The report of

DATA ANALYSIS TO SUPPORT THE DEVELOPMENT OF A BALTIC SEA SALMON ACTION PLAN

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This report does not necessarily reflect the view of European Commission and in no way anticipates the Commission's future policy in this area

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Introduction

The European Commission (EC) has called for an evaluation of the socio-economic impacts of the International Baltic Sea Fisheries Commission (IBSFC) Baltic Salmon Action (SAP) and the new management objectives and options that were recommended by the International Council for the Exploration of the Sea (ICES) during spring 2008. The EC has decided to revise the SAP and to develop a new management framework in order to ensure the sustainable harvest of wild Baltic salmon stocks in accordance with the CFP. The objective of our study is to assess the impacts of the IBSFC and the future SAPs in a comprehensive manner by use of probabilistic state-of-the-art modelling tools.

In the past few years ICES Baltic Salmon and Trout Assessment working group (WGBAST) has developed a probabilistic biological model to estimate harvest rates and abundances of salmon stocks. In this project, we supplied this model with socio-economic components and simulated the economic and social aspects of commercial and non-commercial Baltic salmon fisheries under different management scenarios.

Management of salmon fisheries in the Baltic Sea has been covered by the IBSFC SAP since 1997. The objective of this plan was to re-establish or recover wild Baltic salmon and to attain for each salmon river a natural production of wild Baltic salmon of at least 50% of the potential. The EC initiated in 2007 the work to revise SAP and develop a new management framework. Based on past experience, different options will be evaluated in order to ensure sustainable management of the Baltic salmon stocks in the future.

Almost all data for the assessment come from Finland, Sweden, Denmark and Poland. These four countries caught about 90 % of the total Baltic salmon catch in 2007. Our report consists of two parts. The first part consists of the short summary that describes the Baltic salmon fisheries and impacts of IBSFC SAP, and the draft impact assessment of the future management options. The second part consists of Annexes 1-7 (142 pages), which describe in detail the analysis results, methods and data.

Terms of Reference

1) Review the socio-economic impact of the current IBSFC SAP
   - Collate the necessary socio-economic data from available sources. Supplement with own data collection where necessary
   - Analyse socio-economic impacts and trends since the adoption of the current Plan for commercial and recreational fishing sectors (onshore and at sea), and fishing tourism activities, both for marine and freshwater areas
2) Evaluate the socio-economic impact of the different management options provided by ICES
   - Use appropriate bio-economic modelling to evaluate the impacts of various management options
   - Analyse socio-economic impacts of management options in the short, medium and long term, for commercial and recreational fishing sectors (onshore and at sea), and fishing tourism activities, both for marine and freshwater areas
3) Synthesise the socio-economic impact assessment with the ICES report to provide an Impact Assessment report. This draft IA report should follow the EC format for such reports.
4) Participate in a stakeholder workshop to be held in September 2008 and present the results of the study.

1 Short summary of Baltic salmon fisheries

In the Baltic Sea the commercial salmon fisheries take place in the Main Basin (off-shore fishery) and along the coasts of Gulf of Bothnia, Gulf of Finland and to some extent in the Gulf of Riga. Commercial salmon fishing season in the Baltic Main Basin occur from October to April. In the coastal areas of the Gulf of Bothnia the fishing season is shorter, mainly June-July when salmon migrate to their home rivers. Recreational fisheries at sea consist of trolling and in some coastal areas also fishing by semi professional gears such as gillnets. River fishery is mainly sport fishing by rod equipment.

The commercial Baltic salmon fisheries have been controlled internationally by quotas and nationally by various technical regulatory measures. In the mid 1990s the status of wild salmon populations was internationally recognised being poor. The main reasons were high natural mortality (M74 and post-smolt mortality) and high fishing mortality in relation to the prevailing production ability of salmon stocks. In order to improve the status of wild Baltic salmon stocks IBSFC launched the SAP in 1997 with the following main objectives:

1) To prevent the extinction of wild populations, further decrease of naturally produced smolts should not be allowed
2) The production of wild salmon should gradually increase to attain by 2010 for each salmon river a natural production of wild Baltic salmon of at least 50% of the best estimate potential and within safe genetic limits, in order to attain better balance between wild and reared salmon.
3) The level of fishing should be maintained as high as possible. Only restrictions necessary reach the first two objectives should be implemented.
4) Wild salmon populations should be re-established in potential salmon rivers.
5) Reared smolts and releases of earlier life stage shall be closely monitored.

Commercial salmon fisheries during IBSFC SAP (1997- 2007)

In 2007 the commercial salmon catch in the Baltic Sea was the lowest recorded since 1980 (Figure 1.1). During the IBSFC SAP period 1997-2007 salmon catch has decreased from 2395 tonnes to 913 tonnes (435 000 and 177 000 salmon respectively). The main focus of the fishery has moved slightly from off-shore to the coast. In 1997 about 88 % of the catch was taken from offshore and in 2007 about 61 %. Preliminary catch data from 2008 indicates a substantial decrease in the offshore catch and some increase in coastal and river catches compared to 2007. Offshore catches has been taken mainly by driftnets in the Baltic Main Basin, and coastal catches by trapnets in the Gulf of Bothnia and Gulf of Finland and at a smaller scale also in the Latvian part of Gulf of Riga. A TAC regulation has been in effect from 1993 in the Baltic Sea but it has restricted the fisheries only in some of the years and only in some of the countries. From 2005 the TAC has not restricted the fishery in any of the countries. In 2007 the nominal commercial catch was about 40% of the TAC.

On the offshore salmon fishery major impact has been induced by driftnet phasing out that started in year 2005 and was completed in the beginning of year 2008. It gradually diminished the number of salmon vessels. National programs to dismantle the salmon vessels have taken place. In 2003-2007 the number of salmon vessels decreased by about 60 %. The fishing effort has decreased accordingly (Figure 1.2). In 2007, in the Main Basin, altogether only 11 active Finnish, Swedish and Danish vessels fished salmon (Table 1.1), each of them employing 2-3 persons onboard. The Polish fleet consisted of 15 salmon vessels and they employed a total of 36 persons onboard. Also high fishing costs and low prices of salmon combined with a low CPUE have decreased the off-shore fishery. Many of the remaining off-shore vessels fish also Baltic cod.

