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Sea Trout and Salmon Populations and Rivers in Denmark

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

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Contents

1. Introduction

This Report gives a description of Danish 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.

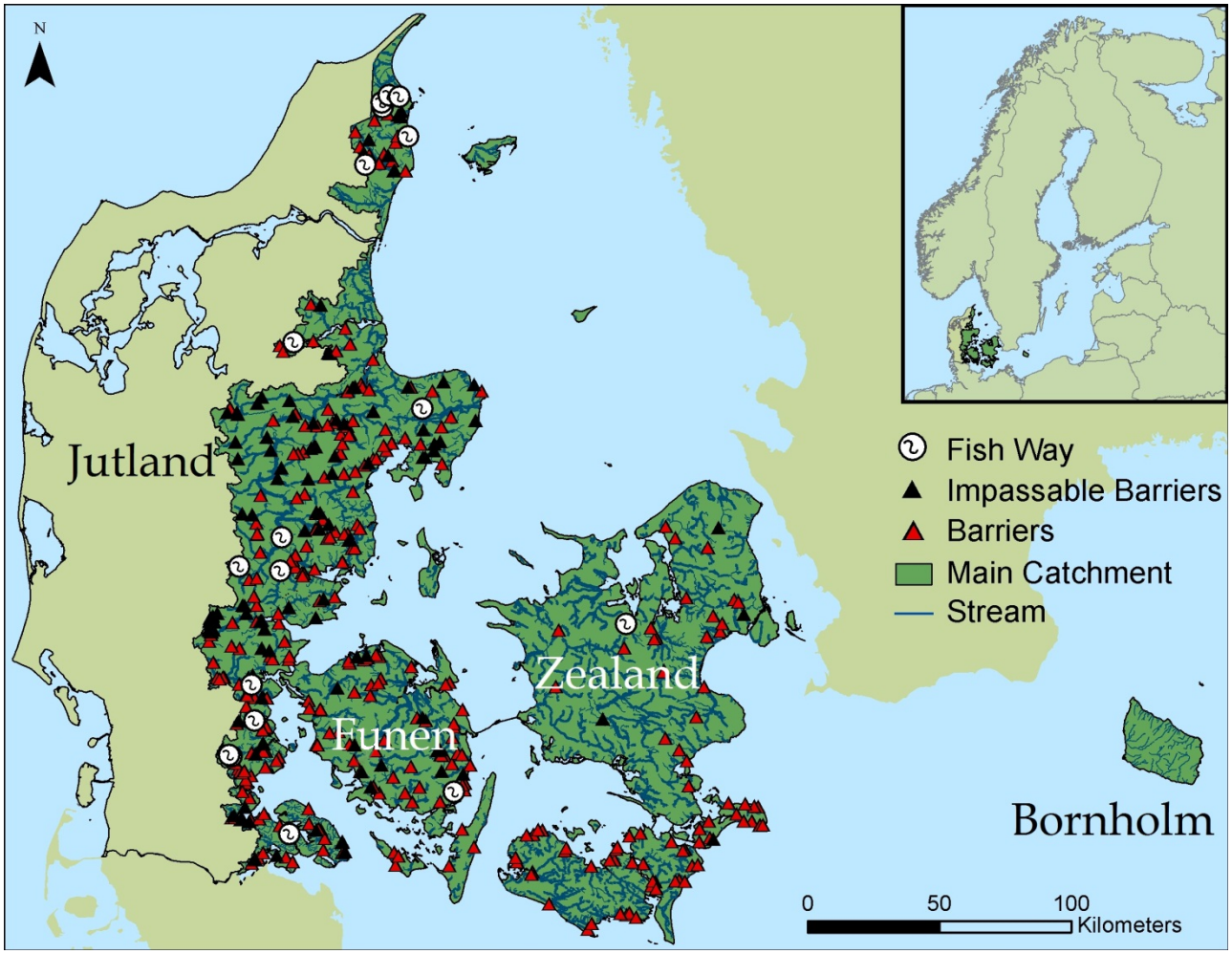

Figure 1. Map of the sea trout and salmon rivers of Denmark. Inserted is information on fish-ways (fish ladders) and known migration barriers.

2. Sea trout populations and rivers in Denmark

Sea trout rivers on the island of Bornholm

Habitat and water quality in the Danish sea trout rivers and streams on the island of Bornholm

The catchment area in the north of the island of Bornholm has a thin layer of quaternary deposits on a granite base and in the middle part there are large deposits on sandstone and slate. On the island approximately 60% of the area is farm land and many pig farms exist. 28% of the catchment area is covered by forest. Most streams not running through forests are shaded by hedges or trees.

The rivers with trout populations vary in size but are all relatively small. They have a rapid and highly variable run-off that is often critically low during summer and autumn. Compared to most other Danish streams, the streams on Bornholm are relatively unaffected by human activity and most streams have a sufficient amount of gravel for sea trout spawning. Dredged and heavily maintained sections are mostly located in the upper reaches not accessible to trout or in areas where the stream is too small for trout populations.

Dry periods result in low discharge that influences the accessibility to spawning grounds for fish and decreases the habitat availability for young fish. This results in large variations in both the trout densities and their production between years.

An estimated 20% of the stream length is degraded physically by dredging, straightening and culverting. The water quality in general is good, but outside urban areas some parts of the streams are still slightly affected by pollution due to outlets of sewage from scattered settlements. Some migration obstacles are still found in the streams, affecting an estimated 40% of the stream length. Also some natural obstacles are found.

The sea trout rivers and streams on the island of Bornholm according to the Water Framework Directive

The name of the main catchment area is 3.1 Bornholm. The river types are natural streams in valleys in rocky (granite) areas in the northern part, natural streams and streams passing through agricultural areas in the middle and south.

Natura 2000

Small parts of the upper reaches of some streams belong to the Natura 2000 network.

The sea trout stocks of the Danish rivers and streams on the island of Bornholm

The relatively good conditions in streams and the termination of releases combined with restrictions in the sea fishery have resulted in a very good state of the sea trout populations. Releases of trout were terminated in 1992 and prior to this only trout originating from local wild trout (partly original strain and partly unknown strain) were released.

Sea trout population facts

Population category: 1 (14), 3(12), 4 (1)
Reproduction area: 11.5 ha
Production capacity: 8,784 (but very variable with flow)
Recent wild smolt production estimate: > 100%

Fishing regulations in the rivers of the island of Bornholm

There is no fishing in the streams on the island of Bornholm. Sea fishery is restricted by space and by the number of gear allowed to each recreational fisherman.

