

Freshwater Fisheries in Iceland

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Introduction

This paper gives a brief overview of the freshwater and salmonid resources in Iceland. There is a growing world-wide demand for angling in a pure and non-polluted environment. Due to its position in the middle of the Atlantic Iceland has not been much affected by acid rain and other polluting effects of the industrial development. There is ample rainfall, which provides good quality water and habitat for various salmonid species. The rivers and lakes are thus in a fairly pristine state and provide good quality angling in a non-crowded environment.

The following information only highlights the main points regarding Icelandic freshwater species and their management. More detailed information can be obtained on the website: www.veidimalastjori.is.

Freshwater Resources

Position and climate

Iceland is located on the mid-Atlantic ridge between 63° and 66° N and 13° and 24° W with an overall area of 103,000 km². It is almost exclusively built of volcanic rocks, primarily basalts and volcanic activity is common. Geothermal resources are abundant in certain parts and most of Icelandic houses are heated with thermal water.

The Icelandic climate is oceanic with relatively mild winters and cool summers. The climate is very much affected by the warm Gulf stream, which bathes its southern and western shores and gets partly deflected to the north coast. The north coast on the other hand is much affected by the cold East Greenland polar current, which greatly affects the climate and marine as well as freshwater resources in that area.

Freshwater species

Five species of freshwater fish are native to Iceland, including Atlantic salmon (*Salmo salar*), Brown trout (*Salmo trutta*), Arctic char (*Salvelinus alpinus*), European eel (*Anguilla anguilla*) and Stickleback (*Gasterosteus aculeatus*). Only the salmonid species are of economic importance in net and sport fisheries. Additionally rainbow trout (*Oncorhynchus mykiss*) were imported to Iceland in the 1950s for fish farming purposes. They also have some importance in put and take fisheries in some areas, but have not propagated to any extent naturally.

Rivers and lakes

There are close to 250 rivers, large and small, in Iceland and they have been classified according to origin into glacial, direct run-off and spring fed rivers. The productivity of the rivers varies greatly according to their location, water source, volume of flow, topography and temperature, especially during the summer months. About 60 rivers produce Atlantic salmon in any quantity but minor runs of salmon are found in many sea trout and char rivers.

About 1800 natural lakes are found in Iceland with a total surface area of 1200 km², which is little more than 1 % of the surface area. Additionally there are several large hydroelectric reservoirs in the interior of the country. Lake productivity varies greatly and is influenced by many factors, such as geology, water temperature, depth and altitude. Due to the cool, temperate climate and short summers, the growing season for fish in both rivers and lakes remains short.

The Atlantic Salmon

Life history and management

The Atlantic salmon ascends about 80 rivers, most of them located in the western half of the country (figure 1). Other major sports fishing areas are located in lowland areas of the northwestern and northeastern coasts as well as the productive agricultural area of the south coast.

The best salmon rivers originate in lakes, which secures stable water flow and favourable temperature during the summer. A river suitable for salmon usually maintains a water temperature of 10° C for a period of three months during the summer. Salmon are thus primarily found in lake-fed and run-off rivers but some glacial streams have harboured salmon, where they have traditionally been harvested with set nets.

Life history

The Atlantic salmon only spawn in rivers, usually in October-November and the fry emerge from the gravel during the following summer. The parr spend 2-5 years, most frequently 3-4 years, in freshwater before migrating to sea as smolts at a size of 20-25 grams.

The salmon spends 1-3 years in the sea before returning to its home river to spawn. Salmon in southern and western Iceland tend to mature early and return as grilse (1-sea-winter salmon), averaging 2.5 kilograms in weight. Fish on the north and east coasts tend to return more as older salmon (2-sea-winters), approximately 4-6 kg. in weight although individual males may reach 10 kg. Salmon spending 3 or more years in the sea are rare.

The geographic difference in age at maturity is probably primarily related to the different oceanographic and climatic conditions in these areas. This is supported by the fact, that repeat spawners (kelts) return after 4 months in the sea in southern Iceland, whereas they spend one year in the sea in northern areas. An increase in age of maturity has also been observed, when ranching stocks from western Iceland have been released in the colder north coast rivers. Stock with genetic tendencies towards late maturity are, however, found in large rivers in both southern and northern Iceland.

Effects of oceanographic and climatic conditions on marine survival of salmon tend to be more pronounced on the north and east coasts of Iceland. This expresses itself in great interannual fluctuation in the size of returning salmon runs and can both be due to poor feeding conditions for smolts and salmon in the sea as well as a reduction or blockage in the outmigration of smolts in the previous spring due to adverse climatic conditions. If such conditions prevail for many years, there is a great reduction in the productivity of the local salmon population, demonstrating that certain areas are marginal for salmon production and a minor adverse climatological change could possibly favour cold water types of salmonids, such as arctic char.

