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Report of the Working Group on North Atlantic Salmon (WGNAS)

4–13 April 2006

ICES Headquarters

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Contents

Executive Summary

- Exploitation continued to decline and nominal catch of Atlantic salmon in 2005 was the lowest in the time series
- Marine survival indices suggest that natural mortality remains high
- North American Commission 2SW stock complex is suffering reduced reproductive capacity
- In the North American Commission area, factors other than fisheries are contributing to continued low adult abundance
- Northern North East Atlantic Commission stock complexes (1SW and MSW) are at risk of suffering reduced reproductive capacity
- Southern North East Atlantic Commission stock complexes (1SW and MSW) are suffering reduced reproductive capacity
- There are no catch options for the 2006–2008 fisheries at West Greenland and the Faroes that would allow the stated precautionary management objectives to be met

1 INTRODUCTION

1.1 Main Tasks

At its 2005 Statutory Meeting, ICES resolved (C. Res. 2005/2ACFM04) that the Working Group on North Atlantic Salmon [WGNAS] (Chair: T Sheehan, USA) will meet in Copenhagen, Denmark, from the 4–13th April 2006 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO). The terms of reference were met and the sections of the report which provide the answers are below:

a)	With respect to Atlantic salmon in the North Atlantic Area:	Section 2
1)	provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched Atlantic salmon in 2005;	2.1 and 2.2
2)	report on significant developments which might assist NASCO with the management of salmon stocks including new or emerging threats to, or opportunities for, salmon conservation and management;	2.3
3)	report on developments in methods to identify origin of Atlantic salmon at a finer resolution than continent of origin (river stocks, country or stock complexes);	2.4
4)	describe sampling programmes for escaped farmed salmon, the precision of the identification methods employed and the reliability of the estimates obtained;	2.5
5)	provide an assessment of the minimum information needed which would signal a significant change in the previously provided advice for each Commission area;	2.6
6)	provide a compilation of tag releases by country in 2005;	2.7
7)	identify relevant data deficiencies, monitoring needs and research requirements [1].	Sec 6
b)	With respect to Atlantic salmon in the North-East Atlantic Commission area:	Section 3
1)	describe the key events of the 2005 fisheries and the status of the stocks2;	3.9
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	3.10
3)	further develop the age-specific stock conservation limits where possible based upon individual river stocks;	3.3

4)	provide annual catch options or alternative management advice for 2006-2008, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]	3.4 and 3.6
5)	update and further refine estimates of by-catch of salmon in pelagic fisheries (including non-catch fishing mortality) with an assessment of impacts on returns to homewaters.	3.11
c)	With respect to Atlantic salmon in the North American Commission area:	Section 4
1)	describe the key events of the 2005 fisheries (including the fishery at St Pierre and Miquelon) and the status of the stocks; [2]	4.9
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	4.10
3)	update age-specific stock conservation limits based on new information as available;	4.3
4)	provide annual catch options or alternative management advice for 2006-2008 with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding. [3]	4.61 and 4.7
d)	With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
1)	describe the events of the 2005 fisheries and the status of the stocks; [2, 4]	5.9
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	5.11
3)	provide annual catch options or alternative management advice for 2006-2008 with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding. [3]	5.4
	Notes: 1. *NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist it in this task.* 2. *In the responses to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and on the by-catch of salmon in any existing and new fisheries for other species is also requested.* 3. *In response to questions 2.4, 3.4 and 4.3 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.* 4. *In response to question 4.1, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1.*	

The Working Group considered 41 Working Documents submitted by participants (Annex 1); other references cited in the report are given in Annex 2. A full address list for the participants is provided in Annex 3. A complete list of acronyms used within this document is provided in Annex 7.

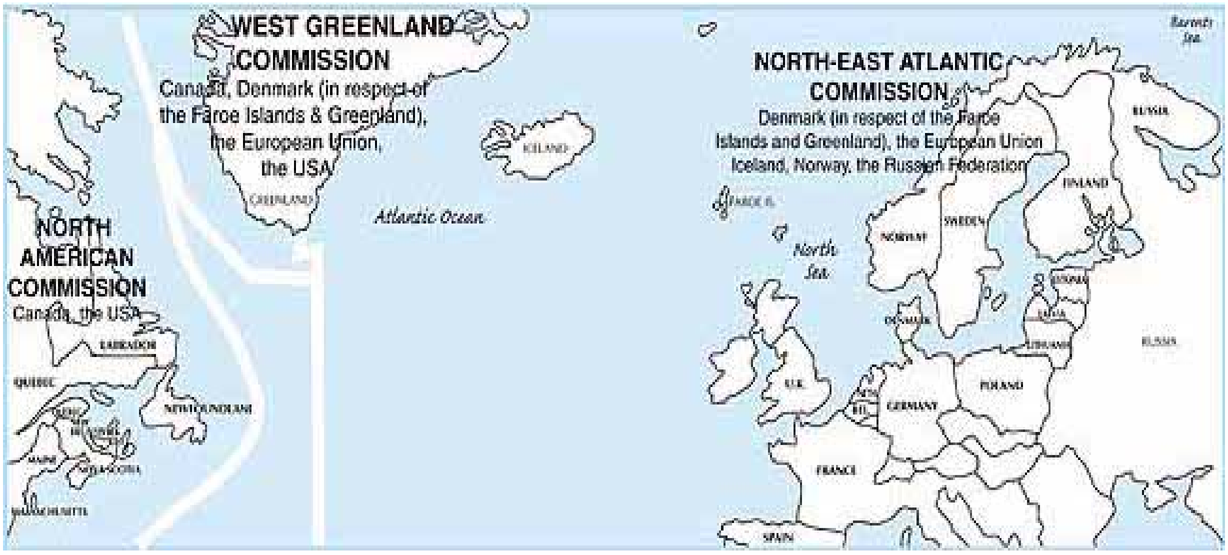
1.2 Participants

Sheehan, T. (Chair)	USA
Amiro, P.	Canada
Carl, J.	Greenland
Caron, F.	Canada
Chaput, G.	Canada
Dahl, J.	Sweden
Erkinaro, J.	Finland
Gudbergsson, G.	Iceland
Hansen, L. P.	Norway
Ingendahl, D.	Germany
Karlsson, L.	Sweden
Legault, C.	USA
MacLean, J. C.	UK (Scotland)
Ó Maoiléidigh, N.	Ireland
Prusov, S.	Russia
Reddin, D. G.	Canada
Russell, I.	UK (England & Wales)
Smith, G. W.	UK (Scotland)
Studenov, I.	Russia
Trial, J.	USA
Vauclin, V.	France

1.3 Management framework for salmon in the North Atlantic

The advice generated by ICES is in response to terms of reference posed by the North Atlantic Salmon Conservation Organisation (NASCO), pursuant to its role in international management of salmon. NASCO was set up in 1984 by international convention (the Convention for the Conservation of Salmon in the North Atlantic Ocean), with a responsibility for the conservation, restoration, enhancement, and rational management of wild salmon in the North Atlantic. While sovereign states retain their role in the regulation of salmon fisheries for salmon originating from their own rivers, distant water salmon fisheries, such as those at Greenland and Faroes, which take salmon originating from rivers of another Party are regulated by NASCO under the terms of the Convention. NASCO now has seven Parties that are signatories to the Convention, including the EU which represents its Member States.

NASCO discharges these responsibilities via three Commission areas shown below:



1.4 Management objectives

NASCO (NASCO CNL31.210) has identified the primary management objective of that organisation as:

"To contribute through consultation and co-operation to the conservation, restoration, enhancement and rational management of salmon stocks taking into account the best scientific advice available".

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks" and NASCOs Standing Committee on the Precautionary Approach interpreted this as being "to maintain both the productive capacity and diversity of salmon stocks".

NASCO's Action Plan for Application of the Precautionary Approach (NASCO, 1999) provides interpretation of how this is to be achieved, as follows:

- "Management measures should be aimed at maintaining all stocks above their conservation limits by the use of management targets".
- Socio-economic factors could be taken into account in applying the Precautionary Approach to fisheries management issues":
- "The precautionary approach is an integrated approach that requires, inter alia, that stock rebuilding programmes (including as appropriate, habitat improvements, stock enhancement, and fishery management actions) be developed for stocks that are below conservation limits".

1.5 Reference points and application of precaution

Conservation limits (CLs) for North Atlantic salmon stock complexes have been defined by ICES as the level of stock (number of spawners) that will achieve long term average maximum sustainable yield (MSY). In many regions of North America, the conservation limits are calculated as the number of spawners required to fully seed the wetted area of the river. In some regions of Europe, pseudo stock-recruitment observations are used to calculate a hockey stick relationship, with the inflection point defining the conservation limits. In the remaining regions, the conservation limits are calculated as the number of spawners that will achieve long-term average maximum sustainable yield (MSY), as derived from the adult-to-adult stock and recruitment relationship (Ricker, 1975; ICES, 1993). NASCO has adopted the region specific conservation limits (NASCO, 1998). The conservation limits are limit reference points (S_{lim}), which should be avoided with high probability.

Management targets have not yet been defined for all North Atlantic salmon stocks. When these have been defined they will play an important role in ICES advice.

For the assessment of the status of stocks and advice on management of national components and geographical groupings of the stock complexes in the NEAC area, where there are no specific management objectives:

- ICES requires that the lower bound of the 95% confidence interval of the current estimate of spawners is above the CL for the stock to be considered at full reproductive capacity.
- When the lower bound of the confidence limit is below the CL, but the mid point is above, then ICES considers the stock to be at risk of suffering reduced reproductive capacity.
- Finally, when the mid point is below the CL, ICES considers the stock to suffer reduced reproductive capacity.

It should be noted that this is equivalent to the ICES precautionary target reference points (S_{pa}). Therefore, stocks are regarded by ICES as being at full reproductive capacity only if they are above the precautionary reference point (S_{pa}). This approach parallels the use of precautionary reference points used for the provision of catch advice for other fish stocks in the ICES area.

For catch advice on fish exploited at West Greenland (non maturing 1SW fish from North America and non maturing 1SW fish from Southern NEAC), ICES has adopted, a risk level of 75% (ICES, 2003) as part of an agreed management plan. ICES applies the same level of risk aversion for catch advice for homewater fisheries on the North American stock complex.

2 ATLANTIC SALMON IN THE NORTH ATLANTIC AREA

2.1 Catches of North Atlantic Salmon

2.1.1 Nominal catches of salmon

The nominal catch of a fishery is defined as the round, fresh weight of fish that are caught and retained. Total nominal catches of salmon reported by country in all fisheries for 1960–2005 are given in Table 2.1.1.1. Catch statistics in the North Atlantic also include fish farm escapees and, in some north-east Atlantic countries, relatively small numbers of ranched fish (see Section 2.2.2). Catch and release has become increasingly commonplace in some countries, but these fish do not appear in the nominal catches (see Section 2.1.2).

Icelandic catches have traditionally been split into two separate categories, wild and ranched, reflecting the fact that Iceland has been the only North Atlantic country where large-scale ranching has been undertaken with the specific intention of harvesting all returns at the release site. However, the release of smolts for ranching purposes ceased in Iceland in 1998. While ranching does occur in some other countries, this is on a much smaller scale. Some of these operations are experimental and at others harvesting does not occur solely at the release site. The ranched component in these countries has therefore been included in the nominal catch.

Figure 2.1.1.1 shows the nominal catch data grouped by the following areas: ‘Northern Europe’ (Norway, Russia, Finland, Iceland, Sweden and Denmark); ‘Southern Europe’ (Ireland, UK (Scotland), UK (England & Wales), UK (Northern Ireland), France and Spain); “North America” (including Canada, USA and St Pierre et Miquelon (France)); and “Greenland and Faroes”.

The provisional total nominal catch for 2005 was 2110 tonnes, 46 t below the confirmed catch for 2004 (2156 t) and the lowest in the time series. The 2005 catch was over 500 t below the average of the last five years (2649 t), and almost 600 t below the average of the last 10 years (2702 t). Nominal catches were below the previous five- and ten-year averages in most countries, and were the lowest recorded in the time series in four countries.

Nominal catches in homewater fisheries split, where available, by sea-age or size category are presented in Table 2.1.1.2 (weight only). The data for 2005 are provisional and, as in Table 2.1.1.1, include both wild and reared salmon and fish farm escapees in some countries. A more detailed breakdown, providing both numbers and weight for different sea-age groups for most countries, is provided at Annex 4. Countries use different methods to partition their catches by sea-age class and these are outlined in the footnotes to Annex 4. The composition of catches in different areas is discussed in more detail in Sections 3, 4, and 5.

Figure 2.1.1.2 presents the nominal catch by country in homewater fisheries partitioned according to whether the catch was taken in coastal, estuarine or riverine areas. Overall, coastal fisheries accounted for 47% of catches in North East Atlantic countries in 2005, in-river fisheries 46% and estuarine fisheries 7%. In North America, coastal fisheries accounted for 20% of the catch in 2004, while in-river fisheries took 59% and estuarine fisheries 20%.

There is considerable variability in the percentage of the catch taken in different fisheries between individual countries. For some countries the entire catch is taken in freshwater, while in other countries the majority of the catch is taken in coastal waters (Figure 2.1.1.2). Data aggregated by region are presented in Figure 2.1.1.3 for the period 1995–2005. Overall, in the NEAC northern area (Iceland, Norway, Russia, Finland and Sweden) around half the catch has typically been taken in coastal waters and half in rivers, although there are no coastal catches in Iceland and Finland. However, the proportion of the catch taken on the coast fell to 37% in 2005. Estuarine catches have comprised no more than 2% of the total in this area. In the NEAC southern area (France, Ireland, Spain, UK (N. Ireland), UK (Scotland) and UK (England & Wales)) most fish (50–64%) have been taken in coastal fisheries with riverine fisheries comprising around 30% and estuarine fisheries under 20%. In North America, the majority of the catch has been taken in freshwater (59–77% in 1999–2005).

2.1.2 Catch and release

The practice of catch and release in rod fisheries has become increasingly common as a salmon management/conservation measure in light of the widespread decline in salmon abundance in the North Atlantic. In some areas of Canada and USA, catch and release has been practiced since 1984, and in more recent years it has also been widely used in many NEAC countries both as a result of statutory regulation and through voluntary practice.

The nominal catches presented in Section 2.1.1 comprise fish which have been caught and retained and do not include salmon that have been caught and released. Table 2.1.2.1 presents catch-and-release information from 1991 to 2005 for seven countries that have records; catch and release may also be practiced in other countries while not being formally recorded. There are large differences in the percentage of the total rod catch that is released: in 2005 this ranged from 17% in Iceland to 87% in Russia, reflecting varying management practices among these countries. Within countries, the percentage of fish released has tended to increase over time. Overall, almost 128 000 salmon were reported to have been released around the North Atlantic in 2005, about 26 000 less than in 2004. There is also evidence from some countries that larger MSW fish are released in higher proportions than smaller fish. Whilst the use of catch and release is likely to result in some fish dying through exhaustion or damage, studies have demonstrated that if fish are appropriately handled, mortality following capture is low and a large proportion of fish survive to spawn (Dempson *et al.*, 2002; Webb, 1998a, 1998b; Whoriskey *et al*., 2000).

2.1.3 Unreported catches

Unreported catches by year (1987–2005) and Commission Area are presented in Table 2.1.3.1. A description of the methods used to evaluate the unreported catches was provided in ICES (2000) and updated for the NEAC Region in ICES (2002). In practice, the estimation methods used by each country have remained relatively unchanged and thus comparisons over time may be appropriate. However, the estimation procedures vary markedly between countries. For example, some countries include only illegally caught fish in the unreported catch, while other countries include estimates of unreported catch by legal gear as well as illegal catches in their estimates. In France, nominal catches include a correction for under-reporting in rod fisheries. Over recent years efforts have been made to reduce the level of unreported catch in a number of countries (e.g. through improved reporting procedures). The introduction of carcass tagging programmes in Ireland and UK (N. Ireland) in recent years is also expected to lead to reductions in unreported catches.

The total unreported catch in NASCO areas in 2005 was estimated to be 717 t, a rise of 5% from 2004 (686 t). The unreported catch in the North East Atlantic Commission Area in 2005 was estimated at 606 t, that for the North American Commission Area 101 t, with 10 t estimated for the West Greenland Commission Area. The unreported catch, expressed as a percentage of the total North Atlantic catch (nominal and unreported), has fluctuated since 1987 (range 23–34%; 26% in 2005), but has had a downward trend over the past 7 years (Figure 2.1.3.1). Estimates for 2005 are presented by country in Table 2.1.3.2. Expressed as a percentage of the total catch for the North Atlantic, these range from 0 to 13% for individual countries. Relative to national catches, unreported catches range between 2% and 56% of country totals.

In the past, salmon fishing by non-contracting parties is known to have taken place in international waters to the north of the Faroe Islands. Typically, a number of surveillance flights have taken place over this area in recent years. These have resulted in no sightings of vessels, although there have been extended periods over the winter period when no flights took place. This is the period when salmon fishing has previously been reported. No information was available regarding surveillance flights in 2005.

2.2 Farming and Sea Ranching of Atlantic Salmon

2.2.1 Production of farmed Atlantic salmon

The provisional estimate of farmed Atlantic salmon production in the North Atlantic area for 2005 is 784 611 t. This represents a decrease on 2004 (831 207 t), but a 5% increase on the 5-year mean (2000–2004) (Table 2.2.1.1 and Figure 2.2.1.1). Most of the North Atlantic production took place in Norway (72%) and UK (Scotland) (17%).

World-wide production of farmed Atlantic salmon has been in excess of one million tonnes since 2002. Total production in 2005 is provisionally estimated at 1 261 638 tonnes (Table 2.2.1.1 and Figure 2.2.1.1), a 9% increase on 2004. Production outside the North Atlantic is currently estimated to have accounted for 38% of total farmed production in 2005, with Chile (405 200 t) contributing the largest proportion of the production in this area. World-wide production of farmed Atlantic salmon in 2005 was almost 600 times the reported nominal catch of Atlantic salmon in the North Atlantic. Farmed salmon therefore dominate world markets.

2.2.2 Production of ranched Atlantic salmon

Ranching has been defined as the production of salmon through smolt releases with the intent of harvesting the total population that returns to freshwater (harvesting can include fish collected for broodstock) (ICES, 1994). The total production of ranched Atlantic salmon in countries bordering the North Atlantic in 2005 was 8 t, a 33% decrease on 2004 (Figure 2.2.2.1). Salmon ranching (smolt releases) ceased in Iceland in 1998. Small catches of ranched fish were recorded in each of the three other countries reporting such fish (Ireland, UK (N. Ireland) and Norway), and the data includes catches in net, trap and rod fisheries. Ranched fish comprised less than 1% of the nominal catch in each of these countries.

2.3 NASCO has asked ICES to report on significant developments which might assist NASCO with the management of salmon stocks including new or emerging threats to, or opportunities for, salmon conservation and management

2.3.1 Evaluation of options to develop a multi-year forecast of PFA_{NA} abundance

The annual stock status reports developed by the Working Group and the subsequent advice provided by ICES have formed the basis for the negotiations and subsequent management of the West Greenland fishery. A forecast of the 1SW non-maturing fish (PFA) is derived from the lagged spawner (LS) abundance, which would contribute to the recruitment. The lagged spawner variable for North America is known for four years beyond the last reconstructed PFA year and forecasts of PFA abundance prior to the West Greenland fishery could be provided for three years. The Working Group reviewed an approach for the provision of multi-year advice based on the presently used model.

The PFA forecast model used by ICES models production rate as a fixed parameter conditional on one of two levels of productivity. The probability of being in one of the two states for the forecast year of interest is determined using the relative change in PFA for a two year lag. For the multi-year forecasts, the probability of being in either state was assumed to be similar for the three forecast years. Alternatively, the probabilities could be determined using changes in PFA with a three year lag or using a four year lag, for the West Greenland fisheries forecasts for year+1 and year+2.

Using the phase shift model and the estimate lagged spawner values, three years of forecasts of PFA could be obtained. The evaluation was done using mid-point values of PFA and lagged spawner abundance. The accuracy of the current year of interest forecast was better than for the subsequent years' forecasts but the precision was unrelated to the multi-year forecast of interest (Figure 2.3.1.1). An alternate approach for determining the phase was to assume that the change in PFA for a two-year lag also applied to the second and third forecast years. When examined retrospectively, the forecasts were variable among the approaches with no obvious bias with either method (Figure 2.3.1.2).

The Working Group concluded that the multi-year forecasts should be obtained using the phase-shift model with the probability of being in the low or high phase determined using a lag of two years and applying this probability to the three forecast years of interest. This approach was used to provide the multi-year forecasts of abundance for the North American PFA as described in Section 5.

In addition, an alternate model of PFA to LS, which did not require an evaluation of the production phase for the forecast years of interest, was reviewed. A dynamic model, as described by Prévost *et al.* (2005), was examined as an option for the provision of multi-year forecasts. There is no functional dynamic implied between PFA and LS other than that production rate in the year of interest will likely be similar to the previous year. Mid-point values of PFA were modelled as a lognormal function of mid-point values of lagged spawners.

$$PFA_i \sim \text{Lognormal}(\mu PFA_i, \sigma PFA)$$

$$\mu PFA_i = \mu\alpha_i + \text{Log}(LS_i)$$

The increment of the mean production rate ($\mu\alpha_i$) and the variation in the production rate vary with time:

$$\mu\alpha_i = \mu\alpha_{i-1} + b_i$$

$$b_i \sim \text{Normal}(b_{i-1}, \sigma b) \quad [b_i \text{ varies over time as a random walk}]$$

Although the dynamic model provided a good fit to the variation in PFA over the entire time series, the posterior forecast distributions of PFA were more uncertain than for the phase-shift models. For short term forecasting, the dynamic model formulation can respond more quickly to changes in recruitment rate but the precision decreases as the forecasts extend beyond the last observed values. It was instructive to fit both models to the data series as both provided the same prognosis of continued low abundance of PFA due to the lagged spawner abundance and the recruitment rate (PFA/LS) being low.

The Working Group recommends that further exploration of the dynamic model be conducted in support of the request to provide multi-year forecasts of PFA for the derivation of catch options. Consideration should be given to incorporating the uncertainties in the PFA and LS input data, as is done for the phase-shift model used by the Working Group to develop catch options.

2.3.2 Post-smolt trawling in the Labrador Sea, Fall 2005

In September of 2005, the Canadian RV "*Wilfred Templeman*" was used to surface trawl for salmon in the Labrador Sea. A total of nine trawl sets and two gillnet sets were made in areas of the Labrador Sea where salmon post-smolts and adult salmon had been caught in previous years. A total of 47 post-smolts and 11 adult salmon were caught during two gillnet sets using gillnets with mesh sizes ranging from 2.5 to 5.5 inches, but only one post-smolt was caught during the trawling. Trawl speeds were 5 knots and the length of time was one hour. The trawl used was the Norwegian designed post-smolt trawl with live capture aquarium attached. The trawl was fishing properly based on the other species caught, which were Atlantic saury, mackerel, lantern fish, jellyfish, lumpfish, squid, and amphipods. The trawl capture of the post-smolt was at night and suggests that salmon might have been deeper in the water column during the day. Salmon tagged with data storage tags have shown that salmon move up and down in the water column during the day and are found closer to the surface at night. Post-smolt catches may be improved by trawling at night, trawling at higher speeds and by pair trawling.

A standard disease survey on 90 salmon, some of which were from 2001, indicated that no disease pathogens were present including tests for ISAV and VHSV.

2.3.3 Fatty acid profiles and stock discrimination

The profile of fatty acids in selected tissues has been shown to differ between recognised stocks of herring, striped bass, cod and redfish and also between two populations of harp seals. The present status of the fatty acid methods has been reviewed by Grahl-Nielsen (2005).

Results from a pilot project on fatty acid profiles in Atlantic salmon were presented to the Working Group. One year old salmon parr from five different river stocks (Imsa, Figgjo, Stryneelva, Namsen and Altaelva) were raised from eggs at the NINA Research Station at Ims, Rogaland, Norway. The fish were reared under identical conditions in the same water and with the same diet. Ten parr from each stock were sampled on April 12 2005 and kept on ice until samples of heart tissue were collected within the next 6 hours. Quantitative estimates of 26 fatty acids were obtained by gas chromatography. Despite large individual variations, the fatty acid profiles of the heart tissue were different between the stocks. This controlled experiment where all external factors, including the diet, were identical demonstrates a genetic component in the determination of the composition of the tissue fatty acids. This indicates the potential for using fatty acid profiles in stock identification either on its own or in combination with other methods.

More research is required to assess the potential use of this method. Key requirements are to test different life stages of salmon in the hatchery with different types of feed, test wild fish at different life stages, and examine the stability of fatty acid profiles in time and space.

2.3.4 Preliminary investigations into the deterrence of cormorants to reduce predation on migratory smolts

The Working Group reviewed results from a study (Maine, USA) whose objective was to assess the efficacy of non-lethal exclusion of double-crested cormorants from the lower Narraguagus River as a means of reducing predation on migrating Atlantic salmon smolts. Double-crested cormorants have long been recognized as an important predator of Atlantic salmon smolts in North America (Meister and Gramlich, 1967). Blackwell *et al.* (1997)

demonstrated that smolts were among the most frequent prey items of double-crested cormorants in the Penobscot River and studies in eastern Canada estimate that smolts composed 3.3% of cormorants' diet in the Maritime Provinces (Cairns, 1998).

Non-lethal cormorant harassment activities were conducted on the Narraguagus River in 2004 and 2005 during daylight hours 4–5 days a week. Harassment activities included pyrotechnics (which produced high pitched whistling and loud explosions), lasers, boat activity, and human approaches and were designed to disperse flocks of cormorants and disrupt predation activities. Time-lapse photography (automated digital cameras deployed streamside) was used to provide abundance estimates of cormorants throughout the study at certain locations. Ultrasonic telemetry was used to evaluate the success of emigrating smolts by identifying the last know locations of individuals. In 2004 and 2005, 60 and 54 smolts, respectively, were included in the study.

Results of this study indicate that harassment activities were successful in displacing birds and changing their behaviour, but were not successful in excluding cormorants from the freshwater and estuary areas entirely. In 2004, three of the four days that no harassment activities took place had the highest counts of cormorants. In 2005, heavy rain and high water caused equipment failure and cormorant counts were unavailable.

Preliminary results suggest that there were no population level benefits related to cormorant harassment activities. Smolt survival to the nearshore environment in 2002–2003 (pre-harassment) was identical to the estimated survival for 2004–2005 (harassment). Analysis of individual migration data is required to assess the efficacy of this technique on improving survival for individual migrating Atlantic salmon smolts. A better understanding of these results may enable the development of harassment programmes that produce population effects.

2.4 NASCO has asked ICES to report on developments in methods to identify origin of Atlantic salmon at a finer resolution than continent of origin (river stocks, country or stock complexes)

Within a mixed stock fishery, the identification of origin and composition of the catch is essential for responsible management. This is especially true for stocks that are protected under various nation-specific endangered species legislations. In addition, the NASCO Decision Structure requires that the stock composition of mixed stock fisheries be considered while developing management plans.

Various genetic stock identification projects are ongoing which may yield significant advances in techniques and methods in coming years. A list is included below with a short description of the main projects that are ongoing; this is not exhaustive.

The Atlantic Salmon Arc Project (ASAP) involves the Westcountry Rivers Trust, the Central Fisheries Board in Ireland, Exeter University, the University of Wales-Bangor, the Xunta of Gallicia, Oviedo University, Mancomunidad de las V Villas and is part of a European Regional Development Program called 'Interreg IIIB, Atlantic Area'. The initial aim of ASAP is to collect samples from the majority of salmon rivers on the Western Atlantic coast of Europe and use methods of Genetic Stock Identification (GSI) to effectively 'genetically type' salmon from particular regions and rivers across the Atlantic Arc Region as defined by the EU. Once this database of genotypes is assembled it is hoped that managers will be able to take a small sample from any salmon caught at sea and quickly assess the river or region of origin.

SALMAN (Atlantic Salmon Microsatellite Analysis Network) was established following a joint meeting of ASAP (above), Fisheries Research Services, Scotland and the United States Geological Services in West Virginia in 2004. A network was established by the participants to agree on standardised screening methods for data to develop an international database on microsatellite variation in Atlantic salmon for using in GSI work at local, regional and continental scales. The network continues to communicate and further the overall goal of establishing a suite of standard genetic markers for salmon stock identification.

FishTrace is an EU project involving 10 geneticists and taxonomists, whose goal is to develop a database of the same name. FishTrace links into one system genetic, taxonomic and biological specimen data for the main European commercial fish species and can be considered as a reference database.

Stock Identification of Irish Salmon Stocks has been set up under the Irish National Development Programme (NDP). The project will initially establish a baseline of genetic markers for all Irish salmon rivers. GIS mapping of spawning areas will provide information relative to identified spawning areas. Subsequently, samples will be taken from the principal fisheries to establish the extent of mixed stock fisheries, particularly on stocks which are failing to meet conservation limits.

These analyses provide researchers and managers an opportunity to estimate the composition of mixed-stock catches at local scales, and the necessary information to evaluate the impact of these fisheries on the contributing stock complexes. The Working Group recommends that sampling programmes for all mixed stock fisheries and populations contributing to mixed-stock fisheries be continued to further support these types of analyses.

Building on work at the laboratories in NAC and NEAC currently studying Atlantic salmon genetics will assure significant progress towards assigning finer scales of origin for Atlantic salmon sampled in any international or homewater mixed-stock fishery. The Working Group recommends the continued development of collaborative efforts to genetically characterise salmon stocks across the North Atlantic.

2.4.1 West Greenland mixed stock fishery

The Working Group previously endorsed the Probabilistic-based Genetic Assignment model (PGA) as an approach to partition the harvest of mixed stock fisheries at a finer scale than continent of origin (ICES, 2005). The Working Group reported on the partitioning of the 2000-2002 West Greenland Atlantic salmon catch. The continental and North American country contributions were estimated in a probabilistic fashion resulting in both an estimate and range of potential contributions. Additional information was brought forth to the Working Group which added to the time series by providing estimates for the 2003–2004 fisheries.

The PGA method agrees with previously reported estimates via deterministic assignments that the North American stock complex dominated the catch in 2000–2004 (approximately 64–73%). Furthermore, more than 96% of the North American contribution was assigned to the Canadian stock complex (Table 2.4.1.1). These percentages are based on 10 000 simulations of the available data.

2.4.2 Spatio-temporal distribution of North American Atlantic salmon populations off West Greenland

The Working Group has previously noted that reference baseline datasets for the European and Canadian stock complexes lacked adequate spatial and temporal coverage for finer scale assignments with acceptable accuracy. Some progress has been made to bolster reference datasets; however, deficiencies remain, particularly for NEAC stocks. The Working Group was informed of a project to evaluate the spatio-temporal distribution of North American Atlantic salmon populations at West Greenland. To achieve this goal, genetic samples will be assigned to reference populations from Québec, the Maritimes and Maine using microsatellite markers. The impacts of fishing will then be estimated by evaluating the contribution of each of these base populations to the annual landings in Greenland over the past 10 years. The impacts of fishing can then be estimated by evaluating the contribution of each of these base populations to the annual landings in Greenland. To date, 70 rivers have been sampled from these regions and will comprise the reference populations for the analyses.

2.4.3 St Pierre et Miquelon mixed stock fishery

The Working Group previously reported on the St Pierre et Miquelon fishery (ICES, 2005). This fishery is a mixed-stock fishery which harvests fish from Canada and the USA. Since 1990, the annual harvest has been approximately 2.2 t. In 2004, a sampling programme was conducted which obtained lengths, weights and scale and tissue samples (n=109 and 25 respectively) from the harvest.

The PGA was applied to the data from the 134 genetic samples (tissue plus scales). As expected, all the samples were assigned to originate from North America. Furthermore, it was estimated that 1.9% of the harvest originated from USA while the remaining 98.1% originated from Canada (Table 2.4.3.1).

2.5 NASCO has asked ICES to describe sampling programmes for escaped farmed salmon, the precision of the identification methods employed and the reliability of the estimates obtained

The production of farmed Atlantic salmon has increased considerably over the past 20 years, and farmed salmon now far outnumber their wild conspecifics. Some of these farmed fish escape into the wild, and this may lead to mixing with local stocks and to potentially harmful effects on other species. Escapes typically involve the escape of post-smolt or adult fish from net pens in the sea. However, Atlantic salmon juveniles may also escape from freshwater hatcheries. In order to assess the extent of mixing with local stocks it is important to be able to reliably identify farmed escapees. The Working Group was asked to comment on the accuracy and reliability of different identification methods and to describe current sampling programmes for escaped farmed salmon.

2.5.1 Techniques for identifying escaped farmed salmon

Techniques for identifying fish farm escapees have recently been reviewed by Fiske *et al.* (2005). The range of identified options is summarised below, together with brief comments on their accuracy for distinguishing farm-origin fish:

Morphology / Morphometry

Farmed salmon commonly have external defects on the fins and elsewhere, which can be used to distinguish them from wild fish. These include:

- Defects of the fin tissue
- Fin ray defects
- Gill cover shortening
- Undershot jaw

- Heavy pigmentation

The extent to which such defects may be manifest will be affected by a range of factors, including the rearing conditions in the farm, the age and stage at the time of escape and the period of time at large prior to capture. Such characteristics commonly allow identification of farm escapees by laymen, although the reliability of detection is unclear. External morphology is commonly regarded as an effective identification criterion for recently escaped fish, but is less suitable for fish that escaped long enough before capture to allow regeneration of the fins and operculae. For more reliable assessment, various discriminant models have been developed based on measurements of fins and other morphological features; when tested on independent groups of salmon of known origin these have shown high precision (usually up to 100%) for fish that have escaped recently. Such methods are less effective at identifying ranched fish, although the best models have been able to classify ranched salmon with 72–83% reliability (Fiske *et al*., 2005).

Scale and otolith pattern recognition

Growth patterns differ among salmon stocks, and detailed scale patterns have been used to distinguish between different groups (e.g. between geographical areas or between farmed and wild origin fish). Scales are not regarded as reliable for discriminating farmed fish that escape early in their life (e.g. at the fry stage) from wild fish. Differences in growth patterns between farmed and wild fish can be detected in both scales and otoliths; six criteria can be used for discrimination purposes:

- Smolt size
- Smolt age
- Fresh water to salt water transition
- Sea-winter band
- Summer checks
- Replacement scales

In USA, using only images of scales from known origin adult salmon, readers had 80% accuracy distinguishing aquaculture fish from wild and restoration fish. Additional information, such as fin condition and body morphology, increases the accuracy of the decisions (USASAC, 2006).

Biochemical and physiological markers

Vaccination – Most farmed salmon are vaccinated and this is mainly by injection into the abdominal cavity. This leads to intra-abdominal adhesions, which can be detected by inspection of the opened abdominal cavity. However, improved vaccines reportedly lead to less severe adhesions, and more than one third of vaccinated fish have adhesions that are difficult to detect.

Pigmentation – The use of carotenoid pigments (canthaxanthin and astaxanthin) in the food of farmed salmon provides another approach for identifying farmed fish. The presence of these pigments in eyed salmon ova or newly hatched fry can also be used as indicators of the prevalence of eggs and alevins from escaped farm fish, although may require careful interpretation since canthaxanthin occurs naturally in freshwater diets. Astaxanthin is also the main pigment in wild salmon. This carotenoid exists in three optical isomers (molecules with the same chemical formula, but in which the atoms are arranged differently), and the ratio of the isomers differs between naturally produced and synthetic forms. The distribution of the isomers has been used to separate farmed and wild fish, although the distribution is also dependent on the time since a salmon escaped. Thus salmon that escaped early in the sea stage can be difficult to distinguish.

Trace elements/Stable isotopes – The water of different streams and rivers can have very distinct trace element compositions. Some of these elements deposit in bones and otoliths of fish as they grow and can provide a chemical signature of the environment at the time of the bone formation. Similarly, variability in environmental stable isotope levels can be reflected in bone structures. Though such methods have not been tested specifically on salmon from fish farms compared to wild fish, it is considered to offer potential for the future.

Genetic markers

The recent development of genetic markers has provided useful new methods for stock identification. By combining information from highly polymorphic DNA markers and new statistical methods (assignment tests) it is possible to assign probabilities that samples originate from different populations. Since farmed Atlantic salmon consist of relatively few strains, this technique has some potential for samples taken in rivers that are genetically divergent from farmed strains. However, to date this is not possible for many populations which are proximate to farmed salmon cages.

In the USA, aquaculture companies have proposed genetic marking based on maintaining databases of parental genotypes, matings and tracking progeny at hatcheries to satisfy permit conditions for a unique company mark. As yet, this method has not been tested, however, a database of parental genotypes and matings has been developed in the last two years.

Large–scale group marking in farms

The methods outlined above, with the possible exception of otolith microchemistry, can class fish as either farmed or wild, but they cannot identify the origin of the farmed fish. This would require marking of the fish at farm sites. There are a number of options, but the use of coded wire microtags has been suggested as the most promising option. Such an approach has not been implemented as routine, although farms in Iceland now require 10% of all fish held in sea cages to be tagged and adipose fin-clipped.

Summary

A range of options exists for screening farmed fish. These cover different requirements and the choice of method needs to be evaluated against the objectives of particular programmes. Where greater certainty is required a combination of methods is likely to be required. For routine monitoring purposes, and where there may be a requirement for fish to be kept alive, there is clearly a need for relatively easy field sampling and laboratory processes. Thus a combination of morphological examination and scale analysis is currently considered be the most practical and cost-effective option in such cases. However, since the most important requirement is to limit the impact of farm escapees on spawning stocks, more emphasis should be placed on physical means to prevent escapes, restrict access to spawning populations (e.g. in-river trapping facilities) and for screening and rapid identification of potential farmed fish.

2.5.2 Sampling programmes in different countries

A number of countries have programmes in place to screen for fish farm escapees:

NAC Area

The only sampling for aquaculture escapes in the USA occurs when fisheries agencies examine returns to traps or weirs. Since 2003, a portion of the farmed smolts have been marked or tagged (fin clips and CWTs). However, most trapped fish carry no mark or tag, and so distinguishing aquaculture escapes at traps has relied mainly on body morphology, fin condition, and scale pattern.

For adults, the Atlantic Salmon Federation began an annual monitoring programme in 1992 for escaped farmed fish in the New Brunswick salmon-farming region on the Magaguadavic River. Over 70% of the Bay of Fundy sea-cage facilities are situated within a 10 km radius of the river's mouth. Further, as many as three farming industry smolt hatcheries have operated within the Magaguadavic River watershed. The river has a fish ladder at a head-of-tide hydroelectric dam that allows examination of all adult salmon attempting to enter the river. Similarly, fish captured in the fishway trap on the St Croix River have been examined. Wild salmon were distinguished from farmed escapees using external morphology notably fin erosion, and scale circuli characteristics (Carr *et al*., 1997). Monitoring has also included counting fences in the Bocabec River (1999–2000) and Dennis Stream (2001–2002).

Atlantic salmon juveniles can also escape from freshwater hatcheries, although there is little information available on these escapes. Rivers in New Brunswick with aquaculture hatcheries have been electrofished in an attempt to assess the scale of juvenile salmon (smolt and parr) escapes, and the distributions of the escapees. Scale characteristics (circuli patterns, smolt age) and fin erosion have been used to distinguish wild from farm-origin parr and smolts. Parr with eroded fins and hatchery-type circuli patterns were almost always captured close to hatchery sites, providing support for the reliability of the identification method (Carr and Whoriskey, in press).

Adult salmon captured in monitored rivers are routinely examined for external signs of farmed salmon escapes. Suspected escaped farmed fish are held for closer examination. All suspected escapes are scale sampled and if the scale pattern confirms an escaped farmed salmon it is removed for possible pathogenic or genetic sampling. All adult salmon, parr or smolts included in supportive breeding programs are genetically screened for continent of origin and for distant origin. Because known farmed salmon originated from one of three populations and generally only one population was used, to date even genetic screening cannot fully differentiate farmed salmon from wild salmon in the southern NAC area. Genetic methods are being developed to permit accurate identification of farmed salmon in these areas. As pedigrees are developed for supportive breeding programs and for farmed salmon monitoring the possibility of exact identification of farmed salmon improves. The NAC subcommittee (ICES, 2002) previously noted the detection of European genes in a collection from the Bay of Fundy prompting voluntary compliance screening.

NEAC area

Finland

The occurrence of fish farm escapees in the River Teno (Finland & Norway) has been monitored since the mid-1980´s by collecting scale samples from various river fisheries. Selected and trained fishermen have sampled all their catches, covering both rod catches and various net fisheries during the fishing season between late May and the end of August. On a few specific occasions scientific sampling has been extended to September and October. Fishermen have been asked to observe the external characteristics of their catches for possible detection of aquaculture fish (e.g. rounded and eroded tail or fins and abnormal number of black spots, especially below the lateral line and on the gill covers). However, the actual identification of origin has been carried out in the laboratory by scale analyses. Special focus has been put on scale characteristics in the freshwater zone, the transition zone between the freshwater and sea, and the marine growth; these are regarded as being are among the best indicators of differences between wild and farmed salmon.

Despite large numbers of scales analysed every year (2000–9000), only low proportions of farmed fish have been detected in catches during the fishing season, less than 0.5 % in most years (max 0.69%). However, data collected later in the year suggest much higher incidences of escaped fish, up to 40–50% in some samples. Although the autumn sample sizes have been small, these observations raise concern about the role of fish farm escapees in the River Teno salmon populations and call for further sampling also after the fishing season. These results are in accordance with data from some Norwegian rivers suggesting later run timing for escapees compared to wild fish (Fiske *et al*., 2001).

Norway

Reports of escaped farmed salmon in Norwegian salmon rivers first appeared in the 1980s, and methods for identification of farm escapees were developed (Lund *et al*., 1989; Lund and Hansen, 1991; Fiske *et al.*, 2005). Since 1989 a number of Norwegian marine fisheries and salmon rivers have been sampled to estimate the occurrence of fish farm escapees. In recent years the number of farmed salmon in the reported Norwegian salmon catches has been estimated to be between 30 000 and 60 000 annually.

Scale samples from salmon caught in river fisheries are provided by anglers during the legal angling season in the summer and obtained from broodstock fisheries in the autumn. Anglers also provide a morphological assessment for each fish. Scale reading combined with morphological assessments is used to estimate the proportion of farmed escapees in the samples. Where the origin assigned by scale reading and morphological assessment differs, the origin of the fish is determined on the basis of scale reading, but when origin cannot be determined conclusively from the scale reading morphological assessment is used to assign the sample. For each river the proportion of farmed salmon in the samples is calculated annually.

The total data set to date comprises about 90 000 records. The number of scales analysed in each river has varied from 29 to 911 (mean 136; median 101) for the summer samples, and from 24 to 449 (mean 87; median 74) for the autumn samples. The summer samples represented only a proportion of the total catch in each river. The autumn scale samples were obtained mainly from fish caught by angling in the period close to spawning after the end of the angling season, but samples were also obtained from fish that were caught by other methods. Most of the wild salmon in the autumn samples were released after the scale samples were taken, or were used as broodstock.

In the sea, commercial fishermen at a variable number of locations along the Norwegian coast and in the fjords collect material for analysis. The fish are caught in bag nets and bend nets. On the coast 500–2500 fish from 6–13 fisheries have been sampled and analysed annually over the years 1989–2005. The corresponding figures from fjord fisheries are 300–1300 fish from 1–9 fisheries over the same period. Although the sampling sites are distributed over a large part of the Norwegian coastline, they are not randomly distributed, and therefore are probably not fully representative.

The behaviour and dispersal of farmed salmon is currently under investigation by means of releases of tagged fish to simulate escaped fish. Groups of individually tagged post-smolts were released in 2005, and tagged adult salmon will be released from different sites on the Norwegian coast in 2006.

Iceland

Salmon farming in the sea has increased in Iceland since 2002, and has been over 6200 t for the past two years. Farms are required to tag approximately 10% of the salmon reared in sea-cages, and the most frequent tagging method is microtagging (CWT) with adipose fin-clips providing an external mark. The Agricultural Authority of Iceland (Directorate of Freshwater Fisheries to 2006) pays for the tags and operates a tagging database. Fish farms can be inspected to check the proportion of tagged fish in cages and to confirm location and movement details are correct.

Accidental farm escapes have to be reported to the authorities. This can lead to licensed actions to initiate an immediate fishery or introduce other methods to prevent further spread of fish. In addition, monitoring of the incident can be instigated (e.g. inspection of the frequency and origin of tagged fish, sexual maturity, determining geographical spread of escaped fish, etc.). Apart from reported incidences there is no systematic screening of fish farm escapees by the authorities. There is no oceanic or coastal fishery in Iceland and the rod fishery takes most of the catch. Many of the Fishery Associations responsible for management of their fish stocks, have scale sampling programs and systematic screening for tagged fish relies on voluntary notification by anglers (aided by a lottery scheme) or inspection by wardens. The lottery scheme, as well as tagging and scale sampling programmes, are advertised at the beginning of the fishing season each year and in the fishing lodges on all the major rivers during the season. Since the mid 1970s, microtags and scales have been used to estimate the return rates of fish from enhancement programs, mainly smolt or parr releases. Fish that have eroded fins or gills are often sent for further inspection at the Institute of Freshwater Fisheries, the organisation that also undertakes scale sample analyses and the reading of microtags. The numbers of tags arising from farmed fish are reported annually, as are the number of farmed fish identified from scale samples.

UK (Scotland)

Two methods are routinely followed in UK (Scotland) for detecting farmed salmon in catches:

- Sampling programmes are undertaken at a small number of fisheries. In these cases, examination of scale patterns, in particular smolt age and estimated back-calculated lengths, are used in conjunction with morphometric observations (dorsal, caudal, pectoral and pelvic fin condition and operculum deformities) to categorise the salmon as wild or farmed.
- All fisheries are required to make a catch return each year. Since 1994, Scottish authorities have asked for wild and farm-origin salmon to be reported separately. This relies solely upon a morphometric assessment. The reliability of the information provided by this method is dependent on the level of scrutiny of the catch and the skill and experience of the observer. Guidance has been provided on how to categorise the salmon caught.

For both methods, the resultant estimates of the incidence of farmed salmon in catches are regarded as minimum values.

UK (England & Wales)

There is no formal requirement for fisheries to report escapees in UK (England & Wales), although previous farm escapees have been reported by some concerned anglers. A study commenced in 2003 in selected coastal fisheries with relatively large annual catches (North East and Severn Estuary), and fish caught in traps on four monitored rivers (Lune, Dee, Tamar, Tyne). Coastal catches are examined by netsmen or fish merchants, and trap-caught salmon by local scientists. This programme was extended to include additional coastal fisheries (North West) and other traps in 2004. Putative escapees are identified according to abnormalities of the snout and opercula, and of the dorsal, caudal and paired ventral fins. Farm-origin fish are subsequently authenticated by scale reading.

UK (N. Ireland)

In UK (N. Ireland) catches have been sampled from the coastal fishery off County Antrim, which extends for approximately 70 km along the north and north east coasts and operates between March and September. There is no systematic reporting of escapees in riverine catches, but fish caught in an adult trap on the R. Bush are screened on a daily basis. Putative escapees are identified according to abnormalities of the snout and opercula, and of the dorsal, caudal and paired ventral fins. Farm-origin fish are subsequently authenticated by scale reading.

Ireland

Catches have been examined on a routine basis in Ireland since 1991, including fish from dealer's premises, and commercial and recreational landings. The catch examined comprises principally drift net catches from the major salmon fishing areas of Donegal, Mayo, Galway and Limerick and the South West (Cork and Kerry). The identification of all escapees is based on a combination of external characteristics, particularly abnormalities of the snout and opercula, and of the dorsal, caudal and paired ventral fins.

Accuracy of the identification

- The catch examined is limited to summertime commercial fisheries and provides no indication of the number of escapees which may enter rivers.
- Escapees are generally regarded as damaged fish and may be identified and sold separately. This often means that these fish are not included in the main catches being examined.
- While the identification features are standardised for all tag scanning operators, the level of expertise and consistency of scanning may be variable.

Precision of the estimate

Generally between 20% and 50% of the declared catch is examined specifically for escapees in the catch. In some areas the scanning rate is much higher e.g. Donegal, Mayo and Galway area where the aquaculture industry is mainly situated. There is no systematic reporting of fish farm escapees in riverine catches in Ireland and the returns of escapees to the River Burrishoole total trapping facility rarely exceed two or three fish per year. Therefore there is a severe lack of information on the incidence of escapees in river catches or more importantly in spawning stocks. Similarly, there were no reports from the industry of escape incidents in 2004 or 2005.

2.5.3 Behaviour of escaped farmed salmon

Information from two studies which simulated the escape of farmed salmon were presented to the Working Group: one based on tracking escaped farmed salmon with acoustic tags, and the other from analysis of tag recoveries from farmed and wild salmon tagged with external tags. The following conclusions were drawn:

1) Wild salmon returned to the river they left as smolts with high precision.
2) Hatchery-reared salmon released as smolts returned to spawn in the river in which they were released.
3) Hatchery-reared salmon released as smolts from a marine site returned to the same geographical sea area in which they were released, and entered rivers in this area to spawn.
4) Farmed salmon released as postsmolts from a marine site survived poorly and strayed in larger numbers and over greater distances than salmon released as smolts.
5) Escaped large farmed salmon were apparently ‘homeless’ and appeared to move with the prevailing current. Survival of these fish improved if they escaped close to maturity.
6) Survival and migratory patterns of farmed fish were dependent on the time of escape.
7) Survival and migratory patterns of farmed fish were also dependent on the life stage at escape.

Further detailed information on these studies is provided by Hansen (2006) and Whoriskey *et al*. (2006).

2.6 NASCO has asked ICES to provide an assessment of the minimum information needed which would signal a significant change in the previously provided catch advice for each Commission area

The Working Group has been asked to provide an assessment of the minimal information needed to signal an unforeseen increase in productivity for stocks contributing to fisheries within each Commission area. The expectation is that an increase in productivity may alter the reliability of the previously provided multi-year catch options and could result in unrealised harvest within various mixed-stock fisheries.

The Working Group considers it highly unlikely that the catch options provided for each Commission area will change during the next three years.

Multi-year forecasts of PFA and catch options were requested and provided for the NEAC, NAC and West Greenland commission areas based on the estimates of the lagged spawner abundance which will contribute to the component of non-maturing 1SW salmon in the Northwest Atlantic. The lagged spawner abundance is set for the PFA years 2006 to 2008 for both NAC and NEAC stocks contributing to West Greenland. Those spawners have already returned to their natal rivers. The progeny of these spawners are present in the rivers in 2006 as fry and parr and in the ocean as post-smolts and non-maturing 1SW salmon.

The North American and southern NEAC MSW stock complexes are currently suffering reduced reproductive capacity. The recruitment from present spawners potentially would contribute to the West Greenland and Faroese mixed-stock fisheries and/or homewater catches within North America and Europe. When considering the relative PFA contributions and smolt ages by stock complexes, it is clear that the effects of an increase in spawning escapement would relate to the PFA more than 4 years into the future.

NASCO’s Action Plan for the Application of the Precautionary Approach (NASCO, 1999) states that management measures should be aimed at maintaining all stocks above their conservation limits. Given these guidelines, it is difficult to consider that any mixed-stock fisheries could meet these management objectives in the near future considering the low spawner escapement in the southern stock areas of North America. Many years of high spawning escapement coupled with increased freshwater production and marine survival would be required before the PFA would have changed sufficiently to provide catch options greater than zero. Also, one year of high PFA abundance should not be considered to be a sustained recovery to a high productivity state and consideration for mixed-stock fisheries should only occur when all contributing stock complexes were above their conservation limits.

In order to assist managers in the use of the multi-year advice, advance notice of possible changes in status which may require further action would be of great benefit. The situations which managers should avoid are to continue fisheries on stocks below conservation limits. Alternatively, if stock status improved dramatically, managers and users would likely be interested in having access to the resource. The Working Group also considers it unlikely that there will be a significant increase in the PFA abundance outside the confidence range provided by the multi-year forecasts. Any significant change in productivity could likely be identified by the various monitoring programs conducted across the North Atlantic. Such a change could be reflected as large changes in adult returns, marine survival, or catch per unit effort in fisheries. The Working Group reviewed possible indicators of these changes and how they could be applied.

For the North American stocks, possible indicators of productivity state include 2SW return rates and returns of large salmon to rivers. Examples of possible indicators and their association with PFA abundance are shown in Figure 2.6.1.

The use of indicators to determine the state of the PFA requires establishing a threshold PFA value and a decision rule, i.e. a level of the indicator variable which would be informative of the level of PFA abundance. The rule would be defined using past observations and a value function. An objective way to determine the decision rule for an indicator is to minimize the number of incorrect assignments. The intent is to avoid false high states and false low states (Figure 2.6.2). A false high state is to conclude the PFA is in a high state when it is in a low state. A false low state is to conclude PFA is low when in fact it is in a high state. A false high state may threaten conservation if fisheries were to proceed. A false low state would result in foregone harvest but would not threaten the resource. Precautionary management would minimize the likelihood of a false high relative to a false low conclusion.

As an example, the decision rules for the three hatchery origin smolt return rates available for North America were determined using an equal penalty for false high states and false low states. For all three stocks, the return rate value which minimizes the sum of incorrect assignments is a return rate of 0.25% (Figure 2.6.3). The gradual decline in the proportion of the rivers in which the return rates were below the decision rule mirrors the decline in PFA during 1987 to 1991 when the PFA slipped toward and finally fell below the spawner reserve level (Figure 2.6.4).

When returns of 2SW salmon or large salmon for some rivers were examined in the same way, the proportion of rivers for which the decision rules were exceeded was highly variable within PFA states and among years (Figure 2.6.5). With the data presented in the example, when the returns to 50% of the indicator rivers had exceeded the river-specific decision rules, the PFA abundance had been above the spawner reserve.

Similar indicators for the southern NEAC MSW stock complex could also be explored (Figure 2.6.6).

After reviewing the examples of possible indicators and their applications, the Working Group made a number of conclusions and suggested approaches for future consideration.

- Return rates of smolts would be better indicators of PFA state as they are corrected for smolt output. Returns to rivers are not, and conclusions based on returns assume that smolt production is comparable over the period of study.
- PFA abundance histories for both NAC and the southern NEAC MSW stock complex describe the movement from a high state to a low state but there are no data on the movement from a low state to a high state. Such data, against which to assess performance of the decision rules, are unlikely to be available in the near future.
- It would be more useful to define the high state of PFA as one which would provide a high probability of meeting the CLs (e.g. 75% probability currently being used to develop catch options). The decision rules for those PFA levels would be different from the examples presented to the Working Group and would be most relevant for fisheries management.
- A compliance rule needs to be developed against which to assess indicator states. One year of positive indicators would not be sufficient to indicate that there has been a change in PFA state. Under precautionary management, the decision to intercede, such as in the reduction of exploitation, would be taken much sooner (e.g. two successive years of negative indicators) than the decision to increase exploitation (e.g. this may require that the indicators be positive in at least 3 of 4 successive years). A number of possible compliance rule scenarios could be examined. An example of a compliance rule applied to UK (England & Wales) salmon fisheries management is provided in Section 2.6.1.

The Working Group recommends further development and analyses of indicators of PFA abundance from monitored rivers in both NAC and NEAC areas.

The Working Group recommends that current Atlantic salmon monitoring programs across the North Atlantic be continued and opportunities for initiating new monitoring programs be explored by all Parties.

2.6.1 Use of compliance rules for the management of salmon fisheries in UK (England & Wales)

The performance of salmon stocks in UK (England & Wales) is assessed using a compliance scheme designed to give an early warning that a river has fallen below its CL. The approach provides a way of summarising the performance of a river's salmon stock over the last 10 years (including the current year), in relation to its CL. The method calculates the probability that the conservation limit will be exceeded four years out of five. If there is a low probability (less than 5%) the river fails to comply. If the probability is high (more than 95%), the river complies in that year, whereas between these probability values we cannot be certain of the stock status. The new scheme also allows extrapolation beyond the current year in order to predict the likely future performance of the stock relative to its CL, and so assess the likely effect of recent management intervention and the need for additional measures.

CLs and management targets form only one part of the assessment of the status of a stock, and management decisions are never based simply on a compliance result alone. Because stocks are naturally variable, the fact that a stock is currently exceeding its CL does not mean that there will be no need for any management action. Similarly, the fact that a stock may fall below its CL for a small proportion of the time may not mean there is a problem. Thus, a range of other factors are taken into account, particularly the structure of the stock and any evidence concerning the status of particular stock components, such as tributary populations or age groups, based for example on patterns of run timing and the production of juveniles in the river sub-catchments.

2.7 Compilation of tag releases and fin clip data by ICES member countries in 2005

Data on releases of tagged, fin-clipped and otherwise marked salmon in 2005 were provided by the Working Group and are compiled as a separate report. In summary (see Table 2.7.1), about 5.64 million salmon were marked in 2005, an increase from the 4.95 million fish marked in 2004. The adipose clip was the most used primary mark (4.13 million), with microtags (0.88 million) the next most common primary mark. Most marks were applied to hatchery-origin juveniles (5.52 million), while 101 035 wild juveniles and 16 407 adults were marked. The use of PIT (Passive Integrated Transponder) tags for marking Atlantic salmon has increased in the later years and are now listed in a separated column in Table 2.7.1. In 2005 14 637 PIT tagged salmon were reported. The Working Group also reports information on various other types of tags including Data Storage Tags (DSTs), radio and/or sonic transmitting tags (pingers).

From 2003, the Working Group has recorded information on marks being applied to farmed salmon. These may help trace the origin of farmed salmon captured in the wild in the case of escape events. At this time, two jurisdictions (USA-Maine, and Iceland) require that some or all of the sea-cage farmed fish reared in their area be marked. In Maine, some firms have opted for a genetic “marking” procedure. The broodstock of these firms has been screened with molecular genetic techniques, which makes it feasible to trace an escaped farmed salmon back to its hatchery of origin through analysis of its DNA. One company has applied ventral fin clip, but has not reported numbers for reasons of commercial confidentiality. In Iceland, coded wire tags are being applied to about 10% of sea-cage farm production. The Icelandic data are included in the separate report mentioned above, but the USA numbers are not included.

2.8 Analysis of historic tagging data

Recently, there has been major focus on research on salmon at sea, but such research is labour intensive and expensive. Most countries in the North Atlantic have tagged a large number of salmon at different life stages, but many of these data have not been properly analysed and published. It is anticipated that a more thorough analysis of the data would improve and enhance the information on salmon at sea.

A substantial amount of data on tagged salmon is available in the different laboratories. A provisional survey revealed that almost 7000 salmon tagged as smolts in home rivers have been recovered at Greenland and in the Norwegian Sea/Faroes. In addition over 800 adult salmon have been recovered from tagging experiments at Greenland and in the Norwegian Sea/Faroes. Important information on oceanic migration routes of Southern European salmon returning to home water is available for many countries, particularly from tag recoveries around the Irish coast which includes 1600 recoveries of UK (England and Wales) coded wire tags, 600 tag recoveries of UK (Scotland) origin, 100 from Spain, 80 from France, 76 from Denmark, 8 from Germany, 2 from Norway and 1 from Faroes, since the mid-1980’s. Other countries will have similar tag recovery information that should also be considered.

Some of the tagging information has been published in the scientific literature and there is also available information in older salmon Working Group reports and other “grey” literature. However, the advanced computer technology and software now available will allow much more comprehensive analyses to be carried out.

The Working Group believes that analysis of this material will generate new information on the marine life history of salmon, for example distribution of different stocks in time and space, migratory routes, migration speed and marine growth. With reports of tagged fish a scale sample is often provided, and may give potential for investigation of scale microchemistry (e.g. trace elements/stable isotopes and genetic analyses). Some of the time series may also help to examine if salmon behaviour and life history have changed over time.

The Working Group recommends that a workshop be held on the development and use of old tagging information from oceanic areas.

The terms of reference for the Group might include:

- Review published information including the grey literature.
- Presentation and evaluation of data (quantity and quality) available from different countries.
- Compilation of an inventory of available databases, and evaluation of metadata for georeferencing.
- Develop testable hypotheses.
- Explain how the material can be used to test the hypotheses.

Table 2.1.1.1. Nominal catch of salmon by country (in tonnes round fresh weight), 1960–2005. (2005 figures include provisional data).

Year	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Den.	Finland	Ireland (4,5)	UK (E & W)	UK (N.Irl.) (5,6)	UK (Scotl.)	France (7)	Spain (8,9)	Faroes (10)	East Grld.	West Grld. (11)	Other (12)	Reported Nominal Catch	NASCO Areas	International waters (13)
1960	1,636	1	-	1,659	1,100	100		40	-	-	743	283	139	1,443	-	33	-	-	60	-	7,237	-	-
1961	1,583	1	-	1,533	790	127		27	-	-	707	232	132	1,185	-	20	-	-	127	-	6,464	-	-
1962	1,719	1	-	1,935	710	125		45	-	-	1,459	318	356	1,738	-	23	-	-	244	-	8,673	-	-
1963	1,861	1	-	1,786	480	145		23	-	-	1,458	325	306	1,725	-	28	-	-	466	-	8,604	-	-
1964	2,069	1	-	2,147	590	135		36	-	-	1,617	307	377	1,907	-	34	-	-	1,539	-	10,759	-	-
1965	2,116	1	-	2,000	590	133		40	-	-	1,457	320	281	1,593	-	42	-	-	861	-	9,434	-	-
1966	2,369	1	-	1,791	570	104	2	36	-	-	1,238	387	287	1,595	-	42	-	-	1,370	-	9,792	-	-
1967	2,863	1	-	1,980	883	144	2	25	-	-	1,463	420	449	2,117	-	43	-	-	1,601	-	11,991	-	-
1968	2,111	1	-	1,514	827	161	1	20	-	-	1,413	282	312	1,578	-	38	5	-	1,127	403	9,793	-	-
1969	2,202	1	-	1,383	360	131	2	22	-	-	1,730	377	267	1,955	-	54	7	-	2,210	893	11,594	-	-
1970	2,323	1	-	1,171	448	182	13	20	-	-	1,787	527	297	1,392	-	45	12	-	2,146	922	11,286	-	-
1971	1,992	1	-	1,207	417	196	8	18	-	-	1,639	426	234	1,421	-	16	-	-	2,689	471	10,735	-	-
1972	1,759	1	-	1,578	462	245	5	18	-	32	1,804	442	210	1,727	34	40	9	-	2,113	486	10,965	-	-
1973	2,434	3	-	1,726	772	148	8	23	-	50	1,930	450	182	2,006	12	24	28	-	2,341	533	12,670	-	-
1974	2,539	1	-	1,633	709	215	10	32	-	76	2,128	383	184	1,628	13	16	20	-	1,917	373	11,877	-	-
1975	2,485	2	-	1,537	811	145	21	26	-	76	2,216	447	164	1,621	25	27	28	-	2,030	475	12,136	-	-
1976	2,506	1	3	1,530	542	216	9	20	-	66	1,561	208	113	1,019	9	21	40	<1	1,175	289	9,327	-	-
1977	2,545	2	-	1,488	497	123	7	10	-	59	1,372	345	110	1,160	19	19	40	6	1,420	192	9,414	-	-
1978	1,545	4	-	1,050	476	285	6	10	-	37	1,230	349	148	1,323	20	32	37	8	984	138	7,682	-	-
1979	1,287	3	-	1,831	455	219	6	12	-	26	1,097	261	99	1,076	10	29	119	<0,5	1,395	193	8,118	-	-
1980	2,680	6	-	1,830	664	241	8	17	-	34	947	360	122	1,134	30	47	536	<0,5	1,194	277	10,127	-	-
1981	2,437	6	-	1,656	463	147	16	26	-	44	685	493	101	1,233	20	25	1,025	<0,5	1,264	313	9,954	-	-
1982	1,798	6	-	1,348	364	130	17	25	-	54	993	286	132	1,092	20	10	606	<0,5	1,077	437	8,395	-	-
1983	1,424	1	3	1,550	507	166	32	28	-	58	1,656	429	187	1,221	16	23	678	<0,5	310	466	8,755	-	-
1984	1,112	2	3	1,623	593	139	20	40	-	46	829	345	78	1,013	25	18	628	<0,5	297	101	6,912	-	-
1985	1,133	2	3	1,561	659	162	55	45	-	49	1,595	361	98	913	22	13	566	7	864	-	8,108	-	-
1986	1,559	2	3	1,598	608	232	59	54	-	37	1,730	430	109	1,271	28	27	530	19	960	-	9,255	315	-
1987	1,784	1	2	1,385	564	181	40	47	-	49	1,239	302	56	922	27	18	576	<0,5	966	-	8,159	2,788	-
1988	1,310	1	2	1,076	420	217	180	40	-	36	1,874	395	114	882	32	18	243	4	893	-	7,737	3,248	-
1989	1,139	2	2	905	364	141	136	29	-	52	1,079	296	142	895	14	7	364	-	337	-	5,904	2,277	-
1990	911	2	2	930	313	146	280	33	13	60	567	338	94	624	15	7	315	-	274	-	4,924	1,890	180-350

Table 2.1.1.1. continued

	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
Year	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Den.	Finland	Ireland (4,5)	UK (E & W)	UK (N.Irl.) (5,6)	UK (Scotl.)	France (7)	Spain (8,9)	Faroes (10)	East Grld.	West Grld. (11)	Other (12)	Reported Nominal Catch	NASCO Areas	International waters (13)
1991	711	1	1	876	215	130	345	38	3	70	404	200	55	462	13	11	95	4	472	-	4,106	1,682	25-100
1992	522	1	2	867	167	175	461	49	10	77	630	171	91	600	20	11	23	5	237	-	4,119	1,962	25-100
1993	373	1	3	923	139	160	496	56	9	70	541	248	83	547	16	8	23	-	-	-	3,696	1,644	25-100
1994	355	0	3	996	141	141	308	44	6	49	804	324	91	649	18	10	6	-	-	-	3,945	1,276	25-100
1995	260	0	1	839	128	150	298	37	3	48	790	295	83	588	10	9	5	2	83	-	3,629	1,060	-
1996	292	0	2	787	131	122	239	33	2	44	685	183	77	427	13	7	-	0	92	-	3,135	1,123	-
1997	229	0	2	630	111	106	50	19	1	45	570	142	93	296	8	3	-	1	58	-	2,364	827	-
1998	157	0	2	740	131	130	34	15	1	48	624	123	78	283	8	4	6	0	11	-	2,396	1,210	-
1999	152	0	2	811	103	120	26	16	1	62	515	150	53	199	11	6	0	0	19	-	2,246	1,032	-
2000	153	0	2	1,176	124	83	2	33	5	95	621	219	78	274	11	7	8	0	21	-	2,913	1,269	-
2001	148	0	2	1,267	114	88	0	33	6	126	730	184	53	251	11	13	0	0	43	-	3,069	1,180	-
2002	148	0	2	1,019	118	97	0	28	5	93	682	161	81	191	11	9	0	0	9	-	2,654	1,039	-
2003	141	0	3	1,071	107	110	0	25	4	78	551	89	56	192	13	7	0	0	9	-	2,456	847	-
2004	161	0	3	784	82	130	0	19	4	39	489	111	48	245	19	7	0	0	15	-	2,156	686	-
2005	129	0	3	888	82	149	0	15	5	47	428	94	45	191	11	9	0	0	14	-	2,110	717	-
Average																							
2000-2004	150	0	2	1,063	109	102	0	28	5	86	615	153	63	231	13	9	2	0	19	-	2,649	1,004	-
1995-2004	184	0	2	912	115	114	65	26	3	68	626	166	70	295	12	7	2	0	36	-	2,702	1,027	-

Key:

1. Includes estimates of some local sales, and, prior to 1984, by-catch.
2. Before 1966, sea trout and sea charr included (5% of total).
3. Figures from 1991 to 2000 do not include catches taken in the recently developed recreational (rod) fishery.
4. From 1994, includes increased reporting of rod catches.
5. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
6. Includes angling catch from 2002.
7. Data for France include some unreported catches.
8. Weights estimated from mean weight of fish caught in Asturias (80-90% of Spanish catch).
9. Catch data for 2005 not available at time of meeting; catch estimated as mean of previous 5 years.
10. Between 1991 & 1999, there was only a research fishery at Faroes. In 1997 & 1999 no fishery took place; the commercial fishery resumed in 2000, but has not operated since 2001.
11. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.
12. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
13. Estimates refer to season ending in given year.

Table 2.1.1.2. Nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2005. (2005 figures include provisional data). S = Salmon (2SW or MSW fish). G = Grilse (1SW fish). Sm = small. Lg = large; for definitions, see Section 4.1. T = S + G or Lg + Sm.

	NAC Area				NEAC (N. Area)											NEAC (S. Area)										
Year	Canada (1)			USA	Norway (2)			Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK(N.I.) (4,6)	UK(Scotland)			France	Spain (7,8)	Total
	Lg	Sm	T	T	S	G	T	T	T	T	T	T	S	G	T	S	G	T	T	T	S	G	T	T	T	T
1960	-	-	1,636	1	-	-	1,659	1,100	100	-	40	-	-	-	-	-	-	743	283	139	971	472	1,443	-	33	7,177
1961	-	-	1,583	1	-	-	1,533	790	127	-	27	-	-	-	-	-	-	707	232	132	811	374	1,185	-	20	6,337
1962	-	-	1,719	1	-	-	1,935	710	125	-	45	-	-	-	-	-	-	1,459	318	356	1,014	724	1,738	-	23	8,429
1963	-	-	1,861	1	-	-	1,786	480	145	-	23	-	-	-	-	-	-	1,458	325	306	1,308	417	1,725	-	28	8,138
1964	-	-	2,069	1	-	-	2,147	590	135	-	36	-	-	-	-	-	-	1,617	307	377	1,210	697	1,907	-	34	9,220
1965	-	-	2,116	1	-	-	2,000	590	133	-	40	-	-	-	-	-	-	1,457	320	281	1,043	550	1,593	-	42	8,573
1966	-	-	2,369	1	-	-	1,791	570	104	2	36	-	-	-	-	-	-	1,238	387	287	1,049	546	1,595	-	42	8,422
1967	-	-	2,863	1	-	-	1,980	883	144	2	25	-	-	-	-	-	-	1,463	420	449	1,233	884	2,117	-	43	10,390
1968	-	-	2,111	1	-	-	1,514	827	161	1	20	-	-	-	-	-	-	1,413	282	312	1,021	557	1,578	-	38	8,258
1969	-	-	2,202	1	801	582	1,383	360	131	2	22	-	-	-	-	-	-	1,730	377	267	997	958	1,955	-	54	8,484
1970	1,562	761	2,323	1	815	356	1,171	448	182	13	20	-	-	-	-	-	-	1,787	527	297	775	617	1,392	-	45	8,206
1971	1,482	510	1,992	1	771	436	1,207	417	196	8	18	-	-	-	-	-	-	1,639	426	234	719	702	1,421	-	16	7,575
1972	1,201	558	1,759	1	1,064	514	1,578	462	245	5	18	-	-	-	32	200	1,604	1,804	442	210	1,013	714	1,727	34	40	8,357
1973	1,651	783	2,434	3	1,220	506	1,726	772	148	8	23	-	-	-	50	244	1,686	1,930	450	182	1,158	848	2,006	12	24	9,768
1974	1,589	950	2,539	1	1,149	484	1,633	709	215	10	32	-	-	-	76	170	1,958	2,128	383	184	912	716	1,628	13	16	9,567
1975	1,573	912	2,485	2	1,038	499	1,537	811	145	21	26	-	-	-	76	274	1,942	2,216	447	164	1,007	614	1,621	25	27	9,603
1976	1,721	785	2,506	1	1,063	467	1,530	542	216	9	20	-	-	-	66	109	1,452	1,561	208	113	522	497	1,019	9	21	7,821
1977	1,883	662	2,545	2	1,018	470	1,488	497	123	7	10	-	-	-	59	145	1,227	1,372	345	110	639	521	1,160	19	19	7,756
1978	1,225	320	1,545	4	668	382	1,050	476	285	6	10	-	-	-	37	147	1,082	1,229	349	148	781	542	1,323	20	32	6,514
1979	705	582	1,287	3	1,150	681	1,831	455	219	6	12	-	-	-	26	105	922	1,027	261	99	598	478	1,076	10	29	6,341
1980	1,763	917	2,680	6	1,352	478	1,830	664	241	8	17	-	-	-	34	202	745	947	360	122	851	283	1,134	30	47	8,120
1981	1,619	818	2,437	6	1,189	467	1,656	463	147	16	26	-	-	-	44	164	521	685	493	101	844	389	1,233	20	25	7,352
1982	1,082	716	1,798	6	985	363	1,348	364	130	17	25	-	49	5	54	63	930	993	286	132	596	496	1,092	20	10	6,275
1983	911	513	1,424	1	957	593	1,550	507	166	32	28	-	51	7	58	150	1,506	1,656	429	187	672	549	1,221	16	23	7,298
1984	645	467	1,112	2	995	628	1,623	593	139	20	40	-	37	9	46	101	728	829	345	78	504	509	1,013	25	18	5,883
1985	540	593	1,133	2	923	638	1,561	659	162	55	45	-	38	11	49	100	1,495	1,595	361	98	514	399	913	22	13	6,668
1986	779	780	1,559	2	1,042	556	1,598	608	232	59	54	-	25	12	37	136	1,594	1,730	430	109	745	526	1,271	28	27	7,744
1987	951	833	1,784	1	894	491	1,385	564	181	40	47	-	34	15	49	127	1,112	1,239	302	56	503	419	922	27	18	6,615
1988	633	677	1,310	1	656	420	1,076	420	217	180	40	-	27	9	36	141	1,733	1,874	395	114	501	381	882	32	18	6,595
1989	590	549	1,139	2	469	436	905	364	141	136	29	-	33	19	52	132	947	1,079	296	142	464	431	895	14	7	5,201
1990	486	425	911	2	545	385	930	313	146	280	33	13	41	19	60	-	-	567	338	94	423	201	624	15	7	4,333
1991	370	341	711	1	535	342	876	215	130	345	38	3	53	17	70	-	-	404	200	55	285	177	462	13	11	3,534
1992	323	199	522	1	566	301	867	167	175	461	49	10	49	28	77	-	-	630	171	91	361	238	599	20	11	3,851
1993	214	159	373	1	611	312	923	139	160	496	56	9	53	17	70	-	-	541	248	83	320	227	547	16	8	3,670
1994	216	139	355	0	581	415	996	141	141	308	44	6	38	11	49	-	-	804	324	91	400	248	648	18	10	3,935
1995	153	107	260	0	590	249	839	128	150	298	37	3	37	11	48	-	-	790	295	83	364	224	588	10	9	3,538
1996	154	138	292	0	571	215	787	131	122	239	33	2	24	20	44	-	-	685	183	77	267	160	427	13	7	3,042
1997	126	103	229	0	389	241	630	111	106	50	19	1	30	15	45	-	-	570	142	93	182	114	296	8	3	2,303
1998	70	87	157	0	445	296	740	131	130	34	15	1	29	19	48	-	-	624	123	78	162	121	283	8	4	2,376
1999	64	88	152	0	493	318	811	103	120	26	16	1	29	33	62	-	-	515	150	53	142	57	199	11	6	2,225
2000	58	95	153	0	673	504	1,176	124	83	2	33	5	56	39	95	-	-	621	219	78	160	114	274	11	7	2,881
2001	61	86	148	0	850	417	1,267	114	88	0	33	6	105	21	126	-	-	730	184	53	150	101	251	11	13	3,024
2002	49	99	148	0	770	249	1,019	118	97	0	28	5	81	12	93	-	-	682	161	81	118	73	191	11	9	2,643
2003	60	81	141	0	708	363	1,071	107	110	0	25	4	63	15	78	-	-	551	89	56	122	70	192	13	7	2,444
2004	68	94	161	0	577	207	784	82	130	0	19	4	32	7	39	-	-	489	111	48	158	87	245	19	7	2,138
2005	73	56	129	0	581	307	888	82	149	0	15	5	31	16	47	-	-	428	94	45	115	76	191	11	9	2,093
Average																										
2000-2004	59	91	150	0	716	348	1063	109	102	0	28	5	67	19	86	-	-	615	153	63	142	89	231	13	9	2626
1995-2004	86	98	184	0	607	306	912	115	114	65	26	3	49	19	68	-	-	626	166	70	183	112	295	12	7	2661

1. Includes estimates of some local sales, and, prior to 1984, by-catch.
2. Before 1966, sea trout and sea charr included (5% of total).
3. Figures from 1991 to 2000 do not include catches of the recently developed recreational (rod) fishery.
4. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
5. From 1994, includes increased reporting of rod catches.
6. Not including angling catch (mainly 1SW).
7. Weights estimated from mean weight of fish caught in Asturias (80-90% of Spanish catch).
8. Catch data for 2005 not available at time of meeting; catch estimated as mean of previous 5 years.

Table 2.1.2.1. Numbers of fish caught and released in rod fisheries along with the % of the total rod catch (released + retained) for countries in the North Atlantic where records are available, 1991–2005. Figures for 2005 are provisional.

Year	Canada		USA		Iceland		Russia		UK (E&W)		UK (Scotland)		Denmark	
	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch
1991	28,497	33	239	50			3,211	51						
1992	46,450	34	407	67			10,120	73						
1993	53,849	41	507	77			11,246	82	1,448	10				
1994	61,830	39	249	95			12,056	83	3,227	13	6,595	8		
1995	47,679	36	370	100			11,904	84	3,189	20	12,133	14		
1996	52,166	33	542	100	669	2	10,745	73	3,428	20	10,409	15		
1997	57,252	49	333	100	1,558	5	14,823	87	3,132	24	10,906	18		
1998	62,895	53	273	100	2,826	7	12,776	81	5,365	31	13,455	18		
1999	55,331	50	211	100	3,055	10	11,450	77	5,447	44	14,839	28		
2000	64,482	55	0	-	2,918	11	12,914	74	7,470	42	21,068	32		
2001	59,387	55	0	-	3,607	12	16,945	76	6,143	43	27,699	38		
2002	50,924	52	0	-	5,985	18	25,248	80	7,658	50	24,042	42		
2003	53,645	55	0	-	5,361	16	33,862	81	6,425	56	28,987	55		
2004	62,316	55	0	-	7,294	16	24,679	76	13,211	48	46,305	60	255	24
2005	45,886	55	0	-	9,150	17	23,592	87	10,737	55	37,836	56	606	37

Table 2.1.3.1. Estimates of unreported catches (tonnes round fresh weight) by various methods within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 1987–2005.

YEAR	NORTH-EAST ATLANTIC	NORTH-AMERICA	WEST GREENLAND	TOTAL
1987	2,554	234	-	2,788
1988	3,087	161	-	3,248
1989	2,103	174	-	2,277
1990	1,779	111	-	1,890
1991	1,555	127	-	1,682
1992	1,825	137	-	1,962
1993	1,471	161	< 12	1,644
1994	1,157	107	< 12	1,276
1995	942	98	20	1,060
1996	947	156	20	1,123
1997	732	90	5	827
1998	1,108	91	11	1,210
1999	887	133	12.5	1,032
2000	1,135	124	10	1,269
2001	1,089	81	10	1,180
2002	946	83	10	1,039
2003	719	118	10	847
2004	575	101	10	686
2005	606	101	10	717
Mean 2000-2004	893	101	10	1,004

Table 2.1.3.2. Estimates of unreported catches (tonnes round fresh weight) by various methods by country within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 2005.

Commission Area	Country	Unreported Catch (tonnes)	Unreported as % of Total North Atlantic Catch (Unreported + Reported)	Unreported as % of Total National Catch (Unreported + Reported
NEAC	Denmark	3	0.1	38
NEAC	Finland	10	0.4	18
NEAC	Iceland	3	0.1	2
NEAC	Ireland	43	1.5	9
NEAC	Norway	380	13.4	30
NEAC	Russia	103	3.6	56
NEAC	Sweden	2	0.1	12
NEAC	France	3	0.1	21
NEAC	UK (E & W)	29	1.0	24
NEAC	UK (N.Ireland)	2	0.1	5
NEAC	UK (Scotland)	28	1.0	13
NAC	Canada	101	3.6	44
NAC	USA	0	0.0	0
WGC	West Greenland	10	0.4	42
	Total Unreported Catch	717	25.4	
	Total Reported Catch of North Atlantic salmon	2,110		

Note: No unreported catch estimate for Spain & St. Pierre et Miquelon.

Table 2.2.1.1. Production of farmed Atlantic salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980-2005.

Year	North Atlantic Area										Outside the North Atlantic Area							World-wide
	Norway	UK (Scot.)	Faroes	Canada	Ireland	USA	Iceland	UK (N.Ire.)	Russia	Total	Chile	West Coast USA	West Coast Canada	Australia	Turkey	Other	Total	Total
1980	4,153	598	0	11	21	0	0	0	0	4,783	0	0	0	0	0	0	0	4,783
1981	8,422	1,133	0	21	35	0	0	0	0	9,611	0	0	0	0	0	0	0	9,611
1982	10,266	2,152	70	38	100	0	0	0	0	12,626	0	0	0	0	0	0	0	12,626
1983	17,000	2,536	110	69	257	0	0	0	0	19,972	0	0	0	0	0	0	0	19,972
1984	22,300	3,912	120	227	385	0	0	0	0	26,944	0	0	0	0	0	0	0	26,944
1985	28,655	6,921	470	359	700	0	91	0	0	37,196	0	0	0	0	0	0	0	37,196
1986	45,675	10,337	1,370	672	1,215	0	123	0	0	59,392	0	0	0	20	0	0	0	59,392
1987	47,417	12,721	3,530	1,334	2,232	365	490	0	0	68,089	3	0	0	50	0	0	53	68,142
1988	80,371	17,951	3,300	3,542	4,700	455	1,053	0	0	111,372	174	0	0	250	0	0	424	111,796
1989	124,000	28,553	8,000	5,865	5,063	905	1,480	0	0	173,866	1,864	1,100	1,000	400	0	700	5,064	178,930
1990	165,000	32,351	13,000	7,810	5,983	2,086	2,800	<100	5	229,035	9,500	700	1,700	1,700	0	800	14,400	243,435
1991	155,000	40,593	15,000	9,395	9,483	4,560	2,680	100	0	236,811	14,991	2,000	3,500	2,700	0	1,400	24,591	261,402
1992	140,000	36,101	17,000	10,380	9,231	5,850	2,100	200	0	220,862	23,769	4,900	6,600	2,500	0	400	38,169	259,031
1993	170,000	48,691	16,000	11,115	12,366	6,755	2,348	<100	0	267,275	29,248	4,200	12,000	4,500	1,000	400	51,348	318,623
1994	204,686	64,066	14,789	12,441	11,616	6,130	2,588	<100	0	316,316	34,077	5,000	16,100	5,000	1,000	800	61,977	378,293
1995	261,522	70,060	9,000	12,550	11,811	10,020	2,880	259	0	378,102	41,093	5,000	16,000	6,000	1,000	0	69,093	447,195
1996	297,557	83,121	18,600	17,715	14,025	10,010	2,772	338	0	444,138	69,960	5,200	17,000	7,500	1,000	600	101,260	545,398
1997	332,581	99,197	22,205	19,354	14,025	13,222	2,554	225	0	503,363	87,700	6,000	28,751	9,000	1,000	900	133,351	636,714
1998	361,879	110,784	20,362	16,418	14,860	13,222	2,686	114	0	540,325	125,000	3,000	33,100	7,068	1,000	400	169,568	709,893
1999	425,154	126,686	37,000	23,370	18,000	12,246	2,900	234	0	645,590	150,000	5,000	38,800	9,195	0	500	203,495	849,085
2000	440,861	128,959	32,000	33,195	17,648	16,461	2,600	250	0	671,974	176,000	5,670	39,300	12,003	0	500	233,473	905,447
2001	436,103	138,519	46,014	37,606	23,312	13,202	2,645	250	0	697,651	200,000	5,443	58,000	13,815	0	500	277,758	975,409
2002	462,495	145,609	45,150	42,131	22,294	6,798	1,471	250	0	726,198	273,000	5,000	71,600	14,699	0	1,000	365,299	1,091,497
2003	509,544	176,596	52,526	39,760	16,500	6,007	3,710	250	298	805,191	261,000	4,000	55,600	13,324	0	1,000	334,924	1,140,115
2004	563,815	158,099	40,492	36,714	16,500	8,514	6,620	250	203	831,207	261,000	4,000	49,784	14,317	0	1,000	330,101	1,161,308
2005	563,815	136,056	18,962	37,386	16,500	5,263	6,200	250	179	784,611	405,200	4,000	50,000	16,827	0	1,000	477,027	1,261,638
Mean 2000-2004	482,564	149,556	43,236	37,881	19,251	10,196	3,409	250		746,444	234,200	4,823	54,857	13,632	0	800	308,311	1,054,755
% change on 2000-2004	+17	-9	-56	-1	-14	-48	+82	+0		+5	+73	-17	-9	+23		+25	+55	+20

Notes: **Data for 2005 are provisional for many countries.**

Where production figures were not available for 2005, values as in 2004 were assumed.

West Coast USA = Washington State.

West Coast Canada = British Columbia.

Australia = Tasmania.

Source of production figures for non-Atlantic areas: miscellaneous fishing publications & Government reports.

'Other' includes South Korea & China.

Table 2.4.1.1. Probabilistic-based Genetic Assignment model results of the 2000-2004 West Greenland Atlantic salmon fisheries. Reported and unreported catch were partitioned by continent (E-European origin and NA-North American origin) and country of origin (CAN-Canadian origin and USA- United States origin) for NA origin fish only.

2000			90% Confidence Interval	
Continent of Origin	Estimate	Percent	lower	upper
NA total	7,731	66.0%	7,657	7,808
E total	3,983	34.0%	3,906	4,057
Country of Origin				
CAN total	7,685	99.4%	7,527	7,793
USA total	46	0.6%	0	192
2001				
NA total	10,766	64.6%	10,673	10,859
E total	5,893	35.4%	5,798	5,985
CAN total	10,402	96.6%	10,046	10,691
USA total	364	3.4%	89	710
2002				
NA total	4,782	70.0%	4,728	4,837
E total	2,054	30.0%	1,999	2,107
CAN total	4,737	99.1%	4,631	4,817
USA total	45	0.9%	0	141
2003				
NA total	4,714	64.2%	4,657	4,771
E total	2,634	35.8%	2,577	2,691
CAN total	4,652	98.7%	4,561	4,732
USA total	62	1.3%	5	132
2004				
NA total	6,197	73.0%	6,138	6,257
E total	2,286	27.0%	2,226	2,345
CAN total	6,184	99.8%	6,111	6,251
USA total	12	0.2%	0	64

Table 2.4.3.1. PGA results of the 2004 Saint-Pierre et Miquelon fishery. Total catch was partitioned by continent of origin (E-European and NA-North American). All NA origin fish were then partitioned by country of origin (CAN- Canadian and USA- United States).

2004			90% Confidence Interval	
Continent of Origin	Estimate	Percent	lower	upper
NA total	1,235	100.0%	1,235	1,235
E total	0	0%	0	0
Country of Origin				
CAN total	1,212	98.1%	1,158	1,235
USA total	23	1.9%	0	77

Table 2.7.1. Summary of Atlantic salmon tagged and marked in 2005 – 'Hatchery' and 'Wild' refer to smolts and parr; ''Adults' relates to both wild and hatchery-origin fish.

		Primary Tag or Mark				
Country	Origin	Microtag	External mark	Adipose clip	Pit tag	Total
Belgium	Hatchery	15,481	0	5,599	0	21,080
	Wild	0	0	0	0	0
	Adult	0	0	0	0	0
	Total	15,481	0	5,599	0	21,080
Canada	Hatchery	0	2,712	1,092,301	0	1,095,013
	Wild	0	22,199	8,760	0	30,959
	Adult	0	5,414	972	0	6,386
	Total	0	30,325	1,102,033	0	1,132,358
France	Hatchery	0	121,308	471,551	0	592,859
	Wild	0	10,387	698	3,655	14,740
	Adult	18	402	549	156	1,125
	Total	15	132,097	472,798	3,811	608,724
Germany	Hatchery	59,237	6,175	128,252	0	193,664
	Wild	0	0	0	0	0
	Adult	0	175	0	0	175
	Total	59,237	6,350	128,252	0	193,839
Iceland[1]	Hatchery	259,880	516	0	0	260,396
	Wild	3,386	0	0	0	3,386
	Adult	0	710	0	0	710
	Total	263,266	1,226	0	0	264,492
Ireland	Hatchery	333,575	0	0	0	333,575
	Wild	4,328	0	0	0	4,328
	Adult	0	0	0	0	0
	Total	337,903	0	0	0	337,903
Norway	Hatchery	48,399	0	0	0	48,399
	Wild	3,347	0	0	0	3,347
	Adult	0	0	0	0	0
	Total	51,746	0	0	0	51,746
Russia	Hatchery	0	0	1,576,200	0	1,576,200
	Wild	0	0	0	0	0
	Adult	0	2,074	0	0	2,074
	Total	0	2,074	1,576,200	0	1,578,274
Spain	Hatchery	163,881	0	308,562	0	472,443
	Wild	0	0	0	0	0
	Adult	0	0	0	0	0
	Total	163,881	0	308,562	0	472,443
Sweden	Hatchery	0	2,659	192,658	0	195,317
	Wild	0	400	0	0	400
	Adult	0	0	0	0	0
	Total	0	3,059	192,658	0	195,717
UK (England & Wales)	Hatchery	69,034	0	119,314	0	188,348
	Wild	12,240	0	14,080	0	26,320
	Adult	0	1,792	0	0	1,792
	Total	81,274	1,792	133,394	0	216,460
UK (N. Ireland)	Hatchery	14,617	3,741	32,476	0	50,834
	Wild	2067	0	0	0	2,067
	Adult	0	0	0	0	0
	Total	16,684	3,741	32,476	0	52,901
UK (Scotland)[2]	Hatchery	4135	1,250	0	0	5,385
	Wild	5860	1193	450	7,472	14,975
	Adult	0	595	0	0	595
	Total	9,995	3,038	450	7,472	20,955
USA[3]	Hatchery	0	172,969	311,487	2,901	487,357
	Wild	0	60	0	453	513
	Adult	0	3,550	0	0	3,550
	Total	0	176,579	311,487	3,354	491,420
All Countries	Hatchery	893,521	305,155	4,104,549	2,901	5,520,870
	Wild	31,228	34,239	23,988	11,580	101,035
	Adult	18	14,537	1,521	156	16,407
	Total	924,767	353,931	4,130,058	14,637	5,638,312

[1] **The number of microtagged hatchery fish in Iceland includes 148,740 fish reared in sea-pens.**

[2] **PIT tagged juveniles in Scotland also adipose fin-clipped.**

[3] **Total numbers include internal tags.**

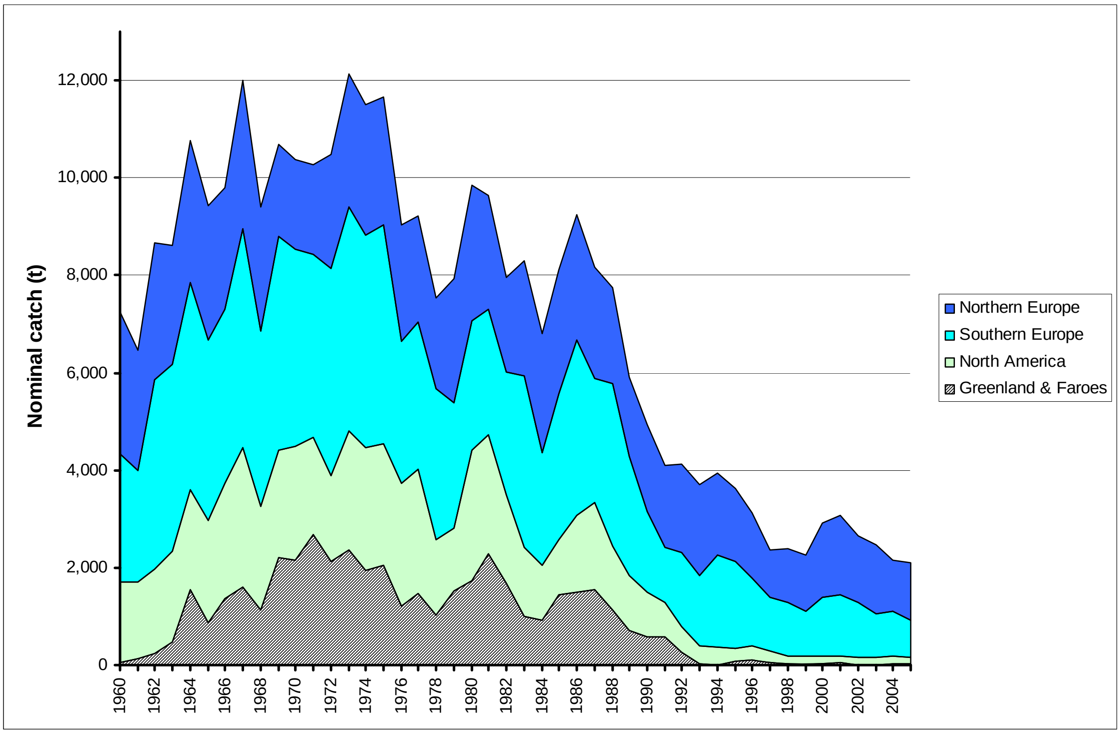


Figure 2.1.1.1. Nominal catches of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2005.

