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30 March–8 April

Copenhagen, Denmark

ICES
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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

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Executive Summary

- In the North Atlantic, exploitation remains low and nominal catch of Atlantic salmon in 2008 was the second lowest in the time-series.
- Marine survival indices remain low.
- The North American Commission 2SW stock complex is suffering reduced reproductive capacity. Factors other than fisheries (marine mortality, fish passage, water quality) are contributing to continued low adult abundance.
- Northern North-East Atlantic Commission stock complexes (1SW and MSW) are at full reproductive capacity prior to the commencement of distant water fisheries.
- Southern North-East Atlantic Commission stock complexes (1SW and MSW) are at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.
- There are no catch options for the fishery at the West Greenland (2009-2011) that would meet precautionary management objectives.

1 Introduction

1.1 Main tasks

At its 2008 Statutory Meeting, ICES resolved (C. Res. 2008/2/ACOM06) that the Working Group on North Atlantic Salmon [WGNAS] (Chair: J. Erkinaro, Finland) will meet in Copenhagen, Denmark, from the 30th March–8th April 2009 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO). The terms of reference were met and the sections of the report which provide the answers are identified below:

a)	With respect to Atlantic Salmon in the North Atlantic area:	Section 2
1)	provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and production of farmed and ranched Atlantic salmon in 2008[1];	2.1 and 2.2
2)	report on significant new or emerging threats to, or opportunities for, salmon conservation and management[2];	2.3 and 2.4
3)	continue the work already initiated to investigate associations between changes in biological characteristics of all life stages of Atlantic salmon, environmental changes and variations in marine survival with a view to identifying predictors of abundance[3];	2.5
4)	provide a compilation of tag releases by country in 2008 and advise on progress with analysing historical tag recovery data from oceanic areas;	2.7
5)	evaluate the results of studies that estimate the level of pre-spawning mortality of salmon caught and released by anglers and the implications for stock assessments;	2.6
6)	identify relevant data deficiencies, monitoring needs and research requirements[4].	Section 6

b)	With respect to Atlantic salmon in the North-East Atlantic Commission area:	Section 3
1)	describe the key events of the 2008 fisheries[5];	3.8
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	3.9
3)	review and report on the development of age-specific stock conservation limits;	3.3

4)	describe the status of the stocks and provide annual catch options or alternative management advice for 2010-2012, 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[6];	3.4, 3.6, and 3.8
5)	further develop methods to forecast PFA for northern and southern stocks with measures of uncertainty.	3.6
6)	further investigate opportunities to develop a framework of indicators that could be used to identify any significant change in previously provided multi-annual management advice	3.10

c)	With respect to Atlantic salmon in the North American Commission area:	Section 4
1)	describe the key events of the 2008 fisheries (including the fishery at St Pierre and Miquelon)[5];	4.6, 4.7 and 4.9
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	4.10
3)	update age-specific stock conservation limits based on new information as available;	4.3
4)	describe the status of the stocks and provide annual catch options or alternative management advice for 2009–2012 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[6].	4.9

d)	With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
1)	describe the key events of the 2008 fisheries[5];	5.8
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	5.10
3)	describe the status of stocks and provide annual catch options or alternative management advice for 2009–2011 with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding[6,7];	5.1, 5.4 and 5.9
4)	update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice.	5.11

Notes:

1) With regard to question a.1, ICES is asked to ensure that the terminology used in presenting the data on ranching is clearly defined. For the estimates of unreported catch the information provided should, where possible, indicate the location of the unreported catch in the following categories: in-river; estuarine; and coastal.
2) With regard to question a.2, ICES is requested to include information on any new research into the migration and distribution of salmon at sea.
3) With regard to question a.3, there is interest in determining if declines in marine survival coincide with changes in the biological characteristics of juveniles in fresh water or are modifying characteristics of adult fish (size at age, age at maturity, condition, sex ratio, growth rates, etc) and with environmental changes.
4) 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.
5) In the responses to questions b.1, c.1 and d.1, ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the bycatch of other species in salmon gear, and on the bycatch of salmon in any existing and new fisheries for other species is also requested.
6) In response to questions b.4, c.4 and d.3 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.
7) In response to question d.3, 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.4 and c.4.

At the 2006 Annual Meeting of NASCO, conditional multi-annual regulatory measures were agreed to in the West Greenland Commission (2006–2008) and for the Faroe Islands (2007–2009) in the Northeast Atlantic Commission. The measures were conditional on a Framework of Indicators (FWI) being provided by ICES, and the acceptance of the FWI by the various parties of each commission. At the 2007 annual meeting of NASCO, Denmark (in respect of the Faroe Islands and Greenland) opted out of the multi-annual regulatory measures as a FWI was not provided by ICES for the fishery in the Faroes (ICES 2007c). In 2007 and 2008, NASCO indicated that no change to the management advice previously provided by ICES was required for the fishery at West Greenland. With the conclusion of the three-year conditional multi-annual regulatory measure agreed in 2006, NASCO requested that ICES undertake a full stock assessment, provide multi-annual catch advice and update the FWI in hopes of setting multi-annual regulatory measures for the 2009 fishing season.

In response to the remaining terms of reference, the Working Group considered 34 Working Documents submitted by participants (Annex 1); other references cited in the report are given in Annex 2. A full address list for the participants is provided in Annex 3. A complete list of acronyms used within this document is provided in Annex 6.

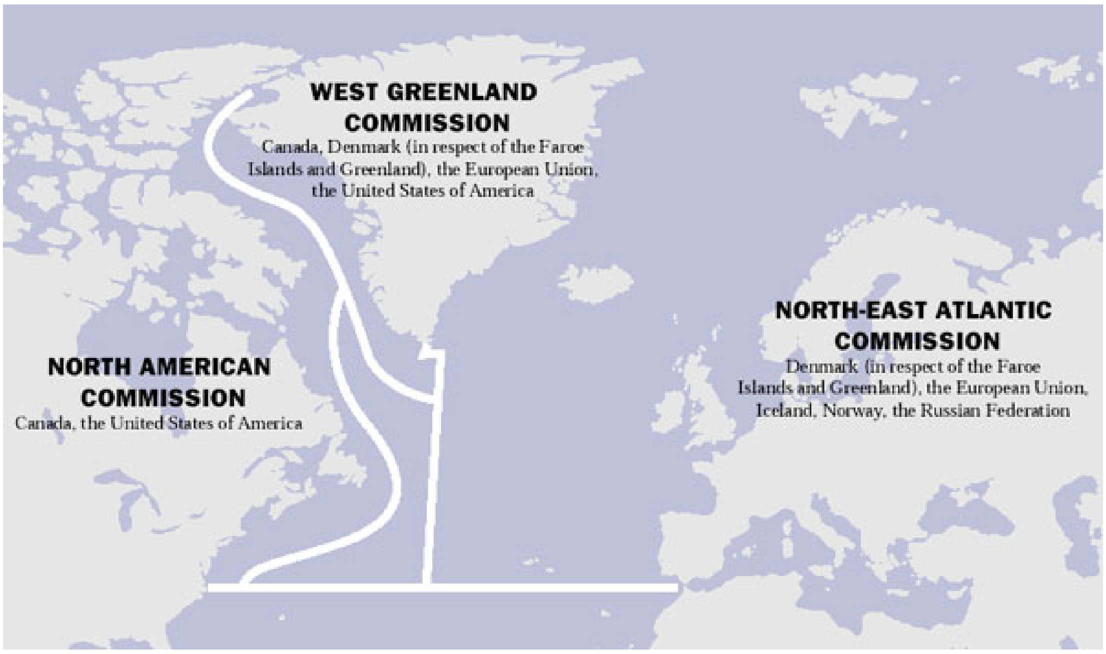
1.2 Participants

MEMBER	COUNTRY
Erkinaro, J. (Chair)	Finland
Beaulaton, L.	France
Chaput, G.	Canada
Dionne, M.	Canada
Fiske, P.	Norway
Gibson, J. A.	Canada
Gudbergsson, G.	Iceland
Hansen, L. P.	Norway
Ingendahl, D.	Germany
Karlsson, L.	Sweden
Kennedy, R.	UK (N. Ireland)
MacLean, J. C.	UK (Scotland)
Nygaard, R.	Denmark
Ó Maoiléidigh, N.	Ireland
Potter, T.	UK (England & Wales)
Prusov, S.	Russia
Reddin, D. G.	Canada
Russell, I.	UK (England & Wales)
Sheehan, T.	USA
Smith, G. W.	UK (Scotland)
Trial, J.	USA
Ustyuzhinskiy, G.	Russia
Vauclin, V.	France
Veinott, G.	Canada
Wennevik, V.	Norway

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 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, 1998).

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

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

1.5 Reference points and application of precaution

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

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

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

- ICES requires that the lower bound of the 95% confidence interval of the current estimate of spawners is above the CL for the stock to be considered at full reproductive capacity.
- When the lower bound of the confidence limit is below the CL, but the midpoint is above, then ICES considers the stock to be at risk of suffering reduced reproductive capacity.
- Finally, when the midpoint 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 target reference point. 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 1960–2008 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, 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. The release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching for rod fisheries in two Icelandic rivers continued into 2008 and has expanded (Table 2.1.1.1). 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 total reported nominal catch of salmon grouped by the following areas: 'Northern Europe' (Norway, Russia, Finland, Iceland, Sweden and Denmark); 'Southern Europe' (Ireland, UK (Scotland), UK (England & Wales), UK (Northern Ireland), France and Spain); 'North America' (Canada, USA and St Pierre et Miquelon (France)); and 'Greenland and Faroes'.

The provisional total nominal catch for 2008 was 1696 tonnes, 148 t above the updated catch for 2007 (1548 t) and the second lowest in the time-series. The 2008 catch was over 370 t below the average of the last five years (2069 t), and over 660 t below the average of the last 10 years (2362 t). Catches were below the previous five- and ten-year averages in all 'Southern Europe' countries and in two of the countries in "Northern Europe".

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 2008 are provisional and, as in Table 2.1.1.1, include both wild and reared salmon and fish farm escapees in some countries. A more detailed breakdown, providing both numbers and weight for different sea-age groups for most countries, is provided at Annex 4. Countries use different methods to partition their catches by sea-age class (outlined in the footnotes to Annex 4). The composition of catches in different areas is discussed in more detail in Sections 3, 4, and 5.

ICES recognises that mixed stock fisheries present particular threats to stock status. These fisheries predominantly operate in coastal areas and NASCO specifically requests that the nominal catches in homewater fisheries be partitioned according to whether the catch is taken in coastal, estuarine or riverine areas. Figure 2.1.1.2 presents these data on a country-by-country basis. It should be noted, however, that the way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries. For example, in some countries these catches are split according to particular gear types and in other countries the split is based on whether fisheries operate inside or outside headlands. While it is generally easier to allocate the freshwater (riverine) component of the catch, it should also be noted that catch and release is now in widespread use in several countries (Section 2.1.2) and these fish are excluded from the nominal catch. Noting these caveats, these data are considered to provide the best available indication of catch in these different fishery areas. Figure 2.1.1.2 shows that there is considerable variability in the distribution of the catch among individual countries. In most countries the majority of the catch is now taken in freshwater; the coastal catch has declined markedly.

Coastal, estuarine and riverine catch data aggregated by region are presented in Figure 2.1.1.3. In Northern Europe, total catches have fluctuated over the period with no apparent trend. Typically about half the catch has been taken in rivers and half in coastal waters (although there are no coastal fisheries in Iceland and Finland), with estuarine catches representing a negligible component of the catch in this area. There was a small reduction in the proportion of the catch taken in coastal waters in 2008. In Southern Europe, catches in all fishery areas have declined over the period and, while coastal fisheries have historically made up the largest component of the catch, these fisheries have declined substantially, reflecting widespread measures to reduce exploitation in a number of countries. In 2008, the majority of the catch in this area was taken in fresh water.

In North America, the total catch over the period 2000–2008 has been relatively constant. The majority of the catch in this area has been taken in riverine fisheries; the catch in coastal fisheries has been relatively small in any year (13 t or less), but has increased as a proportion of the total catch over the period.

2.1.2 Catch and release

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

The nominal catches presented in Section 2.1.1 do not include salmon that have been caught and released. Table 2.1.2.1 presents catch-and-release information from 1991 to 2008 for ten 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 2008 this ranged from 19 % in Iceland to 100 % in USA reflecting varying management practices and angler attitudes among these countries. Within countries, the percentage of fish released has tended to increase over time. Overall, over 204 000 salmon were reported to have been released around the North Atlantic in 2008, about 26,000 more than in 2007. There is also evidence from some countries that larger MSW fish are released in higher proportions than smaller fish. The issue of catch and release is reviewed in more detail in Section 2.6.

2.1.3 Unreported catches

Unreported catches by year (1987–2008) and Commission Area are presented in Table 2.1.3.1 and are presented relative to total nominal catch in Figure 2.1.3.1. A description of the methods used to derive the unreported catches was provided in ICES (2000) and updated for the NEAC Region in ICES 2002. However, no estimate of unreported catch was provided for Canada or Russia in 2008.

In general, the derivation 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. 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 and the introduction of carcase tagging and logbook schemes).

The total unreported catch in NASCO areas in 2008 was estimated to be 443 t. The unreported catch in the North East Atlantic Commission Area in 2008 was estimated at 433 t and that for the West Greenland Commission Area at 10 t. There was no estimate for the North American Commission Area. The 2008 unreported catch by country is provided in Table 2.1.3.2.

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 2008 is 981 kt. This represents a 5% increase on 2007 and a 16% increase on the previous 5-year mean (Table 2.2.1.1 and Figure 2.2.1.1). Production increased slightly in Norway (up 3% on 2007) and UK (Scotland) (up 5% on 2007), and these two countries continue to produce the majority of the farmed salmon in the North Atlantic (76% and 14% respectively). Farmed salmon production continued to reduce considerably in Iceland (down 44% on 2007), but increased markedly in USA.

World-wide production of farmed Atlantic salmon has been in excess of one million tonnes since 2002. It is difficult to source reliable production figures for all countries outside the North Atlantic area and it has been necessary to use 2007 estimates for some countries in deriving a world-wide estimate for 2008. Noting this caveat, total production in 2008 is provisionally estimated at around 1482 kt (Table 2.2.1.1 and Figure 2.2.1.1), a 6% increase on 2007 and the highest in the time-series. Production outside the North Atlantic is dominated by Chile and is estimated to have accounted for 34% of the total in 2008. World-wide production of farmed Atlantic salmon in 2008 was thus over 870 times the reported nominal catch of Atlantic salmon in the North Atlantic.

2.2.2 Harvest 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 release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching with the specific intention of harvesting by rod fisheries has been practiced in two Icelandic rivers since 1990 and these data have now been included in the ranched catch (Table 2.1.1.1). The total harvest of ranched Atlantic salmon in countries bordering the North Atlantic in 2008 was 70 t, the majority of which (68 t) was taken by these Icelandic ranched rod fisheries (Figure 2.2.2.1). Small catches of ranched fish from experimental projects were also recorded in each of the three other countries reporting such fish (Ireland, UK (N. Ireland) and Norway); the data includes catches in net, trap and rod fisheries.

2.3 Development of forecast models

Quantitative catch advice has been provided for the West Greenland Commission fishery using two forecast models; one for the non-maturing 1SW salmon of North

American origin, the other for 1SW non-maturing salmon from the southern NEAC complex (one of the four stock complexes in NEAC but the only one which is affected by the West Greenland fishery). Both models are based on generally similar data and similar approaches, including a lagged spawner variable to define the spawning stock, and a recruitment variable termed the PFA (Pre-Fishery Abundance), with a function relating the spawning component to the recruitment.

Prior to 2009, models have not been used for the maturing 1SW stock complex from southern NEAC nor for any of sea age groups in the northern NEAC stock complex. As such, qualitative catch advice has been provided for the Faroes fishery based on status of the stock complexes relative to stock complex conservation limits.

Following on from recommendations from the Working Group in 2008, a Study Group on Salmon Stock Assessment and Forecasting [SGSSAFE] met in March 2009 to work on the development of new and alternative models for forecasting Atlantic salmon abundance and for the provision of catch advice.

The Study Group presented two working papers to the Working Group addressing modelling approaches, an alternate model for the 2SW North American complex and two new models for the combined maturing and non-maturing age groups of the southern NEAC and the northern NEAC complexes.

The proposed models were fitted and forecasts were derived in a single consistent Bayesian framework under the OpenBUGS 3.0.3 software (http://mathstat.helsinki.fi/openbugs/; Lunn *et al*., 2000).

The data inputs and models presented to the Working Group parallel the approaches presently used by the Working Group for forecasting and provision of catch advice but differ between the Commission areas.

Proposed models		
	NAC	NEAC
Data inputs		
Time period of data	1978 to 2008	1978 to 2008 for southern NEAC 1991 to 2008 for northern NEAC
Spatial aggregation	Separately for six regions of North America	By southern and northern stock complexes
Age components	2SW salmon component only	1SW and MSW age components
Spawners	Lagged spawners by region for 2SW salmon only	Lagged eggs by sea-age component for the southern and northern complexes
Returns	Returns by region of 2SW salmon only	Returns of 1SW and MSW age components by stock complex
Model structure		
Spatial aggregation	Spawners and returns of 2SW salmon for six regions	Spawners and returns for two sea-age components for the southern and northern NEAC complexes
Dynamic function	Random walk dynamic	Random walk dynamic
	Region-specific recruitment rates linked with an annual recruitment rate variable	Sea-age specific recruitment rates linked with a probability of maturing variable

Proposed models		
Latent variables of interest	PFA 1SW non-maturing Recruitment rate by region and year	PFA 1SW maturing and PFA 1SW non-maturing by stock complex Recruitment rate by sea-age component and the probability of maturing variable
Forecast years	2009 to 2011	2009 to 2012

2.3.1 NAC model

The model is summarized in the Directed Acyclical Graph in Figure 2.3.1.1. The year is identified by the i index.

$PFA_{i,k}$ is assumed to be proportional to lagged-spawners ($LS_{i,k}$), with independent identically-distributed (i.i.d.) lognormal errors, and is modelled separately for each region (k = 6; Labrador, Newfoundland, Quebec, Gulf, Scotia-Fundy, USA).

$$PFA_{i,k} = LogN(\mu.PFA_{i,k}\ ,\sigma.PFA^2)$$
$$\mu.PFA_{i,k} = \log(LS_{i,k}) + a_{i,k}$$

The proportionality (log) coefficient $a_{i,k}$ between $LS_{i,k}$ and $PFA_{i,k}$ for each region is modeled dynamically as a random walk with the addition of a regionally common annually varying parameter ($e.y_i$).

$$a_{i+1,k} = a_{i,k} + e.y_{i+1} + \omega_{i+1,k} \qquad with \quad \omega_{i+1,k} \overset{i.i.d}{\sim} N(0, a.\sigma_k^2)$$
$$e.y_i \overset{i.i.d}{\sim} N(0, \sigma.y^2)$$

The common yearly variation ($e.y_i$) accounts for the fact that the fish share a common marine environment during part of their life cycle. The interaction term ($\alpha_{i,k}$) can be interpreted as accounting for regional specificities in the freshwater and / or the marine coastal environment.

The dynamic component of the model requires initialization for the first year (i = 1978) and an uninformative prior is assumed:

$$a_{1,k} \overset{i.i.d}{\sim} N(0,100)$$

$LS_{i,k}$ is a weighted sum of spawners over the years (i) having contributed to produce the $PFA_{i,k}$. The $LS_{i,k}$ are not directly observed but estimated from the run-reconstruction model developed by the Working Group. The model provides probability distributions of LS, conditional on observed data and expertise. The probability distributions are assumed to be normal with known mean LS.m and variance tau.LS. The use of these distributions as likelihood functions is equivalent to having pseudo-observations equal to LS.m issuing from sampling distributions with means and variances equal to LS and tau.LS (Michielsens *et al.*, 2008).

$LS.m_{i,k} \sim N\ (LS_{i,k},\ tau.LS_{i,k})$

Similarly, the returns of 2SW salmon to the six regions ($NR2_{i,k}$) are not directly observed but estimated from the run-reconstruction model. The probability distributions were assumed to be normal with known mean NR2.m and variance tau.NR2. As with the LS variable, the NR2 were treated as pseudo-observations equal to NR2.m issuing from normal sampling distributions with means and variances equal to NR2 and tau.NR2

$NR2.m_{i,k} \sim N(NR2_{i,k}, tau.NR2_{i,k})$

In between the lagged spawners and returns as 2SW salmon, the catches in the various sea fisheries and conditioning for natural mortality as the fish move from the time of the PFA to homewaters are incorporated (Figure 2.3.1.1). The catches in the commercial fisheries of West Greenland and the Newfoundland and Labrador commercial and coastal fisheries (NG1.tot, NC1.tot and NC2.tot) are not directly observed but estimated with error. The catches are converted to numbers of fish of 1SW non-maturing and 2SW fish based on characteristics of the fish in the catch. Their (prior) probability distributions are obtained from catch statistics according to a formal structure included in the model.

Catches of large salmon (assumed to be 2SW salmon) from the St. Pierre & Miquelon fisheries are also included in the model as point estimates.

The natural mortality in the post-PFA time point was assumed constant between years, centred on an instantaneous rate value of 0.03 per month (95% confidence interval range of 0.02 to 0.04).

For the NAC 2SW component, the model was fitted to an historical data series of 30 years, lagged eggs from 1978 to 2006 (considers returns of 2SW salmon including 2007). Although the return and spawner estimates for NAC begin in 1971, the lagged eggs are only available from 1978 due to the smolt age distributions (1 to 6 years).

Comparisons with models presently used by the Working Group

The alternate model proposed by the Study Group differs from the model used by the Working Group in the way observations are considered, the procedure for model fitting, and in the way inferences are drawn on the variables of interest. The Bayesian framework considers the PFA as a latent variable i.e. a variable whose state is conditioned by several components directly influencing its distribution (the parents) and which cannot be observed directly. The model used by the Working Group considers the PFA to be an observation.

The recruitment rate dynamic between lagged spawners and returns is also modeled differently. The two phase model currently used by the Working Group considers that there have been (and will be) two levels of recruitment rate experienced by the populations in NAC. When the populations are in the low phase, they will either remain in the low phase or move to the high phase, there is no possibility of a further decline in recruitment rate or intermediate levels of recruitment rate. The random walk model proposed by the Study Group is more flexible. The recruitment rate may increase or decrease regardless of the present states of the populations. Abrupt changes are not adequately detected because the annual changes are smoothed and the magnitude constrained by the relative changes estimated from the past.

	Working Group model	Alternate model
Input variables	Lagged spawners and PFA are generated from run-reconstruction and treated as observations	Distributions of lagged spawners and returns of 2SW salmon to regions are generated from run-reconstruction and treated as pseudo-observations in the model.
PFA period	August 1 of the second summer at sea for 1SW non-maturing salmon	Same as Working Group model

	WORKING GROUP MODEL	ALTERNATE MODEL
Model dynamic	Incorporates possibility of two phases of productivity between lagged spawners and PFA. Recruitment rate parameter can take one of two levels. NAC aggregate estimate of productivity assumed similar for all regions.	Random walk that models region specific recruitment rate in year i+1 as a function of region specific recruitment rate in year i plus an annual component of change in recruitment rate common to all regions.
Consideration of uncertainty	Uncertainty in LS and PFA are incorporated by creating multiple data sets of LS and PFA from Monte Carlo and summarizing predicted PFA from statistical fitting of the multiple data sets.	Uncertainty in lagged spawners and returns of 2SW salmon to regions are introduced as priors and can be updated. Posterior distributions of PFA and returns to regions are inferred from the model fitting.
Forecast capacity	Forecasts are based on lagged spawner values available for three years beyond the last observed 2SW return year and an estimate of the likelihood of being in the high phase or the low phase of productivity. Forecast values take one of two levels of recruitment rate.	Same forecast capacity as Working Group model excluding the need to estimate the probability of being in a high or low phase. Forecasts are based on estimated lagged spawners and the recruitment rate from the last observed year with variance from the entire time series.
Risk analysis	Assume characteristics of the catches will be similar to the range of values observed during previous five years. Catch options scenarios are explored.	Same as current Working Group model.

2.3.2 NEAC models

The proposed models for the northern NEAC complex and the southern NEAC complex have exactly the same structure and are run independently. A Directed Acyclic Graph (DAG) for the models is provided in Figure 2.3.2.1. The model considers both the maturing *PFA* (denoted *PFAm*) and the non maturing PFA (denoted *PFAnm*).

Two hypotheses about the time-structure of the productivity parameter $\alpha_{m,t}$ were contrasted: random walk and shift level model.

For each year *t*, a proportional relationship is assumed between lagged eggs (LE_t) and the expected means of the maturing PFA, with a recruitment rate factor αm_t (in the log-scale). The recruitment rate is considered to be random with i.i.d log-normal errors.

$$PFAm_t = LogN(\mu.PFAm_t\ ,\ \sigma.PFAm^2)$$
$$\mu.PFAm_t = \log(LE_i) + \alpha m_t$$

Similarly, for each year *t*, a proportional relationship is assumed between LE_t and the expected means of the non maturing *PFA*, with a productivity factor αnm_t (i.i.d. multiplicative log-normal random errors).

$$PFAnm_t = LogN(\mu.PFAnm_t\ ,\ \sigma.PFAnm^2)$$

$$\mu.PFAnm_t = \log(LE_i) + \alpha nm_t$$

The random environmental noise in the recruitment rate of maturing ($\sigma.PFAm_t$) and non maturing PFA ($\sigma.PFAnm_t$) are assumed independent.

However, the recruitment rate for the non maturing *PFA* is modelled dependently on the recruitment rate for the maturing PFA as:

$$\alpha nm_t = \alpha m_t + \log(\frac{1 - p.PFAm_t}{p.PFAm_t})$$

The expected rate of maturing *PFA vs.* total *PFA* recruitment rate is $p.PFAm_t$:

$$\frac{e^{\alpha m_t}}{e^{\alpha m_t} + e^{\alpha nm_t}} = p.PFAm_t$$

Therefore, the hypothesis underlying this model is that the time variability of the recruitment rate for maturing and non maturing PFA will be closely related. A high recruitment rate for maturing PFA will correspond to a high productivity of non maturing PFA. However, time variations of the parameter $p.PFAm_t$ introduce some flexibility in the synchrony of the maturing and non maturing recruitment rates.

Two alternative models for the recruitment rate parameter were explored for the Southern NEAC complex: the random walk model and the shifting level model (for the Northern NEAC complex, only the random walk model was tested due to the shorter time series available).

In the random walk (RW) hypothesis, the recruitment rates are modelled as a first order time varying parameter following a simple random walk with a flat prior on the first value of the time series:

$$t = 1,\ldots,n\text{-}1 \qquad \alpha m_{t+1} = \alpha m_t + \omega_t \quad with \quad \omega_t \overset{i.i.d}{\sim} N(0, \sigma^2{}_{\alpha})$$

The model can be used both for retrospective analysis and forecasts. Provided the variance $\sigma^2{}_{\alpha}$ is large enough, the random walk structure will enable us to capture any kind of change in the recruitment rate along the time series of historical data. The persistence (memory) and possibility of variation will be accounted for at any time in the forecasts. If the productivity level is α at time $t = n$, then the forecasted productivity at time $t = n+1$ is random and normally distributed around the previous level of recruitment rate.

The shifting level (SL) model supposes that the recruitment rate remains constant for periods of time, with abrupt shifts in the levels between periods (Fortin *et al.*, 2004). By contrast with the RW model, it is highly flexible because the number of periods, their duration and the corresponding levels of recruitment rates do not need to be specified a priori.

$$t = 1,\ldots,n\text{-}1 \qquad \alpha_{t+1} = \begin{cases} \alpha_t & with\ proba\ (1 - p_{shift}) \\ \alpha_t^{new} \sim N(\alpha_t, \sigma_{\alpha}^2) & with\ proba\ (p_{shift}) \end{cases}$$

Retrospective analysis enables inference *a posteriori* on the phase(s) (levels, shifting points and duration) in the historical series of data. The probability of seeing a shift at any time *t* is also estimated, and can then be used for forecasting. As with the RW model, the persistence (memory) and possibility of a shift will be accounted for at any time in the forecasts. If the productivity level is α at time $t = n$, then the forecasted productivity at time $t = n+1$ is defined as:

$$\alpha_{n+1} \begin{cases} = \alpha_n \quad \textit{with probability}\ (1 - p_{shift}) \\ = \alpha_n + \omega_n \quad \textit{where}\ \omega_n \sim N(0, \sigma_\alpha{}^2) \quad \textit{with probability}\ p_{shift} \end{cases}$$

Uncertainty in the lagged eggs were accounted for by assuming that the lagged eggs of 1SW and MSW fish were normally distributed with median and standard deviation issued from Monte-Carlo run reconstruction at the scale of the stock complex.

The model is designed to account for the uncertainty about the returns through the pseudo-observation method proposed by Michielsens *et al.*, 2008 and used in the NAC model.

In the model presented to the Working Group, the uncertainty in the returns was not accounted for due to difficulties in model fitting. The model was run with virtually no observation errors on returns (σ_R=1).

The natural mortality in the post-PFA time point was assumed constant among years, centred on an instantaneous rate value of 0.03 per month (95% confidence interval range of 0.02 to 0.04).

Catches of salmon at sea in the West Greenland fisheries (as 1SW non-maturing salmon) and at Faroes (as 1SW maturing and MSW salmon) were introduced as co-variates and incorporated directly within the inference and forecast structure of the model. The inputs for quantifying the uncertainties in the catches are those used for the run-reconstruction and those associated with the sampling procedures of the fisheries.

For southern NEAC, the model was fitted to a 29 year data series of lagged eggs and returns from 1978 to 2006. Although the return estimates to southern NEAC begin in 1971, the lagged eggs are only available from 1978 due to the smolt age distributions (1 to 5 years).

For northern NEAC, the model was fitted to a 16 year data series of lagged eggs and returns for 1991 to 2006. Returns and spawner estimates begin in 1983 but due to the smolt age distributions (1 to 6 years), the lagged eggs are only available from 1991 onward.

For both southern and northern NEAC complexes, forecasts were derived for 4 years of lagged eggs starting from 2007 to 2010. For illustrative purposes, forecasts were derived under the scenario of null exploitation rates (all sea catches =0).

Risks were defined each year as the posterior probability that the PFA would be below the age and stock complex specific SER levels.

Comparisons with model presently used by the Working Group

The Working Group has used a model to forecast the PFA of non-maturing (potential MSW) salmon from the Southern European stock group (ICES, 2002, 2003). The full model takes the form:

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

where: *Spawners* are expressed as lagged egg numbers (all age groups), *PFAm* is pre-fishery abundance of maturing 1SW salmon.

Parameter selection was achieved by adding variables (*Spawners, PFAm* and *Year*) until the addition of others did not result in an increase in the explanatory power of the model. The model has been fitted to data from 1978 to the most recent year and the parameters retained have always been *Spawners* (*LSeggs*) and *Year*. The final model takes the form:

$$Ln(PFA_t/LSeggs_t) = \alpha + \beta^*Ln(LSeggst) + \delta^*Year_t + \varepsilon$$

The year coefficient estimate is negative resulting in a continued decline in recruitment rate over time.

	WORKING GROUP MODEL	ALTERNATE MODEL
Input variables	Lagged eggs and PFA are generated from run-reconstruction and treated as observations.	Distributions of lagged eggs and returns of salmon by sea age group (1SW maturing, MSW salmon) to the southern NEAC and northern NEAC complexes are generated from run-reconstruction and treated as pseudo-observations in the model.
PFA period	Jan. 1 of the first winter at sea of 1SW salmon	Same as current Working Group model
Model dynamic	Proportionate model with year variable that generates a time dependent change in productivity between lagged eggs and PFA. Only one sea age group (1SW non-maturing, i.e. MSW salmon) is modelled for the southern NEAC stock complex. Lagged eggs and year are explanatory and predictive variables in the model.	Random walk model for two age components modelled from a common lagged eggs component. Recruitment rate of 1SW maturing salmon and MSW salmon are not considered independent. Probability of maturing parameter allows annual flexibility in variations in recruitment rate between maturing 1SW salmon and MSW salmon.
Consideration of uncertainty	Midpoints of LSeggs and PFA are used in the fitting. Forecast uncertainty driven by residual error term of the model fit.	Uncertainties in lagged eggs are included as priors; treated as pseudo-observations resulting from the distributions from the Monte Carlo run-reconstructions. Posterior distributions of PFA and returns to stock complexes are inferred from the model fitting. Uncertainties in returns not fully implemented presently due to model fitting constraints.

	WORKING GROUP MODEL	ALTERNATE MODEL
Forecast capacity	Forecasts are based on lagged egg values available for four years beyond the last observed 2SW return year. Year variable has a negative coefficient. Forecasts limited to 1SW non-maturing salmon from southern NEAC complex.	Forecasts are based on lagged egg values available for four years beyond the last observed 2SW return year. Forecasts are based on estimated lagged spawners and the sea age specific recruitment rates from the last observed year with variance from the entire time series. Models available for all four age and stock complex components for NEAC.
Risk analysis	Risk analysis was not developed beyond describing the probability that the PFA abundance of 1SW non-maturing salmon will be below the spawner escapement reserve (SER) prior to any sea fisheries.	Same as current Working Group model. Risk analysis restricted to quantifying probability that the PFA abundance of the sea age groups within the southern and northern complexes will be below the respective SERs.

2.3.3 Preliminary results of the Bayesian framework models for NAC and NEAC

In the models proposed for NAC and NEAC, there was no significant ($p > 0.05$) first order autocorrelation in the residual errors of the PFA variables, most were centered on or close to 0 as per the assumption of the model structure. Further posterior checks of the models should be completed.

NAC model

The average annual recruitment rate parameter for the six regions of North America and the posterior predicted PFA values are consistent with the levels and trends previously reported by ICES (Figure 2.3.3.1). The recruitment rate declined from just under 2 (on the log scale) (or 4 on the base 10 scale) prior to 1989 to about 0.5 or less (1.5 or less on the base 10 scale) and fell as low as -0.26 (0.77 PFA fish per lagged spawner in 2001) (Figure 2.3.3.1). PFA values have fallen from the high of 840 000 fish in 1979 to an average of just over 110 000 fish between 1997 and 2006 (Figure 2.3.3.1).

Recruitment rates declined in all six regions of North America with the earliest steep decline noted for the USA and Scotia-Fundy stocks (1982 to 2001) (Figure 2.3.3.2). The Labrador recruitment rates remained high into 1996 and declined rapidly into 2001. The highest recruitment rates in recent years are inferred for the stocks of Labrador, Quebec, and Gulf at about 1.8 PFA recruits per lagged spawner (Figure 2.3.3.2). In 1979 and 2002, the recruitment rates showed a North American wide increase from the previous year whereas northwest Atlantic wide declines in recruitment rate from the previous year were noted for 1992, 1993 and 2001 (Figure 2.3.3.2).

The region-specific structuring of the recruitment rate parameter in the NAC model can also provide estimates of region-specific PFA, exploitation rates and compliance with the management objectives. The probability of the returns of 2SW salmon having been sufficient to meet the region-specific management objectives defined for the six regions of North America can also be assessed. Retrospectively, since 1991, the region-specific PFAs would have been insufficient for the 2SW returns to regions to be compliant with the present management objectives even in the absence of any fisheries having occurred at sea. The cumulative benefits of having attained higher spawning escapements back to rivers are not considered in this retrospective analysis. These issues will be explored after further diagnostic work.

NEAC models

The trends in the posterior estimates of PFA for both the southern NEAC and northern NEAC complexes closely match the descriptions of PFA trends previously provided by the Working Group.

The total PFA (mature and non-maturing 1SW salmon at January 1 of the first winter at sea) for the southern NEAC complex ranged from 3 to 4 million fish between 1978 and 1989 and declined rapidly to just over 2 million fish in 1990, and fell to its lowest level of just over one million fish in 2006. Over the entire time-series, the maturing proportions averaged about 0.6 with the lowest proportion in 1980 and the highest proportion in 1998. There is an increasing trend in the proportion maturing (8 of 13 values below the average during 1978 to 1990 compared with 3 of 16 values between 1991 and 2006) (Figure 2.3.3.3). The productivity parameters for the maturing and non-maturing components peaked in 1985 and 1986, and reached the lowest values in 1997 (Figure 2.3.3.3).

The series of lagged eggs and returns for the northern NEAC complex is shorter than for the southern NEAC complex, beginning in 1991. Peak PFA abundance was estimated at about 2 million fish in year 2000 with the lowest value of the series in 2004 at over 1 million fish. The proportion maturing has varied around 0.5 over the time series (Figure 2.3.3.4). The productivity parameter is higher on maturing 1SW salmon than on the non-maturing component (Figure 2.3.3.4). The recruitment rate parameters are higher for the northern NEAC compared to the southern NEAC complex, and particularly for the non-maturing 1SW component.

Shifting level models of the productivity parameter for southern NEAC

As mentioned previously, the shifting level (SL) model is an interesting alternative to the simple random walk model (Fortin *et al*., 2004). The SL model supposes that the level of productivity remains relatively constant for periods but can be subjected to abrupt shift in the levels. Under the SL model, the number of periods, their duration and the corresponding levels of productivity are unknown and need not be specified *a priori*.

The southern NEAC time-series of lagged spawners and returns suggested that there has been an abrupt shift in productivity between the 1989 and 1990 PFA years. Productivity was almost halved and this happened rather abruptly.

Due to the shorter time-series for the northern NEAC model, the shift level dynamic was not fitted to that data series as there was no visual suggestion that such a shift in dynamic had occurred over the shorter time-series.

Despite there being some advantages to the SL model, it was not considered sufficiently developed for the provision of catch advice in 2009.

2.3.4 Further work

There is a need for further diagnostic evaluations and model exploration for the data sets in NAC and NEAC. The combined sea age model was not explored for the NAC complex and based on the results for NEAC, this model structure could be quite informative. The NEAC models have only been explored at the stock complex level and disaggregation to lower levels such as the national scale for returns and spawners as was done for NAC would also be a useful path of exploration.

The Working Group recommended that the Study Group (SGSSAFE) continue to develop the models presented for the NAC and NEAC areas, particularly for combining sea age classes and in the spatial disaggregation below the stock complex level.

2.4 NASCO has asked ICES to report on significant, new or emerging threats to, or opportunities for, salmon conservation and management

2.4.1 Genetic population structure and potential for local adaptation in Atlantic salmon

In Atlantic salmon, a wide diversity of phenotypes and genotypes may be observed, resulting from the interaction of the different evolutionary forces including natural selection, gene flow, genetic drift and mutations. The central objective of a recent study in Canada was to assess the genetic variability and evaluate the potential for local adaptation in wild Atlantic salmon. Analyses of neutral molecular markers in 51 salmon rivers revealed a hierarchical genetic structure and suggested the existence of seven regional groups in Québec, Labrador and New-Brunswick (Dionne *et al.*, 2008). Landscape genetic analyses suggested a predominant influence of gene flow and thermal regime adaptation in maintaining genetic differentiation. Indirect evidence also suggested that immigrants from a different regional group were less successful in establishing in the new environment compared to residents. Different levels of genetic structure were also found within some river systems (Dionne *et al.*, 2009). These results highlight the importance of maintaining small-scale variation at the catchment and sub-catchment level in managing Atlantic salmon populations.

Large scale genetic variability at an immuno-competence gene, the Major Histocompatibility Complex (MHC) class IIβ gene, revealed that genetic diversity increased with increasing temperature and bacterial diversity in rivers contrary to patterns with neutral microsatellite markers (Dionne *et al.*, 2007). This increase in MHC diversity with temperature was more pronounced at the peptide-binding region involved in pathogen binding than at other molecular sites. These results agree with the hypothesized influence of temperature-associated pathogen diversity on local adaptation in Atlantic salmon.

Finally, pathogen infections in juvenile salmon were found to be more frequent at the beginning of the summer in southern rather than northern rivers, in concordance with pathogen selection pressure in the wild (Dionne *et al.*, in press). A predominant and possibly introduced pathogen, a myxozoa of the genus *Myxobolus*, was identified in juvenile salmon and two MHC alleles were found to be associated with resistance and susceptibility to that infection, suggesting the importance of MHC genetic variation for pathogen resistance in a changing environment. These results contribute to our understanding on mechanisms maintaining genetic variability and influencing local adaptation in wild Atlantic salmon through analyses in landscape genetics, genetic population structure and patterns of spatio-temporal infectivity in nature. These results also highlight the importance of retaining genetic diversity through the conservation of populations at small spatial scales, thereby maintaining the capacity for populations to adapt to environmental change.

2.4.2 Investigations of Atlantic salmon feeding ecology at West Greenland

The demography of Atlantic salmon across the North Atlantic is dictated by conditions in both the marine and freshwater environments. In the marine environment, these dynamics are driven by factors affecting the survival of postsmolts to maturity and culminate in the return of mature adults to their natal rivers. Survival of salmon stocks during the marine phase has been linked to ocean climate and growth (Friedland *et al.*, 1993; Friedland, 2000) and a regime shift for marine phase salmon has been reported where the productivity of marine phase salmon has decreased 2-3 times since 1990 (Chaput *et al*., 2005). Additional evidence for this regime shift could be reflected in changes in the dietary composition of marine salmon.

As part of the International Sampling Program, which collects biological characteristics data from the West Greenland harvest of Atlantic salmon, additional more detailed sampling was conducted on a predetermined number of fish in 2006 and 2007. The objectives of this effort were to (1) develop protocols for more intense biological sampling at West Greenland to be used during SALSEA West Greenland; (2) to collect current information on the feeding ecology of Atlantic salmon at West Greenland; (3) to augment historical diet information of Atlantic salmon at West Greenland and to investigate the stability of foraging regimes.

Fresh whole fish were purchased directly from individual fishermen in support of this program. A total of 249 samples were collected representing both male and female individuals from both North America and Europe (Table 2.4.2.1). Predominantly, pelagic prey items were consumed, although benthic organisms were also noted (Table 2.4.2.2). Overall, capelin was the primary item consumed in both years, followed by *Parathemisto* sp., a genus of amphipod. The composition of stomach contents differed slightly between 2006 and 2007 and was less varied than the data reported by Lear, 1980 for 1969–1970 (Table 2.4.2.2). Amphipods and capelin were both important in 2006 while capelin was the primary food item in 2007. The diet composition was similar between the stock complexes and sexes (Figure 2.4.2.1), except in 2006 when approximately 50% of the female diet consisted of *Parathemisto* sp., while males consumed primarily capelin (70% by weight). Additionally, MSW salmon appeared to feed almost exclusively on capelin and *Parathemisto* sp.

Capelin, amphipods and sandlance have historically been identified as the primary food items of salmon at West Greenland, although significant temporal and spatial variation has been noted (Hansen, 1965; Templeman, 1967; Lear, 1980; Table 2.4.2.2). The current data suggest that contemporary foraging conditions are similar to historical conditions and that the feeding grounds at West Greenland are rich with capelin. Without concurrent data on the composition of the available prey base, the assertion of salmon being an opportunistic or selective forager remains a point of conjecture.

Although these data suggest that the forage base may have not changed significantly over time, they may be misleading as the 30+ year gap in the time series of salmon diet data may be too coarse to detect changes. During this time, the food base could have shifted away from and back to capelin, the central link between the zooplankton and the higher order predators such as salmon (Frederiksen *et al*., 2006). Major oceanographic and ecosystem level changes in the 1990's (Drinkwater, 1996) likely altered the pelagic prey base and may have influenced salmon productivity, but no direct observations of Atlantic salmon diets from this time period are available to validate this assumption.

Although direct evidence for the link between capelin and salmon productivity are lacking (Carscadden and Reddin, 1982), there is evidence suggesting that the energy content of capelin being delivered to common murre chicks decreased annually along with chick body condition (Devoran and Montevecchi, 2003). Prey species composition delivered to the birds did not change over time; however there was a reduction in the energy being delivered. If the composition of the Atlantic salmon diet in West Greenland has not changed over time (as is suggested by historical and contemporary data) but the quality (i.e., energetic content) of the forage species has reduced, changes in body condition and productivity of salmon may be detectable. Future sampling efforts should focus on collecting additional stomach samples, salmon muscle tissue samples for lipid analysis, tissues for stable isotope analysis and salmon gonads for fecundity/reproductive developmental analysis to help elucidate these relationships. Such efforts should aim to provide good spatial coverage of the fishery and enable possible changes over time to be explored.

2.4.3 Red vent syndrome

Over recent years, there have been reports from a number of countries in the NEAC and NAC areas of salmon returning to rivers with swollen and/or bleeding vents. The condition, known as red vent syndrome (RVS), has been noted since 2005, and has been linked to the presence of a nematode worm, *Anisakis simplex* (Beck *et al*., 2008). This is a common parasite of marine fish and is also found in migratory species. The larval nematode stages in fish are usually found spirally coiled on the mesenteries, internal organs and less frequently in the somatic muscle of host fish. However, their presence in the muscle and connective tissue surrounding the vents of Atlantic salmon is unusual. The reason for their occurrence in the vents of migrating wild salmon, and whether this might be linked to possible environmental factors, or changes in the numbers of prey species (intermediate hosts) or marine mammals (final hosts) is unclear.

A number of regions within the NEAC stock complex observed a notable increase in the incidence of salmon with RVS during 2007 (ICES 2008), but levels were typically a lot lower in NEAC countries during 2008. However, levels of RVS in UK (England & Wales) remained close to the high levels recorded in 2007 in a number of rivers, although levels were lower in other rivers and the severity of the symptoms was generally less prevalent in 2008 than in 2007. For example, on the River Dee, Wales in 2008, 34% of salmon with RVS were classed as having 'severe' symptoms, compared to 47% in 2007. Trapping records from index rivers in UK (England & Wales) over the last 4 years indicate that RVS has generally been less prevalent in early and late running fish than fish returning in mid-season (Figure 2.4.3.1).

It remains unclear whether RVS affects the survival of the fish or their spawning success. However, affected fish have been taken for use as broodstock in a number of countries, successfully stripped of their eggs, and these have developed normally in hatcheries. Provisional results also suggest no significant differences in the condition factors of affected and unaffected fish.

2.4.4 Reduced sensitivity and development of resistance towards treatment in salmon louse (*Lepeophtheirus salmonis*)

In 2008, a number of cases of reduced sensitivity to emamectin benzoate, the oral treatment for sea lice, were discovered on farms located in the west and middle parts of Norway (Johansen *et al*., 2009). Most of these farms were subsequently medicated with bath treatments using pyrethroids, however, some evidence of cross-resistance was observed. The lag time between discovery of resistant lice, and bath-treatment, may have given the opportunity for the resistant lice to spread. Treatments may sometimes result in salmon lice being exposed to sub-lethal doses of emamectin due to the large size of net pens, and strong currents at the farm locality, and this may contribute towards the development of resistance. The number of lice reported by fish farmers on a monthly basis shows that the number of adult lice on salmon in late 2008 and early 2009 were higher in several areas than in the previous two years (www.lusedata.no). This, together with a sudden increase in incidence of treatment failure and indications of resistance give cause for concern. Should resistant lice become widespread, the potential consequences for wild salmon smolts migrating through areas with a high density of fish farms and large numbers of lice would be severe (Revie *et al*., 2009).

2.4.5 Atlantic salmon stock assessment using sonar

There are few techniques for directly enumerating migrating salmon in large drainage basins. Traditional techniques such as counting fences will usually not work on large rivers due to the depth and volume of water. In British Columbia, Alaska and Washington, sonars have long been used for estimating returns to large rivers. However, due to their high initial cost and logistical difficulties they have not been used extensively on salmon rivers in the North Atlantic. Recently, an improved sonar technology (Dual Frequency Identification Sonar -DIDSON; Sound Metrics Corporation: SMC) has become available. These counters are rapidly becoming an alternative to other sonar technologies in the USA, Canada, and Ireland.

Two of these sonar counters (short and long range) were tested on four rivers in 2008: Campbellton and Salmonier in Newfoundland and Eagle and Sand Hill in Labrador. At Campbellton River, 76 salmon kelts were individually released from a smolt trap and all 76 were detected by the counter. A total of 41 salmon kelts of known length were measured with the on-screen measuring tool in the SMC software. The results showed the SMC software was capable of accurately measuring salmon ($r=0.92$, $p<0.001$). Further testing occurred at both Sand Hill for smolts and Salmonier to explore alternative effective ranges. At Eagle River, a site was chosen for the operation of the counters in 2009 with reasonable characteristics for operation and counting. Characteristics included no milling salmon (i.e. risk of repeat detections), the least amount of acoustic noise, and an appropriate bottom profile.

A short range sonar system was also investigated on the Deel River, Moy Catchment, Ireland. Most camera technologies are inadequate in Irish waters due to the high turbidity, which is not a limitation for hydro-acoustic systems. An initial baseline of the salmon run in the Deel River was made by the continuous collection of data between October 2007 and June 2008. These data were used to determine fish sizes and estimate numbers of fish and species in the river. Length measurements for fish of known size were taken at different ranges and compared to test the range dependent length deviations for each fish as they moved at different ranges in the beam. As with the Canadian testing, the lengths determined from the counter had a strong linear relationship with the observed fish lengths in the Deel River ($r^2 = 0.92$) at different ranges. In addition to direct observations, motion detection software was used as an alternative option to 'pick' out fish movements and reduce file size to facilitate post-processing. The accuracy of counting was high between three separate analysts who counted fish in image mode. The accuracy of the semi-automated process compared to the directly observed method for the nett counts (i.e. the total upstream minus the downstream count) was between 83% and 99%. The percentage accuracy for the downstream counts was generally lower than that of the upstream counts and needs to be investigated further. Increased water turbidity and the use of a silt box reduced the range of the sonar system operating on the Deel River site to approximately 10 m.