In the Finnish and Swedish coastal salmon fishery the national technical measures such as closed seasons and areas have been the major tool in regulating the fishery. The number of salmon fishermen has decreased substantially during the last ten years, but the total fishing effort has remained at about the same order of magnitude (Figure 1.3). In 2007 about 340 coastal fishermen reported salmon catches in Finland and Sweden.

Seals have caused major problems for the coastal and offshore fisheries in the Gulf of Bothnia and Gulf of Finland. In Finland about 41 tonnes salmon was discarded in 2007; this was about 20 % of the total salmon catch in the region. The economic value of discarded seal-damaged salmon was estimated at 150 000 EUR. In Sweden log-book data do not allow for compilation of seal damages, but the proportion of seal damages compared to landings have been considered to be at about the same magnitude as in Finland giving a very rough estimate of 26 tonnes seal damaged salmon in 2007. The minimum estimate for the direct observed losses in Finland and Sweden is altogether 67 tonnes (13 000 salmon) with the value of 245 000 EUR. According to a Swedish study (Fjälling 2005) the total catch losses (visible+invisible) may be about twofold compared to the observed losses.

Regulations on dioxin content in fish have restricted the fishery in Denmark and Latvia. In Finland and Sweden exemptions allows sale of salmon in the domestic market.

In 2007 the value of the Baltic salmon catch was about 2.7 million EUR being about 0.5 % of total catch value of all species in Poland, Denmark, Sweden and Finland. These four countries fished about 90% of the total salmon catch in the Baltic Sea.

The total salmon market (supply of salmon, sea trout and rainbow trout) in Poland, Denmark, Sweden and Finland was about 100 000 tonnes in 2005 (Setälä et al. 2007). The share of wild-caught salmon was about 1 %. From 2005 to 2007 the salmon markets in Poland and Finland have grown by about 25%. Farmed salmon is imported mainly from Norway. Rainbow trout is raised also in Finland and Sweden. The wild-caught salmon has established a special niche in the market, and its price is nowadays often higher than that of farmed salmon. In Finland and Sweden the coastal fishermen sold about 45 % of their catch directly to the consumers in order to get a higher price for their catch.

Recreational salmon fisheries

In 2007 recreational fisheries caught about 131 tonnes (40 000 salmon), which was about 13 % of the total Baltic salmon catch. River catch was about 121 tonnes (19 000 salmon) and sea catch was about 110 tonnes (21 000 salmon). Catch estimates are, however, uncertain and available only in some countries. In Sweden and Finland about 37000 anglers fished salmon in rivers in 2007. In the last few years about half of the recreational sea catch (10 000 salmon) has been taken by trolling, and this fishery has been slightly increasing in the southern Main Basin (Denmark, Sweden). Approximately 1500-3000 fishers participated in salmon trolling in 2007.

The total monetary value of recreational fishery for salmon in the Baltic Sea cannot be estimated due to the lack of data. Further, a definition for total monetary value of recreational fisheries is ambiguous. For angling, a minimum estimate would be given for instance by multiplying the number of anglers with the number of sold fishing licence. However, numerous types of fishing licences make it almost impossible to estimate the (weighted) mean price of a licence.

Apart from licence, anglers spend much more money for travelling, equipments, food, accommodation etc. Hence looking at the total expenditures would provide another way of estimating the total monetary value of recreational fishing. However, again the data is lacking. One estimate is available from river Tornionjoki area, where the total expenditures were estimated to be 2 million EUR in 2007. This can be compared to the estimate that recreational fishermen spent on trolling approximately 4 million EUR per year in Denmark and Sweden. Further, in Sweden exists at least 70 companies and in Finland at least 30 companies that provide fishing travelling services at salmon rivers. Studies related to trolling have estimated that the 15-20 jobs that now exist in Bornholm could increase to 70-80 jobs in near future. In Sweden trolling related jobs have been estimated to be near 30.

Economic impacts of IBSFC SAP

According to bio-economic modelling, the mean sum of the Baltic salmon fishery profits for the IBSFC SAP period have been altogether near 23 million EUR (95% probability interval is 21-25 million EUR, Table 1.2). Figure 1.4 illustrates the commercial salmon fishery profits for Finland, Sweden, Denmark and Poland and the total sum of the country specific profits during the SAP period. These profit estimates are based on the salmon catches given by the model, price statistics, fishing costs and effort estimates by country. The bio-economic model overestimates the historical total commercial salmon catches. The model slightly overestimates the catches for Finland and Poland whereas the catches for Sweden and Denmark are underestimates in the last few years. Especially the losses of Sweden and near zero profits for Danish salmon fleet during the latest years should be considered with some caution. The fishing costs in analysis cover variable costs such as fuel and labour costs, but not fixed costs such as the price of the vessel. Zero profits would mean that fishing vessels would cover their operational costs and fishermen would get their salaries, but there would not have been an opportunity to save money for future investments.

Driftnet has been the most important geartype contributing nearly 50% of the total profits during the SAP period. Analysis of individual fisheries shows that Swedish offshore driftnet fishery and Finnish coastal trapnet fishery earned the highest profits. In Denmark long-lining was important even before driftnet ban. It is likely that driftnet ban has affected the economic behaviour of salmon fishermen much more than the IBSFC SAP has.

Social impacts of the IBSFC SAP

According to sociological study the experts who represented commercial and recreational fisher organisations and fishing tourism enterprises had difficulties to see clear improvements coming from IBSFC SAP. Commercial fishing sector's perception was that commercial fisheries have undergone a decreased profitability and recreational fishing sector consider that improvement in stock status has not been strong enough to induce a successful development of fishing tourism. The ultimate aims of the IBSFC SAP have been somewhat unclear. Different fishing sectors did not clearly see which fisheries will finally have opportunity to take the economic advantage of improved salmon stocks, i.e. commercial sea fisheries or fishing tourism in the river valleys. Consequently the conflicts between interest groups have increased in Sweden and Finland.

