ICES WGNAS Report 2005

ICES Advisory Committee on Fishery Management
ICES CM 2005/ACFM:17
REF. I

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

5-14 April 2005

Nuuk, Greenland

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

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer
H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Recommended format for purposes of citation:
ICES. 2005. Report of the Working Group on North Atlantic Salmon (WGNAS), 5-14 April 2005, Nuuk, Greenland. ICES CM 2005/ACFM:17. 291pp.

Contents

1 INTRODUCTION

1.1 Main Tasks

At its 2004 Statutory Meeting, ICES resolved (C. Res. 2004/2ACFM04) that the Working Group on North Atlantic Salmon [WGNAS] (Chair: Dr W Crozier, UK) will meet in Nuuk, Greenland, from the 4-14th April 2005 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO). The terms of reference and sections of the report in which the answers are provided, follow:

a) With respect to Atlantic salmon in the North Atlantic area:	Section 2
i. provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched salmon in 2004;	2.1, 2.2
ii. report on significant developments which might assist NASCO with the management of salmon stocks;	2.4
iii. provide a compilation of tag releases by country in 2004;	2.7
iv. identify relevant data deficiencies, monitoring needs and research requirements.	6
b) With respect to Atlantic salmon in the North-East Atlantic Commission area:	Section 3
i. describe the key events of the 2004 fisheries and the status of the stocks;	3.9
ii. 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
iii. further develop the age-specific stock conservation limits where possible based upon individual river stocks;	3.3
iv. provide catch options or alternative management advice, 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;	3.4, 3.6
v. provide an estimate of by-catch of salmon in pelagic fisheries.	3.11
c) With respect to Atlantic salmon in the North American Commission area:	Section 4
i. describe the key events of the 2004 fisheries and the status of the stocks;	4.9
ii. 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
iii. update age-specific stock conservation limits based on new information as available;	4.3
iv. provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options ff for stock rebuilding;	4.4 and 4.6
v. provide an analysis of any new biological and/or tag return data, to identify the origin and biological characteristics of Atlantic salmon caught at St Pierre and Miquelon.	4.11

d) With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
i. describe the events of the 2004 fisheries and the status of the stocks;	5.9
ii. provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	5.12
iii. provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes);	5.9
iv. provide catch options or alternative management advice 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.	5.4 and 5.6
Notes: *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.* *In the responses to questions b.i, c.i and d.i 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 bycatch of other species in salmon gear, and of salmon in any existing and new fisheries for other species is also requested.* *In response to questions b.iv, c.iv and d.iv provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.* *In response to question d.i, 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 b.i and c.i.*	

The Working Group considered 41 Working Documents submitted by participants (Appendix 1); other references cited in the report are given in Appendix 2. A full address list for the participants is provided in Appendix 3.

1.2 Participants

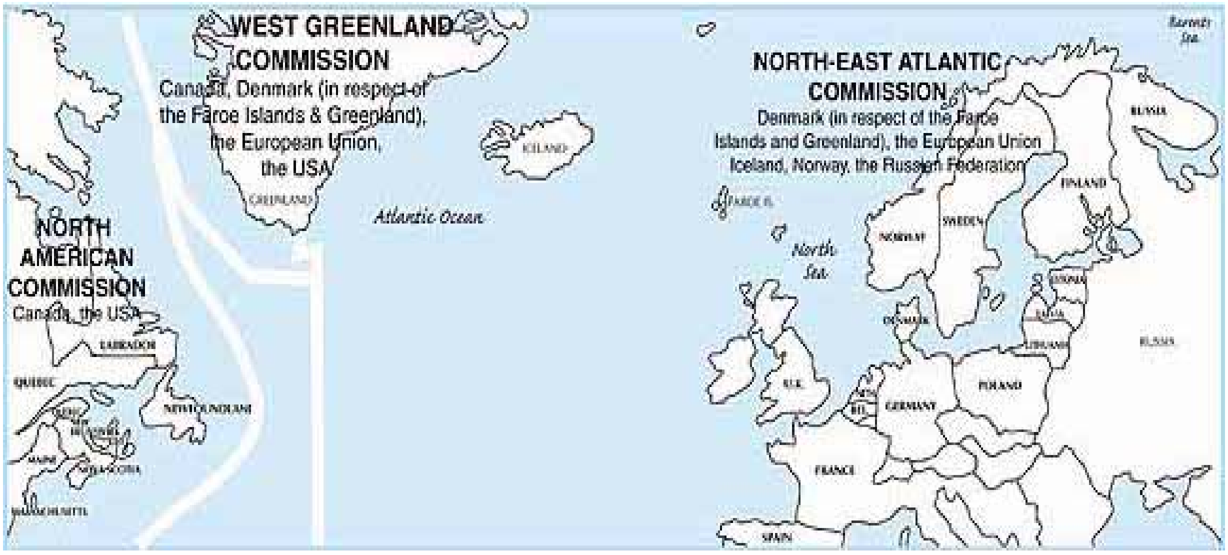
Crozier, W (Chair)	UK (Northern Ireland)
Chaput, G.	Canada
Erkinaro, J.	Finland
Gudbergsson, G.	Iceland
Hansen, L.P.	Norway
Siegstad, H.	Greenland
Carl, J.	Greenland
Holm, M.	Norway
Legault, C.	USA
MacLean, J.C.	UK (Scotland)
Meerburg, D.J.	Canada
Ó Maoiléidigh, N.	Ireland
Prusov, S.	Russia
Reddin, D.G.	Canada
Russell, I.C.	UK (England & Wales)

Sheehan, T.	USA
Smith, G.W.	UK (Scotland)
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), as derived from the adult to adult stock and recruitment relationship (Ricker, 1975; ICES, 1993). NASCO has adopted this definition of CLs (NASCO, 1998). Therefore, the CL is a limit reference point (S_{lim}) which should be avoided with high probability. Management advice for Atlantic salmon is referenced to the S_{lim} conservation limit, therefore stocks assessed here are reported as being outside precautionary limits when the confidence limits of the most recent stock estimate includes S_{lim}.

Management targets have not yet been defined for 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 1960–2004 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 and 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 2004 was 2099 t, 357 t below the confirmed catch for 2003 (2456 t) and the lowest in the time series. The 2004 catch was over 550 t below the average of the last five years (2664 t), and almost 800 t below the average of the last 10 years (2881 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 three 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 2004 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 Appendix 4. Countries use different methods to partition their catches by sea-age class and these are outlined in the footnotes to Appendix 4. The composition of catches in different areas is discussed in more detail in Sections 3, 4, and 5.

Table 2.1.1.3 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 50% of catches in North East Atlantic countries in 2004, in-river fisheries 42% and estuarine fisheries 7%. In North America, coastal fisheries accounted for 17% of the catch in 2004, while in-river fisheries took 66% and estuarine fisheries 18%.

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 1995–2004. Overall, in the NEAC northern area (Iceland, Norway, Russia, Finland and Sweden) around half the catch has been taken in coastal waters and half in rivers, although there are no coastal catches in Iceland and Finland. 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 (66–to 77 % over the period 1999–2004).

2.1.2 Catch and release

The practice of catch and release (also termed hook and release or live 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 2004 for six 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 2004 this ranged from 16% in Iceland to 76% in Russia, reflecting varying management practices among these countries. Within countries, the percentage of fish released has tended to increase over time. Overall, almost 144 000 salmon were reported to have been released around the North Atlantic in 2004, an increase of 12% on 2003, and the highest in the time series. There is also evidence from some countries that larger MSW fish are released in higher proportions than smaller fish.

Concerns have been expressed about the survival of fish following catch and release. Further details are included in Section 2.4.2.

2.1.3 Unreported catches

Unreported catches by year (1987–2004) 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 2004 was estimated to be 686 t, a fall of 19% from 2003 (847 t). The unreported catch in the North East Atlantic Commission Area in 2004 was estimated at 575 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%; 25% in 2004), but has declined over the past 6 years (Figure 2.1.3.1). Estimates for 2004 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 12% for individual countries. Relative to national catches, unreported catches range between 1% and 57% 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. Sixteen surveillance flights were made over the area in 2004. No sightings of vessels were made during the flights, although there was a period of five months over the winter when no surveillance took place. This is the period when salmon fishing has previously been reported.

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 2004 is 796 839 t. This represents a small decrease on 2003 (803 488 t), but a 13% increase on the 5-year mean (1999–2003) (Table 2.2.1.1 and Figure 2.2.1.1). Most of the North Atlantic production took place in Norway (64%) and UK (Scotland) (22%).

World-wide production of farmed Atlantic salmon has been in excess of one million tonnes since 2002. Total production in 2004 is similar to that in 2003 and is provisionally estimated at a little over 1.1 million tonnes (Table 2.2.1.1 and Figure 2.2.1.1). Production outside the North Atlantic is currently estimated to account for about 30% of the total farmed production, with Chile (261 000 t) contributing the largest proportion of the production in this area. World-wide production of farmed Atlantic salmon in 2004 was almost 550 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 2004 was 12 t, an increase of 5 t on 2003 (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), the data including catches in net, trap, and rod fisheries. Ranched fish comprised less than 3% of the nominal catches in each of these countries.

2.3 Update on the estimation of natural mortality at sea of Atlantic salmon

The Working Group was asked to examine further the evidence of changes in M for NAC and NEAC Atlantic salmon stocks, particularly in the second year at sea. The reviews of natural mortality undertaken by the Working Group in 2002 to 2004 were motivated by concerns that the value for natural mortality (M) assumed in the run reconstruction models was not appropriate (ICES, 2002, 2003, 2004a). In 2005, the Working Group reviewed further data from NAC and NEAC stocks to examine for trends in M over time and among stocks.

In 2002, the Working Group reviewed theoretical and empirical methods for estimating M for Atlantic salmon. After analysis of data from selected rivers, the instantaneous monthly mortality rate used in the run-reconstruction model for the North American and NEAC areas was changed from 0.01 to 0.03. In 2003, the Working Group reviewed an analysis of a data set from 5 rivers of the NEAC area extending from the Scorff (France) to the North Esk (Scotland) and east to the Vesturdalsa River (Iceland) and 6 rivers in the NAC area, hatchery and wild stocks, extending from the Scotia-Fundy region to the north shore of the St. Lawrence (Quebec) (ICES, 2003). Both inverse weight and maturity schedule methods were applied to the stocks with appropriate data. The analysis of the river-specific growth data supported the previous conclusion that a linear function characterized the observed weights at age in the marine phase better than the exponential function. The additional analyses confirmed the previous conclusion that monthly mortality in the second year at sea was greater than 1% and distributed around 3%, at least for the wild fish. There were important differences among stocks and even regions which were not accounted for in the generalization over the entire NEAC and NAC areas. It was previously noted that the estimates of mortality derived using the data sets did not account for all the fisheries removals, particularly those in the high seas, and were in fact estimates of Z (*i.e.* total mortality). Reductions in the level of fisheries should however have resulted in the fishing mortality component being a minor portion of the total mortality being estimated.

In 2004, the Working Group examined further the data requirements and assumptions of the models for estimating mortality at sea (ICES, 2004a). The analysis of series of return rate data from several rivers in both NEAC and NAC suggested that M could be higher than 0.03 in the last decade and in several stocks was increasing. Monitored return rates to many stocks in the NAC and NEAC areas are lower now under reduced exploitation than in the 1970s and 1980s when fisheries were more intensive suggesting that natural mortality must have increased as fishing mortality rate declined (Section 3.9.15, Section 4.9.9). The absence of sufficient data to model a temporally varying M in the run-reconstruction models of PFA adds to the uncertainty in the description of the recruitment and spawning stock functions. Large changes in mortality could however be detected under models with constant M as appears to be the case for the North American PFA dynamic. An analysis of changes in total mortality over time may provide an indication of the changes in exploitation if natural mortality is assumed to be constant over time.

2.3.1 An examination of temporal variation in mortality

In 2005, the Working Group reviewed return rates of hatchery and wild origin smolts to 1SW and 2SW from the NAC and NEAC areas. For NEAC, data were available for two hatchery origin stocks and six wild stocks with the longest temporal coverage for the wild and hatchery origin stock of the Burrishoole River (Ireland). For NAC, data from two hatchery origin stocks and five wild stocks were examined with the longest temporal coverage of 1970–2002 period. Estimates of mortality could not be obtained from all year and stock combinations as some years had incomplete information for some of the age groups.

There was no evidence in the analyses presented that marine mortality (Z) had declined despite numerous fisheries reductions and closures, and in some stocks from both NAC and NEAC areas, there was an indication that mortality had increased (Fig. 2.3.1). The estimates from the maturity schedule model were consistently higher than from the inverse weight models. In the northern and southern NEAC areas, both wild and hatchery smolts show a constant decline in marine survival over the last two decades with the sharpest decline in the wild smolts of the southern NEAC area (Section 3.9.15). Similar declines in return rates of hatchery and wild salmon to the NAC area were also reported and returns rates of recent years were low compared to historic levels (Section 4.9.9). The Working Group reviewed evidence from the Miramichi River (NAC Canada) and the Teno River (NEAC Finland) that return rates of maiden salmon to repeat spawning has increased suggesting that the mortality factors affecting smolts in the first year and non-maturing salmon in the second year may be different from those interacting with previous spawners (Section 2.5).

The Working Group supported the extension of the smolt and adult monitoring programs for wild stocks of MSW salmon in the NAC area since 1996 and was encouraged that such activities may provide additional data sets with which to track marine mortality. There continues to be an absence of monitored stocks in the northern areas of both NAC and NEAC. However, opportunities exist to monitor return rates from a large number of hatchery stocks (Table 3.9.15.2) and to assess their value as indicators of wild salmon survival at sea.

2.3.2 The use of hatchery reared salmon as an indicator of survival of wild salmon

Most of the index rivers where data on survival of wild smolts are available are small and mainly support 1 SW fish. The stocks from the index rivers are not representative for MSW stocks originating in large rivers. Because MSW stocks account for a significant proportion of the smolt production, it is important to estimate marine survival of salmon from these rivers too. However, tagging wild smolts in large rivers are very labour demanding and expensive, and it is thus unlikely that estimates of marine survival of wild salmon from such stocks will improve significantly in the near future.

In several countries large numbers of hatchery reared salmon are released for mitigation and experimentation. From numerous tagging experiments it has been shown that hatchery reared salmon are harvested in distant and home water fisheries side by side with wild salmon. There is, however, growing evidence that hatchery reared salmon may differ in life history and behaviour from wild salmon. Hatchery reared salmon home to the river of release with less precision than that of wild fish (Hansen *et al.,* 1993; Jonsson *et al.,* 2003).

Results from analyses carried out by SALMODEL (Crozier *et al.*, 2003) show significant correlations between survival of wild and hatchery reared salmon from the same stocks and smolt cohorts. Additional information presented to the Working Group from Norway supported this and suggests that trends in survival of hatchery reared salmon might be used as an index of survival of wild salmon. In recent years there have been improvements in smolt rearing which may have resulted in enhanced parr growth and subsequent increase in smolt size. This may have contributed to the observations from Norway in recent years that show survival of hatchery reared smolts was similar to that of wild smolts, whereas in the 1980s survival of wild smolts tended to be superiour to that of hatchery reared smolts.

The provisional results from the analyses of survival of wild and hatchery reared smolts show a potential for using hatchery reared smolts as a tool for estimation of survival and survival trends of wild salmon. However, the survival time series should be analysed in more detail particularly to adjust for changes in smolt quality of hatchery reared salmon. Furthermore, there are data available from Ireland, UK (Northern Ireland) and Iceland that could be included and refined. The success of a hatchery programme in this respect is highly dependent on a satisfactory and stable smolt quality over time, and a representative genetic structure for the stock to be released. It is important to develop a smolt production strategy that makes the fish fit for survival in nature and more representative of wild smolts. This may require a different rearing scheme than that to produce smolts for farming. Furthermore, to obtain the best return rates, a tag and release strategy should be developed as well as a strategy to recover tags.

2.4 Significant developments towards the management of salmon

2.4.1 Progress in developing precautionary catch advice for Irish salmon fisheries

The Precautionary Approach to salmon fisheries management adopted by NASCO (NASCO, 1998) includes the following:

- that account be taken at each stage of the risks of not achieving the fisheries management objectives by considering uncertainty in the current state of the stocks, in biological reference points and fishery management capabilities, the formulation of pre-agreed management actions in the form of procedures to be applied over a range of stock conditions.

The methodology for setting conservation limits (CL) for Irish salmon stocks was changed in 2003 from a stock and recruitment curve based on district catch data, unreported catch and exploitation rate data (Potter *et al.*, 1998, Ó Maoiléidigh *et al.*, 2001) to a Wetted Area/ Bayesian hierarchical stock and recruitment model, BHSRA (Prévost *et al*., 2003, Ó Maoiléidigh *et al.*, 2004).

In 2004 and 2005, the catch advice for Irish fisheries was modified to take account of the risk of not achieving fisheries management objectives (conservation limits in all rivers within a district), uncertainty in biological reference points (*i.e.* sex ratio and required egg deposition) and the formulation of pre-agreed management actions in the form of procedures to be applied over a range of stock conditions (harvest guidelines).

Risk analysis and derivation of precautionary catch advice

The methodologies used to modify the wetted area conservation limits are described in Crozier *et al*. (2003). Once estimates of average spawners, average catch, and district CL are produced, precautionary catch advice is formulated by applying harvest guidelines in a risk analysis. ICES (2003) recommended the adoption of a 75% probability level of meeting conservation limits for salmon stocks. This recommendation was also taken into consideration in the provision of catch advice.

Increasing the probability of achieving the required number of females

Although the egg numbers are converted to fish for advice purposes using average biological characteristics, ultimately, the objective is to ensure with high probability that the required number of eggs is achieved, or in a simpler case, that the number of female salmon required is achieved. As such, it is necessary to know how many fish must return to a river to spawn (*i.e.* escape the fisheries) to ensure that there is a sufficient number of females. To ensure (*i.e.* with high probability) that the required number of females will be achieved, the total (males and females) required to escape the fisheries must be calculated (males and females must be considered together, because the fisheries cannot selectively harvest one sex over the other). For example, the probability of obtaining at least 100 females if the returning stock has a 50:50 female to male ratio and exactly 200 fish are released from the fishery is only 50%. This would not be an acceptable level of risk under the Precautionary Approach. Therefore the number of females which would need to escape each fishery to provide a 75% chance of achieving the correct egg deposition has been calculated. In most districts, this is a minor adjustment (moving from 50% to 75%) because the CL for fish is in the thousands. As an example, for the Waterford district, this correction amounts to less than 2% more fish.

Increasing the probability that the CL will be achieved in every river in the district at the same time

Since river-specific CLs have been defined, there is a further objective in ensuring that each individual river meets its CL at a high probability level. Although, the district CLs are based on the individual CLs summed, this number of fish will not be sufficient to ensure that each river meets it’s CL as the distribution of the fish will not necessarily match the proportions required for each individual river. A fish released from the mixed stock fishery may be female from river 1, male from river 1, female from river 2, male from river 2, female from river k, male from river k (where k represents the total number of rivers in the district). It is possible to calculate the number of fish which will meet the CLs in each river simultaneously at a high probability (*i.e.* 75 percent of the time). The end result is that for example, in the Waterford district CL must be increased by 18% in order to have a 75% chance that the river specific CLs will be achieved simultaneously in the 14 rivers in this district.

Risk analysis for the catch advice

Previously, using the deterministic calculation (*i.e.* using the average returns for the period 2000–2004 as the forecast for 2005) and calculating the surplus (returns – CL), there was a 50% chance of meeting or exceeding the CL (or conversely, a 50% chance of not meeting it). However, it is desirable to know the harvest level which would provide a 75% chance (as recommended by ICES) of meeting or exceeding the CL. Initially, a random series of returns is drawn from a normal distribution of the estimated returns for the period 2000–2004. A sequence of harvests (from 0 upwards) is subtracted from these returns to provide the estimated number of fish remaining for spawning. The number of times that the spawners equal or exceed the CL is counted for each level of harvest. This count is used to generate a risk plot which provides the probability of meeting CL at varying levels of harvest i.e. the higher the level of harvest on the returning stock the less likely are the chances of meeting the CL. The harvest level corresponding to a desired probability of meeting the CL: 0.75, 0.9, 1.0 *etc.* can be read off the plot.

Harvest guidelines and precautionary catch advice

The following harvest guidelines apply to the precautionary catch advice:

- Generally, the harvest option providing a 75% chance of meeting the CL in a given district is chosen as the precautionary catch advice (Figure 2.4.1.1).
- In following a precautionary approach, increases over the average catch for the period 2000 to 2004 should not be permitted even if the harvest option at the 75% probability of meeting the CL is higher. This is because each district fishery catches salmon destined for other districts and there is clearly a need to protect vulnerable stocks in these other districts. This advice will be reviewed annually to assess any improvement in the status of these vulnerable stocks (Figure 2.4.1.2).
- Where there is no harvest option which will provide a 75% chance of meeting the district CL, then the precautionary catch advice is that there is no surplus of fish to support a harvest (commercial or rod). This is illustrated in Figure 2.4.1.3.

This advice is predicated on wild fish only (*i.e.* estimated returns from hatchery-released smolts have been removed). It also relates to the total removal of fish by all means, and is not restricted to commercial fisheries. There are eight districts, mainly located on the east and south coasts, where the CL will probably not be met even in the absence of harvests of salmon. In six of the districts, reductions in the average catch in 2005 are indicated if there is to be a 75% chance of meeting the CL. The remaining districts are meeting or exceeding their CLs. In this instance, the average catch is advised for 2005, even where the harvest option providing a 75% chance of meeting the CL is higher. This recognizes the fact that these fisheries intercept salmon destined for districts that are below their CL. The status of these districts will be assessed on an ongoing basis, and the advice will change in line with any significant and consistent improvement in stock size. The maximum harvest by all methods being recommended is 122 541 one-sea winter salmon for the 2005 season.

The scientific process continues to be developed and improved in line with best international practice (including the precautionary approach as adopted by NASCO) and other areas which warrant further attention are:

- the mixed stock nature of district fisheries and the difficulties in assigning stocks in catches to district of origin.
- the accuracy of the wetted area estimate, which is based on a regression model with associated uncertainty.
- deterioration in water quality is a serious issue in a number of districts in east and southeast Ireland (*i.e.* Dundalk, Dublin, Wexford, and Waterford) and will influence the productivity of the rivers in meeting CLs.

- the models used for district catch advice do not include the 2SW and MSW (or repeat spawner) fish in the CL (*i.e.* no input data for this component is entered in the model). In some areas this may underestimate the available spawner capacity.
- information from existing automatic fish counters which may be used to manage on a specific river basis or be used as an index of several or all rivers in a district.

2.4.2 Catch and release

The practice of catch and release in salmon rod fisheries has become a common management/conservation measure. In some areas of Canada and USA, anglers have been required to practice catch and release since 1984. More recently it has also been widely used in many NEAC countries both as a regulation and a voluntary practice. The percentage of the total rod catch released in 2004 was 55% in Canada and ranged from 16% in Iceland to 75% in Russia (Table 2.1.2.1). Within countries, the percentage of salmon released by anglers has tended to increase over time. In 2004, anglers reported releasing almost 144 000 salmon around the North Atlantic, the highest number in the time series. Larger MSW fish are released in higher proportions than smaller fish in some countries.

In assessing the attainment of river-specific conservation limits, Canada (various regions) and UK (England & Wales) make a small allowance for catch-and-release mortality. These corrections vary; up to10% for Canadian regions and 20% for UK (England & Wales). The allowances are based on research studies (detailed in ICES, 2003) documenting that fish are more likely to die when water temperatures are high (>20^{o}C) or if fish are 'played' for an extended period.

The Working Group reviewed a probabilistic method to predict the risk of mortality for caught and released salmon from the Penobscot River, USA. Periods of similar thermal conditions based on median daily temperatures in the catch and release fishery area were identified. For each period, hooking mortality for the number of salmon reported caught and released was drawn from a uniform probability distribution based on the literature (*i.e.* 0.05 to 0.30 for temperatures greater than 20^{o}C). Ten thousand simulations drawing from a random binomial function were done to calculate the number of hooked and released fish that died. The resulting distribution describes the mortality losses from reported numbers of caught and released salmon. Hooking mortality was assumed to be uniform for all salmon (origin, sea-age, and sex). These simulations suggest that mortality following capture can be low. A recent radio tracking study in northwest England found that upwards of 85% of released spring salmon can be expected to survive to spawning (UK Environment Agency, 2003).

The survivors of catch and release angling are vulnerable to being hooked again. Additional information from rod fisheries on four Icelandic rivers documented that 24.4% (range: 22.1–27.8%) of salmon were captured for a second time. Salmon captured a third time were rare (1.8%). Exploitation rates in these rivers range from 45% to 60%. These results provide a means for adjusting the catch and release statistics to account for multiple recapture in these rivers and potentially for Iceland as a whole.

The Working Group encourages studies and further development of probabilistic methods that assess catch and release angling mortality. Models that can relate angling mortality to varying levels of effort would be especially useful. They also noted the need for further studies on the rate of multiple recaptures in catch and release angling in other rivers, especially those where the total salmon run is known.

2.4.3 Regional growth patterns

Pre Fishery Abundance (PFA) of Norwegian salmon has been developed at the national level. It is of interest to estimate PFA for smaller units, as marine survival may vary among river stocks and regions. Therefore it may help to identify survival signals other than return rates of adults from smolt cohorts. One such signal that could be applied for grouping stocks is growth. It has been shown that survival and growth of salmon at sea during the first year are correlated (Friedland *et al.*, 2000).

Systematic collection of salmon scales from anglers' catches has been carried out in seven rivers in Norway. Back-calculated growth of the first year at sea of 1SW fish was systematically lower than that of MSW fish of the same smolt year class in all rivers. For six of the seven river stocks, the first year growth of 1SW and MSW fish of the same smolt year class were significantly correlated (P=0.000–0.018).

Growth of salmon the first year at sea varied among years and stocks, with a systematic trend for slower growth in salmon originating from Northern latitudes. There were significant correlations in growth between salmon originating from nearby rivers (P=0.000–0.024), whereas growth in more distant stocks were less correlated (P=0.007–0.44).

The marine growth of the four most northerly salmon stocks was significantly correlated with the mean sea temperature at 50 m depth in the Norwegian Sea (66° N; 2° E) and mean temperature in the 0–50 m layer in the Barents Sea (70° 30' N – 72° 30' N; 33° 30' E) during July-December. However, the most northerly populations were more strongly correlated with temperatures in the north than with temperatures in the southern area. Growth of salmon from rivers in mid Norway showed highest correlation with temperatures in the Norwegian Sea. Salmon growth from the three most southern rivers was not correlated with temperatures at any of the two stations.

The present results indicate that PFA of Norwegian salmon should be developed at regional levels to improve the estimates. At least two regions should be established, divided by the Lofoten Islands at a latitude of 68° N. The main mortality of salmon seems to take place in the early post-smolt phase. Therefore, ocean climate during this phase is expected to be important for growth and survival. Ocean climate varies considerably along the coast of Norway, and hence, salmon from different stocks experience considerable differences in climate when they migrate to sea.

Further support to the regional grouping of rivers is provided by analyses from three subarctic rivers running to the Barents Sea within a small geographic area in northeastern Europe. Salmon from the rivers Teno/Tana (Finland &Norway), Näätämöjoki/Neidenelva (Finland & Norway), and Kola (Russia) showed significant temporal synchrony in marine growth and variation in abundance, and these variables were also significantly correlated with the sea water temperature in the Barents Sea.

2.5 Long-term projections for stock rebuilding

In 2003 and 2004, the Working Group provided information on long term trajectories for stock rebuilding for specific stocks with different productive capacities and under different conditions of exploitation and starting stock size (relative to CL). The data and analysis indicated that there is an increased probability of not achieving S_{lim} in low productivity rivers when exploitation was increased and that stock productivity was the most important factor in determining the ability of a stock to rebuild in a mixed stock fishery.

The Working Group therefore cautioned that further simulations should also reflect declining stock trajectories and population viability given that the probability of rebuilding in the short term is low in most areas and that the main result of recent management measures may have been to reduce this rate of decline rather than lead to any significant stock rebuilding.

2.5.1 Long term projections of PFA for North America

Seven different types of regression models have been used to relate lagged spawners (LS and Pre-Fishery Abundance for North America ($PFA_{NA,}$ Section 5.10). Some of these allow for a "regime shift" in the relationship identified by the Working Group (ICES, 2003) whereby early years in the time-series demonstrate higher PFA per lagged spawner while the more recent years demonstrate lower PFA per lagged spawner. The LS value for the current year is used to predict a distribution of expected PFA_{NA} in the current year which is used to provide catch advice for the upcoming fishing season in West Greenland. However, medium term (up to 5 years) and long term (up to 20 years) projections have not been developed to date. Therefore the Working Group has adapted and extended the analysis in Section 5.10 to complete the cycle over a longer time period to examine potential long term trajectories in stock size. The only new assumption made is that the allocation by region of surviving fish after the West Greenland fishery in year t is proportional to the distribution of the lagged spawners by region that produced the predicted PFA_{NA} for that year. This additional assumption allows medium and long term predictions for PFA_{NA} to be made, demonstrating directly the implications of the different relationships between LS and PFA_{NA} and also providing a basis for comparison with the simple Population Viability Analysis (PVA) results presented to the Working Group in (ICES, 2004a).

The basic data required for reconstruction of the historical PFA_{NA} are given in Section 5.10. The wide range of functional relationships between LS and PFA_{NA} used in the model, along with the selection procedure to pick the best model, are described in Section 5.8. The predictions in Section 5.8 utilize the measured uncertainty in the regression fit to make stochastic projections of PFA_{NA} for the upcoming year. This has been the end point of this process to date. However, the cycle can be completed by assuming that the PFA_{NA} that is predicted for next year can be allocated to the six regions based on their LS relative abundance (Figure 2.5.1.1). This is a reasonable assumption because the PFA_{NA} value is formed from the returns, which are highly correlated to spawners (perfectly so, if in-river catches are subtracted from the returns). Once the PFA_{NA} is reduced by the West Greenland fishery, allocated to the Sea Fishing Areas (SFAs), and these values reduced by natural mortality and any home water fisheries, the spawners for next year can be derived. Application of the lagging process can then be used to estimate future values of LS and this cycle can be repeated indefinitely into the future.

When stochastic projections are used in the Cycle approach, then uncertainty of PFA_{NA} for every year into the future can be derived by incorporating the appropriate root mean square error from that simulation's model fit. These distributions can be used to show the probability of stock increase or decrease given the assumed natural and fishing mortality rates and the LS-PFA_{NA} relationship chosen. Due to both the large amount of uncertainty in the LS-PFA_{NA} relationship, as well as the use of power functions for this relationship, the stochastic projections can sometimes produce exceedingly large values for PFA_{NA}. To prevent numerical overflows, a cap is placed on the maximum possible value for PFA_{NA} in any year. The cap was arbitrarily set at five million fish, approximately five times greater than the largest PFA_{NA} estimate in the observed time series.

Conducting stochastic projections using this approach under the assumption of no fishing results in a wide range of possible PFA values in the next 20 years, with major differences seen between projections made in the high phase versus the low phase (Figure 2.5.1.2). The high phase projections are limited by the *ad hoc* cap of 5 million fish. Separating the projections by model type reveals that the model selected for a particular simulated dataset determines the overall result of medium to long term projections, as expected (Figure 2.5.1.3).

- This is most clearly seen by comparing model 3 (constant PFA independent of lagged spawner size) with models 4 through 7 (PFA depends upon lagged spawners).
- Models 1 and 2, which do not have a regime shift, were never selected (Table 2.5.1.1).
- In model 3, the projections randomly fluctuate about a mean because no matter how large or small the number of lagged spawners gets, the expected value of PFA is always the same. The median PFA value for the model 3 high phase projections is approximately 450 000, much higher than the median from the model 3 low phase projections.
- The median PFA for models 4–7 always increase to the ad hoc cap when projected in the high phase. Of these model projections, only model 7 has some probability of not increasing to the ad hoc cap of 5 million fish in the next 20 years.
- In contrast, none of the projections of PFA using models 4–7 in the low phase are limited by the *ad hoc* cap of 5 million fish. The projections of model 4 in the low phase increase slightly over the next 20 years while the projections of models 5-7 in the low phase decrease. The decrease is most severe for model 7, with median PFA declining to less than one fish by 2022.
- The projections of models 5–7 in the low phase and the simple PVA presented in ICES (2004a) are similar.
- Eliminating projections under the highly unlikely assumption for long-term projections that LS and PFA are unrelated (models 1 and 3), results in PFA values that, under a scenario where there is no fishing, the PFA is expected to either increase rapidly for the high phase projections or slightly decrease for the low phase projections (Figure 2.5.1.4).

Further PFA projections were next made assuming that a fishery occurs in West Greenland at 20, 50, or 100 t annually for the next 20 years, and that all home river fisheries are stopped (Figures 2.5.1.5-7). The harvest in tons was converted to numbers of fish and split between North America and Europe following the standard WG approach. In all three West Greenland harvests considered, PFA from the high phase projections were essentially the same with large increases up to the ad hoc cap. In contrast, PFA from the low phase projections showed a strong response to West Greenland harvest, with a continued harvest of 100 t causing the median PFA to decline to zero by 2013 (Figure 2.5.1.8). The overlap of medians for the first five years of projections is due to the fact that the lagged spawners that produced these PFA values come from spawners that are already back in the river for most SFAs. Thus, there is no feedback from the cycling nor from forecast catches in West Greenland in this period.

Models that did not relate PFA to LS (models 1 and 3) were selected 15% of the time. However, these are not included in Figures 2.5.1.4-8 as they are not informative for medium and long term projections.

These results demonstrate that medium to long term forecasts of PFA depend most on the phase used for projections. The PFA is much more resilient to fishing when in the high phase than when in the low phase. The ability to detect a switch from the current low phase to the high phase depends on future PFA estimates from observed returns that are much higher than expected from the low phase model. A single observation is not sufficient to claim that a change in phase has occurred, multiple years in the high phase will be required. There is a time lag between observing large PFA and the feedback through the cycle to generate higher returns, spawners, and PFA that needs to be considered when making management decisions.

Future development of long term trajectories should consider the following issues.

- Inclusion of ages other than two, *i.e.* grilse and multi-sea winter ages, should be considered to more accurately reflect the biology of Atlantic salmon.

- The lagged spawner calculations assume equal contribution to PFA_{NA} from the six SFAs. This assumption should be examined to determine if weighting of the SFA would produce a more biologically realistic index.
- The development of juvenile indices could improve the models' ability to forecast PFA_{NA} by including another life stage. Adding another audit point to the cycle would either confirm and stabilize the cycle or else demonstrate that it is incorrect, which could be due to any number of reasons such as differences among region of contribution to PFA, differing impact of high sea or coastal fisheries on the regions, or different natural mortality rates experienced in the different regions.

2.5.2 Potential for rebuilding two multi-sea-winter salmon stocks of the maritime provinces

The ICES (ICES, 2003) catch advice for the management of the West Greenland fishery and the management of the homewater fisheries has been provided on the basis of achieving the conservation objectives of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) and to an alternate objective for the southern regions of achieving at least a 10% increase or a 25% increase relative to the average returns to the regions during a specified time period (Chaput *et al.*, 2005). In this regard it is presumed that stocks in these areas have the potential to rebuild if adequate spawning occurred.

The stock status and short term viability and potential for rebuilding of two multi-sea-winter salmon stocks (Mirimichi River and Saint Johns River) of the maritime provinces of eastern Canada are examined in the context of the ICES advice. Age data were used to assign salmon to their year class (year of egg deposition or year of adult return to the river). Mean fork lengths and proportion female were estimated for the origin, size group, sea age, spawning history and fresh water age combinations in any given year. The eggs per female were calculated from river-specific egg to length fecundity relationships. Eggs in the returns and spawners by origin, size group, sea age, spawning history and fresh water age were calculated from the estimated returns by origin (hatchery and wild) and size group, the proportion female in the age group, and the average eggs per female fish of the age group.

Age structure and relative abundance

Characteristics of these two populations were examined in detail in 2004 (ICES, 2004a). The Atlantic salmon population in the Miramichi is characterized by an expanding spawning age history structure (Table 2.5.2.1). Between 1971 and 1986, there were few repeat spawners in the river with at most two previous spawning migrations. Since 1992 and 1995, adult salmon on their sixth and seventh spawning migrations, respectively, have been sampled in the catches at the estuary trap nets and repeat spawning salmon have comprised 6% to 21% of the total returns of all age groups.

In the Saint John River, repeat spawners made up as much as 7% of the total returns to the river but this was in the early part of the time series, 1970s, and in the last ten years, repeat spawners have represented less than 3% of the total returns with a virtual absence of any salmon beyond a second spawning (Table 2.5.2.2).

As the repeat spawner abundance has increased in the Miramichi, the number of year classes present in the annual spawning migration has increased from four to five in the 1970s to as many as eight to nine year classes in the returns of the 1990s. This contrasts with the Saint John River stock where for either wild salmon or hatchery origin salmon, there has been no change in the number of year classes over time, with generally five year classes present, with a maximum of seven in the earlier portion of the time series.

Replacement ratios of egg production

For a population to replace itself, one egg in the recruitment is required for every egg spawned. For the Miramichi River, the wild salmon stock produced maiden fish recruitment surplus to spawners for most year classes between 1971 and 1989 but was consistently below replacement for the 1990 to 1997 year classes (Figure 2.5.2.1). The eggs in the maiden returns of the 1998 year class (the last year where an assessment was possible) are estimated to have been equivalent to the eggs which were spawned.

For the Saint John River, wild salmon production has varied around the replacement line for the 1972 to 1988 year classes but has decreased sharply and remains well below replacement for the 1989 to 1999 year classes (Figures 2.5.2.2, 2.5.2.3). There are so few repeat spawners in this stock that the difference in the lifetime production of eggs relative to production from maiden salmon is minimal. An examination of the spawners to recruitment plot indicates that the population was sliding down along the replacement line but egg to maiden salmon mortality increased substantially and has remained high for the 1989 and subsequent year classes (Figure 2.5.2.2). Replacement ratio calculations for the hatchery origin salmon indicates a relatively constant rate of return for the 1985 to 1999 year classes (Figure 2.5.2.3).

There has been a decline in the proportion of the eggs produced in the lifetime of the year class by maiden MSW salmon of the Miramichi River (Figure 2.5.2.4). For the 1981 and subsequent year classes, the lifetime egg production from MSW maiden salmon amounts to about 50% of the lifetime production of the year class. The decline from the previous time period is attributable to a decline in 2SW maiden salmon abundance and an increase in the repeat spawner abundance. This contrasts with the Saint John River stock in which the MSW maiden salmon continue to contribute over 80% of the eggs in the lifetime of the year class with a slight decline for the recent three year classes (Figure 2.5.2.4). In the hatchery origin salmon, 1SW maiden salmon can contribute as much as 25% of the eggs during the life time of the cohort and this has increased for the post 1989 year classes.

Constraints to rebuilding in these Maritimes rivers

The replacement ratio calculations indicate that the Miramichi River population had the potential historically to produce a surplus of maiden egg production. In the recent decade, maiden egg production (*i.e.* recruit egg production) has been well below replacement for a time period when spawner egg depositions exceeded the conservation requirements by 50 to 100%. With a decline in egg depositions, returns of maiden fish have resulted in at least the replacement of the parental stock and the potential for increased returns appears feasible. The decline in 1SW and 2SW maiden salmon abundance may have been partly the result of high egg depositions for those year classes and resulting over compensatory density dependent response in freshwater. Freshwater conditions have remained suitable for the survival of high numbers of juveniles from fry to age-1 parr and from age-1 parr to age-2 parr (Figure 2.5.2.5). Since 1999, smolt production from the Northwest Miramichi, one of the two main branches, has ranged from 162 to 390 thousand, a production rate of 1.0 to 2.3 smolts per 100 m^2 of rearing habitat area (Chaput *et al.* 2002). This is less than expected given one-year old and two-year old parr densities ranging between 30 and 47 fish per 100 m^2 (Figure 2.5.2.5). The total biomass of juveniles at the monitored sites in the Northwest Miramichi has averaged 230 to 377 grams per 100 m^2 in the years prior to the smolt emigration year. There is a negative association between the mean biomass of juveniles of the year and the smolt production the following spring. The true dynamic is not well defined because there are no observations for low to medium biomass levels for the river but parr age-1 index plotted against the returns of maiden 1SW and 2SW salmon adjusted to the year of smolt emigration supports the view of a strong over-compensatory relationship in salmon production for the Miramichi. An examination of the spawners to recruitment plot from Figure 2.5.2.2 indicates that there is a greater chance (9 of 11 events) that the recruitment will be less than the spawners when egg depositions exceed

150 million eggs (equivalent to 2.7 eggs per m²) than when egg depositions were less than 150 million.

The prognosis for the Miramichi remains positive. Marine return rates of 1SW and 2SW maiden salmon appear sufficient to replace the eggs which produced them. Size at age has increased such that every female now has the potential to produce more eggs, there is a high survival to second and third spawning, and the interstage survival of the juvenile stages have not changed over time.

The Saint John River population has struggled to replace the spawners throughout the time series. For the last ten year classes, the eggs from the returns of maiden salmon have been substantially below replacement. The hatchery program has maintained a surplus production of eggs in the returns of hatchery origin salmon and the relative rate of production has been fairly constant and positive since the 1985 year class. The dramatic decline in wild salmon relative production strongly suggests that the increased mortality on the wild salmon post 1989 is a freshwater constraint which may be restricted to the environment at Mactaquac and above. The majority of the hatchery origin salmon are from smolt releases just below Mactaquac Dam which would be expected to have been exposed to the same marine mortality factors which wild smolts and salmon would have encountered. The prognosis for any recovery of natural production for the area of the river above the hydro dams is negative. However, the hydro dams may not be the only cause of the declines as the status of the Nashwaak River stock has also declined dramatically in synchrony with the stock of the Saint John River. The Nashwaak population is not affected by hydro-dams directly, has had minimal hatchery intervention, yet the estimated egg depositions have been 7% to 43% of the conservation requirements during 1993 to 2003, similar levels to those achieved in the Saint John River from both wild and hatchery origin salmon (Jones *et al.*, 2004). There are no positive changes in life history characteristics (increased size at age or proportion female, increased survival of previous spawners) and it is likely that the stock will continue to decline.

The continued decline in the Saint John stock contrasted with the apparent rebuilding of the Miramichi stock suggests that the factors which contributed to the decline differ. The restriction in fisheries exploitation, both marine and freshwater, has not been sufficient to arrest the decline in salmon abundance in the Saint John River, whereas in the Miramichi these did result in increased spawning escapement and the production of juvenile salmon to record levels. The outstanding question for the Miramichi is whether sustained high spawning escapements at levels of 50% to 100% above CL may result in inter-cohort competition of the juveniles leading to increased density dependant mortality of parr. Clearly, declines in stocks and sustained failures to achieve CLs may result from a number of factors which may be related or unrelated to insufficient stock abundance.

2.5.3 Catch advice and projected attainment of CLs for an Irish salmon fishing district

The theoretical recovery trajectories developed by ICES (2004a) were extended with a case study using data from an Irish district salmon fishery to examine the implications of current catch advice to the objective of meeting district CLs in subsequent years. Catch advice has been provided for this district based on 75% probability of achievement of the total conservation limit (CL) for all the rivers in the district. Consequences of this catch level for individual rivers along with the district as a whole were examined. Other constant catch levels were also examined. Some general advice for mixed stock fishery management can be provided based on these results.

Parameters for Ricker stock and recruitment functions were obtained from the outputs of transporting stock and recruitment parameters from 13 monitored rivers in Europe using a Bayesian Hierarchical Stock and Recruitment approach (BHSRA, Prevost *et al.,* 2003) to Irish salmon rivers (Ó Maoiléidigh *et al.*, 2004). The parameters H_{opt} (exploitation at optimum spawning stock abundance) and S_{opt} (optimum spawning stock) for the 14 rivers in the selected Irish salmon fishing district were used to obtain the Ricker parameters alpha (α) and beta (β) for the formula;

$$R = \alpha * S * Exp(-\beta * S)$$

Alpha was calculated according to the formula

$$\alpha = Exp(Hopt/(1 - Hopt))$$

and Beta was calculated as;

$$\beta = Hopt / Sopt$$

Recruitment at optimum spawning stock (R_{opt}) was

$$Ropt = Sopt/(1 - Hopt)$$

Projections were dependant on partial recruitment vectors particular to the river. The partial recruitment vector was the proportioned product of matrices consisting of rows for proportional smolt age, sea age at maturity and relative fecundity at sea age.

Obtaining recruits for seven years (the longest period required to obtain complete recruitment) initialized projections at the selected starting stock size before accumulating recruits for any trajectory. Error in trajectories for each river was introduced by applying a lognormal deviate each year with a common variance. These lognormal deviates varied independently among rivers each year. This selection process is a simplification of the model used by Crozier *et al.* (2003) and Prévost *et al.* (2003) that generated the posteriors, which used posterior distributions for H_{opt} and S_{opt}. The reported stock recruitment scale was eggs*m^{-2}. Spawning egg densities were converted to adults through the use of the river specific riverine wetted area and eggs per adult. A total catch was applied jointly to all 14 rivers assuming complete mixing of the stocks so that catch occurred in proportion to abundance in each river. The adults remaining after catch had been removed were converted back to egg densities so that the stock recruitment relationship could be applied. The simulation providing the catch advice for all Irish salmon districts assumes that the s/r parameters for the individual rivers are synchronized to a degree. In the current simulation the rivers are assumed to be independent, resulting in greater variation and more difficulty in achieving the CL simultaneously particularly where there are several smaller rivers.

In the simulations, since the District is currently estimated to be at 63% of S_{opt}, (before exploitation in commercial and recreational fisheries) each river had its starting spawning stock sizes set to 63% of their S_{opt}. Although the 14 rivers had quite similar stock recruitment relationships on an eggs*m^{-2} basis, they varied in size considerably. The CL for the individual rivers ranged from 67 to 13 646 fish, with a three rivers accounting for 91% of the total of 39 164. Projections were run using either no catch or linear increases of catches from zero to 10 000, 20 000 or 50 000 fish. The linearly increasing catch from zero to 10 000 fish has an increase of 526 fish each year. The exploitation rate was not capped, so all of the fish were harvested if the catch was greater than the population abundance, an unlikely occurrence in reality. Forward simulations of 20 years were run 10 000 times in an @Risk© framework in Excel©. The current mean catch from the district (2000–2004) is just over 15 000 fish. The output collected was the probability that the total CL was achieved, the probability that CL was achieved for all 14 rivers simultaneously, and the mean and 90% confidence interval for the number of rivers achieving CL. These outputs were collected for each year of the projections.

When applied to the aggregated district CL, maintaining the catch at 0, immediately resulted in a high probability (> 75%) of achieving the total CL which was maintained throughout the projected time series (Figure 2.5.3.1). Application of the linearly increasing catch of zero to 10 000 fish produced a decrease in the probability of meeting the CL in the first few years but increased subsequently. Maintaining this progression of increasing catch eventually lead to a slight reduction in the probability of the conservation being met. Similarly, a linearly increasing catch of zero to 20 000 initially caused a decrease on the probability of meeting the CL, followed by an increase suggesting that this sequences of catches could be sustained for a short period while rebuilding occurred. Within 10 years however, the probability of meeting the CL decreased significantly as the catch became too large relative to the available population. The linear increase to 50 000 catch option caused an immediate and consistent decline in the probability of meeting the CL.

Although the probability of CL achievement for all 14 rivers simultaneously increased significantly in the projection at 0 catch, it was never higher than 65% (Figure 2.5.3.2). None of the other catch options provides a high probability of meeting the CLs. The difference from the case of total CL achievement is due to the surpluses in some rivers compensating for other rivers being below their CL. The difficulty in meeting the CL in each river is due to the high amount of variability in these simulations as well as the inherent variability of small rivers. The probability of achieving the CL in every river is a much more difficult management measure to achieve than the total CL objective but is clearly desirable. This is also seen by examining the number of rivers that achieve their CL (Figure 2.5.3.3) where higher fishing pressure causes this number to decrease.

This analysis provides some information about the implications of being below CL. In this example the District was 63% of its CL. Some districts in Ireland are exceeding their CL and while this would appear to be a desirable situation, in reality, the recruitment from being at 100% of CL and much higher levels may not be much higher compared to being at the CL. Furthermore, when catch advice is provided for stocks above their CL, it was demonstrated that these catch levels are not sustainable and must decrease as the stock size decreases towards the CL. Similarly, when a stock is below its S_{opt} it is possible to increase the advised catch as the stock improves. Clearly, the attainment of CL in all rivers simultaneously may be difficult to achieve but is still a desirable objective. Finally, catch advice is best provided on a year to year basis following annual assessments of spawners and returns.

2.6 Distribution, behaviour and migration of salmon

2.6.1 DST- tagging of salmon in the Norwegian Sea

An inter-Nordic tagging study including Norway, Faroes and Iceland has been carried out in the sea in 2002–2004. The aim of the study has been to study various marine life history traits such as, winter habitats, diurnal patterns of vertical migration and feeding activities, and in addition to gather information allowing the risk of being intercepted by pelagic fishing gear to be assessed.

Table 2.6.1.1 summarises the tagging carried out in 2002–2004. 734 pre- adult and adult salmon have been captured and 406 of these have been tagged with Data Storage Tags, predominantly in two different areas in the Norwegian Sea (Figure 2.6.1.1). A few salmon have also been tagged and released SE of Iceland and at the shelf outside Mid-Norway. The fish have been captured using a special salmon trawl with a live-fish capture box (modified from Holst and MacDonald, 2000). Depth and temperature recording “Milli”-tags (Star-Oddi) or temperature logging I-button “ salmon”-tags (Texas instruments) have been used at approximately 50/50 ratio. The depth-& temperature-loggers were used on the salmon assessed likely to survive, while the I-buttons were used on fish that were assessed as viable but with scale loss between 15–30%. Fish with a scale loss exceeding 25% were in general discarded. The

DSTs were set to log the temperature and depth at various intervals between 1–120 min. Each fish got an additional bright coloured numbered external tag to facilitate detection. A few scales and the adipose fin were removed for biological analyses. In 2004 a special trough that could contain 4–5 fish recovering from anaesthesia and that could be hoisted over the ship's side by a crane was used for releasing the fish. The salmon thus didn't have to be touched post-operation, which greatly reduced handling stress.

During the study some differences in the environment where the recaptures were made could be observed over the years. Most fish in the Faroes' tagging in 2002 and 2003 were captured north-west, close to the border of the EEZ between Faroes and Iceland, in the relatively cool waters of the front between the cold Icelandic current and the warmer Atlantic water In 2004, however, the highest catch per trawl hours, CPUE, were obtained further south in waters between 8 – 9 C (Figures 2.6.1.2 – 3). Most of the catches in the central Norwegian Sea in April 2004 were also occurring in the warmer Atlantic water. When temperatures were less than 7 C no salmon were captured.

By April 2005, five tagged salmon have been recaptured of those tagged in the central Norwegian Sea. Four salmon were recaptured in Mid-Norwegian rivers/river-estuaries, indicating that the capture area in the Norwegian Sea is a transition or feeding area for fish originating in this region (Figure 2.6.1.1). 439 days of observation mostly on an hourly basis, but mixed with periods with shorter observation intervals is obtained from these recaptures. Common for all four is a period of relative inactivity for the first 14–20 days after release. Preliminary analyses of the data records show that after the initial period the patterns are fairly different, but all have a period of rather extensive diving activity although the maximum diving depths (85 - ~ 280m) and the number of dives per time unit seem to vary considerably from fish to fish. The salmon probably are progressing towards the coast and feeding at the same time during this phase. All fish stay mostly in the uppermost 5–10 m which seems to be the starting point for excursions into deeper layers. When approaching the end point different patterns can be discerned, probably depending on the nature of the fjord, the estuary and finally the river where the salmon arrive. E.g. the River Ätran in Sweden is small, shallow and warm (Figure 2.6.1.4), while the River Surna is a large regulated river with some parts draining cold water from high in the mountains. This can be seen as a fall in temperature when the fish ascends into the river (Figure 2.6.1.5). Further recaptures from the tagging north of Faroes in November 2004 and possibly also 2 SW fish from the tagging in April 2004 in the Norwegian Sea might turn up during the 2005 fishing season.

The conclusions from the preliminary analyses are that a) DSTs are an invaluable tool for studying marine life history traits of the salmon, b) the relatively frequent dives below 20–50 m might make the salmon more vulnerable previously believed to interception by mid-water trawls in some areas, and c) the relatively high costs involved are balanced by the number of observation days obtained from each tag.

2.7 Compilation of tag releases and finclip data by ICES member countries in 2004

Data on releases of tagged, fin-clipped, and otherwise marked salmon in 2004 were provided by the Working Group and are compiled as a separate report. In summary (see Table 2.7.1), about 4.95 million salmon were marked in 2004, an increase from the 3.94 million fish marked in 2003. Primary marks are summarized in three classes: microtags (*i.e.*, coded wire tag), external tags/marks, and adipose clips (without other external marks or fin clips). Secondary marks, primarily adipose clips on fish with coded wire tags or visual implant elastomer (VIE), are also presented in the separate report. The adipose clip was the most used primary mark (3.49 million), with microtags (0.9 million) the next most common primary mark. Most marks were applied to hatchery-origin juveniles (4.83 million), while 110 461 wild juveniles and 17 899 adults were marked.

The tag compilation includes various types of tags including DST, radio and/or sonic transmitting tags (pingers). These recent technologies provide valuable and previously unobtainable information on salmon movements and the environmental conditions they are experiencing, and their use is expected to grow in the future.

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 a left 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.

Table 2.1.1.1 Nominal catch of salmon by country (in tonnes round fresh weight), 1960-2004. (2004 figures include provisional data).

	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
								Sweden				UK	UK	UK				East	West		Reported		
Year	Canada	USA	St. P&M	Norway	Russia	Iceland		(West)	Den.	Finland	Ireland	(E & W)	(N.Irl.)	(Scotl.)	France	Spain	Faroes	Grld.	Grld.	Other	Nominal	NASCO	International
	(1)			(2)	(3)	Wild	Ranch				(4,5)		(5,6)		(7)	(8)	(9)		(10)	(11)	Catch	Areas	waters (12)
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	
								Sweden				UK	UK	UK				East	West		Reported		
Year	Canada	USA	St. P&M	Norway	Russia	Iceland		(West)	Den.	Finland	Ireland	(E & W)	(N.Irl.)	(Scotl.)	France	Spain	Faroes	Grld.	Grld.	Other	Nominal	NASCO	International
	(1)			(2)	(3)	Wild	Ranch				(4,5)		(5,6)		(7)	(8)	(9)		(10)	(11)	Catch	Areas	waters (12)
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	0	92	-	3,135	1,123	-
1997	229	0	2	630	111	106	50	19	1	45	570	142	93	296	8	3	0	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	159	0	3	784	82	130	0	19	4	39	474	108	47	209	19	7	0	0	15	-	2,099	686	-
Average																							
1999-2003	148	0	2	1,069	113	100	6	27	4	91	620	161	64	221	11	8	2	0	20	-	2,668	1,073	-
1994-2003	204	0	2	934	121	115	96	28	3	69	657	187	74	335	11	8	3	0	38	-	2,881	1,086	-

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. 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 between 2001 and 2004.
10. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.
11. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
12. 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), 1960-2004. (2004 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)										
								Russia	Iceland		Sweden					Ireland			UK	UK(N.I.)				France	Spain	
Year	Canada (1)			USA	Norway (2)			(3)	Wild	Ranch	(West)	Denmark	Finland			(4,5)			(E&W)	(4,6)	UK(Scotland)			(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	91	159	0	577	207	784	82	130	0	19	4	32	7	39	-	-	474	108	47	137	72	209	19	7	2,081
Average																										
1999-2003	58	90	148	0	699	370	1069	113	100	6	27	4	67	24	91	-	-	620	161	64	138	83	221	11	8	2643
1994-2003	101	102	204	0	607	327	934	121	115	96	28	3	49	20	69	-	-	657	187	74	207	128	335	11	8	2841

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. 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).

Table 2.1.1.3 The catch (tonnes round fresh weight) and % of the nominal catch by country taken in coastal, estuarine and riverine fisheries.

		Coast		Estuary		River		Total
Country	Year	Weight	%	Weight	%	Weight	%	Weight
Canada	1999	7	5	38	25	105	70	150
	2000	11	7	22	15	117	78	150
	2001	13	9	20	14	112	77	145
	2002	12	8	21	14	114	77	148
	2003	17	12	24	17	100	71	141
	2004	24	15	28	18	106	67	159
Finland	1995	0	0	0	0	48	100	48
	1996	0	0	0	0	44	100	44
	1997	0	0	0	0	45	100	45
	1998	0	0	0	0	48	100	48
	1999	0	0	0	0	62	100	62
	2000	0	0	0	0	95	100	95
	2001	0	0	0	0	126	100	126
	2002	0	0	0	0	93	100	93
	2003	0	0	0	0	78	100	78
	2004	0	0	0	0	39	100	39
France[1]	1995	-	-	2	20	8	80	10
	1996	-	-	4	31	9	69	13
	1997	-	-	3	38	5	63	8
	1998	1	13	2	25	5	63	8
	1999	-	-	4	35	7	65	11
	2000	0.4	4	4	35	7	61	11
	2001	0.4	4	5	44	6	53	11
	2002	2	14	3	30	6	56	11
	2003	-	-	6	44	7	56	13
	2004	-	-	10	51	9	49	19
Iceland	1995	20	13	0	0	130	87	150
	1996	11	9	0	0	111	91	122
	1997	0	0	0	0	106	100	106
	1998	0	0	0	0	130	100	130
	1999	0	0	0	0	120	100	120
	2000	0	0	0	0	83	100	83
	2001	0	0	0	0	88	100	88
	2002	0	0	0	0	97	100	97
	2003	0	0	0	0	110	100	110
	2004	0	0	0	0	130	100	130
Ireland	1995	566	72	140	18	84	11	790
	1996	440	64	134	20	110	16	684
	1997	380	67	100	18	91	16	571
	1998	433	69	92	15	99	16	624
	1999	335	65	83	16	97	19	515
	2000	440	71	79	13	102	16	621
	2001	551	75	109	15	70	10	730
	2002	514	75	89	13	79	12	682
	2003	403	73	92	17	56	10	551
	2004	342	72	76	16	56	12	474
Norway	1995	515	61	0	0	325	39	840
	1996	520	66	0	0	267	34	787
	1997	394	63	0	0	235	37	629
	1998	410	55	0	0	331	45	741
	1999	483	60	0	0	327	40	810
	2000	619	53	0	0	557	47	1,176
	2001	696	55	0	0	570	45	1,266
	2002	596	58	0	0	423	42	1,019
	2003	597	56	0	0	474	44	1,071
	2004	469	60	0	0	316	40	785
Russia	1995	43	33	9	7	77	60	128
	1996	64	49	21	16	46	35	131
	1997	63	57	17	15	32	28	111
	1998	55	42	2	2	74	56	131
	1999	48	47	2	2	52	51	102
	2000	64	52	15	12	45	36	124
	2001	70	61	0	0	44	39	114
	2002	60	51	0	0	58	49	118
	2003	57	53	0	0	50	47	107
	2004	46	56	0	0	36	44	82

Table 2.1.1.3 continued

Country	Year	Coast Weight	Coast %	Estuary Weight	Estuary %	River Weight	River %	Total Weight
Spain	1995	0	0	0	0	9	100	9
	1996	0	0	0	0	7	100	7
	1997	0	0	0	0	4	100	4
	1998	0	0	0	0	4	100	4
	1999	0	0	0	0	6	100	6
	2000	0	0	0	0	7	100	7
	2001	0	0	0	0	13	100	13
	2002	0	0	0	0	9	100	9
	2003	0	0	0	0	7	100	7
	2004	0	0	0	0	7	100	7
Sweden [3]	1995	24	65	0	0	13	35	37
	1996	19	58	0	0	14	42	33
	1997	10	56	0	0	8	44	18
	1998	5	33	0	0	10	67	15
	1999	5	31	0	0	11	69	16
	2000	10	30	0	0	23	70	33
	2001	9	27	0	0	24	73	33
	2002	7	25	0	0	21	75	28
	2003	7	28	0	0	18	72	25
	2004	3	16	0	0	16	84	19
UK	1995	200	68	45	15	49	17	295
England & Wales	1996	83	45	42	23	58	31	183
	1997	81	57	27	19	35	24	142
	1998	65	53	19	16	38	31	123
	1999	101	67	23	15	26	17	150
	2000	157	72	25	12	37	17	219
	2001	129	70	24	13	31	17	184
	2002	108	67	24	15	29	18	161
	2003	42	47	27	30	20	23	89
	2004	39	36	20	18	50	46	108
UK	1999	44	83	9	17	-	-	53
N. Ireland [2]	2000	63	82	14	18	-	-	77
	2001	41	77	12	23	-	-	53
	2002	40	49	24	29	18	22	81
	2003	25	45	20	35	11	20	56
	2004	23	50	11	23	13	27	47
UK	1995	201	34	105	18	282	48	588
Scotland	1996	129	30	80	19	218	51	427
	1997	79	27	33	11	184	62	296
	1998	60	21	28	10	195	69	283
	1999	35	18	23	11	141	71	199
	2000	76	28	41	15	157	57	274
	2001	77	30	22	9	153	61	251
	2002	55	29	20	10	116	61	191
	2003	87	45	23	12	83	43	192
	2004	45	21	21	10	143	69	209
Totals								
North East Atlantic [4]	2004	967	50	137	7	815	42	1,919
North America	2004	27	17	28	18	106	66	162

[1] Data for France include some unreported catches.

[2] Includes rod catch data from 2002.

[3] Estuarine catch included in coastal catch.

[4] Data not available from Denmark.

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, 1991-2004. Figures for 2004 are provisional.

Year	Canada		Iceland		Russia		UK (E&W)		UK (Scotland)		USA	
	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			3,211	51					239	50
1992	46,450	34			10,120	73					407	67
1993	53,849	41			11,246	82	1,448	10			507	77
1994	61,830	39			12,056	83	3,227	13	6,595	8	249	95
1995	47,679	36			11,904	84	3,189	20	12,133	14	370	100
1996	52,166	33	669	2	10,745	73	3,428	20	10,409	15	542	100
1997	57,251	49	1,558	5	14,823	87	3,132	24	10,906	18	333	100
1998	62,938	53	2,826	7	12,776	81	5,365	31	13,455	18	273	100
1999	55,335	50	3,055	10	11,450	77	5,447	44	14,839	28	211	100
2000	64,482	55	2,918	11	12,914	74	7,470	42	21,068	32	0	-
2001	59,387	55	3,607	12	16,945	76	6,143	43	27,699	38	0	-
2002	50,924	52	5,985	18	25,248	80	7,658	50	24,042	42	0	-
2003	53,699	55	5,361	16	33,862	81	6,425	56	28,987	55	0	-
2004	57,005	55	7,294	16	24,679	76	12,379	48	42,430	50	0	-

Table 2.1.3.1 Estimates of unreported catches by various methods in tonnes within national EEZs in the North-East Atlantic, North American and West Greenland Commissions of NASCO, 1987-2004.

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
Mean 1999-2003	955	108	11	1,073

Table 2.1.3.2. Estimates of unreported catches by various methods in tonnes by country within national EEZs in the North-East Atlantic, North American and West Greenland Commissions of NASCO, 2004.

2004 Commission Area	Country	Unreported Catch t	Unreported as % of Total North Atlantic Catch (Unreported + Reported)	Unreported as % of Total National Catch (Unreported + Reported)
NEAC	Denmark	3	0.1	43
NEAC	Finland	10	0.4	20
NEAC	Iceland	3	0.1	2
NEAC	Ireland	47	1.7	9
NEAC	Norway	336	12.1	30
NEAC	Russia	110	4.0	57
NEAC	Sweden	2	0.1	10
NEAC	France	7	0.2	26
NEAC	UK (E & W)	33	1.2	23
NEAC	UK (N.Ireland)	0.3	0.0	0.7
NEAC	UK (Scotland)	24	0.9	10
NAC	Canada	101	3.6	39
NAC	USA	0	0.0	0
WGC	West Greenland	10	0.4	40
	Total Unreported Catch	686	24.6	
	Total Reported Catch of North Atlantic salmon	2,099		

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

Table 2.2.1.1 Production of farmed salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980-2004.

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	12,140	2,554	225	0	502,281	87,700	6,000	28,751	9,000	1,000	900	133,351	635,632
1998	361,879	110,784	20,362	16,418	14,860	13,166	2,686	114	0	540,269	125,000	3,000	42,300	7,068	1,000	400	178,768	719,037
1999	425,154	126,686	37,000	23,370	18,000	12,194	2,900	234	0	645,538	150,000	5,000	38,800	9,195	0	500	203,495	849,033
2000	440,861	128,959	32,000	29,095	17,648	16,400	2,600	250	0	667,813	176,000	5,670	39,300	10,906	0	500	232,376	900,189
2001	436,103	138,519	46,014	37,606	23,312	13,230	2,645	250	0	697,679	200,000	5,443	58,000	11,500	0	500	275,443	973,122
2002	462,495	145,609	45,150	42,131	22,294	6,810	1,471	250	0	726,210	273,000	5,000	72,800	11,000	0	1,000	362,800	1,089,010
2003	507,413	176,596	52,526	39,760	16,500	6,435	3,710	250	298	803,488	261,000	4,000	70,500	15,000	0	1,000	351,500	1,154,988
2004	507,413	176,596	40,492	39,964	16,500	9,121	6,300	250	203	796,839	261,000	4,990	70,500	15,000	0	1,000	352,490	1,149,329
Mean 1999-2003	454,405	143,274	42,538	34,392	19,551	11,014	2,665	247		708,146	212,000	5,023	55,880	11,520	0	700	285,123	993,268
% change on 1999-2003	+12	+23	-5	+16	-16	-17	+136	+1		+13	+23	-1	+26	+30		+43	+24	+16

Notes:
Data for 2004 are provisional for many countries.
Data for 2003 are provisional for UK (Scotland).
Where production figures were not available for 2004, values for 2003 were used (Norway, UK (Scotland) & UK (N.Ireland)).
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.

Model	Selected		Description
1	0	0%	single flat line
2	0	0%	one intercept one slope
3	1499	15%	two flat lines
4	4166	42%	no intercept two slopes
5	87	1%	one intercept two slopes
6	1308	13%	two intercepts one slope
7	2940	29%	two intercepts two slopes
Total	10000		

Table 2.5.1.1 Number of times each model was selected as the best fit to the simulated PFA and LS data.

Year	Spawning migration 1	2	3	4	5	6	7	Total Abundance	Percent Repeat
1971	58,676	1,326	78					60,080	2.3%
1972	74,053	1,271						75,324	1.7%
1973	71,129	608						71,737	0.8%
1974	112,893	2,914	203					116,010	2.7%
1975	90,170	3,379	170					93,719	3.8%
1976	91,696	21,875	810					114,381	19.8%
1977	76,232	1,843	1,510					79,585	4.2%
1978	45,559	3,221						48,780	6.6%
1979	57,453	2,193	373					60,019	4.3%
1980	75,909	1,445	552					77,906	2.6%
1981	76,883	2,597	1,975					81,455	5.6%
1982	105,022	5,408	707					111,137	5.5%
1983	48,957	4,151						53,108	7.8%
1984	43,267	1,419		158				44,844	3.5%
1985	60,916	19,579	1,043					81,538	25.3%
1986	144,318	4,186	330					148,834	3.0%
1987	100,538	3,391	308					104,237	3.5%
1988	139,750	3,131	522	261				143,664	2.7%
1989	86,096	4,766	1,497	83				92,442	6.9%
1990	101,457	7,767	2,351	499				112,074	9.5%
1991	79,153	7,177	2,835	1,684				90,849	12.9%
1992	177,553	5,797	3,895	1,857	408	91		189,600	6.4%
1993	119,323	5,648	3,194	1,631	204			130,000	8.2%
1994	60,539	2,719	714	399	84	63		64,517	6.2%
1995	74,015	3,235	752	357	56	38	19	78,473	5.7%
1996	46,456	3,992	1,131	371	37	56		52,043	10.7%
1997	26,047	4,098	1,609	667	78	26	13	32,538	19.9%
1998	29,861	4,902	2,128	842	117	23	23	37,896	21.2%
1999	31,283	3,442	1,528	724	181	40		37,199	15.9%
2000	40,557	4,104	1,601	904	311	30	15	47,523	14.7%
2001	42,610	4,885	1,194	630	296	57	19	49,691	14.2%
2002	50,731	2,797	948	414	360	53	13	55,317	8.3%
2003	42,849	4,671	1,206	572	164	143	20	49,625	13.7%
2004	58,483	5,439	1,575	536	134	17	17	66,201	11.7%

Table 2.5.2.1. Estimated abundance of previous spawners in the large salmon returns of the Miramichi by number of spawning migrations of the fish. Maiden salmon are on their first spawning migration.

Year	Spawning migration 1	2	3	4	Total abundance	Percent Repeat
1978	11132	348	21		11501	3.2%
1979	13674	855	56	12	14597	6.3%
1980	31895	1104	117	74	33191	3.9%
1981	20046	635	22	32	20735	3.3%
1982	14407	1000	77	26	15509	7.1%
1983	12674	332			13006	2.5%
1984	20325	331			20656	1.6%
1985	19516	307	32		19855	1.7%
1986	14850	820	20		15691	5.4%
1987	13690	377	2		14069	2.7%
1988	13534	164	19		13717	1.3%
1989	15151	236	15		15402	1.6%
1990	12392	295	13		12700	2.4%
1991	13575	294	16		13886	2.2%
1992	13654	134			13788	1.0%
1993	7637	115			7752	1.5%
1994	5774	102	5		5881	1.8%
1995	7259	68	1		7328	0.9%
1996	9925	106			10031	1.1%
1997	5099	127			5226	2.4%
1998	5779	166	4		5949	2.9%
1999	5025	36			5061	0.7%
2000	3565	47			3612	1.3%
2001	2873	33			2906	1.1%
2002	2699	34	1		2734	1.3%
2003	2033	20			2053	1.0%
2004	2190	9			2199	0.4%

Table 2.5.2.2. Estimated abundance of maiden and previous spawners in the returns of wild and hatchery origin salmon to the Saint John River at Mactaquac. Maiden salmon are on their first spawning migration.

CRUISE	AREA	TIME	NO. CAPTURED	NO. TAGGED
Norway- 2002-04	Norwegian Sea	June/July 2002 & 2003; April 2004	224	107*
Faroes- 2002 - 04	Faroes' EEZ, north	October 2002-03 November 2004	482	293**
Iceland – 2002 - 03	Iceland's EEZ, west & east; east	November/ December 2002 January 2003	28	6
Total			734	406

* five tag recaptures ** recapture of an externally tagged salmon - the DST was lost

Table 2.6.1.1 Summary of DST tagging of salmon carried out by Norway, Faroes and Iceland in 2002 – 2004.

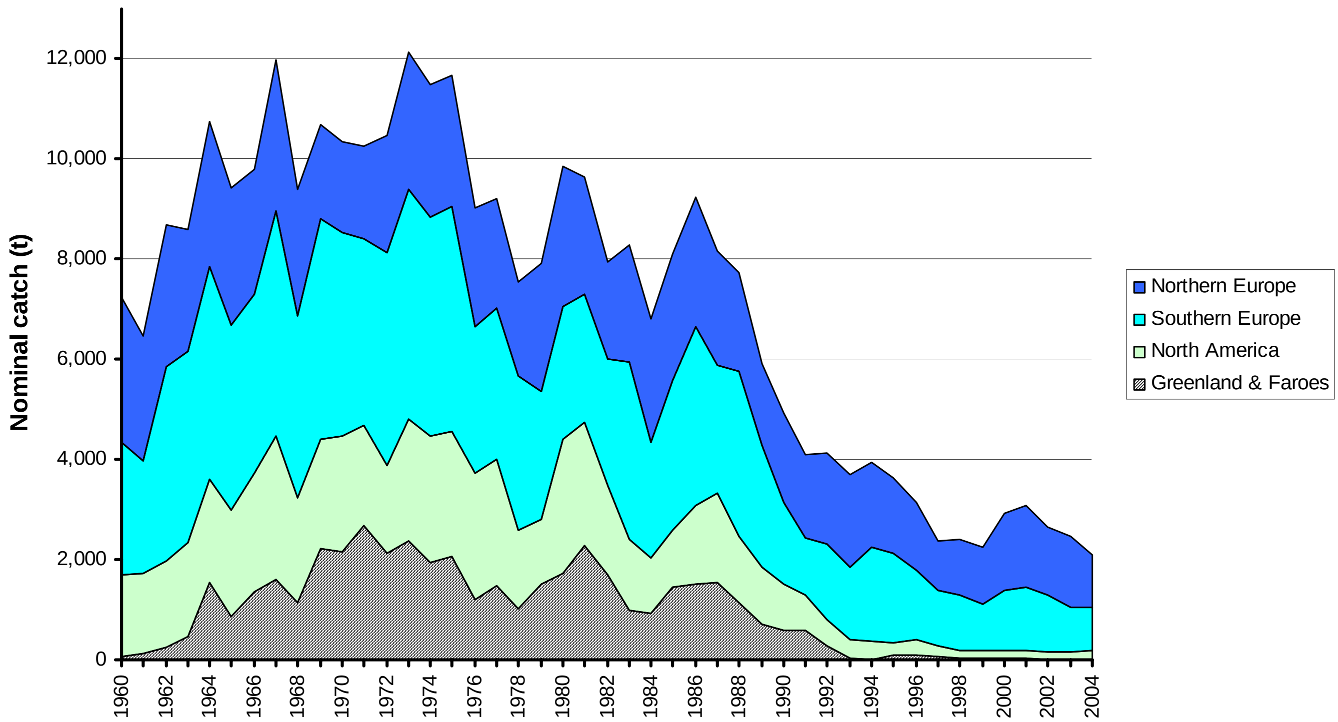
Country	Origin	Primary Tag or Mark Microtag	External mark	Adipose clip	Total
Canada	Hatchery	0	9,347	1,197,991	1,207,338
	Wild	1,073	31,639	4,565	37,277
	Adult	0	6,926	829	7,755
	Total	1,073	47,912	1,203,385	1,252,370
France	Hatchery	0	132,396	458,991	591,387
	Wild	0	28,346	891	29,237
	Adult	15	0	0	15
	Total	15	160,742	459,882	620,639
Germany	Hatchery	43,785	0	95,000	138,785
	Wild	0	0	0	0
	Adult	0	0	0	0
	Total	43,785	0	95,000	138,785
Iceland	Hatchery [1]	278,848	0	0	278,848
	Wild	3,090	0	0	3,090
	Adult	0	513	0	513
	Total	281,938	513	0	282,451
Ireland	Hatchery	392,635	0	0	392,635
	Wild	8,280	0	0	8,280
	Adult	0	0	0	0
	Total	400,915	0	0	400,915
Norway	Hatchery	14,127	54,820	0	68,947
	Wild	1,923	2,446	0	4,369
	Adult	0	282	0	282
	Total	16,050	57,548	0	73,598
Russia	Hatchery	0	0	1,077,620	1,077,620
	Wild	0	0	0	0
	Adult	0	2,402	0	2,402
	Total	0	2,402	1,077,620	1,080,022
Spain	Hatchery	76,160	974	140,326	217,460
	Wild	0	954	0	954
	Adult	0	0	0	0
	Total	76,160	1,928	140,326	218,414
Sweden	Hatchery	0	3,000	40,157	43,157
	Wild	0	552	0	552
	Adult	0	0	0	0
	Total	0	3,552	40,157	43,709
UK (England & Wales)	Hatchery	80,868	0	87,458	168,326
	Wild	9,682	2,800	1,906	14,388
	Adult	0	1,216	0	1,216
	Total	90,550	4,016	89,364	183,930
UK (N. Ireland)	Hatchery	17,436	0	47,610	65,046
	Wild	1784	0	0	1,784
	Adult	0	0	0	0
	Total	19,220	0	47,610	66,830
UK (Scotland)	Hatchery	11043	0	0	11,043
	Wild	4712	2519	2304	9,535
	Adult	0	1292	0	1,292
	Total	15,755	3,811	2,304	21,870
USA [2]	Hatchery	0	568,846	438,204	569,143
	Wild	0	459	0	995
	Adult	0	2,698	0	4,424
	Total	0	572,003	438,204	574,562
All Countries	Hatchery	871,117	769,383	3,488,357	4,829,735
	Wild	30,544	69,715	9,666	110,461
	Adult	15	15,329	829	17,899
	Total	901,676	854,427	3,498,852	4,958,095

[1] The number of microtagged hatchery fish in Iceland includes 200.926 fish reared in seapens.

