

Salmon Management in Iceland
with a special reference to sport fisheries development

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Introduction

In this paper I will give a brief overview of the Atlantic salmon resource in Iceland, highlighting its management, current utilization as well as the development and promotion of the Atlantic salmon sports fishery. There will also be a brief coverage of the sea char and sea trout fisheries, which enjoy increasing popularity.

Distribution of salmon and trout

Figure 1 shows the statistical salmon fishing areas and the distribution of the wild salmon catch since 1974 between areas. Also shown are the main areas for sea char and sea trout.

The Icelandic freshwater fauna is very simple and only 5 species of fish occur naturally in rivers and lakes. Atlantic salmon are the most valuable species, occurring in over 80 rivers located in the lowland areas of Iceland. Over 70% of the wild salmon catch occurs on the south and west coasts, where the grilse component is usually high (areas 1-3 in the figure). The remainder of the catch is taken in rivers on the north and northeast coasts (areas 4-7 in the figure). Two-sea-winter salmon are more abundant in those areas, primarily as a result of inferior average environmental conditions in fresh and salt water (Gudjonsson et al. 1993).

Brown trout and arctic char are abundant in many lakes but a sea run variety is also occurring in various areas as indicated on the figure. Sea char are primarily found in cold streams in the mountainous areas of northwestern, northern and eastern Iceland, where salmon are practically absent. Sea trout are most abundant in lowland areas of the south coast.

Iceland with its glaciers and copious rain has ample hydroelectric power, which has mostly been harnessed in low value glacial streams close to the interior of the country. Effects on freshwater species have thus been minimal.

Catches and abundance of wild salmon in Iceland

Figure 2 shows the catches of Atlantic salmon in Iceland since 1959. Excluded are the catches in ranching stations, which have dominated the catch in recent years. These catch figures demonstrate well the fluctuation in abundance between years, although some general increase was noted, especially in the 1970s. It should be noted that fluctuations tend to be much greater on the north and east coasts, which only represent 30% of the catch (Scarnecchia 1984, Scarnecchia et al. 1989). Such low periods were observed in the 1965 to 1969 period as well as in the early and late 1980s, which corresponded to harsh arctic environmental conditions in the sea off northern Iceland (Isaksson and Gudjonsson 1995).

The Icelandic Management system

The Director and Institute of Freshwater Fisheries are responsible for the management of Iceland's freshwater resources under the auspices of the Ministry of Agriculture.

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. The fishing rights can thus not be separated from the ownership of the land. The law-makers, on the other hand, have taken the overall responsibility for the salmon resource by setting a salmon act, which mostly relates to the fair sharing of the resource among its owners.

Government management and research

Management

The management of Icelandic salmonid resources is entirely based on the salmon act, which originally dates back to 1932, but with many newer revisions. The main principles of the current salmon act are the following :

- 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.
- The ban on coastal and oceanic fisheries for salmon is the real essence of the salmon act and means that Icelandic salmon are only harvested in terminal fisheries, which simplifies all aspects of management.
- 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 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.
- 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.
- A recent revision made it mandatory for river owners to submit a 5 year enhancement plan if they intend to take eggs from their river.

-A regulatory measure set recently specifies that enhancement of rivers must be based on the local stock or similar stocks of nearby origin.

These are only a few examples from a fairly bulky document, but I want to stress that the current spirit in Iceland is to encourage local management of the rivers and limit government management to framework principles, which benefit the whole resource.

Research

Research related to salmon and trout is carried out by the Institute of Freshwater Fisheries, which was established in 1946. The Institute works in close cooperation with the river-owners, which pay for contract research in various rivers, but long term research projects, which relate to the general status of salmon resource are primarily financed by grants. Only the most important projects can be highlighted here.

Smolt and adult counts

One of the most important aspects of salmon management is to know the production capacity of salmon rivers and the survival of salmon during its long feeding migration in the sea. This is done by setting up a counting facility for outgoing smolts and incoming adults in a river. This is in praxis impossible to do in every river so one must select a representative river from each region to be studied.