Specific actions for the development of the salmonid populations

The largest problem to trout on Bornholm is reduced water flow in dry periods. Bogs and moorlands in the catchment areas should be restored to their original hydrological state in order to increase the amount of running water during dry periods.

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

Sea trout rivers on the island of Funen

Habitat and water quality in the Danish sea trout rivers and streams on the island of Funen

On the island Funen there are a large number of small streams around the island and a few intermediate-sized streams. The largest stream is the Odense Å, which runs from the centre of the island in a northward direction into the Odense Fjord. Many of the streams and tributaries have a good gradient since large parts of the island are quite hilly.

Human population density is relatively high in the centre of the island, where the third largest city in Denmark (Odense) is located, and in the south eastern areas. Ground water is extracted for consumption more or less all over the island. Farming is more intense than in the rest of Denmark, occupying 65–71% of the area (country average 62%). Forests and nature areas constitute approximately 11% and 6% of the surface area on the island, respectively (country averages are 11% and 7%). In the centre of the island horticulture is intense.

Many streams have been straightened and made deeper to ensure a rapid run-off from farmed land. For this reason stream environments have also been altered. Channelization is another major reason for the excess erosion and sediment transport in many areas. Water extraction results in drying out of streams. Combined with the lack of shade, the extraction often results in heavy growth of vegetation.

Most of the streams on Funen have been subject to dredging and substantial parts of the upper reaches are culverted. Especially small streams are physically degraded, while conditions in the medium sized streams are better. Due to intense farming stretches of streams are also subjected to chemicals (insecticides).

Many streams have obstacles for salmonid migration, because in the former times many water mills were built in the area. A large number of barriers still exist, especially in the smaller streams.

In the 1960s and 1970s organic pollution e.g. from households, farms and dairies was a major problem in the streams on the island of Funen. It still represents a problem to some extent in the countryside, mainly in the form of scattered loading from households. However, it is not a direct threat to the trout populations.

Over the last decade a large number of local restoration projects have been initiated to remove barriers and to add spawning material and larger stones to the streams from where they have been removed during regulation.

The sea trout rivers and streams on the island of Funen according to the Water Framework Directive

The names of the main catchment areas are 1.12–1.15 Lillebælt/Fyn, Odense Fjord, Fyn Storebælt, Det Sydfynske Øhav. The river types are not specified in the EU Water Plan. The catchment area is hilly moraine formed during the last glaciation. Clay deposits (containing silt, sand, gravel and stone) dominate. Areas with sand, peat and silt are also found.

Natura 2000

The streams on the island of Funen do not belong to the Natura 2000 network.

The sea trout stocks of the Danish rivers and streams on the island of Funen

The size of the sea trout stock has increased significantly during the last two decades e.g. due to the regulation of the sea fishery, and the number of self-sustaining trout populations has increased. Natural sea trout reproduction in 2009 took place in 87% of the sites investigated compared to 66% in 1991 and 79% in 2000. The densities of 0+ trout have more than doubled and the average parr density is 83 parr/100 m^2. In a number of sites the population status has however, not improved, and restoration, e.g. the removal of barriers, still needs to be carried out.

Large numbers of sea trout smolts have been released in the river mouths in order to establish good fishing possibilities. In later years, the focus of the stock management has changed towards restoration of natural trout spawning areas in order to enhance the sea trout reproduction.

Sea trout population facts

Population category: 1 (3 streams/tributaries), 2 (3 streams/tributaries), 3 (67 streams or tributaries), 4 (6 streams/tributaries), 6 (9 streams/tributaries), 8 (9 streams/tributaries)
Reproduction area: 118.6 ha (potential: 1.1 ha)
Production capacity: 93,916 smolts (potential: 853)
Recent wild smolt production estimate: 96%

Fishing regulations in the rivers of the island of Funen

Angling associations at the rivers enforce a catch limit of a maximum of 3 trout per fisher per day and an extended minimum size of 45 cm (national legal size is 40 cm).

Specific actions for the development of the salmonid populations

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Salmonid habitats should be restored by re-meandering, addition of spawning gravel and other restoration measures, especially in the smaller streams to guarantee the persistence of any remaining original populations. Culverted sections should be re-opened. Water extraction in areas of critically low flow should be reduced, and shaded areas should be established along the streams where growth of in-stream vegetation is heavy.

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

Sea trout streams in north eastern Jutland (Mariager Fjord)

Habitat and water quality of the rivers in the north eastern Jutland (Mariager Fjord)

There are three medium-sized streams and several small streams in the Mariager Fjord catchment area. The small streams constitute 69% (incl. tributaries) of the total stream length. In general the streams in the area have a relatively high gradient. Farming is intense and covers 74% of the catchment area (country average 62%), and the density of farm animals is close to 50% above the country average. Areas with nature cover only 1% (country average is 9%) and areas with forest constitute approximately 14% of the area.

Nearly half of the streams (44% of the stream length) in the area have been subject to dredging and about 2% of the upper reaches are culverted. Many streams are heavily maintained. A large number of migration barriers still exist, especially in the smaller streams. Fish farming used to be quite intense in Villestrup Å, but recently all fish farms have been closed and the associated migration barriers are to be removed.

Many streams and stream sections have been straightened and made deeper to ensure a rapid run-off from farmed land. During canalisation and regulation of the streams, gravel and coarse material has been removed and hence a lack of suitable spawning material is frequently a problem in the area. Canalisation is also a major reason for excess erosion and sediment transport in many places. Over the last couple of decades a large number of smaller restoration projects for removing barriers and adding spawning material and larger stones to the streams and tributaries have been undertaken. However, a number of barriers and less than optimal fish passes are still found.

The streams are partly influenced by elevated levels of fine sediment and by ochre (iron oxide). Especially the habitats in some of the smaller streams suffer from organic pollution from scattered houses in the catchment area. Due to roads, parking areas and drainages, some smaller streams are subject to hydraulic overload after heavy rainfall.

While the status in the medium-sized streams is fair (end even good in some streams) the smaller streams do not meet the EU criteria and 23% of the stream length is estimated not to do so by 2015.

The sea trout rivers in the north eastern Jutland (Mariager Fjord) according to the Water Framework Directive

The name of the main catchment area is 1.3 Mariager Fjord. The river types are not specified in the EU Water Plan. The catchment area is hilly moraine soil formed during the last glaciation. Melt water valleys dominate in the areas where the soil contains relatively much sand. Close to the surface the water flows through extensive chalk layers.

Natura 2000

The two larger systems and parts of the tributaries belong to the Natura 2000 network.