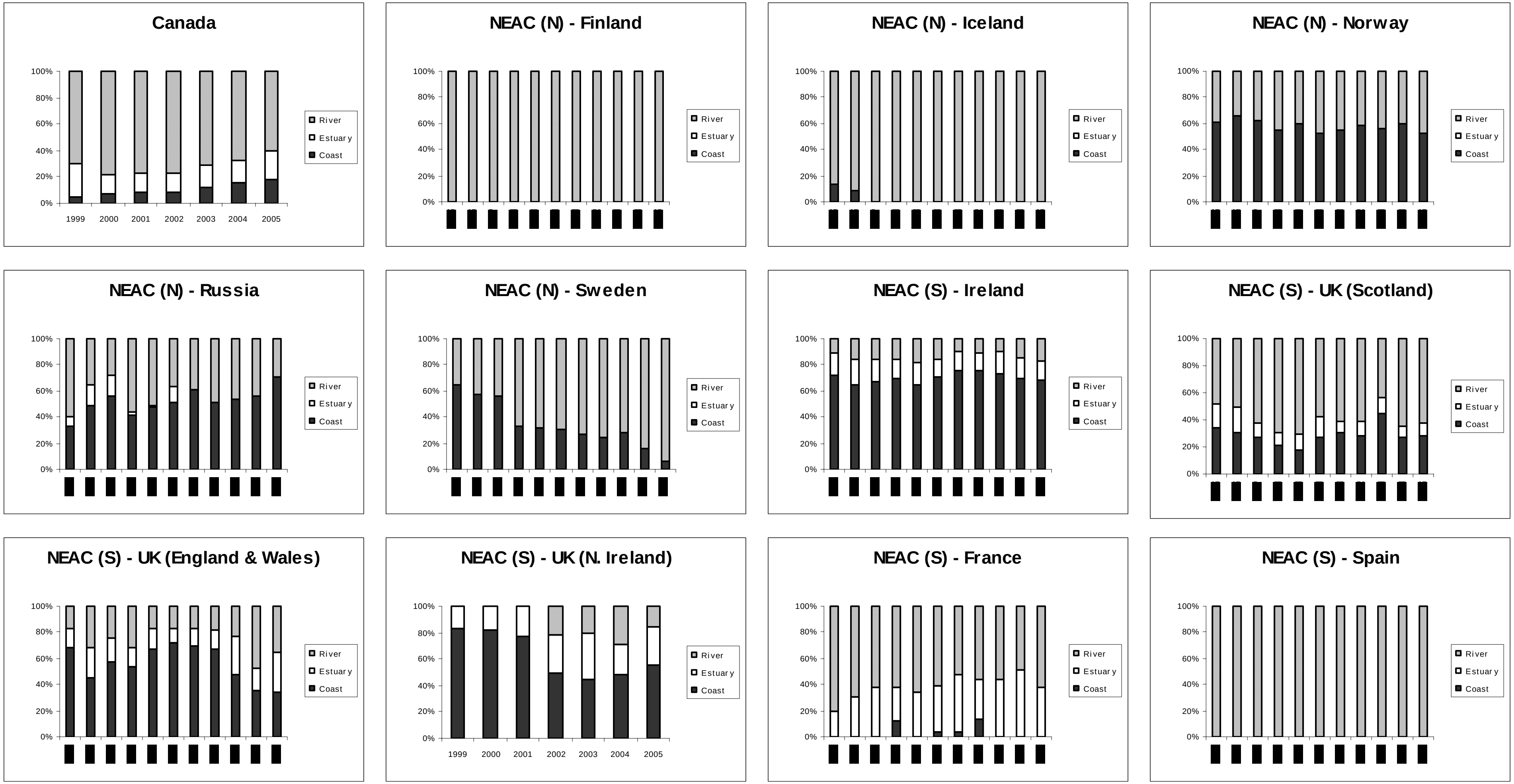


Figure 2.1.1.2. Percentage of nominal catch taken in coastal, estuarine and riverine fisheries by country for 1995–2005 (where available).

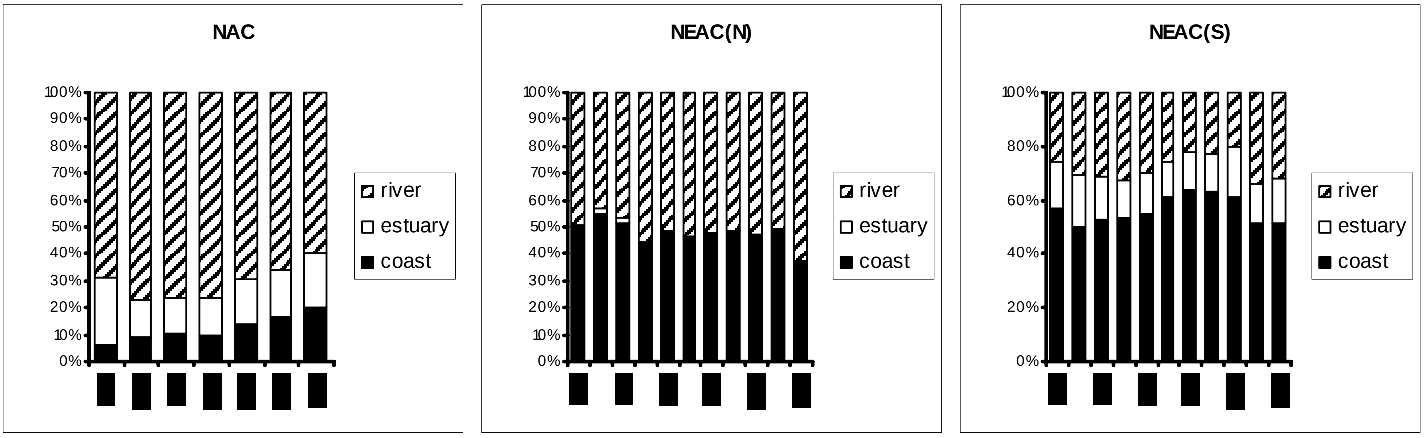


Figure 2.1.1.3. Percentages of nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area (1999–2005) and for the NEAC northern and southern areas (1995–2005).

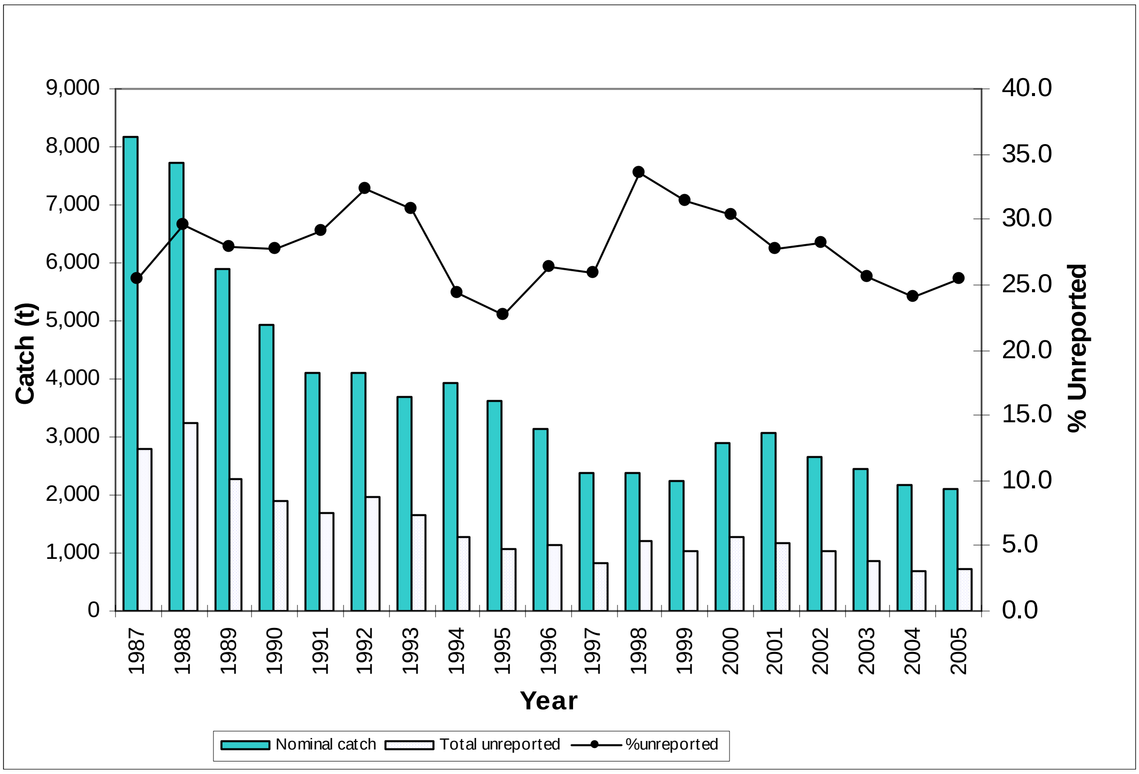


Figure 2.1.3.1. Nominal North Atlantic salmon catch, unreported catch and percentage unreported (expressed as % of total catch – nominal + unreported) in NASCO areas, 1987–2005.

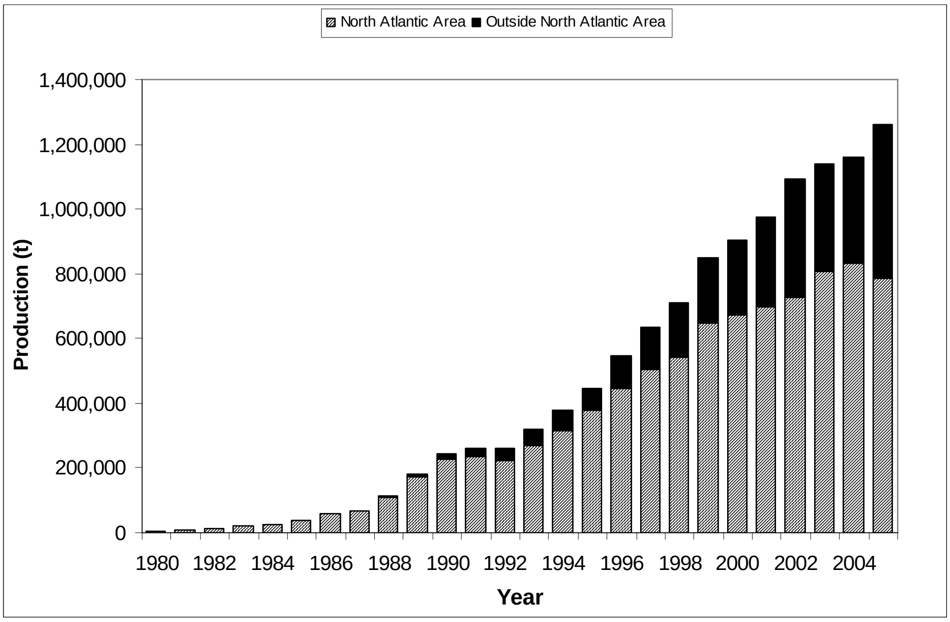


Figure 2.2.1.1. World-wide production of farmed Atlantic salmon, 1980–2005.

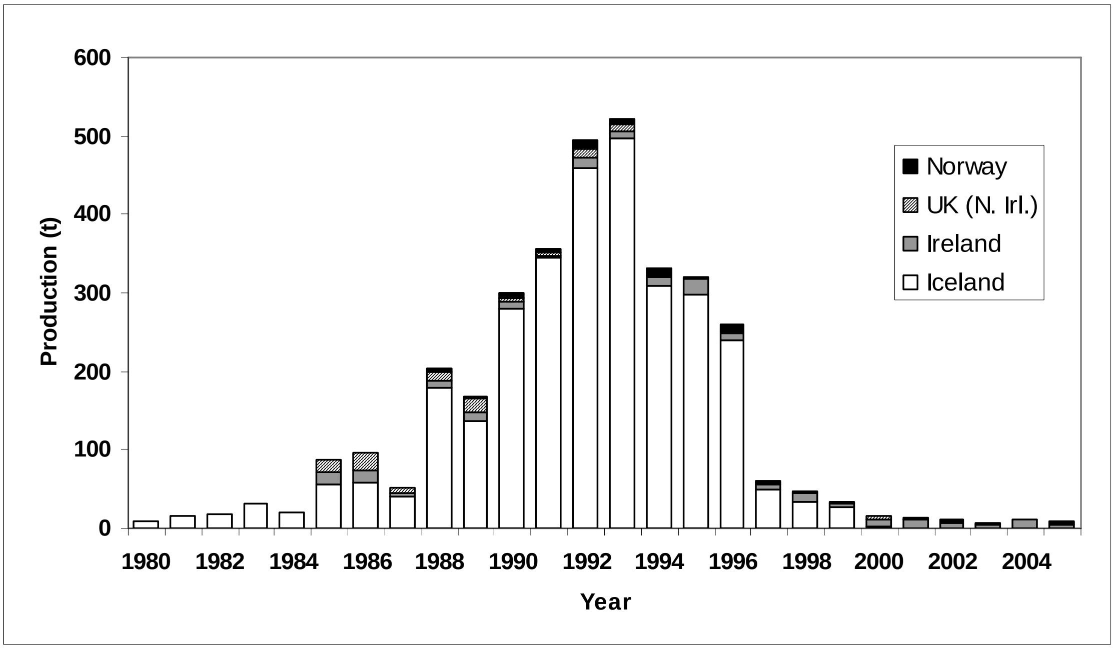


Figure 2.2.2.1. Production of ranched Atlantic salmon (tonnes round fresh weight) as harvested at ranching facilities in the North Atlantic, 1980–2005.

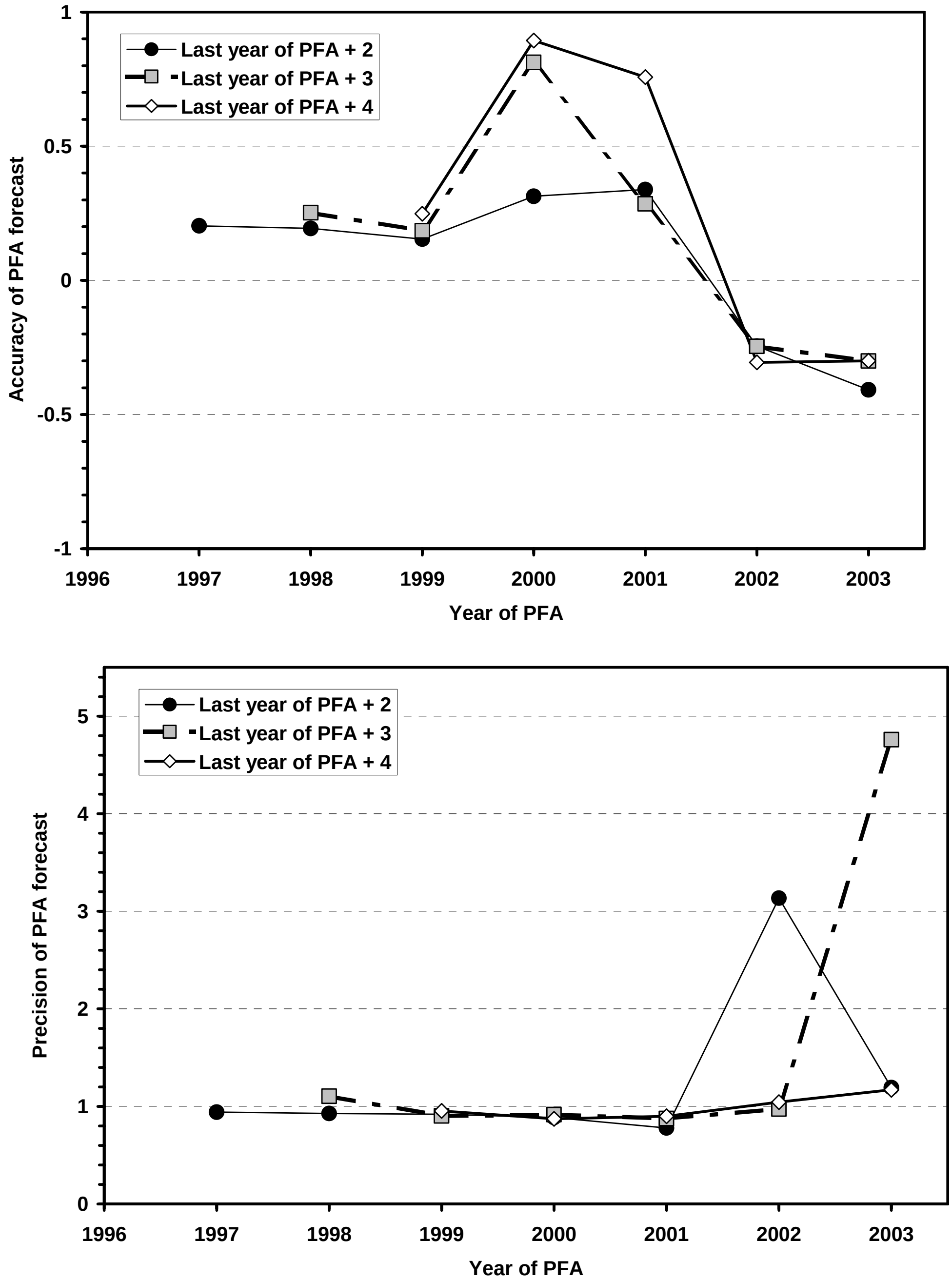


Figure 2.3.1.1. Accuracy (forecast minus observed over observed; upper panel) and precision (95% confidence interval width relative to median) of phase shift model forecast for 1997 to 2003 years of interest using data from 1978 to 1995 sequentially up to 2001.

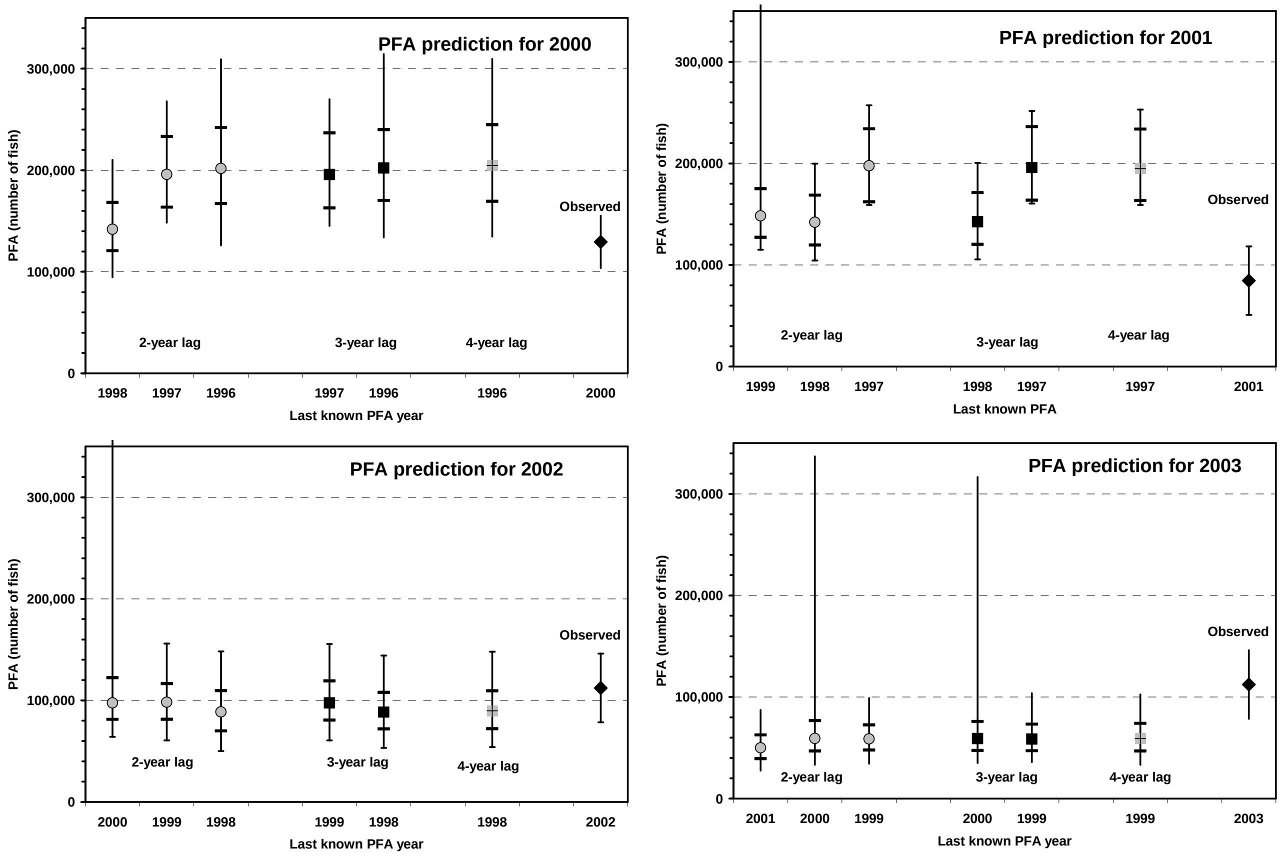


Figure 2.3.1.2. Retrospective analysis of multi-year forecasts for the 2000 to 2003 PFA based on using lags of 2, 3, and 4 years to assess probability of being in either a low or high phase.

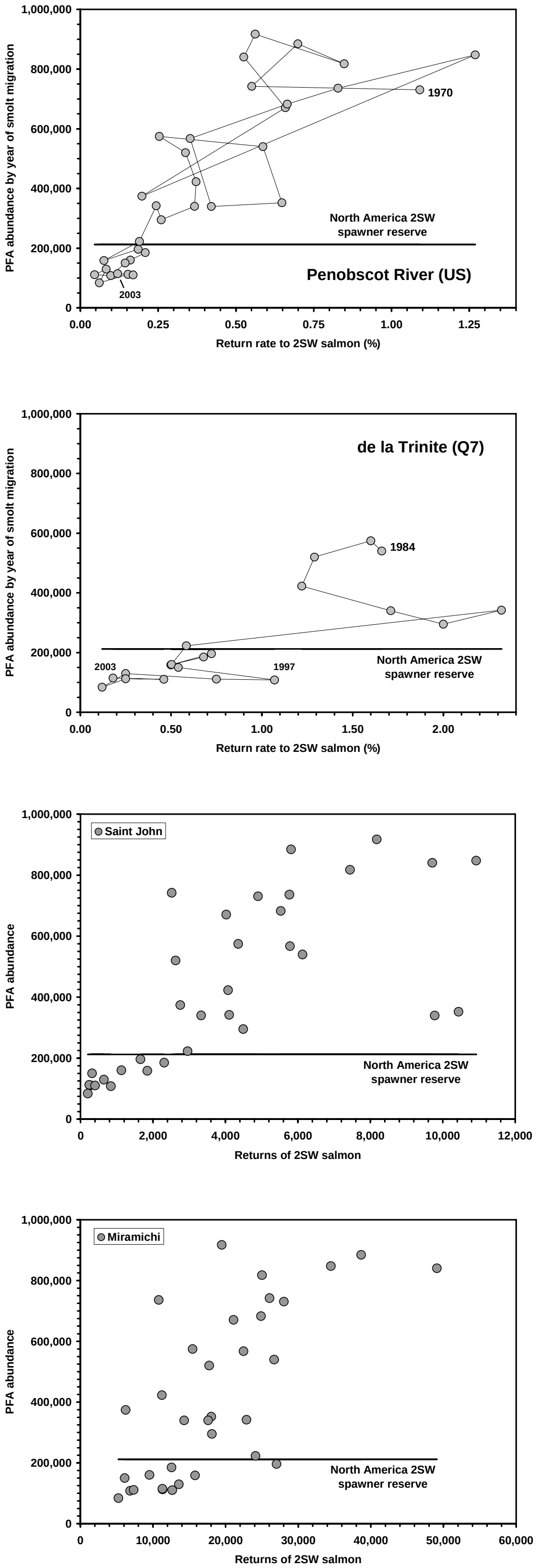


Figure 2.6.1. Examples of return rates to 2SW salmon of wild smolts relative to PFA relationships (upper panels) and 2SW wild salmon returns to PFA relationships (lower panels) available from North America.

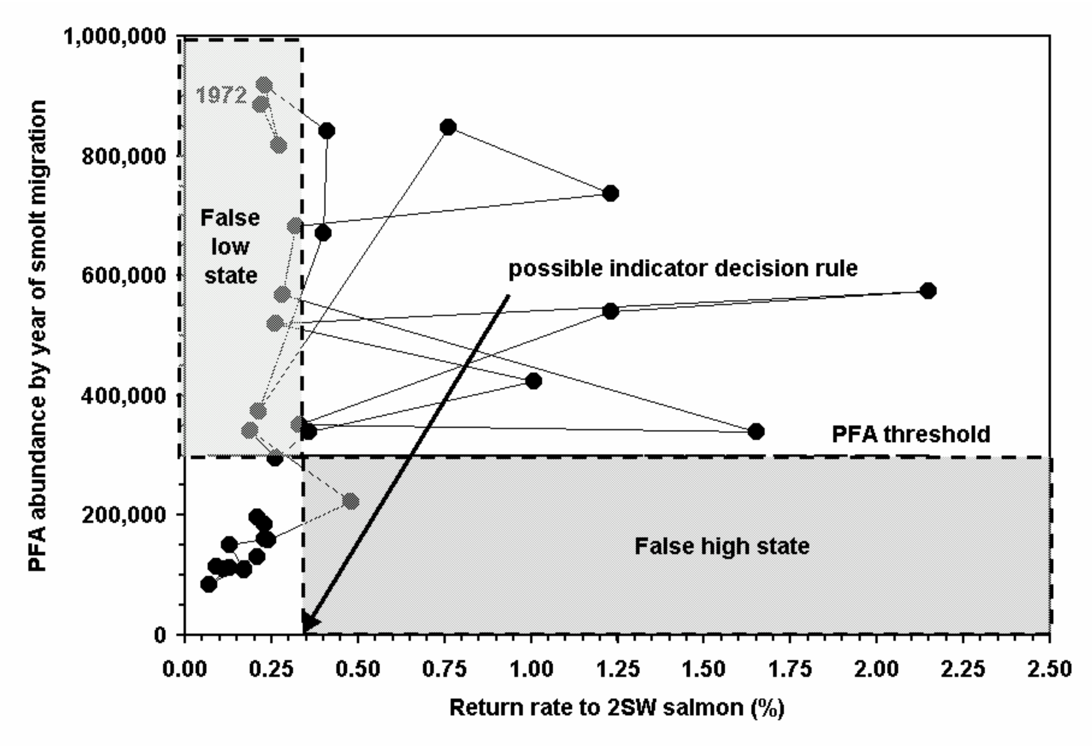


Figure 2.6.2. Illustration of PFA threshold, potential indicator decision rule, and false high state and false low state zones used to objectively define the indicator decision rule relative to a value function that penalizes wrong assignments of PFA state, i.e. observations in either the false high state or false low state quadrats.

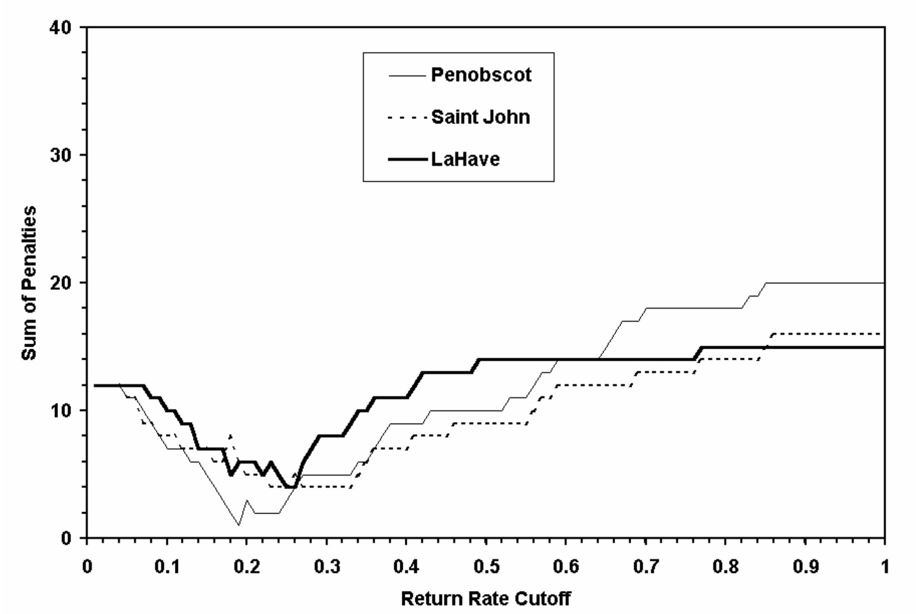


Figure 2.6.3. Penalty function results to define the decision rule for return rates of hatchery origin smolts to 2SW salmon for three rivers of North America. The penalty for a false high equals the penalty for a false low.

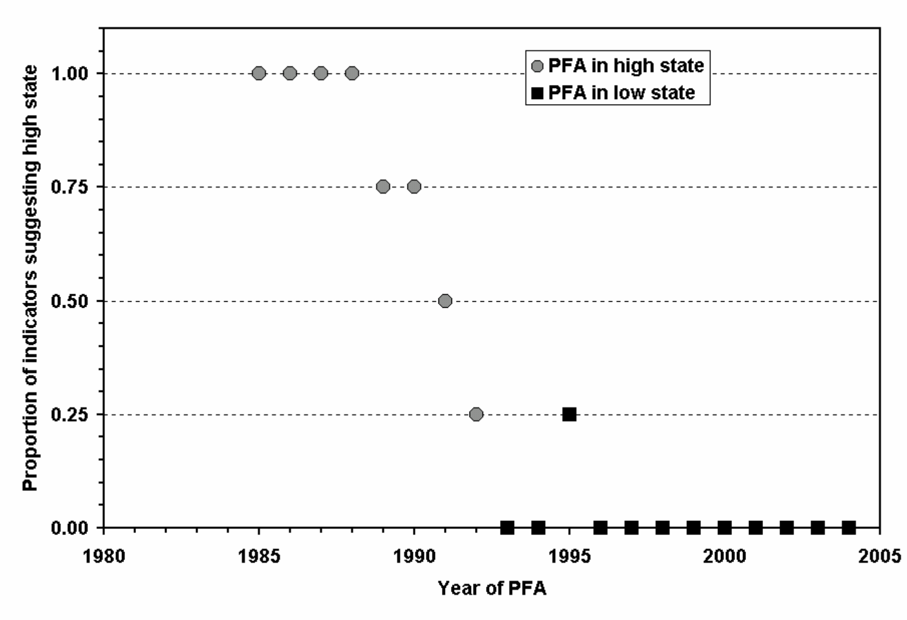


Figure 2.6.4. Assigning the state of PFA abundance for the years 1984–2004 using the return rates of 2SW salmon simultaneously for four stocks in North America.

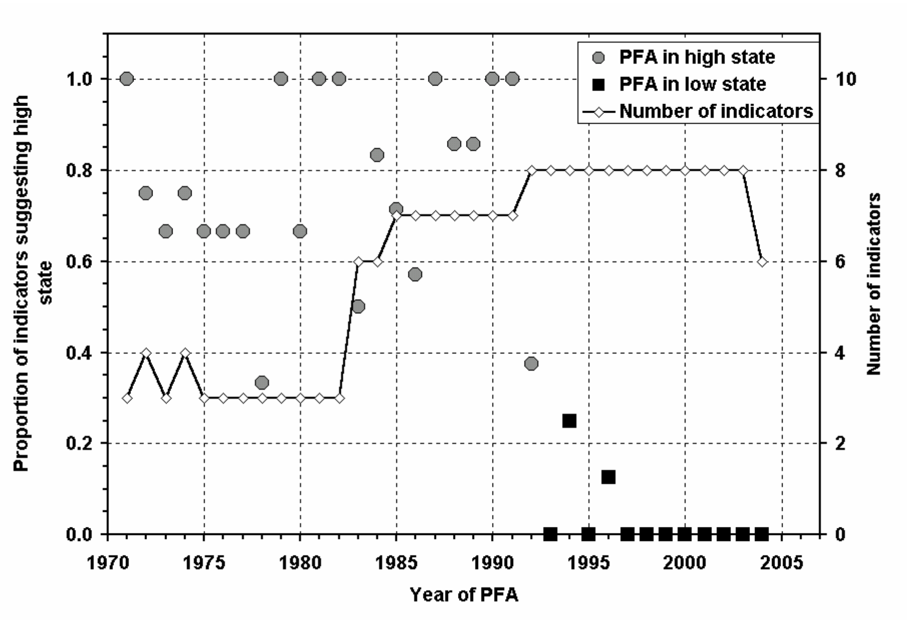


Figure 2.6.5. Assigning the state of PFA abundance for the years 1971–2004 using the returns of large / 2SW salmon simultaneously for three to eight monitored rivers in North America.

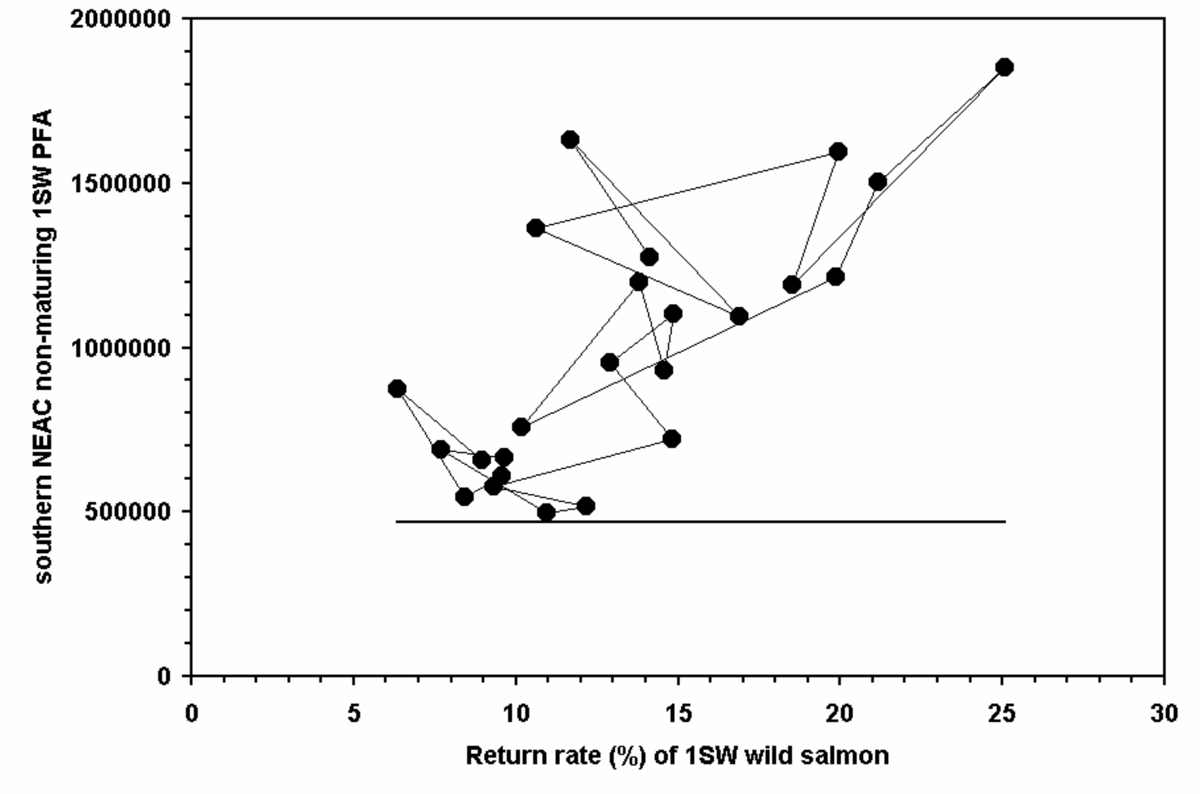


Figure 2.6.6. Example of the association between the return rate of wild smolts to 1SW salmon and the southern NEAC non-maturing 1SW PFA. The horizontal line is the spawner escapement reserve.

3 NORTH-EAST ATLANTIC COMMISSION

3.1 Status of stocks/exploitation

The status of stocks is considered with respect to the following guidance from ICES.

The interpretation of Conservation limits (CLs) has been defined by ICES as the level of stock that will achieve long term average maximum sustainable yield (MSY), as derived from the adult to adult stock and recruitment relationship. NASCO has adopted this definition of CLs (NASCO, 1998). The CL is a limit reference point (S_{lim}). However, management targets have not yet been defined for Atlantic salmon stocks. Therefore stocks in the NEAC Commission have been interpreted to be at full reproductive capacity only if the lower bound of the confidence interval of the most recent spawner estimate is above the CL.

The status of this stock complex with respect to conservation requirements is:

- Northern European 1SW stocks were above the Conservation limit (CL) in 2005. However, these stocks are considered to be at risk of suffering reduced reproductive capacity.
- Northern European MSW stocks were above the CL in 2005 (as they have been for the 5 previous years). However, these stocks are considered to be at risk of suffering reduced reproductive capacity.
- Southern European 1SW stocks were below the CL in 2005 (as they have been for the 3 previous years). These stocks are considered to be suffering reduced reproductive capacity.
- Southern European MSW stocks were below the CL in 2005. These stocks are considered to be suffering reduced reproductive capacity.

The status of stocks is shown in Figure 3.1.1 and is elaborated upon in Section 3.9.

3.2 Management objectives

Management objectives are outlined in section 1.4.

3.3 Reference points

Section 1.5 describes the derivation of reference points for these stocks and stock complexes.

3.3.1 Progress with setting river-specific conservation limits

Most NEAC countries have not developed river-specific conservation limits (CLs). In 2005, progress with setting river-specific CLs and associated compliance assessment was reported for Ireland, UK (Scotland) and UK (England & Wales).

In Ireland in 2004 and 2005, modifications were made to the conservation limits to allow for uncertainty in meeting the CL in each river simultaneously in each district. Harvest guidelines established in 2003 were also modified to reflect the changes in the derivation of the CLs and the catch advice.

In UK (Scotland) work has begun to develop a procedure for setting river specific CLs. Initial work has concentrated on developing a map based useable wetted area model for salmon, which can be readily applied to any catchment, regardless of physical size. This has been developed using GIS applications in conjunction with field based observation and literature review of salmon distribution in Scotland. The next stage of the project will investigate the transportability of a CL, derived from a monitored catchment, to other catchments by means of the useable wetted area model.

In UK (England & Wales), the CL for one river in the south west of the country (River Tamar) was revised following re-evaluation of the accessible wetted area and inclusion of river-specific data on fry and parr densities.

3.3.2 Description of the national conservation limits model

Relatively few river-specific conservation limits have been developed for salmon stocks in the NEAC area. An interim approach has therefore been developed for estimating national conservation limits for countries that cannot provide one based upon river-specific estimates. The approach is based on establishing pseudo-stock-recruitment relationships for national salmon stocks in the North East Atlantic Commission (NEAC) area (Potter *et al.*, 1998).

As described in 2002 (ICES, 2002), the model provides a means for relating estimates of the numbers of spawners and recruits derived from the PFA model. This is achieved by converting the numbers of 1SW and MSW spawners into numbers of eggs deposited, using the proportion of female fish in each age class and the average number of eggs produced per female. The egg deposition in year 'n' is assumed to contribute to the recruitment in years "n+3" to "n+8" in proportion to the numbers of smolts produced of ages 1 to 6 years. These proportions are then used to estimate the 'lagged egg deposition' contributing to the recruitment of maturing and non-maturing 1SW fish in the appropriate years. The plots of lagged eggs (stock) against the 1SW adults in the sea (recruits) have been presented as 'pseudo-stock-recruitment' relationships for each homewater country except for countries with river specific CLs (Figure 3.9.12.1a–j).

ICES and NASCO currently define the conservation limit for salmon as the stock size that will result in the maximum sustainable yield (MSY) in the long term (i.e. S_{lim}). However, it is not straightforward to estimate this point on the national stock-recruitment relationships because the replacement line (i.e. the line on which 'stock' equals 'recruits') is not known for the pseudo-stock-recruitment relationships established by the national model because the stock is expressed as eggs, while the recruits are expressed as adult salmon. In 2001 the Working Group adopted a method for setting biological reference points from "noisy" (uncertain) stock-recruitment relationships, such as provided by the national pseudo-stock-recruitment datasets (ICES, 2001). This model assumes that there is a critical stock level below which recruitment decreases linearly towards zero stock and recruitment, and above which recruitment is constant. The position of the critical stock level is determined by searching for the value that minimises the residual sum of squares. This point is a proxy for S_{lim} and is therefore defined as the conservation limit for salmon stocks. This approach was again applied to the 2005 national stock-recruitment relationship assessment for countries where no river-specific conservation limits have been determined.

3.3.3 National conservation limits

The national model has been run for all countries (Figures 3.9.12.1a–j). For Iceland, Russia, Norway, UK (Northern Ireland), and UK (Scotland) the input data for the PFA analysis (1971–2005) have been provided separately for more than one region. For these countries, the lagged spawner analysis has been conducted for each region separately and these data combined before conservation limits are estimated from the pseudo stock and recruitment relationship. The conservation limits derived from the national model are used for countries where no river-specific conservation limits have been developed. Where river-specific estimates have been derived (i.e. France, Ireland and UK (England & Wales)) they are used to provide national estimates. These values are shown in Table 3.3.3.1. The Working Group has previously noted that outputs from the national model are only designed to provide a provisional guide to the status of stocks in the NEAC area. It will also be noted that the conservation limit estimates may alter from year to year as the input of new data affects the results from the 'pseudo-stock-recruitment' analysis or river specific CLs are refined. This further emphasises the fact that this approach only provides a basis for qualitative catch options.

The estimated national conservation limits have been summed for Northern and Southern Europe (Table 3.3.3.1) and are given in Figure 3.1.1 for comparison with the estimated spawning escapement. The conservation limits have been calculated as 275 630 1SW spawners and 142 651 MSW spawners for the northern NEAC grouping, and 622 079 1SW spawners and 275 326 MSW spawners for the southern NEAC grouping. The conservation limits have also been used to estimate the spawner escapement reserves (SERs) (i.e. the CL increased to take account of natural mortality between the recruitment date (1st Jan) and return to home waters) for maturing and non-maturing 1SW salmon from the Northern and Southern Europe stock complexes. The SERs are shown as horizontal lines in Figure 3.1.1. The Working Group also considers the current SER levels may be less appropriate for evaluating the historic status of stocks (e.g. pre-1985), that in many cases have been estimated with less precision.

3.4 Catch Options

ICES use the catch advice presented in this section to determine whether or not stock complexes are at full reproductive capacity according to the NASCO management objectives.

The Working Group has been asked to provide catch options or alternative management advice, if possible based on a forecast of PFA, with an assessment of risks relative to the objective of exceeding stock conservation limits in the NEAC area. The Working Group reiterated its concerns about harvesting salmon in mixed stock fisheries, particularly for fisheries exploiting individual river stocks and sub-river populations that are suffering reduced reproductive capacity. Annual adjustments in quotas or effort regulations based on changes in the mean status of the stocks are unlikely to provide adequate protection to the individual river stocks that are most heavily exploited by the fishery or are in the weakest condition.

For all stock complexes, the Working Group considers that management of single stock fisheries should be based upon local assessments of the status of stocks. Conservation would be best achieved by fisheries in estuaries and rivers targeting stocks that have been shown to be above biologically-based escapement requirements.

The Working Group also emphasised that the national stock conservation limits discussed above are not appropriate for the management of homewater fisheries, particularly where these exploit separate river stocks. This is because of the relative imprecision of the national conservation limits and because they will not take account of differences in the status of different river stocks or sub-river populations. Nevertheless, the Working Group agreed that the combined conservation limits for the main stock groups (national stocks) exploited by the distant water fisheries could be used to provide general management advice to the distant water fisheries.

Due to the preliminary nature of the conservation limit estimates, the Working Group is unable to provide quantitative catch options for most stock complexes at this stage. Furthermore, to do so requires predictive estimates of PFA which have not yet been developed for all stock complexes. However, a quantitative prediction of PFA for Southern European MSW stocks is again provided. The Working Group considers that the following qualitative catch advice is appropriate based upon the PFA data and estimated SERs shown in Figure 3.1.1. In the evaluation of the status of stocks, PFA or recruitment values should be assessed against the spawner escapement reserve values while the spawner numbers should be compared with the conservation limits.

Based on recent work on resolving the most appropriate stock groupings for management advice for the distant water fisheries (ICES, 2002) the Working Group agreed that advice for the Faroes fishery (both 1SW and MSW) should be based upon all NEAC stocks. Advice for the West Greenland fishery should be based upon southern European MSW salmon stocks only (comprising UK, Ireland, France and Iceland (south/west)).

The interpretations presented below are based on the results presented in Figure 3.1.1.

3.4.1 Northern European 1SW stocks

- The PFA shows a downward trend but has been above the SER throughout the series indicating an exploitable surplus.
- The spawner mid-point has been close to or below the CL throughout most of the time series. In 2005, spawners were above the CL.
- However, consideration of the confidence limits around the spawner estimates indicates that this stock complex is currently **at risk of suffering reduced reproductive capacity**.
- The Working Group considers that the overall exploitation of the stock complex should decrease so that the conservation limit can be consistently met. In addition it should be noted that the inclusion of farmed fish in the Norwegian data would result in the stock status being overestimated. Since very few of these salmon have been caught outside homewater fisheries in Europe, even when fisheries were operating in the Norwegian Sea, management of maturing 1SW salmon should be based upon local assessments of the status of river or sub-river stocks. Thus, the only fisheries on maturing 1SW salmon should be on river stocks shown to be at full reproductive capacity.

3.4.2 Northern European MSW stocks

- The PFA shows a downward trend but has been above the SER throughout the series indicating an exploitable surplus.
- The spawner mid-point has been close to or below CL throughout most of the time series. In 2005, spawners were above the CL.
- However, consideration of the confidence limits around the spawner estimates indicates that this stock complex is **at risk of suffering reduced reproductive capacity**.
- The Working Group considers that the overall exploitation of the stock complex should decrease so that the conservation limit can be consistently met. In addition it should be noted that the inclusion of farmed fish in the Norwegian data would result in the stock status being overestimated. Since very few of these salmon have been caught outside homewater fisheries in Europe, even when fisheries were operating in the Norwegian Sea, management of non-maturing 1SW salmon should be based upon local assessments of the status of river or sub-river stocks. Thus, the only fisheries on non-maturing 1SW salmon should be on river stocks shown to be at full reproductive capacity.

3.4.3 Southern European 1SW stocks

- The PFA shows a downward trend but has been above the SER throughout the series indicating an exploitable surplus. This surplus has been extremely low in the latter part of the time series.
- The spawner mid-point has been close to or below CL throughout most of the time series. In 2005, spawners were marginally below the CL and thus this stock complex is **suffering reduced reproductive capacity**.
- As this stock complex, is suffering reduced reproductive capacity, the Working Group considers that reductions in exploitation are required for as many stocks as possible, to increase the probability of the complex meeting conservation limits. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status. Thus, the

only fisheries on maturing 1SW salmon should be on river stocks that are shown to be at full reproductive capacity.

3.4.4 Southern European MSW stocks

- The PFA shows a downward trend but has been above the SER throughout most of the series indicating an exploitable surplus. There has either been no surplus, or an extremely low surplus, in the latter part of the time series.
- The spawner mid-point has been close to or below CL throughout most of the time series. In 2005, spawners were below the CL and thus this stock complex is **suffering reduced reproductive capacity.**
- The quantitative forecast of PFA for 2006 (489 000) indicates that stock levels will remain close to current levels at least in the next year. The Working Group considers that reductions in exploitation are required for as many stocks as possible, to increase the probability of the complex meeting conservation limits. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status. As there is a less than 75% probability that the PFA forecast for 2006–2008 will be above the SER, there should be no fishing on this complex at either West Greenland or Faroes. The only fisheries on non-maturing 1SW salmon should be on river stocks that are shown to be at full reproductive capacity.

With catch options for three of the four stock groupings above still being provided on the basis of extrapolation from historical PFA data, the Working Group recommends that further progress be made with establishing PFA forecast methodologies. The forecast of PFA for non-maturing 1SW salmon in the Southern European stock complex is used to provide catch options for West Greenland and Faroes. Catch advice would also be significantly enhanced if conservation limits were more certain for national stocks.

3.5 Relevant factors to be considered in management

For all fisheries, the Working Group considers that management of single stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

3.5.1 Grouping of national stocks

National outputs of the NEAC PFA model are combined in the following groups to provide NASCO with catch advice or alternative management advice for the distant water fisheries at West Greenland and Faroes.

Southern European countries:	Northern European countries:
Ireland	Finland
France	Norway
UK (England & Wales)	Russia
UK (Northern Ireland)	Sweden
UK (Scotland)	Iceland (north/east regions)
Iceland (south/west regions)[1]	

1 The Iceland stock complex was spilt into two separate complexes for stock assessment purposes in 2005. Prior to 2005, all regions of Iceland were considered to contribute to the Northern European stock complex.

The groups were deemed appropriate by the Working Group as they fulfilled an agreed set of criteria for defining stock groups for the provision of management advice that were considered in detail at the 2002 meeting (ICES, 2002) and re-evaluated at the 2005 meeting (ICES, 2005). Consideration of the level of exploitation of national stocks at both the distant water fisheries resulted in the proposal that advice for the Faroes fishery (both 1SW and MSW) should be based upon all NEAC area stocks, but that advice for the West Greenland fishery should be based upon Southern European MSW salmon stocks only.

3.6 Pre-Fishery Abundance Forecast for 2006

The Working Group has previously considered the development of a model to forecast the pre-fishery abundance of PFA of non-maturing (potential MSW) salmon from the Southern European stock group (ICES, 2002, 2003).

The full model considered was:

$$PFA = Spawners^{\lambda} \times e^{\beta_0 + \beta_1 Habitat + \beta_2 \log(PFAm) + \beta_3 Year + noise}$$

where *Spawners* are expressed as lagged egg numbers, *PFAm* refers to pre-fishery abundance of maturing 1SW salmon and the habitat term is the same as that previously used in the North American model (ICES, 2003). The best model was selected by adding variables (eg. spawners, habitat, PFA of maturing 1SW salmon and year) until addition of any other parameter was not significant, as has been done in the past (ICES, 2004).

The same variables as last year were found to be significant, *Spawners* and *Year*. The model takes the form:

$\text{Log}(PFA/Spawners) = -1.307\log(Spawners) + 118.7 - 0.050 Year$

This is equivalent to:

$\text{PFA} = Spawners^{-0.307} \text{ x } e^{118.7-0.050 Year}$.

The model was fitted to data from 1978–2004 (Table 3.6.1.1) to predict PFA in the subsequent years 2005–2008. The forecast used for 2005 was 505 000, this updates the previously given forecast (Section 3.8). The forecasted values for 2006, 2007, and 2008 were 489 000, 461 000, and 440 000, respectively (Figure 3.6.1.1).

The predictions using this model and the 95% confidence intervals are given in Table 3.6.1.2. It should be noted that the confidence intervals are wide and this reflects the uncertainty around the point estimate. These predictions have been used as an input to the provision of quantitative catch advice for this stock complex for 2006, 2007, and 2008.

3.7 Projections for 2007 and 2008 for the Southern NEAC stock complex

The quantitative prediction for the southern NEAC MSW stock component gives a projected PFA (at 1st January 2007) of 461 000 fish for catch advice in 2007 and a projected PFA (at 1st January 2008) of 440 000 fish for catch advice in 2008. No projections are available beyond that, or for other stock components or complexes in the NEAC area. The mid-points of the projections are both below the SER and therefore there is no surplus available for exploitation.

3.8 Comparison with previous assessment

3.8.1 National PFA model and national conservation limit model

Provisional catch data for 2004 were updated where appropriate. In addition, two countries made changes to the input data.

Changes were made to some of the exploitation rate indices used for the Irish input data based on new or updated information. Further efforts were made to remove hatchery reared fish from the catch series as these fish are not considered to contribute significantly to spawning or are removed as broodstock in rearing programmes. The presence of these fish may mask declines in wild stocks and over-estimate attainment of CLs.

The conservation limit for UK (England & Wales) was amended to take into account changes in the assessment for the River Tamar (see Section 3.3.1)

3.8.2 PFA forecast model

The revised forecast of the southern NEAC MSW PFA for 2005 provides a PFA mid-point of 505,000. This is close to the value forecast last year at this time of 486 000.

3.9 NASCO has requested ICES to describe the key events of the 2005 fisheries and the status of the stocks

3.9.1 Fishing at Faroes in 2004/2005

No fishery for salmon was carried out in 2004/2005 or, to date, in 2005/2006. Consequently, no sample data are available from the Faroese area for this season. No buyout arrangement has been in effect since 1999.

3.9.2 Significant events in NEAC homewater fisheries in 2005

In UK (England & Wales) progress in efforts to phase out various net fisheries continued in 2005. A byelaw came into force closing the Cumbrian drift net fishery (NW Region); this fishery had previously been subject to a phase out which had been accelerated by subsequent compensation agreements.

Since 2002, salmon fishing effort in Ireland has been affected by the imposition of a commercial fishery TAC. An initial commercial TAC of 219 619 fish was imposed for the 2002 season, followed by reduced TACs of 182 000 fish for 2003 and 162 000 fish in 2004 and 139 900 in 2005. A TAC of 91 000 salmon has been recommended for the 2006 fishery based on the recommendations of the National Salmon Commission. Some local draft net fisheries in two regions were not operated again in 2005 by local agreement. Bag limits were also imposed for angling fisheries.

In 2005 most of the bag nets operating in the Trondheimsfjord, Norway, were bought out, and this resulted in larger salmon runs to the rivers in that area. More detailed assessments of the effects of the buy-out will be available shortly.

3.9.3 Gear and effort

In 2005 no significant changes in the type of gear used for salmon fishing were reported in the NEAC area.

The number of gear units licensed or authorised in several of the NEAC area countries provides a partial measure of effort (Table 3.9.3.1), but does not take into account other restrictions, for example, closed seasons. In addition, there is no indication from these data of the actual number of licences utilised or the time each licencee fished.

Trends in effort are shown in Figures 3.9.3.1 and 3.9.3.2 for the Northern and Southern NEAC countries respectively. In the Northern NEAC area, drift net effort in Norway accounted for the majority of the effort expended in the early part of the time-series. However, this fishery closed in 1989, reducing the overall effort substantially. The two remaining methods, bagnets and bendnets, show contrasting patterns of effort until the early 1990s when both show downward trends until the end of the time-series. In the Archangel region of Russia, the effort in the coastal and in the river fisheries shows a decline for the time series reported although there was a large increase in effort in the coastal net fishery in 2005 compared to the previous year. In the Southern NEAC countries, net effort data show a downward trend of various degrees for UK (England & Wales), UK (Northern Ireland), Ireland, France and UK (Scotland).

Rod effort, where available, show both upward and downward trends for the period reported. In the Northern NEAC area the catch and release rod fishery in the Kola Peninsula in Russia has increased from 1711 fishing days in 1991 to 13 300 in 2004. In Finland the number of fishing days has shown an increase throughout the time period although in the past 3 years successive declines have been recorded. In the Southern NEAC area rod fishing effort shows an increasing trend in UK (England & Wales) over the past 4 years. In Ireland rod fishing effort increased in the early 1990s apparently due to the introduction of one day licences and has remained stable over the past decade.

3.9.4 Catches

NEAC area catches are presented in Table 3.9.4.1. The provisional declared catch in the NEAC area in 2005 was 1,964 tonnes, very similar to that in 2004 (1977 t). The NEAC catch represents 93% of the total North Atlantic nominal catch in 2005. The catch in the NEAC Southern area (778 t) fell by 15% on 2004 and was the lowest in the time series. The catch in the NEAC Northern area (1186 t) was 12% higher than the catch in 2004, but was 15% below the recent 5-year mean and among the lowest in the time series.

Figure 3.9.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2005. The catch in the Southern area has declined over the period from about 4500 t in 1972–75 to below 1500 t since 1986, and is now well below 1000 t. The catch declined particularly sharply in 1976 and again in 1989–91. The catch in the Northern area also shows an overall decline over the time series, but this is less steep than for the Southern area. The catch in the Northern area varied between 1850 and 2700 t from 1971 to 1986, fell to a low of 962 t in 1997, and then increased to over 1500 t in 2001. The catch has shown a downward trend again since this time. Thus, the catch in the Southern area, which comprised around two-thirds of the NEAC total in the early 1970s, has been lower than that in the Northern area since 1999.

3.9.5 Catch per unit effort (CPUE)

CPUE is a measure that can be influenced by various factors, and it is assumed that the CPUE of net fisheries is a more stable indicator of the general status of salmon stocks than rod CPUE; the latter may be more affected by varying local factors, e.g. weather conditions, management measures and angler experience. Both may also be affected by many measures taken to reduce fishing effort, for example, changes in regulations affecting gear. If large changes occur for one or more factors a common pattern may not be evident over larger areas. It is, however, expected that for a relatively stable effort CPUE can reflect changes in the status of stocks and stock size. This can be seen in the changes in CPUE for the Norwegian marine fishery that is also reflected in catch (Section 3.9.4) as well as the calculated PFA values (Section 3.9.13).

An overview of the CPUE data for the NEAC area is presented in Figure 3.9.5.1. The CPUE values presented are standardized indices relative to the averages of the time series. Averages were calculated over the time periods common to the fisheries being compared. The original, more detailed CPUE data are presented in Tables 3.9.5.1–3.9.5.5. The CPUE for rod fisheries have been collected by relating the catch to rod days or angler season, and that of net fisheries was calculated as catch per licence- day, trap month or crew month.

In the Southern NEAC area, CPUE shows a general decrease in the UK (Scotland) net and coble fishery, whereas no trend was observed in the UK (Scotland) fixed engine fishery, the UK (England & Wales) net fisheries or in the French rod fisheries (Figure 3.9.5.1). CPUE for the net fisheries showed mostly lower figures compared to 2004 and the 5-year averages with the exceptions of the North West and Midlands regions (Table 3.9.5.3). The CPUE for the Scottish net fisheries was higher than in 2004 (Table 3.9.5.4). In UK (Northern Ireland), the river Bush rod fishery CPUE has increased after 2002, which was the lowest level in recent years, and the 2005 figure was higher than the 5-year mean (Table 3.9.5.1).

In most of the Northern NEAC area, there has been a general decreasing trend in the CPUE figures for various fisheries in recent years (Figure 3.9.5.1). In comparison with the previous year, most CPUE values were up, but mostly lower than the previous 5-year means (Tables 3.9.5.1, 3.9.5.2 and 3.9.5.5).

3.9.6 Age composition of catches

The percentage of 1SW salmon in NEAC catches is presented in Table 3.9.6.1 and in Figures 3.9.6.1 (Northern area) and 3.9.6.2 (Southern area). Since 1987, the overall proportion of 1SW fish has varied between 54 and 72%. In general, there has been greater variability in the proportion of 1SW fish between countries in recent years (since 1994) than prior to this time. The proportion of 1SW fish in the catch increased in 2005 in all countries except UK (England & Wales) and Russia.

The percentage of 1SW fish in the Northern area was 67% in 2005, above the 5- and 10-year means. On average, 1SW fish comprise a higher proportion of the catch (around 75–85%) in Iceland and Russia than in the other Northern countries (Figure 3.9.6.1). In the Southern European countries (Figure 3.9.6.2), the overall percentage of 1SW fish in the catch (61%) was close to the 5- and 10-year mean (60–61%). The overall percentage of 1SW fish in the catch has varied from 49 to 65% over the time series. On average, 1SW fish comprise a higher proportion of the catch (70–80%) in UK (England & Wales) than in the other countries of Southern NEAC.

3.9.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2005 was again generally low (<2% in most countries) and is similar to the values that have been reported in previous reports (ICES, 2005). Thus, the occurrence of such fish is usually ignored in assessments of the status of national stocks (Section 3.9.12). However, in Norway farmed salmon continue to form a large proportion of the catch in coastal, fjordic and rod fisheries. An assessment of the likely effect of these fish on the output data from the PFA model has been reported previously (ICES, 2001).

3.9.8 National origin of catches

In the course of collecting coded wire tagged salmon from Irish tagging programmes, tags are also recovered from salmon which originate from other countries where coded wire tagging takes place. In 2005, 51 tags originating from fish released from five other countries were recovered in Irish fisheries: 28 from UK (Northern Ireland), 10 from UK (England & Wales), 7 from Spain, 5 from Germany and 1 from Denmark. As only a portion of the catch is scanned, these tag recoveries are then raised to estimate the entire catch of tagged salmon which are landed. This also includes an estimate of unreported catch.

Due to the large difference in the number of tagged salmon being released by each country and the consistency of tagging programmes, tag recoveries can be expressed as recapture rates per 1000 fish released to provide the relative contribution of tagged salmon by each country to the Irish fishery (Table 3.9.8.1). Tag release information is derived from information reported annually to ICES (Reports of the ICES Compilation of Microtags, Finclips and External Tag Releases 1985 to 2004). For UK (England and Wales) tagged parr have comprised a large proportion of the fish tagged in some years, and these are generally regarded as contributing to returns two years after release, but this is known to vary. Similarly, by combining the indices at a country level important regional differences may be obscured. Therefore these data should be regarded as indicative only. Despite these caveats, highest average recapture rates for tagged salmon released in areas other than Ireland are UK (N. Ireland), UK (Scotland), Denmark, France, UK (England and Wales), Spain, Germany and Norway respectively.

These data provide little information on exploitation rates of fish from each country which are taken in Irish fisheries and therefore the potential impacts on individual stocks. In 2004, the Working Group reviewed information resulting from analysis of coded wire tagging (CWT) programmes in UK (England & Wales) and tag recovery programmes in Ireland to estimate the effects of Irish fisheries on salmon stocks returning to UK (England & Wales). River-specific models based on the run reconstruction approach were presented for a number of English and Welsh stocks; the inclusion of confidence limits on the estimates of exploitation marked a further advance on earlier models. The Working Group endorsed this approach.

The tagging studies have demonstrated that salmon from all parts of England and Wales are exploited in the Irish coastal fishery. However, the levels of exploitation have varied between stocks from different regions and from year to year, and have also declined following the introduction of management measures in the Irish fishery since 1997. Based on aggregated data for all available years up to 2004, the extant exploitation rates for the modelled stocks (1SW fish only) are presented in Table 3.9.8.2, for the periods before and after 1997.

Prior to 1997, exploitation rates in the Irish fishery were estimated at about 1% for stocks from the north east of England, higher (17–24%) for two rivers in Wales, but highest (28%) for the River Test in southern England. New management measures were introduced in the Irish fishery in 1997 and since 2002 the fishery has been regulated by quotas, which have reduced each year. Exploitation rate estimates since 1997 indicate a reduction in exploitation of English and Welsh stocks, with average values of 0.5% for the Tyne (data for one year only), 3–11% for Welsh rivers and 12% for the River Test. While it was not possible to use the modelling approach to estimate exploitation rates for other stocks, the overall pattern of tag recapture rates has been consistent with this regional pattern of exploitation. Recent estimates for the River Tamar in south west England (2003 and 2004 only) indicate a current exploitation rate in Ireland of only about 2% for this stock.

The Working Group recognised that exploitation rates varied considerably from year-to-year and that exploitation rates on particular stocks may still be relatively high in some years and negligible in others. For stocks below their conservation limit, the Working Group noted that even low levels of exploitation may represent an impediment to stock recovery, particularly for those rivers designated as Special Areas of Conservation (Section 3.10).

3.9.9 The NEAC-PFA model

The Working Group has previously developed a model to estimate the pre-fishery abundance (PFA) of salmon from countries in the NEAC area. PFA in the NEAC area is defined as the number of 1SW recruits on January 1st in the first sea winter. The method employs a basic run-reconstruction approach similar to that described by Rago *et al.* (1993a) and Potter and Dunkley (1993). The model estimates the PFA from the catch in numbers of 1SW and MSW salmon in each country. These are raised to take account of minimum and maximum estimates of non-reported catches and exploitation rates of these two sea-age groups. Finally these values are raised to take account of the natural mortality between January 1st in the first sea winter and the mid-point of the respective national fisheries. As reported in 2002 (ICES, 2002), the Working Group has determined a natural mortality value of 0.03 (range 0.02–0.04) per month to be appropriate. A Monte Carlo simulation (10000 trials) using ‘Crystal Ball v7.2.1’ in Excel (Decisioneering, 1996) is used to estimate confidence limits on the PFA values. Potter *et al.* (1998) provides full details of the model. Further modifications, to improve the model were incorporated at last year’s Working group meeting (ICES, 2005).

Exploitation rate estimates have been derived for a number of monitored stocks in the NEAC area. These often form the basis of the exploitation values used as inputs to the national PFA model.

3.9.10 Sensitivity of the PFA model

The sensitivity of the PFA and spawner estimates for the Northern and Southern European stock complexes was carried out using the tools within Crystal Ball.

The relative contribution of model parameters to variance in the estimates of recruits (maturing and non-maturing 1SW) and spawner numbers (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES working group for each of the 5 years from 2001 to 2005 (catch data for the years 2000–2004). PFA estimates are particularly sensitive to the marine mortality parameter. This is due both to the range (0.02–0.04) attributed to marine mortality in the Monte Carlo simulation and also to the time over which stocks are raised using the variable. Given a fixed value for M, parameters which have accounted for at least 5% of the variance of a given forecast variable in one or more years are shown in Table 3.9.10.1. Taking both stock complexes together these account for 19 (16%) of the 117 parameters used to estimate PFA and 19 (26%) of the 72 parameters used to estimate spawner numbers.

The sensitivity of forecast variables to these parameters was remarkably consistent between years and analysis of the data presented to the 2006 Working Group provided results which were similar to the previous 5 years.

3.9.11 National input to the NEAC-PFA model

To run the NEAC PFA model, most countries are required to input the following time-series information (beginning in 1971) for 1SW and MSW salmon:

- Catch in numbers
- Unreported catch levels (min and max)
- Exploitation levels (min and max)

The model input data are provided in Tables 3.9.11.1(a-t). For some countries, the data are provided in two or more regional blocks. In these instances, the model output is combined to provide one set of output variables per country (Figures 3.9.12.1(a–j)).

The model input data for Finland consists solely of catches from the River Tana/Teno. These comprise both Finnish and Norwegian net and rod catches. The Norwegian catches from the River Tana/Teno are not included in the Norway data.

Descriptions of how the model input has been derived were presented in detail at the Working Group meeting in 2002 (ICES, 2002). Modifications are reported in the year in which they are first implemented and significant modifications undertaken in 2005 are indicated in Section 3.8.1.

The Working Group noted that some countries were developing PFA models for national management. For example, in Norway, the development of national PFA estimates has been initiated, and some provisional modification to the NEAC model is proposed. The NEAC model uses total exploitation rate. In Norway it is more appropriate to use freshwater exploitation rate, as there are more data available and they are easier to estimate. In contrast to the NEAC model the Norwegian catch in the River Tana is included. The output from the Norwegian model was similar to the results for Norway from the NEAC model.

3.9.12 Description of national stocks as derived from the PFA model

The Working Group has previously noted that the NEAC PFA model provides our best interpretation of available information on national salmon stocks. However, there remains considerable uncertainty around the derived estimates, and national representatives are continuing to improve the data inputs each year on the basis of new data, improved sampling and further analysis.

The National Conservation limits model has been designed as a means to provide a preliminary S_{lim} reference point for countries where river-specific reference points have not been developed. These figures should also be regarded as uncertain and should only be used with caution in developing management options. A further limitation with a single national status of stocks analysis is that it does not capture variations in status in different fishery areas or stock complexes. This has been addressed, at least in part, by the area splits in some countries.

The model output for each country has been displayed as a summary sheet (Figures 3.9.12.1(a–j)) comprising the following:

- Estimated total returns and spawners (±95%cls)
- Estimated total catch (including non-reported) of 1SW and MSW salmon.
- Estimated pre-fishery abundance (PFA) of maturing 1SW and non-maturing 1SW salmon (labelled as 1SW and MSW).
- Total exploitation rate of 1SW and MSW salmon estimated from the total returns and total catches derived from the model.
- National stock-recruitment relationship (PFA against lagged egg deposition), with S_{lim} fitted by the method presented in ICES (2001) for those countries where CLs are not estimated using river specific CLs.

3.9.13 Trends in the PFA for NEAC stocks

Tables 3.9.13.1–3.9.13.6 show combined results from the PFA assessment for the NEAC area. The PFA of maturing and non-maturing 1SW salmon and the numbers of 1SW and MSW spawners for the Northern and Southern European groups are shown in Figure 3.1.1.

The 95% confidence limits (dotted lines for PFA and vertical bars for the spawning escapement) (Figure 3.1.1) indicate the uncertainty in this assessment procedure. The Working Group recognised that the model provides an index of the current and historical status of stocks based upon simple catch and fisheries parameters (i.e. catch and exploitation rate). Errors or inconsistencies in the output largely reflect uncertainties in our best estimates of these parameters.

Recruitment of maturing 1SW salmon (potential grilse) in Northern Europe showed a steady decline from the mid-1980s to the mid-1990s (Figure 3.1.1). Following an upturn in the late 1990s, there has been a steep downturn in recent years. Numbers of non-maturing 1SW recruits (potential MSW returns) for Northern Europe (Figure 3.1.1) are also estimated to have fallen throughout the period from the early 1980s to the late 1990s.

Apart from a short period from 2000 to 2003 this stock complex has not been at full reproductive capacity for most of the time series. More recently, the spawner value shows that the stock complex suffered reduced reproductive capacity in 2004 and was at risk of suffering reduced reproductive capacity in 2005. Similarly, the number of MSW spawners shows that apart from a brief period from 2000 to 2003, this stock complex has not been at full reproductive capacity for most of the time series. Again, the spawner value shows that the stock complex was suffering from reduced reproductive capacity in both 2004 and 2005. These trends in recruitment for the Northern European stocks are broadly consistent with the limited data available on the marine survival of monitored stocks in the Northern area (Section 3.9.14).

In the Southern European stock complex (Figure 3.1.1), the estimated numbers of maturing 1SW recruits have fallen substantially since the 1970s. The PFA estimates of non-maturing 1SW recruits in Southern Europe suggest that the number has followed a fairly steady and substantial decline over the past 30 years (Figure 3.1.1).

With the exception of the early 1970s, four years in the 1980s and more recently in 1998 and 2000, the number of 1SW spawners has not been at full reproductive capacity. In contrast, with the exception of one year in the late 1970s the number of MSW spawners was at full reproductive capacity until 1995. Thereafter, spawners have not been at full reproductive capacity. This is broadly consistent with the general pattern of decline in marine survival of 1SW and 2SW returns in most monitored stocks in the area (Section 3.9.14).

3.9.14 Survival indices for NEAC stocks

An overview of the estimates of marine survival (1988–2004) for wild and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) is presented in Figure 3.9.14.1. The survival values presented are standardized (Z-score) indices relative to the averages of the time series. The original survival indices for different rivers and experimental facilities are presented in Tables 3.9.14.1 and 3.9.14.2.

An overall trend in both Northern and Southern NEAC areas, both wild and hatchery smolts, show a constant decline in marine survival over the past 10–20 years (Figure 3.9.14.1). The steepest decline appears to for the wild smolts in Southern NEAC area. Survival indices of both wild and reared fish in Northern NEAC area, however, have generally shown lesser declines than those in Southern NEAC area (Figure 3.9.14.1).

In Ireland and UK (N-Ireland) survival indices for the latest smolt year classes for wild smolts were at or mostly below those of the previous year and the 5- and 10-year averages. Indices in Iceland and Norway showed mixed results (Table 3.9.14.1). Almost all of the survival indices for the hatchery-reared smolts were below the 5- and 10-year averages, although some figures in 2005 were higher than those of the previous year (Table 3.9.14.2). Return rates of hatchery released fish, however, may not always be a reliable indicator of marine survival of wild fish.

Results from these analyses are consistent with the information on estimated returns and spawners as derived from the PFA model (Section 3.9.12), and suggest that returns are strongly influenced by factors in the marine environment.

3.10 NASCO has requested ICES to provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved

The effect of specific management measures on stocks and fisheries has been evaluated in a number of NEAC countries (Table 3.10.1). Countries not represented within this table haven’t reported on recent management measures implemented by their national governments. Apart from national and local objectives, all of the EU countries have been provided with a specific conservation objective arising from the implementation of Council Directive 92/43/EEC (on the conservation of natural habitats and of wild flora and fauna). This directive states that

"If a species is included under this Directive, it requires measures to be taken by individual member states to maintain or restore them to favorable conservation status in their natural range".

Atlantic salmon has been included as one of the species covered by the Directive. A number of rivers in some countries have been designated as Special Areas of Conservation (SACs), where Atlantic salmon are regarded as a vulnerable qualifying species. *The conservation status of a species* means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within its territory (also defined) and this *conservation status* will be taken as 'favourable' when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis…"

Member States are obliged to take measures to ensure that the exploitation of salmon stocks is compatible with their being maintained at a favourable conservation status. Under the terms of the Directive, every 6 years member states are obliged to submit a report detailing the conservation status of their salmon stocks. The first such report is due to be submitted in 2007.

Summary of country inputs

Most management measures introduced in recent years in relation to international, national and local objectives have aimed to reduce levels of exploitation on NEAC stocks, to increase freshwater escapement and in some countries specifically to meet river specific conservation limits. Some measures have had notable success however the Working Group notes that all four NEAC stock complexes are currently either suffering, or at risk of suffering, reduced reproductive capacity (Section 3.1).

3.11 NASCO has requested ICES to update and further refine estimates of bycatch of salmon in pelagic fisheries (including non-catch fishing mortality) with an assessment of impacts on returns to homewaters

Information for this task was expected from the Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries (SGBYSAL). SGBYSAL were to work by correspondence in 2006 to make available and update disaggregated data on the commercial catches, boats and gear types used in the commercial fishery of mackerel, herring, blue whiting and capelin in the Norwegian Sea (ICES Divisions IIa and Vb), the Northern North Sea (Division IVa), and the west of Ireland and Scotland (Divisions VI a & b; VII b,c,j & c) by ICES Division and absolute week 16-36. In addition, SGBYSAL was asked to explore any new data available for estimating by-catches of Atlantic salmon in the pelagic fisheries in the north East Atlantic, and where possible, give an assessment of their reliability, review any new methods used for intensive screenings of pelagic research hauls for the presence of post-smolts and older salmon, and report by 20th March 2006. Unfortunately, the SGBYSAL was not able to report before the Working Group meeting. However, the Working Group received some information from Russia, Iceland and Faroe Islands and this is reviewed here.

Russia - In 2005 Russia continued the program to study potential Atlantic salmon by-catch in pelagic fisheries in the Norwegian Sea. As in previous years, it consisted of both the pelagic fish survey conducted by research vessel and the screening of commercial catches by observers. In June-July 2005 the Russian RV "Fridtjof Nansen" participated in the annual international herring survey in the Norwegian Sea. A total of 101 pelagic hauls were taken by a research trawl with an opening of 45 x 40 m and 24 mm mesh blinder in accordance to standard methods. The whole catch was screened and each fish was identified and handled individually. One adult salmon was found in catches taken in the northern part of the Norwegian Sea between 71–74° N in the beginning of June. Another 20 days of trawling in the southern part of the Norwegian Sea between 61–64° N took place but no salmon were observed. In July, the central part of the Norwegian Sea between 65–71° N was surveyed and one adult salmon was found.

A screening program on a Russian FV “Persey-4” was carried out in the Norwegian Sea from 24 June to 27 August 2005 during commercial pelagic fishing for mackerel, blue whiting and herring. The area covered located between 64°00 and 74°00 N, and from 03°30 W to 14°30 E.

Samples of pelagic species were taken from commercial hauls by pelagic trawl. The mesh size in the cod-end was 125 mm, and 40 mm in the trawl blinder. Trawl parameters were: vertical opening 35–65 m, distance between doors 58–65 m. The trawl was not rigged with additional floats. A headline was towed at depth of 1–350 m. A total of 182 pelagic hauls were taken and 20 777 fish of various species were handled individually for measurement and other purposes.

In June-July fishing for mackerel took place in the international waters of the Norwegian Sea and in a strip of waters adjacent to the 200-mile limits of the Faroe Islands and Norway. Total catch of pelagic fish was 849 t. No post-smolts nor adult salmon were found in any catches. In the first half of August fishing for blue whiting took place in the international waters of the Norwegian Sea. Total catch of pelagic fish was 328 t. Neither post-smolts nor adult salmon were found. In the second half of August fishing for Atlanto-scandian herring took place in the northern part of the Norwegian Sea. Total catch of herring and blue whiting was 354 t. Post-smolts of Atlantic salmon occurred as by-catch in the period from 17 to 20 August, when near surface aggregations of herring (head line depth 15–30 m) were fished SW from Bear Island. A total of 9 post-smolts were found in catches.

Low catches of salmon in both Russian surveys suggest that Russian vessels in the pelagic fisheries in the Norwegian Sea using traditional pelagic trawl design and rigging are unlikely to catch significant numbers of salmon post smolts or adult salmon. Most salmon catches probably take place during trawl retrieval.

Iceland - In 2004, the Institute of Freshwater Fisheries and the Federation of Icelandic River Owners made a contract with IMG-Gallup in Reykjavik, Iceland, to include two questions regarding salmon by-catch in Gallup’s annual fisherman questionnaire. The questionnaires were run during late December when virtually all Icelandic fishing vessels are at port. The results gave much higher values of by-catch of salmon than anticipated. In order to get more detailed information, a new contract with IMG-Gallup was made in 2005. At the time of the survey 3826 fishermen were registered to Icelandic fishing vessels. A telephone survey for 1 114 fishermen provided a response rate of 61.0% (680 fishermen) and 21.2% (141) reported salmon by-catch compared to 15.5% in the previous survey. The mean number of salmon reported by those who reported bycatch was 6.3. The total number of salmon caught as by-catch by Icelandic fishermen in 2005 was estimated at 5110 salmon (3165 to 7055, 95% CL). Compared to the total catch of 1 667 286 t of all species caught by the Icelandic fishing fleet in 2005, this salmon bycatch was considered to be very small (<0.001%). The survey gives no information on the origin of the salmon caught. A majority of the salmon caught within the EEZ was taken at East and South Iceland during the summer months, June–August, the months of salmon return migration. Grilse comprised 64% of the catch whereas the proportions of post smolts and MSW fish were 19.9% and 21.3%, respectively. The vessels giving most frequent records of salmon caught were the larger ships (>500t) using pelagic trawls and purse seines.

The low frequency of salmon bycatch in Icelandic fisheries suggests that by-catch regulation may not be possible. Further cooperation with the fishermen could be useful to collect information on salmon at sea through the by-catch sampled by fishermen. In addition, surveys such as those conducted in Iceland can be used for collecting information about salmon by-catches. These methods are less expensive than direct onboard observation and sampling on the vessels.

Faroe Islands - No salmon by-catches have been reported in the Faroese herring fisheries in 2005.

Germany – Germany was the only country to respond to the SGBYSAL request to supply disaggregated data. As SGBYSAL did not meet no further analysis was performed.

The Working Group concludes that in the absence of the 2006 SGBYSAL report the conclusions made last year (ICES, 2005) are still valid, i.e. low impacts of salmon bycatches on PFA or returns to homewaters.

Non-catch mortality of salmon related to the operation of fishing gears was not considered by the Working Group as no new information was made available. The Working Group recommends, that information about non-catch mortality should be compiled and analysed by SGBYSAL.

Table 3.3.3.1. Conservation limit options for NEAC stock groups estimated from national lagged egg deposition model and from river specific values (where available).

	National Model CLs		River Specific CLs		Conservation limit used	
	1SW	MSW	1SW	MSW	1SW	MSW
Northern Europe						
Finland	18,450	15,160			18,450	15,160
Iceland (north & east)	13,961	3,764			13,961	3,764
Norway[1]	127,878	82,543			127,878	82,543
Russia	113,182	39,996			113,182	39,996
Sweden	2,159	1,188			2,159	1,188
			Conservation limit		275,630	142,651
			Spawner Escapement Reserve		340,138	243,373

[1]Norwegian conservation limits calculated on data from 1983

	National Model CLs		River Specific CLs		Conservation limit used	
	1SW	MSW	1SW	MSW	1SW	MSW
Southern Europe						
France			17,400	5,100	17,400	5,100
Iceland (south & west)	33,612	4,257			33,612	4,257
Ireland			236,044	15,334	236,044	15,334
UK (E&W)			54,491	29,605	54,491	29,605
UK (NI)	17,089	2,533			17,089	2,533
UK (Sco)	263,443	218,497			263,443	218,497
			Conservation limit		622,079	275,326
			Spawner Escapement Reserve		776,124	469,968

Table 3.6.1.1. Southern NEAC input data (year and spawners/eggs) used in PFA forecast model.

YEAR	HABITAT	EGGS (X10^3)	PFAM	PFAN
1978	1,951	5,324,273	2,154,266	1,219,119
1979	2,058	5,024,184	1,909,239	1,703,737
1980	1,823	4,100,846	1,508,647	1,791,391
1981	1,912	3,612,525	1,220,919	1,310,307
1982	1,703	3,640,271	1,789,529	1,550,165
1983	1,416	3,506,905	2,539,462	1,088,695
1984	1,257	3,384,775	1,792,226	1,266,913
1985	1,410	3,251,472	2,122,452	1,703,874
1986	1,688	3,236,282	2,489,210	1,286,484
1987	1,627	3,890,769	1,820,681	1,631,365
1988	1,698	3,406,771	2,511,622	1,490,000
1989	1,642	3,623,878	2,093,581	1,172,792
1990	1,503	4,226,782	1,282,345	833,253
1991	1,357	4,174,116	1,056,316	1,044,721
1992	1,381	4,597,538	1,520,889	907,383
1993	1,252	4,652,412	1,464,591	1,016,018
1994	1,329	3,880,283	1,558,940	965,632
1995	1,311	3,267,256	1,550,200	758,603
1996	1,470	3,418,945	1,272,625	584,806
1997	1,594	3,622,079	1,158,537	531,244
1998	1,849	3,508,717	1,476,204	543,053
1999	1,741	3,632,862	1,007,440	651,928
2000	1,634	3,199,215	1,521,749	634,881
2001	1,685	2,825,138	1,301,801	571,660
2002	1,865	2,658,319	1,162,967	629,878
2003	1,864	2,510,706	1,116,807	660,582
2004	NA	2,926,000	1,074,158	533,512
2005	NA	2,956,796	1,053,618	NA
2006	NA	2,778,139	NA	NA
2007	NA	2,871,019	NA	NA
2008	NA	2,832,618	NA	NA

Table 3.6.1.2. Predictions and 95% confidence limits (all values in thousands) of PFA non-maturing salmon for Southern NEAC using Spawners (Eggs) and Year.

YEAR	PREDICTED	LOWER	UPPER
2005	505	332	768
2006	489	320	748
2007	461	301	706
2008	440	286	676

Table 3.9.3.1. Number of gear units licensed or authorised by country and gear type.

Year	England & Wales					UK (Scotland)		UK (N. Ireland)			Norway			
	Gillnet licences	Sweepnet	Hand-held net	Fixed engine	Rod & Line	Fixed engine[1]	Net and coble[2]	Driftnet	Draftnet	Bagnets and boxes	Bagnet	Bendnet	Liftnet	Driftnet (No. nets)
1971	437	230	294	79	-	3,069	802	142	305	18	4,608	2,421	26	8,976
1972	308	224	315	76	-	3,437	810	130	307	18	4,215	2,367	24	13,448
1973	291	230	335	70	-	3,241	884	130	303	20	4,047	2,996	32	18,616
1974	280	240	329	69	-	3,182	777	129	307	18	3,382	3,342	29	14,078
1975	269	243	341	69	-	2,978	768	127	314	20	3,150	3,549	25	15,968
1976	275	247	355	70	-	2,854	756	126	287	18	2,569	3,890	22	17,794
1977	273	251	365	71	-	2,742	677	126	293	19	2,680	4,047	26	30,201
1978	249	244	376	70	-	2,572	691	126	284	18	1,980	3,976	12	23,301
1979	241	225	322	68	-	2,698	747	126	274	20	1,835	5,001	17	23,989
1980	233	238	339	69	-	2,892	670	125	258	20	2,118	4,922	20	25,652
1981	232	219	336	72	-	2,704	647	123	239	19	2,060	5,546	19	24,081
1982	232	221	319	72	-	2,415	647	123	221	18	1,843	5,217	27	22,520
1983	232	209	333	74	-	2,530	669.5	120	207	17	1,735	5,428	21	21,813
1984	226	223	354	74	-	2,443	653	121	192	19	1,697	5,386	35	21,210
1985	223	230	375	69	-	2,196	551	122	168	19	1,726	5,848	34	20,329
1986	220	221	368	64	-	1,996	618.5	121	148	18	1,630	5,979	14	17,945
1987	213	206	352	68	-	1,762	577	120	119	18	1,422	6,060	13	17,234
1988	210	212	284	70	-	1,577	402	115	113	18	1,322	5,702	11	15,532
1989	201	199	282	75	-	1,235	355.5	117	108	19	1,888	4,100	16	0
1990	200	204	292	69	-	1,280	339.5	114	106	17	2,375	3,890	7	0
1991	199	187	264	66	-	1,136	289	118	102	18	2,343	3,628	8	0
1992	203	158	267	65	-	850	292.5	121	91	19	2,268	3,342	5	0
1993	187	151	259	55	-	900	263.5	120	73	18	2,869	2,783	-	0
1994	177	158	257	53	37,278	752	243.5	119	68	18	2,630	2,825	-	0
1995	163	156	249	47	34,941	729	221.5	122	68	16	2,542	2,715	-	0
1996	151	132	232	42	35,281	644	200.5	117	66	12	2,280	2,860	-	0
1997	139	131	231	35	32,781	688	190	116	63	12	2,002	1,075	-	0
1998	130	129	196	35	32,525	545	143.5	117	70	12	1,865	1,027	-	0
1999	120	109	178	30	29,132	384	128.5	113	52	11	1,649	989	-	0
2000	110	103	158	32	30,139	385	119	109	57	10	1,557	982	-	0
2001	113	99	143	33	24,350	387	95	107	50	6	1,976	1,081	-	0
2002	113	94	147	32	29,407	427	101	106	47	4	1,666	917	-	0
2003	58	96	160	57	29,936	363	109	105	52	2	1,664	766	-	0
2004	57	75	157	65	32,766	409	96	90	54	2	1,546	659	-	0
2005	59	73	148	65	33,072	289	49	93	57	2	1,453	661	-	0
Mean 2000-2004	90	93	153	44	29,320	394	104	103	52	5	1682	881		0
% change [3]	-34.6	-21.8	-3.3	48.4	12.8	-7.9	4.8	1.5	0.0	-58.3	-1.1	-13.1		
Mean 1995-2004	115	112	185	41	31,126	496	140	110	58	9	1875	1307		0
% change [3]	-48.9	-35.1	-20.0	59.3	6.3	-41.7	-65.1	-15.6	-1.6	-77.0	-22.5	-49.4		

[1] Number of gear units expressed as trap months.

[2] Number of gear units expressed as crew months.

[3] (2004/mean - 1) * 100

Table 3.9.3.1 Cont'd. Number of gear units licensed or authorised by country and gear type.

