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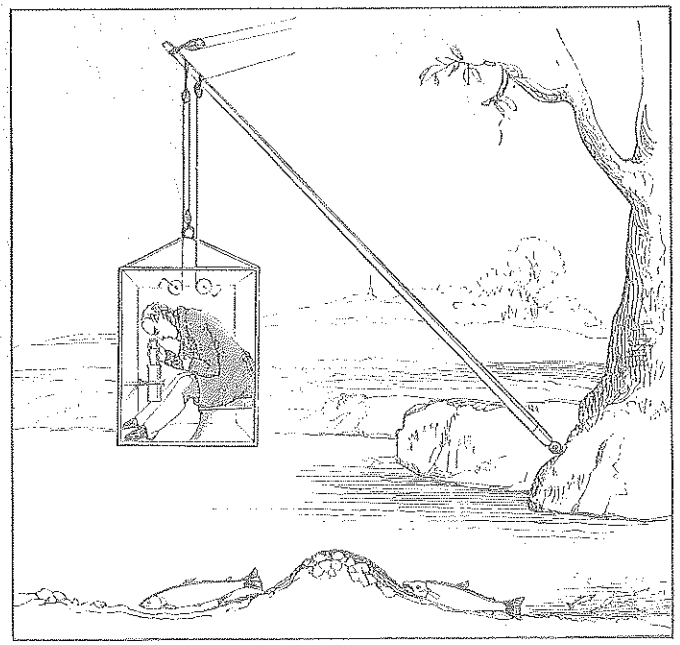

## Scope of activities for the period 1984-85

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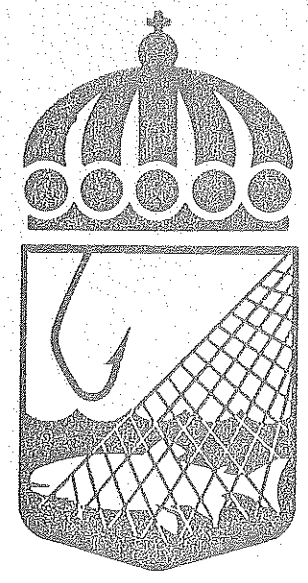

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# SCOPE OF ACTIVITIES FOR THE PERIOD 1984-85

# FÖRORD

I samband med utsändningen av Sötvattenslaboratoriets internationella vetenskapliga serie Report No. 62 bifogades en engelskspråkig översikt av laboratoriets verksamhet. Detta skedde i avsikt att informera omvärlden om vilka vi är och vad vi gör. Vi känner ett behov av att ge samma information även till de huvudsakligen nordiska läsarna av vår Informationsserie, och hoppas ni har överseende med att få informationen på samma sätt som våra övriga medarbetare - nämligen på engelska. Det är vår avsikt att fortsättningsvis ungefär vart annat år uppdatera denna redovisning i liknande form. Jag vill också passa på och tacka Catherine Hill för hennes granskning av engelskan.

Lennart Nyman
laboratoriechef

## INTRODUCTION/BACKGROUND

This report is intended to be published once every two years. The main function of the publication is to give a fairly detailed account of the current research projects carried out at the Institute, including publications, but we also feel that our numerous international contacts - (be they personal or neutral) - may benefit from knowing who we are and what our responsibilities are.

The Drottningholm Institute, as it is sometimes called, was erected on state-owned land through a donation from a private foundation (Knut & Alice Wallenberg Foundation) in 1932. Situated on a small island west of Stockholm and less than a mile north of the Royal Castle at Drottningholm it became the focal point of fisheries research in Sweden. The fisheries biology, technology and management of Swedish freshwater ecosystems were investigated by teams of scientists under the directorships of Gunnar Alm, Sven Runnström and Gunnar Svärdson.

When the National Swedish Board of Fisheries was established in 1948 the Drottningholm Institute became one of its central units, and when the Board was re-organized effective July 1, 1985, the Institute was amalgamated with the Fisheries Research Stations at Kälarne and Älvkarleby to form one of the two sub-units of the new Division of Investigations and Development. The other sub-unit consists of the Institute of Marine Research at Lysekil, on the west coast of Sweden.