The sea trout stocks of the north eastern Jutland (Mariager Fjord)

The size of the sea trout stock has increased significantly during the last two decades, particularly in areas where migration barriers have been removed. Some of the populations are of the original strain. According to the most recent survey (2008), natural reproduction now takes place in approximately 80% of the sites investigated. The increases in sea trout populations have been enhanced by regulations in the sea fishery.

The densities of young of the year trout have increased but they seem to have levelled off in recent years. In the last monitoring the average density was 125 parr/100 m^2. Densities of older fish has been reduced in the smaller streams and increased in one of the larger streams.

Sea trout population facts

Population category: 1 (5 streams/tributaries), 3 (13 streams/tributaries), 4 (1 stream/tributary), 6 (1 tributary)
Reproduction area: 23.2 ha (potential: 0.4)
Production capacity: 18,120 smolts (potential 333 smolts)
Recent wild smolt production estimate: ≈ 100%

Fishing regulations in the rivers of the North-Eastern Jutland (Mariager Fjord)

The majority of the streams are too small for fishing, but some angling occurs in the larger systems. It is not known if there are special regulations.

Specific actions for the development of the salmonid populations

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Heavy maintenance should be either stopped or replaced with a more gentle approach and in places, physical conditions in the streams improved. To facilitate spawning, gravel should be added in suitable places where this is needed, and to prevent excess erosion and sediment

transport the regulated parts of the main rivers should be re-meandered. Culverted sections should be re-opened.

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

Sea trout streams in the north eastern Jutland (Northern Kattegat)

Habitat and water quality in the rivers in the north eastern Jutland (Northern Kattegat)

In the Northern Kattegat and Skagerrak catchment area in the north eastern Jutland there are four medium-sized streams (Voers Å, Sæby Å, Geråa and Elling Å) and several small streams. Farming is intense, covering 66% of the catchment area (country average 62%), and the density of farm animals is a bit above country average. Areas with nature cover 10% of the area (country average is 9%) and areas with forest constitute approximately 13%.

A significant portion of the streams (39% of stream length) in the area have been subject to dredging and about 2% of the upper reaches are culverted. Many streams are heavily maintained. A number of migration barriers still exist, especially in the smaller streams.

Some parts of the streams are influenced by elevated levels of fine sediment, and a few by ochre. Especially some of the smaller streams are influenced by organic pollution from scattered houses in the catchment area. Due to roads, parking areas and drainages some smaller streams are subject to hydraulic overload after heavy rainfall.

The status of the streams is estimated not to be sufficiently good to meet the EU criteria in approximately 37% of stream length by 2015. The status is generally better in the smaller streams of the area when compared to the other parts of the country. However, the status is unknown in a large part of the small streams.

The sea trout rivers in the north eastern Jutland (Northern Kattegat) according to the Water Framework Directive

The name of the main catchment area is 1.1 Northern Kattegat and Skagerrak. The river types are not specified in the EU Water Plan. The catchment area is quite mixed and was formed during the last glaciation period. Land elevation occurred later. The land is formed of hilly moraine with melt water valleys, elevated former sea-bed or sand deposited by wind. The soil contains relatively high proportions of sand.

Natura 2000

Some of the streams in the catchment area belong to the Natura 2000 network.

The sea trout stocks of the north eastern Jutland (Northern Kattegat)

Sea trout populations have declined in some streams, and shown some progress in others. The overall situation of the stocks is worse than in many other parts of the country. In the surveys of fish populations (last carried out in 2003–2007) the general problem for trout populations was found to be the poor physical habitat conditions due to heavy maintenance and regulation of the

streams. In many places, for example in Sæby Å, sediment transport is also a problem. Access to spawning areas is prevented or difficult in a considerable number of tributaries and in a large part of Sæby Å, where a poorly functioning fish-pass is situated close to the outlet to the sea. Sediment transport and the lack of spawning gravel are widespread problems. Over the last couple of decades some restoration projects, such as removing barriers and adding spawning material and larger stones to the streams and tributaries, have been undertaken.

In some small streams organic pollution is still a problem despite of the good gradient and the acceptable water quality in general. Among the small streams, sea trout fry was found in very low densities (only in 7% of the sites investigated during the last survey in 2007).

In the medium-sized streams the situation is varied. In Gerå, for example, the situation is only a little better than in the smaller systems, and trout were found in 21% of the sites investigated. The state of the stock has improved over time but not during the most recent years. In addition to poor physical conditions and some pollution, the lack of spawning gravel was also observed. In the medium-sized system of Sæby Å the sea trout population has declined. In 2006 trout fry were found only in 19% of the sites investigated (in 1998 trout were found in 44% of the sites). This is in part due to erosion and transport of sand in the stream.

Also in the larger system of Voers Å a slow improvement in the distribution has been observed. Trout fry were found in 56% of the sites investigated in the last survey. However, at the same time the distribution of 1+ and older fish had decreased, most likely due to the degraded habitats.

In the northernmost area the situation is not much different from Sæby Å, except that in this area a decline in trout populations was observed in the 1970s and 1980s. Since the 1980s some progress has been observed and trout were found in the last survey in 64–67% of the sites investigated.

Summing up for the area, the sea trout populations have declined in some streams and shown some progress in others, but not at all as much as in many other parts of the country. The reason for this is mainly heavy maintenance, regulation and barriers, resulting in poor habitat conditions and shortage in spawners. In the stream Sæby Å sediment transport is problematic.

Sea trout population facts

Population category: 1 (1 stream), 3 (11 streams or tributaries), 4 (9 streams), 6 (3 streams)
Reproduction area: 34.5 ha
Production capacity: 28,996 smolts
Recent wild smolt production estimate: 73%

Fishing regulations in the rivers of the north eastern Jutland (Northern Kattegat)

Angling is popular in some of the larger streams.In some of the streams spent fish are protected and some gear restrictions are enforced together with a catch limit.

Specific actions for the development of the salmonid populations

Heavy maintenance should be either stopped or replaced with a more gentle approach and physical conditions in the streams improved.

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

To facilitate spawning, gravel should be added in suitable places where this is needed, and excess erosion and sediment transport should be prevented. Organic pollution should be stopped. Culverted sections should be re-opened.

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

Sea trout streams in eastern Jutland (Randers Fjord)

Habitat and water quality in the rivers on the eastern Jutland (Randers Fjord)

The catchment area of the Randers Fjord in eastern Jutland has a varied geology. The landscape was formed during the last glaciation. Most of the catchment area is hilly moraine formed with a large river valley, where the main river, Gudenå, is found. Farming is quite intense covering 70% of the catchment area. Nature areas cover 9% and areas with forest constitute approximately 15%. Human population density is close to the country average and about 25% of the population lives in scattered houses in the country side. The main rivers in the area are Gudenå and Alling Å.