[2] The total numbers includes internal tags.

TABLE 2.7.1. Summary of Atlantic Salmon Tagged and Marked in 2004. 'Hatchery' and 'Wild' refer to smolt and parr; 'Adults' refers to wild and hatchery fish 2004.

Figure 2.1.1.1 Nominal catches of salmon in four North Atlantic regions, 1960-2004



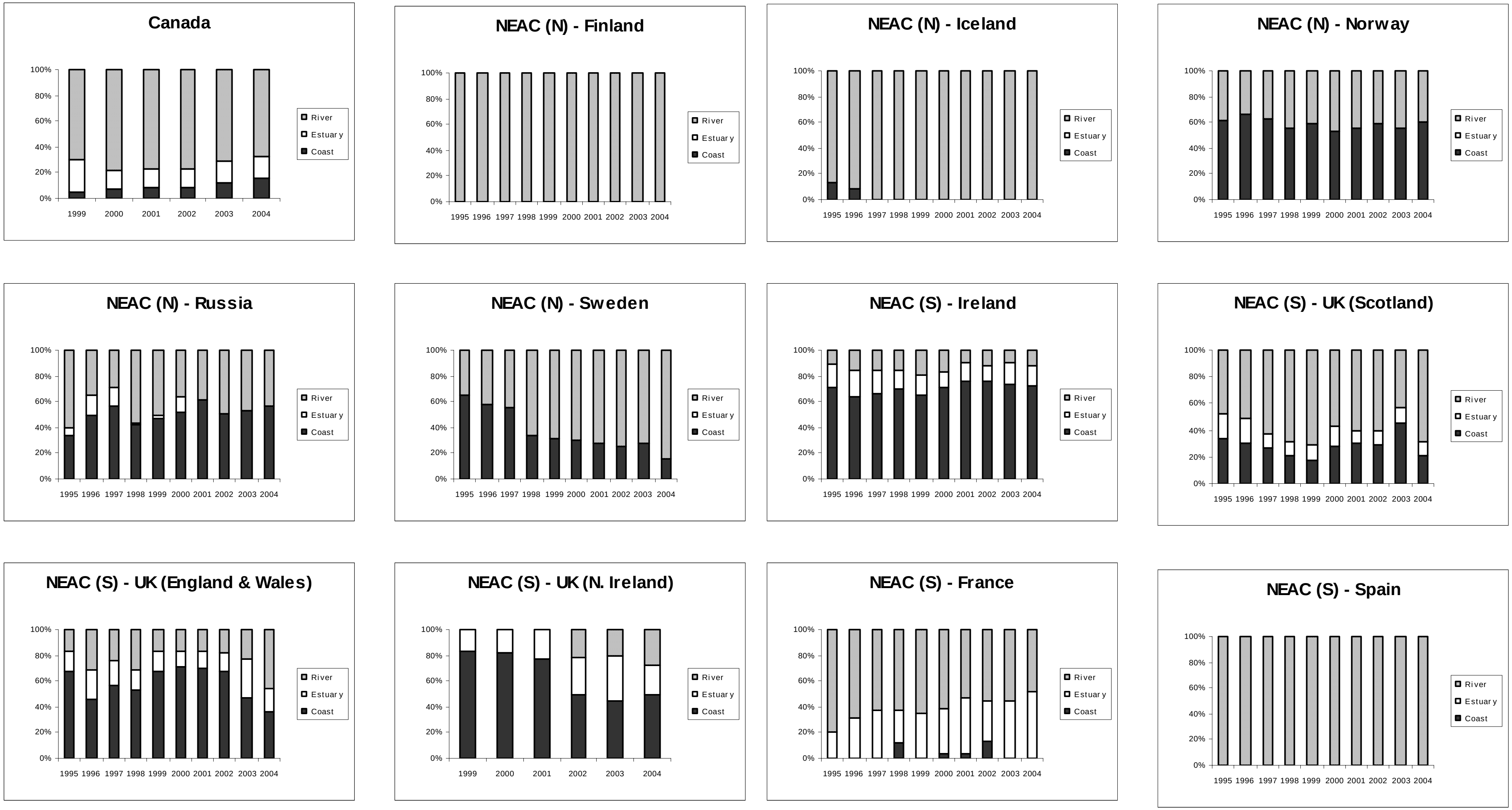


Figure 2.1.1.2. Percentage of nominal catch taken in coastal, estuarine and riverine fisheries by country for 1995-2004 (where available).

Figure 2.1.1.3 Percentages of nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area (1999-2004) and for NEAC northern and southen areas (1995-2004).

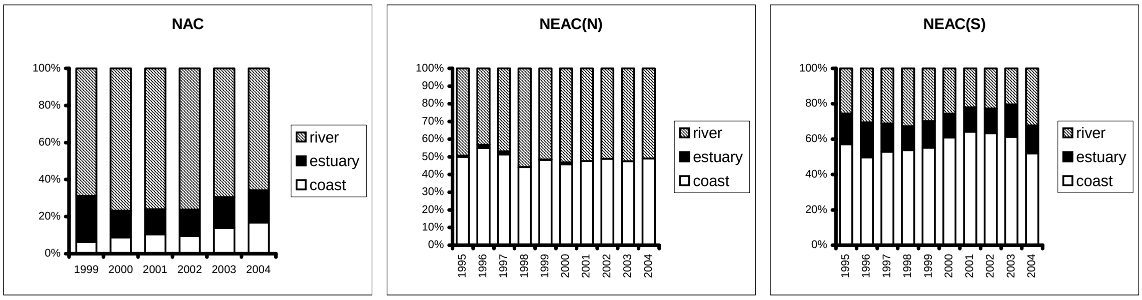


Figure 2.1.3.1 Nominal North Atlantic salmon catch, unreported catch and percentage unreported, expressed as % of total catch (nominal + unreported), in NASCO Areas, 1987-2004.

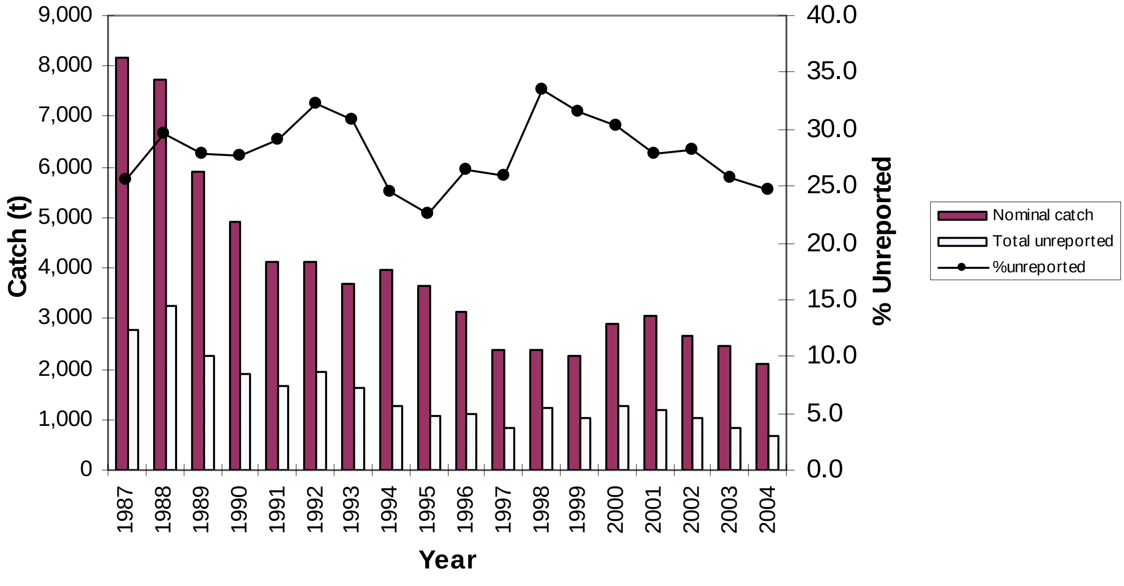


Figure 2.2.1.1. World-wide farmed Atlantic salmon production, 1980-2004.

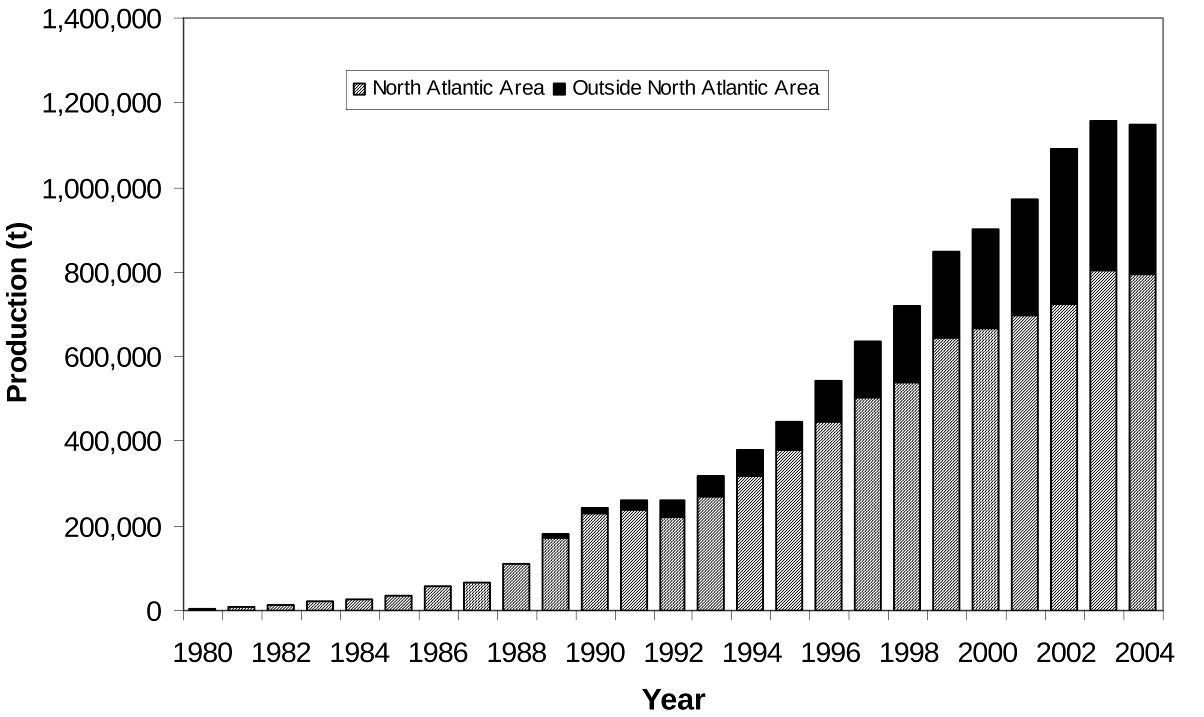
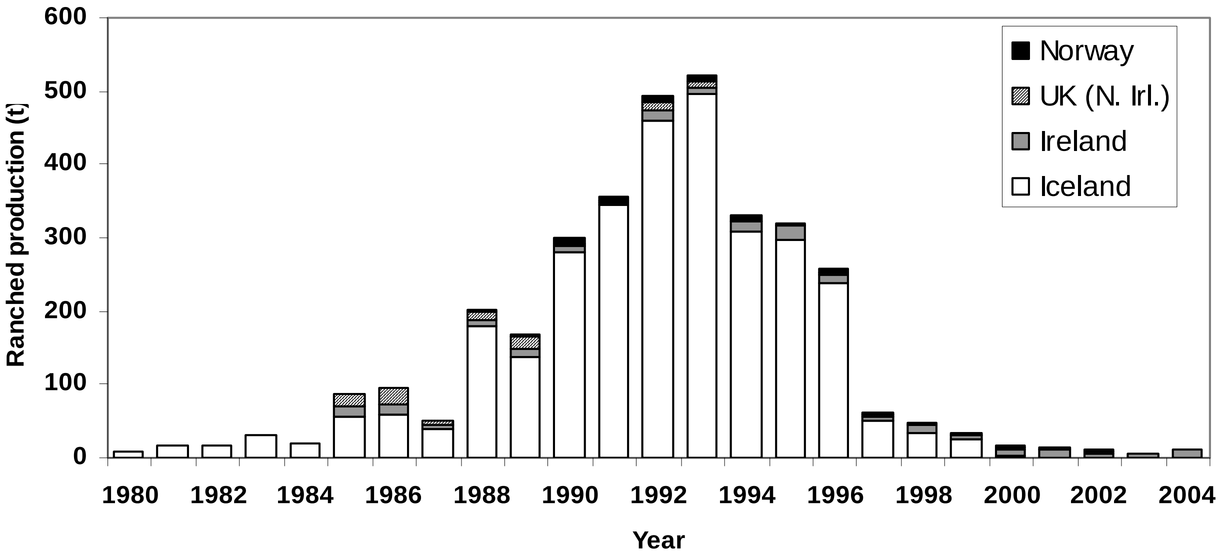


Figure 2.2.2.1. Production of ranched salmon (tonnes round fresh weight) as harvested at ranching facilities in the North Atlantic, 1980-2004.



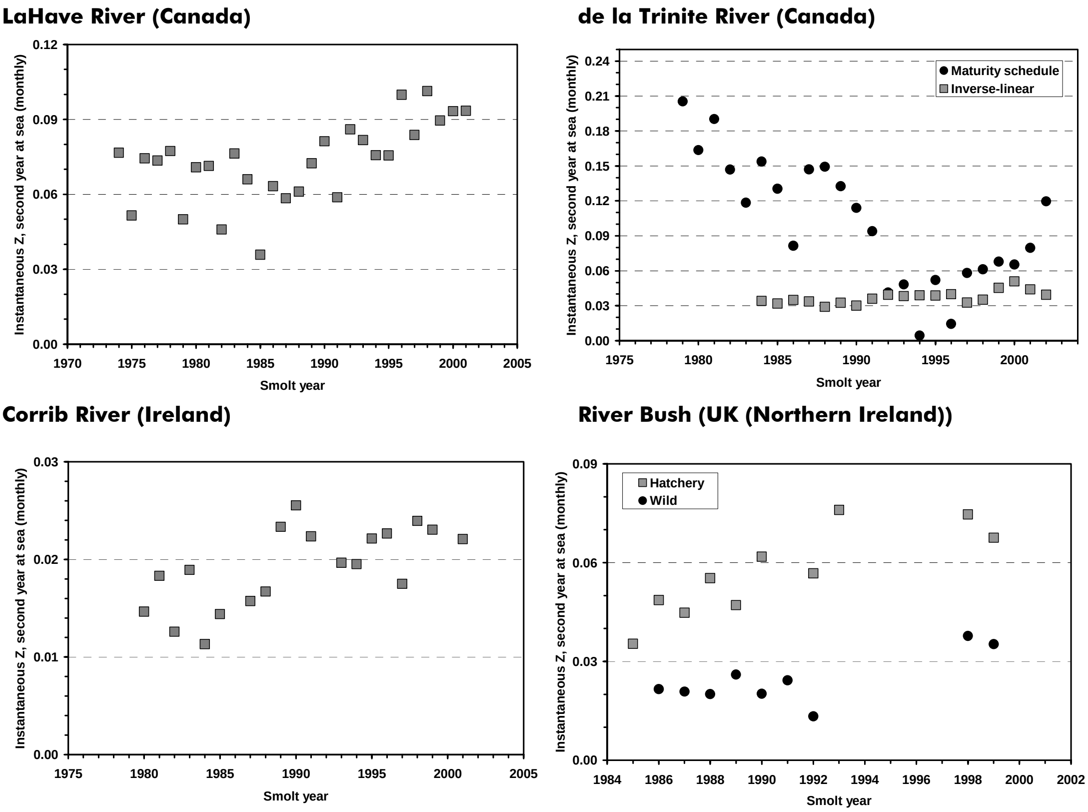


Figure 2.3.1. Estimates of marine mortality in the second year at sea from two stocks in the NAC area (upper panel) and two stocks in the NEAC area (lower panel) based on the inverse-weight method assuming linear growth at sea and the maturity schedule method for one stock. The de la Trinite River and Corrib River are wild stocks. The River Bush is for wild and hatchery stocks whereas the Lahave River is a hatchery stock.

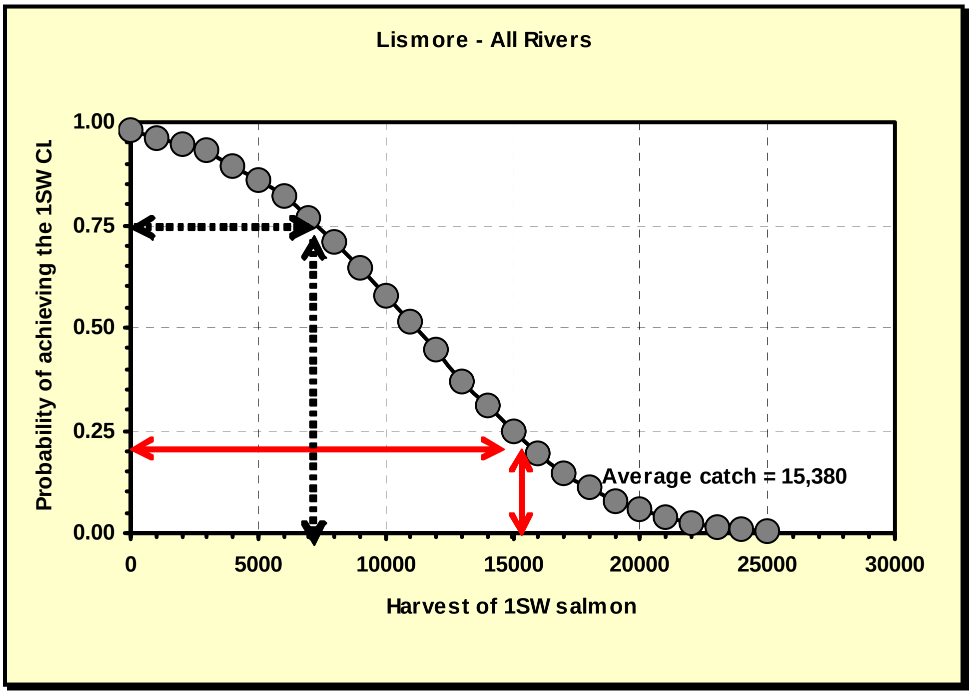


Figure 2.4.1.1 Risk plot showing the probability of meeting or exceeding the district CL and the harvest options by all methods (commercial and rods) of 1 SW salmon. The average catch for the Lismore district (2000 to 2004, all methods, excluding sea trout and hatchery fish, but including an unreported catch) was 15,380 1SW salmon. At this level of harvest there is less than 25% chance that the CL will be met. The harvest option which provides a 75% chance of meeting the CL is approximately 7,200 1SW salmon and this has been recommended as the precautionary catch advice for 2005.

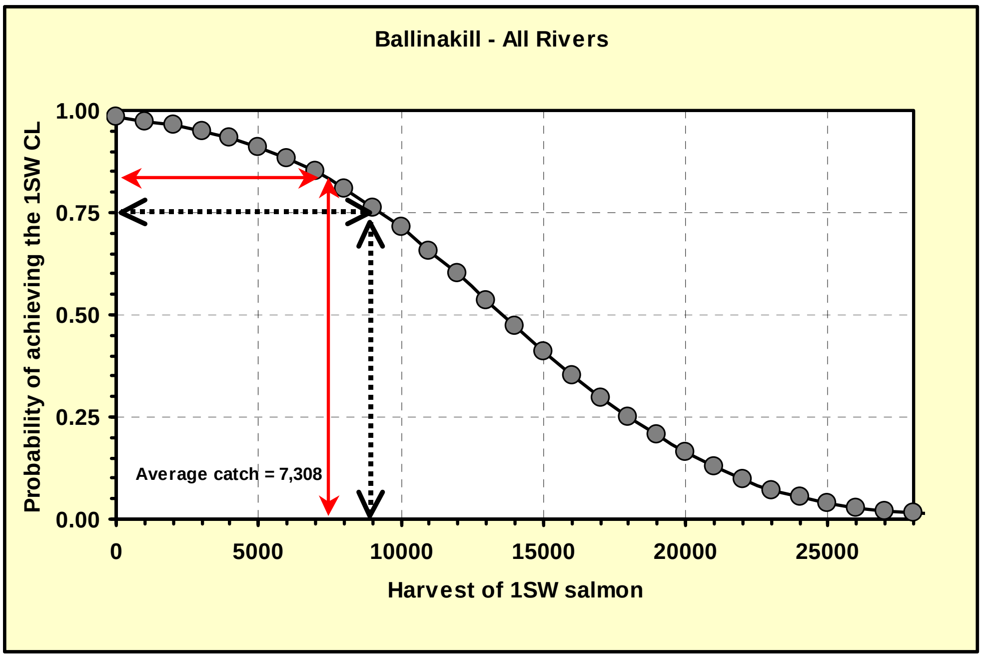


Figure 2.4.1.2 Risk plot showing the probability of meeting or exceeding the district CL (CL) and the harvest options by all methods (commercial and rods) of 1SW salmon. The average catch for the Ballinakill district (2000 to 2004, all methods, excluding sea trout and hatchery fish, but including an unreported catch) was 7,308 1SW salmon. At this level of harvest there is an 85% chance that the CL will be met. The harvest option which provides a 75% chance of meeting the CL is approximately 9,000 1SW salmon. As the average catch is lower than the harvest option at 75%, the lower catch is selected as the precautionary catch advised for 2005. This is because the Ballinakill district fishery catches salmon destined for other districts and there is clearly a need to protect vulnerable stocks in these other districts.

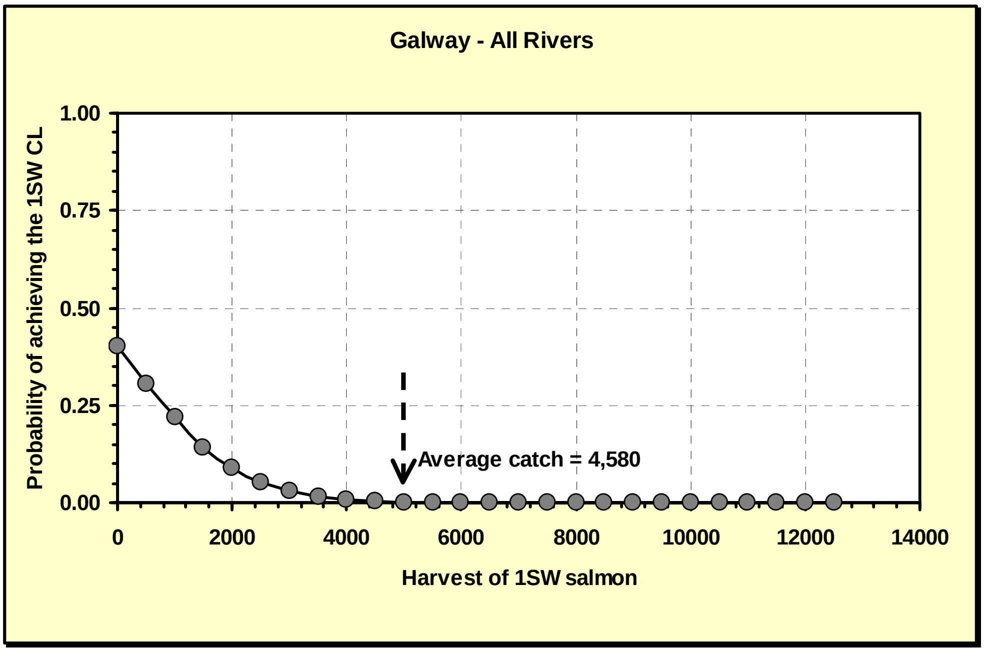


Figure 2.4.1.3 Risk plot showing the probability of meeting or exceeding the district CL (CL) and the harvest options by all methods (commercial and rods) of 1SW salmon. The average catch for the Galway district (2000 to 2004, all methods, excluding sea trout and hatchery fish, but including an unreported catch) was 4,580 1SW salmon. At this level of harvest there is no chance that the CL will be met. Similarly, there is no harvest option which provides 75% chance of meeting the CL. In this instance there is no surplus fish over spawning requirements to support a harvest.

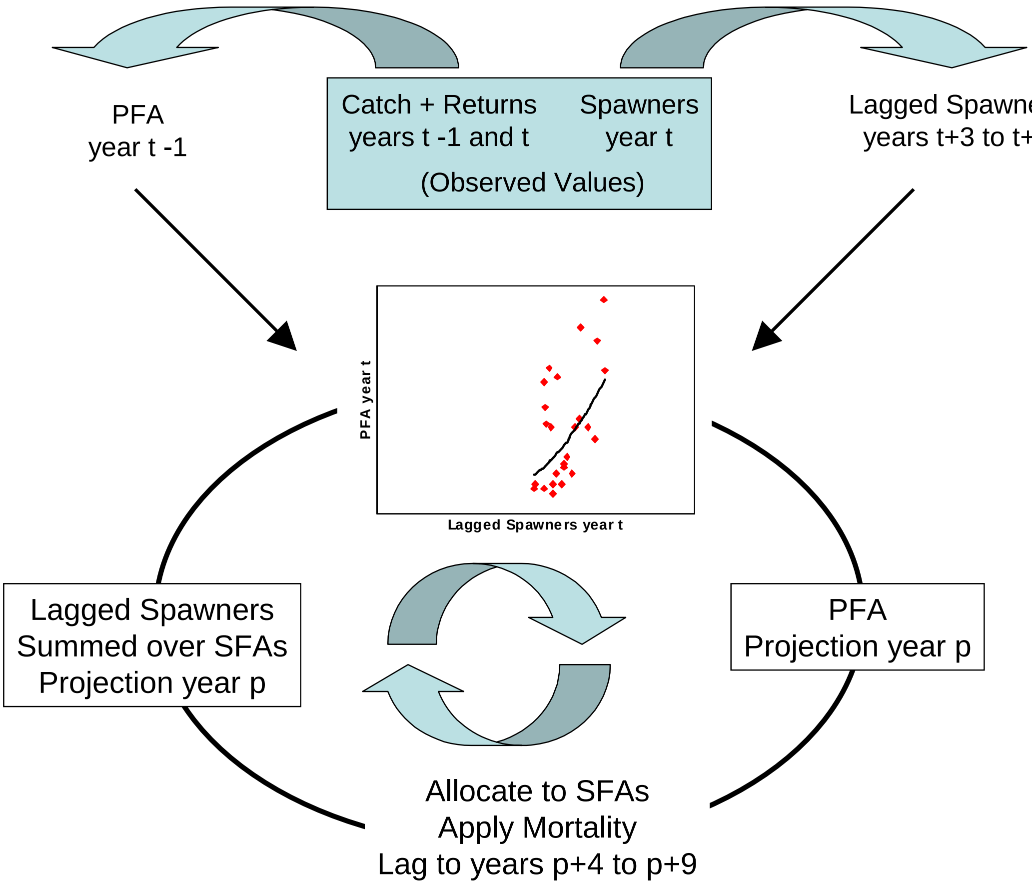


Figure 2.5.1.1. Completing the cycle of PFA projections. See text for details.

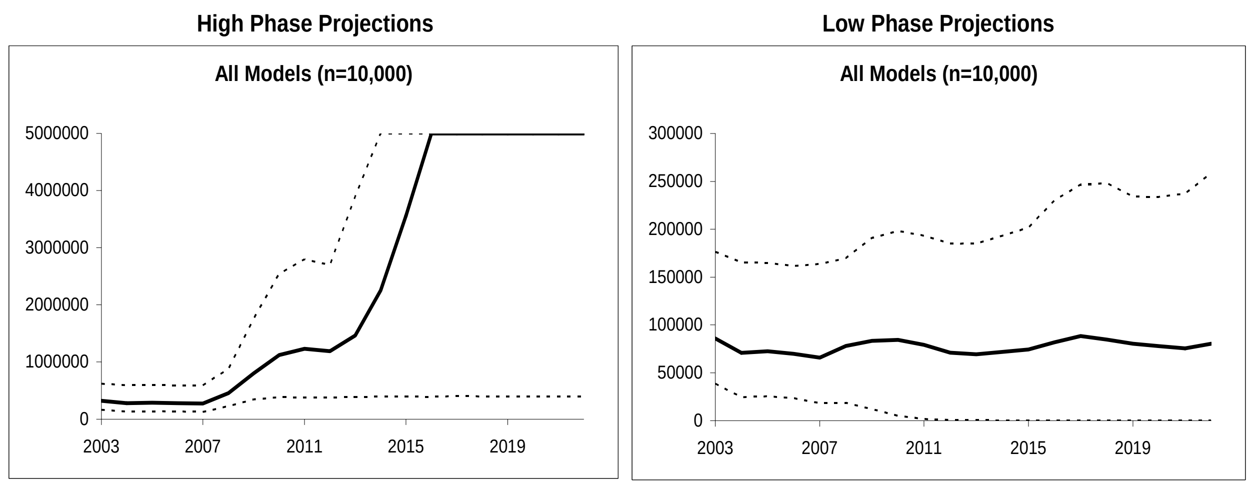


Figure 2.5.1.2. Median and 90% confidence intervals for PFA in the next 20 years assuming no fishing based on 10,000 simulations of historical PFA and LS values and assumption of either high phase or low phase from selected model for projections. Note the large difference in scale between the high phase and low phase projections, maximum y-axis value of 5 million versus 300 thousand, respectively.

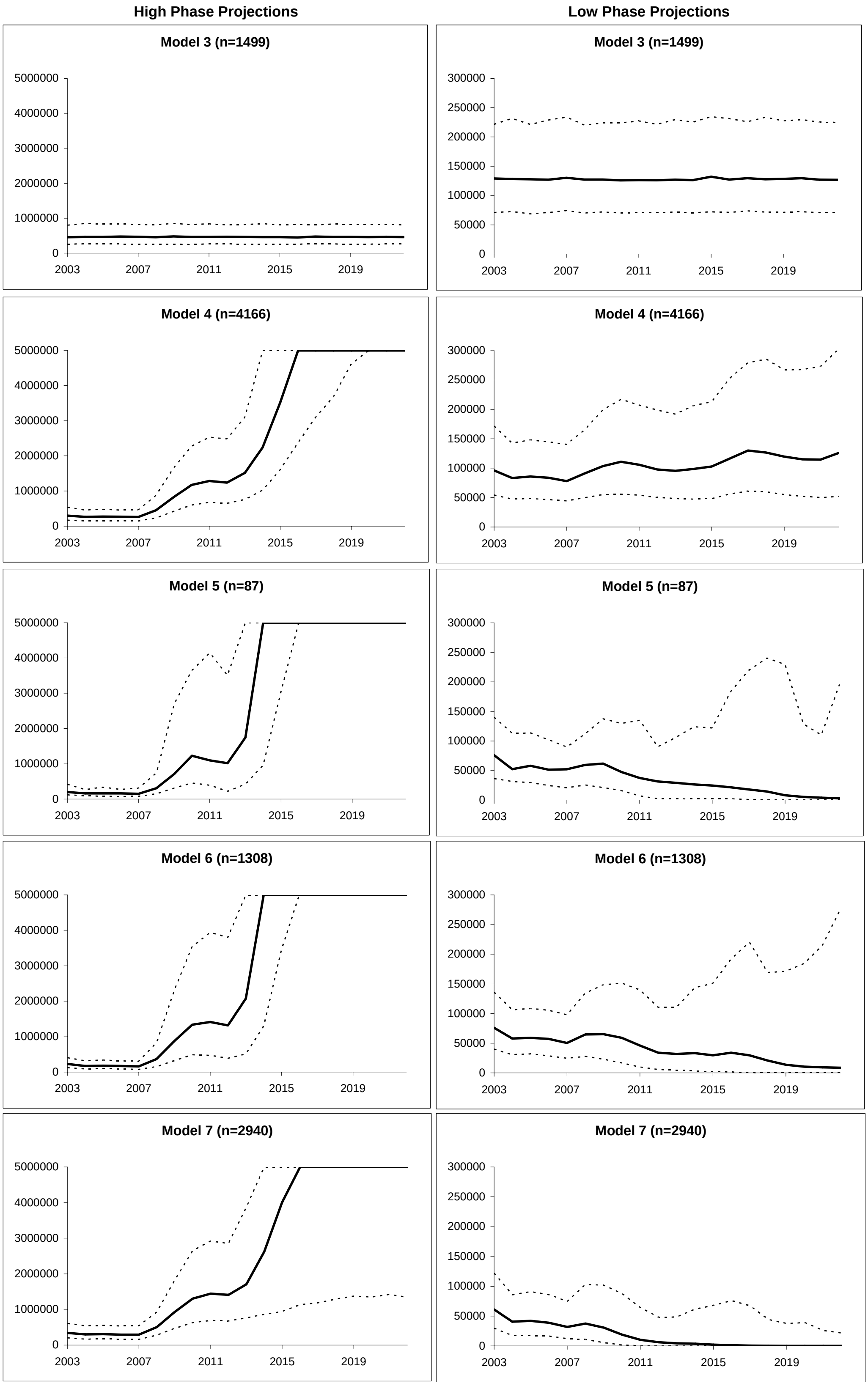


Figure 2.5.1.3 Median and 90% confidence intervals for PFA in the next 20 years assuming no fishing separated by assumption of phase used for projections and selected model. ***Note that the difference in scale makes the high phase projections of model 3 appear lower than the low phase projections.***

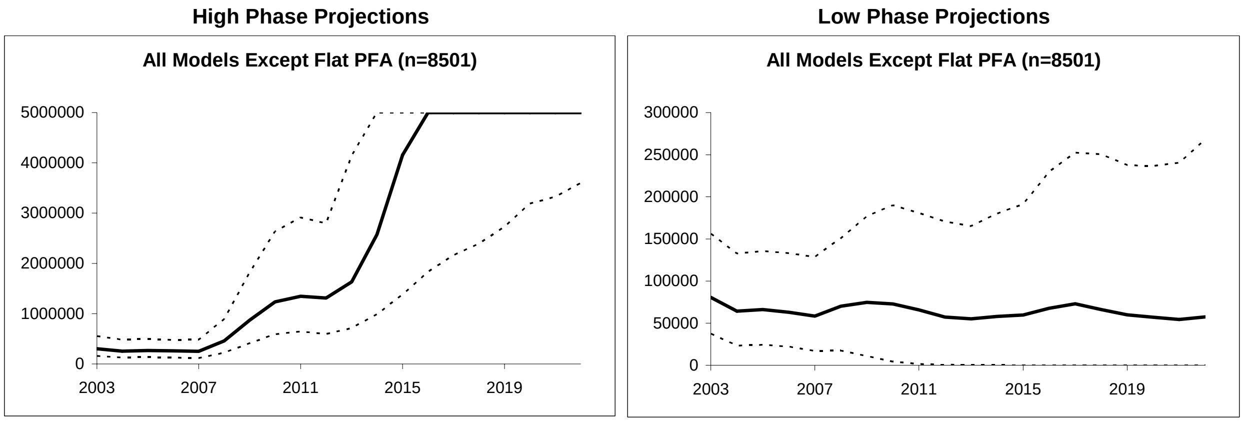


Figure 2.5.1.4. Median and 90% confidence intervals for PFA in the next 20 years assuming no fishing separated by assumption of phase used for projections for all models except those that have a flat relationship between LS and PFA (models 1 and 3).

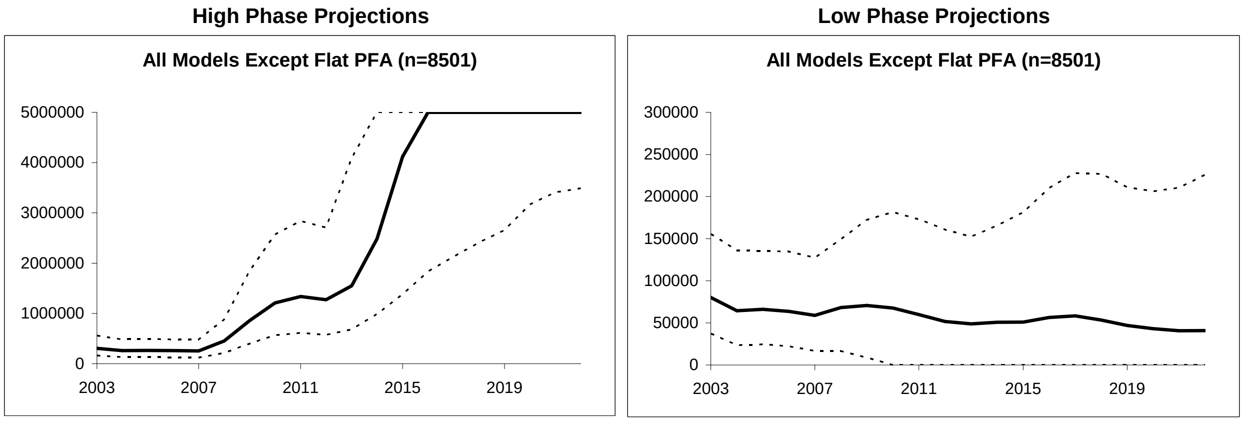


Figure 2.5.1.5. Median and 90% confidence intervals for PFA in the next 20 years assuming 20 tons of fish caught in the West Greenland fishery each year for all models except those that have a flat relationship between LS and PFA (models 1 and 3).

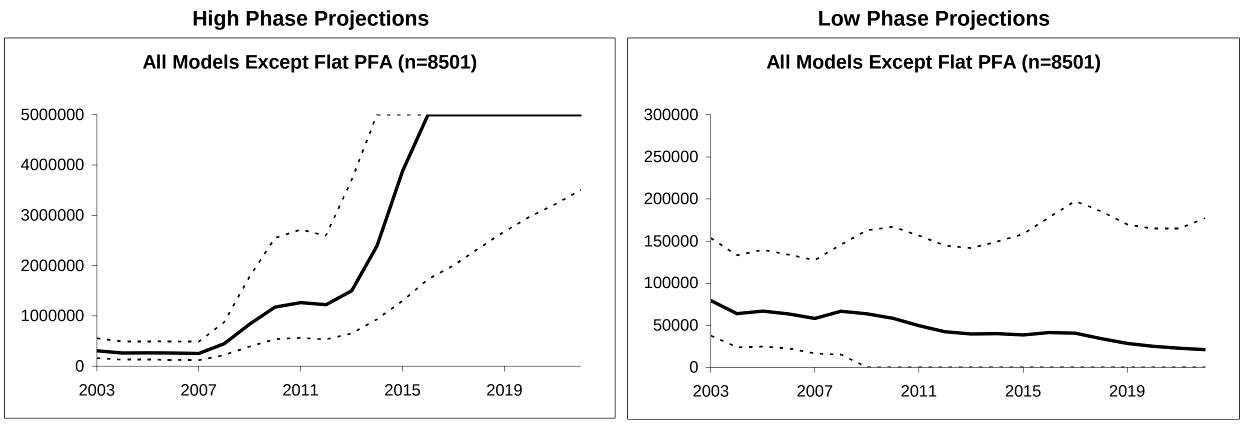


Figure 2.5.1.6. Median and 90% confidence intervals for PFA in the next 20 years assuming 50 tons of fish caught in the West Greenland fishery each year for all models except those that have a flat relationship between LS and PFA (models 1 and 3).

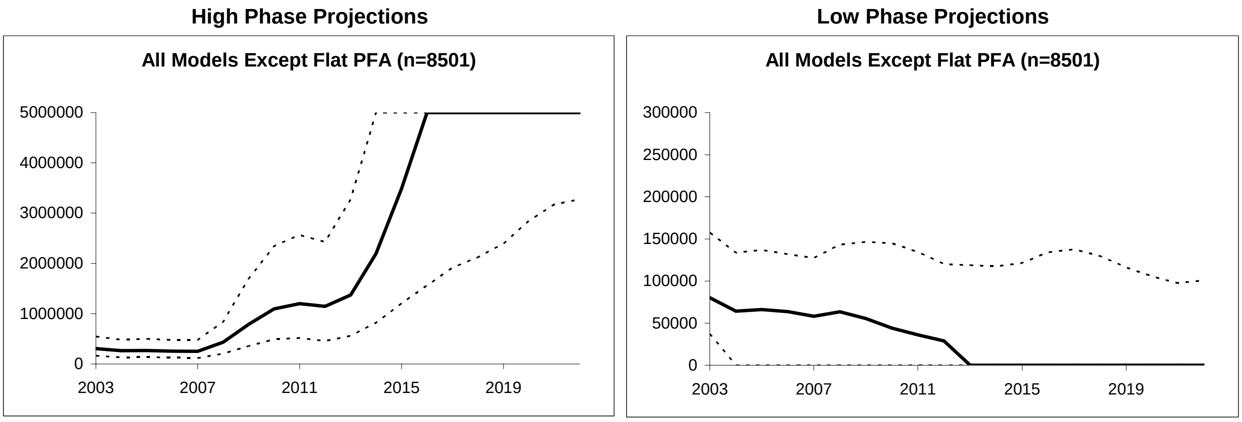


Figure 2.5.1.7. Median and 90% confidence intervals for PFA in the next 20 years assuming 100 tons of fish caught in the West Greenland fishery each year for all models except those that have a flat relationship between LS and PFA (models 1 and 3).

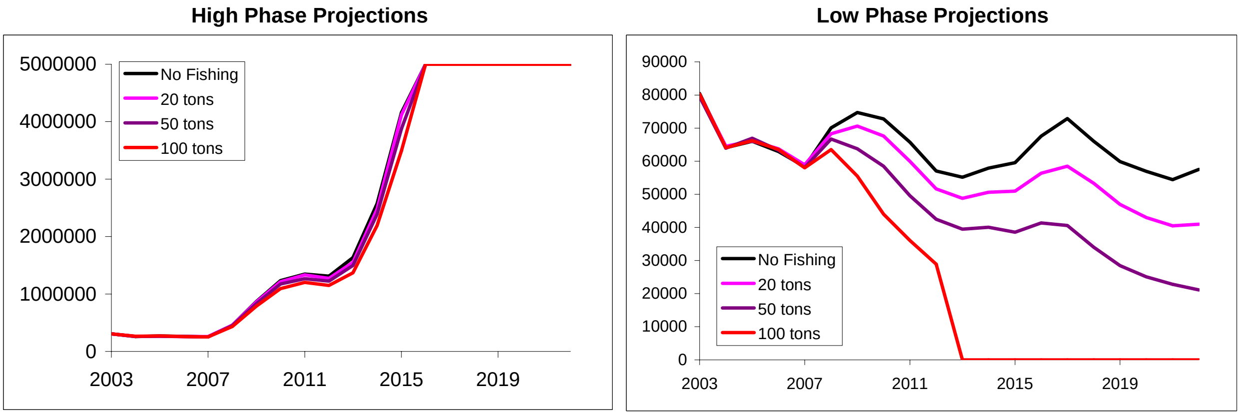


Figure 2.5.1.8. Comparison of medians of PFA from projections assuming different levels of catch in the West Greenland fishery each year for all models except those that have a flat relationship between LS and PFA (models 1 and 3).

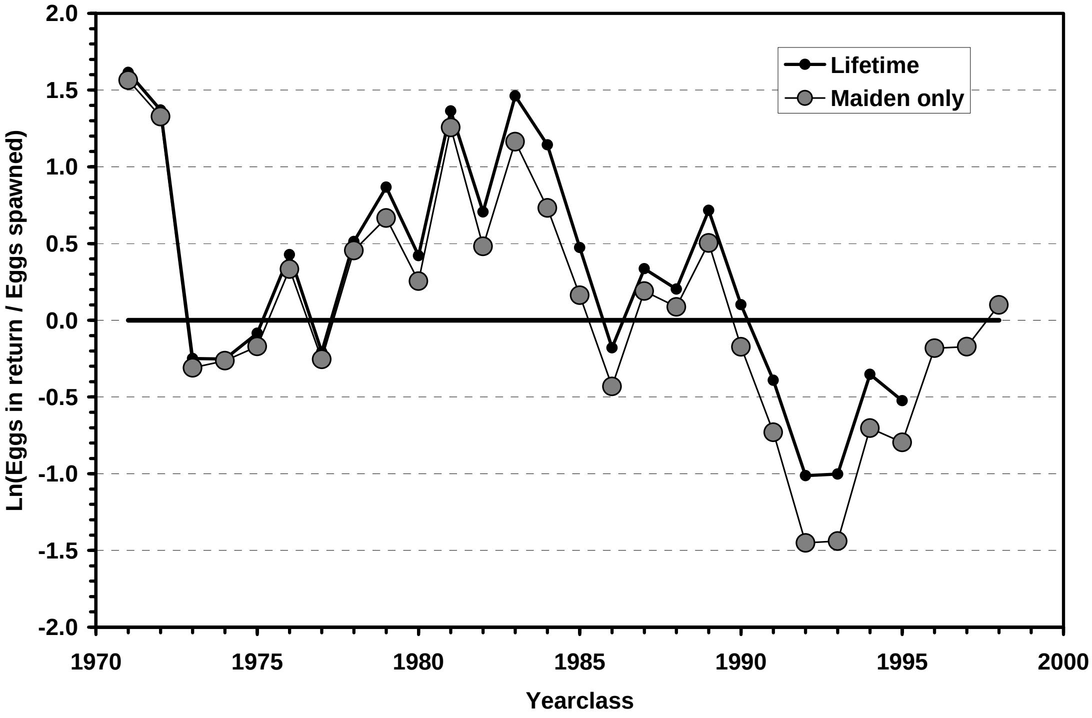
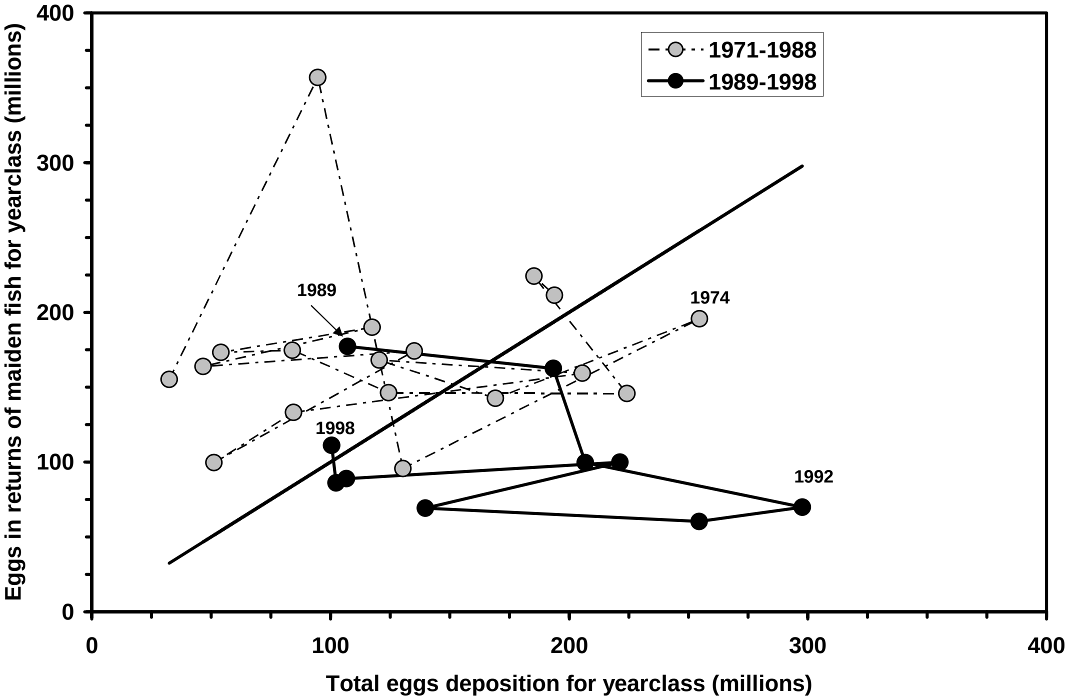


Figure 2.5.2.1. Replacement ratio (Ln of recruitment eggs / spawned eggs) by year class for salmon from the Miramichi River. Negative values indicate that fewer eggs were returned than were spawned to produce them.



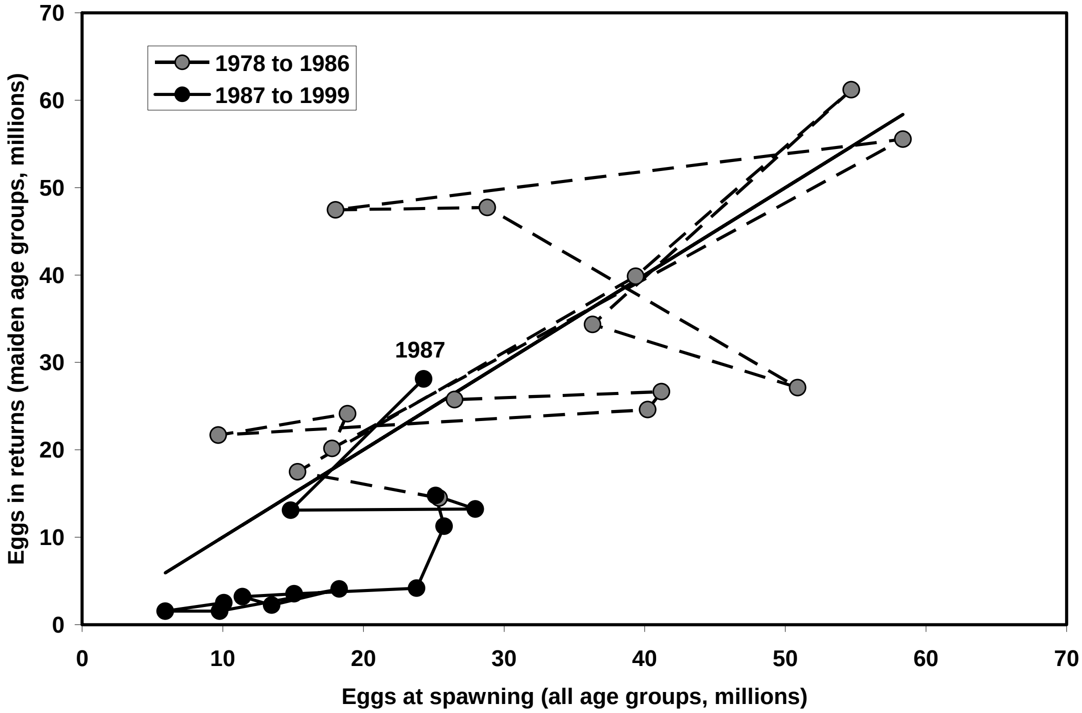


Figure 2.5.2.2. Stock and recruitment relationship for wild salmon from the Miramichi River (upper) and Saint John River (lower). Returns are the eggs in the returns of maiden fish of the year class.

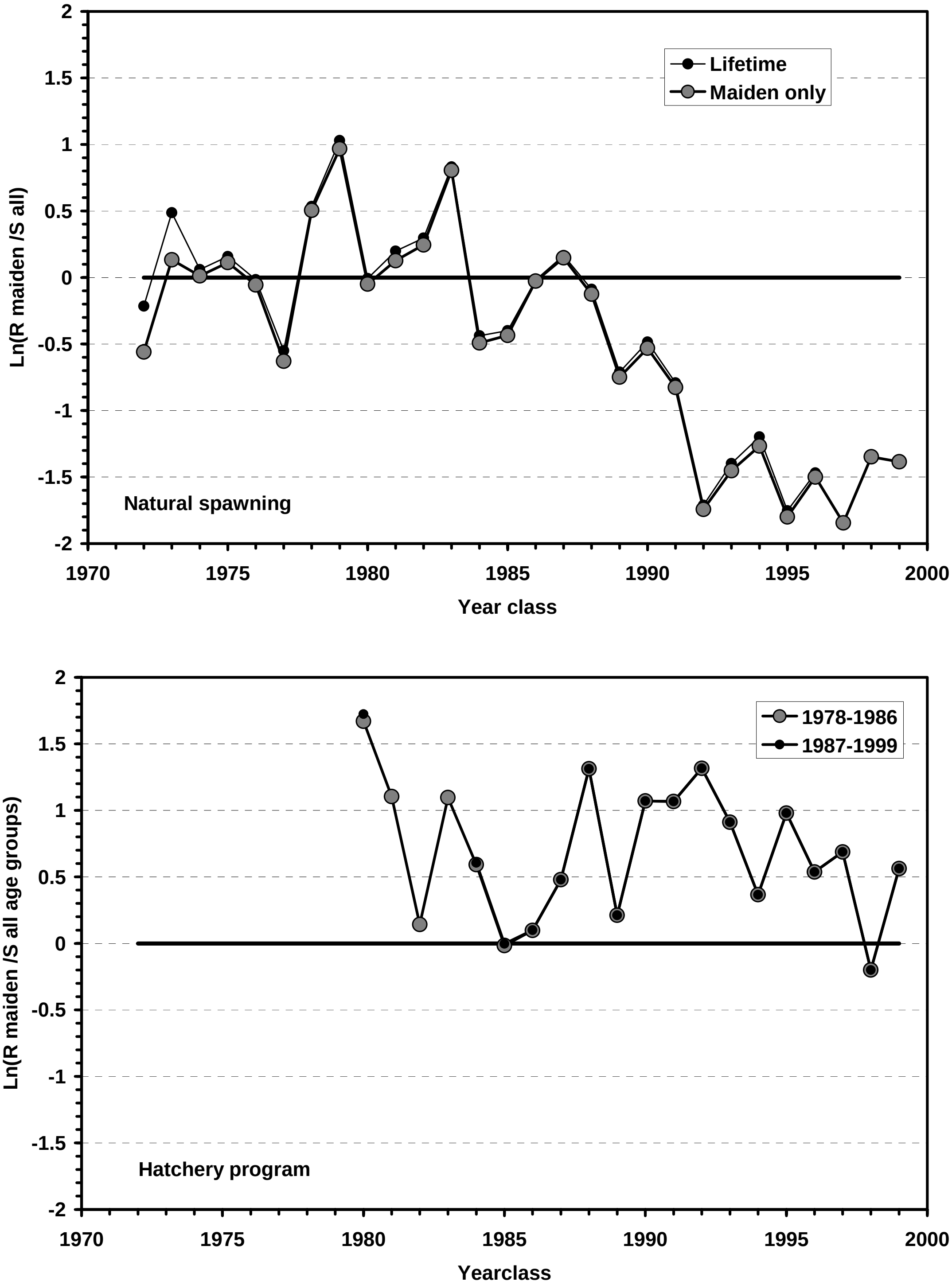
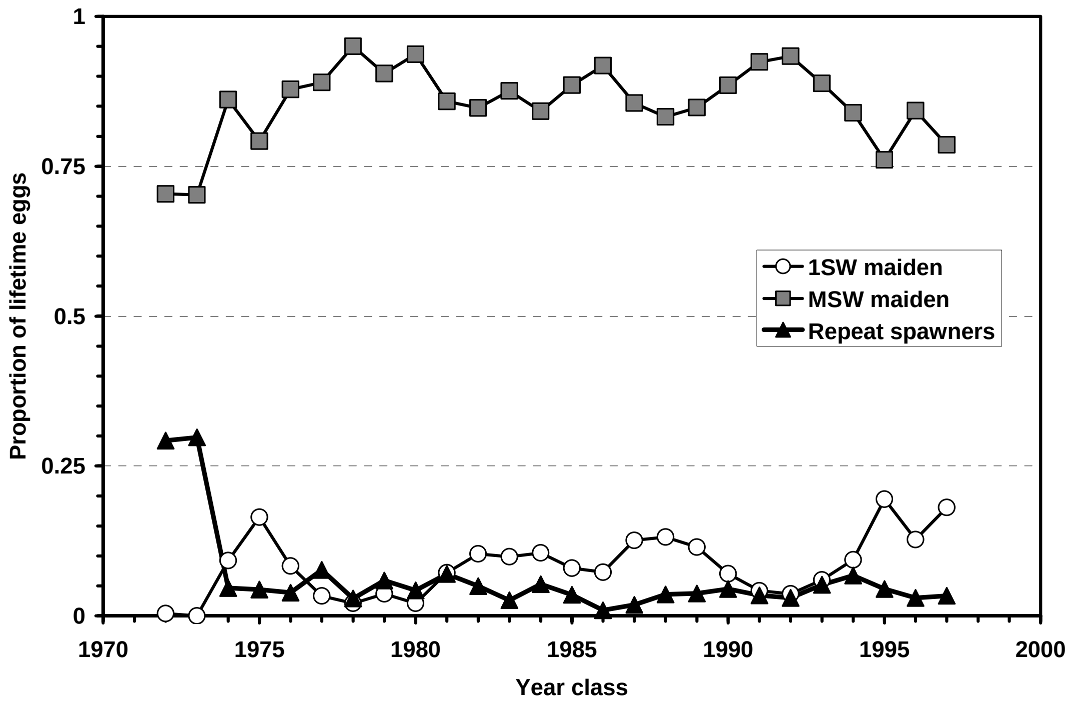


Figure 2.5.2.3. Replacement ratio (Ln of recruitment eggs / spawned eggs) by year class for salmon from the Saint John River at Mactaquac, wild in the upper panel, hatchery origin in the lower panel. Negative values indicate that fewer eggs were returned than were spawned to produce them.



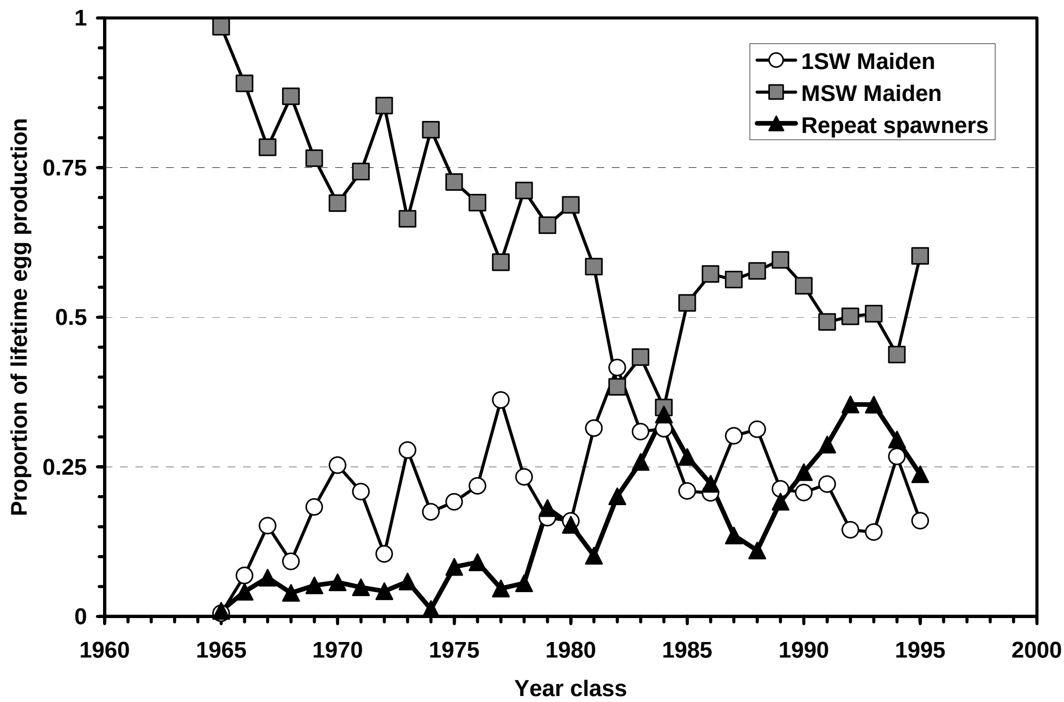
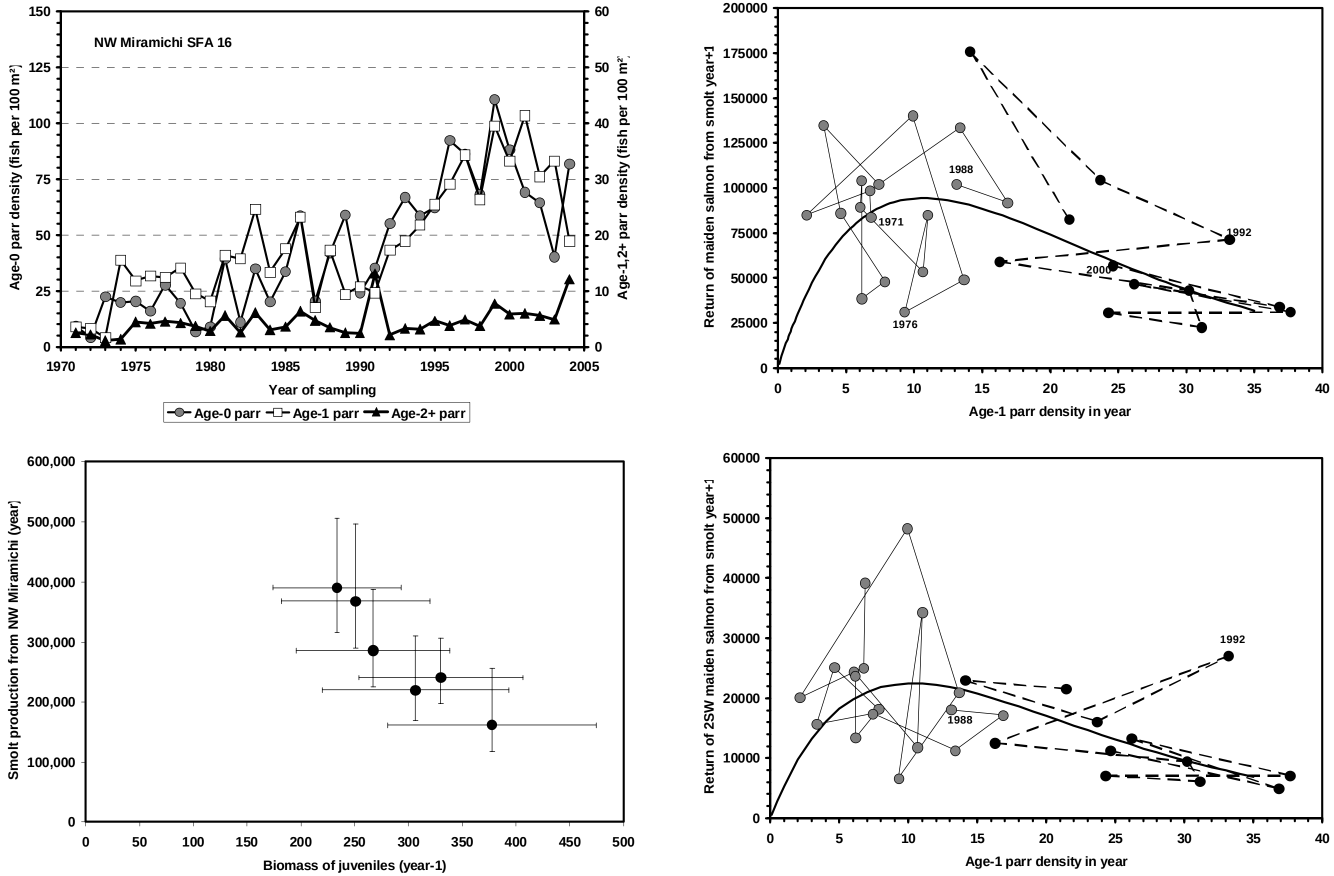


Figure 2.5.2.4. Proportion of the total eggs produced in the lifetime of a year class by 1SW maiden, MSW maiden, and repeat spawners in the returns to the Miramichi River (upper) and in the returns of wild salmon to the Saint John River (lower).

Figure 2.5.2.5. Miramichi juvenile abundance, smolt production relative to juvenile biomass of the Northwest Miramichi (left panel) and the association between age-1 parr density in the year prior to the smolt emigration and the returns of maiden fish and 2SW maiden fish from the corresponding smolt group. Black symbols in the right panels correspond to the years in the lower productivity phase as described by Chaput et al. (2005).



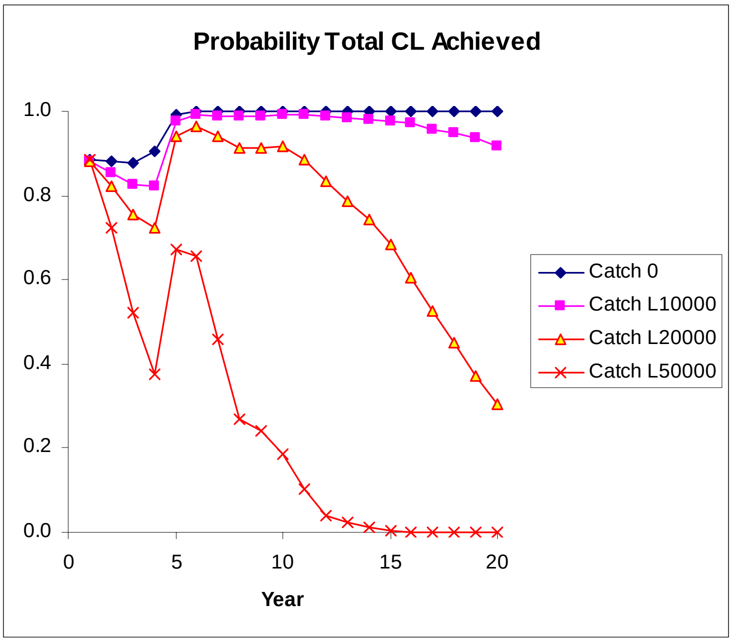


Figure 2.5.3.1. Probability that the total CL is achieved in the district each year under four levels of catch.

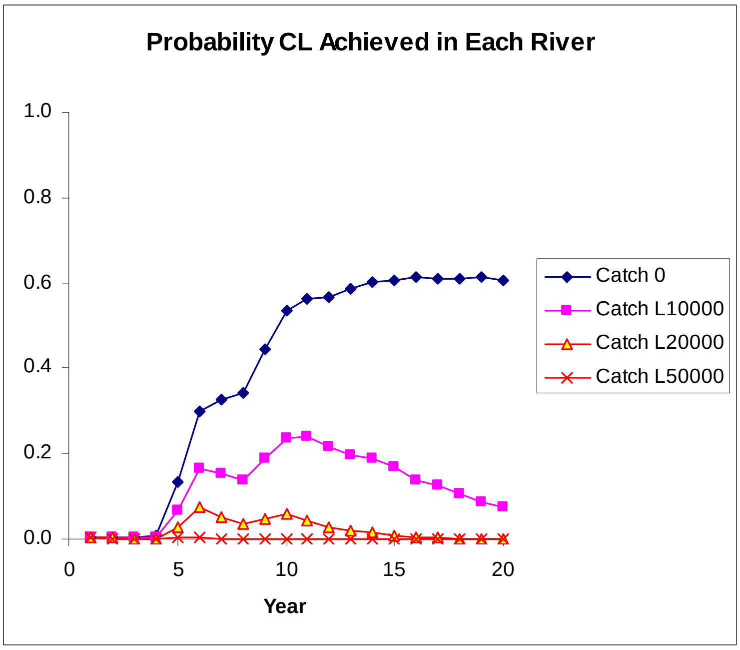


Figure 2.5.3.2 Probability that all 14 rivers achieve their CL for each year under four levels of catch.

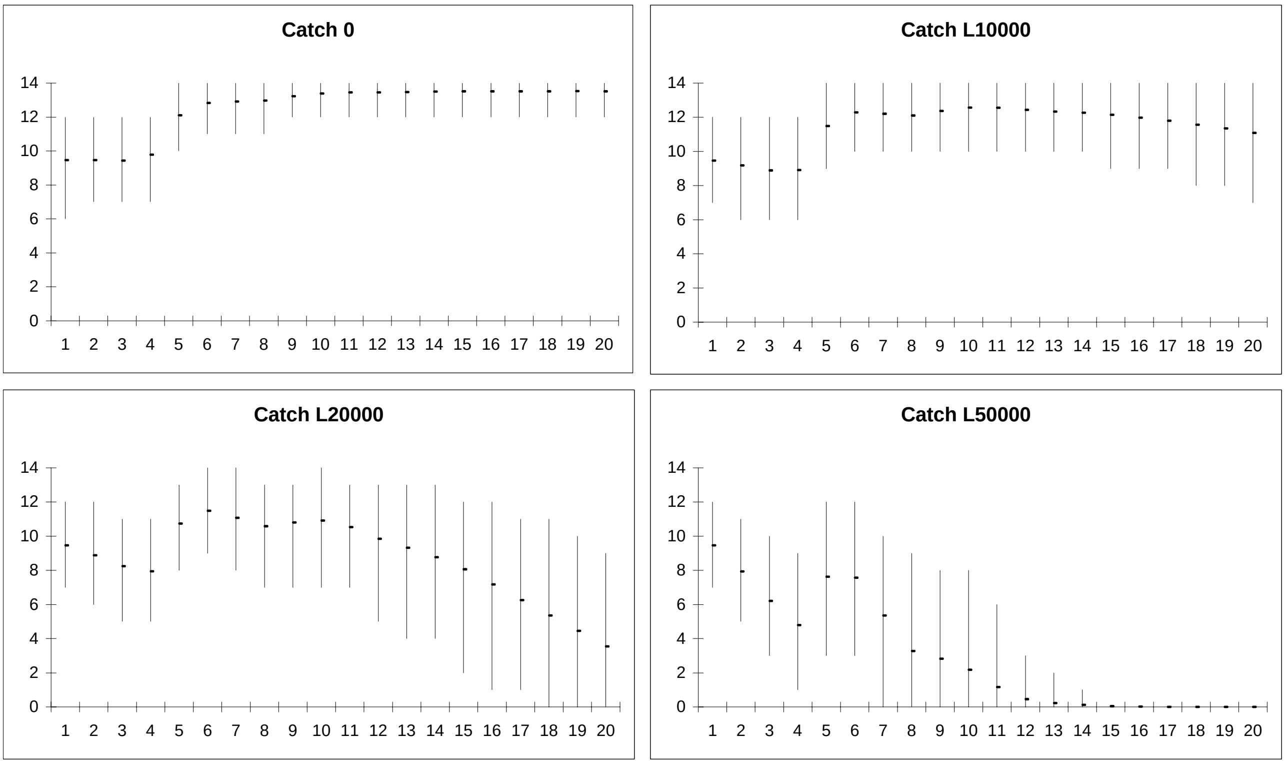


Figure 2.5.3.3. Number of rivers that achieve their CL (mean and 90% confidence interval) each year for four levels of constant catch.

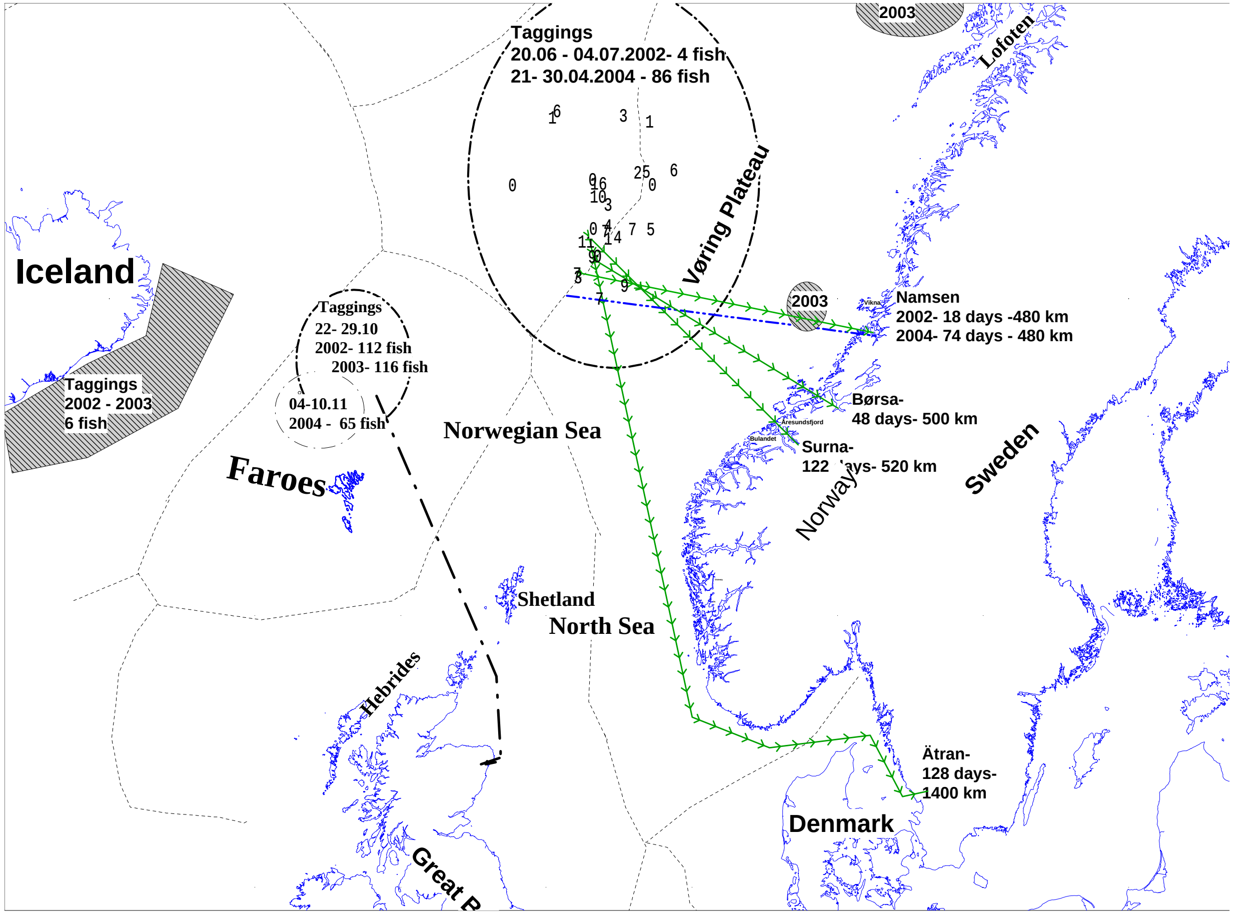


Figure 2.6.1.1 Areas where DST tagging was carried out 2002 – 2004 by The Faroes, Iceland and Norway. Possible migration routes of 4 recaptures from the 2004 releases in the central Norwegian Sea are indicated by arrows. Recapture in 2002 marked with hyphens and dots. Same legend indicates the recapture in Scotland of a fish from the Faroes' 2003 release that had lost its DST. Other legends in the figure.

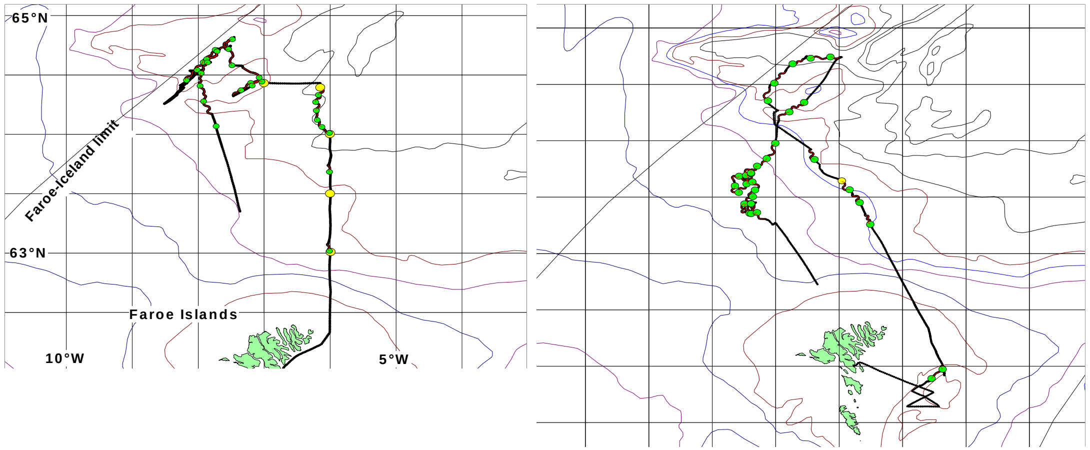


Figure 2.6.1.2 Cruise tracks for the Faroese tagging expeditions in 2003 (left) and 2004 (right).