	Ireland				Finland				France			Russia		
					The Teno River			R. Näätämö				Kola Peninsula	Archangel region	
	Driftnets No.	Draftnets	Other nets Commercial	Rod	Recreational fishery Tourist anglers		Local rod and net fishery	Recreational fishery	Rod and line licences in freshwater	Com. nets in freshwater[1a]	Drift net Licences in estuary[1b,2]	Catch-and-release Fishing days	Commercial, number of gears	
Year					Fishing days	Fishermen	Fishermen	Fishermen					Coastal	In-river
1971	916	697	213	10,566	-	-	-	-	-	-	-			
1972	1,156	678	197	9,612	-	-	-	-	-	-	-			
1973	1,112	713	224	11,660	-	-	-	-	-	-	-			
1974	1,048	681	211	12,845	-	-	-	-	-	-	-			
1975	1,046	672	212	13,142	-	-	-	-	-	-	-			
1976	1,047	677	225	14,139	-	-	-	-	-	-	-			
1977	997	650	211	11,721	-	-	-	-	-	-	-			
1978	1,007	608	209	13,327	-	-	-	-	-	-	-			
1979	924	657	240	12,726	-	-	-	-	-	-	-			
1980	959	601	195	15,864	-	-	-	-	-	-	-			
1981	878	601	195	15,519	16,859	5,742	677	467	-	-	-			
1982	830	560	192	15,697	19,690	7,002	693	484	4,145	55	82			
1983	801	526	190	16,737	20,363	7,053	740	587	3,856	49	82			
1984	819	515	194	14,878	21,149	7,665	737	677	3,911	42	82			
1985	827	526	190	15,929	21,742	7,575	740	866	4,443	40	82			
1986	768	507	183	17,977	21,482	7,404	702	691	5,919	58 [3]	86			
1987	-	-	-	-	22,487	7,759	754	689	5,724 [4]	87 [4]	80			
1988	836	-	-	11,539	21,708	7,755	741	538	4,346	101	76			
1989	801	-	-	16,484	24,118	8,681	742	696	3,789	83	78			
1990	756	525	189	15,395	19,596	7,677	728	614	2,944	71	76			
1991	707	504	182	15,178	22,922	8,286	734	718	2,737	78	71	1,711		
1992	691	535	183	20,263	26,748	9,058	749	875	2,136	57	71	4,088		
1993	673	457	161	23,875	29,461	10,198	755	705	2,104	53	55	6,026	59	199
1994	732	494	176	24,988	26,517	8,985	751	671	1,672	14	59	8,619	60	230
1995	768	512	164	27,056	24,951	8,141	687	716	1,878	17	59	5,822	55	239
1996	778	523	170	29,759	17,625	5,743	672	814	1,798	21	69	6,326	85	330
1997	852	531	172	31,873	16,255	5,036	616	588	2,953	10	59	6,355	68	282
1998	874	513	174	31,565	18,700	5,759	621	673	2,352	16	63	6,034	66	270
1999	874	499	162	32,493	22,935	6,857	616	850	2,225	15	61	7,023	66	194
2000	871	490	158	33,527	28,385	8,275	633	624	2,037 [5]	16	35	7,336	60	173
2001	881	540	155	32,814	33,501	9,367	863	590	2,080	18	42	8,468	53	121
2002	833	544	159	32,814	37,491	10,560	853	660	2,082	18	43	9,624	63	72
2003	877	549	159	32,725	34,979	10,032	832	644	2,048	18	38	11,898	55	84
2004	831	473	136	31,809	29,494	8,771	801	657	2,158	15	38	13,300	62	56
2005	877	518	158	31,809	27,627	7,776	755	705	2,356	16	37	20,309	93	69
Mean 2000-2004	859	519	153	32,738	32,770	9,401	796	635	2,081	17	39	10,125	59	101
% change [6]	2.1	-0.2	3.0	-2.8	-15.7	-17.3	-5.2	11.0	13.2	-5.9	-5.6	100.6	58.7	-31.8
Mean 1995-2004	844	517	161	31644	26432	7854	719	682	2161	16	51	8219	63	182
% change [6]	3.9	0.1	-1.8	0.5	4.5	-1.0	4.9	3.4	9.0	-2.4	-27.0	147.1	46.9	-62.1

[1a] Lower Adour only since 1994 (Southwestern France), due to fishery closure in the Loire Basin.
[1b] Adour estuary only (Southwestern France).
[2] Number of fishermen or boats using drift nets: overestimates the actual number of fishermen targeting salmon by a factor 2 or 3.
[3] Common licence for salmon and sea trout introduced in 1986, leading to a short-term increase in the number of licences issued.
[4] Compulsory declaration of salmon catches in freshwater from 1987 onwards.
[5] Before 2000, equal to the number of salmon licenses sold. From 2000 onwards, number estimated because of a single sea trout and salmon angling license.
[6] (2004/mean - 1) * 100

Table 3.9.4.1. Nominal catch of salmon in NEAC Area (in tonnes round fresh weight), 1960–2005 (2005 figures are provisional).

Year	Southern countries	Northern countries	Faroes (1)	Other catches in international waters	Total Reported Catch	Unreported catches NEAC Area	Unreported catches International waters (2)
1960	2,641	2,899	-	-	5,540	-	-
1961	2,276	2,477	-	-	4,753	-	-
1962	3,894	2,815	-	-	6,709	-	-
1963	3,842	2,434	-	-	6,276	-	-
1964	4,242	2,908	-	-	7,150	-	-
1965	3,693	2,763	-	-	6,456	-	-
1966	3,549	2,503	-	-	6,052	-	-
1967	4,492	3,034	-	-	7,526	-	-
1968	3,623	2,523	5	403	6,554	-	-
1969	4,383	1,898	7	893	7,181	-	-
1970	4,048	1,834	12	922	6,816	-	-
1971	3,736	1,846	-	471	6,053	-	-
1972	4,257	2,340	9	486	7,092	-	-
1973	4,604	2,727	28	533	7,892	-	-
1974	4,352	2,675	20	373	7,420	-	-
1975	4,500	2,616	28	475	7,619	-	-
1976	2,931	2,383	40	289	5,643	-	-
1977	3,025	2,184	40	192	5,441	-	-
1978	3,102	1,864	37	138	5,141	-	-
1979	2,572	2,549	119	193	5,433	-	-
1980	2,640	2,794	536	277	6,247	-	-
1981	2,557	2,352	1,025	313	6,247	-	-
1982	2,533	1,938	606	437	5,514	-	-
1983	3,532	2,341	678	466	7,017	-	-
1984	2,308	2,461	628	101	5,498	-	-
1985	3,002	2,531	566	-	6,099	-	-
1986	3,595	2,588	530	-	6,713	-	-
1987	2,564	2,266	576	-	5,406	2,554	-
1988	3,315	1,969	243	-	5,527	3,087	-
1989	2,433	1,627	364	-	4,424	2,103	-
1990	1,645	1,775	315	-	3,735	1,779	180-350
1991	1,145	1,677	95	-	2,917	1,555	25-100
1992	1,523	1,806	23	-	3,352	1,825	25-100
1993	1,443	1,853	23	-	3,319	1,471	25-100
1994	1,896	1,685	6	-	3,587	1,157	25-100
1995	1,775	1,503	5	-	3,283	942	-
1996	1,392	1,358	-	-	2,750	947	-
1997	1,112	962	-	-	2,074	732	-
1998	1,120	1,099	6	-	2,225	1,108	-
1999	934	1,139	0	-	2,073	887	-
2000	1,210	1,518	8	-	2,736	1,135	-
2001	1,242	1,634	0	-	2,876	1,089	-
2002	1,135	1,360	0	-	2,495	946	-
2003	908	1,394	0	-	2,302	719	-
2004	919	1,058	0	-	1,977	575	-
2005	778	1,186	0	-	1,964	606	-
Means							
2000-2004	1,083	1,393	2	-	2,477	893	-
1995-2004	1,175	1,303	2	-	2,479	908	-

1. Since 1991, fishing carried out at the Faroes has only been for research purposes.
2. Estimates refer to season ending in given year.

Table 3.9.5.1. CPUE for salmon rod catches in Finland (Teno and Naatamo), France and UK (N.Ireland)(Bush).

	Finland (R. Teno)		Finland (R. Naatamo)		France	UK(N.Ire.)(R.Bush)
	Catch per angler season	Catch per angler day	Catch per angler season	Catch per angler day	Catch per angler season	Catch per rod day
Year	kg	kg	kg	kg	Number	Number
1974		2.8				
1975		2.7				
1976		-				
1977		1.4				
1978		1.1				
1979		0.9				
1980		1.1				
1981	3.2	1.2				
1982	3.4	1.1				
1983	3.4	1.2				0.248
1984	2.2	0.8	0.5	0.2		0.083
1985	2.7	0.9	n/a	n/a		0.283
1986	2.1	0.7	n/a	n/a		0.274
1987	2.3	0.8	n/a	n/a	0.39	0.194
1988	1.9	0.7	0.5	0.2	0.73	0.165
1989	2.2	0.8	1.0	0.4	0.55	0.135
1990	2.8	1.1	0.7	0.3	0.71	0.247
1991	3.4	1.2	1.3	0.5	0.60	0.396
1992	4.5	1.5	1.4	0.3	0.94	0.258
1993	3.9	1.3	0.4	0.2	0.88	0.341
1994	2.4	0.8	0.6	0.2	2.31	0.205
1995	2.7	0.9	0.5	0.1	1.15	0.206
1996	3.0	1.0	0.7	0.2	1.57	0.267
1997	3.4	1.0	1.1	0.2	0.44 [1]	0.338
1998	3.0	0.9	1.3	0.3	0.67	0.569
1999	3.7	1.1	0.8	0.2	0.76	0.273
2000	5.0	1.5	0.9	0.2	1.06	0.259
2001	5.9	1.7	1.2	0.3	0.97	0.444
2002	3.1	0.9	0.7	0.2	0.84	0.184
2003	2.6	0.7	0.8	0.2	0.76	0.238
2004	1.4	0.4	0.9	0.2	1.01	0.252
2005	2.7	0.8	1.3	0.2	0.68	0.323
Mean 2000-04	3.6	1.0	0.9	0.2	0.9	0.3

[1] Large numbers of new, inexperienced anglers in 1997 because cheaper licence types were introduced.

Table 3.9.5.2. CPUE for salmon rod catches in the Barents Sea and White Sea basin in Russia.

	Barents Sea Basin, catch per angler day				White Sea Basin, catch per angler day			
Year	Rynda	Kharlovka	Varzina	Iokanga	Ponoy	Varzuga	Kitsa	Umba
1991					2.79	1.87		1.33
1992	2.37	1.45	1.07	0.14	3.49	2.26	1.21	1.37
1993	1.18	1.46	0.49	0.65	2.88	1.28	1.43	2.72
1994	0.71	0.85	0.55	0.33	2.33	1.60	1.59	1.44
1995	0.49	0.78	1.22	0.72	3.46	2.52	1.78	1.20
1996	0.70	0.85	1.50	1.40	3.50	1.44	1.76	0.93
1997	1.20	0.71	0.61	1.41	5.33	2.36	2.48	1.46
1998	1.01	0.55	0.44	0.87	4.54	2.28	2.78	0.98
1999	0.95	0.64	0.43	1.19	3.30	1.71	1.66	0.76
2000	1.35	0.77	0.57	2.28	3.49	1.53	3.02	1.25
2001	1.16	1.27	0.89	0.73	4.20	1.86	1.81	1.04
2002	2.39	0.99	0.80	2.82	5.81	1.44	2.11	0.36
2003	1.61	1.14	0.79	2.01	6.32	1.17	1.61	0.36
2004	1.07	0.75	0.65	1.00	3.44	1.14	1.10	0.36
2005	1.18	1.81	0.46	0.88	2.29	0.57	0.89	0.28
Mean 2000-04	1.52	0.99	0.74	1.77	4.65	1.43	1.93	0.67

Table 3.9.5.3. CPUE data for net and fixed engine fisheries by Region in UK (England & Wales). Data expressed as catch per licence-tide, except for the North East, for which the data are expressed as catch per licence-day.

		Region (aggregated data, various methods)					
Year	North East drift nets	North East	Southern	South West	Midlands	Wales	North West
1988		5.49	10.15			-	-
1989		4.39	16.80			0.90	0.82
1990		5.53	8.56			0.78	0.63
1991		3.20	6.40			0.62	0.51
1992		3.83	5.00			0.69	0.40
1993	8.23	6.43	No fishing			0.68	0.63
1994	9.02	7.53	-			1.02	0.71
1995	11.18	7.84	-			1.00	0.79
1996	4.93	3.74	-			0.73	0.59
1997	6.84	4.40	-	0.56	0.48	0.31	0.63
1998	6.49	3.81	-	0.99	0.42	0.51	0.46
1999	8.77	4.88	-	0.63	0.72	0.44	0.52
2000	12.21	8.11	-	1.05	0.66	0.33	1.05
2001	10.06	6.83	-	0.61	0.79	0.45	0.71
2002	8.23	5.59	-	0.82	1.39	0.57	0.90
2003	7.13	4.82	-	1.06	1.13	0.41	0.62
2004	8.17	5.88		0.95	0.46	0.45	0.69
2005	7.23	4.13		0.49	0.97	0.41	1.28
Mean 2000-04	9.16	6.25		0.90	0.89	0.44	0.79

Table 3.9.5.4. CPUE data for Scottish net fisheries. Catch in numbers of fish per unit effort.

Year	Fixed engine	Net and coble CPUE
	Catch/trap month 1	Catch/crew month
1952	33.91	156.39
1953	33.12	121.73
1954	29.33	162.00
1955	37.09	201.76
1956	25.71	117.48
1957	32.58	178.70
1958	48.36	170.39
1959	33.30	159.34
1960	30.67	177.80
1961	31.00	155.17
1962	43.89	242.00
1963	44.25	182.86
1964	57.92	247.11
1965	43.67	188.61
1966	44.86	210.59
1967	72.57	329.80
1968	46.99	198.47
1969	65.51	327.64
1970	50.28	241.91
1971	57.19	231.61
1972	57.49	248.04
1973	73.74	240.60
1974	63.42	257.11
1975	53.63	235.71
1976	42.88	150.79
1977	45.58	188.67
1978	53.93	196.07
1979	42.20	157.19
1980	37.65	158.62
1981	49.60	183.86
1982	61.29	180.21
1983	55.84	203.59
1984	58.88	155.31
1985	49.60	148.88
1986	75.19	193.42
1987	61.83	145.61
1988	50.57	198.43
1989	71.04	262.35
1990	33.22	145.96
1991	35.87	106.35
1992	59.58	153.66
1993	52.84	125.23
1994	92.13	123.74
1995	75.60	142.27
1996	57.52	110.93
1997	32.96	57.79
1998	36.02	68.67
1999	21.94	58.78
2000	53.73	105.22
2001	60.26	76.14
2002	43.80	67.30
2003	67.30	66.50
2004	51.10	66.50
2005	62.50	87.70
Mean 2000-04	55.24	76.33

[1] Excludes catch and effort for Solway Region

Table 3.9.5.5. CPUE for the marine fishery in Norway. The CPUE is expressed as numbers of salmon caught per net day in bagnets and bendnets divided by salmon weight.

	Bagnet			Bendnet		
Year	**< 3kg**	**3-7 kg**	**>7 kg**	**< 3kg**	**3-7 kg**	**>7 kg**
1998	0.88	0.66	0.12	0.80	0.56	0.13
1999	1.16	0.72	0.16	0.75	0.67	0.17
2000	2.01	0.90	0.17	1.24	0.87	0.17
2001	1.52	1.03	0.22	1.03	1.39	0.36
2002	0.91	1.03	0.26	0.74	0.87	0.32
2003	1.57	0.9	0.26	0.84	0.69	0.28
2004	0.89	0.97	0.25	0.59	0.60	0.17
2005	1.17	0.81	0.27	0.72	0.73	0.33
Mean 2000-04	1.38	0.97	0.23	0.89	0.88	0.26

Table 3.9.6.1. Percentage of 1SW salmon in catches from countries in the North East Atlantic, 1987-2005.

Year	Iceland	Finland	Norway	Russia	Sweden	**Northern countries**	UK (Scot)	UK (E&W)	France	Spain (1)	**Southern countries**
1987		66	61	71		**63**	61	68	77		**63**
1988		63	64	53		**62**	57	69	29		**60**
1989	69	66	73	73	41	**72**	63	65	33		**63**
1990	66	64	68	73	70	**69**	48	52	45		**49**
1991	72	59	65	70	71	**66**	53	71	39		**58**
1992	72	70	62	72	68	**65**	55	77	48		**59**
1993	76	58	61	61	62	**63**	57	81	74	33	**64**
1994	64	55	68	69	64	**67**	54	77	55	61	**61**
1995	72	59	58	70	78	**62**	53	72	60	22	**59**
1996	74	79	53	80	63	**61**	53	65	51	22	**56**
1997	73	69	64	82	54	**68**	54	73	51	21	**60**
1998	82	75	66	82	59	**70**	58	83	71	50	**65**
1999	71	83	65	78	71	**68**	45	70	27	13	**54**
2000	84	71	67	75	69	**69**	54	79	58	63	**65**
2001	81	48	58	74	55	**60**	55	75	51	36	**62**
2002	82	34	49	70	63	**54**	54	75	69	33	**63**
2003	76	51	61	67	47	**62**	52	67	51	16	**55**
2004	85	47	52	68	52	**58**	50	81	40	59	**58**
2005	88	72	63	67	55	**67**	55	76	41	-	**61**
Means											
2000-2004	82	50	57	71	57	**61**	53	75	54	41	**61**
1995-2004	78	62	59	74	61	**63**	53	74	53	33	**60**

Table 3.9.8.1. Recapture rate per 1000 fish released for coded wire tagged salmon taken in Irish fisheries.

Countries of Origin

Fishing year	Ireland	UK (N. Ireland)	UK (England/Wales)	UK (Scotland)	France	Spain	Norway	Denmark	Germany
1985	**103**		0.9	21.5					
1986	**102**		2.9	59.4					
1987	**82**	22	1.5	16.0					
1988	**73**	31	3.4	19.2					
1989	**82**	23	2.4	2.5					
1990	**36**	16	2.1	12.4	2.0				
1991	**26**	23	0.7	4.2					
1992	**46**	23	0.8	0.2	0.4				
1993	**39**	21	0.7	0.1	0.1	0.5	0.08		
1994	**49**	17	1.3	0.3	0.0		0.04		
1995	**63**	15	1.9	0.5	11.4	0.1			
1996	**33**	7	1.0	1.5		0.1			
1997	**40**	11	0.5	0.0		0.1			
1998	**62**	11	0.4	0.5	0.0	1.6		2.0	
1999	**32**	4	3.3	0.0	0.2	0.5		3.8	0.4
2000	**45**	17	3.3	0.2	0.0	0.8			0.3
2001	**55**	24	2.1	0.0		0.4			0.0
2002	**34**	8	2.2	0.5					0.5
2003	**16**	7	1.5	0.0		3.2			0.0
2004	**17**	6	0.4	0.5		0.6		na	0.0
2005	**13**	5	0.4	0.0		0.3		na	0.5
AVERAGE	**49.9**	**15.2**	**1.6**	**6.7**	**1.8**	**0.7**	**0.1**	**2.9**	**0.2**

Table 3.9.8.2. Average exploitation rates in Ireland for selected English and Welsh salmon stocks, based on aggregated data for the periods before and after the introduction of management measures in the Irish fishery in 1997.

River	Pre 1997			Post 1997		
	Years	Expl. Rate (%)	95% CL (a)	Years	Expl. Rate (%)	95% CL (a)
Tyne - NE England	1986-96	1.3	± 0.4	1997	0.5	± 0.7
Wear - NE England	1986-96	0.9	± 0.2	1997	0	
Dee - N. Wales	1992-96	16.8	± 5.7	1997-2004	2.9	± 1.3
Taff - S. Wales	1991-96	24.0	± 7.2	1997-2004	11.1	± 4.7
Tamar - SW England		No data		2003-2004	1.7	± 1.6
Test - S. England	1991-96	28.4	± 5.9	1997-2000	12.0	± 4.2

(a) CLs based on aggregated data and ignore year to year variability.

Table 3.9.10.1. Summary of the results of a sensitivity analysis of the NEAC run-reconstruction model. Given a fixed value for M, the relative contribution of model parameters to the variance in the predictions of the number of recruits (maturing and non-maturing 1SW) and spawners (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES working group for each of the 5 years from 2001 to 2005. Parameters which have accounted for at least 5% of the variance of a given forecast variable in one or more years are indicated by *X*.

Stock complex	Region	Parameter	Forecast Variable			
			PFA		Spawners	
			Maturing	Non-Maturing	1SW	MSW
Northern NEAC	Russia (Kola Peninsula)	Exploitation rate	X	X	X	X
	Norway (mid)	Exploitation rate	X	X	X	X
		Unreported catch	X	X		
	Norway (north)	Exploitation rate		X	X	X
		Unreported catch		X		
	Norway (south)	Exploitation rate	X	X	X	X
	Finland	Exploitation rate		X		X
	Russia (Pechora River)	Exploitation rate				X
	Russia (barents)	Exploitation rate			X	
Southern NEAC	UK (Scot) (East)	Exploitation rate	X	X	X	X
	Ireland	Exploitation rate	X	X	X	X
		Unreported catch	X	X		
	UK (E&W)	Exploitation rate	X	X	X	X
	UK (Scot) (West)	Exploitation rate			X	X

Table 3.9.11.1a. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – River Teno (FINLAND/NORWAY).

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	8,422	8,538	30	40	30	40	40	60	40	70
1972	13,160	13,341	30	40	30	40	40	60	40	70
1973	11,969	15,958	30	40	30	40	40	60	40	70
1974	23,709	23,709	30	40	30	40	40	60	40	70
1975	16,527	26,417	30	40	30	40	40	60	40	70
1976	11,323	21,719	30	40	30	40	40	60	40	70
1977	5,807	13,227	30	40	30	40	40	60	40	70
1978	7,902	8,452	30	40	30	40	40	60	40	70
1979	9,249	7,390	30	40	30	40	40	60	30	60
1980	4,792	8,938	20	30	20	30	40	60	30	60
1981	7,386	9,835	20	30	20	30	40	60	30	60
1982	2,163	12,826	20	30	20	30	40	60	30	60
1983	10,680	13,990	20	30	20	30	40	60	30	60
1984	11,942	13,262	20	30	20	30	40	60	30	60
1985	18,039	10,339	20	30	20	30	40	60	30	60
1986	16,389	9,028	20	30	20	30	40	60	30	60
1987	20,950	11,290	20	30	20	30	40	60	30	60
1988	10,019	7,231	20	30	20	30	40	60	30	60
1989	28,091	10,011	20	30	20	30	50	70	40	70
1990	26,646	12,562	20	30	20	30	50	70	40	70
1991	32,423	15,136	20	30	20	30	50	70	40	70
1992	42,965	16,158	20	30	20	30	50	70	40	70
1993	30,197	18,720	20	30	20	30	50	70	40	70
1994	12,016	15,521	20	30	20	30	50	70	40	70
1995	11,801	9,634	20	30	20	30	50	70	40	70
1996	22,799	6,956	20	30	20	30	40	60	30	60
1997	19,481	10,083	20	30	20	30	40	60	30	60
1998	22,460	8,497	20	30	20	30	40	60	30	60
1999	38,687	8,854	20	30	20	30	50	70	40	60
2000	40,654	19,707	20	30	20	30	50	70	40	60
2001	18,372	28,337	20	30	20	30	50	70	40	60
2002	10,757	22,717	20	30	20	30	40	60	40	60
2003	12,699	16,093	20	30	20	30	40	60	40	60
2004	4,912	7,718	20	30	20	30	40	60	40	60
2005	12,499	5,969	20	30	20	30	40	60	40	60
2006			20	30	20	30	40	60	40	60
2007			20	30	20	30	40	60	40	60
2008			20	30	20	30	40	60	40	60
2009			20	30	20	30	40	60	40	60
2010			20	30	20	30	40	60	40	60

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1b. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – FRANCE.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
	Non-reporting included in exploitation rates until 2002									
1971	1,740	4,060	0	0	0	0	2	5	25	50
1972	3,480	8,120	0	0	0	0	2	5	25	50
1973	2,130	4,970	0	0	0	0	2	5	25	50
1974	990	2,310	0	0	0	0	2	5	25	50
1975	1,980	4,620	0	0	0	0	2	5	25	50
1976	1,820	3,380	0	0	0	0	2	5	25	50
1977	1,400	2,600	0	0	0	0	2	5	25	50
1978	1,435	2,665	0	0	0	0	2	5	25	50
1979	1,645	3,055	0	0	0	0	2	5	25	50
1980	3,430	6,370	0	0	0	0	2	5	25	50
1981	2,720	4,080	0	0	0	0	2	5	20	50
1982	1,680	2,520	0	0	0	0	2	5	20	50
1983	1,800	2,700	0	0	0	0	2	5	20	50
1984	2,960	4,440	0	0	0	0	2	5	20	50
1985	1,100	3,330	0	0	0	0	2	5	20	50
1986	3,400	3,400	0	0	0	0	2	12	20	50
1987	6,000	1,800	0	0	0	0	2	12	20	50
1988	2,100	5,000	0	0	0	0	2	12	20	50
1989	1,100	2,300	0	0	0	0	2	12	20	50
1990	1,900	2,300	0	0	0	0	2	12	20	50
1991	1,400	2,100	0	0	0	0	2	12	20	50
1992	2,500	2,700	0	0	0	0	2	12	20	50
1993	3,600	1,300	0	0	0	0	2	12	20	50
1994	2,800	2,300	0	0	0	0	2	12	20	40
1995	1,669	1,095	0	0	0	0	5	20	20	40
1996	2,063	1,942	0	0	0	0	5	20	20	40
1997	1,060	1,001	0	0	0	0	5	20	20	40
1998	2,065	846	0	0	0	0	5	20	20	40
1999	690	1,831	0	0	0	0	5	20	20	40
2000	1,792	1,277	0	0	0	0	5	20	20	40
2001	1,544	1,489	0	0	0	0	5	20	20	40
2002	2,423	1,065	20	40	15	30	10	30	20	55
2003	1,598	1,540	20	40	15	30	10	30	20	55
2004	1,927	2,880	20	40	15	30	10	30	20	55
2005	1,256	1,771	20	40	15	30	10	30	20	55
2006			20	40	15	30	10	30	20	55
2007			20	40	15	30	10	30	20	55
2008			20	40	15	30	10	30	20	55
2009			20	40	15	30	10	30	20	55
2010			20	40	15	30	10	30	20	55

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1c. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – ICELAND – West & South.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	30,618	16,749	1	3	1	3	40	60	50	70
1972	24,832	25,733	1	3	1	3	40	60	50	70
1973	26,624	23,183	1	3	1	3	40	60	50	70
1974	18,975	20,017	1	3	1	3	40	60	50	70
1975	29,428	21,266	1	3	1	3	40	60	50	70
1976	23,233	18,379	1	3	1	3	40	60	50	70
1977	23,802	17,919	1	3	1	3	40	60	50	70
1978	31,199	23,182	1	3	1	3	40	60	50	70
1979	28,790	14,840	1	3	1	3	40	60	50	70
1980	13,073	20,855	1	3	1	3	40	60	50	70
1981	16,890	13,919	1	3	1	3	40	60	50	70
1982	17,331	9,826	1	3	1	3	40	60	50	70
1983	21,923	16,423	1	3	1	3	40	60	50	70
1984	13,476	13,923	1	3	1	3	40	60	50	70
1985	21,822	10,097	1	3	1	3	40	60	50	70
1986	35,891	8,423	1	3	1	3	40	60	50	70
1987	22,302	7,480	1	3	1	3	40	60	50	70
1988	40,028	8,523	1	3	1	3	40	60	50	70
1989	22,377	7,607	1	3	1	3	40	60	50	70
1990	20,584	7,548	1	3	1	3	40	60	50	70
1991	22,711	7,519	1	3	1	3	40	60	50	70
1992	26,006	8,479	1	3	1	3	40	60	50	70
1993	25,479	4,155	1	3	1	3	40	60	50	70
1994	20,985	6,736	1	3	1	3	40	60	50	70
1995	25,371	6,777	1	3	1	3	40	60	50	70
1996	21,913	4,364	1	3	1	3	40	60	50	70
1997	16,007	4,910	1	3	1	3	40	60	50	70
1998	21,900	3,037	1	3	1	3	40	60	50	70
1999	17,448	5,757	1	3	1	3	40	60	50	70
2000	15,502	1,519	1	3	1	3	40	60	50	70
2001	13,586	2,707	1	3	1	3	40	60	50	70
2002	16,952	2,845	1	3	1	3	40	60	50	70
2003	20,271	4,751	1	3	1	3	40	60	50	70
2004	20,319	3,784	1	3	1	3	40	60	50	70
2005	29,964	3,241	1	3	1	3	40	60	50	70
2006			1	3	1	3	40	60	50	70
2007			1	3	1	3	40	60	50	70
2008			1	3	1	3	40	60	50	70
2009			1	3	1	3	40	60	50	70
2010			1	3	1	3	40	60	50	70

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1d. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – ICELAND - North & East.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	4,610	6,625	1	3	1	3	40	60	50	70
1972	4,223	10,337	1	3	1	3	40	60	50	70
1973	5,060	9,672	1	3	1	3	40	60	50	70
1974	5,047	9,176	1	3	1	3	40	60	50	70
1975	6,152	10,136	1	3	1	3	40	60	50	70
1976	6,184	8,350	1	3	1	3	40	60	50	70
1977	8,597	11,631	1	3	1	3	40	60	50	70
1978	8,739	14,998	1	3	1	3	40	60	50	70
1979	8,363	9,897	1	3	1	3	40	60	50	70
1980	1,268	13,784	1	3	1	3	40	60	50	70
1981	6,528	4,827	1	3	1	3	40	60	50	70
1982	3,007	5,539	1	3	1	3	40	60	50	70
1983	4,437	4,224	1	3	1	3	40	60	50	70
1984	1,611	5,447	1	3	1	3	40	60	50	70
1985	11,116	3,511	1	3	1	3	40	60	50	70
1986	13,827	9,569	1	3	1	3	40	60	50	70
1987	8,145	9,908	1	3	1	3	40	60	50	70
1988	11,775	6,381	1	3	1	3	40	60	50	70
1989	6,342	5,414	1	3	1	3	40	60	50	70
1990	4,752	5,709	1	3	1	3	40	60	50	70
1991	6,900	3,965	1	3	1	3	40	60	50	70
1992	12,996	5,903	1	3	1	3	40	60	50	70
1993	10,689	6,672	1	3	1	3	40	60	50	70
1994	3,414	5,656	1	3	1	3	40	60	50	70
1995	8,776	3,511	1	3	1	3	40	60	50	70
1996	4,681	4,605	1	3	1	3	40	60	50	70
1997	6,406	2,594	1	3	1	3	40	60	50	70
1998	10,905	3,780	1	3	1	3	40	60	50	70
1999	5,326	4,030	1	3	1	3	40	60	50	70
2000	5,595	2,324	1	3	1	3	40	60	50	70
2001	4,976	2,587	1	3	1	3	40	60	50	70
2002	8,437	2,366	1	3	1	3	40	60	50	70
2003	4,478	2,194	1	3	1	3	40	60	50	70
2004	11,823	2,239	1	3	1	3	40	60	50	70
2005	10,279	2,747	1	3	1	3	40	60	50	70
2006			1	3	1	3	40	60	50	70
2007			1	3	1	3	40	60	50	70
2008			1	3	1	3	40	60	50	70
2009			1	3	1	3	40	60	50	70
2010			1	3	1	3	40	60	50	70

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1e. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – IRELAND.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	409,598	46,553	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1972	436,432	49,789	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1973	476,085	54,003	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1974	541,426	60,898	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1975	598,073	68,209	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1976	406,818	47,336	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1977	351,252	41,201	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1978	307,186	35,665	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1979	281,947	32,060	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1980	214,281	35,314	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1981	140,449	26,672	30.00	45.00	30.00	45.00	64.38	87.10	35.00	60.00
1982	268,636	11,706	30.00	45.00	30.00	45.00	61.08	82.64	28.34	44.99
1983	436,173	26,386	30.00	45.00	30.00	45.00	56.14	75.96	10.34	45.41
1984	225,830	20,763	30.00	45.00	30.00	45.00	54.91	74.28	37.02	50.00
1985	433,940	18,972	30.00	45.00	30.00	45.00	63.39	85.76	32.75	39.45
1986	433,947	26,556	30.00	45.00	30.00	45.00	58.40	79.01	36.95	55.00
1987	325,843	26,388	20.00	40.00	20.00	40.00	59.34	80.28	27.50	36.86
1988	391,384	22,062	20.00	40.00	20.00	40.00	52.73	71.34	31.85	43.00
1989	299,460	25,583	20.00	40.00	20.00	40.00	55.85	75.56	38.35	56.00
1990	176,744	15,928	20.00	40.00	20.00	40.00	51.62	69.84	53.85	66.00
1991	120,560	10,346	20.00	40.00	20.00	40.00	50.55	68.39	23.00	30.00
1992	186,099	15,769	20.00	40.00	20.00	40.00	52.75	71.36	47.66	55.26
1993	151,430	13,250	15.00	35.00	15.00	35.00	49.85	67.44	24.00	60.00
1994	236,203	20,675	15.00	35.00	15.00	35.00	60.70	82.12	38.06	43.00
1995	235,793	20,724	15.00	35.00	15.00	35.00	53.94	72.98	40.65	43.00
1996	205,141	18,121	15.00	35.00	15.00	35.00	50.90	68.87	51.93	58.28
1997	172,274	14,846	15.00	35.00	10.00	20.00	42.59	57.62	18.51	43.00
1998	194,309	17,468	15.00	35.00	10.00	20.00	45.66	61.78	60.47	63.25
1999	158,574	14,781	15.00	35.00	10.00	20.00	40.60	54.92	16.00	52.29
2000	199,821	16,847	15.00	35.00	10.00	20.00	36.75	49.72	26.51	35.48
2001	218,976	18,458	5	10	5	10	40.80	55.20	27	43.00
2002	199,000	16,725	5	10	5	10	42.41	57.37	20	35.00
2003	161,523	13,760	5	10	5	10	35.13	47.52	16	27.00
2004	142658	12332	5	10	5	10	42	57	27	43
2005	133072	11255	0	0	5	10	39	53	20	27
2006			5	10	5	10	42	57	16	43
2007			5	10	5	10	42	57	16	43
2008			5	10	5	10	42	57	16	43
2009			5	10	5	10	42	57	16	43
2010			5	10	5	10	42	57	16	43

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1f. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – NORWAY – South.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	40,511	37,105	40	60	40	60	65	85	65	85
1984	34,248	38,614	40	60	40	60	65	85	65	85
1985	47,877	36,968	40	60	40	60	65	85	65	85
1986	51,839	41,890	40	60	40	60	65	85	65	85
1987	48,690	39,641	40	60	40	60	65	85	65	85
1988	53,775	37,145	40	60	40	60	65	85	65	85
1989	43,128	25,279	40	60	40	60	55	75	55	75
1990	44,259	25,907	40	60	40	60	55	75	55	75
1991	30,771	19,054	40	60	40	60	55	75	55	75
1992	32,488	24,124	40	60	40	60	55	75	55	75
1993	34,503	22,835	30	50	30	50	55	75	55	75
1994	42,551	20,903	30	50	30	50	55	75	55	75
1995	32,685	24,725	30	50	30	50	55	75	55	75
1996	27,739	26,029	30	50	30	50	55	75	55	75
1997	31,381	14,922	25	45	25	45	50	70	50	70
1998	38,299	16,966	25	45	25	45	50	70	50	70
1999	31,256	9,881	25	45	25	45	50	70	50	70
2000	54,671	22,208	25	45	25	45	50	70	50	70
2001	59,425	29,896	25	45	25	45	50	70	50	70
2002	39,068	21,513	25	45	25	45	50	70	50	70
2003	41,642	28,168	20	40	20	40	50	70	50	70
2004	35,616	22,226	20	40	20	40	50	70	50	70
2005	51,159	22,350	20	40	20	40	50	70	50	70
2006			20	40	20	40	50	70	50	70
2007			20	40	20	40	50	70	50	70
2008			20	40	20	40	50	70	50	70
2009			20	40	20	40	50	70	50	70
2010			20	40	20	40	50	70	50	70

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1g. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – NORWAY – Mid.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	121,221	74,648	40	60	40	60	65	85	65	85
1984	94,373	67,639	40	60	40	60	65	85	65	85
1985	114,613	56,641	40	60	40	60	65	85	65	85
1986	106,921	77,225	40	60	40	60	65	85	65	85
1987	83,669	62,216	40	60	40	60	65	85	65	85
1988	80,111	45,609	40	60	40	60	65	85	65	85
1989	94,897	30,862	40	60	40	60	55	75	55	75
1990	78,888	40,174	40	60	40	60	55	75	55	75
1991	67,370	30,087	40	60	40	60	55	75	55	75
1992	51,463	33,092	40	60	40	60	55	75	55	75
1993	58,326	28,184	30	50	30	50	55	75	55	75
1994	113,427	33,520	30	50	30	50	55	75	55	75
1995	57,813	42,696	30	50	30	50	55	75	55	75
1996	28,925	31,613	30	50	30	50	55	75	55	75
1997	43,127	20,565	25	45	25	45	50	70	50	70
1998	63,497	26,817	25	45	25	45	50	70	50	70
1999	60,689	28,792	25	45	25	45	50	70	50	70
2000	109,278	42,452	25	45	25	45	50	70	50	70
2001	88,096	52,031	25	45	25	45	50	70	50	70
2002	42,669	52,774	25	45	25	45	50	70	50	70
2003	91,118	46,963	20	40	20	40	50	70	50	70
2004	38,286	49,760	20	40	20	40	50	70	50	70
2005	63,749	37,941	20	40	20	40	50	70	50	70
2006			20	40	20	40	50	70	50	70
2007			20	40	20	40	50	70	50	70
2008			20	40	20	40	50	70	50	70
2009			20	40	20	40	50	70	50	70
2010			20	40	20	40	50	70	50	70

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1h. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – NORWAY – North.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	104,040	49,413	40	60	40	60	70	90	70	90
1984	150,372	58,858	40	60	40	60	70	90	70	90
1985	118,841	58,956	40	60	40	60	70	90	70	90
1986	84,150	63,418	40	60	40	60	70	90	70	90
1987	72,370	34,232	40	60	40	60	70	90	70	90
1988	53,880	32,140	40	60	40	60	70	90	70	90
1989	42,010	13,934	40	60	40	60	60	80	60	80
1990	38,216	17,321	40	60	40	60	60	80	60	80
1991	42,888	21,789	40	60	40	60	60	80	60	80
1992	34,593	19,265	40	60	40	60	60	80	60	80
1993	51,440	39,014	30	50	30	50	60	80	60	80
1994	37,489	33,411	30	50	30	50	60	80	60	80
1995	36,283	26,037	30	50	30	50	60	80	60	80
1996	40,792	36,636	30	50	30	50	60	80	60	80
1997	39,930	30,115	25	45	25	45	60	80	60	80
1998	46,645	34,806	25	45	25	45	60	80	60	80
1999	46,394	46,744	25	45	25	45	60	80	60	80
2000	61,854	51,569	25	45	25	45	60	80	60	80
2001	46,331	54,023	25	45	25	45	60	80	60	80
2002	38,101	43,100	25	45	25	45	60	80	60	80
2003	44,947	35,972	20	40	20	40	60	80	60	80
2004	34,640	28,077	20	40	20	40	60	80	60	80
2005	45,530	33,334	20	40	20	40	60	80	60	80
2006			20	40	20	40	60	80	60	80
2007			20	40	20	40	60	80	60	80
2008			20	40	20	40	60	80	60	80
2009			20	40	20	40	60	80	60	80
2010			20	40	20	40	60	80	60	80

M(min)=	0.02	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.04		1SW(max)	9	MSW(max)	18

Table 3.9.11.1i. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – RUSSIA – (Archangelsk & Karelia).

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	134	16,592	5	15	5	15	40	80	40	80
1972	116	14,434	5	15	5	15	40	80	40	80
1973	169	20,924	5	15	5	15	40	80	40	80
1974	170	21,137	5	15	5	15	40	80	40	80
1975	140	17,398	5	15	5	15	40	80	40	80
1976	111	13,781	5	15	5	15	40	80	40	80
1977	78	9,722	5	15	5	15	40	80	40	80
1978	82	10,134	5	15	5	15	40	80	40	80
1979	112	13,903	5	15	5	15	40	80	40	80
1980	156	19,397	5	15	5	15	40	80	40	80
1981	68	8,394	5	15	5	15	40	80	40	80
1982	71	8,797	5	15	5	15	40	80	40	80
1983	48	11,938	5	15	5	15	40	80	40	80
1984	21	10,680	5	15	5	15	40	80	40	80
1985	454	11,183	5	15	5	15	40	80	40	80
1986	12	12,291	5	15	5	15	40	80	40	80
1987	647	8,734	5	15	5	15	40	80	40	80
1988	224	9,978	5	15	5	15	40	80	40	80
1989	989	10,245	5	15	5	15	40	80	40	80
1990	1,418	8,429	10	20	10	20	40	80	40	80
1991	421	8,725	15	25	15	25	40	80	40	80
1992	1,031	3,949	20	30	20	30	40	80	40	80
1993	196	4,251	25	35	25	35	40	80	40	80
1994	334	5,631	30	40	30	40	40	80	40	80
1995	386	5,214	40	50	40	50	40	80	40	80
1996	231	3,753	50	60	50	60	40	80	40	80
1997	721	3,351	50	60	50	60	40	80	40	80
1998	585	4,208	50	60	50	60	40	80	40	80
1999	299	3,101	50	60	50	60	40	80	40	80
2000	514	3,382	50	60	50	60	40	80	40	80
2001	363	2,348	50	60	50	60	40	80	40	80
2002	1,676	2,439	50	60	50	60	40	80	40	80
2003	893	2,041	50	60	50	60	40	80	40	80
2004	990	3,761	50	60	50	60	40	80	40	80
2005	1,252	3,809	50	60	50	60	40	80	40	80
2006			50	60	50	60	40	80	40	80
2007			50	60	50	60	40	80	40	80
2008			50	60	50	60	40	80	40	80
2009			50	60	50	60	40	80	40	80
2010			50	60	50	60	40	80	40	80

M(min)=	0.02	Return time (m)	1SW(min)	7	MSW(min)	19
M(max)=	0.04		1SW(max)	8	MSW(max)	21

Table 3.9.11.1j. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – RUSSIA – (Kola peninsula: Barents Sea Basin).

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	4892	5979	10	20	10	20	40	50	40	50
1972	7978	9750	10	20	10	20	40	50	40	50
1973	9376	11460	10	20	10	20	35	45	35	45
1974	12794	15638	10	20	10	20	35	45	35	45
1975	13872	13872	10	20	10	20	40	50	40	50
1976	11493	14048	10	20	10	20	50	60	50	60
1977	7257	8253	10	20	10	20	45	55	45	55
1978	7106	7113	10	20	10	20	50	60	50	60
1979	6707	3141	10	20	10	20	35	45	35	45
1980	6621	5216	10	20	10	20	35	45	35	45
1981	4547	5973	10	20	10	20	35	45	35	45
1982	5159	4798	10	20	10	20	30	40	30	40
1983	8,504	9,943	10	20	10	20	30	40	30	40
1984	9,453	12,601	10	20	10	20	30	40	30	40
1985	6,774	7,877	10	20	10	20	30	40	30	40
1986	10,147	5,352	10	20	10	20	35	45	35	45
1987	8,560	5,149	10	20	10	20	35	45	35	45
1988	6,644	3,655	10	20	10	20	30	40	30	40
1989	13,424	6,787	10	20	10	20	35	45	35	45
1990	16,038	8,234	10	20	10	20	35	45	35	45
1991	4,550	7,568	10	20	10	20	25	35	25	35
1992	11,394	7,109	10	20	10	20	25	35	25	35
1993	8,642	5,690	10	20	10	20	25	35	25	35
1994	6,101	4,632	10	20	10	20	25	35	25	35
1995	6,318	3,693	10	20	10	20	25	35	25	35
1996	6,815	1,701	15	25	15	25	20	30	20	30
1997	3,564	867	20	30	20	30	10	20	10	20
1998	1,854	280	30	40	30	40	10	15	10	15
1999	1,510	424	35	45	35	45	5	10	5	10
2000	805	323	45	55	45	55	4	8	4	8
2001	591	241	55	65	55	65	2	5	2	5
2002	1,436	2,478	40	60	40	60	5	15	15	25
2003	1,938	1,095	40	60	40	60	5	15	15	25
2004	1,095	850	40	60	40	60	5	15	15	25
2005	859	426	50	70	50	70	5	15	15	25
2006			40	60	40	60	5	15	15	25
2007			40	60	40	60	5	15	15	25
2008			40	60	40	60	5	15	15	25
2009			40	60	40	60	5	15	15	25
2010			40	60	40	60	5	15	15	25

M(min)=	0.020	Return time (m)	1SW(min)	6	MSW(min)	17
M(max)=	0.040		1SW(max)	8	MSW(max)	20

Table 3.9.11.1k. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – RUSSIA – (Kola peninsula: White Sea Basin).

Year	Catch (numbers) **Current year returns**		Unrep. as % of 1SW		Unrep. as % of MSW		Exp. rate 1SW (%)		Exp. Rate MSW (%)		Catch (numbers) **Previous year returns**	
	1SW	MSW	min	max	min	max	min	max	min	max	1SW	MSW
1971	67,845	29,077	1	5	1	5	40	60	50	70		
1972	45,837	19,644	1	5	1	5	40	60	50	70		
1973	68,684	29,436	1	5	1	5	40	60	50	70		
1974	63,892	27,382	1	5	1	5	40	60	50	70		
1975	109,038	46,730	1	5	1	5	40	60	50	70		
1976	76,281	41,075	1	5	1	5	40	60	50	70		
1977	47,943	32,392	1	5	1	5	40	60	50	70		
1978	49,291	17,307	1	5	1	5	40	60	50	70		
1979	69,511	21,369	1	5	1	5	40	60	50	70		
1980	46,037	23,241	1	5	1	5	40	60	50	70		
1981	40,172	12,747	1	5	1	5	40	60	50	70		
1982	32,619	14,840	1	5	1	5	40	60	50	70		
1983	54,217	20,840	1	5	1	5	40	60	50	70		
1984	56,786	16,893	1	5	1	5	40	60	50	70		
1985	87,274	16,876	1	5	1	5	40	60	50	70		
1986	72,102	17,681	1	5	1	5	40	60	50	70		
1987	79,639	12,501	1	5	1	5	40	60	40	60		
1988	44,813	18,777	1	5	1	5	40	50	40	50		
1989	53,293	11,448	5	10	5	10	40	50	40	50		
1990	44,409	11,152	10	15	10	15	40	50	40	50		
1991	31,978	6,263	15	20	15	20	30	40	30	40		
1992	23,827	3,680	20	25	20	25	20	30	20	30		
1993	20,987	5,552	20	30	20	30	20	30	20	30		
1994	25,178	3,680	25	35	25	35	20	30	10	20		
1995	19,381	2,847	30	40	30	40	20	30	10	20		
1996	27,097	2,710	30	40	30	40	20	30	10	20		
1997	27,695	2,085	30	40	30	40	20	30	10	20		
1998	32,693	1,963	30	40	30	40	20	30	10	20		
1999	22,330	2,841	30	40	30	40	20	30	10	20		
2000	26,376	4,396	30	40	30	40	20	30	10	20		
2001	20,483	3,959	30	40	30	40	10	20	10	20	1215	663
2002	19,174	3,937	30	40	30	40	10	20	10	20	2176	784
2003	15,687	3,734	30	40	30	40	10	20	10	20	3717	1182
2004	10,947	1,990	30	40	30	40	10	20	10	20	3989	1301
2005	13,172	2,388	30	40	30	40	10	20	10	20	1212	878

M(min)=	0.020	Return time (m)	1SW(min)	7	MSW(min)	18
M(max)=	0.040		1SW(max)	10	MSW(max)	21

Table 3.9.11.1l. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – RUSSIA – (Pechora River).

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	605	17,728	10	30	10	30	50	80	50	80
1972	825	24,175	10	30	10	30	50	80	50	80
1973	1,705	49,962	10	30	10	30	50	80	50	80
1974	1,320	38,680	10	30	10	30	50	80	50	80
1975	1,298	38,046	10	30	10	30	50	80	50	80
1976	991	34,394	10	30	10	30	50	80	50	80
1977	589	20,464	10	30	10	30	50	80	50	80
1978	759	26,341	10	30	10	30	50	80	50	80
1979	421	14,614	10	30	10	30	50	80	50	80
1980	1,123	39,001	10	30	10	30	50	80	50	80
1981	126	20,874	10	30	10	30	50	80	50	80
1982	54	13,546	10	30	10	30	50	80	50	80
1983	598	16,002	10	30	10	30	50	80	50	80
1984	1,833	15,967	10	30	10	30	50	80	50	80
1985	2,763	29,738	10	30	10	30	50	80	50	80
1986	66	32,734	10	30	10	30	50	80	50	80
1987	21	21,179	10	30	10	30	50	80	50	80
1988	3,184	12,816	10	30	10	30	50	80	50	80
			Input data for analisis of total adult returns to Home Waters				**Input data for spawner abundance analysis**			
	Estimated numbers of adult returns to fresh water		**Marine Unrep. as % of adult returns to FW 1SW**		**Marine Unrep. as % of adult returns to FW MSW**		**Freshwater Unrep. as % of adult returns to FW 1SW**		**Freshwater Unrep. as % of adult returns to FW MSW**	
	1SW	**MSW**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
1989	24,596	27,404	5	15	5	15	50	80	50	80
1990	50	49,950	5	15	5	15	50	80	50	80
1991	7,975	47,025	5	15	5	15	50	80	50	80
1992	550	54,450	5	15	5	15	50	80	50	80
1993	68	67,932	5	15	5	15	50	80	50	80
1994	3,900	48,100	5	15	5	15	50	80	50	80
1995	9,280	70,720	5	15	5	15	50	80	50	80
1996	8,664	48,336	5	15	5	15	50	80	50	80
1997	1,440	38,560	5	15	5	15	50	80	50	80
1998	780	59,220	5	15	5	15	50	80	50	80
1999	2,120	37,880	5	15	5	15	50	80	50	80
2000	84	83,916	5	15	5	15	50	80	50	80
2001	2,244	41,756	5	15	5	15	50	80	50	80
2002	405	44,595	5	15	5	15	50	80	50	80
2003	0	21,000	5	15	5	15	50	80	50	80
2004	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	19
M(max)=	0.040		1SW(max)	8	MSW(max)	21

Table 3.9.11.1m. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – SWEDEN.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	6,330	420	15	45	15	45	40	65	45	70
1972	5,005	295	15	45	15	45	40	65	45	70
1973	6,210	1,025	15	45	15	45	40	65	45	70
1974	8,935	660	15	45	15	45	40	65	45	70
1975	9,620	160	15	45	15	45	40	65	45	70
1976	5,420	480	15	45	15	45	40	65	45	70
1977	2,555	360	15	45	15	45	40	65	45	70
1978	2,917	275	15	45	15	45	40	65	45	70
1979	3,080	800	15	45	15	45	40	65	45	70
1980	3,920	1,400	15	45	15	45	40	65	45	70
1981	7,095	407	15	45	15	45	40	65	45	70
1982	6,230	1,460	15	45	15	45	40	65	45	70
1983	8,290	1,005	15	45	15	45	40	65	45	70
1984	11,680	1,410	15	45	15	45	40	65	45	70
1985	13,890	590	15	45	15	45	40	65	45	70
1986	14,635	570	15	45	15	45	40	65	45	70
1987	11,860	1,700	15	45	15	45	40	65	45	70
1988	9,930	1,650	15	45	15	45	40	65	45	70
1989	3,180	4,610	15	45	15	45	40	65	45	70
1990	7,430	3,135	5	25	5	25	30	60	35	65
1991	8,990	3,620	5	25	5	25	30	60	35	65
1992	9,850	4,655	5	25	5	25	30	60	35	65
1993	10,540	6,370	5	25	5	25	30	60	35	65
1994	8,035	4,660	5	25	5	25	30	60	35	65
1995	9,761	2,770	5	25	5	25	25	50	30	55
1996	6,008	3,542	5	25	5	25	25	50	30	55
1997	2,747	2,307	5	25	5	25	25	50	30	55
1998	2,421	1,702	5	25	5	25	25	50	30	55
1999	3,573	1,460	5	25	5	25	25	50	30	55
2000	7,103	3,196	5	25	5	25	25	50	30	55
2001	4,634	3,853	5	25	5	25	25	50	30	55
2002	4,733	2,826	5	25	5	25	25	50	30	55
2003	2,891	3,214	5	25	5	25	25	50	30	55
2004	2,494	2,330	5	25	5	25	25	50	30	55
2005	2,122	1,770	5	25	5	25	25	50	30	55
2006			5	25	5	25	25	50	30	55
2007			5	25	5	25	25	50	30	55
2008			5	25	5	25	25	50	30	55
2009			5	25	5	25	25	50	30	55
2010			5	25	5	25	25	50	30	55

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1n. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (ENGLAND & WALES).

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	28,915	23,611	29	48	29	48	36	56	30	50
1972	24,613	34,364	29	49	29	49	35	55	29	49
1973	28,989	26,097	29	48	29	48	35	55	29	49
1974	35,431	18,776	29	49	29	49	34	54	29	49
1975	36,465	25,819	29	48	29	48	35	55	29	49
1976	25,422	14,113	28	46	28	46	35	55	30	50
1977	27,836	17,260	29	49	29	49	36	56	31	51
1978	31,397	14,228	29	48	29	48	36	56	30	50
1979	29,030	6,803	29	48	29	48	35	55	30	50
1980	26,997	22,019	29	49	29	49	36	56	30	50
1981	28,414	31,115	29	48	29	48	36	56	30	50
1982	24,139	12,003	29	48	29	48	36	56	30	50
1983	35,903	13,861	28	46	28	46	37	57	31	51
1984	31,923	11,355	27	46	27	46	37	57	31	51
1985	30,759	16,020	29	49	29	49	37	57	31	51
1986	35,695	21,822	28	47	28	47	37	57	31	51
1987	36,339	17,101	29	48	29	48	37	57	31	51
1988	47,989	21,560	30	50	30	50	37	57	31	51
1989	33,610	18,098	28	46	28	46	38	58	32	52
1990	24,152	22,294	28	46	28	46	38	58	32	52
1991	23,018	9,402	28	47	28	47	37	57	31	51
1992	22,787	6,806	30	50	30	50	37	57	31	51
1993	30,526	7,160	28	47	28	47	34	54	28	48
1994	41,662	12,444	18	30	18	30	35	55	29	49
1995	30,148	11,724	17	28	17	28	32	52	26	46
1996	21,848	11,764	15	26	15	26	31	51	25	45
1997	18,690	6,913	14	24	14	24	27	47	22	42
1998	19,466	3,987	14	24	14	24	25	45	20	40
1999	14,603	6,872	13	22	13	22	20	40	12	32
2000	23,116	6,145	11	19	11	19	20	40	8	28
2001	19,119	6,037	11	18	11	18	18	38	7	27
2002	17,676	5,582	11	19	11	19	19	39	7	27
2003	10,459	5,152	13	22	13	22	17	37	6	26
2004	19092	4478	13	22	13	22	19	39	7	27
2005	14867	4695	13	22	13	22	18	38	7	27
2006			13	22	13	22	19	39	7	27
2007			13	22	13	22	19	39	7	27
2008			13	22	13	22	19	39	7	27
2009			13	22	13	22	19	39	7	27
2010			13	22	13	22	19	39	7	27

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	17
M(max)=	0.040		1SW(max)	9	MSW(max)	19

Table 3.9.11.1o. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (N. IRELAND) – Foyle Fisheries Area.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	78,037	5,874	10	33	10	33	75	85	45	55
1972	64,663	4,867	10	33	10	33	75	85	45	55
1973	57,469	4,326	10	33	10	33	75	85	45	55
1974	72,587	5,464	10	33	10	33	75	85	45	55
1975	51,061	3,843	10	33	10	33	75	85	45	55
1976	36,206	2,725	10	33	10	33	75	85	45	55
1977	36,510	2,748	10	33	10	33	75	85	45	55
1978	44,557	3,354	10	33	10	33	75	85	45	55
1979	34,413	2,590	10	33	10	33	75	85	45	55
1980	45,777	3,446	10	33	10	33	75	85	45	55
1981	32,346	2,435	10	33	10	33	75	85	45	55
1982	55,946	4,211	10	33	10	33	75	85	45	55
1983	77,424	5,828	10	33	10	33	75	85	45	55
1984	27,465	2,067	10	33	10	33	75	85	45	55
1985	37,685	2,836	10	33	10	33	75	85	45	55
1986	43,109	3,245	10	33	10	33	75	85	45	55
1987	17,189	1,294	10	33	10	33	62	76	41	51
1988	43,974	3,310	10	33	10	33	58	71	32	40
1989	60,288	4,538	10	37	10	37	80	98	54	66
1990	39,875	3,001	10	17	10	17	56	68	34	42
1991	21,709	1,634	10	17	10	17	58	71	39	47
1992	39,299	2,958	10	23	10	23	50	62	30	36
1993	35,366	2,662	10	17	10	17	37	45	11	13
1994	36,144	2,720	10	28	10	28	63	77	36	44
1995	33,398	2,514	10	17	10	17	60	74	38	46
1996	28,406	2,138	10	20	10	20	47	67	24	44
1997	40,886	3,077	5	15	5	15	50	70	24	44
1998	37,154	2,797	5	15	5	15	20	30	15	30
1999	21,660	1,630	5	15	5	15	58	68	25	40
2000	30,385	2,287	5	15	5	15	53	63	25	40
2001	21,368	1,608	0	10	0	10	45	55	25	35
2002	37,914	2,854	0	5	0	5	45	65	25	35
2003	30,441	2,291	0	1	0	1	40	55	20	30
2004	20,730	1,560	0	1	0	1	30	40	15	25
2005	23,746	1,787	0	1	0	1	25	35	45	55
2006			0	1	0	1	30	40	15	25
2007			0	1	0	1	30	40	15	25
2008			0	1	0	1	30	40	15	25
2009			0	1	0	1	30	40	15	25
2010			0	1	0	1	30	40	15	25

M(min)= 0.02   Return time (m)= 1SW(min) 7   MSW(min) 16

M(max)= 0.04   1SW(max) 9   MSW(max) 18

Table 3.9.11.1p. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (N. IRELAND) – FCB Area.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	35506	2673	10	33	10	33	75	85	45	55
1972	34550	2601	10	33	10	33	75	85	45	55
1973	29229	2200	10	33	10	33	75	85	45	55
1974	22307	1679	10	33	10	33	75	85	45	55
1975	26701	2010	10	33	10	33	75	85	45	55
1976	17886	1346	10	33	10	33	75	85	45	55
1977	16778	1263	10	33	10	33	75	85	45	55
1978	24857	1871	10	33	10	33	75	85	45	55
1979	14323	1078	10	33	10	33	75	85	45	55
1980	15967	1202	10	33	10	33	75	85	45	55
1981	15994	1204	10	33	10	33	75	85	45	55
1982	14068	1059	10	33	10	33	75	85	45	55
1983	20,845	1,569	10	33	10	33	75	85	45	55
1984	11,109	836	10	33	10	33	75	85	45	55
1985	12,369	931	10	33	10	33	75	85	45	55
1986	13,160	991	10	33	10	33	75	85	45	55
1987	9,240	695	10	33	10	33	62	76	41	51
1988	14,320	1,078	10	33	10	33	58	71	32	40
1989	15,081	1,135	10	37	10	37	80	98	54	66
1990	9,499	715	10	17	10	17	56	68	34	42
1991	6,987	526	10	17	10	17	58	71	39	47
1992	9,346	703	10	23	10	23	50	62	30	36
1993	7,906	595	10	17	10	17	37	45	11	13
1994	11,206	843	10	28	10	28	63	77	36	44
1995	11,637	876	10	17	10	17	60	74	38	46
1996	10,383	781	10	20	10	20	47	67	24	44
1997	10,479	789	5	15	5	15	50	70	24	44
1998	9,375	706	5	15	5	15	20	30	15	30
1999	9,011	678	5	15	5	15	58	68	25	40
2000	10,598	798	5	15	5	15	53	63	25	40
2001	8,104	610	0	10	0	10	45	55	25	35
2002	3,315	249	0	5	0	5	45	65	25	35
2003	2,236	168	0	5	0	5	40	55	20	30
2004	2,411	181	0	1	0	1	30	40	15	25
2005	3,012	227	0	1	0	1	25	35	45	55
2006			0	1	0	1	30	40	15	25
2007			0	1	0	1	30	40	15	25
2008			0	1	0	1	30	40	15	25
2009			0	1	0	1	30	40	15	25
2010			0	1	0	1	30	40	15	25

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16
M(max)=	0.040		1SW(max)	9	MSW(max)	18

Table 3.9.11.1q. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (SCOTLAND) – East.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	216,873	135,527	15	35	15	35	62.8	87.9	39.9	59.9
1972	220,106	183,872	15	35	15	35	64.0	89.6	41.2	61.7
1973	259,773	204,825	15	35	15	35	62.4	87.4	39.9	59.8
1974	245,424	158,951	15	35	15	35	68.3	95.6	45.1	67.6
1975	181,940	180,828	15	35	15	35	67.1	93.9	44.0	66.1
1976	150,069	92,179	15	35	15	35	63.8	89.3	40.5	60.8
1977	154,306	118,645	15	35	15	35	67.9	95.0	44.6	66.9
1978	158,844	139,688	15	35	15	35	63.0	88.2	40.8	61.2
1979	160,791	116,514	15	35	15	35	65.3	91.4	43.1	64.6
1980	101,665	155,646	10	25	10	25	64.0	89.6	41.6	62.4
1981	129,690	156,683	10	25	10	25	63.3	88.6	41.0	61.4
1982	175,355	113,180	10	25	10	25	59.2	82.9	36.2	54.3
1983	170,843	126,104	10	25	10	25	64.2	89.8	39.5	59.3
1984	175,675	90,829	10	25	10	25	58.4	81.8	35.1	52.7
1985	133,073	95,012	10	25	10	25	51.5	72.2	31.1	46.7
1986	180,276	128,813	10	25	10	25	49.6	69.4	30.0	45.1
1987	139,252	88,519	10	25	10	25	53.8	75.3	32.4	48.6
1988	118,580	91,068	10	25	10	25	33.6	47.0	23.4	35.0
1989	142,992	85,348	5	15	5	15	31.3	43.8	22.4	33.5
1990	63,297	73,954	5	15	5	15	33.2	46.5	23.0	34.5
1991	53,835	53,676	5	15	5	15	30.7	42.9	22.0	32.9
1992	79,883	67,968	5	15	5	15	26.8	37.5	20.7	31.0
1993	73,396	60,496	5	15	5	15	29.4	41.2	21.5	32.3
1994	80,405	72,616	5	15	5	15	27.6	38.6	20.9	31.3
1995	72,961	69,047	5	15	5	15	25.8	36.1	20.3	30.5
1996	56,610	50,356	5	15	5	15	24.0	33.6	19.6	29.4
1997	37,448	34,862	5	15	5	15	25.5	35.7	20.1	30.2
1998	44,952	32,231	5	15	5	15	20.2	28.3	18.3	27.5
1999	20,907	27,011	5	15	5	15	20.7	28.9	18.7	28.0
2000	36,871	31,280	5	15	5	15	18.2	25.5	17.8	26.7
2001	36,646	30,470	5	15	5	15	17.0	23.8	17.1	26.1
2002	26,618	21,740	5	15	5	15	16.1	22.5	16.9	25.4
2003	25,830	24,244	5	15	5	15	14.5	20.0	15.0	23.5
2004	31,324	30,676	5	15	5	15	14.5	20.0	15.0	23.5
2005	24,986	21,017	5	15	5	15	14.5	20.0	15.0	23.5
2006			5	15	5	15	14.5	20.0	15.0	23.5
2007			5	15	5	15	14.5	20.0	15.0	23.5
2008			5	15	5	15	14.5	20.0	15.0	23.5
2009			5	15	5	15	14.5	20.0	15.0	23.5
2010			5	15	5	15	14.5	20.0	15.0	23.5

M(min)=	0.02	Return time (m)=	1SW(min)	7	MSW(min)	17.0
M(max)=	0.04		1SW(max)	8	MSW(max)	18.0

Table 3.9.11.1r. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (SCOTLAND) – West.

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	45287	26074	25	45	25	45	31.4	44.0	20.0	29.9
1972	31359	34151	25	45	25	45	32.0	44.8	20.6	30.9
1973	33317	33095	25	45	25	45	31.2	43.7	19.9	29.9
1974	43992	29406	25	45	25	45	34.2	47.8	22.5	33.8
1975	40424	27150	25	45	25	45	33.5	46.9	22.0	33.0
1976	38423	22403	25	45	25	45	31.9	44.7	20.3	30.4
1977	39958	20342	25	45	25	45	33.9	47.5	22.3	33.5
1978	45626	23266	25	45	25	45	31.5	44.1	20.4	30.6
1979	26445	15995	25	45	25	45	32.7	45.7	21.5	32.3
1980	19776	16942	20	35	20	35	32.0	44.8	20.8	31.2
1981	21048	18038	20	35	20	35	31.6	44.3	20.5	30.7
1982	32706	15062	20	35	20	35	29.6	41.5	18.1	27.2
1983	38,774	19,857	20	35	20	35	32.1	44.9	19.8	29.6
1984	37,404	16,384	20	35	20	35	29.2	40.9	17.6	26.3
1985	24,887	19,611	20	35	20	35	25.8	36.1	15.6	23.4
1986	22,579	19,584	20	35	20	35	24.8	34.7	15.0	22.5
1987	25,533	15,475	20	35	20	35	26.9	37.6	16.2	24.3
1988	30,518	21,094	20	35	20	35	16.8	23.5	11.7	17.5
1989	31,949	18,538	15	25	15	25	15.6	21.9	11.2	16.8
1990	17,797	13,970	15	25	15	25	16.6	23.2	11.5	17.2
1991	19,773	11,517	15	25	15	25	15.3	21.5	11.0	16.5
1992	21,793	14,873	15	25	15	25	13.4	18.7	10.3	15.5
1993	21,121	11,230	15	25	15	25	14.7	20.6	10.8	16.2
1994	18,258	12,316	15	25	15	25	13.8	19.3	10.4	15.6
1995	16,843	9,141	15	25	15	25	12.9	18.0	10.2	15.2
1996	9,559	7,472	15	25	15	25	12.0	16.8	9.8	14.7
1997	9,066	5,504	15	25	15	25	12.7	17.8	10.1	15.1
1998	8,369	6,150	15	25	15	25	10.1	14.1	9.2	13.8
1999	4,147	3,587	15	25	15	25	10.3	14.5	9.3	14.0
2000	6,974	5,301	15	25	15	25	9.1	12.7	8.9	13.4
2001	5,603	4,191	15	25	15	25	8.5	11.9	8.5	13.1
2002	4,691	4,548	15	25	15	25	8.0	11.2	8.5	12.7
2003	3,536	3,061	15	25	15	25	4.0	5.5	4.0	6.5
2004	5,836	6,010	15	25	15	25	6.0	8.0	6.0	9.0
2005	6,790	5,066	15	25	15	25	6.0	8.0	6.0	9.0
2006			15	25	15	25	6.0	8.0	6.0	9.0
2007			15	25	15	25	6.0	8.0	6.0	9.0
2008			15	25	15	25	6.0	8.0	6.0	9.0
2009			15	25	15	25	6.0	8.0	6.0	9.0
2010			15	25	15	25	6.0	8.0	6.0	9.0

M(min)=	0.020	Return time (m)=	1SW(min)	7	MSW(min)	16.0
M(max)=	0.040		1SW(max)	9	MSW(max)	18.0

Table 3.9.11.1s. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – FAROES.

Year n/n+1	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Prop'n wild
	1SW	MSW	min	max	min	max	min	max	min	max	
1971	2,620	105,796	5	15	0	0	100	100	100	100	1.00
1972	2,754	111,187	5	15	0	0	100	100	100	100	1.00
1973	3,121	126,012	5	15	0	0	100	100	100	100	1.00
1974	2,186	88,276	5	15	0	0	100	100	100	100	1.00
1975	2,798	112,984	5	15	0	0	100	100	100	100	1.00
1976	1,830	73,900	5	15	0	0	100	100	100	100	1.00
1977	1,291	52,112	5	15	0	0	100	100	100	100	1.00
1978	974	39,309	5	15	0	0	100	100	100	100	1.00
1979	1,736	70,082	5	15	0	0	100	100	100	100	1.00
1980	4,523	182,616	5	15	0	0	100	100	100	100	1.00
1981	7,443	300,542	5	15	0	0	100	100	100	100	0.98
1982	6,859	276,957	5	15	0	0	100	100	100	100	0.98
1983	15,861	215,349	5	15	0	0	100	100	100	100	0.98
1984	5,534	138,227	5	15	0	0	100	100	100	100	0.96
1985	378	158,103	5	15	0	0	100	100	100	100	0.92
1986	1,979	180,934	5	15	0	0	100	100	100	100	0.96
1987	90	166,244	5	15	0	0	100	100	100	100	0.97
1988	8,637	87,629	5	15	0	0	100	100	100	100	0.92
1989	1,788	121,965	5	15	0	0	100	100	100	100	0.82
1990	1,989	140,054	5	15	0	0	100	100	100	100	0.54
1991	943	84,935	5	15	0	0	100	100	100	100	0.54
1992	68	35,700	5	15	0	0	100	100	100	100	0.62
1993	6	30,023	5	15	0	0	100	100	100	100	0.69
1994	15	31,672	5	15	0	0	100	100	100	100	0.72
1995	18	34,662	5	15	0	0	100	100	100	100	0.80
1996	101	28,381	5	15	0	0	100	100	100	100	0.75
1997	0	0	10	20	0	0	100	100	100	100	0.80
1998	339	1,424	10	20	0	0	100	100	100	100	0.80
1999	0	0	10	20	0	0	100	100	100	100	0.80
2000	225	1,765	10	20	0	0	100	100	100	100	0.80
2001	0	0	10	20	0	0	100	100	100	100	0.80
2002	0	0	0	0	0	0	100	100	100	100	0.80
2003	0	0	0	0	0	0	100	100	100	100	0.80
2004	0	0	0	0	0	0	100	100	100	100	0.80
2005	0	0	0	0	0	0	100	100	100	100	0.80
2006	0	0	0	0	0	0	100	100	100	100	0.80
2007	0	0	0	0	0	0	100	100	100	100	0.80
2008	0	0	0	0	0	0	100	100	100	100	0.80
2009	0	0	0	0	0	0	100	100	100	100	0.80
2010	0	0	0	0	0	0	100	100	100	100	0.80

M(min)= 0.020
M(max)= 0.040

Return time (m)= 1SW(min) 0, MSW(min) 1; 1SW(max) 1, MSW(max) 2

Prop'n 1SW returning as grilse = min 0.170; max 0.270

Table 3.9.11.1t. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – WEST GREENLAND.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Prop'n EU
	1SW	MSW	min	max	min	max	min	max	min	max	
1971	0	856,369	0	0	5	15	100	100	100	100	**0.50**
1972	0	614,244	0	0	5	15	100	100	100	100	**0.50**
1973	0	560,048	0	0	5	15	100	100	100	100	**0.50**
1974	0	535,475	0	0	5	15	100	100	100	100	**0.50**
1975	0	650,641	0	0	5	15	100	100	100	100	**0.50**
1976	0	386,513	0	0	5	15	100	100	100	100	**0.50**
1977	0	442,368	0	0	5	15	100	100	100	100	**0.50**
1978	0	293,731	0	0	5	15	100	100	100	100	0.48
1979	0	417,665	0	0	5	15	100	100	100	100	0.50
1980	0	370,807	0	0	5	15	100	100	100	100	0.52
1981	0	398,738	0	0	5	15	100	100	100	100	0.41
1982	0	346,302	0	0	5	15	100	100	100	100	0.38
1983	0	100,000	0	0	5	15	100	100	100	100	0.60
1984	0	95,498	0	0	5	15	100	100	100	100	0.50
1985	0	301,045	0	0	5	15	100	100	100	100	0.50
1986	0	316,832	0	0	5	15	100	100	100	100	0.43
1987	0	305,696	0	0	5	15	100	100	100	100	0.41
1988	0	280,818	0	0	5	15	100	100	100	100	0.57
1989	0	117,422	0	0	5	15	100	100	100	100	0.44
1990	0	101,859	0	0	5	15	100	100	100	100	0.26
1991	0	178,113	0	0	5	15	100	100	100	100	0.37
1992	0	84,342	0	0	5	15	100	100	100	100	0.55
1993	0	2,000	0	0	-25	25	100	100	100	100	**0.3**
1994	0	2,000	0	0	-25	25	100	100	100	100	**0.3**
1995	0	32,422	0	0	5	15	100	100	100	100	0.32
1996	0	31,944	0	0	0	0	100	100	100	100	0.27
1997	0	21,402	0	0	0	0	100	100	100	100	0.20
1998	0	3,957	0	0	0	0	100	100	100	100	0.21
1999	0	6,169	0	0	0	0	100	100	100	100	0.10
2000	0	8,171	0	0	30	50	100	100	100	100	0.30
2001	0	14,333	0	0	14	24	100	100	100	100	0.31
2002	0	3,369	0	0	43	63	100	100	100	100	0.32
2003	0	4,050	0	0	35	55	100	100	100	100	0.32
2004	0	5,412	0	0	30	50	100	100	100	100	0.27
2005	0	4,784	0	0	39	59	100	100	100	100	0.24
2006	0	0	0	0	0	0	100	100	100	100	0.00
2007	0	0	0	0	0	0	100	100	100	100	0.00
2008	0	0	0	0	0	0	100	100	100	100	0.00
2009	0	0	0	0	0	0	100	100	100	100	0.00
2010	0	0	0	0	0	0	100	100	100	100	0.00

M(min)= 0.020   Return time (m)= 1SW(min) 7   MSW(min) 8
M(max)= 0.040   1SW(max) 8   MSW(max) 10

Table 3.9.13.1. Estimated number of RETURNING 1SW salmon by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland N&E	Norway	Russia	Sweden	Total			France	Iceland S&W	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
						2.5%	50.0%	97.5%							2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	25,927	9,413		153,883	17,453				49,215	62,538	1,053,188	102,879	181,758	666,000	1,866,242	**2,131,722**	2,463,663			
1972	40,584	8,635		117,271	13,835				99,426	50,784	1,124,563	90,576	158,843	572,717	1,835,645	**2,116,423**	2,478,870			
1973	36,908	10,322		172,701	17,108				61,041	54,262	1,223,271	105,603	138,770	697,422	2,000,123	**2,294,273**	2,688,620			
1974	72,612	10,326		172,560	24,729				28,246	38,718	1,398,156	132,674	151,850	666,994	2,100,999	**2,426,152**	2,857,263			
1975	51,006	12,543		263,263	26,539				56,494	60,030	1,539,839	132,527	124,637	549,007	2,122,546	**2,476,240**	2,950,871			
1976	34,954	12,585		183,822	15,037				52,252	47,425	1,047,901	90,148	86,715	448,144	1,535,359	**1,781,767**	2,106,793			
1977	17,913	17,615		117,359	7,019				40,048	48,657	906,063	100,096	85,424	495,047	1,463,631	**1,684,187**	1,969,622			
1978	24,321	17,840		118,446	8,062				40,780	63,594	790,929	111,728	111,252	566,986	1,496,100	**1,694,351**	1,950,570			
1979	28,514	17,071		164,044	8,515				46,869	58,717	729,965	105,615	78,000	474,282	1,323,135	**1,502,240**	1,738,039			
1980	12,783	2,583		116,931	10,823				97,826	26,698	554,079	97,180	98,534	298,970	1,043,334	**1,186,920**	1,364,618			
1981	19,707	13,309		96,926	19,639				77,766	34,488	291,088	101,258	77,537	370,378	870,845	**961,113**	1,064,394			
1982	5,775	6,161		84,974	17,295				47,928	35,403	602,454	85,983	111,567	512,955	1,264,475	**1,407,974**	1,574,099			
1983	28,560	9,053	701,914	142,207	22,950	795,157	**908,118**	1,040,836	51,126	44,623	1,062,677	122,238	157,062	548,856	1,781,454	**1,996,388**	2,264,139	2,656,982	**2,909,678**	3,202,632
1984	31,957	3,286	729,349	153,047	32,332	834,091	**951,718**	1,094,121	84,514	27,547	560,190	107,929	61,666	560,679	1,269,535	**1,411,800**	1,577,706	2,174,957	**2,366,129**	2,577,927
1985	48,078	22,742	740,399	209,362	38,363	944,835	**1,063,502**	1,206,530	31,307	44,375	934,098	108,609	79,941	465,260	1,480,308	**1,670,942**	1,906,962	2,503,895	**2,740,288**	3,014,334
1986	43,670	28,196	643,081	178,979	40,498	835,217	**939,600**	1,060,772	48,648	73,099	1,042,072	122,596	89,980	569,076	1,732,434	**1,958,935**	2,240,290	2,648,402	**2,901,840**	3,204,931
1987	56,080	16,607	542,414	190,959	32,703	751,737	**842,729**	946,217	85,780	45,477	672,515	126,771	49,067	432,056	1,253,817	**1,431,369**	1,668,984	2,071,882	**2,278,300**	2,535,082
1988	26,737	24,129	500,286	131,946	27,430	633,777	**712,326**	801,066	30,262	81,600	909,571	171,672	115,570	648,108	1,758,614	**1,978,191**	2,236,810	2,450,822	**2,689,470**	2,966,371
1989	62,586	12,951	552,484	197,000	8,810	744,330	**835,873**	949,513	15,742	45,649	658,070	112,005	111,401	696,534	1,479,157	**1,651,707**	1,849,079	2,291,835	**2,491,559**	2,716,850
1990	59,311	9,702	496,711	163,332	19,568	669,255	**749,943**	848,570	27,332	41,955	409,426	80,443	91,996	348,138	908,005	**1,010,141**	1,131,957	1,628,080	**1,763,307**	1,915,924
1991	72,228	14,123	431,216	138,326	23,659	606,909	**682,144**	768,851	19,917	46,467	290,999	79,118	51,505	336,567	749,708	**832,652**	930,020	1,404,265	**1,517,050**	1,642,973
1992	95,528	26,515	364,068	171,427	25,858	617,567	**687,232**	763,112	35,628	53,002	431,063	81,536	104,382	480,296	1,076,566	**1,199,511**	1,343,099	1,743,687	**1,888,281**	2,049,536
1993	67,308	21,872	366,338	146,971	27,853	572,422	**633,280**	702,064	51,448	52,047	346,883	112,266	122,197	455,221	1,042,552	**1,155,615**	1,296,096	1,658,141	**1,790,566**	1,944,533
1994	26,729	6,943	495,478	173,535	21,158	642,220	**726,052**	828,721	39,415	42,749	444,880	122,411	83,780	482,185	1,107,568	**1,229,421**	1,376,361	1,805,600	**1,958,267**	2,132,321
1995	26,258	17,840	322,332	156,012	30,972	500,370	**556,742**	620,149	13,471	51,602	498,913	93,100	77,867	481,424	1,101,896	**1,221,918**	1,366,478	1,646,206	**1,780,578**	1,936,621
1996	60,785	9,574	246,045	211,836	18,876	495,951	**551,340**	614,911	16,670	44,929	460,398	67,293	80,262	327,659	895,310	**1,002,870**	1,131,033	1,432,382	**1,555,976**	1,697,649
1997	52,014	13,090	282,432	207,670	8,656	510,331	**568,371**	633,530	8,451	32,765	461,663	62,296	95,435	247,363	810,605	**911,576**	1,036,549	1,361,303	**1,481,884**	1,619,173
1998	59,896	22,194	368,279	227,437	7,615	619,006	**690,112**	771,237	16,406	44,783	484,841	68,335	208,381	330,892	1,046,608	**1,163,141**	1,302,267	1,715,111	**1,854,523**	2,013,903
1999	86,004	10,810	341,974	176,508	11,181	567,142	**630,405**	700,510	5,465	35,658	445,551	59,107	54,239	186,382	699,145	**793,359**	913,956	1,309,885	**1,424,620**	1,563,733
2000	90,505	11,443	563,480	192,696	22,463	793,006	**883,875**	991,187	14,258	31,591	620,019	90,559	78,689	355,550	1,064,552	**1,200,291**	1,370,077	1,914,607	**2,088,460**	2,283,338
2001	40,930	10,155	485,719	260,161	14,572	713,992	**819,874**	946,399	12,383	27,645	493,546	79,617	62,163	342,663	934,584	**1,025,960**	1,133,126	1,700,845	**1,849,280**	2,014,303
2002	28,842	17,260	297,032	236,244	14,830	521,369	**601,046**	707,278	17,482	34,617	432,847	72,127	76,853	277,826	836,251	**916,572**	1,011,205	1,402,941	**1,521,552**	1,659,830
2003	33,901	9,168	412,220	211,281	9,128	594,590	**681,393**	789,475	11,468	41,510	424,749	46,949	69,169	279,783	802,092	**880,624**	967,592	1,440,540	**1,565,155**	1,703,759
2004	13,112	24,080	249,778	147,637	7,803	397,299	**450,955**	518,708	13,948	41,614	308,179	79,720	66,430	329,389	776,445	**848,029**	932,682	1,205,028	**1,301,205**	1,406,491
2005	33,376	21,024	370,857	168,904	6,723	535,703	**607,136**	693,318	8,963	61,205	313,992	64,648	89,593	302,128	760,951	**830,590**	908,595	1,334,850	**1,440,429**	1,553,057
10yr Av.	49,937	14,880	361,782	204,037	12,185	574,839	**648,451**	736,655	12,549	39,632	444,579	69,065	88,121	297,964	862,654	**957,301**	1,070,708	1,481,749	**1,608,308**	1,751,524

Table 3.9.13.2. Estimated number of RETURNING MSW salmon by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland N&E	Norway	Russia	Sweden	Total			France	Iceland S&W	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
						2.5%	50.0%	97.5%							2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	24,086	11,245		132,443	1,061				10,847	28,547	157,654	96,387	21,932	612,711	822,933	**938,029**	1,080,143			
1972	37,395	17,564		134,537	741				21,628	43,726	168,788	145,908	19,170	783,888	1,041,494	**1,194,548**	1,377,078			
1973	44,776	16,429		222,646	2,584				13,296	39,404	183,981	109,685	16,752	854,675	1,068,499	**1,225,689**	1,431,300			
1974	66,381	15,615		210,345	1,666				6,166	33,947	206,860	79,639	18,303	603,108	829,677	**955,031**	1,105,739			
1975	74,082	17,196		225,271	403				12,327	36,161	232,168	108,370	15,011	667,593	939,060	**1,079,189**	1,248,711			
1976	60,842	14,182		195,307	1,208				8,984	31,205	160,151	56,379	10,445	401,443	585,512	**676,108**	781,761			
1977	36,969	19,806		134,457	906				6,938	30,411	139,406	69,680	10,276	462,592	634,396	**724,675**	835,286			
1978	23,675	25,472		116,162	693				7,118	39,346	120,897	58,239	13,398	560,361	701,888	**805,295**	938,484			
1979	25,338	16,853		101,419	2,012				8,115	25,269	109,382	27,797	9,410	410,173	510,341	**592,959**	694,427			
1980	26,524	23,370		169,102	3,529				16,999	35,408	119,838	91,099	11,895	516,402	705,594	**800,712**	916,491			
1981	29,205	8,202		96,604	1,030				11,555	23,668	88,107	127,570	9,359	576,571	746,109	**844,315**	963,640			
1982	38,018	9,409		85,362	3,670				7,231	16,720	51,512	49,113	13,512	445,788	515,881	**587,851**	677,380			
1983	41,366	7,195	427,873	124,098	2,535	538,756	**605,563**	686,454	7,723	27,929	151,943	53,766	19,013	484,096	642,266	**761,458**	991,356			
1984	39,490	9,238	436,881	123,752	3,564	547,531	**615,197**	693,378	12,671	23,687	76,358	43,894	7,447	400,267	503,568	**566,255**	646,131	1,088,371	**1,184,305**	1,293,205
1985	30,686	5,980	403,732	135,249	1,489	514,524	**578,066**	653,325	9,492	17,178	84,200	64,577	9,661	493,222	604,631	**681,279**	774,593	1,154,564	**1,262,309**	1,382,045
1986	26,822	16,277	484,311	133,698	1,436	589,485	**664,552**	754,601	9,729	14,322	94,807	85,524	10,846	629,498	746,572	**850,808**	978,397	1,386,525	**1,519,123**	1,673,285
1987	33,428	16,874	363,307	99,479	4,276	460,570	**518,510**	586,555	5,137	12,742	118,076	68,409	5,550	405,563	545,548	**618,384**	703,527	1,042,134	**1,138,569**	1,244,764
1988	21,435	10,871	306,271	99,808	4,165	393,919	**443,520**	498,649	14,300	14,509	84,960	88,637	15,650	624,313	743,618	**845,403**	969,690	1,172,030	**1,290,538**	1,427,582
1989	24,339	9,218	216,109	97,131	11,619	322,763	**359,631**	402,801	6,525	12,900	78,515	68,677	12,427	544,142	642,765	**726,657**	829,060	993,908	**1,087,928**	1,198,755
1990	30,701	9,712	257,260	124,666	7,377	387,627	**430,976**	481,601	6,556	12,823	37,491	84,764	11,328	471,739	558,922	**629,221**	713,718	975,534	**1,061,740**	1,158,361
1991	36,685	6,742	216,713	122,289	8,611	355,380	**393,201**	436,431	5,974	12,764	56,132	37,014	5,818	342,166	409,347	**462,182**	526,696	788,085	**856,575**	934,464
1992	39,306	10,063	235,486	116,339	10,981	373,186	**413,387**	459,535	7,708	14,449	43,888	27,880	13,326	451,106	491,302	**558,546**	643,142	892,992	**973,357**	1,069,601
1993	45,420	11,330	226,941	137,878	15,092	402,114	**438,508**	479,668	3,719	7,059	42,102	30,393	31,423	375,657	433,840	**494,659**	569,936	861,274	**935,272**	1,018,548
1994	37,569	9,611	222,145	121,775	11,010	367,718	**404,962**	445,896	7,644	11,448	68,164	42,071	11,048	455,598	530,201	**596,001**	682,641	923,021	**1,002,796**	1,097,793
1995	23,324	5,983	238,442	138,579	7,704	377,802	**415,305**	459,487	3,669	11,547	66,149	41,883	9,351	430,139	501,482	**566,178**	647,475	904,283	**982,461**	1,075,613
1996	20,678	7,828	238,272	104,667	9,818	345,647	**383,272**	424,963	6,492	7,430	43,823	42,244	10,239	321,981	384,634	**435,454**	498,409	753,487	**820,236**	895,228
1997	30,049	4,412	159,212	85,163	6,434	260,451	**287,382**	317,661	3,345	8,366	56,532	26,782	12,756	225,361	295,560	**338,744**	393,442	573,587	**626,631**	688,397
1998	25,229	6,447	191,790	105,553	4,717	304,535	**334,956**	368,969	2,823	5,166	33,271	16,437	17,460	233,895	275,362	**310,255**	354,527	597,096	**646,234**	703,137
1999	23,591	6,861	204,389	92,960	4,074	300,273	**333,819**	371,985	6,074	9,787	50,622	37,950	7,945	200,827	274,186	**319,987**	383,963	595,514	**654,844**	726,239
2000	52,729	3,956	283,044	162,094	8,896	466,257	**512,956**	564,435	4,253	2,587	63,989	40,276	10,636	256,287	338,897	**385,215**	443,022	832,135	**899,483**	972,838
2001	75,485	4,409	333,175	114,524	10,727	487,466	**541,624**	601,365	4,935	4,607	57,325	41,847	7,824	246,597	322,783	**371,939**	436,288	837,187	**915,821**	1,002,904
2002	60,541	4,026	288,892	125,046	7,867	476,655	**525,081**	579,146	3,670	4,845	65,965	38,975	10,662	202,673	291,546	**334,323**	391,996	794,819	**860,899**	936,925
2003	42,876	3,723	255,639	87,222	8,935	386,959	**425,224**	469,693	5,315	8,097	69,508	39,083	9,947	231,025	318,181	**371,375**	440,616	729,522	**797,622**	879,500
2004	20,621	3,803	231,001	67,113	6,511	312,774	**347,185**	387,942	9,927	6,435	38,058	32,112	8,784	288,302	337,029	**390,684**	456,817	672,695	**738,862**	815,519
2005	15,908	4,671	214,745	76,309	4,927	309,360	**339,575**	375,476	6,090	5,502	51,806	33,553	4,048	217,239	271,953	**314,876**	369,067	599,498	**655,472**	720,152
10yr Av.	36,771	5,014	240,016	102,065	7,291	365,038	**403,107**	446,163	5,292	6,282	53,090	34,926	10,030	242,419	311,013	**357,285**	416,815	698,554	**761,610**	834,084

