



WHO TOOK THE FISH?-
FISHING FOR SALMON IN THE 1980s IN FINLAND

by

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ABSTRACT

The total commercial catches of salmon increased considerably in Finland in 1989 and 1990. In 1990 the catches were exceptional and nearly four times larger than in 1980. The most important gear are trapnet (approximately 30 % of the catch in 1990), driftnet (45 %) and longline (10 %). In the exceptional year 1990 trap net catches were nearly eight fold larger than in 1980. The long line catches have increased somewhat, but their relative share of the total catches has decreased. The number of Finnish fishing enterprises (vessels or fishermen) catching salmon has remained steady or decreased in the Baltic Main Basin, but has increased especially in the Bothnian Bay. These structural changes can be explained by the introduction of new efficient technology (trapnets), regulations (long line) and successful stocking programs. The importance of salmon fishing as a source of income has increased in Finland during the 1980s. Despite a general decrease in the number of enterprises those catching salmon have increased to 1000. A considerable number of these take only incidental catches. The total catches are dominated by those catching more than 2400 kg per year and they are a fraction (10-20 %) of those reporting salmon catches. Recreational fishing has not been a major taker of salmon in the Main Basin or the Gulf of Bothnia, but its importance is likely to increase in the near future. A potential increase of recreational fishing coupled with a likely decrease in the availability of fish will complicate salmon management issues further.

1 Introduction

The Baltic salmon stocks are assessed each year by ICES at the request of the International Baltic Sea Fishery Commission. The raw material for the assessments have traditionally been landing statistics, aggregate data on fishing effort, catch per unit of effort, extensive tagging data, escapement data from selected rivers and information on parr densities and smolt production in some rivers (e.g. Anon. 1991a). The management of salmon in the Baltic has been a difficult issue primarily because of the poor state of the wild salmon stocks and the abundantly available salmon of reared origin (e.g. Hildén 1990). The state of the

wild stocks calls for a reduction of the fishing effort (Anon. 1991b) and some attempts have been made internationally at the International Baltic Sea Fishery Commission and nationally in some areas or for some fishing gear. For 1991 a quota of 3350 tonnes has been accepted for the stocks of the Gulf of Bothnia and the Main Basin, and it will, if it is adhered to, reduce the fishing effort. The problems of the salmon management are by no means past because a number of unsolved conflicts remain (Hildén and Kuikka 1990, Nybacka et al. 1991). Traditional biological advice and the data used for deriving the advice level have relatively little to offer for a policy maker, simply because the aggregate data commonly used give a crude picture of the nature of the fisheries problem although it may be sufficient to describe the dynamics of the stocks.

In this study we aim at giving additional information on the commercial fishing for salmon in Finland. We begin by displaying traditional data on the fishery and the catches as an overview. We increase the resolution by focusing on the distribution of catches on individual fishermen and we make an attempt to explain the structural changes in the fishery which have occurred during the 1980s. Finally we discuss potential management implications.

2 Materials and methods

The Finnish Game and Fisheries Research Institute collects catch reports from fishermen fishing in the Baltic Sea. According to Finnish Law (Statute 225/88) all catches have to be reported to the research institute which has primary responsibility for the monitoring of the fisheries and stocks. Vessels above 12 m (l.o.a) give daily reports in fishing log books, smaller vessels report monthly catches and small scale fishermen for whom fishing is a minor part time occupation give yearly reports.

Because all fishermen do not supply the reports a certain portion of the catch has to be estimated using a stratified procedure. In recent years the response rate has been 75 to 95 percent depending on the stratum. The full time professional fishermen generally have the highest response rates and hence the estimated share of the catches are relatively small.

All data were analysed by SAS-statistical software (SAS 1987). A primary aim was to identify different classes of fishermen. Classes were defined by gear, size of yearly catch and area. The relative and absolute importance of different classes were then examined in terms of catches and number of persons involved.

Explanations for structural changes of the salmon fishing were sought in technological innovations, stocking rates, catches per unit of effort and national and international regulations affecting salmon fishing.