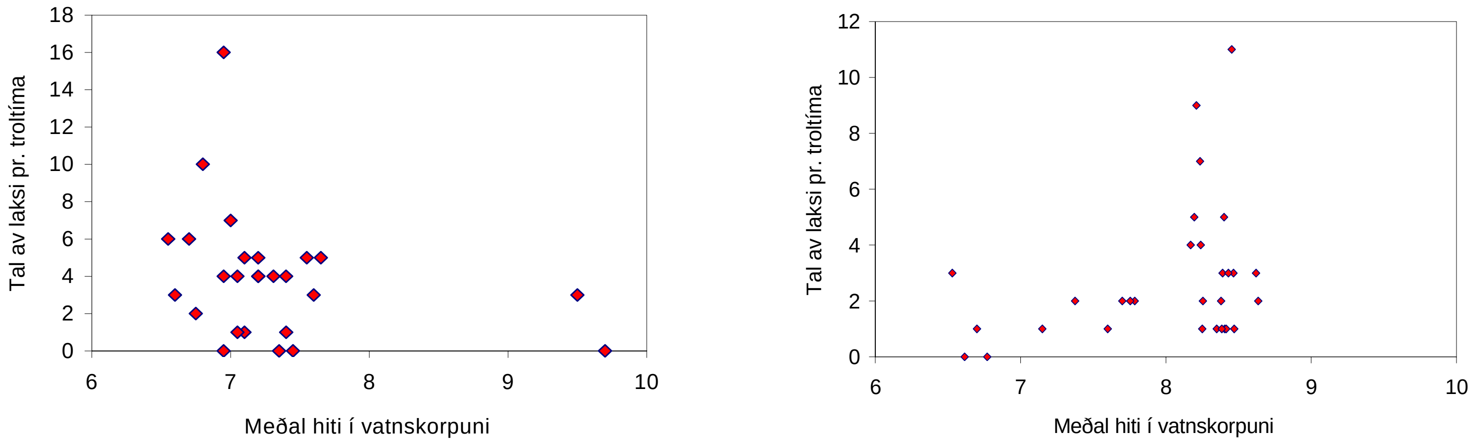


Figure 2.6.1.3 Catch per unit of effort (trawl hours) in relation to the surface temperatures north of Faroes in 2003 (left) and 2004 (right). Number of salmon on the vertical axis and temperatures on the horizontal axis

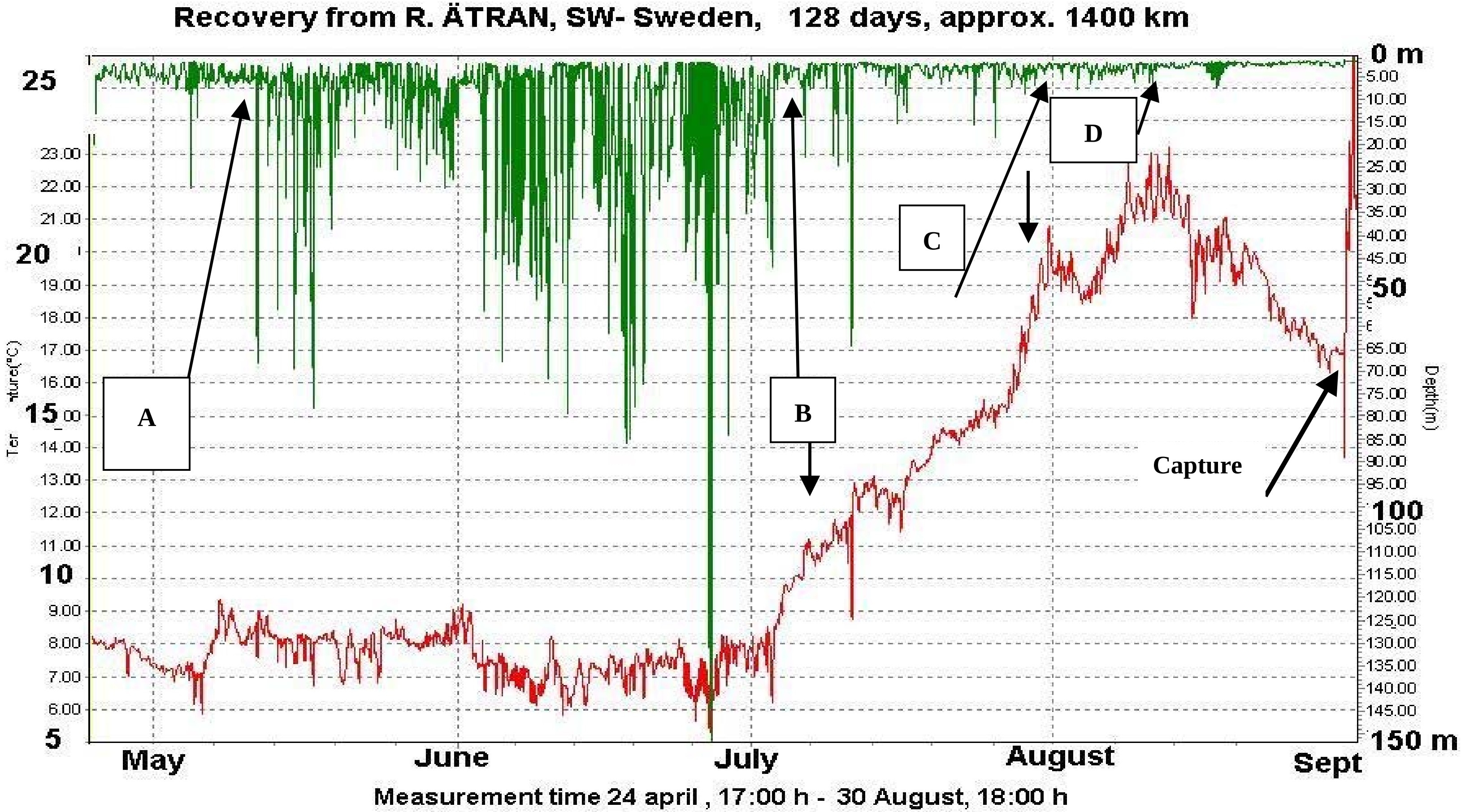


Figure 2.6.1.4. Data records of a salmon recovered in R. Ätran, Sweden. Depth above and temperature track below. To the left of A) post-release period , and probable periods of B) feeding and migration activity, C) Coastal migration (rising temperature), D) Estuarine dwelling and migration followed by in-river dwelling when the diving activity ceases.

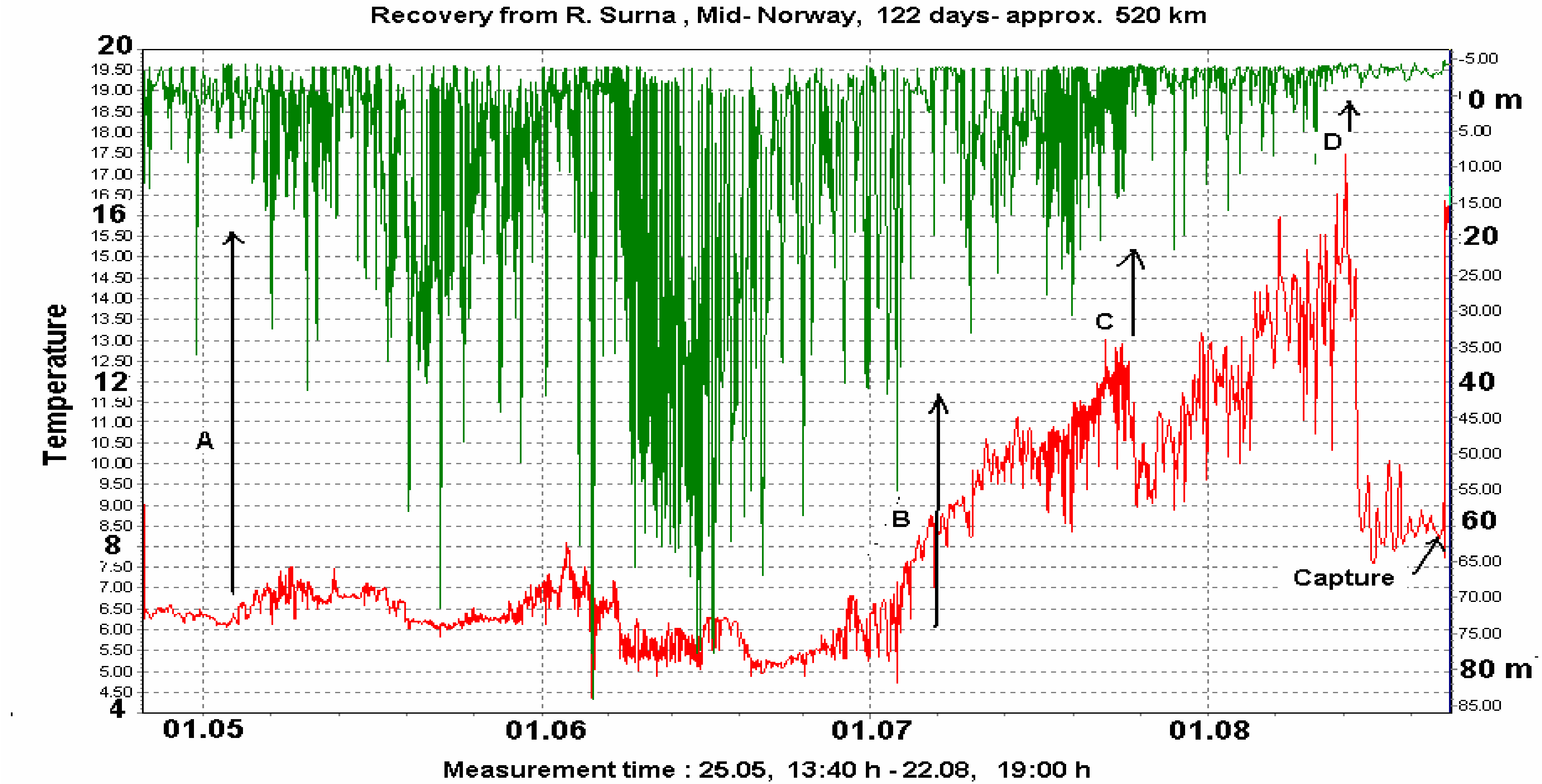


Figure 2.6.1.5. Data records of a salmon recovered in R. Surna , Mid- Norway. Depth above and temperature graph below. A) Post-release period , and probable periods of B) feeding and migration activity, C) Coastal migration (rising temperature), D) Estuarine dwelling and migration followed by in-river dwelling when the diving activity ceases. The R. Surna is a relatively cold- water-river draining from high mountains and is regulated by power dams.

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 within precautionary reference limits 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 below the Conservation limit (CL) in 2004. These stocks are considered to be outside precautionary limits.
- Northern European MSW stocks were above the CL in 2004 (as they have been for the 4 previous years). However, these stocks are considered to be outside precautionary limits.
- Southern European 1SW stocks were below the CL in 2004 (as they have been for the 2 previous years). These stocks are considered to be outside precautionary limits.
- Southern European MSW stocks were slightly above the CL in 2004 (as they were in 2003). These stocks are considered to be outside precautionary limits.

Therefore, all these stock complexes are considered to be outside precautionary limits.

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 yet developed river-specific conservation limits (CLs). In 2004, progress with setting river-specific CLs and associated compliance assessment was reported for UK (England & Wales) and Ireland.

A new compliance assessment scheme designed to assess the performance of salmon stocks in England and Wales, and provide an early warning that a river has fallen below its CL, was introduced in 2004. This new approach retains the same underlying statistical assumptions and operating characteristics of the earlier scheme, and 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. Bayesian regression analyses are applied to egg deposition estimates from the last 10 years, on the assumption that there might be an underlying trend over the period. 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 the stock status is considered 'uncertain'. 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.

Section 2.4.1 outlines changes to management using river specific CLs applied for Irish salmon rivers in 2005. The main changes were:

- Increasing the probability of achieving the required number of females to meet the male: female ratio.
- Increasing the fish requirement to increase the probability that the CL will be achieved simultaneously in every river in the district.

In each instance the probability was increased to 75%. This resulted in an increase in the CL for each river individually and a resultant increase in the National CL from 212 910 to 251 378 (increase of 18%).

Automatic fish counters have been in place for several years in approximately 15 rivers and these will be used to examine the current status of individual stocks relative to attainment of rivers specific CLs in future.

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 (Figure 3.9.13.1a-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. A modified version of this method, which updated the approach first used by ICES in 2001, by allowing uncertainty around these estimates to be described was outlined in 2002 (ICES, 2002). This approach was again applied to the 2004 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 3.9.13.1a-j). For Iceland, Russia, Norway, UK (Northern Ireland), and UK (Scotland) the input data for the PFA analysis (1971-2004) have been provided separately for more than one region; the lagged spawner analysis has therefore been conducted for each region separately and the estimated conservation limits combined. 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 'pseudo-stock-recruitment relationship'. This further emphasises the fact that this approach only provides a basis for qualitative catch advice.

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. Note that, compared to previous years estimates, one region of Iceland is now included in the Northern European stock complex while the other is included in the Southern European stock complex (see section 3.5.1). The conservation limits have been calculated as 269 194 1SW spawners and 144 263 MSW spawners for the northern NEAC grouping, and 610 520 1SW spawners and 277 985 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 Advice on management

ICES use the catch advice presented in this section to determine whether stock complexes are within precautionary reference limits 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 at 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 for 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 require 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. [NB 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 (sec 3.5.1)) 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)).

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 CL throughout most of the time series. In 2004, spawners were below the CL.
- Consideration of the confidence limits around the spawner estimates indicates that this stock complex is currently **outside precautionary limits**.
- 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 within precautionary limits.

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 CL throughout most of the time series. In 2004, spawners were marginally above the CL.
- However, consideration of the confidence limits around the spawner estimates indicates that this stock complex has fallen **outside precautionary limits** in 2004. This is a change compared to the status in recent years.
- The Working Group considers that the overall exploitation, particularly in mixed stock fisheries, should immediately 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. Thus, the only fisheries on non-maturing 1SW salmon should be on river stocks shown to be within precautionary limits.

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 CL throughout most of the time series. In 2004, spawners were marginally below the CL.
- Consideration of the confidence limits around the spawner estimates indicates that this stock complex is currently **outside precautionary limits.**
- As this stock complex remains outside precautionary limits, 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 within precautionary limits.

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 CL throughout most of the time series. In 2004, spawners were marginally above the CL.
- However, consideration of the confidence limits around the spawner estimates indicates that this stock complex remains **outside precautionary limits.**
- This stock complex is currently outside precautionary limits and the quantitative forecast of PFA for 2005 (486 000) 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. Thus, the only fisheries on non-maturing 1SW salmon should be on river stocks that are shown to be within precautionary limits.

With catch advice 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 advice for West Greenland. 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, ICES considers that management 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 only those stocks that are within precautionary limits. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be within precautionary limits. 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)

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). In 2005, the Working Group, re-evaluated tag re-capture information previously provided by Iceland (ICES, 2002) and decided that the south/west region of Iceland would be included in the southern grouping while the north/east regions would remain in the northern grouping. 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 (comprising UK countries, Ireland, France and Iceland (south/west regions)).

3.6 Catch forecast for 2005

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). Stocks in this group are the main European contributors to the West Greenland fishery (See Section 3.5.1).

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)

Model options were re-evaluated in 2004 when the Working Group explored the relative contribution of several variables to predictions of PFA (ICES, 2004a). This indicated that *Year* provided the best fit of the 2-parameter models with only the subsequent addition of *Spawners* providing a significant improvement to the model. Therefore, in 2004, the Working Group decided to apply a model that used only the *Year* and *Spawners* terms to predict the PFA of non-maturing salmon as in 2003. This model was again used in 2005. The model takes the form:

$$\text{Log}(PFA/Spawners) = -1.264\log(Spawners) + 120.0 - 0.051Year$$

This is equivalent to:

$$\text{PFA} = Spawners^{-0.264} \text{ x } e^{120.0-0.051Year}$$

The model was fitted to data from 1978–2003 (Table 3.6.1.1) to predict PFA in the subsequent years 2004–2005. The forecast used for 2004 was 524 000, this updates the previously given forecast (Section 3.8). It should be noted that the comparison of the forecasts for 2004 derived last year and this year are not strictly comparable as Iceland (south/west) is now included in the Southern European stock complex. The forecasted value for 2005 was 486 000 (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 2005.

3.7 Medium to long term projections

The quantitative prediction for the southern NEAC MSW stock component gives a projected PFA (at 1st January 2005) of 486,000 fish for catch advice in 2005. No projections are available beyond that, or for other stock components or complexes in the NEAC area.

3.8 Comparison with previous assessment

National PFA model and national conservation limit model

Five countries made changes to the input data to these models.

Unreported catch rates for France in 2002 and 2003 were previously set at 2%-5% for both 1SW and MSW catches. These have been increased to 20–40% for the 1SW and to 15-30% for the MSW salmon to take account of recent information on illegal catches made by nets in the coastal zone (Bay of the Mont Saint-Michel, Normandy) and in some estuaries (for example the River Nivelle, South-West) as well as to reflect the absence of estimated catches for the drift net fishery of the Adour estuary. Exploitation rates on 1SW salmon for the same years have been increased from 5%-20% to 10%-30% to take account of new estimates from the Adour basin.

The proportion of 1SW salmon in the UK (Northern Ireland) catch has been decreased from 95% to 93% throughout the time series following analysis of scale sample data. Rod catch data for 2002 onwards have also become available and are included in the analysis.

Size and sea age composition of the returns in 2003 for Russia (Pechora River) region was based on limited sample data and has been revised using data from other years.

In Ireland, the national CL is currently derived from transported stock and recruitment data applied to the wetted areas of all rivers. In 2005, the Irish CL was increased from 212 910 to 251 378 for 1 and 2SW salmon combined (see S.2.4.1 for details of the methods and justification). Other changes in 2005 include correcting the catch series to remove some of the hatchery reared returns which are not considered to contribute significantly to spawning and returns in subsequent generations. Also, including numbers of reared fish in the returns in some districts may mask declines in wild stocks and overestimate the attainment of CLs. New exploitation rate indices for wild stocks (1 and 2SW) are being developed which may replace exploitation rates used in the current model in the future.

Updated river specific conservation limits for UK (England & Wales) have been received and have resulted in an increase in the national total.

PFA forecast model

The revised forecast of the southern NEAC MSW PFA for 2004 provides a PFA mid-point of 524 000. This is close to the value forecast last year at this time of 489 000. However, in comparing these two forecasts it must be noted that the estimate derived this year encompasses Iceland (south/west) in the Southern European stock complex. The Iceland (south/west) component accounts for approximately 3% of the NEAC MSW PFA.

3.9 NASCO has requested ICES to describe the key events of the 2004 fisheries and the status of the stocks

3.9.1 Fishing at Faroes in 2003/2004

No fishery for salmon was carried out in 2003/2004 or, to date, in 2004/2005. Consequently, no sample data are available from the Faroese area for this season. No buyout arrangement has been arranged since 1999.

3.9.2 Significant events in NEAC homewater fisheries in 2004

In UK (England & Wales) progress in efforts to phase out various net fisheries continued in 2004. To reduce the mixed-stock fisheries, new net limitation orders and closure bylaws were introduced in 2004 for various net fisheries in South West and North West Regions and in Wales.

Since 2002, all salmon fishermen in Ireland (commercial and rod) have been obliged to tag their catch with carcass tags indicating the region, year and method of capture and to record details of the catch in a logbook 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. A TAC of 139 900 is currently being considered for the 2005 fishery based on the recommendations of the National Salmon Commission.

3.9.3 Gear and effort

In 2004 no significant changes in the type of gear used for salmon fishery 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 licence 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 liftnet fishery, which made a minor contribution to overall effort, showed a decreasing trend until it ceased to operate in 1993. 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. 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 showed a slight decline from the previous year. In the Southern NEAC area rod fishing effort show a decreasing trend in UK (England & Wales) over the period presented although there was a slight increase from the previous year. In Ireland rod fishing effort increased in the early 1990s apparently due to the introduction of one day licences.

3.9.4 Catches

NEAC area catches are presented in Table 3.9.4.1. The provisional declared catch in the NEAC area in 2004 was 1922 tonnes**,** down 17% on 2003, but representing 92% of the total North Atlantic nominal catch in 2004. The catch in the NEAC Southern area (864 t) fell by 5% on 2003 and was the lowest in the time series. The catch in the NEAC Northern area (1058 t) was also among the lowest in the time series and was down 24% on 2003. For the purpose of catch reporting Iceland has been retained in the Northern European grouping. (For the purpose of PFA modelling catch data for Iceland has been split into two regions, one contributing to the Northern group and the other to the Southern group (Section 3.5.1)).

Figure 3.9.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2004. 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 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 declined again since this time to 1058 t. Thus, the catch in the Southern area, which comprised around two-thirds of the NEAC total in the early 1970s, is now lower than that in the Northern area.

3.9.5 Catch per unit effort (CPUE)

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. 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 show a general decrease in UK (Scotland) net and coble fisheries, whereas no trend was observed in UK (Scotland) fixed engine fisheries, UK (England & Wales) net fisheries and in France rod fisheries (Figure 3.9.5.1). In UK (England & Wales) CPUE for the net fishery showed both higher and lower figures compared to 2003 but were generally below the 5-year averages (Table 3.9.5.3). The CPUE for the Scottish net fisheries was lower than in 2003 and at or below the previous 5-year averages (Table 3.9.5.4). In UK (Northern Ireland), the river Bush rod fishery CPUE showed a general increase until the late 1990, followed by a decrease, but has slightly increased after 2002 which was the lowest level in recent years (Table 3.9.5.1).

In most of the Northern NEAC area, there has been a general increasing trend in the CPUE figures for various fisheries in recent years, but the figures since 2002 have generally been lower than before (Tables 3.9.5.1 & 3.9.5.5). In comparison with the previous year, all CPUE values were down and the River Teno rod fisheries (Finland) showed lowest figures in the time series since 1977 (Fig. 3.9.5.1). All figures were also lower than the previous 5-year means (Table 3.9.5.2).

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).

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). The percentage of 1SW fish in the Northern area in 2004 was 58 %, below the 5- and 10-year means (63–64%). 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 decreased in 2004 in Finland and Norway, but increased in other countries. On average, 1SW fish comprise a higher proportion of the catch (around 75-80%) in Iceland and Russia than in the other countries (60–65%).

For the Southern European countries (Figure 3.9.6.2), the overall percentage of 1SW fish in the catch (59%) was close to the 5- and 10-year mean (60%), the percentage increasing in 2 countries and decreasing in the others except UK (England & Wales). The overall percentage of 1SW fish in the catch has varied from 49 to 65% over the time series. The percentage of 1SW fish in the catch decreased in 2004 in all countries. On average, 1SW fish comprise a higher proportion of the catch (around 75%) in UK (England & Wales) than in the other southern countries (around 55% in UK (Scotland) and France, and 35% in Spain).

3.9.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2004 was again generally low (<2% in most countries) and is similar to the values that have been reported in previous reports (*e.g.* ICES, 2004a). Thus, the occurrence of such fish is usually ignored in assessments of the status of national stocks (Section 3.9.13). 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 was included in ICES (2001).

3.9.8 National origin of catches

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). The favoured approach for estimating exploitation rates in distant water fisheries, works backwards from estimates of the numbers of each sea-age class of salmon returning to spawn (Potter and Dunkley, 1993; Rago *et al.*, 1993a; Potter, *et al.*, 2004). River-specific models based on this 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 demonstrated that salmon from all parts of England and Wales are exploited in the Irish coastal fishery. However, 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 in 1997. Based on aggregated data for all available years, the extant exploitation rates for the modelled stocks (1SW fish only) are presented in Table 3.9.8.1 for the periods before and after the management changes in the Irish fishery.

Prior to the introduction of the management measures, exploitation rates in the Irish fishery were estimated at about 1% for stocks from the north east of England, higher (15 to 22%) for the two rivers in Wales, but highest (28%) for the River Test in southern England. Since the introduction of the regulatory changes, exploitation rates have fallen to 0.5% for the Tyne (data for one year only), 2 to 10% 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 was consistent with this regional pattern of exploitation.

Noting that exploitation rates in the Irish fishery were higher on hatchery stocks than on wild stocks (*e.g.* R. Burrishoole and R. Bush) the Working Group advised applying a correction factor where tags from hatchery-reared and wild salmon had been combined to provide adequate tag returns for the analyses.

It therefore appears that exploitation on salmon from north east England in the Irish fishery is negligible, that exploitation on stocks from north west England and north Wales is currently low, but that levels increase for rivers further south in Wales and for rivers in southern and possibly south west England. The Working Group also 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.

In 2004, a number of tags originating from fish released from other countries (34 from UK (Northern Ireland), 8 from UK (England & Wales), 2 from UK (Scotland), 2 from Spain and 2 from Denmark) were recovered in Irish fisheries.

3.9.9 Summary of homewater fisheries in the NEAC area

In the NEAC area, there has been a general reduction in catches since the 1980s. This reflects a decline in fishing effort, as a consequence of management as well as a reduction in the size of stocks. The overall nominal catch in the NEAC area in 2004 (2640 t) represented a 17% decrease on the catch for 2003 and a 23% decrease on the average 1999–2003 catch. Catches in the Southern area decreased compared to 2003 (by 5%) and substantially on the 1999–2003 mean value (by 20%). In the Northern area, substantial decreases in catch were recorded compared to both the 2003 (by 24%) and the 1999-2003 mean values (by 25%).

While there have been no major changes in the types of commercial fishing gear used, both northern and southern Europe have experienced general reductions in the number of licensed gear units. In contrast, there are no consistent trends for the rod fishing effort in NEAC countries.

CPUE of rod and line fisheries have undergone substantial decreases in the last two or three years for most Northern NEAC rivers that are documented. In seven out of eight rivers of Russia, the CPUE values in 2004 were below their five-year average, by 22% to 52%. The River Teno (Finland) showed a sharper decrease and was 66% below its 5-year mean. In contrast, Rivers Näätamo (Finland) and Bush (UK (Northern Ireland)) did not show clear trends or variations. The CPUE of the rod and line fishery in France in 2004 increased, after three years of decline, and was 15% in excess of its 5-year average. The CPUE of engines show no clear trend or differences from previous years in UK (England & Wales) except in the Midlands, where they were 51% below the previous five year average, and in the North-East, where CPUE increased in 2004 compared to 2003, after three years of decrease. In UK (Scotland), CPUE went down in 2004 compared to 2003 for all gears, and this was the fourth consecutive year of decrease for the Net and Coble fishery. In Norway, CPUE were also down on the five-year mean for small salmon (<3 kg) for the bagnets (by 38%) and for all sizes of fish in the bagnet fisheries (by 33%–36%).

The proportion of 1SW salmon in catches varies considerably both among countries and within countries among years. No general trend is apparent in the southern NEAC area taken as a whole. In the northern countries, lower proportions of 1SW salmon are observed since 2000 (54%–62%) in comparison with the 1987–1999 period (61%–72%).

Despite the continued high levels of production in the salmon farming industry, the incidence of farmed and ranched salmon in NEAC homewater fisheries was generally low (<2%) and similar to recent years. The exception to this is Norway, where farmed salmon still comprise a large proportion of the catch in several of the coastal, fjordic and rod fisheries.

3.9.10 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 an ‘m’ value of 0.03 per month to be appropriate. A Monte Carlo simulation (1000 runs) using ‘Crystal Ball’ in Excel (Decisioneering, 1996) is used to estimate confidence limits on the PFA values. Potter *et al.* (1998) provides full details of the model.

As was noted in ICES (2004a), many of the model outputs from the Monte Carlo simulations do not conform to normal distributions as had previously been assumed. As a result, the use of mean and standard deviations both to describe these outputs and to manipulate variables within the model are considered inappropriate. The model has therefore been modified so that all outputs are now characterised in terms of their median, 2.5 and 97.5 percentile values. The structure of the model has also been changed so that parameters are combined within Monte Carlo simulations. The effects of these changes on the estimated PFA and SERs for Northern and Southern European stock complexes are of the order of 2% or less.

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.

3.9.11 Sensitivity of the PFA model

A sensitivity analysis for the spreadsheet model which generates PFA estimates in the NEAC area was described in ICES (2002).

The sensitivity of the overall assessment of PFA for the NEAC Area, and for the Northern and Southern European stock complexes, depends on the values of the various parameters provided for different countries, and these will also be weighted by the national catches. The analysis provided an evaluation of the effects (% change) on the assessment of PFA of maturing and non-maturing 1SW salmon from Northern and Southern Europe of making changes to the non-reporting rate (‘R’), the exploitation rate (‘U’) and the time of return to homewaters (‘t’).

Changes to the parameter values listed in the text table below had a greater than 5% effect on the respective (*i.e.* Northern or Southern European) PFA estimates indicating that particular attention should be paid to ensuring that these parameter values are accurate.

Country (Region)	Sea-age	Parameter
Norway (mid)	1SW	Non-reporting rate
Norway (North)	MSW	Non-reporting rate
Ireland	1SW	Non-reporting rate
Ireland	1SW	Exploitation rate
Scotland (East)	1SW	Exploitation rate
Scotland (East & West)	MSW	Exploitation rate
Scotland (East)	MSW	Non-reporting rate

The Working Group noted that changes had been made to the structure of the model and agreed that a sensitivity analysis should be undertaken for the revised model.

3.9.12 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 3.9.12.1(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 with the exception of Iceland where, as described in Section 3.5.1, outputs for the North & East region are included within the Northern NEAC assessment while the South & West region are included within the Southern NEAC assessment. 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 2004 are indicated in Section 3.8.

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. Different 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.

3.9.13 Status 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. 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 3.9.13.1(a to 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).

The Working Group noted that CLs may not be appropriate for quantitative catch advice at national levels, however they are regarded as useful indicators of overall stock status. Stock status, expressed as outside or within precautionary limits, and the method by which conservation limit was determined is summarised by country below.

COUNTRY	1SW SPAWNERS	MSW SPAWNERS	DETERMINATION OF CONSERVATION LIMIT
Northern NEAC			
Finland	outside	outside	National CL model
Iceland	outside	outside	National CL model
Norway	outside	outside	National CL model
Russia	outside	outside	National CL model
Sweden	within	within	National CL model
Southern NEAC			
France	outside	outside	River Specific
Ireland	outside	outside	River Specific
UK(England & Wales)	outside	outside	River Specific
UK (Northern Ireland)	within	within	National CL model
UK (Scotland)	outside	outside	National CL model

3.9.14 Trends in the PFA for NEAC stocks

Tables 3.9.14.1 to 3.9.14.6 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 high level of uncertainty in this assessment procedure. However, the Working Group recognised that the model provided an interpretation of our current understanding of national fisheries and stocks based upon simple parameters. Errors or inconsistencies in the output largely reflect uncertainties in our best estimates of these parameters. The results, however, need to be interpreted with caution.

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. The number of 1SW spawners has been outside the precautionary reference limits for most of the time series. Although it was within these limits for 5 of the last 6 years, the 2004 spawner value is again outside precautionary reference limits. This is consistent with a decline in PFA over the recent period.

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. The number of MSW spawners was outside the precautionary reference limits for most of the time series. Although it has been within these limits since 2000, the 2004 spawner value has again fallen outside precautionary reference limits. 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 3.9.15).

In the Southern European stock complex (Figure 3.1.1), the estimated numbers of maturing 1SW recruits have fallen substantially since the 1970s. With the exception of the early 1970s and two years in the late 1980s, the number of 1SW spawners has been outside the precautionary reference limits for most of the time series and remains so in 2004. This pattern is consistent with the data obtained from a number of monitored stocks which showed survival of wild smolts to return as 1SW fish fell to very low levels in the Southern European area (Section 3.9.15).

The PFA estimates suggest that the number of non-maturing 1SW recruits in Southern Europe has followed a fairly steady and substantial decline over the past 30 years (Figure 3.1.1). The number of MSW spawners was generally within the precautionary reference limits for most of the time series until 1995. Thereafter, spawners have been outside precautionary reference limits. This is broadly consistent with the general pattern of decline in marine survival of 2SW returns in most monitored stocks in the area (Section 3.9.15).

3.9.15 Survival indices for NEAC stocks

An overview of the estimates of marine survival for wild and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) for the 2003 and 2002 smolt year classes (returning 1SW and 2SW salmon, respectively) is presented in Fig. 3.9.15.1. 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 3.9.15.1 and 3.9.15.2.

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 (Fig. 3.9.15.1). 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 (Fig. 3.9.15.1).

In Iceland and Ireland, survival indices for the latest smolt year classes for wild smolts were at or above those of the previous year and the 5- and 10-year averages. However, the opposite was true for indices in UK (N-Ireland) whereas indices in Norway showed mixed results (Table 3.9.15.1). A majority of the survival indices for the hatchery-reared smolts were below those of the previous year and the 5- and 10-year averages (Table 3.9.15.2). Exceptions include returns of reared 1+ smolts in the River Bush (UK N-Ireland) and those in the River Lee (Ireland) (Table 3.9.15.2). 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 3.9.13), 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.

NEAC northern area

Russia

Commercial catches have continued to decline as a result of various management changes, including the prohibition of some important in-river fisheries, aimed at reducing the fishing effort and enhancing the development of recreational catch-and-release fisheries. The mean commercial catch in the last five years (2000–2004) is 26% below that of the previous five years (1995–1999).

NEAC southern area

Ireland

Apart from primary legislation (not described here), a range of secondary legislation has been introduced recently for the effective management and regulation of the salmon fishery. These management measures have been introduced with the objectives of (a) reducing exploitation rates on wild salmon stocks, particularly in areas that are believed to be outside precautionary limits, and (b) increasing escapement to freshwater. Measures include:

- The Wild Salmon and Sea Trout Tagging Scheme Regulations, 2004 provide for a scheme of carcass tagging and quotas in each of the 17 fisheries districts.
- A system of on-the-spot fines in the area of inland fisheries.
- A prohibition, from 1 January to 31 October in each year, on the sale of salmon or sea trout caught by rod and line.
- Changes to the season opening and closing dates, and the weekly close times, for commercial salmon and trout fishing in 2004; this affects the use of drift net, draft net, snap net and other fishing engines.
- A bag limit of 1 salmon or 1 sea trout over 40 centimetres per angler per day from 1 January to 31 May, and a bag limit of 3 fish being either salmon or sea trout over 40 centimetres per angler per day from 1 June to the end of the fishing season, subject to a total allowable catch of 20 fish per year.

a) The first objective has been met, with a general decline in exploitation rate on wild salmon from 65% (pre 1997) to 48% (post 1997) for wild salmon and a reduction from 82% to 67% for hatchery returns for the same periods. Exploitation on salmon from UK (England & Wales) in the Irish fishery has also been reduced by about a half following the introduction of the management measures in the fishery in 1997 (Section 3.9.8).

b) In the context of increasing escapement to freshwater, information from index rivers suggests a marginal increase in survival to fresh water from 5.1%, on average, (pre 1997) to 5.6% (post 1997). An increase in returns to freshwater for hatchery stocks is also noted (0.8% to 1.4%) for the same periods.

With the recent provision of catch advice for Irish salmon fisheries on a district basis, the emphasis is beginning to shift towards the objective of meeting or exceeding conservation limits in all districts. Although the process is only recent (2002 starting year), and TACs have been set which result in significant reductions in commercial catches, this objective is not as yet being met.

UK (Northern Ireland)

Significant management measures came into effect in 2002, aimed at reducing exploitation on salmon stocks in the Fisheries Conservancy Board (FCB) area. A voluntary buyout agreement with commercial licensed net operators has resulted in a reduction in nets licensed from 27 in 2000 to 6 for the 2004 season. Accompanying measures to regulate angling, first introduced on a voluntary basis in 2001, operated again in 2004, following introduction of appropriate byelaws. These included catch and release from the start of the season until the end of May and a daily bag limit of two fish per angler from 1st June to the end of the season. While the impact of these measures on stock status will require some years to fully evaluate, it is noted that the voluntary net buyout scheme probably contributed to the reduction in net catch in the FCB area from 23.4 t in 2001 to 5.8 t in 2004.

UK (England & Wales)

Salmon stocks are managed with the objective of meeting river-specific conservation limits. A review in 2004 demonstrated that, whilst many conservation measures had been implemented, the majority of stocks remained below the CL and a significant number were in decline. An action plan has been drawn up to take forward the review's recommendations. A range of national and local measures have been implemented over recent years to address concerns about stock status. In particular, measures have been implemented to safeguard MSW 'spring' fish and phase out coastal mixed stock fisheries.

a) Spring salmon – National measures were introduced in 1999 to protect MSW spring salmon; these closed all net fisheries for salmon before 1 June and introduced compulsory catch and release for rod fisheries up to mid June. These measures are estimated, in 2004, to have saved around 1200 salmon from capture by net fisheries and around 2200 by rod fisheries before June 1. These estimates are based on the catch and the average proportion of fish taken in this period in the 5 years prior to the measures being introduced; the latter estimate has been adjusted for catch and release. A 5-year review of these measures, completed in 2003, found that spawning escapement of spring salmon may have increased by up to one third on some rivers as a result of the measures, but that spring salmon stocks are still seriously depleted on many rivers. The review concluded that the measures should remain in place until 2008.

b) Mixed stock fisheries – Since 1993, there has also been a policy to phase out coastal mixed stock salmon fisheries. In 2003, compensation arrangements helped accelerate the phase out of the fishery on the north east coast. Nine other small coastal mixed stock fisheries have also been subject to reductions in recent years, eight of which are no longer operating. The overall effect of these measures has been to reduce the catches in these coastal fisheries from an average of about 41 000 fish for the period 1988–92 to a little under 32 000 for the period 1998–2002 and around 11 000 fish in 2003 and 2004.

UK (Scotland)

Concerns about the status of early-running MSW salmon led to a voluntary agreement to delay fishing until the beginning of April. Members of the Salmon Net Fishing Association, to which the majority of active net operators are affiliated, have observed this agreement since 2000. This has resulted in about an 80% reduction in the catch of MSW salmon by nets and fixed engines in the months of February and March compared with the previous five years.

France

Various measures have been introduced with the objectives of reducing exploitation, on MSW fish in particular, and increasing spawning escapement and compliance with river-specific CLs.

Sport and commercial fisheries in the Loire-Allier basin have been closed since 1994 to aid recovery of the population. However, this did not seem to enhance salmon numbers. Physical obstructions and other environmental factors are now considered the more likely impediments to recovery of this population.

In Brittany and Lower Normandy, TACs introduced in 1996 have been successful in reducing catches and probably increasing spawner numbers, although the only monitored river, the Scorff, has failed to meet its CL consistently since 1994. Early season restrictions failed to protect spring salmon. However, MSW TACs have led to temporary closures on some rivers and have reduced MSW catches in Brittany since 2000 and Lower Normandy since 2003.

In the Adour-Gaves basin, management measures introduced between 1999 and 2003 resulted in some reduction in rod catch, although not in the proportion of MSW caught. Rod catches increased in 2004 once the measures lapsed and there has also been a steady increase in fishing effort and catches in the estuary drift net fishery over the last 5 years. The current regulations have therefore been unable to reduce overall exploitation or pressure on MSW salmon.

In conclusion, most management measures introduced in recent years in relation to national and local objectives have aimed to reduce levels of exploitation on NEAC stocks. However, despite these, the Working Group notes that all four NEAC stock complexes are currently outside precautionary reference points (Section 3.1).

3.11 NASCO has requested ICES to provide an estimate of bycatch of salmon in pelagic fisheries.

3.11.1 Estimate of bycatch of salmon in pelagic fisheries

Reports over a number of years have indicated the possibility of postsmolts and salmon being intercepted in various pelagic fisheries and in trawl fisheries in particular. However, preliminary estimates derived from observed ratios of salmon and mackerel taken in research and commercial fisheries scaled with the total mackerel catch in the Norwegian Sea have been highly variable. (ICES, 2002, 2003, 2004a). A study group on Bycatches of Salmon in Pelagic Fisheries (SGBYSAL) was initiated in 2004 to examine available data on commercial pelagic fisheries and distribution of salmon in more detail. The study group identified some areas of overlap between postsmolts and mackerel fisheries. These were ICES fishing areas IIa (Norwegian Sea) and VIa-IVa (West and north of UK and Scotland- northern North Sea (Figure 3.11.1.1). In addition a possible overlap was also identified in IIb (Northern Norwegian Sea). The Study Group at that time noted that it could not meet all the terms of references in part due to insufficient knowledge of the spatial and temporal postsmolt distribution, lack of weekly disaggregated catch data by ICES statistical rectangle on the relevant fisheries and lack of technical expertise on comparability of research and commercial gear types and the potential of different gears to catch salmon. ICES recommended that SGBYSAL should meet again in 2005 provided disaggregated pelagic catch data and appropriate expertise were available, in order to make any significant progress.

As these requirements were met, the Study Group on Bycatches of Salmon in Pelagic Fisheries had its second meeting in Bergen, Norway, 8- 11 April 2005.

SGBYSAL- Terms of Reference

a) Work with the WGMHSA, HAWG, and WGNPBW as well as national laboratories to make available disaggregated data on the commercial catches of mackerel and herring 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 standard week 16–36. Data provided by a number of countries.

b) Work with the WGMHSA, HAWG and WGNPBW as well as national laboratories to make available disaggregated data on the number of boats and gear types used in the commercial fishery of mackerel, herring and horse mackerel 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 & k) by ICES Division and standard week 16-36Explore new data available for estimating bycatches of Atlantic salmon in the pelagic fisheries in the north East Atlantic and where possible give an assessment of their reliability.

d) Explore analytical methods to allow catch rates of salmon in research surveys to be extrapolated to catch rates in commercial fisheries.

e) Review any new methods used for intensive screenings of pelagic research hauls for the presence of post-smolts (small salmon in their first year at sea, generally < 45 cm) and older salmon.

Data available

Considerable progress was made in 2005 with several countries providing disaggregated catch data (per week & ICES statistical rectangle) for a number of years from 1970 onwards, which was pooled into a sample database. These data represent the individual daily landings recorded which are aggregated by week. However, there was data for most countries only for 2000-2003, from which data a sub-sample database was formed. Table 3.11.1.1 indicates the number of weekly catch records provided for each fleet and species. For each ICES Division there is a weekly landing record in weight of fish and by gear type. While this is not an indication of the volume of fish caught or the effort employed by each fleet, it provides an indication of amount of disaggregated data available to the Study Group for further analyses. The relative amount of disaggregated data per statistical rectangle is summarised in Table 3.11.1.2. This sub-sample database was then used for an example-estimate with calculations of potential bycatches by two different methods, which are presented in Table 3.11.1.6.

Considerations

A review of the database provided the following guidelines:

a) only data on pelagic trawl catches on a weekly basis for those years provided by most countries, *i.e.* 2000–2003 would be used (see previous sections in this chapter),

b) in some individual years the IMR pelagic surveys had insufficient coverage of the salmon distribution either on a temporal or a spatial scale, and very few salmon had been captured Therefore data for postsmolt research captures was pooled (1990–2003, Figure 3.11.1.2)

c) note the shortcomings of the postsmolt and salmon research database, which covers only part of the assumed spatial and temporal distribution of salmon, and in some areas is influenced more by the other research priorities than the salmon distribution objective.

Postsmolt and pelagic trawl-catches, distribution in weeks

In order to identify the overlap between postsmolt distribution and the pelagic fisheries the weekly distribution of postsmolt and the pelagic catches was compared for each of the weeks 23–32 separately (*i.e.* the weeks from which postsmolt research records are available). The comparison showed a strong overlap for weeks 26–28 in particular (see Figures 3.11.1.3a-d). These weeks were subsequently selected for estimating the potential postsmolt bycatch when applying different methods, catch ratios and time periods.

Gear

There are a number of design and operational differences between the survey trawl and commercial trawls. These are shown below and include the overall size, towing speeds, ratios of width to height and the mesh sizes used in the construction, particularly in the fore sections of the nets.

	Mesh Size Fore Part (Full Mesh m)	Net Height (m)	Net Width (m)	Minimum Cod-End Mesh Size (mm)	Towing Speed (Knots)
Norwegian Salmon survey trawl	0.8	10	40	20	4.8
Norwegian Pelagic survey trawl	3.2	30	40	22	3.5
Russian Pelagic Survey Trawl	6 - 50	40	50	24, 32, 40	3.5 – 5.0
Russian Pelagic Commercial Trawl	6 - 50	50 – 100	100 - 200	35, 40	5.5 – 6.5

Only the Russian pelagic survey trawl had similar design properties to the commercial gears in use in the fishery. In the absence of relative efficiency estimates from the two other survey gears in comparison with the commercial trawl, it is recommended that only the catch data from the Russian research survey and the commercial trawl catch scanning should be used for extrapolation purposes. It should also be noted that the Russian pelagic survey trawl is operated at a different towing speed from the commercial trawl and at times with smaller cod-end mesh size. In this regard, the effect of towing speed on the catchability of salmon is unknown.

The fisheries

The detailed description of the various pelagic fisheries was given in ICES (2004b). Based on the area covered and the general operation depth, the fishery with the greatest potential to intercept postsmolts was identified to be the near surface mackerel trawl, Table 3.11.1.3.

Further information on the potential for detection of post-smolts during on-board screening of catches on Russian factory trawlers

Since the end of 1990's scientific observers have been working onboard Russian vessels fishing herring, mackerel and blue whiting in the Norwegian Sea. The vessels are subject to inspection by Russian, Norwegian, Faroese and NEAFC authorities. In addition, all the Russian commercial catches of mackerel and herring and most of the blue whiting catches are used for human consumption and most vessels freeze and store their products onboard. Consequently all catches are sorted and packed by species in standard boxes that include smaller packs of whole or filleted fish. Some of the vessels also produce canned fish. A smaller part of the blue whiting catch is used for fish meal and oil production. In all cases the catch is loaded from the trawl onto an accumulation conveyor in the vessels factory immediately and sorted by the crew. In this instance it is suggested that that the fish are essentially handled more or less individually before packing or milling and that the probability of detecting salmon (either post-smolts or adults) should therefore be very high.

Observed ratio of post-smolts per tonne of mackerel in research and commercial catches, 2002–2003.

The Working Group agreed that the ratios of postsmolts to tonne of mackerel obtained from the Norwegian research surveys could not be used as those research trawls differ markedly from the commercially used trawls. Thus only the data from Russian research ships and observer based screenings of commercial trawl catches should be used. These ratios are presented in Tables 3.11.1. 4 and 3.11.1.5.

Estimates of the bycatch of post-smolt salmon

Two estimates of post-smolt catch rate (*i.e.* post-smolts/tonne mackerel) were available based on:

a) Russian research trawl catches
b) Russian observer based screening of commercial mackerel catches

By-catch estimates were developed by applying these catch rates to disaggregated trawl catches of mackerel:

- Estimates were calculated for the whole area IIA, IVa and Vb, using disaggregated catches of mackerel in 2001 and 2002.
- Two standard time periods were selected i.e., the total period from which post-smolt records exist (weeks 21–31), and the peak period (weeks 26–28).
- Only mackerel catches in rectangles with simultaneous salmon catches were included.

The results indicate a wide variation in potential post-smolt by-catch depending mainly on the catch rates used (Table 3.11.1.1).

The Working Group notes that the resultant estimates based on the **research trawl** (40 188–154 482 post-smolts, depending on range of weeks considered), may over-estimate the ratio of post-smolts to mackerel taken, as the research trawl operates at lower speed, and thus may be less effective in catching mackerel.

In contrast, the estimates based on ratios derived from the **observer based screening** and individual handling on board factory ships (14–52 post-smolts, depending on range of weeks considered), may be underestimates, due to difficulties in observing smolts amongst a large catch of mackerel on board a commercial vessel.

The Working Group notes that despite using the best available information, including appropriate disaggregation of catches, there is a very wide variation in the results. Therefore, although the estimates are thought to encompass the likely range of bycatch, these values cannot be regarded as formal estimates of bycatch for any particular year or fishery. Further developments and data would be required before by-catch estimates could be used as part of the overall assessment of salmon stocks in the NEAC area or for specific management advice.

Due to the absence of documented ratios of post-smolts or salmon to catches of other species of pelagic fish it is not possible to make any estimates of bycatches from fisheries other than mackerel fisheries at present. The Working Group recommends that future estimates should be refined, if possible with annual estimates, based on observer based screening of catches. As yet, no other relevant pelagic fisheries have provided salmon catch rate data, but in the light of information presented by the Study Group, the possible interception of salmon by *e.g.* herring or blue whiting fisheries should be further investigated.

Despite this, the Working Group notes that the upper estimate of potential salmon post-smolt bycatch in the mackerel fishery (154 482) represents approximately 5% of the estimated combined PFA for the NEAC stock complexes (10-year average 3.4 million). As PFA is estimated at 1st January of the first sea winter and the post-smolt surveys are carried out in June/July of the first year at sea, further mortality will take place between the survey and the estimate of PFA, therefore the percentage of PFA accounted for by by-catch will be lower.

Estimate of the bycatch of adult salmon

The Working Group expanded the analysis carried out on postsmolt bycatch to provide an estimate of adult salmon bycatch. Adult salmon were reported also from the Russian scientific surveys and the observer-based screenings.

Table 3.11.1.8 provides an example using mackerel catches in weeks 21–32 in 2001. The observed ratios of adult salmon to total catch of mackerel from the Russian scientific and commercial fishery have been scaled with the tonnage of mackerel taken in the overlapping rectangle for a specific period (±2 weeks from the time when the postsmolt capture was registered). Only catches from rectangles where salmon have been recorded were used for scaling up, and mackerel catches from rectangles with no salmon were thus excluded. Likewise catches from overlapping statistical rectangles where a difference of more than two weeks between the reported salmon capture and week of the recorded mackerel catch were not applied.

Extrapolation from the research catch shows that the number of adult salmon potentially taken ranged from 0 to 4,460. The observer based estimate provides a range of 15 to 32 salmon. As for postsmolts, the reason for the differences may be the lower effectiveness of the research trawl to catch mackerel, thus leading to an overestimate of the ratio of salmon to mackerel.

The Working Group recommends that a comparable exercise should be carried out using data from trawl fisheries other than mackerel.

The Working Group discussed the possibility of using indirect estimation methods (surveys, polls) of commercial fishermen to estimate the occurrence and frequency of salmon bycatch in different areas fisheries and time of year. These methods may also provide an approximation of the potential number of salmon taken. The Working Group underlines the importance of using recognised and proven survey professionals operating in such fields as social science research and socio-economic evaluation etc. It was recognised that direct onboard observation is the most reliable method of bycatch estimation.

The Working Group on North Atlantic Salmon endorses the recommendations from the Study Group on Bycatch of Salmon in Pelagic Fisheries.

3.11.2 Sampling of post-smolts and pre-adults in Norway and the Norwegian Sea

There was only one research cruise specifically targeting salmon at sea in Norway in 2004. However, relevant data was collected during two fjord surveys surveying the status of salmon lice infections in selected SW-Norwegian fjords. The targeted cruise for salmon took place in the last part of April between 66–68ºN and was designed to tag and release adult salmon with DST tags. The outcome of this project is described in Section 2. There were no cruises dedicated to postsmolt investigations at sea due to constraints in available ship time, but the salmon trawl was used to capture spawning mackerel during a mackerel egg survey in the area north of Ireland up to the Shetland- Faroes Channel. During this cruise 124 postsmolts were caught in 8 of 14 stations sampled. The last time this area was surveyed was in 1995–97, so these captures extend the database on the temporal and spatial distribution of postsmolts. Relative to other years, the CPUE in the southern area was considered high at 16.2. CPUE for adult salmon captures was calculated for the first time and indicated a relatively high density of salmon in the area sampled as well as demonstrating the effectiveness of the salmon research trawl. The cruises where salmon were obtained are summarised in Table 3.11.2.1. and salmon captures in 2004 are presented in Figure 3.11.2.1. The distribution of the total captures of adult salmon and postsmolts since 1990 is shown in Figure 3.11.1.2.

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	18,000	15,477			18,000	15,477
Iceland (north & east)	13,554	3,837			13,554	3,837
Norway[1]	125,613	82,955			125,613	82,955
Russia	109,661	40,872			109,661	40,872
Sweden	2,367	1,122			2,367	1,122
			Conservation limit		269,194	144,263
			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)	32,658	4,654			32,658	4,654
Ireland			236,044	15,334	236,044	15,334
UK (E&W)			52,093	29,218	52,093	29,218
UK (NI)	16,495	2,784			16,495	2,784
UK (Sco)	255,831	220,895			255,831	220,895
			Conservation limit		610,520	277,985
			Spawner Escapement Reserve		776,124	469,968

YEAR	EGGS (X10^3)	NON MATURING 1SW PFA
1978	5,319,215	1224550
1979	5,025,672	1693919
1980	4,099,942	1793566
1981	3,615,223	1310018
1982	3,633,413	1553554
1983	3,497,888	1090909
1984	3,384,221	1262500
1985	3,340,424	1701860
1986	3,248,570	1284109
1987	3,941,734	1579406
1988	3,442,171	1470904
1989	3,622,475	1164105
1990	4,235,130	792232
1991	4,272,641	1043327
1992	4,595,504	907896
1993	4,619,990	995659
1994	3,900,213	926312
1995	3,220,385	754033
1996	3,378,795	555090
1997	3,600,600	531481
1998	3,426,976	508477
1999	3,469,103	653286
2000	3,183,308	649317
2001	2,675,472	576986
2002	2,564,177	602355
2003	2,356,560	630453
2004	2,690,586	
2005	2,942,136	

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

YEAR	PREDICTION	LOWER LIMIT	UPPER LIMIT
2004	524	338	813
2005	486	313	755

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.*

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

Table 3.9.3.1 Numbers 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[1]	Fixed engine[2]	Net and coble[3]	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	30,894	239	108	90	54	2	1,546	659	-	0
Mean 1999-2003	103	100	157	37	28,593	389	111	108	52	7	1,702	947		0
% change[4]	-44.6	-25.1	-0.1	76.6	8.0	-6.7	-1.4	-2.8	0.8	-69.7	-2.3	-19.1		
Mean 1994-2003	127	121	195	40	31,577	530	155	113	59	10	1,983	1,524		0
% change[4]	-55.3	-37.9	-19.5	64.1	-2.2	-54.9	-30.4	-20.4	-8.9	-80.6	-22.0	-56.8		

[1] Total number of rods days fished, data for 2004 is provisional.

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

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

[4] (2004/mean - 1) * 100

Table 3.9.3.1 continued 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
Mean 1999-2003	867	524	159	32,875	31,458	9,018	759	674	2,095	17	44	7,697	62	129
% change [6]	-4.2	-9.8	-14.2	-3.2	-6.2	-2.7	5.5	-2.5	3.1	-11.8	-13.2	72.8	0.6	-56.5
Mean 1994-2003	834	520	165	30,961	26,134	7,876	714	683	2,113	16	53	7,751	63	200
% change [6]	-0.4	-9.0	-17.5	2.7	12.9	11.4	12.1	-3.8	2.2	-8.0	-28.0	71.6	-1.7	-71.9

[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), 1960-2004 (2004 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	864	1,058	0	-	1,922	575	-
Means							
1999-2003	1,086	1,409	2	-	2,496	955	-
1994-2003	1,272	1,365	3	-	2,640	966	-

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 fisheries in Finland (Teno, 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	0.43 [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	0.79	0.259
2001	5.9	1.7	1.2	0.3	0.65	0.444
2002	3.1	0.9	0.7	0.2		0.184
2003	2.6	0.7	0.8	0.2		0.238
2004	1.4	0.4	0.9	0.2		0.252
Mean 1999-03	4.1	1.2	0.9	0.2	0.7	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 fisheries 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
Mean 1999-03	1.49	0.96	0.69	1.81	4.62	1.54	2.04	0.75

Table 3.9.5.3 CPUE data for net and fixed engine salmon fisheries by Region in UK (England & Wales). Data expressed as catch per licence-tide, except the North East, for which the data are recorded 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
Mean 1999-03	9.28	6.05		0.83	0.94	0.44	0.76

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	53.70	56.50
Mean 1999-03	49.41	74.79

[1] Excludes catch and effort for Solway Region

Table 3.9.5.5 Catch per unit effort 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
Mean 1999-03	1.43	0.92	0.21	0.92	0.90	0.26

Table 3.9.6.1. Percentage of 1SW salmon in catches from countries in the North East Atlantic, 1987-2004

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	**59**
Means											
1999-2003	79	58	60	73	61	**63**	52	73	51	32	**60**
1994-2003	76	62	61	75	62	**64**	53	74	55	34	**60**

1. Based on catches in Asturias (90 % of the Spanish catch).

Table 3.9.8.1. 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 managemnet measures in the Irish fishery in 1997.

River - region	Pre 1997 management changes			Post 1997 management changes		
	Years	Expl. Rate (%)	95% CL (a)	Years	Expl. Rate (%)	95% CL (a)
River Tyne - NE England	1986-96	1.4	± 0.4	1997	0.5	± 0.8
River Wear - NE England	1986-96	0.9	± 0.2		No data	
River Dee - N. Wales	1992-96	15.3	± 5.3	1997-2003	2	± 1.0
River Taff - S. Wales	1991-96	22.0	± 6.8	1997-2003	9.8	± 4.2
River Test - S. England	1991-96	28.4	± 5.9	1997-2000	11.9	± 4.2

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

Table 3.9.12.1a Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1b Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1c Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1d Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1e Input data for NEAC Area 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	410,066	46,605	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1972	437,270	49,882	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1973	476,144	54,009	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1974	542,316	60,997	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1975	598,649	68,274	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1976	407,073	47,364	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1977	351,880	41,271	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1978	307,674	35,720	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1979	282,908	32,167	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1980	215,346	35,484	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1981	138,731	26,354	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1982	270,259	11,771	30.00	45.00	30.00	45.00	62.08	83.99	28.34	44.99
1983	438,397	26,516	30.00	45.00	30.00	45.00	54.78	74.11	10.34	45.41
1984	225,316	20,721	30.00	45.00	30.00	45.00	53.76	72.74	37.02	50.00
1985	430,965	18,855	30.00	45.00	30.00	45.00	63.45	85.84	32.75	39.45
1986	444,092	27,133	30.00	45.00	30.00	45.00	58.01	78.49	36.95	54.30
1987	325,797	26,385	20.00	40.00	20.00	40.00	53.92	72.94	27.50	36.86
1988	394,237	22,218	20.00	40.00	20.00	40.00	48.19	65.20	31.85	94.21
1989	294,636	25,190	20.00	40.00	20.00	40.00	53.55	72.44	38.35	78.00
1990	174,260	15,725	20.00	40.00	20.00	40.00	48.74	65.94	53.85	76.69
1991	121,044	10,386	20.00	40.00	20.00	40.00	45.34	61.34	30.47	61.54
1992	184,351	15,627	20.00	40.00	20.00	40.00	54.23	73.36	47.66	55.26
1993	144,965	12,699	15.00	35.00	15.00	35.00	50.12	67.81	23.59	56.43
1994	228,266	20,013	15.00	35.00	15.00	35.00	60.24	81.51	38.06	62.08
1995	227,132	20,002	15.00	35.00	15.00	35.00	56.25	76.10	40.65	88.47
1996	199,566	17,651	15.00	35.00	15.00	35.00	48.03	64.98	51.93	58.28
1997	170,679	14,706	15.00	35.00	10.00	20.00	47.00	63.58	18.51	74.44
1998	195,779	17,587	15.00	35.00	10.00	20.00	48.59	65.74	60.47	63.25
1999	158,808	14,800	15.00	35.00	10.00	20.00	44.39	60.06	42.70	52.29
2000	197,586	16,656	15.00	35.00	10.00	20.00	46.39	62.76	26.51	35.48
2001	220,578	18,588	5	10	5	10	40.80	55.20	27	37.51
2002	200,713	16,864	5	10	5	10	42.41	57.37	20	35.00
2003	164,425	14,001	5	10	5	10	35.13	47.52	16	43.00
2004	142499	12319	5	10	5	10	42	57	16	43
2005	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1f Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1g Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1h Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1i Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1j Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1k Input data for NEAC Area 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	1,215	663
2002	19,174	3,937	30	40	30	40	10	20	10	20	2,176	784
2003	15,687	3,734	30	40	20	30	10	20	10	20	3,717	1,182
2004	10,947	1,990	30	40	30	40	10	20	10	20	3,989	1,301
2005	0	0	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1l Input data for NEAC Area 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	1,650	31,350	5	15	5	15	50	80	50	80
2004	6,075	20,925	5	15	5	15	50	80	50	80
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 3.9.12.1m Input data for NEAC Area 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1n Input data for NEAC Area Pre Fishery Abundance analysis using Monte Carlo simulation - UK(England and 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	31	51
1972	24,613	34,364	29	49	29	49	35	55	30	50
1973	28,989	26,097	29	48	29	48	35	55	29	49
1974	35,431	18,776	29	49	29	49	35	55	29	49
1975	36,465	25,819	29	48	29	48	35	55	29	49
1976	25,422	14,113	28	46	28	46	36	56	30	50
1977	27,836	17,260	29	49	29	49	37	57	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	37	57	31	51
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	29	48	29	48	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	15,032	6,442	13	22	13	22	20	40	12	32
2000	23,116	6,145	11	19	11	19	20	40	8	28
2001	18,867	6,289	11	18	11	18	18	38	7	27
2002	17,443	5,814	11	19	11	19	19	39	7	27
2003	10,459	5,152	13	22	13	22	17	37	6	26
2004	18497	4339	13	22	13	22	19	39	7	27
2005	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1o Input data for NEAC Area Pre Fishery Abundance analysis using Monte Carlo simulation - UK(Northern 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	0	0	0	0	0	0	0	0	0	0

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

Table 3.9.12.1p Input data for NEAC Area Pre Fishery Abundance analysis using Monte Carlo simulation - UK(Northern 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	2,382	179	0	1	0	1	30	40	15	25
2005	0	0	0	0	0	0	0	0	0	0

M(min)= 0.020 Return time (m)= 1SW(min) 7 MSW(min) 16

M(max)= 0.040 1SW(max) 9 MSW(max) 18

Table 3.9.12.1q Input data for NEAC Area 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	80,498	72,523	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	37,468	34,845	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	27,014	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	26,579	21,720	5	15	5	15	16.1	22.5	16.9	25.4
2003	25,817	24,214	5	15	5	15	14.5	20.0	15.0	23.5
2004	26,769	26,926	5	15	5	15	14.5	20.0	15.0	23.5
2005	0	0	0	0	0	0	0.0	0.0	0.0	0.0

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 3.9.12.1r Input data for NEAC Area 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	24,939	19,636	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	18,277	12,295	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	5,509	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	4,149	3,589	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	4,194	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	3,060	15	25	15	25	4.0	5.5	4.0	6.5
2004	4,920	5,647	15	25	15	25	6.0	8.0	6.0	9.0
2005	0	0	0	0	0	0	0	0	0	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 3.9.12.1s Input data for NEAC Area 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

M(min)= 0.020 Return time (m)= 1SW(min) 0 MSW(min) 1
M(max)= 0.040 1SW(max) 1 MSW(max) 2

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

Table 3.9.12.1t Input data for NEAC Area 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	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 3.9.14.1 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	25,936	9,396		154,310	17,392				49,832	62,475	1,052,216	101,917	181,294	664,965	1,872,309	**2,131,530**	2,472,624			
1972	40,717	8,616		117,445	13,813				99,598	50,866	1,123,125	90,053	159,078	572,563	1,833,674	**2,104,233**	2,467,976			
1973	36,846	10,323		173,208	17,134				61,223	54,320	1,227,057	105,649	138,709	699,285	1,998,547	**2,299,816**	2,693,224			
1974	72,776	10,326		172,968	24,730				28,334	38,499	1,398,289	131,941	151,343	668,745	2,084,953	**2,416,282**	2,851,565			
1975	50,857	12,543		264,188	26,455				56,496	60,163	1,536,785	133,472	124,375	549,876	2,124,974	**2,474,281**	2,950,951			
1976	34,930	12,664		184,861	15,085				51,776	47,539	1,047,721	88,182	86,476	448,120	1,538,304	**1,781,152**	2,105,647			
1977	17,864	17,554		117,523	7,054				40,341	48,617	907,495	99,167	85,217	495,078	1,479,626	**1,693,640**	1,977,355			
1978	24,281	17,874		118,472	8,112				41,308	63,500	791,472	111,276	111,106	566,559	1,500,566	**1,699,988**	1,956,857			
1979	28,546	17,125		163,962	8,512				47,181	58,844	730,375	104,351	77,938	475,331	1,331,508	**1,513,032**	1,748,499			
1980	12,811	2,586		117,029	10,834				98,346	26,739	552,431	96,867	98,714	299,331	1,045,562	**1,186,874**	1,369,191			
1981	19,782	13,351		96,632	19,539				78,036	34,488	357,381	100,047	77,245	370,002	922,508	**1,029,465**	1,159,388			
1982	5,793	6,125		85,018	17,228				47,925	35,474	594,756	84,853	111,803	514,217	1,256,866	**1,397,188**	1,563,950			
1983	28,512	9,039	702,152	141,667	22,896	794,924	**907,639**	1,039,104	51,292	44,830	1,092,639	123,250	156,976	549,336	1,814,218	**2,037,980**	2,314,634	2,689,605	**2,948,709**	3,252,880
1984	31,886	3,286	729,028	152,842	32,316	835,128	**951,233**	1,090,525	84,455	27,465	572,757	106,861	61,824	560,787	1,275,055	**1,421,172**	1,591,048	2,186,523	**2,375,670**	2,593,077
1985	48,136	22,624	742,030	209,232	38,286	942,749	**1,063,346**	1,202,638	31,554	44,522	928,584	107,205	79,918	464,761	1,472,841	**1,666,540**	1,900,539	2,500,644	**2,732,065**	2,999,124
1986	43,863	28,134	643,076	178,830	40,376	835,197	**938,298**	1,055,552	48,574	73,319	1,047,842	123,395	89,774	568,707	1,741,942	**1,969,804**	2,252,370	2,657,409	**2,911,044**	3,210,114
1987	55,770	16,564	542,120	191,069	32,806	750,739	**841,552**	944,617	87,011	45,476	738,801	126,047	49,266	430,827	1,320,542	**1,510,636**	1,757,869	2,137,980	**2,355,036**	2,618,070
1988	26,887	24,029	500,082	132,010	27,425	634,102	**710,124**	799,227	30,194	81,555	999,722	169,759	115,655	648,865	1,812,272	**2,045,522**	2,330,722	2,510,942	**2,760,090**	3,057,450
1989	62,565	12,918	552,721	196,806	8,803	742,591	**835,256**	947,226	15,499	45,679	672,797	111,185	111,539	696,509	1,486,529	**1,656,908**	1,863,650	2,293,131	**2,496,397**	2,723,354
1990	59,365	9,672	496,611	163,556	19,601	665,799	**750,393**	848,813	27,220	41,960	436,561	80,905	92,291	347,809	926,211	**1,032,136**	1,164,472	1,645,388	**1,785,588**	1,944,502
1991	71,986	14,091	430,674	138,455	23,696	608,487	**681,432**	765,250	19,816	46,318	326,159	78,115	51,444	336,875	788,371	**874,161**	977,365	1,444,119	**1,557,255**	1,687,309
1992	95,402	26,465	363,028	171,249	25,703	619,097	**686,056**	761,477	36,332	53,107	414,088	81,071	104,335	479,475	1,067,958	**1,186,493**	1,326,452	1,733,299	**1,874,332**	2,031,849
1993	67,316	21,774	365,747	146,706	27,653	572,300	**631,259**	699,469	51,704	52,141	329,648	112,427	122,083	455,109	1,041,985	**1,146,749**	1,285,438	1,656,264	**1,779,686**	1,930,154
1994	26,714	6,961	494,280	173,421	21,048	644,087	**725,973**	826,416	39,664	42,768	431,869	122,390	83,857	482,390	1,089,798	**1,212,392**	1,353,566	1,786,734	**1,939,877**	2,109,982
1995	26,230	17,900	322,658	155,850	30,626	495,315	**550,952**	613,869	13,354	51,779	461,425	93,213	77,905	482,501	1,067,851	**1,184,733**	1,321,182	1,606,457	**1,736,966**	1,883,211
1996	60,947	9,580	245,885	212,045	19,017	493,949	**547,146**	606,854	16,606	44,669	472,426	68,132	80,529	328,222	902,946	**1,013,637**	1,146,357	1,438,677	**1,561,196**	1,705,595
1997	51,904	13,094	283,077	208,878	8,626	507,339	**566,190**	631,544	8,485	32,657	412,836	61,919	95,176	247,375	775,293	**867,135**	979,208	1,322,749	**1,434,193**	1,564,950
1998	59,886	22,228	368,505	227,638	7,618	617,517	**688,737**	769,789	16,475	44,807	460,490	68,713	207,733	330,703	1,020,333	**1,136,089**	1,268,363	1,687,778	**1,826,349**	1,982,006
1999	86,212	10,874	342,490	176,787	11,241	565,924	**627,856**	699,134	5,536	35,611	407,270	59,769	54,200	188,193	675,921	**764,360**	874,287	1,281,963	**1,394,078**	1,519,513
2000	90,888	11,413	563,429	192,570	22,384	787,623	**880,124**	986,491	14,161	31,488	485,622	89,565	78,703	355,953	952,298	**1,063,316**	1,197,214	1,797,311	**1,946,598**	2,111,714
2001	40,877	10,183	485,744	261,572	14,544	711,466	**816,105**	945,315	12,360	27,876	497,393	78,239	62,126	342,303	940,545	**1,034,095**	1,138,265	1,705,094	**1,854,396**	2,017,632
2002	28,658	17,191	297,480	235,844	14,957	520,293	**597,041**	704,438	17,519	34,634	435,093	71,232	76,845	275,957	838,248	**920,757**	1,012,900	1,397,528	**1,522,544**	1,660,371
2003	33,940	9,152	412,811	210,887	9,115	593,097	**680,099**	789,414	11,458	41,350	430,844	47,205	69,161	279,633	808,185	**887,070**	974,714	1,445,749	**1,569,357**	1,711,089
2004	13,159	24,074	250,023	148,288	7,871	396,373	**450,992**	518,206	13,819	41,512	309,243	78,706	66,460	284,431	733,187	**802,506**	879,730	1,161,496	**1,255,625**	1,354,693
10yr Av.	49,270	14,569	357,210	203,036	14,600	568,890	640,524	726,506	12,977	38,638	437,264	71,669	86,884	311,527	871,481	967,370	1,079,222	1,484,480	1,610,130	1,751,077

Table 3.9.14.2 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	23,911	11,315		132,556	1,056				10,774	28,468	157,112	95,236	21,933	613,813	824,303	**940,011**	1,078,661			
1972	37,315	17,551		134,735	744				21,574	43,675	168,941	143,335	19,165	784,698	1,041,352	**1,194,140**	1,374,134			
1973	44,562	16,452		223,236	2,574				13,221	39,358	183,271	108,568	16,734	855,501	1,073,235	**1,230,178**	1,430,383			
1974	66,223	15,678		209,718	1,664				6,166	34,023	206,237	79,365	18,306	601,277	836,017	**957,324**	1,108,334			
1975	74,420	17,224		225,399	402				12,356	36,115	231,274	107,054	15,005	667,399	939,293	**1,084,685**	1,255,310			
1976	60,823	14,213		194,906	1,213				9,016	31,237	160,436	55,771	10,457	400,392	587,202	**677,517**	783,576			
1977	37,143	19,798		134,383	908				6,890	30,544	139,620	70,087	10,283	461,962	632,220	**723,980**	837,523			
1978	23,717	25,484		116,143	694				7,091	39,471	120,471	57,540	13,405	558,972	705,498	**813,029**	941,779			
1979	25,424	16,838		101,476	2,019				8,152	25,235	109,276	27,984	9,409	408,201	512,510	**595,798**	696,488			
1980	26,619	23,489		168,995	3,537				17,026	35,506	120,371	90,259	11,914	518,428	700,763	**795,604**	913,539			
1981	29,100	8,225		96,690	1,027				11,603	23,728	89,342	125,444	9,307	577,639	751,086	**846,809**	963,702			
1982	38,365	9,423		85,344	3,690				7,210	16,696	51,853	48,154	13,487	446,005	517,502	**586,768**	678,678			
1983	41,475	7,184	428,078	123,939	2,527	536,963	**605,069**	684,364	7,717	27,917	152,704	54,188	18,921	485,074	650,066	**767,802**	1,001,492			
1984	39,653	9,281	436,649	123,899	3,558	546,106	**614,740**	692,414	12,784	23,635	76,513	43,485	7,449	400,201	505,210	**568,602**	647,884	1,086,640	**1,185,739**	1,295,806
1985	30,513	5,977	403,171	135,397	1,489	516,204	**577,224**	649,059	9,535	17,223	83,740	64,404	9,645	493,582	603,403	**680,242**	773,359	1,155,724	**1,259,933**	1,376,955
1986	26,739	16,281	483,784	133,931	1,436	588,461	**662,482**	749,239	9,744	14,243	95,977	86,908	10,835	629,579	748,314	**852,171**	979,895	1,382,774	**1,516,625**	1,670,801
1987	33,414	16,860	362,160	99,453	4,278	461,065	**517,621**	583,617	5,141	12,693	117,845	68,205	5,556	404,594	544,994	**616,740**	705,448	1,040,430	**1,135,570**	1,246,844
1988	21,524	10,870	305,844	99,787	4,154	396,361	**442,853**	496,698	14,316	14,495	50,521	87,586	15,630	624,148	708,946	**811,931**	941,928	1,138,366	**1,257,494**	1,397,226
1989	24,305	9,186	216,251	97,092	11,655	322,671	**359,920**	403,120	6,582	12,889	62,288	69,007	12,428	543,688	628,980	**713,497**	816,668	979,456	**1,073,747**	1,186,705
1990	30,678	9,716	257,403	124,754	7,438	387,337	**430,374**	481,566	6,572	12,842	34,669	85,132	11,333	471,458	554,175	**624,264**	709,645	970,888	**1,055,957**	1,155,618
1991	36,710	6,758	217,297	122,322	8,544	355,477	**392,267**	435,497	5,961	12,775	32,649	36,568	5,827	341,981	384,453	**438,325**	502,580	763,979	**831,807**	907,839
1992	39,143	10,062	235,183	116,412	11,000	373,075	**412,595**	458,694	7,694	14,406	43,557	27,866	13,305	449,582	492,621	**561,069**	644,328	893,920	**974,526**	1,068,949
1993	45,308	11,358	226,787	137,776	15,009	401,665	**438,155**	479,156	3,709	7,071	42,550	30,370	31,388	375,888	435,027	**494,580**	568,416	861,546	**934,791**	1,018,609
1994	37,598	9,608	221,979	121,852	10,982	366,658	**404,819**	446,950	7,648	11,447	53,483	42,477	11,046	454,348	514,702	**584,992**	669,756	908,438	**990,665**	1,085,427
1995	23,423	5,969	238,138	138,698	7,730	377,651	**413,958**	457,185	3,634	11,526	41,381	42,335	9,345	430,660	476,387	**541,666**	626,514	879,530	**957,478**	1,051,064
1996	20,669	7,830	238,383	104,539	9,840	344,550	**381,393**	423,420	6,497	7,414	42,821	42,603	10,256	321,409	382,535	**433,061**	497,621	750,054	**816,578**	893,603
1997	29,954	4,411	159,270	85,195	6,401	259,042	**285,820**	316,731	3,347	8,347	37,221	26,774	12,717	225,434	275,378	**321,047**	380,544	551,619	**607,789**	672,514
1998	25,281	6,429	191,230	105,477	4,730	303,980	**333,825**	367,647	2,819	5,177	33,464	16,445	17,376	233,455	275,419	**311,046**	355,855	596,907	**645,937**	700,986
1999	23,654	6,860	204,578	93,171	4,053	300,423	**333,201**	370,415	6,086	9,796	36,687	35,802	7,946	198,745	265,698	**299,188**	342,166	583,071	**633,323**	689,069
2000	52,584	3,949	282,936	162,217	8,859	465,927	**511,531**	562,023	4,247	2,590	63,287	40,752	10,602	256,947	339,300	**385,610**	446,687	828,835	**897,717**	976,204
2001	75,544	4,387	333,112	114,655	10,728	484,520	**538,879**	599,158	4,970	4,604	62,953	43,989	7,854	247,994	332,217	**380,243**	451,432	843,659	**921,159**	1,011,543
2002	60,650	4,025	288,940	125,599	7,851	475,697	**523,530**	577,658	3,692	4,848	66,410	40,130	10,617	203,808	293,225	**336,807**	396,572	793,309	**861,359**	941,000
2003	43,014	3,730	255,821	87,317	8,937	386,375	**423,907**	467,117	5,298	8,109	51,327	39,021	9,906	230,822	298,681	**354,838**	427,239	708,960	**780,715**	861,940
2004	20,541	3,802	231,206	67,217	6,471	312,485	**347,277**	387,951	9,929	6,424	45,311	30,795	8,751	260,873	316,906	**370,642**	438,819	651,923	**719,044**	797,411
10yr Av.	37,531	5,139	242,361	108,408	7,560	371,065	**409,332**	452,931	5,052	6,883	48,086	35,865	10,537	261,015	325,575	**373,415**	436,345	718,787	**784,110**	859,533