Table 3.9.13.3. Estimated pre fishery abundance of MATURING 1SW salmon (potential 1SW returns) by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	33,146	11,979		198,365	22,326				62,802	91,622	1,339,204	131,205	231,210	838,832	2,304,128	**2,707,588**	3,218,627			
1972	51,825	11,002		150,206	17,722				126,783	75,430	1,429,874	115,420	201,994	721,430	2,262,476	**2,689,379**	3,225,204			
1973	47,232	13,147		221,896	21,914				77,835	82,473	1,557,122	134,767	176,895	877,137	2,466,512	**2,911,753**	3,499,218			
1974	92,564	13,135		220,383	31,491				36,140	62,615	1,777,316	169,030	193,270	839,413	2,593,506	**3,077,288**	3,717,486			
1975	65,043	15,954		338,196	33,863				72,023	92,882	1,958,215	168,885	158,604	691,311	2,631,343	**3,149,495**	3,836,607			
1976	44,522	16,036		236,275	19,187				66,740	76,815	1,336,996	115,194	110,325	565,276	1,899,433	**2,265,729**	2,754,166			
1977	22,838	22,445		150,494	8,993				51,108	84,627	1,152,208	127,426	108,816	623,624	1,807,354	**2,140,494**	2,563,169			
1978	30,983	22,736		152,143	10,289				52,023	103,970	1,011,440	142,095	141,581	713,954	1,837,528	**2,154,266**	2,536,925			
1979	36,371	21,730		211,042	10,938				59,868	96,870	927,298	134,725	99,251	596,338	1,626,514	**1,909,239**	2,265,447			
1980	16,495	3,295		150,492	14,028				124,887	37,179	705,784	124,236	125,566	376,898	1,284,371	**1,508,647**	1,791,416			
1981	25,473	16,929		125,130	25,344				99,323	61,014	370,901	129,768	98,924	466,716	1,070,941	**1,220,919**	1,394,515			
1982	7,710	7,852		109,653	22,298				61,498	52,921	766,782	110,090	142,411	647,023	1,556,011	**1,789,529**	2,066,450			
1983	36,794	11,530	894,858	182,609	29,542	987,703	**1,161,159**	1,367,723	65,461	68,628	1,353,518	156,514	200,482	692,227	2,186,379	**2,539,462**	2,961,535			
1984	40,886	4,182	928,783	195,969	41,322	1,031,699	**1,212,756**	1,434,057	107,684	39,251	712,773	137,796	78,696	705,788	1,562,805	**1,792,226**	2,058,338	2,674,855	**3,011,352**	3,394,003
1985	61,198	28,936	942,737	269,214	48,836	1,168,667	**1,357,950**	1,592,458	40,005	86,031	1,187,976	138,526	101,975	585,369	1,822,531	**2,122,452**	2,495,232	3,073,168	**3,486,315**	3,968,180
1986	55,952	35,875	818,392	230,007	51,838	1,034,402	**1,197,882**	1,393,368	62,180	129,956	1,324,690	156,761	114,598	716,528	2,136,428	**2,489,210**	2,928,962	3,248,191	**3,692,605**	4,213,380
1987	71,460	21,124	690,716	245,603	41,711	929,555	**1,076,847**	1,245,315	109,149	79,549	855,060	161,687	62,592	544,059	1,545,394	**1,820,681**	2,175,277	2,542,211	**2,901,813**	3,328,745
1988	34,216	30,668	637,115	168,863	35,055	786,590	**908,974**	1,054,171	38,537	135,550	1,157,025	219,199	147,427	817,250	2,158,883	**2,511,622**	2,919,363	3,003,211	**3,422,844**	3,893,077
1989	79,799	16,472	703,816	250,582	11,332	920,190	**1,065,950**	1,243,442	20,176	74,928	835,744	142,710	141,907	878,266	1,818,879	**2,093,581**	2,428,418	2,806,730	**3,162,323**	3,578,867
1990	75,568	12,342	632,169	207,966	25,022	826,113	**956,087**	1,113,178	34,911	65,926	521,844	102,364	117,236	439,047	1,115,410	**1,282,345**	1,484,135	1,992,830	**2,241,560**	2,530,677
1991	91,975	17,997	548,533	177,476	30,223	750,914	**870,261**	1,010,805	25,445	77,231	369,561	100,861	65,609	424,496	921,302	**1,056,316**	1,212,707	1,718,515	**1,929,312**	2,165,359
1992	121,548	33,699	462,580	218,894	33,020	760,925	**875,709**	1,002,949	45,312	101,748	547,134	103,867	132,696	604,438	1,321,911	**1,520,889**	1,755,841	2,128,849	**2,400,585**	2,697,781
1993	85,812	27,828	465,447	188,125	35,432	704,566	**806,908**	925,774	65,465	94,310	440,606	142,905	155,523	573,243	1,281,735	**1,464,591**	1,692,916	2,026,991	**2,274,337**	2,560,442
1994	34,079	8,854	630,653	222,237	26,842	793,773	**926,047**	1,088,738	50,249	63,374	564,566	155,983	106,537	607,429	1,356,371	**1,558,940**	1,798,710	2,201,977	**2,489,678**	2,813,029
1995	33,414	22,726	410,236	199,654	39,511	618,049	**709,794**	819,337	17,209	89,279	633,582	118,427	99,137	606,080	1,351,417	**1,550,200**	1,791,312	2,008,933	**2,261,192**	2,558,683
1996	77,496	12,208	312,823	271,339	24,058	611,816	**703,520**	810,753	21,270	69,286	584,797	85,602	102,141	412,157	1,100,465	**1,272,625**	1,481,693	1,756,274	**1,978,571**	2,239,281
1997	66,202	16,651	359,191	265,564	11,022	627,072	**724,785**	835,490	10,748	58,406	586,496	79,425	121,498	311,549	998,087	**1,158,537**	1,354,944	1,663,595	**1,885,337**	2,135,106
1998	76,192	28,300	468,028	292,215	9,689	764,555	**881,500**	1,017,876	20,848	85,814	615,884	87,132	264,968	416,543	1,284,931	**1,476,204**	1,701,720	2,097,016	**2,359,940**	2,655,457
1999	109,397	13,811	435,000	225,595	14,263	700,490	**802,376**	922,341	6,947	59,462	565,478	75,271	68,961	234,532	860,664	**1,007,440**	1,190,384	1,604,976	**1,811,963**	2,057,880
2000	115,319	14,560	716,138	247,196	28,573	976,547	**1,127,391**	1,304,765	18,219	55,140	788,950	115,356	100,103	447,182	1,311,653	**1,521,749**	1,789,839	2,349,842	**2,655,237**	3,008,042
2001	51,975	12,937	618,777	333,262	18,579	881,928	**1,045,487**	1,245,692	15,748	48,493	627,013	101,348	79,044	431,309	1,144,723	**1,301,801**	1,487,929	2,082,081	**2,350,132**	2,651,269
2002	36,627	21,977	377,812	303,495	18,881	648,649	**768,024**	927,405	22,303	66,412	550,609	91,889	97,742	349,299	1,023,878	**1,162,967**	1,332,387	1,718,387	**1,934,168**	2,194,963
2003	43,131	11,678	524,535	269,763	11,653	735,676	**869,025**	1,037,130	14,570	64,554	541,435	59,714	88,154	352,449	981,645	**1,116,807**	1,275,207	1,764,485	**1,988,874**	2,250,505
2004	16,702	30,688	317,596	188,620	9,944	490,717	**575,431**	680,279	17,777	84,297	392,425	101,403	84,715	414,965	948,053	**1,074,158**	1,221,718	1,472,897	**1,651,304**	1,856,590
2005	42,500	26,772	471,588	216,349	8,550	661,640	**775,559**	910,248	11,440	104,873	399,968	82,279	114,021	380,818	932,162	**1,053,618**	1,196,364	1,629,818	**1,832,061**	2,055,930
10yr Av.	63,554	18,958	460,149	261,340	15,521	709,909	**827,310**	969,198	15,987	69,674	565,306	87,942	112,135	375,081	1,058,626	**1,214,591**	1,403,218	1,813,937	**2,044,759**	2,310,502

Table 3.9.13.4. Estimated pre fishery abundance of NON-MATURING 1SW salmon (potential MSW returns) by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	63,066	30,097		262,555	6,017				53,088	73,872	381,299	346,768	32,007	1,752,408	2,192,467	**2,659,962**	3,221,912			
1972	75,485	28,207		421,475	8,909				34,334	66,669	380,946	259,558	27,981	1,759,050	2,071,420	**2,547,338**	3,126,531			
1973	111,632	26,638		392,797	6,393				21,367	57,308	411,075	201,018	30,598	1,298,871	1,670,463	**2,033,781**	2,495,392			
1974	124,487	29,361		423,984	4,755				31,200	60,990	452,512	247,908	25,062	1,404,513	1,826,482	**2,234,612**	2,744,266			
1975	102,088	24,306		363,198	5,459				27,876	52,661	342,679	170,125	17,437	998,256	1,349,863	**1,623,157**	1,951,296			
1976	62,056	33,440		250,785	3,768				19,259	51,318	277,949	163,741	17,179	974,089	1,241,397	**1,514,356**	1,857,084			
1977	39,938	42,916		214,953	3,179				20,632	66,138	252,927	149,502	22,385	1,164,472	1,380,115	**1,685,784**	2,071,779			
1978	42,604	28,529		195,813	5,741				19,166	42,592	217,312	80,422	15,690	840,023	988,193	**1,219,119**	1,515,701			
1979	44,557	39,900		337,331	11,318				36,703	60,039	256,129	207,132	19,849	1,109,052	1,408,375	**1,703,737**	2,072,598			
1980	49,139	14,834		232,238	10,181				26,991	40,737	207,775	270,147	15,582	1,220,104	1,482,202	**1,791,391**	2,186,031			
1981	64,159	16,823		209,407	13,978				18,569	28,999	139,063	127,419	22,531	967,483	1,085,100	**1,310,307**	1,590,355			
1982	69,789	12,881		265,779	10,459				18,111	47,514	297,138	126,867	31,641	989,497	1,225,876	**1,550,165**	2,043,741			
1983	65,892	16,057	800,489	250,676	10,088	941,283	**1,144,407**	1,396,192	23,557	40,183	149,832	92,732	12,434	765,634	892,244	**1,088,695**	1,332,510	1,868,156	**2,234,331**	2,666,817
1984	51,372	10,570	744,124	271,777	6,655	887,432	**1,083,162**	1,320,573	17,794	29,243	160,276	125,378	16,123	911,292	1,029,682	**1,266,913**	1,559,061	1,957,713	**2,351,841**	2,820,935
1985	44,962	27,902	887,661	271,262	7,301	1,015,314	**1,237,770**	1,516,188	22,258	24,640	201,318	184,413	18,133	1,241,147	1,391,315	**1,703,874**	2,096,953	2,455,136	**2,944,385**	3,532,731
1986	56,030	28,842	683,479	209,843	11,874	816,609	**989,265**	1,205,026	13,924	21,972	236,402	151,617	9,248	847,474	1,059,643	**1,286,484**	1,563,682	1,910,357	**2,279,508**	2,716,256
1987	36,120	18,567	556,699	197,284	9,805	669,336	**816,850**	997,028	28,974	24,668	173,749	181,937	26,133	1,188,817	1,333,435	**1,631,365**	2,018,094	2,036,716	**2,451,809**	2,961,571
1988	40,909	15,942	418,653	197,342	23,042	577,583	**695,298**	843,200	17,265	22,099	172,397	156,318	20,750	1,095,937	1,222,958	**1,490,000**	1,816,731	1,827,299	**2,189,122**	2,623,616
1989	51,343	16,697	482,296	244,815	15,550	667,967	**809,721**	979,596	13,055	21,936	80,944	160,087	18,889	869,876	954,935	**1,172,792**	1,448,940	1,652,404	**1,983,198**	2,385,083
1990	61,328	11,485	384,873	226,565	15,727	574,445	**699,573**	853,397	11,076	21,532	102,214	70,747	9,707	612,640	671,751	**833,253**	1,038,277	1,270,897	**1,534,142**	1,847,722
1991	65,771	16,896	405,252	208,958	19,223	581,362	**713,503**	873,494	15,528	24,337	88,699	62,932	22,212	828,074	840,994	**1,044,721**	1,296,494	1,452,790	**1,760,588**	2,131,397
1992	76,208	19,053	388,841	247,341	26,005	621,438	**755,710**	913,920	8,057	11,902	81,521	62,953	52,353	682,311	727,428	**907,383**	1,131,404	1,375,634	**1,664,451**	2,006,666
1993	63,023	16,156	381,336	221,631	18,970	572,943	**700,103**	852,206	12,867	19,227	115,204	73,501	18,422	775,708	812,128	**1,016,018**	1,279,464	1,408,101	**1,716,786**	2,089,672
1994	39,110	10,085	409,088	251,212	13,549	587,733	**719,141**	877,028	6,158	19,361	111,961	73,183	15,595	733,513	768,945	**965,632**	1,219,661	1,382,895	**1,685,878**	2,056,526
1995	34,486	13,205	409,156	191,581	17,084	540,664	**662,542**	810,645	11,292	12,492	76,911	75,651	17,133	559,587	605,557	**758,603**	950,706	1,171,605	**1,422,314**	1,725,921
1996	50,153	7,408	266,761	151,794	10,865	396,774	**487,063**	595,557	5,967	13,985	96,705	48,226	21,350	389,997	465,349	**584,806**	737,032	881,199	**1,073,730**	1,305,381
1997	42,189	10,785	320,812	187,634	7,974	461,845	**566,162**	692,257	4,884	8,644	56,487	29,379	29,295	399,432	423,160	**531,244**	667,582	904,151	**1,097,208**	1,331,611
1998	39,528	11,498	341,223	165,905	6,853	457,477	**564,353**	696,077	10,202	16,385	85,748	65,627	13,311	340,959	423,047	**543,053**	700,421	900,657	**1,111,022**	1,358,293
1999	88,250	6,613	472,547	288,616	14,921	707,128	**866,930**	1,058,665	7,170	4,339	107,161	69,653	17,777	436,124	517,153	**651,928**	820,152	1,254,051	**1,522,212**	1,840,801
2000	126,124	7,379	556,910	203,898	18,022	740,047	**913,218**	1,124,897	8,408	7,708	96,896	72,677	13,062	421,216	499,233	**634,881**	813,027	1,268,635	**1,549,693**	1,889,420
2001	100,988	6,734	482,339	222,372	13,173	722,677	**886,303**	1,083,122	6,321	8,090	111,587	68,549	17,799	346,762	453,442	**571,660**	729,462	1,199,772	**1,460,204**	1,770,118
2002	71,633	6,234	426,489	155,689	14,977	586,724	**716,790**	877,070	9,016	13,523	117,096	67,865	16,632	391,920	491,820	**629,878**	807,367	1,103,306	**1,349,748**	1,645,257
2003	34,531	6,367	385,968	119,753	10,927	475,604	**585,889**	718,999	16,697	10,792	64,207	56,166	14,706	488,967	519,791	**660,582**	845,499	1,017,264	**1,249,409**	1,529,079
2004	26,621	7,829	358,477	136,351	8,239	467,603	**573,673**	703,904	10,304	9,221	87,084	58,240	6,750	368,270	420,105	**533,512**	680,559	907,379	**1,110,904**	1,354,648
10yr Av.	61,450	8,405	402,068	182,359	12,304	555,654	**682,292**	836,119	9,026	10,518	89,988	61,203	16,782	414,323	481,866	**610,015**	775,181	1,060,802	**1,294,644**	1,575,053

Table 3.9.13.5. Estimated number of 1SW SPAWNERS by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland N&E	Norway	Russia	Sweden	Total			France	Iceland S&W	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
						2.5%	50.0%	97.5%							2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	12,937	4,714		77,251	8,274				47,475	31,309	391,918	55,487	36,290	262,559	213,344	**882,588**	285,489			
1972	20,205	4,326		59,385	6,539				95,946	25,441	419,332	49,627	31,818	201,476	231,232	**870,952**	309,987			
1973	18,485	5,158		88,526	8,055				58,911	27,100	456,650	58,105	27,768	256,596	241,059	**940,714**	332,347			
1974	36,012	5,180		89,767	11,617				27,256	19,347	524,336	73,979	30,407	226,766	262,424	**955,106**	363,696			
1975	25,442	6,267		132,694	12,469				54,514	30,009	573,543	72,440	25,031	203,668	279,715	**1,011,904**	406,271			
1976	17,497	6,282		90,229	7,081				50,432	23,729	392,509	49,565	17,329	175,158	197,603	**728,304**	276,322			
1977	8,925	8,844		58,494	3,285				38,648	24,343	339,441	53,805	17,086	186,160	173,682	**705,588**	245,477			
1978	12,108	8,922		58,210	3,806				39,345	31,745	296,792	60,012	22,273	239,578	162,870	**741,378**	217,223			
1979	14,246	8,534		83,790	4,008				45,224	29,333	274,256	57,876	15,614	175,187	149,396	**649,307**	200,182			
1980	6,370	1,289		60,071	5,106				94,396	13,364	207,477	52,269	19,785	117,954	124,097	**548,261**	157,362			
1981	9,823	6,647		49,923	9,258				75,046	17,258	70,565	54,375	15,551	143,945	78,494	**425,761**	89,780			
1982	2,888	3,094		45,112	8,204				46,248	17,702	168,503	46,316	22,251	215,655	114,725	**567,877**	133,063			
1983	14,330	4,526	163,686	75,492	10,801	69,148	**272,970**	80,004	49,326	22,261	359,130	64,721	31,562	223,357	164,687	**824,725**	214,770	187,742	**1,100,228**	226,466
1984	15,995	1,641	164,901	80,990	15,236	71,432	**281,542**	82,803	81,554	13,798	197,735	56,901	12,327	245,259	119,280	**668,496**	139,289	147,499	**952,677**	163,712
1985	24,004	11,395	172,071	107,335	18,073	76,955	**337,197**	90,668	30,207	22,117	236,954	57,422	16,026	226,172	145,158	**640,799**	183,162	177,409	**982,022**	204,002
1986	21,796	14,087	151,973	92,577	19,131	67,417	**304,570**	77,047	45,248	36,457	327,296	64,977	18,026	274,971	179,885	**824,379**	230,008	196,263	**1,129,947**	239,605
1987	28,116	8,293	127,550	98,068	15,393	60,929	**282,063**	69,700	79,780	22,713	202,026	67,027	15,229	200,161	143,732	**635,090**	208,537	161,475	**919,251**	220,744
1988	13,331	12,116	119,788	73,605	12,933	46,632	**233,542**	53,322	28,162	40,741	344,474	90,830	41,072	424,668	176,233	**1,026,629**	209,149	184,898	**1,261,982**	216,129
1989	25,108	6,470	189,363	104,006	4,154	61,026	**329,599**	76,362	14,642	22,849	223,903	57,913	12,337	469,847	139,577	**842,110**	164,959	158,579	**1,175,173**	179,684
1990	23,770	4,851	170,278	91,957	10,749	55,324	**302,932**	67,517	25,432	20,955	159,564	41,723	34,900	227,826	84,031	**549,378**	100,628	103,859	**854,417**	120,406
1991	28,874	7,077	145,859	87,691	13,014	51,759	**285,604**	61,243	18,517	23,299	117,222	41,820	18,330	234,440	70,540	**480,488**	81,306	89,949	**767,513**	97,062
1992	38,086	13,253	123,886	125,501	14,203	52,755	**319,250**	57,807	33,128	26,444	162,584	43,071	46,014	349,440	106,039	**690,342**	123,320	119,348	**1,010,462**	136,274
1993	26,932	10,967	123,315	108,384	15,364	47,612	**287,959**	54,306	47,848	26,049	143,240	62,817	72,151	315,532	99,549	**715,520**	131,127	112,696	**1,004,456**	139,758
1994	10,678	3,460	170,787	126,863	11,566	64,216	**326,009**	77,352	36,615	21,332	127,344	67,251	25,158	337,464	105,329	**662,506**	128,390	128,691	**990,687**	146,886
1995	10,492	8,893	109,362	111,055	19,377	45,532	**262,435**	50,156	11,802	25,709	180,963	54,108	25,763	345,472	98,830	**685,265**	119,797	111,425	**948,793**	130,810
1996	30,359	4,797	82,142	154,675	11,761	46,950	**287,415**	55,988	14,607	22,563	183,558	39,742	34,473	242,614	89,298	**556,331**	104,939	102,717	**844,876**	117,454
1997	26,011	6,554	105,265	157,316	5,417	51,075	**304,961**	57,967	7,391	16,432	229,209	39,139	38,369	181,120	82,529	**530,531**	103,020	101,427	**837,322**	114,975
1998	29,881	11,072	137,766	172,262	4,740	61,358	**360,967**	71,462	14,341	22,430	223,182	44,218	156,539	257,431	100,093	**742,655**	118,261	120,760	**1,104,784**	137,344
1999	34,321	5,378	127,739	137,158	6,946	52,883	**315,321**	60,536	4,775	17,850	232,260	41,385	20,141	142,649	76,719	**481,888**	99,954	96,562	**797,967**	118,772
2000	36,222	5,733	213,864	149,146	14,070	74,314	**422,716**	89,944	12,466	15,772	351,422	63,396	33,069	279,304	115,473	**793,049**	143,010	146,224	**1,218,679**	167,214
2001	16,366	5,075	185,927	224,342	9,108	91,652	**446,919**	119,383	10,839	13,791	256,407	57,199	31,049	273,580	90,874	**673,065**	105,391	139,544	**1,125,174**	156,817
2002	14,496	8,654	111,211	199,995	9,236	71,573	**348,505**	103,169	13,975	17,304	217,280	51,268	23,179	224,251	79,325	**581,965**	92,643	114,414	**935,462**	134,627
2003	16,947	4,599	156,899	179,847	5,716	77,724	**369,485**	98,910	9,160	20,835	249,604	34,256	29,826	241,639	77,863	**603,757**	86,095	117,721	**976,552**	131,025
2004	6,556	12,012	93,723	121,773	4,838	47,736	**246,915**	63,981	11,176	20,878	154,190	56,478	36,051	280,679	70,781	**581,635**	83,563	92,510	**831,567**	103,067
2005	16,701	10,552	140,646	141,426	4,210	63,273	**318,943**	79,632	7,151	30,644	169,995	46,650	62,713	260,718	68,979	**573,004**	77,182	99,131	**894,812**	108,601
10yr Av.	22,786	7,442	135,518	163,794	7,604	63,854	**342,215**	80,097	10,588	19,850	226,711	47,373	46,541	238,398	85,193	**611,788**	101,406	113,101	**956,720**	128,990

Table 3.9.13.6. Estimated number of MSW SPAWNERS by NEAC country or region and year.

	Northern Europe								Southern Europe									NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				2.5%	50.0%	97.5%		N&E					2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	10,889	4,481		54,810	450				6,787	11,451	82,340	57,667	10,991	356,680	103,670	**571,527**	126,901			
1972	16,880	7,016		56,470	312				13,508	17,468	88,484	88,416	9,597	446,736	133,511	**713,638**	162,879			
1973	20,175	6,554		92,928	1,084				8,326	15,728	96,913	66,542	8,397	491,243	137,221	**732,887**	180,361			
1974	29,921	6,252		91,477	701				3,856	13,510	108,242	48,429	9,150	321,194	111,413	**535,647**	133,729			
1975	33,206	6,853		93,716	169				7,707	14,464	121,983	65,797	7,512	354,712	126,024	**610,356**	150,480			
1976	27,249	5,672		77,781	512				5,604	12,448	83,680	33,741	5,231	235,941	81,692	**392,281**	94,022			
1977	16,532	7,943		54,825	381				4,338	12,124	72,549	40,925	5,148	246,460	80,502	**413,524**	97,189			
1978	10,607	10,163		45,551	292				4,453	15,689	63,477	34,854	6,699	317,220	91,297	**467,865**	117,212			
1979	13,928	6,750		41,812	847				5,060	10,140	57,465	16,566	4,713	218,430	72,101	**326,244**	89,789			
1980	14,579	9,306		68,583	1,494				10,629	14,116	62,802	54,592	5,945	279,015	86,744	**461,043**	108,390			
1981	16,086	3,275		40,797	435				7,475	9,474	46,140	76,429	4,677	318,179	88,654	**512,788**	111,124			
1982	20,911	3,757		37,661	1,540				4,711	6,697	32,652	29,341	6,762	267,594	65,586	**371,169**	83,309			
1983	22,759	2,881	101,421	57,536	1,074	42,553	**188,513**	50,774	5,023	11,167	109,559	31,467	9,511	278,096	114,246	**486,947**	228,470	124,969	**677,810**	232,888
1984	21,685	3,685	103,132	59,461	1,505	42,889	**191,965**	47,587	8,231	9,492	43,027	25,853	3,722	249,218	57,719	**359,514**	73,690	75,606	**553,360**	86,769
1985	16,823	2,394	94,988	58,836	629	41,296	**175,005**	47,404	6,162	6,869	53,840	37,940	4,838	328,379	70,310	**463,371**	87,444	85,188	**639,613**	100,152
1986	14,755	6,508	114,616	54,433	608	48,166	**193,523**	56,722	6,329	5,726	51,124	50,175	5,429	418,365	95,945	**570,971**	118,604	110,046	**765,422**	134,107
1987	18,329	6,763	87,916	44,240	1,796	37,269	**160,412**	43,014	3,337	5,109	79,864	40,064	3,005	264,108	67,442	**411,472**	78,300	79,072	**572,925**	89,367
1988	11,804	4,354	73,573	48,996	1,758	30,088	**141,452**	35,165	9,300	5,813	53,012	52,126	10,027	467,921	96,172	**618,381**	118,302	103,702	**760,545**	123,689
1989	10,967	3,689	74,348	44,994	4,894	26,624	**140,205**	30,311	4,225	5,134	41,453	39,595	4,991	411,252	80,156	**524,945**	99,221	85,355	**665,244**	105,501
1990	13,884	3,884	88,430	55,157	3,663	31,539	**166,079**	36,608	4,256	5,121	15,006	48,964	7,029	346,368	68,188	**457,076**	82,066	77,391	**624,203**	87,966
1991	16,360	2,696	73,427	59,631	4,319	29,141	**158,507**	31,980	3,874	5,092	41,218	21,744	3,315	260,642	50,958	**345,667**	62,836	60,899	**504,806**	71,302
1992	17,685	4,035	80,668	57,237	5,468	30,264	**166,254**	34,721	5,008	5,797	21,322	16,311	8,923	352,586	65,196	**414,506**	82,994	74,062	**581,889**	90,079
1993	20,355	4,523	75,636	66,863	7,534	31,202	**176,837**	32,827	2,419	2,822	24,257	18,756	27,650	286,778	59,826	**374,549**	73,281	69,543	**553,001**	80,396
1994	16,831	3,837	74,758	66,547	5,478	30,864	**169,806**	33,566	5,344	4,572	40,550	25,648	6,637	349,587	63,730	**442,146**	84,481	73,968	**613,269**	90,678
1995	10,486	2,400	81,202	67,564	4,414	31,444	**167,480**	35,641	2,574	4,627	38,472	26,690	5,430	328,900	62,230	**422,936**	79,283	72,027	**591,058**	88,108
1996	11,407	3,129	79,735	54,015	5,618	30,021	**155,874**	32,491	4,550	2,979	19,706	27,344	6,789	251,277	48,866	**320,933**	62,009	60,128	**477,693**	69,935
1997	16,561	1,766	57,741	44,637	3,688	23,737	**126,136**	26,309	2,344	3,353	39,040	18,267	8,452	174,742	42,617	**256,700**	53,832	50,715	**383,336**	60,139
1998	13,849	2,587	69,866	48,405	2,695	26,288	**138,623**	29,839	1,977	2,065	12,694	11,493	13,555	187,764	34,113	**233,201**	43,917	45,752	**372,794**	53,960
1999	11,782	2,750	71,906	52,738	2,349	27,586	**143,370**	30,941	4,243	3,906	33,279	29,585	5,374	159,140	45,550	**249,351**	63,231	55,964	**393,752**	67,953
2000	26,353	1,584	102,816	85,088	5,095	39,730	**222,775**	43,619	2,976	1,038	44,159	33,026	7,199	207,818	45,630	**310,352**	57,291	63,363	**534,072**	70,355
2001	37,527	1,767	122,556	71,520	6,172	44,757	**242,692**	49,452	3,446	1,842	37,394	34,762	5,488	200,795	48,646	**299,232**	64,453	69,534	**543,298**	80,536
2002	30,216	1,612	107,031	75,229	4,517	40,123	**257,323**	44,268	2,297	1,941	47,865	32,377	6,616	167,012	42,598	**272,308**	57,261	60,485	**530,631**	69,529
2003	21,296	1,485	95,774	52,146	5,125	32,055	**202,881**	36,801	3,335	3,247	54,567	32,860	6,987	197,811	52,916	**310,052**	69,271	64,755	**513,789**	77,795
2004	10,298	1,518	87,397	38,274	3,750	28,123	**159,258**	33,299	6,166	2,576	24,759	26,685	6,497	245,057	53,344	**321,003**	65,418	62,065	**480,869**	72,761
2005	7,939	1,868	79,924	41,981	2,828	26,070	**158,063**	29,791	3,800	2,192	39,644	27,848	2,024	185,841	42,517	**259,534**	53,872	52,876	**418,293**	61,472
10yr Av.	18,723	2,007	87,474	56,403	4,184	31,849	**180,699**	35,681	3,513	2,514	35,311	27,425	6,898	197,726	45,680	**283,267**	59,056	58,564	**464,853**	68,444

Table 3.9.14.1. Estimated survival of wild smolts (%) to return to homewaters (prior to coastal fisheries) for various monitored rivers in the NE Atlantic Area.

Smolt	Iceland[1]					Ireland		Norway[2]				UK (Scotland)[2]		France	UK (NI)[7]
migration	Ellidaar	R.Vesturdalsa[4]		R.Midfjardara[4]		R. Corrib		R. Halselva		R. Imsa		North Esk		Nivelle[5]	R. Bush
year	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	MSW	All ages	1SW[3]
1975	20.8														
1980						17.9	1.1								
1981						7.6	3.8			17.3	4.0	11.6	5.2		
1982						20.9	3.3			5.3	1.2	10.5	5.0		
1983		2.0				10.0	1.8			13.5	1.3				
1984						26.2	2.0			12.1	1.8	7.8	3.5		
1985	9.4					18.9	1.8			10.2	2.1	19.9	5.8		
1986						-	-			3.8	4.2			15.1	31.3
1987				2.4	1.4	16.6	0.7	2.0	0.3	17.3	5.6	11.9	3.1	2.6	35.1
1988	12.7			0.6	0.9	14.6	0.7	5.8	0.7	13.3	1.1			2.4	36.2
1989	8.1	1.1	2.0	0.2	0.7	6.7	0.7	2.1	1.0	8.7	2.2	7.0	4.2	3.5	25.0
1990	5.4	1.0	1.0	1.2	1.3	5.0	0.6	3.9	1.6	3.0	1.3	6.4	2.9	1.8	34.7
1991	8.8	4.2	0.6	1.1	0.5	7.3	1.3	2.1	0.3	8.7	1.2	9.6	4.2	9.2	27.8
1992	9.6	2.4	0.8	1.4	0.5	7.3	-	2.1	0.4	6.7	0.9			8.9	29.0
1993	9.8			1.0	1.1	10.8	0.1	2.1	0.0	15.6				7.2 [6]	
1994	9.0			1.4	0.6	9.8	1.4	0.6	0.4			13.7	2.3	2.3 [6]	27.1
1995	9.4	1.6	1.2	0.3	0.9	8.4	0.1	0.9	0.0	1.8	1.5	9.8	3.7	4.4	
1996	4.6	1.4	0.3	1.2	0.7	6.3	1.2	2.8	0.0	3.5	0.9	9.3	3.4	3.4	31.0
1997	5.3	0.7	0.5	2.4	0.5	12.7	0.8	0.8	0.0	1.7	0.3	9.6	4.4	2.7	19.8
1998	5.3	1.0	1.0	1.3		5.5	1.1	1.5	0.6	7.2	1.0			1.9	13.4
1999	7.7	1.3	0.9			6.4	0.9	1.3	0.0	4.1	2.2			2.8	16.5
2000	6.3	0.8	0.5			9.4	0.0	0.4	1.1	12.5	1.7	5.9	2.3	3.3	10.1
2001	5.1	2.8	1.1			7.2	1.1	1.3	1.3	4.1	2.2	9.0	3.2	0.4	12.4
2002	4.4	0.8	0.8			6	0.5	0.8	0.5	5.8	1.0	3.2	2.5	0.8 #	11.3
2003	9.1	1.2	0.2			8.3	0.5	4.3	0.9	3.5	0.7	9.6		0.5	6.8
2004	7.7	1.7				5.2		3.1		6.0					6.8
Mean															
(5-year)	6.3	1.3	0.8			7.1	0.7	1.6	0.6	6.2	1.4	6.9	3.1	1.6	11.8
(10-year)	6.9	1.3	0.8	1.3	0.8	8.3	0.7	1.5	0.4	6.0	1.3	8.8	3.1	2.7	16.5

[1] Microtags.

[2] Carlin tags, not corrected for tagging mortality.

[3] Microtags, corrected for tagging mortality.

[4] Assumes 50% exploitation in rod fishery.

[5] From 0+ stage in autumn.

[6] Incomplete returns.

[7] Assumes 30% exploitation in trap fishery.

Table 3.9.14.2. Estimated survival of hatchery smolts (%) to return to homewaters (prior to coastal fisheries) for monitored rivers and experimental facilities in the NE Atlantic Area.

Smolt year	Iceland[1]		Norway[2]						Sweden[2]	
	R. Ranga		R. Halselva		R. Imsa		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1981					10.1	1.3				
1982					4.2	0.6				
1983					1.6	0.1				
1984					3.8	0.4	3.5	3.0	11.8	1.1
1985					5.8	1.3	3.4	1.9	11.8	0.9
1986					4.7	0.8	6.1	2.2	7.9	2.5
1987			1.5		9.8	1.0	1.7	0.7	8.4	2.4
1988			1.2	0.1	9.5	0.7	0.5	0.3	4.3	0.6
1989	1.6	0.1	1.9	0.5	3.0	0.9	1.9	1.3	5.0	1.3
1990	0.9	0.2	2.1	0.3	2.8	1.5	0.3	0.4	5.2	3.1
1991	0.1	0.0	0.6	0.0	3.2	0.7	0.1	0.1	3.6	1.1
1992	0.4	0.1	0.5	0.0	3.8	0.7	0.4	0.6	1.5	0.4
1993	0.9	0.1	-	-	6.5	0.5	3.0	1.0	2.6	0.9
1994	1.2	0.2	-	-	6.2	0.6	1.2	0.9	4.0	1.2
1995	0.9	0.1	-	-	0.4	0.0	0.7	0.3	3.9	0.6
1996	0.1	0.0	1.2	0.2	2.1	0.2	0.3	0.2	3.5	0.5
1997	0.2	0.1	0.6	0.0	1.0	0.0	0.5	0.2	0.6	0.5
1998	0.5	0.0	0.5	0.5	2.4	0.1	1.9	0.7	1.6	0.9
1999	0.6	0.0	2.3	0.2	12.0	1.1	1.9	1.6	2.1	
2000	1.0	0.1	1.0	0.7	8.4	0.1	1.1	0.6		
2001	0.2	0.1	1.9	0.6	3.4	0.1	2.5	1.1		
2002	0.4		1.4	0.0	4.5	0.8	1.2	0.7		
2003			0.5	0.3	2.6	0.6	0.3	0.6		
2004			0.2		3.6		0.4			
Mean										
(5-year)	0.6	0.1	1.4	0.4	6.2	0.4	1.4	0.9	2.1	
(10-year)	0.6	0.1	1.2	0.3	4.3	0.5	1.2	0.7	2.6	

[1] Microtagged.

[2] Carlin-tagged, not corrected for tagging mortality.

Table 3.9.14.2 Cont'd. Estimated survival of hatchery smolts (%) to 1SW adult return to homewaters, (prior to coastal fisheries) for monitored rivers and experimental facilities in Ireland and UK (N.Ireland).

Smolt year	Ireland									UK (N. Ireland)[3]	
	R. Shannon	R. Screebe	R. Burrishoole[1]	R. Delphi	R. Bunowen	R. Lee	R. Corrib Cong.[2]	R. Corrib Galway[2]	R. Erne	R. Bush 1+ smolts	R. Bush 2+
1980	8.6		3.3			8.3	0.9				
1981	2.8		6.9			2.0	1.5				
1982	4.0		8.2			16.3	2.7	16.1			
1983	3.9		2.3			2.0	2.8	4.1		1.9	8.1
1984	5.0	10.4	23.5			2.3	5.2	13.2	9.2	13.3	
1985	17.8	12.3	26.3			14.7	1.4	14.4	7.9	15.4	17.5
1986	2.1	0.4	7.6			16.4		7.6	10.1	2.0	9.7
1987	4.7	8.3	11.2			8.8		2.2	7.0	6.5	19.4
1988	4.9	9.2	13.8			5.5	4.2		2.6	4.9	6.0
1989	5.0	1.6	7.9			1.7	6.0	4.9	1.2	8.1	23.2
1990	1.3	0.0	7.1			2.5	0.2	2.3	2.5	5.6	5.6
1991	4.2	0.2	12.5	11.3		0.8	4.9	4.0	1.3	5.4	8.8
1992	4.4	1.3	6.3	10.7	4.2		0.9	0.6		6.0	7.8
1993	2.9	2.2	12.0	14.0	5.4		1.0			1.1	5.8
1994	5.2	1.9	14.3	3.9	10.8			5.3		1.6	
1995	3.6	4.1	6.6	3.4	3.5		2.4			3.1	2.4
1996	2.9	1.8	5.3	10.1	3.4					2.0	2.3
1997	6.0	0.4	13.3	16.2	5.3	7.0			7.6	-	4.1
1998	3.1	1.3	4.9	7.0	2.9	4.6	3.3	2.9	2.5	2.3	4.5
1999	1.0	2.8	8.1	15.4	2.0			3.6	3.5	2.7	5.8
2000	1.2	3.8	11.8	15.9	5.4	3.5	6.7		4.0	2.8	4.4
2001	2.0	2.5	9.7	17.2	3.2	2.0	3.4		5.9	1.1	2.2
2002	1.0	4.1	9.2	11.5	2.0	1.9		2.0	1.9	0.7	3.1
2003	1.2		6.0	3.7	1.6	4.3		1.2	1.0	2.5	1.9
2004	0.4	1.8	9.3	7.4	1.8	2.0		4.5	3.2	0.7	1.9
Mean											
(5-year)	1.3	3.3	9.0	12.7	2.8	2.9	5.1	2.3	3.3	1.9	3.5
(10-year)	2.7	2.5	8.9	10.4	4.0	3.9	4.0	3.0	3.8	2.1	3.4

[1] Return rates to rod fishery with constant effort.

[2] Different release sites

[3] Microtagged.

Table 3.10.1. Summary of national objectives, recent management measures and attainment of management objectives.

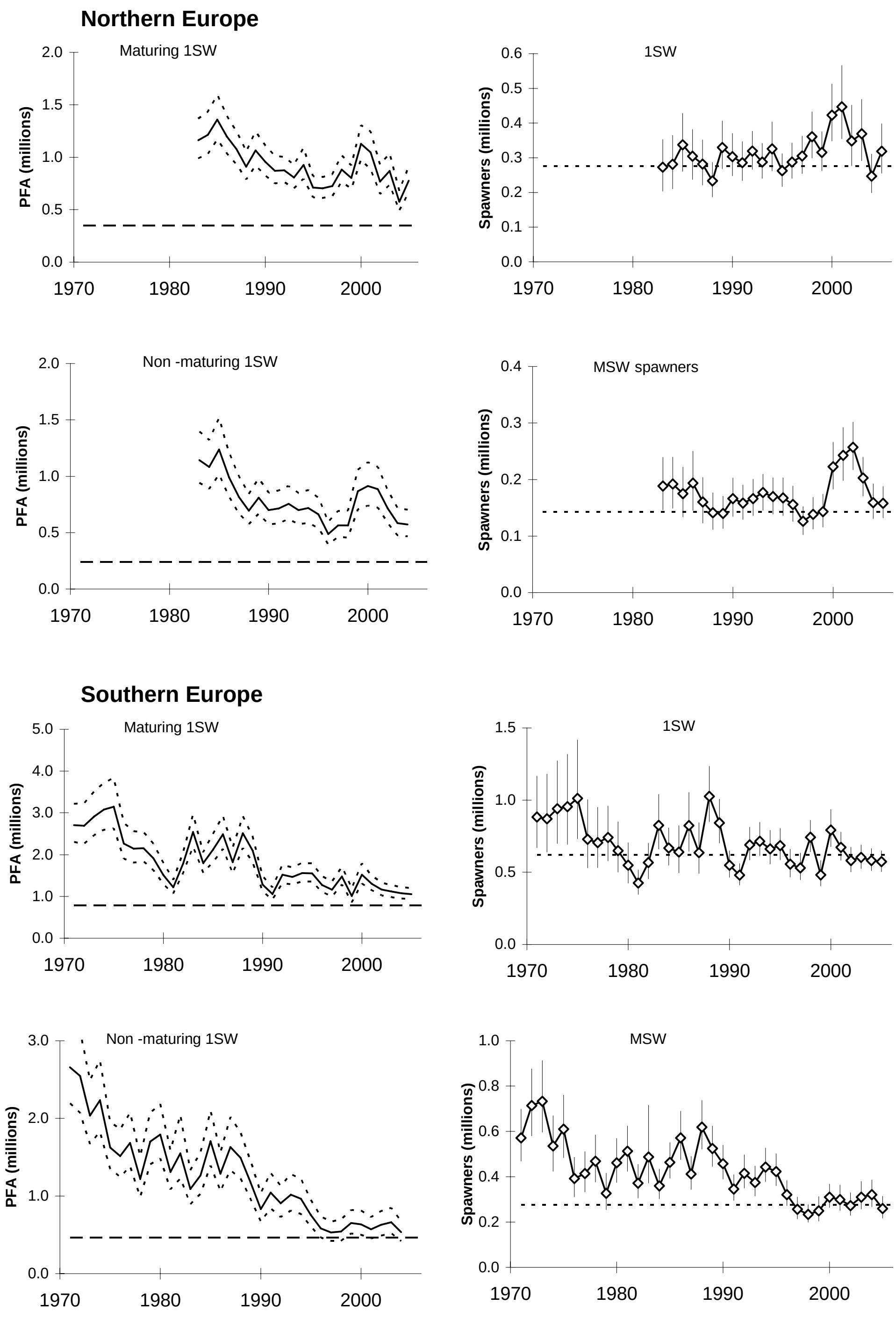
Country	Objective	Measure	Assessment	Outcome/extent achieved	Further consideration
Russia	Reduce fishing effort and enhance recreational catch and release fisheries	Various management measures including prohibition of some important in-river fisheries	Examination of catch statistics	Mean commercial catch reduced by 55% (2001-2005 compared to 1996-2000). Catch and release increased by 50% in past 5 years	Further reductions likely to be introduced
Ireland	Reduce exploitation rates and increase freshwater returns leading to 75% probability of simultaneous attainment of CLs in all rivers	TAC imposed in 2002 which has been reduced by 17%, 11%, 14% annually or 36% in total. Restrictions in angling catch including bag limits	Examination of coded wire tagging returns to Irish and UK rivers pre and post imposition of TACs Examination of fish counter data	Homewater exploitation rate reduced from 61% (pre-2002) to 46% (post 2002) for wild salmon, 82% to 69% for hatchery salmon Exploitation rate on UK stocks reduced by about 50% following management measures in 1997 and imposition of TACs	Further restrictions to fisheries including a lower TAC in 2006 (91,000 salmon) and restrictions on angling fisheries. Proposal to end mixed stock fisheries on stocks below CL by 2007
	Maintain salmon stocks in SAC rivers at favourable conservation status	TAC imposed in 2002 which has been reduced by 17%, 11%, 14% annually or 36% in total. Restrictions in angling catch including bag limits	Examination of counter/rod data to assess CL compliance for 26 SAC rivers	10 are probably meeting CL, 8 are above 50% of CL, 6 are below 50% of CL , and 2 are of uncertain status.	EU Water framework Directive likely to have a beneficial effect on salmonid habitat
UK (England	Safeguard MSW stock component	Spring salmon - measures introduced in 1999	Estimated 1,200 salmon saved from net fisheries. 1,700 saved from rod fisheries in 2005	Spawning escapement of spring salmon may have increased by up to one third on some rivers due to measures	Measures will remain in place till 2008 at least
	Stocks to meet or exceed CLs in at least 4 years of 5	Mixed stock fisheries measures including phase out, closures or reductions in fisheries	Examination of catch statistics and annual compliance	Coastal fishery catch reduced from average of 41,000 (88-92) to under 32,000 (98-02) and 10,000 (03-05). Declared rod catch in 5 north east rivers 55% higher on average in 3 years since buyout (2003) relative to average of 5 years before buyout	Continuing to phase out remaining mixed stock fisheries and focus on other limiting factors
			Examination of counter information	Recorded runs into the Tyne 98% higher since 2003 compared with mean of previous 5 years.	Continue monitoring
	To meet a management target on the River Lune of 14.4 million eggs or about 5,000 adults	Regulations on River Lune 2000 to reduce exploitation in net and rod fisheries by 50% and 25% resp.	Assessment of counter data catch statistics and juvenile assessment	Increase in salmon spawning from 3618 +/- 575 to 7,102 =/- 1,539. Management target exceeded in all years since the regulation Increase in juvenile production 80% increase in net catch in 2005	Continue to meet management objectives
	Maintain salmon stocks in SAC rivers at favourable conservation status	As above	Examination of counter/rod data to assess CL compliance for 18 SAC rivers	2 are currently considered to be complying with the management objective	Continue with management plan to meet management objectives

Table 3.10.1 Cont'd. Summary of national objectives, recent management measures and attainment of management objectives.

Country	Objective	Measure	Assessment	Outcome/extent achieved	Further consideration
UK (Scotland)	Improve status of early running MSW salmon	Agreement by Salmon Net Fishing Association to delay fishing to beginning of April from '2000	Examination of catch statistics	80% reduction in MSW net fishery catch in February to March relative to previous 5 yr mean	Further reduction in exploitation
		Bervie, N. and S. Esk salmon district net fishery delayed till May with catch and release only for angling	Examination of catch statistics	Believed to have increased escapement	Measure to be considered again in 2006
France	Reduce exploitation on MSW in particular and increase escapement and compliance with river specific CLs	Closure since 1994 of Loire-Allier sport and commercial fisheries	Measured against compliance objectives for the area	This did not seem to enhance salmon numbers	Physical obstructions and other environmental factors also being considered as potential limiting factors
		TACs introduced in 1996 in Brittany and Lower Normandy. MSW TACs have lead to temporary closures on some rivers	Examination of catch statistics	Reduced catch in MSW catch in Brittany since 2000 and Lower Normandy since 2003. Reduced catch has probably allowed an increase in escapement.	Monitored river (Scorff) has failed to meet CL consistently since 1994 so further measures may be considered.
		Management measures in the Adour-Gaves basin in 1999 and '2003	Examination of catch statistics	Rod catch increased in 2004 and 2005 when measures lapsed. A steady increase in effort and catch of estuary drift net fishery for 1999 to 2004 also occurred. Some reduction in rod catch but current regulations have been unable to reduce overall exploitation or pressure on MSW stocks	Continue to monitor stock status
Germany	Reintroduction of Atlantic salmon stocks extinct since the middle of 20th century but improvements in conditions and water quality were thought to be sufficient to support salmon	Restocking of rivers running into North Sea (Rhine, Ems, Weser and Elbe). 2 million juveniles (mainly fry) released annually	Trap and counter data (Sieg, upper Rhine)	200-500 adults recorded annually. Return rates of less than 1%	Low return rates thought to reflect obstructions to migration in the Rhine delta as well as spawning tributaries and probably due to bye-catch in non-target fisheries
	Establish free migration routes for salmon and other migratory fishes and rehabilitation of habitat in rivers basins	Collaborative programme has started e.g. Rheineprogramm 2020	Assessment in progress	Assessment in progress	Assessment in progress

Figure 3.1.1. **Estimated recruitment (PFA), with 95% confidence limits, Spawning Escapement Reserve for maturing and non-maturing salmon in Northern & Southern Europe.**

Estimated spawning escapement and with 95% confidence limits, and conservation limits for 1SW and MSW salmon in Northern & Southern Europe.



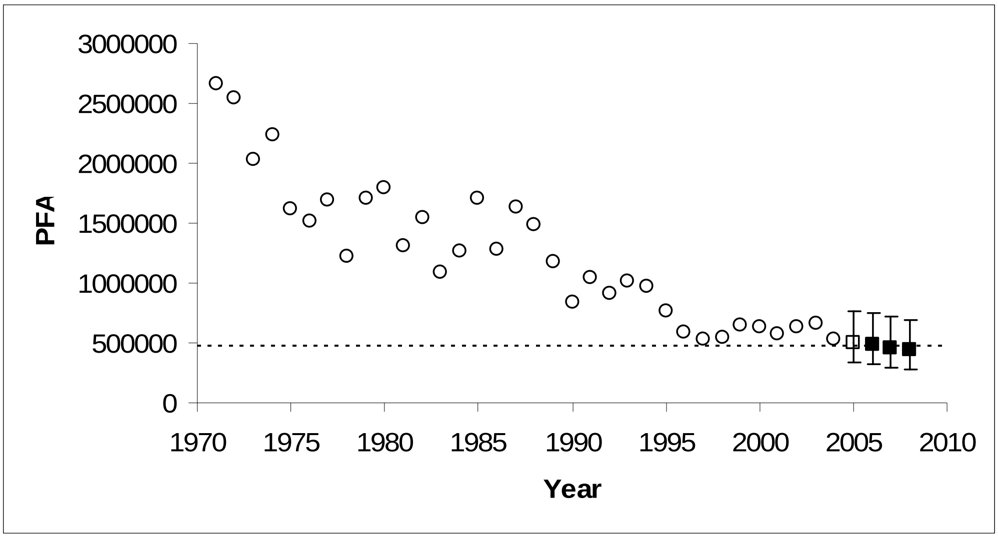


Figure 3.6.1.1. PFA trends and predictions (+/- 95% confidence limits) for non-maturing 1SW European stock. ***Note: open square is 2005 update and blocked squares are 2006 to 2008 forecasts.***

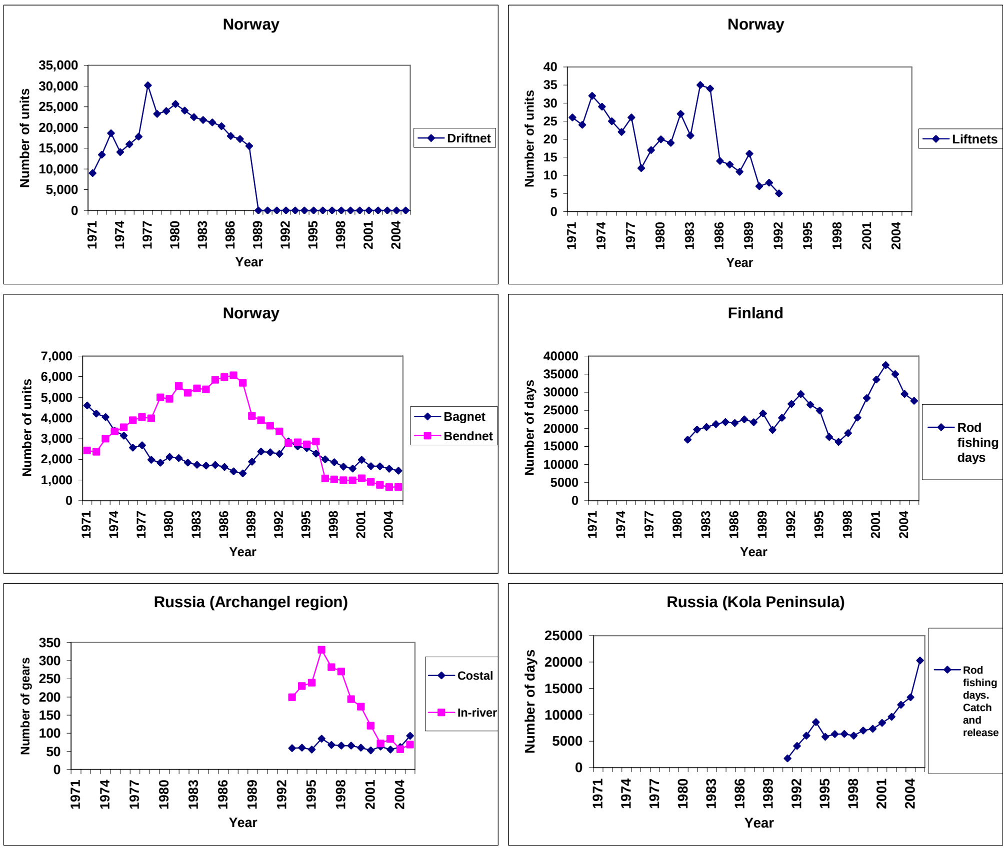


Figure 3.9.3.1. Overview of effort as reported for various fisheries and countries 1971-2005 in the Northern NEAC area.

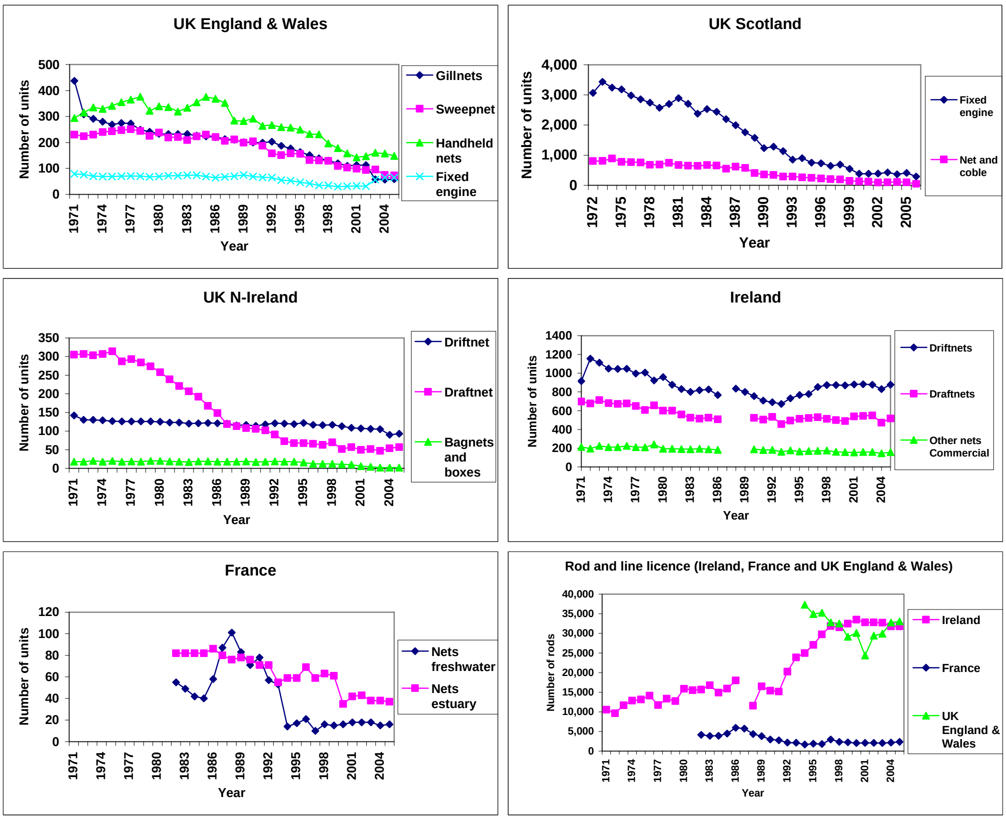


Figure 3.9.3.2. Overview of effort as reported for various fisheries and countries 1971-2005 in the Southern NEAC area.

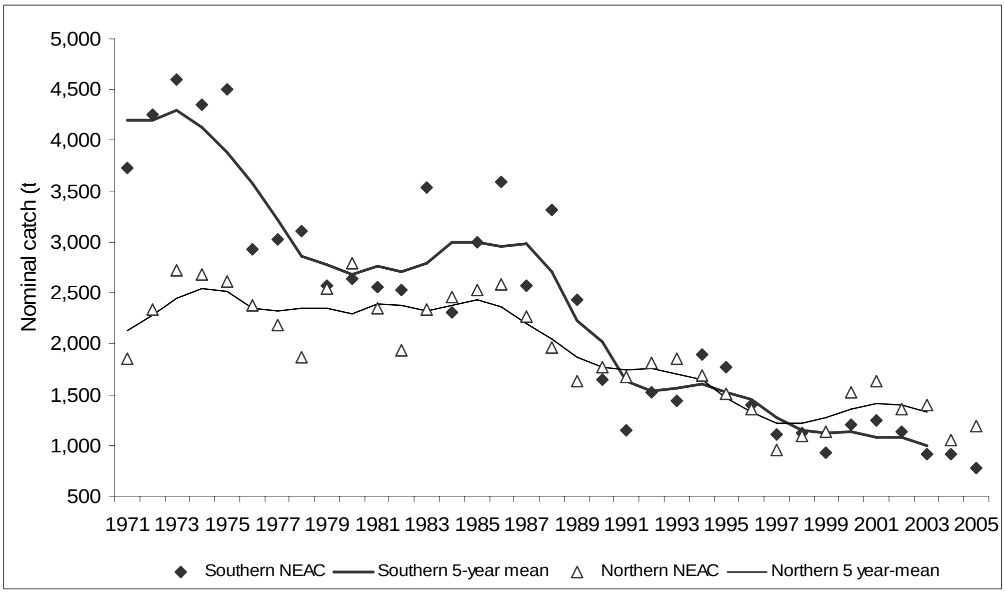


Figure 3.9.4.1. Nominal catch of salmon and 5-year running means in the Southern and Northern NEAC Areas, 1971–2005.

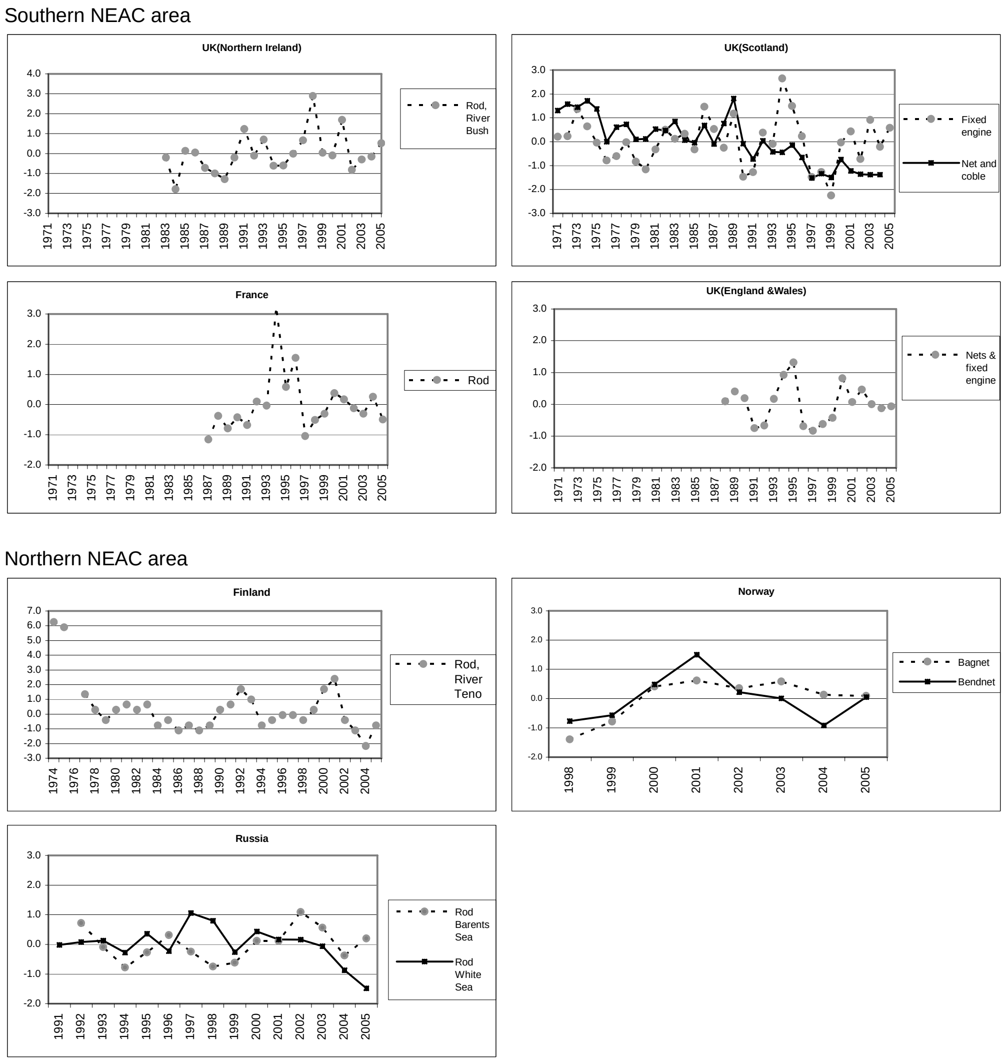


Figure 3.9.5.1. CPUE indices in various fisheries of the NEAC countries. Vertical axes represent standardised (Z-score) index values, or averages of several series, relative to the average of the time series (0,0).

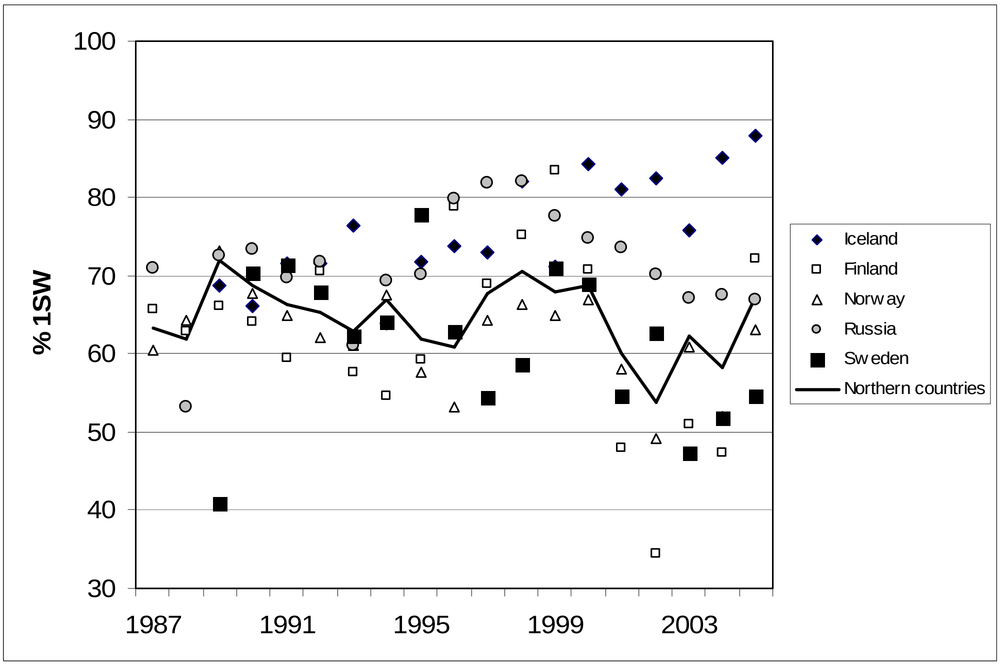


Figure 3.9.6.1. Percentage of 1SW salmon in the reported catch for Northern NEAC countries, 1987-2005. Solid line denotes mean value from catches in all NEAC Northern countries.

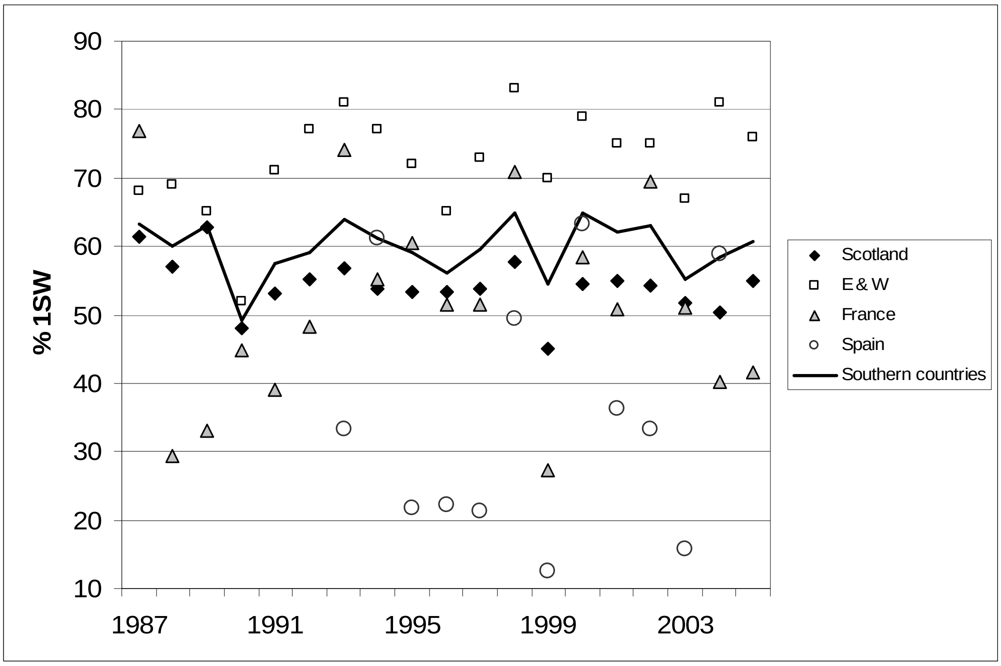


Figure 3.9.6.2. Percentage of 1SW salmon in the reported catch for Southern NEAC countries, 1987-2005. Solid line denotes mean value from catches in all NEAC Southern countries.

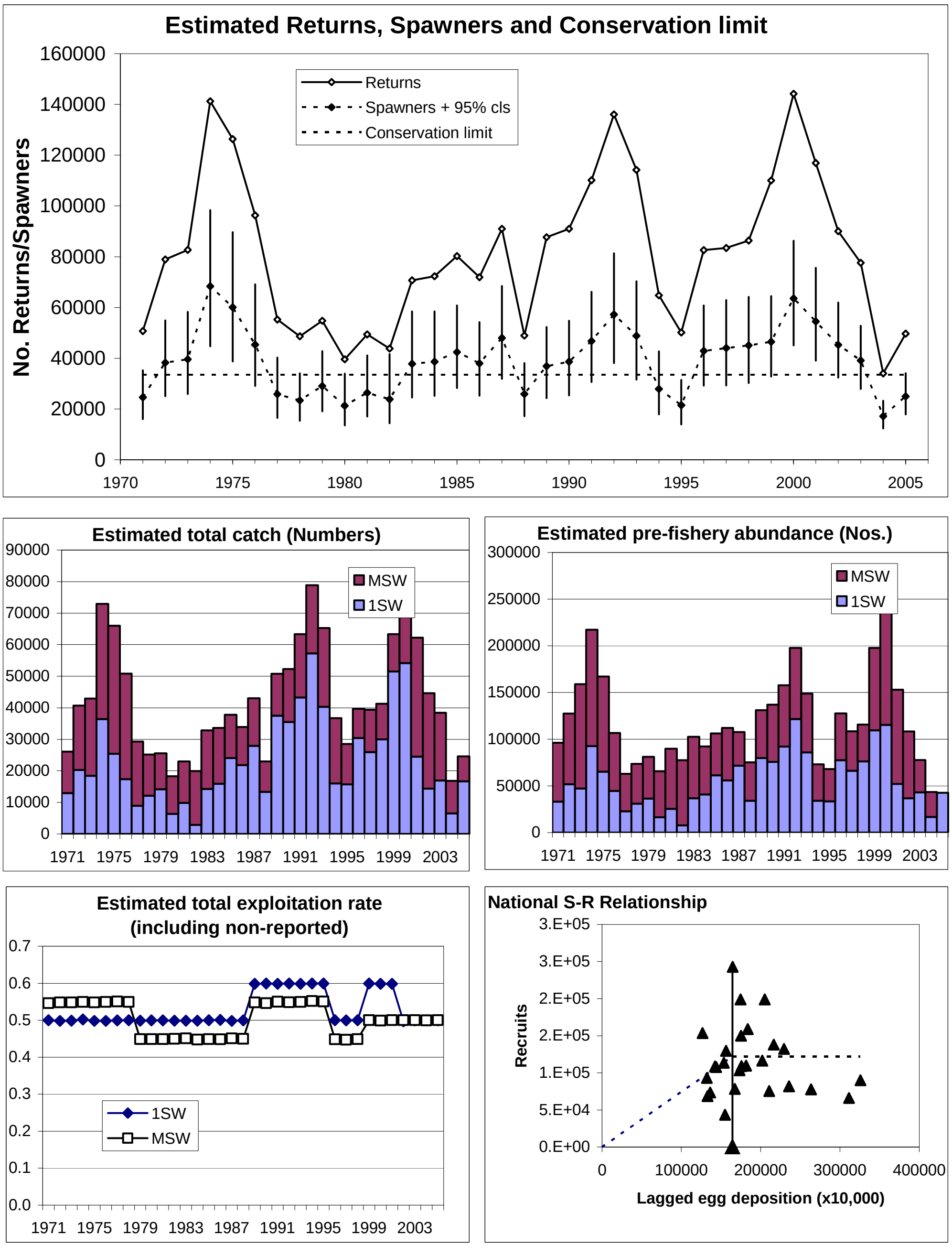


Figure 3.9.12.1a. Summary of fisheries and stock description. R. Tana/Teno (Finland & Norway combined).

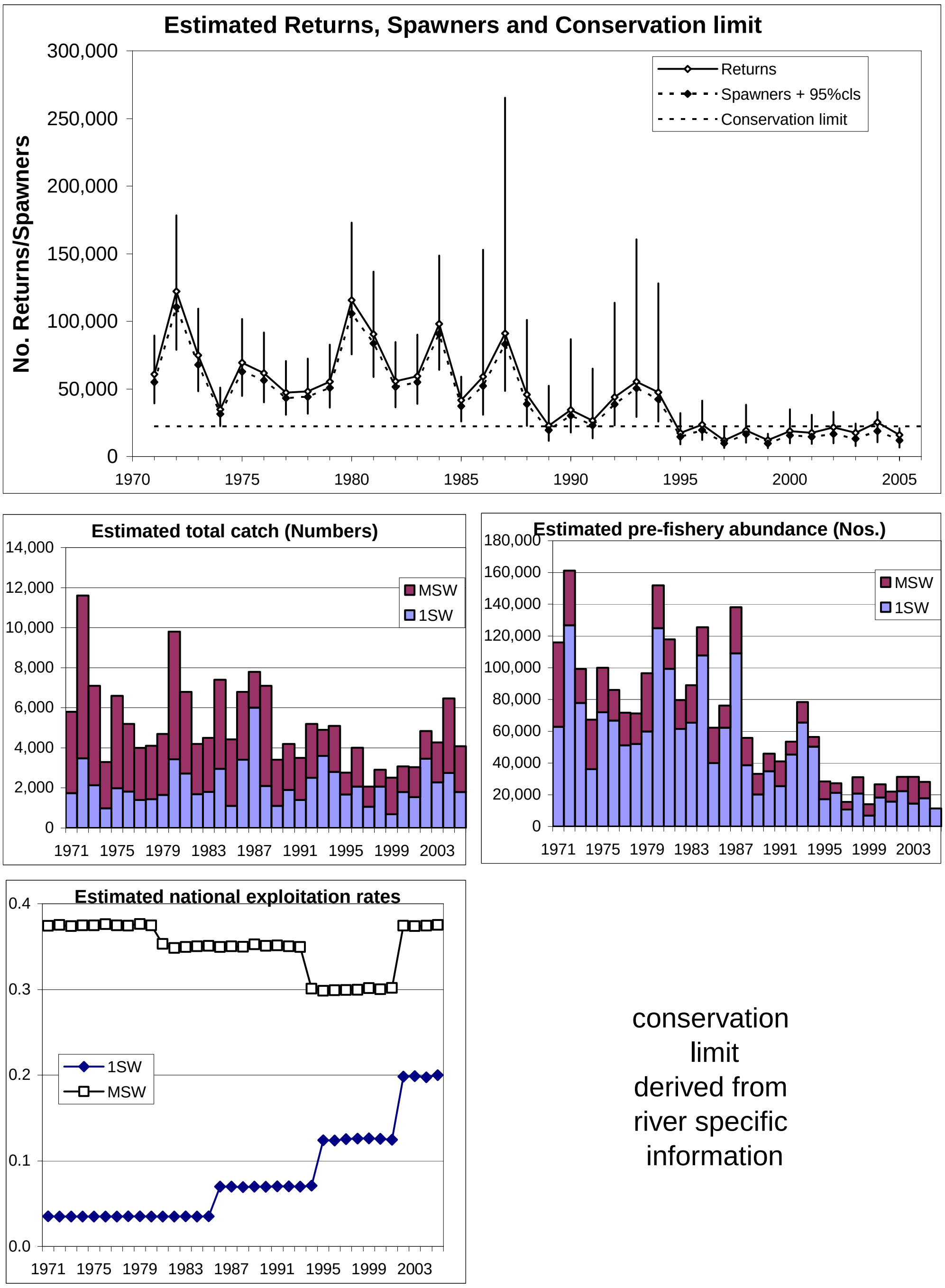


Figure 3.9.12.1b. Summary of fisheries and stock description. France.

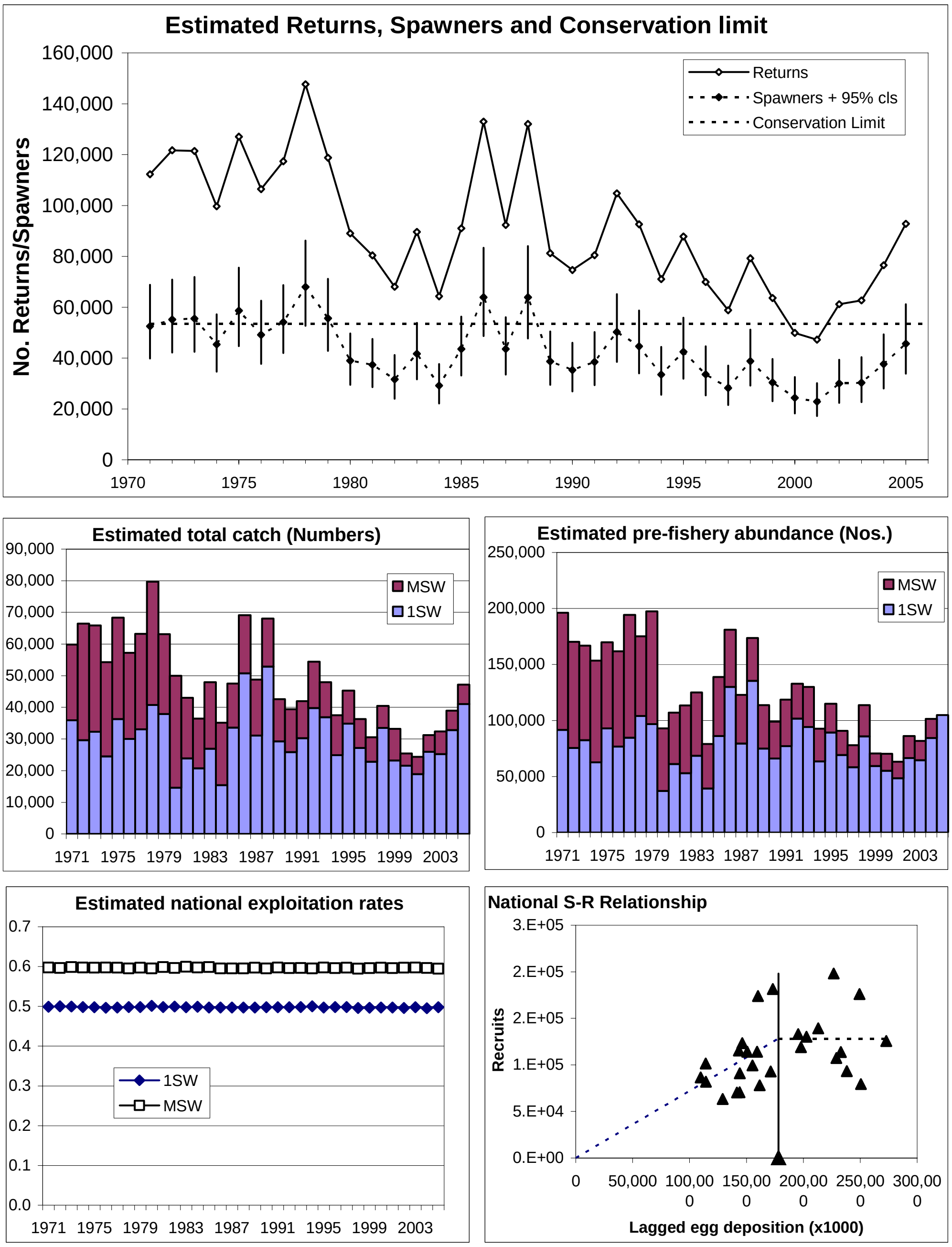


Figure 3.9.12.1c. Summary of fisheries and stock description. Iceland.

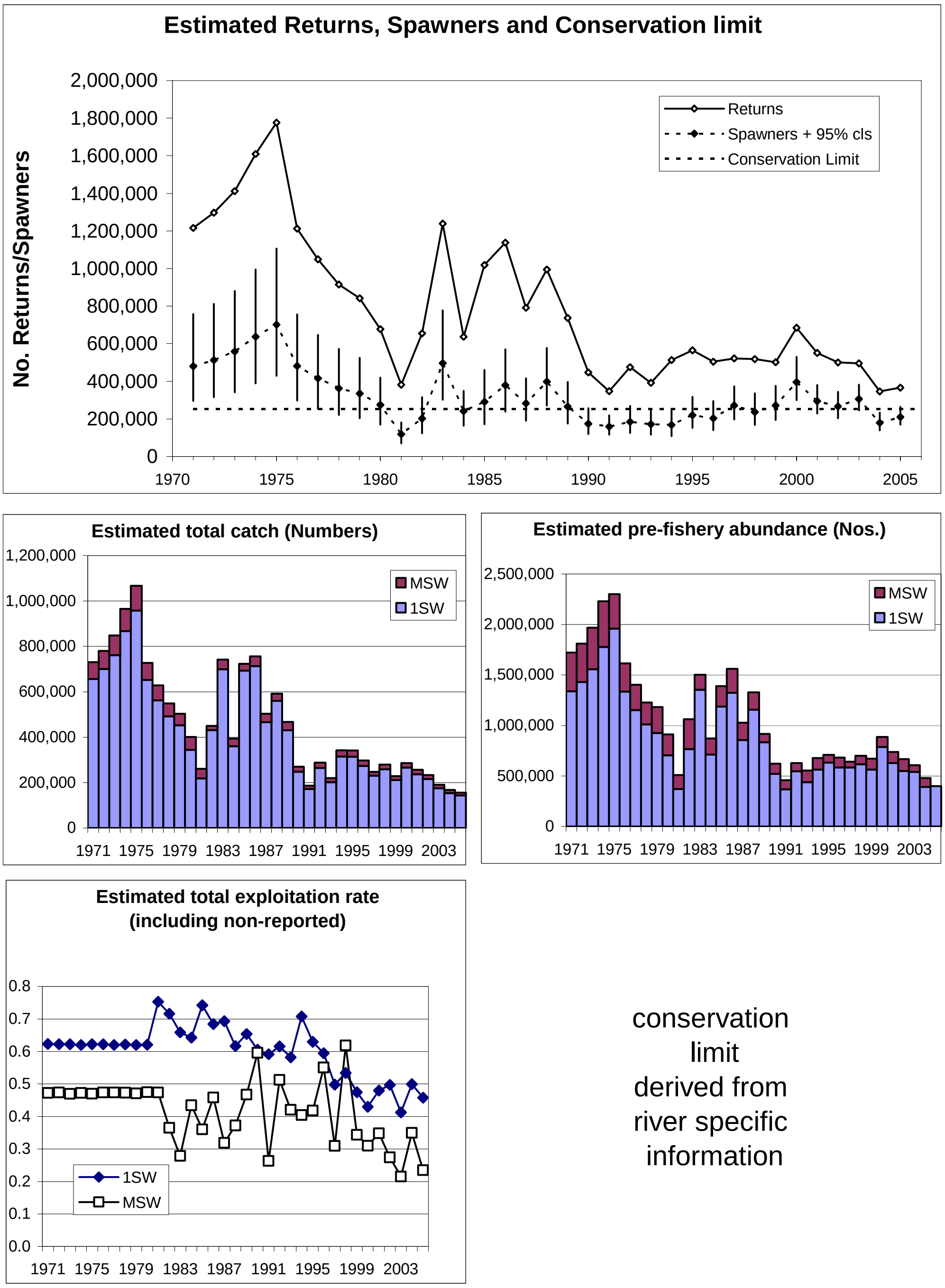


Figure 3.9.12.1d. Summary of fisheries and stock description. Ireland.

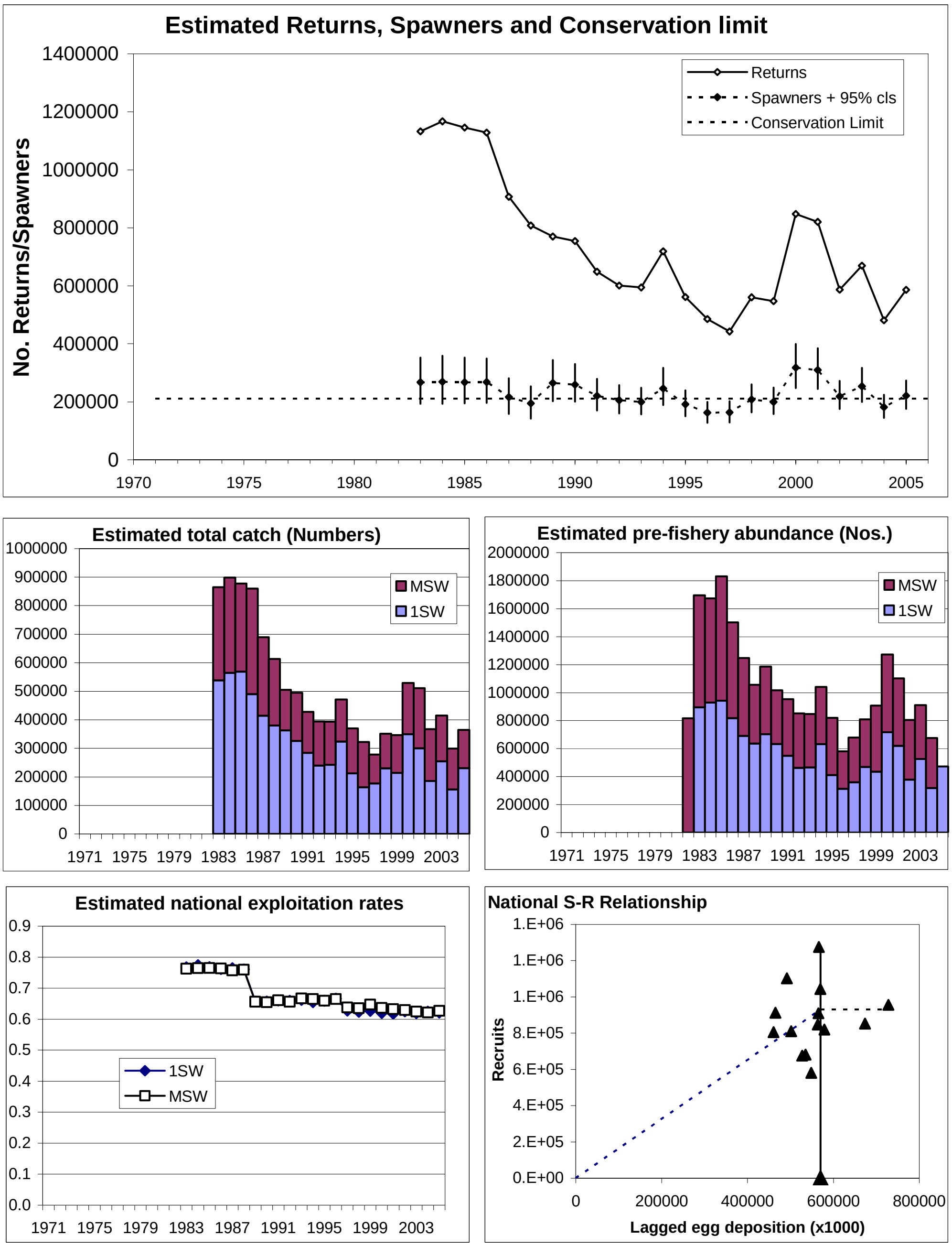


Figure 3.9.12.1e. Summary of fisheries and stock description. Norway (minus Norwegian rod catches from the R. Teno).

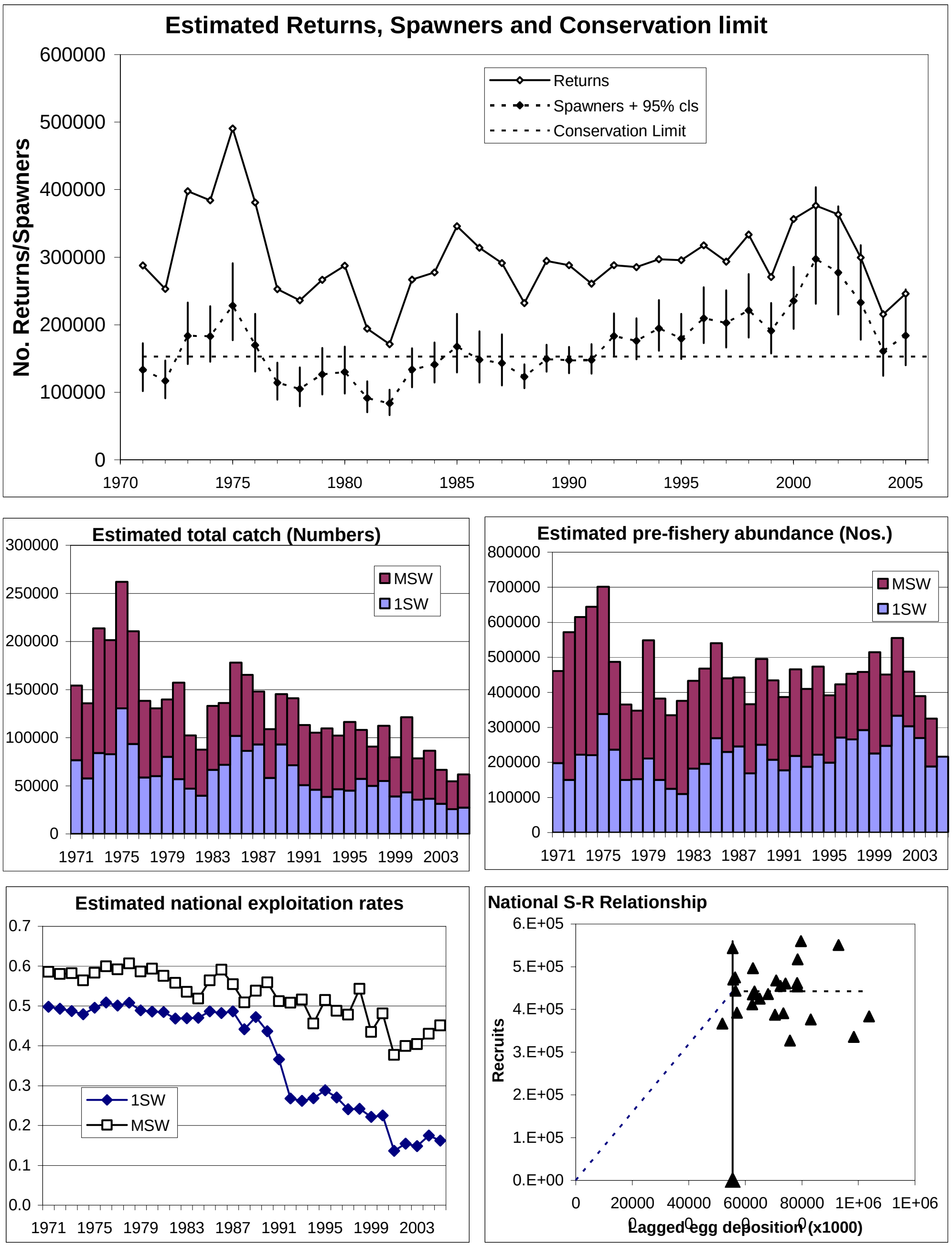


Figure 3.9.12.1f. Summary of fisheries and stock description. Russia.

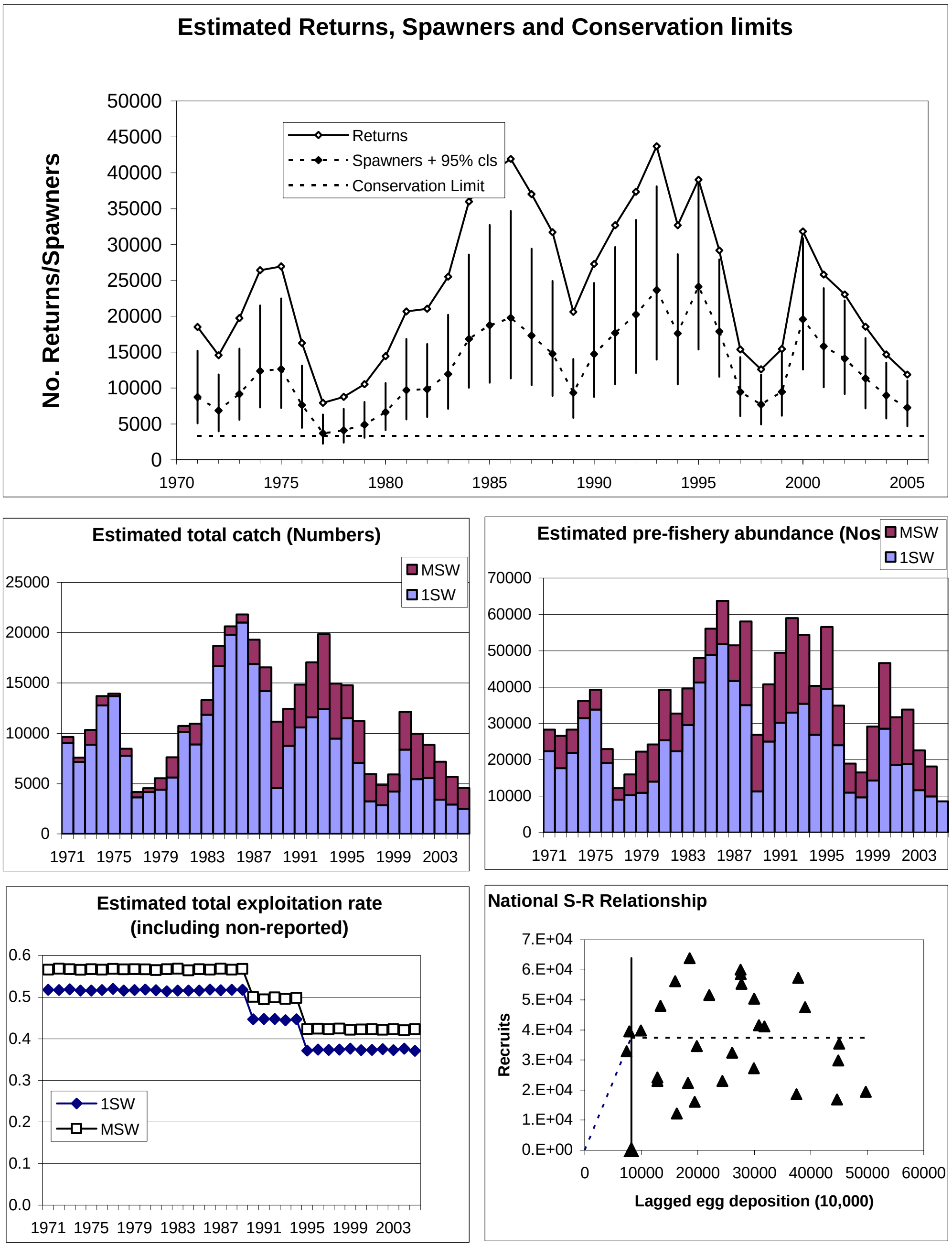


Figure 3.9.12.1g. Summary of fisheries and stock description. Sweden.

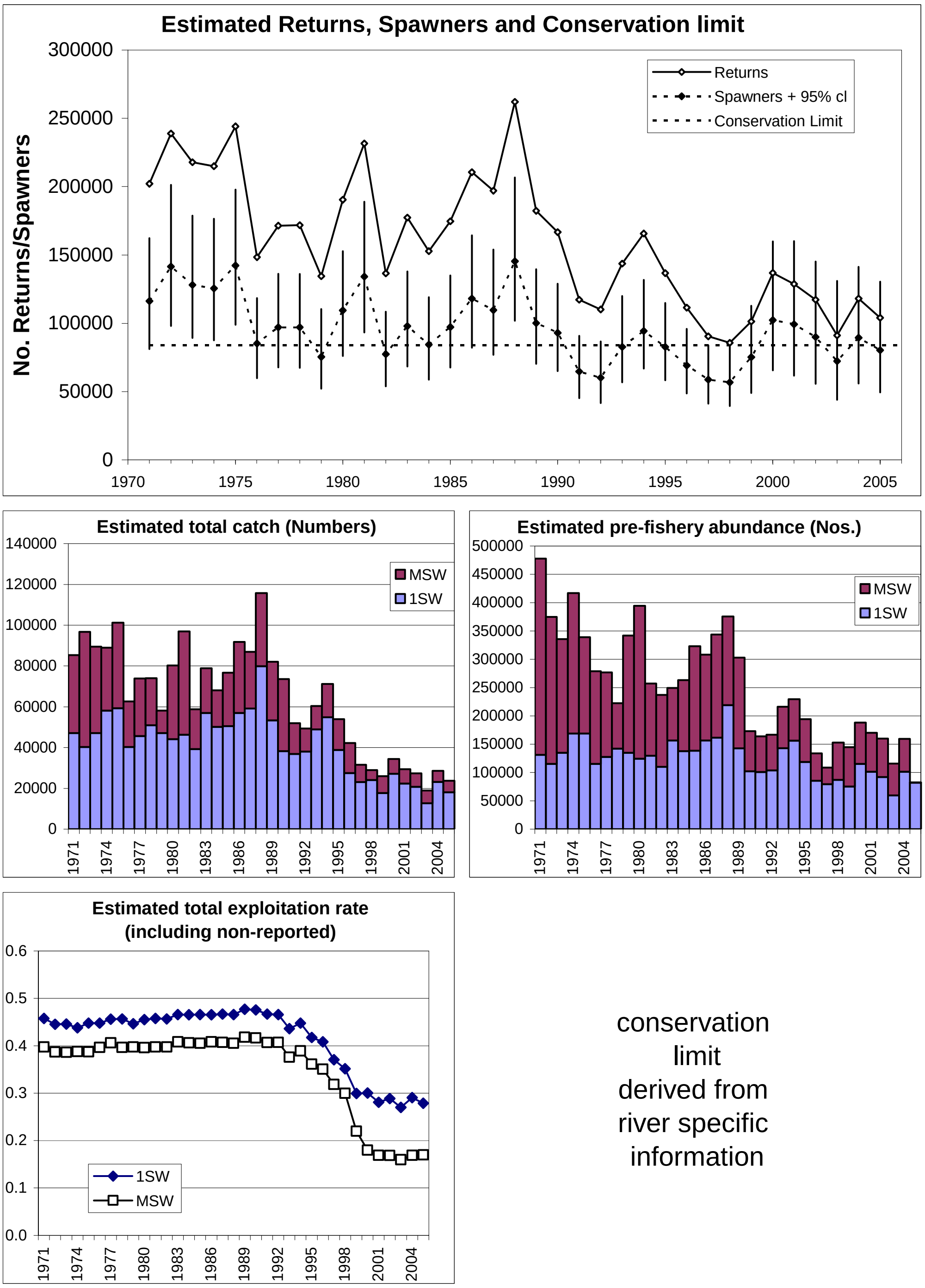


Figure 3.9.12.1h. Summary of fisheries and stock description. UK (England & Wales).