3 Results

3.1 Catches and distribution of catches on areas, gears and seasons

The Finnish salmon catches varied between 500 and 700 tonnes from 1980 to 1983. From 1984 the catches have been relatively stable on a higher level, but in 1989 and 1990 catches increased to record high levels (Fig. 1). The largest increase occurred in 1990 in the Gulf of Bothnia; in the Bothnian Bay (ICES subdivision 31) catches were an order of magnitude and in the Bothnian Sea (SD 30) five times larger than they were in 1980.

Fluctuations are typical for the offshore catches in the Bothnian Sea and the Baltic Main

Basin, whereas catches have increased steadily in the Bothnian Bay from very low levels in the early 1980s (Fig. 1).

The most important fishing gears for salmon are the drift net, the long line and trap net. The drift net is still the most important gear in terms of catch, but its relative share decreased especially in 1990. The long line has lost ground relatively speaking during the 1980s and in 1990 it accounted for only approximately 10 percent of the catch. The trap nets, which in their present form is a recent technological invention, have increased their share to 30 percent. The general tendency has been an increase of the coastal fishing gear relative to offshore gear (Fig. 2). Especially in the Gulf of Finland (SD 32) the trap nets have rapidly displaced the long line as the most important gear.

The seasonal distribution of the catches was relatively stable throughout the 1980s and the catch accumulated at a nearly constant rate over the months. The distribution of the catches in 1990 was, however, clearly different with rapid accumulation of the total catch in spring and early summer due to the coastal fisheries (Fig. 3).