Table 3.9.14.3 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	33,181	11,996		198,489	22,414				63,596	91,364	1,345,743	129,989	231,532	838,736	2,347,634	**2,703,451**	3,171,459			
1972	51,608	10,973		150,661	17,737				126,068	75,852	1,432,514	114,635	202,517	722,051	2,297,490	**2,668,074**	3,163,279			
1973	47,169	13,128		222,105	21,906				77,635	82,394	1,555,084	134,836	176,330	878,509	2,505,357	**2,916,455**	3,457,723			
1974	92,994	13,098		221,230	31,491				35,923	62,660	1,772,800	167,478	193,041	842,278	2,618,451	**3,064,188**	3,654,022			
1975	64,967	15,985		339,366	34,019				71,947	92,593	1,965,618	169,832	158,427	691,974	2,667,654	**3,137,329**	3,788,510			
1976	44,443	16,030		236,788	19,201				66,024	76,533	1,329,295	112,630	110,345	564,017	1,930,358	**2,260,085**	2,712,977			
1977	22,845	22,340		150,856	9,042				50,553	84,617	1,153,086	125,497	108,465	623,534	1,854,939	**2,148,795**	2,549,805			
1978	31,071	22,672		152,337	10,337				52,003	104,202	1,006,390	141,439	141,271	713,535	1,881,595	**2,154,362**	2,505,101			
1979	36,355	21,668		211,458	10,928				60,648	97,059	926,555	133,661	99,385	597,289	1,666,820	**1,921,345**	2,240,423			
1980	16,537	3,288		150,460	13,962				124,640	37,265	703,354	123,575	125,463	377,847	1,315,832	**1,508,003**	1,758,222			
1981	25,454	16,916		124,882	25,252				98,906	61,018	456,348	128,169	98,680	466,697	1,161,303	**1,308,735**	1,482,475			
1982	7,707	7,806		109,962	22,247				61,287	52,903	754,640	108,307	142,734	647,490	1,579,096	**1,774,027**	2,006,678			
1983	36,544	11,534	894,670	182,490	29,617	1,008,389	**1,160,639**	1,340,565	66,181	68,675	1,395,739	156,857	199,895	692,866	2,274,163	**2,585,868**	2,986,739			
1984	40,598	4,188	927,966	195,809	41,235	1,055,969	**1,214,155**	1,404,990	107,389	39,150	730,556	136,250	78,700	705,828	1,599,822	**1,802,102**	2,036,489	2,760,989	**3,020,798**	3,319,942
1985	61,498	28,867	943,260	269,021	48,867	1,190,590	**1,357,334**	1,548,064	40,188	86,245	1,181,279	136,938	101,836	586,674	1,847,486	**2,113,920**	2,444,065	3,154,611	**3,474,884**	3,853,579
1986	55,936	35,969	818,044	229,516	51,481	1,056,413	**1,196,601**	1,359,538	62,333	129,755	1,330,713	157,238	114,720	714,701	2,189,495	**2,499,024**	2,892,330	3,352,929	**3,700,056**	4,120,717
1987	71,306	21,190	691,300	245,848	41,632	950,978	**1,075,615**	1,217,350	109,105	79,592	940,619	160,590	62,605	543,778	1,659,359	**1,916,375**	2,249,877	2,706,197	**2,995,359**	3,355,958
1988	34,204	30,643	636,157	169,186	34,961	806,215	**906,577**	1,028,226	38,547	135,495	1,267,189	215,707	147,414	818,264	2,278,766	**2,596,185**	2,992,309	3,166,680	**3,507,947**	3,923,655
1989	79,561	16,417	704,779	250,759	11,303	937,909	**1,064,436**	1,218,396	20,231	74,887	856,530	142,104	141,947	879,498	1,861,285	**2,100,225**	2,392,768	2,887,818	**3,171,940**	3,489,501
1990	75,409	12,393	632,740	208,363	24,870	843,496	**956,073**	1,089,655	34,919	65,822	554,319	102,524	117,255	437,953	1,164,913	**1,308,870**	1,491,078	2,077,625	**2,269,765**	2,487,915
1991	91,695	17,929	549,222	177,545	30,132	770,079	**869,070**	986,584	25,634	77,415	414,992	99,363	65,556	424,323	993,185	**1,108,758**	1,252,383	1,827,607	**1,980,007**	2,157,877
1992	121,950	33,864	462,292	219,065	32,960	782,633	**874,115**	976,325	45,657	101,811	527,812	103,002	132,760	605,001	1,341,935	**1,503,207**	1,696,539	2,188,630	**2,380,419**	2,594,811
1993	85,669	27,781	464,608	188,715	35,154	723,244	**805,051**	898,123	66,159	94,427	418,882	143,448	155,519	572,445	1,306,908	**1,454,109**	1,638,864	2,089,758	**2,261,850**	2,465,487
1994	34,096	8,856	630,261	222,584	26,685	812,108	**925,386**	1,067,127	50,898	63,520	547,953	155,893	106,784	607,718	1,367,254	**1,534,723**	1,734,914	2,258,090	**2,464,791**	2,704,620
1995	33,460	22,842	410,168	200,081	39,354	627,251	**702,857**	790,306	17,170	89,187	584,803	119,086	99,057	606,869	1,341,305	**1,499,995**	1,694,507	2,026,451	**2,205,458**	2,412,665
1996	77,685	12,145	312,284	272,619	24,186	624,496	**698,550**	785,476	21,229	69,368	601,726	86,339	102,385	413,463	1,131,912	**1,285,401**	1,468,763	1,813,417	**1,986,003**	2,184,716
1997	66,117	16,613	359,621	267,211	11,050	642,403	**722,971**	814,864	10,764	58,522	525,576	78,601	121,498	311,297	973,370	**1,099,343**	1,258,960	1,670,079	**1,823,370**	2,006,080
1998	76,108	28,281	468,864	293,260	9,727	780,569	**879,076**	995,546	20,961	85,652	581,918	87,418	264,837	416,219	1,280,883	**1,441,028**	1,626,186	2,128,490	**2,321,081**	2,542,684
1999	109,142	13,868	435,591	225,786	14,366	715,180	**800,429**	900,019	7,087	59,421	519,671	76,026	68,790	236,756	846,029	**969,108**	1,120,166	1,616,836	**1,772,517**	1,948,629
2000	115,336	14,504	716,500	247,838	28,501	994,662	**1,123,209**	1,268,841	18,126	54,943	617,887	113,847	100,078	447,308	1,194,080	**1,347,457**	1,534,989	2,267,634	**2,475,482**	2,706,987
2001	51,981	12,916	617,742	334,347	18,571	898,779	**1,041,939**	1,215,362	15,827	48,498	631,491	99,342	79,085	431,381	1,177,115	**1,309,306**	1,467,317	2,149,167	**2,356,356**	2,585,201
2002	36,449	21,865	377,701	302,870	18,935	655,514	**762,808**	911,675	22,107	66,258	554,155	90,120	97,882	347,548	1,048,420	**1,166,810**	1,301,956	1,763,459	**1,935,612**	2,131,200
2003	43,195	11,660	524,225	271,025	11,636	749,172	**867,169**	1,014,792	14,586	64,501	546,959	59,824	88,364	352,303	1,008,550	**1,124,102**	1,257,510	1,822,239	**1,994,548**	2,193,134
2004	16,636	30,810	317,959	188,948	9,987	503,141	**575,386**	666,599	17,611	84,305	394,371	99,870	84,519	357,281	918,659	**1,016,494**	1,127,627	1,464,924	**1,595,060**	1,735,121
10yr Av.	62,611	18,550	454,066	260,398	18,631	719,117	817,439	936,348	16,547	68,066	555,856	91,047	110,649	392,043	1,092,032	1,225,904	1,385,798	1,872,270	2,046,549	2,244,642

Table 3.9.14.4 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 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	63,535	29,738		262,405	6,019				52,918	73,438	382,895	341,555	31,905	1,756,784	2,328,921	**2,655,562**	3,058,416			
1972	75,278	27,884		421,666	8,931				34,159	66,215	380,797	256,776	27,856	1,764,486	2,215,001	**2,551,354**	2,986,190			
1973	111,304	26,377		391,389	6,383				21,357	56,812	411,283	200,090	30,590	1,300,623	1,776,870	**2,041,347**	2,366,200			
1974	124,523	29,166		423,903	4,752				31,211	60,630	452,688	246,778	25,064	1,404,192	1,939,228	**2,246,061**	2,612,813			
1975	102,341	24,027		363,311	5,465				27,849	52,367	342,836	168,775	17,432	1,000,713	1,432,822	**1,625,410**	1,855,769			
1976	62,142	33,169		250,571	3,770				19,199	50,987	279,558	163,243	17,161	974,862	1,314,107	**1,513,654**	1,761,333			
1977	39,963	42,899		214,507	3,178				20,660	65,800	252,147	148,808	22,377	1,164,749	1,468,263	**1,696,525**	1,981,233			
1978	42,370	28,298		195,502	5,746				19,240	42,269	216,962	80,680	15,685	839,616	1,050,571	**1,226,750**	1,446,245			
1979	44,527	39,696		337,040	11,331				36,604	59,391	256,369	205,570	19,883	1,111,290	1,477,397	**1,693,420**	1,968,173			
1980	49,141	14,292		231,873	10,188				26,964	40,138	209,388	265,472	15,568	1,223,674	1,566,800	**1,797,747**	2,078,300			
1981	63,521	16,339		208,709	13,988				18,441	28,452	139,509	125,543	22,507	968,344	1,143,601	**1,307,822**	1,526,213			
1982	69,555	12,455		265,470	10,453				18,063	47,015	297,402	127,677	31,637	991,752	1,311,984	**1,554,072**	1,978,797			
1983	65,568	15,767	799,718	250,422	10,092	1,007,104	**1,144,450**	1,312,020	23,553	39,886	150,297	91,988	12,427	765,471	945,260	**1,091,582**	1,271,006	2,030,060	**2,241,528**	2,481,419
1984	51,556	10,262	743,463	271,103	6,664	955,363	**1,082,122**	1,235,064	17,808	28,886	159,801	124,736	16,087	911,826	1,087,315	**1,264,303**	1,483,223	2,119,059	**2,351,945**	2,610,453
1985	44,829	27,605	887,877	271,586	7,307	1,084,348	**1,237,235**	1,421,077	22,105	24,256	202,604	185,899	18,112	1,243,045	1,467,370	**1,702,356**	2,004,973	2,654,650	**2,943,310**	3,292,705
1986	56,163	28,477	683,474	209,743	11,871	873,212	**990,248**	1,132,379	13,970	21,515	235,915	150,908	9,259	847,872	1,121,676	**1,283,231**	1,484,322	2,072,408	**2,276,687**	2,519,655
1987	36,220	18,316	556,112	196,976	9,788	717,555	**817,987**	933,182	28,919	24,364	117,288	180,220	26,092	1,192,418	1,348,568	**1,577,598**	1,856,046	2,141,460	**2,399,422**	2,702,177
1988	40,790	15,682	418,514	197,193	23,052	619,996	**696,446**	787,190	17,315	21,833	146,060	156,345	20,762	1,095,189	1,271,960	**1,465,478**	1,712,943	1,954,393	**2,165,322**	2,427,081
1989	51,008	16,441	482,462	244,782	15,581	720,625	**809,122**	917,232	13,123	21,652	76,177	160,949	18,892	872,093	1,001,363	**1,165,287**	1,373,688	1,783,354	**1,976,175**	2,209,812
1990	61,576	11,354	385,019	226,253	15,705	621,809	**698,984**	791,832	11,061	21,443	63,652	70,126	9,702	614,039	671,378	**792,443**	941,665	1,349,813	**1,494,667**	1,667,977
1991	65,550	16,867	404,575	209,131	19,207	632,892	**714,125**	812,407	15,524	24,150	87,853	62,782	22,225	827,298	890,546	**1,045,356**	1,240,414	1,582,894	**1,762,519**	1,983,681
1992	76,273	19,027	389,298	246,766	26,004	675,005	**755,154**	845,357	8,014	11,850	82,298	63,107	52,330	684,592	773,067	**905,407**	1,077,107	1,503,158	**1,664,301**	1,857,062
1993	63,004	16,085	380,670	221,636	19,109	620,817	**700,571**	792,097	12,865	19,195	91,091	73,845	18,426	774,731	834,147	**995,577**	1,201,769	1,512,473	**1,699,729**	1,920,487
1994	39,226	10,011	409,219	251,125	13,482	637,330	**717,560**	812,377	6,097	19,291	71,027	73,626	15,604	734,047	769,039	**925,178**	1,122,885	1,466,698	**1,646,408**	1,864,552
1995	34,639	13,135	408,947	190,860	17,102	582,808	**661,109**	751,010	11,170	12,408	75,100	75,936	17,107	558,998	640,053	**755,113**	905,213	1,270,508	**1,418,903**	1,594,531
1996	49,761	7,389	267,111	151,830	10,838	427,824	**485,902**	550,440	5,948	13,949	63,891	47,835	21,275	390,786	457,706	**554,830**	679,357	927,310	**1,043,745**	1,177,226
1997	42,129	10,734	320,116	187,329	8,013	499,417	**565,078**	641,461	4,912	8,638	56,724	29,283	29,229	398,929	449,540	**531,411**	635,641	989,293	**1,099,081**	1,223,147
1998	39,483	11,452	341,218	165,717	6,831	494,244	**563,938**	648,385	10,248	16,334	61,357	61,535	13,268	337,818	429,424	**507,438**	606,389	964,887	**1,073,774**	1,199,644
1999	87,867	6,611	473,061	288,542	14,940	767,575	**865,879**	979,593	7,123	4,313	105,892	69,940	17,736	436,000	551,488	**653,252**	784,165	1,370,493	**1,521,580**	1,694,432
2000	126,005	7,360	556,227	203,839	17,848	795,122	**910,372**	1,041,327	8,407	7,684	105,580	77,044	13,034	424,471	541,697	**649,215**	793,399	1,398,160	**1,563,310**	1,758,761
2001	101,508	6,748	482,520	222,633	13,233	780,539	**885,186**	1,004,103	6,337	8,072	112,599	70,780	17,750	349,403	484,131	**576,739**	698,026	1,318,005	**1,464,241**	1,629,766
2002	71,728	6,242	426,807	155,578	14,962	632,775	**716,014**	813,234	8,991	13,496	86,478	66,832	16,583	391,253	490,763	**602,088**	744,447	1,179,314	**1,320,229**	1,488,666
2003	34,556	6,383	386,550	119,833	10,851	513,368	**587,084**	676,281	16,751	10,738	75,565	53,766	14,686	442,175	520,487	**628,772**	769,275	1,079,913	**1,217,921**	1,381,405
2004																				
10yr Av.	62,690	8,607	407,178	193,729	12,810	613,100	**695,812**	791,821	8,598	11,492	81,421	62,658	17,627	446,388	533,433	**638,403**	773,880	1,196,458	**1,336,919**	1,501,213

Table 3.9.14.5 Estimated number of 1SW SPAWNERS 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	12,980	4,697		77,548	8,242				48,175	31,400	396,074	54,542	36,472	262,993	209,131	**884,545**	290,176			
1972	20,151	4,316		59,724	6,512				95,530	25,336	418,826	48,968	31,796	201,782	223,851	**858,835**	311,885			
1973	18,490	5,137		88,789	8,048				58,717	26,981	454,658	57,859	27,823	256,166	243,145	**944,221**	335,596			
1974	36,340	5,125		90,013	11,593				27,222	19,473	523,638	72,441	30,415	227,747	262,212	**943,780**	370,705			
1975	25,392	6,263		133,920	12,578				54,513	30,118	578,713	73,079	24,972	203,182	274,439	**1,009,610**	398,855			
1976	17,458	6,291		90,396	7,139				50,100	23,534	391,430	47,889	17,334	174,926	197,360	**728,938**	276,328			
1977	8,961	8,752		58,359	3,331				38,412	24,303	340,003	52,579	17,114	186,269	174,563	**717,667**	239,626			
1978	12,200	8,892		58,172	3,829				39,507	31,887	295,585	59,706	22,267	238,969	162,343	**746,925**	219,740			
1979	14,227	8,475		84,021	4,011				45,745	29,345	272,417	57,003	15,654	176,544	149,283	**659,663**	198,111			
1980	6,428	1,289		60,115	5,090				94,351	13,294	206,642	52,064	19,737	118,019	120,818	**547,913**	160,541			
1981	9,862	6,625		49,665	9,233				75,038	17,215	134,577	53,520	15,504	144,024	95,314	**491,731**	114,818			
1982	2,886	3,061		45,450	8,149				46,079	17,617	158,642	44,957	22,347	215,786	113,927	**556,149**	133,038			
1983	14,144	4,529	163,658	75,212	10,839	67,165	**271,571**	80,787	49,884	22,388	388,310	64,986	31,443	223,606	170,674	**862,787**	217,718	191,467	**1,136,435**	236,326
1984	15,830	1,643	164,696	80,467	15,207	70,426	**281,436**	83,508	81,346	13,775	211,343	56,138	12,310	244,956	120,472	**676,359**	142,342	143,438	**959,274**	165,466
1985	24,021	11,346	172,648	107,323	18,137	78,022	**336,762**	87,297	30,372	22,212	235,140	56,221	16,092	226,455	146,140	**638,661**	181,781	171,584	**977,564**	202,849
1986	21,965	14,178	150,858	92,104	19,064	66,702	**302,986**	76,608	45,519	36,443	329,278	64,673	18,027	273,410	184,993	**838,363**	225,066	197,325	**1,141,999**	236,747
1987	28,019	8,323	128,258	98,011	15,204	59,658	**280,378**	70,370	79,349	22,710	270,327	66,262	15,245	199,709	153,307	**715,152**	218,634	168,806	**995,955**	226,542
1988	13,360	12,031	119,969	73,650	12,798	45,847	**232,672**	53,290	28,031	40,872	430,507	88,445	41,132	425,673	184,280	**1,095,487**	228,357	193,245	**1,329,801**	235,203
1989	24,979	6,428	189,693	103,863	4,142	62,506	**330,231**	76,723	14,676	22,818	248,795	57,568	12,331	471,311	140,858	**858,877**	171,519	159,918	**1,190,861**	185,833
1990	23,664	4,875	169,877	91,922	10,652	54,797	**302,460**	67,634	25,526	20,938	185,757	41,751	35,047	227,518	88,597	**571,296**	110,281	109,722	**876,742**	124,880
1991	28,879	7,026	146,470	88,022	13,006	49,334	**284,315**	59,031	18,669	23,037	152,255	40,788	18,322	234,276	73,157	**521,283**	87,437	89,165	**806,866**	103,565
1992	38,450	13,316	123,074	125,572	14,232	51,487	**317,409**	56,969	33,480	26,336	149,674	42,496	45,969	349,450	99,345	**679,400**	120,694	113,868	**997,799**	133,761
1993	27,045	10,922	122,869	109,110	15,164	46,569	**286,842**	52,778	48,357	25,959	134,848	62,921	72,178	314,760	94,660	**713,941**	130,494	107,421	**1,002,224**	137,231
1994	10,727	3,474	169,974	126,367	11,420	63,155	**324,978**	76,188	37,071	21,414	124,534	67,525	25,247	337,592	105,676	**655,845**	123,976	126,960	**983,700**	142,309
1995	10,487	8,914	109,396	111,416	19,345	44,476	**256,890**	49,273	11,824	26,043	154,425	54,825	25,802	346,077	96,328	**660,372**	112,891	110,085	**918,050**	122,251
1996	30,543	4,781	81,883	155,415	11,839	45,185	**283,094**	53,547	14,537	22,231	204,533	40,378	34,730	243,350	90,931	**573,264**	110,698	104,756	**858,348**	120,003
1997	25,957	6,537	105,367	158,176	5,426	51,635	**302,910**	57,864	7,385	16,468	184,056	38,738	38,246	180,785	75,331	**487,737**	91,824	93,289	**792,260**	109,503
1998	29,961	11,108	138,209	172,705	4,782	60,569	**359,028**	70,188	14,366	22,377	195,095	44,656	156,176	256,726	99,084	**713,206**	113,198	119,380	**1,073,456**	134,391
1999	34,060	5,442	127,676	137,211	7,050	52,716	**313,006**	60,096	4,878	17,750	195,589	41,340	20,059	143,968	71,155	**451,560**	89,142	92,881	**766,449**	104,619
2000	36,250	5,663	212,898	149,200	13,984	74,824	**418,748**	88,141	12,435	15,763	220,223	62,307	33,024	279,383	93,391	**659,335**	110,813	127,900	**1,080,296**	137,216
2001	16,372	5,089	186,131	225,628	9,081	91,120	**444,220**	119,784	10,861	13,870	258,240	55,938	31,117	274,151	91,894	**679,278**	102,622	141,071	**1,128,919**	151,895
2002	14,277	8,569	111,311	199,074	9,290	69,868	**345,304**	102,706	13,880	17,302	218,183	50,247	23,130	222,905	81,312	**584,500**	91,425	119,833	**935,411**	133,919
2003	16,977	4,585	156,539	180,084	5,722	76,643	**367,876**	100,347	9,193	20,724	252,685	34,312	30,057	241,662	77,344	**607,370**	86,760	116,920	**977,974**	133,289
2004	6,537	12,132	94,049	121,534	4,878	47,932	**246,899**	62,972	11,042	20,746	155,607	56,241	36,056	241,154	68,726	**543,335**	76,012	89,331	**792,993**	95,479
10yr Av.	22,142	7,282	132,346	161,044	9,140	61,497	**333,797**	76,492	11,040	19,327	203,864	47,898	42,840	243,016	84,550	**595,996**	98,538	111,545	**932,416**	124,257

Table 3.9.14.6 Estimated number of MSW 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 N&E	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	10,893	4,540		54,627	447				6,765	11,342	83,054	56,223	10,945	357,833	103,087	**571,898**	122,795			
1972	17,067	7,065		56,525	315				13,418	17,582	89,277	86,065	9,569	449,323	132,976	**714,364**	160,475			
1973	20,224	6,604		92,906	1,095				8,185	15,805	96,655	65,501	8,370	491,650	137,034	**738,384**	176,519			
1974	29,786	6,212		91,281	697				3,843	13,546	107,796	48,106	9,167	320,273	107,639	**538,351**	134,910			
1975	33,324	6,901		93,802	169				7,710	14,428	121,853	65,345	7,518	354,590	128,282	**615,025**	151,721			
1976	27,469	5,643		77,615	512				5,562	12,412	83,917	33,269	5,229	236,398	79,549	**393,322**	95,593			
1977	16,678	7,885		54,805	384				4,330	12,234	73,482	41,208	5,144	246,492	81,400	**413,159**	99,660			
1978	10,692	10,198		45,714	292				4,464	15,650	63,309	34,386	6,727	317,816	93,272	**475,537**	113,625			
1979	13,754	6,676		41,768	850				5,121	10,137	56,784	16,759	4,710	217,919	71,148	**329,277**	88,312			
1980	14,519	9,407		68,752	1,490				10,581	14,085	62,911	53,999	5,956	279,398	86,935	**456,120**	107,486			
1981	16,084	3,296		40,753	436				7,509	9,487	46,532	74,518	4,669	319,111	87,142	**514,845**	108,636			
1982	20,883	3,793		37,528	1,549				4,647	6,713	32,771	28,491	6,757	267,888	63,846	**370,759**	84,659			
1983	22,714	2,879	101,253	57,493	1,063	42,895	**187,598**	50,009	4,993	11,157	109,336	32,068	9,504	279,000	110,933	**492,383**	231,830	126,222	**683,062**	232,933
1984	21,625	3,689	103,363	59,543	1,495	41,756	**190,834**	48,912	8,221	9,501	43,255	25,603	3,722	249,572	58,561	**361,868**	73,495	75,922	**554,492**	87,862
1985	17,033	2,388	94,667	58,794	629	37,475	**174,086**	43,968	6,209	6,893	53,632	37,672	4,834	328,473	70,786	**462,255**	87,168	85,147	**637,582**	98,024
1986	14,640	6,508	114,506	54,514	608	44,100	**191,689**	52,484	6,230	5,775	51,803	50,696	5,435	418,803	96,316	**572,038**	119,956	110,650	**765,081**	128,298
1987	18,369	6,704	87,547	44,125	1,789	35,394	**159,903**	41,069	3,340	5,055	79,855	40,217	3,004	262,706	65,302	**409,914**	81,643	77,414	**571,080**	90,575
1988	11,867	4,314	73,430	49,015	1,755	28,509	**140,872**	34,010	9,415	5,788	18,510	51,542	10,025	467,995	98,905	**585,137**	124,306	105,622	**726,971**	129,075
1989	10,893	3,688	74,058	45,010	4,926	26,577	**140,433**	29,406	4,243	5,189	25,944	40,023	4,969	411,004	81,354	**512,349**	100,080	86,416	**652,624**	106,049
1990	13,668	3,847	88,417	55,006	3,659	29,678	**165,649**	35,399	4,327	5,151	12,005	49,902	7,029	346,444	66,865	**452,154**	82,950	74,762	**619,078**	89,655
1991	16,702	2,690	73,550	59,642	4,291	26,947	**157,631**	31,246	3,886	5,116	17,662	21,398	3,322	261,083	52,356	**321,857**	62,558	60,836	**480,229**	68,870
1992	17,675	4,026	79,891	57,236	5,439	28,614	**165,930**	32,995	5,012	5,758	21,026	16,356	8,910	351,375	66,339	**416,736**	81,905	74,460	**583,569**	87,198
1993	20,654	4,521	75,755	66,803	7,542	28,138	**176,144**	31,938	2,404	2,829	25,389	18,818	27,641	287,090	58,222	**375,402**	72,316	67,533	**552,765**	78,956
1994	17,004	3,804	74,551	66,679	5,513	29,460	**169,390**	34,628	5,384	4,617	26,672	26,003	6,631	349,669	68,265	**432,283**	83,282	76,309	**602,192**	90,478
1995	10,642	2,368	81,016	67,819	4,390	28,256	**166,066**	33,018	2,532	4,610	14,730	27,086	5,429	329,393	63,477	**399,449**	83,126	72,184	**567,027**	88,448
1996	11,382	3,126	80,118	53,891	5,588	27,945	**153,818**	31,450	4,504	2,967	19,224	27,707	6,785	251,376	49,007	**319,378**	63,186	59,078	**475,098**	70,938
1997	16,329	1,762	57,463	44,731	3,676	22,193	**124,658**	25,935	2,339	3,331	19,603	18,074	8,378	174,826	45,410	**239,251**	59,372	52,311	**364,473**	63,283
1998	13,942	2,561	69,576	48,606	2,740	24,441	**137,556**	27,457	1,983	2,075	12,755	11,503	13,517	187,669	34,661	**233,877**	43,894	45,400	**372,328**	51,377
1999	11,788	2,739	71,981	52,599	2,343	26,009	**142,556**	29,711	4,295	3,938	19,307	27,942	5,373	157,509	33,048	**229,148**	42,602	43,996	**372,325**	51,297
2000	26,244	1,584	103,123	85,038	5,113	37,243	**221,187**	41,286	2,954	1,027	43,484	33,125	7,173	208,483	45,888	**311,112**	60,596	61,978	**532,361**	72,859
2001	37,754	1,760	122,640	71,563	6,084	43,593	**240,234**	49,307	3,463	1,839	42,494	37,044	5,467	202,274	47,446	**307,148**	70,636	68,907	**548,656**	83,509
2002	30,437	1,615	106,972	75,363	4,540	39,067	**255,313**	44,230	2,282	1,925	48,158	33,607	6,582	168,221	43,413	**274,288**	59,692	61,302	**530,690**	73,971
2003	21,550	1,484	95,857	52,108	5,148	31,339	**201,430**	36,014	3,324	3,234	36,391	32,082	6,945	197,533	55,836	**293,351**	72,165	66,982	**496,192**	79,520
2004	10,323	1,524	87,584	38,349	3,711	27,939	**159,224**	32,751	6,242	2,571	31,601	25,641	6,463	222,305	53,740	**305,796**	67,795	62,143	**465,572**	74,710
10yr Av.	19,039	2,052	87,633	59,007	4,333	30,803	**180,204**	35,116	3,392	2,752	28,775	27,381	7,211	209,959	47,193	**291,280**	62,307	59,428	**472,472**	70,991

Table 3.9.15.1 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	1.8	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	2.0	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	0.8	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	2.2	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	4.0	2.2	-	-	2.8	16.5
2000	6.3	0.8	0.5	-		9.4	0.0	0.3	1.0	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	3.6	2.0	9.0	3.2	0.4	12.4
2002	4.4	0.8				6.1		1.1	0.2	5.5	0.8	3.2	2.5	0.5	11.3
2003	9.1	1.2				8.0		3.6		3.3					6.8
Mean															
(5-year)	5.7	1.2	0.7	-	-	7.9	0.7	1.1	0.5	5.8	1.3	6.9	3.1	1.9	13.9
(10-year)	7.0	1.4	0.8	1.3	0.7	8.2	0.7	1.3	0.3	6.9	1.2	9.7	3.4	4.6	21.8

[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 3.9.15.2 Estimated survival of hatchery smolts (%) to adult 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	6.7	0.5	2.0	1.8	2.1	
2000	1.0	0.1	1.1	0.2	5.8	0.0	1.3	0.7		
2001	0.2	0.1	1.9	0.3	2.3	0.2	2.5	1.1		
2002	0.4		1.3	0.0	2.1	0.3	1.2	0.8		
2003			0.3		2.5		0.3			
Mean										
(5-year)	0.6	0.1	1.2	0.2	3.9	0.2	1.8	1.0	1.9	0.9
(10-year)	0.6	0.1	1.3	0.2	3.6	0.2	1.5	0.8	2.6	0.8

[1] Microtagged.

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

Table 3.9.15.2 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	2+ smolts
1980	8.6		3.3			8.3	0.9				
1981	2.8		6.9			2.0	1.2				
1982	4.1		8.2			16.3	2.7	16.1			
1983	3.9		2.3			2.0	1.7	4.1		1.9	8.1
1984	4.9	10.4	23.5			2.3	5.2	13.2	9.2	13.3	-
1985	4.8	12.3	26.3			14.7	1.4	14.4	7.9	15.4	17.5
1986	9.1	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	4.1	0.2	11.4	9.7		0.8	3.5	4.0	1.3	5.4	8.8
1992	4.3	1.3	5.3	9.8	4.2	-	0.9	0.6	-	6.0	7.8
1993	2.9	2.2	12.0	13.0	5.4	-	1.0	-	-	1.1	5.8
1994	5.1	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	9.8	3.4	-	-	-	-	2.0	2.3
1997	6.0	0.4	13.3	15.8	5.3	7.0	-	-	7.6	-	4.1
1998	3.1	1.3	5.6	6.9	2.9	4.6	3.3	2.9	2.5	2.3	4.5
1999	1.0	2.8	8.2	14.5	2.0	-	-	3.6	3.5	2.7	5.8
2000	1.2	3.8	11.8	14.2	5.4	3.5	6.7	-	4.0	2.8	4.4
2001	2.0	2.5	9.7	17.0	3.2	2.0	3.4	-	5.9	1.1	2.2
2002	1.0	4.1	9.2	10.3	2.0	2.0	-	2.0	1.9	0.7	3.1
2003	1.1	0.0	5.8	3.6	1.6	4.2	-	1.1	1.0	2.5	1.9
Mean											
(5-year)	1.7	2.9	8.9	12.6	3.1	3.0	4.5	2.8	3.6	2.0	4.0
(10-year)	2.9	2.5	9.6	10.9	4.4	3.8	3.4	3.5	4.2	1.9	3.8

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

[2] Different release sites

[3] Microtagged.

			Number of weeks of disaggregated data				
Country	Species	Gear	2000	2001	2002	2003	Grand Total
Denmark	Herring	PT	114	89	66	65	334
	Mackerel	PT	12	26	15	4	57
Den Total			126	115	81	69	391
Faroes	BWH	BT	1	10			11
		PS	66	10			76
		PT	159	124			283
	BWH Total		226	144			370
	Cap	PS	51	25			76
	Herring	PS	110	45			155
		PT	4	29			33
	Herring Total		114	74			188
	Mackerel	PS	52				52
		PT	15				15
	Mackerel Total		67				67
Far Total			458				458
Germany	BWH	PT	34	39	35	56	164
	Herring	PT	69	93	83	100	345
	Mackerel	PT	16	32	26	13	87
Ger Total			119	164	144	169	596
Ireland	Herring	PPT	21	25	13	87	146
		PT	42	32			74
	Herring Total		63	57	13	87	220
	Mackerel	PPT	56	61	52	59	228
		PT	15	22	18	1	56
	Mackerel Total		71	83	70	60	284
Irl Total			134	140	83	147	504
Norway	BWH	PS	75	95	20	25	215
		PT	634	810	802	1225	3471
	BWH Total		709	905	822	1250	3686
	Herring	DRFNT			11	7	18
		PS	1486	1455	1171	1809	5921
		PT	174	83	65	68	390
	Herring Total		1660	1538	1247	1884	6329
	Mackerel	DRFNT	4	7	458	502	971
		PS	846	884	1378	900	4008
		PT	115	144	3136	2733	6128
	Mackerel Total		965	1035	4972	4135	11107
Nor Total			3334	3478	7041	7269	21122
Russia	BWH	PT	643	795	826	903	3167
	Herring	PS	37	34	10		81
		PT	245	299	393	494	1431
	Mackerel	PT	404	342	314	364	1424
Rus Total			1329	1470	1543	1761	6103
UK(England and Wales)	Herring	BT	105	95	96	26	322
		PPT	94	118	108	152	472
		PT	357	376	270	291	1294
	Herring Total		556	589	474	469	2088
	Mackerel	BT	163	132	97	60	452
		PPT	173	248	289	299	1009
		PT	1543	1440	1192	1272	5447
	Mackerel Total		1879	1820	1578	1631	6908
UK(England and Wales) Total			2435	2409	2052	2100	8996
UK(Scotland)	Herring	BT				1	1
		PPT	182	199	165	72	618
		PS	94	30	9		133
		PT	250	153	165	195	763
	Herring Total		526	382	339	268	1515
	Mackerel	PPT	4	2			6
		PT	129	14	1	3	147
	Mackerel Total		133	16	1	3	153
UK(Scotland) Total			659	398	340	271	1668
Grand Total			8594	8174	11284	11786	39838

Table 3.11.1.1 The number of disaggregated weekly catch records provided to the Study Group for each country, fleet and species i.e. for each ICES Division there is a weekly landing record in weight of fish and by gear type. (BWH = Blue Whiting, PT = Pelagic trawl, PPT = Pair trawl, BT = Bottom trawl, PS = Purse seine, DRFNT = Driftnet)

	Species			
Division	Blue Whiting	Capelin	Herring	Mackerel
I		*		
IIa	*****	*	*****	*****
IIa			*	
IIb	*		*	
IVa	*		*****	***
IVa			****	
IVb			**	**
IVb			*	
Va	**	**	*	
Vb	***		*	*
Vb1	***			*
Vb2	*			
VIa	***		***	***
VIa			***	
VIb	*			*
VIIa			*	
VIIb	*		*	***
VIIc	*			
VIIe				*
VIIg			**	*
VIIh				*
VIII				*
VIIIa				*
VIIj			*	**
VIIk	*		*	
XIVa		*	*	

*** less than 30 weekly catch records ** 30 –100, ***101 -1000,**
******1000 – 3000**

Table 3.11.1.2 Relative density of disaggregated weekly catch records by ICES Division.

TIME	QUARTER 2 WEEKS 16 - 25														
Fishery	IVb			VIa			VIIb			VIIc			VIIj		
	Country	Gear	Depth	Country	Gear	Depth	Country	Gear	Depth	Country	Gear	Depth	Country	Gear	Depth
Mackerel				ENG SCO IRL DE	PT/PPT PT/PPT PT/PPT PT/PPT	D D D D	ENG SCO IRL	PT/PPT PT/PPT PT/PPT	D D D	IRL	PT/PPT	D	*ENG* *SCO* *FR* *IRL* *DE* **NL***	*PT/PPT* *PT/PPT* *PT/PPT* *PT/PPT* *PT/PPT* *PT/PPT*	*0 –50* *0 –50* *0 –50* *0 –50* *0 –50* *0 –50*
Herring				SCO	PT/PPT	20+									
Blue-whiting				NL NO DE	PT/PPT PT/PPT PT/PPT	D D D									
Capelin															
Horse Mackerel	*DK*	*PT*	*0 - 50*										*ENG* *IRL* *NL*	*PT/PPT* *PT/PPT* *PT/PPT*	*0 –50* *0 –50* *0 -50*

Bycatches of "salmon" have been recorded in catches landed in the Netherlands, but according to information provided to the SGBYSAL, the majority and possibly all of these "salmon" are actually sea trout (ICES 2004d; Potter, pers. com.)

Table 3.11.1.3 The nations (their applied fishing gears and fishing depths) participating in fisheries that might overlap with the distribution of salmon. The fisheries shadowed are fisheries with a potential for catching salmon. Bold type are fisheries with reported bycatches of post-smolts. The fisheries in *Italics* are those with a potential, but from which there are no bycatch reports. (Areas refer to ICES fishing areas; Q is the quarter of the year). Further explanations at the end of the continued table.

Table to be continued

Table 3.11.1.3 Continued

QUATER	QUARTER 2 (WEEKS 20 – 26)						QUARTER 3 (WEEKS 27 – 36)		
Fishery	IVa			Vb			IIa		
	Country	Gear	Depth	Country	Gear	Depth	Country	Gear	Depth
Makerel	*ENG* *SCO* *RUS*	*PT/PPT* *PT/PPT* *PT*	*0-50*	RUS	PT	S	NO RUS FO	PS PT PS	S S S
Herring	RUS	PT	20+	RUS	PT	20+	RUS	PT/PS	20+/S
Blue-whiting	RUS	PT	D	NL NO DE RUS	PT PT PT PT	D D D D	RUS NO FO DE	PT	D
Capelin**							*ICE* *NO* *FO*	*PS* *PS* *PS*	*S* *S* *S*
Horse Mackerel	*DK*	*PT*	*0 - 50*						

**Iceland, East Greenland, Jan Mayen

Depth profiles, relative to depth of headline:

S – surface fishery

0-50 – Top upper layers

20+ - Variable but not shallower than 20 meters

D – Deeper than 50m

Gear codes

PT – Single pelagic trawl

PPT – Pelagic pair trawl

PS – Purse seine

YEAR	NO OF HAULS TAKEN	TOTAL CATCH, T	MACKEREL CATCH, T	NO OF SALMON CAUGHT		RATIO BETWEEN SALMON AND MACKEREL (FISH PER METRIC TON)	
				Adults	Post-smolt	Adults	Post-smolt
2002	82	13.7	5.4	3	32	0.56	5.93*
2003	31	15.6	13.3	0	0	0	0

*****most of the postsmolts were caught north of 69°N where the mackerel fishery is not significant

Table 3.11.1.4 Summarized data from the pelagic fish surveys conducted in the Norwegian Sea in June-July 2002-2003 by Russian research vessels.

YEAR	NO OF HAULS SCREENED	TOTAL CATCH, T	MACKEREL CATCH, T	NO OF SALMON FOUND		RATIO BETWEEN SALMON AND MACKEREL (FISH PER METRIC TON)	
				Adults	Post-smolt	Adults	Post-smolt
2002	1070	10,921	7,760	15	12	0.0019	0.0015
2003	416	7,200	3,800	15	1	0.0039	0.0003

Table 3.11.1.5 Summarized data of the screening of catches from the Russian mackerel fishery in the Norwegian Sea in June-August 2002-2003.

2001	SMOLT CATCH RATE/ T MACKEREL	PERIOD WEEKS	CATCH (T)	BY-CATCH (N)
Russian research survey	5.93	21-31	26051	**154482**
Russian observer programme	0.002	21-31	26051	**52**
Russian research survey	5.93	26-28	6777	**40188**
Russian observer programme	0.002	26-28	6777	**14**

2002	**Smolt catch rate/ t mackerel**	**Period weeks**	**Catch (t)**	**By-catch (n)**
Russian research survey	5.93	21-31	21265	**126101**
Russian observer programme	0.002	21-31	21265	**43**
Russian research survey	5.93	26-28	7594	**45032**
Russian observer programme	0.002	26-28	7594	**15**

Table 3.11.1.6. Estimates of by-catch of salmon post-smolts potentially taken in the Norwegian Sea for two periods in 2001 and 2002.

Data source	Observed ratio, no. adult salmon per tonne mackerel	ICES areas VIa & b – IVa		ICES areas IIa –V a & b	
		Total commercial catch (**t**) in statistical rectangles with overlap	No. salmon potentially taken	Total commercial catch (**t**) in statistical rectangles with overlap	No. salmon potentially taken
Russian pelagic research survey, 2002	0.556	1 514	2574	8 027	4460
Russian pelagic research survey, July 2003	0	1 514	0	8 027	0
Russian observer programme, June 2002	0.002	1 514	3	8 027	15
Russian observer programme, 2003	0.004	1 514	6	8 027	32

Table 3.11.1.7. Estimate of the bycatch of adult salmon in weeks 21 – 32 in the 2001 mackerel fishery for two groups of ICES areas.

YEAR AND CRUISE	GEAR	DATES	TOTAL NUMBER OF SURFACE HAULS	% HAULS WITH POST-SMOLT CAPTURES	NUMBER OF POST-SMOLTS CAPTURED	NUMBER OF SALMON CAPTURED	MEAN CPUE POST-SMOLTS	AREA SURVEYED
2004-1[SS]	*Salmon trawl* [A]*; Fish lift*	*21.4 - 30.04*[SS]	*28*	*(89.3)***	*0*	*136*	*(4.05)***	*Norwegian Sea, 65.02°-67.6°N; 1.16° W- 5.47°E. DST-tagging of 1 and 2–SW salmon*
2004- 2[SL]	Salmon trawl [A]; Fish lift	*14 – 28.05* [SL]	*27*	*Na*	*320*	*2*	*Na*	*Sognefjord, West Norway, Salmon lice invetigation*
2004-3[SL]	Salmon trawl [A]; *Fish lift*	*24-28.05*[SL]	*25*	*na*	*213*	*0*	*Na*	*Hardangerfjord, SW Norway, Salmon lice investigation*
2004-4	Salmon trawl [A];	*22.05 –09.06*	*14*	*57.1*	*124*	*1*	*16.21*	*Ireland –Faroes-Shetland channel 52.2-60.8°N; 14.9 – 5.55°W, Mackerel-egg survey*
2004-5-8[PEL]	Midwater trawl	*July-August; November*	*0(>200)*	*na*	*0*	*3*	*na*	*Various areas, Norwegian and Barents Seas*
		TOTAL 2004	***94***					
		1990 - 2003	***2656***		***5081***	***246***		
TOTAL	**1990 - 2004**		**2750**		**5738**	**388**		

* 0 surface trawls but >200 mid-water trawls included

** CPUE calculated for adult salmon, because no smolts were captured

[A] Dimensions of trawl opening 10 x 40

[B] Dimensions of the Åkra trawl opening 25 x 25 m

[SS] Cruises dedicated to salmon investigations

[SL] Cruises dedicated to salmon lice investigations

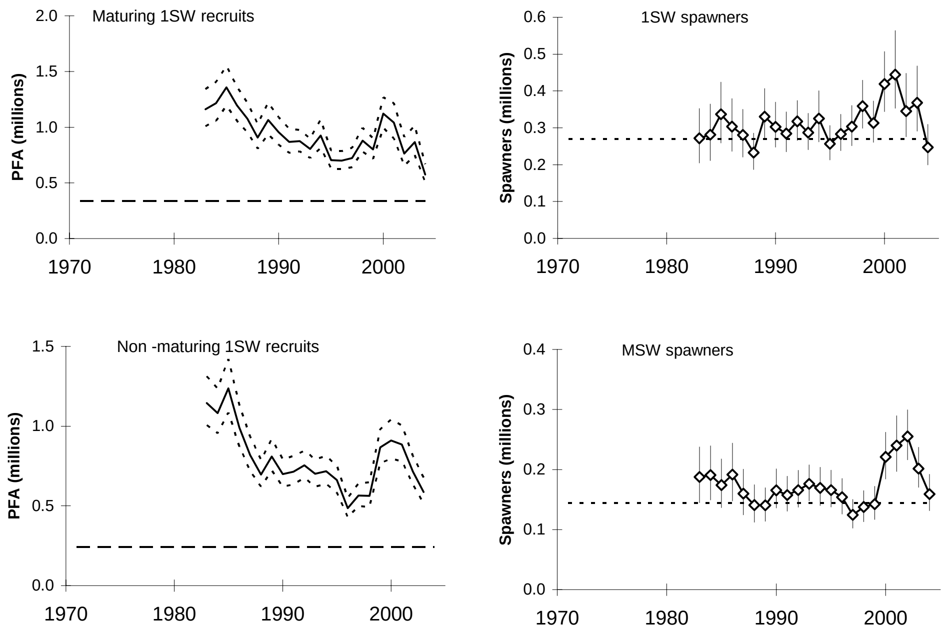
[PEL] Miscellaneous pelagic surveys

Table 3.11.2.1. Cruises with surface trawling (flotation on trawl wings), captures of post-smolts and older salmon and post-smolt catch per unit effort (CPUE, trawl hours) in 2004 and summary of catches, 1990 – 2004.

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

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

Northern Europe



Southern Europe

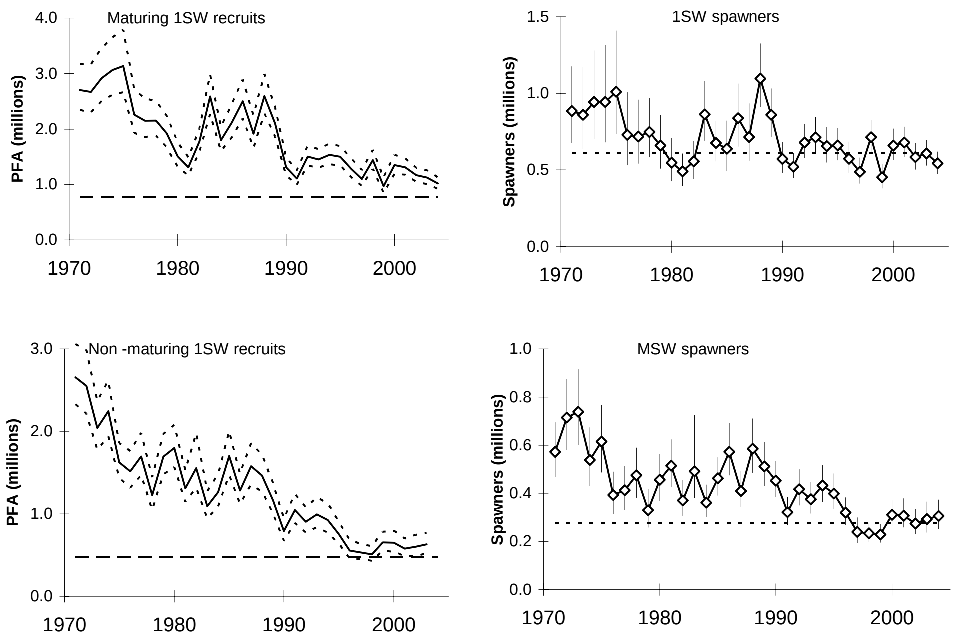


Figure 3.6.1.1 PFA trends and predictions (+/- 95% confidence intervals) for non-maturing 1SW European stock

Note: open square is 2004 update and blocked square is 2005 forecast

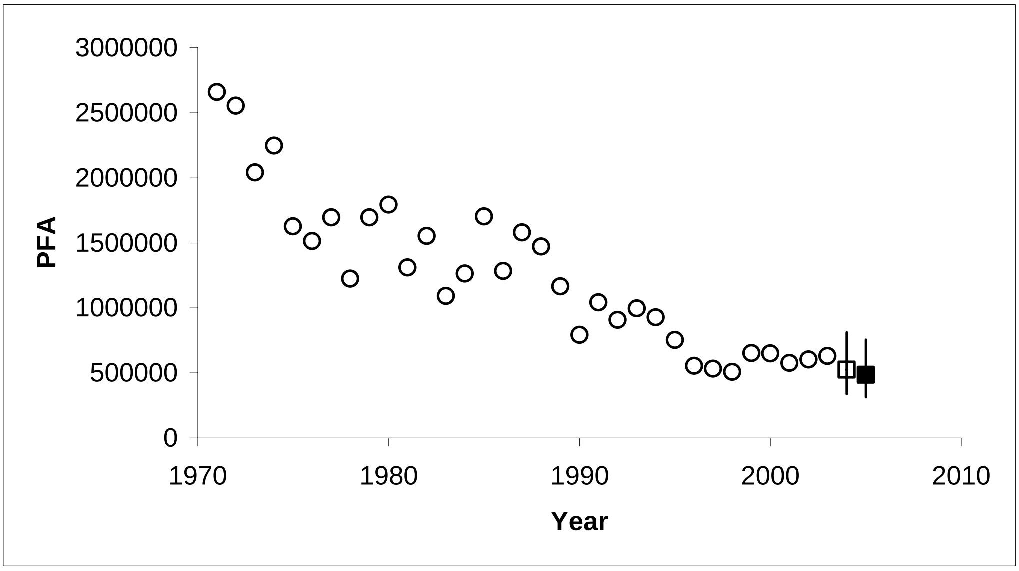


Figure 3.9.3.1 Overview of effort as reported for various fisheries and countries 1971-2004 in the Northern NEAC area.

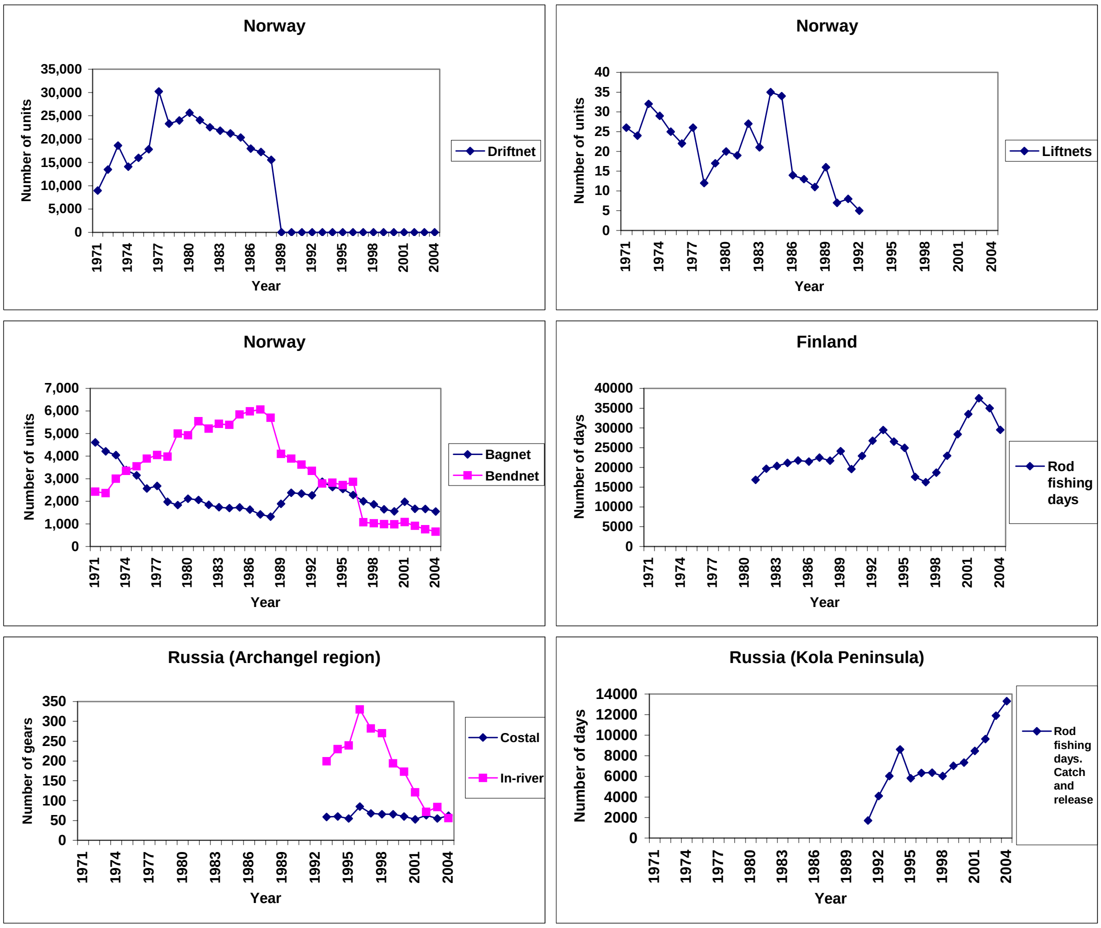


Figure 3.9.3.2 Overview of effort as reported for various fisheries and countries 1971-2004 in the Southern NEAC area.

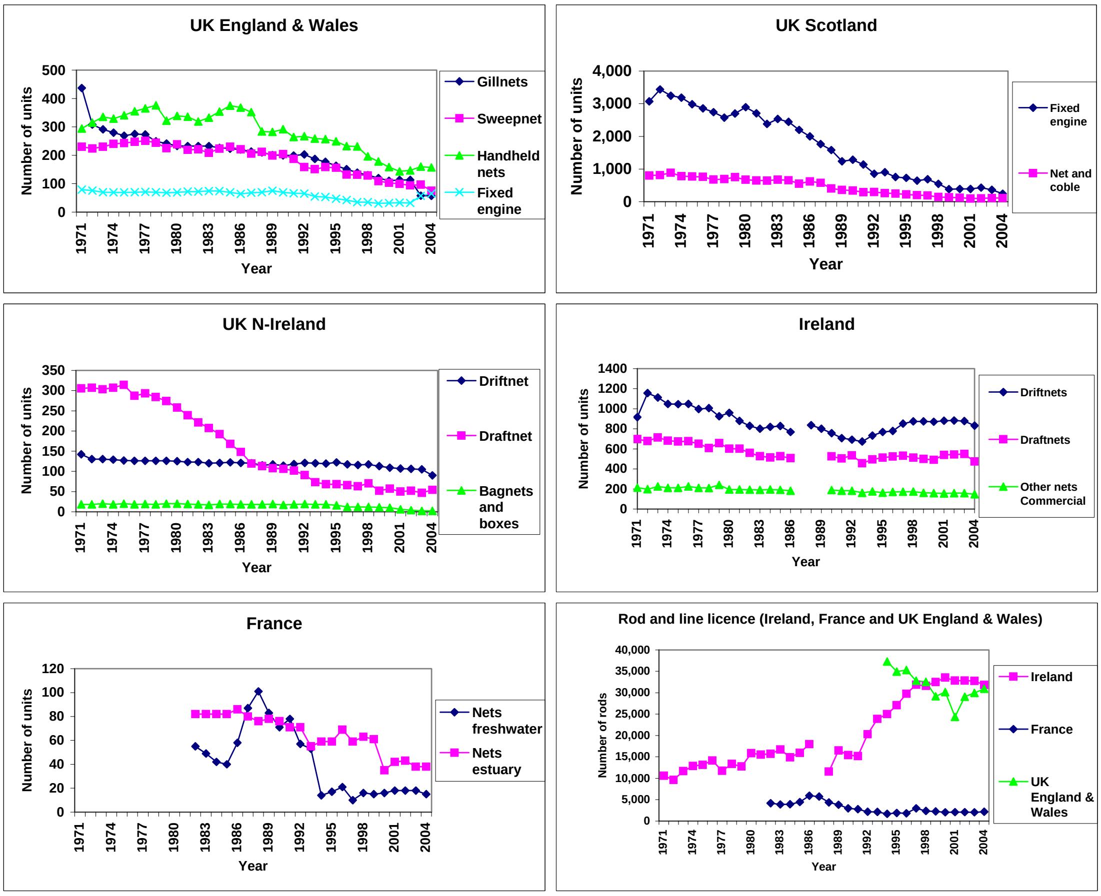


Figure 3.9.4.1. Nominal catches of salmon and 5-year running means in the Southern and Northern NEAC Areas, 1971-2004.

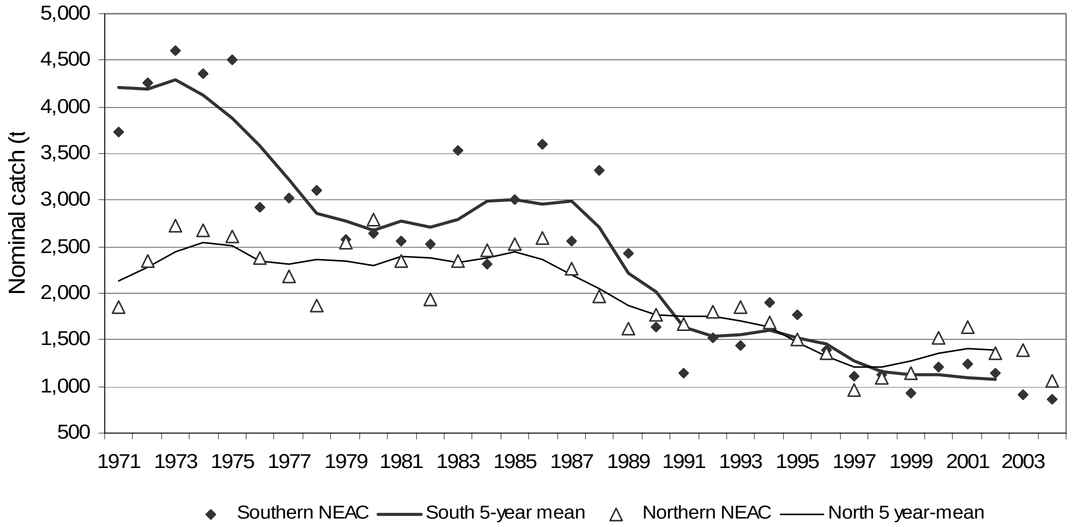
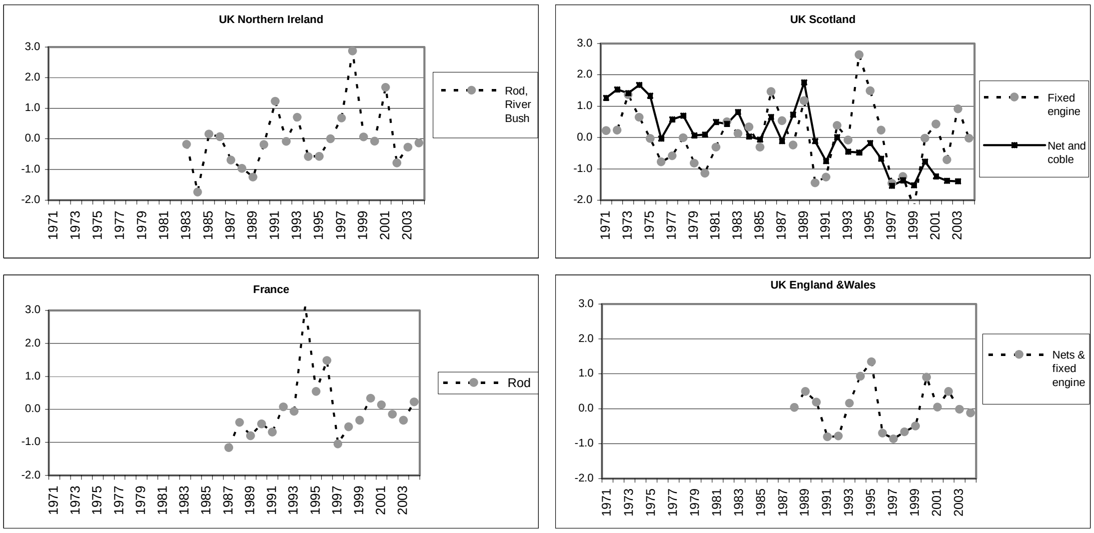


Fig. 3.9.5.1. CPUE indices in various fisheries of the NEAC countries. Vertical axes represent standardized (Z-score) index values, or averages of several series, relative to the average of the time series (0.0).

Southern NEAC area



Northern NEAC area

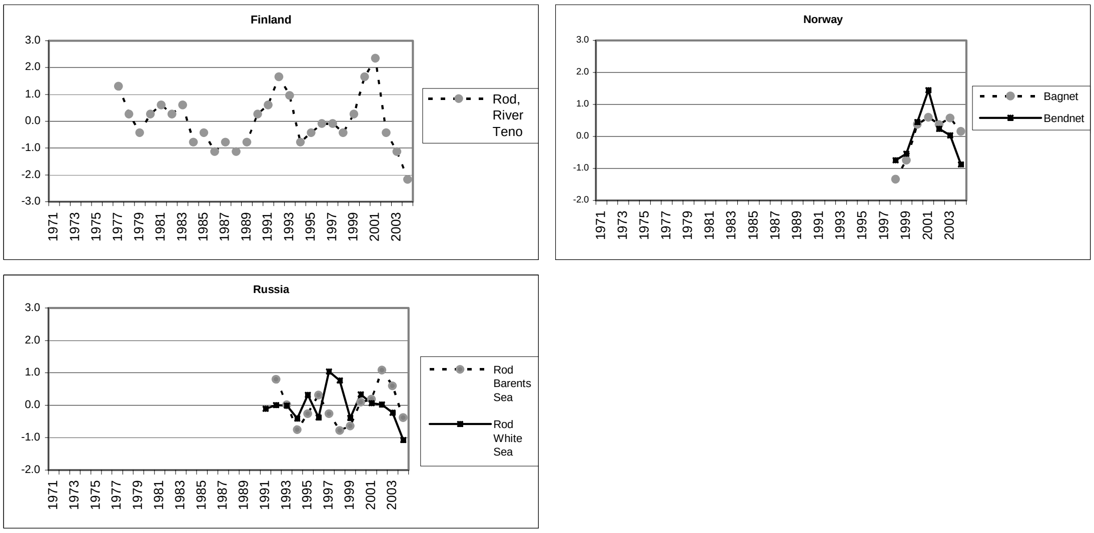


Figure 3.9.6.1. Percentage of 1SW salmon in the reported catch for Northern NEAC countries, 1987-2004. Solid line denotes mean value from catches in all NEAC northern countries.

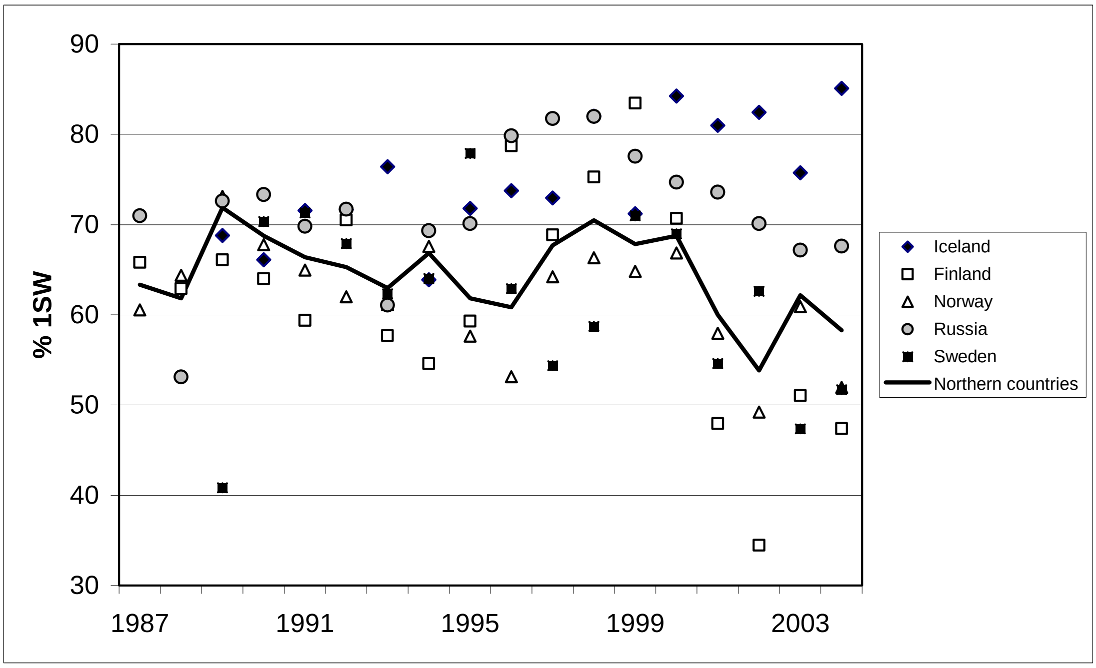


Figure 3.9.6.2. Percentage of 1SW salmon in the reported catch for Southern NEAC countries, 1987-2004. Solid line denotes mean value from catches in all NEAC southern countries.