Such counting facilities have been set up in southwestern Iceland in the Elliðaár river, in Miðfjarðará, a salmon river on the north coast as well as in a small river on the northeast coast of Iceland. It is known that the north and south coasts of Iceland are affected by very different climatic and oceanographic factors and tag recoveries indicate, that the migratory patterns of the salmon from those areas in the sea is quite different. It was therefore considered necessary to have index rivers in 3 areas.

These facilities, which only have been in continuous operation for about 6 years have already demonstrated that they are an integral part of a sound management system and have been a real eye-opener regarding the problems that the salmon have to face throughout their complex life cycle.

Electric fishing surveys

Electric fishing surveys are conducted in many rivers in Iceland each year and are mostly paid for by the respective river owners. These surveys have given a good indication of the strength of year classes of fry in the rivers. These surveys are thus good indicators regarding spawning success and survival in the river. They have, however, only been marginal in predicting future salmon runs. In combination with trapping data, however, they are of great importance.

Ranching and rearing research

The Institute of Freshwater Fisheries is also responsible for management and research regarding salmon farming, ranching and enhancement. In 1961 the Institute established Kollafjörður Experimental Fish Farm, which did pioneering work regarding enhancement and in particular salmon ranching. The primary role of the fish farm today is to perform selective breeding of salmon for use in farming and ranching (Jonasson 1995).

Local river management and development

Local management

Lets now look at some aspects of local river management. The river associations are more or less responsible for the management of their own river. They decide in plenum, whether they want to exploit the salmon with nets or through angling. They resolve, whether they want to use all they angling rods that they have beent allocated from the managers and can choose to fix a bag limit to a certain number of salmon per rod. The river owners either decide to sell licences directly to anglers or rent the river for the season to angling clubs. The revenue can be significant and a river with an average catch of 1000 salmon is currently rented for ca. 250 thousand US dollars.

River development

The river associations spend considerable amount on river development and improvement. Every stream has a comfortable fishing lodge with private facilities in each room and a high standard of cuisine for the anglers. If requested, guides can be provided for foreign visitors. Frequently roads have to be built along the rivers, which can be isolated and inaccessible by foot. The river owners also frequently hire wardens to prevent poaching and illegal fishing practices.

Recording of catches

Each fishing lodge contains a log book used for recording every salmon that is caught during the season. The weight and sex of the salmon is recorded as well as bait and any tags or marks on the fish.

The catch books are provided by the Institute of Freshwater Fisheries, which processes and assembles the statistics after the season. Iceland has some of the most complete angling statistics in the world, going back to the 1940s. This accurate documentation is probably one of the reasons for the high value of the salmon angling resource today and the successful management of the resource.

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 (Gudjonsson 1988).

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.

Purchases and leases of quotas

Icelandic river associations in cooperation with angling interests have been involved in the buying and leasing of salmon quotas both locally and internationally. In the late 1980s the owners of the tributaries of the river Hvítá on Iceland's west coast came to an agreement with the net fishermen on Hvítá river that they would stop salmon fishing against a certain fixed annual payment. This agreement has been renewed annually with significant benefits for the salmon angling in the tributary rivers, primarily in years of low salmon abundance.

In the wake of this agreement the Iceland based "North Atlantic Salmon Fund" established by Orri Vigfússon in 1991 initiated negotiations regarding leases of salmon quotas in the Faroese and West Greenland fisheries. The fund currently raises funds internationally to purchase salmon fishing rights and encourage river enhancement with the aim of harvesting the salmon only in rivers by angling.

New and recent developments

In recent years there have been considerable new developments related to the Atlantic salmon interests in Iceland. The most significant one is the development of a significant commercial salmon ranching industry in Iceland, but other developments relate to the sustenance of salmon angling through smolt releases as well as put and take fisheries for Atlantic salmon. These can only be very briefly reviewed starting with commercial ranching.

Commercial salmon ranching

In recent years there has been considerable increase in salmon ranching in western Iceland, where conditions seem to be more favourable than in the northern part (Isaksson 1994). The largest commercial ranching station, which is only a release facility, is shown in figure 3. The operating principles are fairly simple.