Commercial coastal fishers have been disappointed not being allowed to increase their fishing effort despite that the management objective of 50 % of the potential production has been attained in many wild salmon rivers. Fishers have also had difficulties to separate measures and impacts associated to IBSFC SAP from other processes and managements measures that have taken place at the same time in the Baltic salmon fisheries (the driftnet phasing out and regulations on dioxin).

2 Draft Impact assessment of future management options

2.1 Problem definition

The management of salmon in the Baltic Sea has been subject to Salmon Action Plan (SAP) adopted by the IBSFC in 1997. Since the time period covered by SAP will end in 2010 and the plan is already obsolete relative to fishing, the EC has decided to develop management options for a new SAP to address all critical life stages of salmon and all marked human impacts on salmon. Management shall ensure the sustainable development of fishing activities from an environmental, economic and social point of view.

ICES has evaluated the biological impact of the IBSFC SAP and concluded that SAP has been partially successful in achieving its objective of recovering natural smolt production of salmon rivers to 50% of their potential by 2010 (ICES 2008a). Success has largely varied by regions. Natural smolt production in all salmon rivers in Bothnia Bay is likely to achieve or exceed 50% of its potential by 2010. Some of the rivers in the remainder of the Baltic Sea are unlikely to achieve the objective of 50%. None of the rivers of the Gulf of Finland are likely to achieve the objective.

ICES has stated that SAP should not be continued in its current form. ICES has advised that the current target for smolt production should be increased and management measures should cover the whole life cycle of salmon.

This impact assessment explored socio-economic consequences in commercial and recreational fisheries if when aiming to a higher smolt production and if the commercial salmon fishing were reduced.

2.2 Objectives

ICES advised that the current target of smolt production of 50% of its potential should be increased to at least 75%, which would for many Baltic salmon stocks correspond the MSY level. In other words the objective of attaining 75% of the potential smolt production capacity would be in accordance with Johannesburg declaration (and CFP). However, because of the uncertainty associated to the sources of natural mortality (M74 and post-smolt mortality) and to the estimated potential production capacity (PP) of each river, it would not be very likely to attain the 75 % smolt-production target in an average wild salmon river by 2015 even with no-fishing scenario (ICES 2008b). Nevertheless, it is possible even though not very likely that river Tornionjoki, which has recovered well during the IBSFC SAP, is already at the smolt production rate of 75 % of PP (Figure 2.2.1).

BS RAC has suggested that wild salmon rivers should be divided in two categories depending on each rivers present status and potential ability to recover in a medium term. The smolt production target would be set to 50% of PP for less resilient rivers and to 75 % of PP for the higher resilient rivers. In the sociological study we explored fisher's commitment also to this management objective.

2.3 Policy options

For the renewing process of Baltic salmon management plan the EC requested ICES to provide a range of options (including objectives and measures) for the future management plan for Baltic Sea salmon. The first option should be continuing management as of today. The second option should explore the consequences of managing only through measures in the marine environment. Further options should include an integrated approach with management objectives and measures in both, fresh water and marine environment

However, ICES did not provide management options and therefore after discussions with the DG MARE four management options were specified for the bio-economic analysis (Table 2.3.1 topmost panel). The fishing effort in base case scenario was assumed to develop as ICES (ICES 2008) had estimated. This took into account the substantial decrease in off shore salmon fishing from 2008 onwards

as a consequence of driftnet ban. In effort reduction scenarios the same reduction rate of effort at a time was assumed in all countries. The total closure of fishing (zero efforts scenario) was excluded from the analysis as a politically irrelevant option. Increased effort would have been an appropriate scenario from the economic point of view, but it was left out because of the biological concerns associated to the status of wild salmon stocks.

Valuation study explored one management option that was specified by a combination of different management measures that would improve fishing conditions in the River Tornionjoki (Table 2.3.1 panel in middle). The effort reduction in sea fisheries was formulated as a catch quota limitation, and it was consistent with the effort reduction scenarios in the bio-economic analysis.

Sociological study explored four management options with different smolt production targets and quota regimes (Table 2.3.1 lowest panel). Option A regarded the continuation of the IBSFC SAP with the smolt production target 50% of the potential. The management measures would be targeted primarily at open sea and coastal fisheries. The option B was the present management with no specified long term management plan or a special objective for smolt production. Management would be targeted primarily to the open sea and coastal fisheries. In the option C the objective for smolt production would be 75% of the potential in each river. In this option the management would be targeted to all salmon fisheries. In the option D the objective for smolt production would be divided in two categories (75 % and 50%) depending on the status of the river concerned. Also in this option the management would be targeted to all salmon fisheries. Options were derived from the ICES advice and Baltic Sea RAC recommendation.

2.4 Analyses of impacts

Bio-economic analysis

Bio-economic impacts of options for future SAP was analysed by applying the ICES Baltic salmon assessment model supplied with the economic extension part. The analysis assumed uncertainty regarding the future fishing effort taking into account the driftnet ban. The results showed a shift of the focus of salmon catch from the offshore to the coasts and rivers.

Valuation of a new management plan for the river Tornionjoki

A stated preference valuation survey was conducted to anglers in the River Tornionjoki area in Finland and Sweden. The results are based on the analysis of 185 responses. Contingent valuation method was applied to estimate anglers' willingness to pay (WTP) for the implementation of the new management program. The program was described as a change in the policy and angler relevant characteristics, which were defined based on the pilot valuation survey and literature (Table 2.3.1 panel in middle). In addition a choice experiment method was used to analyse anglers' WTP for the different characteristics of the new management plan

Preliminary contingent valuation results suggest a mean WTP of 28 EUR per angler per year for the proposed future program. Then anglers' aggregate WTP was 288 400 EUR per year based on the number of the salmon anglers in the river Tornionjoki area, about 10 300 persons currently. Also the results of the choice experiment study presented high support for the new regulation program. The study revealed that even though the respondents preferred limitations on salmon catch in sea, they did not support banning the sea fishery completely. Further, the results indicated significant WTP for an improved employment in the river valleys. The estimated WTP per person is low compared to other studies, and it should be regarded as a preliminary minimum estimate.