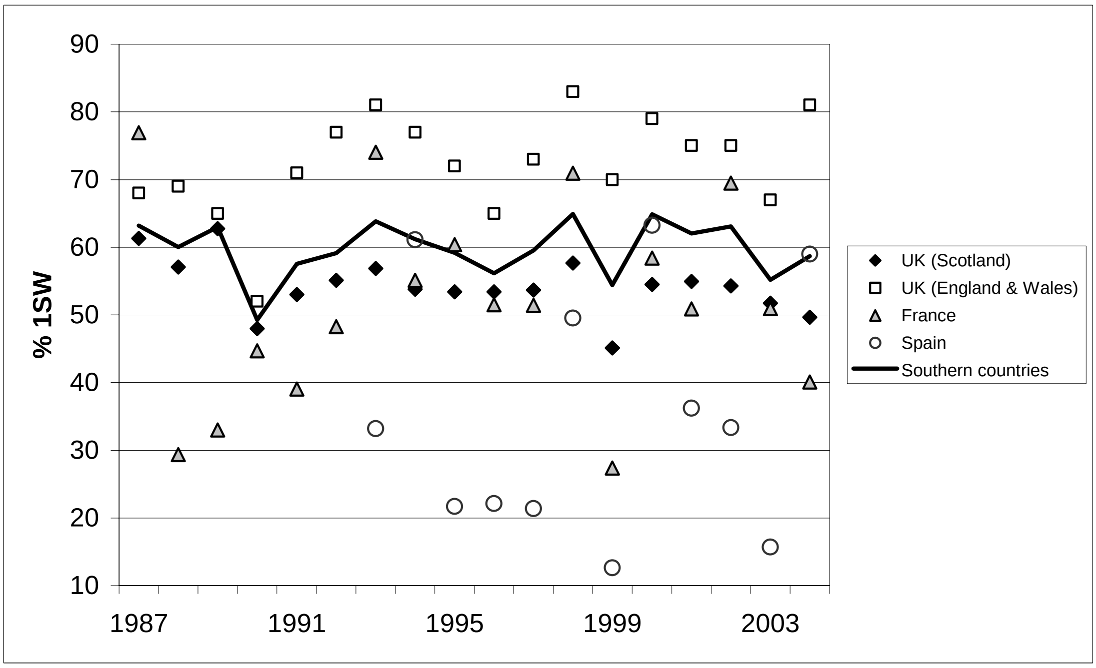


Figure 3.9.13.1a

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

FINLAND (including Norwegian R. Teno catch)

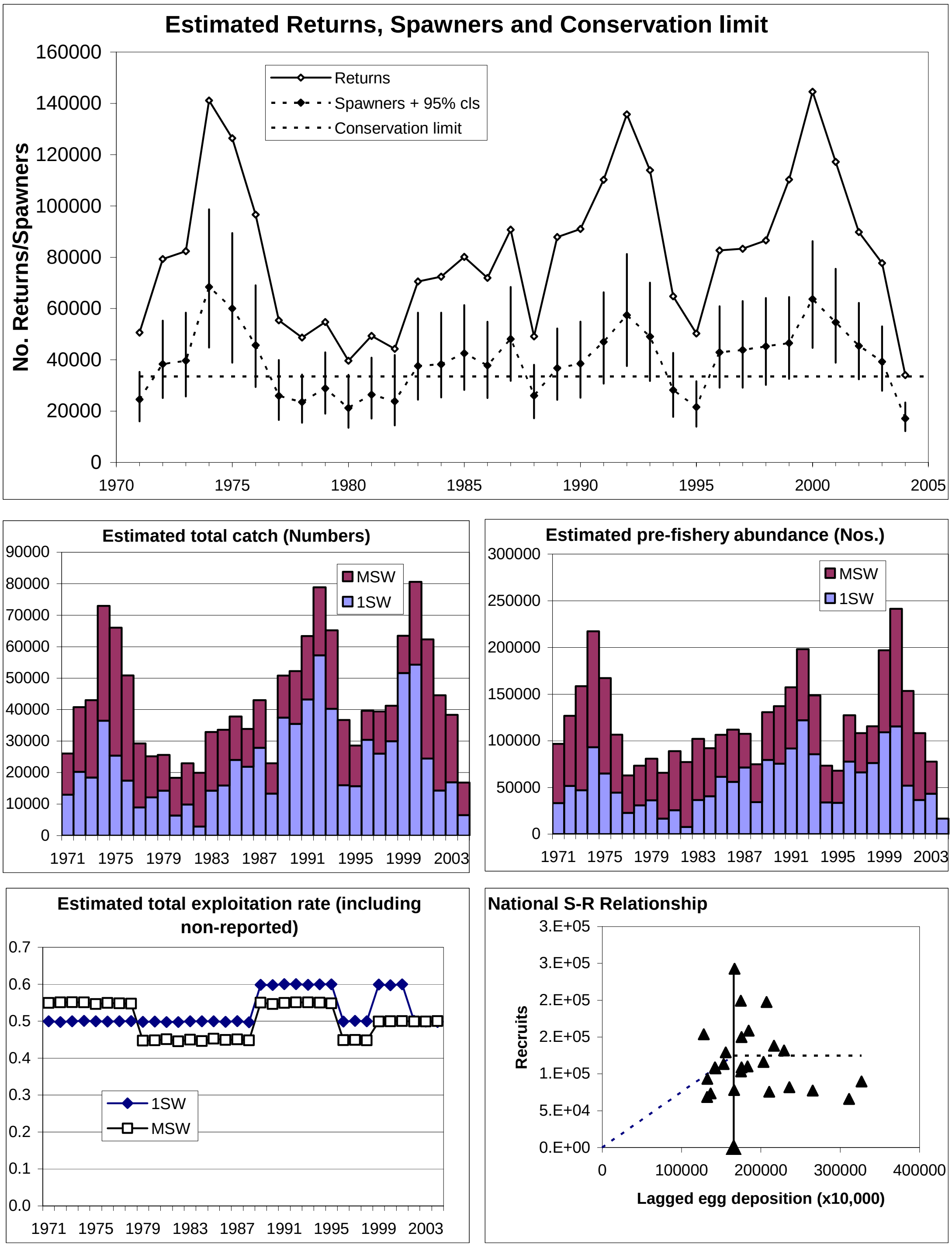


Figure 3.9.13.1b
SUMMARY OF FISHERIES AND STOCK DESCRIPTION
France

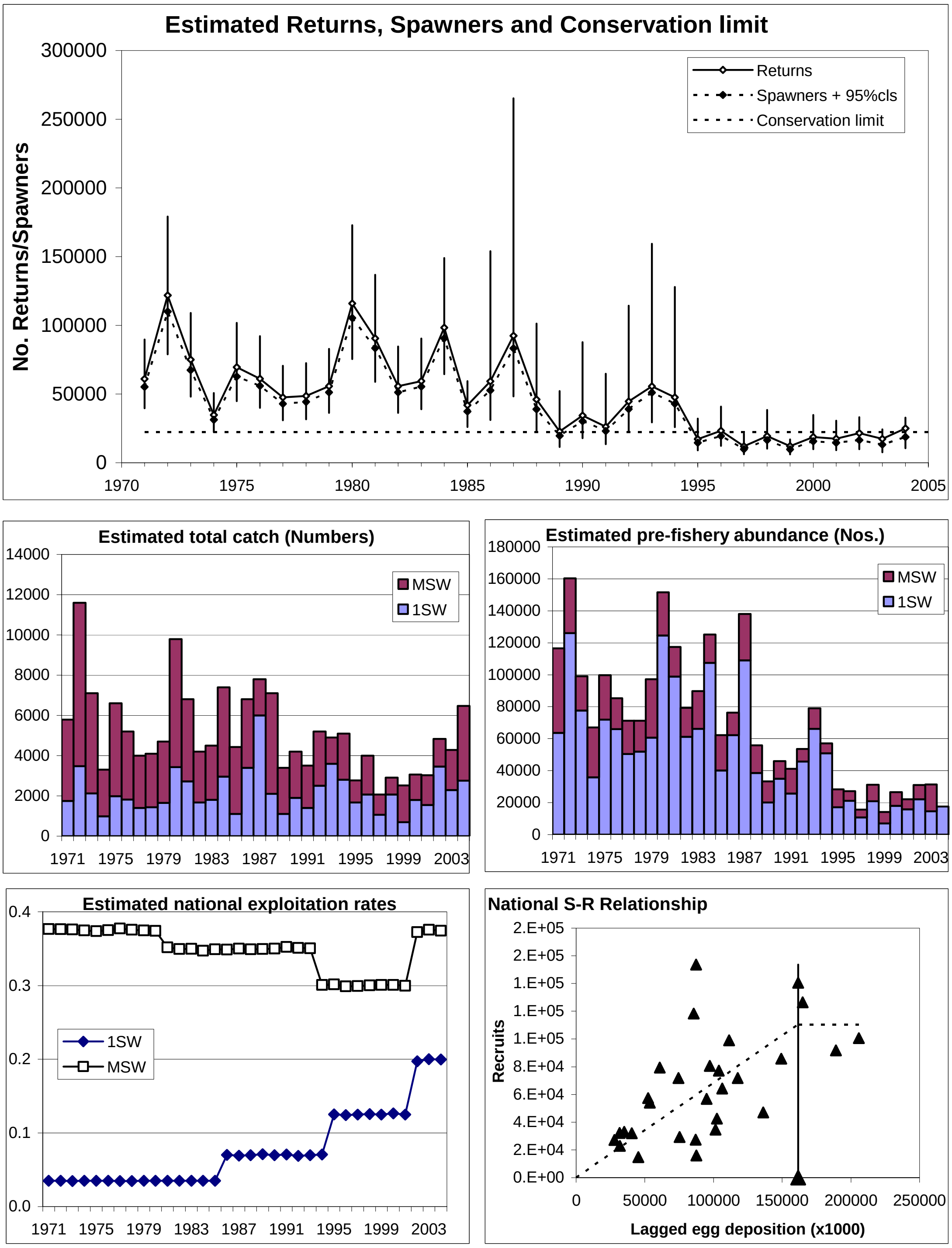


Figure 3.9.13.1c

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

ICELAND

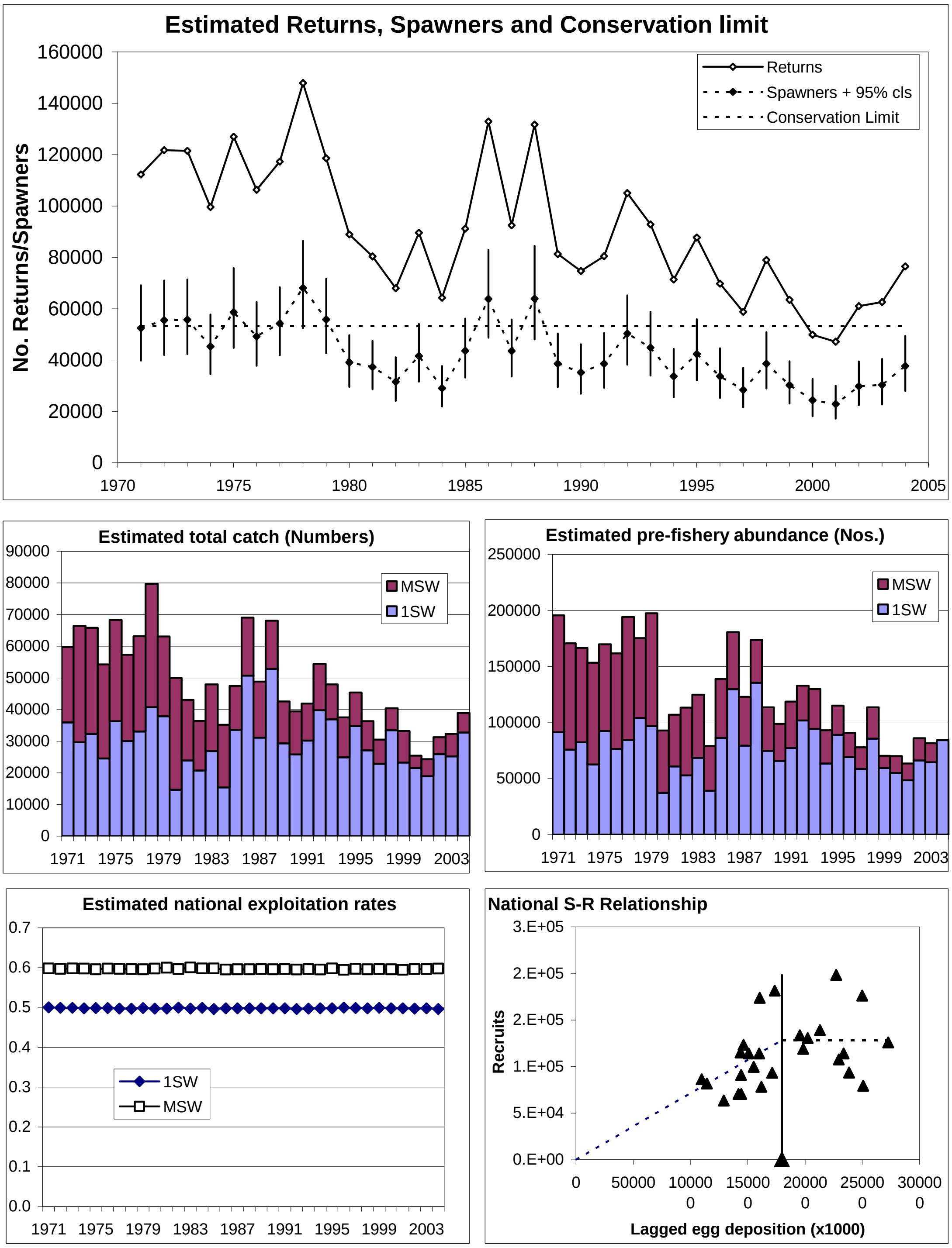


Figure 3.9.13.1d
SUMMARY OF FISHERIES AND STOCK DESCRIPTION
IRELAND

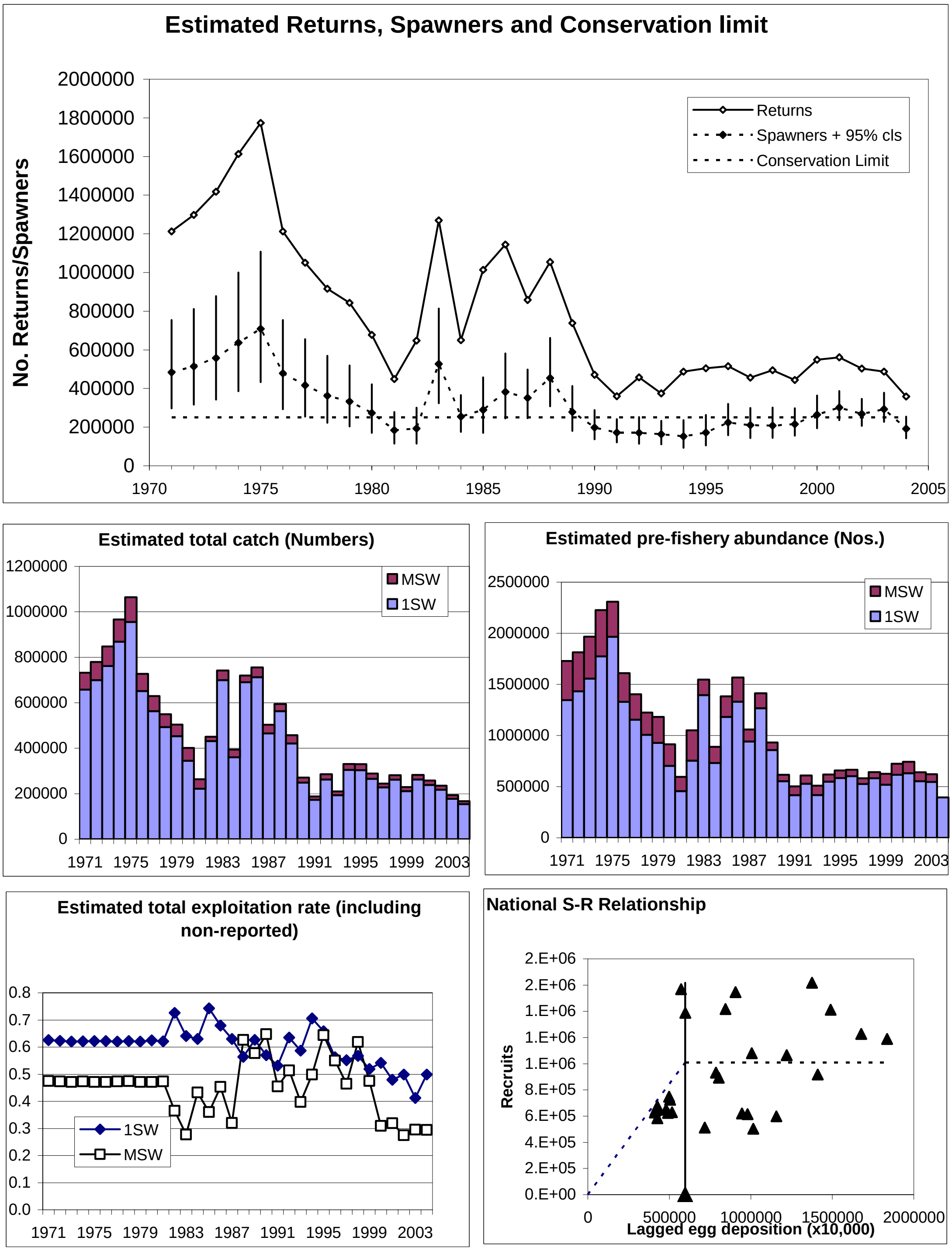


Figure 3.9.13.1e

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

Norway (minus Norwegian rod catches from the R. Teno)

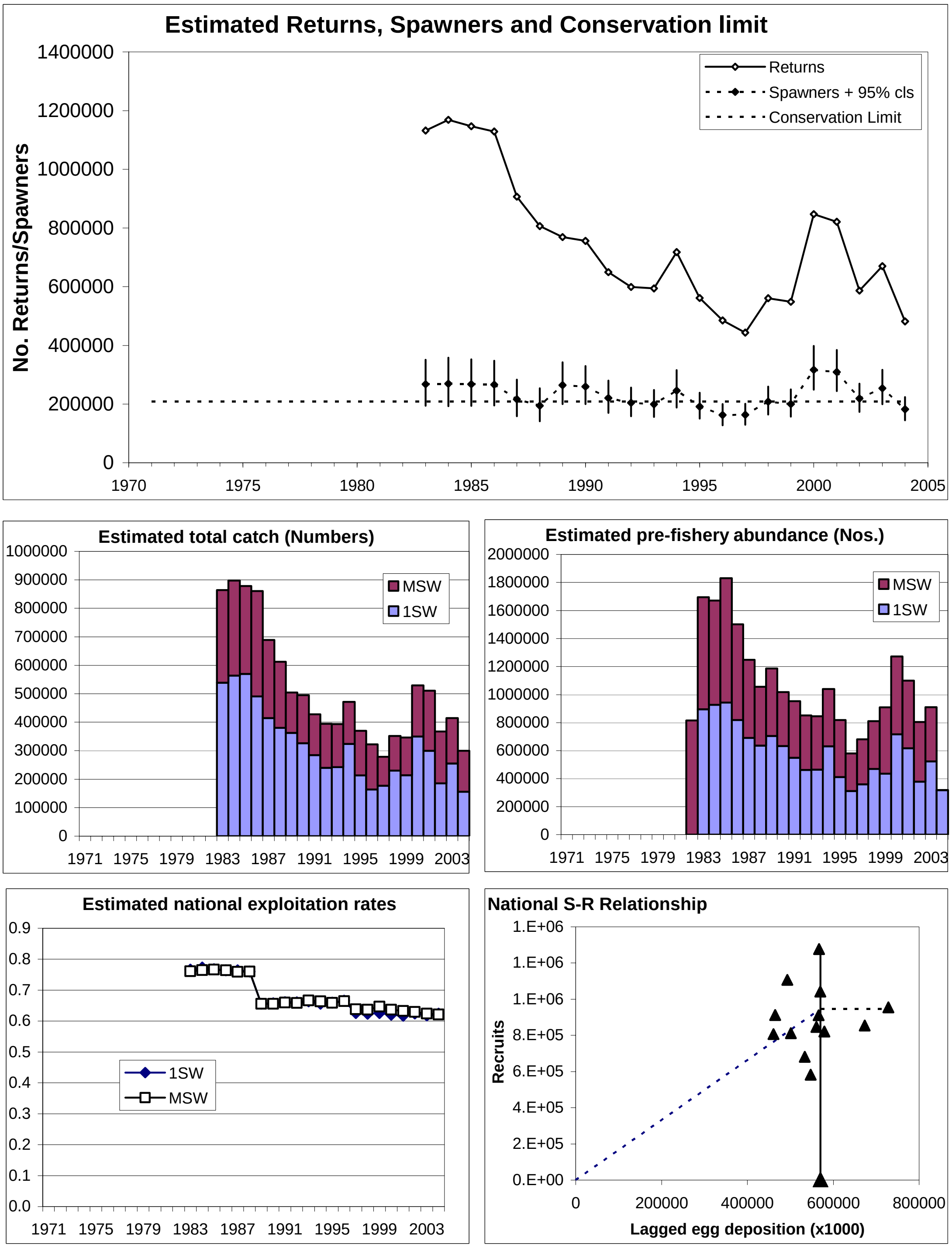


Figure 3.9.13.1f

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

RUSSIA

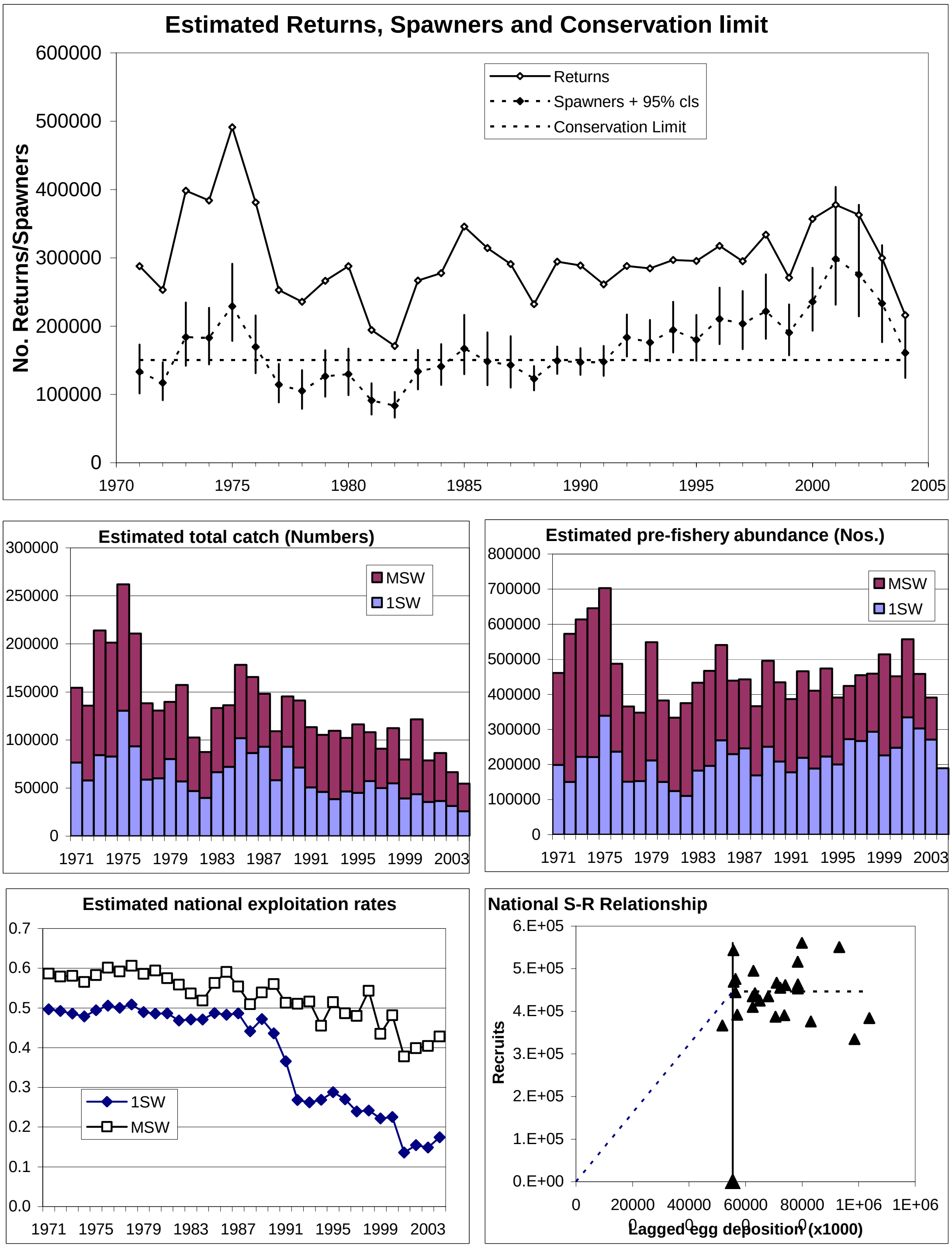


Figure 3.9.13.1g

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

SWEDEN

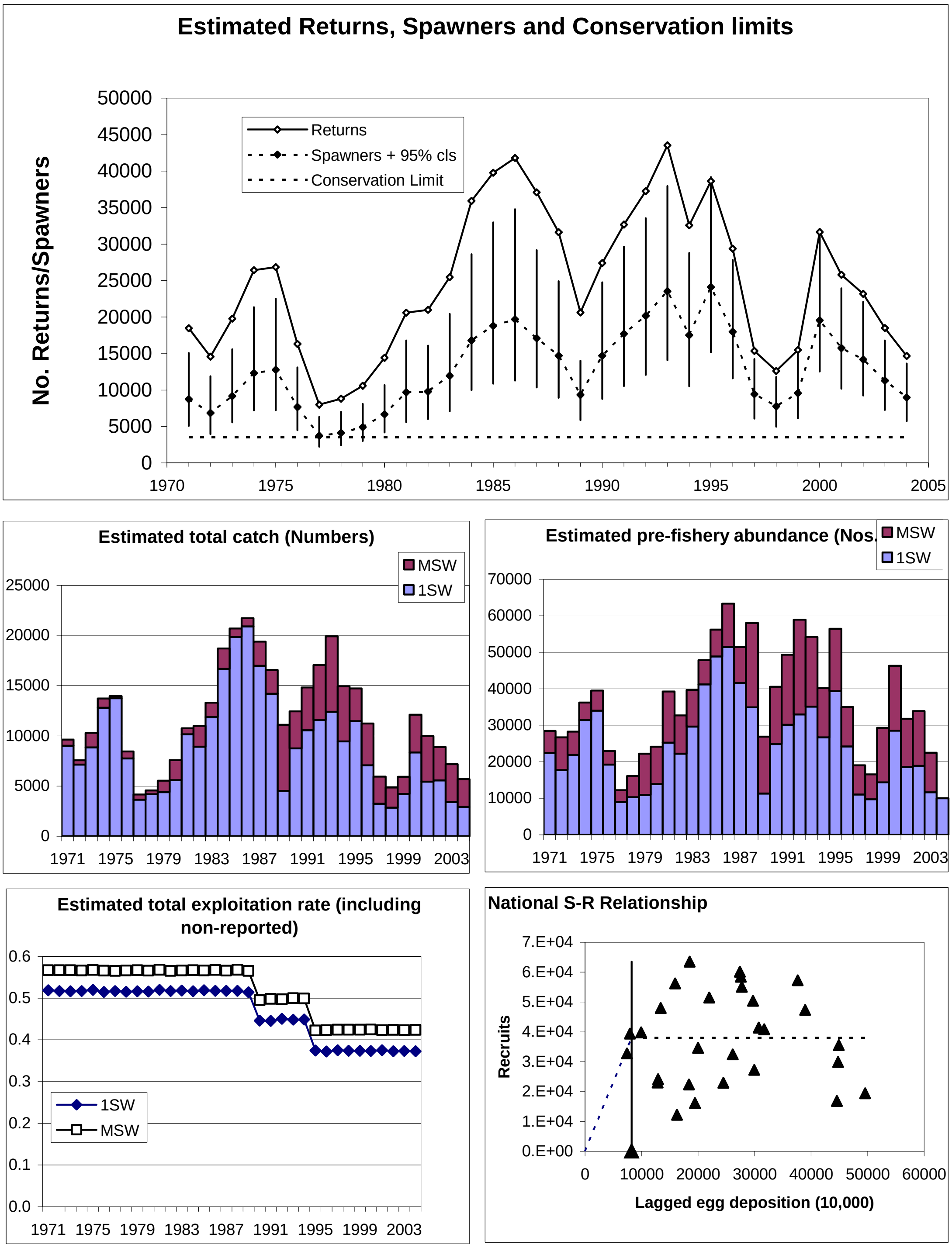


Figure 3.9.13.1h

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

UK(England and Wales)

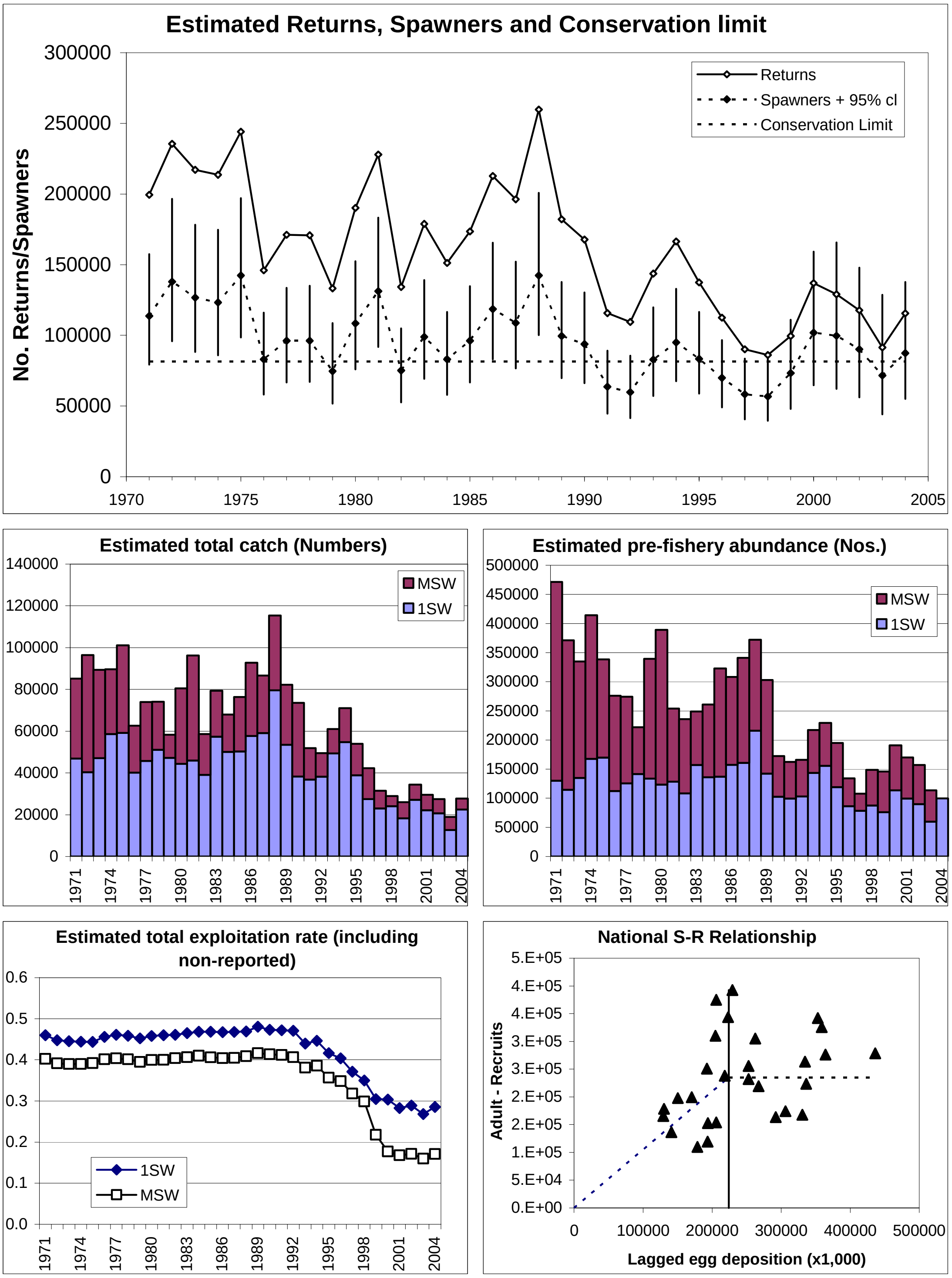


Figure 3.9.13.1i

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

UK(Northern Ireland)

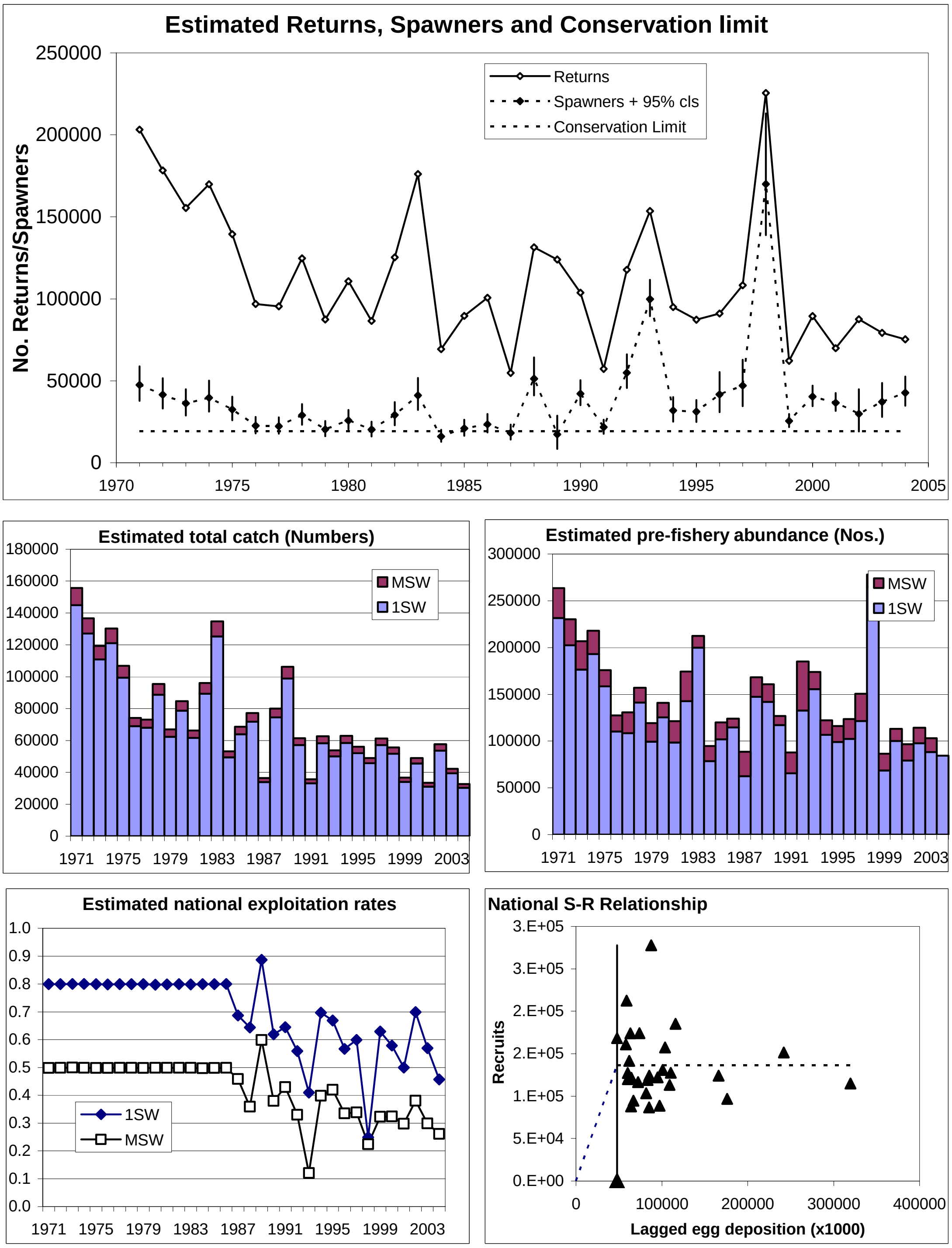


Figure 3.9.13.1j

SUMMARY OF FISHERIES AND STOCK DESCRIPTION

UK(Scotland)

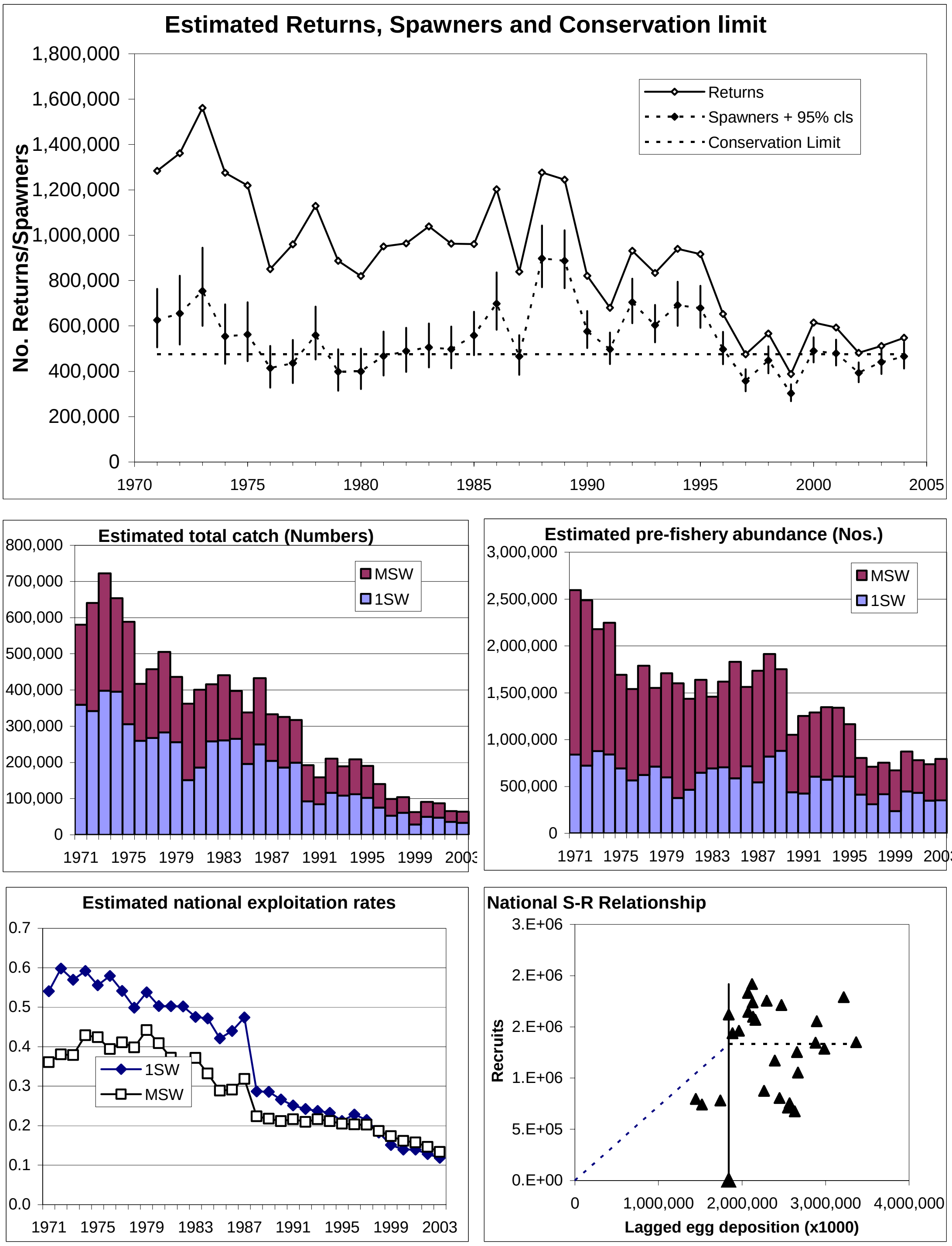
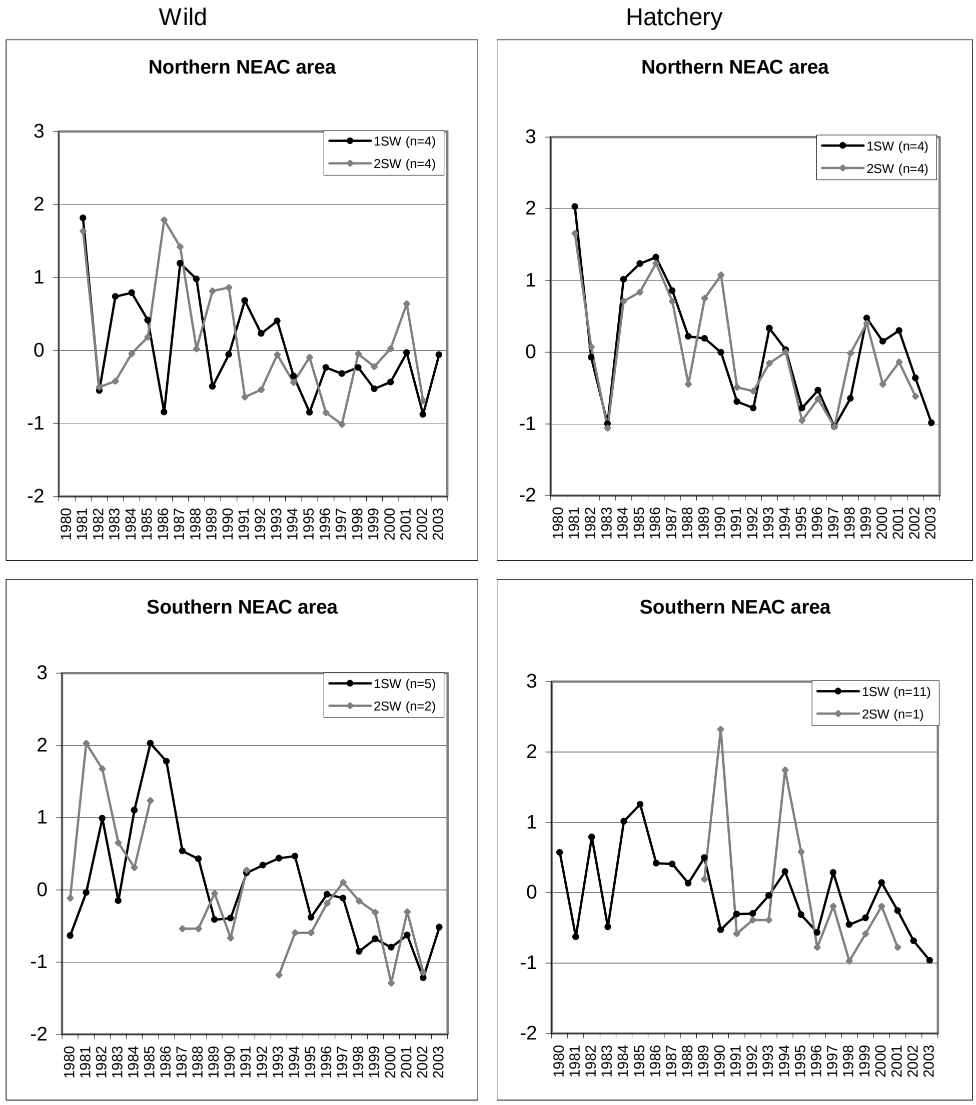


Figure 3.9.15.1. An overview of the estimated survival indices of wild and hatchery smolts to adult returns to homewaters (prior to coastal fisheries) in Northern and Southern NEAC area.
Index values represent averages of standardized (Z-score) survival estimates for monitored rivers and experimental facilities, and are relative to the average of the time series (0).
The number of rivers included are indicated in each panel legend.



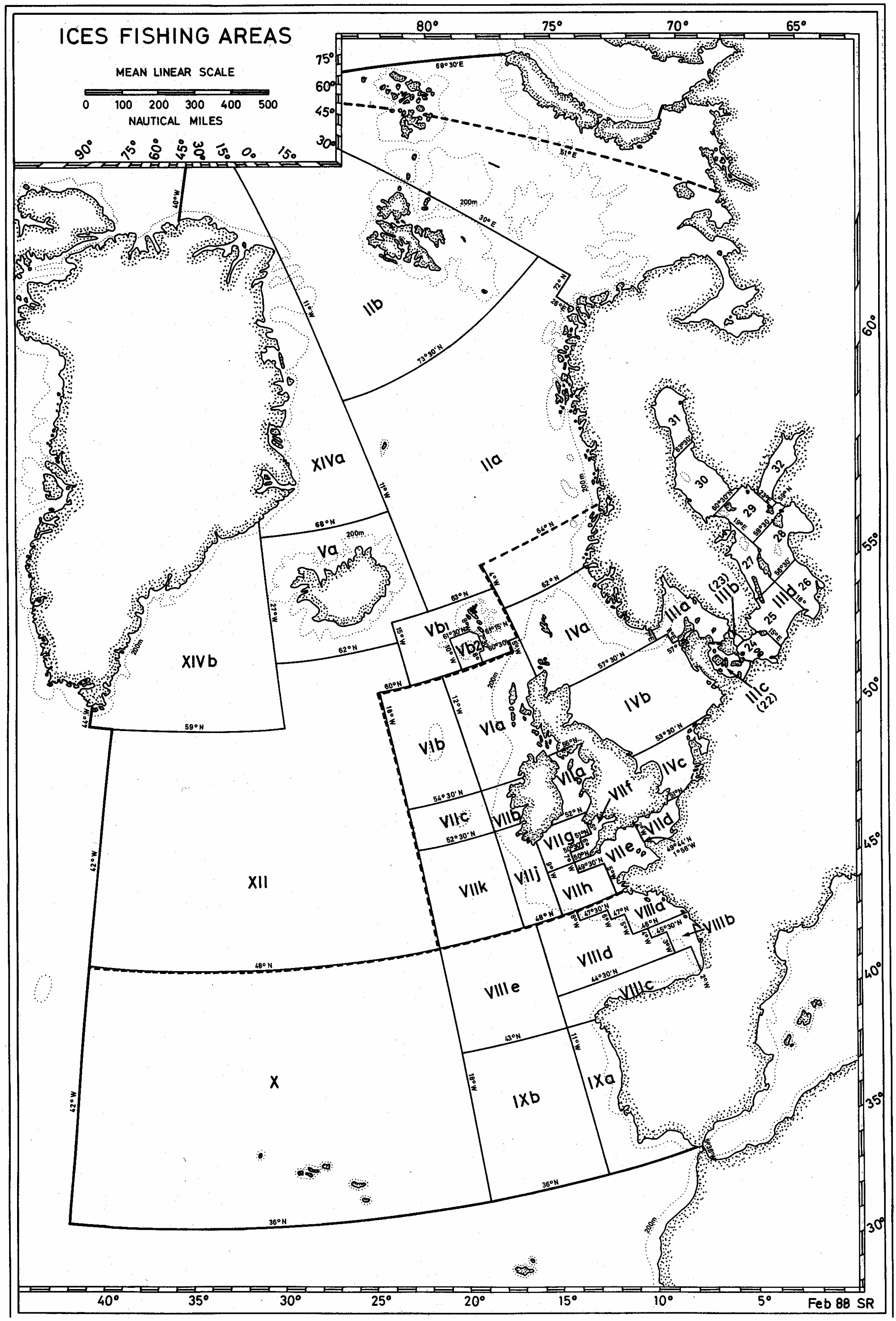


Figure 3.11.1.1. ICES Fishing Areas

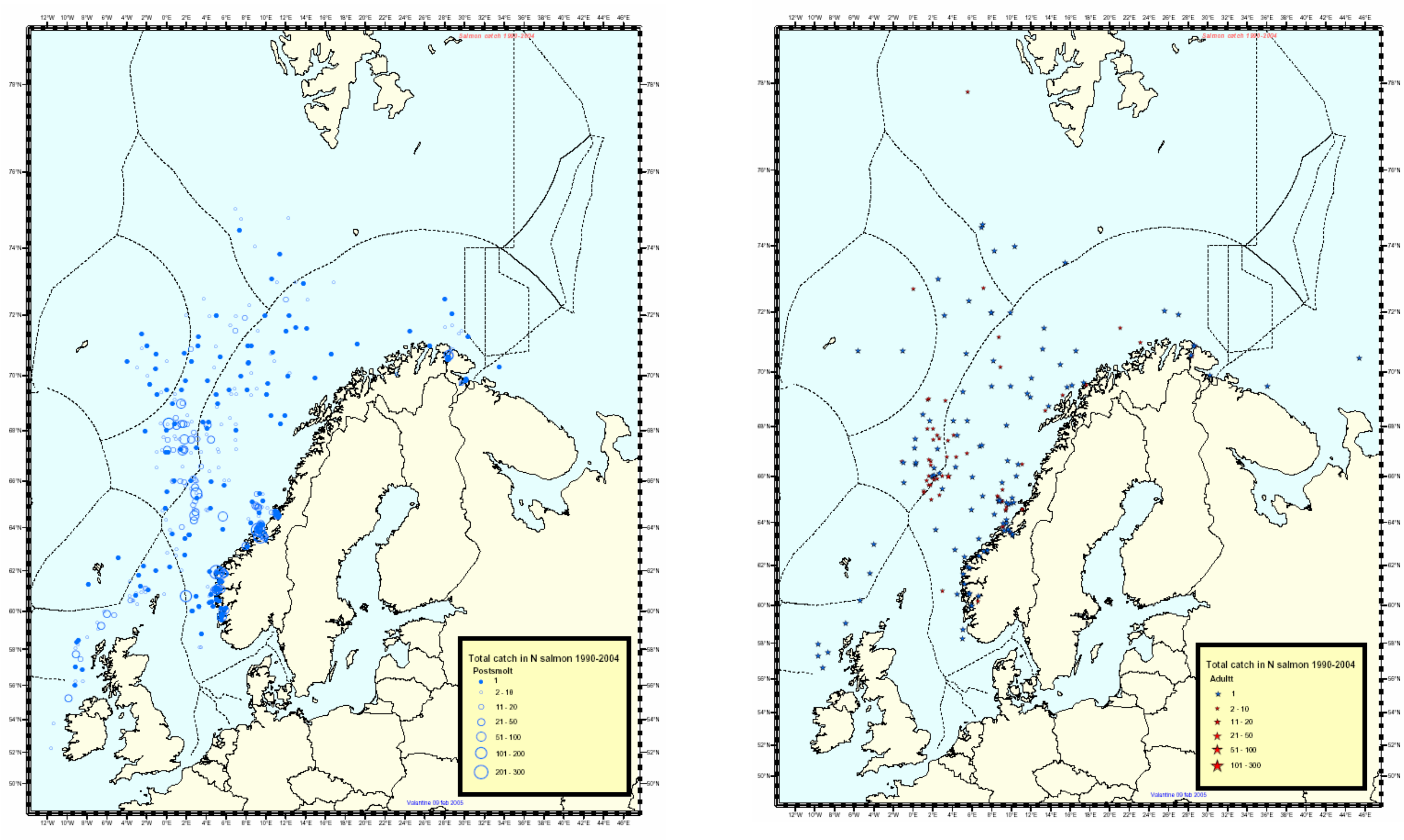


Figure 3.11.1.2 Distribution of total number of postsmolts (left panel) and adult salmon (right panel) in Norwegian research trawls in 1990–2004. Symbol size proportional with number of fish in the catch, legends in figure

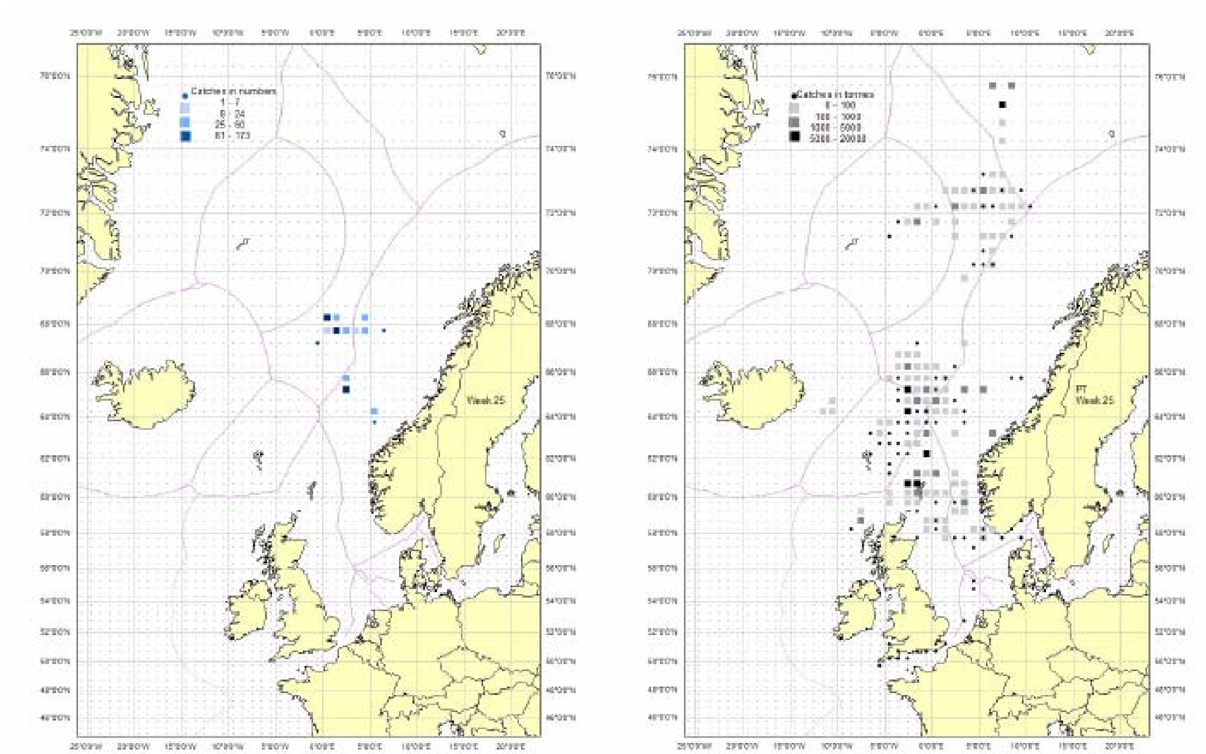


Figure 3.11.1.3a Week 25 - Distribution of salmon research captures 1990–2003 (left) and reported landings from pelagic fisheries in 2000–2003 per ICES statistical rectangles (legends in figures).

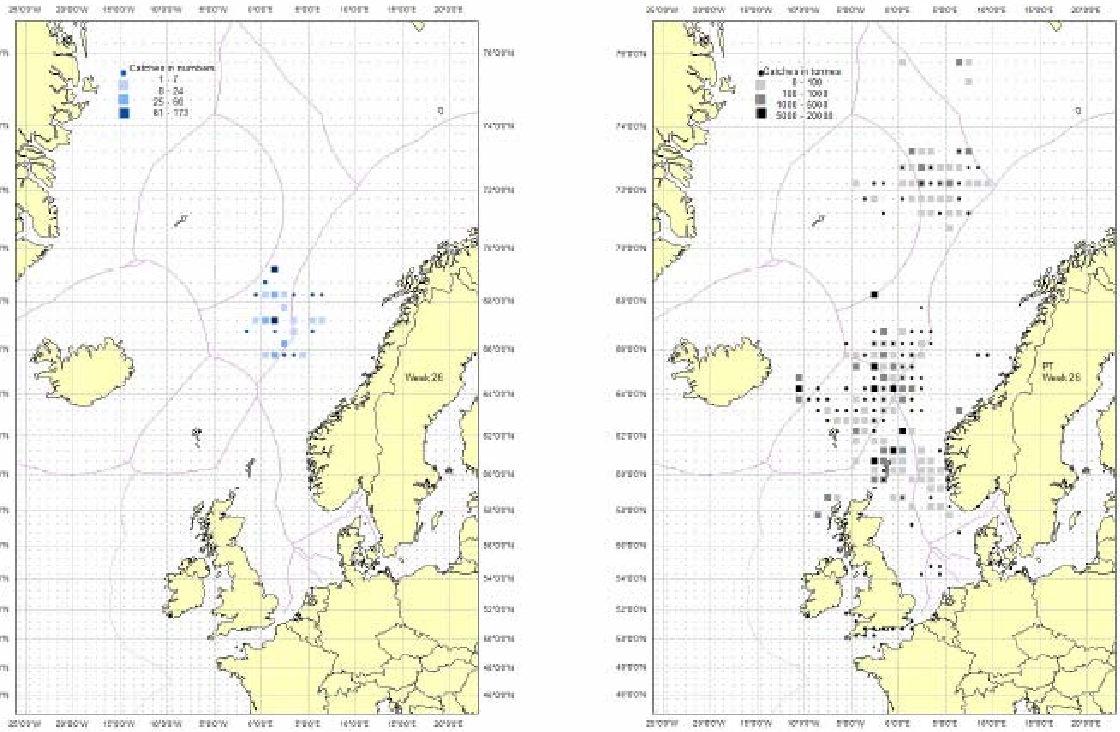


Figure 3.11.1.3b Week 26 - Distribution of salmon research captures 1990–2003 (left) and reported landings from pelagic fisheries in 2000–2003 per ICES statistical rectangles (legends in figures).

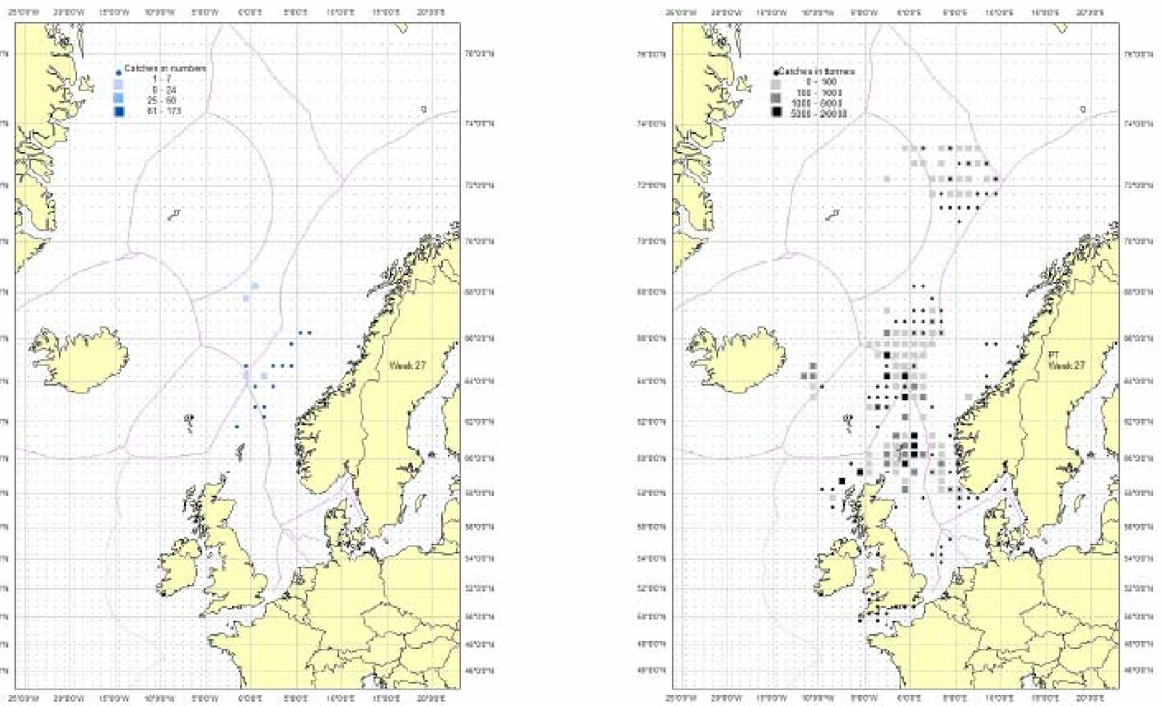


Figure 3.11.1.3c Week 27 - Distribution of salmon research captures 1990–2003 (left) and reported landings from pelagic fisheries in 2000–2003 per ICES statistical rectangles (legends in figures).

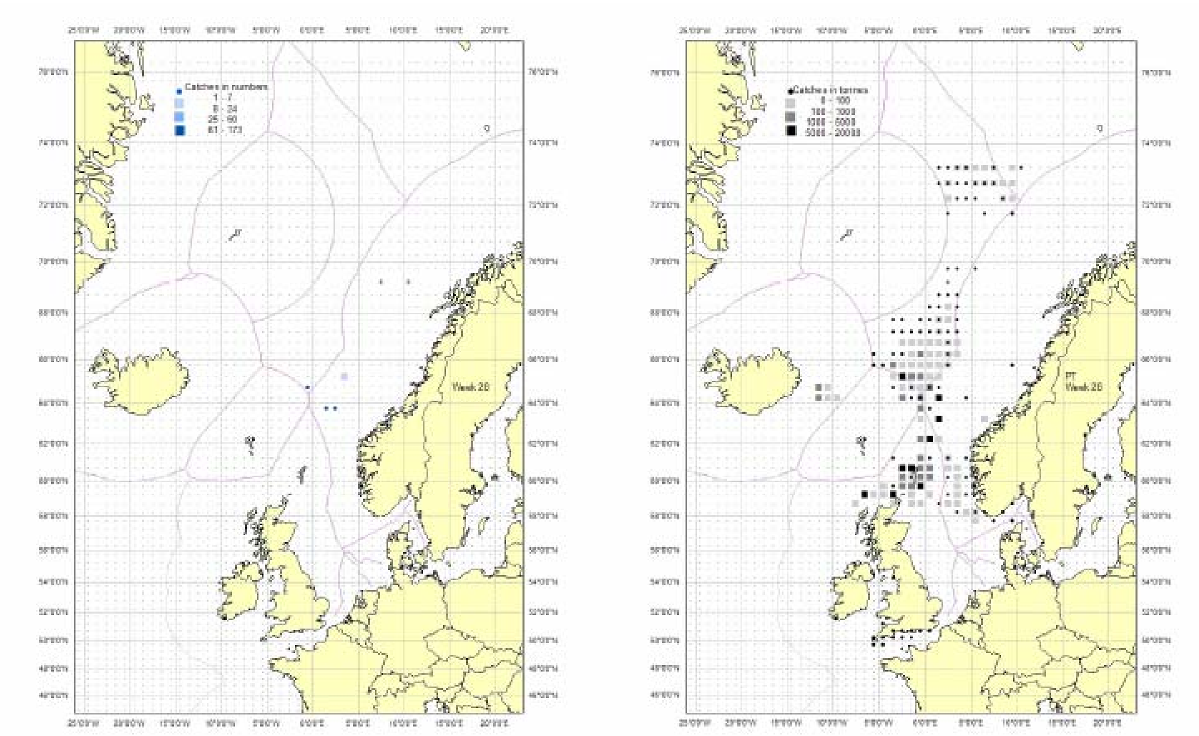


Figure 3.11.1.3d Week 28 - Distribution of salmon research captures 1990–2003 (left) and reported landings from pelagic fisheries in 2000–2003 per ICES statistical rectangles (legends in figures).

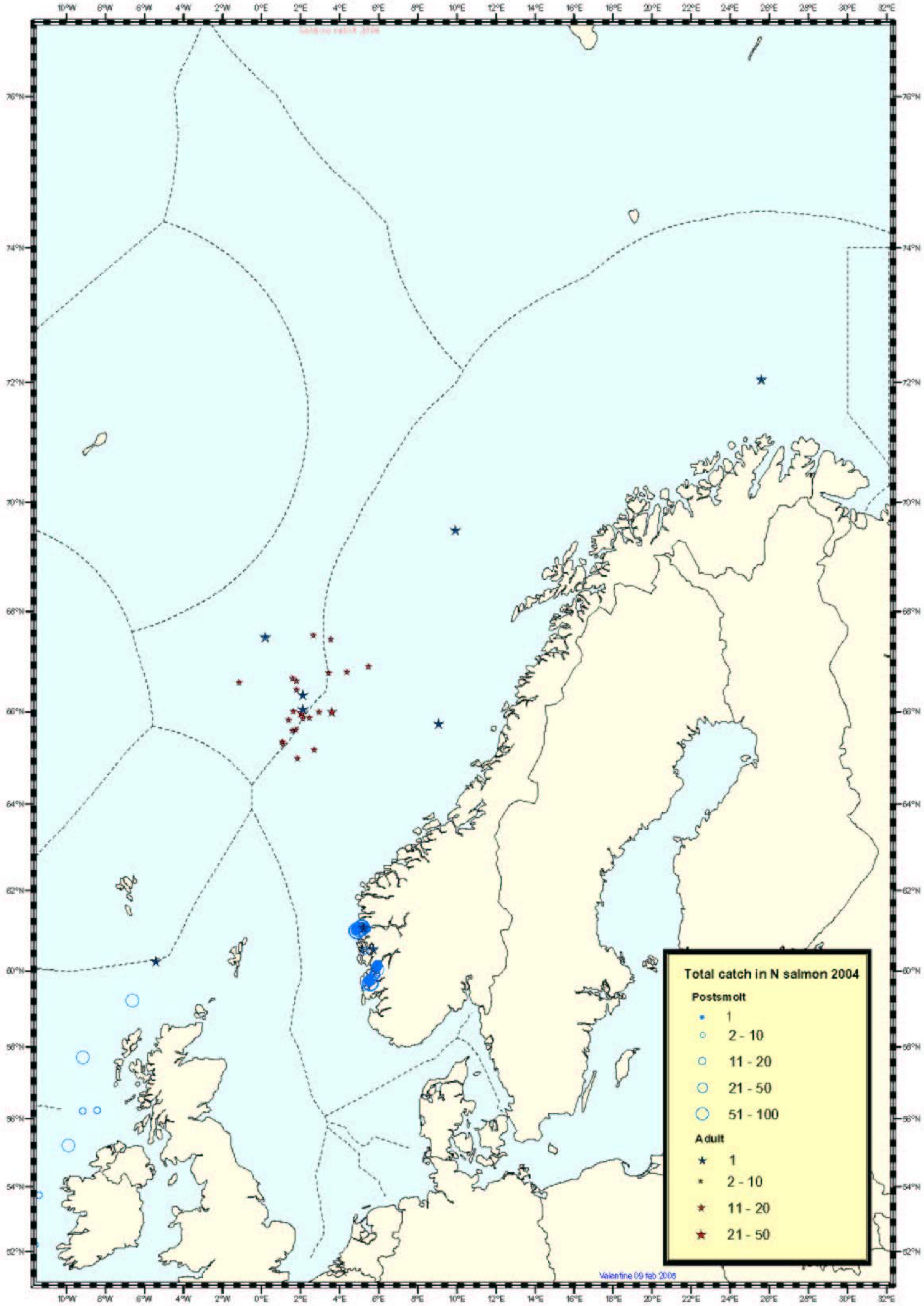


Figure 3.11.2.1 Total number of postsmolts (circles) and adult salmon (stars) captured in Norwegian research surveys in 2004. Legends in figure.

4 NORTH AMERICAN COMMISSION

4.1 Status of stocks/exploitation

In 2004, the overall conservation limit (S_{lim}) for 2SW salmon was only met in the Newfoundland area, therefore the stock complexes in the other regions are considered to be below reproductive capacity.

The stock status is elaborated in section 4.9.

4.2 Management objectives

Management objectives are outlined in section 1.4.

4.3 Reference points

As precautionary reference points have not been developed for these stocks, management advice is therefore referenced to the S_{lim} conservation limit (see section 1.5). Thus, these limits should be avoided with high probability (*i.e.* at least 75%). In Atlantic Canada, CLs have been set on the basis of stock and recruitment studies which provided for MSY on a limited number of river stocks where data was available, and these derived egg deposition rates were used on the remainder of rivers where only habitat area and spawner demographics were available, as documented in O'Connell, *et al.* (1997). The added production from lacustrine areas in SFA 14B of Labrador and throughout Newfoundland was also accommodated. In USA, conservation limits were set following a similar approach. Recently, for stocks in Quebec, stock-recruitment analysis for six local rivers was used to define the CL, defined as the S_{MSY} level at 75% probability level, calculated by Bayesian analysis. For the purposes of management, egg deposition requirements are converted into 2SW fish equivalents. These are presented by fishery management zone in Table 4.3.1.

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.

4.4 Advice on management

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. 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

For all fisheries, ICES considers that management 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 only those stocks that are within precautionary limits. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be within precautionary limits. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

4.6 Catch forecast for 2005

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 by the producing nations.

It is possible to provide catch advice for the North American Commission area for two years. The revised forecast for 2005 for 2SW maturing fish is based on an updated forecast of the 2004 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2004 as 1SW non-maturing fish. The second is an estimate for 2006 (see section 4.7) based on the pre-fishery abundance forecast for 2005 from Section 5. A consequence of these annual revisions is that the catch options for 2SW equivalents in North America may change compared to the options developed the year before.

Catch advice for 2005 fisheries on 2SW maturing salmon

The updated forecast of the pre-fishery abundance for 2004 provides a PFA mid-point of 118 600, about 18% higher than that forecast last year (see section 5.8).

In order to compare the PFA to conservation limits, the pre-fishery abundance of 118 600 can be expressed as 2SW equivalents by considering natural mortality of 3% per month for 11 months (a factor of 0.72), resulting in 85 392 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2004 for both the Labrador (459) and Greenland (2775) fisheries (Tables 4.9.1.1 and 4.9.1.2) for a total of 3234 2SW salmon equivalents already harvested. Adjusted for natural mortality, this equates to 82 158 2SW salmon potentially returning to North America in 2005.

As the predicted number of 2SW salmon returning to North America (82 158) in 2005 is substantially lower than the 2SW conservation limit (S_{lim}) of 152 548, there are no harvest possibilities at forecasted levels (at probability levels of 75%). Harvest possibilities 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 in some areas of eastern North America provide a more detailed consideration of expectations for 2005, taking into consideration the contribution of all sea ages of salmon to the spawning population.

Labrador:

Based on returns to four counting facilities, stocks appear low considering the management measures implemented to increase stock abundance. Total returns of small and large salmon in English River (SFA 1) have declined for the fourth consecutive year. For SFA 2, returns of small salmon increased in Muddy Bay Brook, Sand Hill River and Southwest Brook, compared to 2003. Large salmon declined in Muddy Bay Brook and Sand Hill River but increased in Southwest Brook. Abundance of large salmon (mainly 2SW) remains low and is a cause of concern because of the large contribution they make to egg deposition. There are no projections of future returns for Labrador stocks.

Newfoundland:

When compared to 2003, returns of small and large salmon improved for most rivers. Returns of small salmon improved relative to the moratorium mean returns (1992–2003), to the highest level in eight years, in most cases, but this was not as pronounced for large salmon. Abundance of salmon during the moratorium years continues to be lower than prior to the closure of the commercial fisheries. Smolt production in insular Newfoundland increased in four out of five stocks, by comparison with 2003. Higher survivals have occurred in the past, even in years when directed ocean fisheries for salmon were in existence. Lower abundance is expected to continue with some small increases until such a time as sea survival improves.

Gulf:

In all rivers of the Gulf Region, large salmon returns and spawners were either similar or improved from 2003 and spawning escapement was above or approximated the conservation requirement. Small salmon abundance was higher than in 2003 and generally higher than the previous five year average abundance. The largest salmon producing river, the Miramichi, met its conservation requirements in 2004. The outlook for 2005 is for higher returns of large salmon relative to 2004, with a 40% chance of meeting the conservation requirement in the Miramichi River overall. Because the majority of salmon returning to the Morell and to other PEI rivers (SFA 17) are of hatchery origin, current fisheries have little impact on future runs. In all areas of the Gulf, with the exception of the southeast New Brunswick rivers which are closed to salmon fishing, juvenile abundance in rivers was higher than in 2003 and remains at historical high levels.

Scotia-Fundy:

Returns of small salmon in 2004 and forecasts of returns in 2005 suggest a continuation of the low abundances and possible extirpations of some salmon populations in the Maritimes Region. Only two of eleven assessed rivers met their conservation requirements in 2004 and one of those, the LaHave River, achieved its conservation requirement as a result of returns of hatchery origin salmon. Return rates of wild smolts to two monitored rivers improved in 2004 to the highest levels of the past five years. Supportive rearing programs are expected to move away from fishery enhancement objectives and 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 extend their persistence.

Québec:

The estimated recruits and spawners of 1SW salmon to Quebec increased by about 35% from 2003, and by about 30% from the previous five-year mean. Returns of small salmon were the second highest in the range measured in the last 10 years. Large salmon returns and spawners were down by 12% and 16%, respectively, from 2003 but unchanged (+2% and 3%) from the 1999–2003 average. The abundance of MSW salmon was similar to that observed in the last six years but low compared to historical data. The decrease in returns of large salmon in 2004 was anticipated as a result of the low abundance of small salmon the previous year (ICES, 2004). Based on relationships between small salmon in one year and large salmon of the subsequent year, returns of large salmon should increase in 2005 on a majority of Québec rivers. Lower smolt runs in 2004 should result in lower small salmon returns compared to 2004. In general, salmon populations for rivers on the south shore of the St-Lawrence River should approximate or exceed the conservation requirements but returns to some north shore rivers are expected to be below the threshold.

USA:

Salmon returns (both large and small) in 2005 are not expected to be sufficient to meet conservation limits in any river, including those receiving hatchery stocking.

4.7 Medium to long-term projections

Catch advice for 2006 fisheries on 2SW maturing salmon

Most catches (85%) 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.

Catch options which could be derived from the pre-fishery abundance forecast for 2005 (120 400 at the 50% probability level – see Figure 5.4.1)) would apply principally to North American fisheries in 2006 and hence the level of fisheries in 2005 needs to be accounted for before providing them. Accounting for mortality and the conservation limit and considering an allocation of 60% of the surplus to North America, the only risk averse catch option for 2SW salmon in 2006 is "zero" catch. This "zero" catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

4.8 Comparison with previous assessment and advice

The revised forecast of the pre-fishery abundance for 2004 provides a PFA mid-point of 118 600. This is about 18% higher than the value forecast last year at this time of 100 400. This is mainly due to slight changes in the input values to the model used to forecast PFA for these stocks, as detailed in Section 5.

4.9 NASCO has requested ICES to describe key events of the 2004 fisheries and the status of the stocks

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

Catch histories of salmon, expressed as 2SW salmon equivalents, which could have been available to the Greenland fishery, 1972–2004, 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. An Aboriginal Peoples' fishery occurred in 1998–2004 that may have harvested, to some degree, mixed stocks, and catches for this fishery have been included (Tables 4.9.1.1, 4.9.1.2). 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 (Table 4.9.1.1). 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 13 300 2SW salmon equivalents. In the most recent five years estimated (that is those since the closure of the Labrador commercial fishery), those taken as non-maturing fish in Labrador comprise 3%, or less, of the total in North America.

Of the North American fisheries on the cohort destined to be 2SW salmon, 74% of the catch comes from terminal fisheries in the most recent year. This value has ranged from as low as 20% in 1973, 1976 and 1987 to values of 74–91% in 1996–2004 fisheries (Table 4.9.1.1). The percentage increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries however this value decreased in 2004 to 74% from 83% in 2003. The number of 2SW salmon equivalents taken in the food fisheries in Labrador (3412) in 2004 was the highest since the commercial fishery closed in 1997.

Table 4.9.1.2 shows the mortalities expressed as 2SW equivalents in Canada, USA, and Greenland for 1972–2004, by applying a mortality of 3% per month for 11 months to the estimates of harvests of 1SW non-maturing North American salmon in the Greenland fishery. The percentage of the total 2SW equivalents that have been harvested in North American waters has ranged from 48–100%, with the most recent year estimated at 87%. The two years when 100% of the mortality occurred in North America were the years when the Greenland commercial fishery did not operate, and no estimates exist for the subsistence fishery at Greenland in those years.

4.9.2 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 Société de la Faune et des Parcs du Québec and the fishing areas are designated by Q1 through Q11 (Figure 4.9.2.1). 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 2004: Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. Commercial quotas normally fished by Aboriginal peoples in Ungava Bay (zone Q11) remained closed. Hence there were no commercial fisheries in Canada in 2004.

The following management measures were in effect in 2004.

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 and Newfoundland (SFAs 1 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2004. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries, except in Labrador. Harvests which 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 and, for the first time in 2004, the Labrador Metis Nation, resulted in fisheries in estuaries and coastal areas. There were no food fisheries on the island of Newfoundland in

2004. Harvest by Aboriginal peoples with recreational licenses are reported under the recreational harvest categories.

Residents food fisheries in Labrador

In the Lake Melville (SFA 1) and the coastal southern Labrador (SFA 2) areas, DFO allowed a food fishery, using gillnets, for local residents. 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 to complete logbooks.

Recreational fisheries

Unless otherwise determined by management authorities, 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 2004 varied by area (Figure 4.9.2.2). Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries.

The seasonal bag limits in the recreational fishery remained at eight small salmon in New Brunswick and in Nova Scotia. 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 Nova Scotia (SFA 18), the daily retention limits were two small salmon. The maximum daily catch limit was four fish daily. 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 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.

A five-year (2002–2006) management plan was introduced in Newfoundland and Labrador in 2002, based upon the river classification system utilized for SFAs 3–14B in 1999–2001. For insular Newfoundland (SFAs 3–14A) and the Strait of Belle Isle and southern Labrador (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 of Labrador, there was a seasonal limit of four fish, only one of which could be a large salmon, except in those rivers (now Class II) of SFA 2 crossed by the new Trans Labrador Highway, where a seasonal retention limit of two small salmon and no large salmon was imposed.

In Québec, three different fishing permits are sold. The first allows a retention of seven salmon for the season. The second is a one day permit and allows a 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 in Q8 and Q11, and three fish in zone Q9. 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 31 rivers, retention of small salmon only was in force on 24 rivers. Harvest of large salmon was permitted for part of the season on 3 rivers, whereas small salmon can be kept for the whole season. On the last 16 rivers, small and large salmon could be harvested for the entire season.

USA

There was no fishery for sea-run Atlantic salmon in the USA in 2004 as a result of angling closures in 1999. Therefore effort measured by license sales, was zero.

France (Islands of Saint-Pierre and Miquelon)

In 2004, there were 13 professional and 42 recreational gillnet licenses issued for the fishery that operates between May 1 and July 31. Due to a sharp decline in other fish resources exploited by the professional fishermen (lumpfish, snow crab and cod), more of them have expressed interest in having salmon licenses and have asked for an increase in the number of licences that could be compensated by a reduction in the number of recreational licences.

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

4.9.3 Catches in 2004

Canada

The provisional harvest of salmon in 2004 by all users was 159 t, about 13% higher than the 2003 harvest (Table 2.1.1.1; Figure 4.9.3.1). The 2004 harvest was 52 726 small salmon and 12 941 large salmon, 13% more small salmon and 15% more large salmon, compared to 2003 (Appendix 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 (Figure 4.9.3.1). These reductions were introduced as a result of declining abundance of salmon.

The 2004 harvest of small and large salmon, by number, was divided among the three user groups in different proportions depending on the province and the fish-size group exploited (Table 4.9.3.1). Newfoundland reported the largest proportion of the total harvest of small salmon and Québec reported the greatest share of the large salmon harvest. Recreational fisheries exploited the greatest number of small salmon in each province, accounting for 79% of the total small salmon harvests in eastern Canada. In years previous to 1999, commercial fisheries took the largest share of large salmon and in the years 2000–2004, food fisheries (including the Labrador resident food fishery) accounted for the largest share with 2004 at 63% by number.

Aboriginal peoples' food fisheries

Harvests in 2004 (by weight) were up 36 % from 2003 and 35 % 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*	60.4	66	44

* In 2004, the new Labrador Metis Nation harvest accounted for 11t.

Residents fishing for food in Labrador

The estimated total catch for the fishery in 2004 was 2.2 t, about 880 fish (75% small salmon by number). This value is significantly lower than last year's estimate of 6.6 t, as a result of many former residents fishing for food now fishing under a food fishery permit for Metis.

Recreational fisheries

Harvest in recreational fisheries in 2004 totaled 46 377 small and large salmon, 2% below the previous 5-year average, 8% above the 2003 harvest level, and the second lowest total harvest reported (Figure 4.9.3.2). The small salmon harvest of 41 802 fish was 3% below the previous 5-year mean. The large salmon harvest of 4575 fish was about 2% greater than the previous five-year mean. Small and large salmon harvests were up 9% and down 3% from 2003, respectively. The small salmon size group has contributed 88% 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 (Figure 4.9.3.2).

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, they are voluntarily releasing angled fish. In addition, numerous areas in the Maritimes Region in 2004 were closed to retention of all sizes of salmon (Figure 4.9.2.2). In 2004, about 57 000 salmon (about 24 700 large and 32 300 small) were caught and released (Table 4.9.3.2), representing about 55% of the total number caught, including retained fish. This was a 6% increase from the number released in 2003. Most of the fish released were in Newfoundland (46%), followed by New Brunswick (33%), Québec (15%), Nova Scotia (6%), and Prince Edward Island (0.3%). Expressed as a proportion of the fish caught, that is, the sum of the retained and released fish, Nova Scotia released the highest percentage (77%), followed by Prince Edward Island (70%), New Brunswick (58%), Newfoundland (56%), and Québec (44%). As has been mentioned in Section 2.4.2., there is some mortality on these released fish, which is accounted for when individual rivers are assessed for their attainment of conservation limits.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2004 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 2004 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.

By stock groupings used for Canadian stocks throughout the report, the unreported catch estimates for 2004 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 legal harvest of sea-run Atlantic salmon in the USA in 2004.

Unreported catches in the USA were estimated to be 0 t.

France (Islands of Saint-Pierre and Miquelon)

The total harvest in 2004 was reported to be 2.8 t from professional and recreational fishermen, about the same as in 2003 and among the largest catches recorded since 1983 (Table 2.1.1.1). Professional and recreational fishermen reported catching 1499 kg and 1285 kg of salmon, respectively in 2004.

Year	Professional Licenses (kg)	Recreational Licenses (kg)	Total (kg)
1990	1,146	734	1,880
1991	632	530	1,162
1992	1,295	1,024	2,319
1993	1,902	1,041	2,943
1994	2,633	790	3,423
1995	392	445	837
1996	951	617	1,568
1997	762	729	1,491
1998	1,039	1,268	2,307
1999	1,182	1,140	2,322
2000	1,134	1,133	2,267
2001	1,544	611	2,155
2002	1,223	729	1,952
2003	1,620	1,272	2,892
2004	1,499	1,285	2,784

There is no estimate of unreported catch.

4.9.4 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 2004. The fisheries of Saint-Pierre and Miquelon catch salmon of both Canadian and US origin. Sampling was carried out on this fishery in 2003 and 2004 (see section 4.11).

Fish designated as being of wild origin are defined as the progeny of fish where mate selection occurred naturally (eggs not stripped and fertilized artificially) and whose life cycle is completed in the natural environment (ICES, 1997). Hatchery-origin fish, designated as fish introduced into the rivers at any life stage, were identified on the basis of the presence of marks or an adipose clip, from fin deformations, and/or from scale characteristics. Not all hatchery fish could be identified as such in the returns because of stocking in the early life stages. Commercial fish-farm escapees were differentiated from hatchery fish on the basis of scale characteristics and fin erosion (especially of the tail), although the identification of early life stage escapees is also problematic.

The returns in 2004 to the majority of the rivers in Newfoundland and to most rivers of the Gulf of St. Lawrence and Québec were comprised exclusively of wild salmon (Figure 4.9.4.1). Hatchery-origin salmon made up varying proportions of the total returns and were most abundant in the rivers of the Bay of Fundy, the Atlantic coast of Nova Scotia and the USA. Aquaculture escapees were noted in the returns to two rivers of the Bay of Fundy (Magaguadavic in Canada and the St. Croix on the border between Canada and USA). In the USA, most returns (89%) originated from hatchery smolts and the balance (11%) originated from either natural spawning or hatchery fry (Figure 4.9.4.2).

Aquaculture production of Atlantic salmon in eastern Canada has increased annually, exceeding 10 000 t in 1992 and has been about 40 000 t for the past three years (Table 2.2.1.1). Escapes of Atlantic salmon have occurred annually. Reports of these escapes have not been made available to the Working Group.

In the Magaguadavic River (SFA 23; Table 4.9.4.1), which is located in close proximity to the centre of both the Canadian and USA east coast salmon farming areas, the proportion of the adult run composed of fish farm escapees has been high (greater than 50%) since 1994. Escaped fish were not observed between 1983 and 1988. Since 1992, escaped fish have comprised between 33% and 90% of adult salmon counts. However, while fish farm escapees have dominated the run in terms of percentages, in absolute terms, their numbers have been trending downwards (Table 4.9.4.1). Fish farm escapees were also monitored in the St. Croix River (Canada/USA border), and Maine's Dennys, Narraguagus and Union rivers. The St. Croix and Dennys rivers are also in close proximity to the principal USA and Canadian salmon farming areas, whereas the Narraguagus and Union are more to the south, but have a few farm sites located in their vicinity. Percentages of returns that were fish farm escapees in the returns to the St. Croix and Dennys rivers in 2004 were 29% and 0% respectively. In both the Union and Narraguagus rivers, no fish farm escapees were observed in 2004.

4.9.5 Elaboration on status of stocks

There are approximately 550 Atlantic salmon rivers 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 specific rivers, because they compose significant fractions of the salmon resource or are indicators of patterns within a region, or because of the demands by user groups, or as a result of requests for biological advice from fisheries management. The status is evaluated by examining trends in returns and escapement relative to the conservation requirements.