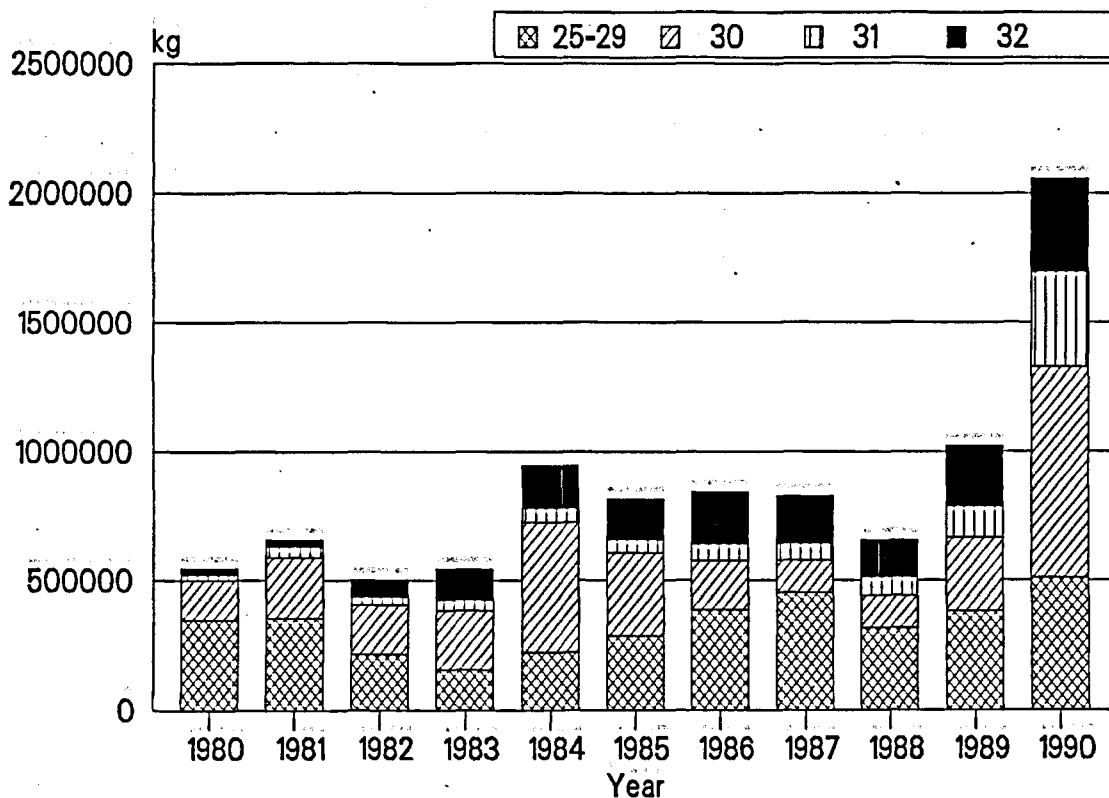


Fig. 1. Commercial catches of salmon by Finnish fishermen from 1980 to 1990 in different sea areas. Area 25-29 = Baltic Main Basin; 30 = Bothnian Sea; 31 = Bothnian Bay; 32 = Gulf of Finland. Statistics of the Finnish Game and Fisheries Research Institute.

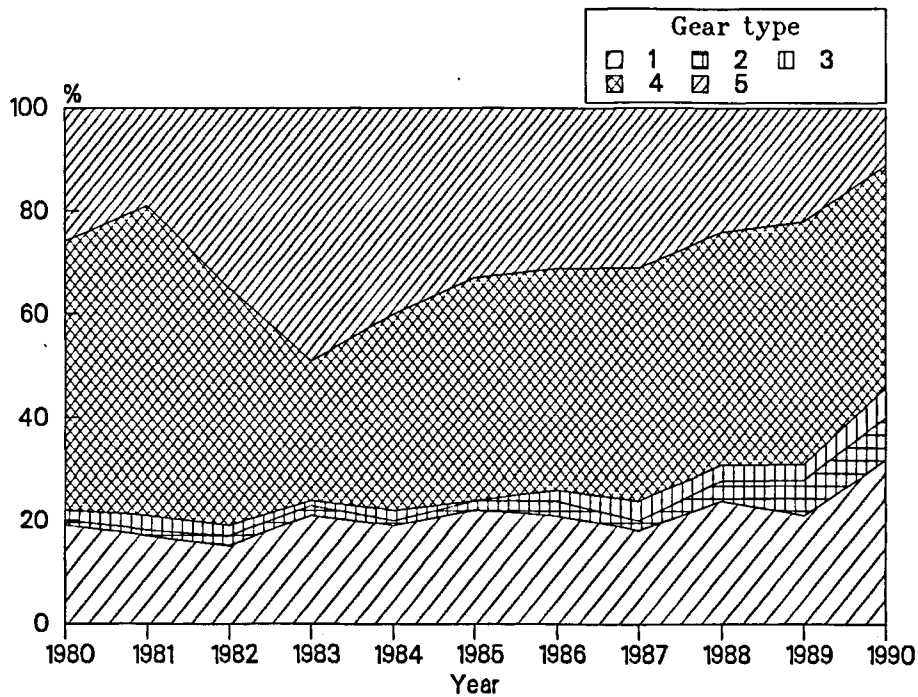


Fig. 2. The contribution of the main gear types to the total catch of salmon in the Finnish fisheries. Gear type 1 = salmon trap net; 2 = other trap net; 3 = other (coastal) gear; 4 = drift net; 5 = long line. Statistics of the Finnish Game and Fisheries Research Institute