Sociological impacts of future management options

In the sociological study, commitment of fishers to the four management options was examined using Bayesian decision analysis. Data was collected through a web-questionnaire sent to experts who represented commercial and recreational fisher organisations and fishing tourism enterprises in all Baltic

Sea countries except Russia. Experts were considered to be able to express the views of their reference group. In all, 55 responds were gotten from Sweden, Finland, Estonia, Lithuania, Denmark and Germany.

2.5 Comparing the options

In the base case scenario economic consequences are rather mute in both commercial and recreational salmon fisheries in all of the analysed countries compared to the management option of a reduced fishing effort. Reducing fishing effort has a negative impact on the commercial fisheries in all countries (Table 2.5.1). Most likely, a decrease in the profits of commercial fleet in all analysed fishing effort reduction scenarios is a result of the driftnet ban. Evidently, the ban has decreased the fishing effort so that there will be more salmon available for the rest of the fleet to harvest profitably given the assumptions of future effort trends. Consequently, saving fish for future by reducing effort would harm the commercial salmon fleet without having almost any effect in the short term on the probability to meet the management target. However, decreasing fishing effort in the commercial sector would increase the catch potential in the recreational sector. We assume that the recreational sector in Finland and Sweden would benefit more since in these two countries the salmon recreational fishing takes place both at sea (trolling) and in the salmon rivers (angling) whereas in Poland there is no significant recreational fishing, and in Denmark trolling is the only option for recreational use of salmon resource. The qualitative interpretation of the bio-economic impacts suggests similar effect for all effort reduction scenarios. Only the magnitude of impact differs slightly

Commitment to future management options

The feeling of the experts was that the positive trend in salmon stocks that has taken place during the last few years has not yet influenced the lives of the stakeholders. Thus a new management plan was regarded important among all stakeholder groups, to continue the recovery process that started by the IBSFC SAP. Both commercial and recreational fishing sectors have high hopes on salmon regarding the possibilities to make a livelihood and thus to keep the sparsely populated regions alive. In addition, the results suggest that a new management plan would be needed to increase consensus between the stakeholder groups.

The option D was regarded as most preferable alternative and as a good compromise between the commercial and recreational sectors as the smolt production target could be adjusted to each river (Table 2.5.2 and 2.5.3). Thus it might have a positive impact in interaction and trust between actors as well as in confidence in overall fisheries management. Almost all groups had some commitment to this option even though the recreational sector would not fully commit to it due to their concern about the too low smolt production targets.

The option A was found obscure in regard to the development of salmon stocks. The current distrust among stakeholders might retain, and positive interaction between stakeholder groups would be unlikely to emerge. Option B was seen to maintain the salmon stocks at the present state or even deteriorate them. No positive impact on employment would be expectable. Negotiations on the annual management measures would take place every year. This might decrease the confidence on fisheries management and increase distrust between the actor groups. Option C was seen as a potential risk for bringing new restrictions especially to the coastal fishery, and potentially ceasing the commercial fishing. Sense of unjust treatment would increase and overall confidence in fisheries management would decrease among the commercial fishers. For the fishing tourism this option might have a very positive impact and the confidence of the recreational fishing sector in fisheries management might be enhanced. This option might lead to increasing distrust between the interest groups.

Synthesis

Baltic salmon is commercially exploited in a mixed stock fishery. There is no single salmon stock to be harvested but several naturally reproducing wild salmon stocks whose natal rivers are located in the different Baltic Sea riparian countries. Further, the wild stocks mix with hatchery-reared salmon. Recreational salmon fishery is also an important use of the resource. Consequently, the Baltic salmon fishery system is very complex, consisting of distinct migratory salmon stocks and several user groups with conflicting interests.

The complex system, together with the fact that salmon landing has been about 0.5 % of the total of landings of Baltic Sea fleet, created a problem to choose the appropriate resolution for analysis. The STECF approach of analysing the economic performance of the fishing fleet did not provide such a detailed resolution that would useful for our analysis on the Baltic salmon fishery. Further, EIAA (Economic Interpretation of ACFM Advice) model on which the STECF analysis is based, do not have a build-in feedback dynamics between fish stock and fishery, which was essential for our analysis on Baltic salmon fleet in order to explore the trade-offs associated with the biological management objectives and harvesting plans. We chose ICES stock assessment model for the Baltic salmon as the best available population dynamic model essential for fulfilling the DG MARE demand for the use of appropriate bio-economic model, and we built the economic part on top of this ICES model. This choice allowed a direct comparison between our results and the biological impact assessment conducted by ICES.

The original aim was to evaluate socio-economic impacts of the different management options. ICES, however, did not provide different management options but a revised management objective for wild Baltic salmon stocks. The intended top-down planning approach was not able to suggest potential management options from the perspective of all stakeholders. During the course of the project we found out that an appropriate management plan should include more characteristics than the reference points proposed by ICES. Consequently, our project defined, depending on the particular task, the future SAP in a slightly different manner (Table 2.4.1).

The bio-economic study dealt with four options of reduced commercial salmon fishing proposed by DG MARE. In the valuation study the future SAP was described as a combination of different characteristics of the SAP. These accounted for important factors from the recreational fishers' and decision makers' point of views. It is essential to recognize how the levels of characteristics such as sea catch changes after the implementation of the management program. The sociological study defined four management options that differed in their biological objectives and which stakeholders the potential fishing regulations will affect. To summarize, our three perspectives for future SAP fleshed out each other and provided guidelines for the future SAP potentially to be accepted by the different stakeholders.