## SCOPE OF ACTIVITIES

The major responsibility of the Institute is to provide basic knowledge about the national resources of freshwater fish, including anadromous and catadromous species and freshwater crayfish.

More specifically, the Institute shall provide basic data for establishing techniques and methods aimed at managing these resources for commercial and recreational purposes with due consideration to conservation issues.

Considering the limited number of staff (a total of around 30 people not including the two research stations) the Institute has been forced to concentrate its resources on a few selected project areas, the plans for which are scrutinized and approved annually by the Fishery Board's Research Council. The eight project areas currently dealt with are presented in more detail below.

Responsibility for national research on the subject of freshwater fish also calls for cooperation with the national universities, where the Institute maintains contact with scientists working on aquatic ecology and supervises research students.

Besides cooperation with the official international bodies of EIFAC and ICES the Institute also maintains close ties with

similar research institutes in other countries, primarily in Finland, Norway and Canada. The Institute publishes two journals, the Report Series in English with an international distribution, and the Information Series in Swedish (with English summaries) and a mainly Nordic distribution.

We hope that this publication will inform you about our activities in such a way that future contacts will be simplified and facilitated. If you have suggestions about how our presentation could be even more valuable to you, do not hesitate to let us know.

Drottningholm, December 13, 1985.

Lennart Nyman
Director

# EFFECTS OF ACIDIFICATION AND LIMING ON FISH AND FISHERIES

Efforts to counteract the effects of atmospheric pollution have been going on in Sweden since the beginning of the 1970s. A trial program with liming of lakes and streams was initiated in 1977 and has continued since 1982 at an increased scale.

The aim of the present project is to study the effects of liming on fisheries and fish, including important fish food organisms. Special attention is given to improving liming techniques in running waters and on surrounding wetlands. Fishery management in limed waters is another important task, since it is clear that far from all limed waters are recolonized by the fish species or fish food organisms that have been eliminated as a result of acidification.

Funding: The project is entirely funded by the National Swedish Environmental Protection Board.

Staff: Project manager: Per Nyberg. Others: Erik Degerman, Maria Hanson and Arne Johlander.

Sub-projects:

Long-term monitoring of effects of liming on fish populations in selected lakes and rivers. Approximately 120 lakes and 20 streams are investigated. Gill-net fishing is performed using standardized methods.

Effects of acidification and liming on populations of the glacial relict Arctic char (Salvelinus alpinus) in the southern and central parts of Sweden. This subproject is performed in cooperation with the National Environmental Protection Board Agency, which studies water chemistry, phytoplankton and zooplankton.

Effects of acidification and liming on invertebrate glacial relicts. During 1983-84 approximately 70 lakes in central Sweden were investigated by using a special bottom trawl.

Fishery management in acidified and limed waters. In particular, field trials on the fertilization of acidified lakes and the stocking of prey fish, e.g, smelt (Osmerus eperlanus). Stocking of brown trout (Salmo trutta) is also carried out in a few lakes.

Evaluation of biological results from liming projects during the trial period (1976-82) for the liming of surface waters. Test fishing and to a lesser extent other biological studies were carried out in ca. 150 different lakes and ca. 20 streams in southern and central Sweden. The different investigations were carried out by local organisations and also include liming data and chemical data, which will be evaluated by the National Swedish Board of Fisheries.

The extent of acidification on evertebrates and fish populations in streams in northern Sweden.

Some recent publications:

Andersson, P. & P. Nyberg. 1984. Experiments with brown trout (Salmo trutta) during spring in mountain streams at low pH and elevated levels of iron, manganese and aluminium. Rep.Inst.Freshw.Res., Drottningholm 61:34-47.

Degerman, E., J.-E. Fogelgren, B. Tengelin & E. Thörnelöf. 1985. Occurrence of brown trout, Atlantic salmon and eel in small acidified watercourses on the west coast of Sweden. Inform.Inst.Freshw.Res., Drottningholm (1). 84 p. (In Swedish with English summary.)

