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KALANTUTKIMUSOSASTO

MONISTETTUJA JULKAISUJA

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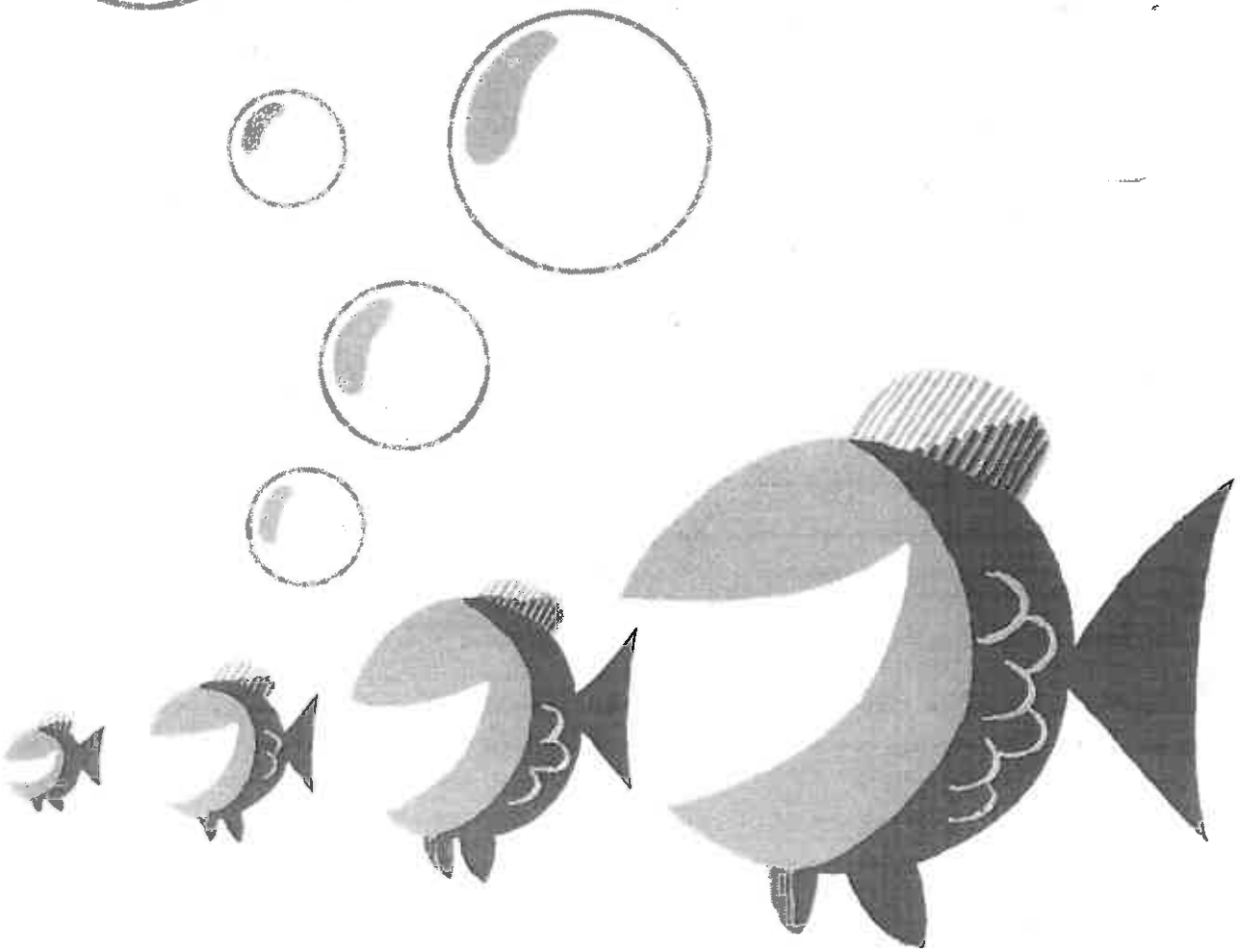

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COUNTRY REPORT OF FINLAND FOR THE INTERSESSIONAL PERIOD 1978 - 1980[1]

Kai Westman, Pekka Tuunainen, Juha Jurvelius
and Markku Pursiainen

COUNTRY REPORT OF FINLAND FOR THE INTERSESSIONAL PERIOD 1980 - 1981 [2]