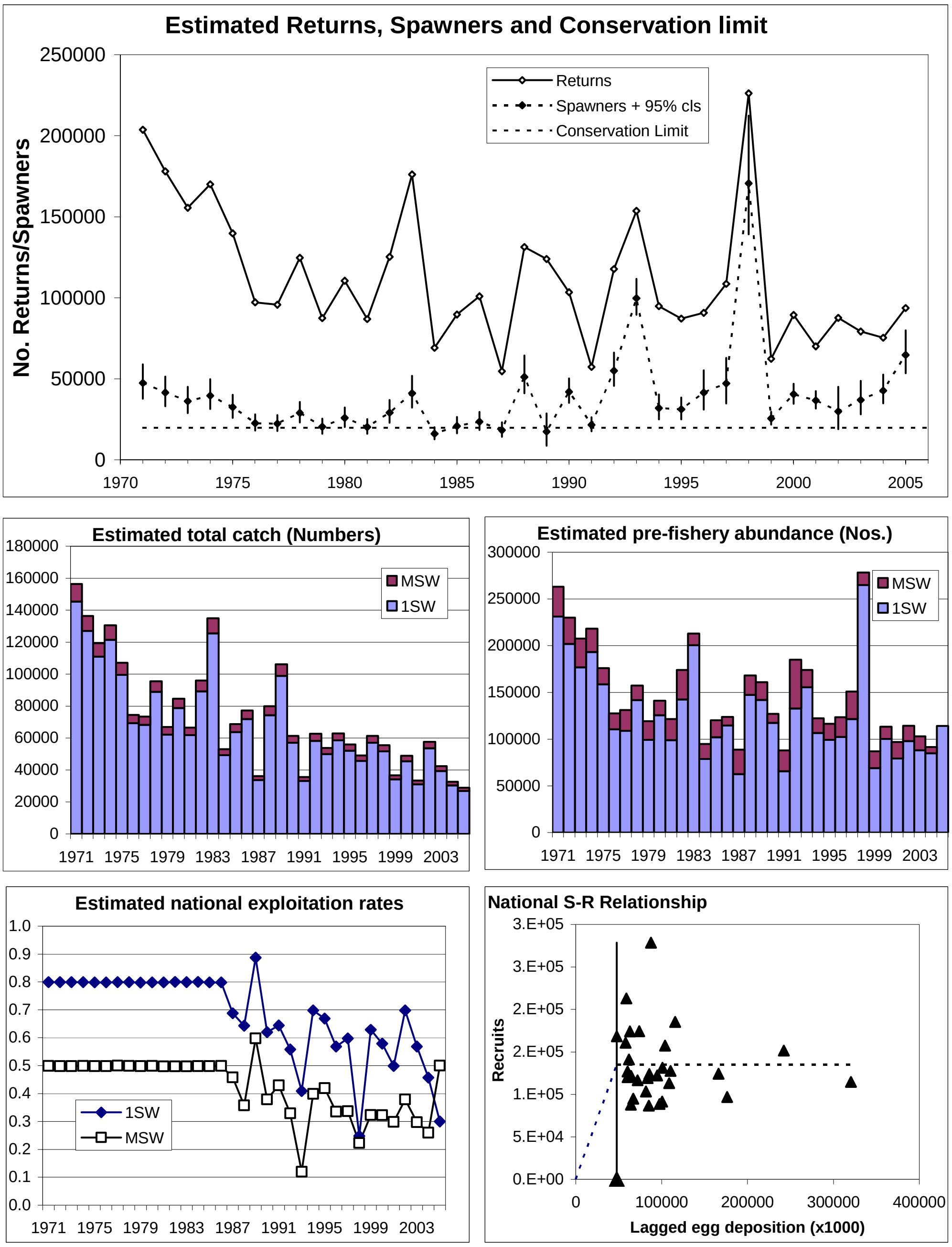


Figure 3.9.12.1i. Summary of fisheries and stock description. UK (Northern Ireland).

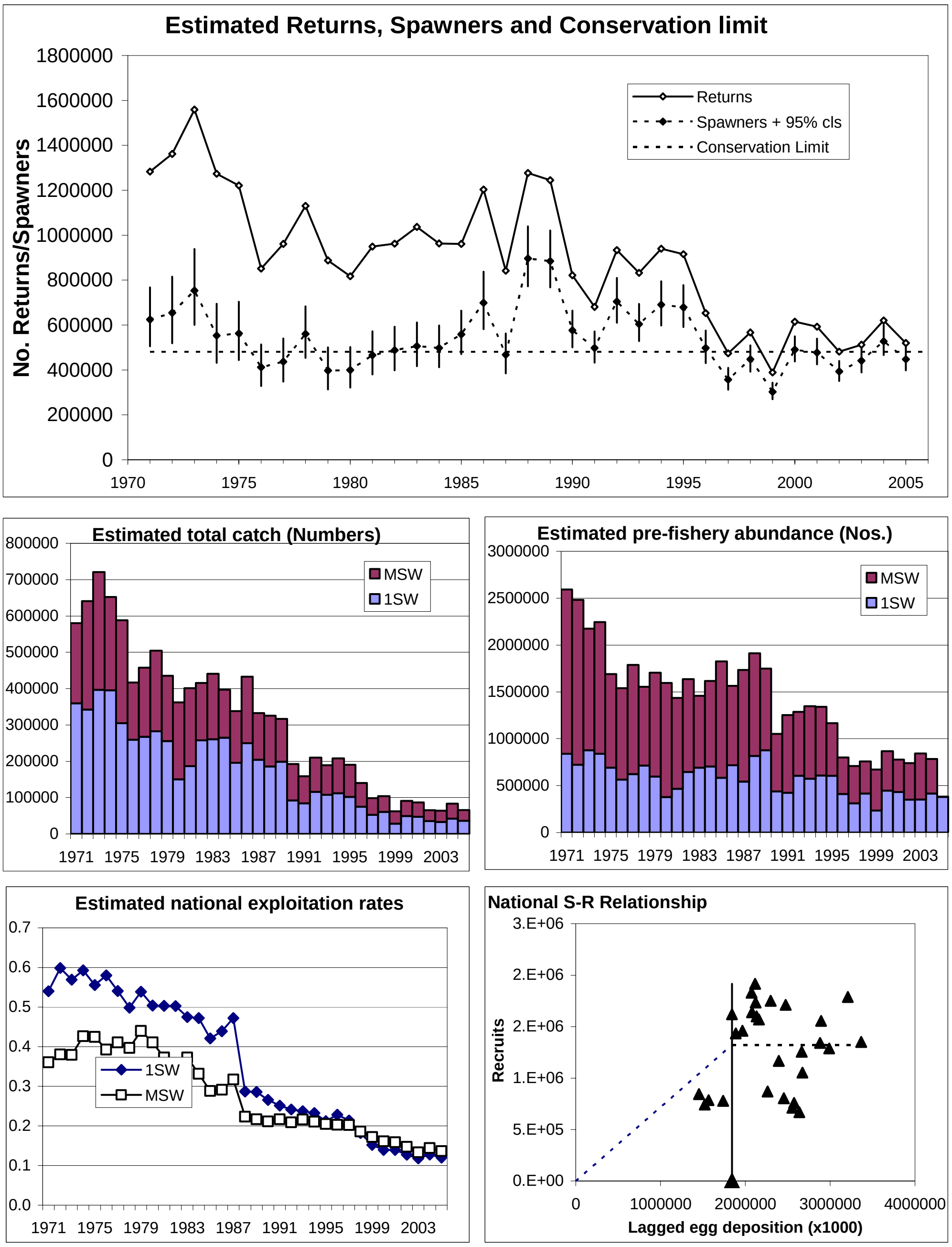


Figure 3.9.12.1j. Summary of fisheries and stock description. UK (Scotland).

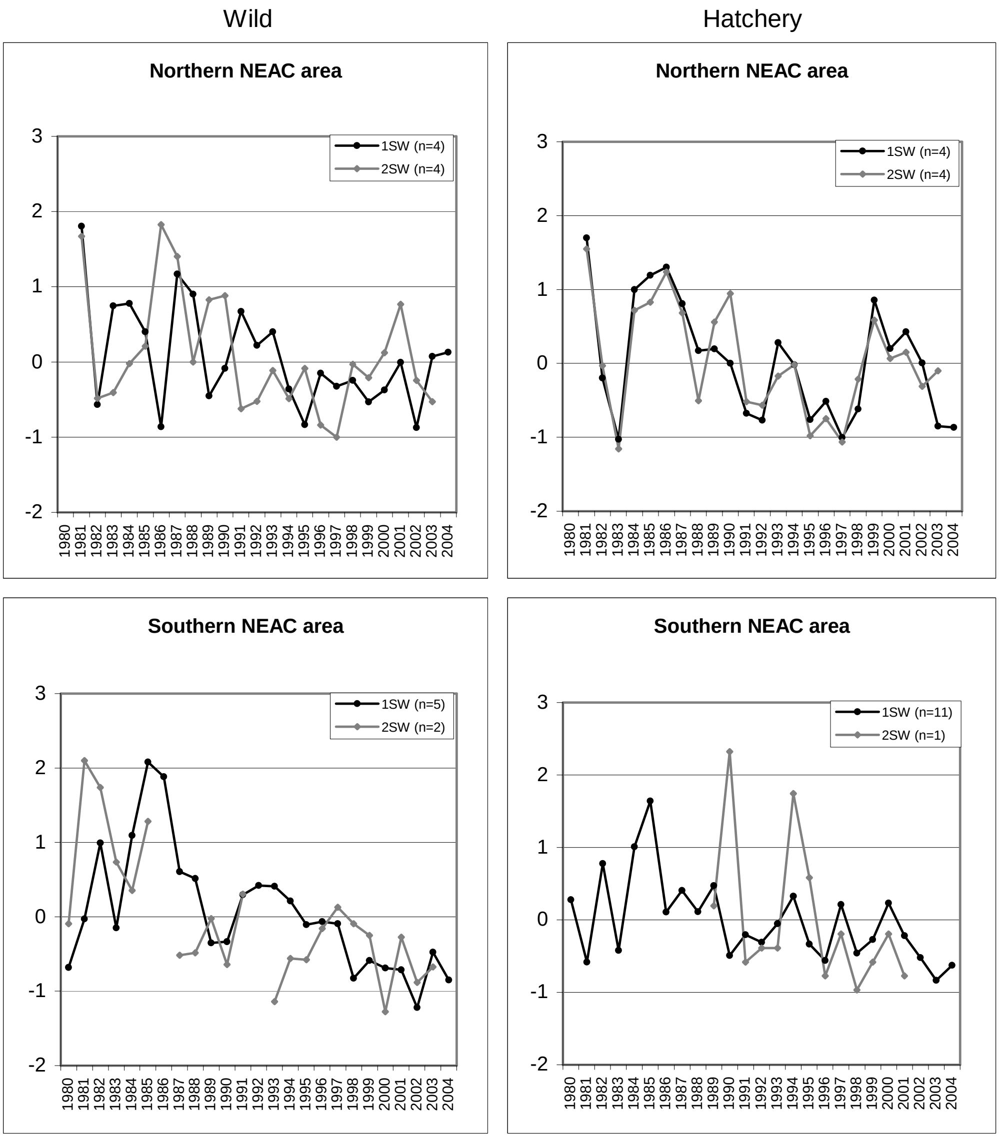


Figure 3.9.14.1. Survival indices of wild and hatchery smolts to adult returns to homewaters (prior to coastal fisheries) in the Northern and Southern NEAC Areas. Vertical axes represent standardised (Z-score) survival estimates and are relative to the average of the time series (0) derived from periods where data from the majority of the rivers are available (ie. Northern wild, from 1987; Northern hatchery, from 1984; Southern wild 2SW from 1980 (recent data not updated); Southern hatchery 1SW from 1984 and Southern hatchery 2SW from 1989). The number of rivers included is indicated in each panel legend.

4 NORTH AMERICAN COMMISSION

4.1 Status of stocks/exploitation

In 2005, the midpoint of the spawner estimates for six geographic areas indicated that all areas except Newfoundland were below their conservation limit (S_{lim}) $_{for}$ 2SW salmon and are suffering reduced reproductive capacity. Newfoundland was at risk of suffering reduced reproductive capacity.

The stock status is elaborated in section 4.9.

4.2 Management objectives

Management objectives are included in section 1.4.

4.3 Reference points

There are no changes recommended in the 2SW salmon conservation limits (S_{lim}) from those identified previously. Conservation limits for 2SW salmon for Canada now total 123 349 and for the USA, 29 199 for a combined total of 152 548.

Country and Comission Area	**Stock Area**	**2SW spawner requirement**
	Labrador	34 746
	Newfoundland	4 022
	Gulf of St. Lawrence	30 430
	Québec	29 446
	Scotia-Fundy	24 705
Canada Total		123 349
USA		29 199
North American Total		152 548

4.4 Management advice

River specific management of catch is required to meet river specific biological conservation requirements. Where spawning requirements are being achieved, there are no biological reasons to restrict harvest. Advice regarding management of this stock complex in the fishery at West Greenland is provided in Section 5.

4.5 Relevant factors to be considered in management

ICES considers that management for all fisheries should be based upon assessments of the status of individual stocks. Fisheries on mixed stocks, either in coastal waters or on the high seas, pose particular difficulties for management as they cannot target stocks that are at full reproductive capacity. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and rivers are more likely to meet this requirement**.**

4.6 Revised forecast of 2SW maturing fish for 2006

Catch options are only provided for the non-maturing 1SW and maturing 2SW components as the maturing 1SW component is not fished outside home waters, and in the absence of significant marine interceptory fisheries, is managed in home waters.

It is possible to provide catch options for the North American Commission area for four years. The revised forecast for 2006 for 2SW maturing fish is based on an updated forecast of the 2005 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2005 as 1SW non-maturing fish. The estimates for the 2007–2009 fisheries on maturing 2SW salmon are based on the pre-fishery abundance forecast for 2006–2008 from Section 5

4.6.1 Catch options for 2006 fisheries on 2SW maturing salmon

The updated forecast of the pre-fishery abundance for 2005 provides a PFA mid-point of 126 000, about 5% higher than the forecast last year (see Section 5.8). The 2005 pre-fishery abundance of maturing 2SW salmon will be available in homewaters in 2006.

To compare the PFA to conservation limits, the pre-fishery abundance of 126 000 fish can be expressed as 2SW equivalents by considering natural mortality of 3% per month for 11 months resulting in 90 584 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2005 for both the Labrador (823 midpoint of estimates) and Greenland (3360) fisheries (Table 4.9.10.3). Adjusted for natural mortality these catches equate to 2952 2SW salmon equivalents which potentially leaves 87 346 2SW salmon to return to rivers in North America in 2006.

As the predicted number of 2SW salmon returning to North America in 2006 is substantially lower than the 2SW conservation limit (S_{lim}) of 152 548, there are no catch options at probability levels of 75%. Catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

Regional assessments for some areas provide more detailed considerations of expectations for 2006 that take into consideration the contribution of all sea ages of salmon to the spawning population.

Labrador

Total returns of small and large salmon in English River (SFA 1) have increased over those of 2004. Returns of small salmon were the second highest in the 7 year time series while large were the fourth highest. For SFA 2, returns of small salmon were the highest recorded at Muddy Bay Brook, Sand Hill River and Southwest Brook. Large salmon returns were the highest recorded at Sand Hill River. Large salmon declined in Muddy Bay Brook but increased in Southwest Brook. Overall abundance of large salmon (mainly 2SW) remains low and is a cause of concern because of the large contribution they make to egg deposition.

Newfoundland

Except for most monitored rivers in SFA 4 and 5, there was a general decline in returns of small and large salmon compared to 2004 and in the years since the commercial fishery closure. Abundance of salmon since the commercial fishery closure continues to be lower than prior to the closure. Abundance of small salmon in south coast rivers have not improved since the commercial fishery closures. Returns of large salmon fell by 40–60% in three monitored rivers by comparison with 2004. Decreases in returns of small salmon were observed in five out of the seven rivers assessed in SFA 13 in 2005 relative to 2004. Returns of large salmon were similar or lower than 2004 in five of the seven rivers. Although 2SW salmon are a small component of large salmon in Newfoundland there is concern with the low level of 2SW salmon spawners in SFA13 where a greater proportion of 2SW salmon were present. Higher marine survivals occurred in the past, even in years when directed ocean fisheries for salmon existed. Lower abundance is expected to continue with some small increases until such a time as sea survival improves.

Gulf

In assessed rivers of the Gulf Region, large salmon returns and spawners were comparable to those of 2004. The largest salmon producing river, the Miramichi, achieved 85% of its conservation requirements in 2005. Spawning escapement was above or approximated the conservation requirement in three other assessed rivers. Small salmon abundance was lower than in 2004 but similar to the previous five year average abundance. The outlook for 2006 is for similar level of returns of large salmon relative to previous five years.

Scotia-Fundy

Returns of 1SW salmon declined 10% while returns of 2SW salmon declined 28% in 2005. Only two of twelve assessed rivers met their conservation requirements in 2005. Return rates of wild smolts to two monitored rivers decreased in 2005. Forecasts of returns in 2006 suggest a continuation of the low abundances and possible extirpations of some salmon populations in SFA 19 to 23. Supportive rearing programs have moved away from fishery enhancement towards population maintenance by rearing parr to mature adult spawners, pedigree breeding and earlier ages for stocking. Wild salmon populations are now critically low in an extensive portion of this region and remnant populations require alternative conservation actions to fisheries regulation to maintain their genetic integrity and maintain their persistence.

Québec

The estimated recruits and spawners of 1SW salmon to Québec decreased by 32% from 2004, and by 16% from the previous five-year mean. Returns of small salmon were the second lowest in the range measured in the last 10 years. Large salmon returns and spawners were unchanged from 2004 (-3% and 0%) and from the previous 5 year average (-2% and +2%). The abundance of large salmon was similar to that observed in the last seven years but low compared to historical data. Based on relationships between small salmon in one year and large salmon of the subsequent year, returns of large salmon will likely decrease in 2006 on a majority of Québec rivers. Higher smolt runs in 2005 may result in higher small salmon returns compared to 2005. In general, salmon populations for rivers on the south shore of the St-Lawrence River may approximate or exceed the conservation requirements but returns to some north shore rivers are expected to remain below the conservation limit.

USA

Salmon returns (both 1SW and 2SW) in 2006 are not expected to be sufficient to meet conservation limits in any river, including those receiving hatchery stocking.

4.7 Projections for 2006–2008 for non-maturing 1SW

Catch options derived from the pre-fishery abundance forecast for 2006–2008 would apply principally to North American fisheries in 2007–2009. Accounting for potential catches in 2006–2008, and natural mortality to home waters, the management objective to achieve conservation escapements, as well as the allocation of 60% of the surplus to North America, the only risk averse catch option for 2SW salmon in 2007–2009 is zero catch on the composite North American stock (see Section 5).

4.8 Comparison with previous assessment and advice

The revised forecast of the pre-fishery abundance for 2005 provides a PFA mid-point of 126 000. This is about 5% higher than the value forecast last year at this time of 120 400. This is mainly due to slight changes in the input values to the model used to forecast PFA for these stocks as well as changes in the parameter values resulting from the additional year of PFA and lagged spawner values used in the model.

4.9 NASCO has requested ICES to describe key events of the 2005 fisheries and the status of the stocks

4.9.1 Key events of the 2005 fisheries

- The majority of harvest fisheries were directed to small salmon.
- 82% of the retained catch occurred in rivers or estuaries and 18% were captured in coastal waters.
- Retention catch was 32 585 salmon in 2005, down 31% from the five year mean.
- Catches remain low relative to pre 1990 values.

4.9.2 Catch of North American salmon, expressed as 2SW salmon equivalents

Catch histories (1972–2005) of salmon, expressed as 2SW salmon equivalents are provided in Tables 4.9.1.1 and 4.9.1.2. The Newfoundland–Labrador commercial fishery historically was a mixed stock fishery and harvested both maturing and non-maturing 1SW salmon as well as 2SW maturing salmon. The harvest in these fisheries of repeat spawners and older sea-ages was not considered in the run reconstructions.

Harvests of 1SW non-maturing salmon in Newfoundland-Labrador commercial fisheries have been adjusted by natural mortalities of 3% per month for 13 months, and 2SW harvests in these same fisheries have been adjusted by one month to express all harvests as 2SW equivalents in the year and time they would reach rivers of origin. Starting in 1998, the Labrador commercial fishery was closed. Catches for Aboriginal Peoples' fisheries in Labrador (1998–2005) which to some degree may have harvested mixed stocks have been included. As well, a residents' food fishery in Labrador which started in 2000 is included. Mortalities (principally in fisheries) in mixed stock and terminal fisheries areas in Canada are summed with those of USA to estimate total 2SW equivalent mortalities in North America. The terminal fisheries areas included coastal and river catches of all areas, except Newfoundland and Labrador where only river catches were included. Catch equivalents within North America peaked at about 365 000 in 1976 and are now about 11 900 2SW salmon equivalents. In the most recent five years estimated (that is those since the closure of the Labrador commercial fishery), catch of non-maturing fish in Labrador comprise 4%, or less, of the total in North America.

In recent years the catch of cohorts destined to be 2SW salmon in terminal fisheries of North America was 74% of the total catch. The values ranged from 20 to 31% in 1972-1982 to 74–91% in 1996–2005 (Table 4.9.1.1). Percentages increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries. The number of 2SW salmon equivalents taken in the food fisheries in Labrador was 2952 fish in 2005.

The percentage of the total 2SW equivalents that have been harvested in North American waters has ranged from 47 to 100%, with the most recent year estimated at 81% (Table 4.9.1.2). The two years when 100% of the mortality occurred in North America were the years when the Greenland commercial fishery did not operate and there were no estimates for the subsistence fishery at Greenland in those years.

4.9.3 Gear and effort

Canada

The 23 areas for which the Department of Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Québec, the management is delegated to the Ministère des Ressources naturelles et de la Faune and the fishing areas are designated by Q1 through Q11 (Figure 4.9.3.1). Harvest (fish which are retained) and catches (including harvests and fish caught–and-–released in recreational fisheries) are categorized in two size groups: small and large. Small salmon, generally 1SW, in the recreational fisheries refer to salmon less than 63 cm fork length, whereas in commercial fisheries, it refers to salmon less than 2.7 kg whole weight. Large salmon, generally MSW, in recreational fisheries are greater than or equal to 63 cm fork length and in commercial fisheries refer to salmon greater than or equal to 2.7 kg whole weight.

Three user groups exploited salmon in Canada in 2005: Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in Canada in 2005.

Most catches (82%, Figure 2.1.1.2) in North America now take place in rivers or in estuaries. Fisheries are principally managed on a river-by-river basis and, in areas where retention of large salmon is allowed, it is closely controlled. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located close to river mouths and likely harvest few salmon from other than local rivers.

The following management measures were in effect in 2005.

Aboriginal peoples' food fisheries

In Québec, Aboriginal peoples' food fisheries took place subject to agreements or through permits issued to the bands. There are 10 bands with subsistence fisheries in addition to the fishing activities of the Inuit in Ungava (Q11), who fished in estuaries or within rivers. The permits generally stipulate gear, season, and catch limits. Catches for subsistence fisheries have to be reported collectively by each Aboriginal user group. However, if reports are not available, the catches are estimated. In the Maritimes (SFAs 15 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2005. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries. Harvests that occurred both within and outside agreements were obtained directly from the Aboriginal peoples. In Labrador (SFAs 1 and 2), food fishery arrangements with the Labrador Inuit Association, the Innu First Nation, and the Labrador Metis Nation, resulted in fisheries in estuaries and coastal areas. By agreement with First Nations there were no food fisheries for salmon in Newfoundland in 2005. Harvest by Aboriginal peoples with recreational licenses is reported under the recreational harvest categories.

Residents food fisheries in Labrador

In 2005 a licensed food fishery for local residents took place, using gillnets, in Lake Melville (SFA 1) and in coastal southern Labrador (SFA 2) areas. Residents who requested a license were permitted to retain a maximum of four salmon of any size while fishing for trout and charr; four salmon tags accompanied each license. All licensees were requested to complete logbooks.

Recreational fisheries

Licenses are required for all persons fishing recreationally for Atlantic salmon. Gear is generally restricted to fly fishing and there are restrictive daily/seasonal bag limits. Recreational fisheries management in 2005 varied by area (Figure 4.9.3.2). Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries.

In New Brunswick and in Nova Scotia the seasonal bag limits in the recreational fishery remained at eight small salmon. In SFA 16 and in Nepisiquit River (SFA 15) of New Brunswick, the small salmon daily retention limit remained at one fish. In the remainder of SFA 15 and in the north shore of Nova Scotia (SFA 18), the daily retention limits were two small salmon. The maximum daily catch limit including released fish was four. In SFA 17 (PEI), the season and daily bag limits were seven and one respectively. Catch–and–release fishing only for all sizes of Atlantic salmon was in effect in SFA 19 of Nova Scotia. In SFAs 20–23 of Nova Scotia and New Brunswick, most rivers were closed to all salmon angling, except for four acid-impacted rivers on the Atlantic coast of Nova Scotia, where retention of small salmon resultant of stocking was allowed. As well, five other eastern and southern shore (SFA 20,21) rivers and all but one river of eastern Cape Breton (SFA19) were opened for a hook and release fishery.

In Newfoundland and Labrador a five-year (2002–2006) management plan was introduced in 2002, based on a river classification system utilized for SFAs 3–14B in 1999–2001. In Newfoundland in SFAs 3–14A and SFA2 & 14B, retention limits ranged from a seasonal limit of six fish on Class I rivers, to no retention and catch-and-release only on Class IV rivers . Some rivers were closed to all angling and were not assigned a class number. In SFA 1 and some rivers of SFA 2, there was a seasonal limit of four fish, only one of which could be a large salmon. In those rivers (now Class II) of SFA 2 crossed by the Trans Labrador Highway, a seasonal retention limit of two small salmon and no retention of large salmon was applied.

In Québec, three different fishing permits are sold. The first allows retention of seven salmon for the season. The second is a one day permit and allows retention of two salmon. The third type of permit is for catch and release only. In the northern zones, the management regimes for Q8, Q9 and Q11 (44 rivers) were applied uniformly to rivers within each zone. Retention of both small and large salmon was generally allowed throughout these northern zones. The daily limit was two fish but in some rivers, stricter limits were applied by local groups. Also, in Q11, if the first fish caught was a large salmon, fishing stopped for the day. Release of large salmon occurred mainly on a voluntary basis in these zones. The 74 rivers of the southern zones were managed river by river. Fishing was not allowed on 30 rivers, retention of small salmon only was in force on 28 rivers. Harvest of large salmon was permitted for part of the season on 7 rivers, whereas small salmon could be kept for the whole season. On the remaining 9 rivers, small and large salmon could be harvested for the entire season.

USA

In the USA there was no recreational fishery for sea-run Atlantic salmon in 2005 as a result of angling closures in 1999. Therefore effort, measured by license sales, was 0.

France (Islands of Saint-Pierre and Miquelon)

In 2005, there were 14 professional and 52 recreational gillnet licenses issued for the fishery that operates between May 1 and July 31. These figures do not reflect accurately the fishing effort: in 2005, only 8 professional and 24 recreational fishermen actually fished.

Year	Number of Professional Licenses	Number of Recreational Licenses
1995	12	42
1996	12	42
1997	6	36
1998	9	42
1999	7	40
2000	8	35
2001	10	42
2002	12	42
2003	12	42
2004	13	42
2005	14	52

4.9.4 Catches in 2005

Canada

The provisional harvest of salmon in 2005 by all users was 129 t, about 20% lower than the 2004 harvest (Table 2.1.1.1; Figure 4.9.4.1). The 2005 harvest was 41 709 small salmon and 10 949 large salmon, 23% less small salmon and 15% less large salmon, compared to 2004 (Annex 4). The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998, and the closure of the Québec commercial fishery in 2000. These reductions were introduced as a result of declining abundance of salmon.

Aboriginal peoples' food fisheries

Harvests in 2005 (by weight) were down 7 % from 2004 and 14 % higher than the previous 5-year average harvest.

Aboriginal peoples' food fisheries			
Year	Harvest (t)	% large	
		by weight	by number
1990	31.9	78	
1991	29.1	87	
1992	34.2	83	
1993	42.6	83	
1994	41.7	83	58
1995	32.8	82	56
1996	47.9	87	65
1997	39.4	91	74
1998	47.9	83	63
1999	45.9	73	49
2000	45.7	68	41
2001	42.1	72	47
2002	46.3	68	43
2003	44.3	72	49
2004	60.8	66	44
2005	56.4	57	35

Residents fishing for food in Labrador

The estimated total catch for the fishery in 2005 was 2.6 t, about 1135 fish (80% small salmon by number).

Recreational fisheries

Harvest in recreational fisheries in 2005 totalled 32 585 small and large salmon, 31% below the previous 5-year average, 32% below the 2004 harvest level, and the lowest total harvest reported (Figure 4.9.4.2). The small salmon harvest of 28 468 fish was 34% below 2004 and the previous 5-year mean. The large salmon harvest of 4117 fish was 7% below the previous five-year mean and 10% below 2004. The small salmon size group has contributed 87% on average of the total harvests since the imposition of catch-and-release recreational fisheries in the Maritimes and insular Newfoundland (SFA 3 to 14B, 15 to 23) in 1984.

In 1984, anglers were required to release all large salmon in the Maritime provinces and insular Newfoundland. In more recent years, anglers have been required to release all salmon on some rivers for conservation reasons and, on others, anglers voluntarily release caught fish. In addition, numerous areas in the Maritimes Region in 2005 were closed to retention of all sizes of salmon (Figure 4.9.3.2). In 2005, about 45 900 salmon (about 20 600 large and 25 300 small) were caught and released (Table 4.9.4.2), representing about 58% of the total number caught, including retained fish. This was a 21% decrease from the number released in 2004. Most of the fish released were in Newfoundland (50%), followed by New Brunswick (26%), Québec (16%), Nova Scotia (8%), and Prince Edward Island (0.4%). Expressed as a proportion of the fish caught, that is, the sum of the retained and released fish, Nova Scotia released the highest percentage (90%), followed by New Brunswick (67%), Prince Edward Island (62%), Newfoundland (55%), and Québec (50%). There is some mortality on these released fish, which is accounted for in rivers assessed for their attainment of conservation limits.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2005 and the catch therefore was zero. Catches have decreased from a peak in 1980 of almost 2500 t to zero as a result of effort reductions, low abundance of stocks, and closures of fisheries.

Unreported catches

Canada's unreported catch estimate for 2005 was about 101 t. Estimates were included for all five provinces and within each province, for all salmon fishing areas (SFA). Estimates were provided mainly by enforcement staff. In all areas, most unreported catch arises from illegal fishing or illegal retention of bycatch of salmon.

The unreported catch estimates for 2005 were:

STOCK AREA	UNREPORTED CATCH (t)
Labrador	2
Newfoundland	42
Gulf	40
Scotia-Fundy	1
Québec	16
Total	101

USA

All fisheries (commercial and recreational) for sea-run Atlantic salmon within the USA remained closed, including rivers previously open to catch-and-release fishing. Thus, there was no harvest of sea-run Atlantic salmon in the USA in 2005. Unreported catches in the USA were estimated to be 0 t.

France (Islands of Saint-Pierre and Miquelon)

The total reported harvest in 2005 was 3.3 t from professional and recreational fishermen, an increase of 0.5 t from 2004 and among the largest catches recorded since 1983 (Table 2.1.1.1). Professional and recreational fishermen reported catching 2243 kg and 1044 kg of salmon, respectively in 2005. There is no estimate of unreported catch.

In 2005, 310 salmon were sampled, of which 295 were measured for fork length. The smallest fish was 49 cm, largest 90 cm. There were two distinct size modes, 72% of the fish being smaller than 63.0cm. These salmon are in large part maturing 1SW fish.

YEAR	PROFESSIONAL LICENSES (KG)	RECREATIONAL LICENSES (KG)	TOTAL (KG)
1990	1146	734	1880
1991	632	530	1162
1992	1295	1024	2319
1993	1902	1041	2943
1994	2633	790	3423
1995	392	445	837
1996	951	617	1568
1997	762	729	1491
1998	1039	1268	2307
1999	1182	1140	2322
2000	1134	1133	2267
2001	1544	611	2155
2002	1223	729	1952
2003	1620	1272	2892
2004	1499	1285	2784
2005	2243	1044	3287

4.9.5 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. These fisheries have been closed. The Aboriginal Peoples' and resident food fisheries that exist in Labrador may intercept some salmon from other areas of North America although there are no reports of tagged fish being captured there in 2005. The fisheries of Saint-Pierre and Miquelon catch salmon of both Canadian and USA origin. Sampling was carried out on this fishery in 2003, 2004 and 2005. Estimates of continent of origin were 100% NA in 2004 of which 98% originated in Canada and 2% originated in the USA (see Section 2.4.3).

4.9.6 Exploitation rates

Canada

There is no directed exploitation by commercial fisheries. In the Newfoundland angling fishery, exploitation rates on retained small salmon only for rivers with counting facilities ranged from a high of 11% on Exploits River to a low of 3% on Crabbes River. Overall, exploitation of small salmon in these rivers declined from 30% in 1986 to 10% in 2005 and was the lowest in the 22 years. In Labrador, exploitation on small salmon ranged from 3% at Sand Hill River to 2% at Muddy Bay Brook. Exploitation on large salmon was less than 1%.

USA

There was no exploitation of USA salmon in home waters, and no tagged salmon of USA origin were reported in Canadian fisheries in 2005.

4.9.7 Elaboration on status of stocks

To date approximately 550 Atlantic salmon rivers have been identified in eastern Canada and 21 rivers in eastern USA, each of which could contain at least one population of salmon. Assessments are prepared for a limited number of rivers.

4.9.7.1 Measures of abundance in monitored rivers

4.9.7.1.1 Smolt and juvenile abundance

Canada

Wild smolt production was estimated in 15 rivers in 2005. Of these, eight rivers have at least ten years of information (Figure 4.9.7.1).

In 2005, smolt production decreased (>10% change) from 2004 in three of five monitored rivers in Newfoundland and in five of six monitored rivers of the Maritimes Provinces, but increased in the two monitored rivers of Québec (Figure 4.9.7.1). The smolt production scaled to the size of the river using the conservation egg requirements was highest in the rivers of Québec and low in the southern rivers of the Maritimes and USA.

Juvenile salmon abundance has been monitored annually since 1971 in the Miramichi (SFA 16) and Restigouche (SFA 15) rivers and for shorter and variable time periods in a large number of other rivers in the Maritime Provinces. In the rivers of the southern Gulf of St. Lawrence, densities of young-of-the-year (age 0+) and parr (age-1+ and 2+) have increased (>10% change) since 1985 in response to increased spawning escapements and densities of fry and parr in 2005 remained at high values. Rivers in SFAs 20 and 21 along the Atlantic coast of Nova Scotia are high in dissolved organics, have low productivity, and influenced by acid deposition. In the acidified St. Mary's River, fry and older parr densities remained among the lowest of record (1985–2005). Trends in densities of age-1+ and older parr in the outer Bay of Fundy (SFA 23) have varied since 1980, with densities in the Nashwaak River and Saint John River above Mactaquac Dam declining in response to reduced spawning escapements. For the salmon stock in 33 rivers of the inner Bay of Fundy (SFA 22 and a portion of SFA 23), juvenile densities remained critically low.

USA

Wild salmon smolt production has been estimated on the Narraguagus River for nine years (Figure 4.9.7.1). Smolt production in 2005 was less than 2004 and 45% below previous five-year mean production. The mean juvenile densities in this river have been low over the period of sampling dating to 1997.

4.9.7.1.2 Estimates of total adult abundance by geographic area

Returns of 1SW and 2SW salmon to each region (Tables 4.9.7.1 and 4.97.2; Figures 4.9.7.2 and 4.9.7.3; and Annex 5) were estimated by the methods and variables reported by Rago *et al.* (1993b) and reported in ICES (1993). The returns for both sea-age groups were derived by applying a variety of methods to data available for individual river systems and management areas. These methods included counts of salmon at monitoring facilities, population estimates from mark-recapture studies, and the application of angling and commercial catch statistics, angling exploitation rates, and measurements of freshwater habitat. The 2SW component of the MSW returns was determined using the sea-age composition of one or more indicator stocks.

Returns are the number of salmon that returned to the geographic region, including fish caught by homewater commercial fisheries, except in the case of the Newfoundland and Labrador regions where returns do not include landings in commercial and food fisheries. This avoided double counting fish because commercial catches in Newfoundland and Labrador and food fisheries in Labrador were added to returns to create the PFA of North American salmon. The basis for estimates of 2SW and 1SW salmon returns and spawners for Labrador (SFAs 1, 2 & 14B) prior to 1998 are catch data from angling and commercial fisheries. In 1998, the commercial fishery in Labrador was closed and the model for returns and spawners from commercial catch data could not be used. From 2002–2005, there were counting projects on four salmon rivers in Labrador. Because the same four out of about 100 rivers (one in SFA 1A, Northern Labrador and three in SFA 2) were monitored, the Working Group extrapolated from return rates per accessible drainage areas to the unsurveyed rivers in Labrador (ICES 2005).

Estimates of 1SW and 2SW returns and spawners for Newfoundland (SFAs 3–12 & 14A) were previously documented based on the classification scheme of the Salmon Management Plan. Returns and spawners were updated for 2004 and new estimates were provided for 2005 based on catches, calculated exploitation rates and large to small salmon ratios from the Licence Stub Return System in 2005.

Prior to closures of fisheries in 1985 returns of salmon to SFA 19 to 21 could be estimated by sums of catches and counts across fisheries. Since 1985, returns to SFA 19 to 21 were based on a significant relationship between catch in these SFAs and an index river, LaHave River, where counts have been made in a fishway trap since 1972.

Total returns of salmon to USA rivers are the sum of trap catches and redd based estimates.

Returns do not include aquaculture escapes in rivers where removal is possible. In the Magaguadavic River (SFA 23) there were 63 fish farm escapees were removed in 2005. Aquaculture escapes were also intercepted on the St. Croix (42) and Dennys (8) rivers and Union River (4).

Canada

Labrador

The mid-point of the estimated returns (221 750) of 1SW salmon to Labrador rivers in 2005 is 129% higher than in 2004 and is the highest recorded (Figure 4.9.7.2, Annex 5). The mid-point (13 300) of the estimated 2SW returns to Labrador rivers in 2005 was 14% higher than in 2004 and 11% lower than the recent 5–year average of 14 900 (Figure 4.9.7.3).

Newfoundland

The mid-point of the estimated returns (251 800) of 1SW salmon to Newfoundland rivers in 2005 is 25% higher than in 2004 and 33% higher than the average 1SW returns (189 150) for the past five years (Figure 4.9.7.2). The mid-point (5430) of the estimated 2SW returns to Newfoundland rivers in 2005 was 24% higher than in 2004 and higher than the recent 5-year average of 4700 (Figure 4.9.7.3).

Québec

The mid-point of the estimated returns to Québec in 2005 of 1SW salmon (25 108) is 32% lower than that observed in 2004 and is 16% lower than the previous five-year mean (Figure 4.9.7.2). The mid-point of the estimated returns of 2SW (28 309) salmon is similar to that observed for 2004 and the previous five-year mean (Figure 4.9.7.3).

Gulf of St. Lawrence, SFAs 15–18

The mid-point (48 500) of the estimated returns in 2005 of 1SW salmon to the Gulf of St. Lawrence was 32% lower than 2004. The values noted in 1997 through 2004 are low relative to the values observed during 1985-1993 (Figure 4.9.7.2). The mid-point (26 900) of the estimate of 2SW returns in 2005 is about the same as the estimate for 2004 (Figure 4.9.7.3). Returns of 2SW salmon have declined since 1995 with a slight improvement shown in 2001 and 2003–2004, relative to the years prior to 1995.

Scotia-Fundy, SFAs 19–23

The mid-point (6961) of the estimate of the 1SW returns in 2005 to the Scotia-Fundy Region was a 10% decrease from the 2004 estimate, and the third lowest value in the time-series, 1971–2005. Returns have generally been low since 1990 (Figure 4.9.7.2). The mid-point (1695) of the 2SW returns in 2005 is 28% lower than the returns in 2004 and remains among the lower value in the time-series, 1971–2005 (Figure 4.9.7.3). A declining trend in returns has been observed from 1985 to 2005.

USA

Total returns of salmon to USA rivers was 1313, a 20% decrease from returns in 2004 (1635). Total salmon returns to the rivers of New England remain below the long term average of 2143 (1967-2004). The 2005 level is above the 10-year average and below the 5-year average (Figure 4.9.7.2). Returns of 1SW salmon were 319, the same as in 2004 and greater than the 5-year average (306) but lower than the 10-year (333) average. The 2SW returns in 2005 to USA rivers were 994 fish, an increase over the 5–year (856) but not the 10–year (1177) averages (Figure 4.9.7.3).

4.9.7.1.3 Estimates of spawning escapements

Updated estimates for 1SW spawners were derived for the six geographic regions (Table 4.9.7.3). Estimates of 2SW spawners, 1971–2005 are provided in Table 4.9.7.4. These estimates were calculated by subtracting the in-river removals from the estimates of returns to rivers and/or adding stocked spawners. A comparison between the numbers of spawners, returns, and conservation limits (S_{lim}) for 2SW salmon is shown in Figure 4.9.7.3 (there are no spawning requirements defined specifically for 1SW salmon).

Canada

Labrador

As previously explained, spawner estimates for Labrador in 1998–2005 were developed, using the monitoring facilities for 2002–2005 and the proportional method for 1998–2001. The mid-point of the estimated numbers of 2SW spawners (13 100) was 17% above the previous year and was 38% of the total 2SW conservation limit (S_{lim}) for all rivers (Figure 4.9.7.3). The 2SW spawner limit has only been exceeded once (1998) since 1971. The mid-point of the estimated numbers of 1SW spawners (219 300) was 133% above that estimated for 2004 (Figure 4.9.7.2).

Newfoundland

The mid-point of the estimated numbers of 2SW spawners (5300) in 2005 was 31% above that estimated in 2004 (4000) and was 132% of the total 2SW conservation limit (S_{lim}) for all rivers. The 2SW spawner limit has been met or exceeded eleven years since 1992 (Figure 4.9.7.3). The 1SW spawners (238 900) in 2005 were 30% higher than the 180 200 1SW spawners in 2004. The 1SW spawners since 1992 were higher than the spawners in 1989–91 and similar to levels in the late 1970s and 1980s (Figure 4.9.7.2), although in 1995–1996 they were unusually high. There had been a general increase in both 2SW and 1SW spawners during the period 1992–96 and 1998–2000, and this is consistent with the closure of the commercial fisheries in Newfoundland. In 1997, a strong decrease occurred in the 1SW spawners.

Québec

The mid-point of the estimated numbers of 2SW spawners (20 500) in 2005 was similar to that observed for 2004 and was about 70% of the total 2SW conservation limit (S_{lim}) for all rivers (Figure 4.9.7.3). The spawning escapement in 2005 ranked approximately in the middle of the range in the time-series (1971–2005), with 1971 having been the lowest and the 2003 value was the second highest since 1995. Estimates of the numbers of 2SW spawners approximated the conservation limit from 1971 to 1990 but were below the limit since 1990. The mid-point of the estimated 1SW spawners in 2005 (18 300) was about 30% lower than in 2004 (Figure 4.9.7.2) and is about average the values since 1992.

Gulf of St. Lawrence

The mid-point of the estimated numbers of 2SW spawners (26 200) in 2005 was about 6% higher than estimated in 2004 and was about 86% of the total 2SW conservation limits (S_{lim}) for the region (Figure 4.9.7.3). These rivers have not met their 2SW spawner limits since 1995. The mid-point of the estimated spawning escapement of 1SW salmon (31 900) decreased by 31% from 2004 and was about average for the last ten years. The abundance remains low relative to the peak (150 000) observed in 1992 (Figure 4.9.7.2). Spawning escapement was higher in the mid-1980s than before or after.

Scotia-Fundy

The mid-point of the estimated numbers of 2SW spawners (1600) in 2005 is a 29% decrease from 2004 and is about 6% of the total 2SW conservation limits (S_{lim}) for rivers in this region (Figure 4.9.7.3). Neither the spawner estimates nor the conservation limits include rivers of the inner Bay of Fundy (SFA 22 and part of SFA 23) as these rivers are minor contributors to distant water fisheries and spawning escapements are extremely low. The 2SW spawning escapement in the rest of the area has been generally declining since 1985. The mid-point of the estimated 1SW spawners (6 800) in 2005 is a 9% decrease from 2004. There has been a general downward trend in 1SW spawners since 1990 (Figure 4.9.7.2).

USA

Pre-spawning adults were stocked into USA rivers, however, even with these, all age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2005 (1088 salmon) represented 3.7% of the 2SW spawner requirements for all USA rivers combined.

4.9.7.1.4 Reconstructed spawning escapements

Lagged spawners for North America were derived following the technique outlined in ICES (2005). Spawners in each geographic area were allocated (weighted forward) to the year of the non-maturing 1SW component in the Northwest Atlantic using the weighted smolt age proportions from each area (Table 4.9.7.5). The original USA smolt age distributions are used to allocate the USA spawners for years 1971-1989 and the new distribution for 1990 onward. Changes were made to the USA portion of the table due to declines in natural spawning for USA Atlantic salmon populations and changes in hatchery and stocking practices. The total spawners for a given recruitment year in each area is the sum of the lagged spawners. Because the smolt age distributions in North America range from one to six years and the time-series of estimated 2SW spawners to North America begins in 1971, the first recruiting year for which the total spawning stock size can be estimated is 1979 (although a value for 1978 was obtained by leaving out the 6-year old smolt contribution which represents 4% of the Labrador stock complex).

Spawning escapement of 2SW salmon to several stock complexes has been below S_{lim} (Labrador, Québec, Scotia-Fundy, USA) since at least the 1980s (Table 4.9.7.6). Lagged 2SW spawner abundance has decreased in Labrador and Newfoundland over the past five years, has remained steady in Québec, steady but low in Scotia Fundy while it increased in 2005 in the Gulf from the previous five year low (Figure 4.9.7.4). Only the Newfoundland stock complex has received spawning escapements that have exceeded the area's requirements, all other complexes were below requirement, although some areas increased slightly in 2005.

The relative contributions of the stocks from these six geographic areas to the total spawning escapement of 2SW salmon has varied over time (Table 4.9.7.6, Figure 4.9.7.5). The reduced potential contribution of Scotia-Fundy stocks and the initial increased proportion of the spawning stock from the Gulf of St. Lawrence and, more recently, from Labrador rivers to future recruitment is most noticeable.

4.9.8 Egg depositions in 2005

Egg depositions by all sea-ages combined in 2005 exceeded or equalled the river specific conservation limits in 34 of the 81 assessed rivers (42%) and were less than 50% of conservation limits in 26 other rivers (32%) (Figure 4.9.8.1). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia (SFA 19-23) where 11 of the 14 rivers assessed (79%) had egg depositions that were less than 50% of conservation limits. None of the four assessed rivers in Gulf and 24% of the assessed rivers in Québec had egg depositions less than 50% of conservation limits. For 3 of 4 of the Gulf rivers and 55% of the Québec rivers, egg depositions equalled or exceeded conservation limits (Figure 4.9.8.1). In Newfoundland, 38% of the rivers assessed met or exceeded the conservation limits and 9% had egg depositions that were less than 50% of limits. Most of the deficits occurred in the southwest rivers of Newfoundland (SFA 13).

All age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2005 (1313 salmon) represented 4.5% of the 2SW spawner requirements for all USA rivers combined. Spawning 2SW salmon exclusively, expressed as the percentage of conservation requirement was 3.0% for all USA rivers combined. On an individual river basis, the Penobscot River met 10.2% of its spawner requirement while all the other USA rivers were between 0.0–0.4% of their 2SW requirements (Figure 4.9.8.1).

4.9.9 Marine survival rates

In 2005, data were available from twelve wild and three hatchery populations from rivers distributed among Newfoundland (SFAs 4, 9, 11, and 14a), Québec (Q2 and Q7), Maritimes (SFAs 16, 21, and 23) and (USA) (Penobscot and Narraguagus rivers).

In 2005, estimated return rates for 1SW fish declined or were unchanged from the previous year in 1 of 3 hatchery stocks and declined in 8 of 11 wild stocks (Figure 4.9.9.1 – Figure 4.9.9.4). By contrast, 2SW return rates from smolts in 2003 increased in 4 of 6 wild stocks while they decreased in all three hatchery stocks, consistent with observed increases or decreases in 1SW return rates the previous year from the same smolt cohort.

Time series of return rates of smolts to 1SW and 2SW adults (Figures 4.9.9.5) provide insight into management measures and/or temporal changes in marine survival of wild and hatchery 1SW and 2SW stocks. Specifically:

- Survival of fish from many rivers is low compared to historical levels, especially in the south.
- Survival of stocks to home waters did not increase as expected after closure of the commercial fisheries in 1984 and 1992,

- 1SW return rates in MSW salmon stocks (Maritimes, Québec, USA) are lower than those in predominantly 1SW salmon stocks of Newfoundland,
- 1SW return rates in MSW salmon stocks of the Maritimes exceed those of 2SW salmon but 2SW returns rates are greater than 1SW return rates in Québec and Maine populations, and
- Return rates of wild stocks exceed those of hatchery stocks.

SUMMARY OF RETURN RATES OF MONITORED STOCKS FOR THE LAST FIVE YEARS

Origin	Age Group	Region	Return rate		Number of stocks
			Mean (%)	Range (%)	
Wild	1SW	Maritimes	3.4	1.1 to 6.4	4
		Québec	0.6	0.3 to 1.0	2
		Newfoundland	5.4	2.4 to 11.4	5
Wild	2SW	Maine (USA)	0.7	0.2 to 1.2	1
		Maritimes	1.0	0.2 to 2.2	3
		Québec	0.6	0.1 to 1.4	2
Hatchery	1SW	Maine (USA)	0.05	0.03 to 0.07	1
		Maritimes	0.50	0.27 to 0.87	2
Hatchery	2SW	Maine (USA)	0.12	0.06 to 0.17	1
		Maritimes	0.12	0.05 to 0.21	2

4.9.10 Pre-fisheries abundance

4.9.10.1 North American run-reconstruction model

The Working Group has used the “North American Run-Reconstruction Model” to estimate pre-fishery abundance, which serves as the basis of abundance forecasts used in the provision of catch advice. The catch statistics used to derive returns and spawner estimates have been updated from those used in ICES (2005, Table 4.9.10.1). The North American Run-Reconstruction Model has also been used to estimate the fishery exploitation rates for West Greenland and in home waters.

4.9.10.2 Non-maturing 1SW salmon

The non-maturing component of 1SW fish, destined to be 2SW returns (excludes 3SW and previous spawners) is represented by the pre-fishery abundance estimator for year i designated as [NN1(i)]. Definitions of the variables are given in Table 4.9.10.2. It is constructed by summing 2SW returns in year i+1 [NR2(i+1)], 2SW salmon catches in commercial and Aboriginal peoples’ food fisheries in Canada [NC2(i+1)], and catches in year i from fisheries on non-maturing 1SW salmon in Canada [NC1(i)] and Greenland [NG1(i)] (Table 4.9.10.3). In Labrador, Aboriginal peoples’ food harvests of small (AH_s) and large salmon (AH_l) were included in the reported catches for 1999–2005 (Table 4.9.10.1). Because harvests occurred in both Lake Melville and coastal areas of northern Labrador, the fraction of these catches that are immature was labelled as af_imm. This was necessary because non-maturing salmon do not occur in Lake Melville where much of the catch originated. However, non-maturing salmon may occur in coastal marine areas in the remainder of northern Labrador. Consequently, af_imm for the fraction of Aboriginal peoples’ harvests that was non-maturing was set at 0.05 to 0.1 which is half of f_imm from commercial fishery samples. The full details and equations for calculating prefishery abundance are in ICES (2004).

This estimated pre-fishery abundance represents the extant population. The model does not take into account non-catch fishing mortality in any of the fisheries. This is because rates for non-catch fishing mortality are not available on an annual basis and are not well described for some of the fisheries harvesting potential or actual 2SW salmon. The West Greenland (1993 and 1994), Newfoundland (1992–2005), and Labrador commercial fishery (1998–2005), were closed in these years.

As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate of PFA is available is 2004. This is because pre-fishery abundance estimates for 2005 require 2SW returns to rivers in North America in 2006. The minimum and maximum values of the catches and returns for the 2SW cohort are summarized in Table 4.9.10.3. The 2004 abundance estimates ranged between 72 809 and 156 347 salmon. The mid-point of this range (114 578) is similar to the 2003 value (110 318) and is the 6^{th} lowest in the 33-year time-series (Figure 4.9.10.1). Even though the 2004 value has increased considerably from 2001, which was the lowest in the time series, the general trend towards lower values in recent years is still evident and current year values are still much lower than the 917 282 in 1975. The Working Group expressed concern over the continued low numbers, which remain considerably lower than the conservation limits (Figure 4.9.7.3).

4.9.10.3 Maturing 1SW salmon

Maturing 1SW salmon are in some areas a major component of salmon stocks, and their abundance provides an index of the entire smolt cohort.

For the commercial catches in Newfoundland and Labrador, all small salmon are assumed to be 1SW fish. Catch samples, show the percentage of 1SW salmon in excess of 95%. Large salmon are primarily MSW salmon, but some maturing and non-maturing 1SW are also present in commercial catches in SFAs 1–7, 14B. Estimates of fractions of non-maturing salmon present in the Newfoundland and Labrador catch were presented in ICES (1991). The large category in SFAs 1–7 and 14B consists of 0.1–0.3 1SW salmon (Rago *et al*., 1993a; ICES, 1993). Salmon catches in SFAs 8–14A are mainly maturing salmon (Idler *et al*., 1981). These values were assumed to apply to the Aboriginal food fishery catches in marine coastal areas of northern Labrador. Catches used in the run-reconstruction model for the Newfoundland commercial fishery were set to zero for 1992–2005 and for Labrador for 1998–2005 to remain consistent with catches used in other years in these areas. Full details on the method used to calculate the numbers of maturing 1SW salmon are in ICES (2004).

The minimum and maximum values of the catches and returns for the 1SW cohort are summarized in Table 4.9.10.4 and the mid-point values are shown in Figure 4.9.10.1. The mid-point of the range of pre-fishery abundance estimates for 2005 (581 362) is 33% higher than in 2004 (436 086), had increased considerably from the value of 309 034 in 1994, which was the lowest estimated in the time-series 1971–2005.

4.9.10.4 Total 1SW recruits (maturing and non-maturing)

The pre-fishery abundance of 1SW maturing salmon for the 1971–2005 and 1SW non-maturing salmon from North America for 1971–2004 were combined to give total recruits (Figure 4.9.10.1 and Figure 4.9.10.2). While maturing 1SW salmon in 1998–2005 have increased over the lowest value achieved in 1994, the non-maturing portion of these cohorts remained unchanged since 1997. The prefishery abundance of the non-maturing portion (potential 2SW salmon) has been consistently well below the Spawning Escapement Reserve (derived from S_{lim}) since 1993. Although the declining trend appears common to both maturing and non-maturing portions of the cohort, non-maturing 1SW salmon have declined further.

4.9.11 Summary on status of stocks

In 2005, the midpoint of the spawner estimates for six geographic areas indicated that all areas except Newfoundland were below their conservation limit (S_{lim}) for 2SW salmon and are suffering reduced reproductive capacity. Newfoundland was at risk of suffering reduced reproductive capacity (Figure 4.9.7.3.).

Estimates of pre-fishery abundance suggest a continuation of low numbers of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has oscillated around a generally declining trend since the 1970s (Figure 4.9.10.2). During 1993 to 2005, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. The decline from earlier higher levels of abundance has been more severe for the 2SW salmon component than for the small salmon (maturing as 1SW salmon) age group (Figure 4.9.10.1).

In 2005, the conservation limit (S_{lim}) for 2SW salmon was only met in Newfoundland.

The returns in 2005 of 2SW fish increased slightly from 2004 in Labrador, Newfoundland, and in the Gulf of St. Lawrence but declined in Québec, Scotia Fundy and in the USA. However, in all areas returns remain close to the lower end of the 35-year time-series (1971–2005). While 2SW salmon are a minor component of Newfoundland stocks even here decreases of about 30% have occurred from peak levels of the 1990's. Returns in 2005 of 1SW salmon increased from 2004 in Newfoundland and Labrador but declined or were similar in all other areas.

The rank of the estimated returns in the 1971–2005 time-series and the proportions of the 2SW conservation limit achieved in 2005 for six regions in North America are shown below:

Region	Rank of 2005 returns in 1971-2005, (35=lowest)		Rank of 2005 returns in 1996-2005 (10=lowest)		Mid-point estimate of 2SW spawners as percentage of conservation limit (S_{LIM})
	1SW	2SW	1SW	2SW	(%)
Labrador	1	20	1	7	38
Newfoundland	2	12	2	6	132
Québec	25	33	9	8	70
Gulf	25	24	4	2	86
Scotia-Fundy	33	34	8	9	6
USA	19	31	6	7	4

Egg depositions by all sea-ages combined in 2005 exceeded or equalled the river specific conservation limits in 34 of the 81 assessed rivers (42%) and were less than 50% of conservation limits in 26 other rivers (32%, Figure 4.9.8.1).

Generally wild smolt production declined in monitored rivers of eastern Canada in 2005. Measures of marine survival rates over time indicate that survival of North America stocks to home waters have not increased as expected as a result of fisheries changes. Return rates to 1SW and 2SW salmon remain variable and unpredictable with higher return rates in the northern areas (Newfoundland) and lower rates in the southern areas, including southern Newfoundland, Maritimes and USA.

Based on the genera1 decrease in 1SW returns in 2005 in most areas except Newfoundland and Labrador a decrease is expected for 2SW salmon in 2005. Return rates of 2SW salmon in monitored stocks remain low. An additional concern is the number of salmon stocks suffering reduced reproductive capacity in eastern Canada, particularly in the Bay of Fundy and Atlantic coast of Nova Scotia. USA salmon stocks exhibit these same downward trends. Most salmon rivers in the USA are hatchery-dependent and remain at low levels compared to conservation requirements. Despite major changes in fisheries management, returns have continued to decline in these southern areas and many populations are currently threatened with extirpation.

4.10 NASCO has requested ICES to evaluate the extent to which the objectives of any significant management measures introduced in recent years have been achieved

There have been no significant management measures introduced within the NAC in recent years

Table 4.9.1.1. Catches expressed as 2SW salmon equivalents in North American salmon fisheries, 1972–2005. Only mid-points of the estimated values have been used.

	CANADA												
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i						USA	Total	
Year i	NF-LAB Comm 1SW (Year i-1) (b)	Year i % 1SW of total 2SW equivalents	Year i NF-LAB Comm 2SW (b)	Year i NF-Lab comm total	Labrador rivers (a)	Nfld rivers (a)	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total			Terminal Fisheries as a % of Total
1972	20,857	9	153,775	174,632	314	633	27,417	22,389	6,801	232,186	346	232,532	25
1973	17,971	6	219,175	237,146	719	895	32,751	17,914	6,680	296,105	327	296,433	20
1974	24,564	7	235,910	260,475	593	542	47,631	21,430	12,734	343,405	247	343,652	24
1975	24,181	7	237,598	261,779	241	528	41,097	15,677	12,375	331,696	389	332,085	21
1976	35,801	10	256,586	292,388	618	412	42,139	18,090	11,111	364,758	191	364,949	20
1977	27,519	8	241,217	268,736	954	946	42,301	33,433	15,562	361,932	1,355	363,287	26
1978	27,836	11	157,299	185,135	580	559	37,421	23,806	10,781	258,281	894	259,175	29
1979	14,086	10	92,058	106,144	469	144	25,234	6,300	4,506	142,798	433	143,231	26
1980	20,894	6	217,209	238,103	646	699	53,567	29,832	18,411	341,257	1,533	342,789	31
1981	34,486	11	201,336	235,822	384	485	44,375	16,329	13,988	311,383	1,267	312,650	25
1982	34,341	14	134,417	168,757	473	433	35,204	25,709	12,353	242,929	1,413	244,342	31
1983	25,701	12	111,562	137,263	313	445	34,472	27,097	13,515	213,105	386	213,491	36
1984	19,432	14	82,807	102,238	379	215	24,408	5,997	3,971	137,210	675	137,884	26
1985	14,650	11	78,760	93,410	219	15	27,483	2,708	4,930	128,765	645	129,410	28
1986	19,832	12	104,890	124,723	340	39	33,846	4,542	2,824	166,313	606	166,919	25
1987	25,163	13	132,208	157,371	457	20	33,807	3,757	1,370	196,781	300	197,082	20
1988	32,081	21	81,130	113,211	514	29	34,262	3,832	1,373	153,220	248	153,468	26
1989	22,197	16	81,355	103,551	337	9	28,901	3,426	265	136,488	397	136,886	24
1990	19,577	18	57,359	76,937	261	24	27,986	2,700	593	108,501	696	109,197	30
1991	12,048	14	40,433	52,481	66	16	29,277	1,777	1,331	84,949	231	85,180	38
1992	9,979	14	25,108	35,087	581	67	30,016	2,673	1,114	69,539	167	69,706	50
1993	3,229	8	13,273	16,502	273	63	23,153	1,211	1,110	42,312	166	42,478	61
1994	2,139	5	11,938	14,077	355	165	24,052	2,206	756	41,612	1	41,613	66
1995	1,242	3	8,677	9,918	331	155	23,331	2,007	330	36,073	0	36,073	73
1996	1,075	3	5,646	6,721	273	183	22,413	2,389	766	32,746	0	32,746	79
1997	969	4	5,390	6,360	155	157	18,574	1,849	581	27,675	0	27,675	77
1998	1,155	7	1,872	3,027	276	112	11,256	2,238	322	17,231	0	17,231	82
1999	179	1	894	1,073	311	72	9,032	1,127	450	12,064	0	12,064	91
2000	152	1	1,115	1,267	404	218	9,425	1,714	193	13,221	0	13,221	90
2001	286	2	1,380	1,666	336	102	10,104	616	255	13,079	0	13,079	87
2002	263	3	1,185	1,448	221	152	7,297	306	179	9,603	0	9,603	85
2003	312	3	1,794	2,106	221	68	8,870	590	189	12,045	0	12,045	83
2004	355	3	3,049	3,403	221	75	8,756	644	105	13,206	0	13,206	74
2005	470	4	2,482	2,952	221	120	7,803	665	94	11,855	0	11,855	75
2006	557												

NF-Lab comm as 1SW = NC1(mid-pt) * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries)
NF-Lab comm as 2SW = NC2 (mid-pt) * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal fisheries)
Terminal fisheries = 2SW returns (mid-pt) - 2SW spawners (mid-pt)
a - starting in 1993, includes estimated mortality of 10% on hook and released fish
b - starting in 1998, there was no commercial fishery in Labrador; numbers reflect size of aboriginal fish harvest in 1998-2004and resident food fishery harvest in 2000-2004

Table 4.9.1.2. Catches of North American salmon expressed as 2SW salmon equivalents, 1972–2006, in North America and Greenland.

Year	Canadian Total	USA Total	North America Total	% USA of Total North American	Greenland Total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic
1972	232,186	346	232,532	0.15	206,814	439,346	53
1973	296,105	327	296,433	0.11	144,348	440,781	67
1974	343,405	247	343,652	0.07	173,615	517,267	66
1975	331,696	389	332,085	0.12	158,583	490,668	68
1976	364,758	191	364,949	0.05	200,464	565,413	65
1977	361,932	1,355	363,287	0.37	112,077	475,364	76
1978	258,281	894	259,175	0.34	136,386	395,561	66
1979	142,798	433	143,231	0.30	85,446	228,677	63
1980	341,257	1,533	342,789	0.45	143,829	486,618	70
1981	311,383	1,267	312,650	0.41	135,157	447,807	70
1982	242,929	1,413	244,342	0.58	163,718	408,060	60
1983	213,105	386	213,491	0.18	139,985	353,476	60
1984	137,210	675	137,884	0.49	23,897	161,781	85
1985	128,765	645	129,410	0.50	27,978	157,388	82
1986	166,313	606	166,919	0.36	100,098	267,017	63
1987	196,781	300	197,082	0.15	123,472	320,553	61
1988	153,220	248	153,468	0.16	124,868	278,336	55
1989	136,488	397	136,886	0.29	83,947	220,832	62
1990	108,501	696	109,197	0.64	43,634	152,831	71
1991	84,949	231	85,180	0.27	52,560	137,740	62
1992	69,539	167	69,706	0.24	79,571	149,277	47
1993	42,050	166	42,216	0.39	30,091	72,307	58
1994	41,537	1	41,538	0.00	0	41,538	100
1995	36,355	0	36,355	0.00	0	36,355	100
1996	32,728	0	32,728	0.00	15,343	48,070	68
1997	27,759	0	27,759	0.00	15,776	43,535	64
1998	16,868	0	16,868	0.00	12,088	28,956	58
1999	12,054	0	12,054	0.00	2,175	14,230	85
2000	13,210	0	13,210	0.00	3,863	17,074	77
2001	13,234	0	13,234	0.00	4,005	17,239	77
2002	9,603	0	9,603	0.00	6,982	16,585	58
2003	12,045	0	12,045	0.00	1,617	13,661	88
2004	13,206	0	13,206	0.00	1,914	15,120	87
2005	11,855	0	11,855	0.00	2,755	14,610	81
2006	557	-	557	-	2,416	-	-

Greenland harvest of 2SW equivalents = NG1 * 0.718924 (M of 0.03 per month for 11 months to July of Canadian terminal fisheries)

Table 4.9.4.2. The numbers of hooked and released salmon in the angling fisheries of Eastern Canada.

Year	Newfoundland			Nova Scotia			New Brunswick					Prince Edward Island			Quebec			CANADA*		
	Small	Large	Total	Small	Large	Total	Small Kelt	Small Bright	Large Kelt	Large Bright	Total	Small	Large	Total	Small	Large	Total	**SMALL**	**LARGE**	**TOTAL**
1984				939	1,655	2,594	661	851	1,020	14,479	17,011							**2,451**	**17,154**	**19,605**
1985		315	315	1,323	6,346	7,669	1,098	3,963	3,809	17,815	26,685			67				**6,384**	**28,285**	**34,669**
1986		798	798	1,463	10,750	12,213	5,217	9,333	6,941	25,316	46,807							**16,013**	**43,805**	**59,818**
1987		410	410	1,311	6,339	7,650	7,269	10,597	5,723	20,295	43,884							**19,177**	**32,767**	**51,944**
1988		600	600	1,146	6,795	7,941	6,703	10,503	7,182	19,442	43,830	767	256	1,023				**19,119**	**34,275**	**53,394**
1989		183	183	1,562	6,960	8,522	9,566	8,518	7,756	22,127	47,967							**19,646**	**37,026**	**56,672**
1990		503	503	1,782	5,504	7,286	4,435	7,346	6,067	16,231	34,079			1,066				**13,563**	**28,305**	**41,868**
1991		336	336	908	5,482	6,390	3,161	3,501	3,169	10,650	20,481	1,103	187	1,290				**8,673**	**19,824**	**28,497**
1992	5,893	1,423	7,316	737	5,093	5,830	2,966	8,349	5,681	16,308	33,304			1,250				**17,945**	**28,505**	**46,450**
1993	18,196	1,731	19,927	1,076	3,998	5,074	4,422	7,276	4,624	12,526	28,848							**30,970**	**22,879**	**53,849**
1994	24,442	5,032	29,474	796	2,894	3,690	4,153	7,443	4,790	11,556	27,942	577	147	724				**37,411**	**24,419**	**61,830**
1995	26,273	5,166	31,439	979	2,861	3,840	770	4,260	880	5,220	11,130	209	139	348		922	922	**32,491**	**15,188**	**47,679**
1996	34,342	6,209	40,551	3,526	5,661	9,187						472	238	710		1,718	1,718	**38,340**	**13,826**	**52,166**
1997	25,316	4,720	30,036	713	3,363	4,076	3,457	4,870	3,786	8,874	20,987	210	118	328	182	1,643	1,825	**34,748**	**22,504**	**57,252**
1998	31,368	4,375	35,743	688	2,476	3,164	3,154	5,760	3,452	8,298	20,664	233	114	347	297	2,680	2,977	**41,500**	**21,395**	**62,895**
1999	24,567	4,153	28,720	562	2,186	2,748	3,155	5,631	3,456	8,281	20,523	192	157	349	298	2,693	2,991	**34,405**	**20,926**	**55,331**
2000	29,705	6,479	36,184	407	1,303	1,710	3,154	6,689	3,455	8,690	21,988	101	46	147	445	4,008	4,453	**40,501**	**23,981**	**64,482**
2001	22,348	5,184	27,532	527	1,199	1,726	3,094	6,166	3,829	11,252	24,341	202	103	305	809	4,674	5,483	**33,146**	**26,241**	**59,387**
2002	23,071	3,992	27,063	829	1,100	1,929	1,034	7,351	2,190	5,349	15,924	207	31	238	852	4,918	5,770	**33,344**	**17,580**	**50,924**
2003	21,379	4,965	26,344	626	2,106	2,732	1,555	5,375	1,042	7,981	15,953	240	123	363	1,238	7,015	8,253	**30,413**	**23,232**	**53,645**
2004	23,430	5,168	28,598	828	2,339	3,167	1,050	7,517	4,935	8,100	21,602	135	68	203	1291	7455	8746	**34,251**	**28,065**	**62,316**
2005	19,023	3,855	22,878	919	2,634	3,553	1,520	2,635	2,202	5,369	11,726	84	84	168	1,116	6,445	7,561	**25,297**	**20,589**	**45,886**

* totals for all years prior to 1997 are incomplete and are considered minimal estimates
blank cells indicate no information available

Table 4.9.7.1. Estimated numbers of 1SW returns in North America by geographic regions, 1971–2005.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	32,966	115,382	112,644	226,129	14,969	22,453	33,119	57,968	11,515	19,525	32	205,245	441,490	323,367
1972	24,675	86,362	109,282	219,412	12,470	18,704	42,202	73,700	9,522	16,915	18	198,169	415,112	306,640
1973	5,399	18,897	144,267	289,447	16,585	24,877	43,682	77,061	14,766	24,823	23	224,723	435,128	329,925
1974	27,034	94,619	85,216	170,748	16,791	25,186	65,673	114,068	26,723	44,336	55	221,492	449,011	335,252
1975	53,660	187,809	112,272	225,165	18,071	27,106	58,613	101,878	25,940	36,316	84	268,640	578,358	423,499
1976	37,540	131,391	115,034	230,595	19,959	29,938	90,309	155,669	36,931	55,937	186	299,959	603,716	451,837
1977	33,409	116,931	110,114	220,501	18,190	27,285	31,323	56,070	30,860	48,387	75	223,972	469,250	346,611
1978	16,155	56,542	97,375	195,048	16,971	25,456	26,008	45,407	12,457	16,587	155	169,121	339,195	254,158
1979	21,943	76,800	107,402	215,160	21,683	32,524	50,877	93,190	30,875	49,052	250	233,029	466,976	350,003
1980	49,670	173,845	121,038	242,499	29,791	44,686	45,718	81,695	49,925	73,560	818	296,959	617,103	457,031
1981	55,046	192,662	157,425	315,347	41,667	62,501	70,244	128,432	37,371	62,083	1,130	362,884	762,155	562,519
1982	38,136	133,474	141,247	283,002	23,699	35,549	79,879	143,370	23,839	38,208	334	307,134	633,938	470,536
1983	23,732	83,061	109,934	220,216	17,987	26,981	25,337	43,905	15,553	23,775	295	192,838	398,233	295,536
1984	12,283	42,991	130,836	262,061	21,566	30,894	37,697	63,906	27,954	47,493	598	230,934	447,943	339,438
1985	22,732	79,563	121,731	243,727	22,771	33,262	61,256	110,517	29,410	51,983	392	258,292	519,444	388,868
1986	34,270	119,945	125,329	251,033	33,758	46,937	114,720	204,378	30,935	54,678	758	339,770	677,730	508,750
1987	42,938	150,283	128,578	257,473	37,816	54,034	86,567	155,985	31,746	55,564	1,128	328,773	674,466	501,620
1988	39,892	139,623	133,237	266,895	43,943	62,193	123,582	223,211	32,992	56,935	992	374,639	749,850	562,244
1989	27,113	94,896	60,260	120,661	34,568	48,407	72,945	129,462	34,957	59,662	1,258	231,102	454,347	342,725
1990	15,853	55,485	99,543	199,416	39,962	54,792	84,996	161,505	33,939	60,828	687	274,980	532,713	403,847
1991	12,849	44,970	64,552	129,308	31,488	42,755	56,531	108,066	19,759	31,555	310	185,489	356,964	271,226
1992	17,993	62,094	118,778	237,811	35,257	48,742	150,372	234,582	22,832	37,340	1,194	346,427	621,764	484,095
1993	25,186	80,938	134,150	268,550	30,645	42,156	75,221	195,457	16,714	27,539	466	282,382	615,107	448,744
1994	18,159	56,888	91,495	189,808	29,667	40,170	50,440	83,027	8,216	11,583	436	198,413	381,912	290,163
1995	25,022	76,453	167,485	301,743	23,851	32,368	46,546	72,939	14,239	21,822	213	277,356	505,537	391,447
1996	51,867	153,553	200,277	422,635	32,008	42,558	40,223	70,561	22,795	36,047	651	347,821	726,005	536,913
1997	66,972	169,030	118,973	192,852	24,300	33,018	22,215	43,688	7,173	10,467	365	239,998	449,420	344,709
1998	9,233	192,621	150,644	202,611	24,495	34,301	28,926	55,130	14,948	22,625	403	228,649	507,690	368,170
1999	6,761	188,043	163,417	215,042	25,880	36,679	27,757	46,616	8,045	11,588	419	232,280	498,387	365,333
2000	4,022	216,034	148,710	254,736	24,129	35,070	37,874	57,237	8,801	13,697	270	223,806	577,043	400,425
2001	3,419	169,125	136,949	194,299	16,939	24,452	31,370	52,440	4,021	5,966	266	192,963	446,548	319,756
2002	60,917	148,152	134,679	187,273	28,609	39,275	52,977	89,502	6,876	10,937	450	284,508	475,589	380,049
2003	47,127	127,368	174,862	256,264	23,142	31,892	30,486	53,537	4,135	6,509	237	279,988	475,807	377,898
2004	68,331	125,093	160,252	243,479	30,423	43,266	52,564	90,563	5,951	9,437	319	317,841	512,157	414,999
2005	146,359	297,143	214,683	288,962	20,685	29,531	32,294	64,598	5,456	8,467	319	419,796	689,020	554,408

Labrador : SFAs 1,2&14B
Newfoundland: SFAs 3-14A
Gulf of St. Lawrence: SFAs 15-18
Scotia-Fundy: SFAs 19-23 (SFA 22 is not included as it does not produce 2SW salmon)
Quebec: Q1-Q11

Table 4.9.7.2. Estimated numbers of 2SW returns in North America by geographic regions, 1971–2005.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	4,312	29,279	2,388	8,923	34,568	51,852	29,450	46,846	11,187	16,410	653	81,905	153,310	117,607
1972	3,706	25,168	2,511	9,003	45,094	67,642	35,604	59,953	14,028	19,731	1,383	102,328	182,881	142,604
1973	5,183	35,196	2,995	11,527	49,765	74,647	34,871	59,568	10,359	14,793	1,427	104,600	197,158	150,879
1974	5,003	34,148	1,940	6,596	66,762	100,143	49,044	83,418	21,902	29,071	1,394	146,045	254,771	200,408
1975	4,772	32,392	2,305	7,725	56,695	85,042	31,153	51,874	23,944	31,496	2,331	121,200	210,860	166,030
1976	5,519	37,401	2,334	7,698	56,365	84,547	29,238	51,439	21,768	29,837	1,317	116,541	212,240	164,390
1977	4,867	33,051	1,845	6,247	66,442	99,663	58,774	100,788	28,606	39,215	1,998	162,533	280,963	221,748
1978	3,864	26,147	1,991	6,396	59,826	89,739	30,411	51,505	16,946	22,561	4,208	117,247	200,555	158,901
1979	2,231	15,058	1,088	3,644	32,994	49,491	8,643	14,337	8,962	12,968	1,942	55,860	97,440	76,650
1980	5,190	35,259	2,432	7,778	78,447	117,670	43,359	73,863	31,897	44,823	5,796	167,121	285,189	226,155
1981	4,734	32,051	3,451	12,035	61,633	92,449	17,695	29,615	19,030	28,169	5,601	112,144	199,921	156,033
1982	3,491	23,662	2,914	9,012	54,655	81,982	31,591	51,156	17,516	24,182	6,056	116,222	196,049	156,136
1983	2,538	17,181	2,586	8,225	44,886	67,329	28,987	46,897	14,310	20,753	2,155	95,462	162,540	129,001
1984	1,806	12,252	2,233	7,060	44,661	59,160	20,437	34,150	17,938	27,899	3,222	90,298	143,743	117,020
1985	1,448	9,779	958	3,059	45,916	61,460	22,965	43,606	22,841	38,784	5,529	99,657	162,218	130,937
1986	2,470	16,720	1,606	5,245	55,159	72,560	35,866	71,110	18,102	33,101	6,176	119,379	204,912	162,145
1987	3,289	22,341	1,336	4,433	52,699	68,365	22,289	48,137	11,529	20,679	3,081	94,223	167,036	130,629
1988	2,068	14,037	1,563	5,068	56,870	75,387	25,976	50,039	10,370	19,830	3,286	100,134	167,646	133,890
1989	2,018	13,653	697	2,299	51,656	67,066	17,094	35,461	11,939	21,818	3,197	86,602	143,493	115,047
1990	1,148	7,790	1,347	4,401	50,261	66,352	23,152	51,735	10,248	18,871	5,051	91,207	154,201	122,704
1991	548	3,740	1,054	3,429	46,841	60,724	19,711	42,977	10,613	17,884	2,647	81,415	131,401	106,408
1992	2,515	15,548	3,111	10,554	46,917	61,285	30,396	59,868	9,777	16,456	2,459	95,174	166,171	130,673
1993	3,858	18,234	1,499	5,094	37,023	46,484	18,731	74,077	6,791	10,536	2,231	70,133	156,656	113,395
1994	5,653	24,396	1,495	5,226	37,703	47,180	20,372	43,698	4,464	6,674	1,346	71,032	128,519	99,776
1995	12,368	44,205	2,243	7,535	43,755	54,186	29,885	50,879	5,382	8,484	1,748	95,382	167,038	131,210
1996	9,113	32,759	2,964	8,832	39,413	49,846	17,775	37,200	7,458	11,786	2,407	79,130	142,829	110,979
1997	8,919	26,674	3,469	8,538	32,443	41,017	14,774	37,114	3,847	5,888	1,611	65,063	120,841	92,952
1998	21,886	50,512	4,280	8,813	24,358	31,832	8,447	26,746	2,261	3,466	1,526	62,759	122,896	92,827
1999	5,245	30,259	2,599	9,661	25,415	33,710	9,475	20,747	3,814	5,594	1,168	47,715	101,139	74,427
2000	7,108	32,391	2,022	12,023	24,317	33,992	10,451	20,965	1,859	2,992	533	46,290	102,896	74,593
2001	7,869	36,361	1,614	7,832	25,562	35,398	17,510	32,424	3,444	5,370	788	56,788	118,173	87,480
2002	5,446	17,586	1,268	5,796	18,714	26,135	7,249	19,082	734	1,063	511	33,921	70,172	52,047
2003	4,006	15,399	1,419	6,894	28,787	38,262	15,303	34,747	2,579	4,323	1,192	53,287	100,818	77,052
2004	6,578	16,395	1,309	6,934	25,401	33,206	15,095	35,728	1,920	2,807	1,283	51,587	96,353	73,970
2005	5,341	21,322	2,020	8,836	24,621	31,997	12,944	40,836	1,320	2,069	984	47,230	106,044	76,637

Labrador : SFAs 1,2&14B
Newfoundland: SFAs 3-14A
Gulf of St. Lawrence: SFAs 15-18
Scotia-Fundy: SFAs 19-23 (SFA 22 is not included as it does not produce 2SW salmon)
Quebec: Q1-Q11

Table 4.9.7.3. Estimated numbers of 1SW spawners in North America by geographic regions, 1971–2005.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	29,032	111,448	85,978	199,463	9,338	14,007	18,716	35,529	4,800	12,810	29	147,894	373,287	260,590
1972	21,728	83,415	84,880	195,010	8,213	12,320	22,887	43,310	2,992	10,385	17	140,718	344,457	242,587
1973	0	11,405	108,785	253,965	10,987	16,480	26,487	51,224	8,658	18,715	13	154,930	351,802	253,366
1974	24,533	92,118	58,731	144,263	10,067	15,100	45,433	84,673	16,209	33,822	40	155,012	370,016	262,514
1975	49,688	183,837	78,882	191,775	11,606	17,409	40,112	74,913	18,232	28,608	67	198,586	496,608	347,597
1976	31,814	125,665	80,571	196,132	12,979	19,469	52,731	99,791	24,589	43,595	151	202,836	484,803	343,819
1977	28,815	112,337	75,762	186,149	12,004	18,006	13,347	27,572	16,704	34,231	54	146,686	378,350	262,518
1978	13,464	53,851	68,756	166,429	11,447	17,170	13,011	25,469	5,678	9,808	127	112,483	272,854	192,668
1979	17,825	72,682	76,233	183,991	15,863	23,795	28,140	57,265	18,577	36,754	247	156,884	374,732	265,808
1980	45,870	170,045	85,189	206,650	20,817	31,226	25,033	50,265	28,878	52,513	722	206,509	511,420	358,964
1981	49,855	187,471	110,755	268,677	30,952	46,428	37,319	77,324	18,236	42,948	1,009	248,126	623,858	435,992
1982	34,032	129,370	99,376	241,131	16,877	25,316	49,069	96,935	12,179	26,548	290	211,823	519,591	365,707
1983	19,360	78,689	77,514	187,796	12,030	18,045	12,829	24,669	7,747	15,969	255	129,734	325,423	227,578
1984	9,348	40,056	91,505	222,730	16,316	24,957	16,992	33,633	17,964	37,503	540	152,665	359,420	256,043
1985	19,631	76,462	85,179	207,175	15,608	25,140	37,309	73,871	18,158	40,731	363	176,248	423,742	299,995
1986	30,806	116,481	87,833	213,537	22,230	33,855	77,407	149,553	21,204	44,947	660	240,138	559,033	399,586
1987	37,572	144,917	104,096	232,991	25,789	40,481	56,020	110,287	21,589	45,407	1,087	246,152	575,169	410,660
1988	34,369	134,100	93,396	227,054	28,582	44,815	80,885	159,806	23,288	47,231	923	261,443	613,930	437,686
1989	22,429	90,212	41,798	102,199	24,710	37,319	42,163	81,697	23,873	48,578	1,080	156,053	361,086	258,569
1990	12,544	52,176	69,576	169,449	26,594	39,826	49,779	124,531	22,753	49,642	617	181,863	436,243	309,053
1991	10,526	42,647	44,023	108,779	20,582	30,433	36,478	87,038	13,814	25,610	235	125,658	294,741	210,200
1992	15,229	59,331	95,096	214,129	21,754	33,583	106,964	192,842	15,125	29,633	1,124	255,293	530,642	392,968
1993	22,499	78,251	107,816	242,217	17,493	27,444	50,102	169,880	11,539	22,252	444	209,894	540,487	375,190
1994	15,242	53,971	60,194	158,507	16,758	25,642	27,055	56,937	6,918	10,218	427	126,594	305,703	216,148
1995	22,199	73,630	134,676	268,934	14,409	21,548	21,223	46,851	12,114	19,697	213	204,834	430,872	317,853
1996	48,924	150,610	161,780	384,138	18,923	27,805	13,753	41,225	19,253	32,472	651	263,284	636,901	450,093
1997	64,389	166,446	93,841	167,720	14,724	22,210	7,121	25,768	6,143	9,428	365	186,583	391,937	289,260
1998	6,726	190,114	125,215	177,182	16,743	25,730	16,683	36,724	14,520	22,172	403	180,290	452,325	316,308
1999	4,244	185,526	138,692	190,317	18,969	28,808	16,581	31,282	7,666	11,203	419	186,571	447,555	317,063
2000	752	212,764	124,643	230,669	16,444	25,865	23,150	38,650	8,460	13,331	270	173,719	521,547	347,633
2001	906	166,612	111,756	169,106	10,836	16,989	18,920	36,376	3,718	5,634	266	146,402	394,983	270,693
2002	58,341	145,576	111,970	164,564	17,070	25,625	31,822	62,935	6,607	10,635	450	226,261	409,786	318,023
2003	44,522	124,763	151,998	233,401	15,445	23,187	18,479	36,691	3,912	6,262	237	234,594	424,541	329,567
2004	65,927	122,689	138,564	221,790	20,513	32,081	30,842	61,246	5,726	9,179	319	261,891	447,305	354,598
2005	143,937	294,720	196,734	271,013	14,295	22,278	20,308	43,458	5,286	8,265	319	380,879	640,052	510,466

Labrador : SFAs 1,2&14B
Newfoundland: SFAs 3-14A
Gulf of St. Lawrence: SFAs 15-18
Scotia-Fundy: SFAs 19-23 (SFA 22 is not included as it does not produce 2SW salmon)
Quebec: Q1-Q11

Table 4.9.7.4. Estimated numbers of 2SW spawners in North America by geographic regions, 1971–2005.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	4,012	28,882	1,817	8,055	11,822	17,733	4,270	8,251	4,496	9,032	490	26,907	72,444	49,675
1972	3,435	24,812	2,008	8,240	23,160	34,741	17,768	33,012	7,459	12,699	1,038	54,868	114,541	84,705
1973	4,565	34,376	2,283	10,449	23,564	35,346	20,469	38,143	3,949	7,844	1,100	55,929	127,256	91,593
1974	4,490	33,475	1,510	5,942	28,657	42,985	31,661	57,942	9,526	15,979	1,147	76,991	157,470	117,231
1975	4,564	32,119	1,888	7,086	23,818	35,726	18,450	33,223	11,861	18,830	1,942	62,522	128,926	95,724
1976	4,984	36,701	2,011	7,198	22,653	33,980	14,787	29,709	11,045	18,337	1,126	56,608	127,051	91,829
1977	4,042	31,969	1,114	5,088	32,602	48,902	32,485	60,210	13,578	23,119	643	84,462	169,932	127,197
1978	3,361	25,490	1,557	5,712	29,889	44,834	11,446	22,859	6,517	11,428	3,314	56,085	113,637	84,861
1979	1,823	14,528	980	3,463	12,807	19,210	3,541	6,839	4,683	8,234	1,509	25,343	53,783	39,563
1980	4,633	34,525	1,888	6,925	35,594	53,390	19,884	37,673	14,270	25,628	4,263	80,533	162,404	121,468
1981	4,403	31,615	3,074	11,442	26,132	39,199	4,599	10,054	5,870	13,353	4,334	48,412	109,997	79,205
1982	3,081	23,127	2,579	8,481	26,492	39,738	10,965	20,363	5,656	11,335	4,643	53,416	107,687	80,551
1983	2,267	16,824	2,244	7,677	17,308	25,963	7,375	14,316	1,505	6,529	1,769	32,468	73,078	52,773
1984	1,478	11,822	2,063	6,800	22,345	32,659	15,308	27,285	14,245	23,650	2,547	57,986	104,763	81,374
1985	1,258	9,530	946	3,042	20,668	31,742	21,057	40,100	18,185	33,580	4,884	66,997	122,877	94,937
1986	2,177	16,334	1,575	5,198	24,088	35,939	32,682	65,210	15,435	30,120	5,570	81,526	158,371	119,949
1987	2,895	21,821	1,320	4,409	21,723	31,727	19,532	43,380	10,235	19,233	2,781	58,487	123,351	90,919
1988	1,625	13,452	1,540	5,033	25,390	38,343	23,296	45,055	9,074	18,381	3,038	63,963	123,303	93,633
1989	1,727	13,270	690	2,289	25,016	35,905	14,604	31,099	11,689	21,539	2,800	56,526	106,901	81,713
1990	923	7,493	1,327	4,372	24,422	36,219	21,030	48,457	9,688	18,245	4,356	61,745	119,142	90,443
1991	491	3,665	1,041	3,410	19,959	29,052	18,294	40,840	9,356	16,479	2,416	51,558	95,862	73,710
1992	2,012	14,889	3,057	10,474	19,337	28,833	28,297	56,620	8,725	15,280	2,292	63,720	128,388	96,054
1993	3,624	17,922	1,449	5,017	15,774	21,428	17,721	72,665	5,710	9,921	2,065	46,343	129,017	87,680
1994	5,347	23,992	1,368	5,024	15,631	21,147	18,718	40,940	3,682	6,093	1,344	46,090	98,540	72,315
1995	12,083	43,828	2,125	7,343	22,575	28,703	28,275	48,475	4,672	7,971	1,748	71,477	138,069	104,773
1996	8,878	32,448	2,824	8,605	19,010	25,421	15,946	34,250	6,507	11,242	2,407	55,572	114,373	84,973
1997	8,785	26,497	3,348	8,346	15,531	20,780	13,317	34,873	3,095	5,311	1,611	45,688	97,418	71,553
1998	21,574	50,200	4,195	8,674	14,240	19,439	6,777	23,940	2,210	3,599	1,526	50,521	107,378	78,950
1999	4,832	29,846	2,551	9,565	17,250	23,811	8,663	19,303	3,250	5,278	1,168	37,715	88,971	63,343
2000	6,701	31,984	1,829	11,781	16,128	23,331	8,947	19,040	1,639	2,847	1,587	36,833	90,571	63,702
2001	7,384	35,876	1,534	7,709	16,696	24,056	16,997	31,705	2,992	5,002	1,491	47,095	105,840	76,467
2002	5,263	17,370	1,175	5,586	12,467	17,787	7,040	18,679	568	871	511	27,025	60,804	43,914
2003	3,793	15,147	1,375	6,803	20,738	28,570	14,858	34,013	2,401	4,123	1,192	44,357	89,849	67,103
2004	6,332	16,104	1,259	6,834	17,462	23,633	14,645	34,891	1,823	2,694	1,283	42,804	85,438	64,121
2005	5,107	21,046	1,841	8,776	17,529	23,483	12,557	39,893	1,235	1,967	1,088	39,356	96,253	67,804

Labrador : SFAs 1,2&14B
Newfoundland: SFAs 3-14A
Gulf of St. Lawrence: SFAs 15-18
Scotia-Fundy: SFAs 19-23 (SFA 22 is not included as it does not produce 2SW salmon)
Quebec: Q1-Q11

Table 4.9.7.5. Smolt age distributions in six stock areas of North America used to weight forward the spawning escapement in the current year to the year of the non-maturing 1SW component in the Northwest Atlantic.