Nyberg, P. 1984. Effects of liming on fisheries. Phil.Trans.R. Soc.Lond. B 305:549-560.

Nyberg, P. 1984. Impact of Chaoborus predation on planktonic crustacean communities in some acidified and limed forest lakes in Sweden. Rep.Inst.Freshw.Res., Drottningholm 61:154-166.

EEL

Eel (Anguilla anguilla) is an important species for the commercial fisheries in Sweden, both in lakes and in the sea. Eels are caught both as growing yellow eels and as migrating silver eels.

During the last five years the importance of eels in aquaculture has increased and there is a great demand for starting material, i.e. glass eel. Unfortunately the supply of eel has decreased, as the immigration of glass eels to Northern Europe has diminished.

A project called "The decline of the Baltic eel stock" was commenced in 1977 and the main purpose was to describe and quantify the decrease in immigration of glass eels, elvers and yellow eels to Swedish waters. A second aim was to assess measures taken to strengthen eel stocks, i.e. stocking.

The methods used were age- and sex determination of yellow eels sampled in ten different localities along the Swedish coast and in some rivers.

The main project was later divided into several sub-projects.

Funding: Provided on a yearly basis by the National Swedish Board of Fisheries.

Staff: Project manager: Håkan Wickström. Others: Gunnar Forsberg. Co-operation with regional Fishery consultants and private individuals throughout the country.

Sub-projects:

Stocking of experimental lakes with eels of different size.

Tagging of yellow eels.

Collection of data from fixed traps which catch ascending eels.

Investigation of the effects of aquaculture in heated water on the sex differentiation of eels.

Work is also done within the EIFAC Working Party on Eel.

Some recent publications:

Wickström, H. 1979. Preliminary recommendations for stocking with eels. Inform.Inst.Freshw.Res., Drottningholm (5). 24 p. (In Swedish with English summary.)

Wickström, H. 1983. Eel (Anguilla anguilla (L.)). Inform.Inst. Freshw.Res., Drottningholm (2): 42-46. (In Swedish.)

Wickström, H. 1984. The Swedish Eel Stocking Programme. EIFAC Tech.Pap. (42). Suppl. Vol. 1:68-83.

## CRAYFISH

Crayfish are ecologically important in Swedish waters. Crayfish constitute a large economic resource since they fetch a high price on the domestic market. Stocks of domestic species Astacus astacus have dwindled by 90% this century due to the lethal crayfish plague.

After careful initial trials since 1960 a large scale introduction of plague resistant Pacifastacus leniusculus began in 1969. At present about 400 Swedish natural waters are stocked with this North American species. So far this has been a success. From a large test-fishing programme data are compiled and used to develop guidelines for promotion of new stocks and management of crayfish stocks in general. Steps are taken to protect the remaining domestic crayfish populations.

Environmental factors such as climate, acidification, the regulation of waters and modern intensive cultivation of fields and forests have a strong adverse effect on crayfish populations. Predation, especially by eel, also has a strong impact. Research on these topics is done in cooperation with other institutions.

Crayfish farming in ponds is a rapidly growing business in Sweden at present. Information is supplied to the fisheries administration and to the public. Some research in this field is done at the institute and some in cooperation with other institutes.

Funding: Partly financed by the National Swedish Board of Fisheries, partly self-financed.

Staff: Project manager: Magnus Fürst. Others: Arne Fjälling.

Some recent publications:

Fjälling, A. & M. Fürst. 1985. The introduction of the crayfish Pacifastacus leniusculus into Swedish waters: 1969-84. Inform.Inst.Freshw.Res., Drottningholm (8). 29 p. (In Swedish with English summary.)

Fürst, M. 1984-01-26. PM on farming of crayfish for stocking in Alby, Ange. (In Swedish.)

Fürst, M. 1985. The Swedish crayfish. p. 284-294. In Fisheries biology. Ed.: G. Svärdson & N.-A. Nilsson. LT publisher, Stockholm. (In Swedish.)