Juha Jurvelius, Markku Pursiainen, Kai Westman
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COUNTRY REPORT OF FINLAND FOR THE INTERSESSIONAL PERIOD 1978 - 1980

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1 FISHERIES BIOLOGY AND MANAGEMENT (SUB-COMMISSION I)

1. Fishing in inland waters

The inland waters of Finland cover 31,000 km^2, which is about 9.4 % of the country's total area. There are over 60,000 lakes, 17 of which have a surface area of more than 200 km^2 each. The lakes are shallow, the average depth being 7 m and the total volume 220 km^3. Together they have a total shore length of 130,000 km. From a statistical point of view, nearly one hectare of lake area and about 30 m of shoreline are available per capita of the population (4.8 million in 1978). The total length of the rivers exceeds 20,000 km.

In 1978 about 370,000 households were engaged in fishing in inland waters: some 800,000 people. About 3,000 households were engaged in commercial fishing and the rest fished for recreation and their own use.

According to calculations made by the Finnish Game and Fisheries Research Institute (FGFRI), the catch from inland waters was 30,200 tons (about 10 kg/ha) in 1978. This was about 22 % of the total catch for the country. The combined catch of six species, vendace (Coregonus albula) (6,500 tons), perch (Perca fluviatilis) (8,100 tons), pike (Esox lucius) (5,300 tons), bream (Abramis brama) (2 100 tons), burbot

(Lota lota) (1,300 tons) and whitefish (Coregonus lavaretus) (1,100 tons) was nearly 25,000 tons; this corresponds to about 82 % of the total catch from inland waters. Due to the low level of the fluctuating vendace stocks, this species has not been caught as much during the last few years as in the 60's. About 24 % (5,700 tons) of the total catch from inland waters was taken by professional and semi-professional fishermen.

The value of the total catch from inland waters was about 148 million Finnish marks (about 38 million USD).

The annual catch of the native crayfish (Astacus astacus) was estimated to have been about 2-4 million specimens, which corresponds to a value of about 3-6 million Finnish marks (0.8-1.5 million USD).

2. Development of eel fishery resources

In accordance with the recommendations 76/2 and 76/3 of the ninth session of EIFAC, the catch statistics for eel have been collected annually since 1976. The total eel catch in 1978 was about 66 tons, of which 50 tons was from inland waters. Of these 50 tons, 48 tons were fished by non-professional fishermen and only 2 tons by semi-professional fishermen. The value of inland eel catches was about 360,000 Finnish marks (about 93,000 USD). Finland's eel fisheries are almost totally dependent on stocking with glass eels from France or young eels from elsewhere. The stocking rate has been rather low during recent years, due to the risks of spreading communicable fish diseases together with the stocking material.

The joint ICES/EIFAC working group on the eel is still working with the 180 otoliths which were collected in 1977 from eel populations of known age in two Finnish lakes in accordance with EIFAC recommendation 76/1. Reseach on eel catches, eel fishing methods and stocking results have been continued.

3. Economic aspects of sport and commercial fisheries

The FGFRI has studied the profitability of commerical fisheries since 1973 by collecting annual data (catch and

effort statistics for different fish species and fishing methods, yield, expenses, investments and working time) from some 100 fishing households and fishing enterprises. Nearly half of these are involved in fishing in inland waters. The average earnings per year and per hour in a fishing household or enterprise as well as the profitability of different fishing methods are calculated on the basis of this information.

Being the most popular leisure-time acitivity in Finland, recreational fishing is of great economic and social importance. Anyone who wants to fish other than by angling with natural bait must purchase a general fishing licence (15 Fmk). About 361,000 households bought licences for inland waters in 1978. About 98 % of the 800,000 people involved were recreational fishermen. The most important fish species caught by recreational fishermen were perch and pike. In 1978, the FGFRI made a nation-wide survey of the recreational and subsistence fisheries. A large amount of data was collected with questionnaires: e.g. number of fishermen in different fishing areas, number of fishing days, the basis of fishing rights, total catches, catches with different fishing methods and gear, catches per fishermen, the utilization of the catch, efforts, costs, investments, etc.