Bio-economic analysis enabled us to quantify the trade-offs associated with different management options. The results showed that reducing fishing effort in commercial fisheries leads to lower profits in commercial fisheries, higher level of protection for weak stocks, and greater abundance of salmon in rivers (Table 2.5.1). The proportional decrease in the total profits applies to all countries. However, only the countries with recreational fisheries stand to benefit from the effort reduction in commercial fishing. An increase of salmon in rivers will likely lead to an increase in the number of recreational fishermen, which probably will stimulate regional economy.

Improvements in the catch potential have been found to increase the recreational fishermen's WTP for stock restoration programs and to increase the angling activity. A significant majority of the recreational fishermen surveyed here expressed a positive WTP for future management program. However, even though the anglers appreciated the positive effects of reduction in the commercial salmon fishery for them, they did not support a complete ban on commercial fishery. Also the increase in recreational fishing activity would induce improved employment in river valleys, which anglers found important. In other surveys anglers have not been observed to be willing to pay for such effects. Further, litera-

ture suggests that the public (anglers excluded) would be willing to pay for an improvement in the status of salmon stocks as a result of management measures.

According to our sociological study the most preferable options among the stakeholders were the one where international TAC management covers both sea and rivers. In addition, because it not likely to reach a 75% smolt production treshold for all rivers even in long term, the objective of 50% production would be set for some rivers in this management option. Also our bio-economic study supports this type of management option, since in such a management plan less productive salmon rivers would not restrict bio-economically sound exploitation of more productive salmon stocks.

To summarise the main findings of our three sub-studies, we propose that management objectives related to adult salmon returning to their native rivers should be considered instead, or together with, the management objectives based on juvenile salmon production. Regional or even river specific management options would be preferable over traditional TAC regulation since they would be better at taking into account the differences in the abilities of specific rivers to reach their biological management objectives.

2.6 Monitoring and evaluation

The present information suggests that off-shore commercial salmon fishery will decrease due to drift-net ban and more salmon will survive to the coastal and river fisheries (base-case scenario in our assessment). Also the recreational trolling fishing in the southern Baltic Sea is expected to grow. This will move the relative focus from commercial fishery towards the recreational fisheries i.e. recreational fisheries will generate the relatively higher fishing mortality than at present. Consequently the management of recreational fisheries will get more important role. Apart from the established biological monitoring also socio-economic monitoring will be needed in a wider scale. The potential core indicators in monitoring the future management are the number of recreational fishermen, number of sold licences, catches and number of companies offering fishing services.

The fishermen's degree of commitment is an important indicator when evaluating the success of the management plan from the sociological point of view. The higher degree of commitment among the all fishermen groups the higher probability to reach the management objectives. The degree of commitment would be possible to monitor by frequent questionnaires directed to the organisations in BS RAC (by utilising the effective web tools). Also information on the potential problems in implementation of the management program would be possible to explore for the evaluation purposes.

In biological monitoring the estimation the fishing mortally generated by recreational fishing will require more attention. In addition ICES (2008a) has suggested that future management of Baltic salmon should include river-specific elements to address the recovery needs of weak populations in small rivers.

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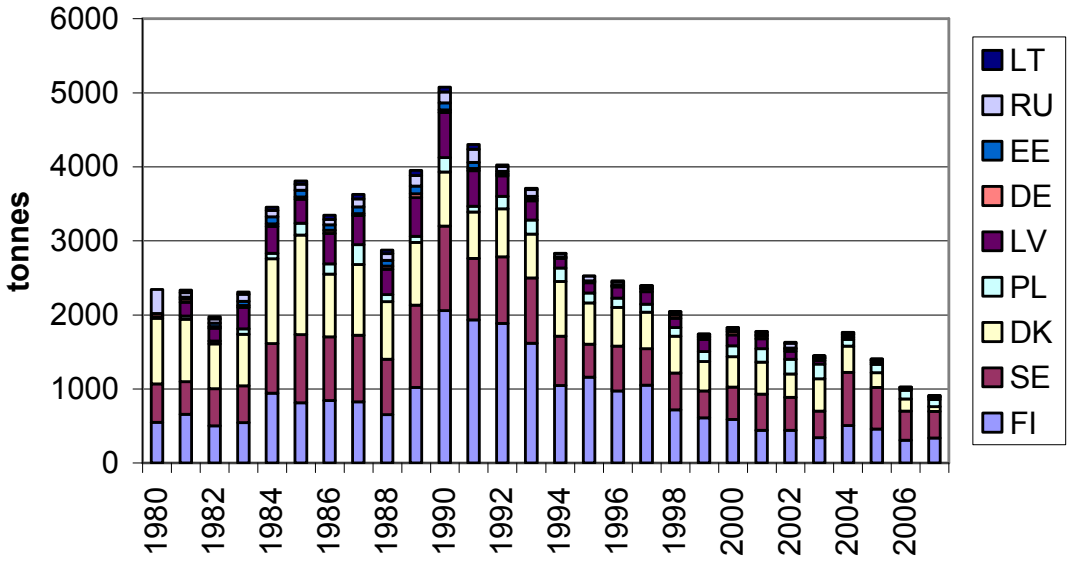

Figure 1.1. Commercial Baltic salmon catches by country in 1980-2007 (ICES).