## FISH TAGGING AND POPULATION ESTIMATES

The Institute of Freshwater Research is responsible for coordinating fish tagging in Sweden. The main motives for this activity are (a) to achieve a better understanding of the migratory phase in different species and stocks of fish, (b) to study where and when the fish populations are harvested, and (c) to control the quality of the fish stocked.

In 1984 about 120,000 fish were tagged. The Institute of Freshwater Research was responsible for 35,000 of these and the Salmon Research Institute was responsible for the remainder. All reports of recapture (about 15,500 in 1984) are sent to the former institute for practical reasons. The administrative activities, such as filing the data, correspondence and the payment of rewards for each recapture, are the basic prerequisites for routine studies on the percentage of recapture and economic feasibility, as well as for more detailed studies on the biological consequences of stocking in fisheries management.

In 1982 a computer system was introduced in order to facilitate the handling of incoming data.

Fish tagging is also a tool for population estimates. Another means of assessment is the use of acoustic surveys. During the last two years the fish-tagging group has participated in investigations carried out by Norwegian fishery biologists at the National Museum, Oslo, using echo integration techniques. Equipment similar to that used by the Norwegians was purchased in 1985.

The yearly work schedule is planned by the director of the Institute in cooperation with the personnel of the fish-tagging group and the fish-farming group of the National Swedish Board of Fisheries.

The fish-tagging group works in close cooperation with other units dealing with fish tagging, such as the Salmon Research Institute (LFI) and the Fish Culture Station in Älvkarleby, but also with corresponding institutes abroad.

In connection with acoustic surveys the group maintains close contact with the Marine Research Institute of the National Swedish Board of Fisheries as well as the Zoological Museum in Oslo, Norway.

Special activities during 1985 include tagging of the Gullspång strain of trout in Lake Laxsjön, tagging of whitefish in the Bothnian Bay (the Kvarken area) and an acoustic survey in Lake Storsjön (Jämtland County).

Funding: Government budget money is not used to fund the activities of this group. The administrative section is self-sustaining and the statistical evaluation is financed by special funds from the National Swedish Board of Fisheries.

Staff: Project manager: Olof Enderlein. Others: Eivor Meyer and Berit Sers.

Some recent publications:

Brabrand, A. 1984. Registration of fish populations in Lake Vättern using hydro-acoustic methods. Laboratorium for ferskvannsokologi og innlandsfiske. Rapp., Oslo, 65. 21 p. (In Norwegian.)

Lehtonen, H. & O. Enderlein. 1984. The cisco (Coregonus albula L.) in the Bothnian Bay - theirs or ours. Inform.Inst. Freshw. Res., Drottningholm (2). 24 p. (In Swedish with English summary.)

## FISHERIES MANAGEMENT IN RESERVOIRS

This project deals mainly with introductions of new fish-food organisms into impounded lakes. The purpose of the introductions was to compensate for the loss of littoral fauna following impoundment. The fish populations, which consist mainly of brown trout (Salmo trutta), Arctic char (Salvelinus alpinus species complex), grayling (Thymallus thymallus), whitefish (Coregonus spp.) and burbot (Lota lota) have suffered from the reduced food supply, and fisheries have been subjected to great losses.

The project started in 1960 and the effects of introductions of the opossum shrimp Mysis relicta and the amphipods Pallasea quadrispinosa and Gammaracanthus lacustris have been studied. Several papers have been published on the effects of Mysis, including a final report. Work is still being done on the consequences of Pallasea introductions, but results concerning effects on fish are still preliminary due to the short time period since the introductions (15 years). Gammaracanthus has become established in two lakes only, and an evaluation is difficult, as these populations are sparse. The project terminates in 1985, but it is hoped that a programme of minor follow-up studies will continue in the future.

In August 1985 a Mysid workshop was held near Drottningholm for members of the Mysid Research Group. More than 20 scientists from Scandinavia, Europe, Great Britain, North America and India attended.