Smolts, which are reared in distant smolt stations, are released from seawater pens in mid summer after a 1-2 month adaption in freshwater rearing pens. Recaptures are performed through an efficient seining process in the estuarine area. Most of the recaptures take place during the months of June through August with a peak in July. Commercial ranching is still in developmental stages and is as yet by no means economical.

Contribution of ranching in the total salmon catch

Figure 4 shows the development in total salmon catches in Iceland during the last 20 years. The figure shows that the contribution of ranching in the catch was minimal until 1984, but then started increasing at a high rate. During the last 5

years the ranching contribution has been ranging from 60-80% of the total catch. It has been estimated that strays from ranching stations into all rivers, as measured through coded wire tags, are ranging from 1-4% of the total number of salmon returning to the ranching sites. Since strays seem to be of minor relevance, concerns have been raised, that ranching stations might be harvesting wild salmon from nearby rivers. These complaints are still unfounded.

Sustenance of angling with smolts

It has been clear for some time that salmon ranching in a salmon river would be more economical than comparable releases in order to produce salmon for the market, considering, that the value of each sports caught salmon is at least 10 fold compared to a ranched salmon. Since the accepted definition of ranching assumes that all returning salmon are harvested (Anon 1994), which can not be done in a sports fishery, I have preferred to call this operation sustenance of angling with smolts, which basically is one form of enhancement.

In 1989 some Icelandic anglers leased the Rangá river and released over 100 thousand smolts. Prior releases into the river had been minimal. The salmon catch in 1990 was over 1600 salmon, which was the record catch for any one river in that year. The increase from the previous year was approximately 15 fold. The program has continued to show considerable success and in 1994 it had the 3d highest angling catch in Iceland. It seems, therefore, that such sustenance programs might increase in importance in the years to come.

Importance of release ponds

Release ponds are the key players in any smolt release program in Iceland (Isaksson and Oskarsson 1986). Many such ponds are located on the Rangá river and it has been found that the returning salmon tend to congregate below the outflow of the ponds, creating a fishing beat. This congregation of salmon in certain areas is probably one of the main reasons for the success of the program, considering, that even distribution of the salmon throughout the river would make them more difficult to catch.

Put and take fishery for salmon

With increased quantity of salmon returning to ranching stations, there has been a development of a put-and-take fishery for Atlantic salmon in rivers, which sustain very small or no populations of Atlantic salmon. This fishing is often available at a lower price than in the established salmon rivers and has grown in popularity, especially among the younger generation.

Development of sea char and sea trout rivers

I just want to say a few words about the development of sea char and sea trout angling in Iceland. These fisheries are much less developed than the salmon fisheries and catch records are incomplete. With increased cost of salmon angling the trout rivers are getting more popular, especially sea trout rivers on Iceland's

south coast. Fishing lodges are usually more primitive on these rivers and they tend to cater more to families with children. There is no doubt that these low cost trout fisheries on rivers and lakes are important nursery areas for the salmon fishermen of the future.

Promotion of the salmon fisheries

There is no question that marketing of angling is not as easy as it used to be. The angling community is being pressured by various moral and environmental issues ranging from the use of lead sinkers in rivers to various concerns related to the treatment of animals. On top of this come a great variety of new leisure activities such as golf and the opening up of new fishing areas e.g. in Russia.

The Icelandic river associations are trying to promote salmon fishing worldwide and are distributing brochures for most of the top rivers. There is no question that salmonid angling is still very popular in many parts of the world and successful marketing is just a question of reaching the ears and eyes of the proper clientèle through the maze of today's advertising. In these brochures there is a brief description of the river along with recent catch statistics as well as some information on the availability of fishing and booking contacts. Icelandic salmon rivers are now even being promoted through computer via the Inter-Net system.

Value and stability of the resource

Finally a few words about the value of the Icelandic salmon and trout resources. It has been estimated that the revenue from salmon and trout fishing licences in Iceland amounts to 8 million US dollars, of which over 80% stem from the salmon fisheries. Considering the fringe benefits to the local economy this figure must be multiplied with at least a factor of 4, which brings the total value to 32 million US dollars. This in turn is mostly related to an angling catch of 30,000 salmon, which brings the value of each sports caught salmon to about 1000 dollars, which must be considered a sizeable sum and worth preserving.