In northern Lapland, about one third of the people are directly dependent on natural resources for their livelihood. The importance of fishing in their households and the state of fish stocks were studied. The measures necessary to quarantee the continuation of their fishing were discussed on the basis of the results. In these water areas, sports fishing, which is directed partly at the same fish stocks which are harvested in commercial and subsistence fisheries, has increased rapidly. Because of this, the stocks of brown trout (Salmo trutta m. lacustris) in particular have decreased considerably.

4. Survey and appraisal of inland waters

According to recommendation 78/3 of the tenth Session of EIFAC (Hamburg) that the intercalibration experiment

carried out in Finland in 1976 should be extended to pelagic species, a field study has been planned by the "EIFAC Working Group on the international intercalibration exercise of fish sampling methods in lakes" in co-operation with the Secretary of EIFAC. This study will be carried out from 1 to 14 September 1980 in the northern part of Lake Konnevesi (about 69 km^2) in Central Finland. Vendace, whitefish and smelt stocks in the lake will be estimated by the mark-recapture method and by echo survey. After echo sounding, trawl samples will be taken from the observed fish stocks. In a preliminary echo survey, the diurnal, horizontal and vertical migrations of the pelagic fish in the northern part of Lake Konnevesi were studied in 1978 and 1979. The mark-recapture programme began in autumn 1979 and will continue until September 1980. Research workers and technicians from the Federal Republic of Germany, Norway, Poland, Sweden, the United Kingdom and Finland are expected to participate in the exercise. A preliminary echo survey has also been made in Lake Inari (about 1,000 km^2) in northern Finland.

MSY (maximum sustained yield) studies of vendace, whitefish, pike, perch, burbot, bream, pike-perch, smelt, roach and ide in some larger lakes and in the coastal area of the Baltic Sea have been continued during the intersessional period. Studies on the numbers and mortality of eggs and of young stages of vendace and whitefish have also been expanded to investigate the recruitment and factors affecting it.

5. Management of inland waters

River damming for hydroelectric power plants and river construction operations with reservoirs have seriously damaged the stocks of many river spawning fish species. For example, the natural salmon (Salmo salar) smolt production from the Finnish territory to the Baltic is nowadays less than 350,000 specimens instead of the 2.5 million specimens in the natural state.

Some rivers or parts of them have been restored in order to increase the natural salmon, land-locked salmon, sea trout (S. trutta trutta) and brown trout (S. trutta lacustris) smolt production and grayling (Thymallus thymallus) and white-

fish (Coregonus lavaretus and C. muksun) fingerling production. The largest restoration operations were on the River Simojoki, which flows into the Gulf of Bothnia. The succes of these operations has been seen clearly on the basis of investigations carried out.

Investigations on the natural smolt production in the great northern rivers (River Tornionjoki, River Tenojoki and River Näätämönjoki) have been continued.

Extensive fish stocking programmes form the main part of the management of economically important fish stocks. Salmonids and coregonids, in particular, and also some important spring spawning fish are stocked in great amounts annually. The following numbers of fish were stocked in natural waters in 1978 (some earlier stages than these mentioned were also stocked, but they have not been included because of the poor profitability of such stockings):

Baltic salmon	2 summers old and older	313,000	specim.
Land-locked salmon	"	67,000	"
Sea trout	"	551,000	"
Brown trout	"	883,000	"
Other salmonids (lake trout, char, etc)	"	176,000	"
Grayling	1 summer old and older	314,000	"
Coregonids	fry	113,683,000	"
"	1 summer old and older	21,708,000	"
Vendace	fry	550,000	"
Pike	fry	16,328,000	"
"	fingerling	911,000	"
Pike-perch	fry	450,000	"
"	fingerling	30,000	"
Bream	brood fish	10,000	"
Eel	elvers and young eels	445,000	"
Crayfish	brood crayfish	19,000	"

To evaluate the stocking results, some 15,600 salmon and 15,500 other salmonid smolts were tagged, mostly with Carlin-type tags, in 1978. In addition, about 27,300 other fish were tagged either for stocking evaluation or because of research activities.

In 1979 the numbers of tagged fish were 18,600 for salmon, 43,100 land-locked salmon and other salmonids and 20,400 for other fish species.