Funding: Since 1976 the project has been funded mainly by the Hydroelectricity Industry (VASO) in cooperation with the National Swedish Board of Fisheries. Funding is also provided on a yearly basis by the National Swedish Board of Fisheries.

Staff: Project manager Magnus Fürst. Others: Johan Hammar and Catherine Hill.

Some recent publications:

Fjälling, A. 1985. Fishing gear for hydro-electric reservoirs - final report on investigations by the FÅK group 1976-83. Inform.Inst.Freshw.Res., Drottningholm (2). 31 p. (In Swedish with English summary.)

Fürst, M. & J. Hammar. 1984. Effects of water level fluctuations on the recruitment of Arctic charr. p. 303-311. In Biology of the Arctic charr. Eds.: L. Johnson & B.L. Burns. Proceedings of the International Symposium on Arctic charr, Winnipeg, Manitoba, May 1981. Univ.Manitoba Press, Winnipeg.

Fürst, M., J. Hammar & C. Hill. 1985. The introduction of Mysis relicta in Sweden: effects on fish in impounded lakes. p. 202-206. In Habitat modification and freshwater fisheries. Proceedings of a symposium of the European Inland Fisheries Advisory Commission. Ed.: J.S. Alabaster. Butterworths, London.

Fürst, M., J. Hammar, C. Hill, U. Boström & B. Kinsten. 1984. Effects of the introduction of Mysis relicta into impounded lakes in Sweden. Inform.Inst.Freshw.Res., Drottningholm (1). 84 p. (In Swedish with English summary.)

Fürst, M., J. Hammar, C. Hill, U. Boström & B. Kinsten. 1984. Effects of the introduction of Mysis relicta into impounded lakes. p. 129-143. In Interaksjoner mellom trofiske nivåer i ferskvann. Eds.: S. Bosheim & M. Nicholls. Norsk Limnologforening, Oslo. (In Swedish with English summary.)

Hammar, J. 1984. Ecological characters of different combinations of sympatric populations of Arctic charr in Sweden. p. 35-63. In Biology of the Arctic charr. Eds.: L. Johnson & B.L. Burns. Proceedings of the International Symposium on Arctic charr, Winnipeg, Manitoba, May 1981. Univ.Manitoba Press, Winnipeg.

Hammar, J. & J. Henricson. 1984. Effects of introduced Mysis relicta on infestation rates of Diphyllobothrium spp. in Arctic char (Salvelinus spp.) and whitefish (Coregonus spp.) species complex in northern Sweden. p. 145-162. In Interaksjoner mellom trofiske nivåer i ferksvann. Eds.: S. Bosheim & M. Nicholls. Norsk Limnologforening, Oslo. (In Swedish with English summary.)

Hanson, M. 1984. Effects of impoundment on whitefish, perch, brown trout and stickleback in Lake Lulejaure. Inform.Inst. Freshw.Res., Drottningholm (9). 63 p. (In Swedish with English summary.)

Hill, C. & U. Boström. 1985. Effects of the introduction of Mysis relicta on the quality of Arctic char. Infomr.Inst. Freshw.Res., Drottningholm (3). 54 p. (In Swedish with English summary.)

## FISH STOCK REGISTRIES

The main part of activities within this project area are carried out at the Fisheries Research Station at Kälarne, in the eastern part of the province of Jämtland in northern Sweden. Research is aimed at fulfilling the national need for protecting the genetic resources of indigenous fish species, as well as at providing commercial fishermen, recreational fishermen and those engaged in aquaculture with data on the performance and limitations of the various stocks commercially available.

This line of research calls for interdisciplinary cooperation with a number of research bodies with competence in ethology, ecology, populations genetics, physiology, fish breeding etc. The main goal is to provide fish stocks that are well suited to various "tasks", be it the stocking of natural waters, put-and-take fishing, aquaculture or purely nature conservation. The Institute has two functions in this respect, to engage in direct research and to coordinate the research of other institutions. Currently only one external project is being carried out, viz. that on the giant catfish (Silurus glanis).