The development and use of these technologies will provide opportunities for assessing salmon in large rivers that are presently not being monitored and for improving advice to managers.

2.4.6 Smolt migration on the River Rhine

The downstream migration of Atlantic salmon smolts was once again monitored in 2008 in the River Rhine using the NEDAP Trail system (Breukelaar *et al.,* 1998). The study aims to investigate the success of downstream migration through Germany and the Netherlands and to assess the migration routes in relation to the obstructions within the partly dammed Rhine Delta, particularly the Haringvliet sluices. Overall, 120 tagged fish were released into two tributaries of the River Rhine in 2008 about 330 km from the sea. The smolts (hatchery 2^+, weight >150 g) were tagged with a transponder (length 3.5 cm, weight 11.5 g) by implantation into the body cavity, and allowed to recover for ten days in the hatchery before release to the river. Within that period no post tagging mortality was observed. The tagged fish were detected by fixed antenna arrays when leaving the tributary and during their migration through the Rhine Delta to the sea. The NEDAP trail system is based on inductive coupling between an antenna loop on the river bottom and a ferrite rod antenna within the transponders. When the fish passes each detection station the unique ID-number of the transponder is recorded.

By the end of the migration period (end of April), 80 out of 120 tagged fish (67%) had been detected leaving the tributary and 22 (18 %) had been recorded reaching the sea after passage through the delta. The loss of 34 tagged fish occurred in the German part of the Rhine (29 %) with another 24 fish (20 %) lost in the delta (the Netherlands). Losses in 2008 were significantly higher than in 2007 when 46% were recorded reaching the sea. This may reflect higher discharge in 2007. The study will be repeated after the re-opening of the Haringvliet dam. This is scheduled to occur by the end of 2010 and is aimed specifically at improving conditions for migratory fish species during their passage from freshwater to the sea and vice versa.

2.4.7 Reintroduction of salmon into the River Rhine

The programme of reintroducing Atlantic salmon to the River Rhine started 20 years ago. It is part of a wider ecological rehabilitation programme involving all countries bordering the river and coordinated by the International Commission for the Protection of the River Rhine (ICPR). This was initiated in response to catastrophic river pollution in Switzerland in 1986 which killed hundreds of thousands of fish. The programme aims to bring about significant ecological improvement of the Rhine and its tributaries enabling the re-establishment of migratory fish species such as salmon.

Stocking of juvenile salmon started in 1988 and the first adult salmon was recorded in the River Sieg, a tributary of the Rhine, in 1990, more than 30 years after the extinction of salmon from the Rhine catchment. Naturally produced juvenile salmon were first observed in 1994 and since the start of the programme more than 5000 adult salmon have been recorded in the Rhine and its tributaries. Stocking of juveniles is planned to continue in the coming years with more than 1 million individuals released each year. Access to suitable juvenile salmon habitat in the upper part of the Rhine and most of its tributaries is still restricted by dams and weirs, and fish migrating downstream have to pass hydropower plants. However, future improvements in both fish passage and water quality are expected as a result of the implementation of the Water Framework Directive, and this should facilitate the restoration of the salmon population in the River Rhine.

2.4.8 European regulations

The Working Group has previously noted the implications for salmon stocks arising from the implementation of Council Directive 92/43/EEC (on the conservation of natural habitats and of wild flora and fauna). European Member States are obliged to maintain or restore habitats and species to favourable conservation status and to take measures to ensure that the exploitation of salmon stocks is compatible with this. Under the terms of the Directive, rivers can be designated as Special Areas of Conservation (SACs). Where salmon are listed as a "qualifying species" this confers additional protection measures specifically targeted at salmon in these rivers. Under the Directive, States are also obliged to submit a report every 6 years detailing the conservation status of their salmon stocks. The first of these reports were submitted in 2007. Comprehensive reports on each EU member state are now available at:

http://circa.europa.eu/Public/irc/env/monnat/library?l=/habitats_reporting/reporting_2001-2007/ms-reports_2001-2006&vm=detailed&sb=Title

The Working Group notes that salmon management in European Member States is increasingly linked with the Water Framework Directive (Directive 2000/60/EC) (WFD), and its 6 year planning cycle. The WFD aims to protect and enhance the water environment, and promotes a new approach to water management through river-based planning. The Directive requires the development of River Basin Management Plans (RBMP) and Programmes of Measures (PoM) with the aim of achieving Good Ecological Status or, for artificial or more modified waters, Good Ecological Potential.

Member States are required to identify River Basin Districts (RBDs) and 'characterise' these by assessing the pressures and impacts on the water environment, such as overuse or pollution. Once that is complete, RBMPs for each District will set out how these impacts will be reduced through its PoM. RBMPs and PoMs need to be agreed, finalised and published by December 2009 for the first round of the WFD planning cycle. Monitoring programmes will then chart progress towards achievement of Good Ecological Status. The second round plans are due to be published in 2015. The status of migratory species and access to habitats will be important elements to take into account when assessing Good Ecological Status.

The EU data collection regulation (EU DCR) has been updated and expanded recently to include both salmon and eels and extended to inland waters. This will have impacts at Community level relating specifically to the requirement for a multi-annual Community programme for collection, management and use of biological, technical, environmental, and socio-economic data concerning:

- a) commercial fisheries carried out by Community fishing vessels:
  - 1) within Community waters and commercial fisheries for eels and salmon in inland waters;
  - 2) outside Community waters;
- b) recreational fisheries carried out within Community waters and recreational fisheries for eels and salmon in inland waters;
- c) aquaculture activities related to marine species, including eels and salmon, carried out within the Member States and the Community waters;
- d) industries processing fisheries products-these to be defined in accordance with the procedure referred to in Article 27(2).

2.5 NASCO has asked ICES to continue work already initiated to investigate associations between changes in biological characteristics of all life stages of Atlantic salmon, environmental changes and variations in marine survival with a view to identifying predictors of abundance

ICES have been asked by NASCO to 'continue the work already initiated to investigate associations between changes in biological characteristics of all life stages of Atlantic salmon, environmental changes and variations in marine survival with a view to identifying predictors of abundance'. The Working Group considered a preliminary report from the Study Group on the Identification of Biological Characteristics for Use as Predictors of Salmon Abundance [SGBICEPS], which ICES established with the following terms of reference:

a) identify data sources and compile time-series of data on marine mortality of salmon, salmon abundance, biological characteristics of salmon and related environmental information;

b) consider hypotheses relating marine mortality and/or abundance trends for Atlantic salmon stocks with changes in biological characteristics of all life stages and environmental changes;

c) conduct preliminary analyses to explore the available datasets and test the hypotheses.

As a foundation for addressing the ToR, the Study Group completed a preliminary review of the available information on the life history strategies of salmon and changes in the biological characteristics of the fish in relation to key environmental variables. This overview considered both the marine and freshwater stages of the salmon's life-cycle and attempted to highlight a number of the existing (and sometimes conflicting) hypotheses relating to factors regulating the mortality of salmon.

Data sources

Biological characteristics-The Study Group continued the work initiated by the Working Group (ICES, 2008) to compile a suite of standard biological measures over time-series (>15 years) sufficient to account for natural variability and to facilitate trend analysis. This process was facilitated by a standardised data entry spreadsheet which was completed by relevant agencies throughout the North Atlantic. Data on average annual values for various biological characteristics for stocks were provided from Canada, USA, Iceland, Russia, Finland, Norway, Sweden, UK (Scotland), UK (England & Wales), UK (N. Ireland) and France (Table 2.5.1).

Abundance metrics-A series of tables were assembled with the available abundance metrics and datasets on survival/mortality for different indicator stocks and stock complexes around the North Atlantic. These were primarily sourced from the Working Group (ICES, 2008) and included national and river-specific PFA estimates for 1SW and MSW fish and marine survival estimates for individual stocks. Information detailing the assessment methods used to derive the various abundance measures (e.g. trap, fish counter, mark/recapture), the PFA calculation methods (e.g. coded wire tagging, run reconstruction model), the nature of river return data (i.e. before or after fishery exploitation) were also compiled.

Environmental variables-The Study Group reviewed the types of environmental information that could be employed to develop exploratory analyses, with particular emphasis on marine environmental data. However, the Study Group recognised that the lack of a clear understanding of the distribution of salmon at sea remained a constraint in this regard. The Study Group also recognised that specific requirements for environmental data or efforts to link these with changes in biological characteristics would need to be refined once clear hypotheses could be developed, for example in relation to observed changes in specific stocks or stock complexes. This would be more appropriate once provisional analyses had been completed and potential common patterns or trends identified.

Data quality issues

In taking forward preliminary analyses of available data sets, the Study Group noted a number of constraints and caveats, mostly relating to sampling programmes and methodological differences, which would need to be taken into account. In addition to clarifying the stock abundance variable (e.g. before or after fishery exploitation) these issues included:

- Full season or part season monitoring-information derived from traps or counters has the advantage that it can be collected throughout the year, whereas information derived from fisheries is restricted to the fishing season.
- Weight/condition-this is likely to vary according to where fish are sampled. Data derived from net fisheries are more likely to be representative of fresh run fish while weights derived from rod fisheries (and possibly in some cases trap data) will be derived from a mix of fresh run and earlier run fish which may have already lost some body weight. However fisheries may be size selective.
- Ages-ages determined from scale readings will be more reliable than ages estimated by a size (length or weight) split.
- River age-data relating to mean river age are typically derived from scale analysis of returning adults. The Study Group recognised that such data might not accurately reflect the age composition of smolt cohorts, for example if different age/size classes of smolts are subject to differential rates of mortality in the sea.
- Sex ratio-most data are believed to be derived from observation of external morphometric features. The reliability of such observations will vary at different times of the season and among different observers.
- Sample size-analysis of annual mean data has potential drawbacks. Adding a "sample size" variable would allow a better appreciation of the likely error around the mean values for each of the variables considered.

The Study Group recommended that in taking forward and extending any further analyses, all data sets should include a full description of data sources and of the methodology used to record each variable to aid interpretation.

Assessment of Fulton's K versus Relative Mass Index, W_R

The Study Group compared the condition factors (Fulton's K) derived from the annual mean length and mean weight of each year class within a time series against the alternative Relative Mass Index (W_R) approach described by Todd *et al.*, 2008. The latter provides a reliable measure of condition factor for individual fish, and one which is largely free of length-dependence.

A number of time-series providing length and weight data for individual fish were derived from sampling programmes around the UK and Ireland, and were used to derive both Fulton's K and W_R. These included both wild and hatchery-origin fish. Figure 2.5.1 illustrates the relationship between these two metrics for a number of wild stocks and shows a clear and consistent pattern. The Study Group concluded that the simple condition factor derived from the mean length and weights for each year class within a population provides an adequate qualitative descriptor of variation in condition factor at the population level. It was clear that the regression coefficients of the various data sets are very similar; hatchery-origin fish showed the same morphometric relationship. It was also clear that even small sample sizes lead to the derivation of plausible measures of annual condition.

The regression intercepts ("elevations") seem to be population-dependent, most probably reflecting inherent differences in the shape of fish from different populations (e.g. River Dee fish are notably different to the remainder in Figure 2.5.1). Thus, while condition factors derived from simple mean length and weight data provide an objective, qualitative means of deciding whether or not a population time series is showing systematic increase, decrease, or no change, this approach has limitations for between-stock comparisons.

Preliminary data analyses

Trends over time-The Study Group examined the various stock-specific biological characteristics for possible time trends using the non-parametric Mann-Kendall statistic (Mann, 1945; Kendall, 1975) and the statistical programming environment R (R Development Core Team, 2007). This analysis was performed over a standardised time period (1984 on), typically extending to 2007. The null hypothesis was that there is no trend. The results are presented in Table 2.5.2. Missing values indicate no time series available; 'o' indicates a non statistically significant trend ($P>0.05$); '-' a negative trend ($p<0.05$); and '+' a positive trend ($p<0.05$). There are significant trends over time for many of the variables explored.

Wider geographical patterns

The Study Group examined two approaches for looking at patterns in the changes in biological characteristics over broader spatial scales. For these purposes the individual river stocks were allocated to different groupings. For the first approach, the conventional NAC (Canada and USA) and NEAC north (Russia, Norway, Finland, Iceland (N&E)) and NEAC south (UK, France and Iceland (S&W)) stock complexes were used. However, for the second analysis the NAC rivers were further subdivided into two groups based on a latitudinal split. Thus the rivers Western Arm Brook, Middle Brook, Conne and Miramichi were allocated to a northern NAC group and the other N American rivers to a southern NAC group.

The first approach used a standardised (z-score) analysis to examine the trend in mean smolt age. This analysis was restricted to wild stocks. For this purpose, the data for year n were standardised in relation to the mean smolt age between 1984 and 1993 as follows:

$$Z_n = (\text{Mean smolt age}_n - \text{mean smolt age}_{1983\text{-}94}) / STD_{1983\text{-}94}$$

The results of this analysis are presented in Figures 2.5.2 to 2.5.4. and indicate that in the samples from the NAC area and the NEAC Southern area there has been a statistically significant decline in mean smolt age from the 1970s and 1960s, respectively ($P<0.05$). In contrast, for the samples from the NEAC Northern area smolt age has remained constant since the early 1970s ($P>0.05$). For this area there is an indication of an increase in mean smolt age up until the late 1990s–early 2000s followed by a recent decline.

The second approach used meta-analysis, which statistically combines the results of several studies (in this case different rivers) to address a shared research hypothesis. This approach was used to explore relationships for most of the biological characteristics available; results are summarised in Table 2.5.3, 'o' denotes a non-significant relationship, '+' indicates a significant increase relative to the mean and '-' denotes a significant decrease. These analyses also indicated a number of significant trends over time for certain variables at the stock complex level. With respect to smolt age, the meta-analysis provided results consistent with the earlier z-score approach, although with this approach a statistically significant decrease was only apparent for the NAC Northern area.

The Study Group noted that further work would be necessary to explore trends, investigate possible common patterns or regional groupings, and develop hypotheses. However, the following provides an example in relation to the observed decline in mean smolt age. This change may be the consequence of an increase in growth rate as the faster growing parr migrate to sea earlier (Metcalfe *et al.*, 1989; Økland *et al.*, 1993). The increase in growth rate may relate to an increase in temperature (Elliott *et al.*, 2000), and/or an increase in growth as a result of density dependent processes (Gibson, 1993; Jenkins *et al.*, 1999; Imre *et al.*, 2005; Lobón-Cerviá, 2005), and/or increased freshwater production. One of the probable consequences of the increase in growth rate and smolts migrating at an earlier age is to dampen the impact of an increase in marine mortality. This assumes that the higher survival rate to smolt for a one-year-old smolt (S1) is not outweighed by their higher marine mortality. A decline in smolt age may affect reproductive success as egg size is smaller for S1 as opposed to S2 smolts of the same sea age and early survival (egg to swim-up) may also be lower (Moffett *et al.*, 2006).

These possible effects might be explored further to assess whether available data sources (adult and juvenile) tell a common story, to investigate possible implications for pre-smolt and post-smolt survival and adult return (perhaps even the age and size composition of adult fish), and what marine environmental effects might influence this.

Two way plots

The Study Group also completed some preliminary analyses to investigate potential inter-relationships between selected stock characteristics for each river, for the period from 1984. Simple linear regression models were used to test each relationship. Initial results suggest that, for a number of stocks, the size of returning 1SW salmon is positively correlated with the size of returning 2SW in both the same year and in the subsequent year. The former is consistent with common factors operating on the fish from the two sea-age groups during their return migration, while the latter may suggest that common factors operating in the first period at sea may have a larger influence on growth and size at maturity. A number of significant, but variable, relationships were also demonstrated between the river age of migrating smolts and the subsequent sea-age, and between the size of returning fish and the river-specific stock status variable. Further work is required to explore these relationships and to consider possible hypotheses.

Case studies

The Study Group reviewed information from a number of river or area-specific investigations.

River Frome (Southern England)

- Adult returns declined sharply in the late 1980s early 1990s. At the same time, there was a general shift to a higher proportion of grilse. Median date of migration into the river has become later.
- Size of 1SW salmon has decreased between 1965 and 1995, with the size of 2SW fish has increased over the same period.
- Mean size of smolts has increased after 1985. At the same time the mean age of smolts has declined, such that it is now close to 1.

- Evidence of strong link between smolt size and sea age. Small smolts have a lower probability of being grilse than large smolts. This relationship is particularly marked for females.

River Bush (N. Ireland)

- The smolt run on the river consists primarily of two-year-old smolts. There is no obvious trend in smolt age over the time-series, although there has been a small increase in the proportion of one-year-old smolts in recent years. There is also no obvious trend in smolt size.
- However, there has been a shift towards earlier smolt run timing and this was linked to the subsequent survival of returning adults. One possible mechanism for this is a larger thermal discrepancy between river and sea water at the time of the smolt run in these years.
- There have also been changes over the time period in the proportion of 1SW returning salmon (increasing) and in their mean length (getting smaller).

Later age-at-maturity in Norwegian salmon stocks in recent years

- There is a significant positive relationship between the PFA of 1SW Norwegian salmon stocks in one year and the PFA of 2SW salmon in the following year. However, in recent years there is evidence for three regions in Norway that more salmon return as 2SW fish than would be expected based on this relationship.
- The apparent later age-at-maturity may be explained both by more salmon delaying age-at-maturity, or that the survival in the second year at sea has increased relative to the survival in the first year at sea. If the first is true one might expect an increase in the proportion of male salmon among 2SW fish (since grilse are traditionally male dominated), whereas sex ratio among 2SW fish is likely to be unchanged if the second explanation is more valid.

Baltic salmon

The Study Group noted that WGBAST were also addressing concerns related to at-sea survival of salmon. To date, the key findings from WGBAST were:

- Evidence of strong year effects among stocks suggesting common factors applying at a Baltic wide level; e.g. changes in environment or factors acting in the main feeding area.
- Preliminary indications suggest that survival of post-smolts in the Baltic Sea may be density-dependent; several survival indices were negatively correlated with the total production of wild and reared smolts in the Baltic. Salmon survival also correlated positively with herring recruitment. Together, these results highlight the possible influences of ecosystem changes in the Baltic.
- Some results suggest that seals may affect survival rates of salmon. However, the available information on grey seal diet is limited, and more information is needed on seal ecology, their spatial distribution in spring and summer months, and on post-smolt migration routes in order to evaluate this.

- There was little objective information on the effects of rearing conditions on post-smolt survival rates and no direct evidence for a negative association between length of reared smolts and their survival at sea.

The Study Group noted a number of Swedish salmon tagging studies. Recapture rates had declined in recent years, largely reflecting reductions in fisheries and poorer reporting rates; time series of recaptures from hatcheries and/or in-river sampling sites were therefore of greatest value for analysis. The post-smolt survival of hatchery populations was typically lower than that for wild populations. Correlations have been confirmed between smolt condition (e.g. fin damage, etc.) and recovery rates, although it was noted that hatchery fish possess many characteristics which make them different from wild fish.

The Working Group recognised the progress made by SGBICEPS and recommended that further co-ordinated efforts are made to collate data from stocks throughout the geographic range and to continue with the analysis of data sets and the development of hypotheses.

2.6 NASCO has asked ICES to evaluate the results of studies that estimate the level of pre-spawning mortality of salmon caught and released by anglers and the implications for stock assessments

The Working Group reviewed information from a number of countries.

Pre-spawning mortality

Mortality of Atlantic salmon after catch and release (C&R) has been reported to be highly variable (Dempson *et al*., 2002; Thorstad *et al*., 2008), with temperature often cited as an important factor (Dempson *et al*., 2002; Thorstad *et al*., 2003a). C&R angling at low temperatures (below 17–18°C) generally shows lower post release mortalities than C&R at higher temperatures (Table 2.6.1, Figure 2.6.1). There is, however, a lack of studies on the survival after C&R at higher temperatures from release until to spawning and there are no studies on its relationship with survival to repeat spawning.

In addition to the studies reported in Table 2.6.1, a two year study was carried out by the Central Fisheries Board, Ireland on the C&R of Atlantic salmon, taken by lure or fly fishing, on three Irish rivers in the south west and west of Ireland between 2006 and 2007. Seventy one salmon were tagged over two seasons, with radio transmitters. Survival of fly-caught salmon to spawning was 98%, compared to 60% survival to spawning for salmon caught on lures. Wounds left from lure hooks were larger and caused blood loss, which may have contributed to increased mortality from lure angling. Water temperature varied between 9º C and 15°C at the time of tagging and had no impact on the subsequent survival. The results of this research demonstrate that, when the correct procedures are followed during C&R and water temperature is low, there is a high survival of salmon caught by fly fishing through to spawning.

Most of the studies that report mortality rates after C&R have used skilled anglers or artificially hooked already captive fish. This may lead to lower mortality than would be expected if less experienced anglers caught fish. Since C&R fishing is performed, in practice, by anglers with a wide variety of experience, studies in "ideal" situations probably underestimate mortality. In typical rod fisheries, mortality caused by direct injuries to the fish may be apparent. For example, a study of logbooks from the rivers Kharlovka, Eastern Litsa and Ponoi in Russia, showed hooking in the gills caused profuse bleeding in 5–7 % of the catches. In a similar study of logbooks documenting captures in the River Alta in Norway, 7 % of the salmon were described as deeply hooked (hooked in the throat), and 7 % were also characterised as being in bad condition at release (Thorstad *et al.*, 2003a). Efforts have been made in a number of countries to inform anglers about good C&R practice through, for example, free instruction videos and advisory leaflets.

The Working Group considered that C&R recreational fisheries provide an intermediate management strategy between a full retention fishery and fishery closure for populations that are below target levels. Although not fully explored, its population-level effects could be evaluated using the equilibrium dynamics models used to calculate reference points such as the fishing mortality at maximum sustainable yield (Fmsy) or biomass at maximum sustainable yield (Bmsy). The effects would be conditional on life history traits such as freshwater productivity, survival at-sea and repeat spawning frequency. C&R fisheries would be expected to result in population sizes that are higher than those in a full retention fishery, but lower than those expected to result from fishery closure (Figure 2.6.2). A similar relationship is expected for the lifetime reproductive rates (Figure 2.6.2). As such, they have the potential to slow recovery rates relative to fishery closures, although population growth is expected to be more rapid with a C&R fishery than a full retention fishery.

Multiple recaptures

In all studies, less than 25% of fish that had been marked upon release after capture by rod and line were caught a second time, and an even lower proportion was caught a third time (Table 2.6.2). In most rivers where we have estimates of exploitation rates for salmon caught for the first time, the recapture rates after C&R are lower than the exploitation rate (Table 2.6.2). Thus, using marking of C&R fish to estimate exploitation rates or population size is likely to lead to underestimation of the exploitation rate and overestimation of the true population size. There is a need for further studies of the recapture rate of C&R salmon in rivers where exploitation rates are assessed with other methods in order to quantify the relationship between multiple recaptures and exploitation rate.

Implications for stock assessments

If all C&R salmon are counted as survivors, this will lead to an overestimation of the number of spawners. The reasons for this are twofold: (i) released salmon will suffer increased mortality relative to uncaught salmon and (ii) a proportion of the fish will be caught more than once.

At present, the effect of catch on stock assessment is handled differently by different countries. In assessing annual compliance with river specific conservation limits in UK (England and Wales), account is taken of the fish caught and released by anglers; 20% mortality is assumed. The increasing level of C&R is also taken into account in estimating the exploitation rate in salmon fisheries in UK (England & Wales) used in the NEAC run-reconstruction model. However, with increasing emphasis on C&R, and ~100% C&R on a number of rivers, it is unclear to what extent catches might be affected by repeat capture.

In Ireland, estimates of the numbers of fish returning to rivers in the run reconstruction model are based on the numbers caught and killed plus the number caught and released raised by an overall catch rate. The spawners are calculated as returns to homewater minus the number caught and killed, but are not corrected for multiple catches or increased mortality due to C&R.

For Norway, Iceland, Russia, Sweden, UK (Northern Ireland) and UK (Scotland) the input to the run reconstruction model is based on the number of salmon caught and killed, and the increase of C&R in recent years is at present dealt with by reducing the exploitation rate in the model input. These estimates are qualitatively assessed and no formal method for estimating the effect of C&R on estimates of returns has been developed. No correction for increased mortality due to C&R is included when estimating the spawner escapement.

In Canada, the spawning escapement is reduced by a factor of between 3 and 10 % of the C&R salmon. This is to account for mortality due to C&R, which is thought to differ among rivers as a result of factors such as run timing, water temperature, or fishing season.

In USA, there is at present no correction for mortality due to C&R when computing spawner escapement. However, the number of fish caught relative to the stock size is small.

Given the information presented, the Working Group recognised the need to correct for C&R mortality. However, river-specific conditions at the time of fisheries vary; Table 2.6.1 provides general guidance on appropriate values to apply.

2.7 NASCO has asked ICES to provide a compilation of tag releases by country in 2008 and advise on progress with compiling historical tag recovery data from oceanic areas

2.7.1 Compilation of tag releases and fin clip data by ICES member countries in 2008

Data on releases of tagged, fin-clipped and otherwise marked salmon in 2008 were provided to the Working Group and are compiled as a separate report (ICES 2009b). In summary (Table 2.7.1.1), about 4.5 million salmon were marked in 2008, an increase from the 4.36 million fish marked in 2007. The adipose clip was the most commonly used primary mark (3.52 million), with coded wire microtags (0.92 million) the next most common primary mark. Most marks were applied to hatchery-origin juveniles (4.37 million), while 155 722 wild juveniles and 20 713 adults were also marked. The use of PIT (Passive Integrated Transponder) and other implanted tags for marking Atlantic salmon has increased in recent years and these are now listed in a separate column in Table 2.7.1.1. In 2008, 6722 PIT tagged salmon, Data Storage Tags (DSTs), radio and/or sonic transmitting tags (pingers) were also used.

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 and Iceland) require that some or all of the sea-cage farmed fish reared in their area be marked. In USA, some firms have opted for a genetic “marking” procedure. The broodstock has been screened with molecular genetic techniques, which makes it feasible to trace an escaped farmed salmon back to its hatchery of origin through analysis of its DNA. One company has applied ventral fin clips, 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.

2.7.2 Summary of the Workshop on Salmon Historical Information-New Investigations from old tagging data (WKSHINI)

The Workshop, established by ICES, on Salmon Historical Information-New Investigations from Old Tagging Data (WKSHINI) (ICES, 2008) has been held and the results were presented to the Working Group.

The Workshop updated information from historical oceanic tagging and recovery programmes in the format agreed at the WKDUHSTI Workshop (ICES, 2007). Data were provided from a number of countries, including tag recoveries in oceanic areas from smolt tagging in home waters, and a number of hypotheses relating to oceanic migration and distribution were tested. The information was used to describe distribution of salmon of different origins and sea age in time and space and first attempts were made to assess changes in the distribution over time and in relation to hydrographical data.

NW Atlantic

In many cases where the precise recovery location was unknown only the NAFO Division was available for tag recoveries and the recapture latitude and longitude were set to the midpoint for each individual NAFO Division. In total, 4743 recaptured salmon that could be allocated to a specific NAFO Division were included in the analyses. Countries of origin were Canada, Iceland, Ireland, Norway, Sweden, UK (Scotland), UK (England & Wales), UK (Northern Ireland) and USA. The majority of the fish was released as hatchery-reared smolts.

For all countries of origin, salmon tag recoveries were not uniformly distributed across the respective NAFO divisions at Greenland (all chi-square tests $p < 0.0001$). Canadian and USA salmon were more commonly captured in northern locations (NAFO Divisions 1B and 1C) while European origin stocks tended to be caught further south in NAFO Divisions 1E and 1F.

Recovery of North American origin salmon differed significantly from that of European salmon at West Greenland. Collectively, 35% of North American tag recoveries originated in NAFO Divisions 1A and 1B versus only 17% of European salmon while 56% of the tag recoveries of European salmon came from NAFO areas 1E and 1F with only 17% of North American origin salmon reported recovered in these areas.

For both North American salmon and European salmon the distributions before and after 1989 were found to differ among NAFO Divisions. In both cases, North American and European salmon were found further south at Greenland in the later period then in the former. This may have been temperature related as period 2 has been cooler then period 1. Also, it may be related to fishery management changes whereby fishing times may have been more extensive in earlier years then later.

Within North America, the distribution of Canadian and USA tag recaptures at West Greenland was also found to differ. Canadian salmon were more commonly recaptured in northern areas than USA fish.

A comparison of European salmon (Norway, UK (Scotland), Ireland and UK (England & Wales)) yielded similar results with Scottish and Norwegian salmon recovered more in northern areas while salmon from Ireland and UK (England and Wales) were more likely to be recaptured in south west Greenland.

NE Atlantic

Tag recoveries in the NE Atlantic were reported from: Canada, Denmark, Faroes, France, Iceland, Ireland, Norway, Spain, Sweden, UK (England & Wales), UK (N. Ireland), UK (Scotland), USA, France, and Russia. The majority of the recaptures were released as hatchery-reared smolts. An exact recovery position was available for 2509 of the recaptured fish.

The observed spatial distribution of salmon recoveries north of the Faroes suggested clumping around two main areas, one north-easterly and one south-westerly. Significance testing of this apparent distribution was done and resulted in rejection of the hypothesis that the distribution of salmon at sea is random.

Catch areas for sea age groups 0, 1, 2 and 3 were clustered and the catches of MSW fish appear to have been more prevalent in the northeast catch area. However, a caveat here is the possibility that the sea age distribution might be confounded by the differences in the spatial distribution of the fishery in a year.

The results indicate a clear spatial difference between the recaptures in autumn and winter. Early in the season the salmon were clustered to the southwest, and later to the northeast. However, the fishing effort (cpue) needs to be incorporated to account for potential influences from changes in the fishery.

Owing to time and data restraints only a preliminary assessment of two smaller groups of countries was possible. The Northern stocks were identified as Norway, Sweden and UK (Scotland) and the southern stocks as Ireland and UK (England & Wales). A visual inspection of the distribution of recaptures from these northern and southern stock groups is suggestive of a more northerly location of recaptures from the northern group. This observation needs to be examined in more detail with significance testing and incorporation of data indicating fishing effort.

The hypothesis that the distribution and migration of salmon at sea is independent of (fishing) season has not been tested in the present report, but previous studies in the Faroese zone have revealed that the country of origin of the salmon caught in autumn differs from the composition in winter (Jacobsen *et al*., 2001), supporting a rejection of the hypothesis.

The Workshop was not able to test all hypotheses put forward in the WKDUHSTI report 2007 owing to complexities in data compilation and data gaps. However, the Workshop provided a basis for further work, with the creation of a common database holding release and recovery information and with digitized positions ready for multilayered GIS analyses.

It was recommended that a similar Workshop be held sometime in 2009 to complete compilation of available data and analyses of the resulting distributions of salmon at sea. ICES endorsed this and decided that A Workshop on Learning from Salmon Tagging Records [WKLUSTRE]) will meet in London, UK, from 16–18 September 2009 (Chair: Lars Petter Hansen, Norway) to:

a) further develop the international database of marine tagging and tag recovery information for Atlantic salmon;

b) use the database to investigate the distribution of salmon of different river (stock) origins and sea ages in time and space, and assess changes in the distribution over time in relation to hydrographical factors;

c) investigate the use of the tagging database to verify outputs from migration models; and

d) make recommendations in relation to future salmon tagging studies and investigations of salmon mortality at sea.

WKLUSTRE will report by 30 November 2009 for the attention of the WGNAS, TGRECORDS and SCICOM.

Table 2.1.1.1 Reported total nominal catch of salmon by country (in tonnes round fresh weight), 1960–2008. (2008 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)				(5,6)		(6,7)		(8)	(9)	(10)		(11)	(12)	Catch	Areas (13)	waters (14)
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	141	285	33	13	60	567	338	94	624	15	7	315	-	274	-	4,925	1,890	180-350

Table 2.1.1.1 continued.

Year	NAC Area: Canada (1)	NAC Area: USA	NAC Area: St. P&M	NEAC (N. Area): Norway (2)	NEAC (N. Area): Russia (3)	NEAC (N. Area): Iceland Wild	NEAC (N. Area): Iceland Ranch (4)	NEAC (N. Area): Sweden (West)	NEAC (N. Area): Den.	NEAC (N. Area): Finland	NEAC (S. Area): Ireland (5,6)	NEAC (S. Area): UK (E & W)	NEAC (S. Area): UK (N.Irl.) (6,7)	NEAC (S. Area): UK (Scotl.)	NEAC (S. Area): France (8)	NEAC (S. Area): Spain (9)	Faroes & Greenland: Faroes (10)	Faroes & Greenland: East Grld.	Faroes & Greenland: West Grld. (11)	Faroes & Greenland: Other (12)	Total Reported Nominal Catch	Unreported catches: NASCO Areas (13)	Unreported catches: International waters (14)
1991	711	1	1	876	215	129	346	38	3	70	404	200	55	462	13	11	95	4	472	-	4,106	1,682	25-100
1992	522	1	2	867	167	174	462	49	10	77	630	171	91	600	20	11	23	5	237	-	4,119	1,962	25-100
1993	373	1	3	923	139	157	499	56	9	70	541	248	83	547	16	8	23	-	-	-	3,696	1,644	25-100
1994	355	0	3	996	141	136	313	44	6	49	804	324	91	649	18	10	6	-	-	-	3,945	1,276	25-100
1995	260	0	1	839	128	146	303	37	3	48	790	295	83	588	10	9	5	2	83	-	3,629	1,060	-
1996	292	0	2	787	131	118	243	33	2	44	685	183	77	427	13	7	-	0	92	-	3,136	1,123	-
1997	229	0	2	630	111	97	59	19	1	45	570	142	93	296	8	3	-	1	58	-	2,364	827	-
1998	157	0	2	740	131	119	46	15	1	48	624	123	78	283	8	4	6	0	11	-	2,396	1,210	-
1999	152	0	2	811	103	111	35	16	1	62	515	150	53	199	11	6	0	0	19	-	2,247	1,032	-
2000	153	0	2	1,176	124	73	11	33	5	95	621	219	78	274	11	7	8	0	21	-	2,912	1,269	-
2001	148	0	2	1,267	114	74	14	33	6	126	730	184	53	251	11	13	0	0	43	-	3,069	1,180	-
2002	148	0	2	1,019	118	90	7	28	5	93	682	161	81	191	11	9	0	0	9	-	2,654	1,039	-
2003	141	0	3	1,071	107	99	11	25	4	78	551	89	56	192	13	7	0	0	9	-	2,455	847	-
2004	161	0	3	784	82	112	18	19	4	39	489	111	48	245	19	7	0	0	15	-	2,156	686	-
2005	139	0	3	888	82	129	21	15	8	47	422	97	52	215	11	13	0	0	15	-	2,156	700	-
2006	137	0	3	932	91	96	17	14	2	67	326	80	29	192	13	11	0	0	22	-	2,032	670	-
2007	112	0	2	767	63	91	36	16	3	58	85	71	30	169	11	10	0	0	25	-	1,548	475	-
2008	148	0	4	807	73	125	68	18	9	71	88	68	22	146	12	10	0	0	26	-	1,696	443	-
Average																							
2003-2007	138	0	3	888	85	105	20	18	4	58	375	89	43	203	13	10	0	0	17	-	2,069	676	-
1998-2007	145	0	3	946	101	99	22	21	4	71	505	128	56	221	12	9	1	0	19	-	2,362	911	-

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 recreational (rod) fishery.
4. From 1990, catch includes fish ranched for both commercial and angling purposes.
5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and log books from 2002.
6. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
7. Angling catch (derived from carcase tagging and log books) first included in 2002.
8. Data for France include some unreported catches.
9. Weights estimated from mean weight of fish caught in Asturias (80-90% of Spanish catch). No data available for Spain for 2008; catch assumed as in 2007.
10. Between 1991 & 1999, there was only a research fishery at Faroes. In 1997 & 1999 no fishery took place; the commercial fishery resumed in 2000, but has not operated since 2001.
11. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.
12. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
13. No unreported catch estimate Canada in 2007-2008 and for Russia in 2008.
14. Estimates refer to season ending in given year.

Table 2.1.1.2 Reported total nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2008. (2008 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 + S.

	NAC Area				NEAC (N. Area)											NEAC (S. Area)										
Year	Canada (1)			USA	Norway (2)			Russia (3)	Iceland		Sweden (West)	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK(N.I.) (4,6)	UK(Scotland)			France	Spain (7)	Total
									Wild	Ranch																
	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

Table 2.1.1.2 continued.

	NAC Area				NEAC (N. Area)											NEAC (S. Area)										
Year	Canada (1)			USA	Norway (2)			Russia (3)	Iceland		Sweden (West)	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK(N.I.) (4,6)	UK(Scotland)			France	Spain (7)	Total
									Wild	Ranch																
	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
1991	370	341	711	1	535	342	876	215	129	346	38	3	53	17	70	-	-	404	200	55	285	177	462	13	11	3,534
1992	323	199	522	1	566	301	867	167	174	462	49	10	49	28	77	-	-	630	171	91	361	238	599	20	11	3,851
1993	214	159	373	1	611	312	923	139	157	499	56	9	53	17	70	-	-	541	248	83	320	227	547	16	8	3,670
1994	216	139	355	0	581	415	996	141	136	313	44	6	38	11	49	-	-	804	324	91	400	248	648	18	10	3,934
1995	153	107	260	0	590	249	839	128	146	303	37	3	37	11	48	-	-	790	295	83	364	224	588	10	9	3,538
1996	154	138	292	0	571	215	787	131	118	243	33	2	24	20	44	-	-	685	183	77	267	160	427	13	7	3,042
1997	126	103	229	0	389	241	630	111	97	59	19	1	30	15	45	-	-	570	142	93	182	114	296	8	3	2,303
1998	70	87	157	0	445	296	740	131	119	46	15	1	29	19	48	-	-	624	123	78	162	121	283	8	4	2,376
1999	64	88	152	0	493	318	811	103	111	35	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	73	11	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	74	14	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	90	7	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	99	11	25	4	63	15	78	-	-	551	89	56	122	70	192	13	7	2,443
2004	68	94	161	0	577	207	784	82	112	18	19	4	32	7	39	-	-	489	111	48	158	87	245	19	7	2,138
2005	56	83	139	0	581	307	888	82	129	21	15	8	31	16	47	-	-	422	97	52	125	90	215	11	13	2,137
2006	55	82	137	0	671	261	932	91	96	17	14	2	38	29	67	-	-	326	80	29	117	75	192	13	11	2,007
2007	48	64	112	0	627	140	767	63	91	36	16	3	52	6	58	-	-	85	71	30	99	70	169	11	10	1,521
2008	57	90	148	0	637	170	807	73	125	68	18	9	65	6	71	-	-	88	68	22	104	42	146	12	10	1,666
Average																										
2003-2007	57	81	138	0	633	256	888	85	105	20	18	4	43	15	58	-	-	375	89	43	124	78	203	13	10	2049
1998-2007	59	86	145	0	640	306	946	101	99	22	21	4	52	20	71	-	-	505	128	56	135	86	221	12	9	2340

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 recreational (rod) fishery.
4. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and log books from 2002.
6. Angling catch (derived from carcase tagging and log books) first included in 2002.
7. No data available for Spain for 2008; catch assumed as in 2007.

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, 1991–2008. Figures for 2008 are provisional.

Year	Canada		USA		Iceland		Russia		UK (E&W)	
	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch
1991	28,497	33	239	50			3,211	51		
1992	46,450	34	407	67			10,120	73		
1993	53,849	41	507	77			11,246	82	1,448	10
1994	61,830	39	249	95			12,056	83	3,227	13
1995	47,679	36	370	100			11,904	84	3,189	20
1996	52,166	33	542	100	669	2	10,745	73	3,428	20
1997	57,252	49	333	100	1,558	6	14,823	87	3,132	24
1998	62,895	53	273	100	2,826	8	12,776	81	5,365	31
1999	55,331	50	211	100	3,055	11	11,450	77	5,447	44
2000	64,482	55	0	-	2,918	12	12,914	74	7,470	42
2001	59,387	55	0	-	3,607	15	16,945	76	6,143	43
2002	50,924	52	0	-	5,985	19	25,248	80	7,658	50
2003	53,645	55	0	-	5,361	17	33,862	81	6,425	56
2004	62,316	55	0	-	7,294	17	24,679	76	13,211	48
2005	63,005	62	0	-	9,224	19	23,592	87	11,983	56
2006	60,486	62	1	100	8,735	23	33,380	82	10,959	56
2007	44,423	59	3	100	9,263	24	44,341	90	10,913	55
2008	58,004	57	61	100	15,398	19	41,881	86	11,947	54
Average 2003-2007	56,775	59	1	100	7,975	20	31,971	83	10,698	54
1998-2007	57,689	56	49	100	5,827	16	23,919	80	8,557	48

Year	UK (Scotland)		Ireland		UK (N Ireland) [1]		Denmark		Norway	
	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										
1992										
1993										
1994	6,595	8								
1995	12,151	14								
1996	10,413	15								
1997	10,965	18								
1998	13,464	18								
1999	14,846	28								
2000	21,072	32								
2001	27,724	38								
2002	24,058	42								
2003	29,160	56								
2004	46,279	50					255	19		
2005	45,970	55	2,553	12			606	27		
2006	47,471	55	5,409	22	302	18	794	65		
2007	55,472	61	13,125	40	470	16	959	57		
2008	55,366	63	13,312	37	648	20	2,033	71	5,512	-
Average 2003-2007	44,870	55								
1998-2007	32,552	43								

Key: [1] Data for FCB area only

Table 2.1.3.1 Estimates of unreported catches (tonnes round fresh weight) by various methods within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 1987–2008.

Year	North-East Atlantic	North-America	West Greenland	Total
1987	2,554	234	-	2,788
1988	3,087	161	-	3,248
1989	2,103	174	-	2,277
1990	1,779	111	-	1,890
1991	1,555	127	-	1,682
1992	1,825	137	-	1,962
1993	1,471	161	< 12	1,644
1994	1,157	107	< 12	1,276
1995	942	98	20	1,060
1996	947	156	20	1,123
1997	732	90	5	827
1998	1,108	91	11	1,210
1999	887	133	12.5	1,032
2000	1,135	124	10	1,269
2001	1,089	81	10	1,180
2002	946	83	10	1,039
2003	719	118	10	847
2004	575	101	10	686
2005	605	85	10	700
2006	604	56	10	670
2007 *	465	-	10	475
2008 **	433	-	10	443
Mean 2003-2007	594	90	10	676

* No unreported catch estimate available for Canada in 2007.

** No unreported catch estimate available for Canada and Russia in 2008.

Table 2.1.3.2 Estimates of unreported catches (tonnes round fresh weight) by various methods by country within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 2008.

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	4	0.2	31
NEAC	Finland	15	0.7	17
NEAC	Iceland	12	0.6	6
NEAC	Ireland	9	0.4	9
NEAC	Norway	346	16.2	30
NEAC	Sweden	2	0.1	10
NEAC	France	3	0.1	0
NEAC	UK (E & W)	23	1.1	25
NEAC	UK (N.Ireland)	0	0.0	0
NEAC	UK (Scotland)	20	0.9	12
NAC	USA	0	0.0	0
WGC	West Greenland	10	0.5	28
	Total Unreported Catch *	443	20.7	
	Total Reported Catch of North Atlantic salmon	1,695		

* No unreported catch estimate available for Canada and Russia in 2008.
Unreported catch estimates not provided for Spain & St. Pierre et Miquelon

Table 2.2.1.1 Production of farmed Atlantic salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980–2008.

Year	North Atlantic Area										Outside the North Atlantic Area							World-wide
	Norway	UK (Scot.)	Faroes	Canada	Ireland	USA	Iceland	UK (N.Ire.)	Russia	Total	Chile	West Coast USA	West Coast Canada	Australia	Turkey	Other	Total	Total
1980	4,153	598	0	11	21	0	0	0	0	4,783	0	0	0	0	0	0	0	4,783
1981	8,422	1,133	0	21	35	0	0	0	0	9,611	0	0	0	0	0	0	0	9,611
1982	10,266	2,152	70	38	100	0	0	0	0	12,626	0	0	0	0	0	0	0	12,626
1983	17,000	2,536	110	69	257	0	0	0	0	19,972	0	0	0	0	0	0	0	19,972
1984	22,300	3,912	120	227	385	0	0	0	0	26,944	0	0	0	0	0	0	0	26,944
1985	28,655	6,921	470	359	700	0	91	0	0	37,196	0	0	0	0	0	0	0	37,196
1986	45,675	10,337	1,370	672	1,215	0	123	0	0	59,392	0	0	0	20	0	0	0	59,392
1987	47,417	12,721	3,530	1,334	2,232	365	490	0	0	68,089	3	0	0	50	0	0	53	68,142
1988	80,371	17,951	3,300	3,542	4,700	455	1,053	0	0	111,372	174	0	0	250	0	0	424	111,796
1989	124,000	28,553	8,000	5,865	5,063	905	1,480	0	0	173,866	1,864	1,100	1,000	400	0	700	5,064	178,930
1990	165,000	32,351	13,000	7,810	5,983	2,086	2,800	<100	5	229,035	9,500	700	1,700	1,700	0	800	14,400	243,435
1991	155,000	40,593	15,000	9,395	9,483	4,560	2,680	100	0	236,811	14,991	2,000	3,500	2,700	0	1,400	24,591	261,402
1992	140,000	36,101	17,000	10,380	9,231	5,850	2,100	200	0	220,862	23,769	4,900	6,600	2,500	0	400	38,169	259,031
1993	170,000	48,691	16,000	11,115	12,366	6,755	2,348	<100	0	267,275	29,248	4,200	12,000	4,500	1,000	400	51,348	318,623
1994	204,686	64,066	14,789	12,441	11,616	6,130	2,588	<100	0	316,316	34,077	5,000	16,100	5,000	1,000	800	61,977	378,293
1995	261,522	70,060	9,000	12,550	11,811	10,020	2,880	259	0	378,102	41,093	5,000	16,000	6,000	1,000	0	69,093	447,195
1996	297,557	83,121	18,600	17,715	14,025	10,010	2,772	338	0	444,138	69,960	5,200	17,000	7,500	1,000	600	101,260	545,398
1997	332,581	99,197	22,205	19,354	14,025	13,222	2,554	225	0	503,363	87,700	6,000	28,751	9,000	1,000	900	133,351	636,714
1998	361,879	110,784	20,362	16,418	14,860	13,222	2,686	114	0	540,325	125,000	3,000	33,100	7,068	1,000	400	169,568	709,893
1999	425,154	126,686	37,000	23,370	18,000	12,246	2,900	234	0	645,590	150,000	5,000	38,800	9,195	0	500	203,495	849,085
2000	440,861	128,959	32,000	33,195	17,648	16,461	2,600	250	0	671,974	176,000	5,670	39,300	12,003	0	500	233,473	905,447
2001	436,103	138,519	46,014	37,606	23,312	13,202	2,645	250	0	697,651	200,000	5,443	58,000	13,815	0	500	277,758	975,409
2002	462,495	145,609	45,150	42,131	22,294	6,798	1,471	250	0	726,198	273,000	5,948	71,600	14,699	0	1,000	366,247	1,092,445
2003	509,544	176,596	52,526	39,760	16,347	6,007	3,710	250	298	805,038	261,000	5,935	55,600	13,324	0	1,000	336,859	1,141,897
2004	563,815	158,099	40,492	39,014	14,067	8,515	6,620	250	203	831,075	261,000	10,307	46,100	14,317	0	1,000	332,724	1,163,799
2005	586,512	129,588	18,962	44,090	13,764	5,263	6,300	250	179	804,908	385,000	6,110	53,800	16,827	0	1,000	462,737	1,267,645
2006	626,382	131,847	11,905	47,880	13,700	4,674	5,745	250	229	842,612	370,000	5,811	70,018	22,417	0	1,000	469,246	1,311,858
2007	723,000	129,930	22,305	45,936	9,923	2,715	1,158	250	280	935,497	371,809	7,117	73,600	23,982	0	1,000	452,279	1,399,543
2008	741,000	136,775	36,000	45,936	11,000	9,014	650	250	380	981,005	393,000	7,699	73,600	25,769	0	1,000	501,068	1,482,073
5-yr mean 2003-2007	601,851	145,212	29,238	43,336	13,560	5,435	4,707	250	238	843,826	329,762	7,056	59,824	18,173	0	1,000	410,769	1,256,948
% change on 5-year mean	+23	-6	+23	+6	-19	+66	-86	0	+60	+16	+19	+9	+23	+42		0	+22	+18

Notes: Data for 2008 are provisional for many countries.
Where production figures were not available for 2008, values as in 2007 were assumed.
West Coast USA = Washington State.
West Coast Canada = British Columbia.
Australia = Tasmania. This is mostly Atlantic salmon, but includes a small component of trout
Source of production figures for non-Atlantic areas: miscellaneous fishing publications & Government reports
'Other' includes South Korea & China.

Table 2.4.2.1 Summary of Atlantic salmon stomach samples collected from the West Greenland harvest in 2006 and 2007. Total number of samples is provided by year and according to collection date. The continent of origin and sex totals and percents with corresponding biological characteristics data are also provided (NA = North American origin and EUR = European origin).