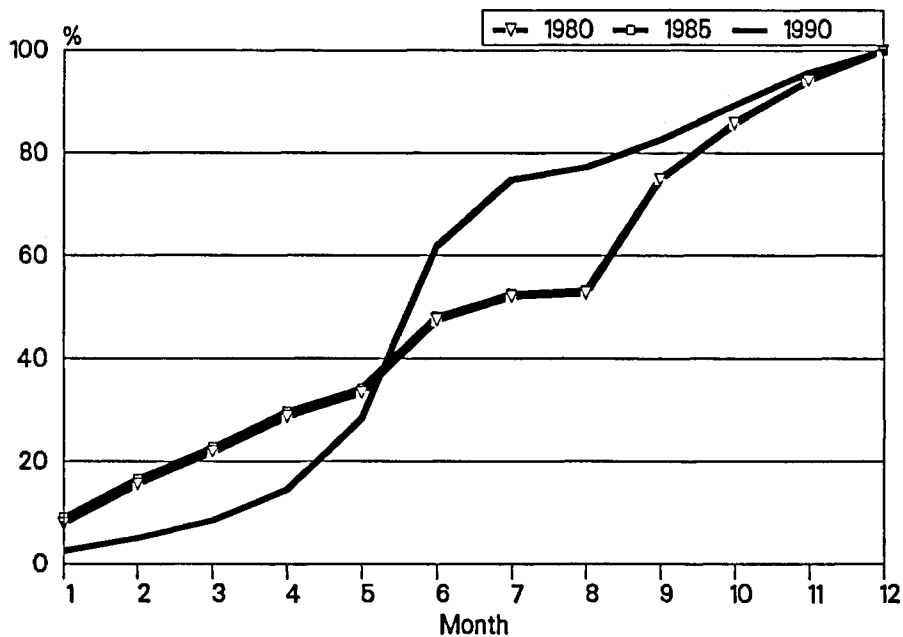


Fig. 3. The accumulation of the total yearly catch of salmon in 1980, 1985 and 1990. Statistics of the Finnish Game and Fisheries Research Institute.

3.2 The fishermen and the catch per fisherman

The total number of commercial fishing enterprises (single fishermen or fishing vessels) catching salmon remained relatively constant around 700 throughout 1980s, but increased in 1989 and in 1990 it reached 1000 enterprises. The largest increase occurred in the Bothnian Bay and in 1990 about 40 percent of all enterprises catching salmon fished in the Bothnian Bay. In 1980 only 20 percent of those catching salmon fished in this area. Of the gear primarily targetted at salmon the salmon trap nets engage the largest number of enterprises.

Of those catching salmon many report only relatively small catches. The dynamics of the total catch is governed by those catching large amounts of salmon. In 1980s a large salmon catch was 2400 kg per year and only about 70 enterprises had catches of at least this size. Yet they accounted for most of the total catch (70 %). In 1990 the distribution had shifted and about 200 enterprises caught more than 2400 kg per year. Their share of the total catch was 80 percent (Fig. 4).