Funding: Basic resources such as materials, technical equipment, and work space are provided by the National Swedish Board of Fisheries. Supplementary funding is varied and comes from government sources, Swedish research councils and the World Wildlife Fund.

Staff: Coordinators: Lennart Nyman and Jan Henricson. Others: Magnus Fürst, Johan Hammar, Maria Hanson, Olle Ring, plus external staff.

Sub-projects:

(A) Fisheries Research Station, Kälarne

This station was formally opened in August 1983 and research is still carried out on a moderate scale only. The reason for this is the poor financial situation, whereby government funds cover the buildings only, and practically all salaries, the cost of fish production and direct research activities have to be financed by external sources, mainly research councils.

Project 1
"Comparative studies of brood fish reared in ponds and net cages"

A pilot project comparing Arctic char (Salvelinus alpinus), Gullspång-stock salmon (Salmo salar) and rainbow trout (Salmo gairdneri) reared in a pond on the Station premises with those reared in net cages in a suitable lake in the region. A site for the cages is still lacking, as is funding for the project. There is an urgent need for solving the economic situation, as a university course in aquaculture was carried out in the autumn of 1985 (in cooperation with the regional university in Östersund and the national University of Umeå).
Project manager: Knut Svensson

Project 2
"Development of techniques for quality-control of fish eggs"

Standardized test hatching of eggs has been monitored since 1984. The scope of future activities depends on funding from research councils.
Project manager: Knut Svensson

Project 3
"Comparative studies of various types of troughs for fish rearing"

Primary research will focus on lighting conditions and trough colour. The scope of activities depends on funding from research councils.
Project manager: Knut Svensson

Project 4
"Development of techniques for rearing grayling in troughs"

Techniques will be developed specifically for rearing grayling (Thymallus thymallus). The emphasis is on types of troughs and feed as well as on wintering conditions. The scope of activities depends on funding from research councils.
Project manager: Knut Svensson

Project 5
"Effects of culture on fish: A genetic and ecological perspective"

A long-term study on the possible negative effects of rearing salmonid fish in troughs and ponds. Emphasis is on the problems incurred by a limited number of parental fish and the absence of natural selection. Laboratory and field experiments combining population genetics (electrophoresis), ecology and ethology. Trout (Salmo trutta) and landlocked salmon (Gullspång stock).
Project manager: Lennart Nyman

Project 6
"Comparative studies on fry fed on various brands of feed"

Various brands of pellets will be compared, including those made from leaf protein. Cooperation with the regional university in Östersund.
Project manager: Knut Svensson

Project 7
"Feeding ecology"

Studies on food-web specialization by various species of salmonids. Laboratory and field experiments with natural and artificial feeds. Feeds will be presented to the fish in a variety of standardized ways. Four stocks of trout will be tested initially.
Project manager: Maria Hanson

Project 8
"Genetic and ecological characterization of the Arctic char"

Population genetic analyses of numerous stocks of char. Comparative growth studies in standardized environments. Food ecology studies using artificial and natural feeds are being performed.
Project manager: Lennart Nyman

(B) Drottningholm Institute

Project 9
"The giant catfish project"

The European catfish Silurus glanis is in danger of extinction in Sweden. The project studies the possible causes and aims at proposing conservation measures.
Project manager: Jan Erik Nathanson

Some recent publications:

Andreasson, S., L. Nyman, B. Holmberg & K. Dahlqvist. 1984. Conservation of the genetic resources of Swedish fish stocks. National Swedish Board of Fisheries, Rapp. 1984-09-12. 54 p. (In Swedish.)

Gydemo, R. 1984. Preliminary survey results of the distribution of the Arctic charr species complex in Iceland. p. 91-107. In Biology of the Arctic charr. Eds.: L. Johnson & B.L. Burns. Proceedings of the International Symposium on Arctic charr, Winnipeg, Manitoba, May 1981. Univ.Manitoba Press, Winnipeg.

Hammar, J. 1984. The geographical distribution and systematics of the Arctic char species complex in Svalbard. p. 11-20. In Arktis som livsmiljö. Voksenåsen, Norway, October 1982. (In Swedish.)