The river Gudenå is the largest river in the area and it has a total length of approximately 160 km. In the lower parts of the Gudenå two larger tributaries, Nørreå and Lillå, join the river along with several small tributaries. River Gudenå is dammed at 36 km from the outlet with a hydropower station at Tange that was built in 1921. Upstream of the hydropower station there is a 13 km long reservoir (Lake Tange) that covers previous salmon spawning grounds. Upstream of the Tange hydropower station there are 5 barriers in the main river and numerous barriers in the many tributaries. There are more or less functional by-passes/fishways at all of the barriers but some of them probably need additional water or reconstruction to be fully functional.

The majority of the streams (75% of stream length) in the area have been subject to dredging and approximately 9% of the upper reaches are culverted. Extensive parts of the streams and stream sections have been straightened and made deeper to ensure a rapid run-off from farmed land. For this reason many streams are also being heavily maintained. A large number of migration barriers still exist, especially in the smaller streams.

During channelization and regulation of the streams, gravel and coarse material was removed and lack of suitable spawning material is frequently a problem in the area. In the main river of Gudenå, upstream of the lowermost hydropower station at Tange, gravel in the river needs mechanic clearing of deposited sand and silt in order to be useable as spawning gravel for sea trout, because of many years of sedimentation. Channelization is also a major reason for excess erosion and sediment transport in many places.

In some small streams organic pollution is still a problem. In several tributaries of the Gudenå ochre levels are problematic. Some parts of the streams are influenced by elevated levels of fine sediment. The water quality of some of the smaller streams suffers from organic pollution from scattered houses in the catchment area. Due to roads, parking areas and drainages streams are often subject to hydraulic overload after heavy rainfall. Bank erosion and sediment loading represent a problem in some areas.

The status of especially the smaller streams is not sufficiently good to meet with EU criteria and some 23 % of stream length is estimated not to do so by 2015. Over the last couple of decades a large number of smaller restoration projects have been undertaken in order to remove barriers and to add spawning material and larger stones to the streams and tributaries, where this has been

removed during regulation. However, a large number of migration obstacles still exist, many of which in the Gudenå upstream the hydropower station at Tange.

The sea trout rivers in the eastern Jutland (Randers Fjord) according to the Water Framework Directive

The name of the main catchment area is 1.5 Randers Fjord. The river type is not specified in the EU Water Plan.
The catchment area is quite large with a varied geology. The landscape was formed during the last glaciation. Most of it is hilly moraine formed with a large river valley, where the main Gudenå is found.

Natura 2000

Some of the streams in the catchment area belong to the Natura 2000 network.

The sea trout and salmon stocks of the eastern Jutland (Randers Fjord)

Shortly after the construction of the lowermost Tange dam in the Gudenå in 1921 the original salmon population went extinct, and sea trout populations were reduced to about a half of previous levels. A number of attempts to create passage at the power plant have been made with various types of fish-ways, but none of them have functioned satisfactory. Downstream migrating salmonid smolts passing the lake have also been found to have high mortality levels. The following description provided covers only the area below the Tange power plant. Upstream to this only resident trout of land-locked migratory trout (lake trout) are found.

In general the size of the sea trout stocks has not increased in the area (based on distribution and parr density data). However, the status of the stocks varies: there have been some significant improvements in some areas (especially in one of the larger tributaries of Gudenå) and declines in other areas. Progress has been observed particularly in areas where migration barriers have been removed.

In the most recent survey in 2002-2003 natural reproduction was found to occur at approximately 57% of the sites investigated in the Gudenå and its tributaries and at 76% of the sites in the smaller systems. In general the densities of parr have not improved in the Gudenå tributaries (57 parr per 100 m^2), while in the rest of the systems there have been significant improvements (from a density of 15 parr per 100 m^2 in 1992 to 81 parr per 100 m^2). Densities of older fish have been reduced in the smaller streams and increased in one of the larger streams. These increases have been enhanced by regulations in the sea fishery.

In Gudenå on average 102,000 one-year-old salmon smolts have been released annually in 1990–2009 and 10,700 two-year-old salmon smolts in 1993–2009. During the first years a number of different strains were tested, but during the last 8 years only salmon of the Skjernå/Storå strain (original Danish strain from western Jutland) and from the Swedish Ätran strain have been used. The stocking has resulted in spawners returning to the river, but no stable successful spawning has been observed. The reason to this is the lack of suitable spawning areas downstream of the Tange hydropower plant.

Occasional salmon spawning has been observed in the main river (with very poor survival of eggs) and in a few tributaries, but presently the levels are so low that a self-reproducing population has not been established.

Sea trout population facts

Population category: 1 (5 streams/triburaries), 3 (27 streams/tributaries), 4 (3 streams/tributaries), 5 (1 stream/tributary), 6 (96 streams/tributaries)
Reproduction area: 48 ha (potential: 72.5 ha)
Production capacity: 36,732 smolts (potential: 62,710)
Recent wild smolt production estimate: 82%

Fishing regulations in the rivers of the eastern Jutland (Randers Fjord)

Angling is popular in the larger streams in the area. In Gudenå fishing is intense, mainly targeting salmon. In the lower part of Gudenå a catch limit is enforced and on some sections also gear limits and an extended closed season.

Specific actions for the development of the salmonid populations

The major problem in this area is the blocking of passage in the main river Gudenå at the Tange hydropower station. A number of possible solutions to this problem have been proposed ranging from complete removal of the barrier and the lake, to bypasses with a different length. Presently, it has been decided not to remove the artificial lake. All suggested proposals will ensure upstream passage for salmon and trout, but only long bypasses completely cutting out passage through the lake will ensure good survival for downstream migrating smolts.

The large number of other existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Heavy maintenance should be either stopped or replaced with a more gentle approach and physical conditions in the streams improved. Culverted sections in tributaries should be reopened. The sources of organic pollution should be found and the pollution stopped. Also pollution with clay particles from the mining industry should be stopped. In areas with streams drying out and which are drained or where ground water is extracted draining should be given up and ground water extraction reduced.

Gravel should be added in suitable sea trout spawning places where needed, and to prevent excess erosion and sediment transport the regulated parts of the main river should be re-meandered. In the main river, in the section upstream the lowermost hydropower station at Tange, the substrate should be cleared from fine material when a solution the problems at the hydropower station is found. In places where ochre pollution occurs, the leaking of water with iron should be prevented or the water purified before entering the streams.