	2006 (Sep 20–Sep 28)				2007 (Aug 09–Sep 05)			
	NA (60, 61%)		EUR (39, 39%)		NA (137, 93%)		EUR (11, 7%)	
	M	F	M	F	M	F	M	F
Number	9 (15%)	51 (85%)	10 (26%)	29 (74%)	13 (9%)	124 (91%)	4 (36%)	7 (64%)
1SW	100%	90%	100%	97%	100%	96%	75%	100%
Length (SD)	649.7 (25.0)	661.1 (39.9)	661.0 (38.2)	658.4 (32.7)	643.9 (25.2)	625.4 (38.2)	645.0 (18.2)	615.0 (24.6)
Weight (SD)	3.6 (0.4)	3.6 (0.9)	3.7 (0.7)	3.7 (0.6)	3.0 (0.5)	2.8 (0.7)	2.9 (0.4)	2.7 (0.3)

Table 2.4.2.2 Stomach composition of Atlantic salmon caught with gillnets in NAFO Divisions 1C and 1D from August 15 to November 4 in 1969 and 1970 (reported in Lear 1972; 1980) compared to Atlantic salmon caught in NAFO Division 1D in from August and September in 2006 and 2007.

Year	1969–1970	2006	2007
Month-Day	Aug 15–Nov4	Sep 20–Sep 28	Aug 09–Sep 05
NAFO Division	1C & 1D	1D	1D
Prey Items	Percent Composition (by weight)		
unidentified material	4.24	0.11	2.8
fish remains	5.35	6.34	1.47
unidentified invertebrates	0.14	0.06	
capelin	64.69	38.37	92.15
lancet	1.18	-	-
arctic cod	0.39	-	-
sandlance	14.55	0.81	0.46
daubed shanny	0.15	-	-
sculpin	0.01	-	0.35
polychaete	0.04	-	-
amphipod	7.35	53.84	2.76
euphausiids	1.9	0.05	-
squid	-	0.41	-
total	100	100	100

Table 2.5.1 Biological characteristics data set made available to SGBICEPS (Y denotes data available for all or part of the time-series).

Stock complex	Country	Stock	Hatchery/Wild	Time series	Latitude	Stock status	Median run date	Mean run date	River age mean	Sea age mean	Prop. Run by sea-age	Mean fork length	Mean whole weight	Prop. female by sea-age	Prop. maiden spawners by sea-age class
NAC	Canada	Western Arm Brook	W	1971-06	51.2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	Middle Brook	W	1975-05	48.8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	Conne River	W	1986-06	47.9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	Miramichi	W	1971-07	47.0	Y			Y	Y	Y	Y	Y	Y	Y
	Canada	Nashwaak	W	1972-07	46.0	Y	Y	Y	Y	Y	Y	Y		Y	Y
	Canada	St John (Mactaquac)	W	1978-07	45.3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	St John (Mactaquac)	H	1978-07	45.3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	La Have	W	1970-07	44.4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Canada	La Have	H	1972-07	44.4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	USA	Penobscot	H	1978-07	44.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N NEAC	Finland/Norway	Teno	W	1972-07	70.8	Y			Y	Y	Y	Y	Y	Y	
	Finland/Norway	Näätämöjoki	W	1975-06	69.7	Y			Y	Y	Y	Y	Y	Y	
	Russia	Tuloma	W	1983-08	68.9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Norway	Årgårdsvassdraget	W	1992-07	64.3	Y			Y	Y	Y	Y	Y		
	Norway	Gaula	W	1989-07	63.3	Y			Y	Y	Y	Y	Y		
	Iceland (N&E)	Laxa I Adaldalur	W	1974-07	65.6						Y		Y	Y	
	Iceland (N&E)	Hofsa	W	1971-07	65.4						Y		Y	Y	
S NEAC	Iceland (S&W)	Nordura	W	1968-07	64.6						Y		Y	Y	
	Iceland (S&W)	Ellidaar	W	1949-07	64.1						Y		Y	Y	
	UK (Scot)	N. Esk	W	1981-07	56.7						Y	Y	Y		
	UK (NI)	Bush	W	1973-07	55.1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	UK (E&W)	Lune	W	1987-07	54.0	Y			Y	Y	Y	Y	Y		
	UK (E&W)	Dee	W	1937-07	53.4	Y			Y	Y	Y	Y	Y	Y	
	UK (E&W)	Wye	W	1910-07	51.6	Y		Y	Y	Y	Y	Y	Y		
	UK (E&W)	Frome	W	1968-08	50.7	Y			Y		Y	Y			
	France	Bresle	W	1984-08	50.1					Y	Y	Y			

Table 2.5.2 Trends in biological characteristics over time: 'o' means not enough evidence at the 5% level to detect a trend. '+' is a positive trend (p>0.05), '-' is a negative trend (p<0.05).

Stock complex	Country	Stock	H/W	Time series	Latitude	Stock status	Median run date	Mean run date	Mean rver age	Mean sea age	Prop. 1SW in run	Prop. 2SW in run	Prop. PS in run	1SW length	1SW weight	1SW condition	2SW length	2SW weight	2SW condition	PS length	PS weight	PS condition	Prop. female in 1SW	Prop. female in 2SW	Prop. female in PS	Prop. maiden spawners - 1SW	Prop. maiden spawners - 2SW
NAC	Canada	Western Arm Brook	W	1984-06	51.2	+	-	o	-	+	o	o	o	+	+	+	-	o	o	+	+	o	o	o		o	o
	Canada	Middle Brook	W	1984-05	48.8	o	o	o	o	o	o	o	o	+	+	o				+	+	o	-			o	o
	Canada	Conne River	W	1984-06	47.9	-	o	o	o	+	-	o	+	+	+	o	o			o	o	o	o	o		-	+
	Canada	Miramichi	W	1984-07	47.0	-			-	+	o	o	+	+	o	-	+	o	o	+	+	o	-	+	+	o	o
	Canada	Nashwaak	W	1984-07	46.0	-	o	o	-	-	+	-		o			+						o	o		+	-
	Canada	St John (Mactaquac)	W	1984-07	45.3	-	-	-	-	o	+	o		o	o	o	o	-	-				o	o		o	-
	Canada	St John (Mactaquac)	H	1984-07	45.3	-	-	-	-	-	+	-		o	o	o	-	-	-				o	o		+	-
	Canada	La Have	W	1984-07	44.4	o	-	o	+	o	o	o	o	o	+	+	o	+	+	o	+		o	+	+	o	o
	Canada	La Have	H	1984-07	44.4	o	o	o	-	o	o	+	o	o	+	+	o	+	+	o	+		o	+	o	o	o
	USA	Penobscot	H	1984-07	44.5	-	-	-	o	-	+	o	o	o	+	+	o	o	+	o	o	o	-	o	o	+	o
N NEAC	Finland/Norway	Teno	W	1984-07	70.8	o			+	-	o	o	+	o	o	+	o	o	o	o	o	o	o	o	-		
	Finland/Norway	Näätämöjoki	W	1984-06	69.7	o			+	-	+	o	o	+	o	o	o	o	o	o	o	o	o	-	o		
	Russia	Tuloma	W	1984-08	68.9	o	o	+	-	-	o	o	o	o	o	o	-	-	o	o	o	o	o	o	o	+	o
	Norway	Årgårdsvassdraget	W	1992-07	64.3	o			o	+	o	+	o	o	o	o	o	o	o	o	o	o					
	Norway	Gaula	W	1989-07	63.3	o			-	+	o	o	+	o	o	o	o	o	o	o	o	o					
	Iceland (N&E)	Laxa I Adaldalur	W	1984-07	65.6						+												o	-			
	Iceland (N&E)	Hofsa	W	1984-07	65.4						+												o	+			
S NEAC	Iceland (S&W)	Nordura	W	1984-07	64.6						+												o	+			
	Iceland (S&W)	Ellidaar	W	1984-07	64.1						+												+	o			
	UK (Scot)	N. Esk	W	1984-07	56.7						o	o		-	-	-	o	-	o								
	UK (NI)	Bush	W	1984-07	55.1	-	+	o	o	o	+	-	o	o	o	o	o	-	-	o	o	o	o	o	o	+	-
	UK (E&W)	Lune	W	1987-07	54.0	o			o	o	o	o		o	o	o	o	-	o								
	UK (E&W)	Dee	W	1984-07	53.4	-			-	-	+	-	o	o	+	+	+	+	+	-	-	-	-	+	o		
	UK (E&W)	Wye	W	1984-07	51.6	o		+	-	-	+	+	-	+	+	o	o	o	o	-	-	o					
	UK (E&W)	Frome	W	1984-08	50.7	-			-					-			+										
	France	Bresle	W	1984-08	50.1					o	o	o	o	o			o										

Table 2.5.3 Results of meta analysis at the stock complex level - indicating significant increase (+) or decrease (-) relative to the mean (o denotes non-significant relationship).

Stock complex	H/W	Time series	Latitude	Stock size - 1SW	Stock size - 2SW	Mean river age	Mean sea age	Mean total age	Median run date	Mean run date	Prop. 1SW in run	Prop. 2SW in run	Prop. PS in run	Mean length - 1SW	Mean weight - 1SW	Condition - 1SW	Mean length - 2SW	Mean weight - 2SW	Condition - 2SW	Mean length - PS	Mean weight - PS	Condition - PS	Prop. female in 1SW	Prop. female in 2SW	Prop. female in PS	Prop. maiden spawners - 1SW	Prop. maiden spawners - 2SW
NAC (N)	W	1984-07	47.0 - 51.2	o	+	-	+	o	-	-	o	o	+	+	+	o	o	o	o	+	+	o	o	o	+	o	o
NAC (S)	H/W	1984-07	44.4 - 46.0	-	-	o	o	-	o	-	o	o	o	o	o	o	o	o	o	o	o		o	+	o	o	o
N NEAC	W	1984-07	65.4 - 70.8	+	o	o	o	o			+	+	o	o	o	o	-	-	o	o	o	o	o	o	-		
S NEAC	W	1984-07	50.1 - 64.6	o	o	-	-	-		+	+	o	-	o	o	o	o	o	o	-	-	o	o	+	+		

Table 2.6.1. Summary of C&R experiments on Atlantic salmon that provide mortality rates and details of the methods used. (NS – Nova Scotia; NB - New Brunswick; NL – Newfoundland; ON – Ontario).

Author	Purpose	Method	Origin	Location	Life stage	Telemetry	Method	Numbers of fish	Study Period	Mortality Rate in %	Water Temperature
Tufts et al. 1991	Pysiology	Hatchery	Wild	LaHave R, NS	Small		Chased	6	24 hours	0	18
Booth et al. 1995	Pysiology	In-river	Wild	Miramichi R, NB	Large		Hooked	20	24 hours	0	6 ± 1
Brobbel et al. 1996	Pysiology	In-river	Wild	Miramichi R, NB	Small		Hooked	24	12 hours	0	4 ± 1
Brobbel et al. 1996	Pysiology	In-river	Wild	Miramichi R, NB	Small		Hooked	25	12 hours	12	16 ± 1
Wilkie et al. 1996	Pysiology	In-river	Wild	Miramichi R, NB	Small		Hooked	10	12 hours	40	22
Anderson et al.1998	Pysiology	Hatchery	Wild	Exploits R, NL	Small		Hooked	5	72 hours	80	20 ± 2
Anderson et al.1998	Pysiology	Hatchery	Wild	Exploits R, NL	Small		Hooked	5	72 hours	0	16.5 ± 1
Anderson et al.1998	Pysiology	Hatchery	Hatchery	Alma, ON	Small		Hooked	6	72 hours	0	8 ± 1
Wilkie et al. 1997	Pysiology	Hatchery	Hatchery	Margaree R, NS	Small		Chased	10	72 hours	0	12
Wilkie et al. 1997	Pysiology	Hatchery	Hatchery	Margaree R, NS	Small		Chased	10	72 hours	0	18
Wilkie et al. 1997	Pysiology	Hatchery	Hatchery	Margaree R, NS	Small		Chased	10	72 hours	30	23
Dempson et al. 2002	Mortality	Natural	Wild	Conne R, NL	Small		Angled	8	14-40 days	0	12.2 ± 1.7
Dempson et al. 2002	Mortality	Natural	Wild	Conne R, NL	Small		Angled	20	14-40 days	10	16.1 ± 1.4
Dempson et al. 2002	Mortality	Natural	Wild	Conne R, NL	Small		Angled	21	14-40 days	9.5	19.4 ± 1.3
Thorstad et al. 2003	Mortality	Natural	Wild	Alta R, Norway	Small&large	Telemetry	Angled	30	Up to spawning	3	12.2 ± 2.2
Mäkinen et al. 2000	Migration	Natural	Wild	R. Teno, Finland	Small	Telemetry	Angled	5	Unknown	0	9.4 ± 1.0
Whoriskey et al. 2000	Mortality	Natural	Wild	R. Ponoi, Russia	Small&large	Telemetry	Angled	62	24 hours	2	Not listed
Webb 1998	Mortality	Natural	Wild	R. Dee, Scotland	Small&large	Telemetry	Angled	25	Up to spawning	4	Not listed
Grant 1980	Stocking	Hatchery	Wild	R. Grimsa&Adaldal, Iceland	Large		Angled	30	Up to spawning	4	Not listed
Gowan 2004	Mortality	Natural	Wild	River Eden, Cumbria, UK	Small&large	Telemetry	Angled	208	Up to spawning	7-37	5-18, 11.9 ± 3
Svenning 2007	Migration	Natural	Wild	Målselva, Norway	Small&large	Telemetry	Angled	37	Up to spawning	0	12
Thorstad et al. 2007	Mortality	Natural	Wild	Alta R, Norway	Large	Telemetry	Angled	18	Up to spawning	6	12-14
Thorstad et al. 2003b	Migration	Natural	Wild	Orkla R, Norway	Small&large	Telemetry	Angled	34	Up to spawning	0	11.5-15
Davidson et al. 1994	Egg survival	Laboratory	Wild	Miramichi R, NB	Small&large		Hooked	26	Up to spawning	0	5-6
Warner & Johnson 1998	Mortality	Natural	Landlocked	Moosehead lake, Maine	Small		Angled	175	minimum 2 days	22	16.5
Warner 1976	Mortality	Laboratory	Landlocked	Cobb fish cultural station, Maine	Small		Angled	1200	minimum 9 days	3	12.5
Warner 1979	Mortality	Laboratory	Landlocked	Casco cultural fish station, Maine	Small		Angled	1221	3-5 days	5	13-15

Table 2.6.2 Information relating to multiple recaptures of salmon after C&R.

Location	Study	Method	N	Percent recaptured once	Percent recaptured twice	Percent recapture of released a second time	Estimate of exploitation rate in river (percent)
Ponoi River, Russia	Whoriskey et al 2000	Floy tags	2520	11	0.5		10-19
Ponoi River, Russia	Whoriskey et al 2000	Telmetry	Unknown	7.2			10-19
Alta River, Norway	Thorstad et al. 2003a	Ancor T-tags	353	4	0.3		50-70
Aberdeeshire Dee, Scotland	Webb 1998 and references therein	Unknown	Unknown	5-20			Unknown
Hofsa, Iceland	Gudbergsson & Einarsson 2009	Floy tags or Dart tags	592	23.5	1.7	14.3	Unknown
Sela, Iceland	Gudbergsson & Einarsson 2009	Floy tags or Dart tags	605	24.6	2.3	22.2	75-80
Grimsa, Iceland	Gudbergsson & Einarsson 2009	Floy tags or Dart tags	234	17.9	0	0	Unknown
Haffjardara, Iceland	Gudbergsson & Einarsson 2009	Floy tags or Dart tags	379	14.8	0.3	6.7	Unknown

Table 2.7.1.1 Summary of Atlantic salmon tagged and marked in 2008-'Hatchery' and 'Wild' refer to smolts and parr; 'Adults' relates to both wild and hatchery-origin fish.

		Primary Tag or Mark				
Country	Origin	Microtag	External mark	Adipose clip	Pit tag[1]	Total
Canada	Hatchery	0	9,705	784,004	35	793,744
	Wild	9,804	22,610	23,521	137	56,072
	Adult	0	2,693	3,256	57	6,006
	Total	9,804	35,008	810,781	229	855,822
France	Hatchery			448,700		448,700
	Wild		1,504	1,317	483	3,304
	Adult		606			606
	Total	0	2,110	450,017	483	452,610
Germany	Hatchery	35,103		6,000	0	41,103
	Wild			0	0	0
	Adult			0	0	0
	Total	35,103	0	6,000	0	41,103
Iceland	Hatchery	44,175	0	0	0	44,175
	Wild	1,886	0	0	0	1,886
	Adult	0	4,694	0	0	4,694
	Total	46,061	4,694	0	0	50,755
Ireland	Hatchery	287,945	0	0	0	287,945
	Wild	9,580	0	0	0	9,580
	Adult	0	0	0	0	0
	Total	297,525	0	0	0	297,525
Norway	Hatchery	60,414	59,826	0	0	120,240
	Wild		1,076	0	0	1,076
	Adult		1,306	0	0	1,306
	Total	60,414	62,208	0	0	122,622
Russia	Hatchery	0	0	1,145,420	0	1,145,420
	Wild	0	0	0	0	0
	Adult	0	2,602	0	0	2,602
	Total	0	2,602	1,145,420	0	1,148,022
Spain	Hatchery	311,967	0	329,465	0	641,432
	Wild	0	0	0	0	0
	Adult	0	0	0	0	0
	Total	311,967	0	329,465	0	641,432
Sweden	Hatchery	0	3,000	149,916	0	152,916
	Wild	0	448	0	0	448
	Adult	0	0	0	0	0
	Total	0	3,448	149,916	0	153,364
UK (England & Wales)	Hatchery	30,463	0	110,032	0	140,495
	Wild	11,353	0	15,564	0	26,917
	Adult	0	758	0	0	758
	Total	41,816	758	125,596	0	168,170
UK (N. Ireland)	Hatchery	17,177	0	28,690	0	45,867
	Wild	1,410	0	0	0	1,410
	Adult	0	0	0	0	0
	Total	18,587	0	28,690	0	47,277
UK (Scotland)	Hatchery	51,810	0	0	0	51,810
	Wild	6,975	3,426	0	3,479	13,880
	Adult		726	0	0	726
	Total	58,785	4,152	0	3,479	66,416
USA	Hatchery	0	0	463,479	842	464,321
	Wild	0	0	0	46	46
	Adult	0	2,372	0	1,643	4,015
	Total	0	2,372	463,479	2,531	468,382
All Countries	Hatchery	839,054	72,531	3,465,706	877	4,378,168
	Wild	76,111	29,064	46,402	4,145	155,722
	Adult	0	15,757	3,256	1,700	20,713
	Total	915,165	117,352	3,515,364	6,722	4,554,603

[1] Includes pit tags or other internal tags

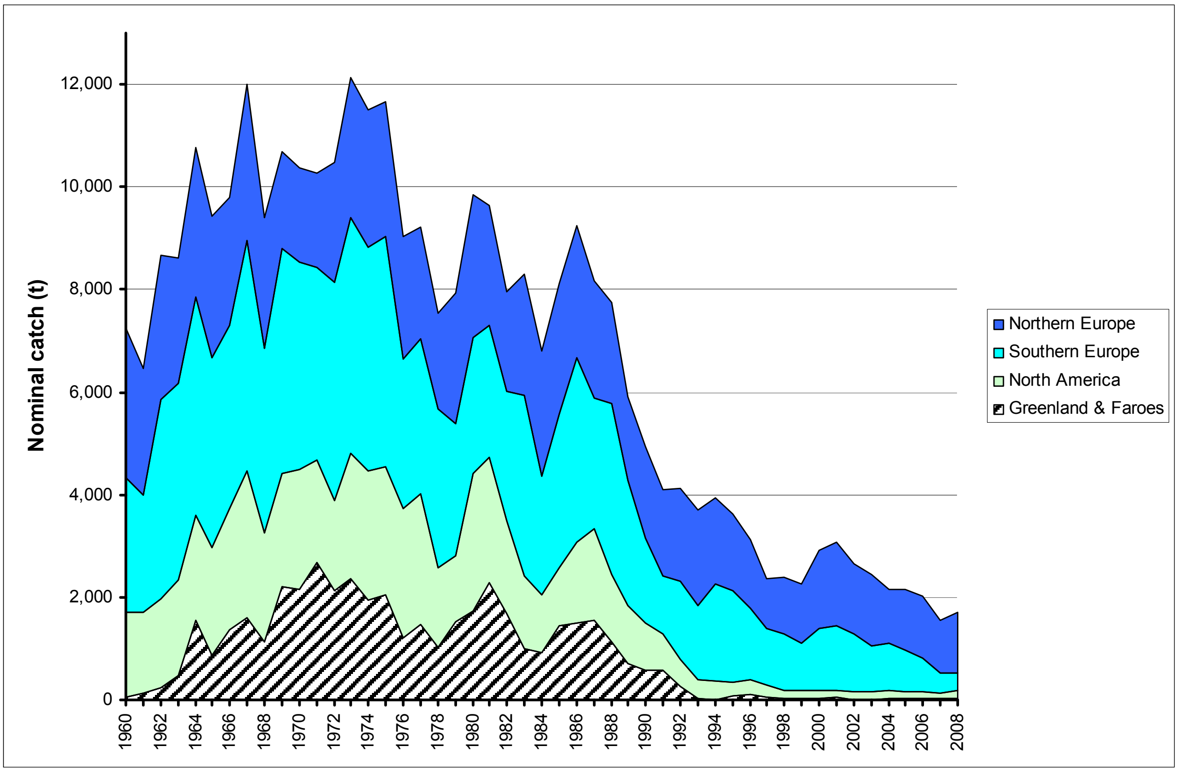


Figure 2.1.1.1 Reported total nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2008.

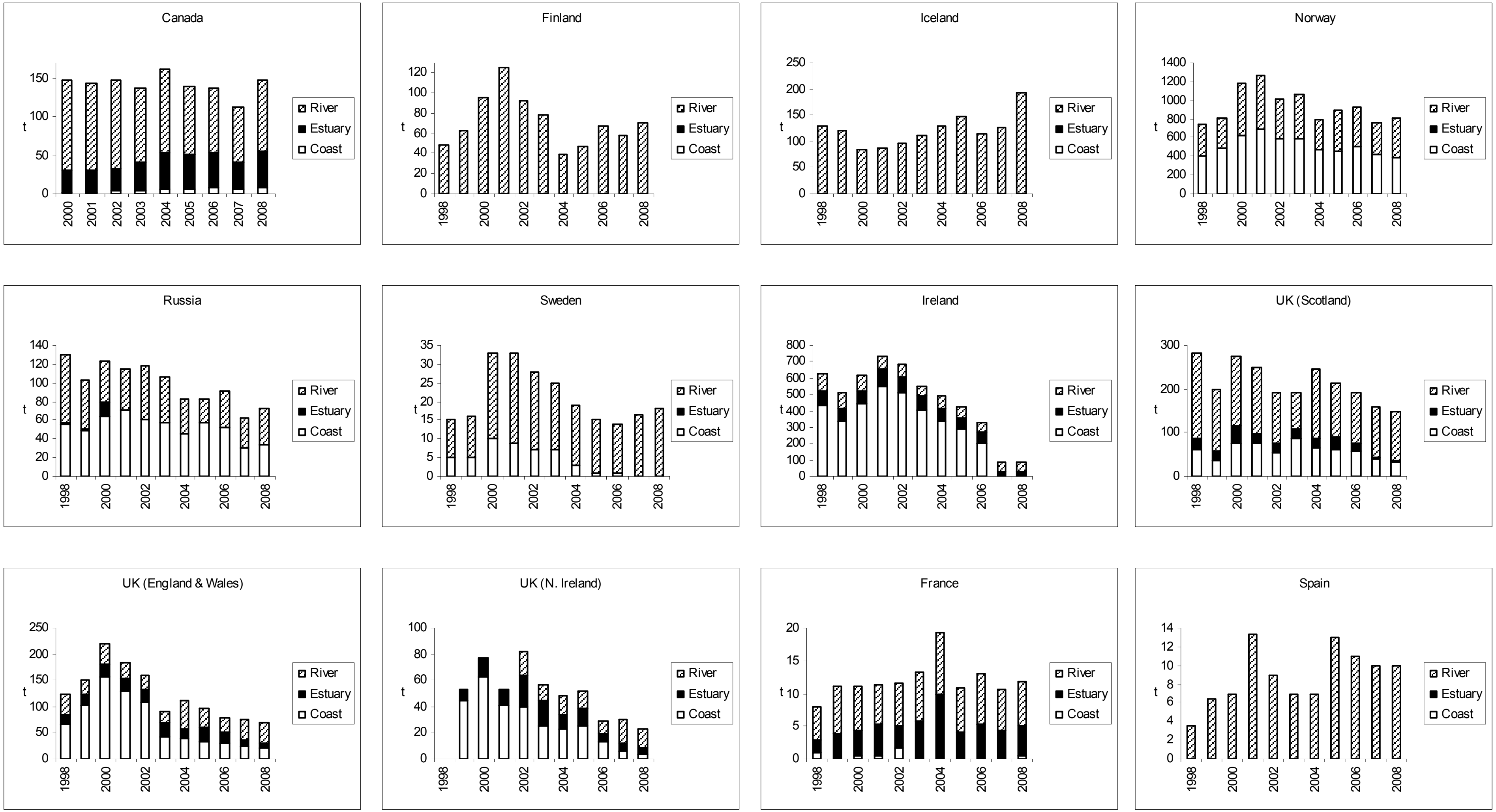


Figure 2.1.1.2 Nominal catch (tonnes) taken in coastal, estuarine and riverine fisheries by country. Note that time series and y-axes vary.

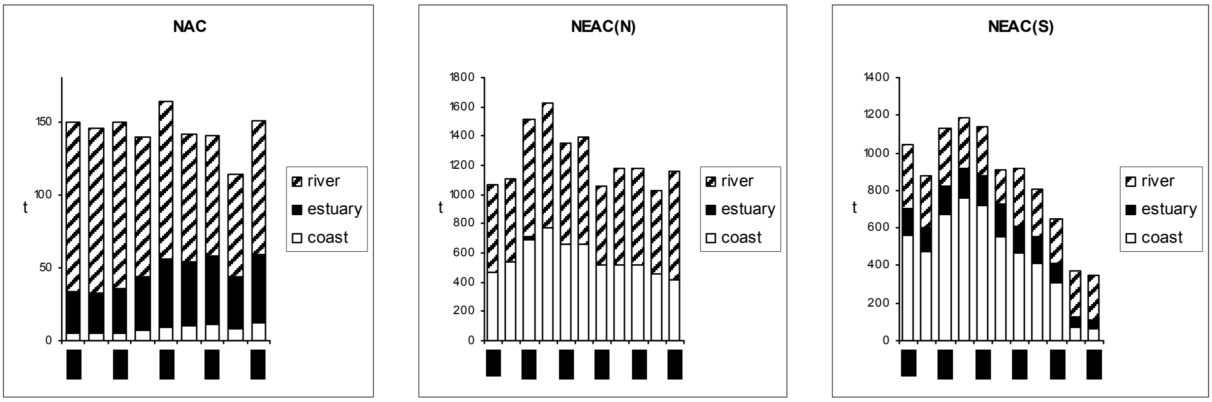


Figure 2.1.1.3 Nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area, and for the NEAC northern and southern areas. Note that time series and y-axes vary.

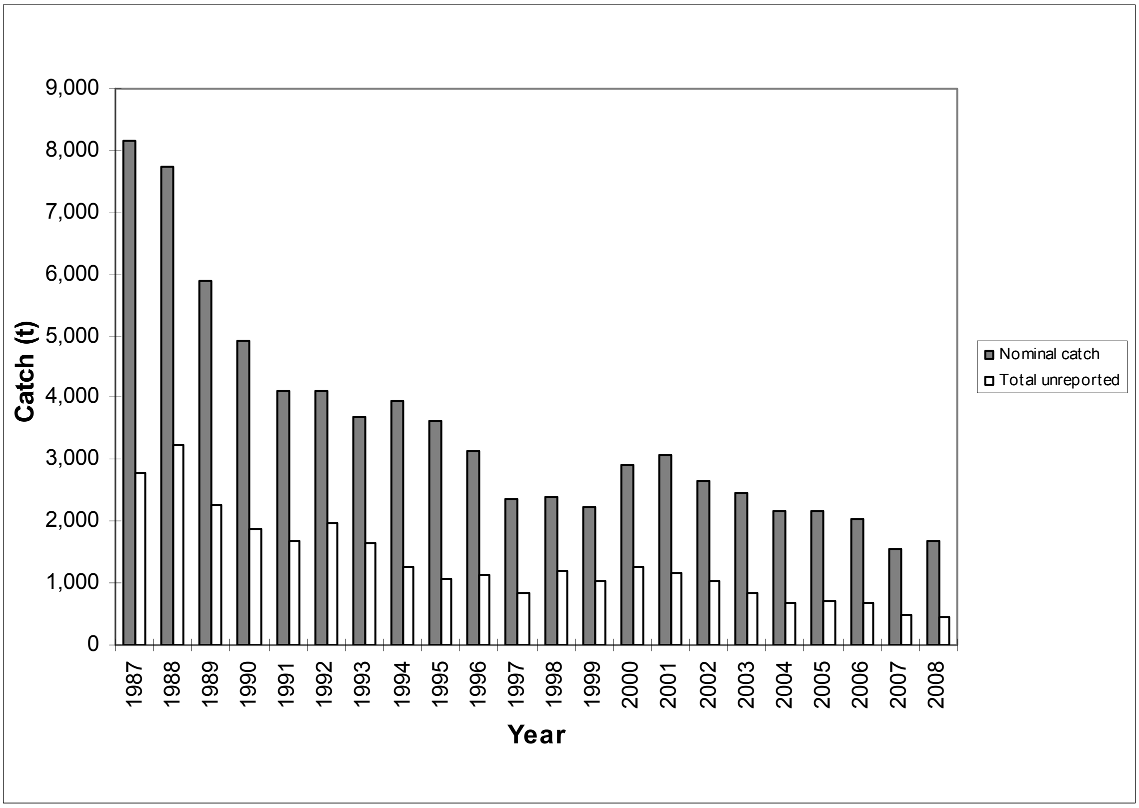


Figure 2.1.3.1 Nominal North Atlantic salmon catch and unreported catch in NASCO areas, 1987–2008.

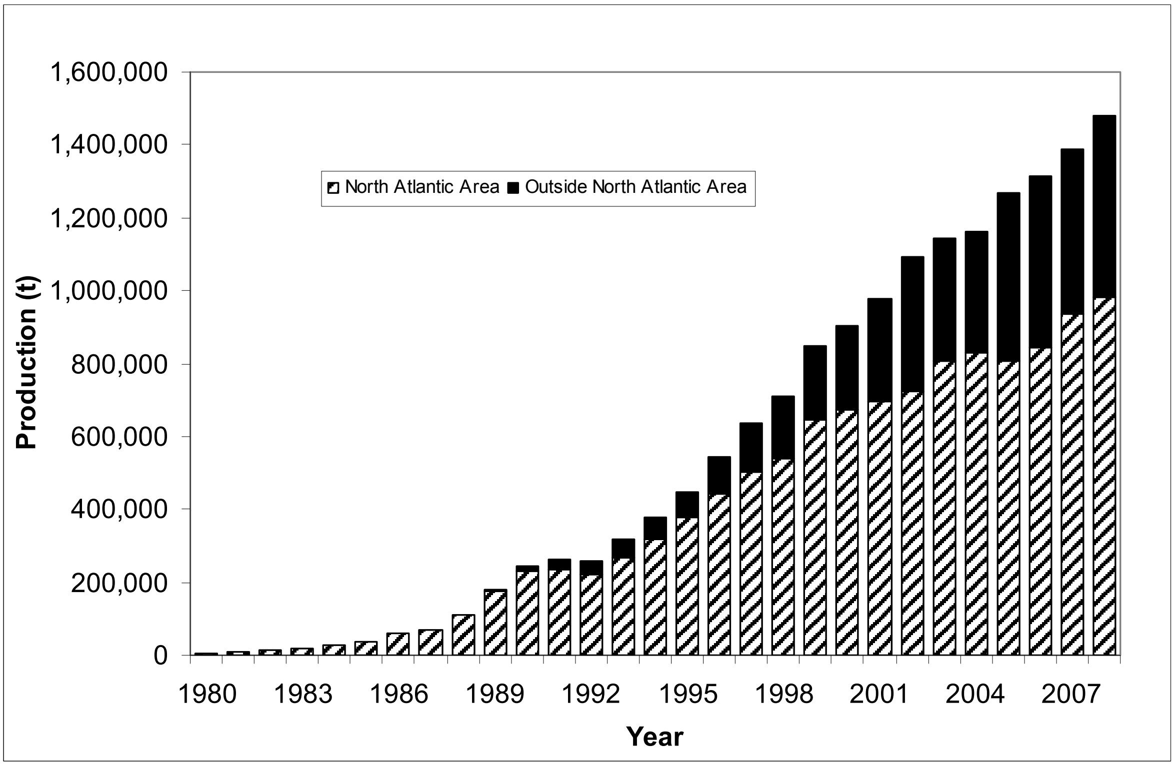


Figure 2.2.1.1 World-wide production of farmed Atlantic salmon, 1980–2008.

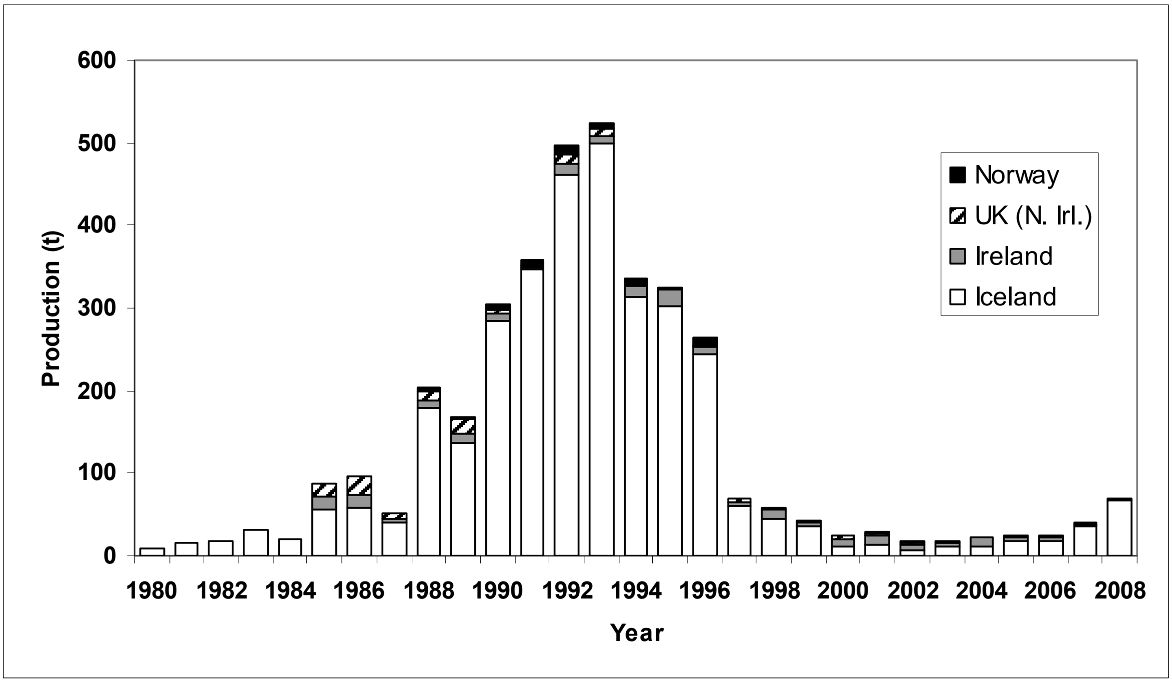


Figure 2.2.2.1 Production of ranched Atlantic salmon (tonnes round fresh weight) in the North Atlantic, 1980–2008.

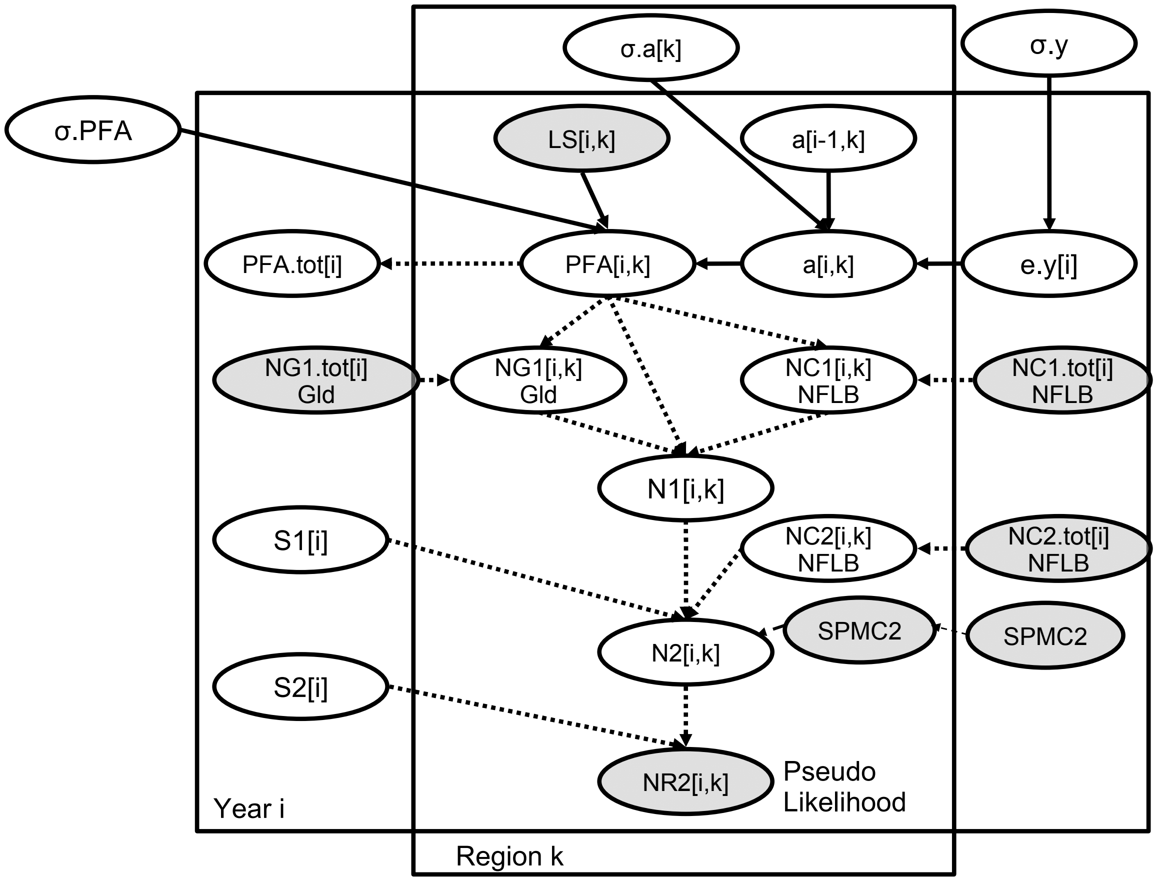


Figure 2.3.1.1 Directed Acyclical Graph (DAG) of the proposed structure of the region disaggregated forecast model for 2SW salmon of North American origin. Ellipses in grey are observations (or pseudo-observations) derived from sampling programs or from sub-models (run-reconstruction).

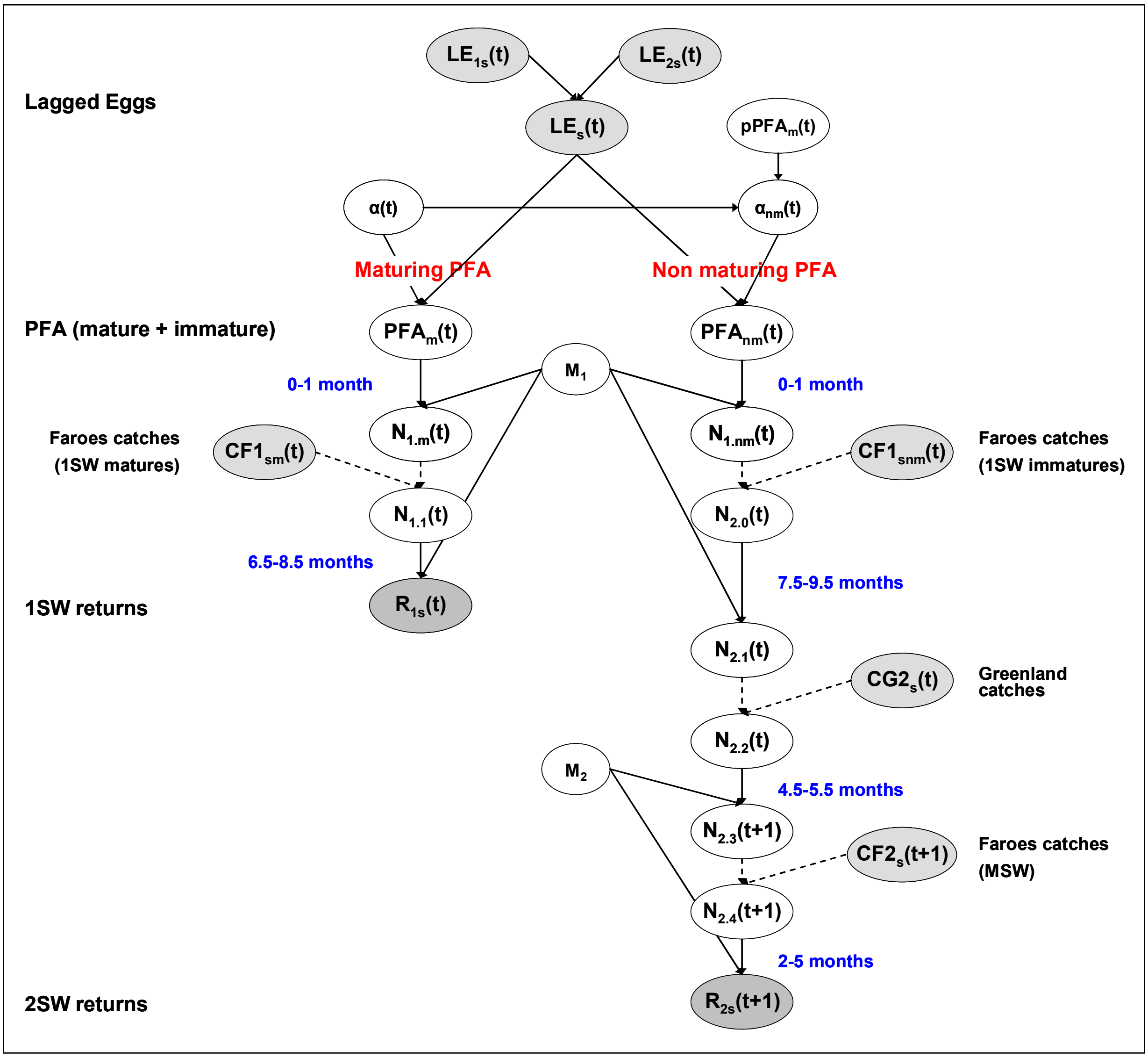


Figure 2.3.2.1 Directed Acyclical Graph (DAG) of the proposed structure of the combined sea age model for the southern NEAC and northern NEAC forecast models. Ellipses in grey are observations (or pseudo-observations) derived from sampling programs or from sub-models (run-reconstruction).

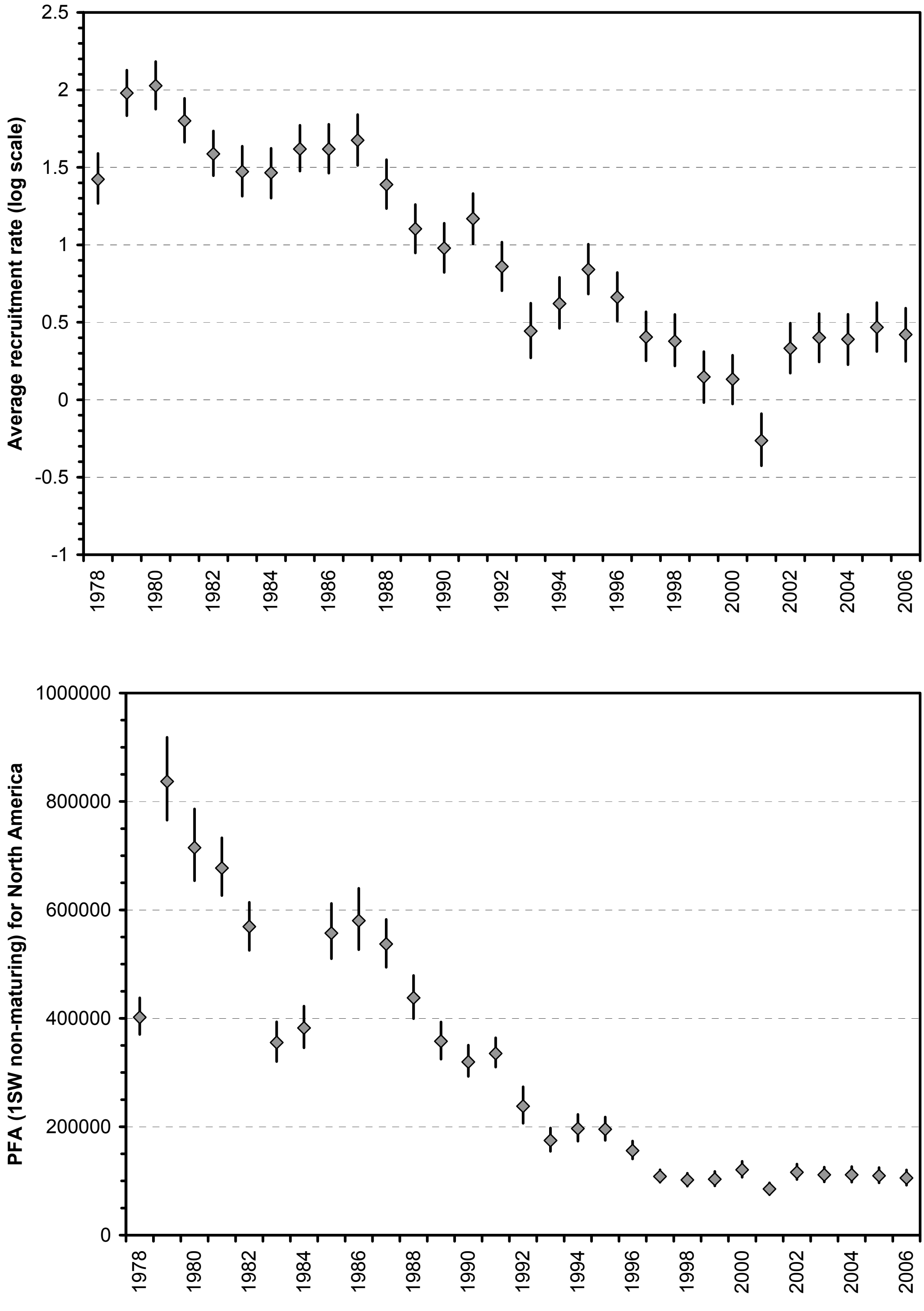
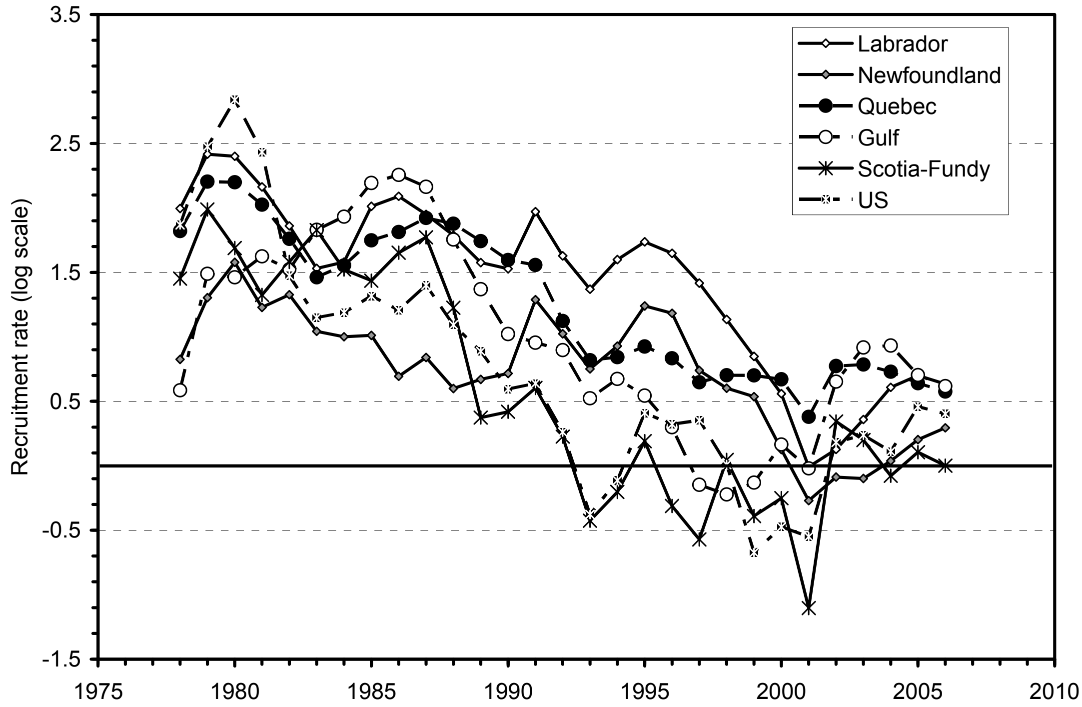


Figure 2.3.3.1 Average recruitment rate (log scale) (upper panel) and posterior distributions of PFA for North America (lower panel) based on the region-specific random walk model, for lagged eggs and PFA years 1978 to 2006. Diamond symbols are the medians and the vertical lines are the 95% Bayesian credible intervals of the posterior distributions.