Hammar, J. 1985. The geographical distribution of the Arctic char (Salvelinus alpinus (L.)) species complex i Svalbard. p. 29-37. In Proceedings of the third ISACF workshop on Arctic char, 1984. ISACF Inform.Ser. (3). Inst.Freshw.Res., Drottningholm.

Nyman, L. 1984. Future problems for the research on fish breeding in Sweden. Aquaculture NKJ-Symposium, Kolbotn (Norway). 3 p. (In Swedish.)

Nyman, L. 1984. Recent and future activities by the Nordic Council's expert group on gene banks for fish. Aquaculture NKJ-Symposium, Kolbotn (Norway). 3 p. (In Swedish.)

Nyman, L. 1984. An ecologist, ornithologist, wildlife manager and evolutionary scientist in a fisheries biology setting - Gunnar Svärdson. Inform.Inst.Freshw.Res., Drottningholm (8). 30 p. (In Swedish with English summary.)

Nyman, L. 1984. Management of allopatric and sympatric populations of landlocked Arctic charr in Sweden. p. 23-34. In Biology of the Arctic Charr. Eds.: L. Johnson & B. Burns. Univ.Manitoba Press.

Nyman, L., J. Hammar & R. Gydemo. 1985. Lethal, sex-linked genes associated with homozygosity at the Esterase-2 locus in Arctic char? p. 125-130. In Proceedings of the third ISACF workshop on Arctic char, 1984. ISACF Inform.Ser. (3). Inst.Freshw.Res., Drottningholm.

## MONITORING FISH STOCKS IN VARIOUS TYPES OF LAKES

Originally this project area was focused on large lakes with extensive commercial fisheries. Studies of species interactions and foodwebs necessitated cooperation with other organizations. Year-class fluctuations and dominance relationships between fish species, as they may be construed from available statistics and test fishing trials, normally form the data base for the stock analyses. The major emphasis is on explaining the interaction between lake trophic level, fishing pressure and the dominant species of fish.

In recent years the activities within this project area have concentrated on monitoring smaller lakes of various types using standardized methods of fishing with so-called survey nets. Normally lakes are visited once every two, three or five years. This enables us to test the various biological models which form the net result of our pooled knowledge.

As an example of "where and why" we fish, the lakes eligible for standardized fishing in 1985 are described below:

Lake Ören (province of Småland): typical locality for spring-spawning cisco (Coregonus albula), which is now endangered as is a local stock of Arctic char, probably as a result of increased eutrophication.

Lakes Västansjön and Bollvattnet (province of Lappland): a study of the effects of a net-fishing ban on char and perch (Perca fluviatilis).

Lakes Lejaren and Värgaren (province of Jämtland): this year (1985) will probably be the last in a long-term study on the effects of char invasion on a formerly allopatric trout stock. Lake Lejaren is also the subject of a comparative investigation on the growth and size distribution of fish caught with survey nets and standard nets respectively.

Lake Glensjön (province of Jämtland): the effect of the introduction of smelt (Osmerus eperlanus) in a high-mountain lake on stocks of trout, char, burbot (Lota lota) and minnow (Phoxinus phoxinus).

Lake Vättern (provinces of Småland, Östergötland and Västergötland): investigation on the effect of new fishery regulations effective January 1984. Important species are char, whitefish (Coregonus sp.) and introduced salmon.

Lake Fardume (province of Gotland): study of the effect of a large-scale introduction of elvers (Anguilla anguilla) on a practically unexploited fish population in a eutrophic lake.

Lake Garnsviken (province of Uppland): effects on fish and crayfish (Astacus astacus) populations of a heat-extraction project.

Lake Vallentunasjön (province of Uppland): same as above.

Lake Blåsjön (province of Jämtland): the classical locality for research on Mysis relicta - fish interactions. In the course of the study two new fish species have entered the system, minnow and a char species.

Lake Mesvattnet (province of Jämtland): the last year of a study on the effect of Mysis introduction on a population of trout and char.