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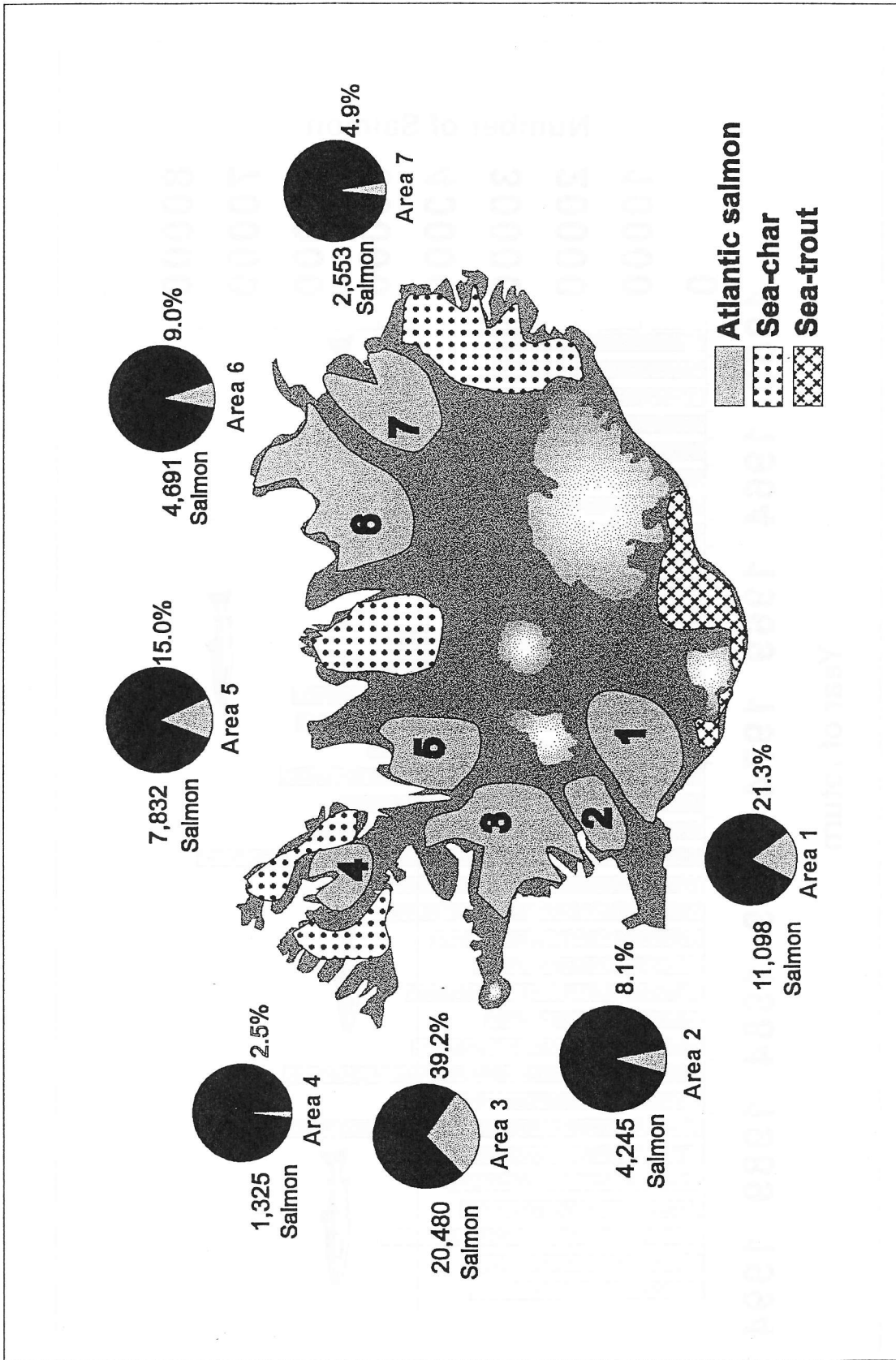