	Smolt age (years)					
Stock area	1	2	3	4	5	6
Labrador	0.0	0.0	0.077	0.542	0.341	0.040
Newfoundland	0.0	0.041	0.598	0.324	0.038	0.0
Québec	0.0	0.058	0.464	0.378	0.089	0.010
Gulf of St. Lawrence	0.0	0.398	0.573	0.029	0.0	0.0
Scotia-Fundy	0.0	0.600	0.394	0.006	0.0	0.0
USA, 1971-1989	0.377	0.520	0.103	0.0	0.0	0.0
USA, 1990-2003	0.6274	0.3508	0.0218	0.0	0.0	0.0

Table 4.9.7.6. The mid-points of 2SW spawners and lagged spawners for North America and to each of the geographic areas. Lagged refers to the allocation of spawners to the year in which they would have contributed to the year of prefishery abundance.

	North America		Prefishery	Recruits/	Labrador (L)		Newfoundland (N)		Quebec (Q)		Gulf of St. Lawrence (G)		Scotia-Fundy (S)		USA (US)	
	Total 2SW	Lagged 2SW	abundance	2SW lagged												
Year	spawners	spawners	recruits	spawner	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged
1971	49675		730732		16447		4936		14777		6261		6764		490	
1972	84705		742060		14124		5124		28951		25390		10079		1038	
1973	91593		884679		19470		6366		29455		29306		5896		1100	
1974	117231		817732		18982		3726		35821		44802		12752		1147	
1975	95724		917282		18341		4487		29772		25836		15345		1942	
1976	91829		840510		20842		4605		28316		22248		14691		1126	
1977	127197		670646		18006		3101		40752		46347		18348		643	
1978	84861	95524	374325	3.92	14425	14759	3635	5802	37362	28128	17152	35360	8973	10034	3314	1442
1979	39563	107013	847626	7.92	8175	17486	2221	4664	16008	32232	5190	36809	6459	14270	1509	1553
1980	121468	96086	736023	7.66	19579	18903	4406	4316	44492	31940	28779	24963	19949	14937	4263	1029
1981	79205	104065	682597	6.56	18009	18795	7258	4472	32666	30266	7327	31944	9612	16888	4334	1699
1982	80551	107269	567290	5.29	13104	19695	5530	3661	33115	34821	15664	34034	8496	12699	4643	2358
1983	52773	82167	339893	4.14	9546	18710	4961	3440	21636	36526	10845	13244	4017	7514	1769	2733
1984	81374	79786	352236	4.41	6650	15422	4432	2801	27502	28065	21296	14925	18947	14569	2547	4006
1985	94937	85392	539963	6.32	5394	11576	1994	3786	26205	32359	30578	19559	25882	13668	4884	4443
1986	119949	80959	574509	7.10	9255	15361	3386	6075	30013	35728	48946	11269	22777	8998	5570	3528
1987	90919	78592	520156	6.62	12358	17772	2865	6023	26725	33119	31456	13506	14734	5813	2781	2359
1988	93633	79004	422740	5.35	7538	14762	3287	5209	31866	27538	34176	15145	13728	13002	3038	3347
1989	81713	93796	340070	3.63	7498	10875	1490	4544	30461	25762	22851	24688	16614	23026	2800	4901
1990	90443	102732	295155	2.87	4208	7799	2850	2951	30320	26580	34744	37620	13966	23978	4356	3805
1991	73710	99735	342105	3.43	2078	6285	2225	2953	24506	28072	29567	41457	12917	17965	2416	3003
1992	96054	89423	222815	2.49	8451	8072	6765	3018	24085	28227	42459	33050	12002	14173	2292	2883
1993	87680	92185	158550	1.72	10773	10649	3233	3080	18601	29616	45193	29594	7816	15464	2065	3781
1994	72315	88099	196412	2.23	14669	9247	3196	2178	18389	30646	29829	27915	4888	15007	1344	3105
1995	104773	88063	185151	2.10	27955	7453	4734	2400	25639	30138	38375	32341	6322	13350	1748	2381
1996	84973	84548	160167	1.89	20663	5299	5714	2585	22216	27289	25098	34850	8875	12373	2407	2152
1997	71553	87352	150243	1.72	17641	3511	5847	5004	18155	24550	24095	43176	4203	9493	1611	1618
1998	78950	78632	108059	1.37	35887	6285	6435	4337	16839	21312	15358	39005	2904	6080	1526	1613
1999	63343	74390	110907	1.49	17339	9930	6058	3404	20531	19459	13983	33680	4264	5764	1168	2152
2000	63702	82970	129596	1.56	19343	14110	6805	4219	19730	22055	13994	32847	2243	7845	1587	1893
2001	76467	83097	84145	1.01	21630	22173	4622	5307	20376	22898	24351	25088	3997	6056	1491	1575
2002	43914	74149	112382	1.52	11316	22675	3381	5786	15127	20286	12860	20650	720	3449	511	1303
2003	67103	65041	110318	1.70	9470	20485	4089	6202	24654	18121	24435	15067	3262	3727	1192	1439
2004	64121	71312	114578	1.61	11218	27626	4046	6202	20547	18894	24768	14029	2258	3043	1283	1518
2005	67804	72385			13077	23828	5308	6460	20506	19796	26225	18116	1601	3307	1088	878
2006		67093				19497		5331		19806		19480		2020		960
2007		63252				19884		3939		18129		17801		2264		1234
2008		67307				15012		3877		20380		24233		2645		1159

Spawners lagged by:
Labrador = 0.0768 x i-5 spawners + 0.542 x i-6 + 0.341 x i-7 + 0.0401 x i-8
Newfoundland = 0.0408 x i-4 spawners + 0.5979 x i-5 + 0.3237 x i-6 + 0.0375 x i-7
Quebec = 0.0577 x i-4 spawners + 0.4644 x i-5 + 0.3783 x i-6 + 0.0892 x i-7 + 0.0104 x i-8
Gulf = 0.3979 x i-4 spawners + 0.5731 x i-5 + 0.0291 x i-6
Scotia-Fundy = 0.6002 x i-4 spawners + 0.3942 x i-5 + 0.0055 x i-6
USA = 0.3767 x i-3 spawners + 0.520 x i-4 + 0.1033 x i-5, 1971-1989
& 0.6274 x i-3 spawners + 0.3508 x i-4 + 0.0218 x i-5, 1990-2003.

Table 4.9.10.1. Run reconstruction data inputs for harvests used to estimate pre-fishery abundance of maturing and non-maturing 1SW salmon of North American origin (terms defined in Table 4.9.10.2).

	{1}			{1-7, 14b}		{8-14a}		{1-7, 14b}
1SW Year (i)	AH_Small (i)	AH_Large (i+1)	AH_Large (i)	H_Small (i)	H_Large (i)	H_Small (i)	H_Large (i+1)	H_Large (i+1)
1971	0	0	0	158896	199176	70936	42861	144496
1972	0	0	0	143232	144496	111141	43627	227779
1973	0	0	0	188725	227779	176907	85714	196726
1974	0	0	0	192195	196726	153278	72814	215025
1975	0	0	0	302348	215025	91935	95714	210858
1976	0	0	0	221766	210858	118779	63449	231393
1977	0	0	0	220093	231393	57472	37653	155546
1978	0	0	0	102403	155546	38180	29122	82174
1979	0	0	0	186558	82174	62622	54307	211896
1980	0	0	0	290127	211896	94291	38663	211006
1981	0	0	0	288902	211006	60668	35055	129319
1982	0	0	0	222894	129319	77017	28215	108430
1983	0	0	0	166033	108430	55683	15135	87742
1984	0	0	0	123774	87742	52813	24383	70970
1985	0	0	0	178719	70970	79275	22036	107561
1986	0	0	0	222671	107561	91912	19241	146242
1987	0	0	0	281762	146242	82401	14763	86047
1988	0	0	0	198484	86047	74620	15577	85319
1989	0	0	0	172861	85319	60884	11639	59334
1990	0	0	0	104788	59334	46053	10259	39257
1991	0	0	0	89099	39257	42721	0	32341
1992	0	0	0	24249	32341	0	0	17096
1993	0	0	0	17074	17096	0	0	15377
1994	0	0	0	8640	15377	0	0	11176
1995	0	0	0	7980	11176	0	0	7272
1996	0	0	0	7849	7272	0	0	6943
1997	0	2269	0	9753	6943	0	0	0
1998	2988	1084	2269	0	0	0	0	0
1999	2739	1352	1084	0	0	0	0	0
2000	5323	1673	1352	0	0	0	0	0
2001	4789	1437	1673	0	0	0	0	0
2002	5806	2175	1437	0	0	0	0	0
2003	6477	3696	2175	0	0	0	0	0
2004	8385	3009	3696	0	0	0	0	0
2005	10276	0	3009	0	0	0	0	0

Table 4.9.10.2 Definitions of key variables used in continental run-reconstruction models for North American salmon.

i	Year of the fishery on 1SW salmon in Greenland and Canada
M	Natural mortality rate (0.03 per month)
t1	Time between the mid-point of the Canadian fishery and return to river = 1 months
S1	Survival of 1SW salmon between the homewater fishery and return to river {exp(-M t1)}
H_s(i)	Number of "Small" salmon caught in Canada in year i; fish <2.7 kg
H_l(i)	Number of "Large" salmon caught in Canada in year i; fish >=2.7 kg
AH_s	Aboriginal and resident food harvests of small salmon in northern Labrador
AH_l	Aboriginal and resident food harvest of large salmon in northern Labrador
f_imm	Fraction of 1SW salmon that are immature, i.e. non-maturing: range = 0.1 to 0.2
af_imm	Fraction of 1SW salmon that are immature in native and resident food fisheries in N Lab
q	Fraction of 1SW salmon present in the large size market category; range = 0.1 to 0.3
MC1(i)	Harvest of maturing 1SW salmon in Newfoundland and Labrador in year i
i+1	Year of fishery on 2SW salmon in Canada
MR1(i)	Return estimates of maturing 1SW salmon in Atlantic Canada in year i
NN1(i)	Pre-fishery abundance of non-maturing 1SW + maturing 2SW salmon in year i
NR(i)	Return estimates of non-maturing + maturing 2SW salmon in year i
NR2(i+1)	Return estimates of maturing 2SW salmon in Canada
NC1(i)	Harvest of non-maturing 1SW salmon in Nfld + Labrador in year i
NC2(i+1)	Harvest of maturing 2SW salmon in Canada
NG(i)	Catch of 1SW North American origin salmon at Greenland
S2	Survival of 2SW salmon between Greenland and homewater fisheries
MN1(i)	Pre-fishery abundance of maturing 1SW salmon in year i
RFL1	Labrador raising factor for 1SW used to adjust pre-fishery abundance
RFL2	Labrador raising factor for 2SW used to adjust pre-fishery abundance

Table 4.9.10.3. Run reconstruction data inputs used to estimate pre-fishery abundance of non-maturing (NN1) 1SW salmon of North American origin (terms defined in Table 4.9.10.2).

	NG1	NC1		NC2		NR2		NN1		mid-
1SW		min	max	min	max	min	max	min	max	point
Year (i)	(i)	(i)	(i)	(i+1)	(i+1)	(i+1)	(i+1)	(i)	(i)	(i)
1971	287672	17881	43730	144008	172907	102328	182881	642279	819184	730732
1972	200784	15768	37316	203072	248628	104600	197158	636167	847954	742060
1973	241493	21150	51412	223422	262767	146045	254771	767376	1001982	884679
1974	220584	21187	50243	223332	266337	121200	210860	711821	923643	817732
1975	278839	32385	73371	243315	285486	116541	212240	801769	1032796	917282
1976	155896	24285	57005	225424	271703	162533	280963	710550	970471	840510
1977	189709	24323	57902	146535	177644	117247	200555	574920	766372	670646
1978	118853	11796	29813	86644	103079	55860	97440	325305	423344	374325
1979	200061	19478	42242	202634	245013	167121	285189	725526	969725	847626
1980	187999	31132	70739	186367	228568	112144	199921	626689	845357	736023
1981	227727	31000	70441	125578	151442	116222	196049	589902	775292	682597
1982	194715	23583	52338	104116	125802	95462	162540	491624	642955	567290
1983	33240	17688	39712	76554	94103	90298	143743	279866	399920	339893
1984	38916	13255	30019	74062	88256	99657	162218	290764	413708	352236
1985	139233	18582	40002	97329	118841	119379	204912	455247	624679	539963
1986	171745	23343	50988	121610	150859	94223	167036	490306	658712	574509
1987	173687	29639	65127	74996	92205	100134	167646	443842	596469	520156
1988	116767	20709	44860	75300	92364	86602	143493	359581	485900	422740
1989	60693	18139	39691	53173	65040	91207	154201	277474	402667	340070
1990	73109	11072	24518	37739	45590	81415	131401	248369	341942	295155
1991	110680	9302	20175	22639	29107	95174	166171	282926	401284	342105
1992	41855	2748	6790	11967	15386	70133	156656	158311	287319	222815
1993	0	1878	4441	10764	13839	71032	128519	115212	201888	158550
1994	0	1018	2651	7823	10058	95382	167038	144251	248572	196412
1995	21341	910	2267	5090	6545	79130	142829	139189	231113	185151
1996	21944	858	2006	4860	6249	65063	120841	119863	200471	160167
1997	16814	1045	2367	1588	2269	62759	122896	107299	193188	150243
1998	3026	161	367	759	1084	47715	101139	70582	145537	108059
1999	5374	142	306	946	1352	46290	102896	71182	150631	110907
2000	5571	273	573	1171	1673	56788	118173	86415	172776	129596
2001	9712	248	529	1006	1437	33921	70172	58501	109788	84145
2002	2249	297	624	1523	2175	53287	100818	78722	146043	112382
2003	2663	335	713	2587	3696	51587	96353	78246	142390	110318
2004	3832	438	949	2106	3009	47230	106044	72809	156347	114578
2005	3360	529	1118	0	0	0	0	3889	4478	4183

Table 4.9.10.4. Run reconstruction data inputs and estimated pre-fishery abundance for maturing (MN1) 1SW salmon (grilse) of North American origin (terms defined in Table 4.9.10.2).

1SW Year (i)	MC1 min (i)	max (i)	MR1 min (i)	max (i)	MN1 min (i)	max (i)	mid-point (i)
1971	213987	267720	205245	441490	425482	722655	574069
1972	237286	279064	198169	415112	441490	706818	574154
1973	346109	408260	224723	435128	577676	856639	717157
1974	322772	379370	221492	449011	551009	842055	696532
1975	351015	422105	268640	578358	627836	1018077	822957
1976	313060	375300	299959	603716	622155	997402	809778
1977	252058	318032	223972	469250	482850	801573	642212
1978	132546	172340	169121	339195	306818	521865	414342
1979	218442	252711	233029	466976	458568	733909	596239
1980	343344	412617	296959	617103	649347	1048513	848930
1981	308670	377651	362884	762155	682605	1163018	922811
1982	265678	312538	307134	633938	582165	965782	773973
1983	197184	234389	192838	398233	395895	644750	520322
1984	158852	187900	230934	447943	396818	649485	523152
1985	227928	259284	258292	519444	494086	794548	644317
1986	278654	321357	339770	677730	628771	1019727	824249
1987	319510	375472	328773	674466	658296	1070479	864387
1988	240291	276488	374639	749850	626339	1049175	837757
1989	205998	239495	231102	454347	444139	707679	575909
1990	134630	156382	274980	532713	417984	705319	561652
1991	117141	133509	185489	356964	308278	501344	404811
1992	21986	30556	346427	621764	378963	671255	525109
1993	15027	19983	282382	615107	306009	653822	479915
1994	8142	11928	198413	381912	212598	405471	309034
1995	7278	10200	277356	505537	293081	531133	412107
1996	6861	9028	347821	726005	365275	757143	561209
1997	8358	10652	239998	449420	255665	473759	364712
1998	2893	3485	228649	507690	238506	526637	382571
1999	2563	2911	232280	498387	241916	516476	379196
2000	4912	5442	223806	577043	235535	600059	417797
2001	4461	5026	192963	446548	203301	465174	334237
2002	5355	5925	284508	475589	298528	495998	397263
2003	6025	6773	279988	475807	294540	497071	395806
2004	7879	9019	317841	512157	335400	536773	436086
2005	9519	10620	419796	689020	442100	720624	581362

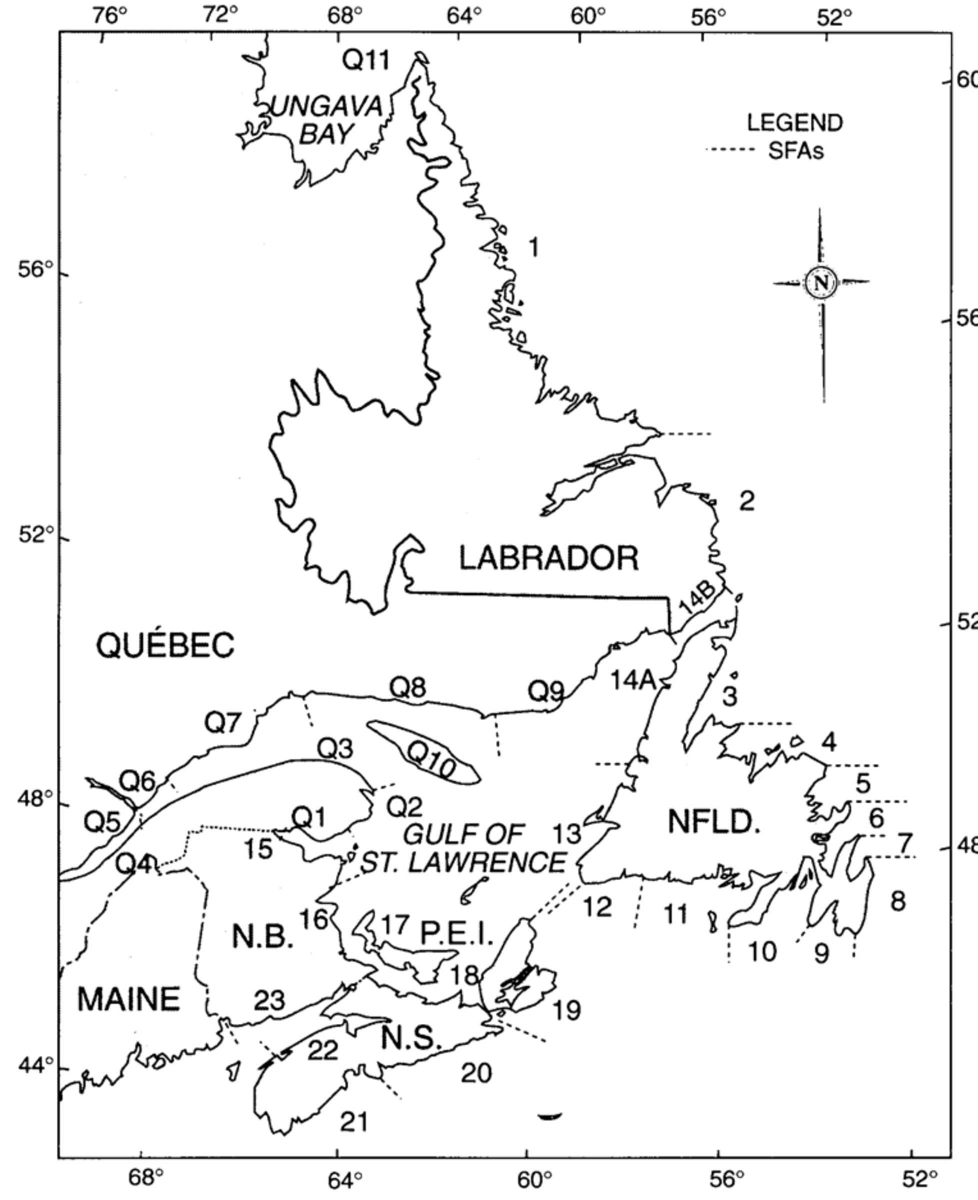


Figure 4.9.3.1. Map of Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada.

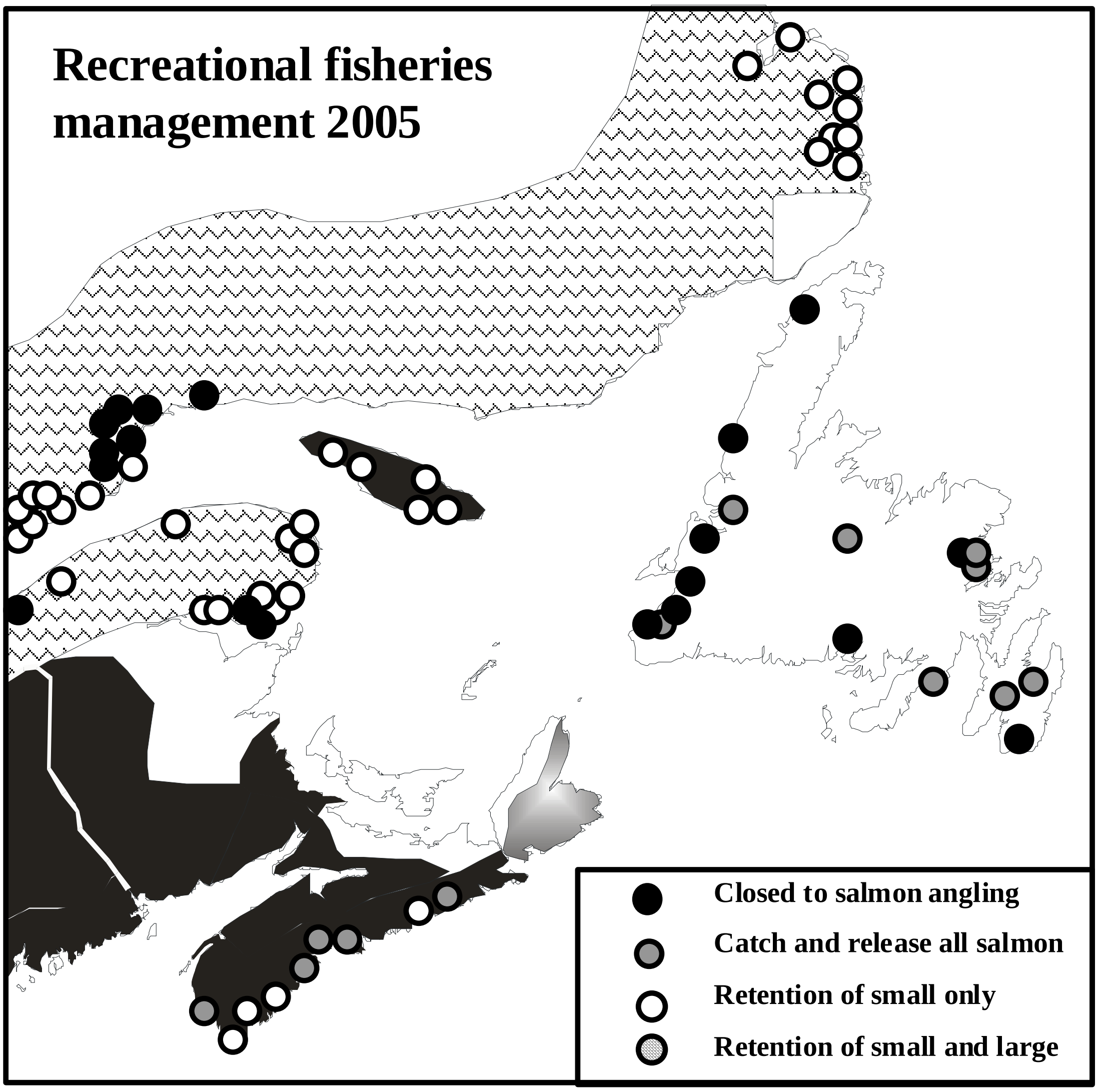


Figure 4.9.3.2. Summary of recreational fisheries management in eastern Canada and Maine (USA) during 2005.

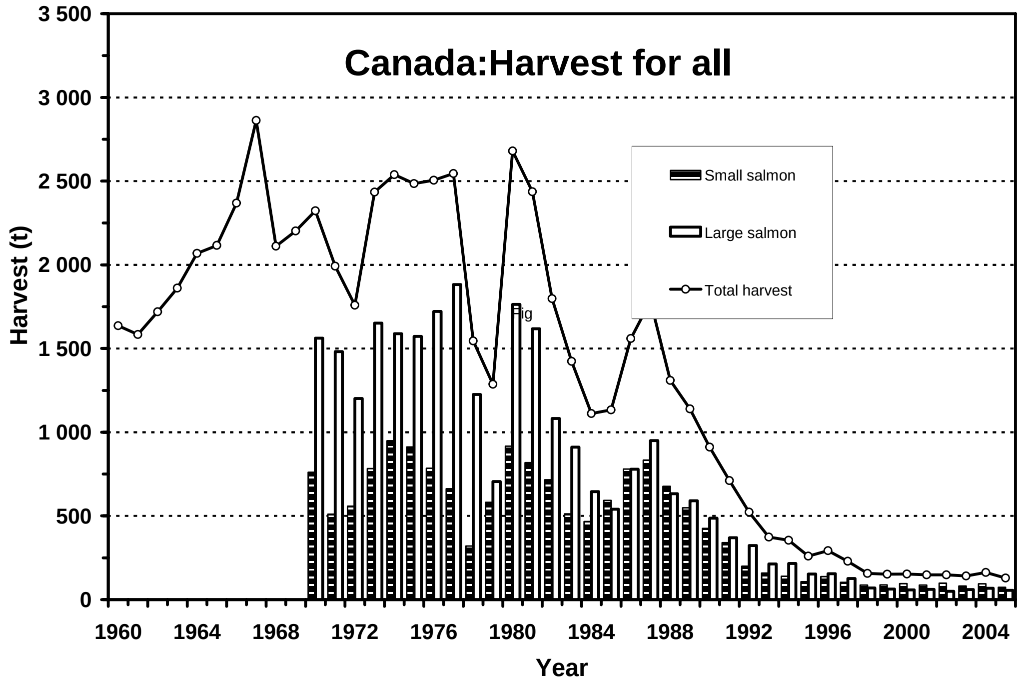


Figure 4.9.4.1. Harvest (t) of small salmon, large salmon and combined for Canada, 1960–2005 by all users.

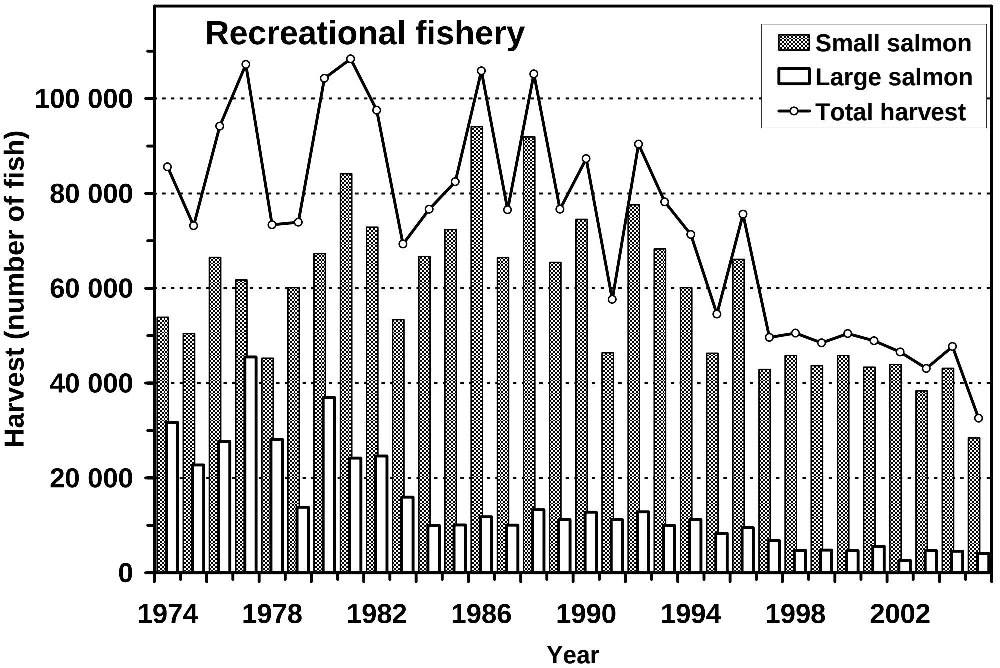


Figure 4.9.4.2. Harvest (number) of small salmon, large salmon and both sizes combined in the recreational fisheries of Canada, 1974– 2005

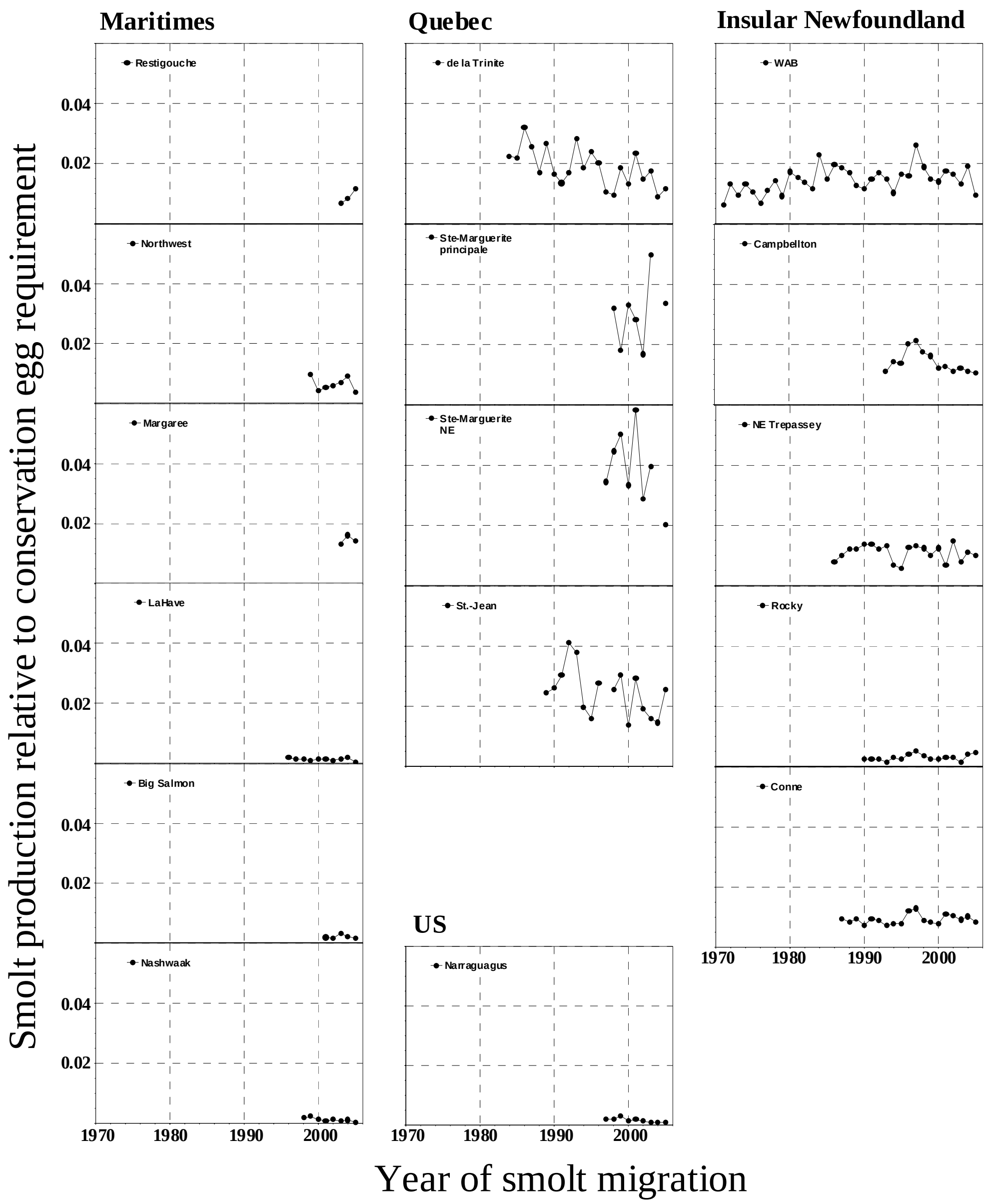


Figure 4.9.7.1. Wild smolt production trends from fifteen monitored rivers in eastern Canada and one river of eastern USA, 1971–2005. Smolt production is expressed relative to the conservation egg requirements of the rivers.

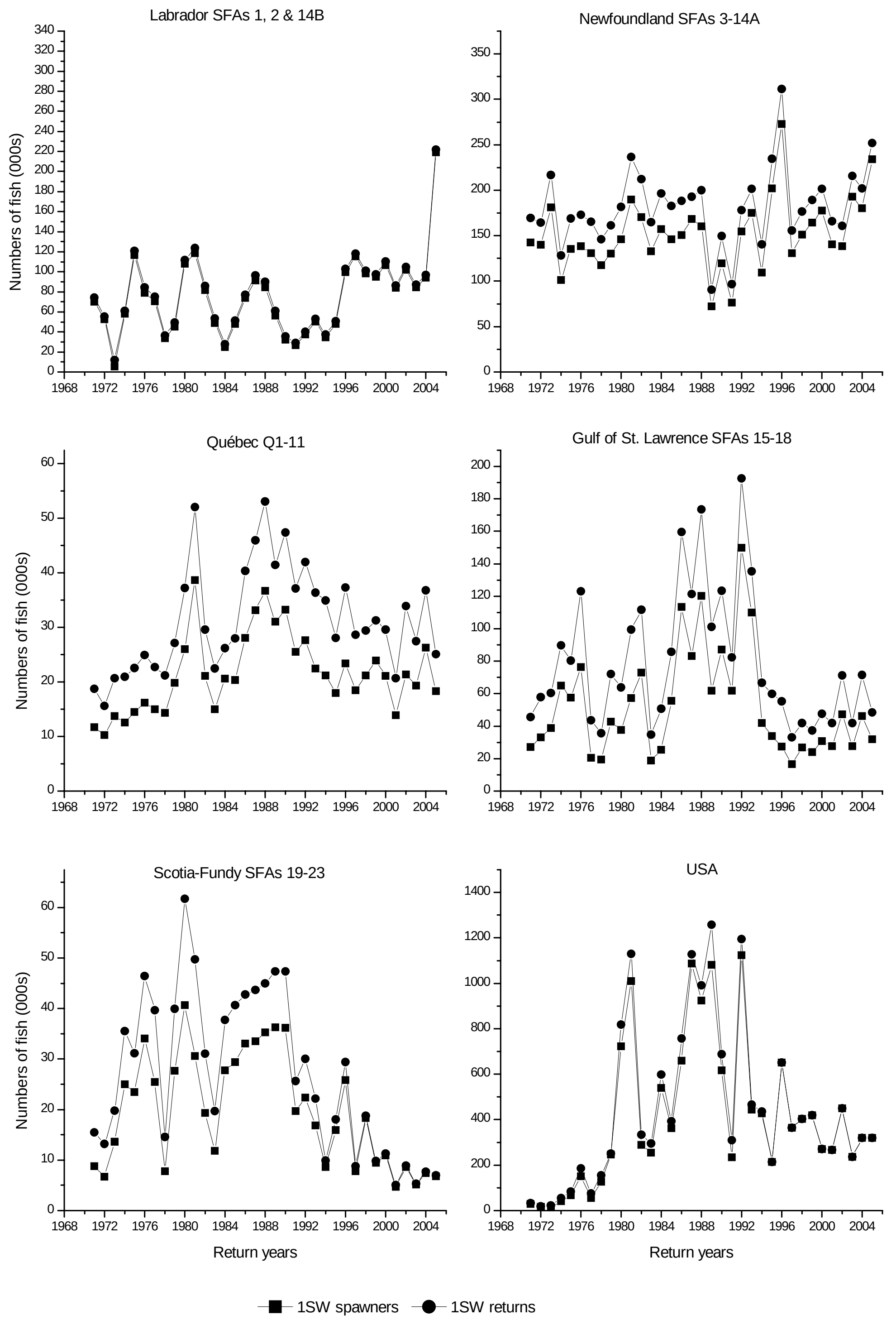


Figure 4.9.7.2. Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Returns and spawners for USA are total numbers of fish.

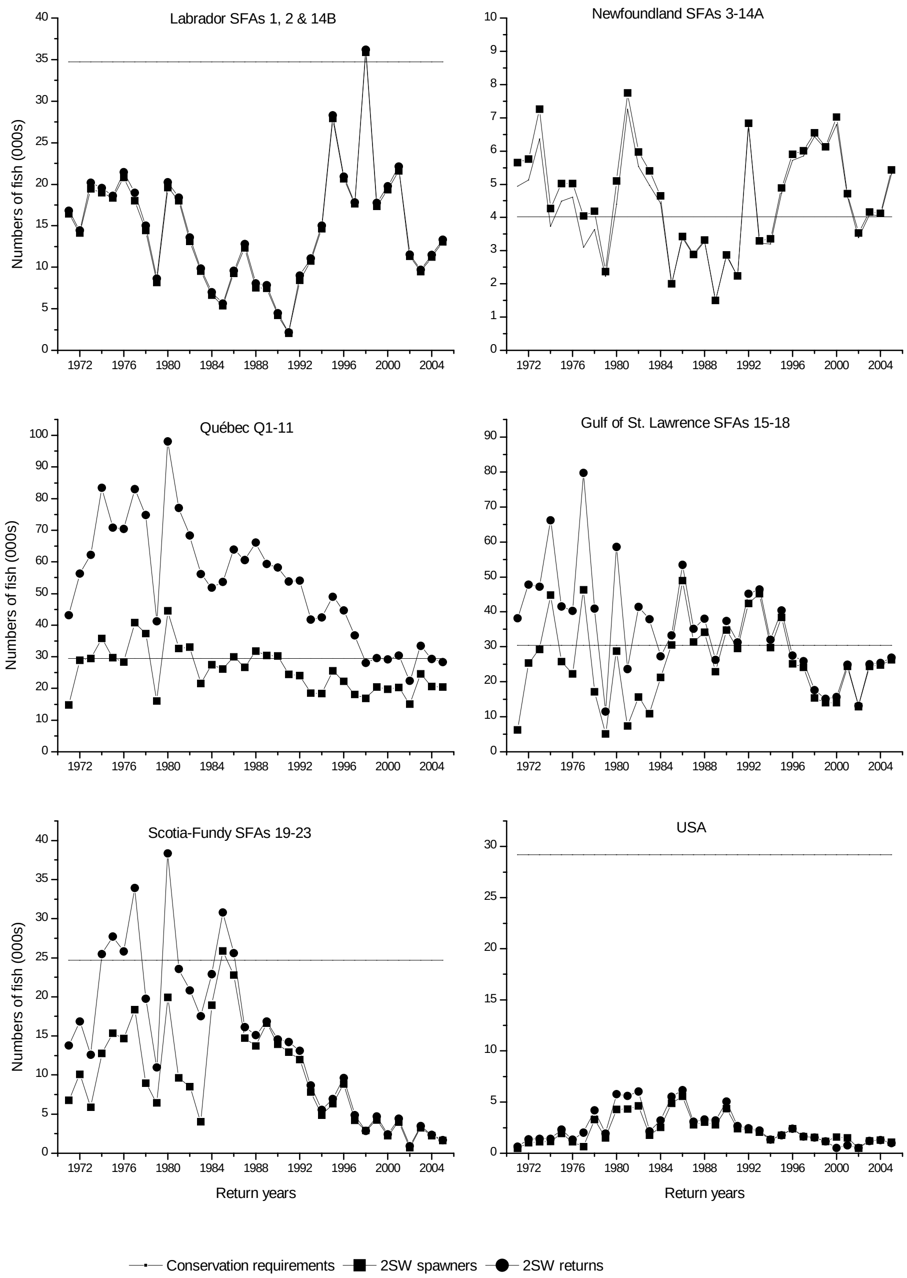


Figure 4.9.7.3. Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation requirements for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

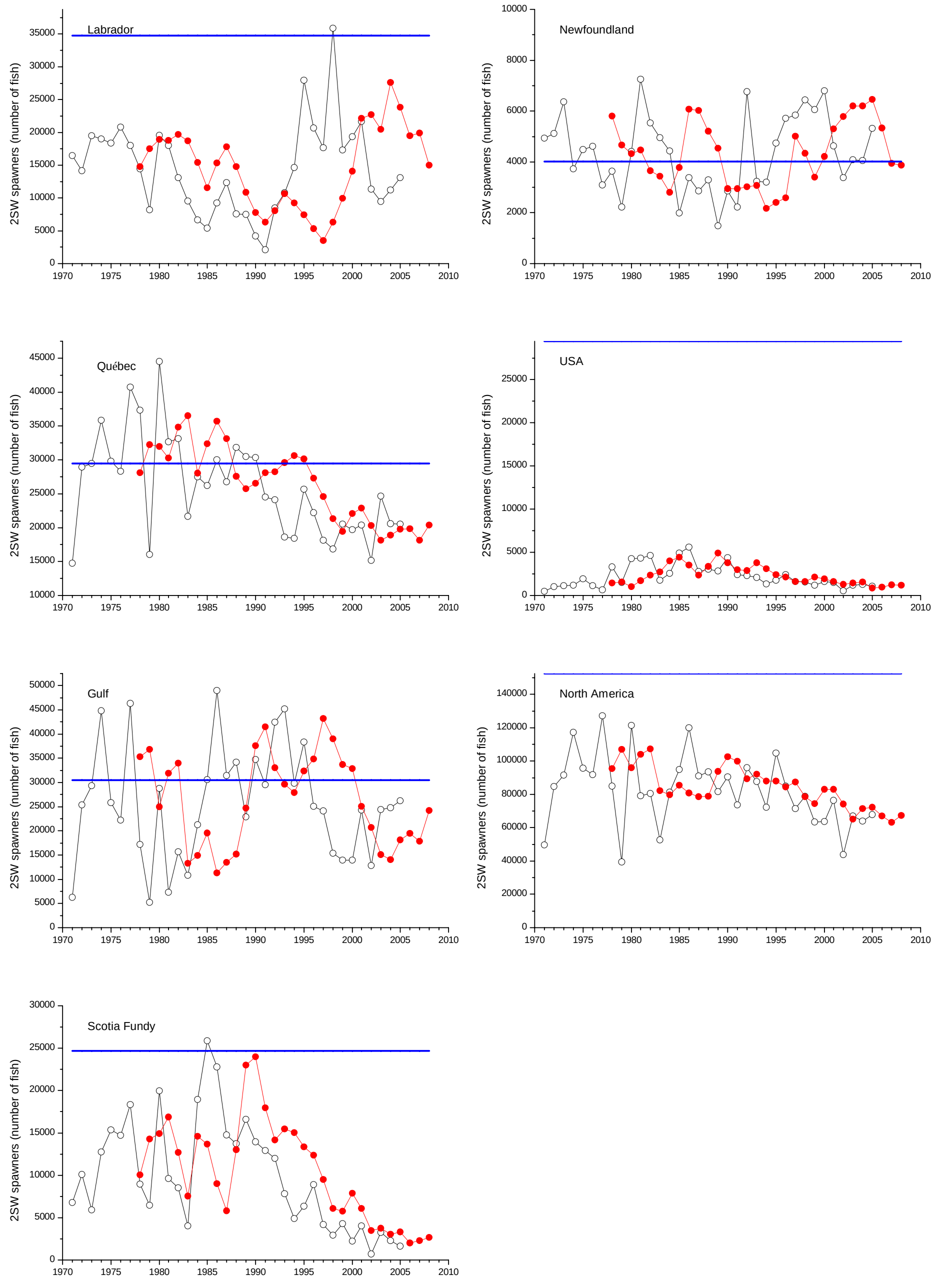


Figure 4.9.7.4. Midpoints of lagged spawners (solid circles) and estimated annual spawners (open circles) as contribution to potential recruitment in the year of prefishery abundance (PFA) for six geographic areas of North America. The horizontal line represents the spawning requirement (in terms of 2SW fish) in each geographic area.

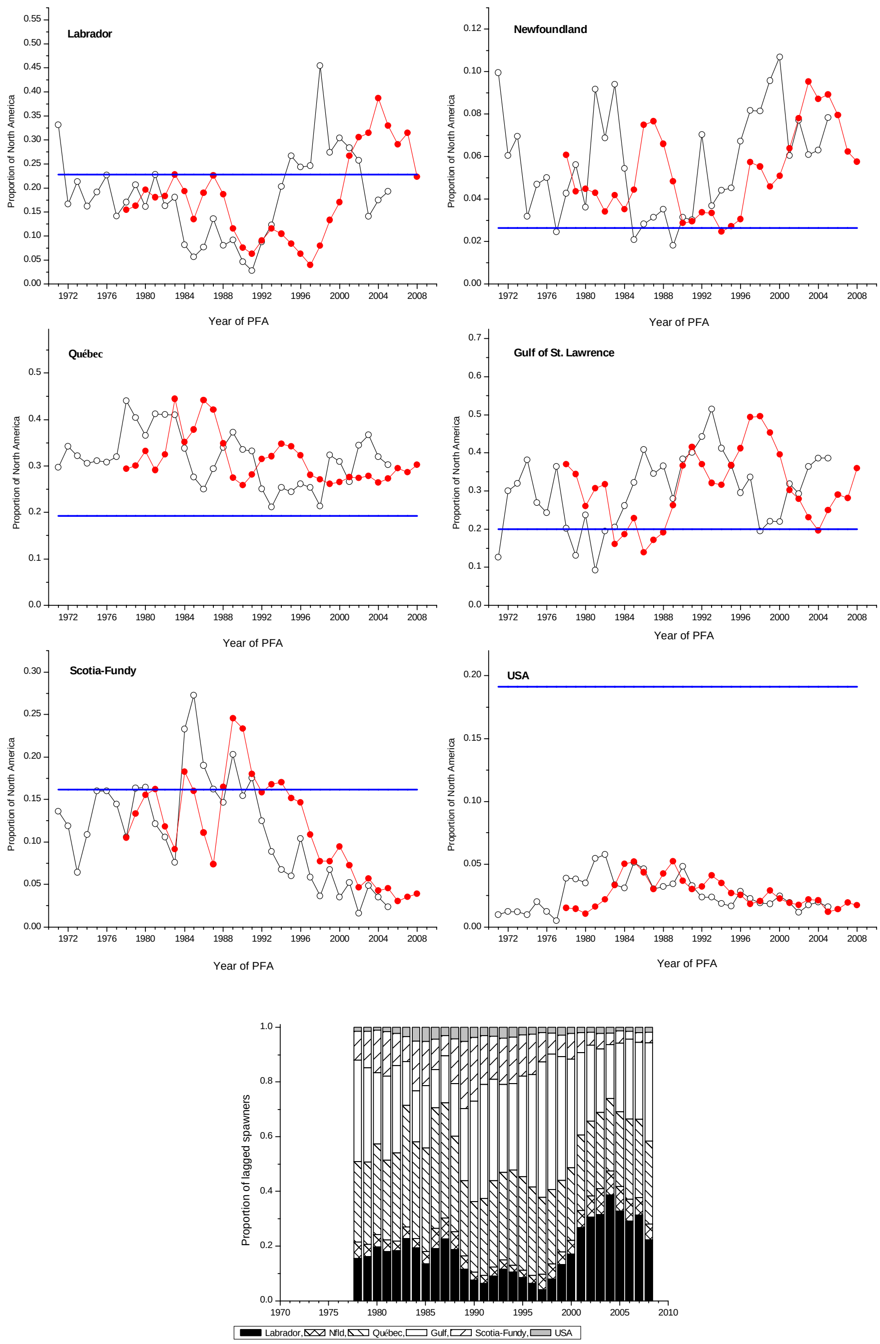


Figure 4.9.7.5. Proportion of spawners (mid-points) lagged to year of PFA (solid circles) and as returns to rivers (open circles) in six geographic areas of North America relative to the total lagged spawner or annual spawning escapement to North America. The horizontal line represents the theoretical spawner proportions for each area based on the 2SW spawner requirement for North America.

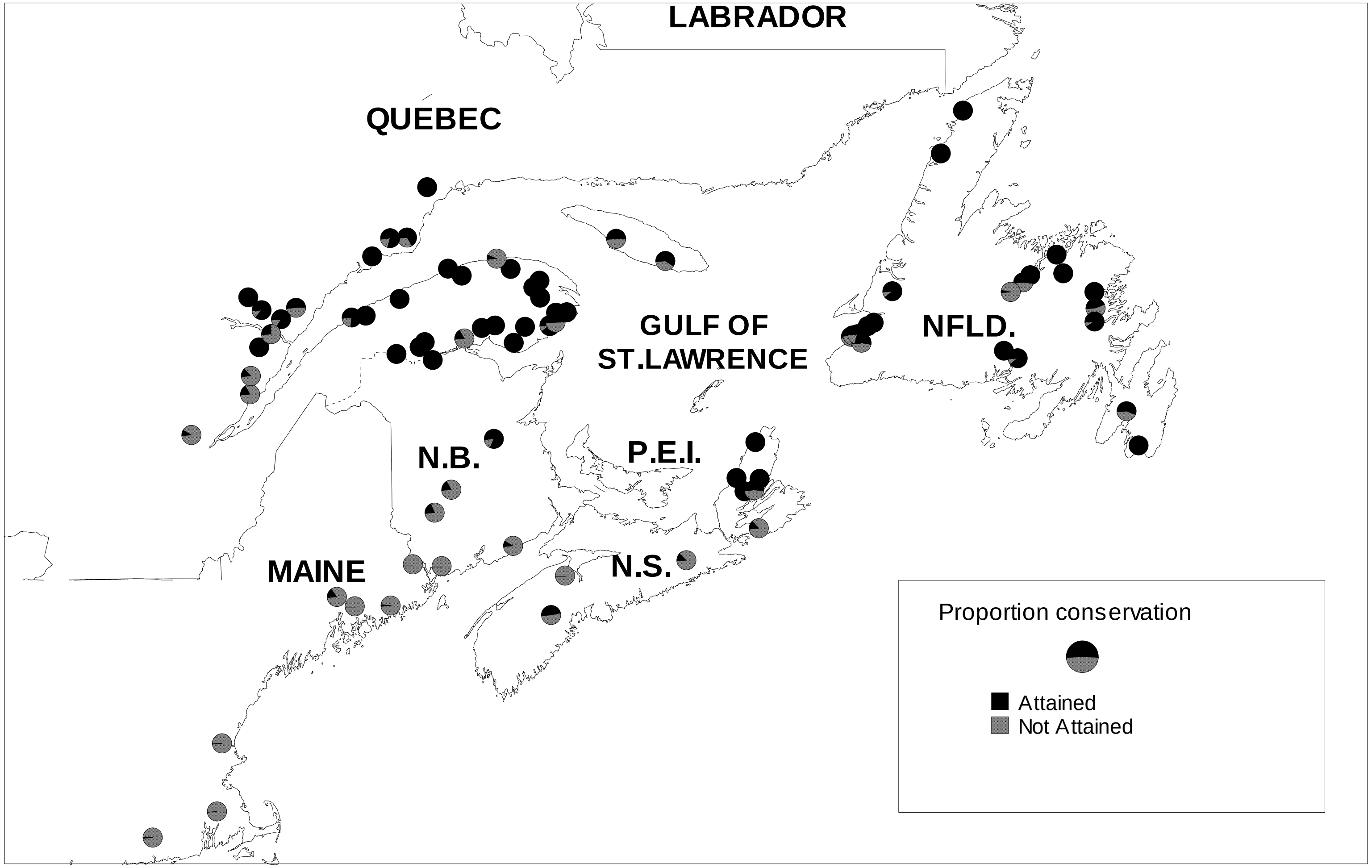


Figure 4.9.8.1. Proportion of the conservation requirement attained in assessed rivers of the North American Commission in 2005.

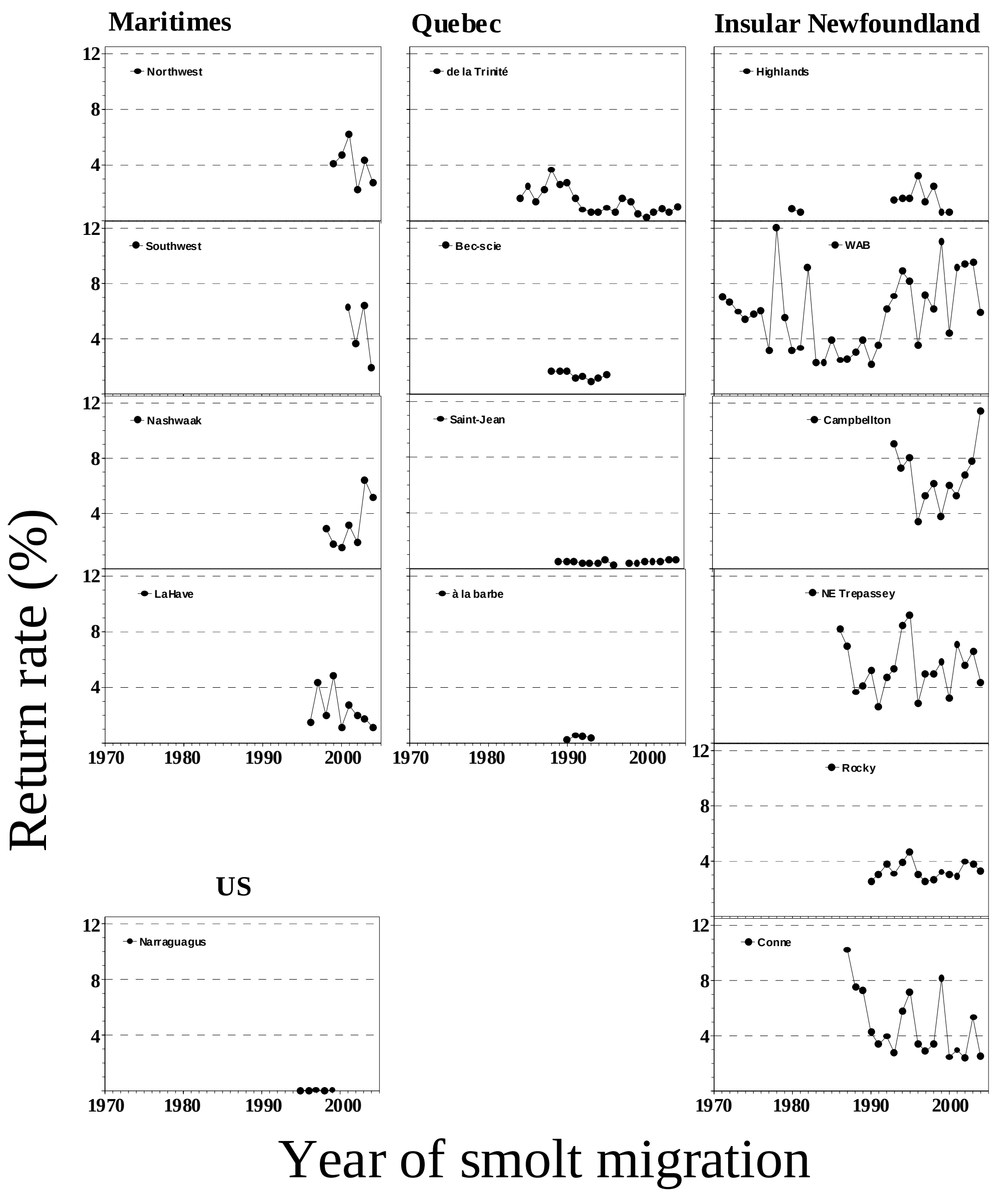


Figure 4.9.9.1. Return rates (%) of wild smolts to return as 1SW salmon from the rivers in North America which were monitored in 2005. Rivers are ordered roughly north to south in each region.

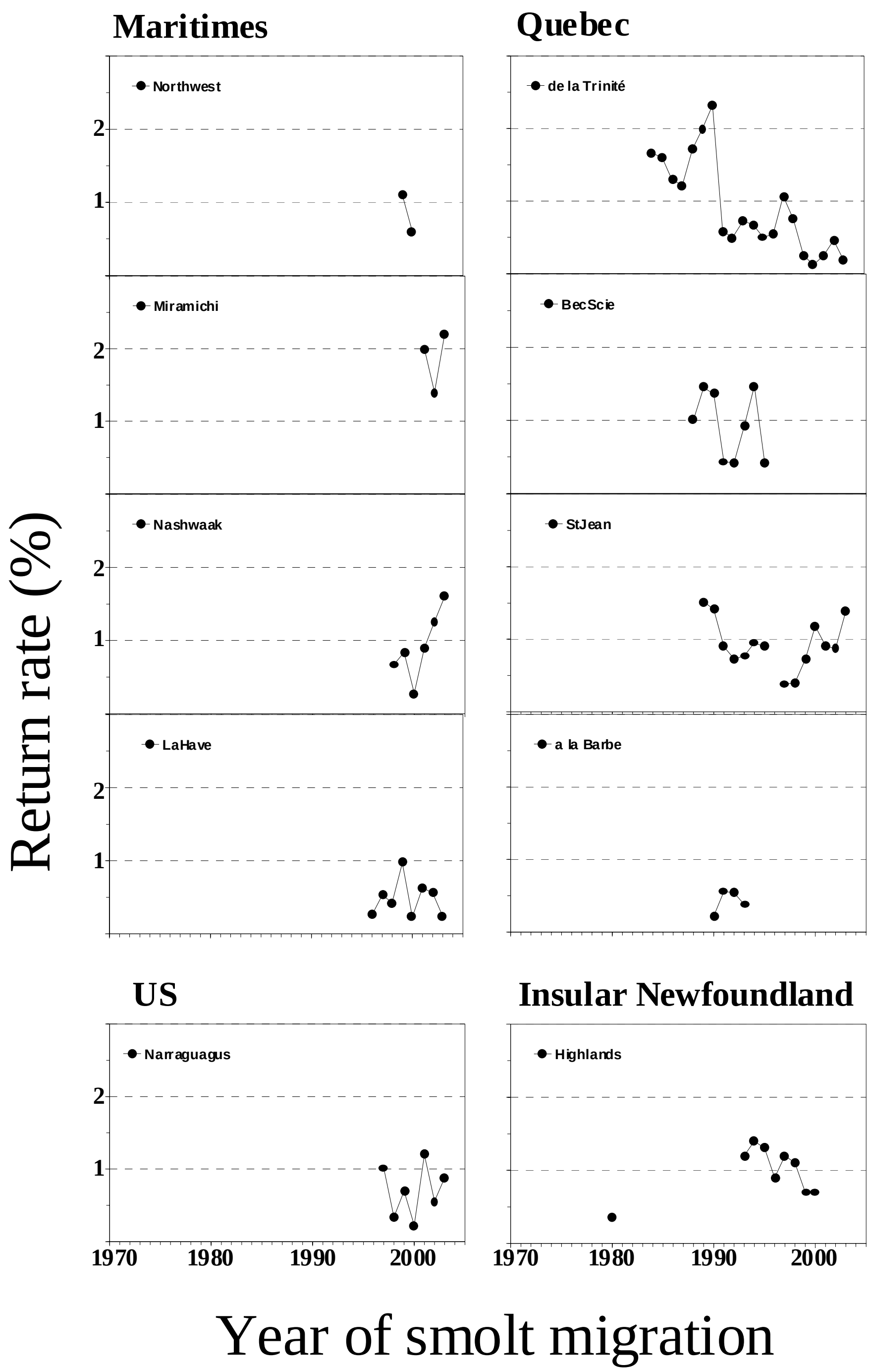


Figure 4.9.9.2. Return rates (%) of wild smolts to return as 2SW salmon from the rivers in North America which were monitored in 2005. Rivers are ordered roughly north to south in each region.

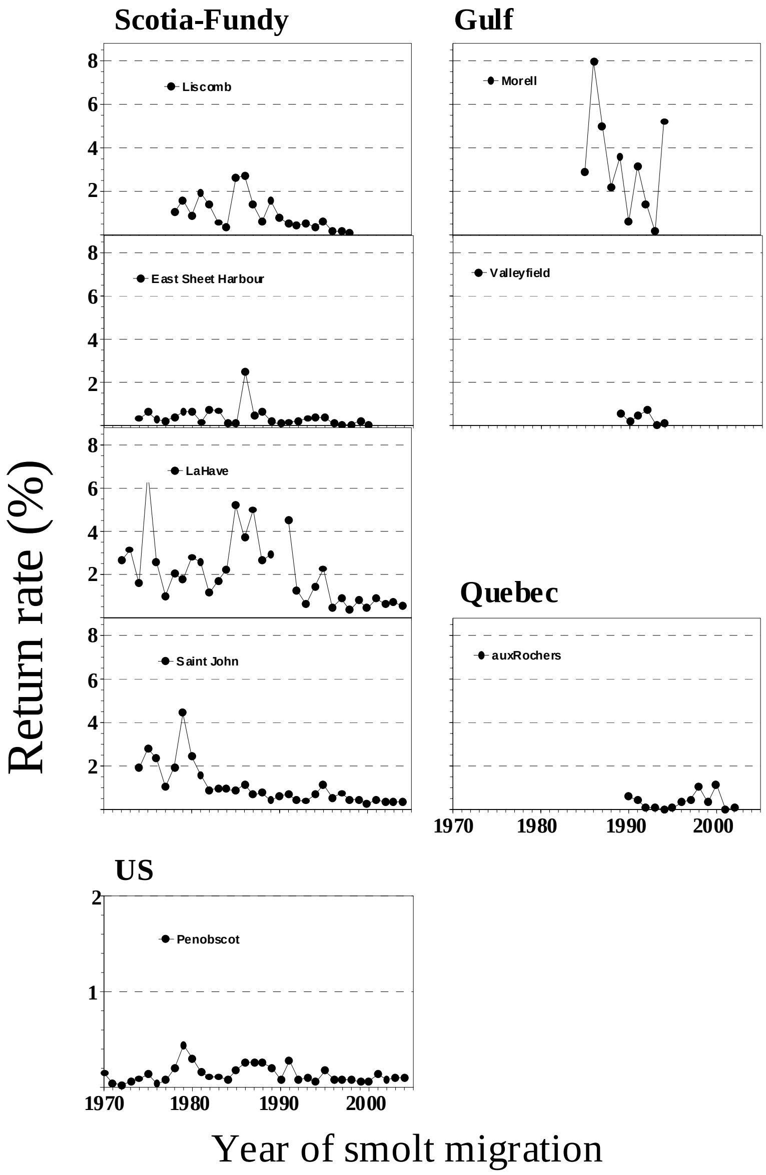


Figure 4.9.9.3. Return rates (%) of hatchery origin smolts to return as 1SW salmon from the rivers in North America which were monitored in 2005. Rivers are ordered roughly north to south in each region.

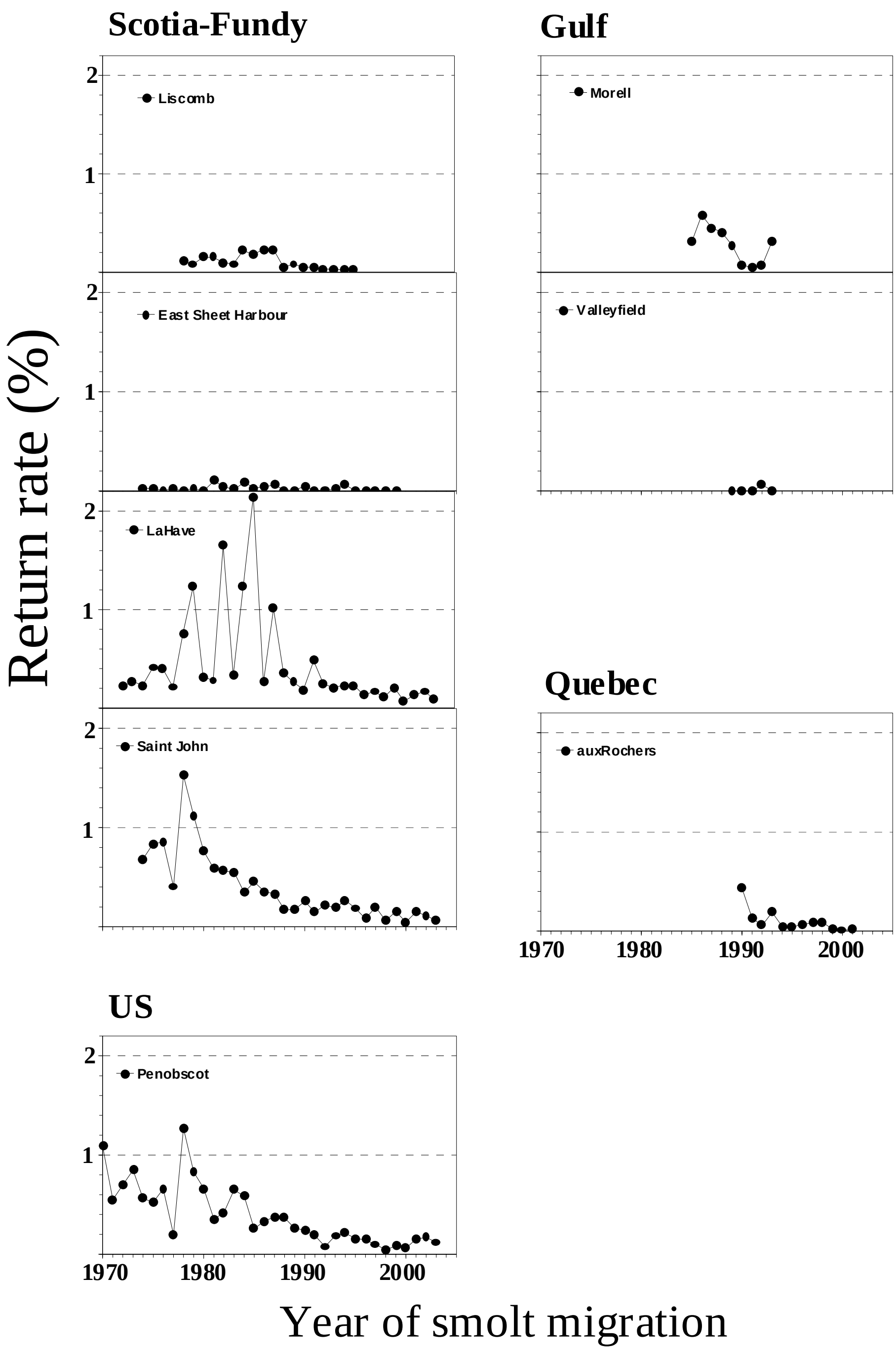


Figure 4.9.9.4. Return rates (%) of hatchery origin smolts to return as 2SW salmon from the rivers in North America which were monitored in 2005. Rivers are ordered roughly north to south in each region.

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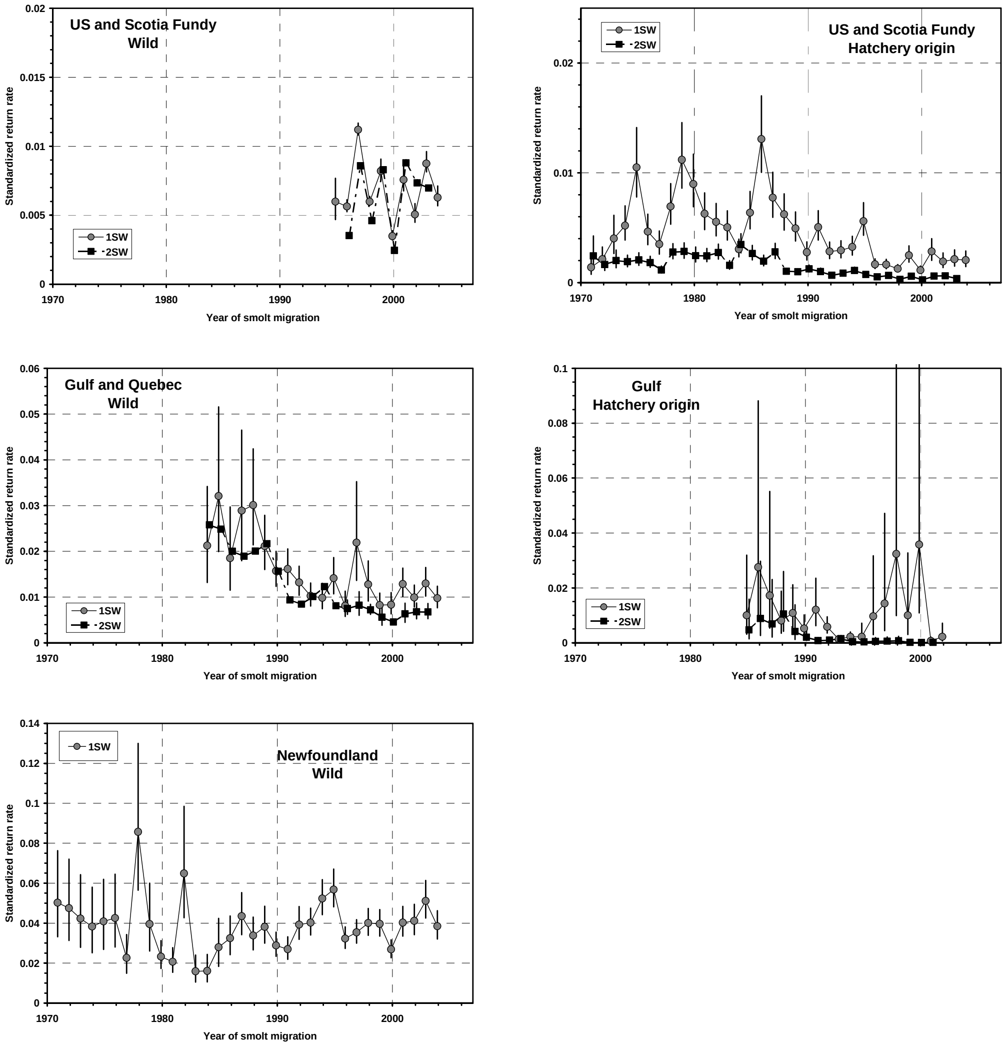


Figure 4.9.9.5. Standardized return rate indices of wild and hatchery origin smolts to adult returns to rivers in the south (USA and Scotia-Fundy), north (Gulf and Québec), and Newfoundland regions. The standardized values are annual means derived from a GLM analysis for a reference river in the each time series, age group, and region. The individual river return rates are summarized in Figure 4.9.1.1 to 4.9.1.4. Survival rates were log transformed prior to analysis.

Figure 4.9.10.1. Prefishery abundance estimate of maturing and non-maturing salmon in North America. Open symbols are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America and the grey symbols for deriving returns to Labrador using returns per unit of drainage area.

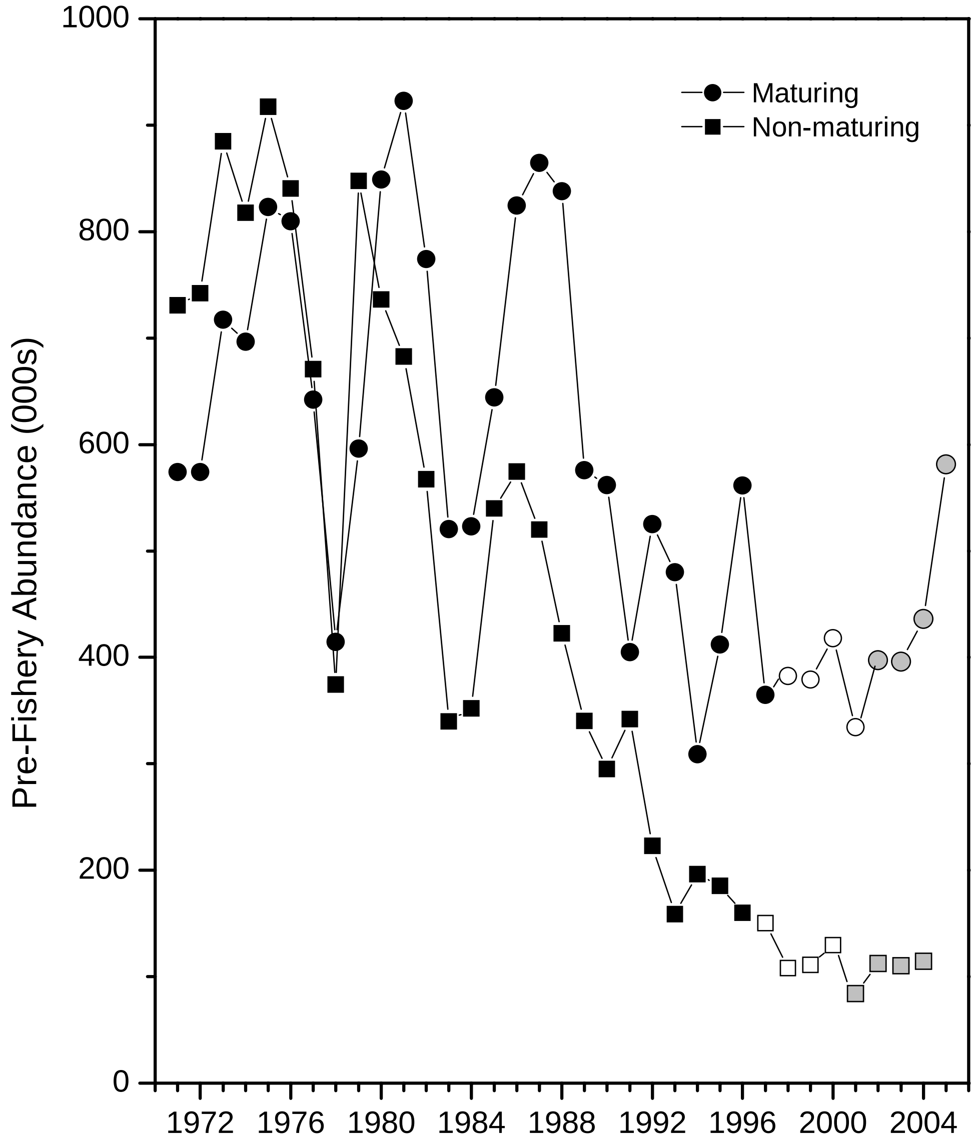
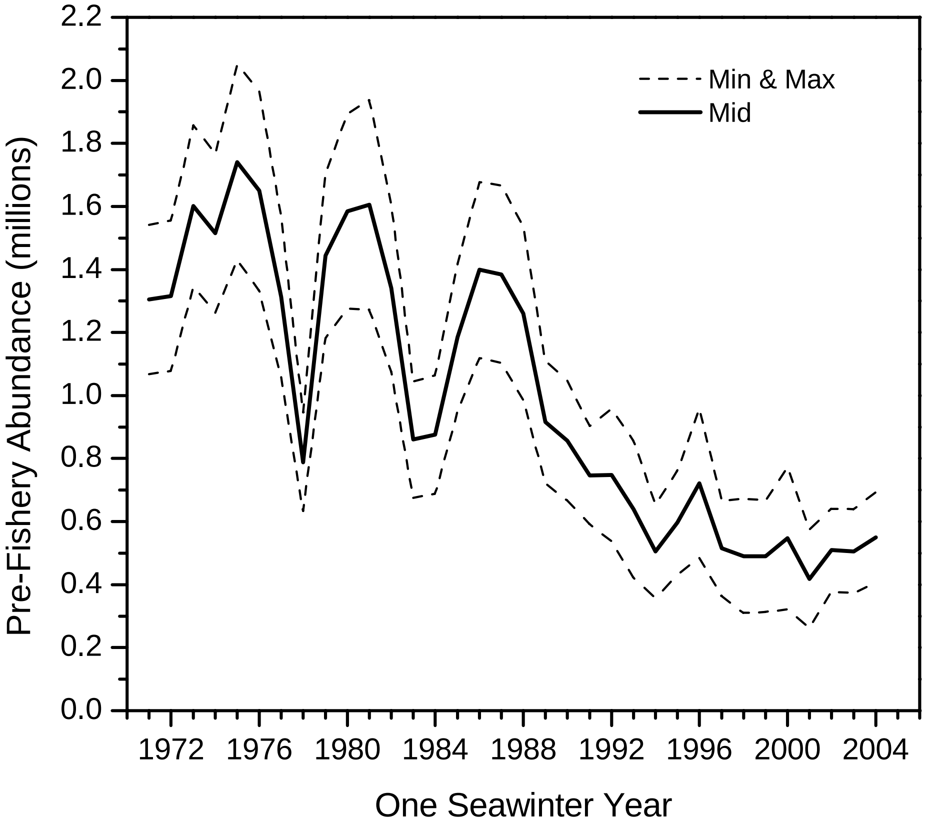


Figure 4.9.10.2. Total 1SW recruits (non-maturing and maturing) originating in North America.



5 ATLANTIC SALMON IN THE WEST GREENLAND COMMISSION

5.1 Status of stocks/exploitation

The Working Group considers the stock complex at West Greenland to be below S_{lim} and thus suffering reduced reproductive capacity.

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, most of which are destined to return to home waters in Europe or North America as MSW fish. The primary MSW European stocks contributing to the fishery in West Greenland are thought to originate from the southern stock complex, although low numbers may originate from other stock complexes. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland. Repeat spawners, including salmon that spawned first as 1-sea-winter, and 2SW salmon also contribute to the fishery.

The Working Group notes that the North American stock complex of non-maturing salmon has declined to among the lowest levels in the time series (Figure 4.9.10.1). The non-maturing 1SW salmon from Southern Europe have been declining steadily since the 1970s (Figure 3.1.1).

In European and North American areas, the overall status of stocks contributing to the West Greenland fishery is among the lowest recorded, and as a result, the status of stocks within the West Greenland area is thought to be extremely low compared to historical levels. Status of stocks in the NEAC and NAC areas are presented in the relevant commission sections (Sections 3.1 and 4.9).

The Working Group noted that tentative exploitation rates for non-maturing 1SW fish at West Greenland can be calculated for each Continent by dividing the recorded harvest of 1SW salmon at West Greenland by the PFA estimate for the corresponding year (Table 5.1.1.1). These exploitation rates in the last five years have averaged around 5% for North American salmon and less than 1% for the Southern European stock.

5.2 Management objectives

For management advice for the West Greenland fishery, NASCO has adopted a precautionary management plan requiring at least a 75% probability of achieving three management objectives:

- Meeting the conservation limits (S_{lim}) simultaneously in the four northern regions of North America: Labrador, Newfoundland, Quebec, and Gulf.
- For the two southern regions in North America, Scotia-Fundy and USA, where there is a zero chance of meeting conservation limits: achieve increases in returns relative to previous years with the hope of rebuilding the stocks. In 2004, ICES established 1992–1996 as the range of years to define the baseline for the Scotia-Fundy and USA regions to assess PFA_{NA} abundance and fishery options. Improvements of greater than 10% and greater than 25% relative to returns during this base period are evaluated. Although, the 25% increase is the limiting factor because if it is achieved, by definition the 10% increase is also achieved.
- Meeting the conservation limits (S_{lim}) for the Southern NEAC MSW complex.

Although not a formal management objective, ICES also provides the probability of returns to North America being equal or less than the previous five-year average. The Working Group recommends that NASCO choose one level (10% or 25%) for the improvements in Scotia-

Fundy and USA returns relative to returns during 1992–1996 to carry forward in catch options.

5.3 Reference points

The reference points for West Greenland catch options are the spawner reserves for North American and Southern European stock complex. These numbers are based on region specific conservation limits derived in three ways. In many regions of North America, the conservation limits are calculated as the number of spawners required to fully seed the wetted area of the river. In some regions of Europe, pseudo stock-recruitment observations are used to calculate a hockey stick relationship, with the inflection point defining the conservation limits. In the remaining regions, the conservation limits are calculated as the number of spawners that will achieve long-term average maximum sustainable yield (MSY), as derived from the adult-to-adult stock and recruitment relationship (Ricker, 1975; ICES, 1993). NASCO has adopted these region specific conservation limits (NASCO, 1998). The conservation limits are limit reference points (S_{lim}), which should be avoided with high probability.

Conservation limits for North America are limited to 2SW salmon and southern European stocks are limited to MSW fish because fish at West Greenland are primarily (> 90%) 1SW non-maturing salmon destined to mature as either 2SW or 3SW salmon. The 2SW spawner limits of salmon stocks from North America total 152 548 fish, with 123 349 required in Canadian rivers and 29 199 in USA rivers (see Section 4.3). Tagging information and biological sampling indicate that the majority of the European salmon caught at West Greenland originate from the southern stock complex. The current conservation limit estimate for Southern European MSW stocks is approximately 275 000 fish (Section 3.3.3). There is still considerable uncertainty in the conservation limits for European stocks and estimates may change from year to year as the input of new data affects the pseudo-stock-recruitment relationship.

Spawner escapement reserve is the number of salmon required at West Greenland to ensure returns to a region the following year achieve region-specific conservation requirements. To calculate escapement spawner reserves, expected losses from natural mortality over the migration time from West Greenland to home rivers (8 months for Southern Europe and 11 months for North America) are added to regional conservation limits. For North America, the calculation assumes that the abundance of returning Atlantic salmon by region in 2006 will be proportional to the abundance of lagged spawners by region in the last five years (Figure 5.3.1). For example, to achieve the Newfoundland 2SW requirement of 4022 2SW salmon, a total of 66 329 fish would be required to leave West Greenland at the PFA_{NA} stage (Table 5.3.1). In the regions with lower stock performance, total PFA_{NA} abundance of about 623 000 fish would be required for the Scotia-Fundy region, and PFA_{NA} abundance of over 2.1 million fish would be required to achieve the USA conservation requirements.

5.4 Management advice

The Working Group followed the process developed last year for providing catch options for West Greenland using the PFA and conservation limits of the NAC and NEAC areas. The risks of the Greenland fishery to NAC and NEAC stock complexes are developed in parallel and combined into a single catch option table.

5.4.1 Catch options for West Greenland

None of the stated management objectives would allow a fishery at West Greenland to take place in 2006, 2007, or 2008.

In the absence of any marine fishing mortality, there is a very low probability (3 %) that the returns of 2SW salmon to North America in 2007 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 5.4.1.1). There is essentially no chance (<1%) that the returns in the southern regions (Scotia-Fundy and USA) will be greater than the returns observed in the 1992–1996 base period. There is a 68% probability that the MSW conservation limit for southern Europe will be met in 2006 (Table 5.4.1.1). Lastly, there is a 65% probability that returns in all regions of North America will be greater than the average of the period 2001 to 2005 in the absence of a fishery (Table 5.4.1.2).

In the absence of any marine fishing mortality, there is a very low probability (3 % probability) that the returns of 2SW salmon to North America in 2008 and 2009 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 5.4.1.1). There is essentially no chance (<1%) that the returns in the southern regions (Scotia-Fundy and USA) will be 10% or 25% greater than the returns observed in the 1992–1996 base period. There is a 60% and 54% probability that the MSW returns for southern Europe will meet the conservation limit in 2008 and 2009 (Tables 5.4.1.1). Lastly, there is a 61% probability for 2008 and a 66% probability for 2009 that returns in all regions of North America will be greater than the average of the period 2001–2005 (Table 5.4.1.2).

5.5 Relevant factors to be considered in management

At its annual meeting in June 2005 NASCO agreed to restrict the fishery at West Greenland *to that amount used for internal subsistence consumption in Greenland, which in the past has been estimated at 20 tons.* Consequently, the Greenlandic authorities set the commercial quota to nil, i.e. landings to fish plants, sale of salmon to shops, and commercial export of salmon from Greenland was forbidden. Licensed fishermen were allowed to sell salmon at the open markets, to hotels, restaurants, and institutions. A private fishery for personal consumption without a license was allowed. All catches, licensed and private, were to be reported to the License Office on a daily basis. In agreement with the Organization for Fishermen and Hunters in Greenland the fishery for salmon was allowed from August 1 to October 31.

5.6 Prefishery abundance forecast for 2006

5.6.1 North American stock complex

The Working Group has described two temporal phases (ICES 2003) of salmon production in the Northwest Atlantic. Lower recruitment rates are evident throughout eastern Canada and USA. The PFA_{NA} forecast for 2006 has a median value of 119 000 (Figure 5.6.1.1).

5.6.2 Southern European MSW stock complex

The southern European PFA forecast for 2006 has a median value of 489 000 (Table 3.6.1.2). The spawning escapement to southern Europe MSW stocks has not exceeded conservation limit throughout most of the time period (Figure 3.1.1).

5.7 Projections for 2007 and 2008

Projections of PFA are made for three years for the NAC and the NEAC. The forecasts for 2007 and 2008 are based on the same models used for the 2006 PFA forecast. For the NAC the same probability of being in the low phase used in 2006 was used.

5.7.1 North American stock complex

For 2007 and 2008, the PFA_{NA} forecasts remain among the lowest in the time series. For 2007, the median value is 114 000 fish and is highly unlikely to meet the 2SW spawner reserve of

212 189 salmon to North America (Figure 5.7.1.1). For 2008, the median forecast value is 120 000, also highly unlikely to meet the 2SW spawner reserve to North America (Figure 5.7.1.2).

5.7.2 Southern European MSW stock complex

The PFA for NEAC MSW southern stock complex is expected to decline in 2007 and 2008 (Figure 3.6.1.1). For 2007, the median value is 461 000 fish and for 2008, the median forecast value is 440 000 fish. It is unlikely that spawner reserves will be met in either year.

5.8 Comparison with previous assessment and advice

The catch option for the West Greenland fishery has been the same since 2003. The current modelling approach has provided stable comparisons of the previous years predictions and updated PFA_{NA} in the last two years. For 2005, the median value of the updated analysis for NAC has increased to 126 000 fish from the 120 400 predicted in the previous year's analysis. The variability of the two predictions was similar. The revised forecast of the southern NEAC MSW PFA for 2005 provides a PFA mid-point of 505 000. This is close to the value forecast last year at this time of 486 000.

5.9 NASCO has requested ICES to describe the events of the 2005 fishery and status of the stocks

5.9.1 Catch and effort in 2005

By the end of the season a total of 13.8 t of landed salmon were reported (Table 5.9.1.1). In total, 145 reports were received, which is lower than the 169 reports last year. Similar to last year, total catches in northern NAFO divisions (1A and 1B; Figure 5.9.1.1) were higher than they generally have been in previous years (Table 5.9.1.2). Catches from the more southerly divisions 1C, 1D, 1E and 1F fluctuated around levels that have been observed in recent years. The temporal distribution of the reported landings varies annually. There is also a portion of the landing reports without data for week (14% in 2005) that are allocated proportionally to the weeks when landings were reported by division. In 2005, catches were lower in standard weeks 33 and 34 than the first week of the season, then increased over the next four weeks and declined thereafter. Harvest in weeks 33 and 34 may were influenced by the opening of an unrestricted harvest season for caribou. It is difficult to interpret if the temporal distribution of reported catches represents changes in stock distribution, in fishing effort, or reporting practice.

The number of active participants in the salmon fishery has decreased sharply since 1987, when more than 500 licenses were active and there was an allowable catch of more than 900 tons. In 2005 there were 185 licenses issued, an increase from approximately 150 in 2003 and 2004. For the 2005 fishery, 75 fishermen, of whom 29 were licensed, reported catches. The number of fishermen reporting catches has steadily increased from 42 to 75 over the last 3 years. Approximately 57% of the licenses were issued in the northern two NAFO Divisions 1A and 1B. Given that sampling has provided more fish than were reported in Nuuk in 2005 and only a low proportion of license holders report catches, this suggested that the nominal catch is underestimated. The Working Group recommends that the Home Rule Government of Greenland provide information on the extent of fishing activity by all license holders. Further, it would be helpful if reports filled out by fishermen offered the option to report date of catch and number of fishing nets.

There is presently no quantitative approach for estimating the magnitude of personal consumption or subsistence fishing. Thus, unreported catch is likely to have been at the same level proposed in recent years (around 10 t).

5.9.2 Biological characteristics of the catches

The international sampling program for landings at West Greenland initiated by NASCO in 2001 was continued in 2005. The sampling teams from Greenland, Ireland, UK (Scotland), UK (England & Wales), and United States were in place at the start of the fishery and continued through October. Tissue and biological samples were collected from four landing sites: Qaqortoq (NAFO Div. 1F), Nuuk (NAFO Div. 1D), Maniitsoq (NAFO Div. 1C), and Qasigiannguit (NAFO Div. 1A) (Figure 5.9.1.1). In total, 854 salmon were inspected for the presence of tags, representing 23 % by weight of the reported landings. Of these 767 were measured for fork length and weight, scales were collected and tissue removed for DNA analysis (Table 5.9.2.1). The broad geographic distribution of the subsistence fishery caused practical problems for the sampling teams. However, temporal coverage was adequate. More salmon have been sampled than reported in the official statistics for the 3rd year in a row in Nuuk, and for the sixth time since 2002 when including all the sampling areas. Where this has occurred, the Working Group adjusted the total landings by replacing the reported catch with the weight of fish sampled to use in assessment calculations (Table 5.9.2.2).

The smallest fish sampled was 56 cm fork length and weighed 1.36 kg gutted weight while the largest was 87 cm and weighed 8.94 kg gutted weight. The average weight of a fish from the 2005 catch was 3.31 kg across all ages, with North American 1SW fish averaging 65.9 cm and European 1SW fish averaging 66.4 cm in length (Table 5.9.2.2). The mean lengths and mean weights for the 2005 samples were among the highest in the last decade. It should be noted that the average weight is not adjusted for standard week and may not represent a true increase in mean weight over years. The Working Group recommends that for proper comparison among years, the mean weights be standardized to a common time period (week).

North American salmon up to river age 6 were caught at West Greenland in 2005 (Table 5.9.2.4), with approximately 36% being river age 3 and 31% being river age 4. The river ages of European salmon ranged from 1 to 5 (Table 5.9.2.4). Over half (60.5%) of the European fish in the catch were river-age 2 and 15% were river age 3. The proportion of the European origin river age 1 salmon in the catch has ranged been between 9% and 19% since 2001 (Table 5.9.2.4).