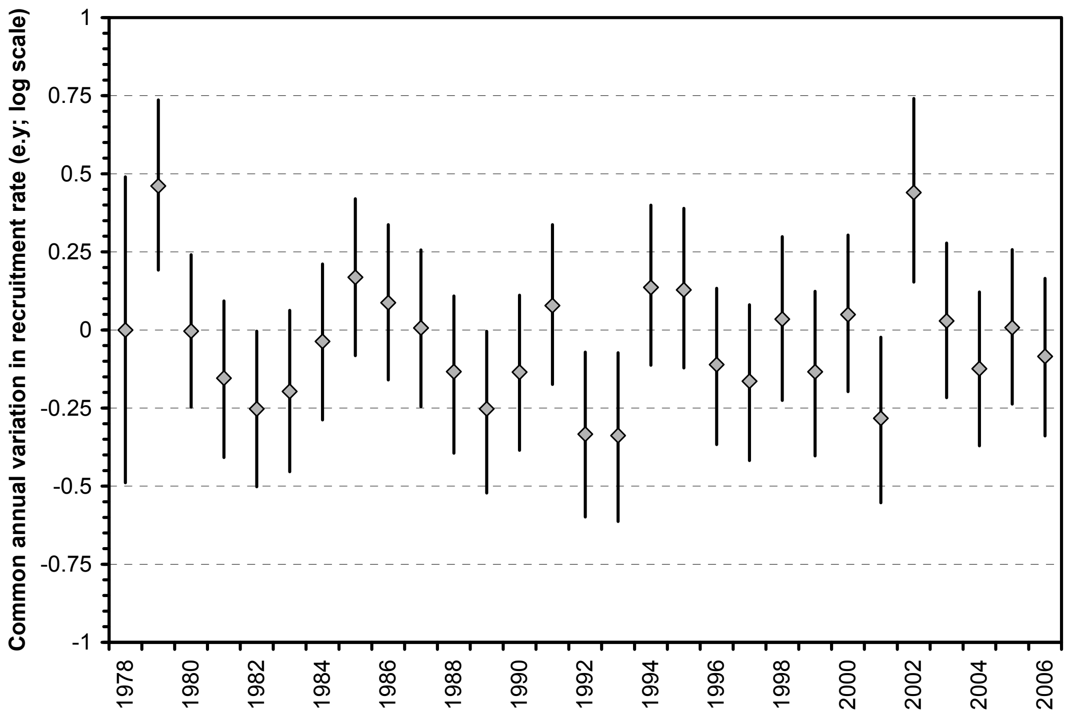
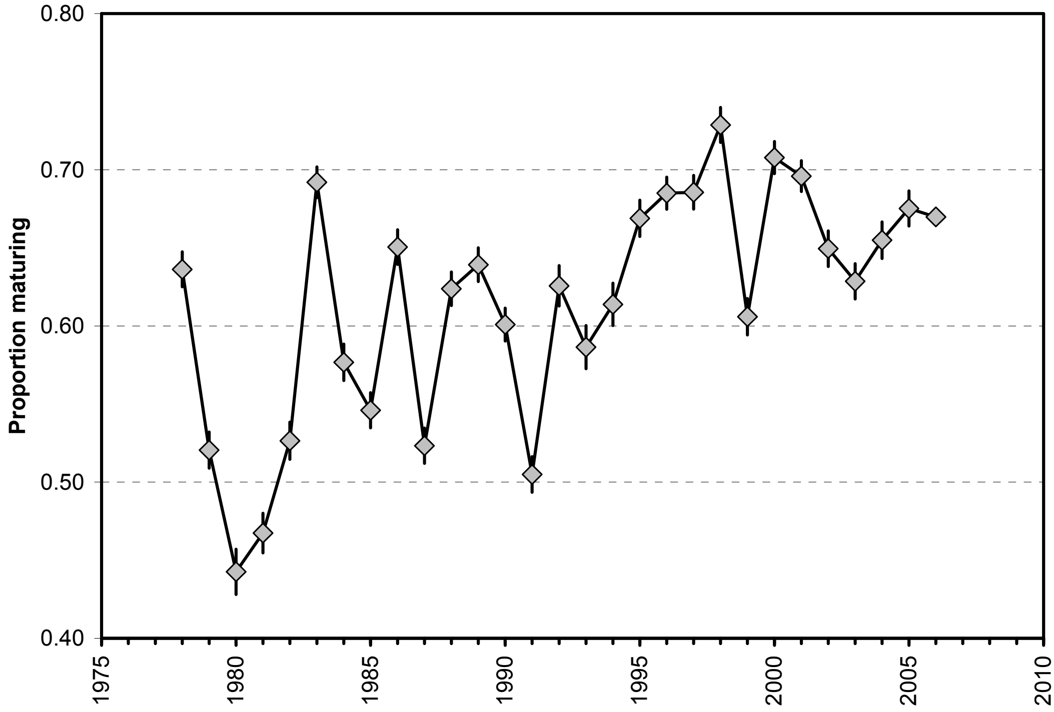


Figure 2.3.3.2 Point estimates of the region-specific recruitment rate (log scale) (upper panel) and posterior distributions of the regionally common annual variation (e.y; log scale; lower panel) based on the region-specific random walk model, for lagged eggs and PFA years 1978 to 2006. In the lower panel, diamond symbols are the medians and the vertical lines are the 95% Bayesian credible intervals of the posterior distributions.



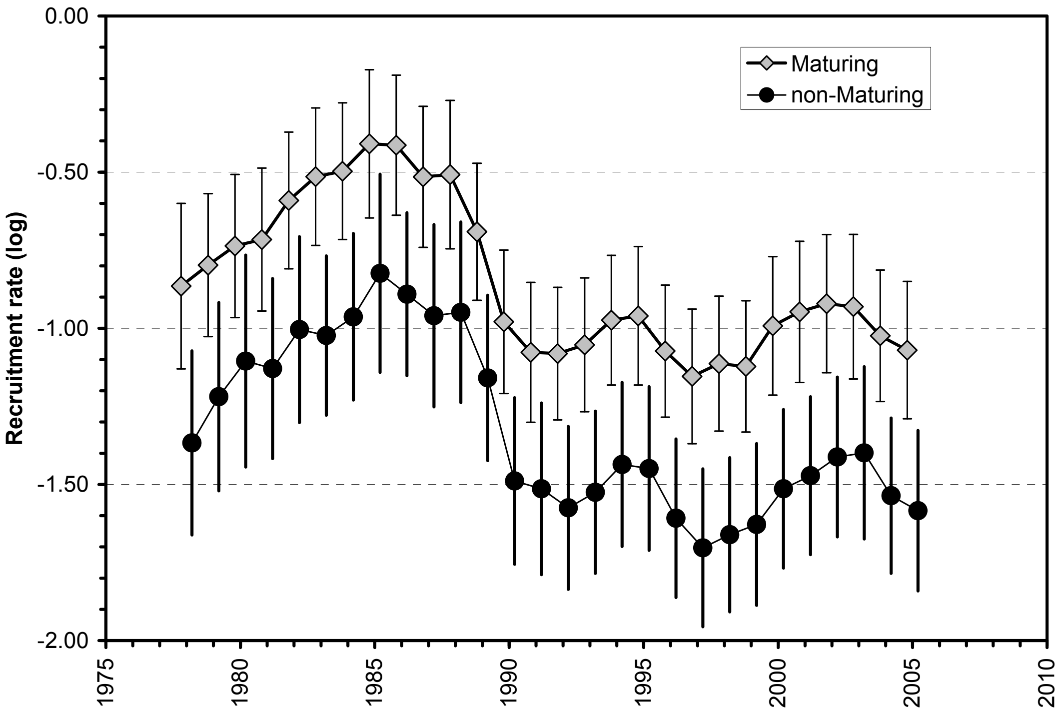


Figure 2.3.3.3 Median values (and 95% Bayesian credible interval range) of the posterior distributions of the proportion of the PFA maturing at 1SW salmon (upper panel) and of the recruitment rate parameter estimates for the maturing component and the non-maturing component (lower panel) for the southern NEAC stock complex.

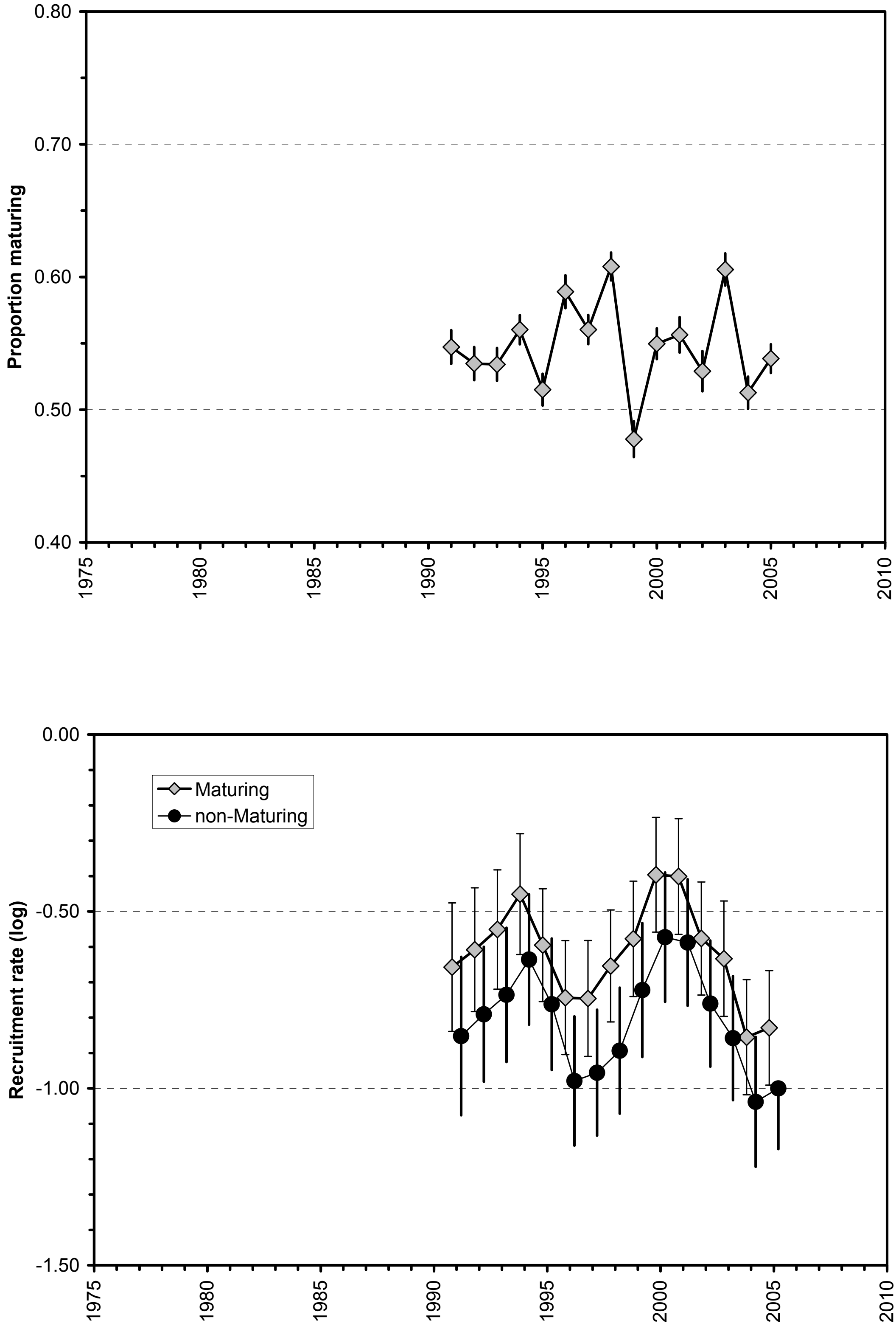


Figure 2.3.3.4 Median values (and 95% Bayesian credible interval range) of the posterior distributions of the proportion of the PFA maturing at 1SW salmon (upper panel) and of the recruitment rate parameter estimates for the maturing component and the non-maturing component (lower panel) for the northern NEAC stock complex.

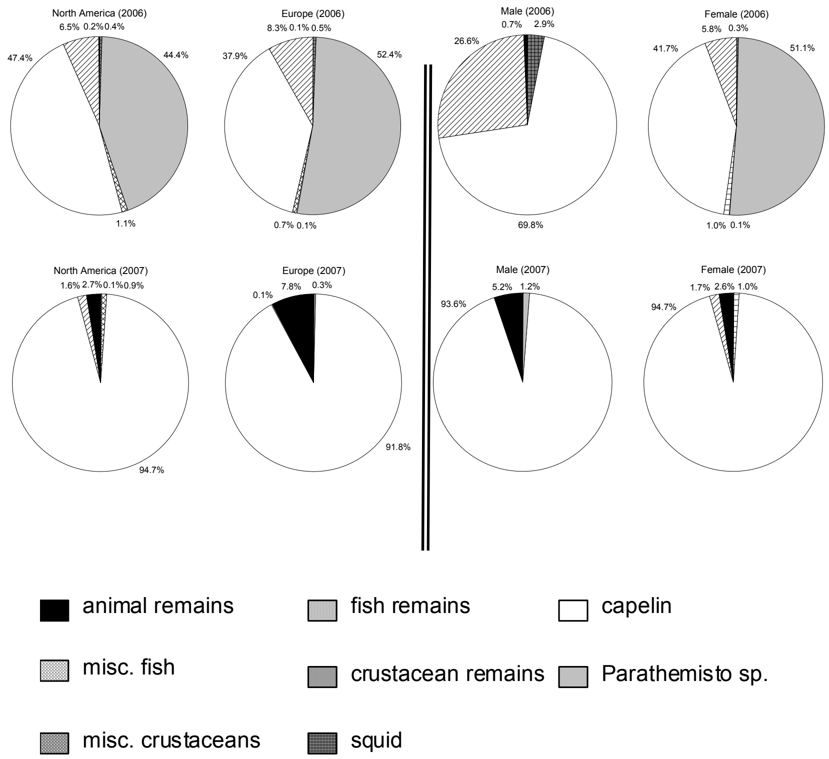
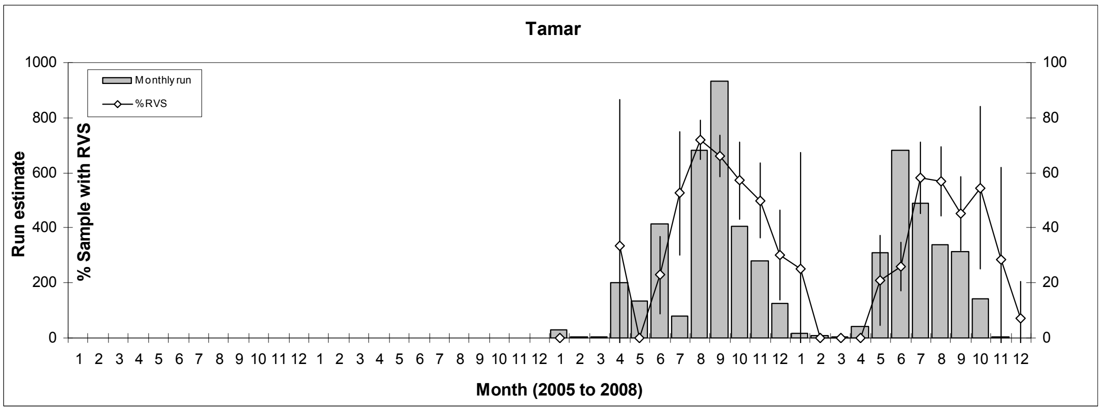
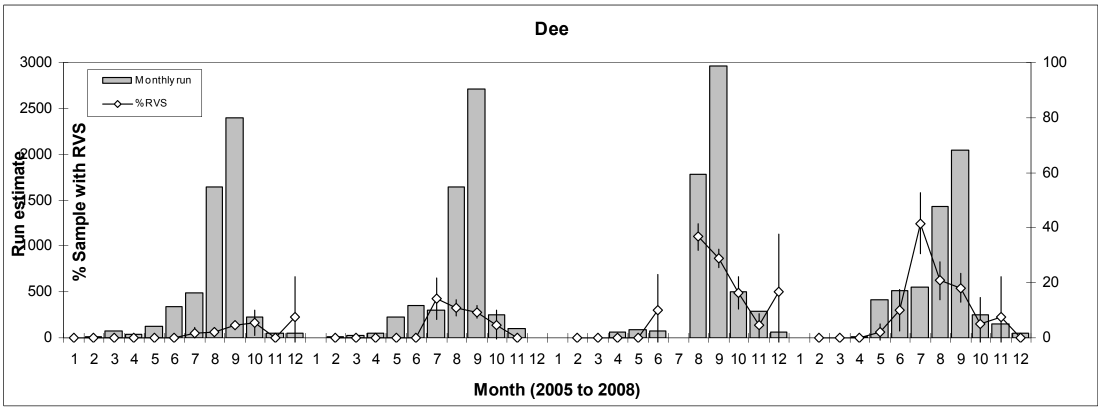


Figure 2.4.2.1 Dietary composition of North American versus European (left) and male versus female (right) Atlantic salmon collected from Nuuk, Greenland in 2006 and 2007. Miscellaneous fish include sculpin and sandlance. Miscellaneous crustaceans include hyperiids, gammarids and euphausiids.





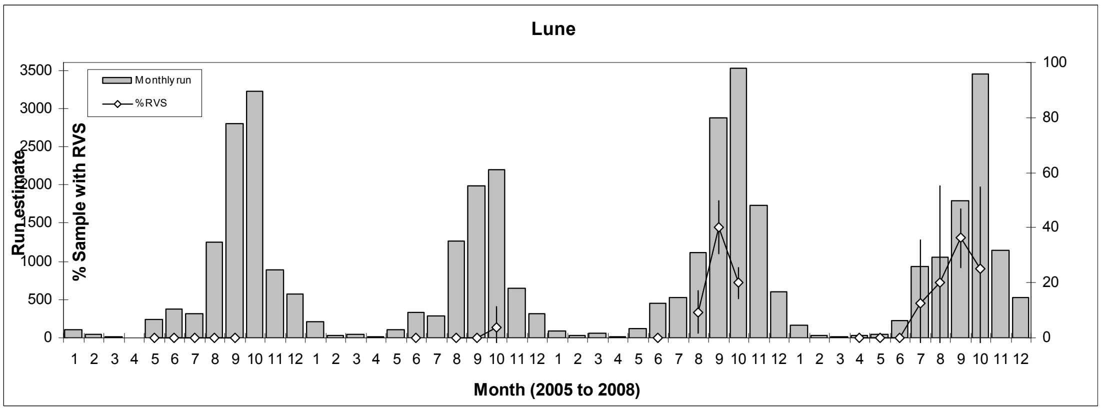


Figure 2.4.3.1. Seasonal variation in the incidence of salmon with symptoms of red vent syndrome (RVS) on the Rivers Tamar, Dee and Lune, UK (England & Wales), 2005-2008 (error bars indicate approximate 95% confidence limits).

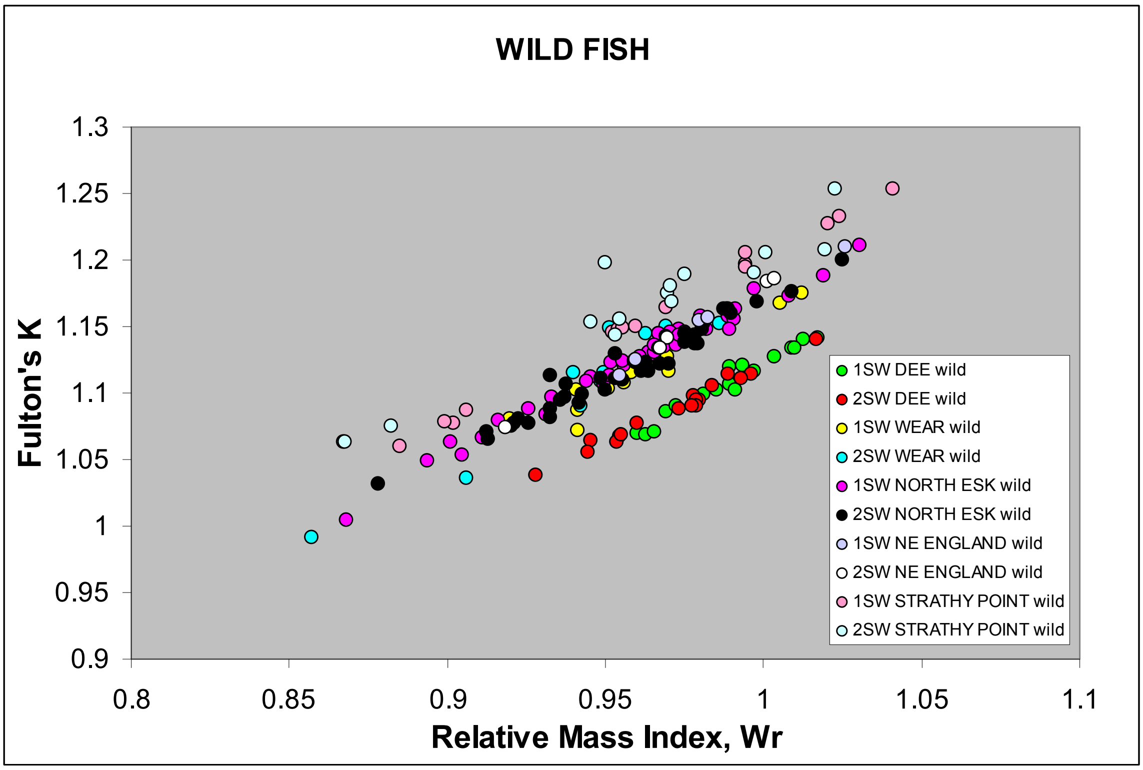


Figure 2.5.1 Scatterplots comparing Fulton's condition Factor with the relative mass index of wild 1SW and 2SW salmon captured in coastal or estuarine net fisheries in UK(Scotland) and UK(England & Wales). The exception is the River Dee (Wales), the data for which include a small proportion of hatchery-reared fish and for which all captures are from the head-of-tide trap.

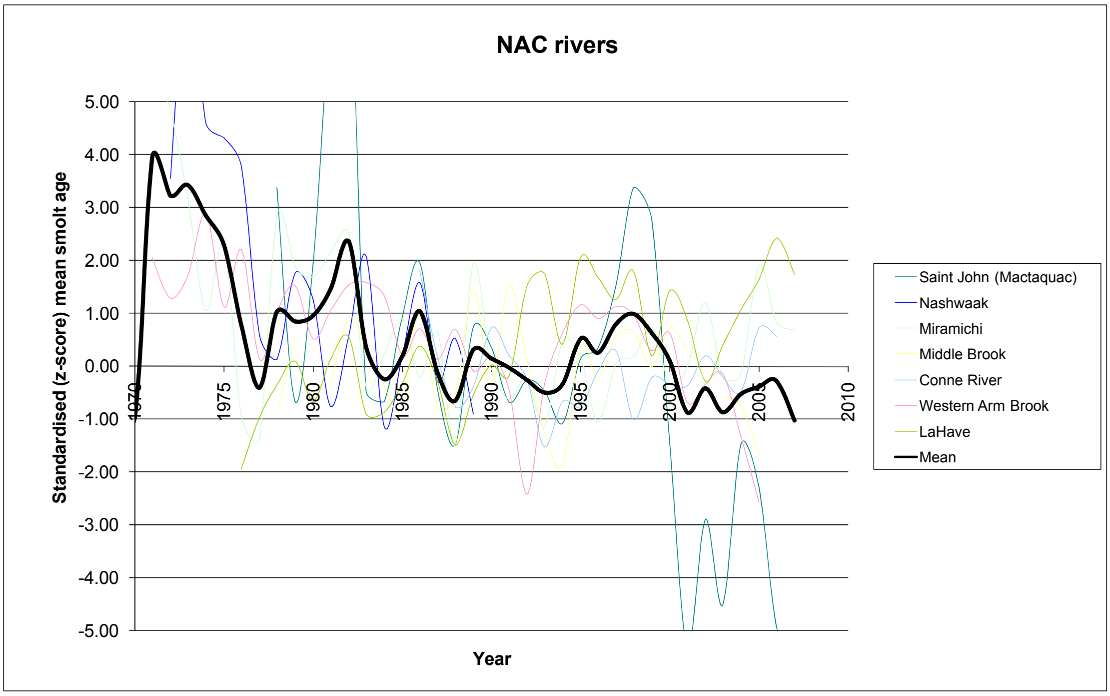


Figure 2.5.2. Standardised mean (z-score) smolt ages for available data sets from NAC rivers. Data back calculated from returning adult salmon and standardised in relation to the mean smolt age between 1984 and 1993.

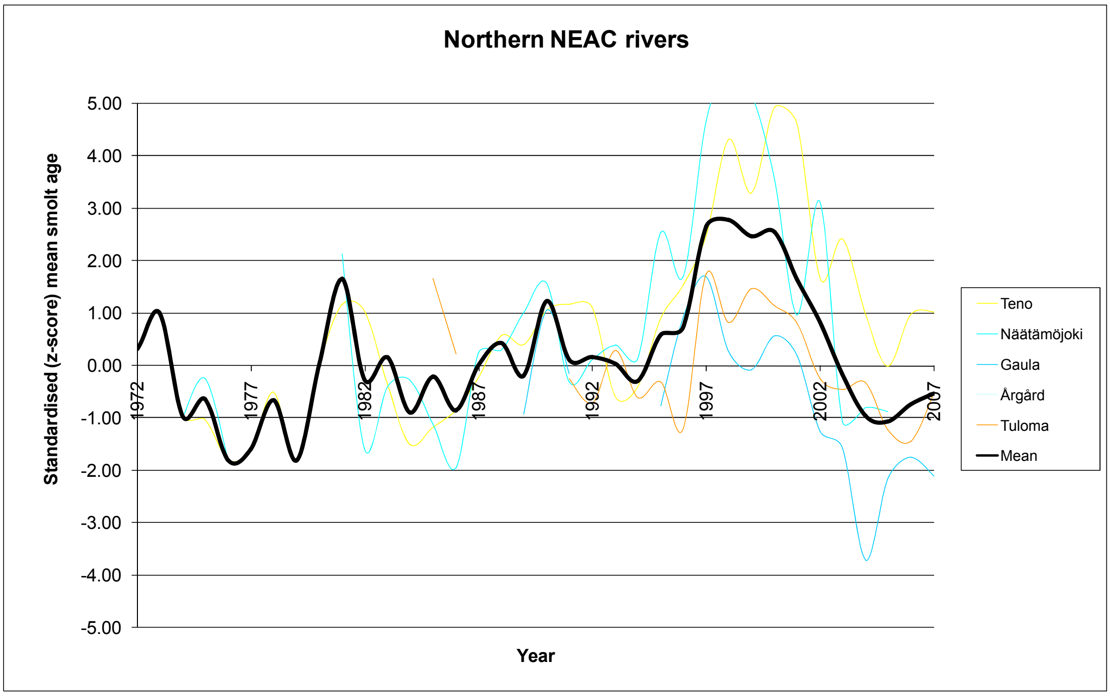


Figure 2.5.3 Standardised mean (z-score) smolt ages for available data sets from Northern NEAC rivers. Data back calculated from returning adult salmon and standardised in relation to the mean smolt age between 1984 and 1993.

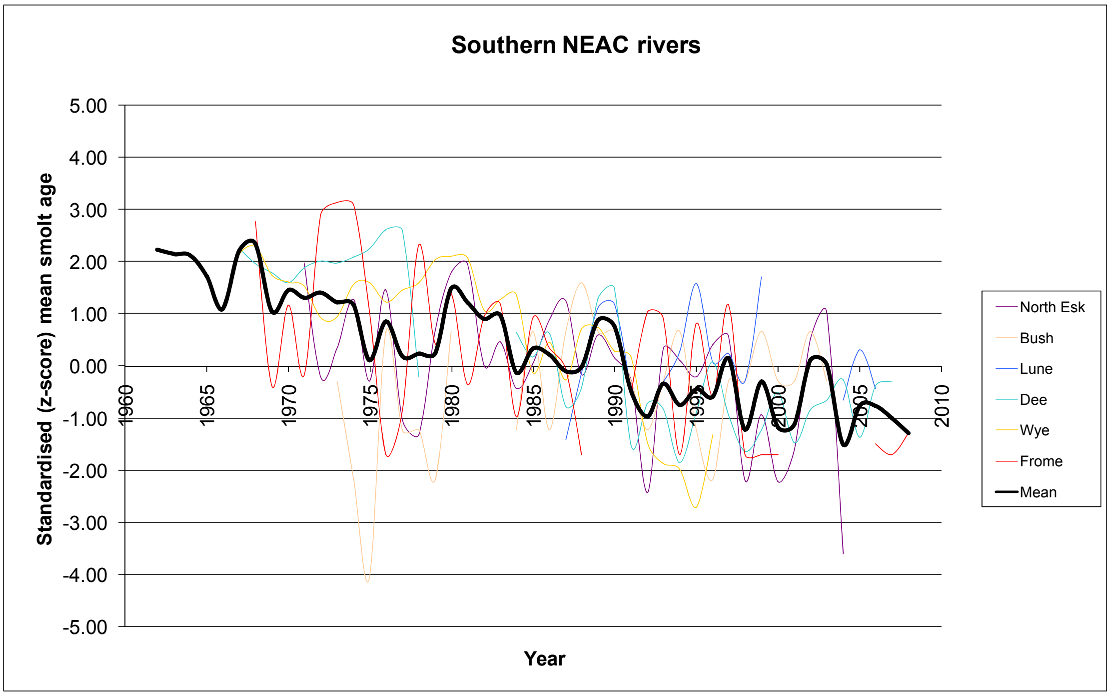


Figure 2.5.4 Standardised mean (z-score) smolt ages for available data sets from Southern NEAC rivers. Data back calculated from returning adult salmon and standardised in relation to the mean smolt age between 1984 and 1993.

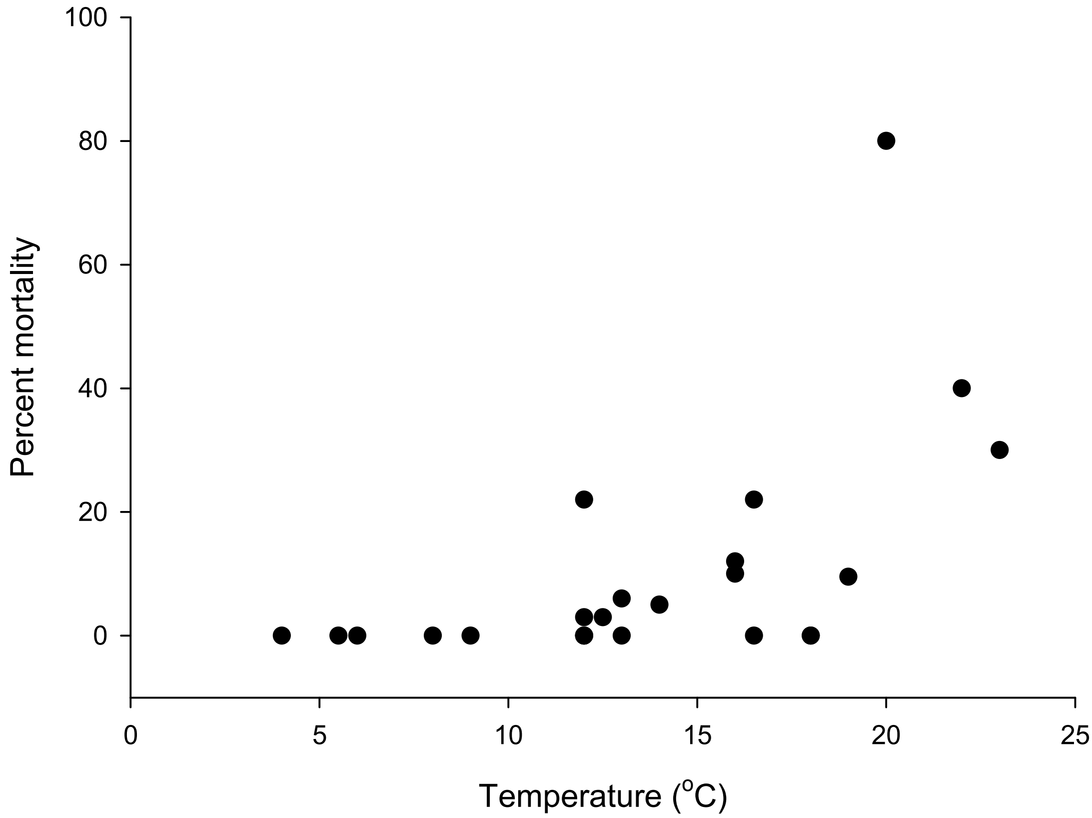


Figure 2.6.1 Mortality of Atlantic salmon after C&R at different water temperatures (average, if given, or median) (From the data presented in Table 2.6.1).

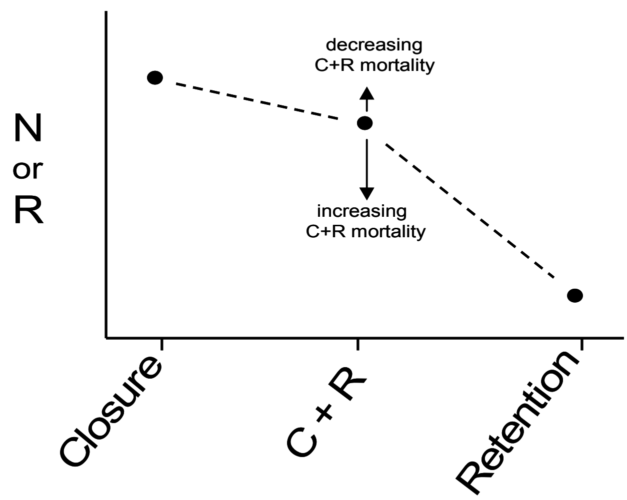


Figure 2.6.2 Schematic representation of the effect of C&R mortality on population size (N) and population growth rate (R) relative to fishery closures or full retention fisheries.

3 North-East Atlantic Commission

3.1 Status of stocks/exploitation

The current 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). NASCO has adopted this definition of CLs (NASCO, 1998). The CL is a limit reference point; having populations fall below these limits should be avoided with high probability. However, management targets have not yet been adopted for all Atlantic salmon stocks. Therefore homewater stocks in the NEAC area have been interpreted to be at full reproductive capacity only if the lower bound of the 95% confidence interval of the most recent spawner estimate is above the CL. In a similar manner, the status of stocks prior to the commencement of distant water fisheries has been interpreted to be at full reproductive capacity only if the lower bound of the 95% confidence interval of the most recent pre fishery abundance (PFA) estimate is above the Spawner Escapement Reserve (SER).

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)[1]
Iceland (south/west regions)1	

Justification for these groupings is provided in Section 3.5.1.

The status of these stock complexes, based on the NEAC run reconstruction model 1971 to 2008, prior to the commencement of distant water fisheries with respect to the SER requirements is:

- Northern European 1SW stock complex is considered to be at full reproductive capacity.
- Northern European MSW stock complex is considered to be at full reproductive capacity.
- Southern European 1SW stock complex is considered to be at risk of suffering reduced reproductive capacity.
- Southern European MSW stock complex is considered to be at risk of suffering reduced reproductive capacity.

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

The status of stocks is shown in Figure 3.1.1 and is elaborated upon in Section 3.4.

Estimated exploitation rates have generally been decreasing over the time period for both 1SW and MSW stocks in Northern and Southern NEAC areas (Figures 3.8.15.1 and 3.8.15.2). Exploitation on Northern 1SW stocks is higher than on Southern 1SW and considerably higher for MSW stocks. The current estimates for both stock complexes are amongst the lowest in the time series.

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 Description of the national conservation limits model

River-specific CLs have been developed for salmon stocks in some countries in the NEAC area. An interim approach has therefore been developed for estimating national CLs 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 NEAC area (Potter *et al.*, 1998).

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

ICES currently define the CL for salmon as the stock size that will result in the maximum sustainable yield (MSY) in the long term. 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 the national pseudo-stock-recruitment datasets (ICES, 2001). This model assumes that there is a critical spawning stock level below which recruitment decreases linearly towards zero, 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 CL for salmon stocks. This approach was again applied to the 2008 national stock-recruitment relationship assessment for countries where no river-specific CLs have been determined.

3.3.2 National conservation limits

The national CL model has been run for all countries (see Section 3.8.12) and the CLs are used for countries where no river specific CLs 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 (Table 3.3.2.1).

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. The estimated national CLs have been summed for Northern and Southern Europe and are given in Figure 3.1.1 for comparison with the estimated spawning escapement. The CLs have been calculated as:

- Northern NEAC 1SW spawners–210 958
- Northern NEAC MSW spawners–183 198
- Southern NEAC 1SW spawners–608 246
- Southern NEAC MSW spawners–261 635

The CLs have also been used to estimate the 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 in Figure 3.1.1 and Table 3.3.2.1. 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.

3.3.3 Progress with setting river-specific conservation limits

Most NEAC countries have not developed river-specific CLs. In 2008, progress with setting, and developing, river-specific CLs and associated compliance assessment was reported for UK (Northern Ireland), UK (Scotland), Iceland and Norway.

In UK (Northern Ireland), conservation limits have previously been determined in the Fisheries Commission Board (FCB) area for a number of important (index) salmon rivers. CLs were established through the transport of optimal productivity metrics determined from the River Bush stock recruitment study to measured habitat parameters from each index river. Adult returns are monitored on the index catchments primarily by resistivity fish counters, although rod catch has been used to estimate spawning escapement on the Shimna River. Technical problems were encountered in 2008 on some fish counters and alternative stock assessment methods will be applied retrospectively to maintain the integrity of these time series. Thus, the efficacy of rod catch and redd count data as auxiliary stock assessment tools on the other index rivers is presently being investigated to provide insurance against potential future counter failures.

In the Foyle area of UK (N. Ireland), a spawning target based management system has been operating in the Foyle fishery area for many years (Elson and Tuomi, 1975), and was revised in 1998. It is now based on juvenile salmonid habitat assessments. The Loughs Agency has established conservation limits and compliance monitoring for a number of rivers within the catchment. Fish counts were compromised on the Rivers Finn, Mourne and Faughan in 2008, preventing assessment of compliance against CL. A comprehensive independent review of the counter programme has thus been initiated by the Agency and is due to report early in 2009.

In UK (Scotland), work has continued to develop procedures for setting catchment specific CLs. GIS applications, in conjunction with field based observation and a literature review of salmon distribution, have been used to develop a map based useable wetted area model for salmon which can be used to transport CLs among catchments. A CL has been previously derived for the North Esk and this has been transported, using the useable wetted area model, to each of the 109 defined salmon fishery districts in Scotland to provide provisional CLs. Refinements to the useable wetted area transport model have been undertaken in 2008: preliminary estimates of spawning escapement in 63 of these districts have been derived and compliance with CL assessed.

In Iceland, work is progressing on several rivers to derive river specific CLs. Several datasets and techniques (catch data, counter data, habitat mapping, wetted area and juvenile surveys) are being used to estimate salmon production, run size and spawning escapement. To date work has indicated that rivers present a wide range in salmon production, from 2.1 to 57.7 adult fish per ha wetted area, which suggests that there will also be large differences in the spawning requirements. There are relatively few rivers for which wetted area has been established, but an effort will be made to increase this number in the coming years. Juvenile surveys will be used to calculate the relationship between spawning and recruitment and rod catch statistics to transfer CL between rivers of a given type. In the salmon act of 2006, the responsibility of fishing rights requires owners to harvest their fish stocks based on sustainable principles. The fishery associations are required to make harvest plans, which subsequently need to be approved by the Competent Management Authority (Fiskistofa). This system will facilitate the setting of river specific CLs but may take 5–10 years before being fully adopted.

In Norway, CLs have been set for 180 rivers since 2007. The CLs are based on stock recruitment relationships in nine rivers, and work is in progress to estimate conservation limits for a further 200 rivers, based on similarities in productivity and stock age structure. In 2008, stock recruitment relationships have been established for the River Imsa. The spawning target in the River Imsa is between 6 and 10 eggs per m^2, which represents between 20 and 30 females. The long term average smolt production in the river is 15 per 100 m^2 per year. In addition, provisional stock/recruitment data from the small River Halselva, (Northern Norway), have been made available. At the mouth of the river, a trap was established in 1987 to catch all downstream migrating smolts and upstream migrating adults. The smolt age of salmon in the river is usually 4–5 years (range 3–6 years). The relationship between number of eggs laid and number of smolts descending is not linear, indicating that egg deposition, in all years except one, has been below the conservation limit. Because the relationship is heavily dependent on one single point, the conservation limit is still not considered valid.

Productivity is mostly based on catch statistics, and scale samples are used to assess the river age and sea age structure in a sub set of the populations. To derive the CLs, wetted areas have been computed from digital maps and analysis of river length accessible to adult fish. CLs for salmon populations are grouped into four categories of egg densities, approximately 1, 2, 4 and 6 eggs/m^2 wetted area. Most of the rivers fall into the 2 and 4 eggs/m^2 wetted area categories.

3.4 Management advice

The Working Group considers that the following qualitative catch advice is appropriate based upon the PFA data and estimated SERs shown in Figure 3.1.1. In the evaluation of the status of stocks, PFA or recruitment values should be assessed against the SER values while the spawner numbers should be compared with the CLs. Further, for the first time, quantitative forecasts based on the newly developed

Bayesian forecast models (see Sections 2.3 and 3.6.2) are provided for all four NEAC stock complexes.

Based on recent work on resolving the most appropriate stock groupings for management advice for the distant water fisheries (ICES, 2002, 2005) the Working Group agreed that:

- Advice for the Faroes fishery should be based upon all NEAC stocks.
- Advice for the West Greenland fishery should be based upon Southern NEAC non-maturing 1SW salmon stocks.

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

3.4.1 Northern European maturing 1SW stock

- The lower bound of the PFA estimate has been above the SER throughout the time series, indicating an exploitable surplus and that this stock is currently at full reproductive capacity prior to the commencement of distant water fisheries.
- The lower bound of the spawner estimate has fluctuated around the CL throughout most of the time-series. In 2008, the mid-point of the spawner estimate was below the CL for only the second time in the series and this stock complex is suffering reduced reproductive capacity after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.
- Further, the newly developed Bayesian forecast model shows that the lower bounds of the forecasted PFA for 2009 to 2012 are below SER indicating that the stock may be at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.

3.4.2 Northern European non-maturing 1SW stock

- The lower bound of the PFA estimate has been above the SER throughout the time-series indicating an exploitable surplus and that this stock is currently at full reproductive capacity prior to the commencement of distant water fisheries.
- The lower bound of the spawner estimate has fluctuated around the CL throughout most of the time-series. In 2008, the lower bound of the spawner estimate was above the CL and this stock complex is currently at full reproductive capacity after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on non-maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.
- Further, the newly developed Bayesian forecast model shows that the lower bounds of the forecasted PFA for 2009 to 2012 are below SER indicat-

ing that the stock may be at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.

3.4.3 Southern European maturing 1SW stocks

- The lower bound of the PFA estimate has been above the SER throughout most of the time-series, but is currently below. Thus this stock complex is currently at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.
- The mid-point and the lower bound of the spawner estimate have fluctuated around the CL throughout most of the time series. In 2008, the mid-point of the spawner estimate is below the CL and thus this stock complex is suffering reduced reproductive capacity after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.
- Further, the newly developed Bayesian forecast model shows that the lower bounds of the forecasted PFA for 2009 to 2012 are below SER indicating that the stock may be at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.

3.4.4 Southern European non-maturing 1SW stocks

- The lower bound of the PFA estimate has fluctuated around the SER throughout the latter part of the time series and is currently below. Thus this stock complex is currently at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries.
- The mid-point and the lower bound of spawner estimate have been close to or below the CL since 1997. Currently, the mid-point of the spawner estimate is below the CL and thus this stock complex is suffering reduced reproductive capacity after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex, with the exception of the West Greenland fishery, the precautionary approach is to fish only on non-maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.
- Further, the newly developed Bayesian forecast model shows that the lower bounds of the forecasted PFA for 2009 to 2012 are below SER indicating that the stock may be at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries. There are no catch options at West Greenland that would allow the management objectives to be met for this stock complex.

3.5 Relevant factors to be considered in management

The management for all fisheries should be based upon assessments of the status of individual stocks. Fisheries on mixed stocks, particularly in coastal waters or on the high seas, pose particular difficulties for management, as they cannot target only stocks that are at full reproductive capacity if there are stocks below conservation limit within the mixed stock being fished. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and especially rivers are more likely to meet this requirement. It should also be noted that the inclusion of farmed fish in the Norwegian data would result in the stock status being overestimated.

The Working Group also emphasised that the national stock CLs discussed above are not appropriate for the management of homewater fisheries, particularly where these exploit multiple river stocks. This is because of the relative imprecision of the national CLs 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 CLs for national stocks exploited by the distant water fisheries could be used to provide general management advice to the distant water fisheries.

3.5.1 Grouping of national stocks

National outputs of the NEAC PFA model are combined into Southern European and northern European groups (see Section 3.1) to provide NASCO with catch advice or alternative management advice for the distant water fisheries at West Greenland and Faroes.

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

3.6 Pre-fishery abundance forecasts

3.6.1 Pre-fishery abundance forecasts for the Southern NEAC stock complex using the existing regression model

The Working Group has previously used a regression model to forecast the PFA of non-maturing (potential MSW) salmon from the Southern European stock group (ICES, 2002, 2003). The model has been used to provide such forecasts (ICES, 2006) which are used as one of the inputs to the risk analysis of the catch options for the Greenland fishery (ICES, 2008). The full model takes the form

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

where *Spawners* are expressed as lagged egg numbers, *PFAm* refers to pre-fishery abundance of maturing 1SW salmon (derived from NEAC PFA model-see Section 3.8.9) and the habitat term is the same as that previously used in the North American model (ICES, 2003). The *Habitat* parameter has not been included in the model since 2003 due to lack of available data and difficulties in incorporating it into the forecast.

Provision of 3-year management advice for the Faroese fishery requires that PFA forecasts be extended to 2012. The number of years for which forecasts may be provided is limited by the *Spawner* (lagged egg) parameter within the model. The time series for this parameter extends only as far as those lagged eggs assigned to 1-year old smolts from the most recent available spawning year; lagged eggs for 2011 are derived from 2004-2008 spawner estimates. As previously described (ICES, 2007), to allow PFA forecasts for 2012, lagged egg production assigned to 1-year old smolts for 2012 for each home water country was estimated by taking the average of the previous 5 years.

In previous years (ICES, 2004), parameter selection was achieved by adding variables (Spawners, PFAm and Year) until the addition of others did not result in an increase in the explanatory power of the model. The model was fitted to data from 1978 to 2007 (Table 3.6.1.1) and, as in previous years, the parameters selected were *Spawners* and *Year*. The final model took the form

$$\text{Log}(PFA/Spawners) = -1.31\log(Spawners) + 115.1 - 0.049Year$$

which is equivalent to:

$$PFA = Spawners^{-0.31} \times e^{115.1 - 0.049Year}$$

The PFA forecasts (Figure 3.6.1.1, Table 3.6.1.2) indicate that from 2009 to 2012, the stock complex will be suffering reduced reproductive capacity.

3.6.2 New forecast models

Prior to 2009, forecast models have not been used for the maturing 1SW stock complex from southern NEAC nor for sea age groups in the northern NEAC stock complex. The Working Group reviewed an alternate Bayesian forecast model for the southern NEAC 1SW non-maturing complex and new Bayesian models for the other three complexes. The proposed models have the same structure and are run independently. A Directed Acyclic Graph (DAG) for the models is provided in Figure 2.3.2.1.

Both the maturing *PFA* (denoted *PFAm*) and the non maturing PFA (denoted *PFAnm*) recruitment streams are modeled together. For each year *t*, a proportional relationship is assumed between lagged eggs (LE_t) and the expected means of the maturing PFA, with a recruitment rate factor αm_t (in the log-scale).

$$PFAm_t = LogN(\mu.PFAm_t\ ,\ \sigma.PFAm^2)$$
$$\mu.PFAm_t = \log(LE_i) + \alpha m_t$$

Similarly, for each year *t*, a proportional relationship is assumed between LE_t and the expected means of the non maturing *PFA*, with a productivity factor αnm_t.

$$PFAnm_t = LogN(\mu.PFAnm_t\ ,\ \sigma.PFAnm^2)$$
$$\mu.PFAnm_t = \log(LE_i) + \alpha nm_t$$

The recruitment rate for the non maturing *PFA* is dependent on the recruitment rate for the maturing PFA, modified by a variable that estimates the proportion maturing (see Section 2.3). In this way, the temporal variation of the recruitment rate for maturing and non maturing PFA will be closely related. However, time variations of the maturity parameter introduce some flexibility in the synchrony of the maturing and non maturing recruitment rates.

The recruitment rates are modelled as a first order time varying parameter following a simple random walk:

$$t = 1,\ldots,n-1 \qquad \alpha m_{t+1} = \alpha m_t + \omega_t \quad with \quad \omega_t \overset{i.i.d}{\sim} N(0, \sigma^2_{\alpha})$$

Uncertainty in the lagged eggs were accounted for by assuming that the lagged eggs of 1SW and MSW fish were normally distributed with median and standard deviation derived from the Monte-Carlo run reconstruction at the scale of the stock complex. In the model presented to the Working Group, the uncertainty in the returns was not accounted for due to difficulties in model fitting. Catches of salmon at sea in the West Greenland fisheries (as 1SW non-maturing salmon) and at Faroes (as 1SW maturing and MSW salmon) were introduced as covariates and incorporated directly within the inference and forecast structure of the model. For southern NEAC, the data were available for a 31 year time series of lagged eggs and returns (1978 to 2008). For northern NEAC, data were available for an 18 year time series, 1991 to 2008. The proposed models were fitted and forecasts were derived in a consistent Bayesian framework (see Section 2.3).