Figure 1. The average yearly catch of wild Atlantic salmon 1974-1993 and the proportion caught in each of the seven districts in Iceland. Also shown are the main sea-char and sea-trout areas in Iceland

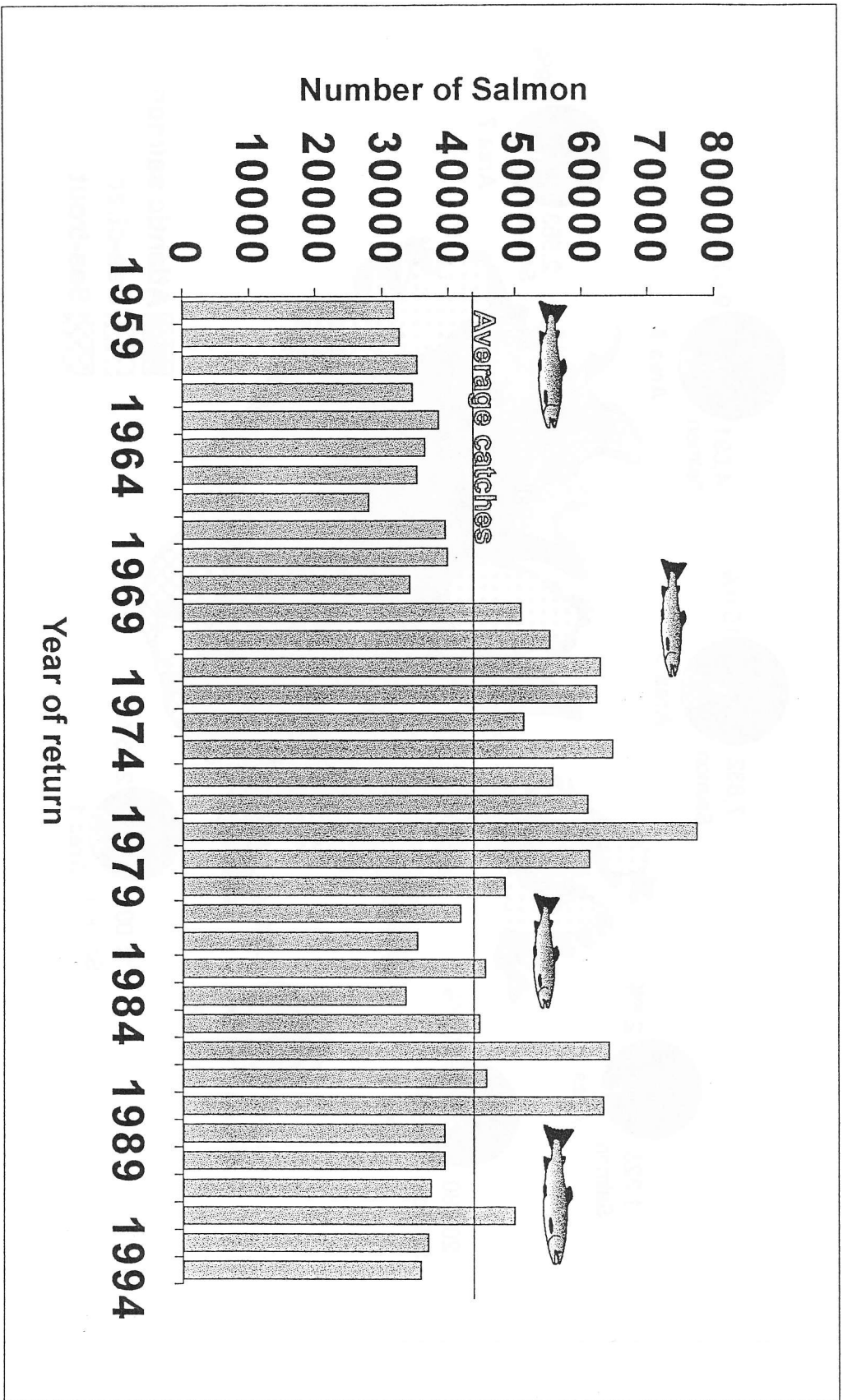


Figure 2. Net and sports fishery in Icelandic salmon rivers 1959 - 1994