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

Sea trout streams in eastern Jutland (Djursland)

Habitat and water quality in the rivers on the eastern Jutland (Djursland)

There are a large number of small streams along the coast and in the central part of the catchment area of Djursland in the eastern Jutland. There is one larger stream in the area called Grenåen. Many of the streams in the area have a relatively high gradient in the upstream areas, but in the lower run the gradients are often low. A relatively large proportion of the human population of the area (41%) lives in scattered houses. Farming is relatively intense in the area, but the density of farm animals is below country average. Areas with nature are a bit below country average (9%), while areas with forest constitute approximately 22% of the area (country average 11%).

Many of the streams (approximately 75% of stream length) in the area have been subject to dredging and substantial parts of the upper reaches are culverted (9% of stream length). Many streams are heavily maintained. A number of migration barriers still exist, especially in the smaller streams.

Some parts of the streams are influenced by elevated levels of fine sediment and a few by ochre. Especially some of the smaller streams suffer from organic pollution from scattered houses in the catchment area. Due to roads, parking areas and drainages some smaller streams are subject to hydraulic overload after heavy rainfall. Parts of the streams are also affected by extraction of ground water resulting in reduced flow.

Especially the status of the smaller streams is not sufficiently good to meet with EU criteria and some 56% of stream length is not expected to do so by 2015. This is mostly due to heavy maintenance and previous regulations of the streams, but also due to pollution. Over the last decade some smaller restoration projects for removing barriers and adding spawning material and larger stones to the streams and tributaries have been undertaken.

The sea trout rivers in the eastern Jutland (Djursland) according to the Water Framework Directive

The name of the main catchment area is 1.6 Djursland. The river type is not specified in the EU Water Plan. The catchment area is hilly moraine formed during last glaciation and highly variable. The largest stream passes through a long melt water valley. This area has a very low gradient being formerly a saline fjord area. Through land elevation the area was initially a lake, but through a large irrigation project the lake dried out around 1872.

Natura 2000

A small proportion of the streams in the catchment area belong to the Natura 2000 network.

The sea trout stocks of the eastern Jutland (Djursland)

Many of the smaller systems in Djursland are not suitable for trout due to either slow flow (low gradient) or previous regulation and heavy maintenance. In places where the streams are suitable and have potential for sea trout production access to spawning and nursery areas is frequently impeded by barriers. In general the populations have not shown quite as positive development as in many other parts of Denmark.

According to the most recent surveys (2004 in smaller systems and 2009 in Grenåen) natural sea trout reproduction took place in 55% of the sites investigated in the smaller systems and in 66% of the sites investigated in Grenåen. Both improvements and declines in the populations were observed. In the stream of Grenåen the average density of the young of the year in 2009 was 80 parr/100 m^2. The increase in sea trout population has been enhanced by regulations in the sea fishery. Several barriers are found, some of them completely blocking access to upstream areas.

Sea trout population facts

Population category: 1 (3 streams/tributaries), 3 (19 streams/tributaries), 4 (4 streams/tributaries), 6 (1 stream/tributary)
Reproduction area: 22.5ha
Production capacity: 19,817 smolts
Recent wild smolt production estimate: ≈ 100%

Fishing regulations in the rivers of the eastern Jutland (Djursland)

The majority of the streams are too small for fishing, but in Grenåen some angling occurs. In addition to national rules a catch limit is enforced.

Specific actions for the development of the salmonid populations

Heavy maintenance should be either stopped or replaced with a more gentle approach. In places with suitable gradient and heavily regulated streams re-meandering should be considered.

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

To facilitate sea trout spawning, gravel should be added in suitable places. Culverted sections should be re-opened. To prevent excess erosion and sediment transport the regulated parts of the main river should be re-meandered. In places where ochre pollution occurs, the leaking of water with iron should be prevented or the water purified before entering the streams.

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

Sea trout streams in central and eastern Jutland

Habitat and water quality in the rivers of the central and eastern Jutland

In the catchment areas of Århus Bugt and Horsens Fjord Lillebælt in the central and eastern Jutland there are a large number of small trout streams and a few intermediate-sized streams. The two largest systems are Århus Å in the northern part and Bygholm Å in the southern part. Many of the streams in the area have a relatively high gradient. Urbanisation is high near the city of Århus and the human population density is above country average. Ground water is extracted mainly for consumption. Farming is relatively intense in the catchment area. Approximately 9% of the area is forest and 6% is covered by nature areas.

The stream Århus Å passes through two lakes near the outlet. The lower lake (Brabrand) has been there since the land elevation after the last glaciation of a fjord area back in history, while a new

lake just upstream to lake Brabrand was constructed artificially in a low meadow area in 2003 with the purpose of reducing nitrogen load to the sea area along the coast.

In the Bygholm Å there is a 2.6 km long and narrow lake that was formed as a result of hydropower development in 1918. There is an upstream fish passage that was improved in 2001 with a 600-m-long rapid carrying a large part of the total discharge replacing the old fish pass.

Many of the streams (at least 60–75% of stream length) in the area have been subject to regulation (dredging) and substantial parts of the upper reaches are culverted. Many streams are heavily maintained. A large number of migration barriers still exist, especially in the smaller streams. Streams may pass one or more lakes, which influences their hydrology. Some parts of the streams are influenced by elevated levels of fine sediment and by ochre. Especially some of the smaller streams are influenced by organic pollution from scattered houses in the catchment area. Due to roads, parking areas and drainages some smaller streams are subject to hydraulic overload after heavy rainfall.

Status of especially the smaller streams is not sufficiently good to meet the EU criteria and some 40% of stream length is not expected to do so by 2015. This is partly due to heavy maintenance of the streams.

The sea trout rivers in the central and eastern Jutland according to the Water Framework Directive

The name of the main catchment area is 1.7 Århus Bugt and 1.9 Horsens Fjord Lillebælt. The river type is not specified in the EU Water Plan. The catchment area is hilly moraine formed during the last glaciation, melt water valleys dominate the area, where the soil is nutrient rich with a high content of chalk.

Natura 2000

A very small part of the streams in the catchment area belong to the Natura 2000 network

The sea trout stocks of the central and eastern Jutland

The sea trout stock has increased significantly in size during the last two decades, particularly in the smaller stream systems and in Bygholm, resulting in an increase in the number of self-sustaining trout populations. According to the most recent surveys (2004–2010) natural reproduction took place in 66–88% of the sites investigated, depending on the area. It should be noted that this was before construction of the most recently formed artificial lakes. The densities of young of the year trout have increased; at the last monitoring the average densities varied between 59 and 83 parr/100 m^2, depending on the area. The increases in sea trout populations have been enhanced by regulations in the sea fishery.

