the sea have a protected zone of 200 m radius from the mouth during this period. Net fishing is only allowed in lake-like habitats in certain rivers, and salmon and trout may not be caught. All stocked sea trout are fin-clipped.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for these rivers.

- Landscape hydrology must be restored by re-establishing wetlands. Straight ditches must

- be removed or blocked.
- Effective riparian buffer zones must be established throughout the catchments to lessen the load of nutrients and sediment.
 - Continued river bed restoration is required in several streams; most urgent is the reestablishment of large structures (boulders, logs) and spawning beds.
 - Re-meandering of straightened channels should be allowed, and preferably initiated by establishing large structures along shores allowing for free meandering of the river within the river channel.
 - Liming of acidified waters will be required for several decades in some areas.
 - Opening of fish ways through dams are also required. When possible technical fish-ladders should be avoided and nature-like by-pass channels used instead.

Sea trout streams of the Kattegat

Basic hydrological facts (median for all rivers)

River length: 14 km
Size of catchment area: 52 km²
Average flow: 0.6 m³/s
Daily lowest flow: No information
Number of migration hindrances: No information

Habitat and water quality in the sea trout streams flowing to the Kattegat

Totally 60 trout populations were reported from the Kattegatt. Several of the larger (>200 km²) rivers also hold salmon. Eighteen rivers are tributaries to larger rivers.

The water quality is affected by eutrophication in several rivers, but generally not to such an extent that trout production is affected. Also acidification is common and liming operations are undertaken repeatedly in 65% of the rivers. Without liming many stocks would decrease severely.

The bed load from forestry and agriculture is large, due to improper land use practices and lack of riparian buffer zones. A problem is summer drought due to draining of wetlands and water withdrawal for irrigation. During these low water periods the water temperature becomes high as the insolation is high. Only little shade is available in the agricultural landscape.

The rivers and streams are generally blocked by several dams, both active hydropower dams and old unused dams. Many of the smaller streams have road culverts regarded as partial or total migration obstacles. Several (approximately 50) fishways have been established in the coastal rivers, often with recorded improved trout production.

Swedish Kattegat rivers and streams according to the Water Framework Directive

The name of the water management district is **Skagerrak and Kattegat River Basin District** and the river types are mainly small rivers draining to the sea.

Ecological status: Generally Fair (20% Good, 2% Poor)

Biological status: Generally Good

Physical & chemical status: Generally Good

Hydrologic & morphological status: Good/Fair (32% Good)

The main measures in the water management plan are to establish fish ways at power plants and dams, continue liming, to establish riparian buffer zones, hydrologic restoration of catchment and to decrease net fishing in shallow coastal waters.

Natura 2000

Two of the rivers are more or less totally included in Natura 2000, River Ätran-Högvadsån and River Rolfsån. Both hold salmon and trout. The estuaries of another three rivers are included in coastal Natura 2000 areas. Further small parts (rapid areas) of Rivers Nissan and Lagan are protected.

The sea trout stocks of the Swedish streams and rivers flowing to the Kattegat

All wild stocks are self-sustaining. 98% are classified as being in category 1. Stocking is not common, but is undertaken annually in River Lagan, Göta älv and Nissan. In the two former wild stocks are lacking in the main channel, but is present in tributaries. In general all wild trout stocks are small, due to small rivers. The stocks are in a good state.

Sea trout population facts

Population category: 1 (98% of the rivers)

Reproduction area: No information

Production capacity: No information

Recent wild smolt production estimate: No information

Fishing regulations in the Swedish Kattegat rivers and streams

The minimum size of trout is 45 cm. Fishing for trout is prohibited October 1 – March 31 in the sea. All trout rivers and streams have protected areas at the estuary from fishing during September 1 – December 31 to protect migrating spawners in the estuary. There are 32 protected areas at river mouths in Kattegat. Some of these areas are very large with several river mouths included. Net fishing is not allowed in rivers. All stocked sea trout are fin-clipped.

Specific actions for the development of the salmonid populations

The recommendations in the general report of the HELCOM SALAR project concerning accessibility and river fisheries management are applicable for these rivers.

- Landscape hydrology must be restored by re-meandering straightened channels, re-establishing wetlands and restoration of lowered lakes. Straight ditches must be removed or blocked.

- No new wetlands shall be established that impedes fish migration.
- Effective riparian buffer zones must be established through-out the catchments to lessen load of nutrients and sediment.
- A strict regulation of water withdrawal for irrigation purposes is required in most lowland streams (agricultural areas).
- Continued river bed restoration is required in several streams; most urgent is the re-establishment of large structures (boulders, logs) and spawning beds.
- Re-meandering of straightened channels should be allowed, and preferably initiated by establishing large structures along shores allowing for free meandering of the river within the river channel.
- Liming of acidified waters will be required for several decades in especially south-western Sweden.
- Opening of fish ways through dams are also required. When possible technical fish-ladders should be avoided and nature-like by-pass channels used instead.

4. Acknowledgements

HELCOM wishes to express its most sincere thanks to the nominated expert of Sweden, Erik Degerman from the Swedish Board of Fisheries, who has prepared texts and coordinated the HELCOM SALAR project work in Sweden; and his team of experts, Håkan Häggström from Swedish Environmental Protection Agency and Jens Persson at the Swedish Board of Fisheries and Mikael Andersson from the Swedish Board of Fisheries.

HELCOM expresses its gratitude to all the experts that have participated in the HELCOM SALAR project. The report would not have been produced without their collective effort.

HELCOM is grateful to Leena Närhi, Bitdesign, for designing layout for the cover of the report.

This report has been funded through a co-financing agreement between the European Union (European Commission, Directorate General for Maritime Affairs and Fisheries) and HELCOM (Overview of the state of salmon (*Salmo salar*) and sea trout (*Salmo trutta*) populations in rivers flowing to the Baltic Sea – SI2.546540).



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