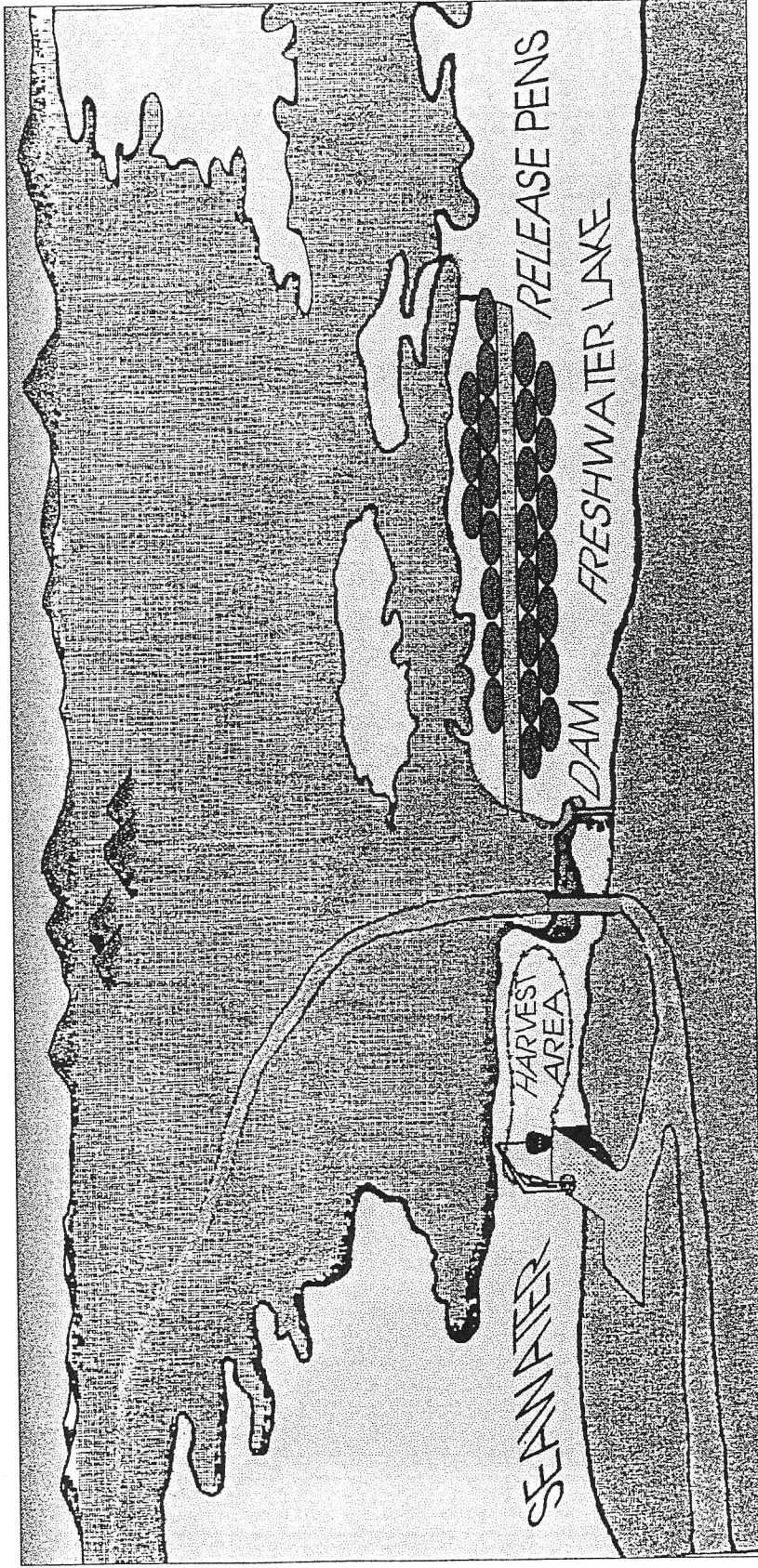


Figure 3. Overview of the Hraunsfjörður ranching facility, showing the smolt rearing cages and the dam creating the freshwater lake. The trapping of adult salmon is conducted within 100 meters of the highway bridge.