Mortality in downstream migrating smolts in the Bygholm Å was investigated in 1992, showing mortalities around 60–80% in the lake. The mortality of the downstream migrating smolts in Århus Å was investigated the year after the construction of the artificial lake (i.e. before a normal population of lake-dwelling fish were reached). The mortality of trout passing the 3 km long new lake and the original lake together (totally 6 km in length) were around 80% due to avian and pike predation. In one smaller stream in the area (Egå) an artificial lake was established in 2006, also with the purpose of reducing nitrogen load to marine areas. Here smolt mortalities were investigated both in the stream before construction and after construction of the lake (2007–2010). Before construction mortality at passage through the stream was zero, while it varies between 70–

80% after the construction. It has been calculated that with mortalities at this level it will not be possible to sustain a sea trout population in the stream.

Electrofishing surveys in the upstream sections have shown that sea trout migration has drastically diminished.

Sea trout population facts

Population category: 1 (10 streams/tributaries), 3 (43 streams/tributaries), 4 (8 streams/tributaries), 5 (1 stream/tributary), 6 (2 streams/tributaries)
Reproduction area: 73.4 ha
Production capacity: 55,564 smolts
Recent wild smolt production estimate: 74%

Fishing regulations in the rivers of the central and eastern Jutland

The majority of the streams are too small for fishing, but in the larger systems some angling occurs. Generally an extended closed season is enforced. In some streams there are catch restrictions, gear restrictions and in one stream spent fish are protected.

Specific actions for the development of the salmonid populations

Where streams pass through artificial lakes, the streams need to be moved so as not to pass through the lake. Future artificial lakes in the lower reaches of trout streams should, if needed, be constructed in a way that streams are not passing through them. It is possible to construct inlets to lakes, not resulting in smolt entering the lakes.

Existing barriers and fish ways and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Heavy maintenance should be either stopped or replaced with a more gentle approach. Culverted sections should be reopened. To facilitate spawning, gravel should be added in suitable places where this is needed, and to prevent excess erosion and sediment transport the regulated parts of the main river should be re-meandered.

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

Sea trout rivers in northwestern Zealand

Habitat and water quality in the Danish sea trout rivers in northwestern Zealand

In the north western Zealand small streams dominate and one medium-sized stream is found. One stream passes through a lake and several streams receive water from lakes. Human population density is below the country average and about one third of the human population lives scattered in the country in parts of the area. Agriculture dominates in land use in the catchment area, but large areas with nature are also found.

Almost all the streams have been subject to dredging and large parts of the upper reaches are culverted. Many streams are heavily maintained and some migration barriers still exist. Organic pollution may enter the rivers from scattered houses in the countryside. Ochre influences a small proportion of the stream length.
Practically all the smaller streams in the area have a very low gradient, are channelized and are not suitable for sea trout. The few exceptions that would be suitable have such a low flow that they often dry out. Large sections of the streams still have poor habitat conditions for sea trout due to previous regulation and heavy maintenance. A few barriers are found, gravel for spawning is missing and transportation of fine sediment sometimes occurs.

Acceptable conditions are estimated to be found in 24% of the stream length, and by 2015 61% of stream length is not expected to meet with the criteria of the Water Framework Directive.

The sea trout rivers in northwestern Zealand according to the Water Framework Directive

The name of the main catchment area is Name 2.1 Kalundborg Fjord. The river type is not specified in the EU Water Plan. The landscape in the catchment area is hilly moraine with lateral moraines and tunnel valleys formed during last glaciation period. In the soil clay and sand dominate.

Natura 2000

A substantial part of one stream in the catchment area belongs to the Natura 2000 network.

The sea trout stocks of the Danish rivers in northwestern Zealand
There is one medium-sized system where the sea trout population has increased significantly. In the last survey, in 2006, sea trout were found in 59% of the sites investigated. The average density is still modest with 29 fry per 100 m^2, but this is a tremendous improvement from just 1 fry per 100 m^2 in 1998. Locally much higher densities were observed (up to 400 per 100 m^2) in areas where restoration has been carried out. Densities of older trout are in general quite low. The increase in sea trout population has been enhanced by regulations in the sea fishery.

Sea trout population facts

Population categories: 4 and 5
Reproduction area: 7.5 ha
Production capacity: 5,661 smolts
Recent wild smolt production estimate: 54%

Fishing regulations in the rivers of northwestern Zealand

Sport fishing primarily occurs in the medium-sized stream or along the coast. There are no special regulations for angling.

Specific actions for the development of the salmonid populations

Maintenance should be minimized if it is carried out at all, and habitat quality should be taken into consideration. Culverted sections should be reopened and natural shape on the section restored.

The few remaining barriers should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

To facilitate spawning and to prevent excess erosion and sediment transport the regulated parts of the main rivers should be re-meandered. Gravel should be added in suitable places where needed. Areas with physical variation and sufficient depth for larger trout should be ensured, e.g. by adding larger stones to wide and shallow stream sections.

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

Sea trout rivers in Isefjord and Roskilde Fjord (north Zealand)

Habitat and water quality in the Danish sea trout rivers in Isefjord and Roskilde Fjord (north Zealand)

Urbanization is high in the southern and eastern parts of the Isefjord and Roskilde Fjord area. Main land use is agriculture, recreational cottages and areas with nature are found. Small streams dominate in the area, with a few medium-sized systems. There are some lakes in the north-eastern part of the area.

With a few exceptions all streams in the area have been subject to dredging and substantial parts of the upper reaches are culverted. Many streams are heavily maintained. Some migration barriers still exist. Organic pollution may enter the rivers from the scattered houses in the countryside Ochre influences short segments of the rivers. It is estimated that 12% of the stream length will meet the criteria set by the Water Framework Directive.

The sea trout rivers in Isefjord and Roskilde Fjord (north Zealand) according to the Water Framework Directive

The name of the main catchment area is 2.2 Isefjord and Roskilde Fjord. The river type is not specified in the EU Water Plan. Catchment area is hilly moraine formed during last glaciation, in the northern part sandy soils and in the southern clay content is higher. Part of the area is diked-in and water is pumped out through canals.

Natura 2000

Upper sections of some streams in the catchment area belong to the Natura 2000 network.