The large Finnish lakes, e.g. Lake Saimaa (4,400 km^2), Lake Päijänne (1,100 km^2), Lake Inari (1,000 km^2), Lake Puruvesi (400 km^2) and Lake Konnevesi (200 km^2) have been studied for many years to gather information especially on fish stocks, production biology, fishing and management methods. Research programmes were also started in Lake Karjalan Pyhäjärvi (250 km^2) and Lake Paasivesi (110 km^2) with special reference to natural vendace (Coregonus albula) and whitefish as well as stocked whitefish. An extensive study of the fisheries on the Oulujoki watercourse (drainage area 22,925 km^2, Oulujärvi surface area 887 km^2) has been completed for the development and planning of fisheries. A new planning programme has been started in the Finnish area of North Karelia (eastern and central parts of the Vuoksi water course).

The utilization of coarse fish stocks (roach, small perch and small whitefish) has increased as a result of the development of fishing techniques, transport and markets. This is especially important in eutrophicated waters as well as in the great eastern and northern lakes with abundant populations of these species, e.g. Lake Pielinen (850 km^2), Lake Inari (1,000 km^2), as well as the large man-made lakes of Lokka (417-216 km^2) and Porttipahta (214-43 km^2).

6. Crayfish

Owing to the large number of water bodies and their long shoreline, Finland has exceptionally high potential for crayfish production. The disastrous crayfish plague, Aphanomyces astaci, and the various engineering works undertaken on the rivers (draining, dredging, regulation, etc.) have been the main obstacle to the full utilization of these natural resources and are still the greatest threat to crayfish stocks.

FGFRI has continued an extensive research programme aimed at developing crayfish fisheries in Finland. In 1978-1979 particular attention was paid to comparative studies of the only native crayfish species, Astacus astacus and Pacifastacus

leniusculus, a plague-resistant crayfish species introduced into Finland from North-America since 1967. The aim of the research has been to investigate and compare both species, their bionomics and life histories, e.g. growth, reproduction, behaviour and environmental requirements as well as the populations: their structure and densities in different biotopes, recruitment, mortality, etc. A subject of special interest has been the relationships between the two species, particularly competition between them, e.g. for biotopes. Studies have also been made concerning crayfish sampling methods, e.g. with electric fishing, the management of crayfish stocks, the cultivation of crayfish and the fishing equipment. A new, folding trap model which prevents crayfish from escaping has been developed.

A research programme based on the comparative physiology of Astacus and Pacifastacus and the effects of pollution on the physiology of crayfish has been continued by FGFRI in co-operation with the University of Helsinki, Division of Zoology. Research on the ecology and physiology of crayfish is also carried out at the University of Kuopio and University of Turku.

The Second Scandinavian Symposium on Freshwater Crayfish was organized by the FGFRI at Lammi on 25-27 September 1979.

7. Other subjects

During the intersessional period, a committee reviewed the aims and objectives of fisheries production, adminisration and research. A fishing convention on the River Tenojoki has been made between Finland and Norway. This convention presumes e.g. that common research has to be carried out to conserve the fish stocks.

The "Finnish-Soviet Boundary Water Commission" founded in 1964 has continued its work on questions of mutual interest concerning also fisheries in the border region. The trout research project on the River Koutajoki has been completed. New bilateral research on Lake Karjalan Pyhäjärvi (200 km^2 in Finland and 50 km^2 in the U.S.S.R.) was begun in 1979. The fishing pressure on the Finnish part of the lake is heavier than on the Soviet part where the stocks are nearly

unexploited. The aim of the study is to compare the vendace and whitefish population structures on each part of the lake.

The "Finnish-Swedish Boundary River Commission" was founded in 1971. The Commission has organized the monitoring of the fish stocks and fisheries of the River Tornionjoki. Joint salmon cultivation began in 1978. Its purpose is to stock the rapids of the river with 1-year old salmon. Because of high fishing pressure on the Baltic Sea the spawning stock, and thus also the number of young, decreased drastically in the 1970's.