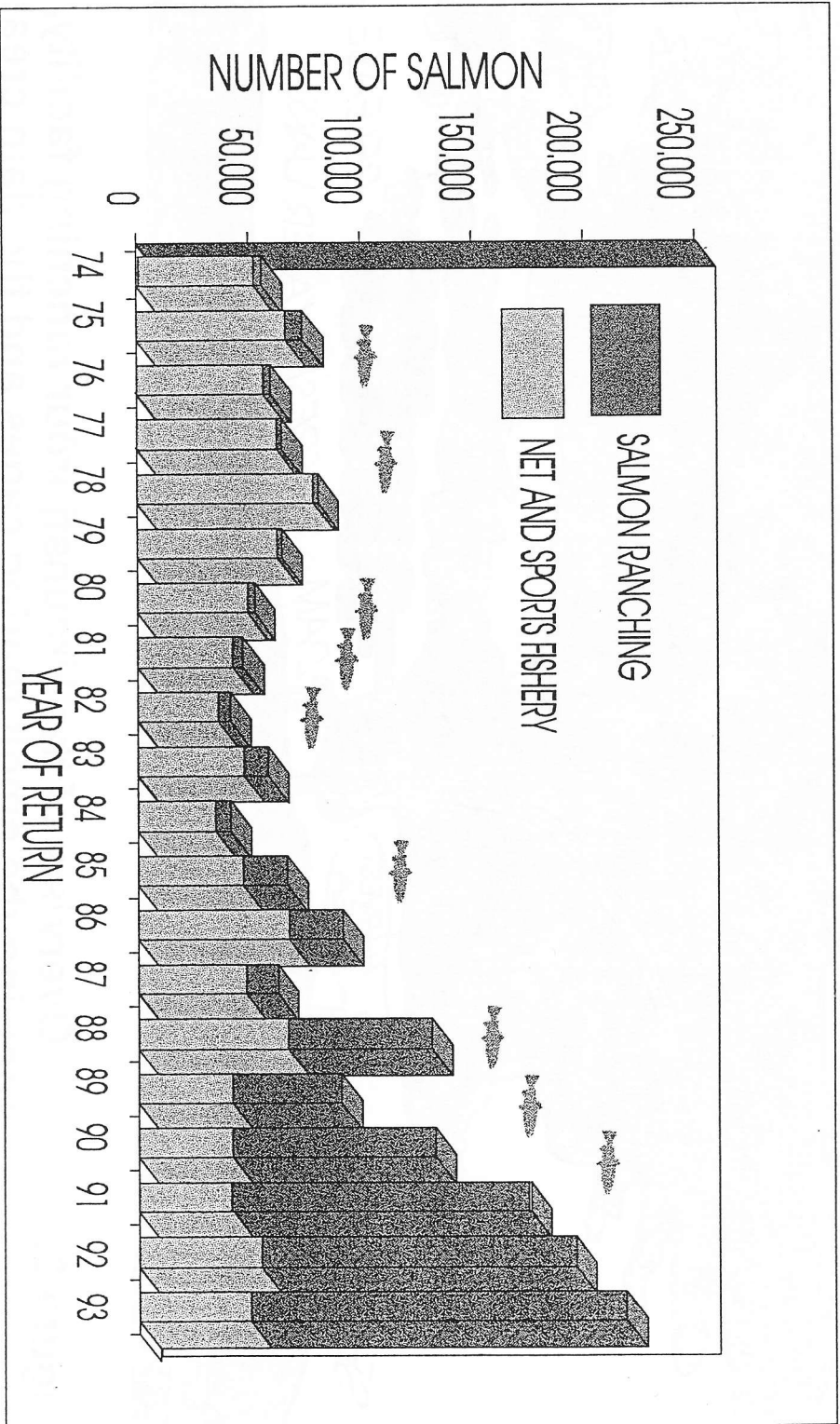


Figure 4. Contribution of salmon ranching to the total Icelandic salmon catch during the last 20 years