The sea trout stocks of the Danish rivers in Isefjord and Roskilde Fjord (North Zealand)

In the streams of the eastern part of the Isefjord and Roskilde Fjord area the sea trout populations have shown some overall progress. Trout were found in 61% of the sites investigated in the last survey (2006). Densities in the western part of the area were only 12 fry per 100 m^2, while it in the western part was 80 fry per 100 m^2. In some streams the size of the sea trout populations has increased, but in others the population size has remained constant. In a few systems sea trout are hardly found at all. The main reason for the progress is restoration work carried out by both private anglers and local communities, and slight reductions in the extraction of ground water.

In the western part of the area sea trout populations have increased very much in a couple of streams mainly as a result of restoration work (re-establishment of spawning gravel, establishment of functional fish passes at barriers and opening of passages), but also partly due to fishing regulations at the sea. In some places sea trout populations have not increased in size which is mainly due to the poor habitat quality. The increase in sea trout population has been enhanced by regulations in the sea fishery.

Sea trout population facts

Population category: 3 (5 streams/tributaries), 4 (8 streams/tributaries)
Reproduction area: 17.7 ha
Production capacity: 18,044 smolts
Recent wild smolt production estimate: 47%

Fishing regulations in the rivers in Isefjord and Roskilde Fjord (north Zealand)

Angling takes place in several of the medium-sized streams. In some of them the primary target for fishing is brown trout. In one stream where population has been increased substantially over the last two decades a strongly limiting catch restriction has been enforced (individual quota of 2 sea trout per year), but since very few trout are actually kept, fishing in this river is in reality a catch and release fishery. In this stream catching of brown trout is prohibited.

In some of the streams in the area a large number of smolts are released, mainly to enhance fishing possibilities. Otherwise no special regulations apply for fishing in this area.

Specific actions for the development of the salmonid populations

Existing barriers and fishways and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Maintenance should be minimized and take habitat quality into consideration. Culverted sections should be reopened and natural shape on the section restored. To facilitate spawning and to prevent excess erosion and sediment transport the regulated parts of the main rivers should be re-meandered.

Gravel should be added in suitable places where needed. Areas with physical variation and sufficient depth for larger trout should be ensured, e.g. by adding larger stones to wide and shallow stream sections.

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

Sea trout rivers on the east coast of Zealand

Habitat and water quality in the Danish sea trout rivers on the east coast of Zealand

In the northern part of the east coast of Zealand small streams dominate, while some medium-sized streams are found in the south of the area. In the north some of the streams receive water from lakes. Human population density is high and urbanization intense near the capital

Copenhagen that is situated in the centre of the area. In the northern part the main land use is agriculture, recreational cottages, and large areas with forest and nature exist. In the southern part urbanization is heavy along the coast, and agriculture is intense due to the fertile land. Also extraction of ground water is heavy in the area.

Most of the streams have been subject to dredging and substantial parts of the upper reaches are culverted. Many streams are heavily maintained. Some migration barriers still exist. Organic pollution may enter the rivers from the scattered houses in the countryside.

6–15% of the stream length is currently estimated to meet the criteria of the Water Framework Directive. Locally ground water is pumped into the streams from ground water in order to prevent them from drying out. Even though there have been improvements in the habitat quality many places are still not suitable for sea trout due to poor physical conditions, pollution, barriers and risk of streams drying out.

Especially sections with deeper water and conditions suitable for larger trout are needed. In the northern part maintenance is not a specific problem, but in some places gravel for spawning is still needed. Sand transport is sometimes heavy, and a few barriers and culverts exist.

The sea trout rivers on the east coast of Zealand according to the Water Framework Directive

The name of the main catchment area is 2.3 Øresund, 2.4 Køge Bugt. The river type is not specified in the EU Water Plan – catchment area is hilly moraine formed during last glaciations period, in the northern part sandy soils dominate and in the southern part the clay content of the soil is higher.

Natura 2000

A part of the streams in the catchment area belong to the Natura 2000 network.

The sea trout stocks of the Danish rivers on the east coast of Zealand

In a number of streams in the area much restoration work to enhance the sea trout populations has been carried out in recent years, and overall the populations have responded positively, showing a large progress in the number of sites where trout are found. At the latest survey (2005) sea trout were found in some 68–84% of sites. The increase in sea trout population has been enhanced by regulations in the sea fishery. Densities in the southern part was on average 40 fry per 100 m^2 on sites with conditions suitable for trout, while it in the northern part was 72 fry per 100 m^2.

Sea trout population facts

Population category: 1 (3 streams/tributaries), 3 (9 streams or tributaries), 4 (7 streams/tributaries), 6 (2 streams/tributaries)
Reproduction area: 29.3 ha
Production capacity: 22,556 smolts
Recent wild smolt production estimate: 62%

Fishing regulations in the rivers on the east coast of Zealand

Angling takes place in several of the medium-sized streams. In some of them the primary target for fishing is not trout, but trout are caught as by-catch, also during the season closed by national

regulations. These trout must be released after capture. In one stream there is an elevated minimum catch size for resident brown trout. Otherwise no special regulations apply for fishing in this area.

Specific actions for the development of the salmonid populations

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Maintenance should be minimized and take habitat quality into consideration – especially in the southern part of the area and culverted sections should be re-opened. To facilitate spawning and to prevent excess erosion and sediment transport the regulated parts of the main rivers should be re-meandered.

Gravel should be added in suitable places where needed. Areas with physical variation and sufficient depth for larger trout should be ensured, e.g. by adding larger stones to wide and shallow stream sections. Extraction of ground water should, in critical areas, be minimized, or, as an alternative stream flow should be supplemented with pumped ground water when flow reaches a critical low level.

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

Sea trout rivers on the southern, south-eastern, and south-western coasts of Zealand

Habitat and water quality in the Danish sea trout rivers on the southern, south-eastern and south-western coasts of Zealand

In the catchment areas of Køge Bugt, Smålandsfarvendet and Østersøen in Zealand, small streams are numerous. Only a few medium-sized and larger streams are found. Some streams pass through lakes.

Human population density is below country average in the area. In the north eastern part of the area urbanization is heavy along the coast, and agriculture is intense. Farming is quite intense covering almost 80% of the area, while areas with nature are very scarce (1–2% of the area). Forests cover 11%. Extraction of ground water is heavy in some parts. There are a relatively large proportion of scattered households.

Most of the streams have been subject to dredging and substantial parts of upper reaches are culverted. Many streams are heavily maintained. Some migration barriers still exist. Organic pollution may enter the rivers from the scattered houses in the countryside.

Extraction of ground water is estimated to affect some 8% of the stream length. 4–8% of the stream length is estimated to currently meet the criteria of the Water Framework Directive.