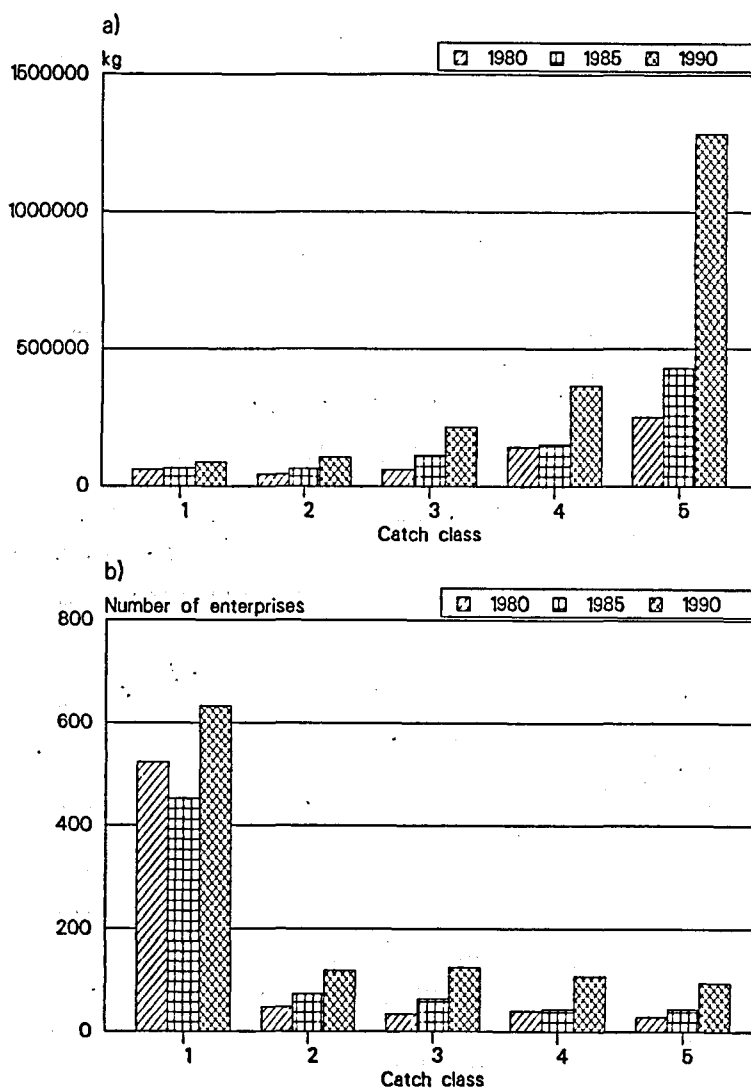


Fig. 4. The distribution of a) the total salmon catch and b) the the number of enterprises in classes defined by the individual yearly catch of the enterprises in 1980, 1985 and 1990. Catch class 1 = yearly catch < 600 kg; 2 = 600 - 1199; 3 = 1200 - 2399; 4 = 2400 - 4799; 5 = 4800 -; Statistics of the Finnish Game and Fisheries Research Institute.

There are considerable differences between gears and areas in the distribution of catches. In 1980 only a handful of the trap net enterprises in the Bothnian Bay (SD 31) caught more than 1800 kg salmon per year whereas a third of all trap netters caught more than 1800 kg per year in this area in 1990. A similar, but less dramatic increase occurred in the trap net fishery in the Bothnian Sea (SD 30) and also in other gear (Table 1).

Table 1. The distribution of trap netters according to yearly individual trap net catches in the Gulf of Bothnia. The numbers are estimated from catch reports and rounded to the nearest integer.

Class of catches (kg/year)	Bothnian Sea (SD 30)			Bothnian Bay (SD 31)		
	1980	1985	1990	1980	1985	1990
- 300	49	41	16	68	109	32
300 - 599	31	32	16	4	16	22
600 - 899	13	8	15	0	0	10
900 - 1799	10	17	24	2	14	22
1800 -	4	5	34	1	4	43
Total	107	103	106	75	143	129

3.3 Catch per unit of effort in different gears and seasons

The catch per unit of effort varies seasonally in all gears. In the fisheries exploiting the Gulf of Bothnia - Main Basin salmon stocks trap nets give high catch rates in May to July, whereas gill nets, mostly drift nets, generally have high catch rates during autumn (Fig. 5). The long line fishery has the highest catch rates during midwinter. There is considerable variation between years (Fig. 5). During 1990 catch rates were exceptionally high in June in the trap net fishery. In the gill net fishery catch rates were high compared with the average, and record high levels were reached in spring. During other season catch rates were high, but not generally above previous maxima. The constant high level throughout the year was truly exceptional. The long line also had catch rates at or above the maxima for the whole period (Fig. 5). Note that little weight should be given to large gill net or long line catches per unit of effort in late spring and summer because observations are few.