II FISH CULTURE AND DISEASES (SUB-COMMISSION II)

1. Fish culture

The production of rainbow trout (Salmo gairdneri), the only fish farmed in Finland for consumption, has continued to increase during the intersessional period. The production was about 3,205 tons in 1978, of which 809 tons was in brackish water in net pens. The number of private fish farms, which produced all fish for consumption was a little over 100. A few large farms with an annual production of 100-400 tons produced the main proportion of the total production. Marketed rainbow trout are 0.5-1.0 kg in weight.

The production of stocking material has increased during the intersessional period. The production of 2 - 3 year old salmon, trout and char for stocking purposes amounted to 1.7 million specimens in 1979 and will be doubled in a few years when stocking with salmon, sea trout and migratory whitefish young for the Gulf of Bothnia begins to compensate the losses caused by damming of the River Kemijoki and the River Iijoki. 1-summer old whitefish (Coregonids) and also pike and pike-perch fingerlings are produced in large ponds with natural food supplies for stocking natural waters. The number of such ponds was about 500 with total area of 3,800 hectares in 1978. The State's fish farms produce the stocking material together with private fish farms.

The FGFRI, which is responsible for State fish farming, has nine fish farms and the construction of five new farms

is being planned. The State's fish farms have about 30,000 m^2 of plastic or concrete tanks and pools for intensive rearing of brood fishes and stocking material, and some 1,300 ha of ponds for rearing fish with natural food supplies. The main aims of the State fish rearing is to produce eggs and fry for the rearing of stocking material, to preserve threatened valuable fish specimens and stocks, to control stocking material throughout the country and to carry out research on fish rearing and management methods.

The research carried out on fish cultivation by the FGFRI during the intersessional period has dealt mainly with trout and salmon, and also with coregonids, pike, pike-perch and crayfish. There have also been projects concerned with selective breeding of rainbow trout and physiological studies of cultivated fish.

2. Fish feeds

Some domestic dry feeds for rainbow trout are available in Finland. At the beginning of 1978, research was started on development of a domestic dry feed formula for Baltic salmon. The newly developed salmon feed will come on to the market in 1980. The utilization of low value fish (roach, smelt, etc.) and also of Baltic herring has increased, especially in net pens in brackish waters. Dried smelt meal is also used as additional food for coregonids in natural food ponds.

3. Economic evaluation of fish culture

The FGFRI made an extensive study of the profitability of fish farming in Finland at the beginning of 1970's. The study included some 70 fish farms. In accordance with the EIFAC recommendations, some additional studies are under way among a number of representative fish farms.

4. Controlled reproduction of cultivated fish

The FGFRI is continuing experiments on the use of pituitary hormones in the breeding of pike-perch. The research programme on the advance determination of the sex of rainbow trout fry is also continuing with the aim of obtaining more females than males for farming.

5. Introduction of exotic species

No new introductions other than the importation of elvers and young eels mentioned earlier have been made during the intersessional period. Stocking with fingerlings of the eastern peled whitefish (Coregonus peled) and with 2-3 year old North American lake trout (Salvelinus namaycush), imported into Finland in the 1950s and 1960s and now produced in Finland, has continued. Self-reproducting stocks have not yet been successful, but stocking has been economically profitable.

The North American crayfish (Pacifastacus leniusculus) which was first imported in to Finland in 1967, has developed self-reproducting stocks in some waters. Stocking with Finnish material has continued, and also small-scale imports have been made from Sweden.

6. Fish diseases

At present 50 fish farms are registered for official health inspection by the State Veterinary Medical Institute. A veterinarian visits each fish farm once a year to check that it is free from infectious diseases. Control samples are investigated at regular intervals at the State Veterinary Medical Institute.

Most of the recommendations proposed in the draft for the Control of the Spread of Major Communicable Fish Diseases in Aviemore in 1974 are in force in Finland.

In 1976, a disease with very similar histological and macroscopical symptoms to UDN (Ulcerative Dermal Necrosis) was detected in nature salmon at the mouths of the River Kemi-

joki and the River Oulujoki in the Gulf of Bothnia and in salmon and trout at Laukaa Fish Culture Research Station. In Laukaa, the mortality in the affected brood fish groups was about 35 %. Although a definite diagnosis could not be made, transport of fish and fish eggs from Laukaa Fish Culture Research Station were prohibited; this caused a lack of trout for stocking purposes in southern Finland. No similar infections have since been detected in Laukaa or elsewhere in Finland. Since January 1978, Laukaa Fish Culture Research Station has been allowed to deliver fish eggs to other fish farms. On the south-western coast of Finland, in brackish water, sarcomatosis (lymphomatosis) is a very common disease in pike (Esox lucius). The disease causes losses to fishermen in that area.