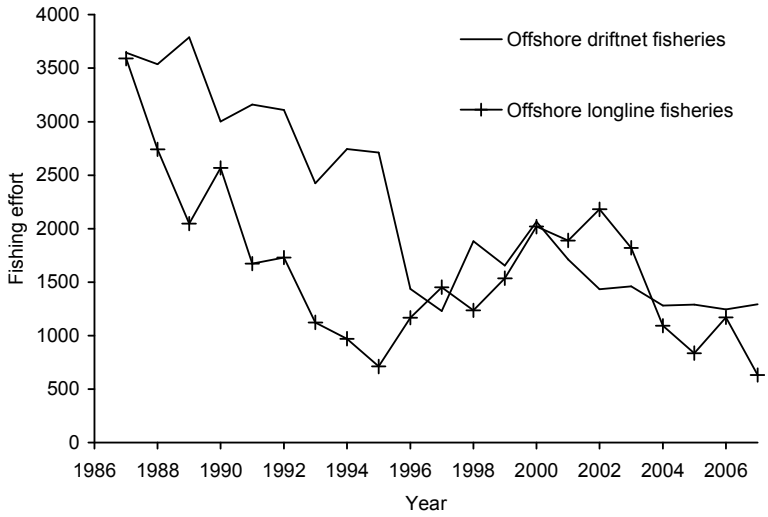

Figure 1.2. The fishing effort of salmon by gear type in the Baltic Sea off-shore fisheries in the period 1987-2005 (effort units are in thousand geardays, ICES 2008).

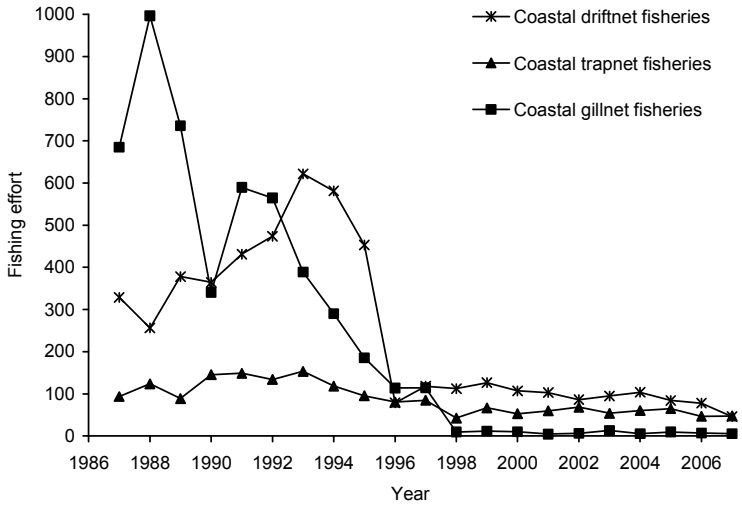

Figure 1.3. The fishing effort of salmon by gear type in the Baltic Sea coastal fisheries in the period 1987-2005 (effort units are in thousand geardays, ICES 2008).

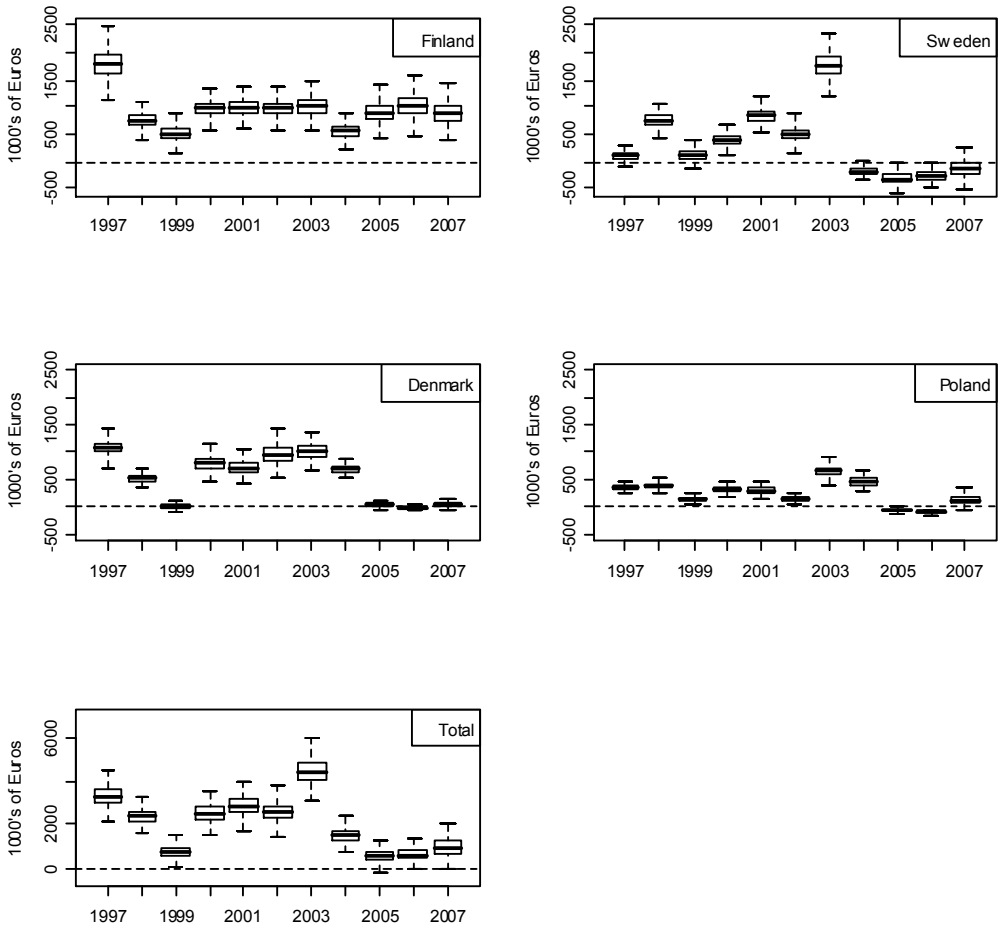

Figure 1.4. Total profits for the commercial Baltic salmon fishery in Finland, Sweden, Denmark and Poland in 1997-2007. Note the different values for y-axis for total profits compared to the country specific profits.