Measures of abundance in monitored rivers

Smolt and juvenile abundance

Counts of smolts provide direct measurements of the outputs from the freshwater habitat. Previous reports have documented the high annual variability in the annual smolt output. In tributaries, smolt output can vary by five times but in the counts for entire rivers, annual smolt output has generally varied by a factor of three.

Canada

Wild smolt production was estimated in 13 rivers of eastern Canada in 2004. Of these, seven rivers have at least ten years of information (Figure 4.9.5.1). In numerous other rivers, juvenile abundance surveys have been conducted.

In 2004, smolt production increased from the previous year in four of five monitored rivers in Newfoundland, decreased in the monitored rivers of Québec, and increased in the six monitored rivers of the Maritimes Provinces (Figure 4.9.5.1). Relative to the previous five-year mean, wild smolt production in 2004 increased in six of the ten rivers (+9% to +62%) while decreases of 13% to 49% were observed in the other four rivers.

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, densities of young-of-the-year (fry) and parr (juveniles of one or more years old) have increased since 1985 in response to increased spawning escapements and densities of parr in 2004 remained at high values. Fry densities were generally increased from the previous year in monitored rivers of the Gulf. Rivers of SFAs 20 and 21 along the Atlantic coast of Nova Scotia are generally organic stained, of lower productivity, and when combined with acid precipitation, can result in acidic conditions lethal to salmon. In the low-acidified St. Mary's River, fry (age 0+) and older parr (age-1+ and 2+) densities were the lowest of record (1985 to 2004). Trends in densities of age-1+ and older parr in the outer Bay of Fundy (SFA 23) have varied since 1980. Parr densities in the Nashwaak River and Saint John River above Mactaquac Dam have generally declined in accordance with reduced spawning escapements. In 2004, parr densities increased on the Saint John River and declined on the Nashwaak River from the previous year. 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 in 2004.

USA

Wild salmon smolt production has been estimated on the Narraguagus River for eight years (Figure 4.9.5.1). Smolt production in 2004 was similar to 2003 but 48% below previous five-year mean production. The mean juvenile densities in this river have been low over the period of sampling dating to 1990.

Estimates of total abundance by geographic area

For assessment purposes, the following regions were considered: Labrador (SFA 1, 2, & 14B), Newfoundland (SFA 3–14A), Québec (Q1–Q11), Gulf of St. Lawrence (SFA 15–18), Scotia-Fundy (SFA 19–23), and USA. Returns of 1SW and 2SW salmon to each region (Tables 4.9.5.1 and 4.9.5.2; Figures 4.9.5.2 and 4.9.5.3; and Appendix 5) were estimated by updating the methods and variables used 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 (Appendix 5). The 2SW component of the MSW returns was determined using the sea-age composition of one or more indicator stocks.

In the context used here, "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 was done to avoid double counting of fish when commercial catches in Newfoundland and Labrador and food fisheries in Labrador are added to returns of all geographic areas in North America to create the PFA of North American salmon.

Canada

Labrador

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 which continued in 2004, and so the model developed to determine returns and spawners from commercial catch data could not be used. In 2002–2004, there were counting projects that took place on four Labrador rivers, out of about 100 rivers with salmon (one in SFA 1B, Northern Labrador and three in SFA 2). Because they were on the same four rivers each year, the Working Group decided it was possible to extrapolate from return rates for small and large salmon per accessible drainage areas in these four rivers to unsurveyed ones in the remainder of Labrador. The area accessible drainages were 9267 km^2 for Lake Melville (SFA 1A), 25 485 km^2 for Northern Labrador (SFA 1B), 28 160 km^2 for Southern Labrador (SFA 2), and 2651 km^2 for the Straits Area (SFA 14B). Accessible drainage area in the counting facility rivers was 1878 km^2 resulting in an expansion factor of 35 to one. Not all rivers in Lake Melville were included due to a lack of information on presence of salmon populations in rivers in this region of Labrador. The Working Group recognized that this was a crude method for deriving returns and spawners for Labrador and that, if additional information on drainage areas and information from counting fences becomes available, particularly for Lake Melville, these should be added in future. The text table below shows the return rates of small and large salmon developed for the counting fence rivers for the four areas of Labrador used to derive returns and spawners for the period of 2002–2004:

Area	Size	2002	2003	2004
Lake Melville (SFA 1A) and Northern Labrador (SFA 1B)	**Small**	0.47–2.57	0.28–1.84	0.28–0.62
	Large	0.05–0.45	0.021–0.28	0.08–0.32
Southern (SFA 2) and Labrador Straits (SFA 14 B)	**Small**	0.50–2.72	0.41–2.75	1.60–3.56
	Large	0.05–0.49	0.04–0.54	0.13–0.52

Return rates for SFAs 1A and 1B were derived from English River return rates with maximum and minimum values developed using the observed variability of return rates in SFA 2.

Total returns and spawners for Labrador, 2002–2004 were estimated by Monte Carlo simulation based on 10 000 random draws from the range of values in the above table assuming return rates per km^2 of accessible drainage were uniformly distributed. The return rates for each SFA were then multiplied by the total accessible drainage area to derive total returns of small and large salmon. Because the Working Group was estimating returns from in-river data, ranges of values were developed to convert numbers of small and large salmon to numbers of 1SW and 2SW salmon from scale age information collected from counting fences and angling fisheries in Labrador. In total for the years 2002–2003, there were 1392 small salmon and 244 large salmon samples available. A bootstrap procedure was used to develop estimates of the proportions of sea age 1 salmon in estimates of small salmon returns and spawners, proportions of sea age 2 salmon in estimates of large salmon returns and spawners and proportions of sea age 1 salmon in the estimates of large salmon returns.

Sea age correction factors were:

- Small to 1SW – 96 to 100%
- Large to 2SW – 60 to 71%
- Small overlap in large – 12 to 21%

Spawners of 1SW and 2SW salmon were derived similar to previous years by subtraction of angling catches from the returns (including an estimate of hook and release mortalities).

For the years, 1998–2001 when only one or two counting projects took place in Labrador, the raising factors previously used and explained in Section 4.9.7 of 1.04 to 1.49 for small salmon and 1.05 to 1.27 for large salmon were used to estimate returns and spawners for Labrador from the overall PFA minus catches in Greenland as was the case in previous years. However, in this case returns were derived for Labrador by subtracting landings in food fisheries. Also, catches in 1994–2004 were updated to reflect changes made to catch statistics in Labrador from the Licence Stub Return System.

The mid-point of the estimated returns (96 700) of 1SW salmon to Labrador rivers in 2004 is 11% higher than in 2003 and about the same as the average 1SW returns (97 000) for the past five years (Figure 4.9.5.2, Appendix 5). The mid-point (11 500) of the estimated 2SW returns to Labrador rivers in 2004 was 18% higher than in 2003 and 29% lower than the recent 5–year average of 14 800 (Figure 4.9.5.3, Appendix 5).

Newfoundland

The estimates of 1SW and 2SW returns and spawners for insular Newfoundland (SFAs 3–12 & 14A) were previously documented based on the classification scheme of the Salmon Management Plan. Catches in 2003 and the calculated exploitation rates and large:small salmon ratios were updated to reflect changes made to catch statistics in Newfoundland from the Licence Stub Return System and catches in 2004 and exploitation rates were calculated.

The mid-point of the estimated returns (222 000) of 1SW salmon to Newfoundland rivers in 2004 is 3% higher than in 2003 and 19% higher than the average 1SW returns (186 600) for the past five years (Figure 4.9.5.2, Appendix 5). The mid-point (4600) of the estimated 2SW returns to Newfoundland rivers in 2004 was 10% higher than in 2003 and 10% lower than the recent 5-year average of 5,100 (Figure 4.9.5.3, Appendix 5).

Québec

The mid-point (36 900) of the estimated returns of 1SW salmon to Québec in 2004 is 34% higher than that observed in 2003 and is 29% higher than the previous five-year mean (Figure 4.9.5.2, Appendix 5).The mid-point (29 500) of the estimated returns of 2SW salmon in Québec in 2004 is 12% lower than that observed for 2003 (Figure 4.9.5.3) and 2% lower than the previous five-year mean.

Gulf of St. Lawrence, SFAs 15–18

The mid-point (70 900) of the estimated returns in 2004 of 1SW salmon returning to the Gulf of St. Lawrence was a 69% increase from 2003. The values noted in 1997 through 2004 are low relative to the values observed during 1985-1994 (Figure 4.9.5.2, Appendix 5). The mid-point (26 400) of the estimate of 2SW returns in 2004 is 5% higher than the estimate for 2003 (Figure 4.9.5.3, Appendix 5), and similar to 2001. Returns of 2SW salmon have declined since 1995 with only slight improvement shown in 2001 and 2003–2004, relative to the years prior to 1995.

Scotia-Fundy, SFAs 19–23

Prior to 1985 and closures in fisheries, 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 SFA's and an index river, LaHave River, where counts have been made in a fishway trap since 1972. The regression consisted of an intercept and a coefficient applied to the count of wild salmon at the fishway. Since 1985, the number of returns has decreased to a point where the total return approximates or is less than the intercept value. Therefore, in 2004 a new regression without an intercept was estimated and applied to counts since 1985. This results in substantially lower estimates of returns at low index counts as currently is the case. All ancillary data, swim-thru counts, mark and recapture by seining and electrofishing as well as counts in at least one other fishway trap, indicate that salmon, particularly MSW salmon, are at record lows in these rivers. Because stocking of hatchery produced smolts is high in the LaHave River and disproportionate across these SFA's and because of the possibility of increased recruitment of wild smolts from hatchery spawning salmon, the returns to these SFAs may be overestimated.

The mid-point (7700) of the estimate of the 1SW returns in 2004 to the Scotia-Fundy Region was a 45% increase from the 2003 estimate, and the third lowest value in the time-series, 1971–2004. Returns have generally been low since 1990 (Figure 4.9.5.2, Appendix 5). The mid-point (2200) of the 2SW returns in 2004 is 35% lower than the returns in 2003 but still the third lowest value in the time-series, 1971–2004 (Figure 4.9.5.3, Appendix 5). A declining trend in returns has been observed from 1985 to 2004.

USA

Total salmon returns for USA rivers in 2004 were based on trap and weir catches and estimated from a linear regression model based on redd counts for unmonitored rivers. The 1SW returns and spawners to USA rivers in 2004 were 319 fish (Figure 4.9.5.2). This was a decrease from the 2003 estimate and equal to the 5-year average (319) but lower than the 10-year (339) average. The 2SW returns in 2004 to USA rivers were 1283 fish, an increase over the 5–year (808) and 10–year (1170) averages (Figure 4.9.5.3). There were 33 3SW and repeat spawners compared to 7 in 2003.

Run-reconstruction estimates of spawning escapement

Updated estimates for 1SW spawners were derived for the six geographic regions (Table 4.9.5.3). Estimates of 2SW spawners, 1971–2004 are provided in Table 4.9.5.4. These estimates were derived by subtracting the in-river removals from the estimates of returns to rivers. A comparison between the numbers of spawners, returns, and conservation limits (S_{lim}) for 2SW salmon is shown in Figure 4.9.5.3 (there are no spawning requirements defined specifically for 1SW salmon).

Canada

Labrador

As previously explained, spawner estimates for Labrador in 1998 – 2004 were developed, using the monitoring facilities for 2002–2004 and the proportional method for 1998–2001 The mid-point of the estimated numbers of 2SW spawners (11 200) was 18% above the previous year and was 32% of the total 2SW conservation limit (S_{lim}) for all rivers (Figure 4.9.5.3). The 2SW spawner limit has only been exceeded once (1998) since 1971. The mid-point of the estimated numbers of 1SW spawners (94 200) was 11% above that estimated for 2003 (Figure 4.9.5.2).

Newfoundland

The mid-point of the estimated numbers of 2SW spawners (4500) in 2004 was 11% above that estimated in 2003 (4100) and was 113% of the total 2SW conservation limit (S_{lim}) for all rivers. The 2SW spawner limit has been met or exceeded in eleven years since 1984 (Figure 4.9.5.3). The 1SW spawners (201 900) in 2004 were 5% higher than the 193 700 1SW spawners in 2003. The 1SW spawners since 1992 were higher than the spawners in 1989–91 and similar to levels in the late 1970s and 1980s (Figure 4.9.5.2), 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 1998–2001, and this is consistent with the closure of the commercial fisheries in Newfoundland. For 1997, decreases occurred most strongly in the 1SW spawners.

Québec

The mid-point of the estimated numbers of 2SW spawners (20 700) in 2004 was 16% lower than that observed for 2003 and was about 70% of the total 2SW conservation limit (S_{lim}) for all rivers (Figure 4.9.5.3). The spawning escapement in 2004 ranked approximately in the middle of the range in the time-series (1971–2004), with 1971 having been the lowest and the 2004 value was the second highest since 1997. Estimates of the numbers of 2SW spawners approximated the spawner limit from 1971 to 1990; however, they have been below the limit since 1990. The mid-point of the estimated 1SW spawners in 2004 (26 300) was about 36% higher than in 2003 (Figure 4.9.5.2) and the highest value since 1992.

Gulf of St. Lawrence

The mid-point of the estimated numbers of 2SW spawners (24 700) in 2004 was about 5% higher than estimated in 2003 and was about 85% of the total 2SW conservation limits (S_{lim}) for all rivers in this region (Figure 4.9.5.3). This is the ninth time in ten years that these rivers have not exceeded their 2SW spawner limits. The mid-point of the estimated spawning escapement of 1SW salmon (47 200) increased by 71% from 2003 and was the second highest value in the last ten years. The abundance remains low relative to the peak (154 000) observed in 1992 (Figure 4.9.5.2). Spawning escapement has on average been higher in the mid-1980s than it was before and after this period.

Scotia-Fundy

The mid-point of the estimated numbers of 2SW spawners (2100) in 2004 is a 34% decrease from 2003, the second lowest in the time series, 1971–2004 and is about 9% of the total 2SW conservation limits (S_{lim}) for rivers in this region (Figure 4.9.5.3). 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 do not contribute 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 (7500) in 2004 is a 47% increase from 2003 and is the fifth lowest in the time-series, 1971–2004. There has been a general downward trend in 1SW spawners since 1990 (Figure 4.9.5.2).

USA

All age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2004 (1635 salmon) represented 5.6% of the 2SW spawner requirements for all USA rivers combined. Spawning 2SW salmon, expressed as the percentage of conservation requirement was only 4.4% for all USA rivers combined (Figure 4.9.5.3). On an individual river basis, the Penobscot River met 14.8% of its spawner requirement while all the other US rivers met between 0.3-4.2% of their 2SW requirements.

Summary

The rank of the estimated returns in the 1971–2004 time-series and the proportion of the 2SW conservation limit achieved in 2004 for six regions in North America is shown below:

Region	Rank of 2004 returns in 1971-2004 (1=highest)		Rank of 2004 returns in 1994-2004 (1=highest)		Mid-point estimate of 2SW spawners as proportion of conservation limit (S_{LIM})
	1SW	2SW	1SW	2SW	(%)
Labrador	10	22	7	10	32
Newfoundland	4	19	3	8	113
Québec	11	31	2	8	70
Gulf	17	24	2	4	85
Scotia-Fundy	32	33	9	10	9
USA	19	28	7	6	4

4.9.6 Exploitation rates

Canada

There is no exploitation by commercial fisheries and the only remaining fisheries are for recreation and food.

USA

There was no exploitation of USA salmon in home waters, and no salmon of USA origin were reported in Canadian fisheries in 2004.

4.9.7 Pre-fisheries abundance

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 (2004, Table 4.9.7.1). The North American run-reconstruction model has also been used to estimate the fishery exploitation rates for West Greenland and in home waters.

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 4.9.7.2. 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)]. In Labrador, Aboriginal peoples' food harvests of small (AH_s) and large salmon (AH_l) were included in the reported catches for 1999–2004. 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 equations used to calculate NC1 and NC2 are as follows:

Eq. 4.2.3.1 $NC1(i) = [(H\_s(i)_{\{1\text{-}7,14b\}} + H\_l(i)_{\{1\text{-}7,14b\}} * q) * f\_imm]$

$+ [(AH\_s(i) + AH\_l(i) * q) * af\_imm]$, and

Eq. 4.2.3.2 $NC2(i+1) = [H\_l(i+1)_{\{1\text{-}7,14b\}} * (1\text{-}q)] + [AH\_l(i+1) * (1\text{-}q)]$

As in 1998–2003, the commercial fishery in Labrador remained closed in 2004. In past reports, salmon returns and spawners for Labrador, which make up one of the six geographical areas contributing to NR2 for Canada, were based on commercial fishery data. Since the commercial fishery was closed in Labrador beginning in 1998, the time-series also ended. However, in order to estimate pre-fishery abundance it was still necessary to include Labrador returns for 1998–2004. Consequently, a raising factor was developed by dividing pre-fishery abundance without Labrador into pre-fishery abundance with Labrador based on the time-series of Labrador recruit estimates and pre-fishery abundance data from 1971–97. The raising factor (RFL2) to estimate returns to Labrador for 1998–2001 for 2SW salmon was set to the low and high range of values in the time-series which was 1.05 to 1.27. As described in a previous section, a new time series for Labrador has been developed for 1971–1997 using commercial catch data expanded to total returns by exploitation rates, 1998–2001 using the raising factors, and 2002–2004 using return rates per km^2 of accessible drainage area from monitored rivers expanded to total drainage area. An assumed natural mortality rate [M] of 0.03 per month is used to adjust the numbers between the salmon fisheries on the 1SW and 2SW salmon (10 months) and between the fishery on 2SW salmon and returns to the rivers (1 month) as shown below:

E.q. 4.2.3.3 $NN1(i) = RFL2*[(NR2(i+1) / S1+ NC2(i+1))/S2 + NC1(i)] + NG1(i)$

where the parameters S1 and S2 are defined as exp(-M *1) and exp(-M *10), respectively. A detailed explanation of the model used to determine pre-fishery abundance is given in Rago *et al*. (1993a).

This estimated pre-fishery abundance represents the extant population and does not account for the fraction of the population present in a given fishery area. 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. Commercial catches were not included in the run-reconstruction model for the West Greenland fishery (1993 and 1994), Newfoundland fishery (1992–2004), and Labrador fishery (1998–2004), as these fisheries were closed.

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 2003. This is because pre-fishery abundance estimates for 2004 require 2SW returns to rivers in North America in the year 2005, which of course are as of yet unavailable. The minimum and maximum values of the catches and returns for the 2SW cohort are summarized in Table 4.9.7.3. The 2003 abundance estimates ranged between 78 572 and 146 249 salmon. The mid-point of this range (112 410) is almost identical to the 2002 value (112 282) and is the 5th lowest in the 32-year time-series (Figure 4.9.7.1). The most recent six years are shown with hollow symbols to represent the new time series of Labrador values estimated for these. Even though the 2003 value has increased considerably from the 2001 year, 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.

Maturing 1SW salmon

Estimation of an aggregate measure of abundance has utility for identifying trends, evaluating management measures, and investigating the influence of the marine environment on survival, distribution, and abundance of salmon. Maturing 1SW salmon are in some areas a major component of salmon stocks, and measuring their abundance is thought to be important to provide measures of abundance of the entire cohort from a specific smolt class.

For the commercial catches in Newfoundland and Labrador, all small salmon are assumed to be 1SW fish based on catch samples, which show the percentage of 1SW salmon to be 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.

Similar to calculations to determine non-maturing 1SW salmon, a raising factor was also required to include Labrador returns in the maturing component of pre-fishery abundance necessitated by the closure of the commercial fishery in Labrador in 1998. Consequently, a raising factor was developed by dividing pre-fishery abundance without Labrador into pre-fishery abundance with Labrador based on the time-series of Labrador recruit estimates and pre-fishery abundance data from 1971–97. The raising factor (RFL1) to estimate returns to Labrador for 1998–2004 for 1SW salmon was set to the low and high range of values in the time-series, which were 1.04 to 1.59. As described in a previous section, a new time series for Labrador has been developed using commercial catch data expanded to total returns by exploitation rates as before for 1971–1997, 1998–2001 using the raising factors, and 2002–2004 using return rates per km^2 of accessible drainage area from counting fence rivers expanded to total drainage area.

The maturing 1SW component is represented by the pre-fishery abundance estimator for year i [MN1(i)]. It is constructed by summing maturing 1SW returns in year i [MR1(i)] in Canada and the USA and catches in year i from commercial and food fisheries on maturing 1SW salmon in Newfoundland and Labrador [MC1(i)]. An assumed natural mortality rate [M] of 0.03 per month is used to adjust the numbers between the fishery on 1SW salmon and returns to the rivers (1 month) as shown below:

Eq. 4.2.3.4 $$MN1(i) = [MR1(i) / S1+ MC1(i)] * RFL1$$

where the parameter S1 is defined as exp(-M * 1).

Eq. 4.2.3.5 $$MC1(i) = [(1\text{-}f\_imm)(H\_s(i)_{\{1\text{-}7,14b\}} + q*H\_l(i)_{\{1\text{-}7,14b\}})] + H\_s(i)_{\{8\text{–}14a\}} + [(1\text{-}af\_imm)(AH\_s(i) + q*AH\_l(i))]$$

This estimated pre-fishery abundance represents the extant population and does not account for the fraction of the population present in a given fishery area. 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 the fisheries harvesting 1SW salmon. Thus, catches used in the run-reconstruction model for the Newfoundland commercial fishery were set to zero for 1992–2004 and for Labrador for 1998–2004 to remain consistent with catches used in other years in these areas.

The minimum and maximum values of the catches and returns for the 1SW cohort are summarized in Table 4.9.7.4 and the mid-point values are shown in Figure 4.9.7.1. The most recent five years are shown with hollow symbols to show the difference in techniques for estimating the Labrador values for these years. The mid-point of the range of pre-fishery abundance estimates for 2004 (456 002) is 15% higher than in 2003 (395 831) which had increased considerably from the low 1994 value of 309 034, which was the lowest, estimated in the time-series 1971–2004. The reduced values observed in 1978 and 1983–84 and 1994 were followed by large increases in pre-fishery abundance.

Total 1SW recruits (maturing and non-maturing)

Figure 4.9.7.1 shows the pre-fishery abundance of 1SW maturing for the 1971–2003 and 1SW non-maturing salmon from North America for 1971–2004. Figure 4.9.7.2 shows these data combined to give the total 1SW recruits. While maturing 1SW salmon in 1998–2004 have increased over the lowest value achieved in 1994, the non-maturing portion of these cohorts remained unchanged since 1997. As 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, this situation is considered to be very serious. The decline in recruits in the time-series is alarming. Although the declining trend appears common to both maturing and non-maturing portions of the cohort, non-maturing 1SW salmon have declined further. The Working Group expressed concerns about these stock trends.

Comparison of PFA derived from old and new data

Comparison of PFA values including the new data for deriving returns and spawners for Labrador, 2002–2004 and changes to the inputs from SFAs 19–21, 1998–2004 indicates only minor differences in results between the old PFA and new PFA values (Fig. 4.9.7.3). As the data remained the same for values derived in 1971–1997, PFA values did not change. The Working Group recommended using these new values of PFA for predictive purposes and the provision of catch advice.

Escapement variability in North America

The projected numbers of potential 2SW spawners that could have returned to North America in the absence of fisheries can be computed from estimates of the pre-fishery abundance taking into consideration the 11 months of natural mortality at 3% per month. These values, termed potential 2SW recruits, along with total North American 2SW returns, spawners, and conservation limits (S_{lim}) are shown in Figure 4.9.7.4 and indicate that the overall North American conservation limit could have been met, in the absence of all fisheries prior to, but not since 1994. The difference between the potential 2SW recruits and actual 2SW returns reflect the extent to which mixed stock fisheries at West Greenland and in SFAs 1–14 have reduced the populations.

Similarly, the impact of the Greenland fishery can be considered by subtracting the non-maturing 1SW salmon (accounting for natural mortality) harvested there from the total potential 2SW recruits. These values, termed 2SW recruits to North America, are also shown in Figure 4.9.7.4. The difference between the 2SW recruits to North America and the 2SW returns reflects the impact of removals by the commercial fisheries of Newfoundland and Labrador when they were open and the Labrador food fisheries since reports began in 1998. The 2SW recruits to North America indicate that, even if there had not been a West Greenland commercial fishery, conservation limits could not have been met since 1992. The difference between the actual 2SW returns and the spawner numbers reflects in-river removals throughout North America and coastal removals in Québec, Gulf, and Scotia Fundy regions.

Following on the technique outlined in previous reports (ICES, 1994, 1995), the 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). In 2004, discrepancies between the US smolt age proportions currently used in the lagged spawner estimates and contemporary smolt age proportions were identified and corrected. Changes were made to the USA portion of the table due to declines in natural spawning for US Atlantic salmon populations and changes in hatchery and stocking practices. The original USA smolt age distributions are used to allocate the USA spawners for years 1971–1989 and the new distribution for 1990 onward. It was recommended in 2004 that a review and updating, if required, of the Canadian smolt age distribution be undertaken.

The smolt age distributions of Labrador and Gulf 2SW salmon were examined in 2005. Adult ageing data for 2SW salmon for all available Labrador rivers for the time period 1970–2003 were used. Spatial coverage of rivers in Labrador has improved in the last decade but few rivers were sampled consistently over extended periods. The river age distributions differed within the Salmon Fishing Areas in Labrador, with generally higher proportions of older smolts in the northern area. The year-specific river age distributions in Labrador suggest an increase to a higher proportion of river age-3 2SW salmon in recent years but the change was not considered sufficient nor the time period clearly enough defined to warrant a change in the smolt age structure used for Labrador at this time.

The biological data set from the Gulf region consisted of a 34-year continuous time series of adult sampling from the Miramichi River. The 2SW maiden component by year class has comprised on average 49% 2-year old smolt, 51% 3-year old smolt and less than 1% 4-year old smolt. Other rivers from the Gulf include the Restigouche River (SFA 15) for which recent data indicate a mean smolt age distribution of 32% age-2, 64% age-3, and 4% age-4 smolts. When combined, there was no obvious change in smolt age distribution over time and no change to the values used by the Working Group was required.

The Working Group recommended that the smolt age distributions for the six North American areas should be re-evaluated on a five-year schedule, beginning in 2009.

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 (Table 4.9.7.5).

Spawning escapement of 2SW salmon to several stock complexes has been below S_{lim} (Labrador, Québec, Scotia-Fundy, USA) since at least the 1980s (Figure 4.9.7.5). In the last four years, lagged spawner abundance has been increasing in Labrador and Newfoundland, but decreasing in all other areas. 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 2004.

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 4.9.7.6). 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 2004

Egg depositions by all sea-ages combined in 2004 exceeded or equaled the river specific conservation limits in 43 of the 87 assessed rivers (49%) and were less than 50% of conservation limits in 27 other rivers (31%) (Figure 4.9.8.1). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 9 of the 12 rivers assessed (75%) had egg depositions that were less than 50% of conservation limits. Proportionally fewer rivers in Gulf (0%) and Québec (18%) had egg depositions less than 50% of conservation limits. For 100% of the Gulf rivers and 61% of the Quebec rivers, egg depositions equaled or exceeded conservation limits (Figure 4.9.8.1). In Newfoundland, 61% of the rivers assessed met or exceeded the conservation limits and 13% had egg depositions that were less than 50% of limits. Most of the deficits occurred in the east and southwest rivers of Newfoundland (SFA 13). All age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2004 (1,635 salmon) represented 4.6% of the 2SW spawner requirements for all USA rivers combined. Spawning 2SW salmon exclusively, expressed as the percentage of conservation requirement was 4.4% for all USA rivers combined. On an individual river basis, the Penobscot River met 14.8% of its spawner requirement while all the other USA rivers met between 0.3–4.2% of their 2SW requirements (Figure 4.9.8.1).

4.9.9 Marine survival rates

With the closure of most sea fisheries, counts of smolts and returning adult salmon can provide indices (% smolt survival) of natural survival at sea. These estimates are potentially influenced by annual variation in the size, age and sex composition of smolts leaving freshwater and possibly, annual variation in sea-age at maturity. Data available in 2004 on rivers with smolt counts and corresponding adult counts were from twelve wild and three hatchery populations distributed among Newfoundland (SFAs 4, 9, 11, and 14a), Québec (Q2 and Q7), Nova Scotia (SFA 21), New Brunswick (SFAs 16, and 23) and Maine (USA) (Penobscot and Narraguagus) rivers.

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	3.6	1.2 to 6.4	4
		Quebec	0.5	0.3 to 1.4	2
		Newfoundland	5.5	2.1 to 11.1	5
Wild	2SW	Maine (USA)	0.5	0.1 to 0.8	1
		Maritimes	0.9	0.2 to 2.0	3
		Quebec	0.6	0.1 to 1.2	2
Hatchery	1SW	Maine (USA)	0.04	0.03 to 0.07	1
		Maritimes	0.53	0.27 to 0.87	2
Hatchery	2SW	Maine (USA)	0.10	0.05 to 0.17	1
		Maritimes	0.12	0.05 to 0.21	2

Examination of return rates of 1SW and 2SW adults over time (Figures 4.9.9.1 to 4.9.9.4) provide insight into the impact of changes in management measures and possible changes in marine survival of wild and hatchery 1SW and 2SW stocks. In general the plots suggest:

- Survival of North American stocks to home waters has not increased as expected after closure of the commercial fisheries in 1984 and 1992,
- 1SW survival greatly exceeded that of 2SW fish (except for Maine, where survival of 2SW fish generally exceeds that of 1SW fish),
- Survival of wild stocks exceeds that of hatchery stocks, and
- Survival of fish from many rivers in North America is low compared to historic levels, especially in the south.

In 2004, estimated return rates for 1SW fish improved from the previous year in 2 of 3 hatchery stocks and in 10 of 11 wild stocks. By contrast, 2SW return rates from smolts in 2002 decreased in 4 of 6 wild stocks while they improved in 2 of 3 hatchery stocks, consistent with observed increases or decreases in 1SW return rates the previous year from the same smolt cohort.

4.9.10 Summary on status of stocks

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 oscillated around a generally declining trend since the 1970s. (Figure 4.9.7.2). During 1993 to 2004, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. A 21% increase however has occurred between 2001 and 2003, the most recent year for which it is possible to estimate the total population. 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.

The returns in 2004 of 2SW fish increased slightly from 2003 in Labrador, Newfoundland, the Gulf of St. Lawrence and the USA however they are still close to the lower end of the 33-year time-series (1971-2003). In Quebec and Scotia-Fundy, 2SW returns decreased from the previous year. In Newfoundland, the 2SW salmon are a minor age group component of the stocks in this area and even here, decreases of about 30% have occurred from peak levels of a few years ago. Returns of 1SW salmon increased from 2003 in all areas.

When compared to conservation limits, 2SW spawners in 2004 only exceeded the limit in one area (Newfoundland 113%); the other areas were less than (Gulf 85%, Quebec 70%), or substantially less than (Labrador 32%, Scotia-Fundy 9%, USA 4%) the limits.

Trends in abundance of small salmon and large salmon within the geographic areas show a general synchrony among the rivers. Returns of large salmon in North America increased slightly from 2003, while small salmon returns increased substantially in most areas. For the rivers of Newfoundland, both small and large salmon returns increased from 2003, and remained high relative to the years before the closure of the commercial fisheries. Large salmon in Newfoundland are predominantly repeat-spawning 1SW salmon, while in other areas of eastern Canada, 2SW and 3SW salmon make up varying proportions of the returns.

Egg depositions by all sea-ages combined in 2004 exceeded or equaled the river specific conservation limits in 43 of the 87 assessed rivers (49%) and were less than 50% of conservation limits in 27 other rivers (31%) (Figure 4.9.8.1). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 9 of the 12 rivers assessed (75%) had egg depositions that were less than 50% of conservation limits. Proportionally fewer rivers in Gulf (0%) and Québec (18%) had egg depositions less than 50% of conservation limits. For 100% of the Gulf rivers and 61% of the Quebec rivers, egg depositions equaled or exceeded conservation limits (Figure 4.9.8.1). In Newfoundland, 61% of the rivers assessed met or exceeded the conservation limits and 13% had egg depositions that were less than 50% of limits. Most of the deficits occurred in the east and southwest rivers of Newfoundland (SFA 13). All USA rivers had egg depositions less than 5% of conservation limits. The Penobscot River in the USA met 14.8% of its egg deposition requirements while all the other US rivers were 5% or less of their requirements.

In 2004, the overall conservation limit (S_{lim}) for 2SW salmon was met only in Newfoundland. The overall 2SW conservation limit for Canada could have been met or exceeded in only nine (1974–78, 1980–82 and 1986) of the past 32 years (considering the mid-points of the estimates) by the reduction of terminal fisheries (Figure 4.9.7.4). In the remaining years, conservation limits could not have been met even if all terminal harvests had been eliminated. It is only within the last decade that Québec and the Gulf areas have failed to achieve their overall 2SW salmon conservation limits.

Substantive increases in spawning escapements in recent years in northeast coast Newfoundland rivers and high smolt and juvenile production in many rivers, in conjunction with suitable ocean climate indices, were suggestive of the potential for improved adult salmon returns for

1998 through 2004. Colder oceanic conditions both nearshore and in the Labrador Sea in the early 1990s are thought to have contributed to lower survival of salmon stocks in eastern Canada during that period.

Measures of marine survival rates over time indicate that survival of North America stocks to home waters has 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 Maine (US). Return rates to 2SW salmon in the multi-sea-winter monitored stocks have not exceeded 2% in the last five years. Generally improved wild smolt production in 10 of 13 monitored rivers of eastern Canada may provide increased returns of 1SW salmon in 2005 if survival rates are similar to or improve from 2004.

Based on the genera1ly improved 1SW returns in 2004, an increase is expected for large salmon in 2005 although return rates of 2SW salmon in monitored stocks remain low. An additional concern is the low abundance levels of many salmon stocks in rivers 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.

4.11 NASCO has asked ICES to provide an analysis of any new biological and/or tag return data to identify the origin and biological characteristics of Atlantic salmon caught at St. Pierre and Miquelon

Sampling of the fishery took place in both 2003 and 2004 and was reported to the Working Group in 2005. Approximately 30% of the reported catch was sampled in each year:

	2003	2004
Number of sampling periods	12	11
Sampling Time Period	June 4–July 6	June 5–June 29
Gutted weight sampled (kg)	872	837
Number of fish sampled	340	355
Fish sampled for scales	0	166
Fish sampled for genetics	0	25

The size distribution of fish sampled was similar in both years, with two distinct size modes noted, with the smaller fish averaging approximately 56 cm and the larger fish averaging approximately 76 cm. The smaller sized fish were the most common, about 80% of those sampled.

Scale analysis provided information on the age of salmon captured in the fishery in 2004. There were three sea-ages noted in the 143 usable scale samples: 1SW (81.1%), 2SW (18.2%) and a repeat spawner (0.7%).

River age distributions were:

RIVER AGE	% (141 SAMPLES)
1	0.7
2	29.8
3	49.7
4	17.7
5	2.1

Results were not yet available on the genetic origin of the 25 sampled fish. While the river age distribution is generally characteristic of eastern Canadian wild stocks, the river age 1 fish likely originated from a hatchery in Canada or from a hatchery or river in the USA.

4.12 Data deficiencies and research needs

Data deficiencies and research needs for the NAC area are presented in Section 6.

Country	Stock Area	Management zone	2SW spawner requirement	
Canada	Labrador	SFA 1	7,992	
		SFA 2	25,369	
		SFA 14B	1,390	
	Subtotal			34,746
	Newfoundland	SFA 3	240	
		SFA 4	488	
		SFA 5	233	
		SFA 6 to 8	13	
		SFA 9 to 12	212	
		SFA 13	2,544	
		SFA 14A	292	
	Subtotal			4,022
	Gulf of St. Lawrence	SFA 15	5,656	
		SFA 16	21,050	
		SFA 17	537	
		SFA 18	3,187	
	Subtotal			30,430
	Québec	Q1	2,532	
		Q2	1,797	
		Q3	1,788	
		Q5	948	
		Q6	818	
		Q7	2,021	
		Q8	11,195	
		Q9	3,378	
		Q10	1,582	
		Q11	3,387	
	Subtotal			29,446
	Scotia-Fundy	SFA 19	3,138	
		SFA 20	2,691	
		SFA 21	5,817	
		SFA 22	0	
		SFA 23	13,059	
	Subtotal			24,705
Total				123,349
USA	Connecticut		9,727	
	Merrimack		2,599	
	Penobscot		6,838	
	Other Maine rivers		9,668	
	Paucatuck		367	
Total				29,199
North American Total				152,548

Table 4.3.1.2 SW spawning requirements for North America by country, management zone and overall. Management zones are shown in Figure 4.9.2.1.

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	309	179	9,606	0	9,606	85
2003	312	3	1,794	2,106	221	68	8,870	590	189	12,045	0	12,045	83
2004	355	3	3,057	3,412	221	59	8,827	635	105	13,260	0	13,260	74
2005	459			459						459		459	

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, 1972-2005, 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	42,312	166	42,478	0.39	30,091	72,569	59
1994	41,612	1	41,613	0.00	0	41,613	100
1995	36,073	0	36,073	0.00	0	36,073	100
1996	32,746	0	32,746	0.00	15,343	48,089	68
1997	27,675	0	27,675	0.00	15,776	43,451	64
1998	17,231	0	17,231	0.00	12,088	29,319	59
1999	12,064	0	12,064	0.00	2,175	14,240	85
2000	13,221	0	13,221	0.00	3,863	17,084	77
2001	13,079	0	13,079	0.00	4,005	17,084	77
2002	9,606	0	9,606	0.00	6,989	16,596	58
2003	12,045	0	12,045	0.00	1,627	13,672	88
2004	13,260	0	13,260	0.00	1,958	15,218	87
2005	459	-	459	-	2,755	-	-

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

	% of provincial harvest			% of	
	Aboriginal peoples' food fisheries	Recreational fisheries	Resident food fisheries	eastern Canada	Number of fish
		Small salmon			
Newfoundland / Labrador	26.3	71.4	2.3	54.3	28,610
Québec	12.8	87.2	0.0	14.4	7,570
New Brunswick	11.4	88.6	0.0	29.4	15,508
P.E.I.	0.0	100.0	0.0	0.1	76
Nova Scotia	1.1	98.9	0.0	1.8	962
		Large salmon			
Newfoundland / Labrador	88.0	6.5	5.5	30.6	3,965
Québec	47.3	52.7	0.0	63.3	8,191
New Brunswick	100.0	0.0	0.0	5.7	739
P.E.I.	-	-	-	0.0	0
Nova Scotia	100.0	0.0	0.0	0.4	46
Eastern Canada		**% by user group**			
Small salmon	19.5	79.3	1.2		52,726
Large salmon	63.0	35.4	1.7		12,941

Table 4.9.3.1. Percentages by user group and province of small and large salmon harvested (by number) in the Atlantic salmon fisheries of eastern Canada during 2004.

Year	Newfoundland & Labrador			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	1,620	5,375	1,092	7,981	16,068	177	125	302	1,238	7,015	8,253	**30,415**	**23,284**	**53,699**
2004	21,506	4,740	26,246	829	2,365	3,194	1,098	7,517	2,028	8,100	18,743	118	63	181	1,276	7,365	8,641	**32,344**	**24,661**	**57,005**

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

Table 4.9.3.2. Hook-and-release Atlantic salmon caught by recreational fishermen in Canada, 1984 – 2004.

	Dennys			*Narraguagus*			*St Croix*			*Union*			*Magaguadavic*		
Year	*1SW*	*MSW*	*AQ*	*1SW*	*MSW*	*AQ*	*1SW*	*MSW*	*AQ*	*1SW*	*MSW*	*AQ*	*1SW*	*MSW*	*AQ*
1992													155	138	148
1993													113	124	154
1994				4	47	1	47	37	97	0	0		43	88	1200
1995				0	56	0	15	31	14	0	0		50	29	712
1996				10	54	8	23	109	20	6	63		21	48	240
1997				1	36	0	26	2	42	0	8		33	26	119
1998				1	21	0	32	9	25	2	11		27	4	222
1999				6	26	3	8	5	23	3	6	63	12	12	90
2000	1	1	28	13	10	0	10	10	30	1	1	3	14	0	30
2001	4	13	62	5	27	1	13	7	58	0	0	2	11	6	130
2002	2	0	4	4	4	0	14	6	5	0	5	6	7	0	35
2003	3	6	2	0	21	0	6	9	9	1	0	0	3	3	22
2004	0	1	0	1	10	0	6	4	4	5	14	0	2	0	17

Data from fishway traps except Dennys weirs
Blanks are no data

Table 4.9.4.1. Counts of wild/hatchery and escaped farm salmon (AQ) at counting facilities in rivers of eastern Maine, USA, and the Magaguadavic River (SFA 23, Canada)

Table 4.9.5.1 Estimated numbers of 1SW returns in North America by geographic regions, 1971 – 2004.

	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	53,015	89,709	6,876	10,937	450	284,547	475,796	380,171
2003	47,127	127,368	174,862	256,264	23,142	31,892	30,493	53,578	4,135	6,509	237	279,996	475,849	377,922
2004	68,331	125,093	176,138	267,925	30,452	43,311	51,961	89,780	5,951	9,437	319	333,153	535,865	434,509

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 4.9.5.2 Estimated numbers of 2SW returns in North America by geographic regions, 1971 – 2004.

	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	6,764	11,087	2,231	70,106	157,208	113,657
1994	5,653	24,396	1,495	5,226	37,703	47,180	20,372	43,698	4,379	6,908	1,346	70,947	128,754	99,851
1995	12,368	44,205	2,243	7,535	43,755	54,186	29,885	50,879	4,985	8,317	1,748	94,984	166,871	130,927
1996	9,113	32,759	2,964	8,832	39,413	49,846	17,775	37,200	7,227	12,054	2,407	78,898	143,097	110,998
1997	8,919	26,674	3,469	8,538	32,443	41,017	14,774	37,114	3,645	5,922	1,611	64,861	120,875	92,868
1998	21,886	50,512	4,280	8,813	24,358	31,832	8,447	26,746	2,514	3,939	1,526	63,012	123,368	93,190
1999	5,245	30,259	2,599	9,661	25,415	33,710	9,475	20,747	3,691	5,737	1,168	47,593	101,282	74,437
2000	7,108	32,391	2,022	12,023	24,317	33,992	10,451	20,965	1,822	3,049	533	46,254	102,954	74,604
2001	7,869	36,361	1,614	7,832	25,562	35,398	17,510	32,424	3,231	5,273	788	56,574	118,076	87,325
2002	5,446	17,586	1,268	5,796	18,714	26,135	7,317	19,448	774	1,173	511	34,029	70,649	52,339
2003	4,006	15,399	1,419	6,894	28,787	38,262	15,306	34,763	2,452	4,268	1,192	53,162	100,777	76,970
2004	6,578	16,395	1,334	7,830	25,539	33,450	15,313	37,447	1,722	2,669	1,283	51,771	99,074	75,423

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 4.9.5.3. Estimated numbers of 1SW spawners in North America by geographic regions, 1971-2004.

	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	31,836	63,088	6,607	10,635	450	226,274	409,939	318,106
2003	44,522	124,763	151,998	233,401	15,445	23,187	18,482	36,721	3,912	6,262	237	234,597	424,572	329,584
2004	65,853	122,615	156,024	247,799	20,513	32,095	31,132	63,174	5,726	9,179	319	279,568	475,181	377,375

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 4.9.5.4. Estimated numbers of 2SW spawners in North America by geographic regions, 1971-2004.

	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	7,106	19,041	608	981	511	27,130	61,276	44,203
2003	3,793	15,147	1,375	6,803	20,738	28,570	14,860	34,028	2,274	4,068	1,192	44,232	89,808	67,020
2004	6,325	16,095	1,295	7,751	17,533	23,802	14,866	36,625	1,625	2,556	1,283	42,927	88,111	65,519

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 4.9.7.1 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 4.9.7.2).

	{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	3706	2175	0	0	0	0	0
2004	8179	0	3706	0	0	0	0	0

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

Table 4.9.7.3 Run reconstruction data inputs used to estimate pre-fishery abundance of non-maturing (NN1) 1SW salmon of North American origin (terms defined in Table 4.9.7.2).

1SW Year (i)	NG1 (i)	NC1 min (i)	max (i)	NC2 min (i+1)	max (i+1)	NR2 min (i+1)	max (i+1)	NN1 min (i)	max (i)	mid-point (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	70106	157208	158272	288085	223179
1993	0	1878	4441	10764	13839	70947	128754	115094	202214	158654
1994	0	1018	2651	7823	10058	94984	166871	143698	248340	196019
1995	21341	910	2267	5090	6545	78898	143097	138867	231486	185177
1996	21944	858	2006	4860	6249	64861	120875	119582	200519	160050
1997	16814	1045	2367	1588	2269	63012	123368	107650	193845	150748
1998	3026	161	367	759	1084	47593	101282	70411	145736	108073
1999	5374	142	306	946	1352	46254	102954	71131	150711	110921
2000	5571	273	573	1171	1673	56574	118076	86118	172642	129380
2001	9722	248	529	1006	1437	34029	70649	58661	110461	84561
2002	2263	297	624	1523	2175	53162	100777	78563	146001	112282
2003	2724	335	713	2594	3706	51771	99074	78572	146249	112410
2004	3832	427	929	0	0	0	0	4259	4761	4510

Table 4.9.7.4 Run reconstruction data inputs and estimated pre-fishery abundance for maturing (MN1) 1SW salmon (grilse) of North American origin (terms defined in Table 4.9.7.2).

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	284547	475796	298567	496212	397389
2003	6025	6773	279996	475849	294548	497114	395831
2004	7695	8826	333153	535865	350994	561011	456002

	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 4.9.7.5. 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.

Table 4.9.7.6. The mid-point 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	223179	2.50	8451	8072	6765	3018	24085	28227	42459	33050	12002	14173	2292	2883
1993	87680	92185	158654	1.72	10773	10649	3233	3080	18601	29616	45193	29594	7816	15464	2065	3781
1994	72315	88099	196019	2.22	14669	9247	3196	2178	18389	30646	29829	27915	4888	15007	1344	3105
1995	104773	88063	185177	2.10	27955	7453	4734	2400	25639	30138	38375	32341	6322	13350	1748	2381
1996	84973	84548	160050	1.89	20663	5299	5714	2585	22216	27289	25098	34850	8875	12373	2407	2152
1997	71553	87352	150748	1.73	17641	3511	5847	5004	18155	24550	24095	43176	4203	9493	1611	1618
1998	78950	78632	108073	1.37	35887	6285	6435	4337	16839	21312	15358	39005	2904	6080	1526	1613
1999	63343	74390	110921	1.49	17339	9930	6058	3404	20531	19459	13983	33680	4264	5764	1168	2152
2000	63702	82970	129380	1.56	19343	14110	6805	4219	19730	22055	13994	32847	2243	7845	1587	1893
2001	76467	83097	84561	1.02	21630	22173	4622	5307	20376	22898	24351	25088	3997	6056	1491	1575
2002	44203	74149	112282	1.51	11316	22675	3381	5786	15127	20286	13073	20650	795	3449	511	1303
2003	67020	65041	112410	1.73	9470	20485	4089	6202	24654	18121	24444	15067	3171	3727	1192	1439
2004	65519	71312			11210	27626	4523	6202	20667	18894	25745	14029	2090	3043	1283	1518
2005		72385				23828		6460		19796		18116		3307		878
2006		67223				19497		5331		19806		19565		2065		960
2007		63352				19884		3939		18129		17927		2238		1234

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.

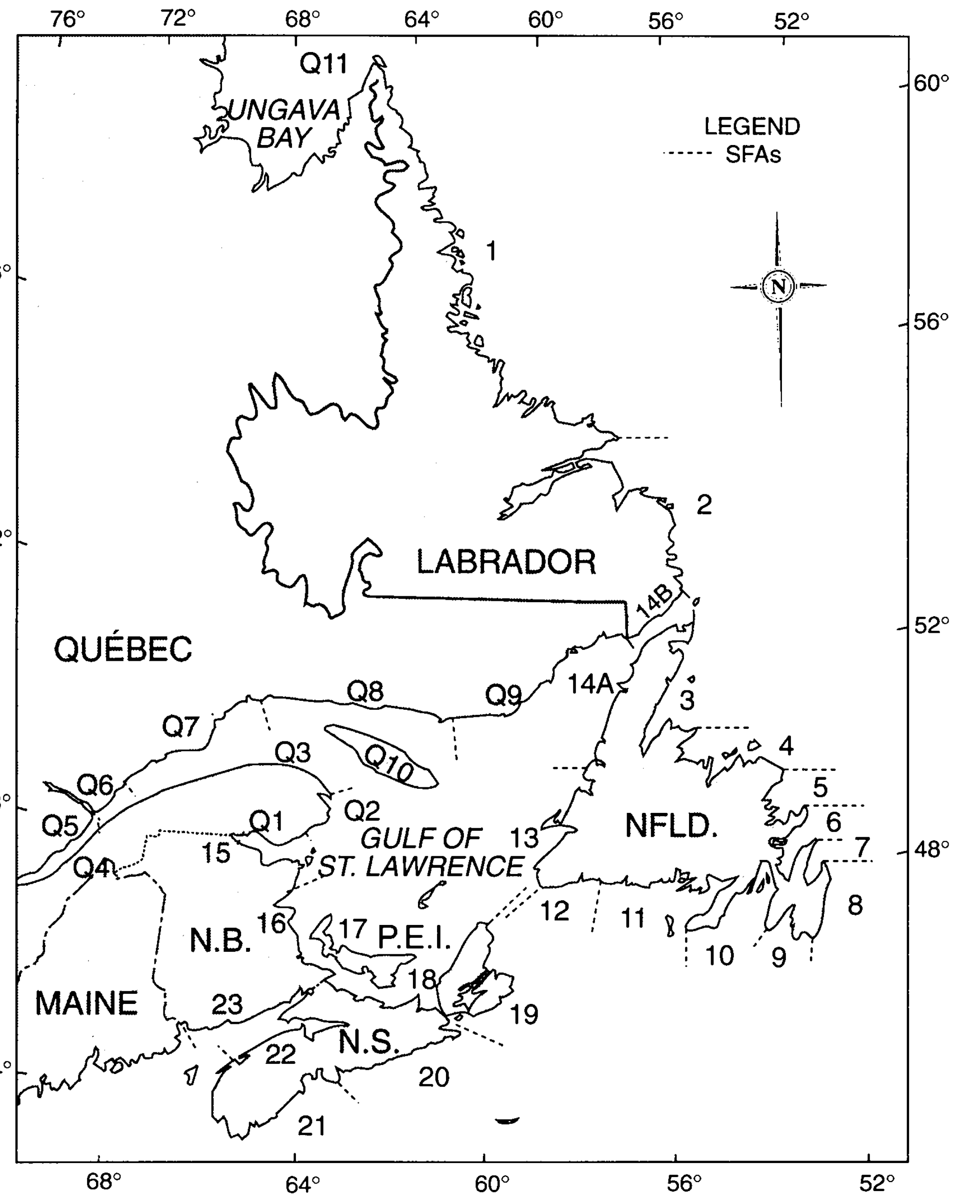
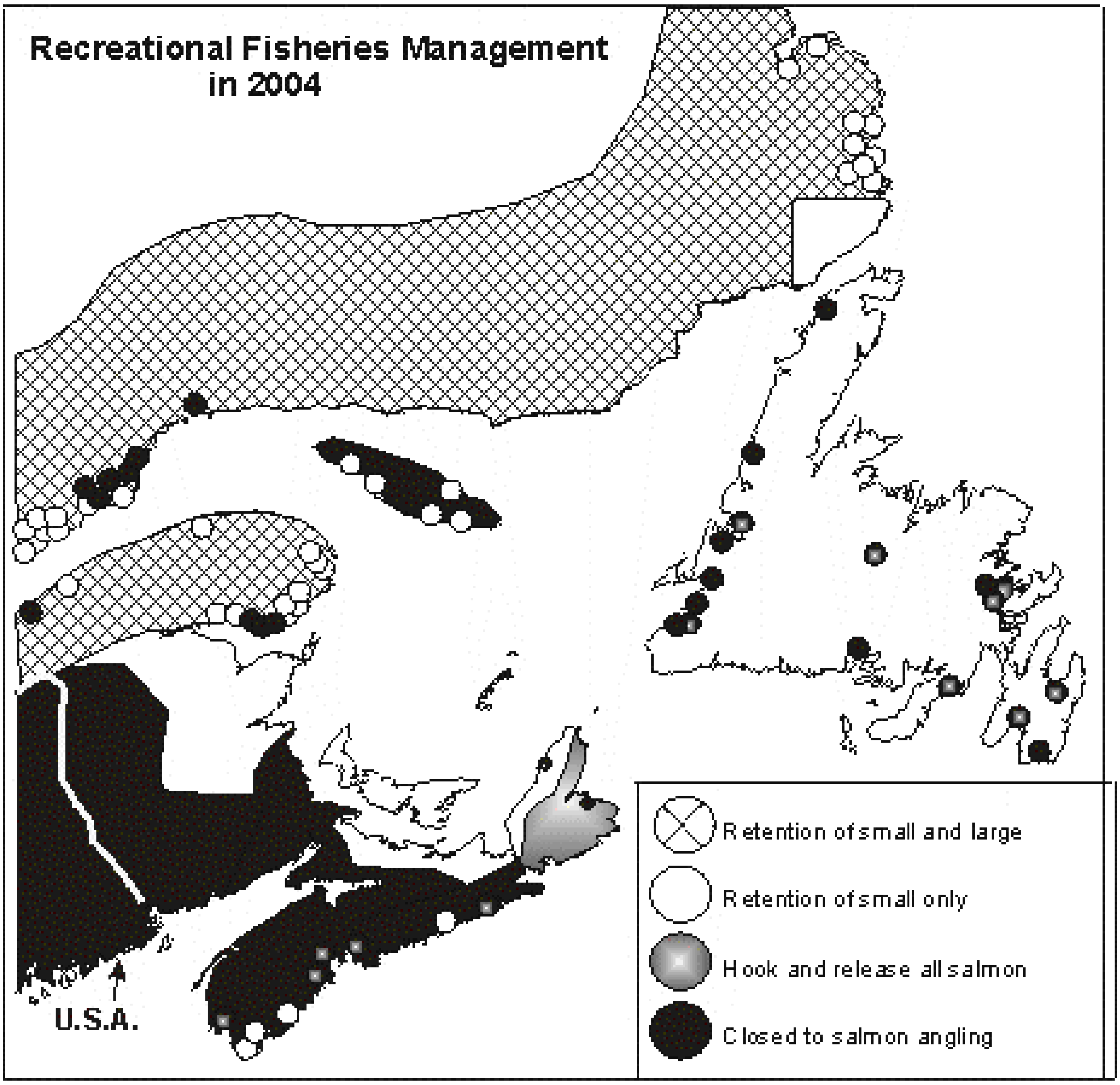


Figure 4.9.2.1. Map of Salmon Fishing Areas (SFAs) and Quebec Management Zones (Qs) in Canada.

Figure 4.9.2.2. Summary of recreational fisheries management in eastern Canada and Maine (U.S.A.) during 2004.



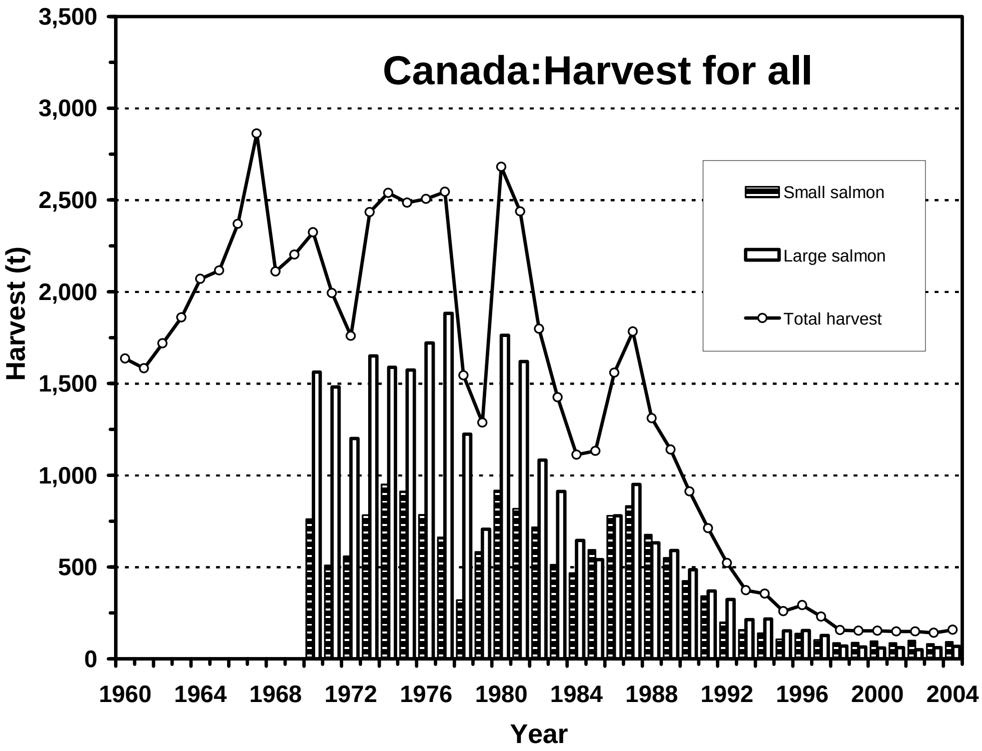


Figure 4.9.3.1. Harvest (t) of small salmon, large salmon, and combined for Canada, 1960-2004 by all users.

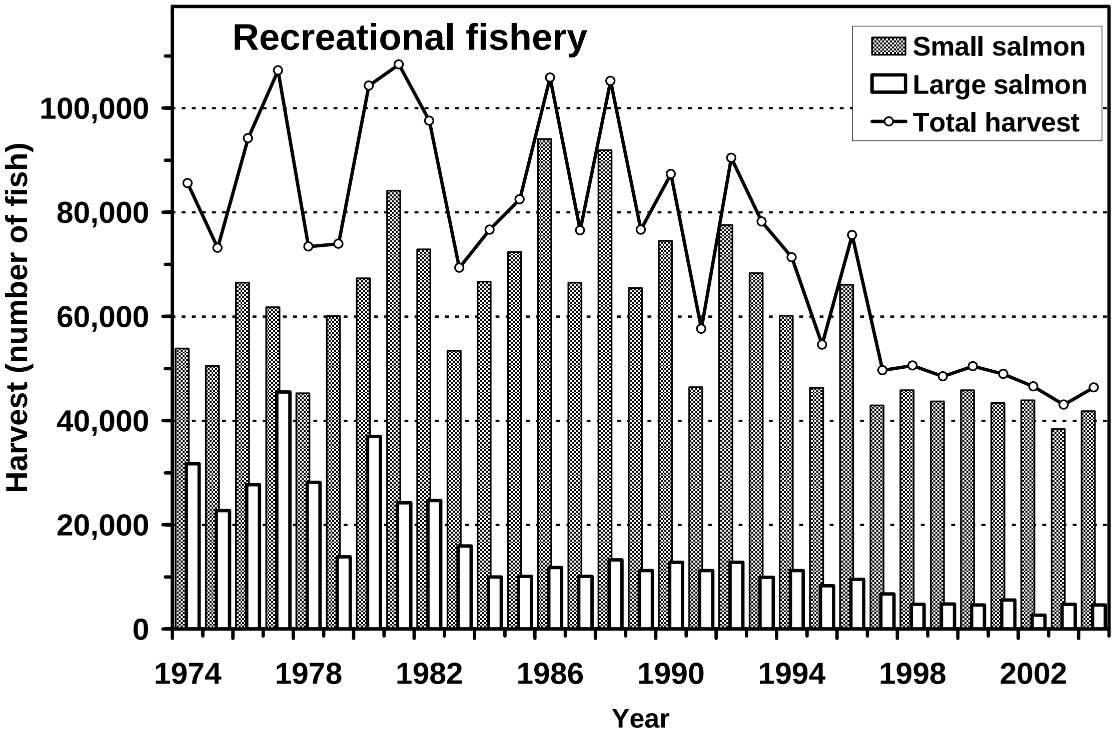


Figure 4.9.3.2. Harvest (number) of small and large salmon and both sizes combined in the recreational fisheries of Canada, 1974 to 2004.

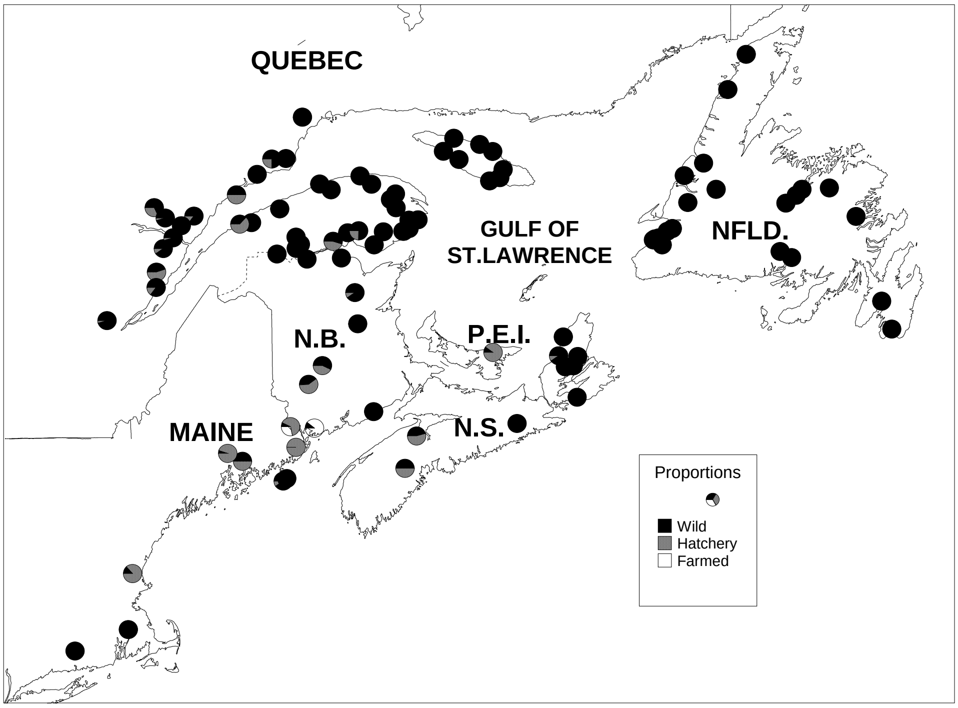


Figure 4.9.4.1. Proportions of wild (black) hatchery (grey) and farmed (clear) Atlantic salmon at assessment rivers in the North American Commission Area in 2004.

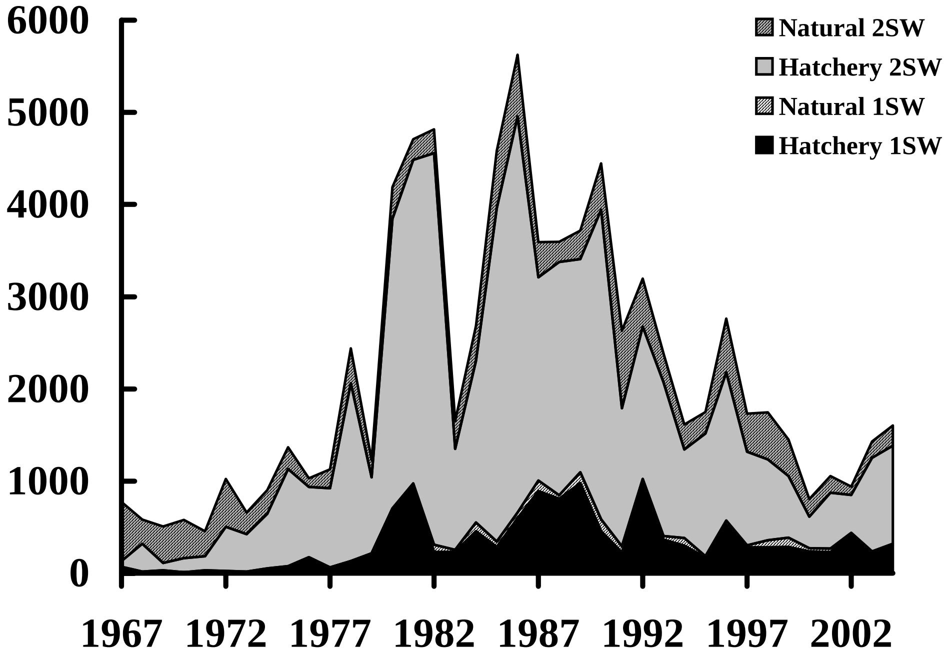


Figure 4.9.4.2. Documented returns of Atlantic salmon to USA rivers, 1967 to 2004. Natural refers to fry stocked or wild individuals.

Figure 4.9.5.1. Wild smolt production trends from fourteen monitored rivers in eastern Canada and one river of eastern USA, 1971 to 2004. Smolt production is expressed relative to the conservation egg requirements for each river (smolt output / conservation egg requirements).

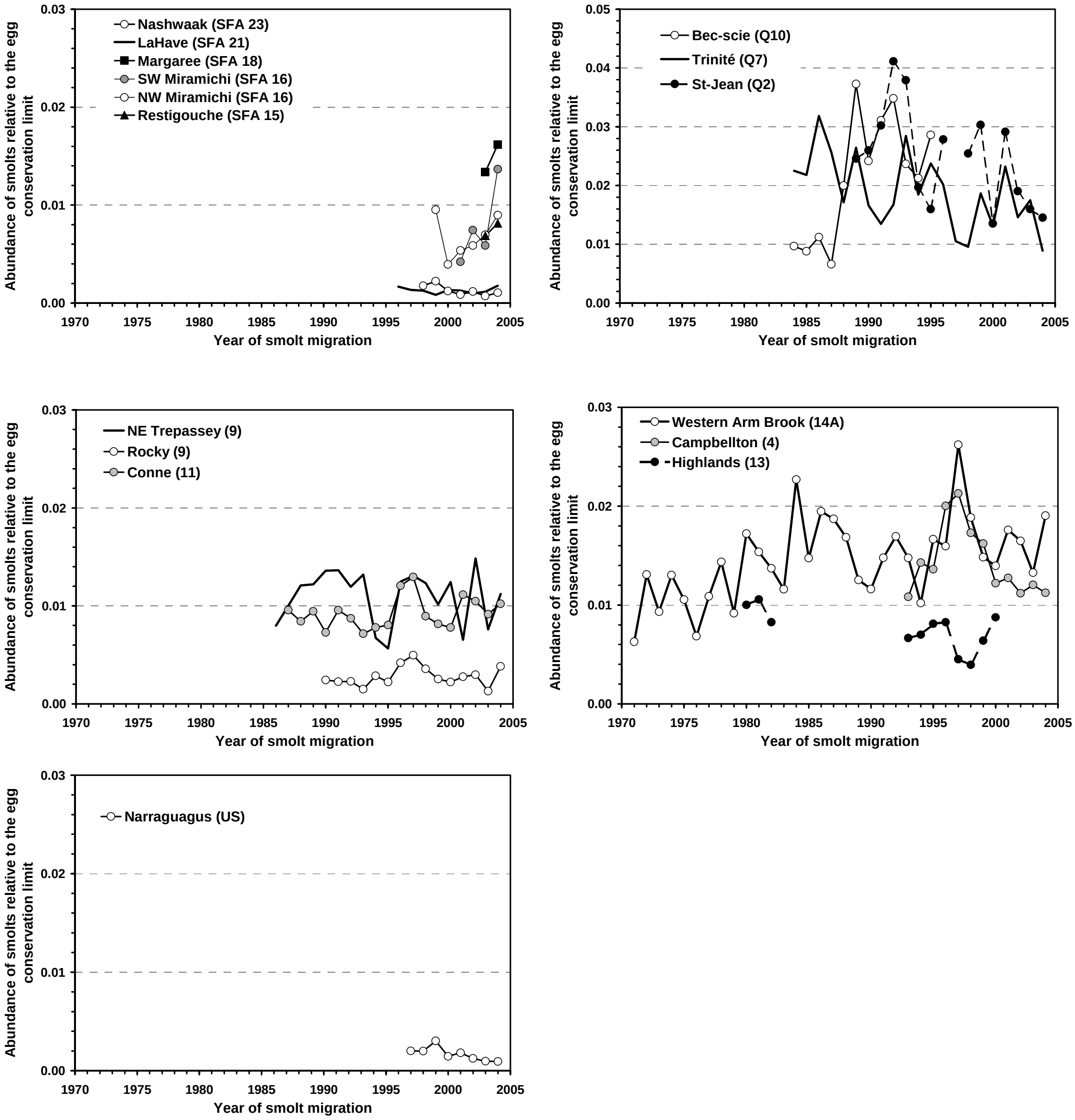
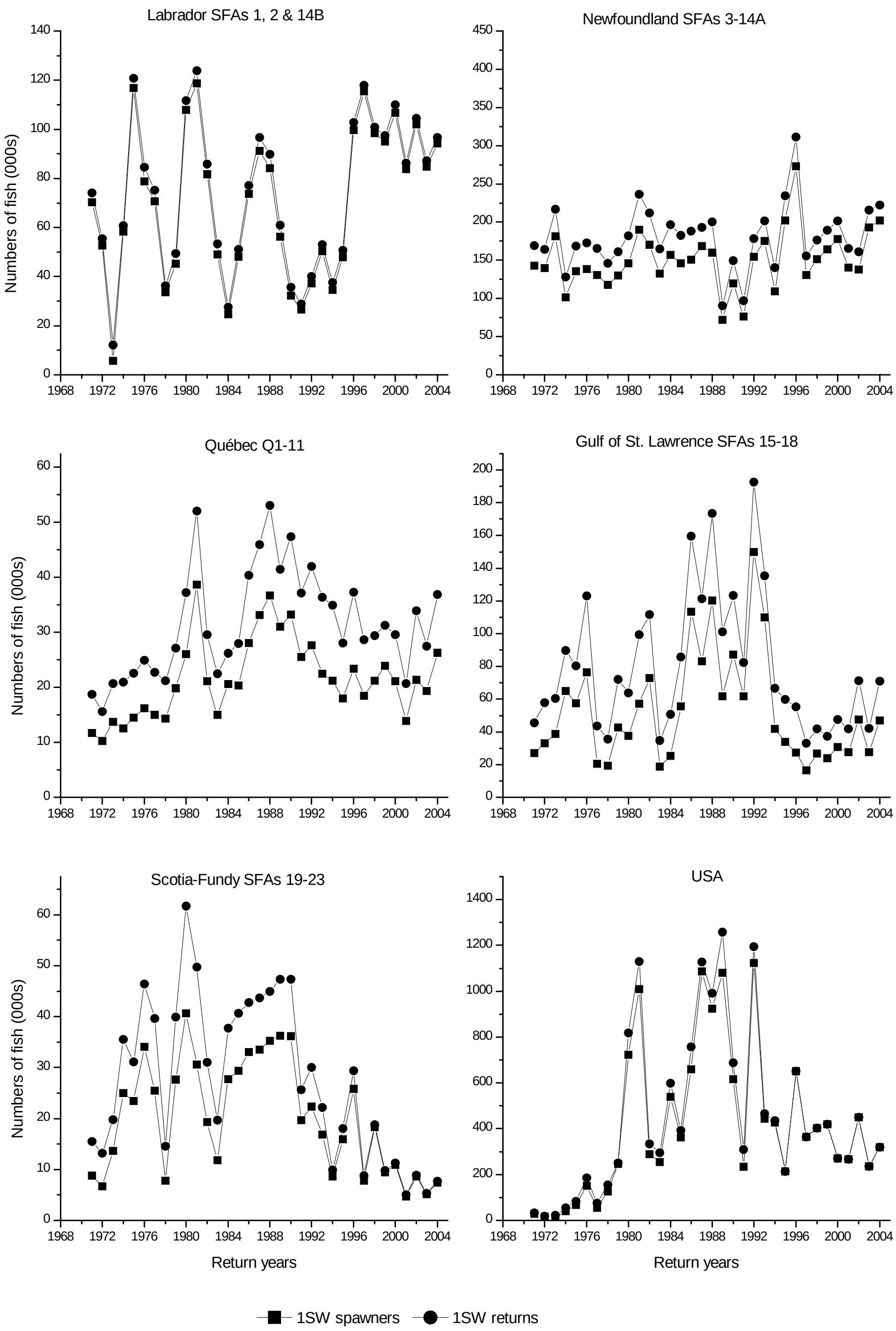


Figure 4.9.5.2 Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.



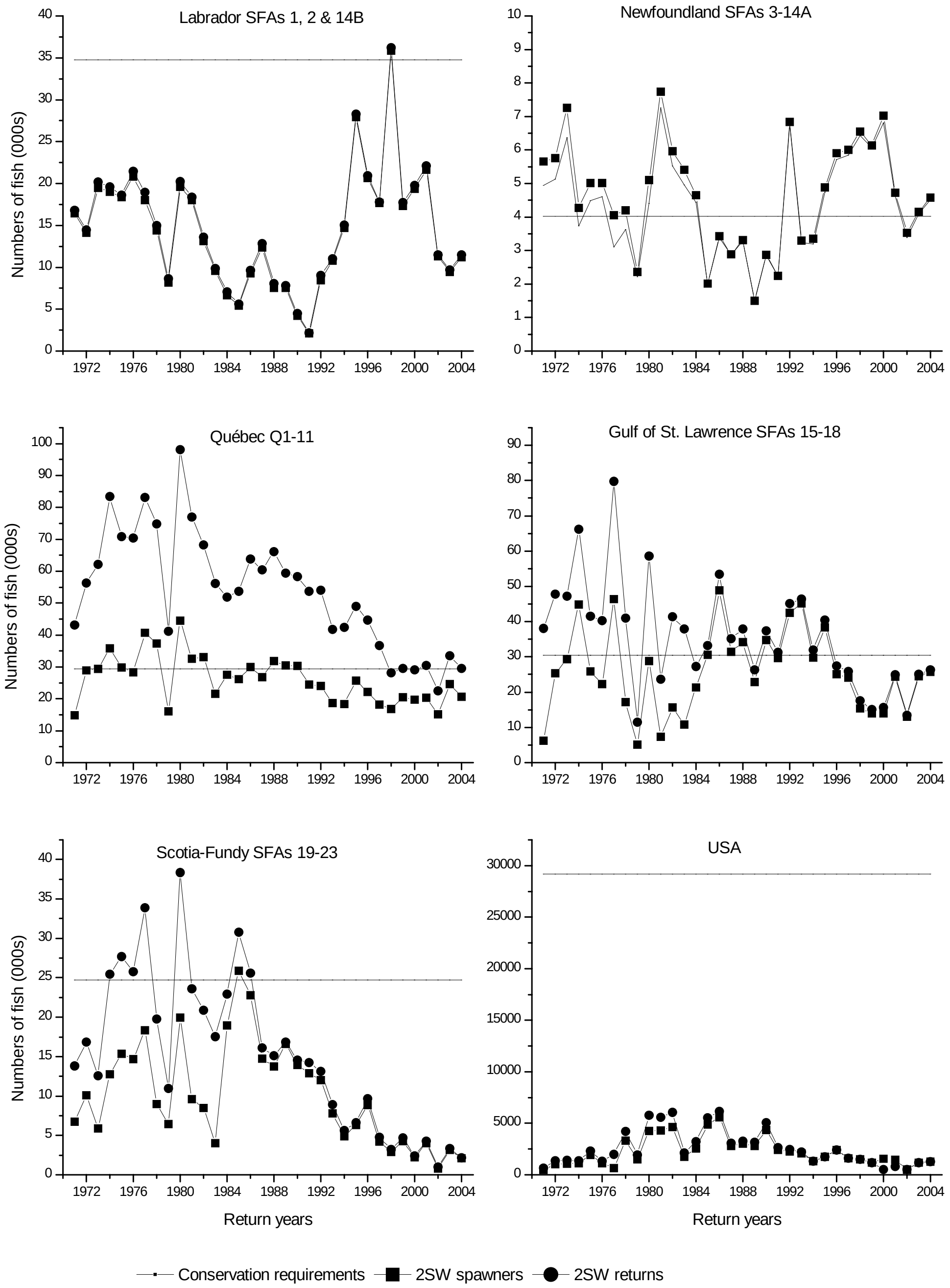


Figure 4.9.5.3 Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation requirements for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

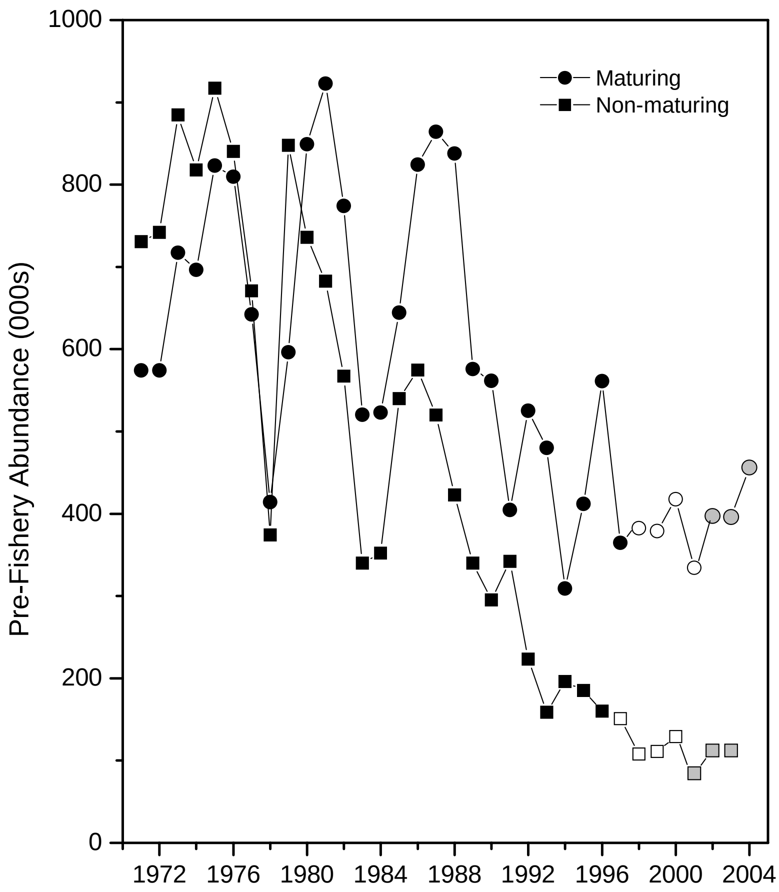


Fig. 4.9.7.1. Prefishery abundance estimate of maturing and non-maturing salmon in North America. Open symbols are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America and grey symbols are returns estimated from returns per unit of drainage area.