Lake Storuman (province of Lappland): tests of a pelagic fish trawl. Evaluation of its usefulness in quantitative analyses of echo-integration surveys.

Each year a seminar is held in which the results of the annual test fishing investigations are discussed. In this way a continuous flow of new knowledge into all project areas is guaranteed.

Funding: Primarily government funding.

Staff: Coordinator: Olof Filipsson. Others: Eva Bergstrand, Gunnel Hasselrot, Nils-Arvid Nilsson, Lennart Nyman, Gun Odén, Gun Svensson.

Some recent publications:

Filipsson, O. 1984. Results of the test fishing in 1984. Catch analyses from the following lakes: Asaträsk (province of Gotland), Hageby träsk (province of Gotland), Västansjön (province of Lappland), Bollvattnet (province of Lappland), Övre Särvsjön (province of Härjedalen), Storjsön (province of Jämtland), Boksjön (province of Lappland), Mycklaflon (province of Småland), Övre Björkvattnet (province of Lappland). 31 p. (In Swedish.)

Hammar, J. & O. Filipsson. 1985. Ecological testfishing with the Lundgren gillnets of multiple mesh size: the Drottningholm technique modified for Newfoundland Arctic char populations. Rep.Inst.Freshw.Res., Drottningholm 62:12-35.

Nilsson, N.-A. 1985. Consequences of the rotenone treatment of a subarctic Swedish lake on the fish and zooplankton communities. Rep.Inst.Freshw.Res., Drottningholm 62:120-127.

Nilsson, N.-A. 1985. The niche concept and the introduction of exotics. Rep.Inst.Freshw.Res., Drottningholm 62:128-135.

## COOPERATION WITH DEVELOPING COUNTRIES

Ever since 1975 the Institute has been represented (through its Director) on the Advisory Committee on aid for developing countries within the fisheries sector. This committee and its activities are financed by SIDA (Swedish International Development Agency). The committee plans, evaluates and carries out projects mainly within the marine sector, but in recent years a shift towards freshwater fisheries and aquaculture has occurred. Since 1983 another governmental agency - SAREC - has also supported the Drottningholm Institute, and presently a broad-scale project is operated jointly with the Ruhuna University, Matara, Sri Lanka.

These projects are aimed at understanding the ecological relationships between the various species - native and introduced - in old and new reservoirs (tanks), at developing technology for standardized stock-taking schemes and at adapting fishery methods for fish and crustaceans. Preliminary investigations have also been conducted on the productivity of salmonids in the high-mountain streams of the island.

Funding: SAREC and SIDA provide the entire financial backing.

Staff: Coordinator: Lennart Nyman. Others: Olof Enderlein, Arne Fjälling, Magnus Fürst, Rolf Gydemo, Nils-Arvid Nilsson, Håkan Wickström.

Sub-projects:

Project 1
"Feasibility studies on the commercial exploitation of minor cyprinid fishery resources of perennial reservoirs"

The project is directed towards stock-taking of all species of fish in the lowland tanks of the Hambantota District, Sri Lanka, using standardized methods.

Project 2
"Investigations of the hill streams for establishment of salmonids, and the riverine fishery in general"

Stock-taking of salmonids, crayfish and eels in highland and lowland streams and reservoirs.

Some recent publications:

Nichols, E.H. & L. Nyman. 1982. Development of small-scale fisheries in the Bay of Bengal. Report of the Impact Review Mission, FAO, Rome, W/Q 0381. 90 p.

Nyman, L., M. Fürst, K.-J. Gustafson, B. Holmberg, N.-A. Nilsson & N.G. Steffner. 1980. A strategy for Swedish aid to the development of aquaculture and freshwater fisheries. Inform.Inst.Freshw.Res., Drottningholm (8). 22 p.

Nyman, L., H. Ackefors, A. Andreasson, B.-I. Dybern & B. Holmberg. 1983. Prerequisites for Swedish support to aquaculture in developing countries and proposed guidelines for actions. National Swedish Board of Fisheries, Secretariate of Development Cooperation, Fisheries Development Series 10. 91 p.