For both southern and northern NEAC complexes, forecasts for maturing stocks were derived for 4 years of lagged eggs starting from 2009 to 2012 and for non-maturing stocks for 5 years, from 2008 to 2012. Risks were defined each year as the posterior probability that the PFA would be below the age and stock complex specific SER levels. For illustrative purposes, risk analyses were derived based on the probability that the PFA abundance would be greater than or equal to the SER under the scenario of no exploitation.

3.6.3 Results of the NEAC Bayesain forecast models

The trends in the posterior estimates of PFA for both the southern NEAC and northern NEAC complexes closely match the descriptions of PFA trends previously developed by the Working Group (Section 3.8.13).

For the southern NEAC stock complex, the productivity parameters for the maturing and non-maturing components peaked in 1985 and 1986, and reached the lowest values in 1997 (Figure 3.6.3.1). There was a sharp drop in the productivity parameter during 1989 to 1991, the median values post-1991 are all lower than during the previous time period (Figure 3.6.3.1). Over the entire time series, the maturing proportions averaged about 0.6 with the lowest proportion in 1980 and the highest proportion in 1998. There is an increasing trend in the proportion maturing (8 of 13 values below the average during 1978 to 1990 compared with 3 of 16 values between 1991 and 2006) (Figure 3.6.3.2). The total PFA (maturing and non-maturing 1SW salmon at Jan. 1 of the first winter at sea) for the southern NEAC complex ranged from 3 to 4 million fish between 1978 and 1989, declined rapidly to just over 2 million fish in 1990, and fell to its lowest level of just over one million fish in 2006 (Figure 3.6.3.3).

For the northern NEAC complex, peak PFA abundance was estimated at about 2 million fish in year 2000 with the lowest value of the series in 2004 at over 1 million fish (Figure 3.6.3.4). The proportion maturing has varied around 0.5 over the time series but in 2007 there was an abrupt drop in the proportion maturing (Figure 3.6.3.2). The productivity parameter is higher for maturing 1SW salmon than for the non-maturing component, as was the case for the southern NEAC stock complex (Figure 3.6.3.1). The productivity parameters are higher for the northern NEAC compared to the southern NEAC complex, particularly for the non-maturing 1SW component.

Forecasts from these models into 2008 to 2012 for the non-maturing age group and for 2009 to 2012 for the maturing age group were developed within the Bayesian model framework. Variations in the median abundance over the forecasts are related to variations in lagged eggs (Figures 3.6.3.3 and 3.6.3.4) as the productivity parameters are set at the level of the last year with available data (Figures 3.6.3.1). The variability in the productivity parameters increase sequentially over the forecasts.

For the southern NEAC stock complex, the 25th percentiles of the posterior distributions of the forecasts are below the SER for both the maturing and non-maturing age components (Figure 3.6.3.3). The abundances of the northern NEAC age components have declined over the 1983 to 2008 time period. The lower bound of the 95% Bayesian credible interval has fallen below the age-specific SERs for 2009 to 2012 but the expectation is for the 2008 abundance of non-maturing salmon to remain above the SER (Figure 3.6.3.4).

3.6.4 Comparisons with the regression forecast model

The regression forecast model used by the Working Group provides PFA forecasts for only one (Southern NEAC non-maturing 1SW stock) of the four stock complexes currently used to assess the status of stocks in the NEAC commission area. These forecasts were compared with those available from the Bayesian model (Figure 3.6.3.5).

As previously noted, the structure of the ICES regression model generally leads to a forecast of declining PFA with time. This trend is not apparent in forecasts from the Bayesian model where the most credible estimates remain stable for the period from 2008 to 2012 and are consistently higher than those given by the regression model. This difference in the forecasts results from differences in the model structures: in the regression model, the negative value of the year coefficient leads to reduced PFA in the forecast, whereas in the Bayesian model the median productivity parameter estimate remains constant and the forecast tracks changes in lagged spawner abundance. The uncertainty in the forecasts from the Bayesian models is greater than for the log-linear model used by the Working Group; part of the reason is that the input data used by ICES are the midpoints of the lagged eggs and run-reconstructed PFA compared with the Bayesian model that incorporates uncertainty in the lagged eggs variable.

The probability that the PFA of the southern NEAC 1SW non-maturing component will be above the SER in 2009 to 2012 ranges from 0.36 to 0.59 for the regression model. In contrast, the Bayesian model provides a probability range of 0.61 to 0.68 (see text table below).

Probability that the PFA will be greater than or equal to the complex and age specific SERs

		Maturing	Non-Maturing	
Southern complex	SER	834 586	501 086	
	Model	Bayesian	Bayesian	Regression model
	2008		0.71	0.70
	2009	0.68	0.68	0.59
	2010	0.59	0.61	0.55
	2011	0.64	0.66	0.41
	2012	0.60	0.62	0.36

		Maturing	Non-Maturing
Northern complex	SER	291 212	216 904
	Model	Bayesian	Bayesian
	2008		0.99
	2009	0.88	0.95
	2010	0.74	0.87
	2011	0.74	0.86
	2012	0.72	0.85

3.6.5 Use of the NEAC Bayesian forecast models in catch advice

In the absence of specific management objectives for the Faroes fishery, ICES requires that the lower bound of the 95% confidence interval of the PFA estimate be above the SER for the stock to be considered at full reproductive capacity. The Working Group noted that, while the levels of uncertainty are greater in the Bayesian model, both models predict similar values for this lower bound in each of the 5 forecast years. In addition, for the southern NEAC complex, the 25th percentile of the PFA abundances are below the respective SER values. For the West Greenland Commission area, the probability of achieving management objectives has been set to 0.75 (see Section 5.2).

NASCO has not yet defined management objectives for the NEAC stock complexes. A risk framework for the Faroes fishery could be developed in a similar way to that for West Greenland (Figure 5.9.3.1). The risk framework would present the probabilities that the number of fish escaping the high seas fisheries would be sufficient to meet the management objective for each stock complex. In the case of the Southern NEAC non-maturing 1SW complex, this probability will also be conditional on the harvest at West Greenland. Thus, for any harvest scenario at Faroes there would be a probability of meeting the management objective in each of the stock complexes. In order for this approach to be implemented, the following will be required

- management objectives for the Northern NEAC maturing stock complex
- management objectives for the Northern NEAC non-maturing stock complex
- management objectives for the Southern NEAC maturing stock complex
- management objectives for the Southern NEAC non-maturing stock complex
- pre-agreed levels of risk for each management objective
- pre-agreed sharing arrangements among all parties to NASCO

3.7 Comparison with previous assessment

3.7.1 National PFA model and national conservation limit model

Provisional catch data for 2007 were updated where appropriate. The equation for estimating the proportion of maturing salmon in the 1SW catches at Faroes was corrected. The impact of the correction on 1SW maturing catches at Faroes was small because the catch of 1SW maturing fish was also small. In addition, catches at Greenland were treated as point estimates for the 2008 assessment to allow updated data from the NAC assessment to be incorporated into the NEAC assessment.

3.7.2 PFA regression forecast model

The midpoints of updated forecasts of the Southern NEAC MSW PFA for the years 2008 to 2011 were 454 000, 431 000, 420 000 and 392 000 respectively. All were within 2% of the forecasts provided last year (ICES, 2008).

3.8 NASCO has requested ICES to describe the key events of the 2008 fisheries and the status of the stocks

3.8.1 Fishing at Faroes in 2007/2008

No fishery for salmon has been prosecuted since 2000.

It had been noted in previous WG reports that no compensation payments had been made to Faroese fishermen since 1999. However, recent information from the North

Atlantic Salmon Fund (NASF) and the Faroese Felagið Laksaskip confirms that a compensation payment had been made to Felagið Laksaskip during the years 1991–1999 and 2001–2008 (i.e. not in 2000). The reason for this misunderstanding was that neither the Faroese Ministry of Fisheries nor the Faroese Fisheries Laboratory had been made aware of these arrangements.

3.8.2 Significant events in NEAC homewater fisheries in 2008

Ireland

In 2007 and 2008, no driftnet licences were issued. This measure was supported by the introduction of a hardship scheme. Many of the inshore draftnet fishermen voluntarily participated in the hardship scheme, which resulted in a reduction in these licences also. Similarly, in the Foyle area where fisheries are under the joint jurisdiction of the Loughs Agency (a cross-border institution of the Republic of Ireland and UK (N. Ireland)), a voluntary net buyout saw a decrease in driftnet licences from 107 in 2006 to 18 in 2007. All of these licences fished within the Foyle estuary as recommended by the Standing Scientific Committee.

UK (England & Wales)

Progress to reduce netting effort and phase out various net fisheries continued in 2008. A revised net limitation order (NLO) came into force for the Solway Estuary (Rivers Eden & Esk) haaf net fishery (hand-held nets) with the number of nets permitted reduced from 155 to 105. Additional measures were also imposed on this fishery, with the seaward boundary moved some 4 km further up the estuary thus restricting the area available for netting. A number of effort reductions were also agreed for net fisheries in south west England with revised NLO agreements for the River Fowey seine net fishery (reduced to 1 net from 2) and the River Camel driftnet fishery (reduced to 6 nets from 7). The number of seine nets operating on the River Exe, also in south west England, was reduced to 3 nets (from 11 in 2005). The latter was the result of a buy off agreement (8 of the 11 licensees were compensated not to fish for the entire season in 2008). Six of the nine seine nets operating on the River Tywi in Wales were also subject to a buy off agreement in 2008.

Norway

Progress to reduce the marine mixed stock fishery continued. In 2008, the fishing season for bag nets in Southern and Central Norway was further reduced, more so in coastal than in fjord areas. The purpose of these regulations was to reduce exploitation on MSW salmon, and to reduce the exploitation on mixed stocks in coastal areas and in fjord areas with weak and/or threatened populations. Along the coast and in fjords in all counties except in Finnmark the fishing season for bag nets was reduced by at least 14 days at the beginning of the season, or the fisheries were closed. The total number of bagnets was reduced to 957 in 2008 (from 1302 in 2007) which is the lowest number recorded in the time-series. In Finnmark County there were smaller reductions in fishing season and number of fishing-days per week for both bendnets and bagnets than in other regions. The mean percentage of the total catch taken in the sea declined from 49 % in the period 2003–2007 to 42 % in 2008 based on the number of salmon caught, and from 56% to 47% based on the weight of the catch.

3.8.3 Gear and effort

No significant changes in gear type used were reported in 2008, however, substantial changes in effort were recorded. The Irish driftnet fishery was closed in 2007 after an agreement was secured between the Irish government and local fishermen for a permanent buy-out or temporary lease of fishing rights. In 2008, there was a reduction in gear units licensed from UK (England & Wales) and UK (Scotland). In Norway a substantial reduction in gear units was reported for the bagnet fishery following additional restrictions imposed in central Norway. Bagnet and bendnet effort in Norway was the lowest reported in the time-series.

The number of gear units licensed or authorised in several of the NEAC area countries provides a partial measure of effort (Table 3.8.3.1), 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 actively utilised or the time each licensee fished.

Trends in effort are shown in Figures 3.8.3.1 and 3.8.3.2 for the Northern and Southern NEAC countries respectively. In the Northern NEAC area, driftnet 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.

Rod effort, where available, has varied for different areas across the time series. 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 13 604 in 2006 (no data available for 2007 and 2008). In Finland the number of fishing days has shown an increase throughout the time period. In the Southern NEAC area rod licenses in 2008 were close to the to the long term average in UK (England & Wales). In Ireland there has been an apparent increase in the early 1990s in rod fishing effort due to the introduction of one day licences and this has remained stable over the past decade. In France the effort has been fairly stable over last 10 years.

3.8.4 Catches

NEAC area catches are presented in Table 3.8.4.1. The provisional declared catch in the NEAC area in 2008 was 1519 tonnes, representing an increase of around 8% on the 2007 catch (1410 t). The NEAC catch represented around 90% of the total North Atlantic nominal catch in 2008. The catch in the NEAC Southern area (347 t) fell by 8% on 2007 reflecting a decrease of around 50% and 60% on the previous 5 and 10 year averages respectively. These decreases reflect significantly reduced fishing effort, particularly in Ireland. The catch in the NEAC Northern area (1172 t) was around 13% higher than the 2007 catch, but was similar to the previous 5 year and 10 year means.

Figure 3.8.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2008. The catch in the Southern area has declined over the period from about 4500 t in 1972–75 to below 1000 t since 2003 and is now well below 400 t. The catch showed marked declines in 1976, 1989–91 and also in 2007. The catch in the Northern area also indicated an overall decline over the time series, although this decrease was less distinct than the reductions noted in the Southern area. The catch in the Northern area varied between 2000 and 2800 t from 1971 to 1988 and fell to a low of 962 t in 1997 and then increased to over 1600 t in 2001 although it has exhibited a downward trend since this time. Thus, the catch in the Southern area, which comprised around two-thirds of the total NEAC catch in the early 1970s, has been lower than that in the Northern area since 1999.

3.8.5 Catch per unit effort (cpue)

Cpue is a measure that can be influenced by various factors, such as fishing conditions/experience. 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 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. Cpue may be affected by increasing rates of catch and release in rod fisheries. This is discussed further in Section 2.6.

The cpue data are presented in Tables 3.8.5.1–3.8.5.5. 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 has generally decreased in UK (Scotland) and UK (England & Wales) net fisheries (Figure 3.8.5.1). Cpue for net fisheries showed mostly lower figures compared to 2007 and the previous 5-year averages (Table 3.8.5.3). In UK (Northern Ireland), the river Bush rod fishery cpue has increased after 2002, which was the lowest level in recent years, and the 2007 figure was the highest in the time series; the 2008 figure is not far below and remains high (Table 3.8.5.1). In France, the 2008 figure for rod fisheries is just above the 2007 figure but remains below the previous 5-year average (Table 3.8.5.1); no particular trend was detected over years (Figure 3.8.5.1).

In the Northern NEAC area, there has been an increasing trend in cpue figures for the Norwegian net fisheries and the Russian rod fisheries in both the Barents and White Sea rivers (Figure 3.8.5.1). A decreasing trend was noted for rod fisheries in Finland (River Teno) (Figure 3.8.5.1). Most 2008 cpue values showed an increase compared to both 2007 and the previous 5-year means (Tables 3.8.5.1, 3.8.5.2 and 3.8.5.5).

3.8.6 Age composition of catches

The percentage of 1SW salmon in NEAC catches is presented in Table 3.8.6.1 and in Figures 3.8.6.1 (Northern area) and 3.8.6.2 (Southern area). The overall percentage of 1SW fish in the NEAC Northern area catch remained reasonably consistent in the period 1987–2000 (range 61–72%), but has fallen in more recent years (range 50–69%), when greater variability between countries has also been evident. The percentage of 1SW fish in the Northern area remained at a low level in 2008 (54 % compared to 50% in 2007). In 2008, the proportions of 1SW fish in Norway, Sweden, Finland and Russia were among the lowest in the time series. On average, 1SW fish comprise a higher percentage of the catch in Iceland and Russia than in the other Northern area countries (Figure 3.8.6.1). The percentage of 1SW fish in the catch shows an increasing trend in Iceland, but appears to be declining in Norway, Sweden and Finland.

In the NEAC Southern area, the overall percentage of 1SW fish in the catch (53%) was below the recent 5-year (59%) and 10-year means (60%) and has remained reasonably consistent over the time series (range 49–65%), although there is considerable variability among individual countries (Figure 3.8.6.2). On average, 1SW fish comprise a higher proportion of the catch (70–80%) in UK (England & Wales) than in the other Southern NEAC countries.

3.8.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2008 was again generally low (<2% in most countries) and is similar to the values that have been reported in previous years (e.g. ICES, 2008). Thus, the occurrence of such fish is usually ignored in assessments of the status of national stocks (Section 3.8.12). However, in Norway farmed salmon continue to form a large proportion of the catch in coastal (23% in 2008), fjordic (30% in 2008) and rod fisheries (9% in 2008). The level of escaped farmed salmon in Norwegian catches has been lower in recent years than during the period 1989–2002. An assessment of the likely effect of these fish on the output data from the PFA model has been reported previously (ICES, 2001).

3.8.8 National origin of catches

Catches of Russian salmon in Norway

There is direct evidence of Russian origin salmon being caught in coastal mixed-stock fisheries in northernmost Norway. This is on the basis of tagging experiments conducted prior to 1974.

The experiments showed that some tagged adult salmon released at Breivik (Figure 3.8.8.1) and Sørvær at Sørøya in Finnmark County, Norway were then recaptured the same year or one year later in different locations of Russia (Bakshtansky, 1970; Bakshtansky and Nesterov, 1973; Antonova and Chuksina, 1987).

Adult salmon were tagged from bag nets during the period 1962–1974 at Breivik and during the period 1964–1967 at Sørvær. At Breivik a total of 3527 salmon were tagged, and a total of 1036 individuals (29.4%) were reported recaptured, the majority in Norway. Of the total number of recaptures, 136 were reported from Russia (13.1%).

At Sørvær, a total of 1066 salmon were tagged and released. The total number recaptured was 143 individuals (13.4%), the majority of which were caught in Norway and 15 (10.5%) were recaptured in Russia.

The data strongly indicates that during the period of tagging at Sørøya the bycatch of Russian origin salmon was relatively high in northernmost Norway. The data from Sørøya are old and do not necessarily represent the present situation. Jensen *et al.*, 1999 who assessed the effects of the ban on the Norwegian driftnet fishery in 1989 concluded that the driftnet fishery affected Russian salmon populations in rivers draining into the Barents Sea to a lesser extent than Norwegian salmon, and had no effects in rivers draining into the White Sea. However, there are still extensive marine salmon fisheries operating along the migratory route of salmon towards rivers east of Sørøya, which very likely catch Russian salmon. The number of fishermen operating in this area has decreased in recent years. Available information shows a decline in the number of Norwegian fishermen operating in marine waters in Finnmark since 1993.

A better assessment of bycatch of Russian origin salmon in the marine fishery in northernmost Norway would require more data including historical and contemporary information on tag reporting rates, reductions in effort and exploitation in Norway and Russia, and data from the genetic stock identification studies.

Catches of EU salmon in Norway

Based on the tagging experiments at Breivik and Sørøya, migrating salmon were also recaptured in Finland. Assessment of the bycatch of Finnish salmon in Norway is difficult because both Tana and Neiden rivers compose the border between Norway and Finland, and salmon taken in these rivers could potentially originate from either jurisdiction. However, this implies that salmon taken in marine waters in the northernmost part of Norway may also include fish of Finnish origin.

The bycatch of Swedish salmon was high on the west and southwest coast of Norway in the 1970s. However given the subsequent ban on the driftnet fishery along the Norwegian coast, a significant reduction of the coastal bagnets in the west and southwest area and the general ban on bendlnets in Norway (with the exception of the fishery in Finnmark County) present bycatch of Swedish salmon in Norway is probably small.

Catches of Norwegian salmon in other countries

The ICES Working Group on North Atlantic Salmon (ICES 1998) summarized the results from 14 508 adult recaptures of smolts tagged and released in different rivers in Norway during 1990–1996. The great majority were recaptured in Norway (98.77%), 0.59% in Sweden, 0.30% in Denmark and 0.21% in Ireland. Examination of the NINA tag database of about 60 000 adult recoveries from smolt tagging in Norway indicated that most of the foreign recaptures were made in Sweden and Denmark, although these accounted for a very small overall proportion. Very few recaptures were reported from other countries.

In summary, the provisional analysis of the available information suggests that exploitation of foreign origin salmon in Norway is low with the exception of salmon originating from Russia. Exploitation of Norwegian origin salmon in neighboring countries appears to be limited. There may be local issues which are difficult to detect and assess, for example the interception of fish in border rivers which are captured in one jurisdiction and originate from another.

3.8.9 The NEAC-PFA model

The Working Group has previously developed a model to estimate the pre-fishery abundance (PFA) of salmon from countries in the NEAC area. PFA in the NEAC area is defined as the number of 1SW recruits on January 1st in the first sea winter. The model estimates the PFA from the catch in numbers of 1SW and MSW salmon in each country. These are raised to take account of minimum and maximum estimates of non-reported catches and exploitation rates of these two sea-age groups. Finally these values are raised to take account of the natural mortality between January 1st in the first sea winter and the mid-point of the respective national fisheries. As reported in 2002 (ICES, 2002), the Working Group has determined a natural mortality value of 0.03 (range 0.02–0.04) per month to be appropriate. A Monte Carlo simulation (10 000 trials) using 'Crystal Ball v7.2.1' in Excel (Decisioneering, 1996) is used to estimate confidence limits on the PFA values. Potter *et al.*, 1998 provides full details of the model. Further modifications, to improve the model were incorporated during the Working Group meeting in 2005 (ICES, 2005).

3.8.10 Sensitivity of the PFA model

The sensitivity of the PFA and spawner estimates for the Northern and Southern European stock complexes was evaluated using the tools within Crystal Ball. The relative contribution of model parameters to variance in the estimates of recruits (maturing and non-maturing 1SW) and spawner numbers (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES Working Group in 2009 (catch data for 2008). PFA estimates have been shown to be particularly sensitive to the marine mortality parameter (ICES, 2006), due both to the range (0.02–0.04) attributed to marine mortality in the Monte Carlo simulation and also to the time over which stocks are raised.

Given a fixed value for M, parameters which have accounted for at least 5% of the variance of a given variable are shown in Table 3.8.10.1. Taking both stock complexes together these account for 12 (10%) of the 117 parameters used to estimate PFA and 12 (17%) of the 72 parameters used to estimate spawner numbers. The sensitivity of forecast variables to these parameters is consistent with the results of the analysis presented last year (ICES 2008).

3.8.11 National input to the NEAC-PFA model

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

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

The model input data are provided in Tables 3.8.11.1(a–t). For some countries, the data are provided in two or more regional blocks. In these instances, the model output is combined to provide one set of output variables per country.

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

Descriptions of how the model input has been derived were presented in detail at the Working Group meeting in 2002 (ICES, 2002). Modifications are reported in the year in which they are first implemented and significant modifications undertaken in 2008 are indicated in Section 3.7.1.

3.8.12 Description of national stocks as derived from the PFA model

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

The National CLs model has been designed as a means to provide a preliminary CL 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 3.8.12.1(a–j)) comprising the following:

- Estimated total returns and spawners (95% confidence limits).
- 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 pseudo stock-recruitment relationship (PFA against lagged egg deposition), with CL fitted by the method presented in ICES (2001) for those countries where CLs are not estimated using river specific CLs.

3.8.13 Trends in the PFA for NEAC stocks

Tables 3.8.13.1–3.8.13.6 show combined results from the PFA assessment for the NEAC area. The PFA of maturing and non-maturing 1SW salmon and the numbers of 1SW and MSW spawners for the Northern and Southern European groups are shown in Figure 3.1.1.

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

Recruitment patterns of maturing 1SW salmon and of non-maturing 1SW recruits for Northern Europe (Figure 3.1.1) show broadly similar patterns. The general decline over the time period is interrupted by a short period of increased recruitment from 1998 to 2003. Both stock complexes have been at full reproductive capacity prior to the commencement of distant water fisheries throughout the time-series.

Trends in spawner number for the Northern stock complexes for both 1SW and MSW are similar. Throughout most of the time series, both 1SW and MSW spawners have been either at full reproductive capacity or at risk of reduced reproductive capacity. However, in both 2007 and 2008, the 1SW spawner estimate indicated that the stock complex was suffering reduced reproductive capacity. These patterns are broadly consistent with the general pattern of decline in marine survival of 1SW and 2SW returns in most monitored stocks in the area (Section 3.8.14).

Recruitment patterns of maturing 1SW salmon and of non-maturing 1SW recruits for Southern Europe (Figure 3.1.1) show broadly similar declining trends over the time period. The maturing 1SW stock complex has been at full reproductive capacity over most of the time period with the exception of 2006 and 2008 when it was at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries. The non-maturing 1SW stock has been at full reproductive capacity over most of the time period but has been at risk of suffering reduced reproductive capacity before homewater fisheries took place in nine of the twelve years between 1996 and 2007 and was suffering reduced reproductive capacity for the first time in 2006.

Declining trends in spawner number are evident in the Southern stock complexes for both 1SW and MSW. However the 1SW stock has been at risk of reduced reproductive capacity or suffering reduced reproductive capacity for most of the time series. In contrast, the MSW stock has been at full reproductive capacity for most of the time series until 1997 when the stock was either at risk of reduced reproductive capacity or suffering reduced reproductive capacity. This is broadly consistent with the general pattern of decline in marine survival of 1SW and 2SW returns in most monitored stocks in the area (Section 3.8.14).

3.8.14 Survival indices for NEAC stocks

An overview of the trends of marine survival for wild and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) for the 2007 and 2006 smolt year classes (returning 1SW and 2SW salmon, respectively) is presented in Figure 3.8.14.1. The survival indices presented are the annual rates of change in marine survival. The original survival indices for different rivers and experimental facilities are presented in Tables 3.8.14.1 and 3.8.14.2.

The overall trend in for Northern and Southern NEAC areas, in both wild and hatchery smolts, is indicative of a decline in marine survival. The decline across the time series varies between 1% and 20% (Figure 3.8.14.1). Most of the survival indices for wild and reared smolts were below the previous 5- and 10-year averages. Some increases in survival were detected in Iceland for 1SW fish on the Vesturdalsa River and for hatchery reared grilse on the Ranga River (Tables 3.8.14.1 and 3.8.14.2).

Return rates of hatchery released fish, however, may not always be a reliable indicator of marine survival of wild fish.

Results from these analyses are consistent with the information on estimated returns and spawners as derived from the PFA model (Section 3.8.13), and suggest that returns are strongly influenced by factors in the marine environment.

3.8.15 Exploitation indices for NEAC stocks

Exploitation estimates have been charted for 1SW and MSW salmon from the northern and southern NEAC areas for the period 1971–2008 (1983–2008 for Norway) and are displayed in Figures 3.8.15.1 and 3.8.15.2. These figures have been collated from the NEAC pre-fishery abundance model and represent an estimate of total national exploitation rates inclusive of both commercial and recreational fisheries. Data gathered prior to the 1980s represent estimates of national exploitation rates whilst post 1980s exploitation rates have often been subject to more robust analysis informed by projects such as the national coded wire programme in Ireland. The overall rate of change of exploitation within the different countries in the NEAC area has been presented as a plot of the change (% change year^{-1}) in exploitation rate over the time series. This was derived from the slope of the linear regression between time and natural logarithm transformed exploitation rate (Figures 3.8.15.3 and 3.8.15.4).

The exploitation of 1SW salmon in both northern and southern NEAC areas has shown a general decline over the time series (Figures 3.8.15.1 and 3.8.15.2). An increase in the exploitation rate in the northern NEAC area was observed for both 1SW and MSW fish in 1983, however, this can be attributed to the inclusion of Norwegian exploitation data from this point onwards. Exploitation on 1SW salmon in the northern NEAC area was 37% in 2008 representing a decline on the previous 5 year (42%) and 10 year (43%) averages. Exploitation on 1SW fish in the southern NEAC stock was 23% in 2008 indicating a drop on both the previous 5 year (31%) and the 10 year (32%) averages.

The exploitation rate of MSW fish also exhibited an overall decline over the time-series in both northern and southern areas (Figures 3.8.15.1 and 3.8.15.2). Exploitation on MSW salmon in the north NEAC region was 45% in 2008 which was a decrease on previous years (5 year average 50% and 10 year average 51%). Exploitation on MSW fish in southern NEAC also showed a decline in 2008 (27%), in comparison to the previous 5 year average (32%) and the previous 10 year average (33%).

The relative rate of change of exploitation over the entire time-series is charted for the northern NEAC stock complex in Figure 3.8.15.3. This indicates an overall reduction of exploitation in all countries for 1SW and MSW salmon. Exploitation of 1SW fish in Finland has been relatively stable over the time period whilst the largest rate of reduction has been for 1SW salmon in Russia. The southern NEAC countries have also shown a general decrease in exploitation rate (Figure 3.8.15.4) on both 1SW and MSW components. The greatest rate of decrease measured for both 1SW and MSW fish was in UK (Scotland). The only increase in exploitation was detected on 1SW fish in France.

3.9 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

Most management measures introduced in recent years in relation to international, national and local objectives have aimed to reduce levels of exploitation on NEAC stocks, to increase freshwater escapement and in some countries specifically to meet river specific CLs. Many of the inputs relate specifically to national plans or strategies or to commitments under National or EU directives. Although some local measures have had notable success (Table 3.9.1) the Working Group notes that three of the four NEAC stock complexes are currently suffering reduced reproductive capacity after homewater fisheries have taken place (Section 3.4).

3.10 NASCO has requested ICES to further investigate opportunities to develop a framework of indicators that could be used to identify any significant change in previously provided multi-annual management advice

In 2006, ICES provided multi-annual management advice for all three NASCO Commission Areas and presented a preliminary framework (Framework of Indicators - FWI) which would indicate if any significant change in the status of stocks used to inform the previously provided multi-annual management advice had occurred. This FWI was subsequently developed further at the Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance [SGEFISSA] in November 2006 (ICES, 2007a).

The Study Group developed a generalized FWI which could be applied to each NASCO Commission Area. The Working Group (ICES, 2007) adopted a FWI for the Greenland fishery based on the seven contributing regions/stock complex with direct links to the three management objectives established by NASCO for that fishery. However, SGEFISSA was unable to develop a FWI for the Faroese fishery for a number of different reasons. Among these were the lack of quantitative catch advice, the absence of specific management objectives and a sharing agreement for this fishery and the fact that none of the available indicator data sets met the criteria for inclusion in the FWI. The Working Group (ICES, 2007) endorsed the SGEFISSA report of applying the FWI in respect of the West Greenland and North American Commissions. However, in the absence of a FWI for the Faroese fishery, it was recommended that annual assessments be conducted to verify the multi-year catch advice.

The Working Group has updated the NEAC data sets previously examined in the FWI. However, these still did not satisfy the criteria for inclusion in the FWI as being informative of a significant change, since over the time series the PFA estimates have predominately remained above the SER. The Working Group considered that these data sets would need to be re-evaluated for use in the future, should PFA estimates decline to levels consistently below the limit reference points for each stock complex. Alternatively different approaches to that applied in respect of the Greenland fishery should be explored as they are proposed. In the absence of a FWI, the only indication of a change would be provided by a full assessment of the NEAC stock complexes, an option that should be preferred, given that the PFA of these complexes remain close to SERs.

Table 3.3.2.1 Conservation limits 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	14,588	15,683			14,588	15,683
Iceland (north & east)	6,768	1,544			6,768	1,544
Norway[1]	94,037	69,529			94,037	69,529
Russia	113,550	40,431			113,550	40,431
Sweden	1,824	1,202			1,824	1,202
			Conservation limit		230,766	128,389
			Spawner Escapement Reserve		291,212	216,904

[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)	19,805	1,453			19,805	1,453
Ireland			236,044	15,334	236,044	15,334
UK (E&W)			54,491	29,605	54,491	29,605
UK (NI)	17,715	2,325			17,715	2,325
UK (Sco)	311,055	242,516			311,055	242,516
			Conservation limit		656,509	296,333
			Spawner Escapement Reserve		834,586	501,086

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

Model Parameters			Southern NEAC non-maturing PFA
Year	Spawner (lagged eggs)	PFAm	
1978	5,375,061	2,156,166	1,201,472
1979	5,082,898	1,909,716	1,681,213
1980	4,144,089	1,511,892	1,793,226
1981	3,647,601	1,232,796	1,308,401
1982	3,673,839	1,798,399	1,546,015
1983	3,526,516	2,553,645	1,086,116
1984	3,416,337	1,799,512	1,270,988
1985	3,271,791	2,118,221	1,696,591
1986	3,257,640	2,491,307	1,277,337
1987	3,979,968	1,823,219	1,620,967
1988	3,447,064	2,507,120	1,469,387
1989	3,641,731	2,090,592	1,170,551
1990	4,270,908	1,282,166	827,645
1991	4,206,632	1,057,530	1,025,318
1992	4,624,304	1,509,098	889,125
1993	4,677,588	1,462,301	1,015,216
1994	3,900,739	1,554,375	965,690
1995	3,286,451	1,548,374	760,835
1996	3,433,127	1,277,994	583,266
1997	3,642,403	1,159,740	530,021
1998	3,518,637	1,475,759	546,655
1999	3,638,553	1,011,153	652,920
2000	3,218,571	1,525,515	633,461
2001	2,862,594	1,306,849	569,450
2002	2,684,391	1,171,321	626,211
2003	2,567,345	1,123,244	660,732
2004	2,985,882	1,089,172	570,947
2005	3,016,287	1,148,048	552,304
2006	2,834,183	956,526	492,491
2007	2,923,127	1,072,041	510,991
2008	2,892,656	921,077	
2009	2,913,600		
2010	2,719,191		
2011	2,892,168		
2012	2,718,213		

Table 3.6.1.2 Predictions and 95% confidence limits of PFA non-maturing salmon and the associated SERs for Southern NEAC using Spawners (Eggs) and Year for the years 2008 to 2012.

Year	PFA	lower	upper	SER
2008	453,682	306,257	672,074	501,188
2009	431,220	290,303	640,539	501,188
2010	419,733	281,870	625,024	501,188
2011	392,235	262,520	586,044	501,188
2012	380,952	254,458	570,328	501,188

Table 3.8.3.1 Number of gear units licensed or authorised by country and gear type (- indicates no information available).

Year	England & Wales					UK (Scotland)		UK (N. Ireland)			Norway			
	Gillnet licences	Sweepnet	Hand-held net	Fixed engine	Rod & Line	Fixed engine[1]	Net and coble[2]	Driftnet	Draftnet	Bagnets and boxes	Bagnet	Bendnet	Liftnet	Driftnet (No. nets)
1971	437	230	294	79	-	3,069	802	142	305	18	4,608	2,421	26	8,976
1972	308	224	315	76	-	3,437	810	130	307	18	4,215	2,367	24	13,448
1973	291	230	335	70	-	3,241	884	130	303	20	4,047	2,996	32	18,616
1974	280	240	329	69	-	3,182	777	129	307	18	3,382	3,342	29	14,078
1975	269	243	341	69	-	2,978	768	127	314	20	3,150	3,549	25	15,968
1976	275	247	355	70	-	2,854	756	126	287	18	2,569	3,890	22	17,794
1977	273	251	365	71	-	2,742	677	126	293	19	2,680	4,047	26	30,201
1978	249	244	376	70	-	2,572	691	126	284	18	1,980	3,976	12	23,301
1979	241	225	322	68	-	2,698	747	126	274	20	1,835	5,001	17	23,989
1980	233	238	339	69	-	2,892	670	125	258	20	2,118	4,922	20	25,652
1981	232	219	336	72	-	2,704	647	123	239	19	2,060	5,546	19	24,081
1982	232	221	319	72	-	2,415	647	123	221	18	1,843	5,217	27	22,520
1983	232	209	333	74	-	2,530	669.5	120	207	17	1,735	5,428	21	21,813
1984	226	223	354	74	-	2,443	653	121	192	19	1,697	5,386	35	21,210
1985	223	230	375	69	-	2,196	551	122	168	19	1,726	5,848	34	20,329
1986	220	221	368	64	-	1,996	618.5	121	148	18	1,630	5,979	14	17,945
1987	213	206	352	68	-	1,762	577	120	119	18	1,422	6,060	13	17,234
1988	210	212	284	70	-	1,577	402	115	113	18	1,322	5,702	11	15,532
1989	201	199	282	75	-	1,235	355.5	117	108	19	1,888	4,100	16	0
1990	200	204	292	69	-	1,280	339.5	114	106	17	2,375	3,890	7	0
1991	199	187	264	66	-	1,136	289	118	102	18	2,343	3,628	8	0
1992	203	158	267	65	-	850	292.5	121	91	19	2,268	3,342	5	0
1993	187	151	259	55	-	900	263.5	120	73	18	2,869	2,783	-	0
1994	177	158	257	53	37,278	752	243.5	119	68	18	2,630	2,825	-	0
1995	163	156	249	47	34,941	729	221.5	122	68	16	2,542	2,715	-	0
1996	151	132	232	42	35,281	644	200.5	117	66	12	2,280	2,860	-	0
1997	139	131	231	35	32,781	688	190	116	63	12	2,002	1,075	-	0
1998	130	129	196	35	32,525	545	143.5	117	70	12	1,865	1,027	-	0
1999	120	109	178	30	29,132	384	128.5	113	52	11	1,649	989	-	0
2000	110	103	158	32	30,139	385	119	109	57	10	1,557	982	-	0
2001	113	99	143	33	24,350	387	95	107	50	6	1,976	1,081	-	0
2002	113	94	147	32	29,407	427	101	106	47	4	1,666	917	-	0
2003	58	96	160	57	29,936	363	109	105	52	2	1,664	766	-	0
2004	57	75	157	65	32,766	409	96	90	54	2	1,546	659	-	0
2005	59	73	148	65	34,040	382	101	93	57	2	1,453	661	-	0
2006	52	57	147	65	31,606	338	82	107	49	2	1,283	685		
2007	53	45	157	66	32,181	296	66	20	12	2	1,302	669		
2008	55	42	130	66	33,979	175	54	20	12	2	957	653		
Mean 2004-2008	55	58	148	65	32,914	320	80	66	37	2	1,308	665		0
% change [3]	-0.4	-28.1	-12.0	0.9	3.2	-45.3	-32.3	-69.7	-67.4	0.0	-26.8	-1.9		
Mean 1999-2008	79	79	153	51	30754	355	95	87	44	4	1,505	806		0
% change [3]	-30.4	-47.0	-14.8	29.2	10.5	-50.6	-43.2	-77.0	-72.9	-53.5	-36.4	-19.0		

[1] Number of gear units expressed as trap months.
[2] Number of gear units expressed as crew months.
[3] (2008/mean - 1) * 100
[3] (2008/mean - 1) * 100
[4] Dash means "no data"

Table 3.8.3.1 Cont'd. Number of gear units licensed or authorised by country and gear type (- indicates no information available).

Year	Ireland				Finland				France			Russia		
					The Teno River			R. Näätämö				Kola Peninsula	Archangel region	
	Driftnets No.	Draftnets	Other nets Commercial	Rod	Recreational fishery Tourist anglers Fishing days	Fishermen	Local rod and net fishery Fishermen	Recreational fishery Fishermen	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 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	768	507	183	17,977	22,487	7,759	754	689	5,724 [4]	87 [4]	80	-	-	-
1988	836	507	183	11,539	21,708	7,755	741	538	4,346	101	76	-	-	-
1989	801	507	183	16,484	24,118	8,681	742	696	3,789	83	78	-	-	-
1990	756	525	189	15,395	19,596	7,677	728	614	2,944	71	76	-	-	-
1991	707	504	182	15,178	22,922	8,286	734	718	2,737	78	71	1,711	-	-
1992	691	535	183	20,263	26,748	9,058	749	875	2,136	57	71	4,088	-	-
1993	673	457	161	23,875	29,461	10,198	755	705	2,104	53	55	6,026	59	199
1994	732	494	176	24,988	26,517	8,985	751	671	1,672	14	59	8,619	60	230
1995	768	512	164	27,056	24,951	8,141	687	716	1,878	17	59	5,822	55	239
1996	778	523	170	29,759	17,625	5,743	672	814	1,798	21	69	6,326	85	330
1997	852	531	172	31,873	16,255	5,036	616	588	2,953	10	59	6,355	68	282
1998	874	513	174	31,565	18,700	5,759	621	673	2,352	16	63	6,034	66	270
1999	874	499	162	32,493	22,935	6,857	616	850	2,225	15	61	7,023	66	194
2000	871	490	158	33,527	28,385	8,275	633	624	2,037 [5]	16	35	7,336	60	173
2001	881	540	155	32,814	33,501	9,367	863	590	2,080	18	42	8,468	53	121
2002	833	544	159	32,814	37,491	10,560	853	660	2,082	18	43	9,624	63	72
2003	877	549	159	32,725	34,979	10,032	832	644	2,048	18	38	11,898	55	84
2004	831	473	136	31,809	29,494	8,771	801	657	2,158	15	38	13,300	62	56
2005	877	518	158	28,738	27,627	7,776	785	705	2,356	16	37	20,309	93	69
2006	875	533	162	27,337	29,516	7,749	836	552	2,269	12	37	13,604	62	72
2007	0	335	100	19,855	33,664	8,763	780	716	2,431	13	37	n/a	82	53
2,008	0	335	100	20,063	31,143	8,111	756	694	2,401	12	32	n/a	66	62
Mean 2004-2008	517	439	131	25,560	30,289	8,234	792	665	2,323	14	36	15,738	73	62
% change [3]	-100.0	-23.7	-23.8	-21.5	2.8	-1.5	-4.5	4.4	3.4	-11.8	-11.6		-9.6	-0.6
Mean 1999-2008	692	482	145	29,218	30,874	8,626	776	669	2,209	15	40	11,445	66	96
% change [3]	-100.0	-30.4	-31.0	-31.3	0.9	-6.0	-2.5	3.7	8.7	-21.6	-20.0		-0.3	-35.1

[1a] Lower Adour only since 1994 (Southwestern France), due to fishery closure in the Loire Basin.
[1b] Adour estuary only (Southwestern France).
[2] Number of fishermen or boats using drift nets: overestimates the actual number of fishermen targeting salmon by a factor 2 or 3.
[3] Common licence for salmon and sea trout introduced in 1986, leading to a short-term increase in the number of licences issued.
[4] Compulsory declaration of salmon catches in freshwater from 1987 onwards.
[5] Before 2000, equal to the number of salmon licenses sold. From 2000 onwards, number estimated because of a single sea trout and salmon angling license.
[6] (2008/mean - 1) * 100
[7] Dash means "no data"

Table 3.8.4.1 Nominal catch of salmon in NEAC area (in tonnes round fresh weight), 1960–2008 (2008 figures are provisional).

Year	Southern countries	Northern countries	Faroes (1)	Other catches in international waters	Total Reported Catch	Unreported NEAC Area
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
1991	1 145	1 677	95	-	2 917	1 555
1992	1 523	1 806	23	-	3 352	1 825
1993	1 443	1 853	23	-	3 319	1 471
1994	1 896	1 684	6	-	3 586	1 157
1995	1 775	1 503	5	-	3 283	942
1996	1 392	1 358	-	-	2 750	947
1997	1 112	962	-	-	2 074	732
1998	1 120	1 099	6	`	2 225	1 108
1999	934	1 139	0	-	2 073	887
2000	1 210	1 518	8	-	2 736	1 135
2001	1 242	1 634	0	-	2 876	1 089
2002	1 135	1 360	0	-	2 495	946
2003	908	1 394	0	-	2 302	719
2004	919	1 058	0	-	1 977	575
2005	810	1 189	0	-	1 999	605
2006	651	1 219	0	-	1 870	604
2007	376	1 033	0	-	1 410	465
2008	347	1 172	0	-	1 519	429
Means						
2003-2007	733	1179	0	-	1911	594
1998-2007	931	1264	1	-	2196	813

1. Since 1991, fishing carried out at the Faroes has only been for research purposes.
2. Estimates refer to season ending in given year.
3. No unreported catch estimate available for Russia in 2008.

Table 3.8.5.1 Cpue for salmon rod catches in Finland (Teno and Näätämöjoki), 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	2.32	0.205
1995	2.7	0.9	0.5	0.1	1.15	0.206
1996	3.0	1.0	0.7	0.2	1.57	0.267
1997	3.4	1.0	1.1	0.2	0.44 [1]	0.338
1998	3.0	0.9	1.3	0.3	0.67	0.569
1999	3.7	1.1	0.8	0.2	0.76	0.273
2000	5.0	1.5	0.9	0.2	1.06	0.259
2001	5.9	1.7	1.2	0.3	0.97	0.444
2002	3.1	0.9	0.7	0.2	0.84	0.184
2003	2.6	0.7	0.8	0.2	0.76	0.238
2004	1.4	0.4	0.9	0.2	1.25	0.252
2005	2.7	0.8	1.3	0.2	0.74	0.323
2006	3.4	1.0	1.9	0.4	0.89	0.457
2007	2.9	0.8	1.0	0.2	0.74	0.601
2008	4.2	1.1	0.9	0.2	0.77	0.457
Mean 2003-07	2.6	0.7	1.2	0.2	0.88	0.374

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

Table 3.8.5.2 Cpue for salmon rod catches in the Barents Sea and White Sea basin in Russia.

	Barents Sea Basin, catch per angler day					White Sea Basin, catch per angler day			
Year	Rynda	Kharlovka	E. Litsa	Varzina	Iokanga	Ponoy	Varzuga	Kitsa	Umba
1991						2.79	1.87		1.33
1992	2.37	1.45	2.95	1.07	0.14	4.50	2.26	1.21	1.37
1993	1.18	1.46	1.59	0.49	0.65	3.57	1.28	1.43	2.72
1994	0.71	0.85	0.79	0.55	0.33	3.30	1.60	1.59	1.44
1995	0.49	0.78	0.94	1.22	0.72	3.77	2.52	1.78	1.20
1996	0.70	0.85	1.31	1.50	1.40	3.78	1.44	1.76	0.93
1997	1.20	0.71	1.09	0.61	1.41	6.09	2.36	2.48	1.46
1998	1.01	0.55	0.75	0.44	0.87	4.52	2.28	2.78	0.98
1999	0.95	0.77	0.93	0.43	1.19	3.30	1.71	1.66	0.76
2000	1.35	0.77	0.89	0.57	2.28	3.55	1.53	3.02	1.25
2001	1.48	0.92	1.00	0.89	0.73	4.35	1.86	1.81	1.04
2002	2.39	0.99	0.89	0.80	2.82	7.28	1.44	2.11	0.36
2003	1.61	1.14	1.04	0.79	2.01	8.39	1.17	1.61	0.36
2004	1.07	0.98	1.31	0.65	1.00	5.80	1.14	1.10	0.36
2005	1.09	0.82	1.45	0.46	0.88	4.42	0.57	0.89	0.28
2006	0.98	1.49	1.49	1.45		6.28	2.23		0.73
2007	0.92	0.78	1.43	1.16		5.96			
2008						5.73			
Mean 2003-07	1.13	1.04	1.34	0.90	1.30	6.17	1.28	1.20	0.43

Table 3.8.5.3 Cpue data for net and fixed engine fisheries by Region in UK (England & Wales). Data expressed as catch per licence-tide, except for the North East, for which the data are expressed as catch per licence-day.

		Region (aggregated data, various methods)				
Year	North East drift nets	North East	South West [1]	Midlands	Wales [1]	North West
1988		5.49				-
1989		4.39				0.82
1990		5.53				0.63
1991		3.20				0.51
1992		3.83				0.40
1993	8.23	6.43				0.63
1994	9.02	7.53				0.71
1995	11.18	7.84				0.79
1996	4.93	3.74				0.59
1997	6.48	4.40	0.70	0.48	0.14	0.63
1998	5.92	3.81	1.25	0.42	0.12	0.46
1999	8.06	4.88	0.79	0.72	0.24	0.52
2000	13.06	8.11	1.01	0.66	0.19	1.05
2001	10.34	6.83	0.71	0.79	0.21	0.71
2002	8.55	5.59	1.03	1.39	0.28	0.90
2003	7.13	4.82	1.24	1.13	0.18	0.62
2004	8.17	5.88	1.17	0.46	0.21	0.69
2005	7.23	4.13	0.60	0.97	0.21	1.28
2006	5.60	3.20	0.66	0.97	0.14	0.82
2007	7.24	4.17	0.33	1.26	0.11	0.75
2008 [2]	5.24	3.59	0.63	1.33	0.09	0.34
Mean 2003-07	7.07	4.44	0.80	0.96	0.17	0.83

[1] series totally change compare to wg2008 report

[2] figures provisional for 2008

Table 3.8.5.4 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	33.9	156.4
1953	33.1	121.7
1954	29.3	162.0
1955	37.1	201.8
1956	25.7	117.5
1957	32.6	178.7
1958	48.4	170.4
1959	33.3	159.3
1960	30.7	177.8
1961	31.0	155.2
1962	43.9	242.0
1963	44.2	182.9
1964	57.9	247.1
1965	43.7	188.6
1966	44.9	210.6
1967	72.6	329.8
1968	47.0	198.5
1969	65.5	327.6
1970	50.3	241.9
1971	57.2	231.6
1972	57.5	248.0
1973	73.7	240.6
1974	63.4	257.1
1975	53.6	235.7
1976	42.9	150.8
1977	45.6	188.7
1978	53.9	196.1
1979	42.2	157.2
1980	37.6	158.6
1981	49.6	183.9
1982	61.3	180.2
1983	55.8	203.6
1984	58.9	155.3
1985	49.6	148.9
1986	75.2	193.4
1987	61.8	145.6
1988	50.6	198.4
1989	71.0	262.4
1990	33.2	146.0
1991	35.9	106.4
1992	59.6	153.7
1993	52.8	125.2
1994	92.1	123.7
1995	75.6	142.3
1996	57.5	110.9
1997	33.0	57.8
1998	36.0	68.7
1999	21.9	58.8
2000	53.7	105.2
2001	60.3	76.1
2002	43.8	67.3
2003	67.3	66.5
2004	51.1	66.5
2005	55.1	80.9
2006	49.2	76.1
2007	46.4	95.7
2008	56.4	15.8
Mean 2003-07	53.8	77.1

[1] Excludes catch and effort for Solway Region

Table 3.8.5.5 Cpue for the marine fishery in Norway. The cpue is expressed as numbers of salmon caught per net day in bagnets and bendnets partitioned 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	0.90	0.26	0.84	0.69	0.28
2004	0.89	0.97	0.25	0.59	0.60	0.17
2005	1.17	0.81	0.27	0.72	0.73	0.33
2006	1.02	1.33	0.27	0.72	0.86	0.29
2007	0.43	0.90	0.32	0.57	0.95	0.33
2008	1.07	1.13	0.43	0.57	0.97	0.57
Mean 2003-07	1.02	0.98	0.27	0.69	0.77	0.28

Table 3.8.6.1 Percentage of 1SW salmon in catches from countries in the North East Atlantic, 1987–2008.