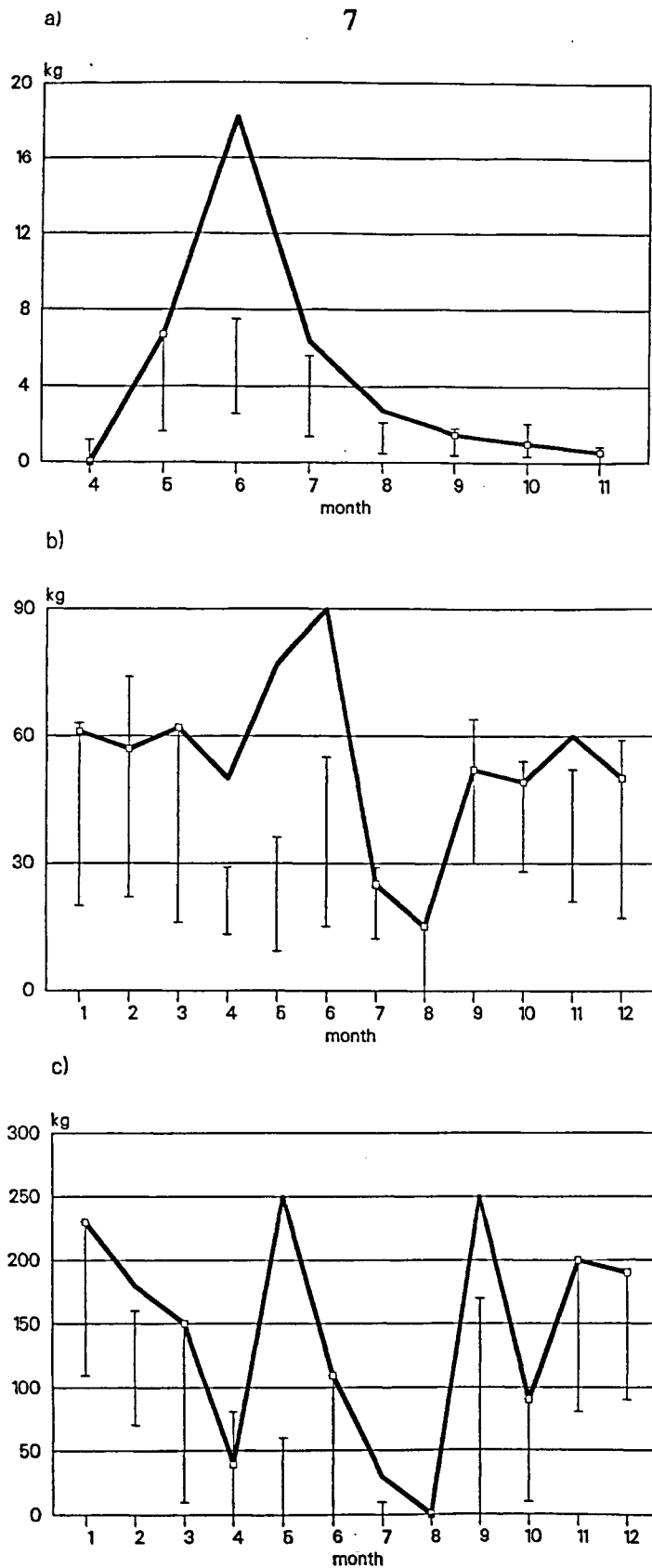


Fig. 5. The average monthly catch per unit of effort in the Gulf of Bothnia and the Baltic Main Basin: a) catch in kg per trap net; b) catch in kg per 100 gill nets; c) catch in kg per 1000 long line hooks per day for the period 1980 to 1990. The bar indicates the variation between the second largest and second smallest value in the series, i.e. 90 percent of the observations fall with these limits. The line with square markers gives the average monthly catch per unit of effort for the year 1990.

4 Discussion

4.1 The changes in the salmon fishery

A major driving force in the development of the Finnish salmon fishery has been the smolt release programs. Most of these have been put into operation following decisions by the Water Courts as compensatory measures for the loss of spawning rivers due to hydroelectric dams. In 1978 and 1979 less than 250 000 smolts were released in Finland into the Gulf of Bothnia (Anon. 1984). Stocking rates increased rapidly and reached nearly 2 million smolts in the Gulf of Bothnia in 1988. Since then the stocking rates have decreased to approximately 1.2 million in the Gulf of Bothnia (Anon. 1991a). The general increase in the catches is related to the increased stocking rates, although fluctuations arise due to fluctuations in the post smolt survival rates and the distribution of fish between sea areas (Ikonen and Parmanne 1991). The exceptional catches in 1990 were mostly due to large releases of salmon, high survival rates at the post smolt stage for the year class 1988, rapid growth of the fish and a decrease of the fishing effort in the main Basin which allowed increasing returns of salmon to coastal waters (Anon. 1991a). The decrease of the fishing effort in the Main Basin was evidently above all due to a decline in the price of salmon which made fishing unprofitable.

The structural changes in the fishery are not only due to the increase of the stocks. The decline of the relative contribution of the long line (Fig. 2) is partly due to the enforcement of additional temporal restrictions in the Main Basin and the Gulf of Bothnia. From 1988 the ban on long line was extended from April 1 until November 15 (Statute 375/87). In the Gulf of Finland, where the same seasonal restrictions do not apply, the long line has not expanded as much as the resource and most of the catch is now taken by the highly efficient trap net fishery.