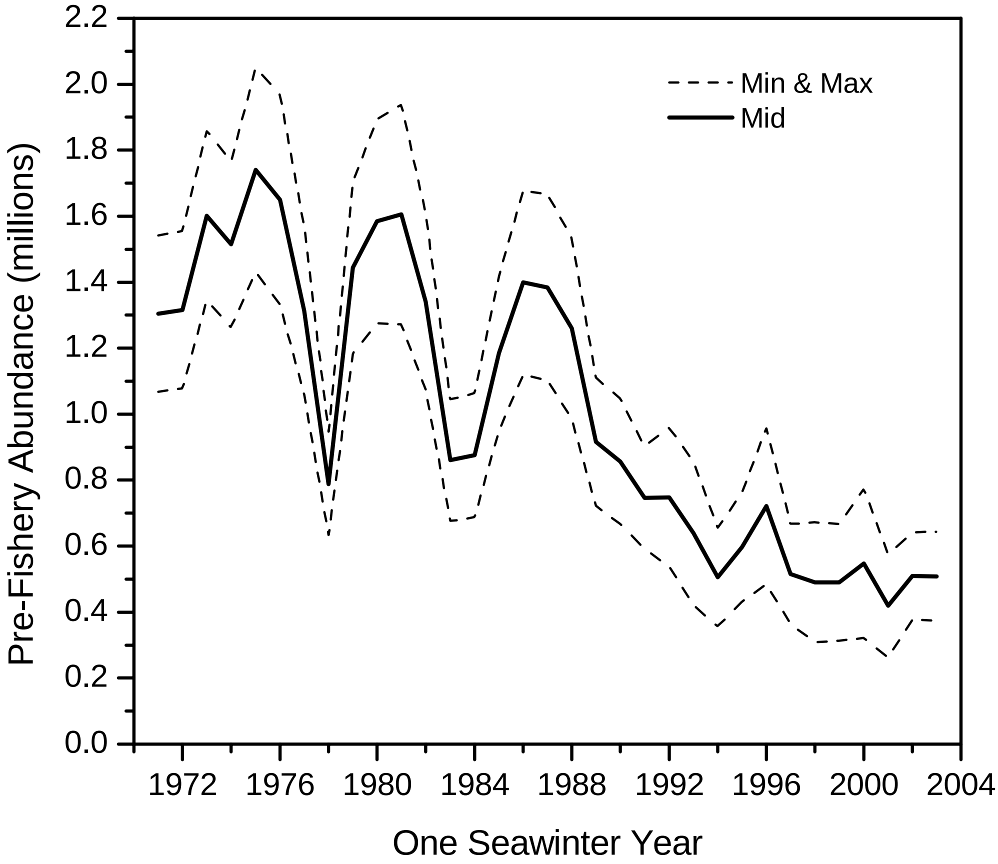


Fig. 4.9.7.2. Total 1SW recruits (non-maturing and maturing) originating in North America.

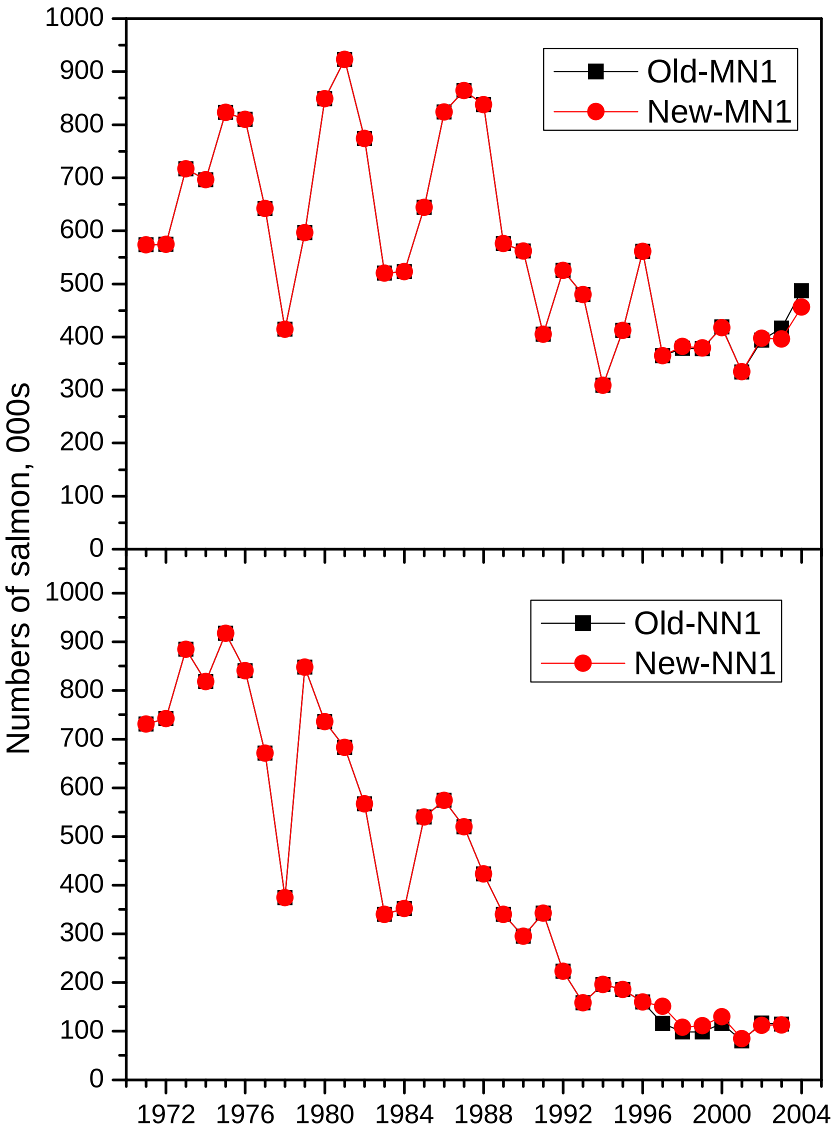


Fig. 4.9.7.3. Total 1SW recruits (non-maturing in lower panel and maturing in upper panel) originating in North America.

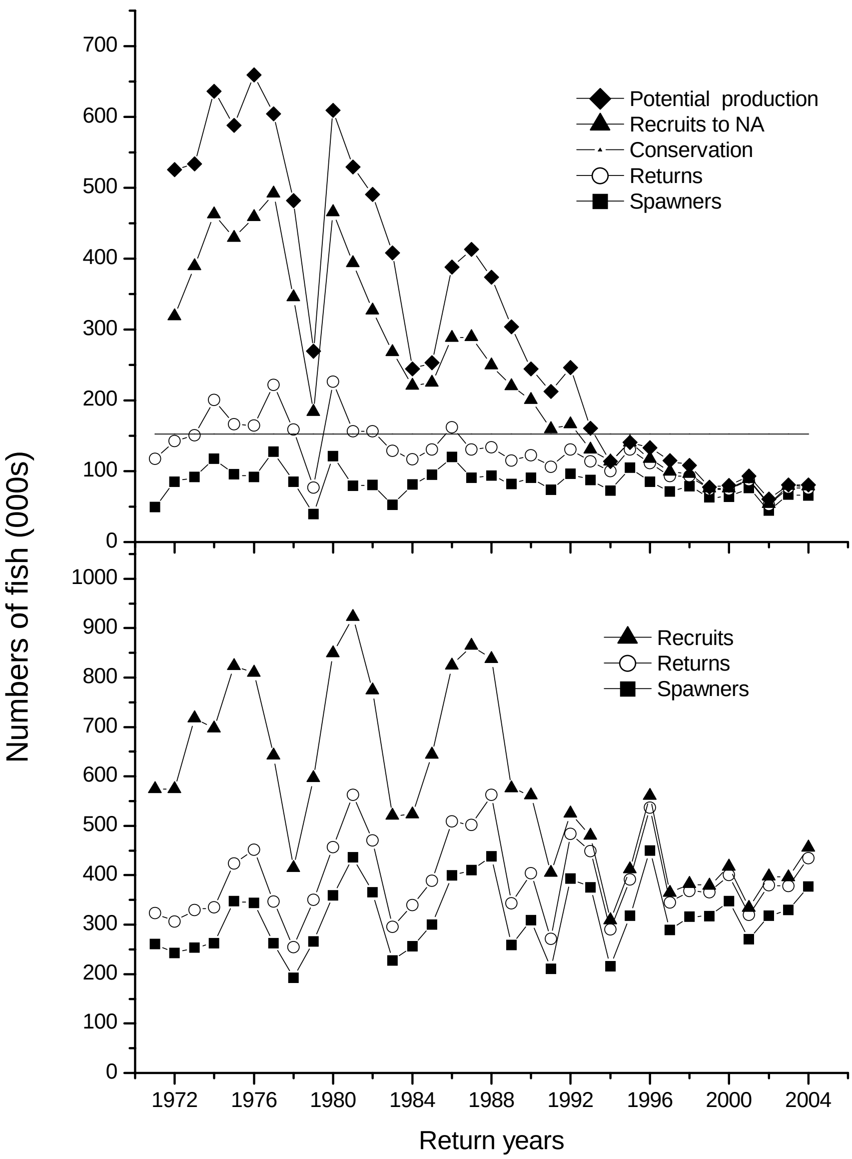


Figure 4.9.7.4. Top panel: comparison of estimated potential 2SW production prior to all fisheries, 2SW recruits available to North America, 1971-2003 and 2SW returns and spawners for 1971-2004. The horizontal line indicates the 2SW conservation limits. Bottom panel: comparison of potential maturing 1SW recruits, 1971-2004 and returns and 1SW spawners for 1971-2004 return years.

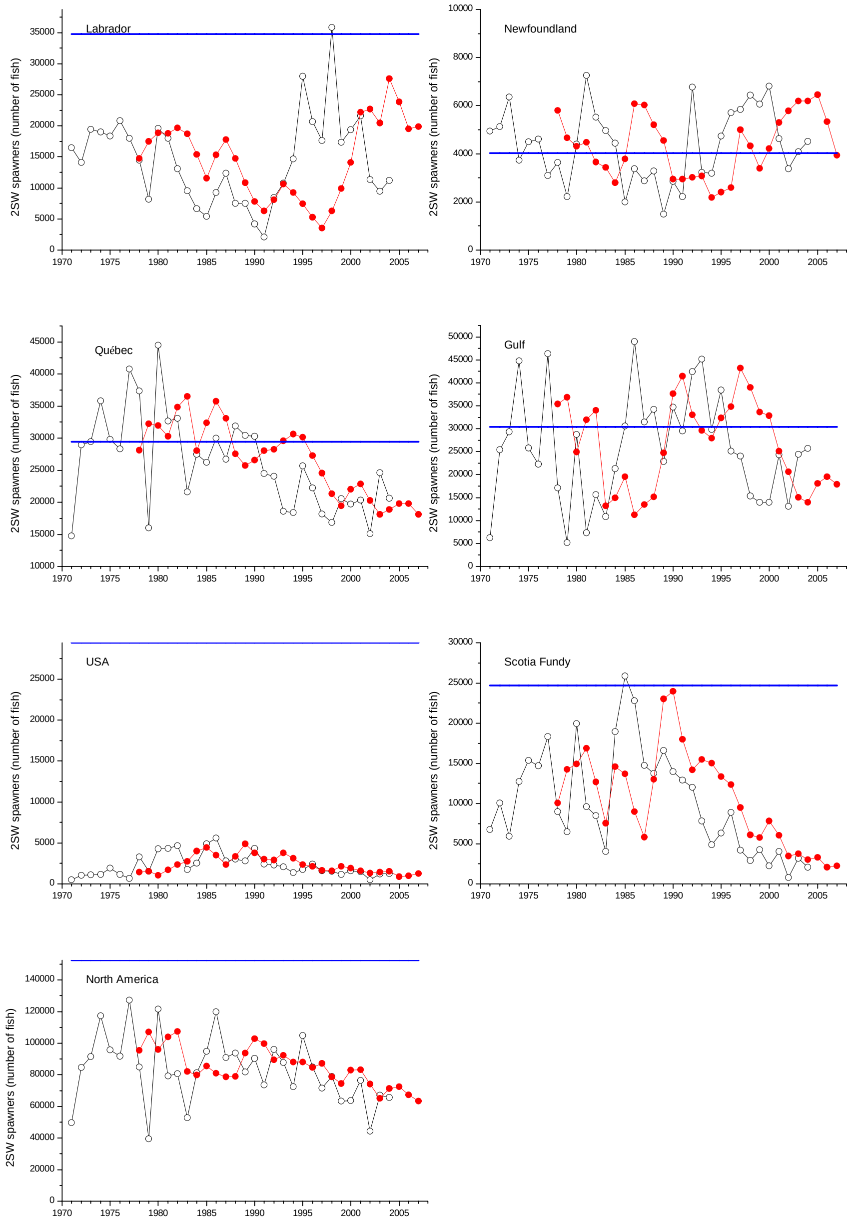
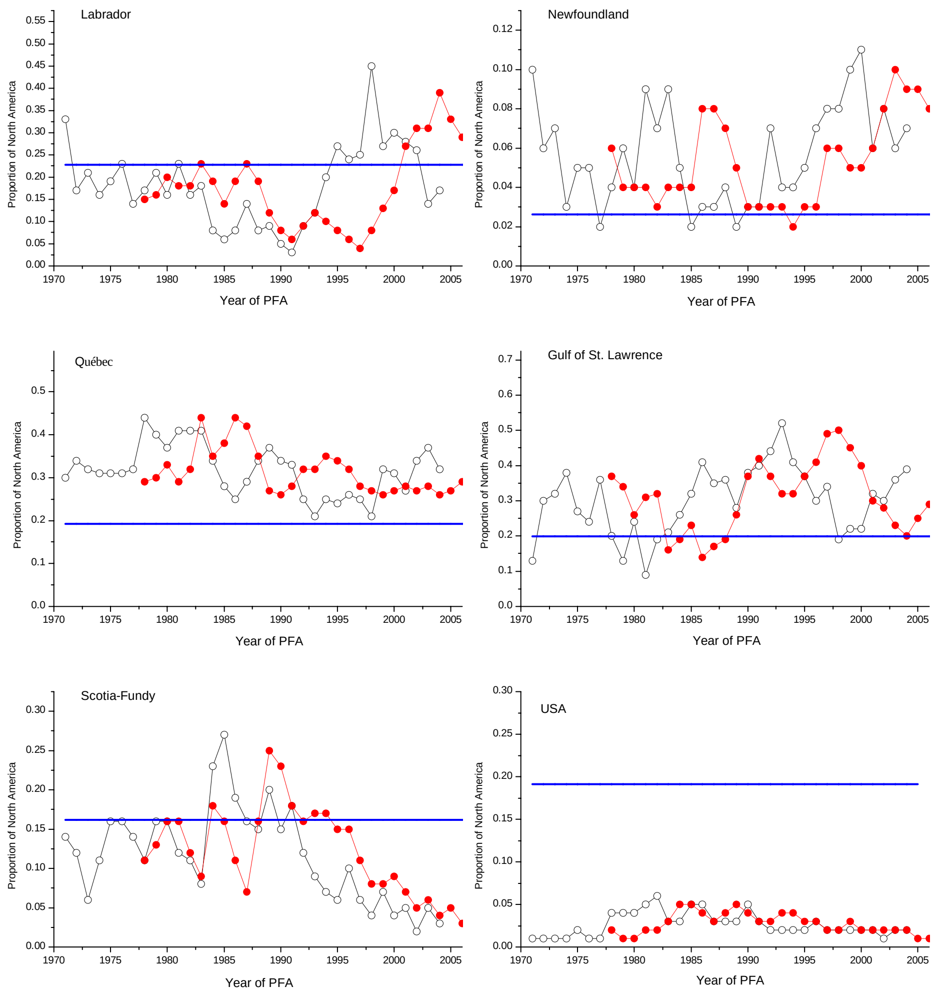
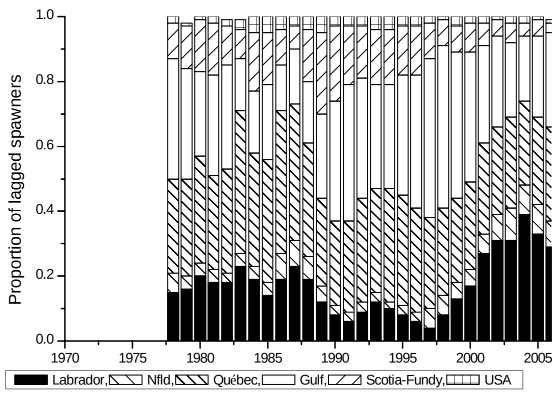


Fig. 4.9.7.5. Midpoints of lagged spawners (solid circles) and estimated annual spawners (open circles) as contribution to potential recruitment in the year of prefishery abundance (PFA) for six geographic areas of North America. The horizontal line represents the spawning requirement (in terms of 2SW fish) in each geographic area.

Fig. 4.9.7.6. 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 total 2SW spawner requirement for North America.





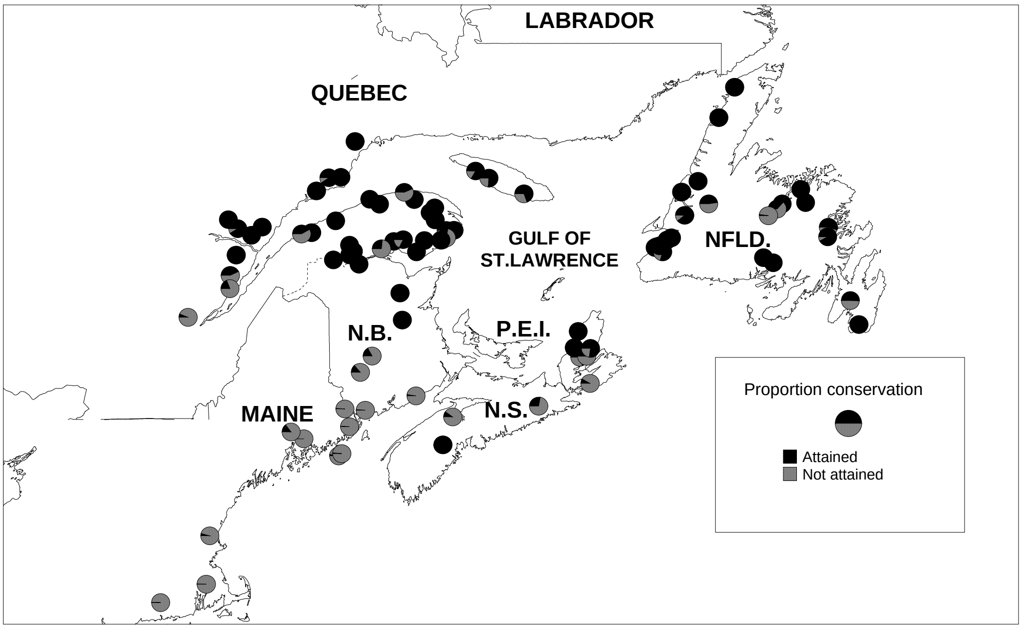
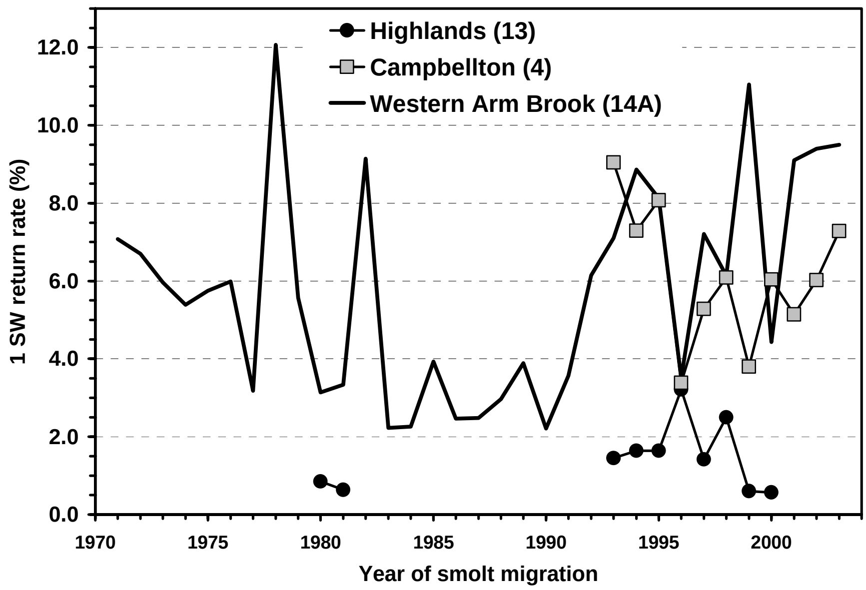


Figure 4.9.8.1 Proportion of the conservation requirement attained in assessed rivers of the North American Commission Area in 2004.



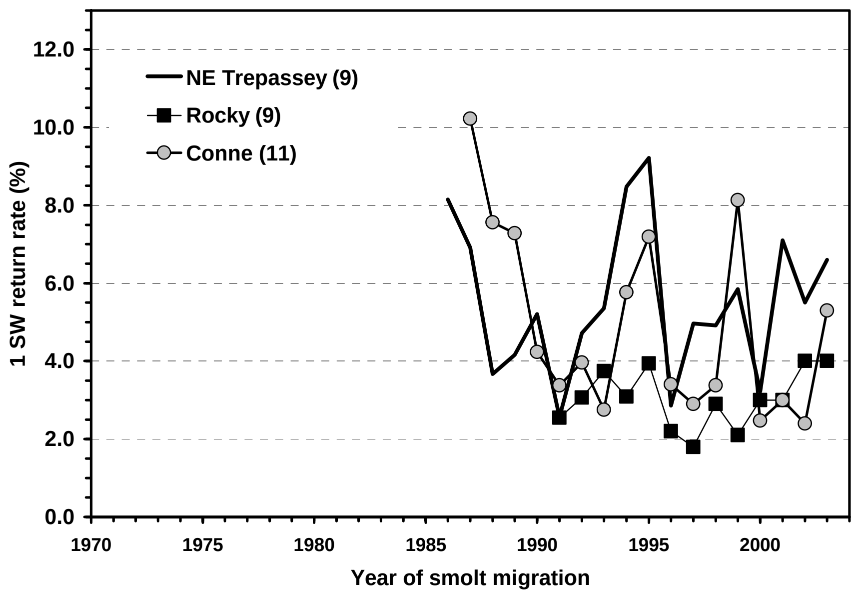
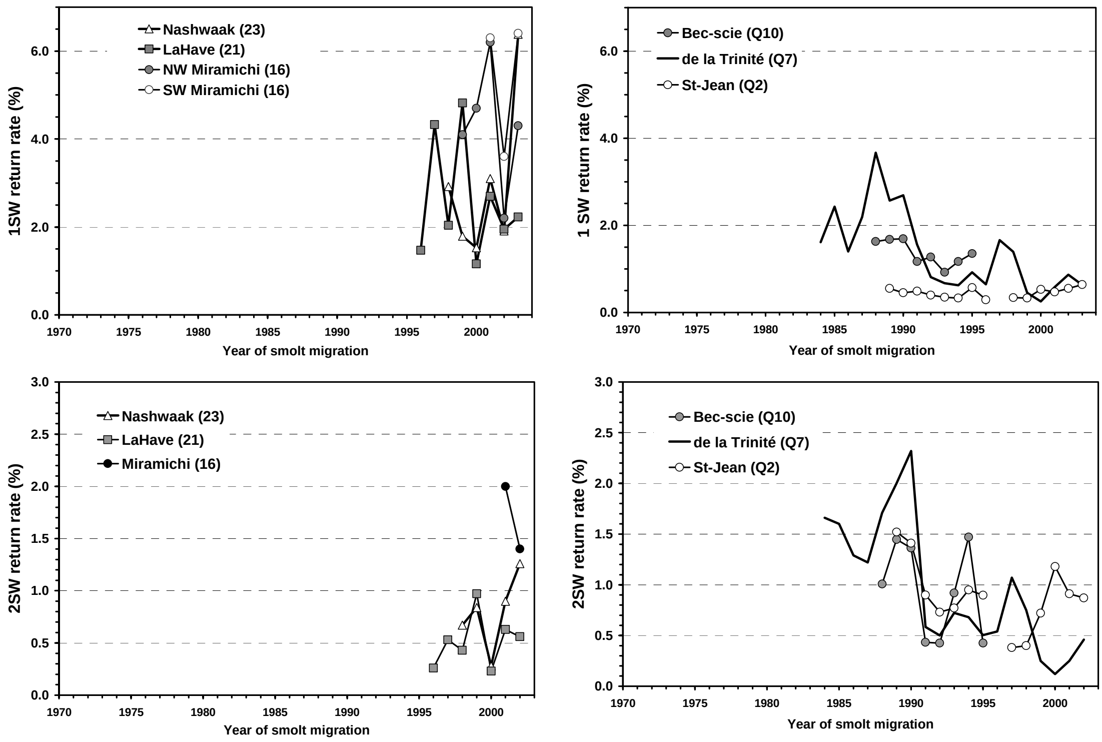


Figure 4.9.9.1. Return rates (%) of wild smolts to return as 1SW salmon from the rivers in west and north Newfoundland (upper) and south Newfoundland (lower).

Figure 4.9.9.2. Return rates (%) of wild smolts to return as 1SW salmon (top panels) and 2SW salmon (bottom panels) from rivers in the Maritime provinces (left panels) and Quebec (right panels).



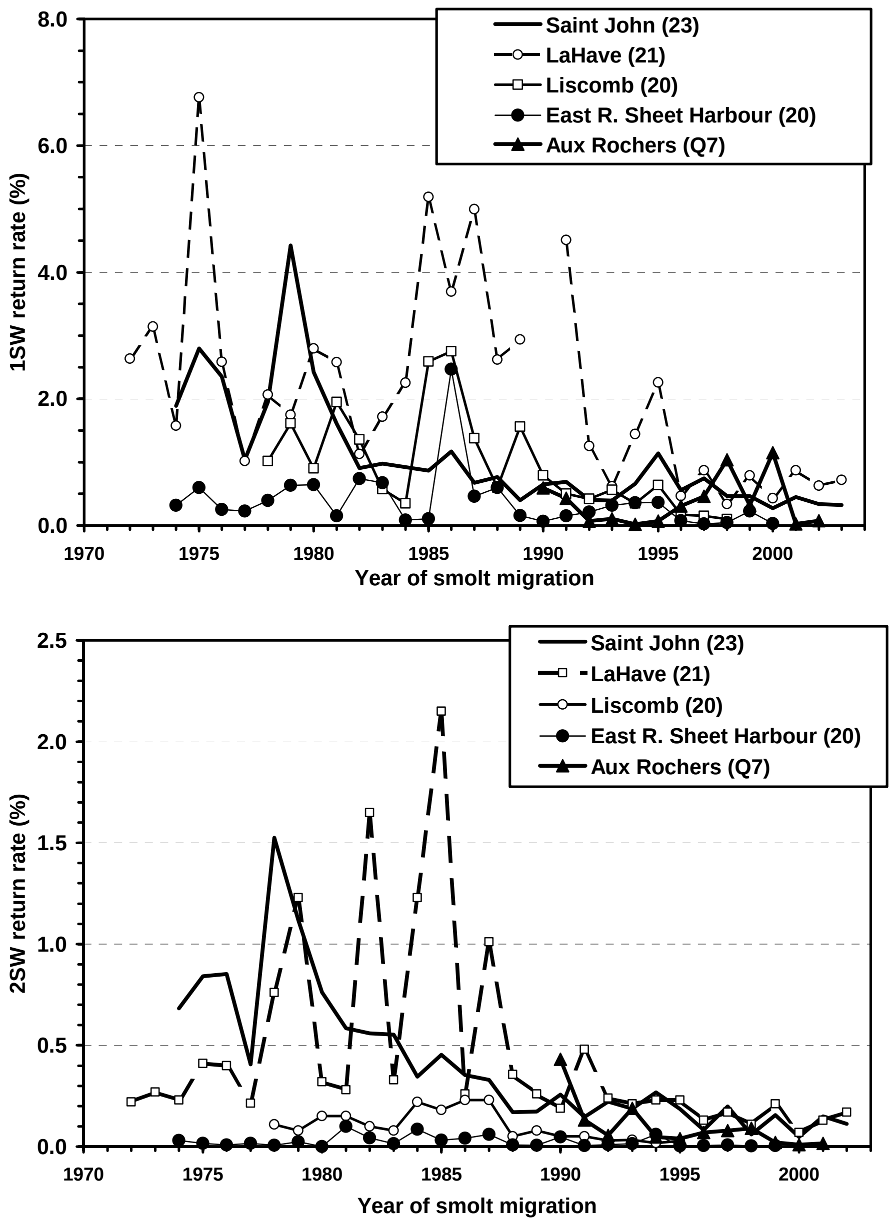
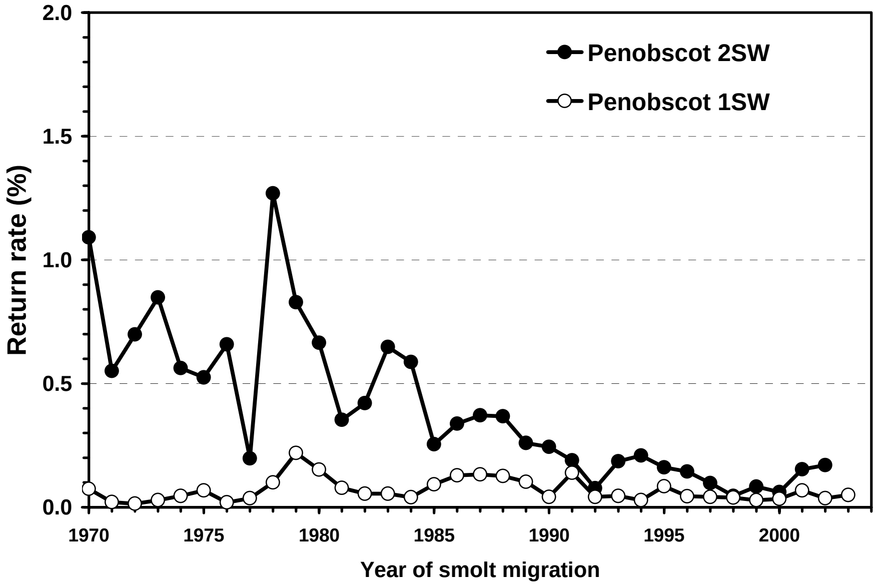


Figure 4.9.9.3. Return rates (%) to the river as 1SW (top) and 2SW (bottom) salmon of hatchery released smolts from eastern Canada.



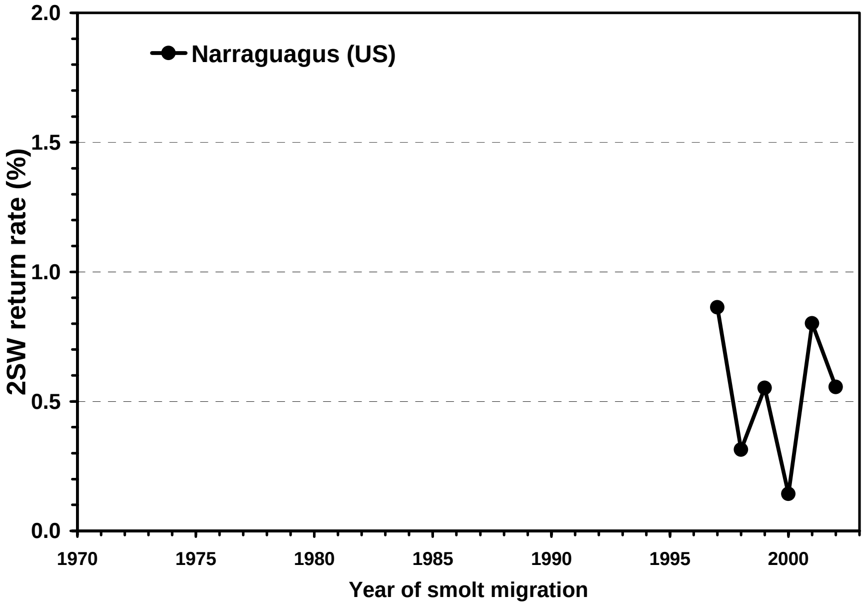


Figure 4.9.9.4. Return rates (%) to the river of hatchery released smolts from the Penobscot River (top) and of wild smolts from the Narraguagus River (bottom), Maine (USA).

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 outside precautionary limits.

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 if they survived. There are also 2SW salmon and repeat spawners, including salmon that had originally spawned for the first time after 1-sea-winter. The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland, although low numbers may originate from northern European rivers. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland.

The Working Group notes that the North American stock complex of non-maturing salmon has declined to record levels and is in a tenuous condition. Despite the closure of Newfoundland commercial fisheries in 1992 and subsequently in Labrador in 1998 and Québec in 2000, sea survival of adults returning to rivers has not improved and in some areas has declined further. The abundance of maturing 1SW salmon has also declined in many areas of eastern North America. Smolt production in 2003 and 2004 in monitored rivers of eastern Canada was similar to the average of the last five years. Unless sea survival improves, the abundance of non-maturing 1SW salmon in the Northwest Atlantic is not expected to increase above the levels of the last five years and is more likely to decline.

The Working Group also noted that the non-maturing 1SW salmon from Southern Europe have been declining steadily since the 1970s (Figure 3.1.1), and the preliminary quantitative prediction of pre-fishery abundance for this stock complex is low for 2005 (486 000 fish) (Figure 3.6.1.1).

In European and North American areas, the overall status of stocks contributing to the West Greenland fishery is at the lowest level 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 of this report.

The Working Group noted that tentative exploitation rates for non-maturing 1SW fish at West Greenland can be calculated by dividing the recorded harvest of 1SW salmon of North American origin at West Greenland by the PFA estimate for the corresponding year. This indicates that exploitation rates in the last five years have averaged around 5% compared to values prior to 1993 averaging 26%, and suggests that recent management measures in this fishery have reduced exploitation in this stock complex.

5.2 Management objectives

NASCO has adopted a precautionary management plan (See Section 1.4). Management advice for Atlantic salmon is referenced to the S_{lim} conservation limit, therefore stock status is assessed as being either within or outside precautionary limits. NASCO considers quotas at West Greenland with the management objectives of meeting the conservation limits (S_{lim}) simultaneously in the four northern regions of North America: Labrador, Newfoundland, Quebec, and Gulf. Further, for the two southern regions, Scotia-Fundy and USA, where there is a zero chance of meeting conservation limits, the alternate objective has been to achieve increases in returns relative to previous years with the hope that this may lead to the rebuilding of stocks. In 2004, the Working Group 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. This provides NASCO with consistent criteria to assess performance of the fisheries management being considered. To assess the potential to rebuild these stocks, the Working Group also calculated the probability of returns to North America being equal or less than the previous five-year average.

The spawning requirement used for North America is for the continent as a whole. However, based on past performance, there is no reason to expect the abundance of salmon in the North Atlantic to be proportional to the regional 2SW spawner requirements. Specifically, the 2SW returns to Scotia-Fundy, and USA have been below their corresponding conservation limits since 1985 (Figure 4.9.5.4). For the 1998–2002 PFA_{NA} years, the most recent years when estimates of lagged spawners are available for all regions of North America, the Quebec and Gulf regions have accounted for a disproportionate number of lagged spawners relative to their 2SW requirements (Figure 5.2.1). Assuming that the abundance of Atlantic salmon in 2005 will be proportional to the abundance of lagged spawners in the last five years, it is possible to calculate the number of salmon required to return to North America to achieve region-specific conservation requirements. For example, to achieve the Newfoundland 2SW requirement of 4022 2SW salmon, a total of 73 764 fish would be required to leave West Greenland at the PFA_{NA} stage (Table 5.2.1). In the regions with lower stock performance, total PFA_{NA} abundance of about 520 630 fish would be required for the Scotia-Fundy region, and PFA_{NA} abundance of over 1.9 million fish would be required to achieve the USA conservation requirements (See Section 4).

5.3 Reference points

As precautionary reference points (S_{pa}) have not been developed for these stocks, management advice references the spawning conservation limit (S_{lim}). According to NASCO management objectives these limits should be avoided with high probability (*i.e.* at least 75%).

Sampling at West Greenland since 1985 has shown that the fishery harvested European and North American fish that are primarily (greater than 90%) 1SW non-maturing salmon destined to mature as either 2SW or 3SW salmon. Usually less than 3% of the harvest is composed of salmon that have previously spawned and a few percent are 2SW salmon that would mature as 3SW or older salmon. Therefore, conservation limits defined for North American stocks have been limited to the 2SW salmon. These numbers have been documented previously by the Working Group and are in Section 4.3. The 2SW spawner limits of salmon stocks from North America total 152 548 fish, with 123 349 and 29 199 required in Canadian and USA rivers, respectively.

Conservation limits for the NEAC area have been split into 1SW and MSW components on the basis of the average age composition of catches in the past ten years. The stocks have also been partitioned into northern and southern stock complexes. 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 278 000 fish (Section 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.

5.4 Advice on management

The Working Group has provided management advice for the West Greenland fishery, based on the NAC stocks, and for the combined NAC and NEAC stock complexes.

Catch advice for the NAC area

For 2005, the PFA_{NA} forecast remains among the lowest of the time-series with a median value of 120 400 fish and a 75% probability that the abundance will be less than 153 200 fish (*i.e.* highly unlikely to meet the 2SW spawner reserve of 212 189 salmon to North America) (Figure 5.4.1). In the absence of any marine-induced fishing mortality, there is a very low probability (9 % probability) that the returns of 2SW salmon to North America in 2006 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 5.4.1). 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. Furthermore, in the absence of a fishery there is a 64% probability that returns in these regions will be less than the average of the period 1999 to 2003 (Table 5.4.2).

Even in the absence of fisheries on the non-maturing 1SW salmon at West Greenland in 2005 and subsequently on the returning 2SW salmon to North America in 2006, there is a very small chance (9%) that the abundance of salmon will be sufficient to achieve the conservation requirements for 2SW salmon in the four northern regions. The probability of realising increases in returns to the southern North American stocks is close to zero. None of the stated management objectives would allow a fishery to take place.

Catch advice for the NAC/NEAC combined

The Working Group followed the process developed last year for providing catch advice for West Greenland using the PFA and CLs of the NAC and NEAC areas. The PFA for NAC and NEAC are applied in parallel to the Greenland fishery and then combined at the end of the process into a single catch advice table (Section 5.10.2). In the absence of any fishery at West Greenland, there is a less than 75% probability that the MSW conservation limit for southern Europe will be met (Table 5.4.1).

Using the 75% probability level, none of the stated management objectives in NAC or NEAC would allow a fishery to take place.

5.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management 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 only those stocks that are within precautionary limits. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be within precautionary limits. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

5.6 Catch forecast for 2005

The Working Group has described two temporal phases (ICES, 2003) of salmon production in the Northwest Atlantic. A phase shift in recruitment per spawner in the northwest Atlantic became apparent during the last two decades. The lower recruitment rate is evident throughout eastern Canada and U.S., especially in the southern regions. Given the present status of salmon stocks, there is no evidence from any of the regions in North America that there will be a turnaround in abundance in 2005.

The Working Group also concluded that the southern European stock complex of non-maturing salmon has declined to record levels. The spawning escapement to southern Europe has not exceeded conservation limit for the stock complex in the last eight years (Figure 3.1.1).

5.7 Medium to long-term projections

Projections of PFA are not made beyond one year for either the NAC or the NEAC. Catch advice for the West Greenland fishery is possible up to 2007 based on available lagged spawners. However, a number of assumptions, in addition to those within the current models, would need to be made. Further, methods were presented to the Working Group (Section 2.5.1) that extend PFA predictions for the medium and long term (5 and 20 years). The PFA projections for 2005 are applicable to homewater fisheries for North American and NEAC stocks in 2006.

North American stocks

Catch options which could be derived from the pre-fishery abundance forecast for 2005 (120 400) would apply principally to North American fisheries in 2006 and hence the level of fisheries in 2005 needs to be accounted for before providing these catch options. Accounting for mortality and the conservation limit and considering an allocation of 60% of the surplus to North America, the only precautionary catch option for 2SW salmon in 2006 is zero catch. This zero catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

NEAC stocks

The quantitative prediction for the southern NEAC MSW stock component gives a projected PFA (at 1st January 2005) of 486 000 in 2005. No projections are available beyond that for this stock complex. The stock group is outside precautionary limits, and the Working Group considers that reductions in exploitation rates are required for as many stocks as possible, in order to ensure that conservation requirements are met for each river stock with high probability. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

5.8 Comparison with previous assessment and advice

The current modelling approach was applied to the PFA_{NA} series that now includes the 2003 PFA to update the 2004 forecast. The median value of the updated analysis has increased to 118 600 fish from 100 000 based on the previous year’s model and data. The upper bound on the distribution is essentially the same 218 300 in the updated analysis versus 218 000 in the previous year’s analysis (Figure 5.8.1).

5.9 NASCO has requested ICES to describe the events of the 2004 fishery and status of the stocks

At its annual meeting in June 2004 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 Organisation for Fishermen and Hunters in Greenland the licensed fishery for salmon was allowed from August 09 to the end of the year.

5.9.1 Catch and effort in 2004

By the end of the season a total of 14.7 t of landed salmon were reported (Table 5.9.1.1). In total, 169 reports were received. The geographical distribution of the reported catches differed from all recent years with catches in NAFO Div. 1A and 1B approximately 27 % of the catch and less than 15 % of the landings reported from NAFO Div. 1F (Table 5.9.1.2). In the last few years approximately 50 % of the catch was in NAFO Div 1F. Based on the information on the landing reports, the temporal distribution of the catches differed from recent years. In 2004, catch was distributed relatively evenly across the weeks, perhaps even increasing in weeks 44 and 45. In the last few years, reported catches decreased during the season.

The number of active participants in the salmon fishery has decreased sharply since 1987, when a catch of more than 900 tons was allowed and more than 500 licenses were active in the fishery. In 2004 there were 151 licenses issued, similar to the 152 in 2003. For the 2004 fishery 66 fishermen reported catch, of these 24 were licensed. This is an increase from the approximately 40 active fishermen in 2002 and 2003. Similar to 2003, approximately 45 % of the licenses were issued for the northern two NAFO Divisions. Given the low proportion of license holders reporting catch and that sampling provided more fish than were reported in Nuuk, this suggests the nominal catch is an underestimate. Since 2002, the Working Group has been unable to estimate average CPUE values comparable to values from previous commercial fisheries. The Working Group recommends that the Home Rule Government of Greenland provide information on the extent of fishing activity by all license holders.

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

5.9.2 Biological characteristics of the catches

An international sampling program instituted by NASCO in 2001 to sample landings at West Greenland has continued. The sampling program in 2004 included sampling teams from Greenland, Ireland, United Kingdom, and United States. Teams were in place at the start of the fishery and continued through October. In total, 1890 specimens, representing 40 % by weight of the landings, were sampled for presence of tags or fork length, weight, scales, and tissue samples for DNA analysis. The broad geographic distribution of the subsistence fishery caused practical problems for the sampling teams. However, the sampling program was fairly successful in adequately sampling the Greenland catch temporally. The sampling teams at Nuuk sampled larger amounts of salmon than reported in the official statistics. Where that occurred, the Working Group adjusted the total landings by replacing the reported catch with the weight of fish sampled to use in assessment calculations.

Tissue and biological samples were collected from three landing sites: Qaqortoq (NAFO Div. 1F), Nuuk (NAFO Div. 1D), and Maniitsoq (NAFO Div. 1C) (Figure 5.9.1). Biological characteristics (length, weight, or age) were recorded from approximately 1,800 fish in catches from NAFO Div. 1C, 1D and 1F in 2004 (Tables 5.9.2.1–5.9.2.3). The smallest fish sampled was 54 cm fork length and weighed 1.46 kg gutted weight while the largest was 95 cm and weighed 10.30 kg. The average weight of a fish from the 2004 catch was 3.18 kg, with North American 1SW fish averaging 64.7 cm and European 1SW fish averaging 64.2 cm in length (Table 5.9.2.1). The mean lengths and mean weights for the 2004 samples were among the highest in the last decade.

The river ages of European salmon ranged from 1 to 5 (Table 5.9.2.2). Over half (58%) of the European fish in the catch were river-age 2 and 20% were river-age 3. Although the proportion of the European origin river-age 1 salmon in the catch has been variable in the last 15 years, it has been between 9% and 18% since 2001 (Table 5.9.2.2). North American salmon up to river-age 6 were caught at West Greenland in 2004 (Table 5.9.2.2), with over half being river-age 3 (52%).

In 2004, 97 % of the European samples were 1SW salmon, with previous spawners 0.2% of the samples and 2SW salmon 2.8% (Table 5.9.2.3). One SW salmon dominated (97%) the North American component, with repeat spawners 2.5% of the samples (Table 5.9.2.3).

The sampling team stationed in Nuuk obtained 120 whole fish to remove tissue for disease testing. These samples were tested for the presence of ISAv by RT-PCR assay only and all test results were negative. The sex of 115 salmon collected in Nuuk between August 12 and September 6, 2004, was determined by examining gonads; of these 35 (30%) were males and 80 (70%) females. The Working Group recommends that sex be determined on as many whole fish as practicable, and methods be considered for determining sex on gutted individuals.

5.9.3 Continent of Origin of catches at West Greenland

Of the 1688 genetically sampled salmon 1647 were successfully genotyped at four microsatellites (Ssa202, Ssa289, SSOSL438, and SSOSL311). A database of 4802 Atlantic salmon genotypes of known origin was used as a baseline to assign the 1647 salmon to continent of origin. Due to missing fork lengths, 1639 samples were carried through to the final sampling database, weights and/or age data. In total, 1192 (72.7%) of the salmon sampled from the 2004 fishery were of North American origin and 447 (27.3%) fish were determined to be of European origin (Table 5.9.3.1).

The Working Group noted that the variability in the composition of the catch among the divisions (see table below) (Chi Square p <0.001) necessitates 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	%
Div. 1C	320	79.0	82	21.0
Div. 1D	753	74.6	256	25.4
Div. 1F	119	52.9	106	47.1

Applying the continental percentages to the adjusted total catch (17.2 t) resulted in estimates of 9.9 t of North American origin and 4.8 t of European origin fish (3900 and 1500 rounded to the nearest 100 fish, respectively) landed in West Greenland in 2004 (Table 5.9.3.2 and Figure 5.9.3.1). Quota reductions have resulted in an overall reduction in the numbers of both North American and European salmon landed at West Greenland.

5.9.4 NASCO has requested ICES to provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes)

Within a mixed stock fishery, the identification of the 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. As an example, the West Greenland Atlantic salmon fishery falls within this category. In 2004, the International Sampling Team determined the origin of ten fish with either external or internal tags. These included one fish from Ireland, four from Canada, and five from USA.

A genetic dichotomy exists between populations from either side of the North Atlantic Ocean and between European populations in Baltic and Atlantic drainages (Ståhl, 1987). One microsatellite locus has shown almost perfect separation of North American and European Atlantic salmon (Taggart *et al.*, 1995; Koljonen *et al.*, 2002). Such hypervariable nuclear DNA marker types can in theory be used to distinguish any distinct population group from one another, provided that there is a demonstrated positive correlation between genetic and geographic distance and that a sufficient number of unlinked loci are studied. However, it remains to be seen how well these markers estimate finer scale composition within a mixed stock fishery where a large number of populations are contributing.

A model was presented at the 2003 Working Group meeting that classified the West Greenland catch not only to continent of origin, but country and sub-country of origin as well. The Probabilistic-based Genetic Assignment model (PGA) uses Monte Carlo sampling to partition the reported and unreported catch estimates to continent, country and within country levels for all North American origin fish. Known misclassification accuracies at the sub-continent level within North America are incorporated and both point and variance estimates are generated for each assignment level. All analyses are conducted at the NAFO division specific level allowing for spatial comparisons of catch at the sub-continent of origin level. The model is flexible enough to allow for the evaluation of catches according to standard week thereby allowing for temporal comparison as well.

A refined PGA model was reviewed at the 2004 Working Group meeting. Sensitivity analyses were conducted to evaluate the PGA model performance and evaluate the extent some assumptions had on the performance. These explored the stability of the PGA model and the estimation strategy for average weight and continent of origin data for divisions where biological samples were not taken. The results from these sensitivity analyses indicated that the model was extremely stable and that the estimation of input data for unsampled divisions is handled properly.

The PGA model was applied to the 2000–2002 West Greenland fisheries data by inputting the genetic assignment data obtained for both continent and country of origin. The genetic assignment data came from samples genotyped at the 11 loci traditionally used for continent of origin assignment (King *et al.*, 2001). The suite of 11 loci allows for suitable classification accuracy within North America to the country of origin level. The year specific West Greenland catch (reported and unreported numbers combined) was partitioned into European and North American origin and then Canadian and USA origin (Table 5.9.4.1).

The 90% confidence intervals for the North American and European contributions to the West Greenland fishery, as determined via the PGA model, encompass the deterministic point estimates reported by the Working Group. Canadian origin fish dominated the North American component of the harvest, ranging from 96%–99% for the period 2000–2002 (Table 5.9.4.1).

The PGA method represents a cost effective means for assigning sampled individuals to origin at a scale finer than continent of origin. The Working Group endorsed the PGA model and was encouraged by the results presented. They supported this approach, which accounts for the inaccuracy of assigning samples to country of origin and the estimation of both point estimates and variance around these estimates. Previous efforts to generate these estimates relied on extensive tagging and recapture programs with accurate estimates of reporting rates for tag recaptures (Jensen, 1990). Limitations of traditional tagging programs are exacerbated when catches are low and geographically dispersed. For example, in 2004 only ten tags were recovered from the West Greenland fishery, whereas, greater than 1600 genetic samples were obtained. A further complication is that estimates of reporting rates are not easily verified. The PGA corrects for misclassification according to verified misclassification rates. These rates can be improved through increase spatial and temporal representation of all stocks potentially contributing to the mixed stock under consideration. 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 Southern NEAC stocks. A collaborative approach toward building reference datasets will improve the ability of assigning origin of Atlantic salmon caught during any mixed stock fishery or sampling endeavor at a finer resolution than continent of origin (river stocks, country or stock complexes).

The Working Group recognizes recent efforts underway to progress towards this goal. A Symposium entitled "Atlantic salmon, Microsatellites and Genetic Stock Identification" was held in Shepherdstown, West Virginia, USA during November 2004. The symposium reviewed existing information on temporal and spatial patterns of microsatellite variation in the Atlantic salmon and considered its implications for use in genetic stock identification (GSI). The participants agreed to standardize screening methods to develop an international database on microsatellite variation in Atlantic salmon, which would be available for genetic stock identification work at local, regional and continental scales across the North Atlantic. Therefore, the Working Group recommends the continued development and support of such collaborative efforts, which build on work at the laboratories in NAC and NEAC currently studying Atlantic salmon genetics.

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

The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland, although low numbers may originate from northern European rivers. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland. The percentage of North American salmon in the West Greenland catch has averaged approximately 70% from 2000–2004 (Table 5.9.3.1).

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 4.9.7.2). During 1993–2004, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972–1990. A 3% decrease occurred between 2002 and 2003, the most recent year for which it is possible to estimate the total population. 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 in 2004 of 2SW fish increased slightly from 2003 however they are still close to the lower end of the 34-year time-series (1971–2004). In Newfoundland, the 2SW salmon are a minor age group component of the stocks in this area and even here, decreases of about 30% have occurred from peak levels of a few years ago. Returns of 1SW salmon generally increased from 2003 in all areas. In 2004, the estimated overall spawning escapement was below the conservation limit (S_{lim}) for the stock complex. Specifically:

Newfoundland:

- 2SW spawners within precautionary limits

Labrador:

- 2SW spawners outside precautionary limits (32% of 2SW S_{lim})

Québec:

- 2SW spawners outside precautionary limits (70% of 2SW S_{lim})

Gulf of St. Lawrence:

- 2SW spawners outside precautionary limits (85% of 2SW S_{lim})

Scotia-Fundy:

- 2SW spawners outside precautionary limits (9% of 2SW S_{lim})
- inner Bay of Fundy stocks are listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada

United States:

- 2SW spawners outside precautionary limits (4% of 2SW S_{lim})
- stocks in 8 rivers are listed as Endangered under the Endangered Species Act

Southern European Stock

The main contributor to the abundance of the European component of the West Greenland stock complex is non-maturing 1SW salmon from southern Europe. The percentage of European fish in catches at West Greenland was around 30% in the early 1990's and the 2000's, but was below 20% from 1996–1999. The contributions of countries within NEAC to this PFA, based on historic tagging data are: France, 2.7%; Ireland, 14.7%; UK (England &Wales), 14.9%; UK (Northern Ireland), <0.01%; UK (Scotland), 64.5%; and northern NEAC countries, 3.2%. Southern European MSW salmon stocks in the NEAC area consistently declined over the past 10–15 years, and the estimated overall spawning escapement has been below conservation limits (S_{lim}) in recent years. Specifically:

France

- MSW spawners outside precautionary limits

Ireland

- MSW spawners outside precautionary limits

UK (England & Wales)

- MSW spawners outside precautionary limits

UK (Northern Ireland)

- MSW spawners within precautionary limits

UK (Scotland)

- MSW spawners outside precautionary limits

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

The forecast model used to estimate pre-fishery abundance of 2SW salmon in 2005 was the same as that used in 2004 (ICES, 2004a). 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 2004. In 2005 the lagged spawner time series that includes all six areas of North America for 1978–2005 was used because a method for deriving Labrador spawners for the recent years was developed.

North American run-reconstruction model

The Working Group has used the North American 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 4.9.7). Region-specific estimates of 2SW returns are listed in Table 4.9.5.2.

Update of Lagged Spawners

The lagged spawner variable used in the forecast model is an index of the 2SW parental stock of the PFA. It provides a means of examining the value in managing for spawning escapement and predicting recruitment in existing fisheries. The calculation procedure is described in Section 4.9.7. The lagged spawner index was the sum of the lagged spawner estimates for six regions of North America, which once again includes Labrador. With inclusion of Labrador, the lagged spawner series begins in the 1978 year of PFA (Section 4.9.7).

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

The advice for any given year has been dependent on obtaining a reliable predictor of the abundance of non-maturing 1SW North American stocks prior to the start of the fishery in Greenland. A two-phase regression between North American pre-fishery abundance (PFA_{NA}) and lagged spawners (LS_{NA}), assuming a break between the phases occurred during 1989 or 1990, was described in 2003 and elaborated upon in 2004. This pattern was reinforced with the addition of the 2003 PFA_{NA} estimate (Figure 5.10.1.1). 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 2003 (Figure 5.10.1.1). The effect of uncertainty in PFA_{NA} and LS_{NA} on the selection of the most parsimonious model and the detection of a phase shift was examined by Monte Carlo simulation. The minimum and maximum values of the PFA_{NA} and lagged spawner variables were calculated from the input data (Figure 5.10.1.2). As in 2004, 42 models were fit to each dataset derived using Monte Carlo simulation. These models included 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 2005 PFA_{NA}. Simulation methods, in the software package SAS (SAS Institute, 1996), were used to generate the probability density function of PFA_{NA} (Appendix 6).

Seven models (Table 5.10.1.1) and eight break years (1986–1993) were run for ten thousand datasets of PFA_{NA} and LS_{NA} created based on the estimated ranges for each year and PFA. One PFA_{NA} prediction was carried forward for the parsimonious model for each randomly selected dataset. 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 5.10.1.3). The approach taken in 2005 was identical to the method used in 2003 and 2004. The two-year lag is used because current year PFA (*i.e.* 2004) is not available due to its dependence upon 2SW returns in the next year.

Although it was possible that up to 42 models might be represented in estimating the distribution of PFA_{NA}, those selected most often were model III and VII and break years 1989 through 1992 (see below). The lagged spawner index variable was informative for PFA_{NA} in 63% of the simulated data sets. In such cases, the break years describing the phase shift were mostly 1991 and to lesser extents, 1992, 1989, and 1988. Model VII (intercept through the origin) was favoured more often (57% of all models). In 37% of the data sets, the lagged spawner variable (Model III) was uninformative and therefore this model with two means describing phases in PFA was selected. The corresponding break years were 1991 and 1992. For the 2005 forecast of PFA_{NA}, the probability (runs/10 000) of being in the high phase was negligible (0.6%) and the probability of being in the lower productivity phase was over 99%.

MODEL	PHASE	1998	1989	1990	1991	1992	1993	MODELS
III	High	0	0	0	1	0	0	
	Low	0	0	0	2260	1395	0	3656
VII	High	1	4	1	29	12	0	
	Low	273	1375	162	2616	1206	1	5680
IV to VI	High	10	6	0	0	0	0	
	Low	300	285	4	48	11	0	664
Phases	High	11	10	1	30	12	0	64
	Low	573	1660	166	4924	2612	1	9936

These estimates were then used to develop the risk analysis and catch advice 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.* reduced catches).

5.10.2 Development and risk assessment of catch options for 2005

The provision of catch advice 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. The undesirable event to be assessed is that the spawning escapement after fisheries will be below the conservation limit.

A composite spawning limit (S_{lim}) for the North American 2SW stock complex was developed by summing the spawning limits of Salmon Fishing Areas in Canada and river basins within the USA (Section 4.3). Details on the methodology to estimate and update the spawner limits (ICES, 1996) were recently provided in ICES (2003).

The risk analysis of catch options for Atlantic salmon from North America incorporates the following input parameter uncertainties:

- the uncertainty in attaining the conservation requirements simultaneously in different regions,
- the uncertainty of the pre-fishery abundance forecast, and
- the uncertainty in the biological parameters used to translate catches (weight) into numbers of North American origin salmon.

The risk analysis proceeds as illustrated in the flowchart of Figure 5.10.2.1. The three primary inputs are the PFA_{NA} forecast for the year of the fishery, the harvest level being considered (t of salmon), and the management objectives for the regions of North America. The uncertainty in the PFA_{NA} is accounted for in the approach 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 2005 fishery, it was assumed that the parameters for $Wt1SW_{NA}$, $Wt1SW_E$, $prop_{NA}$, and $prop_E$, and the ACF could vary uniformly within the values observed in the past five years (Table 5.10.2.1).

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, a total of 11 months at a rate of M = 0.03 (equates to 28.1% mortality). The fish that survive to home waters 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, 1999–2003. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and US are compared to the objective of achieving an increase of 10% and 25% relative to average returns of the base period, 1992–1996. The management objectives are shown in Table 5.10.2.1.

Incorporating southern NEAC PFA into catch advice

The Working Group previously considered a process for the provision of catch advice for West Greenland based on the combined PFA and CLs of the NAC and southern NEAC areas. A procedure for doing this is outlined in Figure 5.10.2.1 in which the PFA for NAC and southern NEAC are applied in parallel to the Greenland fishery and then combined at the end of the process into a single summary plot or catch advice table.

For the southern NEAC evaluation, the following parameter inputs were used.

- The southern NEAC PFA prediction model for MSW salmon from southern Europe and the prediction of PFA_{NEAC} for 2005 are presented in Section 3.6. For 2005, the forecast for the southern Europe MSW salmon on January 1 of the first sea-winter year is 486 000 fish (95% C.I. 313 000 to 755 000).
- Fish returning to home waters are discounted for natural mortality from the time they leave West Greenland to the time they return to rivers, a total of 8 months at a rate of M = 0.03 (equates to 21% mortality).
- The sharing arrangement for the West Greenland fishery used in this example corresponds to the sharing arrangement used for the provision of catch advice for the southern NAC area. Historically, the West Greenland share of the total southern NEAC MSW harvest was on average 40% from 1970–1993.
- The biological characteristics of the fish at West Greenland are simultaneously derived for fish from both continents
- The conservation limit for the southern NEAC MSW salmon is 277 985 (Table 3.3.3.1)

5.10.3 Critical evaluation

Critical evaluations of updates to the model input data were documented during the process of developing catch advice. These include:

- Application of the updated model to estimate the 2004 PFA produced a higher estimate (median 118 600) than the estimate provided last year (median 100 000).
- The lagged spawner variable used in the model declines in 2005 to its lowest value and is used to predict PFA using spawner abundances that are outside the range of previously observed values. The uncertainty of associations increases as the predictor variable gets farther from the mean, which has been the case for the 2004 and 2005 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

Based on the previous five-year average biological characteristics of 1SW non-maturing salmon in the fishery at West Greenland, each tonne of salmon catch equates to from 316–366 fish (5^{th}–95^{th} percentiles). After discounting for eleven months of natural mortality, each tonne not harvested equates to 159–187 fish (5^{th}–95^{th} percentiles) fish returning to home waters in North America and 64–80 (5^{th}–95^{th} percentiles) salmon returning to European home waters. Because these spawners are distributed among a large number of rivers on both continents, it has been difficult to show direct benefits to individual stocks. No further information is available on the effect of recent management measures.

5.12 Data deficiencies and research needs

Data deficiencies and research needs for West Greenland are presented in Section 6.

A - Achieved lagged spawners

Year of PFA	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America
1999	9930	3404	19459	33680	5764	2152	74390
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	14028	3043	1518	71312
% of North America (2000–2004)							
	28.4	7.4	27.2	28.6	6.4	2.1	
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 2000-2004							
	169,981	73,764	146,380	143,646	520,630	1,920,670	

B - 2SW Returns to Regions

	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America
1992-1996	18,380	4,689	42,905	34,450	7,129	1,868	117,679
2000-2004	14,914	4,803	29,016	21,094	2,643	861	73,332

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	7,129	1,868	
	2SW Conservation Limit				Increase relative to base period		
Total	98,644				7,842	2,055	+10%
					8,911	2,336	+25%

Table 5.2.1. 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 2004. B – 2SW returns to the regions of North America for two time periods, 1992–1996, 1999–2004. C – Management objectives for the NAC area used to develop the risk analysis of catch options for the 2005 fishery.

WEST GREENLAND HARVEST (T)	SIMULTANEOUS CONSERVATION (LAB, NF, QUEBEC, GULF)	IMPROVEMENT (SF, USA) OF RETURNS IN 2006		CONSERVATION MSW SALMON SOUTHERN NEAC
		> 10%	> 25%	
0	0.091	0.000	0.000	0.684
5	0.084	0.000	0.000	0.680
10	0.079	0.000	0.000	0.673
15	0.073	0.000	0.000	0.669
20	0.069	0.000	0.000	0.664
25	0.065	0.000	0.000	0.656
30	0.061	0.000	0.000	0.650
35	0.057	0.000	0.000	0.645
40	0.054	0.000	0.000	0.640
45	0.050	0.000	0.000	0.634
50	0.046	0.000	0.000	0.628
100	0.023	0.000	0.000	0.576

Table 5.4.1. Probability of meeting the 2SW conservation limits simultaneously in the four northern areas of North America (Labrador, Newfoundland, Quebec, Gulf); of achieving increases in returns from the 1992 to 1996 base year average in the two southern areas (Scotia-Fundy and USA) of NAC area, of meeting the MSW conservation limit of the southern European stock complex relative to quota options for West Greenland for 2005. A sharing arrangement of 40:60 (F_{NA}) of the salmon from North America and southern European MSW stocks was assumed.

WEST GREENLAND HARVEST (T)	PROBABILITY
0	0.64
5	0.67
10	0.69
15	0.71
20	0.73
25	0.74
30	0.76
35	0.78
40	0.79
45	0.81
50	0.82
100	0.91

Table 5.4.2. Probability of 2SW returns in 2006 being less than the previous five-year average (1999 to 2003) returns to regions of North America, relative to the 2005 catch options at West Greenland.

YEAR	TOTAL	QUOTA
1977	1,420	1,191
1978	984	1,191
1979	1,395	1,191
1980	1,194	1,191
1981	1,264	1,265[2]
1982	1,077	1,253[2]
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	258[4]
1993	0[1]	89[5]
1994	0[1]	137[5]
1995	83	77
1996	92	174[4]
1997	58	57
1998	11	20[6]
1999	19	20[6]
2000	21	20[6]
2001	43	114[7]
2002	9[10]	55[5,8,9]
2003	9[10]	20[6,8,9]
2004	15[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 5.9.1.1. Nominal catches of salmon, West Greenland 1977–2004 (metric tons round fresh weight).

Year	NAFO Division 1A	1B	1C	1D	1E	1F	UNK	West Greenland	East Greenland	Total 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

[1]) The fishery was suspended

+) Small catches <0.5 t

-) No catch

Table 5.9.1.2. Distribution of nominal catches (metric tons) by Greenland vessels (1977-2004).

	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

Table 5.9.2.1. Annual mean fork lengths (cm) and whole weights (kg) of Atlantic salmon caught at West Greenland, 1969–1992 and 1995–2004. NA = North America; E = Europe.

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
Mean	2.9	33.0	38.7	17.4	6.7	1.2	0.1	0.0

Table 5.9.2.2. River age distribution (%) and mean river age for all North American origin salmon caught at West Greenland, 1968–1992 and 1995–2004.

cont.

Table 5.9.2.2. cont.

YEAR	1	2	3	4	5	6	7	8
				Europe				
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
Mean	18.7	61.4	17.2	2.4	0.3	0.0	0.0	0.0

Table 5.9.2.2. cont. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland, 1968–1992 and 1995–2004.

Year	North American			European		
	1SW	2SW	Previous Spawners	1SW	2SW	Previous spawners
1985	92.5	7.2	0.3	95.0	4.7	0.4
1986	95.1	3.9	1.0	97.5	1.9	0.6
1987	96.3	2.3	1.4	98.0	1.7	0.3
1988	96.7	2.0	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	0.7
1991	95.6	4.1	0.4	93.4	6.5	0.2
1992	91.9	8.0	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	0.6
1999[1]	96.8	1.2	2.0	100.0	0.0	0.0
2000[1]	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	1.3	0.5	97.8	2.0	0.3
2002[1]	97.3	0.9	1.8	100.0	0.0	0.0
2003[1]	96.7	1.0	2.3	98.9	1.1	0.0
2004[1]	97.0	0.5	2.5	97.0	2.8	0.2

[1] Catches for local consumption only.

Table 5.9.2.3. Sea-age composition (%) of samples from fishery landings at West Greenland, 1985–2004 by continent of origin.

Source		Sample Size		Continent of origin (%)			
		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	

1 CI - confidence interval calculated by method of Pella and Robertson (1979) for 1984 -86 and binomial distribution for the others.

2 During Fishery

3 Research samples after fishery closed

Table 5.9.3.1. 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 2002–2004).

	Proportion weighted by catch in number		Numbers of Salmon caught	
	NA	E	NA	E
1982	57	43	192,200	143,800
1983	40	60	39,500	60,500
1984	54	46	48,800	41,200
1985	47	53	143,500	161,500
1986	59	41	188,300	131,900
1987	59	41	171,900	126,400
1988	43	57	125,500	168,800
1989	55	45	65,000	52,700
1990	74	26	62,400	21,700
1991	63	37	111,700	65,400
1992	45	55	46,900	38,500
1995	67	33	21,400	10,700
1996	70	30	22,400	9,700
1997	85	15	18,000	3,300
1998	79	21	3,100	900
1999	91	9	5,700	600
2000	65	35	5,100	2,700
2001	67	33	9,400	4,700
2002	72	28	2,200	900
2003	65	35	2,600	1,300
2004	72	28	3,900	1,500

Table 5.9.3.2. The catch weighted percentages and numbers of North American and European Atlantic salmon caught at West Greenland 1982-1992 and 1995-2004. Numbers are rounded to the nearest hundred fish.

Year	Continent of Origin Country of Origin	Estimate	Percent	90% Confidence Interval Lower	Upper
2000	NA total	7,731	66.0%	7,657	7,808
	E total	3,983	34.0%	3,906	4,057
	CAN total	7,685	99.4%	7,527	7,793
	USA total	46	0.6%	0	192
2001	NA total	10,673	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%	4,737	4,817
	USA total	45	0.9%	0	141

Table 5.9.4.1. Probabilistic-based Genetic Assignments for the 2000–2002 West Greenland Atlantic salmon fisheries. Reported and unreported catch in numbers were partitioned by continent (E-European origin and NA-North American origin) and country (CAN- Canadian origin and USA- United States origin) of origin for NA origin fish only.

Model	Function $Ln(PFA_{NA})$ =	Model description
I	$\mu + \xi$	A single mean PFA_{NA}; No phases or lagged spawner index variable
II	$\alpha + \gamma * Ln(LS_{NA}) + \xi$	A single regression of PFA_{NA} on lagged spawner index
III	$\beta * Ph + \xi$	Two means of PFA_{NA} for the two phases; no lagged spawner index variable
IV,V,VI	$\alpha + \beta * Ph + (\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with possible variations in slopes and intercepts
VII	$(\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with intercept through the origin
PFA_{NA} = PFA for North America (1977 to 2002) *LS_{NA} = Lagged spawner index excluding Labrador (1977 to 2002)* *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 1977-1985 and 1986-2002 to 1977-1993 and 1994-2002*		

Table 5.10.1.1. 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.

Biological characteristics in the fishery			
Time period	2000 to 2004		
		Minimum	Maximum
Proportion NA		0.68	0.73
Proportion European		0.27	0.32
Mean weight 1SW NA		2.47	3.11
Mean weight 1SW NEAC		2.81	3.08
Age Correction Factor		1.017	1.030
Conservation spawning objectives (2SW fish)			
Labrador	34,746		
Newfoundland	4,022		
Quebec	29,446		
Gulf	30,430		
Scotia-Fundy	24,705		
USA	29,199		
Alternative management objectives – return of 2SW **salmon**			
	Mean	Minimum	Maximum
Base period	1992 to 1996		
Scotia-Fundy	7,129	5,579	8,549
USA	1,868	1,346	2,407
Recent five-year period	2000 to 2004		
Labrador	40,095	12,140	68,487
Newfoundland	5,054	1,934	7,739
Quebec	29,039	25,394	32,738
Gulf	21,097	14,591	27,325
Scotia-Fundy	2,641	2,075	3,205
USA	861	511	1,283

Table 5.10.2.1. Input parameters and management objectives for the risk analysis of catch advice for the West Greenland salmon fishery for 2005.

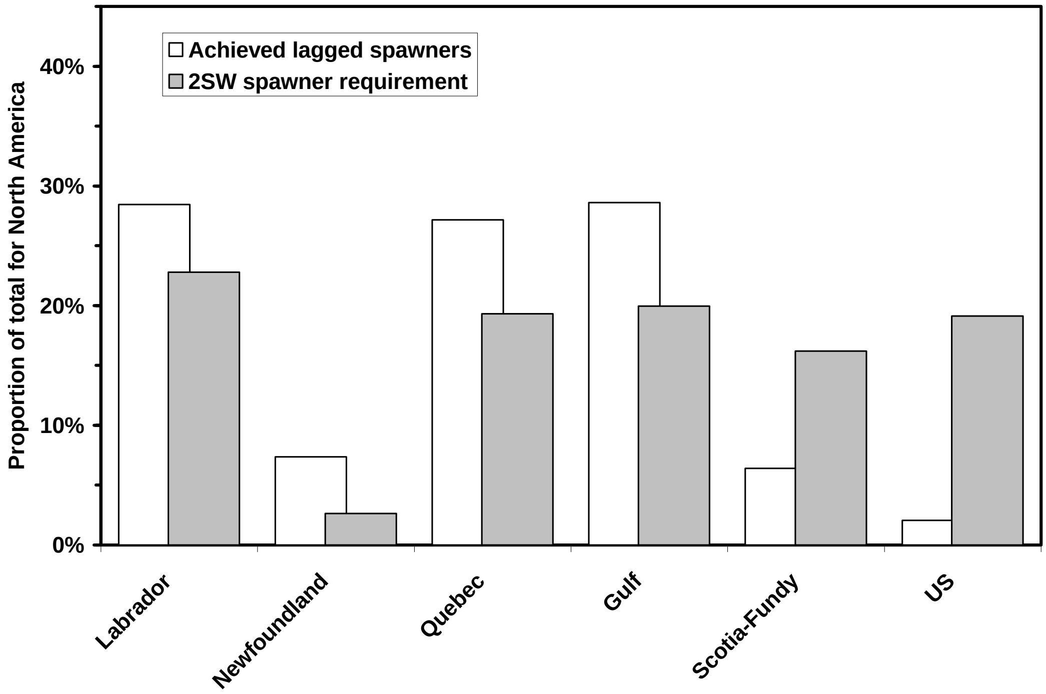


Figure 5.2.1. Average lagged spawners in the six regions of North America for the PFA years 1999 to 2003 and the 2SW spawner requirement in each region expressed as a proportion of the total for North America.