Table 3.8.6.1. Percentage of 1SW salmon in catches from countries in the North East Atlantic, 1987-2008

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	71	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	64	**64**
1994	63	55	68	69	64	**67**	54	77	55	69	**61**
1995	71	59	58	70	78	**62**	53	72	60	26	**59**
1996	73	79	53	80	63	**61**	53	65	51	34	**56**
1997	73	69	64	82	54	**68**	54	73	51	28	**60**
1998	82	75	66	82	59	**70**	58	83	71	54	**65**
1999	70	83	65	78	71	**68**	45	68	27	14	**54**
2000	82	71	67	75	69	**69**	54	79	58	74	**65**
2001	78	48	58	74	55	**60**	55	76	51	40	**63**
2002	83	34	49	70	63	**54**	54	76	69	38	**64**
2003	75	51	61	67	47	**62**	52	67	51	16	**55**
2004	86	47	52	68	52	**58**	50	81	40	67	**59**
2005	87	72	67	66	55	**69**	58	75	41	15	**60**
2006	84	73	54	77	56	**69**	57	77	50	15	**61**
2007	91	30	42	69	33	**50**	57	78	45	26	**61**
2008	89	34	46	58	30	**54**	44	75	42	26	**53**
Means											
2003-2007	85	55	55	69	49	**62**	55	76	45	28	**59**
1997-2007	80	62	60	74	58	**65**	54	76	51	36	**60**

1. Based on catches in Asturias (~90 % of the Spanish catch). No information received from Spain for 2008, the value from 2007 is copied to 2008.

Table 3.8.10.1 Summary of the results of a sensitivity analysis of the NEAC run-reconstruction model. The relative contribution of model parameters to the variance in the predictions of the number of recruits (maturing and non-maturing 1SW) and spawners (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES Working Group in 2009 (2008 catches). Parameters which have accounted for at least 5% of the variance of a given forecast variable in one or more years are indicated by X.

Stock complex	Region	Parameter	Forecast Variable			
			PFA		Spawners	
			Maturing	Non-Maturing	1SW	MSW
Northern NEAC	Russia (Kola Pen. White Sea Basin)	Exploitation rate	X	X	X	
	Norway (mid)	Exploitation rate	X	X	X	X
		Unreported catch	X			
	Norway (north)	Exploitation rate		X	X	X
		Unreported catch				
	Norway (south)	Exploitation rate		X	X	X
Southern NEAC	UK (Scot) (East)	Exploitation rate	X	X	X	X
	Ireland	Exploitation rate	X		X	
	UK (E&W)	Exploitation rate		X		X
	UK (Scot) (West)	Exploitation rate		X		X

Table 3.8.11.1a Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-R. Tana/Teno (Finland/Norway).

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
1971	8,422	8,538	30	40	30	40	40	60	40	70
1972	13,160	13,341	30	40	30	40	40	60	40	70
1973	11,969	15,958	30	40	30	40	40	60	40	70
1974	23,709	23,709	30	40	30	40	40	60	40	70
1975	16,527	26,417	30	40	30	40	40	60	40	70
1976	11,323	21,719	30	40	30	40	40	60	40	70
1977	5,807	13,227	30	40	30	40	40	60	40	70
1978	7,902	8,452	30	40	30	40	40	60	40	70
1979	9,249	7,390	30	40	30	40	40	60	30	60
1980	4,792	8,938	20	30	20	30	40	60	30	60
1981	7,386	9,835	20	30	20	30	40	60	30	60
1982	2,163	12,826	20	30	20	30	40	60	30	60
1983	10,680	13,990	20	30	20	30	40	60	30	60
1984	11,942	13,262	20	30	20	30	40	60	30	60
1985	18,039	10,339	20	30	20	30	40	60	30	60
1986	16,389	9,028	20	30	20	30	40	60	30	60
1987	20,950	11,290	20	30	20	30	40	60	30	60
1988	10,019	7,231	20	30	20	30	40	60	30	60
1989	28,091	10,011	20	30	20	30	50	70	40	70
1990	26,646	12,562	20	30	20	30	50	70	40	70
1991	32,423	15,136	20	30	20	30	50	70	40	70
1992	42,965	16,158	20	30	20	30	50	70	40	70
1993	30,197	18,720	20	30	20	30	50	70	40	70
1994	12,016	15,521	20	30	20	30	50	70	40	70
1995	11,801	9,634	20	30	20	30	50	70	40	70
1996	22,799	6,956	20	30	20	30	40	60	30	60
1997	19,481	10,083	20	30	20	30	40	60	30	60
1998	22,460	8,497	20	30	20	30	40	60	30	60
1999	38,687	8,854	20	30	20	30	50	70	40	60
2000	40,654	19,707	20	30	20	30	50	70	40	60
2001	18,372	28,337	20	30	20	30	50	70	40	60
2002	10,757	22,717	20	30	20	30	40	60	40	60
2003	12,699	16,093	20	30	20	30	40	60	40	60
2004	4,912	7,718	20	30	20	30	40	60	40	60
2005	12,499	5,969	20	30	20	30	40	60	40	60
2006	23,727	10,473	20	30	20	30	40	60	40	60
2007	4,407	14,878	20	30	20	30	40	60	40	60
2008	4,539	14,165	20	30	20	30	40	60	40	60

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

Table 3.8.11.1b Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-France.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
	Non-reporting included in exploitation rates until 2002									
1971	1,740	4,060	0	0	0	0	2	5	25	50
1972	3,480	8,120	0	0	0	0	2	5	25	50
1973	2,130	4,970	0	0	0	0	2	5	25	50
1974	990	2,310	0	0	0	0	2	5	25	50
1975	1,980	4,620	0	0	0	0	2	5	25	50
1976	1,820	3,380	0	0	0	0	2	5	25	50
1977	1,400	2,600	0	0	0	0	2	5	25	50
1978	1,435	2,665	0	0	0	0	2	5	25	50
1979	1,645	3,055	0	0	0	0	2	5	25	50
1980	3,430	6,370	0	0	0	0	2	5	25	50
1981	2,720	4,080	0	0	0	0	2	5	20	50
1982	1,680	2,520	0	0	0	0	2	5	20	50
1983	1,800	2,700	0	0	0	0	2	5	20	50
1984	2,960	4,440	0	0	0	0	2	5	20	50
1985	1,100	3,330	0	0	0	0	2	5	20	50
1986	3,400	3,400	0	0	0	0	2	12	20	50
1987	6,013	1,806	0	0	0	0	2	12	20	50
1988	2,063	4,964	0	0	0	0	2	12	20	50
1989	1,124	2,282	0	0	0	0	2	12	20	50
1990	1,886	2,332	0	0	0	0	2	12	20	50
1991	1,362	2,125	0	0	0	0	2	12	20	50
1992	2,490	2,671	0	0	0	0	2	12	20	50
1993	3,581	1,254	0	0	0	0	2	12	20	50
1994	2,810	2,290	0	0	0	0	2	12	20	40
1995	1,669	1,095	0	0	0	0	5	20	20	40
1996	2,063	1,943	0	0	0	0	5	20	20	40
1997	1,060	1,001	0	0	0	0	5	20	20	40
1998	2,065	846	0	0	0	0	5	20	20	40
1999	690	1,831	0	0	0	0	5	20	20	40
2000	1,792	1,277	0	0	0	0	5	20	20	40
2001	1,544	1,489	0	0	0	0	5	20	20	40
2002	2,423	1,065	20	40	15	30	10	30	20	55
2003	1,598	1,540	20	40	15	30	10	30	20	55
2004	1,927	2,880	20	40	15	30	10	30	20	55
2005	1,256	1,771	20	40	15	30	10	30	20	55
2006	1,763	1,785	20	40	15	30	10	30	20	55
2007	1,378	1,685	20	40	15	30	10	30	20	55
2008	1,365	1,865	20	40	15	30	10	30	20	55

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

Table 3.8.11.1c Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Iceland-West & South.

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
1971	30,618	16,749	1	3	1	3	40	60	60	80
1972	24,832	25,733	1	3	1	3	40	60	60	80
1973	26,624	23,183	1	3	1	3	40	60	60	80
1974	18,975	20,017	1	3	1	3	40	60	60	80
1975	29,428	21,266	1	3	1	3	40	60	60	80
1976	23,233	18,379	1	3	1	3	40	60	60	80
1977	23,802	17,919	1	3	1	3	40	60	60	80
1978	31,199	23,182	1	3	1	3	40	60	60	80
1979	28,790	14,840	1	3	1	3	40	60	60	80
1980	13,073	20,855	1	3	1	3	40	60	60	80
1981	16,890	13,919	1	3	1	3	40	60	60	80
1982	17,331	9,826	1	3	1	3	40	60	60	80
1983	21,923	16,423	1	3	1	3	40	60	60	80
1984	13,476	13,923	1	3	1	3	40	60	60	80
1985	21,822	10,097	1	3	1	3	40	60	60	80
1986	35,891	8,423	1	3	1	3	40	60	60	80
1987	22,302	7,480	1	3	1	3	40	60	60	80
1988	40,028	8,523	1	3	1	3	40	60	60	80
1989	22,377	7,607	1	3	1	3	40	60	60	80
1990	20,584	7,548	1	3	1	3	40	60	60	80
1991	22,711	7,519	1	3	1	3	40	60	60	80
1992	26,006	8,479	1	3	1	3	40	60	60	80
1993	25,479	4,155	1	3	1	3	40	60	60	80
1994	20,985	6,736	1	3	1	3	40	60	60	80
1995	25,371	6,777	10	15	10	15	40	60	60	80
1996	21,913	4,364	10	15	10	15	40	60	60	80
1997	16,007	4,910	10	15	10	15	40	60	60	80
1998	21,900	3,037	10	15	10	15	40	60	60	80
1999	17,448	5,757	10	15	10	15	39	59	58	78
2000	15,502	1,519	10	15	10	15	39	59	56	76
2001	13,586	2,707	10	15	10	15	38	58	57	77
2002	16,952	2,845	10	15	10	15	38	58	55	75
2003	20,271	4,751	10	15	10	15	38	58	58	78
2004	20,319	3,784	10	15	10	15	38	58	57	77
2005	29,969	3,241	10	15	10	15	38	58	55	75
2006	21,153	2,689	10	15	10	15	38	58	55	75
2007	23,728	1,679	10	15	10	15	38	56	56	76
2008	35,650	1,641	10	15	10	15	37	57	47	67

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

Table 3.8.11.1d Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Iceland-North & East.

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
1971	4,610	6,625	1	3	1	3	40	60	60	80
1972	4,223	10,337	1	3	1	3	40	60	60	80
1973	5,060	9,672	1	3	1	3	40	60	60	80
1974	5,047	9,176	1	3	1	3	40	60	60	80
1975	6,152	10,136	1	3	1	3	40	60	60	80
1976	6,184	8,350	1	3	1	3	40	60	60	80
1977	8,597	11,631	1	3	1	3	40	60	60	80
1978	8,739	14,998	1	3	1	3	40	60	60	80
1979	8,363	9,897	1	3	1	3	40	60	60	80
1980	1,268	13,784	1	3	1	3	40	60	60	80
1981	6,528	4,827	1	3	1	3	40	60	60	80
1982	3,007	5,539	1	3	1	3	40	60	60	80
1983	4,437	4,224	1	3	1	3	40	60	60	80
1984	1,611	5,447	1	3	1	3	40	60	60	80
1985	11,116	3,511	1	3	1	3	40	60	60	80
1986	13,827	9,569	1	3	1	3	40	60	60	80
1987	8,145	9,908	1	3	1	3	40	60	60	80
1988	11,775	6,381	1	3	1	3	40	60	60	80
1989	6,342	5,414	1	3	1	3	40	60	60	80
1990	4,752	5,709	1	3	1	3	40	60	60	80
1991	6,900	3,965	1	3	1	3	40	60	60	80
1992	12,996	5,903	1	3	1	3	40	60	60	80
1993	10,689	6,672	1	3	1	3	40	60	60	80
1994	3,414	5,656	1	3	1	3	40	60	60	80
1995	8,776	3,511	10	15	10	15	40	60	60	80
1996	4,681	4,605	10	15	10	15	40	60	60	80
1997	6,406	2,594	10	15	10	15	40	60	60	80
1998	10,905	3,780	10	15	10	15	40	60	60	80
1999	5,326	4,030	10	15	10	15	38	58	55	75
2000	5,595	2,324	10	15	10	15	38	58	54	74
2001	4,976	2,587	10	15	10	15	37	57	52	72
2002	8,437	2,366	10	15	10	15	36	56	50	70
2003	4,478	2,194	10	15	10	15	36	56	43	63
2004	11,823	2,239	10	15	10	15	35	55	45	65
2005	10,297	2,726	10	15	10	15	34	54	44	64
2006	11,082	2,179	10	15	10	15	35	55	35	55
2007	8,046	1,672	10	15	10	15	34	54	26	46
2008	7,075	2,616	10	15	10	15	24	53	34	54

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

Table 3.8.11.1e Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Ireland.

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
1971	409,965	46,594	30	45	30	45	50.00	75.00	35.00	60.00
1972	437,089	49,863	30	45	30	45	50.00	75.00	35.00	60.00
1973	476,131	54,008	30	45	30	45	50.00	75.00	35.00	60.00
1974	542,124	60,976	30	45	30	45	50.00	75.00	35.00	60.00
1975	598,524	68,260	30	45	30	45	50.00	75.00	35.00	60.00
1976	407,018	47,358	30	45	30	45	50.00	75.00	35.00	60.00
1977	351,745	41,256	30	45	30	45	50.00	75.00	35.00	60.00
1978	307,569	35,708	30	45	30	45	50.00	75.00	35.00	60.00
1979	282,700	32,144	30	45	30	45	50.00	75.00	35.00	60.00
1980	215,116	35,447	30	45	30	45	50.00	75.00	35.00	60.00
1981	137,366	26,101	30	45	30	45	64.38	87.10	35.00	60.00
1982	269,847	11,754	30	45	30	45	61.08	82.64	28.34	44.99
1983	437,751	26,479	30	45	30	45	56.14	75.96	10.34	45.41
1984	224,872	20,685	30	45	30	45	54.91	74.28	37.02	50.00
1985	430,315	18,830	30	45	30	45	63.39	85.76	32.75	39.45
1986	443,701	27,111	30	45	30	45	58.40	79.01	36.95	55.00
1987	324,709	26,301	20	40	20	40	59.34	80.28	27.50	36.86
1988	391,475	22,067	20	40	20	40	52.73	71.34	31.85	43.00
1989	297,797	25,447	20	40	20	40	55.85	75.56	38.35	56.00
1990	172,098	15,549	20	40	20	40	51.62	69.84	53.85	66.00
1991	120,408	10,334	20	40	20	40	50.55	68.39	23.00	30.00
1992	182,255	15,456	20	40	20	40	52.75	71.36	47.66	55.26
1993	150,274	13,156	15	35	15	35	49.85	67.44	24.00	60.00
1994	234,126	20,506	15	35	15	35	60.70	82.12	38.06	43.00
1995	232,480	20,454	15	35	15	35	53.94	72.98	40.65	43.00
1996	203,920	18,021	15	35	15	35	50.90	68.87	51.93	58.28
1997	170,774	14,724	15	35	10	20	42.59	57.62	18.51	43.00
1998	191,868	17,269	15	35	10	20	45.66	61.78	60.47	63.25
1999	158,818	14,801	15	35	10	20	40.60	54.92	16.00	52.29
2000	199,827	16,848	15	35	10	20	36.75	49.72	26.51	35.48
2001	218,715	18,436	5	10	5	10	40.80	55.20	27	43.00
2002	198,719	16,702	5	10	5	10	42.41	57.37	20	35.00
2003	161,270	13,745	5	10	5	10	35.13	47.52	16	27.00
2004	142251	12299	5	10	5	10	42	57	27	43
2005	127371	10716	5	10	5	10	38	51	20	27
2006	101938	9740	5	10	5	10	40	53	16	43
2007	30,418	2,477	5	10	5	10	7	24	15	33
2008	30434	2397	5	10	5	10	7	24	15	33

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

Table 3.8.11.1e (cont.) Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Ireland. Net catch and spawner numbers 2007 to 2008.

Year	Net Catch		Catch & release		Spawners Small rivers		Spawners Closed rivers	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
1971								
1972								
1973								
1974								
1975								
1976								
1977								
1978								
1979								
1980								
1981								
1982								
1983								
1984								
1985								
1986								
1987								
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1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								
2001								
2002								
2003								
2004								
2005								
2006								
2007	8,334	679	12,137	988	9,548	777	40,255	3,278
2008	8,334	679	7,316	576	12,206	961	34,382	2,708

Table 3.8.11.1f Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Norway-South.

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
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	40,511	37,105	40	60	40	60	65	85	65	85
1984	34,248	38,614	40	60	40	60	65	85	65	85
1985	47,877	36,968	40	60	40	60	65	85	65	85
1986	51,839	41,890	40	60	40	60	65	85	65	85
1987	48,690	39,641	40	60	40	60	65	85	65	85
1988	53,775	37,145	40	60	40	60	65	85	65	85
1989	43,128	25,279	40	60	40	60	55	75	55	75
1990	44,259	25,907	40	60	40	60	55	75	55	75
1991	30,771	19,054	40	60	40	60	55	75	55	75
1992	32,488	24,124	40	60	40	60	55	75	55	75
1993	34,503	22,835	30	50	30	50	55	75	55	75
1994	42,551	20,903	30	50	30	50	55	75	55	75
1995	32,685	24,725	30	50	30	50	55	75	55	75
1996	27,739	26,029	30	50	30	50	55	75	55	75
1997	31,381	14,922	25	45	25	45	50	70	50	70
1998	38,299	16,966	25	45	25	45	50	70	50	70
1999	31,256	9,881	25	45	25	45	50	70	50	70
2000	54,671	22,208	25	45	25	45	50	70	50	70
2001	59,425	29,896	25	45	25	45	50	70	50	70
2002	39,068	21,513	25	45	25	45	50	70	50	70
2003	41,642	28,168	20	40	20	40	50	70	50	70
2004	35,616	22,226	20	40	20	40	50	70	50	70
2005	51,159	22,350	20	40	20	40	50	70	50	70
2006	36,331	31,235	20	40	20	40	50	70	50	70
2007	18,571	24,514	20	40	20	40	50	70	50	70
2008	18,839	21,492	20	40	20	40	40	60	40	60

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

Table 3.8.11.1g Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Norway-Mid.

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
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	121,221	74,648	40	60	40	60	65	85	65	85
1984	94,373	67,639	40	60	40	60	65	85	65	85
1985	114,613	56,641	40	60	40	60	65	85	65	85
1986	106,921	77,225	40	60	40	60	65	85	65	85
1987	83,669	62,216	40	60	40	60	65	85	65	85
1988	80,111	45,609	40	60	40	60	65	85	65	85
1989	94,897	30,862	40	60	40	60	55	75	55	75
1990	78,888	40,174	40	60	40	60	55	75	55	75
1991	67,370	30,087	40	60	40	60	55	75	55	75
1992	51,463	33,092	40	60	40	60	55	75	55	75
1993	58,326	28,184	30	50	30	50	55	75	55	75
1994	113,427	33,520	30	50	30	50	55	75	55	75
1995	57,813	42,696	30	50	30	50	55	75	55	75
1996	28,925	31,613	30	50	30	50	55	75	55	75
1997	43,127	20,565	25	45	25	45	50	70	50	70
1998	63,497	26,817	25	45	25	45	50	70	50	70
1999	60,689	28,792	25	45	25	45	50	70	50	70
2000	109,278	42,452	25	45	25	45	50	70	50	70
2001	88,096	52,031	25	45	25	45	50	70	50	70
2002	42,669	52,774	25	45	25	45	50	70	50	70
2003	91,118	46,963	20	40	20	40	50	70	50	70
2004	38,286	49,760	20	40	20	40	50	70	50	70
2005	63,749	37,941	20	40	20	40	50	70	50	70
2006	46,495	47,691	20	40	20	40	50	70	50	70
2007	26,608	33,106	20	40	20	40	50	70	50	70
2008	31,936	34,869	20	40	20	40	45	65	45	65

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

Table 3.8.11.1h Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Norway-North.

Year	Catch		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate		Exp. rate	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	104,040	49,413	40	60	40	60	70	90	70	90
1984	150,372	58,858	40	60	40	60	70	90	70	90
1985	118,841	58,956	40	60	40	60	70	90	70	90
1986	84,150	63,418	40	60	40	60	70	90	70	90
1987	72,370	34,232	40	60	40	60	70	90	70	90
1988	53,880	32,140	40	60	40	60	70	90	70	90
1989	42,010	13,934	40	60	40	60	60	80	60	80
1990	38,216	17,321	40	60	40	60	60	80	60	80
1991	42,888	21,789	40	60	40	60	60	80	60	80
1992	34,593	19,265	40	60	40	60	60	80	60	80
1993	51,440	39,014	30	50	30	50	60	80	60	80
1994	37,489	33,411	30	50	30	50	60	80	60	80
1995	36,283	26,037	30	50	30	50	60	80	60	80
1996	40,792	36,636	30	50	30	50	60	80	60	80
1997	39,930	30,115	25	45	25	45	60	80	60	80
1998	46,645	34,806	25	45	25	45	60	80	60	80
1999	46,394	46,744	25	45	25	45	60	80	60	80
2000	61,854	51,569	25	45	25	45	60	80	60	80
2001	46,331	54,023	25	45	25	45	60	80	60	80
2002	38,101	43,100	25	45	25	45	60	80	60	80
2003	44,947	35,972	20	40	20	40	60	80	60	80
2004	34,640	28,077	20	40	20	40	60	80	60	80
2005	45,530	33,334	20	40	20	40	60	80	60	80
2006	48,688	39,508	20	40	20	40	60	80	60	80
2007	28,748	44,550	20	40	20	40	60	80	60	80
2008	34,338	40,553	20	40	20	40	55	75	55	75

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

Table 3.8.11.1i Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Russia-Archangelsk & Karelia.

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
1971	134	16,592	5	15	5	15	40	80	40	80
1972	116	14,434	5	15	5	15	40	80	40	80
1973	169	20,924	5	15	5	15	40	80	40	80
1974	170	21,137	5	15	5	15	40	80	40	80
1975	140	17,398	5	15	5	15	40	80	40	80
1976	111	13,781	5	15	5	15	40	80	40	80
1977	78	9,722	5	15	5	15	40	80	40	80
1978	82	10,134	5	15	5	15	40	80	40	80
1979	112	13,903	5	15	5	15	40	80	40	80
1980	156	19,397	5	15	5	15	40	80	40	80
1981	68	8,394	5	15	5	15	40	80	40	80
1982	71	8,797	5	15	5	15	40	80	40	80
1983	48	11,938	5	15	5	15	40	80	40	80
1984	21	10,680	5	15	5	15	40	80	40	80
1985	454	11,183	5	15	5	15	40	80	40	80
1986	12	12,291	5	15	5	15	40	80	40	80
1987	647	8,734	5	15	5	15	40	80	40	80
1988	224	9,978	5	15	5	15	40	80	40	80
1989	989	10,245	5	15	5	15	40	80	40	80
1990	1,418	8,429	10	20	10	20	40	80	40	80
1991	421	8,725	15	25	15	25	40	80	40	80
1992	1,031	3,949	20	30	20	30	40	80	40	80
1993	196	4,251	25	35	25	35	40	80	40	80
1994	334	5,631	30	40	30	40	40	80	40	80
1995	386	5,214	40	50	40	50	40	80	40	80
1996	231	3,753	50	60	50	60	40	80	40	80
1997	721	3,351	50	60	50	60	40	80	40	80
1998	585	4,208	50	60	50	60	40	80	40	80
1999	299	3,101	50	60	50	60	40	80	40	80
2000	514	3,382	50	60	50	60	40	80	40	80
2001	363	2,348	50	60	50	60	40	80	40	80
2002	1,676	2,439	50	60	50	60	40	80	40	80
2003	893	2,041	50	60	50	60	40	80	40	80
2004	990	3,761	50	60	50	60	40	80	40	80
2005	1,349	4,915	50	60	50	60	40	80	40	80
2006	2,183	2,841	50	60	50	60	40	80	40	80
2007	1,618	2,621	50	60	50	60	40	80	40	80
2008	332	2,496	50	60	50	60	40	80	40	80

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

Table 3.8.11.1j Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Russia-Kola peninsula: Barents Sea Basin.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	4892	5979	10	20	10	20	40	50	40	50
1972	7978	9750	10	20	10	20	40	50	40	50
1973	9376	11460	10	20	10	20	35	45	35	45
1974	12794	15638	10	20	10	20	35	45	35	45
1975	13872	13872	10	20	10	20	40	50	40	50
1976	11493	14048	10	20	10	20	50	60	50	60
1977	7257	8253	10	20	10	20	45	55	45	55
1978	7106	7113	10	20	10	20	50	60	50	60
1979	6707	3141	10	20	10	20	35	45	35	45
1980	6621	5216	10	20	10	20	35	45	35	45
1981	4547	5973	10	20	10	20	35	45	35	45
1982	5159	4798	10	20	10	20	30	40	30	40
1983	8,504	9,943	10	20	10	20	30	40	30	40
1984	9,453	12,601	10	20	10	20	30	40	30	40
1985	6,774	7,877	10	20	10	20	30	40	30	40
1986	10,147	5,352	10	20	10	20	35	45	35	45
1987	8,560	5,149	10	20	10	20	35	45	35	45
1988	6,644	3,655	10	20	10	20	30	40	30	40
1989	13,424	6,787	10	20	10	20	35	45	35	45
1990	16,038	8,234	10	20	10	20	35	45	35	45
1991	4,550	7,568	10	20	10	20	25	35	25	35
1992	11,394	7,109	10	20	10	20	25	35	25	35
1993	8,642	5,690	10	20	10	20	25	35	25	35
1994	6,101	4,632	10	20	10	20	25	35	25	35
1995	6,318	3,693	10	20	10	20	25	35	25	35
1996	6,815	1,701	15	25	15	25	20	30	20	30
1997	3,564	867	20	30	20	30	10	20	10	20
1998	1,854	280	30	40	30	40	10	15	10	15
1999	1,510	424	35	45	35	45	5	10	5	10
2000	805	323	45	55	45	55	4	8	4	8
2001	591	241	55	65	55	65	2	5	2	5
2002	1,436	2,478	40	60	40	60	5	15	15	25
2003	1,938	1,095	40	60	40	60	5	15	15	25
2004	1,095	850	40	60	40	60	5	15	15	25
2005	859	426	50	70	50	70	5	15	15	25
2006	1,372	844	50	70	50	70	5	15	15	25
2007	784	707	50	70	50	70	5	15	15	25
2008	1,446	997	50	70	50	70	10	20	15	25

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

Table 3.8.11.1k Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Russia-Kola peninsula: White Sea Basin.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Year	Rod catch (numbers) Previous year	
	1SW	MSW	min	max	min	max	min	max	min	max		1SW	MSW
1971	67845	29077	1	5	1	5	40	60	50	70	1971		
1972	45837	19644	1	5	1	5	40	60	50	70	1972		
1973	68684	29436	1	5	1	5	40	60	50	70	1973		
1974	63892	27382	1	5	1	5	40	60	50	70	1974		
1975	109038	46730	1	5	1	5	40	60	50	70	1975		
1976	76281	41075	1	5	1	5	40	60	50	70	1976		
1977	47943	32392	1	5	1	5	40	60	50	70	1977		
1978	49291	17307	1	5	1	5	40	60	50	70	1978		
1979	69511	21369	1	5	1	5	40	60	50	70	1979		
1980	46037	23241	1	5	1	5	40	60	50	70	1980		
1981	40172	12747	1	5	1	5	40	60	50	70	1981		
1982	32619	14840	1	5	1	5	40	60	50	70	1982		
1983	54,217	20,840	1	5	1	5	40	60	50	70	1983		
1984	56,786	16,893	1	5	1	5	40	60	50	70	1984		
1985	87,274	16,876	1	5	1	5	40	60	50	70	1985		
1986	72,102	17,681	1	5	1	5	40	60	50	70	1986		
1987	79,639	12,501	1	5	1	5	40	60	40	60	1987		
1988	44,813	18,777	1	5	1	5	40	50	40	50	1988		
1989	53,293	11,448	5	10	5	10	40	50	40	50	1989		
1990	44,409	11,152	10	15	10	15	40	50	40	50	1990		
1991	31,978	6,263	15	20	15	20	30	40	30	40	1991		
1992	23,827	3,680	20	25	20	25	20	30	20	30	1992		
1993	20,987	5,552	20	30	20	30	20	30	20	30	1993		
1994	25,178	3,680	25	35	25	35	20	30	10	20	1994		
1995	19,381	2,847	30	40	30	40	20	30	10	20	1995		
1996	27,097	2,710	30	40	30	40	20	30	10	20	1996		
1997	27,695	2,085	30	40	30	40	20	30	10	20	1997		
1998	32,693	1,963	30	40	30	40	20	30	10	20	1998		
1999	22,330	2,841	30	40	30	40	20	30	10	20	1999		
2000	26,376	4,396	30	40	30	40	20	30	10	20	2000		
2001	20,483	3,959	30	40	30	40	10	20	10	20	2001		
2002	19,174	3,937	30	40	30	40	10	20	10	20	2002		
2003	15,687	3,734	30	40	20	30	10	20	10	20	2003		
2004	10,947	1,990	30	40	30	40	10	20	10	20	2004		
2005	13,172	2,388	30	40	30	40	10	20	10	20	2005	1,212	878
2006	15,004	2,071	30	40	30	40	10	20	10	20	2006	3,852	399
2007	7,807	1,404	30	40	30	40	10	20	10	20	2007	2,264	852
2008	8,447	4,711	30	40	30	40	10	20	10	20	2008	3,175	832

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

Table 3.8.11.1l Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Russia-Pechora River.

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
1971	604.989	17728.01	10	30	10	30	50	80	50	80
1972	825	24175	10	30	10	30	50	80	50	80
1973	1705.011	49961.99	10	30	10	30	50	80	50	80
1974	1320	38680	10	30	10	30	50	80	50	80
1975	1298.352	38045.65	10	30	10	30	50	80	50	80
1976	990.78	34394.22	10	30	10	30	50	80	50	80
1977	589.484	20463.52	10	30	10	30	50	80	50	80
1978	758.8	26341.2	10	30	10	30	50	80	50	80
1979	420.98	14614.02	10	30	10	30	50	80	50	80
1980	1123.472	39000.53	10	30	10	30	50	80	50	80
1981	126	20874	10	30	10	30	50	80	50	80
1982	54.4	13545.6	10	30	10	30	50	80	50	80
1983	597.6	16002.4	10	30	10	30	50	80	50	80
1984	1833.4	15966.6	10	30	10	30	50	80	50	80
1985	2762.5	29737.5	10	30	10	30	50	80	50	80
1986	65.6	32734.4	10	30	10	30	50	80	50	80
1987	21.2	21178.8	10	30	10	30	50	80	50	80
1988	3184	12816	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	24596	27404	5	15	5	15	50	80	50	80
1990	50	49950	5	15	5	15	50	80	50	80
1991	7975	47025	5	15	5	15	50	80	50	80
1992	550	54450	5	15	5	15	50	80	50	80
1993	68	67932	5	15	5	15	50	80	50	80
1994	3900	48100	5	15	5	15	50	80	50	80
1995	9280	70720	5	15	5	15	50	80	50	80
1996	8664	48336	5	15	5	15	50	80	50	80
1997	1440	38560	5	15	5	15	50	80	50	80
1998	780	59220	5	15	5	15	50	80	50	80
1999	2120	37880	5	15	5	15	50	80	50	80
2000	84	83916	5	15	5	15	50	80	50	80
2001	2244	41756	5	15	5	15	50	80	50	80
2002	405	44595	5	15	5	15	50	80	50	80
2003	1650	31350	5	15	5	15	50	80	50	80
2004	6075	20925	5	15	5	15	50	80	50	80
2005	2852	28148	5	15	5	15	50	80	50	80
2006	1472	30528	5	15	5	15	50	80	50	80
2007	817	42183	5	15	5	15	50	80	50	80
2008	300	49700	5	15	5	15	50	80	50	80

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

Table 3.8.11.1m Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Sweden.

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
1971	6,330	420	15	45	15	45	40	65	45	70
1972	5,005	295	15	45	15	45	40	65	45	70
1973	6,210	1,025	15	45	15	45	40	65	45	70
1974	8,935	660	15	45	15	45	40	65	45	70
1975	9,620	160	15	45	15	45	40	65	45	70
1976	5,420	480	15	45	15	45	40	65	45	70
1977	2,555	360	15	45	15	45	40	65	45	70
1978	2,917	275	15	45	15	45	40	65	45	70
1979	3,080	800	15	45	15	45	40	65	45	70
1980	3,920	1,400	15	45	15	45	40	65	45	70
1981	7,095	407	15	45	15	45	40	65	45	70
1982	6,230	1,460	15	45	15	45	40	65	45	70
1983	8,290	1,005	15	45	15	45	40	65	45	70
1984	11,680	1,410	15	45	15	45	40	65	45	70
1985	13,890	590	15	45	15	45	40	65	45	70
1986	14,635	570	15	45	15	45	40	65	45	70
1987	11,860	1,700	15	45	15	45	40	65	45	70
1988	9,930	1,650	15	45	15	45	40	65	45	70
1989	3,180	4,610	15	45	15	45	40	65	45	70
1990	7,430	3,135	5	25	5	25	30	60	35	65
1991	8,990	3,620	5	25	5	25	30	60	35	65
1992	9,850	4,655	5	25	5	25	30	60	35	65
1993	10,540	6,370	5	25	5	25	30	60	35	65
1994	8,035	4,660	5	25	5	25	30	60	35	65
1995	9,761	2,770	5	25	5	25	25	50	30	55
1996	6,008	3,542	5	25	5	25	25	50	30	55
1997	2,747	2,307	5	25	5	25	25	50	30	55
1998	2,421	1,702	5	25	5	25	25	50	30	55
1999	3,573	1,460	5	25	5	25	25	50	30	55
2000	7,103	3,196	5	25	5	25	25	50	30	55
2001	4,634	3,853	5	25	5	25	25	50	30	55
2002	4,733	2,826	5	25	5	25	25	50	30	55
2003	2,891	3,214	5	25	5	25	25	50	30	55
2004	2,494	2,330	5	25	5	25	25	50	30	55
2005	2,122	1,770	5	25	5	25	25	50	30	55
2006	2,585	1,772	5	25	5	25	25	50	30	55
2007	1,228	2,442	5	25	5	25	25	50	30	55
2008	1,197	2,752	5	20	5	20	15	40	20	45
2009			5	20	5	20	15	40	20	45
2010			5	20	5	20	15	40	20	45

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

Table 3.8.11.1n Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-UK (England & Wales).

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
1971	28,915	23,611	29	48	29	48	36	56	30	50
1972	24,613	34,364	29	49	29	49	35	55	29	49
1973	28,989	26,097	29	48	29	48	35	55	29	49
1974	35,431	18,776	29	49	29	49	34	54	29	49
1975	36,465	25,819	29	48	29	48	35	55	29	49
1976	25,422	14,113	28	46	28	46	35	55	30	50
1977	27,836	17,260	29	49	29	49	36	56	31	51
1978	31,397	14,228	29	48	29	48	36	56	30	50
1979	29,030	6,803	29	48	29	48	35	55	30	50
1980	26,997	22,019	29	49	29	49	36	56	30	50
1981	28,414	31,115	29	48	29	48	36	56	30	50
1982	24,139	12,003	29	48	29	48	36	56	30	50
1983	35,903	13,861	28	46	28	46	37	57	31	51
1984	31,923	11,355	27	46	27	46	37	57	31	51
1985	30,759	16,020	29	49	29	49	37	57	31	51
1986	35,695	21,822	28	47	28	47	37	57	31	51
1987	36,339	17,101	29	48	29	48	37	57	31	51
1988	47,989	21,560	30	50	30	50	37	57	31	51
1989	33,610	18,098	28	46	28	46	38	58	32	52
1990	24,152	22,294	28	46	28	46	38	58	32	52
1991	23,018	9,402	28	47	28	47	37	57	31	51
1992	22,787	6,806	30	50	30	50	37	57	31	51
1993	30,526	7,160	28	47	28	47	34	54	28	48
1994	41,662	12,444	18	30	18	30	35	55	29	49
1995	30,148	11,724	17	28	17	28	32	52	26	46
1996	21,848	11,764	15	26	15	26	31	51	25	45
1997	18,690	6,913	14	24	14	24	27	47	22	42
1998	19,466	3,987	14	24	14	24	25	45	20	40
1999	14,603	6,872	13	22	13	22	20	40	12	32
2000	23,116	6,145	11	19	11	19	20	40	8	28
2001	19,119	6,037	11	18	11	18	18	38	7	27
2002	17,676	5,582	11	19	11	19	19	39	7	27
2003	10,459	5,152	13	22	13	22	17	37	6	26
2004	19092	4478	13	22	13	22	19	39	7	27
2005	15200	5067	13	22	13	22	18	38	7	27
2006	13293	3970	13	22	13	22	17	37	6	26
2007	11820	3334	13	22	13	22	17	37	6	26
2008	11051	3684	13	22	13	22	18	38	6	26
2009			13	22	13	22	19	39	7	27
2010			13	22	13	22	19	39	7	27

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

Table 3.8.11.1o Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-UK (N. Ireland)-Foyle Fisheries Area.

Year	Catch		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Reported	
	1SW	MSW	min	max	min	max	min	max	min	max	1SW	MSW
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	9,163	690
2003	30,441	2,291	0	1	0	1	40	55	20	30	4,576	344
2004	20,730	1,560	0	1	0	1	30	40	15	25	4,570	344
2005	23,746	1,787	0	1	0	1	25	35	45	55	7,079	533
2006	11,324	852	0	1	0	1	25	35	25	35	4,886	368
2007	5,050	322	0	1	0	1	5	10	5	10	9,530	608
2008	3,880	292	0	1	0	1	5	15	5	15	6,174	394

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

Table 3.8.11.1p Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-UK (N. Ireland)-FCB Area.

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Reported rod catch	
	1SW	MSW	min	max	min	max	min	max	min	max	1SW	MSW
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	2,218	167
2003	2,236	168	0	5	0	5	40	55	20	30	1,884	141
2004	2,411	181	0	1	0	1	30	40	15	25	3,053	230
2005	3,012	227	0	1	0	1	25	35	45	55	1,791	135
2006	2,288	172	0	1	0	1	25	35	25	35	1,289	97
2007	2,533	162	0	1	0	1	5	10	5	10	2,427	155
2008	1,753	132	0	1	0	1	5	15	5	15	2,388	152

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

Table 3.8.11.1q Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-UK (Scotland)-East.

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
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	180,259	128,613	10	25	10	25	49.6	69.4	30.0	45.1
1987	139,252	88,519	10	25	10	25	53.8	75.3	32.4	48.6
1988	118,580	91,068	10	25	10	25	33.6	47.0	23.4	35.0
1989	142,992	85,348	5	15	5	15	31.3	43.8	22.4	33.5
1990	63,297	73,954	5	15	5	15	33.2	46.5	23.0	34.5
1991	53,835	53,676	5	15	5	15	30.7	42.9	22.0	32.9
1992	79,883	67,968	5	15	5	15	26.8	37.5	20.7	31.0
1993	73,396	60,496	5	15	5	15	29.4	41.2	21.5	32.3
1994	80,405	72,616	5	15	5	15	27.6	38.6	20.9	31.3
1995	72,961	69,047	5	15	5	15	25.8	36.1	20.3	30.5
1996	56,610	50,356	5	15	5	15	24.0	33.6	19.6	29.4
1997	37,448	34,850	5	15	5	15	25.5	35.7	20.1	30.2
1998	44,952	32,231	5	15	5	15	20.2	28.3	18.3	27.5
1999	20,907	27,011	5	15	5	15	20.7	28.9	18.7	28.0
2000	36,871	31,280	5	15	5	15	18.2	25.5	17.8	26.7
2001	36,646	30,470	5	15	5	15	17.0	23.8	17.1	26.1
2002	26,618	21,740	5	15	5	15	16.1	22.5	16.9	25.4
2003	25,830	24,244	5	15	5	15	14.5	20.0	15.0	23.5
2004	31,667	30,773	5	15	5	15	14.5	20.0	15.0	23.5
2005	31,146	23,565	5	15	5	15	14.5	20.0	15.0	23.5
2006	30,424	22,905	5	15	5	15	12.5	18.0	13.0	20.0
2007	25,476	19,356	5	15	5	15	11.0	16.5	11.5	18.5
2008	15,407	19,677	5	15	5	15	8.0	13.5	10.5	17.5

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

Table 3.8.11.1r Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-UK (Scotland)-West.

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
1971	45287	26074	25	45	25	45	31.4	44.0	20.0	29.9
1972	31358	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	18,258	12,316	15	25	15	25	13.8	19.3	10.4	15.6
1995	16,843	9,141	15	25	15	25	12.9	18.0	10.2	15.2
1996	9,559	7,472	15	25	15	25	12.0	16.8	9.8	14.7
1997	9,066	5,504	15	25	15	25	12.7	17.8	10.1	15.1
1998	8,369	6,150	15	25	15	25	10.1	14.1	9.2	13.8
1999	4,147	3,587	15	25	15	25	10.3	14.5	9.3	14.0
2000	6,974	5,301	15	25	15	25	9.1	12.7	8.9	13.4
2001	5,603	4,191	15	25	15	25	8.5	11.9	8.5	13.1
2002	4,691	4,548	15	25	15	25	8.0	11.2	8.5	12.7
2003	3,536	3,061	15	25	15	25	4.0	5.5	4.0	6.5
2004	5,836	6,024	15	25	15	25	6.0	8.0	6.0	9.0
2005	7,428	4,913	15	25	15	25	6.0	8.0	6.0	9.0
2006	5,767	4,403	15	25	15	25	6.0	8.0	6.0	9.0
2007	6,178	4,470	15	25	15	25	6.0	8.0	6.0	9.0
2008	3,505	4,384	15	25	15	25	6.0	8.0	6.0	9.0

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

Table 3.8.11.1s Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-Faroes.

Year n/n+1	Catch (numbers) 1SW	Catch (numbers) MSW	Unrep. as % of total 1SW min	Unrep. as % of total 1SW max	Unrep. as % of total MSW min	Unrep. as % of total MSW max	Exp. rate 1SW (%) min	Exp. rate 1SW (%) max	Exp. rate MSW (%) min	Exp. rate MSW (%) max	Prop'n wild
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	10	20	0	0	100	100	100	100	0.80
2003	0	0	10	20	0	0	100	100	100	100	0.80
2004	0	0	10	20	0	0	100	100	100	100	0.80
2005	0	0	10	20	0	0	100	100	100	100	0.80
2006	0	0	10	20	0	0	100	100	100	100	0.80
2007	0	0	10	20	0	0	100	100	100	100	0.80
2008	0	0	10	20	0	0	100	100	100	100	0.80

Stock composition	1SW	MSW
France	0.05	0
Finland	0.05	0
Iceland	0	0.006
Ireland	0.1	0.057
Norway	0.3	0.396
Russia	0.1	0.183
Sweden	0.05	0.023
UK(E&W)	0.1	0.023
UK(NI)	0.05	0
UK(Sc)	0.2	0.192
Other		0.122
Total	1	1.002

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

Return time (m)= 1SW(min) 0, MSW(min) 13
1SW(max) 1, MSW(max) 14

Prop'n 1SW returning as grilse = min 0.730
max 0.830

Table 3.8.11.1t Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation-West Greenland.