In the Gulf of Finland the coastal trap net fishery developed during the 1980s. The increase of the trap net catches in the Gulf of Bothnia is also remarkable. Catches have increased despite active regulation of the total effort. The reasons for its success are evidently high catchabilities and relatively small investments and operation costs. In addition it has, together with the whitefish fishery, been the only alternative for coastal fishermen who have lost near shore resources of freshwater fish and who have experienced marketing problems with traditional near shore fish such as bream and pike (Hildén et al. 1982).

The trap net can successfully compete on the salmon markets with the off shore fishery which requires larger investments in boats and is more expensive to run (Anon. 1984). This explains partly why the Finnish coastal fishery has thrived at a time when fishing in the Main Basin is reduced due to low prices for salmon. A further explanation is that prices for salmon have been generally higher in Finland than for example in Denmark (Setälä 1991). The price difference is largely a consequence of import restrictions.

Although the trap net fishery is seasonally very limited it is able to take full advantage of any increase in the stock, as demonstrated by the catch per unit of effort values for 1990 (Fig. 5). A potential consequence is, however, marketing problems, because catches are taken within a short period of time (Fig. 3) although the demand is fairly constant. This is shown by the fact that prices for salmon reached their all time low in June 1990 (Setälä 1991).

The off shore fishery is sensitive to international agreements, in 1988 the disappearance of most of the former white zone reduced possibilities to fish in the Baltic Main Basin, although the effect is surprisingly small on the total catch (Fig. 1). An explanation is that stocks increased at the time and any declined caused by the restriction of the fishing areas was masked by the general increase.

The trap net fishery would probably have expanded considerably if the number of fishing sites had been openly accessible. The fisheries administration has restricted the amount of trap nets allowed on state owned water (Anon. 1984) and the sites on private waters are also limited. Temporal restrictions on fishing in state owned waters have been introduced to reduce the efficiency (e.g. Statute 312/90). A potential consequence of these restrictions is an expansion of the gill net fishery in spring. The high catch per unit of effort values for gill nets in the spring of 1990 has provided incentives for such a development (Fig. 5b).

The considerable increase of the salmon catch has not increased the income of fishermen by a comparable amount. The price of salmon has decreased and in real terms the present price is only approximately a fourth of the price in 1980 (Setälä 1991). Thus the very large catch of 1990 corresponded in average deflated dock side value to the catch of 1980. There are no guarantees that lower catches would result in significantly higher prices, because market conditions have changed. The production of rainbow trout has increased approximately four fold from 1980 (Mäkinen 1989) and import restrictions on salmon will be lifted in a foreseeable future according to an European Free Trade Association agreement. A concentration of the catches to the trap net season is also likely to keep prices down (Fig. 3). Some signs of a recovery of the prices have, however, been observed in the Gulf of Finland during 1991 (E. Ikonen, Finnish Game and Fish. Res. Inst., pers. com.).

4.2 Management implications

The stocking programs have recreated a resource which was greatly reduced in the 1950s and 1960s, but the changes in the fisheries have not been reversible. At the time when the Finnish rivers were dammed the salmon fishing was important in the rivers and the river mouths. The damming of the rivers destroyed the river fishing and fishing the vicinity of the river mouths, but it did not stop the development of the off shore fishing in the Baltic Main Basin and Bothnian Sea or the development of coastal fishing in the central and southern Gulf of Bothnia. The off shore fishery increased in the 1950s and 1960s and coastal trap netting increased in the 1970s (Anon. 1984). The increasing stocking rates thus mainly benefitted the off shore fishery and the new efficient coastal trap net fishery.