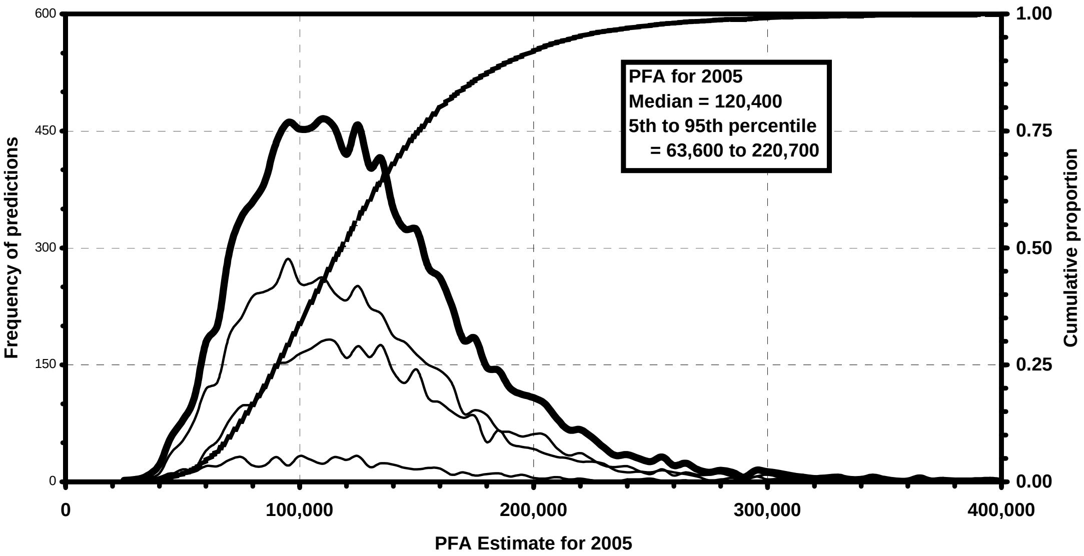


Figure 5.4.1. PFA_{NA} forecast estimate distribution for the year 2005 non-maturing 1SW salmon.

PERCENTILE	ESTIMATE
5	63,645
10	73,321
15	80,509
20	87,109
25	92,725
30	98,151
35	103,830
40	109,312
45	114,715
50	120,360
55	125,768
60	132,023
65	138,048
70	145,407
75	153,173

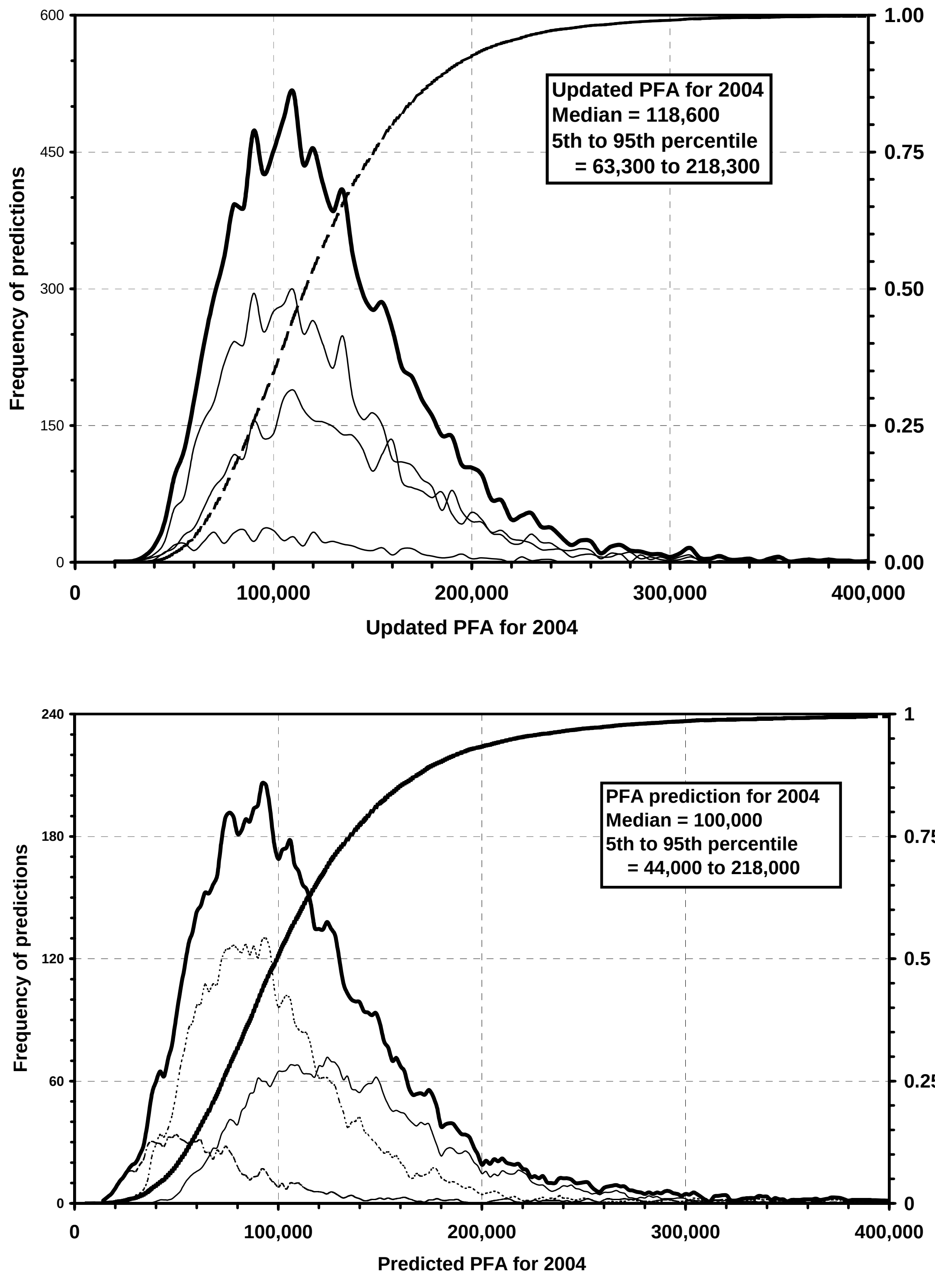


Figure 5.8.1. Revised PFA_{NA} estimated distribution for the 2004 PFA year using the updated data and nested model selection approach of 2005 (upper panel) and PFA forecast distribution using the previous year's formulation and data (lower panel).

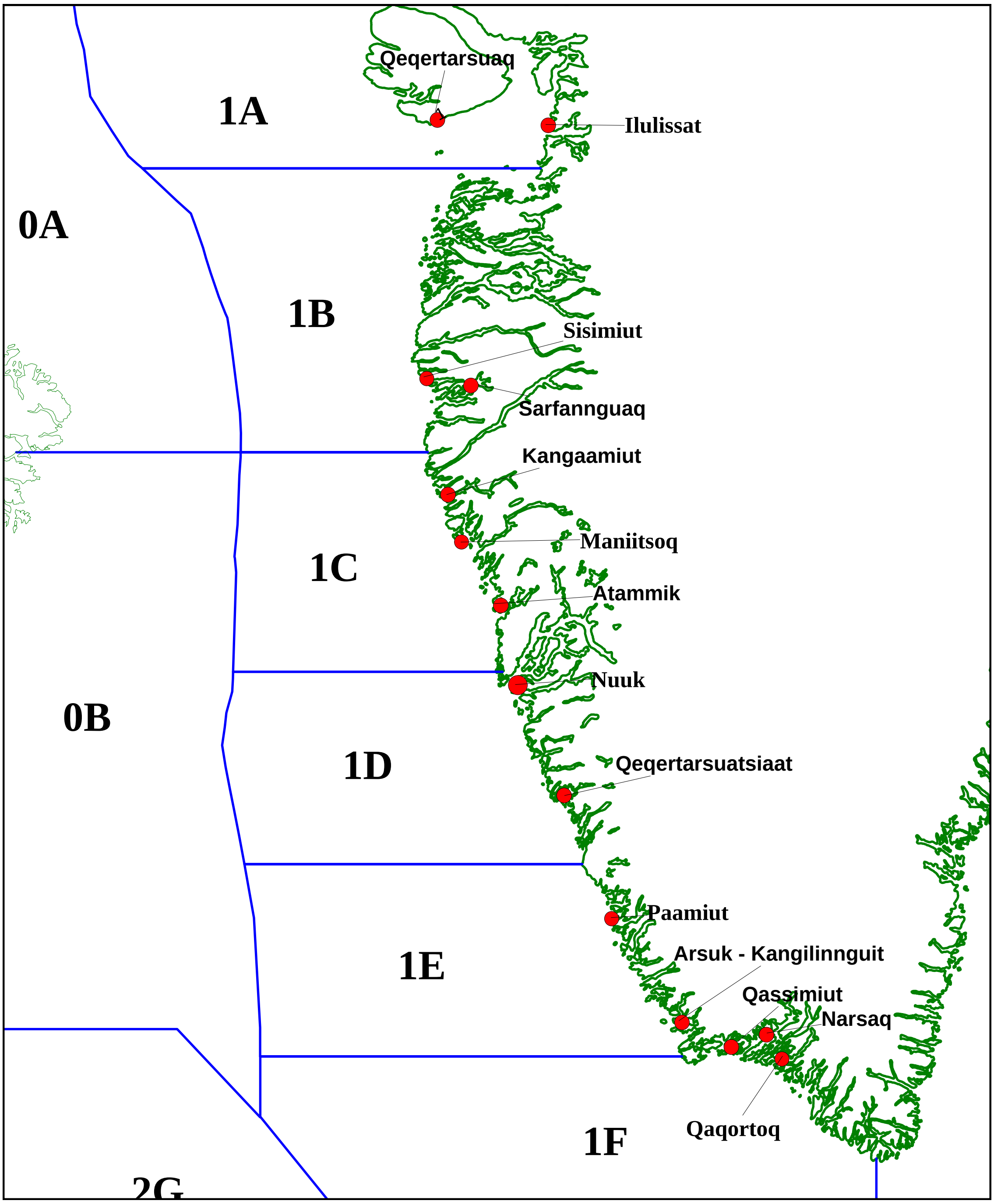


Figure 5.9.1.1. West Greenland NAFO divisions.

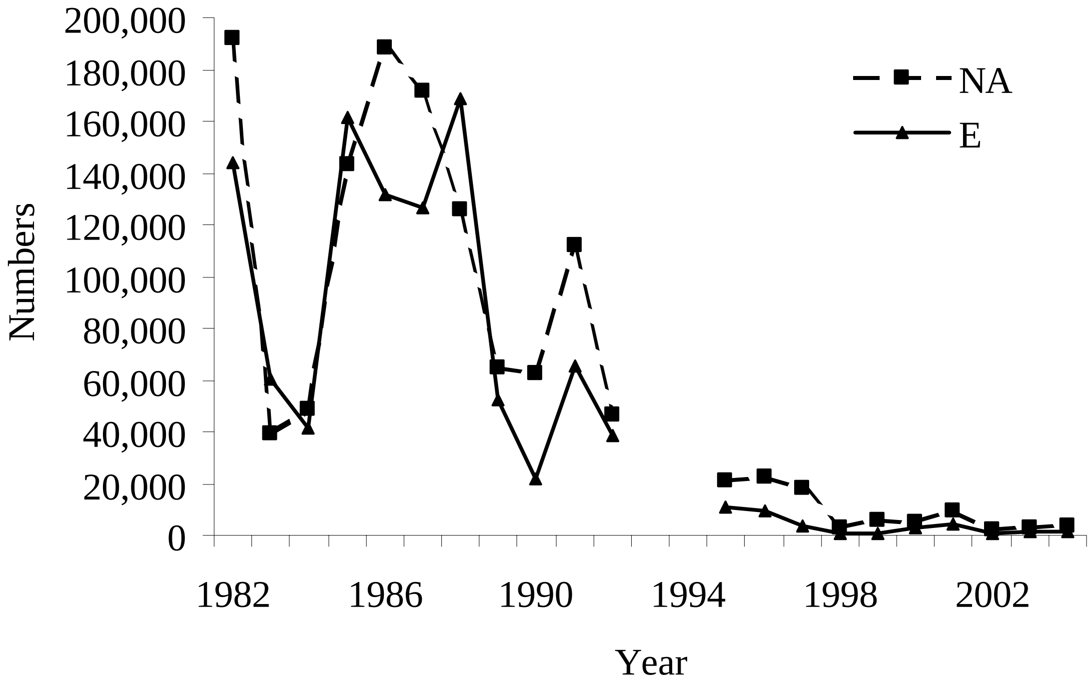


Figure 5.9.3.1. Number of North American (NA) and European (E) salmon caught at West Greenland, 1982-1992 and 1995-2004.

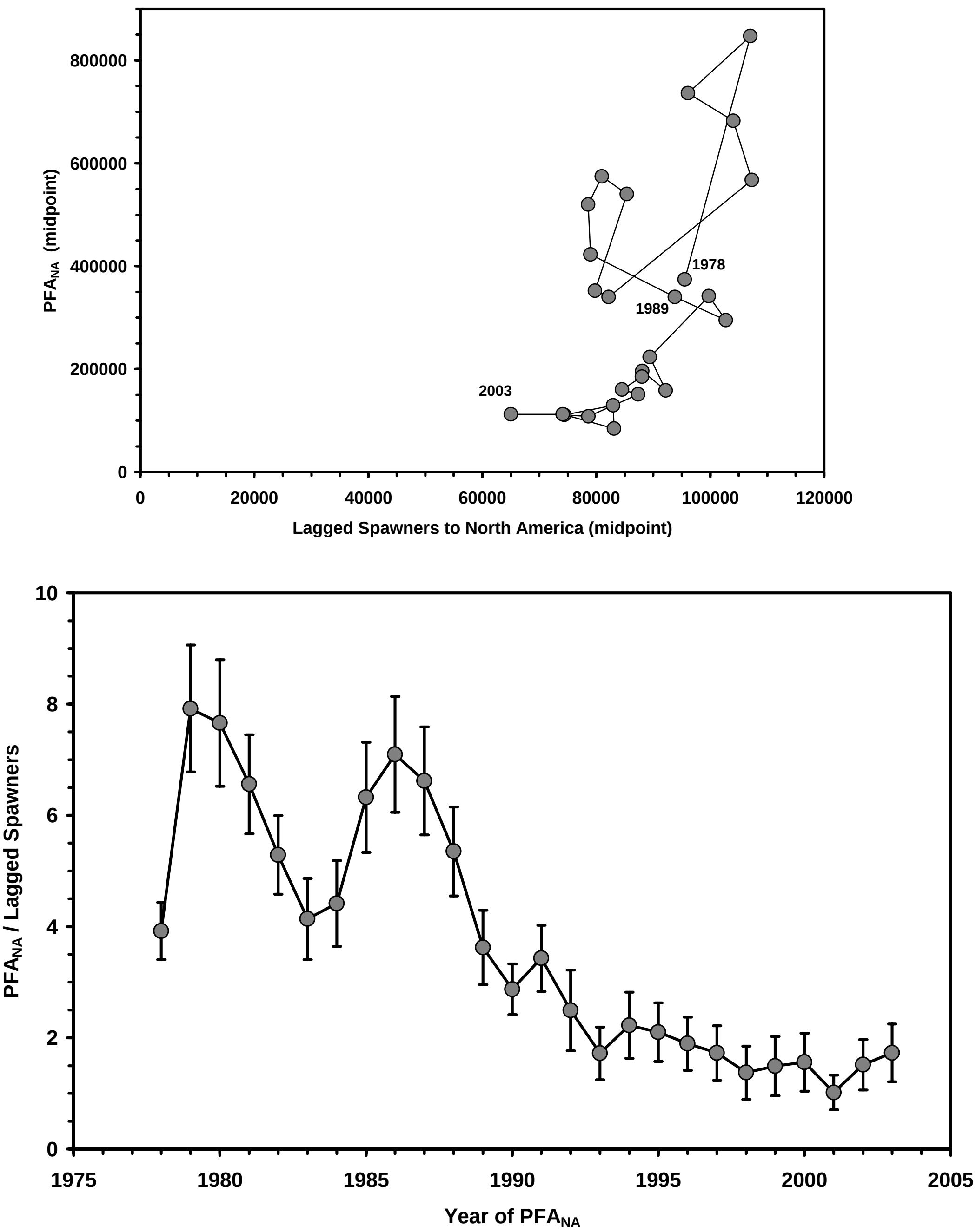
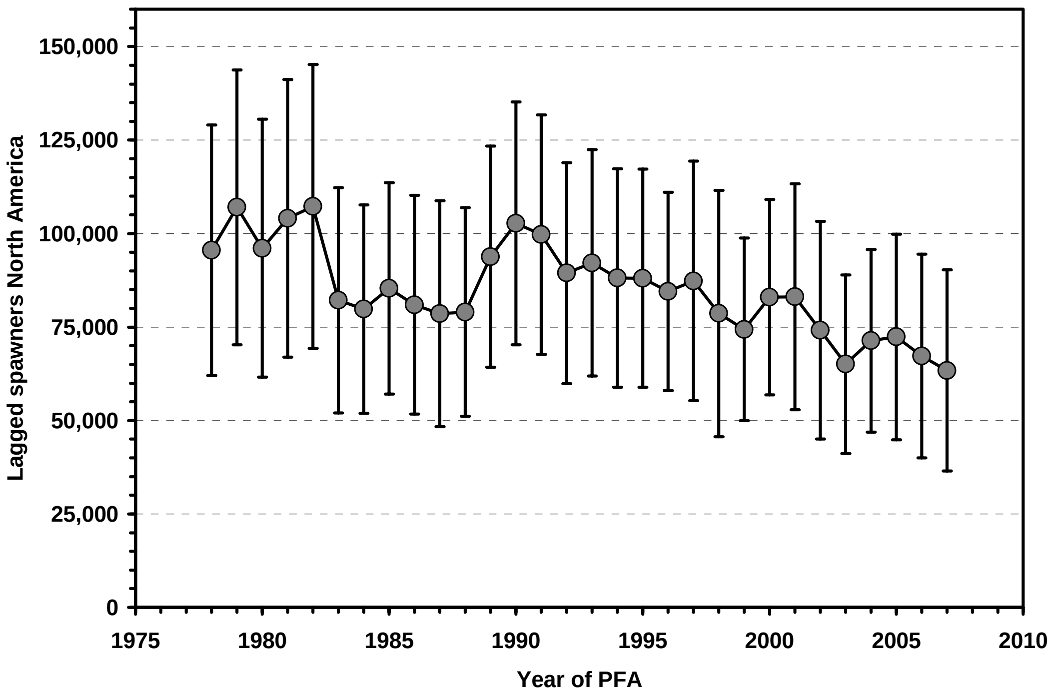


Figure 5.10.1.1. PFA (mid-point) and lagged spawner (mid-point) association for the NAC area showing the sequence from 1978–2003 (upper panel) and the relative change of the PFA to lagged spawners over the time series (lower panel).



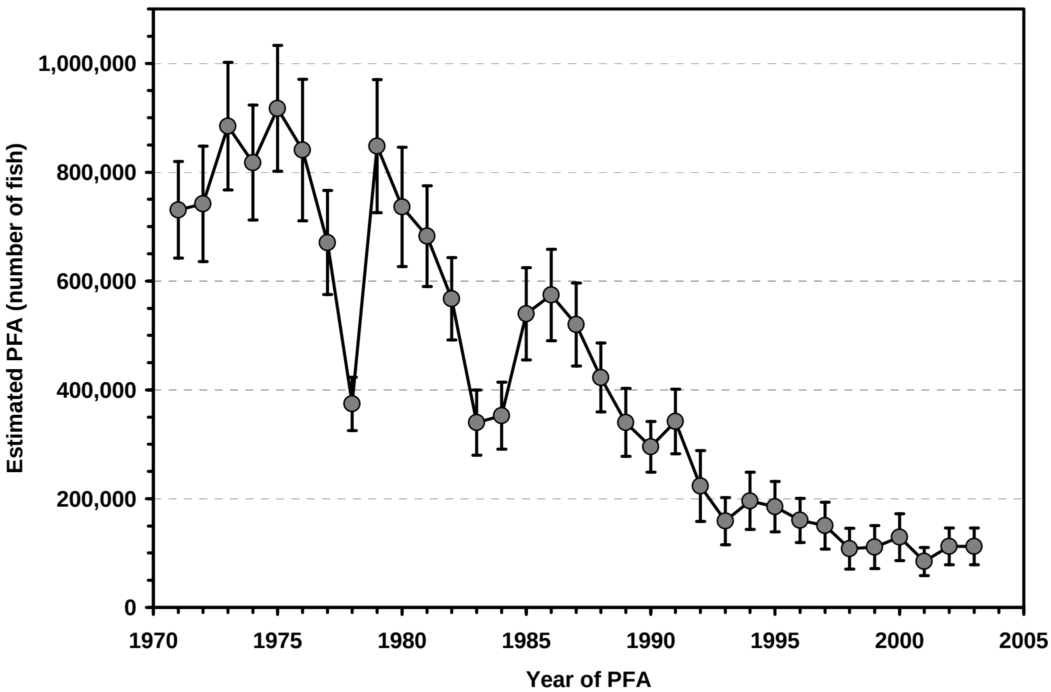


Figure 5.10.1.2. Midpoints and error bars (minimum to maximum range) of lagged spawners in North America for 1978–2007 (upper), and estimated PFA (lower) used in the forecasting of PFA abundance for the NAC area.

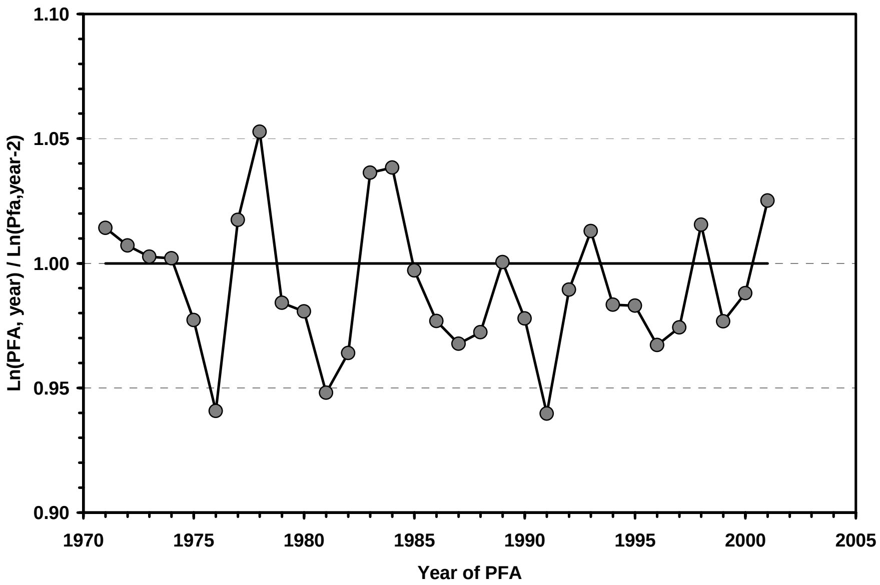


Figure 5.10.1.3. Relative change in Ln(PFA) in year relative to Ln(PFA) in year-2.

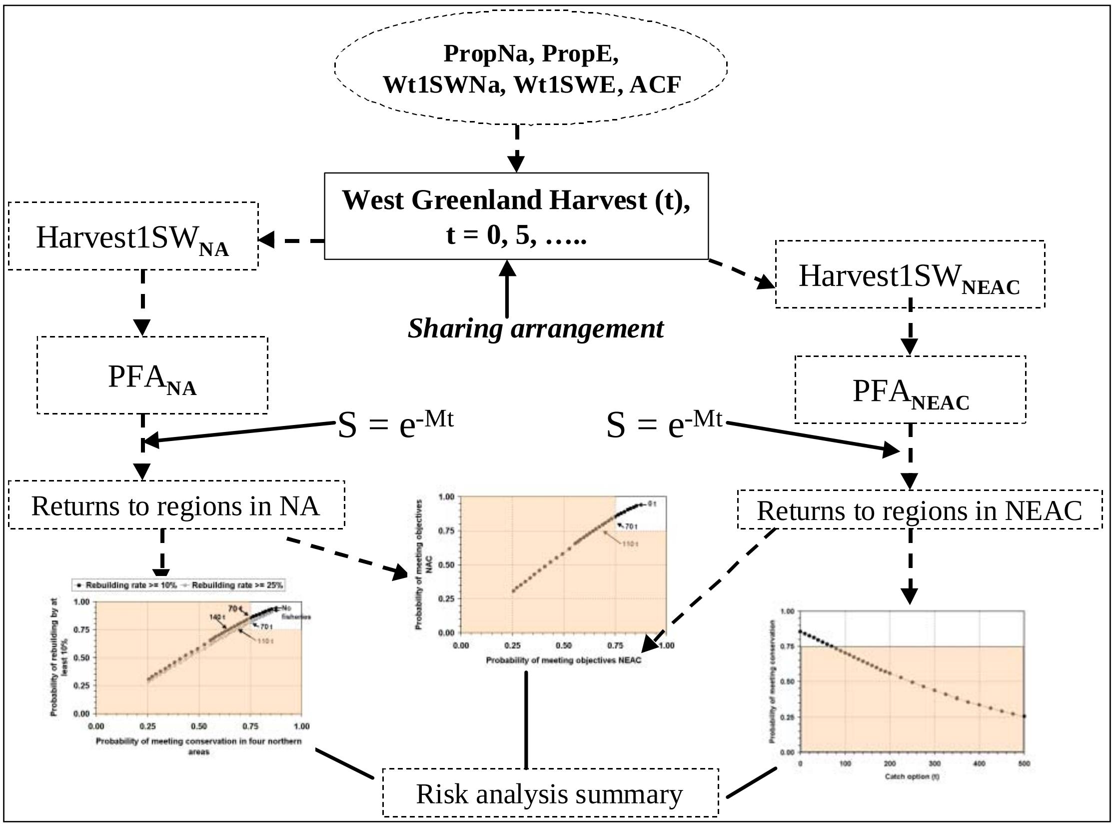


Figure 5.10.2.1. Flowchart, risk analysis for catch options at West Greenland using the PFA_{NA} and the PFA_{NEAC} predictions for the year of the fishery. Inputs with solid borders are considered known without error. Inputs with dashed borders are estimated, contain observation error that is incorporated 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 2006 to address questions posed by ACFM, including those posed by NASCO. The Working Group intends to convene in ICES headquarters in Copenhagen, from the 3rd April to 13th April 2006. 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) Given the importance of M in the provision of catch advice and in the understanding of the dynamics of Atlantic salmon in the ocean, and in order to refine the assessment of M with the maturity schedule method, hatchery release programs should attempt to confirm the sex ratio of the released smolts (Section 2.3).
2) The Working Group recommends that life history characteristics of salmon stocks including age structure, length at age, relative and absolute abundance of repeat spawners, run-timing and other such features be examined for Atlantic salmon stocks to ensure that conservation of salmon goes beyond abundance (Section 2.5.3). In addition, the Working Group notes the need to accurately separate different sea ages in national catches, in order to facilitate monitoring the changes in sea age structure in populations.
3) The Working Group recommends that in regions where fishery closures have not resulted in stock rebuilding, that urgent research work be continued to forecast population viability, to determine the cause or causes of declines, and activities be implemented to reverse declining population trends (Section 2.5).
4) A coordinated tagging/tracking studies should be carried on to give information on migration, distribution, survival and growth of escaped farmed salmon. (Section 2.6).
5) Further basic research is needed on the spatial and temporal distribution of salmon and their predators at sea to assist in explaining variability in survival rates:
    - As depth and temperature recording tags (DSTs) have proven to be a good method in assessing the marine life history of salmon, further DST-tagging experiments on smolts, adult salmon and kelts should be conducted in different areas of the NA area (Section 2.6).
    - Experimental trawling surveys should be conducted to evaluate the vertical distribution of post-smolts and older salmon in the sea, if possible in combination with tagging of post-smolts and salmon with DST tags (Sections 2.6 and 3.11.2).

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

1) Further progress should be made in establishing a PFA predictive model using the PFA of maturing 1SW salmon, in addition to the spawner term, as a predictor variable for the PFA of non-maturing 1SW in the northern NEAC area (Section 3.4).

2) Efforts should be made in developing PFA estimation models for smaller units than national levels as marine survival may vary between rivers and regions and temporal variation in marine growth and abundance are more correlated between rivers in small geographical area than between rivers more distant to each other (Sections 2.4.3 and 3.9.12).

3) 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 (Section 3.9.8).

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

1) There is a need to develop habitat-based spawner requirements in Labrador, and to monitor salmon returns in the Ungava region of Québec (Sections 4.9.5 & 4.9.7).

2) There is a need to investigate changes in the biological characteristics (mean weight, sex ratio, sea-age and river-age composition) of returns to rivers, of smolt output, of spawning stocks of Canadian and US rivers, and the harvest in food fisheries in Labrador. These data and new information on measures of habitat and stock recruitment are necessary to re-evaluate existing estimates of spawner requirements in Canada and USA and for use in the run reconstruction model (Sections 4.9.7).

3) There is a requirement for additional smolt-to-adult survival rates for wild salmon (Section 4.9.9).

4) The Working Group recommends that the smolt age distribution for the six North American areas be re-evaluated on a five-year schedule (next evaluation in 2009) (Section 4.9.7).

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

1) Continued efforts should be made to improve the estimates of the annual catches of salmon taken for private sales and local consumption in Greenland (Section 5.9.1).

2) Efforts should be made by the Home Rule Government of Greenland to provide information on the extent of fishing activity by all license holders (Section 5.9.1).

3) The mean weights, sea and freshwater ages and continent of origin are essential parameters to provide catch advice for the West Greenland fishery. In addition, sampling to determine sex on as many whole fish as practicable and testing for ISAv and other diseases in Atlantic salmon caught in West Greenland methods should be included in the program. Methods for determining sex on gutted individuals should be considered. The Working Group recommends that the sampling program be continued and closely coordinated with fishery harvest plan to be executed annually in West Greenland. (Section 5.9).

4) The Working Group recommends continued development and support of collaborative efforts to genetically characterize salmon stocks (Section 5.9.4). Building on work at the laboratories in NAC and NEAC currently studying Atlantic salmon genetics will assure significant progress toward assigning origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes).

5) Scale analysis of salmon captured at West Greenland indicated an infrequent occurrence of escaped farm salmon. To investigate this observation, farmed salmon need to be genetically characterized and included as baseline populations in continent of origin analyses of samples collected at West Greenland (Section 5.9.3).

6) The Working Group recommends that stage-specific mortality rates be determined, in particular the PFA estimate be verified through at sea research programs, similar to 1972, when an estimate of the non-maturing Atlantic salmon

population at Greenland and the extant population in the western North Atlantic was developed (Section 5.10).

APPENDIX 1

WORKING DOCUMENTS SUBMITTED TO THE WORKING GROUP ON NORTH ATLANTIC SALMON, 2005

1) Crozier W. W., Kennedy G. J. A., Boylan P. and Kennedy R. Summary of salmon fisheries and status of stocks in Northern Ireland for 2004.

2) Siegstad H., Carl, J. and Kanneworff P. The salmon fishery in Greenland 2004.

3) Reddin, D. Redefining the Smolt Age Distribution for Labrador.

4) Anon. Newfoundland and Labrador Atlantic salmon 2004 Stock Status Update.

5) Reddin D. G. Return and spawner estimates Atlantic salmon for Insular Newfoundland, 2004

6) Reddin D. G. Atlantic salmon return and spawner estimates for Labrador.

7) Meerburg D. J. Catch, catch-and-released, and unreported catch estimates for Atlantic salmon in Canada, 2004.

8) Vauclin V. Salmon Fisheries and Status of Salmon Stocks in France: National Report for 2004.

9) Prusov S. V., Krylova S. S., Studenov I. I. and Bugaev V. F. Atlantic salmon fisheries and status of stocks in Russia. National report for 2004.

10) Hansen L. P., Fiske P., Holm M., Jensen A. J., Sægrov H., Arnekleiv J. V., Hvidsten N. A. and Jonsson N. Atlantic salmon; national report for Norway 2004.

11) Holm M., Crozier W., Ómaoileidigh N. Shamray Y., Iversen S., Graham N., Jacobsen J.A., Boyd J., Prusov S. and Belikov S. Draft Report of the Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries, SGBYSAL. 8–11 February 2005 Bergen, Norway.

12) Holm M. Salmon surveys in the NE Atlantic in 2004 – Distribution of catches of post-smolt and salmon.

13) Holm M., Jacobsen J., Sturlaugsson J. and Holst J. C. Preliminary results from DST-tagging of salmon in the Norwegian Sea

14) Amiro P. G., R. A., Jones, and T. L. Marshall. Maritimes Region Expert Opinion on Atlantic Salmon of Salmon Fishing Areas (SFAs) 19-23 for 2004.

15) Caron F. and Fontaine P-M. Status of Atlantic Salmon Stocks in Québec, 2004

16) Caron F. Smolt production, freshwater and sea survival, on two index rivers, the Trinité and Saint-Jean, in Québec.

17) Chaput G., Cameron P., Moore D., Cairns D. and LeBlanc P. Stock status summary for Atlantic salmon from Gulf Region, SFA 15-18 for 2004.

18) Chaput G. and Jones R. Replacement ratios and rebuilding potential for two multi-sea-winter-salmon stocks of the Maritime provinces

19) Chaput G. Update on estimates of mortality of Atlantic salmon of NAC and NEAC

20) Erkinaro J., Länsman M., Kylmäaho M., Kuusela J. and Niemelä E. National report for Finland: salmon fishing season in 2004.

21) Karlsson L. Salmon fisheries and status of salmon stocks in Sweden: National report for 2004.

22) De la Hoz J. Spain-Asturias salmon report 2004 for ICES.

23) MacLean J. C., Smith G. W. and McLaren I. S. National report for UK (Scotland): 2004 season.

24) Anon. Annual assessment of salmon stocks and fisheries in England and Wales, 2004.

25) Russell I., Potter T., Ó Maoiléidigh N., Davidson I., Maxwell D. and Browne J. Exploitation of English and Welsh salmon in the Irish drift net fishery.

26) Smith G. W. and Potter E. C. E. Proposed revisions to the NEAC area Pre-Fishery abundance and National Conservation Limit model.

27) Trial J., Sweka J., Kubiak T., Elskus A., Legault C. and Sheehan T. National report for the United States, 2004.

28) Legault C. and Chaput G. PFA Projections: Completing the Cycle.

29) Sheehan T. F., Reddin D. G., King T. L. and Siegstad H. The international sampling program, continent of origin and biological characteristics of Atlantic salmon collected at West Greenland in 2004.

30) Jensen A. J., Hansen L. P. and Fiske P. Regional variation in sea growth and production in Atlantic salmon.

31) Fiske P., Hansen L. P. and Jensen A. J. Preliminary estimation of prefishery abundance (PFA) for Norwegian Atlantic salmon in the period 1983-2004.

32) Hansen L. P., Jensen A. J. and Fiske P. Can hatchery reared smolts of Atlantic salmon be use of an indicator for marine survival of wild salmon?

33) Gudbergsson G., Antonsson T. and Gudjonsson S. National report from Iceland. The 2004 salmon season.

34) Gudbergsson G. and Einarson S. M. Recapture of tagged salmon in catch and release salmon fishery in Iceland 2003.

35) Ó Maoiléidigh N., Cullen A., McDermott T., Bond N., McLaughlin D., Rogan G. and Cotter D. National Report for Ireland – The 2004 Salmon Season.

36) Ó Maoiléidigh N., McGinnity P., Prévost E., Potter E. C. E., Chaput G., Gargan P., Crozier W., Mills P., Roche W., Boylan P., O´Donavan V., McGarrigle M. and Dromey M. Update on the precautionary catch advice procedure for Irish salmon fisheries in 2005.

37) Sheehan T. F., Legault, C. M., King, T. L. and Spidle, A. P. Probabilistic-based Genetic Assignment model (PGA): Sub-continent of origin assignments of the West Greenland Atlantic salmon catch.

38) Lenormand C. and Briand D. Informations sur la pêche et compte-rendu de l´échantillonnage des captures de saumon atlantique à Saint-Pierre et Miquelon en 2004.

39) Erkinaro, J., Niemelä, E., Dempson, J. B., Julkunen, M., Zubchenko, A., Prusov, S., Svenning, M. A., Ingvaldsen, R., Holm, M. and Hassinen, E. Temporal synchrony in abundance and marine growth of Atlantic salmon in three Barents Sea river

40) Trial, J. G. A method of estimating mortality risk from a catch and release fishery: Penobscot River, Maine 1979 to 1999.

41) Legault, C. M, Ó Maoiléidigh, N. and Chaput, G. Catch advice and projected attainment of conservation limits for an Irish salmon fishing district.

APPENDIX 2

References

Chaput G., Hardie, P., Hayward, J., Moore, D., Sheasgreen, J., and NSPA. 2002. Migrations and biological characteristics of Atlantic salmon (*Salmo salar*) smolts from the Northwest Miramichi River, 1998 to 2000. Canadian Technical Report of Fisheries and Aquatic Sciences, 2415. 70 pp.

Chaput, G., C. Legault, D. Reddin, F. Caron, and P. Amiro. 2005. Provision of catch advice taking account of non-stationarity in productivity of Atlantic salmon (*Salmo salar*) in the Northwest Atlantic. ICES Journal of Marine Science, 62: 131-143.

Crozier, W. W., Potter, E. C. E., Prévost, E., Schon, P–J., and Ó Maoiléidigh, N. 2003. A co-ordinated approach towards the development of a scientific basis for management of wild Atlantic salmon in the north-east Atlantic (SALMODEL – Scientific Report Contract QLK5–1999–01546 to EU Concerted Action Quality of Life and Management of Living Resources). Queen's University of Belfast, Belfast. 431 pp.

Decisioneering, 1996. Crystal Ball - Forecasting and risk analysis for spreadsheet users (Version 4.0). 286 pp.

Friedland, K.D., Hansen, L.P., Dunkley, D.A. & MacLean, J.C. 2000. Linkage between ocean climate, post-smolt growth, and survival of Atlantic salmon (*Salmo salar* L.) in the North Sea area. ICES Journal of Marine Science, 57:419–429.

Hansen, L.P., Jonsson, N. & Jonsson, B. 1993. Oceanic migration of homing Atlantic salmon. Animal Behaviour, 45: 927–941.

Holst, J.C. and McDonald, A. 2000. FISH-LIFT: A device for sampling live fish with trawls. Fisheries Research, 48: 87–91.

ICES 1991. Report of the Working Group on North Atlantic Salmon. Copenhagen, 14–21 March 1991 ICES CM 1991/Assess:12. 156 pp.

ICES. 1993. Report of the North Atlantic Salmon Working Group. Copenhagen, 5–12 March 1993. ICES CM 1993/Assess:10.

ICES. 1994. Report of the North Atlantic Salmon Working Group. Reykjavik, 6–15 April 1994. ICES CM 1994/Assess:16.

ICES 1995. Report of the North Atlantic Salmon Working Group. Copenhagen, 3–12 April 1995. ICES CM 1995/Assess: 14. 191 pp.

ICES. 1996. Report of the Working Group on North Atlantic Salmon. Moncton, Canada, 10–19 April 1996. ICES CM 1996/Assess:11, 227 pp.

ICES. 1997. Report of the Working Group on North Atlantic Salmon. Copenhagen, 7–16 April 1997. ICES CM 1997/Assess:10. 242 pp.

ICES. 2000. Report of the Working Group on North Atlantic Salmon. ICES Headquarters, Copenhagen, April 3 –13. ICES CM 2000/ACFM:13. 301 pp.

ICES 2001. Report of the Working Group on North Atlantic Salmon. Aberdeen, 2–11 April 2001. ICES CM 2001/ACFM:15. 290 pp.

ICES. 2002. Report of the Working Group on North Atlantic Salmon. ICES Headquarters, Copenhagen, 3–13 April 2002. ICES CM 2002/ACFM:14. 299 pp.

ICES. 2003. Report of the Working Group on North Atlantic Salmon. ICES Headquarters, Copenhagen, 31 March–10 April 2003. ICES CM 2003/ACFM:19. 297 pp.

ICES. 2004a. Report of the Working Group on North Atlantic Salmon. Halifax, Canada 29 March–8 April 2004. ICES CM 2004/ACFM:20. 286 pp.

ICES 2004b. Report of the Study Group on the Bycatch of Salmon in Pelagic Fisheries. Bergen Norway, 9–12 March 2004. ICES CM 2004/I:01. 66 pp.

Idler, D.R., S.J. Hwang, L.W. Crim, & D. Reddin. 1981. Determination of sexual maturation stages of Atlantic salmon (*Salmo salar*) captured at sea. Canadian Journal of Fisheries and Aquatic Sciences, 38: 405–413.

Jensen, J. M. 1990. Atlantic salmon at Greenland. Fisheries Research. 10: 29–52.

Jones, R.A., L. Anderson, and T. Goff. 2004. Assessments of Atlantic salmon stocks in southwest New Brunswick, an update to 2003. Fisheries and Oceans Canada Science Canadian Scientific Advisory Secretariat Research Document, 2004/019.

Jonsson, B., Jonsson, N. & Hansen L.P. 2003. Atlantic salmon straying from the River Imsa. Journal of Fish Biology 62: 641–657.

King, T.L., Kalinowski, S.T., Schill, W.B., Spidle, A.P., Lubinski, B.A. 2001. Population structure of Atlantic salmon (*Salmo salar* L.): a range-wide perspective from microsatellite DNA variation. Molecular Ecology, 10: 807–821.

Koljonen, M.L., Tahtinen, J., Saisa, M. and Koskiniemi, J. 2002. Maintance of genetic diversity of Atlantic salmon (*Salmo salar*) by captive breeding programmes and the geographic distribution of microsatellite variation. Aquaculture, 212: 69–92.

NASCO 1998. North Atlantic Salmon Conservation Organisation. Agreement on the adoption of a precautionary approach. Report of the 15th annual meeting of the Council. CNL(98)46. 4 pp.

NASCO 1999. North Atlantic Salmon Conservation Organisation. Action plan for the application of the precautionary approach. CNL(99)48. 14 pp.

O'Connell, M.F., D.G. Reddin, P.G. Amiro, T.L. Marshall, G. Chaput, C.C. Mullins, A. Locke, S.F. O'Neil, and D.K. Cairns. 1997. Estimates of conservation spawner requirements for Atlantic salmon (*Salmo salar* L.) for Canada. Canadian Stock Assessment Secretariat Research Document, 97/100. 58 pp.

Ó Maoiléidigh N., Potter E. C. E., McGinnity P., Whelan K. F., Cullen A., McLaughlin D., and McDermott T. 2001. The significance and interpretation of net catch data. *In* Proceedings of the Atlantic Salmon Trust. Symposium on the Interpretation of Rod and Net Catch Data, Lowestoft, 2001, pp. 15–30. The Atlantic Salmon Trust, Pitlochry. 107 pp.

Ó Maoiléidigh, N., McGinnity, P., Prévost, E., Potter, E. C. E., Gargan, P., Crozier, W. W., Mills, P., and Roche, W. 2004. Application of pre-fishery abundance modelling and Bayesian hierarchical stock and recruitment analysis to the provision of precautionary catch advice for Irish salmon (*Salmo salar* L.) fisheries. ICES Journal of Marine Science, 61: 1370–1378.

Potter, E.C.E. and Dunkley, D.A. 1993. Evaluation of marine exploitation of salmon in Europe. *In* Salmon in the Sea, and new enhancement strategies. pp. 203–219. Ed. By D. Mills. Fishing News Books, Oxford. 424 pp.

Potter, E. C. E., Hansen, L. P., Gudbergsson, G., Crozier, W. W., Erkinaro, J., Insulander, C., MacLean, J., Ó Maoiléidigh, N. S., and Prusov, S. 1998. A method for estimating preliminary CLs for salmon stocks in the NASCO–NEAC area. ICES CM 1998/T: 17. 11 pp.

Potter, E.C.E., Crozier, W.W., Schön, P-J., Nicholson, M.D., Maxwell, D.L., Prévost, E., Erkinaro, J., Gudbergsson, G., Karlsson, L., Hansen, L.P., MacLean, J.C., Ó Maoiléidigh, N., and Prusov, P. 2004. Estimation and forecasting pre-fishery abundance of Atlantic salmon (*Salmo salar* L.) in the Northeast Atlantic for the management of mixed-stock fisheries. ICES Journal of Marine Science, 61: 1359–1369.

Prévost, E., Parent, E., Crozier, W., Davidson, I., Dumas, J., Gudbergsson, G., Hindar, K., McGinnity, P., MacLean, J., and Sættem, L. M. 2003. Setting biological reference points for Atlantic salmon stocks: transfer of information from data-rich to sparse-data situations by Bayesian hierarchical modelling. ICES Journal of Marine Science, 60: 1177–1194.

Rago, P.J., D.G. Reddin, T.R. Porter, D.J. Meerburg, K.D. Friedland & E.C.E. Potter. 1993a. A continental run reconstruction model for the non-maturing component of North American Atlantic salmon: analysis of fisheries in Greenland and Newfoundland-Labrador, 1974–1991. ICES CM 1993/M:25.

Rago, P.J., D.J. Meerburg, D.G. Reddin, G.J. Chaput, T.L. Marshall, B. Dempson, F. Caron, T.R. Porter, K.D. Friedland, and E.T. Baum. 1993b. Estimation and analysis of pre-fishery abundance of the two-sea-winter population of North American Atlantic salmon (*Salmo salar*), 1974–1991. ICES CM 1993/M:24.

Rago, P.J. 2001. Index measures and stock assessment of Atlantic salmon. *In* Stock, recruitment and reference points: assessment and management of Atlantic salmon, pp. 137-176. Ed. by E. Prévost and G. Chaput. INRA Editions.

Ricker, W.E. 1975. Stock and recruitment. Journal of the Fisheries Research Board of Canada, 11: 559-623.

SAS Institute. 1996. GLM procedure of SAS. SAS Institute, Cary, NC, USA.

Ståhl, G. 1987. Genetic population structure of Atlantic salmon. Pages 121-140. *In* Population genetics & fishery management, pp 121–140. Ed. by N. Ryman and F. Utter .University of Washington Press, Seattle.

Taggart, J.B., Verspoor, E., Galvin, P.T., Morán, P., and Ferguson, A. 1995. A minisatellite DNA marker for discriminating between European and North American Atlantic salmon (*Salmo salar*). Canadian Journal of Fisheries and Aquatic Sciences 52: 2305–2311.

UK Environment Agency, 2003. “Review of the Spring Salmon Measures” a Regional Fisheries Ecology & Recreation Advisory Committee Discussion paper, June 2003 available at www.environment-agency.gov.uk/fish.

Appendix 3

List of Participants

Name	Address	Telephone	Fax	E-mail
Walter Crozier (Chair)	DARD River Bush Salmon Station 21 Church Street Bushmills BT57 8Q5 United Kingdom	+ 44 2820 731435	+ 44 2820 732130	walter.crozier@dardni.gov.uk
Gerald Chaput	Dept. of Fisheries and Oceans P.O. Box 5030 Moncton NB E1C 9B6 Canada	+1 506 851 2022	+1 506 851 2147	ChaputG@dfo-mpo.gc.ca
Jaakko Erkinaro	Finnish Game and Fisheries Research Institute Oulu Game and Fisheries Research Tutkijantie 2 FIN-90570 Oulu	+358 205 751 871	+358 205 751 879	jaakko.erkinaro@rktl.fi
Gudni Gudbergsson	Institute of Freshwater Fisheries Vagnhöfda 7 110 Reykjavik Iceland	+354 567 6400	+354 567 6420	gudni.gudbergsson@veidimal.is
Lars Petter Hansen	Norwegian Institute for Nature Research P.O. Box 736, Sentrum N-0105 Oslo Norway	+47 73 80 1400 Direct: +47 73 80 1713	+47 23 35 1101	l.p.hansen@nina.no
Marianne Holm	Institute of Marine Research P.O.Box 1870 Nordnes N 5817 Bergen Norway	+4755 236 892	+4755 238 687	marianne.holm@imr.no
Helle Siegstad	Greenland Institute of Natural Resources P.O. Box 570 DK-3900 Nuuk Denmark	+299 361200	+299 361212	HeSi@natur.gl
Jonathan Carl	Greenland Institute of Natural Resources P.O. Box 570 DK-3900 Nuuk Denmark	+299 361200	+299 361212	JoCa@natur.gl
Christopher Legault	NOAA Fisheries Service 166 Water Street Woods Hole, MA 02543 USA	+1 508 4952025	+1 508 4952393	chris.legault@noaa.gov
Julian MacLean	FRS, FL, Field Station Inchbraoch House South Quay, Ferryden Montrose, Angus DD10 9SL Scotland, United Kingdom	+44 1674 677070	+44 1674 672604	j.c.maclean@marlab.ac.uk

Dave Meerburg	Dept. of Fisheries and Oceans 200 Kent Street Ottawa, Ont. K1A 0E6 Canada	+1 613 990 0286	+1 613 954 0807	meerburd@dfo-mpo.gc.ca
Niall Ó Maoiléidigh	Marine Institute Abbotstown Castleknock Dublin 15 Ireland	+353-1-8228200	+353-1-8205078	Niall.omaoileidigh@marine.ie
Sergei Prusov	Polar Research Institute of Marine Fisheries & Oceanography 6 Knipovitch Street 183763 Murmansk Russia	+7 8152 473658	+7 8152 473331	prusov@pinro.ru
Dave Reddin	Dept. of Fisheries and Oceans PO Box 5667 St. John's Newfoundland A1C 5X1 Canada	+1 709 772 4484	+1 709 772 3578	ReddinD@DFO-MPO.GC.CA
Ian Russell	CEFAS Lowestoft Laboratory Pakefield Rd Lowestoft, Suffolk NR33 0HT United Kingdom	+44 1502 562244 (Inst.) +44 1502 524330 (Dir.)	+44 1502 513865	i.c.russell@cefas.co.uk
Timothy Sheehan	NOAA Fisheries Service 166 Water Street. Woods Hole, MA 02543 USA	+1 508495-2215	+1 5084952393	tim.sheehan@noaa.gov
Gordon Smith	FRS FL Field Station Inchbraoch House South Quay, Ferryden Montrose, Angus DD10 9SL Scotland, United Kingdom	+ 44 1674 677070	+ 44 1674 672604	g.w.smith@marlab.ac.uk
Joan Trial	Maine Atlantic Commission 650 State Street Bangor, Maine, 04401 USA	+1 207 941 4452	+1 207 941 4443	joan.trial@maine.gov
Vincent Vauclin	Conseil Supérieur de la Pêche Délégation régionale n°3 23, rue des garennes 57155 Marly France	+ 33 3 87629336	+ 33 3 87656480	vincent.vauclin@csp.ecologie.gouv.fr

Appendix 4. Reported catch of SALMON in numbers and weight in tonnes (round fresh weight). Catches reported for 2004 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
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	52,726	91	-	-	-	-	-	-	-	-	12,941	68	-	-	65,667	159

Appendix 4. continued

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
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

Appendix 4. continued

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	8,131	15	1,828	7	3,599	38	161	3	6	0	-	-	2,204	15	15,929	78
	2004	3,815	7	1,424	6	1,153	11	251	4	6	1	-	-	1,400	11	8,049	39
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
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

Appendix 4. continued

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
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

Appendix 4. continued

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	474
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	28,766	-	-	-	-	-	-	-	-	-	12,328	-	-	-	41,094	150
	2000	48,153	-	-	-	-	-	-	-	-	-	12,800	-	-	-	60,953	219
	2001	38,480	-	-	-	-	-	-	-	-	-	12,827	-	-	-	51,307	184
	2002	34,252	-	-	-	-	-	-	-	-	-	11,417	-	-	-	45,669	161
	2003	14,878	-	-	-	-	-	-	-	-	-	7,328	-	-	-	22,206	89
	2004	24,157	-	-	-	-	-	-	-	-	-	5,667	-	-	-	29,824	108

Appendix 4. continued

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	31,775	72	-	-	-	-	-	-	-	-	32,200	137	-	-	63,975	209
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	1,822	5	-	-	-	-	-	-	-	-	1,701	8	-	-	3,523	13
	2004	1,927	5	-	-	-	-	-	-	-	-	2,880	14	-	-	4,807	19

Appendix 4. continued

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	-	-	-	-	-	-	-	-	-	-	-	2,021	7

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).

Appendix 5

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

Year	Commercial Small Catch	Grilse Recruits SFA 1, 2 & 14B +Nfld		Grilse to rivers SFA 1,2&14B		Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B	
		Min	Max	Min	Max	Min	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	76629	134052	68331	125093	65853	122615

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

Appendix 5(ii). Estimated numbers of 2SW salmon recruits, returns and spawners for Labrador salmon stocks including west Greenland.

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	8802	19027	1018	9820	20044	6578	16395	6325	16095

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 2002-2004 from counting fence returns and drainage areas

Appendix 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, 1969-2004.
Ret. = retained fish; Rel. = released fish.

	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	18605	176138	267925	156024	247799	10858	35148	0	10548	34835	1334	7830	1295	7751

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.

Appendix 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	11742	25667	6486	20411	2852	6234	2775	6157	4388	9591	4270	9473	0.65

Angling catches were updated for 2001 to 2003. Angling catches for 2004 are preliminary

Appendix 5(v) a. 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 salmon to SFA 16	
			Point			Prop.	2SW Returns			
Year	Min.	Max.	Estimate	Min.	Max.	2SW	Min	Max	Min	Max
1971	19697	32746	24407	19526	32461	0.918	17924	29799	21457	35672
1972	24645	40972	29049	23239	38635	0.965	22427	37284	25538	42456
1973	22896	38065	27192	21754	36165	0.958	20835	34639	23905	39742
1974	33999	56523	42592	34074	56647	0.908	30939	51436	37444	62250
1975	21990	36558	28817	23054	38327	0.868	20011	33267	25334	42117
1976	17118	28459	22801	18241	30325	0.854	15578	25898	20045	33325
1977	43160	71753	51842	41474	68950	0.947	39275	65296	45575	75769
1978	18539	30822	24493	19594	32576	0.861	16871	28048	21532	35797
1979	5484	9117	9054	7243	12042	0.689	4991	8297	7960	13233
1980	30332	50426	36318	29054	48303	0.95	27602	45888	31928	53080
1981	9489	15775	16182	12946	21522	0.667	8635	14355	14226	23651
1982	21875	36368	30758	24606	40908	0.809	19907	33095	27040	44954
1983	19762	32854	27924	22339	37139	0.805	17983	29897	24549	40812
1984	12562	20884	15137	12110	20132	0.944	11431	19005	13307	22123
1985	15861	26369	20738	16590	27582	0.87	14434	23996	18231	30309
1986	23460	39003	31285	25028	41609	0.853	21349	35493	27503	45724
1987	13590	22594	19421	15537	25830	0.796	12367	20561	17073	28385
1988	15599	25933	21745	17396	28921	0.816	14195	23599	19116	31781
1989	9880	16426	17211	13769	22891	0.653	8991	14948	15131	25155
1990	14452	24087	28574	21350	35583	0.616	13152	21919	23462	39102
1991	14892	24820	29949	22400	37333	0.605	13552	22586	24615	41025
1992	21106	30340	37000	31056	44643	0.618	19206	27609	34127	49058
1993	14946	58092	35000	19732	76695	0.689	13601	52863	21684	84280
1994	13155	24008	20946	15870	28962	0.754	11971	21847	17440	31827
1995	24711	35937	32015	26643	38747	0.844	22487	32703	29278	42579
1996	10711	18429	18433	14294	24594	0.682	9747	16771	15708	27026
1997	8254	13759	16399	12931	21554	0.581	7511	12520	14210	23686
1998	4565	11229	14753	10039	24695	0.414	4154	10218	11032	27138
1999	6059	9627	14078	11329	18002	0.487	5513	8761	12449	19782
2000	6280	10757	15492	12058	20653	0.474	5715	9789	13250	22696
2001	12615	17780	21027	17780	25060	0.646	11479	16180	19538	27539
2002	4074	9322	10453	7382	16892	0.502	3707	8483	8112	18563
2003	9549	16916	19361	14849	26305	0.585	8689	15393	16317	28907
2004	10368	20028	22202	16552	31974	0.570	9435	18225	18189	35137

Appendix 5(v) b. Large salmon and 2SW salmon spawners to SFA 16. Same procedure as for returns (Appendix 5(v) a.

	2SW returns to SFA 16		**Large Salmon Returns to the Miramichi River**						**Returns of large salmon to SFA 16**	
			Point			Prop.	2SW Returns			
Year	Min.	Max.	Estimate	Min.	Max.	2SW	Min	Max	Min	Max
1971	19697	32746	24407	19526	32461	0.918	17924	29799	21457	35672
1972	24645	40972	29049	23239	38635	0.965	22427	37284	25538	42456
1973	22896	38065	27192	21754	36165	0.958	20835	34639	23905	39742
1974	33999	56523	42592	34074	56647	0.908	30939	51436	37444	62250
1975	21990	36558	28817	23054	38327	0.868	20011	33267	25334	42117
1976	17118	28459	22801	18241	30325	0.854	15578	25898	20045	33325
1977	43160	71753	51842	41474	68950	0.947	39275	65296	45575	75769
1978	18539	30822	24493	19594	32576	0.861	16871	28048	21532	35797
1979	5484	9117	9054	7243	12042	0.689	4991	8297	7960	13233
1980	30332	50426	36318	29054	48303	0.95	27602	45888	31928	53080
1981	9489	15775	16182	12946	21522	0.667	8635	14355	14226	23651
1982	21875	36368	30758	24606	40908	0.809	19907	33095	27040	44954
1983	19762	32854	27924	22339	37139	0.805	17983	29897	24549	40812
1984	12562	20884	15137	12110	20132	0.944	11431	19005	13307	22123
1985	15861	26369	20738	16590	27582	0.87	14434	23996	18231	30309
1986	23460	39003	31285	25028	41609	0.853	21349	35493	27503	45724
1987	13590	22594	19421	15537	25830	0.796	12367	20561	17073	28385
1988	15599	25933	21745	17396	28921	0.816	14195	23599	19116	31781
1989	9880	16426	17211	13769	22891	0.653	8991	14948	15131	25155
1990	14452	24087	28574	21350	35583	0.616	13152	21919	23462	39102
1991	14892	24820	29949	22400	37333	0.605	13552	22586	24615	41025
1992	21106	30340	37000	31056	44643	0.618	19206	27609	34127	49058
1993	14946	58092	35000	19732	76695	0.689	13601	52863	21684	84280
1994	13155	24008	20946	15870	28962	0.754	11971	21847	17440	31827
1995	24711	35937	32015	26643	38747	0.844	22487	32703	29278	42579
1996	10711	18429	18433	14294	24594	0.682	9747	16771	15708	27026
1997	8254	13759	16399	12931	21554	0.581	7511	12520	14210	23686
1998	4565	11229	14753	10039	24695	0.414	4154	10218	11032	27138
1999	6059	9627	14078	11329	18002	0.487	5513	8761	12449	19782
2000	6280	10757	15492	12058	20653	0.474	5715	9789	13250	22696
2001	12615	17780	21027	17780	25060	0.646	11479	16180	19538	27539
2002	4074	9322	10453	7382	16892	0.502	3707	8483	8112	18563
2003	9549	16916	19361	14849	26305	0.585	8689	15393	16317	28907
2004	10368	20028	22202	16552	31974	0.570	9435	18225	18189	35137

Appendix 5(v) c. 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

Appendix 5(v) d. Small salmon and 1SW salmon spawners to SFA 16. Same procedure as for Appendix 5(v)c.

	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

Appendix 5(vi). Estimated Atlantic salmon returning recruits and spawners to the Morell River, SFA 17, 1970-2004.

	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	151	290	88	227	30	57	29	56	30	57	29	56
70-89 X	213	410	124	321	21	40	20	40	21	40	20	40
90-04 X	818	1587	479	1247	93	181	92	179	93	181	92	179

Notes

Number of small retained salmon in 1993 was not recorded. The number given is the mean for 1986-1992

For 1970-1980, percent small is calculated from numbers of small and large salmon in the retained catch in each year. For 1981-1997, 1999, and 2002, percent small is calculated from numbers of small and large salmon taken at the Leard's Pond trap. For 1998, 2000, 2001, 2003, and 2004 percent small is taken from seining catches at Mooneys Pool.

Small recruits are calculated as small retained salmon/exploitation rate. Angler exploitation was calculated as 0.34, 0.347, and 0.264 of estimated returns in 1994, 1995, and 1996, respectively. For other years the mean of these values is used. The min and max max numbers of small recruits are calculated using exploitation + or - 0.1; e.g. 0.34 + or - 0.1 gives 0.24 and 0.44.

Small spawners = number of small recruits - number of small retained

Large recruits = (number of small recruits/(0.01*percent small))-number of small recruits

Large spawners = number of large recruits - number of large retained

It is asssumed that large salmon and 2SW salmon are equivalent

Appendix 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	731	3,964	265	2,925	1,235	5,894	1,200	5,818	951	5,128	924	5,061
2003	632	3,426	229	2,528	2,140	10,212	2,078	10,079	1,648	8,884	1,600	8,769
2004	979	5,310	355	3,917	2,681	12,791	2,604	12,625	2,064	11,128	2,005	10,984

Appendix 5(viii). Total 1SW returns and spawners, SFAs 19, 20, 21 and 23, 1970-2004.

	RETURNS						TOTAL RETURNS		SPAWNERS						TOTAL SPAWNERS	
	River returns SFA 19-21		Commercial 19-21	SFA 23			SFAs 19,20,21,23		angled 19-21	Spawners 19-21		SFA 23 H+W rtns		Harvest	19,20,21,23	
Year	MIN	MAX		Wild MIN	Wild MAX	Hatch	MIN	MAX		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

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.

Appendix 5(ixa). Total 2SW returns to SFAs 19, 20, 21 and 23, 1970-2004.

	SFA 19		*SFA 20*		*SFA 21*		Total	*SFA 23* Wild	Wild	Htch	Htch	*TOTAL RETURNS*	
	MIN	MAX	MIN	MAX	MIN	MAX	Comm-	MIN	MAX	MIN	MAX	*SFAs 19,20,21,23*	
	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	4,318	5,371			6,764	11,087
1994	833	1,845	242	561	305	773	0	2,999	3,729			4,379	6,908
1995	759	1,582	666	1,565	518	1,339	0	3,042	3,831			4,985	8,317
1996	1,231	2,692	604	1,404	894	2,293	0	4,498	5,665			7,227	12,054
1997	607	1,299	170	387	301	1,026	0	2,567	3,210			3,645	5,922
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				889	1,824	0	1,625	2,115			2,514	3,939
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,439	2,954	0	2,252	2,783			3,691	5,737
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				870	1,786	0	952	1,263			1,822	3,049
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,506	3,091	0	1,725	2,182			3,231	5,273
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				251	515	0	523	658			774	1,173
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,523	3,126	0	929	1,142			2,452	4,268
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				585	1,202	0	1,137	1,467			1,722	2,669

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.

"a": Revision of method, SFA 23, 1993-2004, 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.

Appendix 5(ixb). Total 2SW spawners in SFAs 19, 20, 21 and 23, 1970-2004.

	RETURNS						REMOVALS		SPAWNERS		SFA 23 RETURNS		SFA 23 REMOVALS		TOTAL SPAWNERS	
	SFA 19		SFA 20		SFA 21		angled (19-21)		SFAs (19-21)							
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	4,318	5,371	1,054	1,166	5,710	9,921
1994	833	1,845	242	561	305	773			1,380	3,179	2,999	3,729	697	815	3,682	6,093
1995	759	1,582	666	1,565	518	1,339			1,943	4,486	3,042	3,831	313	346	4,672	7,971
1996	1,231	2,692	604	1,404	894	2,293			2,729	6,389	4,498	5,665	720	812	6,507	11,242
1997	607	1,299	170	387	301	1,026			1,078	2,712	2,567	3,210	550	611	3,095	5,311
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>				889	1,824			889	1,824	1,625	2,115	304	340	2,210	3,599
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,439	2,954			1,439	2,954	2,252	2,783	441	459	3,250	5,278
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>				870	1,786			870	1,786	952	1,263	183	202	1,639	2,847
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,506	3,091			1,506	3,091	1,725	2,182	239	271	2,992	5,002
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>				251	515			251	515	523	658	166	192	608	981
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>				1,523	3,126			1,523	3,126	929	1,142	178	200	2,274	4,068
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>				585	1,202			585	1,202	1,137	1,467	97	113	1,625	2,556

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.

Appendix 5(x). Estimated numbers of salmon returns and spawners for Québec 1969-2004.

	Recruit of small salmon		Recruit of large salmon		Spawner of small salmon		Spawner of large salmon		Recruit of 2SW salmon		Spawner of 2SW salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1969	25,355	38,032	74,653	111,979	16,313	24,470	25,532	38,299	54,496	81,745	18,639	27,958
1970	18,904	28,356	82,680	124,020	11,045	16,568	31,292	46,937	60,356	90,534	22,843	34,264
1971	14,969	22,453	47,354	71,031	9,338	14,007	16,194	24,292	34,568	51,852	11,822	17,733
1972	12,470	18,704	61,773	92,660	8,213	12,320	31,727	47,590	45,094	67,642	23,160	34,741
1973	16,585	24,877	68,171	102,256	10,987	16,480	32,279	48,419	49,765	74,647	23,564	35,346
1974	16,791	25,186	91,455	137,182	10,067	15,100	39,256	58,884	66,762	100,143	28,657	42,985
1975	18,071	27,106	77,664	116,497	11,606	17,409	32,627	48,940	56,695	85,042	23,818	35,726
1976	19,959	29,938	77,212	115,818	12,979	19,469	31,032	46,548	56,365	84,547	22,653	33,980
1977	18,190	27,285	91,017	136,525	12,004	18,006	44,660	66,990	66,442	99,663	32,602	48,902
1978	16,971	25,456	81,953	122,930	11,447	17,170	40,944	61,416	59,826	89,739	29,889	44,834
1979	21,683	32,524	45,197	67,796	15,863	23,795	17,543	26,315	32,994	49,491	12,807	19,210
1980	29,791	44,686	107,461	161,192	20,817	31,226	48,758	73,137	78,447	117,670	35,594	53,390
1981	41,667	62,501	84,428	126,642	30,952	46,428	35,798	53,697	61,633	92,449	26,132	39,199
1982	23,699	35,549	74,870	112,305	16,877	25,316	36,290	54,435	54,655	81,982	26,492	39,738
1983	17,987	26,981	61,488	92,232	12,030	18,045	23,710	35,565	44,886	67,329	17,308	25,963
1984	21,566	30,894	61,180	81,041	16,316	24,957	30,610	44,739	44,661	59,160	22,345	32,659
1985	22,771	33,262	62,899	84,192	15,608	25,140	28,312	43,482	45,916	61,460	20,668	31,742
1986	33,758	46,937	75,561	99,397	22,230	33,855	32,997	49,232	55,159	72,560	24,088	35,939
1987	37,816	54,034	72,190	93,650	25,789	40,481	29,758	43,462	52,699	68,365	21,723	31,727
1988	43,943	62,193	77,904	103,269	28,582	44,815	34,781	52,524	56,870	75,387	25,390	38,343
1989	34,568	48,407	70,762	91,871	24,710	37,319	34,268	49,185	51,656	67,066	25,016	35,905
1990	39,962	54,792	68,851	90,893	26,594	39,826	33,454	49,615	50,261	66,352	24,422	36,219
1991	31,488	42,755	64,166	83,184	20,582	30,433	27,341	39,797	46,841	60,724	19,959	29,052
1992	35,257	48,742	64,271	83,953	21,754	33,583	26,489	39,497	46,917	61,285	19,337	28,833
1993	30,645	42,156	50,717	63,677	17,493	27,444	21,609	29,353	37,023	46,484	15,774	21,428
1994	29,667	40,170	51,649	64,630	16,758	25,642	21,413	28,968	37,703	47,180	15,631	21,147
1995	23,851	32,368	59,939	74,227	14,409	21,548	30,925	39,320	43,755	54,186	22,575	28,703
1996	32,008	42,558	53,990	68,282	18,923	27,805	26,042	34,824	39,413	49,846	19,010	25,421
1997	24,300	33,018	44,442	56,187	14,724	22,210	21,275	28,466	32,443	41,017	15,531	20,780
1998	24,495	34,301	33,368	43,605	16,743	25,730	19,506	26,629	24,358	31,832	14,240	19,439
1999	25,880	36,679	34,815	46,178	18,969	28,808	23,631	32,618	25,415	33,710	17,250	23,811
2000	24,129	35,070	33,312	46,565	16,444	25,865	22,094	31,960	24,317	33,992	16,128	23,331
2001	16,939	24,452	35,016	48,490	10,836	16,989	22,871	32,954	25,562	35,398	16,696	24,056
2002	28,609	39,275	25,635	35,801	17,070	25,625	17,079	24,366	18,714	26,135	12,467	17,787
2003	23,142	31,892	39,435	52,413	15,445	23,187	28,409	39,137	28,787	38,262	20,738	28,570
2004	30,452	43,311	34,986	45,821	20,513	32,095	24,018	32,606	25,539	33,450	17,533	23,802

Appendix 6.

SAS program code for the provision of catch advice for the West Greenland fishery

A – code for forecasting PFA for North America using lagged spawners and phase shift

B – code for the risk analysis of catch options at West Greenland relative to NAC and southern NEAC PFA and CLs

A
```
***FILE NAME:  pfa-model-PREDICTION-2005newPFA-LSNA.sas
Code written by Gerald Chaput, DFO Gulf Region, Canada, revised
April 2005;

OPTIONS NOCENTRE;
    /**** ASCII file containing regional lagged spawner esti-
mates,
          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/Ices2005/greenland-advice2005/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 ****/
Filename in2
"c:/data/Chaput/Ices2005/greenland-advice2005/catch-returns-
2005vers.prn";
data catchreturns;
  infile in2 missover;
  INPUT YEAR NG1 NC1_L NC1_H NC2_L NC2_H NR2_L NR2_H RFL2_L
RFL2_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 inter-
est  ****/
    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 de-
veloping
                  indices of returns for risk analysis
****/
    yearofinterest (keep = sim break year phase lnspawn dumb);
            /**** this file accumulates years for which fore-
casts
                  will be generated, it is required to auto-
matically
                  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);
  if rfl2_l = 1.00 then RAN_RFL2 = 1;
  else RAN_RFL2 = RFL2_L + (RFL2_H - RFL2_L)* RANUNI(0);
          *ratio correction for Labrador;
  nareturns = RAN_RFL2*(((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);
  LSIndex = LSNF+LSQC+LSGF+LSSF+USALS;
    ** all lagged spawnes minus Labrador;
  LSNA = LSLB+LSNF+LSQC+LSGF+LSSF+USALS;
    ** all lagged spawners including Labrador;
  *lnspawn = log(LSIndex);
  lnspawn = log(LSNA);
     ** variable used in forecasting, change to LSNA when
         Labrador is included  ******;
  if year = 2002 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 = 2003 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);
     if year ge 1997 then
        R2LB = nareturns - sum(USAR2, R2SF, R2GF, R2QC, R2NF);
     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--**;

if 1999 le year le 2003 then do;
*** 5 year moving period for proportioning PFA to regions
        slide 5-year period as more recent PFA value is ob-
tained;
  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 2003 then phase = 2;
    ** change end year to last year PFA is known;
  if lnspawn ne . and lnpfa ne . then output fishdata;
  if 2004 le year le 2005 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/Ices2005/greenland-
advice2005/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/Ices2005/greenland-
advice2005/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/Ices2005/greenland-
advice2005/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;
data expectations (keep = sim 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 = mean-
error;
run;
data model0 (keep = sim break model parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 = mean-
error;
  run;
data model1 (keep = sim break model parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 = mean-
error;
  run;
data model2 (keep = sim break model  parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 = mean-
error;
  run;
data model3 (keep = sim break model  parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 re-
sults;
  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 2004 le year le 2005;
     ** 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 solu-
tion;
  output out = pred  p = predpfa  stdi = prederror stdp = mean-
error;
  run;
data model5 (keep = sim break model parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 = mean-
error;
  run;
data model6 (keep = sim break model parameters SS DF); set re-
sults;
  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 2004 le year le 2005;
     ** 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 = 26;
   ** number of observations in the model fitting, N = 27 once
PFA 2003 is known,
      N = 26, when 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 2005 WGNAS meeting,
   interested in updated 2004 forecast for NA and
   2005 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 pre-
dictGLhigh predictGLlow;
  merge modelkeep predyear;
  by sim break model;
  if aicdiff = 0;
  if year = 2004 and phase = 1 then output predictNAhigh;
  if year = 2004 and phase = 2 then output predictNAlow;
  if year = 2005 and phase = 1 then output predictGLhigh;
  if year = 2005 and phase = 2 then output predictGLlow;
  if year = 2004 then output predictNA;
  if year = 2005 then output predictGL;
  /** must update the years in bold  **/
  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 pre-
dicted
   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 AMER-
ICA ****/
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;

/****** 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)=" " for-
mat = 6.;
    class model break phase;
```

```
    table break all, model*phase / rts = 15;
    table break all, model phase / rts = 15;
    run;

data _nul_; set predictionsNA;
  file "c:/data/Chaput/Ices2005/greenland-
advice2005/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/Ices2005/greenland-
advice2005/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;
```

B – Risk analysis program

```
OPTIONS NOCENTRE;
/* RISK-ANALYSIS-NAC-NEAC-2005.SAS
   this is the risk analysis portion of the Greenland advice
   PFA forecast, returns variability, etc. are generated using
previous program called PFA-model-prediciton-2004.sas
   written by Gerald Chaput, DFO Gulf Region    */

data harvestperton (keep = sim NA1SW NEAC1SW);
/*** 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 fish-
ery input parameters for biological characteristics variations
for 2004
        PropNA:  0.68 to 0.73
        PropE:  1 - propNA
        Wt1SWNA:  2.47 to 3.11 kg
        Wt1SWE:  2.81 to 3.08 kg
        ACF:    1.017 to 1.0297
        HarvestNA: harvest of NA 1SW salmon based on bio char-
acteristics.
             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 = 0.68 + ((0.73 - 0.68)*ranuni(seed));  /* change min
and max as required-*/
   propE =  1 - propNA;
   Wt1SWNA = 2.47 + ((3.11 - 2.47)*ranuni(seed)); *** <<-change
min and max as required----;
```

```
   Wt1SWE = 2.81 + ((3.08 - 2.81)*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;

  output harvestperton;  /*** number of fish by continent per
ton of catch----*/
  end;
run;

filename a1 "c:/data/Chaput/Ices2005/greenland-
advice2005/meanretsouth.dat";
/*generated previously, mean returns to southern areas for pe-
riod 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/Ices2005/greenland-
advice2005/meanretall.dat";
/*** mean returns to each region for most recent five years,
1998 to 2002  ****/
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/Ices2005/greenland-
advice2005/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/Ices2005/greenland-advice2005/neac-
mswsouth-pfaforecast-2005.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;
  /* predicted PFA for southern MSW European stock */

/**** 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 ther-
fore 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>=277985);  /* NEAC CL for MSW
southern Europe - 2005 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*objUSles
s0;

       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 ob-
jNAless0 ;
    output out = byton
               sum = consLB consNF consQC consGF consNorth
            objSF10then  objUS10then objSouth10then
            objSF25then objUS25then objSouth25then
            objSFless0 objUSless0 objsouthless0 consneac ob-
jNAless0;
```

```
     run;

data probtable; set byton;
file "c:/data/Chaput/Ices2005/greenland-advice2005/risk-
analysis-results-2005.dat";
      put t 6. consLB 10. consNF 10. consQC  10. consGF  10.
consNorth 10.
               objSF10then  10.  objUS10then  10. ob-
jSouth10then 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;
```

APPENDIX 7
Review Group Report: WGNAS
ICES 25-27 April 2005

The meeting was attended by the WGNAS Chair Walter Crozier, the ACFM Chair Poul Degnbol, the Reviewer Larry Marshall, the Chair of ICES Diadromous Fish Committee Niall Ó Maoiléidigh, and ICES Fisheries Assessment Scientist Henrik Sparholt.

At the present meeting the report of the Working Group of North Atlantic Salmon (WGNAS) was dealt with.

The report was presented by the WG Chair Walter Crozier.

The Working Group was commended for the report.

Generally, the technical parts of the report were accepted and no significant modifications were required. Specific comments on the report are given below:

Regarding the new ICES terminology of the stock status and exploitation. 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 pint is below the CL, ICES considers the stock to suffer reduced reproductive capacity. This is more risk averse than the criterion for advice on West Greenland. 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.

A list of acronyms used should be made by the WGNAS in 2006.

It might be fruitful to try to link the genetic studies of origin of salmon at Greenland to old tagging studies, which also contains information on origin of individual salmon.

For the NAC area similar survival indices as for the NEAC area should be developed and presented by WGNAS in 2006.