The sea trout rivers on the southern, southeastern and southwestern coasts of Zealand according to the Water Framework Directive

The names of the main catchment areas are 2.4 Køge Bugt (southern part), 2.5 Smålandsfarvendet, 2.6 Østersøen. The river types are not specified in the EU Water Plan.
The landscape in the catchment areas is hilly moraine with lateral moraines and tunnel valleys formed during the last glaciation, soil has a high content of clay. On the islands in the south parts are diked-in.

Natura 2000

A very small part of the catchment area belongs to the Natura 2000 network.

The sea trout stocks of the Danish rivers on the southern, southeastern and southwestern coasts of Zealand

In the streams of the south eastern and south western Zealand the populations of trout have increased significantly over the last decades. Fry were found in approximately 80% of the sites investigated at the tatest survey (2005 and 2009). Average densities were between 61 and 123 fry per 100 m^2, depending on the area. Older trout parr have also increased in general, although the distribution has locally diminished. However, large sections of streams are still not suitable for trout due to poor habitat conditions, pollution, barriers and risk of streams drying out.

On the islands south of Zealand the situation is different. Here, only very few streams have sufficient gradient to provide suitable habitat conditions for trout. At the last survey (2002) trout fry were found only in 43% of the sites investigated. Average density on the sites with suitable conditions for trout was 43 fry per 100 m^2.

Sea trout population facts

Population category: 1 (10 streams/tributaries), 3 (13 streams or tributaries), 4 (6 streams/tributaries)
Reproduction area: 42.7 ha
Production capacity: 32,079 smolts
Recent wild smolt production estimate: ≈ 100%

Fishing regulations in the rivers on the southern, southeastern and southwestern coasts of Zealand

Sport fishing takes place in some of the larger systems. In one of the more popular streams for sea trout the fishing intensity is regulated by the maximum number of fishermen being allowed on different sections, but no catch limit or special size limits apply. For the remaining part of the streams it is unknown if special regulations apply.

Specific actions for the development of the salmonid populations

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Maintenance should be minimized if carried out at all and habitat quality taken into consideration. To facilitate spawning and to prevent excess erosion and sediment transport the regulated parts of the main rivers should be re-meandered. Where this is needed, gravel should be added in suitable places for sea trout spawning. Areas with physical variation and sufficient depth for larger trout should be ensured, e.g. by adding larger stones to wide and shallow stream sections. Extraction of ground water should, in critical areas, be minimized, or, as an alternative stream flow should be supplemented with ground water when flow reaches a critical low level.

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

Sea trout streams in south eastern Jutland

Habitat and water quality of the rivers in the south eastern Jutland

A large number of small streams are found along the coast together with a few larger streams (Kolding Å and Vejle Å). Many of these streams have a relatively high gradient. In the lower part of the river Vejle Å two wetland / lake areas were constructed in 2004 and 2009 with the purpose of reducing nitrogen load to the sea area. These wetland areas are fed in part with water from the stream, but measures have been taken to reduce (and almost eliminate) loss of downstream migrating smolts in the lakes. Previously fish farms were numerous at this river and approx 33 fish farms are still found. In R. Kolding four fish farms are found.

The medium sized Hoptrup Å passes through a lake in the lower part of the stream. This lake was re-established after 45 years in, partly with the purpose of removing nitrogen. The effect on the sea trout population has not been evaluated yet.

Many of the streams in the area have been subject to regulation (dredging) and substantial parts of upper reaches are culverted. Many streams have been straightened and made deeper to ensure a rapid run-off from farmed land. For this reason many streams are also being heavily maintained.

During canalisation and regulation of the streams gravel and coarse material was removed and lack of suitable spawning material is frequently a problem in the area. Canalisation is also a major reason for excess erosion and sediment transport in many places. Lack of shade in sections of streams result in heavy growth of vegetation in a few some places and also in a few places organic pollution is also still a problem. A large number of migration barriers still exist, especially in the smaller streams and near the upper ends of the main streams.

Main land use is for farming and in the northern part of the area (close to the towns Kolding, Fredericia and Vejle) urbanization is high. Ground water extraction (mainly for consumption) is quite high in some areas.

The sea trout rivers on the south eastern Jutland according to the Water Framework Directive

The name of the main catchment area is 1.11 Lillebælt/Jylland. The river types are not specified in the EU Water Plan. The catchment area is hilly moraine formed during last glaciation, lateral moraines and melt water valleys dominate the area, where the soil is nutrient rich with a high content of gravel and chalk.

Natura 2000

A small part of the catchment area belongs to the Natura 2000 network.

The sea trout stocks of the north eastern Jutland (Mariager Fjord)

In the smaller streams the sea trout stock has increased significantly during the last two decades, resulting in an increase in the number of self-sustaining trout populations. According to the most recent surveys (2004–2010) natural reproduction now takes place on between 53 and 97% of the sites investigated, depending on the area. Also the densities of young of the year trout were quite high with an average of 133 parr/ 100 m^2.

In the two larger systems the stock has also increased, both in distribution and density. In R. Vejle Å trout were found on 81% of the sites investigated in 2005 compared to 59 % in 1989. Average densities were in 2005 108 parr/100 m^2. In R. Kolding Å the sea trout stock increased mainly in the 1990s and in 2008 parr were found in 94% of the sites investigated with an average density of 65 parr /100 m^2.

During the last couple of decades many migration obstacles have been removed and restoration work carried out both by local anglers and authorities. Concomitantly releases have diminished and in Kolding Å complete terminated.

Sea trout population facts

Population category: 1 (14 streams/tributaries), 2 (24 streams/tributaries), 3 (102 streams/tributaries), 4 (5 streams/tributaries), 5 (1 stream/tributary), 6 (8 streams/tributaries)
Reproduction area: 116.4 ha (potential: 8.8 ha)
Production capacity: 98,913 smolts (potential: 6,069 smolts)
Recent wild smolt production estimate: 87%

Fishing regulations in the rivers of the North-Eastern Jutland (Mariager Fjord)

The majority of the small streams are too small for fishing, but in the larger streams Kolding Å and Vejle Å angling is popular. In these streams extended closed season is enforced together with a catch limit and in parts of Vejle Å fishing pressure is regulated.

Specific actions for the development of the salmonid populations

Existing barriers and bypasses not functioning optimally should be removed (a complete removal is recommended, in order to ensure migration of all types of fauna and to prevent upstream effects from damming of the river, i.e. reduced velocity, sedimentation and increased depth).

Heavy maintenance should be either stopped or replaced with a more gentle approach. Culverted sections should be reopened and natural shape on the section restored. To facilitate spawning gravel should be added where needed, and to prevent excess erosion and sediment transport the regulated parts of the main river should be re-meandered.

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

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