Year	NEAC Catch (numbers)		European stock composition	
	1SW	MSW		MSW
1971	0	565,204	**France**	0.027
1972	0	396,188	**Finland**	0.001
1973	0	285,624	**Iceland**	0.001
1974	0	307,898	**Ireland**	0.147
1975	0	364,359	**Norway**	0.027
1976	0	220,313	**Russia**	0.000
1977	0	232,062	**Sweden**	0.003
1978	0	140,991	**UK(E&W)**	0.149
1979	0	208,832	**UK(NI)**	0.000
1980	0	192,820	**UK(Sc)**	0.645
1981	0	161,489		
1982	0	131,595	**Other**	
1983	0	60,500		
1984	0	47,749	**Total**	1.000
1985	0	152,028		
1986	0	136,238		
1987	0	126,864		
1988	0	158,662		
1989	0	51,666		
1990	0	25,974		
1991	0	62,340		
1992	0	39,219		
1993	0	1,629		
1994	0	1,629		
1995	0	12,674		
1996	0	10,306		
1997	0	4,766		
1998	0	1,701		
1999	0	972		
2000	0	3,594		
2001	0	5,477		
2002	0	2,092		
2003	0	1,999		
2004	0	2,124		
2005	0	1,812		
2006	0	2,765		
2007	0	2,113		
2008	0	1,758		

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

Table 3.8.13.1 Estimated number of returning maturing 1SW salmon 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	26,041	9,399		154,086	17,483				49,520	62,491	1,058,221	102,675	181,816	664,890	1,864,750	**2,127,729**	2,468,165			
1972	40,543	8,589		117,200	13,796				100,584	50,815	1,125,170	90,353	158,988	572,978	1,839,604	**2,111,370**	2,471,170			
1973	36,928	10,317		172,802	17,150				61,178	54,315	1,224,242	105,233	138,679	699,205	1,996,014	**2,293,357**	2,683,119			
1974	73,149	10,324		172,977	24,783				28,141	38,804	1,392,188	133,617	151,800	668,265	2,099,379	**2,419,802**	2,857,055			
1975	50,800	12,567		263,715	26,589				56,795	59,775	1,534,529	132,607	124,584	548,609	2,124,873	**2,468,520**	2,948,462			
1976	34,966	12,594		184,498	15,051				51,849	47,297	1,044,946	90,005	86,706	447,914	1,535,798	**1,780,651**	2,103,185			
1977	17,981	17,555		117,160	7,071				39,965	48,658	905,512	99,780	85,213	495,345	1,465,040	**1,678,398**	1,969,944			
1978	24,308	17,854		118,703	8,026				41,047	63,655	791,262	111,746	111,090	565,934	1,498,040	**1,697,303**	1,954,804			
1979	28,544	17,023		164,066	8,509				47,063	58,775	725,731	106,025	77,997	475,310	1,316,069	**1,503,113**	1,738,331			
1980	12,814	2,584		116,998	10,811				98,083	26,736	554,352	96,905	98,670	298,978	1,041,794	**1,183,662**	1,365,991			
1981	19,752	13,314		96,481	19,585				77,421	34,454	291,974	100,824	77,286	369,823	872,894	**963,004**	1,068,306			
1982	5,752	6,118		84,899	17,203				47,796	35,383	602,708	85,988	112,128	513,723	1,264,235	**1,408,693**	1,569,684			
1983	28,499	9,035	701,613	142,164	22,977	795,643	**906,774**	1,040,286	51,845	44,654	1,065,936	122,143	156,986	549,845	1,782,667	**1,999,951**	2,268,179	2,656,997	**2,913,360**	3,206,872
1984	31,963	3,281	730,583	153,180	32,328	835,789	**950,722**	1,094,792	84,555	27,520	559,690	107,430	61,803	560,775	1,270,741	**1,414,751**	1,578,049	2,178,202	**2,370,523**	2,584,583
1985	48,219	22,659	740,824	209,404	38,321	941,973	**1,061,966**	1,204,584	31,494	44,566	926,560	108,207	79,950	465,504	1,477,160	**1,663,593**	1,898,905	2,504,556	**2,730,840**	3,003,715
1986	43,783	28,180	643,599	178,732	40,371	832,918	**938,438**	1,061,315	48,333	73,303	1,036,249	122,480	89,875	567,943	1,731,067	**1,958,633**	2,230,831	2,640,059	**2,900,529**	3,195,553
1987	56,105	16,634	541,841	190,706	32,663	750,115	**842,216**	946,772	86,613	45,474	668,246	126,584	49,159	430,989	1,254,450	**1,432,837**	1,667,011	2,072,560	**2,278,603**	2,523,626
1988	26,728	24,105	498,349	131,893	27,383	634,813	**712,083**	799,907	29,424	81,904	908,362	172,033	115,884	648,699	1,749,884	**1,970,267**	2,238,111	2,447,271	**2,684,219**	2,967,022
1989	62,475	12,927	553,176	196,582	8,772	744,364	**836,925**	949,089	15,792	45,598	649,912	112,002	111,243	697,315	1,475,243	**1,646,399**	1,847,183	2,283,971	**2,487,770**	2,710,585
1990	59,163	9,681	495,753	163,238	19,518	667,618	**750,305**	846,534	26,895	41,964	407,506	80,460	92,139	348,395	904,085	**1,007,926**	1,134,177	1,624,518	**1,760,258**	1,918,732
1991	72,008	14,051	431,589	138,645	23,542	609,308	**682,024**	768,326	19,340	46,253	290,501	78,963	51,515	336,771	749,318	**833,134**	926,581	1,402,699	**1,517,120**	1,644,818
1992	95,619	26,513	363,217	171,478	26,019	619,567	**687,576**	766,419	35,750	53,043	422,908	81,575	104,389	480,131	1,071,057	**1,189,808**	1,329,502	1,736,730	**1,879,253**	2,038,491
1993	67,335	21,865	365,309	147,407	27,654	571,603	**632,734**	701,189	51,488	52,156	344,120	111,444	122,216	455,635	1,039,190	**1,151,645**	1,291,067	1,658,804	**1,786,056**	1,938,653
1994	26,747	6,964	494,002	174,172	21,108	644,141	**725,968**	832,590	39,922	42,792	440,057	122,120	83,733	482,101	1,104,231	**1,225,597**	1,369,414	1,802,273	**1,954,616**	2,126,517
1995	26,319	20,105	322,378	156,153	30,694	502,143	**559,762**	623,141	13,338	58,054	491,435	92,603	77,800	481,291	1,102,138	**1,220,238**	1,364,412	1,648,512	**1,780,877**	1,934,471
1996	60,818	10,695	245,467	212,059	18,955	498,562	**552,972**	614,976	16,611	50,159	456,062	66,946	80,311	327,665	898,987	**1,006,538**	1,133,979	1,436,781	**1,560,482**	1,700,722
1997	51,949	14,666	282,035	209,415	8,593	511,543	**569,932**	634,588	8,463	36,488	457,186	62,534	95,489	247,601	814,533	**913,969**	1,035,723	1,366,862	**1,485,080**	1,624,110
1998	59,877	24,984	368,680	227,432	7,610	622,624	**694,000**	774,832	16,477	50,005	479,715	68,669	208,063	330,799	1,041,988	**1,163,579**	1,303,646	1,717,699	**1,858,845**	2,016,544
1999	86,025	12,662	341,880	176,673	11,244	568,947	**631,489**	701,500	5,605	40,632	445,005	58,422	54,142	186,328	701,187	**796,836**	913,287	1,312,380	**1,429,767**	1,563,459
2000	90,512	13,303	563,542	192,656	22,397	794,469	**887,000**	993,470	14,324	36,258	619,912	89,054	78,774	356,411	1,068,206	**1,202,571**	1,372,085	1,921,249	**2,091,826**	2,287,721
2001	40,961	12,107	485,566	261,672	14,578	716,922	**820,003**	950,624	12,417	32,402	493,167	79,240	62,188	343,238	940,458	**1,031,511**	1,136,325	1,709,835	**1,854,070**	2,024,098
2002	28,846	20,902	297,773	236,523	14,925	523,454	**603,322**	711,581	17,390	40,455	430,877	72,056	76,944	277,276	842,243	**923,239**	1,017,900	1,409,868	**1,530,276**	1,672,373
2003	33,850	11,121	412,659	210,794	9,076	594,321	**681,144**	788,382	11,524	48,189	422,066	47,238	69,242	280,200	807,765	**885,340**	974,131	1,446,413	**1,568,803**	1,712,519
2004	13,129	30,046	250,003	147,499	7,889	398,983	**452,528**	520,091	13,750	48,353	311,525	78,906	66,482	331,958	784,049	**858,679**	943,456	1,217,650	**1,313,396**	1,418,010
2005	33,436	26,782	371,149	168,276	6,681	539,007	**612,622**	699,000	9,015	71,272	309,371	65,266	89,809	353,679	831,845	**904,977**	989,030	1,412,836	**1,518,622**	1,640,733
2006	63,274	28,145	300,501	204,226	8,177	536,077	**608,400**	702,241	12,653	50,376	237,116	60,008	45,791	341,489	688,508	**755,762**	830,542	1,261,703	**1,367,066**	1,484,489
2007	11,739	20,773	168,604	110,192	3,898	278,488	**316,847**	364,847	9,859	57,619	269,330	52,827	103,869	333,795	728,455	**842,720**	1,068,798	1,035,545	**1,162,124**	1,392,331
2008	12,121	21,098	215,325	114,278	5,007	325,883	**371,390**	426,443	9,762	86,536	267,432	48,685	59,333	234,648	610,159	**725,242**	952,355	970,099	**1,100,211**	1,332,350
10yr Av.	41,389	19,694	340,700	182,279	10,387	527,655	**598,474**	685,818	11,630	51,209	380,580	65,170	70,657	303,902	800,287	892,688	1,019,791	1,369,758	1,493,616	1,652,808

Table 3.8.13.2 Estimated number of returning non-maturing 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	23,916	9,671		132,533	1,058				10,883	24,458	158,010	96,472	21,923	614,065	814,330	**931,859**	1,072,382			
1972	37,251	15,049		134,693	743				21,604	37,357	169,769	145,677	19,159	785,121	1,036,768	**1,188,131**	1,369,799			
1973	44,642	14,115		222,789	2,582				13,252	33,764	182,233	109,965	16,730	856,156	1,062,282	**1,220,475**	1,419,803			
1974	66,166	13,384		209,877	1,659				6,166	29,199	206,312	79,938	18,319	601,890	824,171	**951,164**	1,099,408			
1975	73,971	14,810		225,625	403				12,307	30,986	230,239	108,812	15,008	667,818	932,357	**1,076,307**	1,249,060			
1976	60,782	12,175		195,113	1,211				9,081	26,745	160,302	56,309	10,449	401,925	580,595	**670,878**	776,384			
1977	37,145	16,986		134,364	907				6,943	26,092	139,869	69,441	10,283	463,350	631,581	**719,916**	831,373			
1978	23,734	21,835		116,230	696				7,120	33,797	120,997	58,037	13,409	561,347	694,962	**799,504**	930,502			
1979	25,335	14,454		101,564	2,016				8,160	21,620	108,845	27,821	9,401	407,727	507,806	**588,534**	690,750			
1980	26,650	20,079		169,350	3,533				16,969	30,420	120,146	91,074	11,888	516,493	699,741	**794,140**	910,203			
1981	29,186	7,042		96,723	1,024				11,650	20,249	88,509	127,289	9,324	576,908	742,956	**841,082**	961,918			
1982	37,975	8,076		85,301	3,678				7,236	14,322	51,517	49,034	13,502	446,630	513,132	**584,212**	675,677			
1983	41,233	6,165	428,525	124,014	2,528	535,020	**604,650**	684,394	7,719	23,896	153,025	54,043	18,953	484,328	639,240	**757,970**	992,783			
1984	39,457	7,949	437,321	123,733	3,548	543,519	**613,188**	692,517	12,657	20,319	76,364	43,878	7,458	400,457	500,518	**563,495**	645,095	1,080,782	**1,179,189**	1,289,369
1985	30,768	5,122	403,248	135,520	1,484	515,141	**578,019**	650,751	9,537	14,757	83,701	64,779	9,655	493,507	600,720	**678,123**	774,037	1,154,485	**1,259,101**	1,375,453
1986	26,820	13,920	484,172	133,890	1,432	585,182	**662,275**	750,618	9,719	12,279	94,799	85,951	10,871	629,640	746,432	**848,100**	975,432	1,380,552	**1,513,858**	1,667,096
1987	33,615	14,433	362,905	99,270	4,286	457,085	**516,280**	586,391	5,171	10,914	117,686	68,451	5,546	404,685	542,294	**615,522**	704,334	1,035,354	**1,134,553**	1,242,411
1988	21,508	9,295	305,458	99,875	4,162	394,510	**441,790**	496,785	14,231	12,398	84,905	88,229	15,666	623,229	740,523	**844,709**	968,706	1,171,740	**1,287,953**	1,420,527
1989	24,217	7,901	215,964	97,083	11,650	321,443	**358,378**	401,614	6,540	11,064	77,626	68,769	12,438	544,589	641,805	**724,437**	825,107	991,043	**1,083,722**	1,195,435
1990	30,469	8,319	256,688	124,747	7,421	386,257	**429,249**	481,509	6,631	11,009	37,281	85,197	11,327	471,619	556,691	**624,552**	710,220	970,670	**1,056,561**	1,154,208
1991	36,720	5,772	217,010	122,288	8,603	354,863	**391,889**	436,277	6,121	10,956	56,054	36,808	5,810	342,188	407,022	**458,916**	524,467	785,538	**853,129**	929,417
1992	39,210	8,611	235,501	116,353	10,998	371,646	**411,615**	459,145	7,667	12,379	42,979	27,914	13,328	450,478	488,483	**556,037**	641,010	885,850	**968,854**	1,065,286
1993	45,328	9,694	226,944	137,610	15,063	399,836	**436,367**	477,694	3,591	6,059	42,491	30,408	31,403	376,963	433,608	**492,563**	566,854	857,719	**930,368**	1,014,648
1994	37,878	8,236	222,243	121,726	10,996	364,995	**403,180**	444,691	7,610	9,844	67,562	42,107	11,044	455,540	526,386	**595,248**	681,689	918,379	**1,000,038**	1,096,461
1995	23,465	5,731	237,980	138,723	7,725	377,438	**415,205**	457,874	3,658	11,069	65,204	41,997	9,347	430,959	500,612	**563,945**	646,459	903,840	**980,810**	1,073,753
1996	20,685	7,521	238,542	104,450	9,868	346,520	**382,736**	423,730	6,432	7,130	43,648	42,277	10,257	322,105	384,077	**434,747**	496,267	753,871	**818,659**	890,819
1997	29,869	4,238	159,395	85,118	6,428	259,585	**286,371**	317,508	3,340	8,003	56,710	26,846	12,735	225,268	293,972	**338,069**	391,340	572,232	**625,825**	687,196
1998	25,224	6,166	191,062	105,586	4,729	304,256	**334,687**	369,009	2,820	4,962	32,878	16,511	17,469	233,897	274,632	**309,927**	354,250	595,843	**646,031**	701,740
1999	23,621	7,074	204,421	93,132	4,053	301,225	**333,786**	371,973	6,107	9,674	51,159	37,838	7,948	200,886	275,590	**322,399**	386,909	598,175	**657,089**	730,708
2000	52,630	4,152	282,980	162,259	8,880	467,763	**513,689**	565,976	4,248	2,637	63,980	40,496	10,622	256,485	339,078	**386,088**	447,217	831,928	**900,683**	977,760
2001	75,661	4,765	333,942	115,055	10,679	488,332	**542,210**	602,733	4,950	4,605	57,134	42,355	7,832	246,236	322,715	**370,924**	436,113	837,570	**914,707**	1,001,856
2002	60,812	4,501	288,810	125,438	7,866	441,308	**489,123**	543,931	3,662	4,989	65,919	38,413	10,626	202,582	289,833	**332,972**	391,283	757,291	**823,940**	901,015
2003	43,185	4,742	255,056	87,427	8,933	362,518	**401,711**	445,556	5,317	7,979	69,257	38,597	9,921	231,140	317,342	**369,972**	439,903	704,902	**772,309**	852,952
2004	20,630	4,657	231,074	67,136	6,493	296,358	**331,345**	372,212	9,903	6,451	38,064	31,525	8,783	289,703	337,715	**390,837**	455,807	655,924	**723,198**	798,905
2005	15,931	5,761	214,182	80,476	4,937	290,378	**322,261**	358,473	6,118	5,709	49,258	36,414	4,044	229,815	291,891	**337,555**	397,322	603,659	**660,310**	728,906
2006	28,025	5,554	271,849	77,126	4,897	349,735	**388,236**	431,812	6,157	4,730	35,629	30,443	3,429	237,236	276,037	**325,812**	388,628	650,303	**715,562**	790,870
2007	39,692	5,298	231,181	80,517	6,774	330,761	**364,207**	401,110	5,831	2,905	15,982	25,518	6,587	227,302	246,857	**289,704**	346,730	597,933	**655,218**	720,607
2008	37,804	6,820	244,428	126,196	9,713	386,393	**427,597**	474,674	6,400	3,286	15,197	27,605	4,463	237,563	254,693	**300,627**	363,732	664,202	**730,041**	806,689
10yr Av.	39,799	5,333	255,792	101,476	7,322	371,477	**411,417**	456,845	5,869	5,297	46,158	34,921	7,425	235,895	295,175	**342,689**	405,364	690,189	**755,306**	831,027

Table 3.8.13.3 Estimated pre fishery abundance of maturing 1SW salmon (potential 1SW returns) by NEAC country or region and year.

	Northern Europe								France	Southern Europe								NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	33,663	11,976		199,316	22,690				63,479	79,620	1,347,006	131,634	231,850	838,187	2,298,591	**2,708,244**	3,220,354			
1972	52,159	10,909		151,409	18,041				128,690	64,799	1,431,219	115,879	202,646	722,720	2,266,693	**2,685,566**	3,227,467			
1973	47,572	13,142		222,644	22,437				78,492	69,246	1,559,677	134,947	177,077	880,609	2,466,114	**2,914,732**	3,493,766			
1974	93,497	13,123		221,882	31,841				36,165	49,404	1,774,005	170,880	193,534	841,901	2,592,499	**3,079,551**	3,738,350			
1975	65,414	16,029		339,656	34,284				72,393	76,217	1,954,812	169,889	159,049	692,979	2,628,825	**3,140,288**	3,839,088			
1976	44,855	16,037		237,385	19,445				66,303	60,130	1,330,578	115,243	110,666	566,056	1,900,548	**2,265,189**	2,743,372			
1977	23,122	22,312		150,633	9,223				51,095	61,922	1,151,920	127,340	108,745	624,709	1,809,964	**2,134,930**	2,558,455			
1978	31,145	22,693		152,778	10,380				52,385	81,131	1,006,502	142,410	141,670	714,071	1,844,082	**2,156,166**	2,548,459			
1979	36,660	21,682		210,918	11,137				60,203	75,030	925,681	135,346	99,490	599,352	1,628,544	**1,909,716**	2,273,843			
1980	17,171	3,292		151,394	14,536				125,653	34,043	706,677	125,080	126,461	379,519	1,290,318	**1,511,892**	1,791,930			
1981	26,513	16,944		126,635	26,200				100,009	43,812	374,327	130,856	99,799	470,227	1,079,934	**1,232,796**	1,406,202			
1982	8,614	7,803		111,259	23,138				62,314	45,050	768,128	111,768	143,944	651,934	1,564,993	**1,798,399**	2,069,459			
1983	37,728	11,502	902,456	184,805	30,571	1,000,890	**1,168,881**	1,373,583	67,352	56,892	1,355,268	158,082	200,925	696,696	2,203,916	**2,553,645**	2,978,357			
1984	41,323	4,188	932,433	197,230	41,765	1,036,492	**1,219,728**	1,438,650	108,163	35,061	711,469	138,117	79,297	708,115	1,566,205	**1,799,512**	2,077,225	2,676,293	**3,020,969**	3,414,851
1985	61,964	28,893	946,563	269,853	49,181	1,171,257	**1,360,733**	1,592,452	40,674	56,792	1,174,598	138,752	102,284	587,005	1,814,409	**2,118,221**	2,486,764	3,072,623	**3,482,708**	3,962,663
1986	56,436	35,880	822,985	230,473	51,957	1,039,210	**1,203,025**	1,398,230	62,457	93,246	1,320,939	156,973	115,083	716,698	2,134,682	**2,491,307**	2,918,961	3,256,705	**3,696,740**	4,210,455
1987	71,975	21,190	693,347	246,311	42,042	932,876	**1,078,868**	1,249,574	110,781	57,877	849,660	162,375	63,072	544,465	1,546,396	**1,823,219**	2,173,531	2,549,573	**2,907,660**	3,329,208
1988	34,615	30,603	637,083	169,965	35,475	789,676	**913,589**	1,057,388	38,060	104,261	1,155,921	220,392	148,104	819,134	2,159,690	**2,507,120**	2,928,489	3,008,287	**3,422,376**	3,905,855
1989	80,112	16,451	707,130	250,605	11,557	923,971	**1,069,741**	1,250,411	20,496	58,112	826,599	143,226	141,928	879,202	1,813,355	**2,090,592**	2,411,933	2,801,829	**3,163,753**	3,575,730
1990	75,723	12,337	632,172	208,554	25,175	828,754	**957,536**	1,115,088	34,486	53,454	517,823	103,102	117,652	439,863	1,114,854	**1,282,166**	1,482,419	1,990,126	**2,244,135**	2,529,637
1991	92,008	17,873	550,316	177,925	30,031	754,247	**871,294**	1,012,556	24,842	58,947	369,260	100,764	65,698	424,816	923,207	**1,057,530**	1,215,961	1,717,687	**1,931,019**	2,173,558
1992	121,807	33,770	462,733	219,090	33,183	763,323	**875,827**	1,006,254	45,609	67,650	536,951	103,827	132,788	604,853	1,314,189	**1,509,098**	1,738,437	2,125,727	**2,388,286**	2,685,977
1993	85,814	27,820	465,363	188,540	35,312	703,820	**805,587**	926,836	65,500	66,384	436,860	142,389	155,547	573,580	1,274,716	**1,462,301**	1,683,456	2,024,205	**2,271,559**	2,555,769
1994	34,091	8,861	629,402	223,240	27,005	797,467	**926,833**	1,086,373	50,967	54,537	558,679	155,724	106,552	606,836	1,356,229	**1,554,375**	1,794,612	2,206,067	**2,483,690**	2,806,351
1995	33,511	25,582	410,894	199,691	39,167	620,668	**714,329**	824,777	17,036	73,951	624,234	118,188	99,100	605,519	1,351,470	**1,548,374**	1,782,942	2,011,973	**2,264,516**	2,553,218
1996	77,436	13,615	313,032	271,753	24,259	613,875	**706,045**	814,745	21,193	63,714	580,349	85,552	102,470	413,222	1,102,294	**1,277,994**	1,483,022	1,754,819	**1,985,069**	2,247,119
1997	66,043	18,685	358,662	268,394	10,956	630,652	**726,386**	839,411	10,775	46,413	580,319	79,533	121,430	311,701	996,529	**1,159,740**	1,353,198	1,671,002	**1,887,570**	2,140,986
1998	76,252	31,847	469,041	292,647	9,682	768,495	**885,163**	1,021,310	20,976	63,542	609,012	87,557	264,881	416,424	1,281,344	**1,475,759**	1,703,879	2,098,614	**2,361,307**	2,659,777
1999	109,669	16,129	435,405	226,041	14,300	701,167	**804,944**	922,991	7,117	51,730	565,178	74,274	68,837	234,566	863,041	**1,011,153**	1,191,999	1,603,788	**1,818,936**	2,058,348
2000	115,358	16,943	717,510	247,094	28,546	979,415	**1,130,005**	1,308,404	18,209	46,136	787,389	113,625	100,080	448,106	1,313,784	**1,525,515**	1,789,902	2,350,209	**2,657,702**	3,009,817
2001	52,101	15,408	617,504	335,318	18,549	885,072	**1,046,907**	1,243,998	15,751	41,252	627,024	100,856	79,059	431,685	1,147,311	**1,306,849**	1,494,286	2,087,766	**2,358,441**	2,665,141
2002	36,680	26,607	378,841	303,095	18,992	648,293	**770,423**	937,352	22,194	51,472	548,344	91,610	97,996	348,746	1,028,524	**1,171,321**	1,336,807	1,721,357	**1,947,219**	2,205,033
2003	43,092	14,189	525,116	269,735	11,565	736,588	**869,230**	1,032,790	14,694	61,459	537,088	60,040	88,050	352,839	986,140	**1,123,244**	1,280,622	1,770,721	**1,994,733**	2,253,180
2004	16,711	38,250	318,164	188,621	10,065	493,179	**577,125**	683,796	17,499	61,586	396,589	100,540	84,722	418,353	959,921	**1,089,172**	1,234,968	1,486,501	**1,666,952**	1,869,535
2005	42,596	34,090	471,902	215,755	8,494	666,394	**781,162**	918,685	11,443	90,804	393,278	82,947	114,368	445,869	1,015,579	**1,148,048**	1,299,751	1,721,727	**1,930,510**	2,167,660
2006	80,587	35,777	382,176	261,325	10,394	661,620	**776,553**	920,940	16,096	64,140	301,467	76,259	58,352	430,249	840,219	**956,526**	1,090,298	1,542,208	**1,735,522**	1,957,489
2007	14,944	26,442	214,452	140,801	4,947	344,101	**404,162**	478,581	12,592	73,424	342,131	67,287	132,076	420,294	897,803	**1,072,041**	1,380,508	1,275,928	**1,483,312**	1,810,298
2008	15,427	26,806	273,984	146,531	6,377	402,442	**473,720**	560,345	12,441	110,226	339,776	62,040	75,708	295,402	753,891	**921,077**	1,226,764	1,193,877	**1,402,545**	1,726,139
10yr Av.	52,717	25,064	433,505	233,432	13,223	651,827	**763,423**	900,788	14,804	65,223	483,826	82,948	89,925	382,611	980,621	**1,132,495**	1,332,591	1,675,408	**1,899,587**	2,172,264

Table 3.8.13.4 Estimated pre fishery abundance of non-maturing 1SW salmon (potential MSW returns) by NEAC country or region and year.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland 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	63,133	26,016		270,584	7,381				56,125	63,336	402,064	365,270	31,989	1,837,207	2,299,912	**2,770,158**	3,344,317			
1972	75,499	24,397		429,535	10,294				36,279	57,470	392,096	272,305	27,930	1,818,505	2,144,351	**2,616,636**	3,202,838			
1973	111,297	22,963		397,286	7,029				20,459	49,407	407,025	196,556	30,541	1,286,335	1,635,801	**2,001,024**	2,456,950			
1974	124,526	25,476		432,215	5,845				31,492	52,570	454,967	251,032	25,032	1,422,585	1,836,621	**2,253,313**	2,769,040			
1975	102,428	20,929		367,596	6,077				28,087	45,388	344,991	171,293	17,437	1,007,575	1,352,236	**1,620,963**	1,959,288			
1976	62,723	28,759		254,390	4,229				19,433	44,068	280,354	164,697	17,149	984,193	1,247,805	**1,517,581**	1,859,479			
1977	40,045	36,844		217,232	3,468				20,125	56,755	250,731	146,882	22,380	1,157,381	1,357,145	**1,660,218**	2,048,803			
1978	42,490	24,535		201,057	6,360				18,605	36,539	214,957	77,945	15,683	829,324	969,853	**1,201,472**	1,491,541			
1979	44,923	34,538		351,686	13,061				35,806	51,771	256,698	203,584	19,828	1,104,793	1,380,581	**1,681,213**	2,057,353			
1980	49,161	13,272		255,063	12,958				26,314	35,425	211,126	266,970	15,560	1,227,673	1,471,842	**1,793,226**	2,184,087			
1981	63,994	14,851		228,315	16,324				17,825	25,277	140,791	125,539	22,563	971,757	1,075,047	**1,308,401**	1,601,765			
1982	69,429	11,359		279,822	12,223				17,633	41,048	301,368	126,403	31,534	995,110	1,219,037	**1,546,015**	2,042,322			
1983	66,127	13,922	816,239	258,187	11,028	945,512	**1,165,646**	1,426,870	23,310	34,618	150,649	91,941	12,441	768,535	885,213	**1,086,116**	1,343,270	1,865,685	**2,254,476**	2,717,911
1984	51,527	9,289	767,772	282,343	8,023	914,770	**1,115,335**	1,367,607	17,617	25,349	161,879	126,174	16,123	918,435	1,024,425	**1,270,988**	1,570,355	1,977,514	**2,390,513**	2,885,333
1985	45,170	24,147	913,861	284,157	8,837	1,037,842	**1,273,478**	1,566,850	21,648	21,396	202,315	182,643	18,125	1,241,752	1,378,356	**1,696,591**	2,089,121	2,465,901	**2,970,207**	3,584,376
1986	56,283	24,906	707,498	221,120	13,263	837,131	**1,024,192**	1,252,623	13,481	19,096	235,668	149,788	9,254	845,785	1,049,987	**1,277,337**	1,565,977	1,919,586	**2,305,785**	2,764,552
1987	36,228	16,011	567,168	202,544	10,430	677,159	**830,956**	1,020,365	28,270	21,226	172,866	179,818	26,144	1,184,637	1,313,241	**1,620,967**	2,001,350	2,028,508	**2,454,886**	2,973,474
1988	40,819	13,806	435,050	204,822	23,914	588,541	**718,346**	874,625	16,567	19,124	169,484	153,495	20,750	1,086,750	1,206,262	**1,469,387**	1,802,158	1,823,946	**2,189,962**	2,633,257
1989	51,073	14,475	500,931	252,829	16,618	683,933	**833,935**	1,015,560	12,898	18,976	82,052	160,917	18,894	875,545	950,109	**1,170,551**	1,449,540	1,666,286	**2,005,596**	2,421,017
1990	61,479	9,873	391,287	229,176	16,073	577,375	**707,101**	865,039	11,110	18,565	102,283	70,056	9,696	613,800	668,125	**827,645**	1,028,301	1,269,537	**1,535,748**	1,855,010
1991	65,589	14,503	407,478	209,911	19,354	582,495	**714,189**	875,664	14,980	20,839	85,372	60,900	22,183	819,802	824,623	**1,025,318**	1,278,686	1,435,264	**1,742,864**	2,112,109
1992	76,175	16,335	391,810	247,770	26,024	619,642	**754,000**	917,790	7,401	10,244	80,223	60,752	52,385	675,044	713,771	**889,125**	1,111,424	1,358,930	**1,645,514**	1,991,271
1993	63,215	13,866	384,378	222,804	19,190	573,097	**701,941**	856,044	12,798	16,539	114,940	73,683	18,413	777,946	811,999	**1,015,216**	1,285,251	1,416,085	**1,720,097**	2,099,585
1994	39,322	9,684	412,369	252,860	13,813	590,968	**722,543**	886,200	6,167	18,575	111,226	73,662	15,595	738,879	770,201	**965,690**	1,218,070	1,388,089	**1,689,957**	2,061,691
1995	34,636	12,686	412,316	192,321	17,389	544,075	**666,531**	818,184	11,183	12,017	77,281	76,336	17,125	562,771	609,411	**760,835**	951,272	1,177,140	**1,430,498**	1,735,899
1996	50,202	7,088	266,495	151,404	10,811	393,661	**484,013**	595,701	5,951	13,438	96,595	48,277	21,312	389,902	463,002	**583,266**	738,695	874,770	**1,068,741**	1,305,363
1997	42,211	10,320	319,924	187,427	7,965	460,418	**565,021**	691,124	4,899	8,301	55,670	29,385	29,256	399,423	423,499	**530,021**	664,861	903,478	**1,096,181**	1,330,428
1998	39,545	11,835	341,395	165,874	6,793	455,884	**564,061**	693,487	10,249	16,186	86,134	65,453	13,284	341,610	426,732	**546,655**	710,535	908,287	**1,113,319**	1,365,379
1999	88,124	6,953	473,308	289,140	14,905	707,843	**867,959**	1,060,120	7,136	4,415	107,287	70,308	17,781	435,439	517,852	**652,920**	822,777	1,253,815	**1,523,827**	1,845,925
2000	126,724	7,975	557,923	204,205	17,901	738,994	**913,024**	1,122,442	8,419	7,724	96,235	73,668	13,083	420,045	494,608	**633,461**	807,661	1,264,732	**1,549,462**	1,885,933
2001	102,009	7,540	483,103	222,788	13,162	670,886	**825,308**	1,013,408	6,308	8,349	111,052	67,537	17,776	346,645	449,686	**569,450**	726,003	1,148,394	**1,396,673**	1,699,958
2002	72,164	7,926	427,169	156,263	14,982	548,448	**676,788**	833,683	8,959	13,353	116,193	67,042	16,592	391,456	490,143	**626,211**	805,050	1,064,809	**1,305,771**	1,595,883
2003	34,429	7,781	386,465	119,861	10,876	452,087	**557,617**	692,874	16,616	10,798	63,913	54,529	14,687	491,021	519,091	**660,732**	842,335	998,253	**1,219,480**	1,496,692
2004	26,616	9,654	357,785	143,527	8,267	441,775	**544,572**	672,040	10,315	9,556	82,751	63,035	6,752	388,796	449,575	**570,947**	731,435	914,369	**1,117,260**	1,369,526
2005	47,024	9,293	453,658	137,329	8,220	529,325	**653,320**	804,509	10,388	7,908	59,669	52,562	5,730	402,341	431,201	**552,304**	714,324	983,158	**1,206,883**	1,479,863
2006	66,504	8,891	385,477	142,444	11,376	499,783	**611,495**	749,848	9,855	4,876	27,286	44,471	11,041	386,805	381,940	**492,491**	636,986	904,780	**1,106,291**	1,348,976
2007	63,017	11,412	407,680	225,028	16,295	587,588	**722,791**	886,520	10,792	5,513	25,861	48,000	7,469	404,206	394,460	**510,991**	668,763	1,010,154	**1,236,810**	1,513,222
10yr Av.	66,616	8,926	427,396	180,646	12,278	563,261	**693,694**	852,893	9,904	8,868	77,638	60,660	12,420	400,836	455,529	**581,616**	746,587	1,045,075	**1,277,577**	1,560,136

Table 3.8.13.5 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	13,051	4,695		77,435	8,209				47,780	31,284	395,732	55,122	36,279	262,189	213,782	**880,531**	291,459			
1972	20,263	4,279		59,418	6,498				97,104	25,465	419,515	49,538	31,843	201,471	222,320	**864,998**	308,226			
1973	18,462	5,154		88,634	8,127				59,048	27,137	457,022	57,530	27,856	255,750	243,795	**937,871**	334,246			
1974	36,605	5,172		90,152	11,657				27,151	19,462	521,749	74,723	30,537	226,703	253,980	**947,487**	377,724			
1975	25,376	6,291		132,893	12,600				54,815	29,758	574,462	72,529	25,031	202,929	275,016	**1,007,497**	406,249			
1976	17,497	6,286		91,013	7,115				50,029	23,579	390,550	49,152	17,366	174,729	198,225	**729,672**	274,858			
1977	9,010	8,774		58,289	3,323				38,565	24,340	338,419	53,319	17,064	186,759	170,979	**702,612**	248,203			
1978	12,125	8,946		58,467	3,758				39,612	31,806	297,118	60,049	22,243	239,658	162,410	**743,025**	219,592			
1979	14,253	8,499		83,817	4,018				45,418	29,385	272,040	58,182	15,612	176,899	154,104	**649,789**	201,159			
1980	6,400	1,290		60,116	5,077				94,653	13,390	206,940	52,097	19,781	118,027	123,351	**547,449**	158,924			
1981	9,883	6,654		49,491	9,242				74,701	17,233	70,963	54,007	15,479	144,020	78,677	**426,730**	91,245			
1982	2,868	3,048		45,081	8,090				46,116	17,696	168,210	46,188	22,495	216,186	117,937	**568,722**	131,982			
1983	14,210	4,507	163,833	75,425	10,857	63,983	**260,391**	77,617	50,045	22,305	360,800	64,403	31,501	224,123	167,443	**826,285**	215,102	185,926	**1,090,220**	227,159
1984	16,013	1,640	165,586	81,235	15,190	68,184	**280,100**	80,688	81,595	13,780	196,835	56,658	12,393	245,474	121,174	**670,458**	138,993	143,511	**953,784**	154,932
1985	24,101	11,319	172,140	107,567	17,968	70,464	**321,210**	81,544	30,394	22,302	234,302	57,051	15,994	226,837	141,841	**636,411**	185,813	166,048	**959,052**	201,758
1986	21,881	14,067	152,061	92,366	18,966	64,781	**312,192**	74,621	44,933	36,647	322,218	64,714	17,984	273,309	183,754	**826,240**	221,708	201,099	**1,140,422**	231,477
1987	28,047	8,325	127,756	97,756	15,352	56,766	**277,289**	61,930	80,600	22,736	201,662	66,862	15,293	199,340	146,318	**639,574**	205,273	160,107	**918,471**	210,751
1988	13,335	12,098	118,989	73,654	12,909	47,870	**246,443**	55,820	27,361	41,066	343,903	91,227	41,222	424,915	173,892	**1,023,226**	211,517	183,067	**1,271,357**	219,205
1989	24,847	6,456	189,843	103,710	4,115	61,168	**323,502**	75,494	14,668	22,782	221,237	58,093	12,284	470,795	140,064	**842,170**	163,110	156,317	**1,168,875**	175,329
1990	23,516	4,834	169,593	91,903	10,666	54,090	**308,142**	66,371	25,009	20,951	159,742	41,926	35,053	228,146	85,429	**549,223**	104,339	104,792	**858,714**	123,105
1991	28,787	7,008	145,920	87,950	12,863	49,018	**279,659**	59,604	17,978	23,084	116,893	41,678	18,325	234,673	70,861	**480,952**	80,905	89,696	**761,680**	100,316
1992	38,247	13,249	122,950	125,543	14,366	48,185	**309,080**	54,086	33,260	26,491	160,237	43,025	45,984	349,348	102,881	**686,929**	117,977	113,974	**996,121**	129,297
1993	27,010	10,955	122,520	108,813	15,205	44,843	**292,309**	50,648	47,907	26,153	142,102	62,253	72,102	315,591	98,744	**713,205**	128,932	108,208	**1,006,136**	134,950
1994	10,664	3,483	169,865	127,415	11,552	58,340	**313,708**	74,226	37,112	21,380	125,092	67,188	25,101	337,645	104,767	**662,676**	125,164	125,826	**978,833**	140,870
1995	10,525	10,071	109,327	111,125	19,105	42,254	**273,490**	47,176	11,669	28,997	179,415	53,620	25,788	345,365	98,185	**684,975**	119,590	109,752	**960,632**	126,147
1996	30,335	5,342	81,875	154,752	11,822	38,434	**270,741**	42,639	14,548	25,107	182,852	39,374	34,600	242,564	88,505	**558,139**	102,522	99,142	**829,648**	111,125
1997	25,909	7,355	104,762	159,132	5,330	45,193	**304,853**	49,321	7,403	18,182	227,339	39,377	38,338	181,183	80,549	**531,915**	101,458	95,615	**837,992**	111,734
1998	29,896	12,520	138,884	172,029	4,738	52,670	**351,138**	59,140	14,412	24,930	220,827	44,613	156,256	257,238	103,116	**743,050**	118,641	117,331	**1,095,673**	131,112
1999	34,335	6,553	127,664	137,579	6,986	52,101	**340,934**	54,935	4,915	20,689	231,732	40,698	20,042	142,626	77,404	**482,634**	96,842	97,784	**825,721**	107,715
2000	36,138	6,920	213,414	149,126	13,940	71,414	**415,444**	79,897	12,532	18,524	351,377	61,869	33,116	279,993	111,884	**792,233**	144,324	139,139	**1,209,768**	165,452
2001	16,422	6,404	185,221	226,031	9,070	72,248	**419,453**	86,098	10,873	16,889	257,024	56,789	31,089	274,325	89,018	**676,611**	103,355	120,212	**1,097,865**	135,391
2002	14,451	11,256	112,004	199,917	9,295	65,376	**359,256**	80,034	13,925	21,063	216,152	51,231	23,231	223,773	79,576	**575,273**	93,250	108,366	**936,763**	121,563
2003	16,856	5,997	156,738	179,483	5,657	73,198	**387,617**	83,081	9,208	25,043	247,535	34,560	29,894	241,889	76,539	**600,272**	87,368	108,418	**988,048**	123,649
2004	6,548	16,551	94,078	121,716	4,947	48,336	**269,710**	57,367	10,956	25,098	157,858	55,821	35,605	283,065	73,538	**582,563**	83,444	90,382	**854,037**	98,163
2005	16,709	15,024	140,476	140,652	4,163	55,521	**312,315**	63,323	7,196	37,031	171,659	46,830	54,054	304,628	72,452	**633,326**	82,571	93,057	**946,477**	104,699
2006	31,664	15,507	111,622	171,731	5,120	59,328	**328,765**	69,529	10,091	26,171	126,715	43,865	25,924	296,063	66,529	**541,772**	74,285	91,502	**872,243**	98,065
2007	5,870	11,584	62,250	91,923	2,436	38,194	**206,720**	48,346	7,871	30,539	249,467	38,435	84,290	293,476	114,348	**723,958**	226,329	126,466	**933,638**	230,938
2008	6,050	12,992	93,287	96,581	3,638	36,434	**210,958**	42,213	7,789	45,849	242,370	35,282	45,110	209,639	115,047	**608,246**	226,938	124,001	**821,423**	230,107
10yr Av.	18,504	10,879	129,675	151,474	6,525	57,215	**325,117**	66,482	9,536	26,690	225,189	46,538	38,236	254,948	87,633	**621,689**	121,871	109,933	**948,598**	141,574

Table 3.8.13.6 Estimated number of MSW 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%		N&E					2.5%	50.0%	97.5%	2.5%	50.0%	97.5%
1971	10,758	2,910		54,733	444				6,823	7,364	83,020	57,552	10,981	357,809	103,418	**564,557**	124,666			
1972	16,698	4,504		56,574	313				13,484	11,084	89,277	88,372	9,592	445,960	131,931	**707,477**	160,912			
1973	19,947	4,243		92,870	1,093				8,282	10,114	95,141	66,832	8,377	491,948	137,677	**727,995**	175,591			
1974	29,572	4,029		91,316	698				3,856	8,784	108,023	48,634	9,179	320,112	112,174	**531,073**	131,159			
1975	33,218	4,461		93,862	170				7,687	9,291	120,121	66,033	7,531	354,453	126,685	**605,864**	153,128			
1976	27,215	3,649		77,641	510				5,701	7,980	83,746	33,743	5,226	237,302	81,423	**386,485**	95,080			
1977	16,698	5,128		54,901	381				4,343	7,809	73,362	40,746	5,156	247,429	79,613	**409,895**	97,248			
1978	10,676	6,535		45,684	294				4,455	10,132	63,384	34,624	6,717	317,775	90,265	**462,127**	115,189			
1979	13,932	4,348		42,032	851				5,105	6,473	56,834	16,640	4,706	217,292	69,283	**321,912**	89,057			
1980	14,743	6,006		68,629	1,482				10,599	9,136	62,794	54,440	5,951	279,676	86,950	**454,690**	108,601			
1981	16,006	2,116		40,943	435				7,570	6,051	46,505	76,101	4,665	318,112	89,850	**509,880**	111,632			
1982	20,886	2,426		37,657	1,545				4,716	4,287	32,552	29,231	6,762	268,503	64,293	**367,563**	85,612			
1983	22,547	1,853	102,387	57,467	1,062	41,994	**178,980**	49,293	5,019	7,150	110,602	31,904	9,485	278,262	113,640	**482,850**	232,033	127,503	**664,645**	236,347
1984	21,659	2,391	102,661	59,579	1,492	43,271	**192,641**	49,059	8,217	6,100	43,064	25,794	3,733	249,055	57,763	**356,877**	75,903	76,924	**551,513**	88,996
1985	16,925	1,539	94,514	59,108	624	38,349	**166,782**	44,171	6,207	4,447	53,576	38,123	4,837	328,538	71,193	**460,423**	89,353	83,089	**627,831**	98,609
1986	14,745	4,153	114,253	54,508	604	46,042	**188,122**	54,038	6,319	3,685	51,095	50,370	5,446	420,080	93,387	**567,639**	118,909	106,919	**758,004**	130,051
1987	18,489	4,316	87,303	44,173	1,802	40,205	**167,875**	45,174	3,365	3,283	79,603	40,146	2,997	263,149	67,034	**409,047**	81,646	81,830	**578,123**	91,403
1988	11,847	2,785	73,227	49,023	1,756	30,751	**136,225**	34,658	9,267	3,703	52,993	51,796	10,033	466,825	97,794	**617,232**	117,566	103,973	**754,905**	120,858
1989	10,820	2,374	74,336	44,974	4,917	26,800	**144,612**	31,313	4,258	3,307	40,923	39,799	4,987	411,700	79,459	**523,249**	98,518	85,744	**668,342**	103,851
1990	13,694	2,496	88,171	55,091	3,710	29,567	**157,479**	36,018	4,299	3,303	14,916	49,213	7,025	346,545	65,709	**452,607**	82,800	75,227	**611,138**	88,889
1991	16,479	1,725	73,527	59,752	4,305	27,719	**158,077**	31,547	3,996	3,278	41,143	21,606	3,306	260,861	50,530	**342,675**	63,517	60,166	**502,216**	68,536
1992	17,658	2,591	80,327	57,213	5,456	29,922	**165,897**	34,682	4,996	3,725	20,924	16,366	8,934	352,013	65,795	**412,231**	83,374	74,487	**579,054**	90,144
1993	20,226	2,887	75,842	66,692	7,516	28,897	**164,002**	32,038	2,337	1,816	24,716	18,801	27,638	288,000	57,826	**372,934**	73,184	67,845	**538,263**	78,489
1994	17,125	2,467	74,817	66,442	5,460	29,243	**166,402**	32,678	5,320	2,966	40,191	25,663	6,633	349,982	66,252	**441,271**	84,858	74,901	**609,253**	90,793
1995	10,587	1,722	81,009	67,654	4,443	29,732	**163,390**	33,405	2,563	3,306	37,953	26,833	5,423	329,994	61,267	**420,213**	80,334	71,358	**584,940**	86,770
1996	11,348	2,261	79,803	53,727	5,688	29,392	**163,900**	32,738	4,489	2,138	19,599	27,451	6,821	251,272	49,361	**319,743**	60,657	59,621	**484,783**	66,959
1997	16,417	1,274	57,759	44,531	3,704	23,442	**133,313**	26,708	2,339	2,392	39,399	18,279	8,441	174,558	43,256	**255,451**	52,658	52,231	**390,021**	59,594
1998	13,861	1,852	69,448	48,289	2,713	25,130	**131,493**	27,579	1,974	1,487	12,542	11,579	13,581	187,685	34,289	**232,786**	43,556	44,820	**365,365**	51,328
1999	11,761	2,472	72,368	52,997	2,332	26,230	**144,323**	29,477	4,276	3,093	33,762	29,455	5,376	159,116	46,481	**251,170**	64,114	54,608	**396,188**	70,039
2000	26,310	1,495	102,726	85,092	5,102	35,053	**196,376**	39,686	2,971	898	44,064	33,253	7,190	208,115	46,685	**311,171**	60,176	61,643	**508,322**	69,877
2001	37,802	1,809	123,029	71,914	6,125	46,160	**260,314**	49,762	3,461	1,512	37,185	35,251	5,494	200,375	47,767	**297,972**	64,888	70,794	**559,239**	82,331
2002	30,488	1,798	106,936	75,440	4,505	37,755	**219,918**	43,116	2,289	1,734	47,866	31,825	6,589	166,989	42,689	**269,787**	58,548	59,820	**491,366**	69,058
2003	21,662	2,227	95,595	52,222	5,129	32,600	**189,784**	37,456	3,314	2,548	54,391	32,317	6,962	197,860	52,198	**307,694**	69,371	62,891	**498,126**	78,403
2004	10,322	2,094	87,364	38,244	3,738	29,049	**153,302**	32,276	6,163	2,120	24,760	26,087	6,460	246,490	52,727	**319,984**	64,244	63,940	**474,080**	71,887
2005	7,959	2,646	79,753	43,653	2,834	24,460	**130,106**	28,086	3,831	2,009	37,688	30,217	1,351	195,842	45,199	**278,689**	59,512	52,655	**409,799**	64,888
2006	14,001	3,062	101,825	42,633	2,794	31,372	**168,534**	36,335	3,843	1,654	25,092	25,632	1,935	204,927	49,118	**272,596**	62,491	60,500	**442,405**	71,769
2007	19,773	3,388	84,141	39,234	3,874	27,128	**152,130**	29,643	3,649	989	14,370	21,483	5,337	198,986	42,536	**251,658**	56,571	52,631	**404,525**	62,881
2008	18,855	3,829	105,058	73,735	6,556	31,745	**183,198**	35,722	3,983	1,412	13,227	23,146	3,491	209,021	45,783	**261,635**	62,915	59,777	**446,370**	70,522
10yr Av.	19,893	2,482	95,879	57,516	4,299	32,155	**179,798**	36,156	3,778	1,797	33,240	28,867	5,018	198,772	47,118	**282,236**	62,283	59,926	**463,042**	71,166

Table 3.8.14.1 Estimated survival of wild smolts (%) to return to homewaters (prior to coastal fisheries) for various monitored rivers in the NE Atlantic Area.

Smolt	Iceland[1]			Norway[2]				Ireland		UK (Scotland)[2]		UK (NI)[7]	JK (E & W)		France		
year	R. Ellidaar	R. Vesturdalsa[4]		R. Halselva		R. Imsa		R. Corrib		North Esk		R. Bush	R. Dee		Nivelle[5]	Scorff	Oir
	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	MSW	1SW[3]	1SW	MSW	All ages	All ages	All ages
1975	20.8																
1980								17.9	1.1								
1981						17.3	4.0	7.6	3.8	9.9	4.6						
1982						5.3	1.2	20.9	3.3	11.4	5.0						
1983						13.5	1.3	10.0	1.8								
1984						12.1	1.8	26.2	2.0	6.8	4.5						
1985	9.4					10.2	2.1	18.9	1.8	13.9	5.4						
1986						3.8	4.2	-	-			31.3			15.1		
1987				2.0	0.3	17.3	5.6	16.6	0.7	9.4	3.5	35.1			2.6		
1988	12.7			5.8	0.7	13.3	1.1	14.6	0.7			36.2			2.4		
1989	8.1			2.1	1.0	8.7	2.2	6.7	0.7	6.4	4.0	25.0			3.5		
1990	5.4			3.9	1.6	3.0	1.3	5.0	0.6	6.2	3.2	34.7			1.8		
1991	8.8			2.1	0.3	8.7	1.2	7.3	1.3	7.8	3.2	27.8			9.2		
1992	9.6			2.1	0.4	6.7	0.9	7.3	-			29.0			8.9		5.3
1993	9.8			2.1	0.0	15.6		10.8	0.1				6.3	2.5	7.2 [6]		17.0
1994	9.0			0.6	0.4			9.8	1.4	9.1	3.0	27.1	1.3	1.2	2.3 [6]		3.5
1995	9.4		1.5	0.9	0.0	1.8	1.5	8.4	0.1	8.6	3.9		2.7	0.4	4.4		5.0
1996	4.6	2.5	0.4	2.8	0.0	3.5	0.9	6.3	1.2	7.5	3.5	31.0	4.8	2.1	3.4		4.8
1997	5.3	1.0	1.5	0.8	0.0	1.7	0.3	12.7	0.8	7.8	4.6	19.8	6.2	3.4	2.7		14.0
1998	5.3	1.5	1.0	1.5	0.6	7.2	1.0	5.5	1.1			13.4	2.3	3.7	1.9		6.6
1999	7.7	1.3	1.2	1.3	0.0	4.2	2.2	6.4	0.9			16.5	5.0	12.4	2.8	15.9	
2000	6.3	1.1	0.7	0.4	1.1	12.5	1.7	9.4	0.0	5.3	2.4	10.1	2.0	0.9	3.3	10.9	2.4
2001	5.1	3.4	1.3	1.3	1.3	2.5	2.2	7.2	1.1	4.7	2.8	12.4	4.3	0.0	0.4	6.2	3.7
2002	4.4	1.1	2.3	0.8	0.5	5.5	1.1	6.0	0.5	3.7	3.3	11.3	2.9	0.7	0.8	21.6	3.1
2003	9.1	5.5	0.6	4.3	0.9	3.5	0.7	8.3	2.1			6.8	2.6	0.4	0.5	11.8	
2004	7.7	5.7	0.6	3.1	1.2	6.1	1.3	6.3	0.8	10.2	6.4	6.8	4.5	1.0		6.3	
2005	6.4	2.5	0.9	2.5	0.0	3.7	1.8			7.3	3.0	5.9	5.1	0.5		8.5	
2006	7.1	1.8	1.0	0.0	0.0	0.8	5.1	1.2		3.3	3.5	14.0	4.3	1.4			
2007	19.3	0.9		0.3		0.9		0.9		8.3			1.3				
Mean																	
(5-year)	6.9	3.3	1.1	2.1	0.5	3.9	2.0	5.5	1.1	6.1	4.0	9.0	3.9	0.8	0.7 #	12.1	3.1
(10-year)	6.4	2.5	1.1	1.6	0.6	4.8	1.7	7.0	0.9	6.0	3.7	11.7	3.9	2.4	1.8 #	11.6	6.0

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

	Iceland[1]		Norway[2]						Sweden[2]	
Smolt year	R. Ranga		R. Halselva		R. Imsa		R.		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	0.8	0.2	2.1	0.3	2.8	1.5	0.3	0.4	5.2	3.1
1991	0.0	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	0.7	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	1.1	0.1	-	-	0.4	0.0	0.7	0.3	3.9	0.6
1996	0.2	0.0	1.2	0.2	2.1	0.2	0.3	0.2	3.5	0.5
1997	0.3	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	0.4	0.0	2.3	0.2	12.0	1.1	1.9	1.6	2.1	
2000	0.9	0.1	1.0	0.7	8.4	0.1	1.1	0.6		
2001	0.4	0.1	1.9	0.6	3.4	0.1	2.2	1.2		
2002	0.4		1.4	0.0	4.5	0.8	1.1	0.9		
2003	0.2		0.5	0.3	2.6	0.7	0.3	0.7		
2004	0.6		0.2	0.1	3.6	0.7	0.3	0.4		
2005	1.0		1.2	0.2	2.8	1.1	0.3	0.6		
2006	1.0		0.0	0.1	1.0	2.1	0.1	0.6		
2007	1.8		0.3		0.6		0.2			
Mean										
(5-year)	0.6		0.7	0.1	2.9	1.1	0.4	0.6		
(10-year)	0.6	0.1	1.0	0.3	4.2	0.7	1.0	0.8	1.4	0.7

[1] Microtagged.

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

Table 3.8.14.2 Cont'd. Estimated survival of hatchery smolts (%) to return to 1SW adult return to homewaters (prior to coastal fisheries) for monitored rivers and experimental facilities in Ireland and UK (N. Ireland).