The increase of the stocking rates at the mouths of the northern rivers in the Bay of Bothnia was seen to offer possibilities to increase salmon fishing significantly in the northernmost fishing areas in the 1980s, but the high fishing mortalities in the other fisheries made it impossible. The high fishing mortalities in the off shore and coastal fishery also threatened the few remaining stocks of naturally spawning salmon, a concern expressed many times by the Advisory Committee for Fishery Management (e.g. Anon. 1991b). Thus a strong demand for a reduction of the fishing mortalities has developed at a time when the total resources have increased. The demand has been taken up by both national administrators and local northern fisheries representatives (Anon. 1984). Not surprisingly several other fishermen representatives have had a hard time accepting the need for restrictions when resources appear to be plentiful (Nybacka et al. 1991). Several of the involved actors also see issues of regional equity in the distribution of the catch (Hildén and Kuikka 1990). Some of those demanding considerable reduction in off shore fishing and coastal fishing in the

southern parts of the Gulf of Bothnia claim that this is necessary in order to fulfill the decisions of the Water Court. The argument is that stocking was introduced as a compensation for the loss of catches at the river mouths and their vicinity. This is, however, a rather narrow interpretation of the legislation on compensation. The compensation should be seen as a way of restoring the resource, not a particular structure of the fishery.

The regional and temporal distribution of the catches is a matter of fisheries policy and has little to do with the decisions of the water court. Even if the rivers had not been dammed off-shore fishing and coastal fishing had developed before long, just as they did in the North-Atlantic where considerable effort has been spent on analysing off-shore fisheries (e.g. Anon. 1991b).

If the river mouth and coastal fishery in the northern Bay of Bothnia had been preserved with prompt compensatory stocking at the time of the damming of the rivers the discussion on the right to resources had probably arisen earlier. Management action affecting the distribution could in this case have been taken earlier. As it happened the shift in the distribution of catches occurred largely when the river mouth and coastal fisheries were almost nonexistent and it proceeded without much discussion. Now it is difficult to turn the clock back, and the exceptional year 1990 has in many ways complicated the management issues. Catch expectations are high and if additional restrictions are introduced the management will get the blame also for the reduction of the catches which is likely to occur due to reduced stocking rates and potentially lower post smolt survival rates. In 1990 total stocking rates were 20 percent below those in 1988 and post smolt survival rates may turn out to be lower. Any reduction in the catches is perceived as a threat to the livelihood, especially because expectations of salmon prices are low (see above). New technical or temporal restrictions are likely to meet strong protests. In 1991 trap netters violated openly temporal restrictions because they saw the temporal restrictions as an unfair measure against a particular group of fishermen (Nybacka et al. 1991).

The stocking programs have during the 1980s raised new expectations and also strengthened the general interest in salmon. The remaining rivers with wild populations of salmon are seen to have a great potential for recreational fishing, but the poor state of the resource does not allow it to develop as much as it could. The total recreational catches of salmon in the Baltic Sea was 234 tonnes in 1986, but less than 10 percent was taken in the Bothnian Bay where river fishing is possible (statistics on recreational fisheries from the Finnish Game and Fisheries Research Institute, Leinonen et al. 1991). There is a strong interest in increasing the recreational catches, especially if the salmon can be taken in (restored) rivers. An analysis of the expectations of recreational fishermen has shown that the demand for salmon fishing is very strong (Leinonen and Lehtonen 1991).

The investigation of the number of fishermen has demonstrated that the management of the salmon resources is relatively easy in terms of the number of people and vessels involved. If an agreement on management issues can be reached with approximately 200 persons 80 percent of the exploitation can be regulated (Fig. 4). Yet salmon management has proved to be among the most difficult problems experienced by the Finnish fisheries administration. The likely explanation is that the issues involved have been perceived to be matters of principle, with implications extending far beyond the limited number of commercial fishermen catching salmon (Nybacka et al. 1991). Such issues are the free fishing in off-shore waters, the water owner's right to fish in his own waters, and the general right to resources. At present the total catches cannot be regulated directly and only a part of the effort can be controlled. Thus partial restrictions are likely to get circumvented. The

increasing interest of recreational fishermen is bound to complicate matters further.

The interest in salmon will certainly not diminish but questions concerning e.g. yield optimization will not be the most relevant ones. Catch forecasts and options will play a decisive role in negotiations on the share of the resources taken by the various actors both nationally and internationally. Developing techniques for these purposes will be a major challenge. Understanding the structure of the fisheries may help scientists on the route and therefore we strongly urge salmon working groups to spend time on documenting and analysing changes in the fisheries.

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