Table 1.1. Number of salmon fishing vessels by activity category and country in the Baltic Sea (ICES 2008).

	year	country			
		FIN	SWE	DEN	LAT
active vessels >=60 fishing days per year	1997	8	3	n.a	n.a.
	1998	4	6	6	n.a.
	1999	6	5	1	4
	2000	7	6	3	3
	2001	3	5	5	1
	2002	6	2	6	0
	2003	3	1	3	0
	2004	1	3	0	0
	2005	1	7	0	0
	2006	3	12	3	0
	2007	4	6	1	0
less active vessels <60 fishing days per year	1997	100	55	n.a	n.a.
	1998	64	73	15	n.a.
	1999	61	61	19	24
	2000	55	53	25	28
	2001	34	46	17	29
	2002	40	52	22	28
	2003	52	40	27	32
	2004	52	43	27	17
	2005	44	31	16	12
	2006	24	25	6	9
	2007	24	19	11	4

Table 1.2. Mean sum of the profits and revenues from the salmon fishery by country during 1997-2007, in millions of Euros. The analysis is based on stochastic simulations on population dynamics, but the fishing effort is assumed to be known.

	TOT	FI	SWE	DK	POL
Profit	23	10	4	6	3
Revenue	56	22	17	11	7

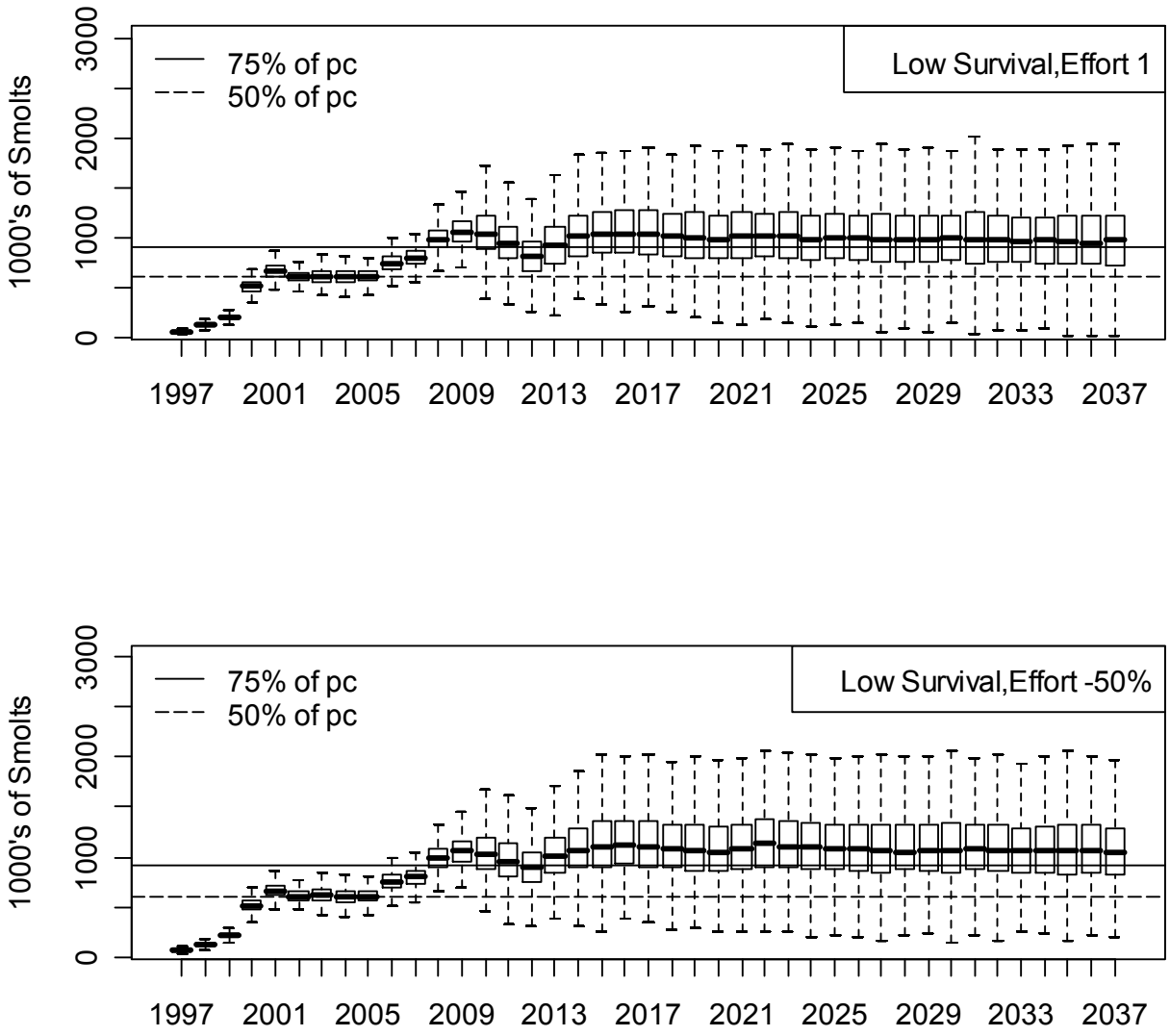

Figure 2.2.1. A trajectory for river Tornionjoki smolt production in 1997-2037. Assuming **low post smolt survival** and base case effort or 50% reduction from the base case effort. Horizontal lines illustrate the median of 75% and 50% of smolt production capacity (pc).

Table 2.4.1. Definitions of management options of future SAP in the different sub-studies of the project.

Bio-Economic Study*

Options		
	1	No Change in the Commercial Fishery
	2	25 % Reduction in the Commercial Fishery
	3	50 % Reduction in the Commercial Fishery
	4	75 % Reduction in the Commercial Fishery

Valuation Study**

	Options	
Atributes of SAP	**Current**	**Future SAP**
Salmon catch in sea fishery	110 000 salmon	70 000 salmon
Fishing control	1 000 hr	2 000 hr
Number of licence, no constrained/quota	10 000, no quota	10 000, quota
Days needed to catch salmon	7 days	3 days
Number of smolts	1 million	1.5 million
New working places in river area	0	30
Salmon management fee (years 2010-2019)	no	yes
In my opinion the best alternative is ?		