Finland is entirely free from the infectious viral diseases IPN (Infectious Pancreatic Necrosis) and VHS (Viral Haemorrhagic Septicaemia).

7. Crayfish diseases

Several new cases of crayfish plague (Aphanomyces astaci) have been observed during the intersessional period. Due to the economic significance of this disease, not only in Finland but in nearly the whole of Europe, research on the spreading and means of control of the plague has been intensified in the FGFRI.

The microsporidian crayfish parasite, Thelohania contejeani, (white tail disease) has been recorded in 35 localities in different parts of the country. In all the cases the infected crayfish constituted less than two per cent of the animals investigated, which is far lower than the frequencies reported from other parts of Europe.

Due to the research carried out at the Institute, two new crayfish diseases have been found which were previously unknown in Finland. The parasite Psorospermium haeckeli was observed in 1975. So far the disease has been recorded in three localities in the south of Finland, but it is obvious that the distribution of the parasite is much wider. The frequency of infection is very high, from 80 to 100 % in different localities. Prorospermium has a pathogenic effect

on crayfish, which finally die, especially during moulting periods. There are no observations of Psorospermium causing mass mortalities in crayfish stocks, perhaps due to the very slow development of the disease. In 1977, the fungal disease caused by Ramularia astaci (burn-spot-disease) was observed in one locality. The life cycle, spreading significance to crayfish and crayfish stocks, means of control, etc. of the parasites are under research.

III FISH AND POLLUTED WATER (SUB-COMMISSION III)

Finnish lakes are highly susceptible to pollution because they are shallow and covered with ice for a large part of the year. In most of the watercourses water is still clean. About 1,100 km^2 of the lake area, i.e. 3 %, is badly polluted. The most extensively polluted areas are near pulp and paper mills and close to towns. Some 10-15 % of the lake area in Finland is polluted to some extent. About 1,900 km of the rivers have been polluted by industry, public sewage, or agriculture and more than 30 % of the total length of the rivers is slightly polluted.

A nationwide water pollution control programme up to 1985 was completed at the National Board of Waters. This programme is considered to be essential for the strategic planning of both water pollution control and the allocation of new load-producing activities. The total costs of the execution of the programme are estimated at several hundred million USD.

The recommendations of the nationwide water pollution control programme have been followed. Minor revisions have been made to the programme. A new survey of the water pollution control situation was made in 1979. All the plans - except that concerning Lapland - of the nineteen intergated water management planning regions have been completed. Revisions aimed at the tightening of water pollution control have been prepared for the new Water Act.

In accordance with recommendations 76/13, 76/14 and 76/15 of 9th Session of the EIFAC (Helsinki), studies on the water quality requirements of freshwater fish have been

continued in Finland. The studies on the effects of pollution on fish stocks and fishery have also been carried out, and the accumulation of heavy metals and some other pollutants in fish has been studied. International cooperation relating to the activities of the Interim Baltic Marine Environment Protection Commissio, ICES's Marine Environmental Quality Committee, OECD and Nordforsk has been implemented. The National Board of Waters and the Finnish Game and Fisheries Research Institute (FGFRI) are responsible for the stucies in this field.

Special interest has been directed towards the effects of effluents from pulp and paper mills on fish stocks, fishing and physiology of fish. The FGFRI and the University of Helsinki, Department of Physiological Zoology, are working together on a 5-6 year project, the aim of which is to apply toxicological and physiological methods to the study and evaluation of damage to fish stocks and fishing caused by pulp and paper mill effluents. The preliminary research was finished in 1978.

In 1979, a three-year programme was started in the Nordic countries to develop routine methods for water quality monitoring. One of its sub-projects deals with methods for fish and invertebrates.

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COUNTRY REPORT OF FINLAND FOR THE INTERSESSIONAL PERIOD 1980 - 1982

Juha Jurvelius, Markku Pursiainen, Kai Westman
and Pekka Tuunainen

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