Icelandic salmon migrate to distant feeding areas and tagged salmon have been reported from West and East Greenland, the Faroes, Norway and Scotland. Returns from large scale microtag releases of hatchery salmon seem to indicate that fish from the southwest, west and northwest coasts migrate primarily towards Greenland, whereas northeast and east coast salmon, although also found in the Greenland area, migrate more into the Norwegian sea.

Management

The backbone of the management system in Iceland is the fact that the fishing rights in rivers and lakes are privately owned and go with the land that adjoins the river. They can furthermore not be separated from the ownership of the land. The fishable sections of the rivers are usually in agricultural areas, where the land is most often owned by farmers.

The current Salmonid Fisheries Act was enacted in 1970, but has been partly revised several times. One of the important provisions of the Act, dating back to 1932, states that salmon fishing in the sea is forbidden, with minor exceptions. Excepted were 9 coastal farms, which had declared salmon fishing as a major income from their estate. None of these heritable fishing rights remain as they have been purchased with private and public funds.

The main principles of Icelandic salmonid management system are the following:

1. The river owners are obliged to form an association to share expenses and income from the river. Share of each owner, which is based upon length of his river bank, catches and salmonid nursery areas is estimated by an appointed committee of experts. These associations are responsible for management of the local fishery in accordance with the Salmonid Fisheries Act, but they often also attend to local conservation, hire wardens, build and run fishing lodges, build fish ladders and undertake various enhancement activities in order to improve fishing.
2. Freshwater gill-netting of salmon, which mostly occurs in glacial main-stem rivers, has been greatly reduced in recent years, primarily through buy-outs and leasing arrangements. Where it occurs it is limited to half the week from Tuesday morning through Friday night. The largest remaining net-fishery occurs on the “Ölfusa” river close to Selfoss (figure 1).
3. The total fishing period for salmon in each river is now limited to 3.5 months within a prescribed period lasting from 20th of May through September 30th.
4. The allocation of rods per river has been based on a principle of one rod for 100 salmon caught through the season, which approximately corresponds to 1 salmon per rod per day. This principle, more than anything, upholds the satisfaction of the anglers, which in most cases have ample room on the river.
5. It is mandatory for river owners to submit a 5 year enhancement plan if they intend to take eggs from their river.
6. A regulatory measure set recently specifies that enhancement of rivers must be based on the local stock or similar stocks of nearby origin.

Status and utilization of the resource

Harvesting methods

Icelandic salmon were traditionally caught in fixed set nets, but the importance of angling started increasing early in the 20th century. The contribution of sports caught salmon has gradually been increasing and is now over 90 % of the total catch. This change both reflects the increased value of the sports fishery as the price of commercially caught salmon has dropped as a result of the great supply of salmon from aquaculture. In some glacial rivers this has led to the buy-out of the nets by the owners of upriver tributaries.

Icelandic salmon can thus only be harvested with rod and line or in riverine gill nets, which were historically used in glacial streams. All fishing is restricted with respect to annual, weekly and daily fishing time and with respect to the number of set nets and rods used on any river. Set nets are e.g. only allowed during half the week, whereas angling is limited to the daylight hours for 3.5 months during the summer.

There is great enthusiasm for salmon angling among Icelanders and a number of foreign anglers visit Iceland each summer. The fishing season starts in early June and extends through September, but each stream can only be fished for 3.5 months. There has been some

increase in “catch and release” in salmon angling, which is currently about 12 % of the total angling catch.

Although wild Atlantic salmon are facing a crisis in many countries, it can be concluded that Icelandic salmonid stocks are in a reasonable state but great care should be exercised in order to safeguard the stocks in rivers, especially those close to populated areas. There are examples of rivers with a recent reduction in salmon catches, which can possibly be linked to their location within or close to urban areas.

Economic value

Atlantic salmon are of great economic value with respect to sports fishing. It has been estimated that the minimum direct and indirect annual revenue from salmon angling amounts to 30 million US \$, which corresponds to \$ 1000,- per angled salmon. This is clearly a valuable resource, which must be conserved and protected.

Enhancement

River associations have invested considerably in enhancement. The primary investment on salmon rivers has been the construction of fishways past impassable waterfalls. During the last 40 years over 50 such fish passes have been built, which have opened up about 500 kilometers of river bed to anadromous fish.

River owners have also invested in hatcheries and rearing stations. Fry have frequently been released in areas inaccessible to salmon with considerable increase in salmon production. Smolts have been released in lower stretches of rivers in order to enhance the smolt output but with variable success.

In recent years there have been considerable new developments related to Atlantic salmon enhancement. The most significant one is the development related to the sustenance of salmon angling through smolt releases. The most prominent development is related to the “Rangár” river system on Iceland’s south coast (figure 1), where a valuable salmon fishery has been created purely through annual smolt releases. The annual salmon angling catch has thus increased from 300 salmon in the 1980s to a catch in excess of 3000 salmon in recent years.