Sociological Study***

Options		**Objective** *% of smolt production capacity*	**TAC** *Sea*	*River*
	A	50	X	-
	B	non	X	-
	C	75	X	X
	D	50 or 75	X	X

*Reductions in the effort are in terms of fishing effort

**Willingness to pay question in the contingent valuation study

***Management options differ in terms of the biological objective and to whom the regulations will be aimed

Table 2.5.1. A qualitative comparison of bio-economic effects of two management options on the catches of different fisheries by country and on the probability to reach 75% of potential production in wild salmon rivers.

	Fisheries	Finland	Sweden	Denmark	Poland	Probability to meet 75% of the management target
Base case	*Commercial*	+/-	+/-	+/-	+/-	--
	Recreational	+/-	+/-	+/-	+/-	
Reduce efforts by 50%	*Commercial*	--	--	--	--	+/-
	Recreational	++	++	+	+/-	

-- significant decrease
+/- neutral effect
+ moderate increase, ++ significant increase

Table 2.5.2. Social impacts of the four management options on fisher groups.

Option **Variable**	**A: Continuation of the IBSFC SAP**	**B: Management as today, no management plan**	**C: New management plan I**	**D: New management plan II**
Interaction and trust between actors	- Conflict and distrust between interest groups retain.	-- No long-term plan → struggle on salmon resource escalates.	- Strict restrictions at sea →escalates feelings of injustice at the coast.	+ Option is seen as a compromise
Confidence in management	- Interpreted as the current situation, seen negatively (unpredictable, short-sighted).	-- No long-term target → no improvement in confidence. Current situation regarded negative.	+ **Recrfishers**: High objective enhances confidence. - **Comfishers** : Strict restrictions → ceasing commercial salmon fishing.	+ Seen as a compromise; river specific implementation flexible → enhances confidence.
Employment sea	- -	- -	-- --	- -
coast	+/-	-	-	+
river	+/-	--	++	+

comfishers: commercial fishermen in sea and coast
recrfishers: recreational fishermen in river areas
+ moderate positive impact , ++ significant positive impact
+/- no change
- moderate negative impact, - - significant negative impact

Table 2.5. Commitment of fisher groups to different management options

Option	**A: Continuation of the IBSFC SAP**	**B: Management as today, no management plan**	**C: New management plan I**	**D: New management plan II**
Commitment	-- **Recrfishers:** Target too low. +/- **Comfishers:** Finnish: No major changes in coastal fishing. Swedish: No improvement in the current situation.	**--** No long-term plan and target: overall commitment reduces.	**+ Recrfishers :** Higher objective enhances belief in development. Target too low. **- Comfishers:** Strict restrictions will cease commercial salmon fishing	**+/- Recrfishers:** Realistic option. Target too low. **+ Comfishers**: Realistic compromise.
Utility	253,5 points	253 points	254 points	256 points

comfishers: commercial fishermen in sea and coast
recrfishers: recreational fishermen in river areas
+ moderate commitment , ++ high commitment
+/- neutral commitment
- low commitment, - - poor commitment

2.7 Participants

Country	Institute	Expert	Task	Main area of qualification
Finland	FGFRI	Tapani Pakarinen	Project Management	Fisheries biologist, expert in assessment and management issues of Baltic salmon
Finland	FGFRI	Jaakko Erkinaro	Project Management	Fisheries biologist, expert in biology, assessment and management issues of Baltic Sea and North Atlantic salmon
Finland	FGFRI	Atso Romakkaniemi	Expert of biological modelling of the Baltic salmon	Fisheries biologist, expert in biology, assessment and management issues of Baltic salmon
Finland	FGFRI	Erkki Ikonen	Advisor on Baltic salmon biology and management issues	Fisheries biologist, expert in assessment and management issues of Baltic salmon
Finland	FGFRI	Jarno Virtanen	Advisor on the economic impact analysis	Expert in fisheries economics and fisheries management issues
Finland	UHel	Marko Lindroos	Supervisor of the economic impact analysis	Expert in fisheries economics
Finland	UHel	Soile Kulmala soile.kulmala@helsinki.fi	Modification of the bio-economic model and running the economical impact analysis	Fisheries economist
Finland	UHel	Katja Parkkila katja.parkkila@helsinki.fi	Valuation of non-commercial fisheries and non-use values in economic impact analysis	Valuation studies in fisheries economics
Finland	UHel	Emmi Nieminen	Collation and review of the socio-economic data and literary	Valuation studies in fisheries economics
Finland	UHel	Emmi Haltia	Valuation of non-commercial fisheries and non-use values in economic impact analysis	Valuation studies in fisheries economics
Finland	UHel	Sakari Kuikka	Advisor on the socio-economic impact analysis and the CFP issues	Fisheries biologist, expert in the fisheries and environmental management issues
Finland	UHel	Päivi Haapasaari paivi.haapasaari@helsinki.fi	Sociological impact analysis	Environmental sociologists, Expert in sociological impact analysis
Finland	UOul	Timo Karjalainen	Sociological impact analysis	Environmental sociologist, Expert in sociological impact analysis
Finland	UOul	Kalle Reinikainen	Sociological impact analysis	Environmental sociologist, Expert in sociological impact analysis
Denmark	DTU Aqua	Stig Pedersen	Collation of Danish fisheries data and valuation studies, expert of the Danish salmon fisheries and management issues	Fisheries biologist, Expert in assessment and management issues of the Baltic salmon
Poland	MIR	Emil Kuzebsky	Collation of Polish fisheries data and valuation studies, Expert of the Polish salmon fisheries and management issues	Fisheries economist
Sweden	SBF	Lars Karlsson	Collation of Swedish fisheries data, Expert of the Swedish salmon fisheries and management issues	Fisheries biologist, expert in assessment and management issues of the Baltic and North Atlantic salmon
Great Britain	ICON	Polina Levontin	Modification of the bio-economic model and running the economic impact analysis	Modelling of the Baltic salmon