In 2005, 96.7 % of the European samples were 1SW salmon, with previous spawners 2.2% of the samples (Table 5.9.2.5). 1SW salmon dominated (94.2%) the North American component, with repeat spawners increasing from 2.2 to 6.4% of the samples compared to last year (Table 5.9.2.5).

Tissue for disease testing was obtained from 81 whole fish in Nuuk. These samples were tested for the presence of ISAv by RT-PCR assay only and all test results were negative. The sex was determined by examining gonads for 148 salmon (95 whole and 53 viscera); of these 16 (11%) were males and 132 (89%) females.

5.9.3 Continent of origin of catches at West Greenland

All 767 samples collected for genetic characterization were genotyped at 11 microsatellites (Ssa14, Ssa289, SSOSL25, SSOSL85, SSOSL311, SSOSL438, Ssa85, Ssa171, Ssa197, Ssa202, and SSLEEN82). A database of approximately 5000 Atlantic salmon genotypes of known origin was used as a baseline to assign these 767 salmon to continent of origin. In total, 76.3% of the salmon sampled from the 2005 fishery were of North American origin and 23.7% fish were of European origin (Table 5.1.1.1).

The continent of origin of the samples varied among the divisions in 2005 (see table below) (Chi Square of 1C, 1D, 1F p =0.006). While 28% of the catch was reported for Division 1A and 1B, the continent of origin was available for only one fish. The Working Group recommends a broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery.

NAFO division	North America		Europe	
	Number	%	Number	%
1 A	1			
1C	130	80.8	31	19.2
1D	354	77.8	101	22.2
1F	100	66.7	50	33..3

Applying the continental percentages to the adjusted total catch (15.8 t) resulted in estimates of 12.1 t of North American origin and 3.7 t of European origin fish (3700 and 1200 rounded to the nearest 100 fish, respectively) landed in West Greenland in 2005 (Table 5.1.1.1 and Figure 5.9.3.1).

5.9.4 Elaboration on status of the stocks in the West Greenland Commission area

MSW stocks from North America and southern Europe contribute to the fishery at West Greenland. The percentage of North American salmon in the West Greenland catch has averaged approximately 70% from 2000–2005 (Table 5.1.1.1).

5.9.4.1 North American Stock

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has declined since the 1970s (Figure 4.9.10.1). During 1993–2005, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972–1990. The decline from earlier higher levels of abundance has been more severe for the 2SW salmon component than for the small salmon (maturing 1SW salmon) age group.

In most regions, the returns of 2SW fish in 2005 increased slightly from 2004, however, they are still close to the lower end of the 35-year time-series (1971–2005). In 2005, the estimated overall spawning escapement was below the conservation limit (S_{lim}) for the stock complex. Specifically 2SW spawners in the regions are:

- **Newfoundland:** at risk of suffering reduced reproductive capacity (132% of 2SW S_{lim})
- **Labrador:** suffering reduced reproductive capacity (38% of 2SW S_{lim})
- **Québec:** suffering reduced reproductive capacity (70% of 2SW S_{lim})
- **Gulf of St. Lawrence**: suffering reduced reproductive capacity (86% of 2SW S_{lim})
- **Scotia-Fundy:** suffering reduced reproductive capacity (6% of 2SW S_{lim}) with Inner Bay of Fundy stocks listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada
- **United States:** suffering reduced reproductive capacity (4% of 2SW S_{lim}) with stocks in the Gulf of Maine Distinct Population Segment listed as Endangered under the Endangered Species Act

5.9.4.2 Southern European Stock

Estimates of pre-fishery abundance suggest a downward trend in Southern European MSW adult salmon over the last 10 years. The midpoint of spawners has been close to or below conservation limits (S_{lim}) in recent years. Specifically:

- **<u>Southern European stock complex:</u>** suffering reduced reproductive capacity (94% of 2SW S_{lim})

5.10 NASCO has requested ICES to provide a detailed explanation and critical examination of any changes to the models used to provide catch options

The forecast models used to estimate pre-fishery abundance of non-maturing 1SW salmon for North America in 2006 was the same as those used in 2004 and 2005 (ICES, 2004, 2005). The approach accounts for uncertainty in the data and in model selection. The overall approach of modelling the natural log transformed PFA_{NA} and LS_{NA} using linear regression and the Monte Carlo method used to derive the probability density for the PFA_{NA} forecast was also retained from previous years.

The modelling to forecast pre-fishery abundance of non-maturing (potential MSW) salmon from the Southern European stock group (ICES, 2002, 2003) was similar to previous years (see Section 3.6). The approach is to select the best model by adding variables (eg. spawners, habitat, PFA of maturing 1SW salmon and year) until addition of any other parameter was not significant (ICES, 2004).

5.10.1 Run-reconstruction models

The Working Group has used run-reconstruction model to estimate pre-fishery abundance of 1SW non-maturing and maturing 2SW fish adjusted by natural mortality to the time prior to the West Greenland fishery (Section 4.9.10 and Section 3.9.9).

5.10.2 Forecast models for pre-fishery abundance of 2SW salmon

For the Southern European stock group the full model considered to forecast the pre-fishery abundance of non-maturing (potential MSW) salmon from the (ICES, 2002, 2003) was:

$$PFA = Spawners^{\lambda} \times e^{\beta_0 + \beta_1 Habitat + \beta_2 \log(PFAm) + \beta_3 Year + noise}$$

where *Spawners* are expressed as lagged egg numbers, *PFAm* refers to pre-fishery abundance of maturing 1SW salmon and the habitat term previously used in the North American model (ICES, 2003). The best model for 2006 was selected by adding variables (eg. spawners, habitat, PFA of maturing 1SW salmon and year) until addition of any other parameter was not significant, as has been done in the past (ICES, 2004).

As in 2005, the variables were significant, *Spawners* and *Year* were significant and the model used was:

$$\text{Log}(PFA/Spawners) = -1.307\log(Spawners) + 118.7 - 0.050 Year$$

For North America, a two-phase regression between pre-fishery abundance (PFA_{NA}) and lagged spawners (LS_{NA}) was updated with the addition of the 2004 PFA_{NA} estimate (Figure 5.10.2.1). The relative recruits (PFA_{NA}) per spawner index (LS_{NA}) has declined from an average of 5.7 during 1978-1989 to an average of 1.9 during the period 1990 to 2004 (Figure 5.10.2.1). As in 2005, a number of models were examined including two models without phase shifts, plus five models with phase shifts and with eight possible break year points (1986–1993) for each model. In each simulation the most parsimonious model was selected using Akaike's Information Criterion and this selected model was used to generate a value for the probability density for the 2006 PFA_{NA}. Simulation methods, in the software package SAS (SAS Institute, 1996), were used to generate the probability density function of PFA_{NA} (Annex 6).

For phase shift models, the probability of being in either phase was based on changes in PFA_{NA} from year t to year t-2 (Figure 5.10.2.1). The approach taken in 2006 was identical to the method used in previous years. The two-year lag is used because current year PFA (i.e 2005) is not available due to its dependence upon 2SW returns in the next year.

Although it was possible that up to 42 combinations of model and break year (8 years * 5 regressions + 2 regressions without break years) might be represented in estimating the distribution of PFA_{NA}, those selected most often were model numbers 2 and 6 and break years 1988 through 1992 (Table 5.10.2.1; 5.10.2.2). The lagged spawner variable was informative for PFA_{NA} in 70% of the simulated data sets. In such cases, the break years describing the phase shift were mostly 1991 and to lesser extents, 1988, 1989 and 1992. The proportional model with the intercept through the origin was selected most often (62% of all models). For the 2006 forecast of PFA_{NA}, the probability (runs/10 000) of being in the high phase was negligible (1.9%) and the probability of being in the lower productivity phase was over 98% (Table 5.10.2.2).

These estimates were then used to develop the risk analysis and catch options presented in Section 5.4. Managers may use this information to determine the relative risks to the stock complex (i.e., not meeting spawning limits S_{lim}) versus the fishery (e.g., size of catches).

5.10.3 Development and risk assessment of catch options

The provision of catch options in a risk framework involves incorporating the uncertainty in the factors used to develop the catch options. The ranges in the uncertainties of all the factors will result in assessments of differing levels of precision. The analysis of risk involves four steps: 1) identifying the sources of uncertainty; 2) describing the precision or imprecision of the assessment; 3) defining a management strategy; and 4) evaluating the probability of an event (either desirable or undesirable) resulting from the fishery action. Atlantic salmon are managed with the objective of achieving spawning conservation limits (S_{lim}). The undesirable event to be assessed is that the spawning escapement after fisheries will be below the conservation limit.

The risk assessment for the two stock complexes in the West Greenland fishery is developed in parallel and then combined at the end of the process into a single summary plot or catch options table (Figure 5.10.3.1). The primary inputs to the risk analysis for the complex at West Greenland are:

- PFA forecast for the year of the fishery; PFA_{NA} and PFA_{NEAC}
- Harvest level being considered (t of salmon)
- Conservation spawning limits

The uncertainty in the PFA_{NA} and PFA_{NEAC} is accounted for in the approaches described in Section 5.10. The number of fish of North American and European origin in a given catch (t) is conditioned by the continent of origin of the fish ($prop_{NA}$, $prop_E$), by the average weight of the fish in the fishery ($Wt1SW_{NA}$, $Wt1SW_E$) and a correction factor by weight for the other age groups in the fishery (ACF). For the 2006 to 2008 fisheries, it was assumed that the parameters for $Wt1SW_{NA}$ (2.84–3.19 kg), $Wt1SW_E$ (2.92–3.33 kg), $prop_{NA}$ (0.67–0.74), and the ACF (1.017–1.030) could vary uniformly within the values observed in the past five years.

For a level of fishery under consideration, the weight of the catch is converted to fish of each continent's origin and subtracted from one of the simulated forecast values of PFA_{NA}. The fish that escape the Greenland fishery are immediately discounted by the fixed sharing fraction (F_{NA}) historically used in the negotiations of the West Greenland fishery. The sharing fraction chosen is the 40:60 West Greenland:North America split. Any sharing fraction can be considered and incorporated at this stage of the risk assessment. After the fishery, fish returning to home waters are discounted for natural mortality from the time they leave West

Greenland to the time they return to rivers. For North America this is a total of 11 months at a rate of M = 0.03 (equates to 28.1% mortality). For Southern European stocks this is a total of 8 months at a rate of M = 0.03 (equates to 21% mortality). The fish that survive to North American homewaters are then distributed among the regions and the total fish escaping to each region is compared to the region's 2SW spawning requirements.

The final step in the risk analysis of the catch options involves combining the conservation requirement with the probability distribution of the returns to North America for different catch options. The returns to North America are partitioned into regional returns based on the regional proportions of 2SW returns of the last five years, 2001 to 2005. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and USA are compared to the objective of achieving an increase of 10% and 25% relative to average returns of the base period, 1992–1996.

5.10.4 Critical evaluation

Critical evaluations of updates to the model input data were documented during the process of developing catch options in the previous section.

- The lagged spawner variables used in the models for the forecast periods were among the lower values in the series used to predict PFA. The uncertainty of associations increases as the predictor variable gets farther from the mean, which has been the case for the 2006 and 2008 projections.

5.11 NASCO has requested ICES to provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved

NASCO management is directed at reducing exploitation to allow river specific conservation limits to be achieved. The first measurable outcome of management at West Greenland is that the fishery caught no more than the negotiated amount. The other measures relate to increasing spawning escapement in homewaters. Although influenced by measures taken in homewaters, it is possible to directly evaluate the extent to which management at West Greenland successfully achieved the objectives (Table 5.11.1).

To date the objective of simultaneous attainment of conservation limits in Labrador, Newfoundland, Quebec and Gulf of St Lawrence has not been achieved. Nor has there been a 10% or 25% increase in spawners to either Scotia-Fundy or the USA. The objective of meeting the conservation limits (S_{lim}) for the Southern NEAC MSW complex has not as yet been achieved.

Table 5.1.1.1. The catch weighted numbers of North American (NA) and European (E) Atlantic salmon caught at West Greenland 1982-1992 and 1995-2005 and PFA for non-maturing 1SW fish for North America and Southern European stock complexes. Catch numbers are rounded to the nearest hundred fish.

Year	Numbers of Salmon caught		PFA non-maturing 1SW	
	NA	E	NA	E
1982	130 900	204 700	567 300	1 550 200
1983	314 900	302 500	339 900	1 088 700
1984	229 000	425 300	352 300	1 267 000
1985	291 200	56 5300	540 000	1 703 900
1986	221 200	393 200	574 600	1 286 500
1987	274 500	285 700	520 200	1 631 400
1988	230 300	305 300	422 800	1 490 000
1989	286 300	364 400	340 100	1 172 800
1990	166 300	220 400	295 200	833 300
1991	199 100	243 400	342 200	1 044 800
1992	126 400	167 500	222 900	907 400
1995	22 100	10 400	185 200	758 700
1996	23 400	8700	160 200	584 900
1997	17 200	4300	150 300	531 300
1998	3200	900	108 100	543 100
1999	5600	700	111 000	652 000
2000	5800	2500	129 600	634 900
2001	9900	4500	84 200	571 700
2002	2300	1100	112 400	629 900
2003	2800	1300	110 400	660 600
2004	4000	1500	114 600	533 600
2005	3700	1200		

Table 5.3.1. A – Lagged spawners achieved, 2SW conservation limits and the PFA number of fish required to meet region specific conservation limits if the returns to the regions are in proportion to the average lagged spawner distributions of 1998 to 2005. B – 2SW returns to the regions of North America for two time periods, 1992–1996, 1999–2005. C – Management objectives for the NAC area used to develop the risk analysis of catch options for the 2006 fishery.

A - Achieved lagged spawners							
Year of PFA	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America
2000	14110	4219	22055	32847	7845	1893	82970
2001	22173	5307	22898	25088	6056	1575	83097
2002	22675	5786	20286	20650	3449	1303	74149
2003	20485	6202	18121	15067	3727	1439	65041
2004	27626	6202	18894	14029	3043	1518	71312
2005	23828	6460	19796	18116	3307	878	72385
% of North America (2001-2005)							
	31.9	8.2	27.3	25.4	5.4	1.8	
2SW Conservation Limit							
Number of fish	34,746	4,022	29,446	30,430	24,705	29,199	152,548
% of NA	22.8	2.6	19.3	19.9	16.2	19.1	
Spawner Reserve corrected for 11 months of M at 0.03 per month							212,189
PFA required to meet regional 2SW conservation limit based on average lagged spawner contributions 2001-2005							
	151,456	66,329	145,479	161,734	623,265	2,148,881	

B - 2SW Returns to Regions and North America							
	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America
1992-1996	16,865	4,855	46,379	38,288	8,781	2,038	117,206
2001-2005	13,630	4,392	28,808	23,092	2,563	952	73,437

C - Management objectives for the NAC area							
	Northern regions				Southern regions		
	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	
	2SW Conservation Limit				Average returns during base period 1992-1996		
Number of fish	34,746	4,022	29,446	30,430	8,781	2,038	
	2SW Conservation Limit				Increase relative to base period		
Total				98,644	9,659	2,242	10%
					10,976	2,548	25%

Table 5.4.1.1. Catch options (t) for West Greenland harvest in 2006, 2007, and 2008 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2006				
West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.029	0.003	0.002	0.685
5	0.027	0.003	0.001	0.681
10	0.026	0.003	0.001	0.677
15	0.024	0.003	0.001	0.672
20	0.023	0.002	0.001	0.668
25	0.022	0.002	0.001	0.661
30	0.021	0.002	0.001	0.656
35	0.019	0.002	0.001	0.650
40	0.018	0.002	0.001	0.646
45	0.017	0.002	0.001	0.641
50	0.016	0.002	0.001	0.636
100	0.010	0.001	**0.001**	0.592

2007				
West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.030	0.006	0.003	0.602
5	0.028	0.006	0.003	0.599
10	0.026	0.006	0.003	0.596
15	0.025	0.006	0.003	0.590
20	0.024	0.006	0.003	0.586
25	0.023	0.005	0.003	0.581
30	0.022	0.005	0.003	0.577
35	0.021	0.005	0.003	0.572
40	0.020	0.005	0.003	0.567
45	0.019	0.004	0.003	0.561
50	0.019	0.004	0.003	0.557
100	0.013	0.003	0.002	0.506

Cont.

Table 5.4.1.1. Continued. Catch options (t) for West Greenland harvest in 2006, 2007, and 2008 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2008				
West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.032	0.007	0.004	0.537
5	0.031	0.007	0.004	0.533
10	0.030	0.006	0.004	0.526
15	0.028	0.006	0.004	0.521
20	0.027	0.006	0.004	0.517
25	0.026	0.006	0.004	0.511
30	0.024	0.006	0.003	0.506
35	0.024	0.006	0.003	0.501
40	0.023	0.006	0.003	0.495
45	0.021	0.005	0.003	0.490
50	0.020	0.005	0.003	0.487
100	0.014	0.004	0.002	0.438

(Lab, NF, Queb, Gulf) = Labrador, Newfoundland, Quebec, Gulf

(SF, USA) = Scotia-Fundy and USA

A sharing arrangement of 40:60 (Fna) was assumed.

Table 5.4.1.2. Probability of 2SW returns in 2007, 2008, and 2009 being less than the previous five-year average (2001–2005) returns to regions of North America, relative to catch options at West Greenland.

West Greenland Harvest	2007	2008	2009
Tons	Probability	Probability	Probability
0	0.345	0.393	0.339
5	0.370	0.418	0.365
10	0.397	0.446	0.393
15	0.421	0.471	0.415
20	0.450	0.496	0.439
25	0.473	0.519	0.466
30	0.498	0.540	0.489
35	0.523	0.565	0.514
40	0.546	0.587	0.538
45	0.567	0.610	0.561
50	0.586	0.632	0.585
100	0.765	0.792	0.768

Table 5.9.1.1. Nominal catches of salmon, West Greenland 1977–2005 (metric tons round fresh weight).

YEAR	TOTAL		QUOTA	
1977	1420		1191	
1978	984		1191	
1979	1395		1191	
1980	1194		1191	
1981	1264		12 652	
1982	1077		12 532	
1983	310		1 191	
1984	297		870	
1985	864		852	
1986	960		909	
1987	966		935	
1988	893			3
1989	337			3
1990	274			3
1991	472		840	
1992	237		2584	
1993		1	895	
1994		1	1375	
1995	83		77	
1996	92		1744	
1997	58		57	
1998	11		206	
1999	19		206	
2000	21		206	
2001	43		1147	
2002	9	10	55	5 8 9
2003	9	10	20	6 8 9
2004	15	10	20	6 8
2005	14	10	20	6 8

[1] The fishery was suspended.
[2] Quota corresponds to specific opening dates of the fishery.
[3] Quota for 1988-90 was 2 520 t with an opening date of 1 August and annual catches not to exceed the annual average (840 t) by more than 10%. Quota adjusted to 900 t in 1989 and 924 t in 1990 for later opening dates.
[4] Set by Greenland authorities.
[5] Quotas were bought out.
[6] Fishery restricted to catches used for internal consumption in Greenland.
[7] Calculated final quota in ad hoc management system.
[8] No factory landing allowed.
[9] Maximum allowable catch
[10] For the assessments the Working Group used higher catch figures for 2002 and 2003 based on information from the sampling programme.

Table 5.9.1.2. Distribution of nominal catches (metric tons) by Greenland vessels (1977-2005).

Year	NAFO Division							Total		
	1A	1B	1C	1D	1E	1F	NK	West Greenland	East Greenland	Greenland
1977	201	393	336	207	237	46	-	1 420	6	1 426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1 395	+	1 395
1980	52	275	404	231	158	74	-	1 194	+	1 194
1981	105	403	348	203	153	32	20	1 264	+	1 264
1982	111	330	239	136	167	76	18	1 077	+	1 077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993 [1]	-	-	-	-	-	-	-	-	-	-
1994 [1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	4	-	14	-	14

[1] The fishery was suspended
\+ Small catches <0.5 t
\- No catch

Table 5.9.2.1. Reported landings provided by the Home Rule Government at West Greenland Atlantic salmon fisheries (kg) by NAFO Division for the 2002–2005 and adjusted landings for divisions where the sampling teams observed more fish landed than were reported.

Year		NAFO Division						
		1A	1B	1C	1D	1E	1F	Total
2002	Reported	14	78	2100	3752	1417	1661	9022
	Adjusted						2408	9769
2003	Reported	619	17	1621	648	1274	4516	8694
	Adjusted			1782	2709		5912	12 312
2004	Reported	3476	611	3516	2433	2609	2068	14 712
	Adjusted				4929			17 209
2005	Reported	1166	2811	2018	681	2646	4465	13 786
	Adjusted				2730			15 835

Table 5.9.2.2. Size of biological samples and percentage (by number) of North American and European salmon in research vessel catches at West Greenland (1969–82) from commercial samples (1978–92 1995–97 and 2001) and from local consumption samples (1998–2000 and 2002–2005).

		Sample Size		Continent of origin (%)			
Source		Length	Scales	NA	(95%CI)[1]	E	(95%CI)
Research	1969	212	212	51	(57,44)	49	(56,43)
	1970	127	127	35	(43,26)	65	(75,57)
	1971	247	247	34	(40,28)	66	(72,50)
	1972	3488	3488	36	(37,34)	64	(66,63)
	1973	102	102	49	(59,39)	51	(61,41)
	1974	834	834	43	(46,39)	57	(61,54)
	1975	528	528	44	(48,40)	56	(60,52)
	1976	420	420	43	(48,38)	57	(62,52)
	1978[2]	606	606	38	(41,34)	62	(66,59)
	1978[3]	49	49	55	(69,41)	45	(59,31)
	1979	328	328	47	(52,41)	53	(59,48)
	1980	617	617	58	(62,54)	42	(46,38)
	1982	443	443	47	(52,43)	53	(58,48)
Commercial	1978	392	392	52	(57,47)	48	(53,43)
	1979	1653	1653	50	(52,48)	50	(52,48)
	1980	978	978	48	(51,45)	52	(55,49)
	1981	4570	1930	59	(61,58)	41	(42,39)
	1982	1949	414	62	(64,60)	38	(40,36)
	1983	4896	1815	40	(41,38)	60	(62,59)
	1984	7282	2720	50	(53,47)	50	(53,47)
	1985	13272	2917	50	(53,46)	50	(54,47)
	1986	20394	3509	57	(66,48)	43	(52,34)
	1987	13425	2960	59	(63,54)	41	(46,37)
	1988	11047	2562	43	(49,38)	57	(62,51)
	1989	9366	2227	56	(60,52)	44	(48,40)
	1990	4897	1208	75	(79,70)	25	(30,21)
	1991	5005	1347	65	(69,61)	35	(39,31)
	1992	6348	1648	54	(57,50)	46	(50,43)
	1995	2045	2045	68	(72,65)	32	(35,28)
	1996	3341	1297	73	(76,71)	27	(29,24)
	1997	794	282	80	(84,75)	20	(25,16)
Local consumption	1998	540	406	79	(84,73)	21	(27,16)
	1999	532	532	90	(97,84)	10	(16,3)
	2000	491	491	70		30	
Commercial	2001	4721	2655	69	(71,67)	31	(33,29)
Local consumption	2002	501	501	68		32	
	2003	1743	1743	68		32	
	2004	1639	1639	73		27	
	2005	767	767	76		24	

Table 5.9.2.3. Annual mean fork lengths (cm) and whole weights (kg) of Atlantic salmon caught at West Greenland 1969–1992 and 1995–2005. NA = North America; E = Europe.

	Whole weight (kg) Sea age & origin									Fork length (cm) Sea age & origin					
	1SW		2SW		PS		All sea ages		TOTAL	1SW		2SW		PS	
	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.9	2.63	2.84	2.71	62.3	63.6	85.7	84	79.4	87.0
1998	2.72	2.83	6.44	-	3.28	4.77	2.76	2.84	2.78	62.0	62.7	84.0	-	66.3	76.0
1999	3.02	3.03	7.59	-	4.2	-	3.09	3.03	3.08	63.8	63.5	86.6	-	70.9	-
2000	2.47	2.81	-	-	2.58	-	2.47	2.81	2.57	60.7	63.2	-	-	64.7	-
2001	2.89	3.03	6.76	5.96	4.41	4.06	2.95	3.09	3	63.1	63.7	81.7	79.1	75.3	72.1
2002	2.84	2.92	7.12	-	5	-	2.89	2.92	2.9	62.6	62.1	83	-	75.8	-
2003	2.94	3.08	8.82	5.58	4.04	-	3.02	3.10	3.04	63.0	64.4	86.1	78.3	71.4	-
2004	3.11	2.95	7.33	5.22	4.71	6.48	3.17	3.22	3.18	64.7	65.0	86.2	76.4	77.6	88
2005	3.19	3.33	7.05	4.19	4.31	2.89	3.31	3.33	3.31	65.9	66.4	83.3	75.5	73.7	62.3

Table 5.9.2.4. River age distribution (%) and mean river age for all North American and European origin salmon caught at West Greenland 1968–1992 and 1995–2005.

YEAR	1	2	3	4	5	6	7	8
					North American			
1968	0.3	19.6	40.4	21.3	16.2	2.2	0	0
1969	0	27.1	45.8	19.6	6.5	0.9	0	0
1970	0	58.1	25.6	11.6	2.3	2.3	0	0
1971	1.2	32.9	36.5	16.5	9.4	3.5	0	0
1972	0.8	31.9	51.4	10.6	3.9	1.2	0.4	0
1973	2	40.8	34.7	18.4	2	2	0	0
1974	0.9	36	36.6	12	11.7	2.6	0.3	0
1975	0.4	17.3	47.6	24.4	6.2	4	0	0
1976	0.7	42.6	30.6	14.6	10.9	0.4	0.4	0
1978	2.7	31.9	43	13.6	6	2	0.9	0
1979	4.2	39.9	40.6	11.3	2.8	1.1	0.1	0
1980	5.9	36.3	32.9	16.3	7.9	0.7	0.1	0
1981	3.5	31.6	37.5	19	6.6	1.6	0.2	0
1982	1.4	37.7	38.3	15.9	5.8	0.7	0	0.2
1983	3.1	47	32.6	12.7	3.7	0.8	0.1	0
1984	4.8	51.7	28.9	9	4.6	0.9	0.2	0
1985	5.1	41	35.7	12.1	4.9	1.1	0.1	0
1986	2	39.9	33.4	20	4	0.7	0	0
1987	3.9	41.4	31.8	16.7	5.8	0.4	0	0
1988	5.2	31.3	30.8	20.9	10.7	1	0.1	0
1989	7.9	39	30.1	15.9	5.9	1.3	0	0
1990	8.8	45.3	30.7	12.1	2.4	0.5	0.1	0
1991	5.2	33.6	43.5	12.8	3.9	0.8	0.3	0
1992	6.7	36.7	34.1	19.1	3.2	0.3	0	0
1995	2.4	19	45.4	22.6	8.8	1.8	0.1	0
1996	1.7	18.7	46	23.8	8.8	0.8	0.1	0
1997	1.3	16.4	48.4	17.6	15.1	1.3	0	0
1998	4	35.1	37	16.5	6.1	1.1	0.1	0
1999	2.7	23.5	50.6	20.3	2.9	0.0	0.0	0
2000	3.2	26.6	38.6	23.4	7.6	0.6	0	0
2001	1.9	15.2	39.4	32	10.8	0.7	0	0
2002	1.5	27.4	46.5	14.2	9.5	0.9	0	0
2003	2.6	28.8	38.9	21	7.6	1.1	0	0
2004	1.9	19.1	51.9	22.9	3.7	0.5	0	0
2005	2.7	21.4	36.3	30.5	8.5	0.5	0	0
Mean	2.9	32.6	38.6	17.7	6.8	1.2	0.1	0.0

Table 5.9.2.4. cont. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland 1968–1992 and 1995–2005.

YEAR	1	2	3	4	5	6	7	8
				European				
1968	21.6	60.3	15.2	2.7	0.3	0	0	0
1969	0	83.8	16.2	0	0	0	0	0
1970	0	90.4	9.6	0	0	0	0	0
1971	9.3	66.5	19.9	3.1	1.2	0	0	0
1972	11	71.2	16.7	1	0.1	0	0	0
1973	26	58	14	2	0	0	0	0
1974	22.9	68.2	8.5	0.4	0	0	0	0
1975	26	53.4	18.2	2.5	0	0	0	0
1976	23.5	67.2	8.4	0.6	0.3	0	0	0
1978	26.2	65.4	8.2	0.2	0	0	0	0
1979	23.6	64.8	11	0.6	0	0	0	0
1980	25.8	56.9	14.7	2.5	0.2	0	0	0
1981	15.4	67.3	15.7	1.6	0	0	0	0
1982	15.6	56.1	23.5	4.2	0.7	0	0	0
1983	34.7	50.2	12.3	2.4	0.3	0.1	0.1	0
1984	22.7	56.9	15.2	4.2	0.9	0.2	0	0
1985	20.2	61.6	14.9	2.7	0.6	0	0	0
1986	19.5	62.5	15.1	2.7	0.2	0	0	0
1987	19.2	62.5	14.8	3.3	0.3	0	0	0
1988	18.4	61.6	17.3	2.3	0.5	0	0	0
1989	18	61.7	17.4	2.7	0.3	0	0	0
1990	15.9	56.3	23	4.4	0.2	0.2	0	0
1991	20.9	47.4	26.3	4.2	1.2	0	0	0
1992	11.8	38.2	42.8	6.5	0.6	0	0	0
1995	14.8	67.3	17.2	0.6	0	0	0	0
1996	15.8	71.1	12.2	0.9	0	0	0	0
1997	4.1	58.1	37.8	0	0	0	0	0
1998	28.6	60.0	7.6	2.9	0.0	1.0	0	0
1999	27.7	65.1	7.2	0	0	0	0	0
2000	36.5	46.7	13.1	2.9	0.7	0	0	0
2001	16	51.2	27.3	4.9	0.7	0	0	0
2002	9.4	62.9	20.1	7.6	0	0	0	0
2003	16.2	58	22.1	3	0.8	0	0	0
2004	18.3	57.7	20.5	3.2	0.2	0	0	0
2005	19.2	60.5	15	5.4	0	0	0	0
Mean	18.7	61.3	17.1	2.5	0.3	0.0	0.0	0.0

[1] Catches for local consumption only.

Table 5.9.2.5. Sea-age composition (%) of samples from fishery landings at West Greenland 1985–2005 by continent of origin.

	North American			European		
Year	1SW	2SW	Previous Spawners	1SW	2SW	Previous Spawners
1985	92.5	7.2	0.3	95	4.7	0.4
1986	95.1	3.9	1	97.5	1.9	0.6
1987	96.3	2.3	1.4	98	1.7	0.3
1988	96.7	2	1.2	98.1	1.3	0.5
1989	92.3	5.2	2.4	95.5	3.8	0.6
1990	95.7	3.4	0.9	96.3	3	0.7
1991	95.6	4.1	0.4	93.4	6.5	0.2
1992	91.9	8	0.1	97.5	2.1	0.4
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	96.8	1.5	1.7	97.3	2.2	0.5
1996	94.1	3.8	2.1	96.1	2.7	1.2
1997	98.2	0.6	1.2	99.3	0.4	0.4
1998[1]	96.8	0.5	2.7	99.4	0	0.6
1999[1]	96.8	1.2	2	100	0	0
2000[1]	97.4	0	2.6	100	0	0
2001	98.2	1.3	0.5	97.8	2	0.3
2002[1]	97.3	0.9	1.8	100	0	0
2003[1]	96.7	1	2.3	98.9	1.1	0
2004[1]	97	0.5	2.5	97	2.8	0.2
2005[1]	92.4	1.2	6.4	96.7	1.1	2.2

[1] Catches for local consumption only

Table 5.10.2.1. Reference number formula and brief description of the nested models included in the approach to modelling lagged spawner index and PFA_{NA} encompassing a possible phase shift relative recruitment per spawner.

NUMBER	FUNCTION $Ln(PFA_{NA})$ =	MODEL DESCRIPTION
0	$\mu + \xi$	A single mean PFA_{NA}; No phases or lagged spawner index variable
1	$\alpha + \gamma * Ln(LS_{NA}) + \xi$	A single regression of PFA_{NA} on lagged spawner index
2	$\beta * Ph + \xi$	Two means of PFA_{NA} for the two phases; no lagged spawner index variable
3 4 5	$\alpha + \beta * Ph + (\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with possible variations in slopes and intercepts
6	$(\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with intercept trough the origin

PFA_{NA} = PFA for North America (1978 to 2004)
LS_{NA} = Lagged spawner index excluding Labrador (1978 to 2004)
Ph = Phase (indicator variable representing two time periods)
α β γ δ = coefficients of the slope and intercept variables
ξ = residual error normal
phase shift periods: ranging from 1978-1985 and 1986-2004 to 1978-1993 and 1994-2004

Table 5.10.2.2. Summary of model and break year selections for forecasting PFA for 2006–2008 based on 10 000 simulations. Break year refers to last year in high phase.

		BREAK YEAR							
MODEL	PHASE	1987	1988	1989	1990	1991	1992	1993	MODELS
2	High								3 037
	Low					2078	959		
3	High		14	11					344
	Low		167	117	5	25	5		
4	High			1					52
			15	19		12	5		
5	High		4	3			1		354
	Low		174	109	5	46	12		
6	High		8	38	3	76	33		6213
	Low		532	1830	235	2488	970		
Phase	High		26	53	3	76	34		192
	Low		888	2075	245	4649	1951		9808

Table 5.11.1. Assessing the objectives of NASCO management of the West Greenland fishery.

Objective	Assessment	Outcome/extent achieved	Further consideration
Reduce exploitation.	Assessment, reported and unreported landings compared to negotiated catch quotas for the fishery.	The fishery caught no more than the negotiated amount	
75% chance of meeting the conservation limits (S_{lim}) simultaneously in the four northern regions of North America	Assessment of returns to North America. Run reconstruction to estimate overall returns (S4.9) related to estimated spawning escapement reserve at West Greenland.	This objective has not yet been achieved in the last five yeas (% of CL for 2001–2005 average) Labrador (38%), Quebec (69%), Gulf (74%), Newfoundland (107%)	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc.
75% chance of achieveing increases in returns relative to previous years with the hope that this leads to the rebuilding Scotia-Fundy and USA stocks.	Assessment of returns to North America. Run reconstruction to estimate overall returns (Sec. 4.9). Improvements of greater than 10% and greater than 25% relative to returns are evaluated (Sec 4.9)	This objective has not been achieved. 10% targets for Scotia-Fundy = 9,659 and USA = 2,242, Not achieved in any year since 2001. 25% targets also not achieved.	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc. Recovery plans developed for the stocks listed as endangered/ at risk.
75% chance of meeting spawner escapement requirement for the Southern NEAC MSW complex.	Assessment of returns to Southern NEAC. Run reconsruction to estimate overall returns (Sec. 3.3) related to estimated spawning escapement reserve at West Greenland.	This objective has not been achieved. Southern NEAC stock complexes in 2005 (94%) and below for previous years	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other biologically limiting factors such as causes of increased or high marine mortality, habitat quality, by-catch, predators etc.

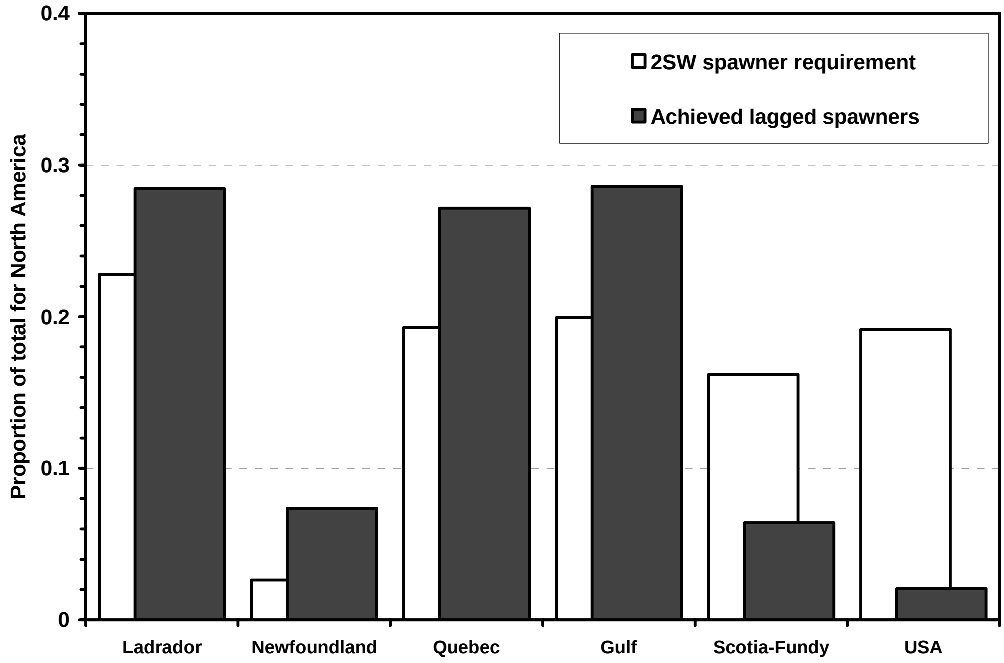
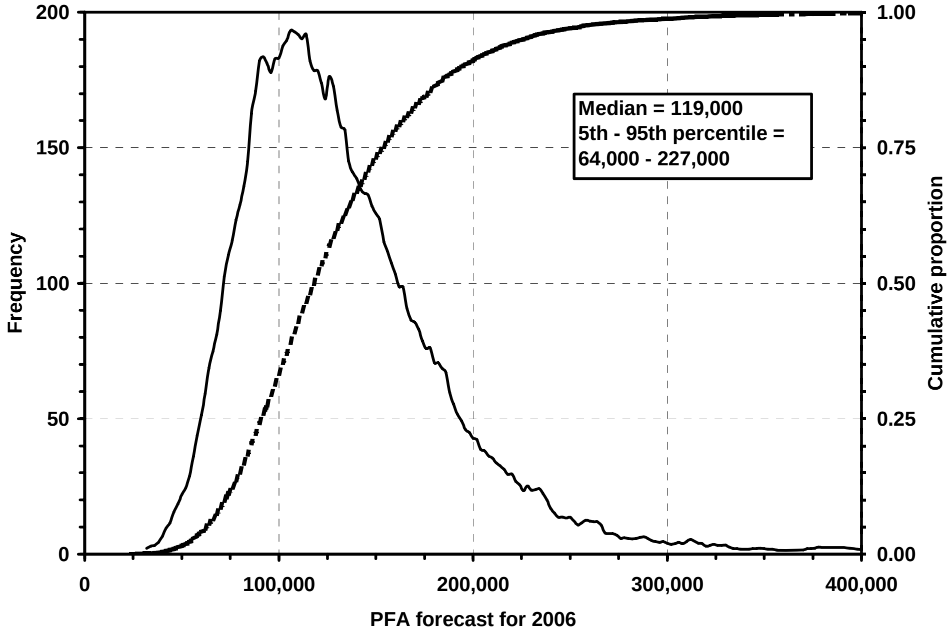
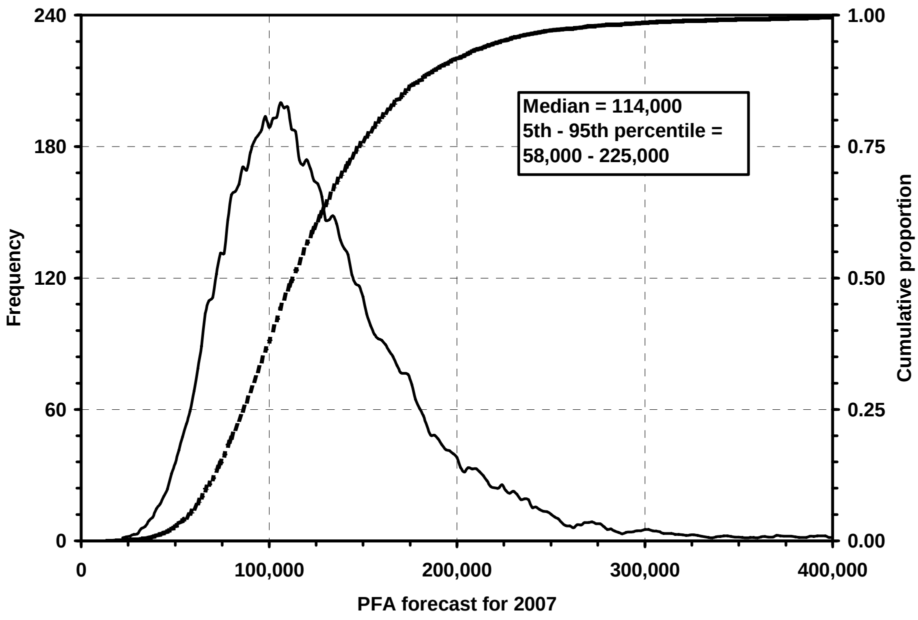


Figure 5.3.1. Average lagged spawners in the six regions of North America for the PFA years 2000 to 2004 and the 2SW spawner requirement in each region expressed as a proportion of the total for North America.



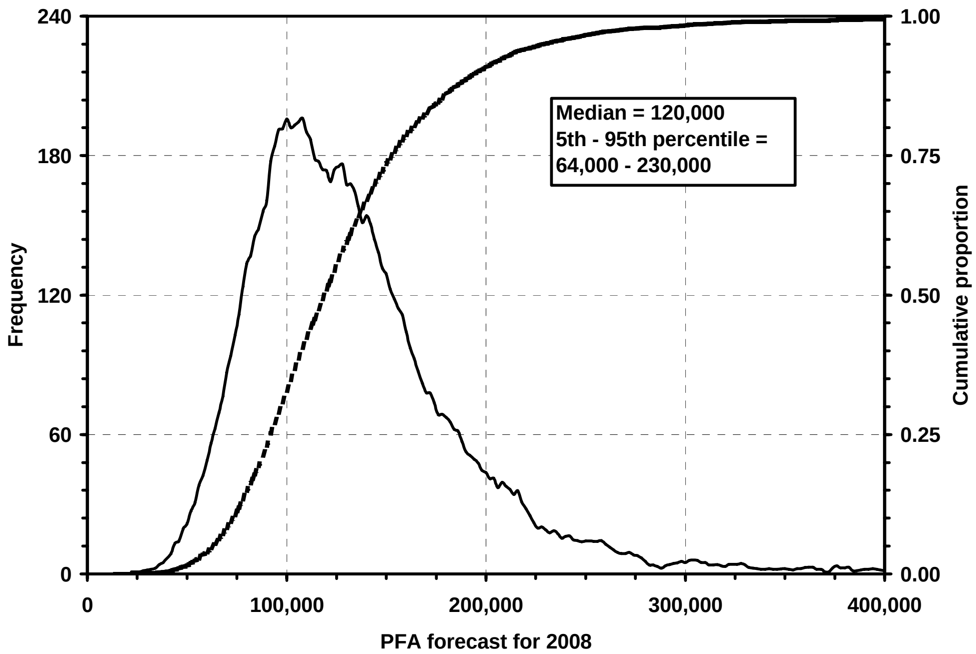
Percentile	Estimate
5	63 679
10	73 159
15	80 991
20	86 553
25	92 097
30	97 712
35	102 728
40	108 064
45	113 318
50	119 184
55	125 073
60	131 062
65	138 231
70	145 865
75	154 513

Figure 5.6.1.1. PFA_{NA} forecast estimate distribution for the year 2006 non-maturing 1SW salmon.



Percentile	Estimate
5	58 409
10	67 679
15	75 262
20	81 430
25	87 283
30	92 469
35	97 917
40	102 987
45	107 900
50	113 620
55	119 414
60	125 707
65	132 601
70	140 081
75	148 669

Figure 5.7.1.1. PFA_{NA} forecast estimate distribution for the year 2007 non-maturing 1SW salmon.



Percentile	Estimate
5	63 865
10	74 066
15	81 087
20	87 775
25	92 856
30	98 248
35	103 214
40	108 394
45	114 201
50	119 829
55	125 568
60	131 899
65	138 210
70	145 354
75	153 688

Figure 5.7.1.2. PFA_{NA} forecast estimate distribution for the year 2008 non-maturing 1SW salmon.

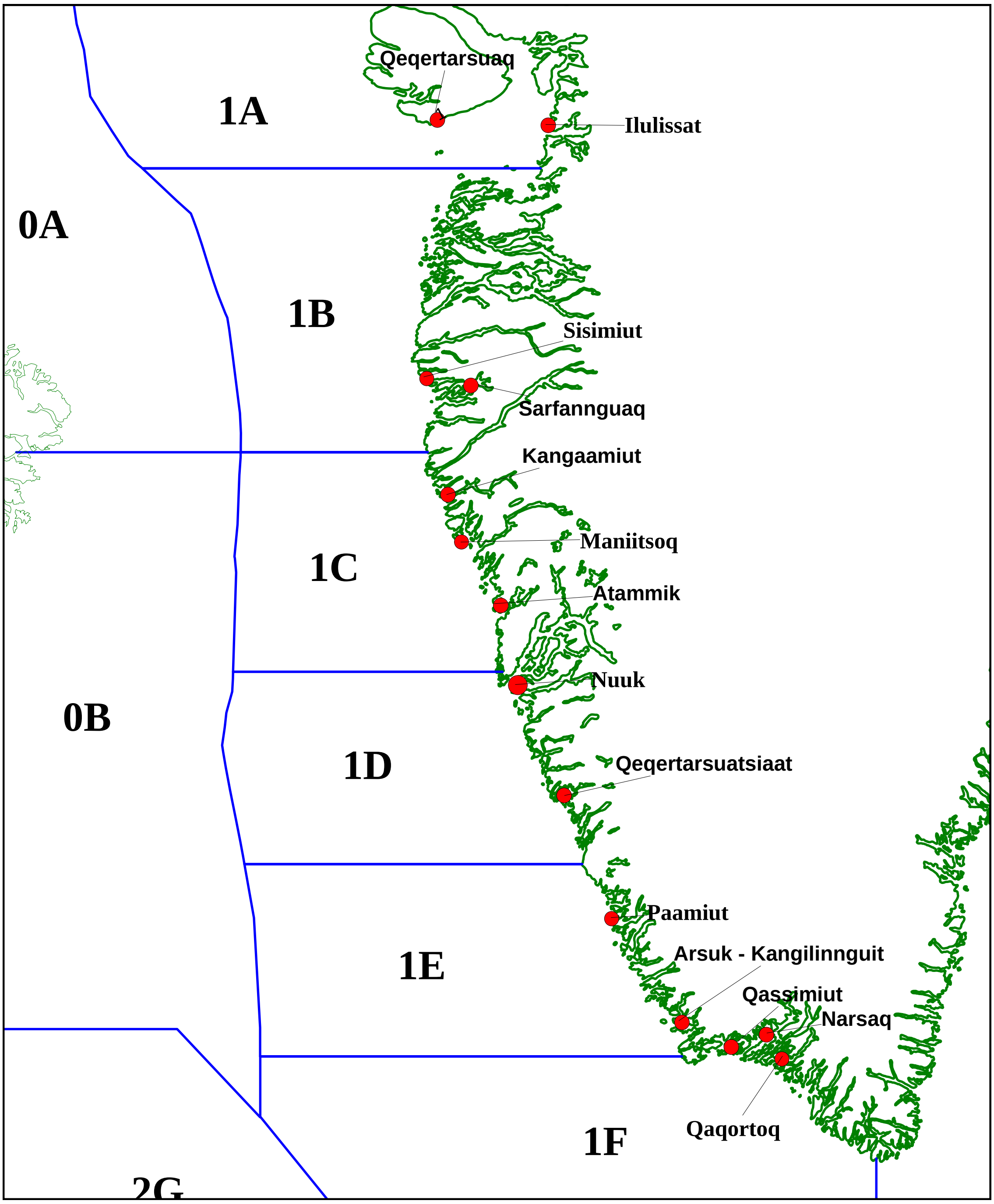


Figure 5.9.1.1. West Greenland NAFO divisions.

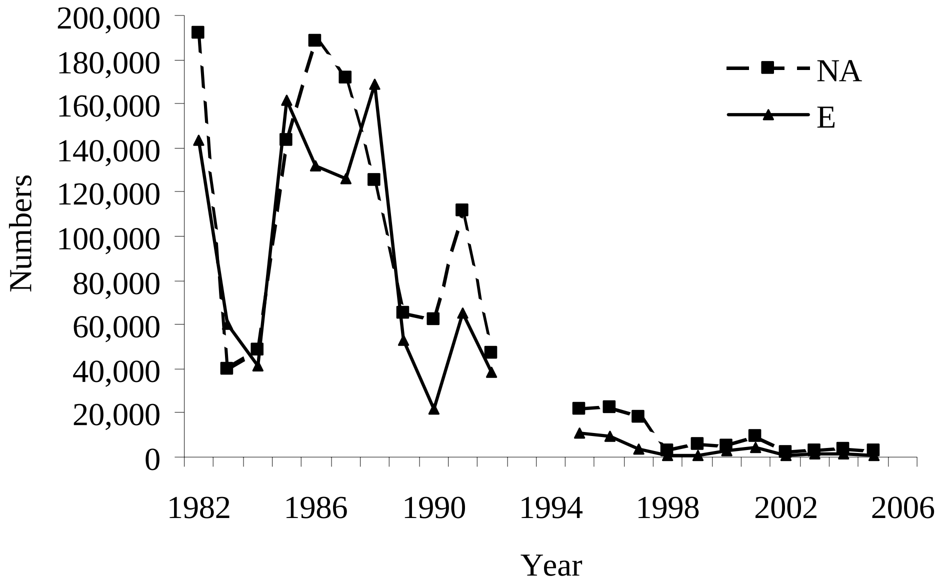


Figure 5.9.3.1. Number of North American (NA) and European (E) salmon caught at West Greenland, 1982–1992 and 1995–2005.

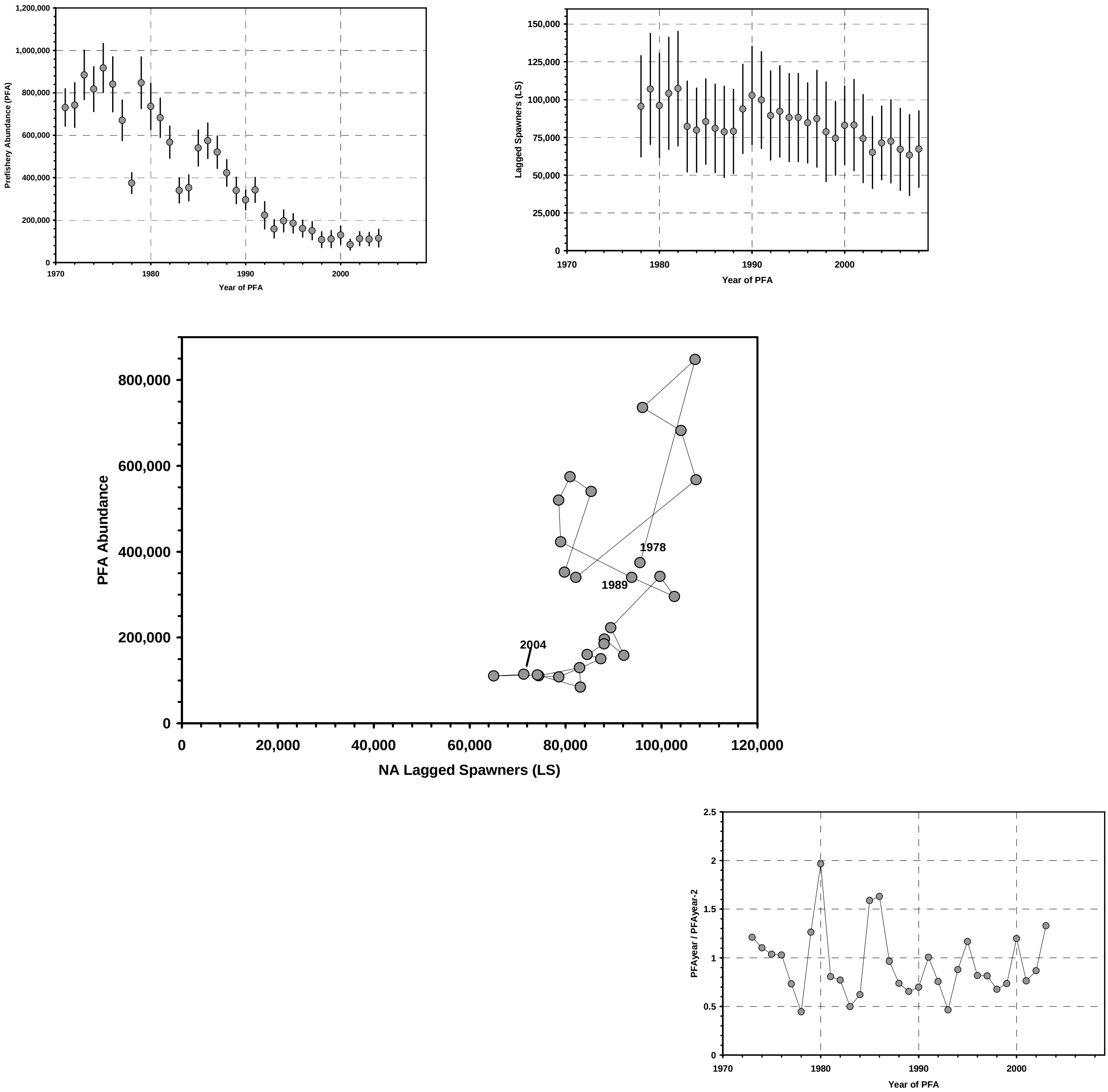


Figure 5.10.2.1. PFA estimates (mid-point, minimum and maximum range; top left), lagged spawners for North America (mid-point, minimum and maximum range; top right), PFA to lagged spawner association for the NAC area showing the sequence from 1978 to 2003 (middle panel), recruitment rate (mid-point, minimum, maximum ratios of PFA to LS; bottom left) and the change of the PFA in year relative to year-2 (bottom right panel).

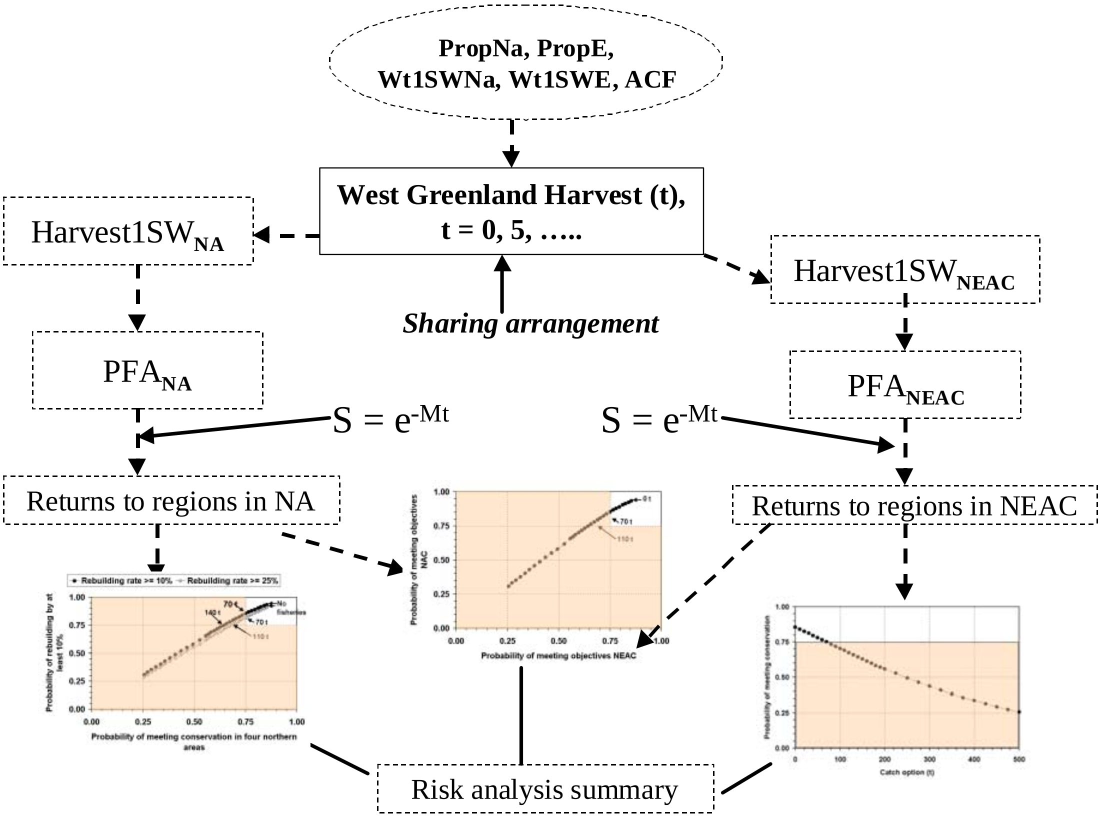


Figure 5.10.3.1. Flowchart, risk analysis for catch options at West Greenland using the PFA_{NA} and the PFA_{NEAC} predictions for the year of the fishery. Inputs with solid borders are considered known without error. Inputs with dashed borders are estimated, contain observation error that is incorporated in the analysis. Solid arrows are functions that introduce or transfer without error whereas dashed arrows transfer errors through the components.

6 NASCO has requested ICES to identify relevent data deficiencies, monitoring needs and research requirements taking into account NASCO's international Atlantic salmon research board's inventory of on-going research relating to salmon mortality in the sea

The Working Group recommends that it should meet in 2007 to address questions posed by ACFM, including those posed by NASCO. The Working Group intends to convene in ICES headquarters in Copenhagen, from 11 to 20 April 2007. It is strongly recommended by the Working Group that this period is adhered in order to provide sufficient time to adequately review and complete the report.

6.1 Data deficiencies and research needs.

Recommendations from Section 2 – Atlantic salmon in the North Atlantic Area:

1) The Working Group recommends the continued development of collaborative efforts to genetically characterize salmon stocks across the North Atlantic and that genetic sampling programmes for all mixed stock fisheries and populations contributing to mixed-stock fisheries be continued.

2) The Working Group recommends that current monitoring programs across the North Atlantic be continued and opportunities for initiating new monitoring programs be explored by all Parties.

3) The Working Group recommends that a workshop be held to assemble and analyze historical tagging information to investigate trends in migration and marine distribution of Atlantic salmon at sea.

4) The Working Group recommends that the ICES Working Group on the Application of Genetics on Fisheries and Mariculture provide a summary of current genetic stock identification techniques and comment upon the precision with which an unknown origin Atlantic salmon can be assigned to origin.

Recommendations from Section 3 – Fisheries and Stocks from the North East Atlantic Commission Area:

1) Noting that exploitation rates in the Irish fishery were higher on hatchery stocks than on wild stocks, the Working Group recommends applying a correction factor where tags from hatchery-reared and wild salmon had been combined to provide adequate tag returns for further analyses.

2) The Working Group recommends, that information about non-catch mortality should be compiled and analysed by SGBYSAL.

Recommendations from Section 4 – Fisheries and Stocks from the North American Commission Area:

no recommendations from North American Commission Area

Recommendations from Section 5 – Atlantic Salmon in the West Greenland Commission Area:

The Working Group recommends that the Home Rule Government of Greenland provide information on the extent of fishing activity by all license holders. Further, it would be helpful if reports filled out by fisherman offered the option to report date of catch and number of fishing nets.

1) The Working Group recommends a broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery.

2) The Working Group recommends that for proper comparison among years, the mean weights be standardized to a common time period (week) to adjust for difference in growth.

3) Continued efforts should be made to improve the estimates of the annual catches of salmon taken for private sales and local consumption in Greenland.

4) The Working Group recommends that NASCO choose one level (10% or 25%) for the improvements in Scotia-Fundy and USA returns relative to returns during 1992 to 1996 to carry forward in catch options.

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Annex 1: Working Documents submitted to the Working Group on North Atlantic Salmon, 2006

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2. Anon. Atlantic salmon overview for Salmon Fishing Areas 20 and 21, the Eastern and Southern shores of Nova Scotia for 2005.
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Annex 4: Reported catch of salmon in numbers and weight (tonnes round fresh weight) be sea-age class. Catches reported for 2005 figures may be provisional. Methods used for estimating age composition given in footnote.

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
West Greenland	1982	315,532	-	17,810	-	-	-	-	-	-	-	-	-	2,688	-	336,030	1,077
	1983	90,500	-	8,100	-	-	-	-	-	-	-	-	-	1,400	-	100,000	310
	1984	78,942	-	10,442	-	-	-	-	-	-	-	-	-	630	-	90,014	297
	1985	292,181	-	18,378	-	-	-	-	-	-	-	-	-	934	-	311,493	864
	1986	307,800	-	9,700	-	-	-	-	-	-	-	-	-	2,600	-	320,100	960
	1987	297,128	-	6,287	-	-	-	-	-	-	-	-	-	2,898	-	306,313	966
	1988	281,356	-	4,602	-	-	-	-	-	-	-	-	-	2,296	-	288,254	893
	1989	110,359	-	5,379	-	-	-	-	-	-	-	-	-	1,875	-	117,613	337
	1990	97,271	-	3,346	-	-	-	-	-	-	-	-	-	860	-	101,477	274
	1991	167,551	415	8,809	53	-	-	-	-	-	-	-	-	743	4	177,103	472
	1992	82,354	217	2,822	18	-	-	-	-	-	-	-	-	364	2	85,540	237
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	31,241	-	558	-	-	-	-	-	-	-	-	-	478	-	32,277	83
	1996	30,613	-	884	-	-	-	-	-	-	-	-	-	568	-	32,065	92
	1997	20,980	-	134	-	-	-	-	-	-	-	-	-	124	-	21,238	58
	1998	3,901	-	17	-	-	-	-	-	-	-	-	-	88	-	4,006	11
	1999	6,124	18	50	0	-	-	-	-	-	-	-	-	84	1	6,258	19
	2000	7,715	21	0	0	-	-	-	-	-	-	-	-	140	0	7,855	21
	2001	14,795	40	324	2	-	-	-	-	-	-	-	-	293	1	15,412	43
	2002	3,344	10	34	0	-	-	-	-	-	-	-	-	27	0	3,405	10
	2003	3,933	12	38	0	-	-	-	-	-	-	-	-	73	0	4,044	12
	2004	4,488	14	51	0	-	-	-	-	-	-	-	-	88	0	4,627	15
	2005	3,120	13	40	0	-	-	-	-	-	-	-	-	180	1	3,340	14
Canada	1982	358,000	716	-	-	-	-	-	-	-	-	240,000	1,082	-	-	598,000	1,798
	1983	265,000	513	-	-	-	-	-	-	-	-	201,000	911	-	-	466,000	1,424
	1984	234,000	467	-	-	-	-	-	-	-	-	143,000	645	-	-	377,000	1,112
	1985	333,084	593	-	-	-	-	-	-	-	-	122,621	540	-	-	455,705	1,133
	1986	417,269	780	-	-	-	-	-	-	-	-	162,305	779	-	-	579,574	1,559
	1987	435,799	833	-	-	-	-	-	-	-	-	203,731	951	-	-	639,530	1,784
	1988	372,178	677	-	-	-	-	-	-	-	-	137,637	633	-	-	509,815	1,310
	1989	304,620	549	-	-	-	-	-	-	-	-	135,484	590	-	-	440,104	1,139
	1990	233,690	425	-	-	-	-	-	-	-	-	106,379	486	-	-	340,069	911
	1991	189,324	341	-	-	-	-	-	-	-	-	82,532	370	-	-	271,856	711
	1992	108,901	199	-	-	-	-	-	-	-	-	66,357	323	-	-	175,258	522
	1993	91,239	159	-	-	-	-	-	-	-	-	45,416	214	-	-	136,655	373
	1994	76,973	139	-	-	-	-	-	-	-	-	42,946	216	-	-	119,919	355
	1995	61,940	107	-	-	-	-	-	-	-	-	34,263	153	-	-	96,203	260
	1996	82,490	138	-	-	-	-	-	-	-	-	31,590	154	-	-	114,080	292
	1997	58,988	103	-	-	-	-	-	-	-	-	26,270	126	-	-	85,258	229
	1998	51,251	87	-	-	-	-	-	-	-	-	13,274	70	-	-	64,525	157
	1999	50,901	88	-	-	-	-	-	-	-	-	11,368	64	-	-	62,269	152
	2000	55,263	95	-	-	-	-	-	-	-	-	10,571	58	-	-	65,834	153
	2001	51,225	86	-	-	-	-	-	-	-	-	11,575	61	-	-	62,800	147
	2002	53,464	99	-	-	-	-	-	-	-	-	8,439	49	-	-	61,903	148
	2003	46,768	81	-	-	-	-	-	-	-	-	11,218	60	-	-	57,986	141
	2004	54,253	94	-	-	-	-	-	-	-	-	12,933	68	-	-	67,186	162
	2005	41,709	73	-	-	-	-	-	-	-	-	10,949	56	-	-	52,658	129

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
USA	1982	33	-	1,206	-	5	-	-	-	-	-	-	-	21	-	1,265	6
	1983	26	-	314	1	2	-	-	-	-	-	-	-	6	-	348	1
	1984	50	-	545	2	2	-	-	-	-	-	-	-	12	-	609	2
	1985	23	-	528	2	2	-	-	-	-	-	-	-	13	-	566	2
	1986	76	-	482	2	2	-	-	-	-	-	-	-	3	-	563	2
	1987	33	-	229	1	10	-	-	-	-	-	-	-	10	-	282	1
	1988	49	-	203	1	3	-	-	-	-	-	-	-	4	-	259	1
	1989	157	0	325	1	2	-	-	-	-	-	-	-	3	-	487	2
	1990	52	0	562	2	12	-	-	-	-	-	-	-	16	-	642	2
	1991	48	0	185	1	1	-	-	-	-	-	-	-	4	-	238	1
	1992	54	0	138	1	1	-	-	-	-	-	-	-	-	-	193	1
	1993	17	-	133	1	0	0	-	-	-	-	-	-	2	-	152	1
	1994	12	-	0	0	0	0	-	-	-	-	-	-	-	-	12	0
	1995	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1996	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1997	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1998	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1999	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2000	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2001	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2002	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2003	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2004	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2005	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
Faroe Islands	1982/83	9,086	-	101,227	-	21,663	-	448	-	29	-	-	-	-	-	132,453	625
	1983/84	4,791	-	107,199	-	12,469	-	49	-	-	-	-	-	-	-	124,508	651
	1984/85	324	-	123,510	-	9,690	-	-	-	-	-	-	-	1,653	-	135,177	598
	1985/86	1,672	-	141,740	-	4,779	-	76	-	-	-	-	-	6,287	-	154,554	545
	1986/87	76	-	133,078	-	7,070	-	80	-	-	-	-	-	-	-	140,304	539
	1987/88	5,833	-	55,728	-	3,450	-	0	-	-	-	-	-	-	-	65,011	208
	1988/89	1,351	-	86,417	-	5,728	-	0	-	-	-	-	-	-	-	93,496	309
	1989/90	1,560	-	103,407	-	6,463	-	6	-	-	-	-	-	-	-	111,436	364
	1990/91	631	-	52,420	-	4,390	-	8	-	-	-	-	-	-	-	57,449	202
	1991/92	16	-	7,611	-	837	-	-	-	-	-	-	-	-	-	8,464	31
	1992/93	-	-	4,212	-	1,203	-	-	-	-	-	-	-	-	-	5,415	22
	1993/94	-	-	1,866	-	206	-	-	-	-	-	-	-	-	-	2,072	7
	1994/95	-	-	1,807	-	156	-	-	-	-	-	-	-	-	-	1,963	6
	1995/96	-	-	268	-	14	-	-	-	-	-	-	-	-	-	282	1
	1996/97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1997/98	339	-	1,315	-	109	-	-	-	-	-	-	-	-	-	1,763	6
	1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1999/00	225	-	1,560	-	205	-	-	-	-	-	-	-	-	-	1,990	8
	2000/01	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2001/02	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2002/03	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2003/04	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2004/05	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2005/06	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Finland	1982	2,598	5	-	-	-	-	-	-	-	-	5,408	49	-	-	8,006	54
	1983	3,916	7	-	-	-	-	-	-	-	-	6,050	51	-	-	9,966	58
	1984	4,899	9	-	-	-	-	-	-	-	-	4,726	37	-	-	9,625	46
	1985	6,201	11	-	-	-	-	-	-	-	-	4,912	38	-	-	11,113	49
	1986	6,131	12	-	-	-	-	-	-	-	-	3,244	25	-	-	9,375	37
	1987	8,696	15	-	-	-	-	-	-	-	-	4,520	34	-	-	13,216	49
	1988	5,926	9	-	-	-	-	-	-	-	-	3,495	27	-	-	9,421	36
	1989	10,395	19	-	-	-	-	-	-	-	-	5,332	33	-	-	15,727	52
	1990	10,084	19	-	-	-	-	-	-	-	-	5,600	41	-	-	15,684	60
	1991	9,213	17	-	-	-	-	-	-	-	-	6,298	53	-	-	15,511	70
	1992	15,017	28	-	-	-	-	-	-	-	-	6,284	49	-	-	21,301	77
	1993	11,157	17	-	-	-	-	-	-	-	-	8,180	53	-	-	19,337	70
	1994	7,493	11	-	-	-	-	-	-	-	-	6,230	38	-	-	13,723	49
	1995	7,786	11	-	-	-	-	-	-	-	-	5,344	38	-	-	13,130	49
	1996	12,230	20	1,275	5	1,424	12	234	4	19	1	-	-	354	3	15,536	44
	1997	10,341	15	2,419	10	1,674	15	141	2	22	1	-	-	418	3	15,015	45
	1998	11,792	19	1,608	7	1,660	16	147	3	0	0	-	-	460	3	15,667	48
	1999	18,830	33	1,528	8	1,579	16	129	2	6	0	-	-	490	3	22,562	62
	2000	20,817	39	5,152	24	2,379	25	110	2	0	0	-	-	991	6	29,449	95
	2001	13,062	21	6,308	32	5,415	58	104	2	0	0	-	-	2,360	13	27,249	126
	2002	6,531	12	5,361	20	4,276	43	148	2	11	0	-	-	2,619	16	18,946	93
	2003	8,130	15	1,828	7	3,599	38	161	3	6	0	-	-	2,204	15	15,928	78
	2004	3,815	7	1,424	6	1,153	11	251	4	6	1	-	-	1,400	11	8,049	39
	2005	9,216	16	1,027	5	1,575	16	66	1	48	1	-	-	837	8	12,769	47
Iceland	1991	30,011	-	11,935	-	-	-	-	-	-	-	-	-	-	-	41,946	130
	1992	38,955	-	15,416	-	-	-	-	-	-	-	-	-	-	-	54,371	175
	1993	37,611	-	11,611	-	-	-	-	-	-	-	-	-	-	-	49,222	160
	1994	25,480	62	14,408	78	-	-	-	-	-	-	-	-	-	-	39,888	140
	1995	34,046	93	13,380	57	-	-	-	-	-	-	-	-	-	-	47,426	150
	1996	28,039	69	9,971	53	-	-	-	-	-	-	-	-	-	-	38,010	122
	1997	23,945	62	8,872	44	-	-	-	-	-	-	-	-	-	-	32,817	106
	1998	35,537	90	7,791	40	-	-	-	-	-	-	-	-	-	-	43,328	130
	1999	20,031	64	8,093	57	-	-	-	-	-	-	-	-	-	-	28,124	120
	2000	23,850	58	4,456	24	-	-	-	-	-	-	-	-	-	-	28,306	82
	2001	23,717	58	5,564	29	-	-	-	-	-	-	-	-	-	-	29,281	87
	2002	26,679	68	5,683	29	-	-	-	-	-	-	-	-	-	-	32,362	97
	2003	27,519	68	8,813	41	-	-	-	-	-	-	-	-	-	-	36,332	110
	2004	38,445	99	6,739	31	-	-	-	-	-	-	-	-	-	-	45,184	130
	2005	47,114	119	6,450	30	-	-	-	-	-	-	-	-	-	-	53,564	149
Sweden	1989	3,181	7	-	-	-	-	-	-	-	-	4,610	22	-	-	7,791	29
	1990	7,428	18	-	-	-	-	-	-	-	-	3,133	15	-	-	10,561	33
	1991	8,987	20	-	-	-	-	-	-	-	-	3,620	18	-	-	12,607	38
	1992	9,850	23	-	-	-	-	-	-	-	-	4,656	26	-	-	14,506	49
	1993	10,540	23	-	-	-	-	-	-	-	-	6,369	33	-	-	16,909	56
	1994	8,304	18	-	-	-	-	-	-	-	-	4,661	26	-	-	12,965	44
	1995	9,761	22	-	-	-	-	-	-	-	-	2,770	14	-	-	12,531	36
	1996	6,008	14	-	-	-	-	-	-	-	-	3,542	19	-	-	9,550	33
	1997	2,747	7	-	-	-	-	-	-	-	-	2,307	12	-	-	5,054	19
	1998	2,421	6	-	-	-	-	-	-	-	-	1,702	9	-	-	4,123	15
	1999	3,573	8	-	-	-	-	-	-	-	-	1,460	8	-	-	5,033	16
	2000	7,103	18	-	-	-	-	-	-	-	-	3,196	15	-	-	10,299	33
	2001	4,634	12	-	-	-	-	-	-	-	-	3,853	21	-	-	8,487	33
	2002	4,733	12	-	-	-	-	-	-	-	-	2,826	16	-	-	7,559	28
	2003	2,891	7	-	-	-	-	-	-	-	-	3,214	18	-	-	6,105	25
	2004	2,494	6	-	-	-	-	-	-	-	-	2,330	13	-	-	4,824	19
	2005	2,122	5	-	-	-	-	-	-	-	-	1,770	10	-	-	3,892	15

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Norway	1981	221,566	467	-	-	-	-	-	-	-	-	213,943	1,189	-	-	435,509	1,656
	1982	163,120	363	-	-	-	-	-	-	-	-	174,229	985	-	-	337,349	1,348
	1983	278,061	593	-	-	-	-	-	-	-	-	171,361	957	-	-	449,422	1,550
	1984	294,365	628	-	-	-	-	-	-	-	-	176,716	995	-	-	471,081	1,623
	1985	299,037	638	-	-	-	-	-	-	-	-	162,403	923	-	-	461,440	1,561
	1986	264,849	556	-	-	-	-	-	-	-	-	191,524	1,042	-	-	456,373	1,598
	1987	235,703	491	-	-	-	-	-	-	-	-	153,554	894	-	-	389,257	1,385
	1988	217,617	420	-	-	-	-	-	-	-	-	120,367	656	-	-	337,984	1,076
	1989	220,170	436	-	-	-	-	-	-	-	-	80,880	469	-	-	301,050	905
	1990	192,500	385	-	-	-	-	-	-	-	-	91,437	545	-	-	283,937	930
	1991	171,041	342	-	-	-	-	-	-	-	-	92,214	535	-	-	263,255	877
	1992	151,291	301	-	-	-	-	-	-	-	-	92,717	566	-	-	244,008	867
	1993	153,407	312	62,403	284	35,147	327	-	-	-	-	-	-	-	-	250,957	923
	1994	-	415	-	319	-	262	-	-	-	-	-	-	-	-	-	996
	1995	134,341	249	71,552	341	27,104	249	-	-	-	-	-	-	-	-	232,997	839
	1996	110,085	215	69,389	322	27,627	249	-	-	-	-	-	-	-	-	207,101	786
	1997	124,387	241	52,842	238	16,448	151	-	-	-	-	-	-	-	-	193,677	630
	1998	162,185	296	66,767	306	15,568	139	-	-	-	-	-	-	-	-	244,520	741
	1999	164,905	318	70,825	326	18,669	167	-	-	-	-	-	-	-	-	254,399	811
	2000	250,468	504	99,934	454	24,319	219	-	-	-	-	-	-	-	-	374,721	1,177
	2001	207,934	417	117,759	554	33,047	295	-	-	-	-	-	-	-	-	358,740	1,266
	2002	127,039	249	98,055	471	33,013	299	-	-	-	-	-	-	-	-	258,107	1,019
	2003	185,574	363	87,993	410	31,099	298	-	-	-	-	-	-	-	-	304,666	1,071
	2004	108,645	207	77,343	371	23,173	206	-	-	-	-	-	-	-	-	209,161	784
	2005	165,900	307	69,488	320	27,507	261	-	-	-	-	-	-	-	-	262,895	888
Russia	1987	97,242	-	27,135	-	9,539	-	556	-	18	-	-	-	2,521	-	137,011	564
	1988	53,158	-	33,395	-	10,256	-	294	-	25	-	-	-	2,937	-	100,065	420
	1989	78,023	-	23,123	-	4,118	-	26	-	0	-	-	-	2,187	-	107,477	364
	1990	70,595	-	20,633	-	2,919	-	101	-	0	-	-	-	2,010	-	96,258	313
	1991	40,603	-	12,458	-	3,060	-	650	-	0	-	-	-	1,375	-	58,146	215
	1992	34,021	-	8,880	-	3,547	-	180	-	0	-	-	-	824	-	47,452	167
	1993	28,100	-	11,780	-	4,280	-	377	-	0	-	-	-	1,470	-	46,007	139
	1994	30,877	-	10,879	-	2,183	-	51	-	0	-	-	-	555	-	44,545	141
	1995	27,775	62	9,642	50	1,803	15	6	0	0	0	-	-	385	2	39,611	129
	1996	33,878	79	7,395	42	1,084	9	40	0.5	0	0	-	-	41	1	42,438	131
	1997	31,857	72	5,837	28	672	6	38	0.5	0	0	-	-	559	3	38,963	110
	1998	34,870	92	6,815	33	181	2	28	0.3	0	0	-	-	638	3	42,532	130
	1999	24,016	66	5,317	25	499	5	0	0	0	0	-	-	1,131	6	30,963	102
	2000	27,702	75	7,027	34	500	5	3	0.1	0	0	-	-	1,853	9	37,085	123
	2001	26,472	61	7,505	39	1,036	10	30	0.4	0	0	-	-	922	5	35,965	115
	2002	24,588	60	8,720	43	1,284	12	3	0	0	0	-	-	480	3	35,075	118
	2003	22,014	50	8,905	42	1,206	12	20	0.3	0	0	-	-	634	4	32,779	107
	2004	17,105	39	6,786	33	880	7	0	0.0	0	0	-	-	529	3	25,300	82
	2005	16,591	39	7,179	33	989	8	1	0.0	0	0	-	-	439	3	25,199	82

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Ireland	1980	248,333	745	-	-	-	-	-	-	-	-	39,608	202	-	-	287,941	947
	1981	173,667	521	-	-	-	-	-	-	-	-	32,159	164	-	-	205,826	685
	1982	310,000	930	-	-	-	-	-	-	-	-	12,353	63	-	-	322,353	993
	1983	502,000	1,506	-	-	-	-	-	-	-	-	29,411	150	-	-	531,411	1,656
	1984	242,666	728	-	-	-	-	-	-	-	-	19,804	101	-	-	262,470	829
	1985	498,333	1,495	-	-	-	-	-	-	-	-	19,608	100	-	-	517,941	1,595
	1986	498,125	1,594	-	-	-	-	-	-	-	-	28,335	136	-	-	526,460	1,730
	1987	358,842	1,112	-	-	-	-	-	-	-	-	27,609	127	-	-	386,451	1,239
	1988	559,297	1,733	-	-	-	-	-	-	-	-	30,599	141	-	-	589,896	1,874
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	330,558	1,079
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188,890	567
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	135,474	404
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235,435	631
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200,120	541
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286,266	804
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288,225	790
	1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	249,623	685
	1997	-	-	-	-	-	-	-	-	-	-	-	-	-	-	209,214	570
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	237,663	624
	1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180,477	515
	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228,220	621
	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270,963	730
	2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	256,808	682
	2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	204,145	551
	2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175,656	488
	2005	150,000	-	-	-	-	-	-	-	-	-	10,000	-	-	-	160,000	428
UK	1985	62,815	-	-	-	-	-	-	-	-	-	32,716	-	-	-	95,531	361
(England & Wales)	1986	68,759	-	-	-	-	-	-	-	-	-	42,035	-	-	-	110,794	430
	1987	56,739	-	-	-	-	-	-	-	-	-	26,700	-	-	-	83,439	302
	1988	76,012	-	-	-	-	-	-	-	-	-	34,151	-	-	-	110,163	395
	1989	54,384	-	-	-	-	-	-	-	-	-	29,284	-	-	-	83,668	296
	1990	45,072	-	-	-	-	-	-	-	-	-	41,604	-	-	-	86,676	338
	1991	36,671	-	-	-	-	-	-	-	-	-	14,978	-	-	-	51,649	200
	1992	34,331	-	-	-	-	-	-	-	-	-	10,255	-	-	-	44,586	171
	1993	56,033	-	-	-	-	-	-	-	-	-	13,144	-	-	-	69,177	248
	1994	67,853	-	-	-	-	-	-	-	-	-	20,268	-	-	-	88,121	324
	1995	57,944	-	-	-	-	-	-	-	-	-	22,534	-	-	-	80,478	295
	1996	30,352	-	-	-	-	-	-	-	-	-	16,344	-	-	-	46,696	183
	1997	30,203	-	-	-	-	-	-	-	-	-	11,171	-	-	-	41,374	142
	1998	30,641	-	-	-	-	-	-	-	-	-	6,276	-	-	-	36,917	123
	1999	27944	-	-	-	-	-	-	-	-	-	13,150	-	-	-	41,094	150
	2000	48,153	-	-	-	-	-	-	-	-	-	12,800	-	-	-	60,953	219
	2001	38993	-	-	-	-	-	-	-	-	-	12,314	-	-	-	51,307	184
	2002	34708	-	-	-	-	-	-	-	-	-	10,961	-	-	-	45,669	161
	2003	14,878	-	-	-	-	-	-	-	-	-	7,328	-	-	-	22,206	90
	2004	24,753	-	-	-	-	-	-	-	-	-	5,806	-	-	-	30,559	106
	2005	19,347	-	-	-	-	-	-	-	-	-	6,110	-	-	-	25,457	94

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
UK (Scotland)	1982	208,061	496	-	-	-	-	-	-	-	-	128,242	596	-	-	336,303	1,092
	1983	209,617	549	-	-	-	-	-	-	-	-	145,961	672	-	-	355,578	1,221
	1984	213,079	509	-	-	-	-	-	-	-	-	107,213	504	-	-	320,292	1,013
	1985	158,012	399	-	-	-	-	-	-	-	-	114,648	514	-	-	272,660	913
	1986	202,855	526	-	-	-	-	-	-	-	-	148,397	745	-	-	351,252	1,271
	1987	164,785	419	-	-	-	-	-	-	-	-	103,994	503	-	-	268,779	922
	1988	149,098	381	-	-	-	-	-	-	-	-	112,162	501	-	-	261,260	882
	1989	174,941	431	-	-	-	-	-	-	-	-	103,886	464	-	-	278,827	895
	1990	81,094	201	-	-	-	-	-	-	-	-	87,924	423	-	-	169,018	624
	1991	73,608	177	-	-	-	-	-	-	-	-	65,193	285	-	-	138,801	462
	1992	101,676	238	-	-	-	-	-	-	-	-	82,841	361	-	-	184,517	599
	1993	94,517	227	-	-	-	-	-	-	-	-	71,726	320	-	-	166,243	547
	1994	99,459	248	-	-	-	-	-	-	-	-	85,404	400	-	-	184,863	648
	1995	89,921	224	-	-	-	-	-	-	-	-	78,452	364	-	-	168,373	588
	1996	66,413	160	-	-	-	-	-	-	-	-	57,920	267	-	-	124,333	427
	1997	46,872	114	-	-	-	-	-	-	-	-	40,427	182	-	-	87,299	296
	1998	53,447	121	-	-	-	-	-	-	-	-	39,248	162	-	-	92,695	283
	1999	25,183	57	-	-	-	-	-	-	-	-	30,651	142	-	-	55,834	199
	2000	43,879	114	-	-	-	-	-	-	-	-	36,657	160	-	-	80,536	274
	2001	42,565	101	-	-	-	-	-	-	-	-	34,908	150	-	-	77,473	251
	2002	31,347	73	-	-	-	-	-	-	-	-	26,383	118	-	-	57,730	191
	2003	29,547	71	-	-	-	-	-	-	-	-	27,544	122	-	-	57,091	192
	2004	37,288	87	-	-	-	-	-	-	-	-	36,745	158	-	-	74,033	245
	2005	31,777	76	-	-	-	-	-	-	-	-	26,082	115	-	-	57,859	191
France	1987	6,013	18	-	-	-	-	-	-	-	-	1,806	9	-	-	7,819	27
	1988	2,063	7	-	-	-	-	-	-	-	-	4,964	25	-	-	7,027	32
	1989	1,124	3	1,971	9	311	2	-	-	-	-	-	-	-	-	3,406	14
	1990	1,886	5	2,186	9	146	1	-	-	-	-	-	-	-	-	4,218	15
	1991	1,362	3	1,935	9	190	1	-	-	-	-	-	-	-	-	3,487	13
	1992	2,490	7	2,450	12	221	2	-	-	-	-	-	-	-	-	5,161	21
	1993	3,581	10	987	4	267	2	-	-	-	-	-	-	-	-	4,835	16
	1994	2,810	7	2,250	10	40	1	-	-	-	-	-	-	-	-	5,100	18
	1995	1,669	4	1,073	5	22	0	-	-	-	-	-	-	-	-	2,764	10
	1996	2,063	5	1,891	9	52	0	-	-	-	-	-	-	-	-	4,006	13
	1997	1,060	3	964	5	37	0	-	-	-	-	-	-	-	-	2,061	8
	1998	2,065	5	824	4	22	0	-	-	-	-	-	-	-	-	2,911	8
	1999	690	2	1,799	9	32	0	-	-	-	-	-	-	-	-	2,521	11
	2000	1,792	4	1,253	6	24	0	-	-	-	-	-	-	-	-	3,069	11
	2001	1,544	4	1,489	7	25	0	-	-	-	-	-	-	-	-	3,058	11
	2002	2,423	6	1,065	5	41	0	-	-	-	-	-	-	-	-	3,529	11
	2003	1,598	5	-	-	-	-	-	-	-	-	1,540	8	-	-	3,138	13
	2004	1,927	5	-	-	-	-	-	-	-	-	2,880	14	-	-	4,807	19
	2005	1,256	3	-	-	-	-	-	-	-	-	1,771	8	-	-	3,027	11

Spain (2)	1993	1,589	-	827	-	75	-	-	-	-	-	-	-	-	-	2,491	8
	1994	1,658	-	1,042	-	14	-	-	-	-	-	-	-	-	-	2,714	10
	1995	389	-	1,373	-	30	-	-	-	-	-	-	-	-	-	1,792	9
	1996	351	-	1,219	-	9	-	-	-	-	-	-	-	-	-	1,579	7
	1997	172	-	604	-	21	-	-	-	-	-	-	-	-	-	797	3
	1998	486	-	486	-	8	-	-	-	-	-	-	-	-	-	980	4
	1999	160	-	1,047	-	42	-	-	-	-	-	-	-	-	-	1,249	6
	2000	1,223	-	705	-	10	-	-	-	-	-	-	-	-	-	1,938	7
	2001	1,138	-	1,913	-	111	-	-	-	-	-	-	-	-	-	3,162	13
	2002	655	-	1,266	-	39	-	-	-	-	-	-	-	-	-	1,960	9
	2003	210	-	1,286	-	18	-	-	-	-	-	-	-	-	-	1,514	7
	2004	1,192	-	829	-	0	-	-	-	-	-	-	-	-	-	2,021	7
	2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. MSW includes all sea ages >1, when this cannot be broken down.
Different methods are used to separate 1SW and MSW salmon in different countries:
- Scale reading: Faroe Islands, Finland (1996 onwards), France, Russia, USA and West Greenland.
- Size (split weight/length): Canada (2.7 kg for nets; 63cm for rods), Finland up until 1995 (3 kg),
Iceland (various splits used at different times and places), Norway (3 kg), UK Scotland (3 kg in some places and 3.7 kg in others),
All countries except Scotland report no problems with using weight to catergorise catches into sea age classes; mis-classification may be very high in some years.
In Norway, catches shown as 3SW refer to salmon of 3SW or greater.
2. Based on catches in Asturias (80-90% of total catch). No data for 2005.

Annex 5(i): Estimated numbers of 1SW salmon returns, recruits and spawners for Labrador

Year	Commercial Small Catch	Grilse Recruits SFA 1, 2 & 14B +Nfld Min	Grilse Recruits SFA 1, 2 & 14B +Nfld Max	Grilse to rivers SFA 1,2&14B Min	Grilse to rivers SFA 1,2&14B Max	Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B Min	Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B Max
*1969	38722	48912	122280	18587	65053	15476	61942
*1970	29441	66584	166459	25302	88556	21289	84543
*1971	38359	86754	216884	32966	115382	29032	111448
*1972	28711	64934	162335	24675	86362	21728	83415
*1973	6282	14208	35520	5399	18897	0	11405
1974	37145	71142	177856	27034	94619	24533	92118
1975	57560	141210	353024	53660	187809	49688	183837
1976	47468	98790	246976	37540	131391	31814	125665
1977	40539	87918	219796	33409	116931	28815	112337
1978	12535	42513	106282	16155	56542	13464	53851
1979	28808	57744	144360	21943	76800	17825	72682
1980	72485	130710	326776	49670	173845	45870	170045
1981	86426	144859	362147	55046	192662	49855	187471
1982	53592	100357	250892	38136	133474	34032	129370
1983	30185	62452	156129	23732	83061	19360	78689
1984	11695	32324	80811	12283	42991	9348	40056
1985	24499	59822	149555	22732	79563	19631	76462
1986	45321	90184	225461	34270	119945	30806	116481
1987	64351	112995	282486	42938	150283	37572	144917
1988	56381	104980	262449	39892	139623	34369	134100
1989	34200	71351	178377	27113	94896	22429	90212
1990	20699	41718	104296	15853	55485	12544	52176
1991	20055	33812	84531	12849	44970	10526	42647
1992	13336	29632	79554	17993	62094	15229	59331
1993	12037	33382	93231	25186	80938	22499	78251
1994	4535	22306	63109	18159	56888	15242	53971
1995	4561	28852	82199	25022	76453	22199	73630
1996	5308	55634	159204	51867	153553	48924	150610
1997	8025	72467	176071	66972	169030	64389	166446
1998	0	9233	192621	9233	192621	6726	190114
1999	0	9500	190782	6761	188043	4244	185526
2000	0	9345	221357	4022	216034	752	212764
2001	0	8209	173915	3419	169125	906	166612
2002	0	66663	154260	60917	148152	58341	145576
2003	0	53606	134301	47127	127368	44522	124763
2004	0	76825	134255	68331	125093	65927	122689
2005	0	156585	308050	146359	297143	143937	294720

Estimates are based on:

EST SMALL RETURNS - (COMM CATCH*PROP LAB ORIGIN)/EXP RATE,

PROP SFAs1,2&14B=.6-.8, SFA 1:0.36-0.42&SFA 2:0.75-0.85(97)

EXP RATE-SFAs1,2&14B=.3-.5(69-91),.22-.39(92),.13-.25(93),

- .10-.19(94),.07-.13(95),.04-.07(96), SFA 1:0.07-0.14&SFA 2:0.04-0.07 (97)

EST GRILSE RETURNS CORRECTED FOR NON-MATURING 1SW - (SMALL RET*PROP GRILSE),

PROP GRILSE SFAs1,2&14B=0.8-0.9

EST RET TO FRESHWATER - (EST GRILSE RET-GRILSE CATCHES)

EST GRILSE SPAWNERS = EST GRILSE RETURNS TO FRESHWATER - GRILSE ANGLING CATCHES

*Catches for 1969-73 are Labrador totals distributed into SFAs as the proportion of landings by SFA in 1974-78.