Trout and char fishing

Brown trout and arctic char are abundant in many lakes but a sea run variety is also occurring in various areas (figure 1). Sea char are primarily found in cold streams in the mountainous areas of northwestern, northern and eastern Iceland, where salmon are practically absent. There are popular angling areas for sea-char on Iceland’s north and northwest-coasts and considerable fishing for landlocked char in lakes all over the country. A pelagic variety of char is found in lake “Þingvallavatn”, which is a deep cold-water lake in southern Iceland (figure 1). A landlocked variety of brown trout also occurs in the lake.

Sea trout are most abundant in lowland areas of the south coast, where they are a popular angling species especially in the vicinity of “Kirkjubæjarklaustur” (figure 1). There is also a prominent sports fishery for landlocked brown trout in the “Veidivötn” lake complex in the southern interior as well as in the upper areas of the river “Laxá”, which flows out of “Lake Mývatn” in the north of Iceland. Landlocked brown trout are also found in numerous lakes all over Iceland.

Administration and research

Freshwater fisheries and aquaculture in Iceland, including the salmon fishery, are managed by the Directorate of Freshwater Fisheries under the auspices of the Ministry of Agriculture. The Directorate administers the fisheries in accordance with the Salmonid Fisheries Act and collects statistics on freshwater fisheries catches and fish farming production. It is also responsible for licensing and regulating enhancement and fish cultural activities, including fish farming and salmon ranching.

The Institute of Freshwater Fisheries acts in an advisory capacity for the Directorate and conducts basic as well as applied research in rivers and lakes all over Iceland. It also advises river associations on enhancement and in-river management.

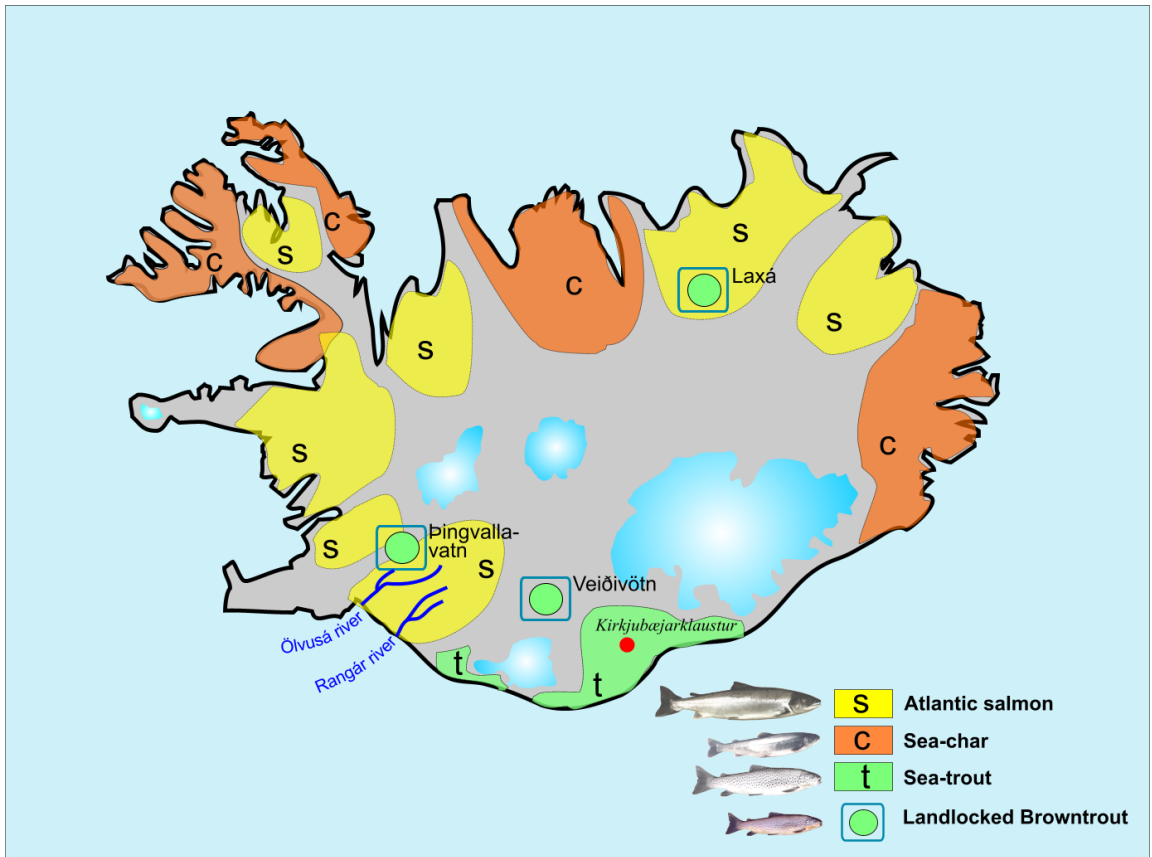


Figure 1. Distribution of the salmonid species in Iceland, also showing the major fishing areas for landlocked brown trout. Less prominent angling for landlocked brown trout and char also occurs in numerous lakes all over Iceland.