Furthermore small catches in 1973 were adjusted by ratio of large:small in 1972&74 (SFA 1-1.4591, SFA 2-2.2225, SFA 14B-1.5506).

Returns in 1998-2001 were estimated from regression

Returns in 2002-2004 from counting fence returns and drainage areas

Annex 5(ii): Estimated numbers of 2SW salmon returns, recruits and spawners for Labrador

Year	Commercial Large Catch	Labrador 2SW Recruits, SFAs 1,2 &14B		NF & Greenland Labrador a Greenland	Labrador salmon Totals		Labrador 2SW to rivers in SFAs 1,2 &14B		Labrador 2SW spawners in SFAs 1,2 &14B Angling catch subtracted	
		Min	Max		Min	Max	Min	Max	Min	Max
*1969	78052	32483	69198	34280	80636	133032	3248	20760	2890	20287
*1970	45479	30258	68490	56379	99561	154121	3026	20547	2676	20085
*1971	64806	43117	97596	24299	85831	163577	4312	29279	4012	28882
*1972	55708	37064	83895	59203	112096	178927	3706	25168	3435	24812
*1973	77902	51830	117319	22348	96314	189771	5183	35196	4565	34376
1974	93036	50030	113827	38035	109433	200476	5003	34148	4490	33475
1975	71168	47715	107974	40919	109012	195006	4772	32392	4564	32119
1976	77796	55186	124671	67730	146485	245646	5519	37401	4984	36701
1977	70158	48669	110171	28482	97937	185706	4867	33051	4042	31969
1978	48934	38644	87155	32668	87816	157045	3864	26147	3361	25490
1979	27073	22315	50194	18636	50481	90267	2231	15058	1823	14528
1980	87067	51899	117530	21426	95490	189152	5190	35259	4633	34525
1981	68581	47343	106836	32768	100331	185233	4734	32051	4403	31615
1982	53085	34910	78873	43678	93497	156236	3491	23662	3081	23127
1983	33320	25378	57268	30804	67021	112531	2538	17181	2267	16824
1984	25258	18063	40839	4026	29802	62306	1806	12252	1478	11822
1985	16789	14481	32596	3977	24644	50494	1448	9779	1258	9530
1986	34071	24703	55734	17738	52991	97275	2470	16720	2177	16334
1987	49799	32885	74471	29695	76625	135970	3289	22341	2895	21821
1988	32386	20681	46789	27842	57355	94614	2068	14037	1625	13452
1989	26836	20181	45509	26728	55528	91673	2018	13653	1727	13270
1990	17316	11482	25967	9771	26158	46828	1148	7790	923	7493
1991	7679	5477	12467	7779	15596	25571	548	3740	491	3665
1992	19608	14756	37045	13713	28469	50758	2515	15548	2012	14889
1993	9651	10242	29482	6592	16834	36074	3858	18234	3624	17922
1994	11056	11396	34514	0	11396	34514	5653	24396	5347	23992
1995	8714	16520	51530	0	16520	51530	12368	44205	12083	43828
1996	5479	11814	37523	4960	16773	42483	9113	32759	8878	32448
1997	5550	12605	31973	5161	17766	37134	8919	26674	8785	26497
1998	0	21886	50512	3990	25876	54502	21886	50512	21574	50200
1999	0	6329	31343	506	6835	31849	5245	30259	4832	29846
2000	0	8460	33743	873	9333	34616	7108	32391	6701	31984
2001	0	9542	38034	1232	10774	39266	7869	36361	7384	35876
2002	0	6308	18606	2960	9268	21567	5446	17586	5263	17370
2003	0	5311	16943	797	6107	17740	4006	15399	3793	15147
2004	0	8796	19019	1018	9814	20037	6578	16395	6332	16104
2005	0	7146	23458	725	7871	24183	5341	21322	5107	21046

Estimates are based on:

EST LARGE RETURNS - (COMM CATCH*PROP LAB ORIGIN)/EXP RATE, PROP SFAs1,2&14B=.6-.8,SFA 1: 0.64-0.72 & SFA 2 0.88-0.95 (97);

EXP RATE-SFAs1,2&14B=.7-.9(69-91),.58-.83(92),.38-.62(93),.29-.50(94), .15-.26(95), .13-.23(96), - SFA 1: 0.22-0.40, SFA 2: 0.16-0.28 (97)

EST 2SW RETURNS - (EST LARGE RETURNS*PROP 2SW), PROP 2SW SFA 1=.7-.9,SFAs 2&14B=.6-.8

WG - are North American 1SW salmon of river age 4 and older of which 70% are Labrador origin

EST RET TO FRESHWATER - (EST 2SW RET-2SW CATCHES)

EST 2SW SPAWNERS = EST 2SW RETURNS TO FRESHWATER - 2SW ANGLING CATCHES

*Catches for 1969-73 are Labrador totals distributed into SFAs as the proportion of landings by SFA in 1974-78.

**1997 Preliminary values adjusted for size category and SFA 14B recruits derived as 0.0426 of SFAs 1+2 based on proportionate drainage areas

Returns in 1998-2001 were estimated from regression

Returns in 2002-2005 from counting fence returns and drainage areas

Annex 5(iii): Atlantic salmon returns to freshwater, total recruits prior to the commercial fishery and spawners summed for Salmon Fishing Area 3-14A, insular Newfoundland, 1969-2005

	Small catch	Small returns to river		Small spawners		Large returns to river		Large catch	Large spawners		2SW returns to river		2SW spawners	
Year	Retained	Min	Max	Min	Max	Min	Max	Retained	Min	Max	Min	Max	Min	Max
1969	34944	109580	219669	74636	184725	10634	25631	2310	8324	23321	2193	8995	1383	7760
1970	30437	140194	281466	109757	251030	12731	29313	2138	10593	27175	3135	11517	2359	10340
1971	26666	112644	226129	85978	199463	9999	23221	1602	8397	21619	2388	8923	1817	8055
1972	24402	109282	219412	84880	195010	10368	23434	1380	8988	22054	2511	9003	2008	8240
1973	35482	144267	289447	108785	253965	13489	31645	1923	11566	29722	2995	11527	2283	10449
1974	26485	85216	170748	58731	144263	10541	21113	1213	9328	19900	1940	6596	1510	5942
1975	33390	112272	225165	78882	191775	11605	23260	1241	10364	22019	2305	7725	1888	7086
1976	34463	115034	230595	80571	196132	10863	21768	1051	9812	20717	2334	7698	2011	7198
1977	34352	110114	220501	75762	186149	9795	19624	2755	7040	16869	1845	6247	1114	5088
1978	28619	97375	195048	68756	166429	7892	15841	1563	6329	14278	1991	6396	1557	5712
1979	31169	107402	215160	76233	183991	5469	10962	561	4908	10401	1088	3644	980	3463
1980	35849	121038	242499	85189	206650	9400	18866	1922	7478	16944	2432	7778	1888	6925
1981	46670	157425	315347	110755	268677	21022	42096	1369	19653	40727	3451	12035	3074	11442
1982	41871	141247	283002	99376	241131	9060	18174	1248	7812	16926	2914	9012	2579	8481
1983	32420	109934	220216	77514	187796	9717	19490	1382	8335	18108	2586	8225	2244	7677
1984	39331	130836	262061	91505	222730	8115	16268	511	7604	15757	2233	7060	2063	6800
1985	36552	121731	243727	85179	207175	3672	7370	0	3641	7339	958	3059	946	3042
1986	37496	125329	251033	87833	213537	7052	14140	0	6972	14060	1606	5245	1575	5198
1987	24482	128578	257473	104096	232991	6394	12817	0	6353	12776	1336	4433	1320	4409
1988	39841	133237	266895	93396	227054	6572	13183	0	6512	13123	1563	5068	1540	5033
1989	18462	60260	120661	41798	102199	3234	6482	0	3216	6463	697	2299	690	2289
1990	29967	99543	199416	69576	169449	5939	11909	0	5889	11859	1347	4401	1327	4372
1991	20529	64552	129308	44023	108779	4534	9090	0	4500	9056	1054	3429	1041	3410
1992	23118	118778	237811	95096	214129	16705	33463	0	16564	33322	3111	10554	3057	10474
1993	24693	134150	268550	107816	242217	8121	16267	0	7957	16103	1499	5094	1449	5017
1994	29225	91495	189808	60194	158507	7776	16029	0	7308	15561	1495	5226	1368	5024
1995	30512	167485	301743	134676	268934	13391	24268	0	12926	23802	2243	7535	2125	7343
1996	35440	200277	422635	161780	384138	17291	35518	0	16719	34946	2964	8832	2824	8605
1997	22819	118973	192852	93841	167720	18213	29000	0	17798	28584	3469	8538	3348	8346
1998	22668	150644	202611	125215	177182	23727	30545	0	23371	30189	4280	8813	4195	8674
1999	22870	163417	215042	138692	190317	22018	37509	0	21697	37189	2599	9661	2551	9565
2000	21808	148710	254736	124643	230669	16432	54789	0	15929	54286	2022	12023	1829	11781
2001	20977	136949	194299	111756	169106	14601	37188	0	14201	36788	1614	7832	1534	7709
2002	20913	134679	187273	111970	164564	10855	26315	0	9555	25015	1268	5796	1175	5586
2003	21226	174862	256264	151998	233401	12456	32090	0	12094	31727	1419	6894	1375	6803
2004	19946	160252	243479	138564	221790	11497	30067	0	11133	29702	1309	6934	1259	6834
2005	16679	214683	288962	196734	271013	19251	40420	0	18966	40134	2020	8836	1841	8776

SRR (Small returns to river) are the sum of Bay St. George small returns (Reddin & Mullins 1996)
plus Humber R small returns (Mullins & Reddin 1996) plus small returns in SFAs 3-12 & 14A.
SSR (Small recruits) = SRR/(1-Exploitation rate commercial (ERC)) where ERC=0.5-0.7, 1969-91 & ERC=0, 1992-98.
SS (Small spawners) = SSR-(SC+(SR*0.1))
SC = small salmon catch retained
SR = small salmon catch released with assumed mortalities at 10%
RL (RATIO large:small) are from counting facilities in SFAs 3-11, 13 & 14A, angling catches in SFA 12.
LRR (Large returns to river) = SRR * RL
LR (Large recruits) = LRR*(1-Exploitation rate large (ERL)), where ERL=0.7-0.9, 1969-91; & ERL=0, 1992-98.
LS (Large spawners) = LRR-large catch retained (LC)-(0.1*large catch released)
2SW-RR (2SW returns to river)= LRR*proportion 2SW of 0.4-0.6 for SFAs 12-14A & 0.1-0.2 for SFAs 3-11.
2SW-S (2SW spawners) = LS * proportion 2SW of 0.4-0.6 for SFAs 12-14A & 0.1-0.2 for SFAs 3-11.
2SW-R (2SW recruits) = LR * proportion 2SW of 0.4-0.6 for SFAs 12-14A& 0.1-0.2 for SFAs 3-11.

Annex 5(iv): Small, large, and 2SW return and spawner estimates for SFA 15

Year	Small salmon				2SW salmon				Large salmon				Proportion 2SW in large salmon
	Returns		Spawners		Returns		Spawners		Returns		Spawners		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
1970	3513	7505	1497	4418	16221	23694	1246	3606	24955	36452	1917	5548	0.65
1971	2629	5566	1116	3246	7863	11318	550	1518	12096	17412	846	2335	0.65
1972	2603	5537	1092	3235	6266	12958	2550	7130	10621	21963	4323	12085	0.59
1973	5146	9852	1589	4720	7835	16023	3096	8648	10588	21653	4184	11686	0.74
1974	2869	6007	1159	3422	9564	19968	3902	11112	13102	27353	5345	15221	0.73
1975	3150	6567	1262	3717	5711	10976	1906	5261	7229	13894	2413	6660	0.79
1976	11884	20582	2619	7647	9362	19301	3804	10878	12318	25396	5005	14313	0.76
1977	7438	14652	2606	7527	11629	23571	4754	13270	14011	28399	5728	15988	0.83
1978	5215	9595	1477	4244	7287	14418	2826	7437	9716	19224	3768	9917	0.75
1979	5451	11163	2223	6260	1864	3196	568	1327	3655	6267	1114	2602	0.51
1980	9692	18781	3164	9285	9294	18255	3708	9717	11473	22537	4577	11997	0.81
1981	11367	21188	3362	9669	5677	9995	1487	3903	12078	21265	3163	8305	0.47
1982	8889	16834	2736	7978	5565	8856	1068	2713	9431	15011	1810	4599	0.59
1983	3621	6207	799	2268	5476	8770	976	2648	9281	14864	1654	4489	0.59
1984	11861	18589	1646	4732	5470	9667	2847	5848	6924	12237	3603	7403	0.79
1985	8525	18272	3639	10801	6175	12741	4788	10140	9802	20224	7600	16096	0.63
1986	12895	27635	5490	16311	10126	20617	7853	16317	13324	27128	10333	21470	0.76
1987	11708	24768	4930	14408	6161	12197	4437	9217	9627	19058	6932	14401	0.64
1988	16037	34159	6796	20027	9213	18880	7151	14979	12796	26222	9932	20804	0.72
1989	7673	16088	3185	9249	5646	11284	4172	8655	9905	19797	7319	15185	0.57
1990	9527	19902	3975	11418	5525	11070	4125	8592	8125	16280	6066	12636	0.68
1991	5276	10962	2219	6270	3092	6104	2311	4694	6185	12207	4621	9388	0.50
1992	10529	22220	4462	12930	5146	10399	3848	8052	9530	19257	7125	14911	0.54
1993	6578	13541	2739	7643	1763	3497	1262	2659	4407	8742	3156	6647	0.40
1994	10446	21861	4390	12580	5096	10286	3828	7990	8493	17143	6379	13317	0.60
1995	3310	6832	1344	3830	3636	7077	2587	5290	5590	10880	3977	8132	0.65
1996	7468	15529	3259	9043	5067	10234	3836	7979	7796	15745	5902	12275	0.65
1997	7666	16238	3572	9898	3446	6891	2605	5392	5302	10602	4008	8295	0.65
1998	7657	18381	3710	12036	1866	4916	390	2584	2871	7562	600	3976	0.65
1999	5712	12785	3096	8614	2225	4778	1632	3709	3423	7350	2511	5706	0.65
2000	7659	12983	4581	9160	3108	4676	1823	3145	4782	7193	2805	4838	0.65
2001	4640	10143	2563	8066	3604	7878	3507	7781	5545	12120	5396	11972	0.65
2002	11838	25877	6539	20578	2246	4910	2186	4850	3456	7555	3363	7462	0.65
2003	3226	7052	1782	5608	4032	8815	3924	8706	6204	13561	6037	13394	0.65
2004	12497	27317	6248	19122	3019	6599	2928	6480	4644	10152	4505	9970	0.65
2005	4535	9913	2268	6939	3540	7739	3434	7599	5446	11906	5283	11691	0.65

Angling catches were updated for 2004. Angling catches for 2005 are preliminary

Annex 5(va): Returns of large salmon and 2SW salmon to SFA 16

	2SW returns to SFA 16		Large Salmon Returns to the Miramichi River						Returns of large saln
			Point			Prop.	2SW Returns		
Year	Min.	Max.	Estimate	Min.	Max.	2SW	Min	Max	Min
1971	19697	32746	24407	19526	32461	0.918	17924	29799	21457
1972	24645	40972	29049	23239	38635	0.965	22427	37284	25538
1973	22896	38065	27192	21754	36165	0.958	20835	34639	23905
1974	33999	56523	42592	34074	56647	0.908	30939	51436	37444
1975	21990	36558	28817	23054	38327	0.868	20011	33267	25334
1976	17118	28459	22801	18241	30325	0.854	15578	25898	20045
1977	43160	71753	51842	41474	68950	0.947	39275	65296	45575
1978	18539	30822	24493	19594	32576	0.861	16871	28048	21532
1979	5484	9117	9054	7243	12042	0.689	4991	8297	7960
1980	30332	50426	36318	29054	48303	0.95	27602	45888	31928
1981	9489	15775	16182	12946	21522	0.667	8635	14355	14226
1982	21875	36368	30758	24606	40908	0.809	19907	33095	27040
1983	19762	32854	27924	22339	37139	0.805	17983	29897	24549
1984	12562	20884	15137	12110	20132	0.944	11431	19005	13307
1985	15861	26369	20738	16590	27582	0.87	14434	23996	18231
1986	23460	39003	31285	25028	41609	0.853	21349	35493	27503
1987	13590	22594	19421	15537	25830	0.796	12367	20561	17073
1988	15599	25933	21745	17396	28921	0.816	14195	23599	19116
1989	9880	16426	17211	13769	22891	0.653	8991	14948	15131
1990	14452	24087	28574	21350	35583	0.616	13152	21919	23462
1991	14892	24820	29949	22400	37333	0.605	13552	22586	24615
1992	21106	30340	37000	31056	44643	0.618	19206	27609	34127
1993	14946	58092	35000	19732	76695	0.689	13601	52863	21684
1994	13155	24008	20946	15870	28962	0.754	11971	21847	17440
1995	24711	35937	32015	26643	38747	0.844	22487	32703	29278
1996	10711	18429	18433	14294	24594	0.682	9747	16771	15708
1997	8254	13759	16399	12931	21554	0.581	7511	12520	14210
1998	4565	11229	14753	10039	24695	0.414	4154	10218	11032
1999	6059	9627	14078	11329	18002	0.487	5513	8761	12449
2000	6280	10757	15492	12058	20653	0.474	5715	9789	13250
2001	12615	17780	21027	17780	25060	0.646	11479	16180	19538
2002	4074	9322	10453	7382	16892	0.502	3707	8483	8112
2003	9549	16916	19361	14849	26305	0.585	8689	15393	16317
2004	10368	20028	22202	16552	31974	0.570	9435	18225	18189
2005	7308	21923	17000	10000	30000	0.665	6650	19950	10989

Annex 5(vb): Large salmon and 2SW salmon spawners to SFA 16. Same procedure as for returns (Annex 5(va))

	2SW spawners to SFA 16		Large Salmon Spawners to the Miramichi River						Large salmon spawn
			Point			Prop.	2SW Spawners		
Year	Min.	Max.	Estimate	Min.	Max.	2SW	Min	Max	Min
1971	3508	5832	4347	3478	5782	0.918	3192	5307	3822
1972	14992	24924	17671	14137	23502	0.965	13643	22681	15535
1973	17134	28486	20349	16279	27064	0.958	15592	25922	17889
1974	27495	45711	34445	27556	45812	0.908	25021	41597	30281
1975	16366	27209	21448	17158	28526	0.868	14893	24760	18855
1976	10760	17889	14332	11466	19062	0.854	9792	16279	12600
1977	27404	45560	32917	26334	43780	0.947	24938	41459	28938
1978	8197	13627	10829	8663	14403	0.861	7459	12401	9520
1979	2751	4573	4541	3633	6040	0.689	2503	4161	3992
1980	15762	26204	18873	15098	25101	0.950	14343	23846	16592
1981	2702	4492	4608	3686	6129	0.667	2459	4088	4051
1982	9429	15676	13258	10606	17633	0.809	8581	14265	11655
1983	5986	9951	8458	6766	11249	0.805	5447	9056	7436
1984	12189	20264	14687	11750	19534	0.944	11092	18440	12912
1985	15390	25586	20122	16098	26762	0.870	14005	23283	17690
1986	22659	37670	30216	24173	40187	0.853	20619	34280	26564
1987	12635	21006	18056	14445	24014	0.796	11498	19116	15873
1988	15050	25021	20980	16784	27903	0.816	13696	22769	18444
1989	8921	14831	15540	12432	20668	0.653	8118	13496	13662
1990	13785	23420	27588	20364	34597	0.616	12544	21312	22378
1991	14321	24249	29089	21540	36473	0.605	13032	22066	23670
1992	20377	29610	35927	29983	43570	0.618	18543	26945	32948
1993	14483	57629	34389	19121	76084	0.689	13179	52442	21012
1994	12826	23679	20549	15473	28565	0.754	11672	21548	17003
1995	24192	35419	31456	26084	38188	0.844	22015	32231	28664
1996	10185	17903	17731	13592	23892	0.682	9268	16292	14936
1997	7727	13231	15573	12105	20728	0.581	7032	12041	13302
1998	4428	10892	14310	9738	23954	0.414	4029	9912	10701
1999	5877	9339	13655	10989	17462	0.487	5348	8498	12076
2000	6092	10435	15027	11696	20034	0.474	5544	9496	12853
2001	12236	17247	20396	17246	24308	0.646	11135	15695	18952
2002	3952	9043	10139	7160	16385	0.502	3596	8229	7869
2003	9262	16408	18780	14403	25516	0.585	8429	14932	15828
2004	10057	19427	21536	16055	31015	0.570	9152	17679	17643
2005	7088	21265	16490	9700	29100	0.665	6451	19352	10659

Annex 5(vc): Returns of small salmon and 1SW salmon to SFA 16.

	1SW returns to SFA 16		Small returns to Miramichi			1SW Returns to Miramichi	
						0.97	1.00
Year	Min.	Max.	Small	Min.	Max.	Min	Max
1971	30420	52137	35673	28538	47445	27682	47445
1972	39461	67633	46275	37020	61546	35909	61546
1973	37986	65104	44545	35636	59245	34567	59245
1974	62607	107303	73418	58734	97646	56972	97646
1975	55345	94857	64902	51922	86320	50364	86320
1976	78095	133848	91580	73264	121801	71066	121801
1977	23658	40547	27743	22194	36898	21529	36898
1978	20711	35496	24287	19430	32302	18847	32302
1979	43460	74487	50965	40772	67783	39549	67783
1980	35464	60782	41588	33270	55312	32272	55312
1981	55661	95399	65273	52218	86813	50652	86813
1982	68543	117477	80379	64303	106904	62374	106904
1983	21476	36807	25184	20147	33495	19543	33495
1984	25333	43418	29707	23766	39510	23053	39510
1985	51847	88862	60800	48640	80864	47181	80864
1986	100240	171802	117549	94039	156340	91218	156340
1987	72327	123962	84816	67853	112805	65817	112805
1988	103966	178189	121919	97535	162152	94609	162152
1989	64153	109953	75231	60185	100057	58379	100057
1990	72484	124286	83500	68000	113100	65960	113100
1991	48713	83516	60900	45700	76000	44329	76000
1992	136440	202198	152600	128000	184000	124160	184000
1993	65555	169011	95000	61500	153800	59655	153800
1994	39087	57794	43571	36669	52592	35569	52592
1995	41524	61253	46458	38956	55741	37787	55741
1996	30041	44423	33610	28183	40425	27337	40425
1997	13470	23300	16139	*12637*	*21203*	12258	21203
1998	19962	31885	23143	18727	29015	18165	29015
1999	21073	29884	23121	19770	27194	19177	27194
2000	29411	40958	32031	27592	37272	26764	37272
2001	25606	37705	28664	24022	34312	23301	34312
2002	40139	59277	44864	37656	53942	36526	53942
2003	26045	41966	30264	24434	38189	23701	38189
2004	39089	58513	43999	36671	53247	35571	53247
2005	26648	49451	32000	25000	45000	24250	45000

Annex 5(vd): Small salmon and 1SW salmon spawners to SFA 16. Same procedure as for Annex 5(vc)

	1SW Spawners to SFA 16		Small Spawners to Miramichi			1SW Spawners to Miramichi	
Year	Min	Max	Small	Min.	Max.	Min	Max
1971	17557	32075	21946	17557	29188	15977	29188
1972	21708	39659	27135	21708	36090	19754	36090
1973	24550	44852	30688	24550	40815	22341	40815
1974	44149	80656	55186	44149	73397	40175	73397
1975	38775	70839	48469	38775	64464	35285	64464
1976	49904	91171	62380	49904	82965	45413	82965
1977	10598	19361	13247	10598	17619	9644	17619
1978	11482	20977	14353	11482	19089	10449	19089
1979	24678	45086	30848	24678	41028	22457	41028
1980	21515	39307	26894	21515	35769	19579	35769
1981	31943	58358	39929	31943	53106	29068	53106
1982	44800	81846	56000	44800	74480	40768	74480
1983	11879	21702	14849	11879	19749	10810	19749
1984	15143	27665	18929	15143	25176	13780	25176
1985	33452	61114	41815	33452	55614	30441	55614
1986	71518	130659	89398	71518	118899	65082	118899
1987	50222	91751	62777	50222	83493	45702	83493
1988	72222	131945	90278	72222	120070	65722	120070
1989	38708	70717	48385	38708	64352	35224	64352
1990	44376	98325	59876	44376	89476	40382	89476
1991	33289	69878	48489	33289	63589	30293	63589
1992	100557	172041	125157	100557	156557	91507	156557
1993	45516	151446	79016	45516	137816	41420	137816
1994	22232	41929	29134	22232	38155	20232	38155
1995	18895	39208	26397	18895	35680	17194	35680
1996	8618	22923	14045	8618	20860	7842	20860
1997	3051	12766	6553	3051	11617	2776	11617
1998	12360	21044	15274	12360	19150	11247	19150
1999	13048	19723	15260	13048	17948	11874	17948
2000	18211	27032	21140	18211	24600	16572	24600
2001	15854	24886	18918	15854	22646	14428	22646
2002	24853	39123	29610	24853	35602	22616	35602
2003	16126	27698	19974	16126	25205	14675	25205
2004	24203	38619	29039	24203	35143	22025	35143
2005	17588	32637	21120	16500	29700	16005	29700

Annex 5(vi): Estimated Atlantic salmon returning recruits and spawners to the Morell River, SFA 17

	Small recruits		Small spawners		Large recruits		Large spawners		2SW recruits		2SW spawners	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	5	9	3	7	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	14	28	8	22	2	5	1	4	2	5	1	4
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	2	5	1	4	5	9	3	7	5	9	3	7
1980	12	23	7	18	2	5	1	4	2	5	1	4
1981	259	498	151	390	40	77	36	73	40	77	36	73
1982	175	336	102	263	16	31	8	23	16	31	8	23
1983	17	32	10	25	17	32	15	30	17	32	15	30
1984	17	32	10	25	13	26	13	26	13	26	13	26
1985	113	217	66	170	8	15	8	15	8	15	8	15
1986	566	1088	330	852	5	11	5	11	5	11	5	11
1987	1141	2194	665	1718	66	128	66	128	66	128	66	128
1988	1542	2963	899	2320	96	185	96	185	96	185	96	185
1989	400	770	233	603	149	287	149	287	149	287	149	287
1990	1842	3539	1074	2771	284	545	284	545	284	545	284	545
1991	1576	3028	919	2371	188	361	188	361	188	361	188	361
1992	1873	3599	1092	2818	95	183	95	183	95	183	95	183
1993	1277	2454	745	1922	22	43	22	43	22	43	22	43
1994	210	385	118	292	169	310	166	307	169	310	166	307
1995	1058	1914	585	1441	85	154	81	151	85	154	81	151
1996	1161	2576	738	2154	158	351	154	347	158	351	154	347
1997	485	932	283	730	31	59	30	58	31	59	30	58
1998	635	1221	370	956	79	151	76	149	79	151	76	149
1999	379	728	221	570	23	45	20	41	23	45	20	41
2000	304	584	177	457	56	108	55	107	56	108	55	107
2001	429	824	250	645	57	110	55	107	57	110	55	107
2002	307	591	179	463	46	88	45	87	46	88	45	87
2003	591	1135	344	889	77	148	74	145	77	148	74	145
2004	163	313	95	245	32	61	31	61	32	61	31	61
2005	225	432	131	338	36	69	34	67	36	69	34	67

Annex 5(vii): Total returns and spawners of small salmon and large salmon, and 2SW salmon returns and spawners to SFA 18.

	Small salmon				Large Salmon				2SW Salmon			
	Returns		Spawners		Returns		Spawners		Returns		Spawners	
Year	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1970	280	1,073	176	842	6,161	7,858	709	2,660	4,744	6,836	546	2,314
1971	69	265	44	208	2,456	3,198	276	1,036	1,891	2,782	213	901
1972	138	530	87	416	6,095	6,924	293	1,101	4,693	6,024	226	958
1973	546	2,095	344	1,645	5,376	6,299	309	1,160	4,140	5,481	238	1,009
1974	197	757	124	595	7,119	7,963	343	1,286	5,481	6,928	264	1,119
1975	118	454	75	357	4,483	4,989	231	864	3,452	4,340	178	752
1976	316	1,212	199	951	3,578	4,223	288	1,080	2,755	3,674	222	939
1977	227	871	143	684	5,175	6,280	424	1,587	3,985	5,463	326	1,381
1978	82	316	52	248	5,954	7,201	550	2,062	4,585	6,265	424	1,794
1979	1,963	7,536	1,237	5,915	1,676	2,315	286	1,071	1,290	2,014	220	932
1980	549	2,108	346	1,655	4,846	5,951	536	2,009	3,732	5,177	413	1,748
1981	2,956	11,348	1,863	8,908	3,234	4,332	487	1,823	2,490	3,769	375	1,586
1982	2,272	8,722	1,432	6,847	5,370	6,783	598	2,242	4,135	5,901	461	1,951
1983	224	858	141	674	4,848	6,024	517	1,938	3,733	5,241	398	1,686
1984	487	1,867	192	1,210	3,105	4,107	336	1,319	2,391	3,573	259	1,148
1985	771	3,167	152	1,786	1,196	5,150	1,130	5,009	921	4,481	870	4,358
1986	1,020	3,854	68	1,731	2,953	13,195	2,811	12,888	2,274	11,479	2,164	11,213
1987	1,391	5,061	202	2,410	3,209	15,193	3,109	14,977	2,471	13,218	2,394	13,030
1988	2,037	7,900	967	5,514	1,387	5,794	1,296	5,598	1,068	5,040	998	4,870
1989	719	2,651	37	1,129	1,842	8,579	1,768	8,420	1,418	7,464	1,362	7,326
1990	1,144	13,778	354	12,017	3,754	18,429	3,683	18,276	2,891	16,033	2,836	15,900
1991	966	10,559	51	8,519	1,998	13,439	1,915	13,260	1,539	11,692	1,475	11,536
1992	1,531	6,565	853	5,053	5,257	21,778	5,166	21,581	4,048	18,947	3,978	18,776
1993	1,812	10,451	1,102	8,869	2,597	14,305	2,538	14,177	2,000	12,445	1,954	12,334
1994	697	2,988	315	2,136	2,534	10,454	2,465	10,304	1,951	9,095	1,898	8,964
1995	655	2,939	400	2,372	1,887	8,862	1,837	8,755	1,453	7,710	1,415	7,617
1996	1,554	8,033	1,138	7,105	2,388	9,408	2,300	9,220	1,839	8,185	1,771	8,021
1997	594	3,219	215	2,375	3,951	18,856	3,838	18,611	3,043	16,404	2,955	16,192
1998	672	3,643	244	2,688	2,517	12,012	2,445	11,856	1,938	10,450	1,883	10,315
1999	594	3,219	215	2,375	1,517	7,238	1,473	7,144	1,168	6,297	1,134	6,215
2000	500	2,712	181	2,001	1,306	6,234	1,269	6,154	1,006	5,424	977	5,354
2001	695	3,767	252	2,780	1,603	7,650	1,557	7,551	1,234	6,655	1,199	6,569
2002	693	3,757	251	2,772	1,147	5,473	1,114	5,402	883	4,762	858	4,700
2003	624	3,384	226	2,497	2,136	10,194	2,075	10,061	1,645	8,868	1,598	8,753
2004	815	4,419	296	3,261	2,177	10,391	2,115	10,256	1,677	9,040	1,628	8,923
2005	886	4,802	321	3,543	2,675	12,764	2,598	12,599	2,060	11,105	2,001	10,961

Annex 5(viii): Total 1SW returns and spawners, SFAs 19, 20, 21 and 23, 1970–2005

	RETURNS						TOTAL		SPAWNERS						TOTAL	
	River returns SFA 19-21		Comm-ercial	SFA 23			RETURNS SFAs 19,20,21,23		angled	Spawners 19-21		SFA 23 H+W rtns		Harvest	SPAWNERS 19,20,21,23	
				Wild	Wild	Hatch										
Year	MIN	MAX	19-21	MIN	MAX		MIN	MAX	19-21	MIN	MAX	MIN	MAX		MIN	MAX
1970	8,236	16,868	3,189	5,206	7,421	100	16,731	27,578	3,609	4,627	13,259	5,306	7,521	1,420	8,513	19,360
1971	6,345	13,062	1,922	2,883	4,176	365	11,515	19,525	2,761	3,584	10,301	3,248	4,541	2,032	4,800	12,810
1972	6,636	13,354	1,055	1,546	2,221	285	9,522	16,915	2,917	3,719	10,437	1,831	2,506	2,558	2,992	10,385
1973	8,225	16,744	1,067	3,509	5,047	1,965	14,766	24,823	3,604	4,621	13,140	5,474	7,012	1,437	8,658	18,715
1974	14,478	29,385	2,050	6,204	8,910	3,991	26,723	44,336	6,340	8,138	23,045	10,195	12,901	2,124	16,209	33,822
1975	5,096	10,393	2,822	11,648	16,727	6,374	25,940	36,316	2,227	2,869	8,166	18,022	23,101	2,659	18,232	28,608
1976	12,421	25,398	1,675	13,761	19,790	9,074	36,931	55,937	5,404	7,017	19,994	22,835	28,864	5,263	24,589	43,595
1977	13,349	27,943	3,773	6,746	9,679	6,992	30,860	48,387	5,841	7,508	22,102	13,738	16,671	4,542	16,704	34,231
1978	2,535	5,241	3,651	3,227	4,651	3,044	12,457	16,587	1,113	1,422	4,128	6,271	7,695	2,015	5,678	9,808
1979	12,365	25,381	3,154	11,529	16,690	3,827	30,875	49,052	5,428	6,937	19,953	15,356	20,517	3,716	18,577	36,754
1980	16,534	33,825	8,252	14,346	20,690	10,793	49,925	73,560	7,253	9,281	26,572	25,139	31,483	5,542	28,878	52,513
1981	18,594	38,329	1,951	11,199	16,176	5,627	37,371	62,083	8,163	10,431	30,166	16,826	21,803	9,021	18,236	42,948
1982	10,008	20,552	2,020	8,773	12,598	3,038	23,839	38,208	4,361	5,647	16,191	11,811	15,636	5,279	12,179	26,548
1983	4,662	9,562	1,621	7,706	11,028	1,564	15,553	23,775	2,047	2,615	7,515	9,270	12,592	4,138	7,747	15,969
1984	12,398	25,815	0	14,105	20,227	1,451	27,954	47,493	4,724	7,674	21,091	15,556	21,678	5,266	17,964	37,503
1985	16,354	34,055	0	11,038	15,910	2,018	29,410	51,983	6,360	9,994	27,695	13,056	17,928	4,892	18,158	40,731
1986	16,661	34,495	0	13,412	19,321	862	30,935	54,678	6,182	10,479	28,313	14,274	20,183	3,549	21,204	44,947
1987	18,388	37,902	0	10,030	14,334	3,328	31,746	55,564	7,056	11,332	30,846	13,358	17,662	3,101	21,589	45,407
1988	16,611	33,851	0	15,131	21,834	1,250	32,992	56,935	6,384	10,227	27,467	16,381	23,084	3,320	23,288	47,231
1989	17,378	35,141	0	16,240	23,182	1,339	34,957	59,662	6,629	10,749	28,512	17,579	24,521	4,455	23,873	48,578
1990	20,119	41,652	0	12,287	17,643	1,533	33,939	60,828	7,391	12,728	34,261	13,820	19,176	3,795	22,753	49,642
1991	6,718	13,870	0	10,602	15,246	2,439	19,759	31,555	2,399	4,319	11,471	13,041	17,685	3,546	13,814	25,610
1992	9,269	18,936	0	11,340	16,181	2,223	22,832	37,340	3,629	5,640	15,307	13,563	18,404	4,078	15,125	29,633
1993	9,104	18,711	0	7,610	8,828		16,714	27,539	3,327	5,777	15,384	5,762	6,868		11,539	22,252
1994	2,446	4,973	0	5,770	6,610		8,216	11,583	493	1,953	4,480	4,965	5,738		6,918	10,218
1995	5,974	12,364	0	8,265	9,458		14,239	21,822	1,885	4,089	10,479	8,025	9,218		12,114	19,697
1996	9,888	20,791	0	12,907	15,256		22,795	36,047	2,211	7,677	18,580	11,576	13,892		19,253	32,472
1997	2,665	5,488	0	4,508	4,979		7,173	10,467	493	2,172	4,995	3,971	4,433		6,143	9,428
1998	5,745	11,824	0	9,203	10,801		14,948	22,625	0	5,745	11,824	8,775	10,348		14,520	22,172
1999	2,537	5,222	0	5,508	6,366		8,045	11,588	67	2,470	5,155	5,196	6,048		7,666	11,203
2000	4,005	8,244	0	4,796	5,453		8,801	13,697	0	4,005	8,244	4,455	5,087		8,460	13,331
2001	1,508	3,104	0	2,513	2,862		4,021	5,966	0	1,508	3,104	2,210	2,530		3,718	5,634
2002	3,375	6,946	0	3,501	3,991		6,876	10,937	0	3,375	6,946	3,232	3,689		6,607	10,635
2003	1,843	3,793	0	2,292	2,716		4,135	6,509	0	1,843	3,793	2,069	2,469		3,912	6,262
2004	2,497	5,140	0	3,454	4,297		5,951	9,437	0	2,497	5,140	3,229	4,039		5,726	9,179
2005	1,859	3,826		3,597	4,641		5,456	8,467	0	1,859	3,826	3,427	4,438		5,286	8,265

SFAs 19, 20, 21: Returns, 1970-1997, estimated as run size (1SW recreational catch / expl. rate [0.2 to 0.45]; where MIN and MAX selected as 5th and 95th percentile values from 1,000 monte carlo estimates) + estimated 1SW fish in commercial landings 1970-1983 (Cutting MS 1984). For 1998-2004, see "a" below.

SFA 22: Inner Fundy stocks and inner-Fundy SFA 23 (primarily 1SW fish) do not go to the North Atlantic.

SFA 23: For 1970-'97, similar to SFAs 19-21 except that estimated wild 1SW returns destined for Mactaquac Dam, Saint John River, replaced values for recreational catch and estimated proportions that production above Mactaquac is of the total (0.4-0.6) river replaced exploitation rates (commercial harvest, bi-catch etc., incl. in estimated returns); hatchery returns attributed to above Mactaquac only; 1SW production in rest of SFA (outer Fundy) omitted.

"a"- Revision of method, SFA 23, 1993-2004, estimated returns to Nashwaak fence raised by proportion of area below Mactaquac (0.21-0.30) and added to total estimated returns originating upriver of Mactaquac (Marshall et al. 1998); MIN and MAX removals below Mactaquac based on Nashwaak losses, Mactaquac losses are a single value and together summed and removed from returns to establish estimate of spawners. SFAs 19-21, estimate of returns 1998-2004 based on regression (revised in March 2005 with intercept set to zero) of LaHave wild counts on MIN and MAX estimates of total SFA 19-21 returns, 1984-1997, because there was no (1998,2000-04) & little (1999) angling in SFAs 20-21.

Annex 5(ixa): Total 2SW returns to SFAs 19, 20, 21 and 23, 1970–2005

	SFA 19		SFA 20		SFA 21		Total	SFA 23				TOTAL RETURNS	
								Wild	Wild	Htch	Htch	SFAs 19,20,21,23	
	MIN	MAX	MIN	MAX	MIN	MAX	Comm-	MIN	MAX	MIN	MAX		
	2SW=0.7-0.9		2SW=0.6-0.9		2SW=0.5-0.9		ercial	2SW= 0.85-0.95		2SW= 0.85-0.95			
Year	Exp. rate=0.2-0.45		Exp. rate=0.2-0.45		Exp. rate=0.2-0.45		19-21	p. abv= 0.4-0.6				MIN	MAX
1970	1,170	2,537	658	1,535	597	1,525	2,644	8,540	12,674	0	0	13,609	20,915
1971	600	1,266	344	802	481	1,199	2,607	7,089	10,463	66	73	11,187	16,410
1972	735	1,614	421	1,002	454	1,198	4,549	7,362	10,809	507	559	14,028	19,731
1973	726	1,571	665	1,532	546	1,437	4,217	3,773	5,559	432	477	10,359	14,793
1974	1,035	2,225	691	1,588	548	1,397	8,873	8,766	12,790	1,989	2,198	21,902	29,071
1975	376	824	149	343	882	2,321	9,430	11,217	16,490	1,890	2,088	23,944	31,496
1976	791	1,672	346	822	441	1,146	5,916	12,304	18,106	1,970	2,175	21,768	29,837
1977	999	2,152	660	1,509	873	2,354	9,205	14,539	21,420	2,330	2,575	28,606	39,215
1978	810	1,739	429	995	655	1,706	6,827	6,059	8,903	2,166	2,391	16,946	22,561
1979	532	1,169	431	978	508	1,288	2,326	4,149	6,084	1,016	1,123	8,962	12,968
1980	1,408	3,051	746	1,714	1,483	3,989	9,204	16,500	24,041	2,556	2,824	31,897	44,823
1981	886	1,856	926	2,133	1,754	4,475	4,438	8,696	12,690	2,330	2,577	19,030	28,169
1982	917	1,990	316	746	682	1,756	5,819	8,266	12,198	1,516	1,673	17,516	24,182
1983	477	1,030	641	1,475	552	1,434	2,978	8,718	12,793	944	1,043	14,310	20,753
1984	828	1,768	638	1,500	766	2,004	0	14,753	21,573	953	1,054	17,938	27,899
1985	1,495	3,132	2,703	6,355	2,102	5,469	0	15,793	23,002	748	826	22,841	38,784
1986	3,500	7,541	2,561	5,987	2,150	5,312	0	9,210	13,507	681	754	18,102	33,101
1987	2,427	5,237	1,066	2,527	1,114	2,872	0	6,512	9,590	410	453	11,529	20,679
1988	2,635	5,724	1,914	4,464	1,105	2,945	0	3,936	5,836	780	861	10,370	19,830
1989	2,236	4,810	1,512	3,485	1,631	4,086	0	6,159	8,994	401	443	11,939	21,818
1990	2,406	5,178	1,085	2,515	1,271	3,260	0	4,994	7,375	492	543	10,248	18,871
1991	1,890	4,050	965	2,200	421	1,071	0	6,739	9,902	598	661	10,613	17,884
1992	1,788	3,923	631	1,488	480	1,236	0	6,213	9,074	665	735	9,777	16,456
1993	876	1,897	1,006	2,321	564	1,498	0	4,345	4,820			6,791	10,536
1994	833	1,845	242	561	305	773	0	3,084	3,495			4,464	6,674
1995	759	1,582	666	1,565	518	1,339	0	3,439	3,998			5,382	8,484
1996	1,231	2,692	604	1,404	894	2,293	0	4,729	5,397			7,458	11,786
1997	607	1,299	170	387	301	1,026	0	2,769	3,176			3,847	5,888
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				889	1,824	0	1,372	1,642			2,261	3,466
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,439	2,954	0	2,375	2,640			3,814	5,594
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				870	1,786	0	988	1,206			1,859	2,992
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,506	3,091	0	1,938	2,279			3,444	5,370
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				251	515	0	483	548			734	1,063
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,523	3,126	0	1,056	1,198			2,579	4,323
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				585	1,202	0	1,335	1,605			1,920	2,807
2005					519	1,065	0	801	1,004			1,320	2,069

SFAs 19, 20, 21: Returns, 1970-'97 estimated as run size (MSW recreational catch * prop. 2SW [range of values]/ expl. rate [range of values]; where MIN and MAX selected as 5th and 95th percentile values from 1,000 monte carlo estimates) + estimated 2SW fish in commercial landings 1970-1983 (Cutting MS 1984). For 1998-2004 see "a" below.

SFA 22: Inner Fundy stocks do not go to north Atlantic.

SFA 23: For 1970-1997 Similar approach as for SFAs 19-21 except that estimated wild MSW returns destined for Mactaquac Dam, Saint John River, replaced values for recreational catch; and estimated proportions that production above Mactaquac is of the total river replaced exploitation rates (commercial harvest,bi-catch etc., incl. in estimated returns) + est. 0.85-0.95* MSW hatchery returns to Mactaquac; 2SW production in rest of SFA omitted. Note revisions to returns from 1993 to 2005 made in 2005.

"a": Revision of method, SFA 23, 1993-2005, estimated MSW returns to Nashwaak fence raised by prop. of area below Mactaquac (0.21-0.30) * prop. 2SW (0.7 & 0.9) and added to estimated MSW hatchery and wild returns * (Marshall et al. MS 1998) (0.85-0.95; 2SW) originating upriver of Mactaquac. MIN & MAX removals below Mactaquac based on Nashwaak losses: Mactaquac losses were a single value and together summed and removed from MSW returns (prevously) to estimate spawners.
SFAs 19-21, estimate of 2SW returns for 1998-'04, based on regression (revised in March 2005 with intercept set to zero) of LaHave wild counts on MIN and MAX estimates of total SFA 19-21 MSW returns and proportion 2SW fish in total MSW returns to LaHave.

Annex 5(ixb): Total 2SW spawners in SFAs 19, 20, 21 and 23, 1970-2005

	RETURNS						REMOVALS		SPAWNERS		SFA 23					
	SFA 19		SFA 20		SFA 21		angled (19-21)		SFAs (19-21)		RETURNS		REMOVALS		TOTAL SPAWNERS	
Year	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1970	1,170	2,537	658	1,535	597	1,525	941	1,375	1,485	4,222	8,540	12,674	7,004	7,828	3,021	9,068
1971	600	1,266	344	802	481	1,199	541	812	884	2,455	7,155	10,536	3,543	3,960	4,496	9,032
1972	735	1,614	421	1,002	454	1,198	623	922	987	2,892	7,869	11,368	1,397	1,562	7,459	12,699
1973	726	1,571	665	1,532	546	1,437	740	1,108	1,197	3,432	4,205	6,036	1,454	1,625	3,949	7,844
1974	1,035	2,225	691	1,588	548	1,397	871	1,277	1,404	3,933	10,755	14,988	2,632	2,942	9,526	15,979
1975	376	824	149	343	882	2,321	534	867	874	2,621	13,107	18,578	2,120	2,369	11,861	18,830
1976	791	1,672	346	822	441	1,146	603	887	975	2,754	14,274	20,281	4,203	4,698	11,045	18,337
1977	999	2,152	660	1,509	873	2,354	967	1,463	1,565	4,552	16,869	23,995	4,856	5,427	13,578	23,119
1978	810	1,739	429	995	655	1,706	723	1,088	1,171	3,352	8,225	11,294	2,879	3,218	6,517	11,428
1979	532	1,169	431	978	508	1,288	560	851	911	2,585	5,165	7,207	1,393	1,557	4,683	8,234
1980	1,408	3,051	746	1,714	1,483	3,989	1,390	2,131	2,247	6,623	19,056	26,865	7,033	7,860	14,270	25,628
1981	886	1,856	926	2,133	1,754	4,475	1,338	2,125	2,228	6,339	11,026	15,267	7,384	8,253	5,870	13,353
1982	917	1,990	316	746	682	1,756	734	1,096	1,181	3,396	9,782	13,871	5,307	5,932	5,656	11,335
1983	477	1,030	641	1,475	552	1,434	633	971	1,037	2,968	9,662	13,836	9,194	10,275	1,505	6,529
1984	828	1,768	638	1,500	766	2,004	267	419	1,965	4,853	15,706	22,627	3,426	3,829	14,245	23,650
1985	1,495	3,132	2,703	6,355	2,102	5,469			6,300	14,956	16,541	23,828	4,656	5,204	18,185	33,580
1986	3,500	7,541	2,561	5,987	2,150	5,312			8,211	18,840	9,891	14,261	2,667	2,981	15,435	30,120
1987	2,427	5,237	1,066	2,527	1,114	2,872			4,607	10,636	6,922	10,043	1,294	1,446	10,235	19,233
1988	2,635	5,724	1,914	4,464	1,105	2,945			5,654	13,133	4,716	6,697	1,296	1,449	9,074	18,381
1989	2,236	4,810	1,512	3,485	1,631	4,086			5,379	12,381	6,560	9,437	250	279	11,689	21,539
1990	2,406	5,178	1,085	2,515	1,271	3,260			4,762	10,953	5,486	7,918	560	626	9,688	18,245
1991	1,890	4,050	965	2,200	421	1,071			3,276	7,321	7,337	10,563	1,257	1,405	9,356	16,479
1992	1,788	3,923	631	1,488	480	1,236			2,899	6,647	6,878	9,809	1,052	1,176	8,725	15,280
1993	876	1,897	1,006	2,321	564	1,498			2,446	5,716	4,345	4,820	1,054	1,166	5,737	9,370
1994	833	1,845	242	561	305	773			1,380	3,179	3,084	3,495	697	815	3,767	5,859
1995	759	1,582	666	1,565	518	1,339			1,943	4,486	3,439	3,998	313	346	5,069	8,138
1996	1,231	2,692	604	1,404	894	2,293			2,729	6,389	4,729	5,397	720	812	6,738	10,974
1997	607	1,299	170	387	301	1,026			1,078	2,712	2,769	3,176	550	611	3,297	5,277
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>				889	1,824			889	1,824	1,372	1,642	304	340	1,957	3,126
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,439	2,954			1,439	2,954	2,375	2,640	441	459	3,373	5,135
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>				870	1,786			870	1,786	988	1,206	183	202	1,676	2,790
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,506	3,091			1,506	3,091	1,938	2,279	239	271	3,205	5,099
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>				251	515			251	515	483	548	166	192	568	871
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,523	3,126			1,523	3,126	1,056	1,198	178	200	2,401	4,123
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>				585	1,202			585	1,202	1,335	1,605	97	113	1,823	2,694
2005	>>>>>>>>>>>>>>>>>>>>>>>>>>				519	1,065			519	1,065	801	1,004	85	102	1,235	1,967

Spawners = returns minus removals where: "returns" are from previous Appendix as are outlines of revisions to methods for SFAs 19-21, 1998-2000, and SFA 23, 1993-2000. "Removals" of 2SW fish in SFAs 19-21 have been few, largely illegal and unascribed since the catch-and-release angling regulations in 1985; removals in SFA 23, 1985-1997, had been in total, the assessed losses to stocks originating above Mactaquac. The revised method, 1993-2000, incorporates 5th and 95th percentile values for losses noted on the Nashwaak raised to the total production area downstream of Mactaquac as well as the previously assessed and used values for stocks upstream of Mactaquac.

Annex 5(x): Estimated numbers of salmon returns and spawners for Québec 1969–2005

	Recruit of small salmon		Recruit of large salmon		Spawner of small salmon		Spawner of large salmon		Spawner of 2SW		Spawner of 2SW	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1 969	25 355	38 032	74 653	111 979	16 313	24 470	25 532	38 299	11 909	17 863	18 639	27 958
1 970	18 904	28 356	82 680	124 020	11 045	16 568	31 292	46 937	8 063	12 094	22 843	34 264
1 971	14 969	22 453	47 354	71 031	9 338	14 007	16 194	24 292	6 817	10 225	11 822	17 733
1 972	12 470	18 704	61 773	92 660	8 213	12 320	31 727	47 590	5 996	8 994	23 160	34 741
1 973	16 585	24 877	68 171	102 256	10 987	16 480	32 279	48 419	8 020	12 031	23 564	35 346
1 974	16 791	25 186	91 455	137 182	10 067	15 100	39 256	58 884	7 349	11 023	28 657	42 985
1 975	18 071	27 106	77 664	116 497	11 606	17 409	32 627	48 940	8 472	12 708	23 818	35 726
1 976	19 959	29 938	77 212	115 818	12 979	19 469	31 032	46 548	9 475	14 212	22 653	33 980
1 977	18 190	27 285	91 017	136 525	12 004	18 006	44 660	66 990	8 763	13 145	32 602	48 902
1 978	16 971	25 456	81 953	122 930	11 447	17 170	40 944	61 416	8 356	12 534	29 889	44 834
1 979	21 683	32 524	45 197	67 796	15 863	23 795	17 543	26 315	11 580	17 370	12 807	19 210
1 980	29 791	44 686	107 461	161 192	20 817	31 226	48 758	73 137	15 196	22 795	35 594	53 390
1 981	41 667	62 501	84 428	126 642	30 952	46 428	35 798	53 697	22 595	33 892	26 132	39 199
1 982	23 699	35 549	74 870	112 305	16 877	25 316	36 290	54 435	12 320	18 480	26 492	39 738
1 983	17 987	26 981	61 488	92 232	12 030	18 045	23 710	35 565	8 782	13 173	17 308	25 963
1 984	21 566	30 894	61 180	81 041	16 316	24 957	30 610	44 739	11 910	18 219	22 345	32 659
1 985	22 771	33 262	62 899	84 192	15 608	25 140	28 312	43 482	11 394	18 352	20 668	31 742
1 986	33 758	46 937	75 561	99 397	22 230	33 855	32 997	49 232	16 228	24 714	24 088	35 939
1 987	37 816	54 034	72 190	93 650	25 789	40 481	29 758	43 462	18 826	29 551	21 723	31 727
1 988	43 943	62 193	77 904	103 269	28 582	44 815	34 781	52 524	20 865	32 715	25 390	38 343
1 989	34 568	48 407	70 762	91 871	24 710	37 319	34 268	49 185	18 038	27 243	25 016	35 905
1 990	39 962	54 792	68 851	90 893	26 594	39 826	33 454	49 615	19 413	29 073	24 422	36 219
1 991	31 488	42 755	64 166	83 184	20 582	30 433	27 341	39 797	15 025	22 216	19 959	29 052
1 992	35 257	48 742	64 271	83 953	21 754	33 583	26 489	39 497	15 880	24 515	19 337	28 833
1 993	30 645	42 156	50 717	63 677	17 493	27 444	21 609	29 353	12 770	20 034	15 774	21 428
1 994	29 667	40 170	51 649	64 630	16 758	25 642	21 413	28 968	12 233	18 719	15 631	21 147
1 995	23 851	32 368	59 939	74 227	14 409	21 548	30 925	39 320	10 519	15 730	22 575	28 703
1 996	32 008	42 558	53 990	68 282	18 923	27 805	26 042	34 824	13 814	20 297	19 010	25 421
1 997	24 300	33 018	44 442	56 187	14 724	22 210	21 275	28 466	10 749	16 214	15 531	20 780
1 998	24 495	34 301	33 368	43 605	16 743	25 730	19 506	26 629	12 223	18 783	14 240	19 439
1 999	25 880	36 679	34 815	46 178	18 969	28 808	23 631	32 618	13 847	21 030	17 250	23 811
2 000	24 129	35 070	33 312	46 565	16 444	25 865	22 094	31 960	12 004	18 881	16 128	23 331
2 001	16 939	24 452	35 016	48 490	10 836	16 989	22 871	32 954	7 910	12 402	16 696	24 056
2 002	28 609	39 275	25 635	35 801	17 070	25 625	17 079	24 366	12 461	18 706	12 467	17 787
2 003	23 142	31 892	39 435	52 413	15 445	23 187	28 409	39 137	11 275	16 926	20 738	28 570
2 004	30 423	43 266	34 796	45 488	20 513	32 081	23 920	32 374	14 974	23 419	17 462	23 633
2 005	20 685	29 531	33 728	43 831	14 295	22 278	24 012	32 168	10 435	16 263	17 529	23 482

Annex 6: SAS program code for the provision of catch options for the West Greenland fishery for 2006–2008

A – code for forecasting PFA for North America using lagged spawners and phase shift

```
***FILE NAME:  pfa-model-PREDICTION-2006newPFA-LSNA.sas
Code updated by Gerald Chaput, DFO Gulf Region, Canada, revised April 2006;

OPTIONS NOCENTRE;
/**** ASCII file containing regional lagged spawner estimates,
 by minimum and maximum generated from Excel table of regional
 lagged spawners, edited and updated by Dave Reddin,
 DFO NL Region, Canada **/
Filename in1
"c:/data/Chaput/Ices2006/greenland-advice2006/regional-lagged-spawners.prn";

data spawners;
  infile in1 missover;
  input year LBLS_L LBLS_H NFLS_L NFLS_H QCLS_L QCLS_H GFLS_L GFLS_H
           SFLS_L SFLS_H USALS;
RUN;

/**** ASCII file containing input data to calculate PFA
 as well as estimates of 2SW returns by region lagged to year of PFA,
 as minimum and maximum generated from Excel table of regional returns
 edited and updated by Dave Reddin, DFO NL Region, Canada
 delete the last PFA entry line (2005 in the case of the 2006 forecast)
 because the returns are incomplete for all regions
 year is the PFA year for all the catch data but for the return data,
 year is the year of 2SW return so they must be lagged back to PFA year
 before deleting last year line ****/
Filename in2
"c:/data/Chaput/Ices2006/greenland-advice2006/catch-returns-2006vers.prn";
data catchreturns;
  infile in2 missover;
  INPUT YEAR NG1 NC1_L NC1_H NC2_L NC2_H NR2_L NR2_H
       LBR2_L LBR2_H NFR2_L NFR2_H QCR2_L QCR2_H GFR2_L GFR2_H
       SFR2_L SFR2_H USAR2;
RUN;
PROC SORT DATA = catchreturns; BY YEAR; RUN;
PROC SORT DATA = spawners; BY YEAR; RUN;
DATA INPUTS; MERGE spawners catchreturns;
  BY YEAR;
  RUN;

/* this section creates various sub-files used in generating PFA estimates, model fits, PFA
predictions and for subsequent risk analysis   */
data fishdata (keep = sim break year phase pfa lnspawn lnpfa dumb)
      /** this is the base file for modelling  */
   pfa (keep = sim year lnpfa)
      /** this is the base file for estimating change in pfa
          relative to year-2 **/
  lnpfa4GL (keep = sim lnpfa4GL)
  lnpfa4NA (keep = sim lnpfa4NA)
     /*** these files are later combined with "pfa" file
       to generate predictions of PFA for the years of interest,
       the earlier year lnpfa4NA is for an update, later year
       lnpfa4GL is for prediction in year of interest  ****/
  returnsall (keep = sim year USAR2 R2SF R2GF R2QC R2NF R2LB R2NA)
  returnssouthnow (keep = sim year R2SF USAR2)
```

```
  RETURNSSOUTH (keep = sim year R2SF USAR2)
    /*** these files are used to accumulate returns by region
        for apportioning PFA to regions and for developing
        indices of returns for risk analysis      ****/
  yearofinterest (keep = sim break year phase lnspawn dumb);
    /**** this file accumulates years for which forecasts
        will be generated, it is required to automatically
          generate forecasts under two phase states   **/
  set inputs;

  maxsim = 10000;   *** maximum number of simulations;

do sim = 1 to maxsim;
/*  incorporating uncertainty in PFA estimated  */
  RAN_C1  = NC1_L + (NC1_H - NC1_L)* RANUNI(0);
  RAN_C2  = NC2_L + (NC2_H - NC2_L)* RANUNI(0);
  RAN_R2  = NR2_L + (NR2_H - NR2_L)* RANUNI(0);
  nareturns = (((RAN_R2*exp(0.03*1) + RAN_C2)*exp(0.03*10))+ RAN_C1);
  pfa = nareturns + NG1;
    * PFA based on equation 4.2.3.3 in WG report;
  lnpfa = log(pfa);

/* calculates uncertainty of lagged spawner index and the lagged spawner
   proportions by region   */
  LSLB = LBLS_L + (LBLS_H - LBLS_L)* RANUNI(0);
  LSNF = NFLS_L + (NFLS_H - NFLS_L)* RANUNI(0);
  LSQC = QCLS_L + (QCLS_H - QCLS_L)* RANUNI(0);
  LSGF = GFLS_L + (GFLS_H - GFLS_L)* RANUNI(0);
  LSSF = SFLS_L + (SFLS_H - SFLS_L)* RANUNI(0);

  LSNA = LSLB+LSNF+LSQC+LSGF+LSSF+USALS;
  ** all lagged spawners including Labrador;
  lnspawn = log(LSNA);
  ** variable used in forecasting, change to LSNA when
     Labrador is included  ******;
  if year = 2003 then do;
   /** for updated forecasts, adjust year as needed
     to update NA forecast, use second to last year
     when PFA has been estimated****/
  lnpfa4NA = lnpfa;
  output lnpfa4NA;
  end;
  if year = 2004 then do;
  /** for forecast of year of interest, Geenland fishery,
     adjust year to last year when PFA has been estimated **/
  lnpfa4GL = lnpfa;
  output lnpfa4GL;
  end;
*** file to prepare data for selecting phase ********;
  if lnpfa ne . then do;
    output pfa;
  end;

  R2SF = SFR2_L + (SFR2_H - SFR2_L)* RANUNI(0);
  R2LB = LBR2_L + (LBR2_H - LBR2_L)* RANUNI(0);
  R2NF = NFR2_L + (NFR2_H - NFR2_L)* RANUNI(0);
  R2QC = QCR2_L + (QCR2_H - QCR2_L)* RANUNI(0);
  R2GF = GFR2_L + (GFR2_H - GFR2_L)* RANUNI(0);
  R2NA = sum(R2LB, R2NF, R2QC, R2GF, R2SF, USAR2);
```

```
if 1991 le year le 1995 then OUTPUT RETURNSSOUTH;
   *** 5 year base period for Scotia-Fundy and
      USA returns improvement year = PFA year --**;

if 2000 le year le 2004 then do;
*** 5 year moving period for proportioning PFA to regions
    slide 5-year period as more recent PFA value is obtained
    year = PFA year  ***;
  OUTPUT RETURNSALL;
  output returnssouthnow;
  end;

 dumb = 1;  * need this to calculate likelihood of null model;

do break = 1985 to 1993;
   * stepping through possible break years;
  if year le break then phase = 1;
  if break lt year le 2004 then phase = 2;
  ** change end year to last year PFA is known;
  if lnspawn ne . and lnpfa ne . then output fishdata;
  if 2005 le year le 2008 then do;
    /** change years of NA update and GL forecast **/
    do i = 1 to 2;
     phase = i;
     output yearofinterest;
     end;
    end;
  end;
end;   * finish generating the data sets;

run;

proc means data = returnssouth noprint nway mean;
 class sim;
 var R2SF USAR2;
 output out = meanretsouth  mean = R2SF USAR2;
 run;
data _nul_; set meanretsouth;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/meanretsouth.dat";
/* file of average returns by simulation to southern areas,
   1991 to 1995 ***/
  put sim 8. R2SF 10.  USAR2 10.;
run;
proc means data = returnssouthnow noprint nway mean;
 class sim;
 var R2SF USAR2;
 output out = meanretsouthnow  mean = R2SF USAR2;
 run;
data _nul_; set meanretsouthnow;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/meanretsouth-now.dat";
  /* file of average returns by simulation to southern areas,
     most recent five years ***/
  put sim 8. R2SF 10.  USAR2 10.;
run;

proc means data = returnsall noprint nway mean;
 class sim;
 var USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
 output out = meanretall  mean = USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
 run;
```

```
data _nul_; set meanretall;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/meanretall.dat";
  /* file of average returns by simulation to all areas,
   most recent five years ***/
 put sim 8. USAR2 10. R2SF 10. R2GF 10. R2QC 10. R2NF 10. R2LB 10. R2NA 10.;
run;

/*** prepares the predictions files for year of interest based on
history of ratio of pfa in year to pfa in year-2  */
data pfa2 (keep = sim year lnpfa2); set pfa;
  year = year+2;
  lnpfa2 = lnpfa;
  run;

proc sort data = pfa; by sim year; run;
proc sort data = pfa2; by sim year; run;
data pfaratio; merge pfa2 pfa;
  by sim year;
  pfaratio = lnpfa/lnpfa2;
  if pfaratio ne . then output pfaratio;
  run;
 proc sort data = lnpfa4NA; by sim; run;
 proc sort data = lnpfa4GL; by sim; run;
data expectations (keep = sim year expectedNA expectedGL);
  /** variable names correspond to years of interest during this analysis,
    i.e. update North America and forecast Greenland  ***/
  merge pfaratio lnpfa4NA lnpfa4GL;
  by sim;
  expectedNA = pfaratio*lnpfa4NA;
  expectedGL = pfaratio*lnpfa4GL;
run;

/*   Model fitting, seven nested models considered    */
/** file to analyze the models for different break years ***/
data analyze; set fishdata yearofinterest;
  run;
proc sort data = analyze; by sim break;  run;

/*model 0, just intercept  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class dumb;
  model lnpfa = dumb /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
run;
data model0 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 2;
      model = 0;
      output;
  end;
run;
data pred0 (keep = sim break model year phase predpfa prederror meanerror); set pred;
  model = 0;
  if 2005 le year le 2008;
   ** adjust to two years for which PFA is still unknown,
     do for each model;
  run;

/*model 1, fixed intercept, just slope  */
```

```
proc glm data = analyze noprint outstat = results;
  by sim break;
  model lnpfa = lnspawn /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model1 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 3;
      model = 1;
      output;
  end;
  run;
data pred1 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 1;
  if 2005 le year le 2008;
    ** adjust to two years for which PFA is still unknown,
       do for each model;
  run;

/*  model 2 - no slope, just intercept, two phases  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model2 (keep = sim break model  parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 3;
      model = 2;
      output;
  end;
  run;
data pred2 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 2;
  if 2005 le year le 2008;
   ** adjust to two years for which PFA is still unknown,
    do for each model;
  run;

/* model 3  different intercept, common slope  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase lnspawn /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model3 (keep = sim break model  parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 4;
      model = 3;
      output;
  end;
  run;
data pred3 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 3;
if 2005 le year le 2008;
```

```
  ** adjust to two years for which PFA is still unknown,
    do for each model;
 run;

/*   model 4 - common intercept, different slope  */
proc glm data = analyze noprint outstat = results;
 by sim break;
 class phase;
 model lnpfa = phase*lnspawn /  intercept solution;
 output out = pred  p = predpfa  stdi = prederror  stdp = meanerror;
 run;
data model4 (keep = sim break model parameters SS DF); set results;
 if _SOURCE_ = "ERROR" then do;
   parameters = 4;
   model = 4;
   output;
 end;
 run;
data pred4 (keep = sim break model year phase predpfa prederror meanerror);
 set pred;
 model = 4;
if 2005 le year le 2008;
    ** adjust to two years for which PFA is still unknown,
      do for each model;
 run;

/*  model 5 - different slope, different intercept, full model  */
proc glm data = analyze noprint outstat = results;
 by sim break;
 class phase;
 model lnpfa = phase lnspawn phase*lnspawn / intercept solution;
 output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
 run;
data model5 (keep = sim break model parameters SS DF); set results;
 if _SOURCE_ = "ERROR" then do;
   parameters = 5;
   model = 5;
   output;
 end;
 run;
data pred5 (keep = sim break model year phase predpfa prederror meanerror);
 set pred;
 model = 5;
if 2005 le year le 2008;
  ** adjust to two years for which PFA is still unknown,
     do for each model;
 run;

/*  model 6 - different slope, intercept through the origin  */
proc glm data = analyze noprint outstat = results;
 by sim break;
 class phase;
 model lnpfa = phase*lnspawn / noint solution;
 output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
 run;
data model6 (keep = sim break model parameters SS DF); set results;
 if _SOURCE_ = "ERROR" then do;
   parameters = 3;
   model = 6;
   output;
```

```
  end;
  run;
data pred6 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 6;
if 2005 le year le 2008;
   ** adjust to two years for which PFA is still unknown,
      do for each model;
  run;

/* calculates negative log likelihood and Akaike information criterion
   for each simulation and model and break year */

data models; set model0 model1 model2 model3 model4 model5 model6;
   N = 27;
* number of observations in the model fitting, N = 27 once PFA 2004 is known and Labrador
is included in LS, adjust for each new year;
   MSE = SS / DF;
   LH = (N/2 *log(2*(3.141593)) + (N/2 * log(MSE)) + (1/(2*MSE))*SS);
   AICc = 2*LH + 2*parameters *(N / (N-parameters-1));
  run;


/* summarizes parsimonious model based on break year,
   and uncertainty in data */
proc sort data = models; by sim;
  run;

proc means data = models noprint min;
/* finds the minimum Akaike value among break year and models for each sim */
  by sim;
  var AICc;
  output out = minac min = minaicc;
  run;

data modelkeep (keep = sim break model aicdiff);
   merge models minac;
* calculates AIC differences as per Burnham and Anderson 1998 for each sim;
  by sim;
  aicdiff = aicc - minaicc;
  run;

/* output predicted PFA for years of interest in phase 1 and phase 2
   for each model and break year */
/* year of interest for forecast for 2006 WGNAS meeting,
   interested in updated 2005 forecast for NA and
   2006 PFA forecast for West Greenland*/
data predyear;
  set pred0 pred1 pred2 pred3 pred4 pred5 pred6;
  run;
proc sort data = modelkeep; by sim break model;
proc sort data = predyear; by sim break model;
data predictNA predictGL predictNAhigh predictNAlow predictGLhigh predictGLlow
predictGLmulti;
  merge modelkeep predyear;
  by sim break model;
  if aicdiff = 0;
  if year = 2005 and phase = 1 then output predictNAhigh;
  if year = 2005 and phase = 2 then output predictNAlow;
  if year = 2006 and phase = 1 then output predictGLhigh;
```

```
  if year = 2006 and phase = 2 then output predictGLlow;
  if year = 2005 then output predictNA;
  if year = 2006 then output predictGL;
  if 2007 le year le 2008 then output predictGLmulti;
  /** must update the years for every new year of modelling **/
  run;

/* calculates the relative probability of the year of interest
   being in either phase 1 or phase 2. Calculate the density based
   on the normal distribution of observing for example, in 2003
   the value of PFA in 2001 times pfaratio within the 2003 predicted
   value distribution. Then sums the exact densities for 2003 in phase 1,
   2003 in phase 2 and calculates relative probabilities of phase 1
   and phase 2. */

proc sort data = predictNAhigh; by sim; run;
proc sort data = predictNAlow; by sim; run;

proc sort data = predictGLhigh; by sim; run;
proc sort data = predictGLlow; by sim; run;
proc sort data = expectations; by sim; run;


/**** REVISED PREDICTIONS FOR UPCOMING 2SW YEAR IN NORTH AMERICA
****/
data densityNAlow;  merge predictNAlow expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedNA-
predpfa)/meanerror)**2));
    ** from Neter, Kutner Nachtsheim and Wasserman 1996
       Applied Linear Regression Models, p. 34-35  ;
  run;
data densityNAhigh;  merge predictNAhigh expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedNA-
predpfa)/meanerror)**2));
    ** from Neter, Kutner Nachtsheim and Wasserman 1996
       Applied Linear Regression Models, p. 34-35  ;
  run;

proc means data = densityNAlow noprint nway sum;
  class sim;  * sum of densities by sim in low phase;
  var density;
  output out = sumNAlow sum = densNAlow;
  run;
proc means data = densityNAhigh noprint nway sum;
  class sim;  * sum of densities by sim in high phase;
  var density;
  output out = sumNAhigh sum = densNAhigh;
  run;
data phaseweightNA; merge sumNAlow sumNAhigh;
  by sim;
  densityNA = densNAlow + densNAhigh;
  weightlow = densNAlow/densityNA;
  if ranuni(0) le weightlow then phasekeep = 2; *** low phase;
  else phasekeep = 1; *** high phase;
  run;

data predictionsNA (keep = sim model break phase predpfa prederror pfa);
  merge phaseweightNA predictNA;
```

```
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
proc tabulate data = predictionsNA noseps formchar(1)=" " format = 6.;
    class model break phase;
    table break all, model*phase / rts = 15;
    table break all, model phase / rts = 15;
    run;

/****** PREDICTIONS FOR West Greenland PFA  ************/
data densityGLlow;  merge predictGLlow expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedGL-
predpfa)/meanerror)**2));
  run;
data densityGLhigh;  merge predictGLhigh expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedGL-
predpfa)/meanerror)**2));
  run;

proc means data = densityGLlow noprint nway sum;
  class sim;  * sum of densities by sim in low phase;
  var density;
  output out = sumGLlow sum = densGLlow;
  run;
proc means data = densityGLhigh noprint nway sum;
  class sim;  * sum of densities by sim in high phase;
  var density;
  output out = sumGLhigh sum = densGLhigh;
  run;
data phaseweightGL ; merge sumGLlow sumGLhigh;
  by sim;
  densityGL = densGLlow + densGLhigh;
  weightlow = densGLlow/densityGL;
  if ranuni(0) le weightlow then phasekeep = 2; *** low phase;
  else phasekeep = 1; *** high phase;
  run;


data predictionsGL (keep = sim model break phase predpfa prederror pfa);
  merge phaseweightGL predictGL;
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
proc tabulate data = predictionsGL noseps formchar(1)=" " format = 6.;
    class model break phase;
    table break all, model*phase / rts = 15;
    table break all, model phase / rts = 15;
    run;

/****** PREDICTIONS FOR West Greenland multi-year PFA  ********/
data predictionsGLmulti (keep = sim year model break phase predpfa prederror pfa);
  merge phaseweightGL predictGLmulti;
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
```

```
proc tabulate data = predictionsGLmulti noseps formchar(1)=" " format = 6.;
    class model break phase year;
    table year, break all, model*phase / rts = 15;
    table year, break all, model phase / rts = 15;
    run;

data _nul_; set predictionsNA;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/predictedNA.dat";
/*** ASCII file containing the predicted values, models kept for each simulation for the
updated NA year of interest ***/
  put sim 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
data _nul_; set predictionsGL;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/predictedGL.dat";
/*** ASCII file containing the predicted values, models kept for each simulation for the
Greenland year of interest ***/
  put sim 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
data _nul_; set predictionsGLmulti;
  file "c:/data/Chaput/Ices2006/greenland-advice2006/predictedGLmulti.dat";
/*** ASCII file containing the predicted values, models kept for each simulation for the
Greenland multi-year forecast ***/
  put sim 8. year 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
```

B – code for the risk analysis of catch options at West Greenland relative to NAC and southern NEAC PFA and CLs

```
OPTIONS NOCENTRE;
/* RISK-ANALYSIS-NAC-NEAC-2006.SAS
   this is the risk analysis portion of the West Greenland catch options
   PFA forecast, returns variability, etc. are generated using previous program, updated by
Gerald Chaput, DFO Gulf Region  April 2006 */

data harvestperton (keep = sim NA1SW NEAC1SW NA1SWRet NEAC1SWRet Total1SW);
/*** this generates number of fish of NA and NEAC origin per ton of catch at West Greenland
***/
  maxsim = 10000;
/*** maximum number of simulations, should match number of simulations from PFA
estimation run ************/

do sim = 1 to maxsim;
   seed = 0;
/* calculating harvest of NA and European fish per ton of fishery input parameters for
biological characteristics variations based on range of values from previous five years of
fishery
     PropNA:  0.67 to 0.74
     PropE:  1 - propNA
     Wt1SWNA:  2.84 to 3.19 kg
     Wt1SWE:  2.92 to 3.33 kg
     ACF:    1.017 to 1.0297
   HarvestNA: harvest of NA 1SW salmon based on bio characteristics.
   Harvest per ton = (1000 / ACF / (propNA*Wt1SWNA + propE*Wt1SWE))*propNA
   HarvestNEAC: harvest of NEAC 1SW salmon based on bio characteristics.
Harvest (per ton) = (1000 / ACF / (propNA*Wt1SWNA + propE*Wt1SWE))*propE */
   propNA = 0.67 + ((0.74 - 0.67)*ranuni(seed));
/* change min and max as required-*/
   propE =  1 - propNA;
   Wt1SWNA = 2.84 + ((3.19 - 2.84)*ranuni(seed));
/* <<-change min and max as required---*/
   Wt1SWE = 2.92 + ((3.33 - 2.92)*ranuni(seed));
/* <<-change min and max as required  */
   ACF = 1.0297 + ((1.050 - 1.0297)*ranuni(seed));
/* <<-change min and max as required  */
   NA1SW = (1000 / ACF / (propNA * Wt1SWNA + propE * Wt1SWE))* propNA;
   NEAC1SW =  (1000 / ACF / (propNA * Wt1SWNA + propE * Wt1SWE))* propE;
   NA1SWRet = NA1SW*exp(-0.03*11);
   NEAC1SWRet = NEAC1SW*exp(-0.03*11);
   Total1SW = NA1SW+NEAC1SW;
  output harvestperton;
/*** number of fish by continent per ton of catch----*/
  end;
run;
proc univariate data = harvestperton;
  var NA1SWRet NEAC1SWRet Total1SW;
  run;

filename a1
"c:/data/Chaput/Ices2006/greenland-advice2006/meanretsouth.dat";
/*generated previously, mean returns to southern areas for period 1992 to 1996*/
data southobj (keep = sim R2SFthen USAR2then); infile a1 missover;
  input sim R2SF USAR2;
  R2SFthen = R2SF;
  USAR2then = USAR2;
```

```
  * mean returns to southern areas for 1992 to 1996;
  run;

filename a2 "c:/data/Chaput/Ices2006/greenland-advice2006/meanretall.dat";
/* mean returns to each region for most recent five years, 2001 to 2005 */
data returnna;
  infile a2 missover;
  input sim USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
  propUSA = USAR2/R2NA;
  propSF = R2SF/R2NA;
  propGF = R2GF/R2NA;
  propQC = R2QC/R2NA;
  propNF = R2NF/R2NA;
  propLB = R2LB/R2NA;
  run;

filename a4 "c:/data/Chaput/Ices2006/greenland-advice2006/predictedGL.dat";
data pfayearnac (keep = sim pfanac); infile a4 missover;
  input sim break model phase pfanac predpfa prederror;
 /* predicted PFA over all models and break years*/
run;
filename a5 "c:/data/Chaput/Ices2006/greenland-advice2006/neac-mswsouth-pfaforecast-
2006.prn";
data pfayearneac (keep = sim pfaneac); infile a5 missover;
  input sim pfaneac;
/* 10000 values of PFA NEAC were derived using CrystallBall and lognormal distibution
parametrized by 95% CI of 313000 to 755000  */
  run;

/**** doing the Greenland risk analysis ********/

data risk; merge southobj harvestperton returnna pfayearnac pfayearneac;
   by sim;
    ShFr = 0.4; /*sharing fraction 40:60 Greenland:NA, used to bump up Greenland quota to
pre-agreed sharing arrangement for NA   ********/
    do t = 0 to 100 by 5;
      na1swt = na1sw * t;
            neac1swt = neac1sw*t;
            returnna = (pfanac - (na1swt/ShFr))*exp(-0.03*11);
            returnneac = (pfaneac*exp(-0.03*7) - (neac1swt/ShFr))*exp(-0.03*8);
            /** NEAC PFA is for Jan. 1 of first year at sea therfore fish are discounted for 7
months (Jan 1 to Aug 1) to get to the Greenland fishery and after harvests are taken, fish are
discounted for 8 months on their return to homewaters  (Aug. 1 to April 1 of next year)  */
      consLB = ((returnna*propLB)>=34746);
            consNF = ((returnna*propNF)>=4022);
            consQC = ((returnna*propQC)>=29446);
            consGF = ((returnna*propGF)>=30430);
            consNorth = consLB*consNF*consQC*consGF;
            consneac = (returnneac>=275326);
/* NEAC CL for MSW southern Europe - 2006 report**/

      objLBless0 = ((returnna*propLB) lt R2LB);
      objNFless0 = ((returnna*propNF) lt R2NF);
      objQCless0 = ((returnna*propQC) lt R2QC);
      objGFless0 = ((returnna*propGF) lt R2GF);
      objSFless0 = ((returnna*propSF) lt R2SF);
      objUSless0 = ((returnna*propUSA) lt USAR2);
      objNAless0 = objLBless0*objNFless0*objQCless0*objGFless0*objSFless0*objUSless0;

     objSouthless0 = objSFless0*objUSless0;
```

```
     objSF10then = ((returnna*propSF) ge (R2SFthen*1.1));
     objUS10then = ((returnna*propUSA) ge (USAR2then*1.1));
     objSF25then = ((returnna*propSF) ge (R2SFthen*1.25));
     objUS25then = ((returnna*propUSA) ge (USAR2then*1.25));
     objSouth10then = objSF10then*objUS10then;
     objSouth25then = objSF25then*objUS25then;

   output risk;
   end;
   run;

proc means data = risk noprint sum nway;
    class t;
    var consLB consNF consQC consGF consNorth
       objSF10then  objUS10then objSouth10then
       objSF25then objUS25then objSouth25then
       objSFless0 objUSless0 objsouthless0 consneac objNAless0 ;
    output out = byton
           sum = consLB consNF consQC consGF consNorth
          objSF10then  objUS10then objSouth10then
          objSF25then objUS25then objSouth25then
          objSFless0 objUSless0 objsouthless0 consneac objNAless0;
run;

data probtable; set byton;
file "c:/data/Chaput/Ices2006/greenland-advice2006/risk-analysis-results-2006.dat";
       put t 6. consLB 10. consNF 10. consQC  10. consGF  10. consNorth 10.
          objSF10then  10.  objUS10then  10. objSouth10then 10.
          objSF25then  10. objUS25then  10. objSouth25then 10.
          objSFless0 10.  objUSless0 10.  objsouthless0 10. consneac 10.
          objNAless0 10.;
run;

proc print data = probtable;
var t consLB consNF consQC consGF consNorth
      objSF10then  objUS10then objSouth10then
      objSF25then objUS25then objSouth25then
      objSFless0 objUSless0 objsouthless0 consneac
      objNAless0;
run;
```

Annex 7: Glossary of acronyms used by the Working Group on North Atlantic Salmon, 2006

1SW *(One-Sea-Winter)* Maiden adult salmon that has spent one winter at sea.

2SW *(Two-Sea-Winter)* Maiden adult salmon that has spent two winters at sea.

ASAP *(The Atlantic Salmon Arc Project)* The initial aim of ASAP is to collect samples from the majority of salmon rivers on the Western Atlantic coast of Europe and use methods of Genetic Stock Identification (GSI).

CL, i.e. S_{lim} *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that undesirable levels are avoided.

CPUE *(Catch Per Unit Effort)* A derived quantity obtained from the independent values of catch and effort.

CWT *(Coded Wire Tag)* The CWT is a length of magnetized stainless steel wire 0.25 mm in diameter. The tag is marked with rows of numbers denoting specific batch or individual codes. Tags are cut from rolls of wire by an injector that hypodermically implants them into suitable tissue. The standard length of a tag is 1.1 mm.

BHSRA *(Bayesian Hierarchical Stock and Recruitment Approach)* Models for the analysis of a group of related stock–recruit data sets. Hierarchical modeling is a statistical technique that allows the modeling of the dependence among parameters that are related or connected through the use of a hierarchical model structure. Hierarchical models can be used to combine data from several independent sources.

DST *(Data Storage Tag)* A miniature data logger with sensors including salinity, temperature, and depth that is attached to fish and other marine animals.

FV *(Fishing Vessel)* A vessel that undertakes cruise for commercial fishing purposes.

GIS *(Geographic Information Systems)* A computer technology that uses a geographic information system as an analytic framework for managing and integrating data.

GSI *(Genetic Stock Identification)* Methods used to 'genetically type' salmon from particular regions and rivers across Atlantic.

ISAV *(Infectious Salmon Anemia Virus)* ISA is a highly infectious disease of Atlantic salmon caused by an enveloped virus.

MSY *(Maximum Sustainable Yield)* The largest average annual catch that may be taken from a stock continuously without affecting the catch of future years; a constant long-term MSY is not a reality in most fisheries, where stock sizes vary with the strength of year classes moving through the fishery.

MSW *(Multi-Sea-Winter)* An adult salmon which has spent two or more winters at sea or a repeat spawner.

PFA *(Pre-Fishery Abundance)* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time.

PGA *(The Probabilistic-based Genetic Assignment model)* An approach to partition the harvest of mixed stock fisheries into their finer origin parts. PGA uses Monte Carlo sampling to partition the reported and unreported catch estimates to continent, country and within country levels.

PIT *(Passive Integrated Transponder)* PIT tags use radio frequency identification technology. PIT tags lack an internal power source. They are energized on encountering an electromagnetic field emitted from a transceiver. The tag's unique identity code is programmed into the microchip's nonvolatile memory.

Q Areas for which the Ministère des Ressources naturelles et de la Faune manages the salmon fisheries in Québec.

RV *(Research Vessel)* A vessel that undertakes cruises to conduct scientific research.

SAC *(Special Areas of Conservation)* To comply with the EU Habitats Directive (92/43/EEC) on Conservation of Natural Habitat and of Wild Fauna and Flora, which stipulates that member states maintain or restore habitats and species to favourable conservation status, a number of rivers in the NEAC area that support important populations of vulnerable qualifying species have been designated SACs. Where salmon is a “qualifying species”, additional protection measures specifically for salmon are required.

SER *(Spawning Escapement Reserve)* The CL increased to take account of natural mortality between the recruitment date (1st January) and return to home waters.

SFA *(Salmon Fishing Areas)* Areas for which the Department of Fisheries and Oceans (DFO) Canada manages the salmon fisheries.

SGBYSAL *(Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries).* The ICES Study Group that was established in 2005 to study Atlantic salmon distribution at sea and fisheries for other species with a potential to intercept salmon.

S_{lim}, i.e. CL *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that the undesirable levels are avoided.

TAC *(Total Allowable Catch)* The quantity of fish that can be taken from each stock each year.

VHSV *(Viral Haemorrhagic Septicaemia Virus)* VHS is a highly infectious virus disease caused by the virus family *Rhabdoviridae*, genus *Novirhabdovirus*.

VIE *(Visual Implant Elastomer)* The VIE tags consist of fluorescent elastomer material which is subcutaneously injected as a liquid into transparent or translucent tissue via a hand-held injector.

This glossary has been extracted from various sources, but chiefly the EU SALMODEL report (Crozier et al.., 2003).

Annex 8: Technical minutes from the ACFM Review Group on Salmon

Working Group: WGNAS

ICES 25-27 April 2006

Participants:

- Martin Pastoors (chair of ACFM, chair of the review group),
- Tim Sheehan (chair of WGNAS),
- Dave Meerbergh (reviewer),
- Niall Ó Maoiléidigh (reviewer, chair of ICES Diadromous Fish Committee)
- Henrik Sparholt (ICES Fisheries Assessment Scientist).

The WGNAS report was presented by the WG Chair Tim Sheehan in a very clear way. The Working Group was commended for the report but the review group did note that the size of the WG report could be trimmed down in size by focussing on the new parts in the analysis of the data and moving the generic issues about descriptions of methods etc into a quality handbook. This could also further trim down the size of the extract of the WG report which is considered to be too extensive as a truly advisory text. There is scope for harmonizing the texts between the NEAC and NAC sections.

In terms of the organization of the report on the ICES network system, the WG is asked to provide all the tables and figures not only in Word format but also in the underlying formats (like Excel) so that the basic information can be extracted from them.

Generally, the technical parts of the report were accepted and no significant modifications were required. Specific comments on the report are given below:

There is a loose usage of terminology. E.g. in section 2 the terminology high phase/low phase is used together with a terminology high state/low state. If we mean the same things, the WG is asked to stick to a consistent terminology. It would be very useful to add a terminology list as an appendix to the report.

In section 3 the RG compiled an overview of total mortality by area but summed over countries which is considered an important diagnostic of the exploitation pressure (see Figure 1).

Suggestions for section 4:

- 4.6 – Catch Options – could be standardized and restrict it mainly to the information pertinent to the catch options (i.e. 2SW fish). Can then have a second paragraph which summarizes other information (i.e. smolt survival rates, hatchery programs…)
- Similar standard reporting of values for returns and spawners – XX amount, % of CL, % compared to last year, % compared to some range…
- Generate Confidence intervals around the NA spawners estimates similar to the PA approach in NEAC (Figure 4.9.10.3)
- Move Forecast model into the NAC section (out of WG section) similar to NEAC.
- The part that pro-rates the PFA back to home waters needs to be better described and moved into the Quality Handbook.

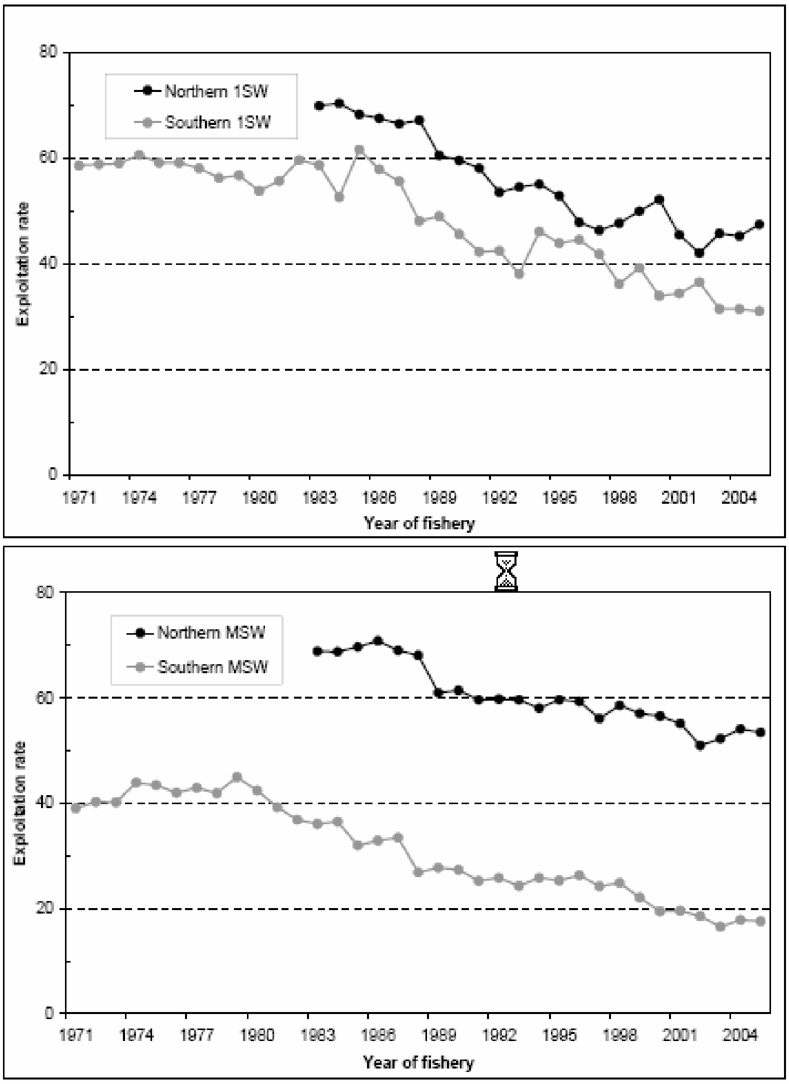

Figure 1. Estimated mean exploitation rates (1971–2005) for Northern and Southern European 1SW and MSW stocks (NEAC)