	Ireland									UK (N. Ireland)[3]	
Smolt year	R. Shannon	R. Screebe	R. Burrishoole[1]	R. Delphi	R. Bunowen	R. Lee	R. Corrib Cong.[2]	R. Corrib Galway[2]	R. Erne	R. Bush 1+ smolts	R. Bush 2+ smolts
1980	8.6		3.3			8.3	0.9				
1981	2.8		6.9			2.0	1.5				
1982	4.0		8.2			16.3	2.7	0.4			
1983	3.9		2.3			2.0	2.8	0.0		1.9	8.1
1984	5.0	10.4	23.5			2.3	5.2	0.0	9.2	13.3	
1985	17.8	12.3	26.3			14.7	1.4	0.0	7.9	15.4	17.5
1986	2.1	0.4	7.6			16.4		0.0	10.1	2.0	9.7
1987	4.7	8.3	11.2			8.8		0.0	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	0.0	1.2	8.1	23.2
1990	1.3	0.0	7.1			2.5	0.2	16.1	2.5	5.6	5.6
1991	4.2	0.2	12.5	11.3		0.8	4.9	4.1	1.3	5.4	8.8
1992	4.4	1.3	6.3	10.7	4.2		0.9	13.2		6.0	7.8
1993	2.9	2.2	12.0	14.0	5.4		1.0			1.1	5.8
1994	5.2	1.9	14.3	3.9	10.8			7.7		1.6	
1995	3.6	4.1	6.6	3.4	3.5		2.4			3.1	2.4
1996	2.9	1.8	5.3	10.1	3.4					2.0	2.3
1997	6.0	0.4	13.3	16.2	5.3	7.0			7.6	-	4.1
1998	3.1	1.3	4.9	7.0	2.9	4.6	3.3	2.3	2.5	2.3	4.5
1999	1.0	2.8	8.1	15.4	2.0			4.0	3.5	2.7	5.8
2000	1.2	3.8	11.8	15.9	5.4	3.5	6.7		4.0	2.8	4.4
2001	2.0	2.5	9.7	17.2	3.2	2.0	3.4		5.9	1.1	2.2
2002	1.0	4.1	9.2	11.5	2.0	1.9		5.3	1.9	0.7	3.1
2003	1.2		6.0	3.7	1.6	4.3			1.0	2.5	1.9
2004	0.4	1.8	9.4	7.6	1.8	2.2			3.1	0.7	1.9
2005	0.6	3.4	4.9	11.0	1.0	1.0			0.9	1.8	1.7
2006	0.3	1.3	5.2	4.3	0.0	0.2	0.4	2.9	0.9	2.0	3.8
2007	0.5	0.8	6.9	3.3	0.0	0.0	0.0	3.6	0.6		
Mean											
(5-year)	0.7	2.7	6.9	7.6	1.3	1.9	0.4	4.1	1.6	1.5	2.5
(10-year)	1.7	2.4	8.3	11.0	2.5	3.0	3.5	3.6	3.1	1.8	3.3

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

[2] Different release sites

[3] Microtagged.

Table 3.9.1 Summary of national objectives, recent management measures and attainment of management objectives.

Country	Objective	Introduced	Assessment period	Measure Taken	Assessment	Outcome/extent achieved	Further consideration
Russia	Reduce commercial fishing effort and enhance recreational fisheries based mostly on catch-and-release principles	1994	Annually	Various management measures including closure of some important commercial in-river fisheries and reductions in quotas for coastal mixed-stock fisheries	Examination of catch statistics	Mean total commercial catch reduced by 50% and mean in-river commercial catch reduced by 83%, while recreational catches increased by 56% (2004-2008 compared to 1999-2003). The percentage of the total recreational catch that was released has ranged from 74% to 90% in the last ten years.	Further restrictions will be considered for fisheries which take mixed stocks and stocks below their Conservation Limits.
Norway	Reduce mixed stock fisheries, and reduce exploitation on MSW salmon.	2008	2008	Along the coast in all counties except Finnmark: Fishing season for bag-nets reduced at the beginning of the season or fisheries closed. In fjords in all counties except Finnmark: Fishing season reduced by at least 14 days at the beginning of the season. Finnmark: Smaller reductions in fishing season and number of fishing-days per week for both bend-nets and bag-nets.	Examination of catch statistics	Mean proportion of the total catch taken in the sea reduced from a mean of 49 % in the period 2003-2007 to 42 % in 2008 based on the number of salmon caught, and from 56 % to 47 % based on the weight of the catch.	A new licence scheme for netsmen is under developement, which may reduce the future netting effort.
	Reduce exploitation in rivers to increase the number of spawners.	2008		Fisheries regulations for individual rivers set in accordance with their assumed stock status. Introduction of daily bag-limits in many rivers, and closure of fisheries in rivers with low population levels.			Compliance of CL's in individual rivers will be assessed.
Iceland	Formally record restrictions on the numbers of rods and nets allowed in individual rivers in an effort regulation plan aimed at providing a fundamental basis for a sustainable salmon fishery.	2008-2009 (based on Fishing Act of 2006)	Every 8 years	Fishery associations or the owners of fishing rights on rivers or lakes are responsible for introducing effort plans. These specify the maximum number of rods and nets allowed on individual rivers or lakes, as well as the annual and daily fishing periods allowed, restrictions on bait, bag limits, catch and release, minimum or maximum landing sizes of fish, etc. Effort plans need to be approved by the Competent Management Authority (CMA) after review by the Institute of Freshwater Fisheries (IFF)	Examination of available information from catch statistics, stock size estimates, exploitation rates, parr densities, historic catch or effort information, etc.	Introduction of effort plans is intended to further underline the responsibilities of owners of fishing rights for sustainable management. The effort plan needs to be taken in to account when fishing rights are leased to anglers or syndicates.	The Competent Management Authority (CMA) can introduce further restrictions at any time as necessary.
Ireland	To conserve the inland fisheries resource in its own right and its viability and economic and social contribution at national, local and community level.	2006	post 2006	Closure of mixed stock fishery in marine and coastal waters. Fisheries only allowed on single stocks which are shown to have a harvestable surplus over the Conservation Limit. These are operated in rivers and estuaries only	Harvest rule based on a catch option which provides at least a 75% chance that the CL will be met.	Commercial catch reduced from over 70% of total catch. Rod catch now 68% of total catch. Catch and release 54% of total rod catch and 35% of the total catch. Increase in river returns and spawners in virtually all rivers assessed with counters or traps in 2007 and 2008.	57 of 80 stocks where a direct assessment can be made are meeting CL. There are also about 60 small rivers (annual rod catch < 10) with uncertain status. Information is being acquired for these
	Maintain salmon stocks in SAC rivers at favourable conservation status	2002	2002 to present	Closure of mixed stock fishery as above.	Examination of counter (14 rivers) or rod catch (16 rivers) data to assess CL compliance for 30 SAC	Following re-appraisal in 2008 and with the closure of the Irish coastal and marine mixed stock fishery, 23 of the 30 SAC rivers are estimated to be meeting CLs	Under the EU Water Framework Directive water quality and fish passage are expected to improve
	To reduce the exploitation of stocks from other countries in Irish fisheries	1979	Annually	Closure of mixed stock fishery as above.	Coded wire tagging returns to Irish and non-Irish rivers pre and post imposition of TACs.	Only 1 tag originating from a country other than Ireland was recaptured in the Irish fishery in 2007. No foreign tags were recaptured from the 2008 fishery.	Catch scanning for Coded Wire Tags in the commercial fisheries should be maintained
Ireland/UK N.Ireland	Development of fisheries and aquaculture, conservation and protection of inland fisheries and sustainable development of marine tourism.	2006	Post 2006	Lough Foyle area which is under the jurisdiction of a joint cross boarder Ireland/UK agency. Commercial fishing resricted to insde the Lough to target single stocks only. Number of drift net and draft net licences reduced.	Fisheries in the Foyle area managed in-season based on counter. Carcass tagging and logbook scheme in place.	Inceased escapement to River Foyle epected	Further development and improvements to in fisheries assessments being undertaken

Table 3.9.1 Cont'd. Summary of national objectives, recent management measures and attainment of management objectives.

Country	Objective	Introduced	Assessment period	Measure Taken	Assessment	Outcome/extent achieved	Further consideration
UK (England & Wales)	Meet objectives of National Salmon Management Strategy (launched in 1996) and ensure stocks meet or exceed CLs in at least 4 years out of 5.	1996	Annually	Programme of Salmon Action Plans (SAPs) for each of the 64 principal salmon rivers to provide prioritised list of actions for each river.	Examination of catch statistics, monitoring data and completion of annual compliance assessment	Programme of SAPs was finalised in 2004 and these are now subject to annual review to ensure they match current circumstances and provide a realistic programme to address issues facing each river.	Continue with targeted actions identified in SAPs and review annually. Process to be progressively linked to Water Framework Directive requirements.
	Safeguard MSW stock component	1999	2008	National spring salmon measures introduced in 1999 (restricted net fishing before June and required compulsory catch & release by anglers up to June 16)	Estimated 800 salmon saved from net fisheries and 1,600 saved from rod fisheries in 2007 due to these measures	Spawning escapement of spring salmon may have increased by up to one third on some rivers due to measures	Approval to renew these measures for a further 10 years was given in December 2008.
	Phase out mixed stock fisheries	1993	Annually	Mixed stock fishery measures imposed since 1993, including phase outs, closures, buy outs and reductions in fisheries.	Examination of catch statistics, monitoring data and completion of annual compliance asessment	Coastal fishery catch reduced from average of 41,000 (88-92) to under 32,000 (98-02) and to about 8,600 (03-08) Declared rod catch in 5 north east rivers 58% higher on average in the 6 years since net buy out in 2003, relative to average of 5 years before buy out. Recorded runs (salmon & sea trout) into the River Tyne 79% higher since NE net buy out in 2003 compared with mean of previous 5 years.	Continuing to phase out remaining mixed stock fisheries and focus on other limiting factors. Annual application of decision structure to assess need for effort controls.
	Reduce exploitation rates and increase freshwater returns leading to compliance with CLs.	1993	Annually	Promote catch and release (mainly voluntary), including 100% catch and release in some catchments.	Examination of catch statistics, release rates and annual compliance	Catch and release increased to over 50% of rod caught fish in recent years & 100% C&R on some catchments. Estimated to have contributed an extra 38 million eggs in 2008.	Continuing promotion of C&R at national and local levels.
	Maintain salmon stocks in SAC rivers at favourable conservation status	1996	annually	Fishing controls, catch and release and addressing issues identified in Salmon Action Plans as appropriate.	Examination of counter/rod data to assess CL compliance for 18 rivers designated as SACs	2 rivers are currently considered to be complying with the management objective of passing the CL 4 years out of 5.	Continue with targeted actions as identified in Salmon Action Plans in order to meet management objectives.
UK (Northern Ireland)	To conserve, enhance, restore and manage salmon stocks in catchments throughout UK (NI) through two salmon management plans (FCB and Loughs Agency areas).	2001	annually	Commercial and recreational fishing restrictions in both areas. Voluntary buyout of coastal netting licences in FCB area 2002.	Examination of recreational and commercial exploitation data collated through carcass tagging schemes in FCB and LA areas	Increased escapement of salmon following commercial and recreational fishing restrictions. Efficacy of FCB measure reported to ICES in 2008.	Continue monitoring and management protocols under the salmon management plans.
	To ensure that in most rivers in most years sufficient adult salmon are spawning to maximise output of smolts from freshwater.	2001	annually	Range of measures to enhance escapement including angling restrictions (daily & seasonal catch limits and seasonal restrictions) Ban on sale of rod caught salmon in LA area in 2008.	Examination of fish counter & rod catch datasets to assess escapement on index rivers with defined CLs.	Increased compliance against CL in many catchments in N. Ireland in 2008.	Further develop monitoring mechanisms and define/refine CLs.
	To monitor escapement and where CLs are not attained to identify and address limitations.	2005-07	2008-2010	Habitat enhancement measure funded by European Economic Area on several selected catchments in Loughs Agency and FCB areas.	Fully quantative electro-fishing	Ongoing	Monitor effect of habitat enhancement schemes.
Ireland/UK N.Ireland	Development of fisheries and aquaculture, conservation and protection of inland fisheries and	2006	Post 2006	Lough Foyle area which is under the jurisdiction of a joint cross boarder Ireland/UK agency. Commercial fishing resricted to insde the Lough to target single	Fisheries in the Foyle area managed in-season based on counter. Carcass tagging	Inceased escapement to River Foyle epected	Further development and improvements to in fisheries assessments being undertaken

Table 3.9.1 Cont'd. Summary of national objectives, recent management measures and attainment of management objectives.

Country	Objective	Introduced	Assessment period	Measure Taken	Assessment	Outcome/extent achieved	Further consideration
UK (Scotland)	Improve status of early running MSW salmon	2000	2007	Agreement by Salmon Net Fishing Association (most, but not all, net fishing operations are members) to delay fishing until the beginning of April. Introduced in 2000	Examination of catch statistics	Annual assessment. Reduction in MSW net fishery catch in February to March relative to period prior to 2000.	Further reduction in exploitation
		2005	Not yet evaluated	Bervie, N.and S. Esk salmon district net fishery delayed until 1st May with catch and release only in the rod fishery until 1st June	Examination of catch statistics	Exploitation removed for both nets and rods for respective periods.	Measure in place for 5 years. Re-evaluation after this period
France	Reduce exploitation on MSW salmon and increase escapement in the Loire basin	1994	2007	Catching salmon has been forbidden in the Loire-Allier catchment since 1994; fishing for other species continues	Salmon counter operating in Vichy (River Allier) since 1996	This did not seem to enhance salmon numbers to the expected level	Illegal exploitation, physical obstructions (e.g. Poutès-Monistrol Hydropower Dam) & other environmental factors, including higher temperatures and fish disease are also concerns and under investigation
	For Brittany and Lower Normandy stocks to comply with river-specific CLs. Reduce exploitation of MSW salmon and target fishing more on 1SW fish	1996, 2000	2000 to 2003	TACs introduced in 1996 in Brittany and Lower Normandy and MSW TACs introduced in 2000. These have lead to temporary closures on some rivers and in some years	Examination of catch statistics	Reduced catches have probably increased spawning numbers. Reduced catch of MSW fish in Brittany since 2000 and Lower Normandy since 2003, but MSW TACS are frequently exceeded on some rivers.	Monitored river (Scorff) has failed to meet CL consistently since 1994. However, the Scorff is not typical of the exploitation pattern in the area (small fishery)
	Reduce exploitation of MSW salmon in the Adour basin	1999	2007	Closure of net and rod fisheries for two days each week with days varying since 1999	Examination of catch statistics	Some reduction in rod catch but current regulations have been unable to reduce the exploitation rate on MSW stocks as expected	Specific limitations on MSW catches should be considered and a CL set for this basin
Germany	Reintroduction of Atlantic salmon. Salmon stocks extinct since the middle of 20th century but improvements in conditions and water quality were thought to be sufficient to support salmon	1988	Annually	Restocking of rivers running into North Sea (Rhine, Ems, Weser and Elbe). Two million juveniles (mainly fry) released annually	Trap and counter data (Sieg, upper Rhine)	300-700 adults recorded annually. Return rates of less than 1%. Records of natural production in some tributaries show an Increase.	Low return rates thought to reflect obstructions to upstream and downstream migration in the Rhine and its Delta as well as spawning tributaries and probably due to by-catch in non-target fisheries
	Establish free migration routes for salmon and other migratory fishes, protection of downstream migrants at power plants and rehabilitation of habitat in rivers basins	1988	Annually	Collaborative programme has started e.g. Rheinprogramm 2020 (ICPR) International Commission for the Protection of the River Rhine	Assessment in progress	Assessment in progress	Improvements expected with measures required under Water Framework Directive.

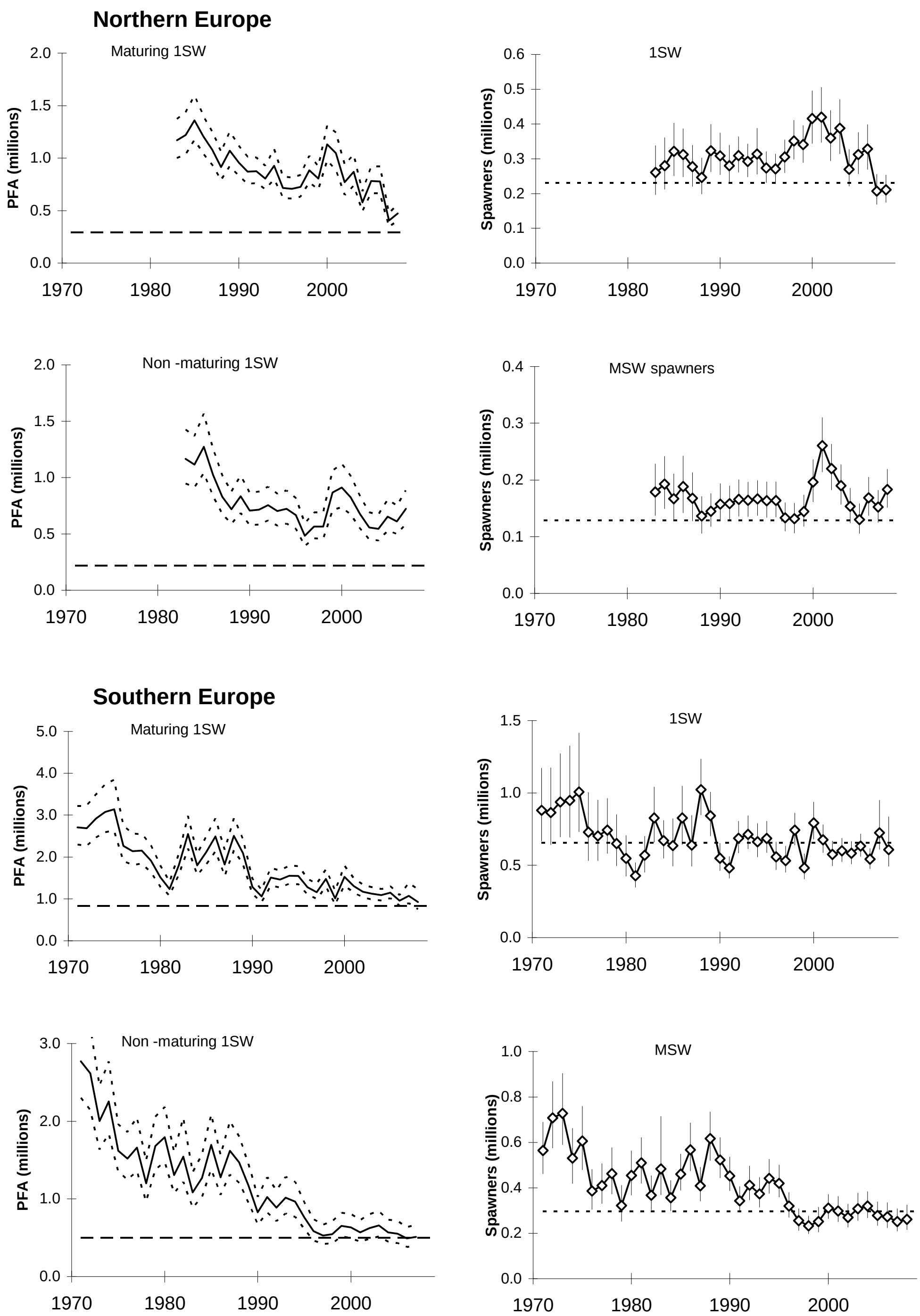


Figure 3.1.1 Estimated PFA (recruits) (left panels) and spawning escapement (right panels), with 95% confidence limits, for maturing 1SW and non-maturing 1SW salmon in Northern and Southern Europe.

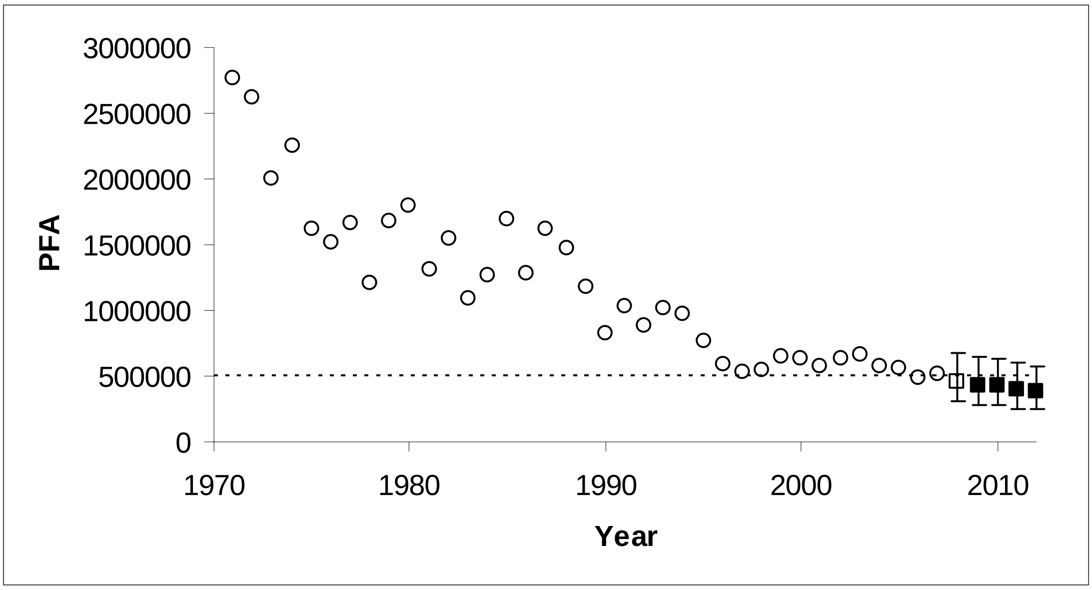


Figure 3.6.1.1 PFA estimates and predictions (95% confidence limits) for non-maturing 1SW southern NEAC stock. Note: open square is 2008 update and blocked squares are 2009 to 2012 forecasts.

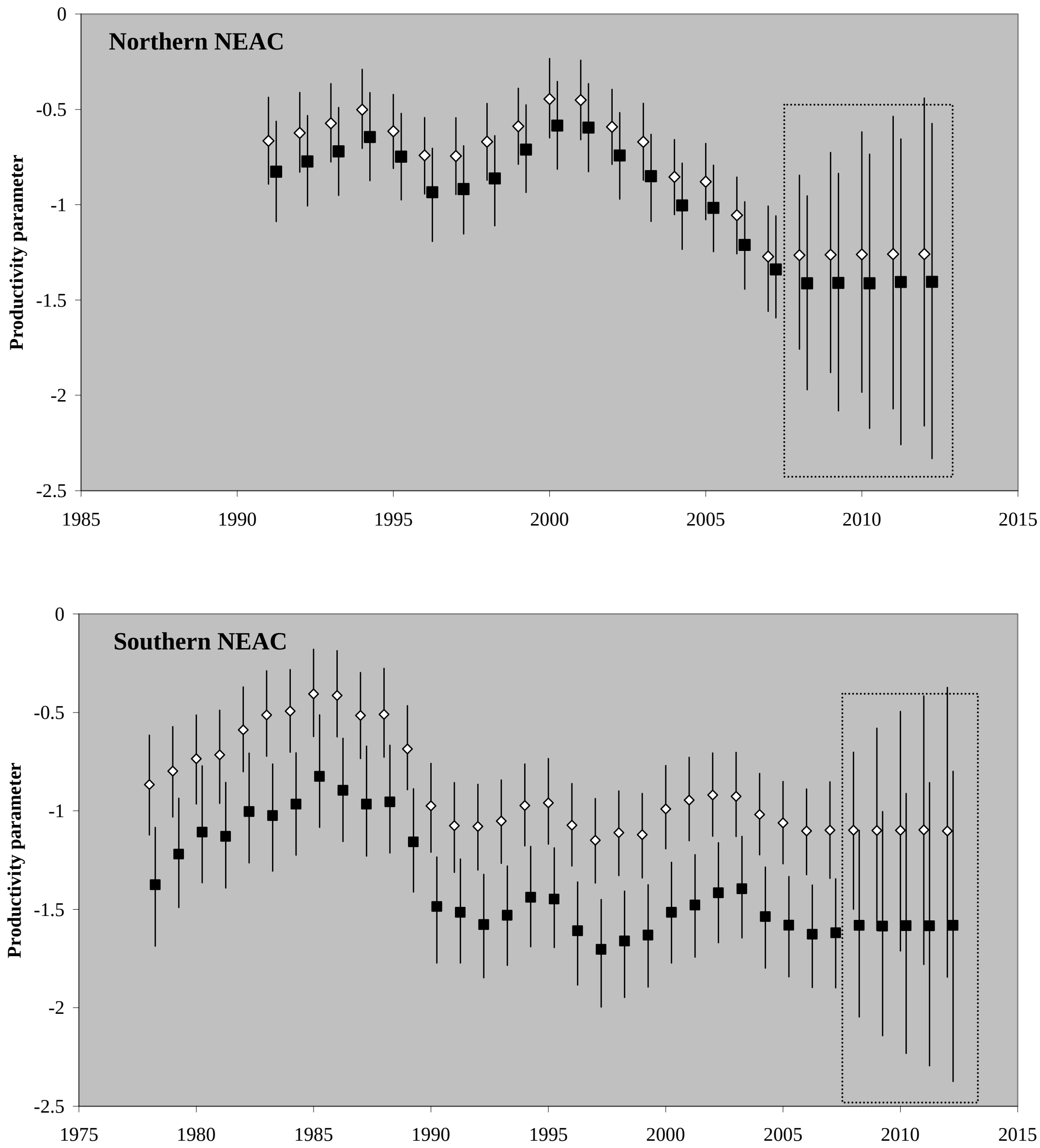
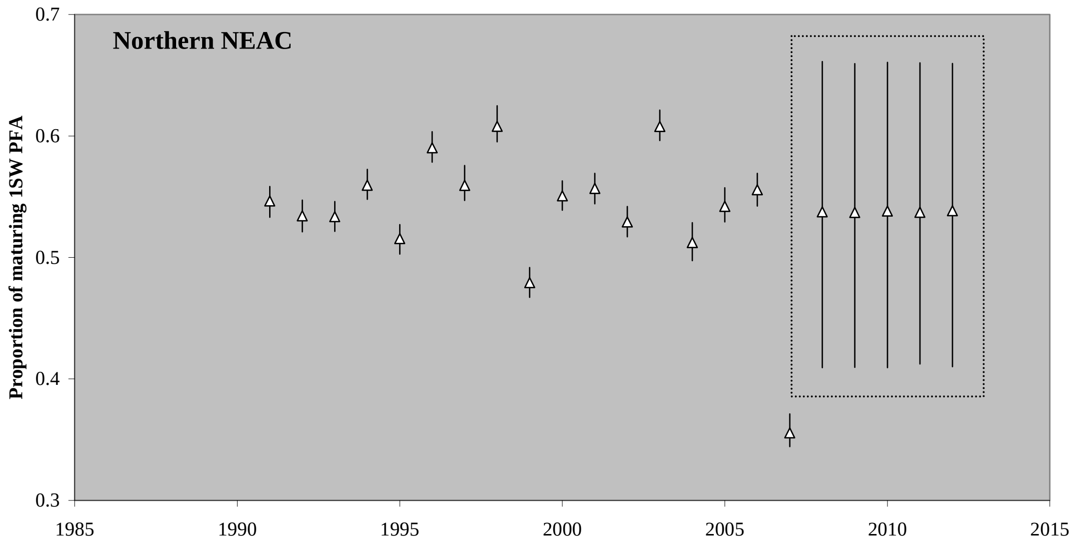


Figure 3.6.3.1 Productivity parameters by year for the maturing (◊) and non-maturing (▪) Northern and Southern NEAC forecast models. The extents of the whiskers represent the 2.5 and 97.5 BCI. Model forecasts are enclosed within the boxed areas.



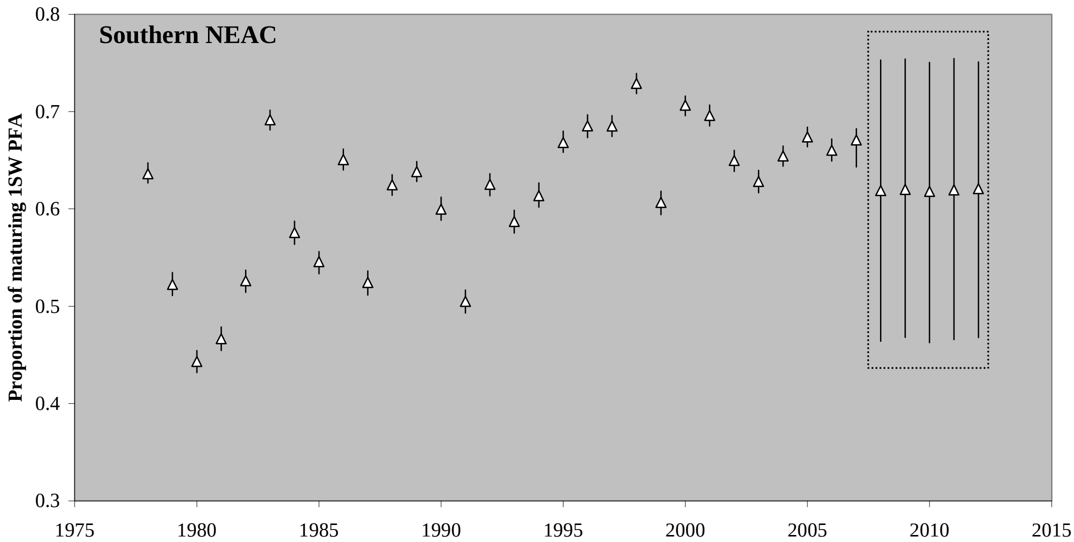


Figure 3.6.3.2 Proportion of maturing 1SW parameter by year for the Northern and Southern NEAC forecast models. The extents of the whiskers represent the 2.5 and 97.5 BCI. Model forecasts are enclosed within the boxed areas.

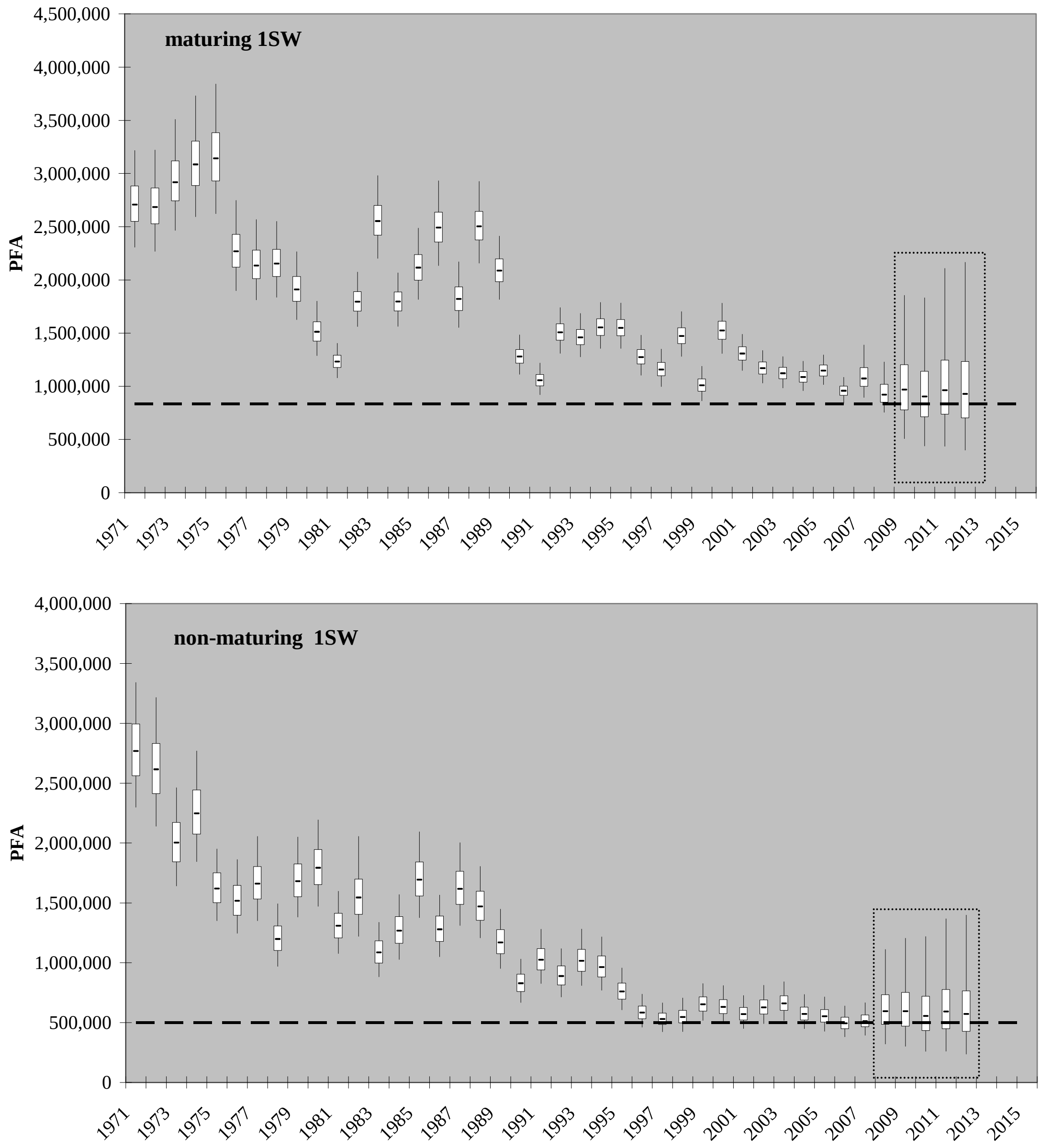


Figure 3.6.3.3 Southern NEAC PFA estimates by year. The extents of the whiskers represent the 2.5 and 97.5 BCI. The SER for the stock complex is represented by the dashed line. Model forecasts are enclosed within the boxed areas.

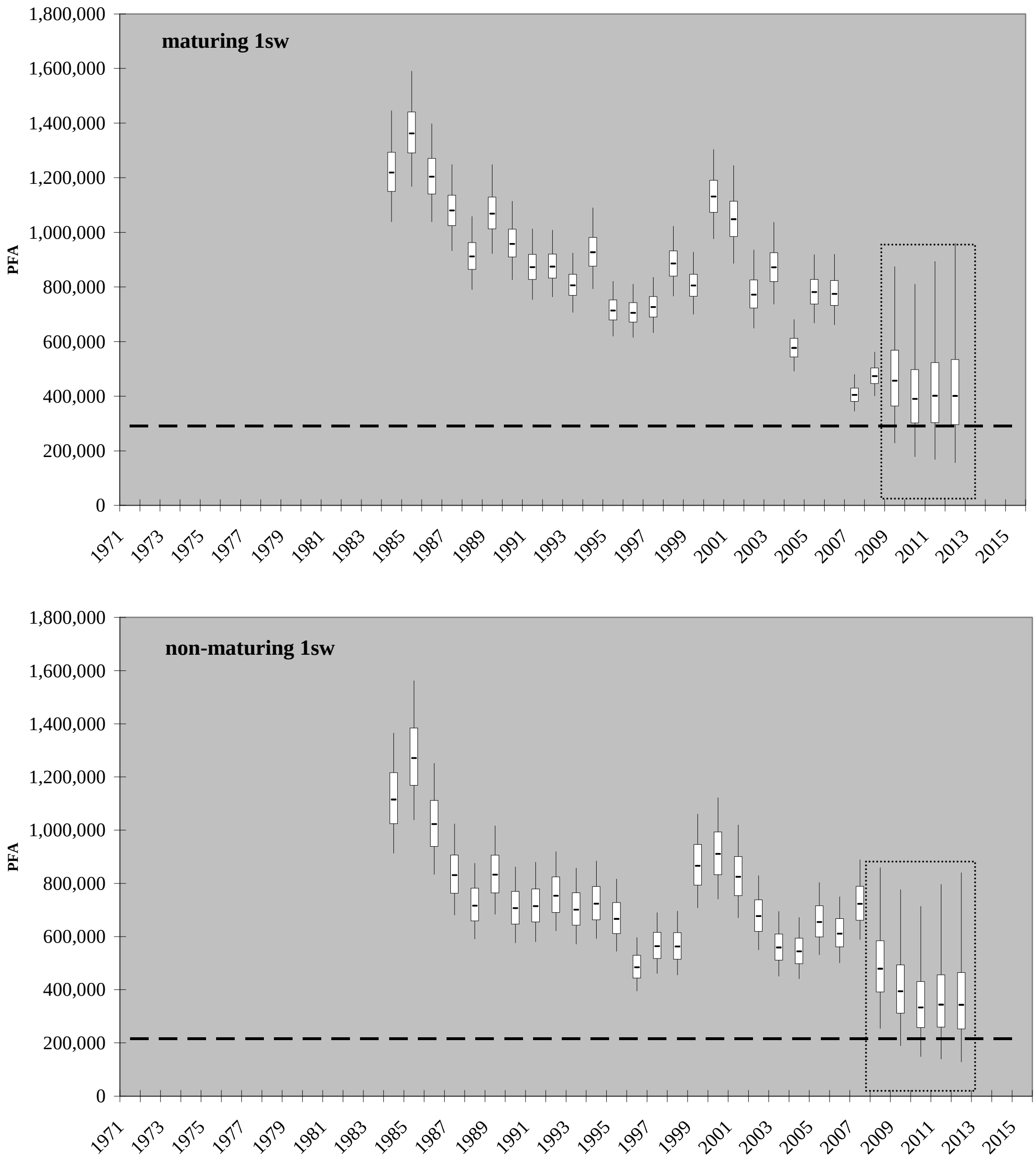


Figure 3.6.3.4 Northern NEAC PFA estimates by year. The extents of the whiskers represent the 2.5 and 97.5 BCI. The SER for the stock complex is represented by the dashed line. Model forecasts are enclosed within the boxed areas.

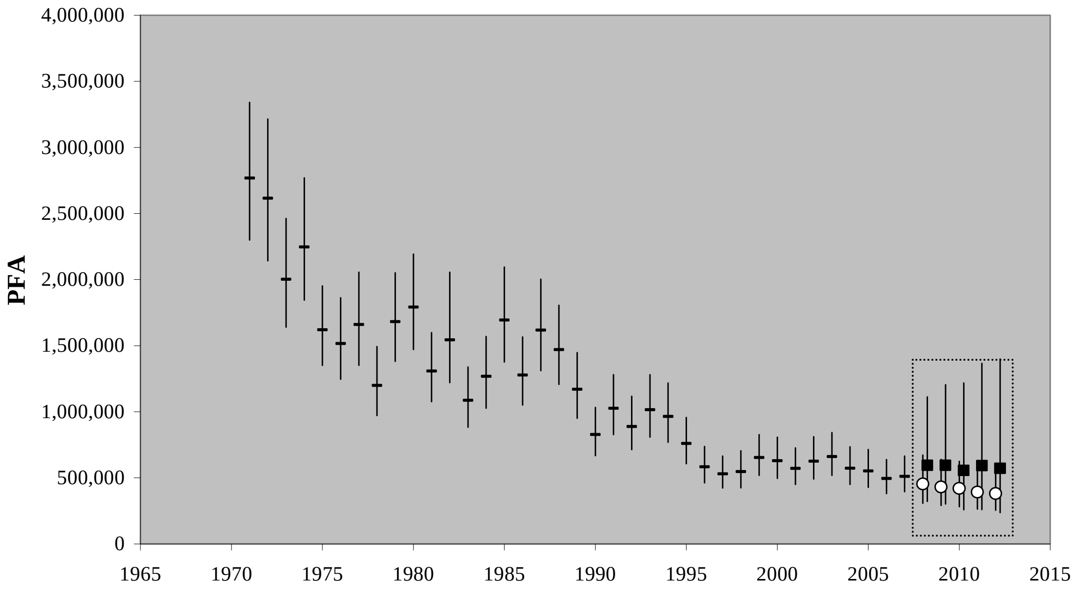


Figure 3.6.3.5 Comparison of model estimates of PFA for the Southern NEAC non-maturing 1SW stock complex. Run reconstruction median estimates (-) together with 95% confidence intervals are shown from 1971 to 2007. Forecasts from the regression model (o) together with 95% confidence intervals and from the Bayesian forecast model (▪) together with 2.5% to 97.5% BCI are shown from 2008 to 2012. Model forecasts are enclosed within the boxed areas.

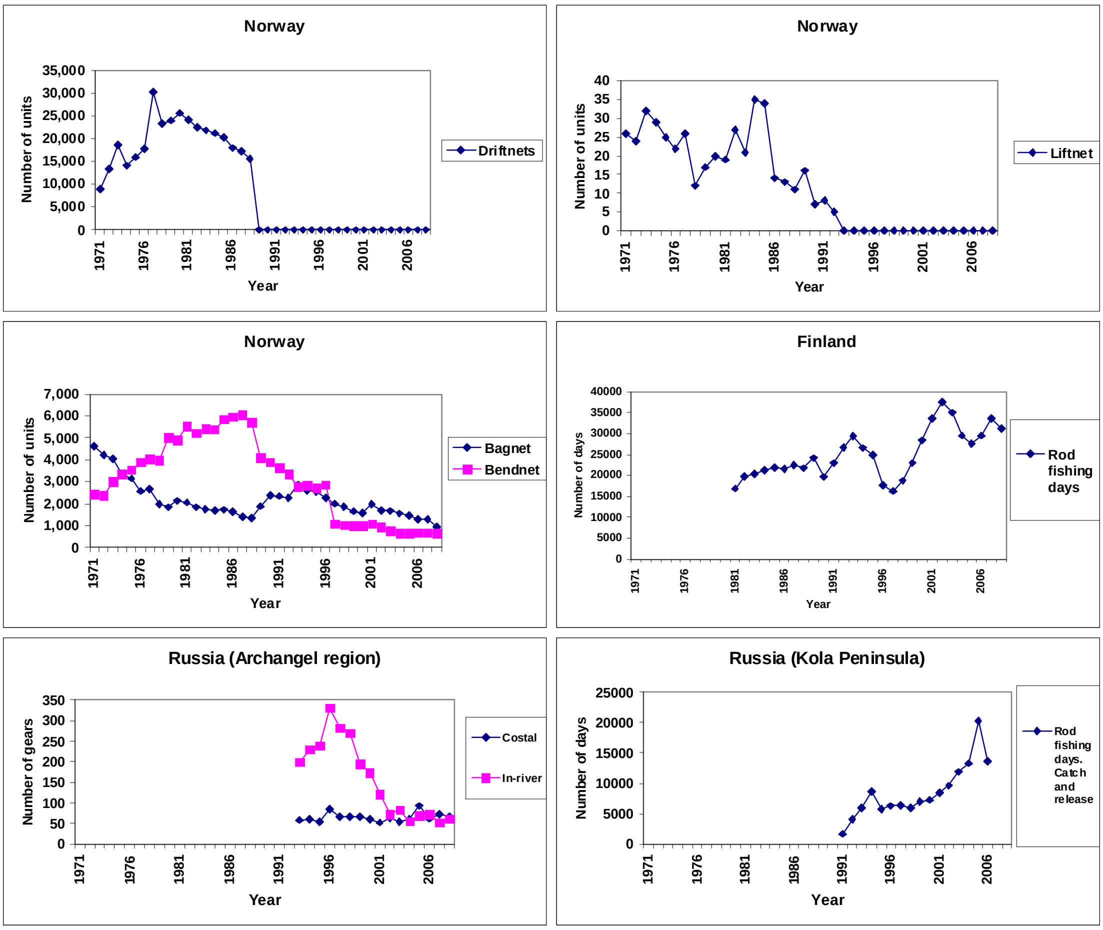


Figure 3.8.3.1. Overview of effort as reported for various fisheries and countries 1971–2008 in the Northern NEAC area.

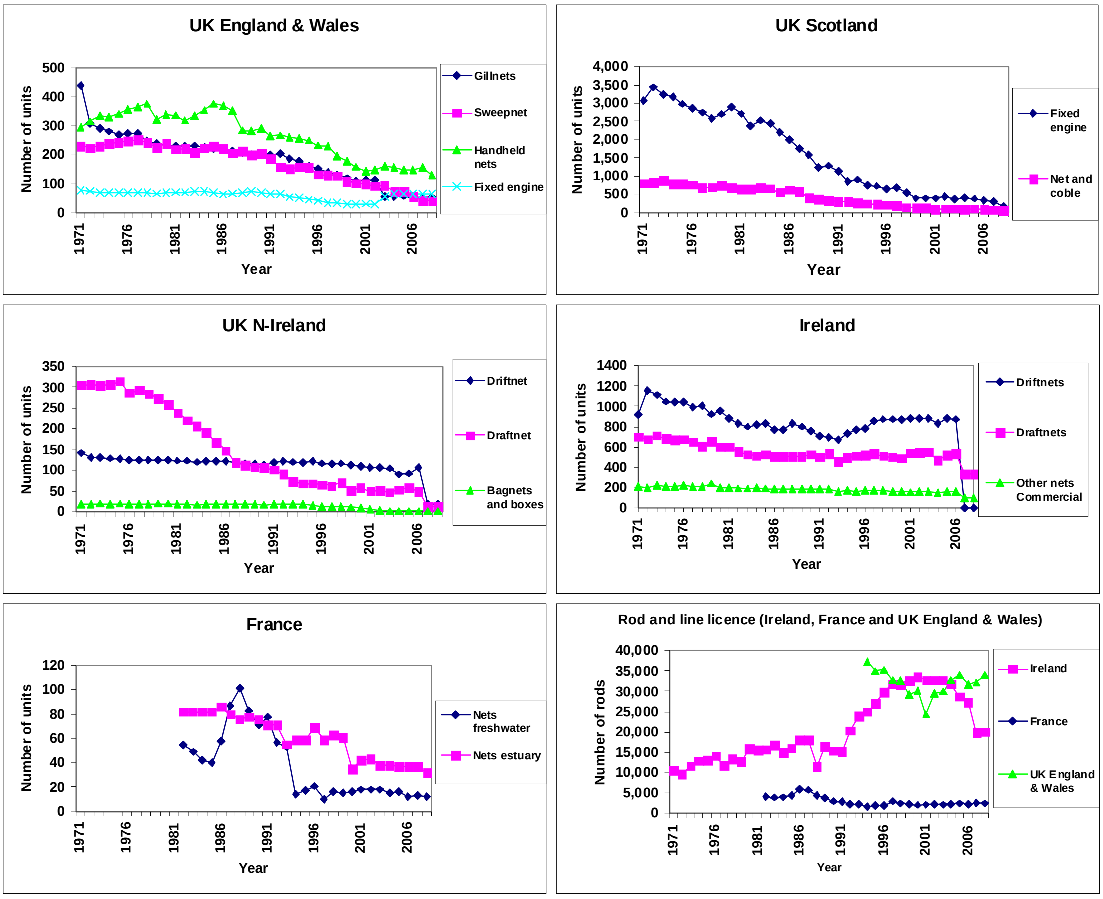


Figure 3.8.3.2. Overview of effort as reported for various fisheries and countries 1971–2008 in the Southern NEAC area.

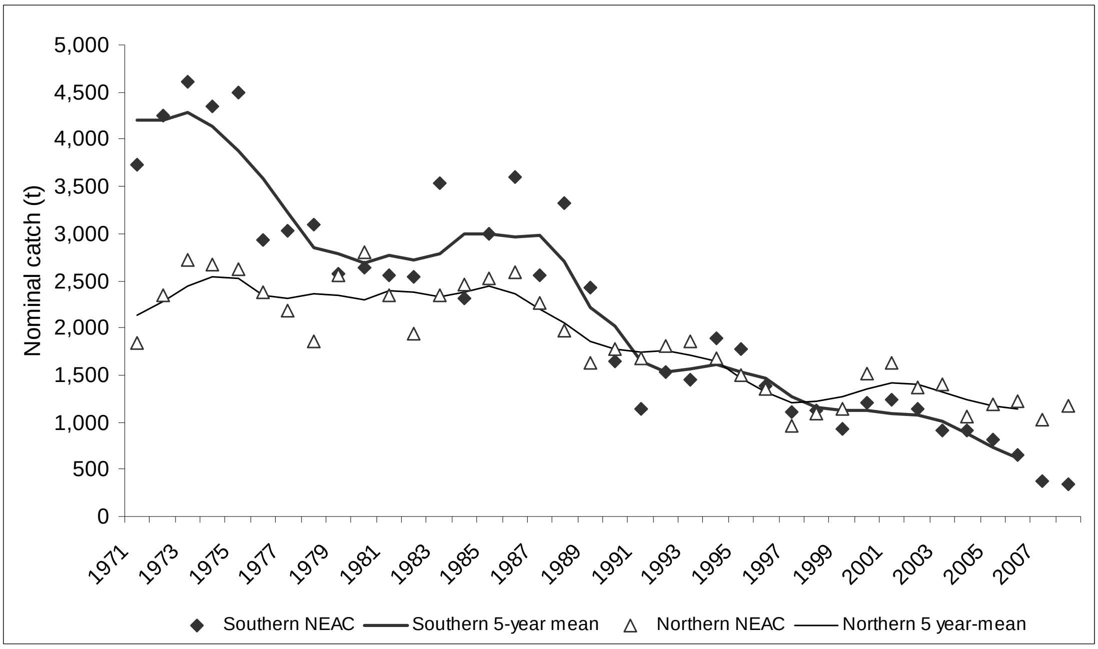


Figure 3.8.4.1 Nominal catch of salmon and 5-year running means in the Southern and Northern NEAC Areas, 1971–2008.

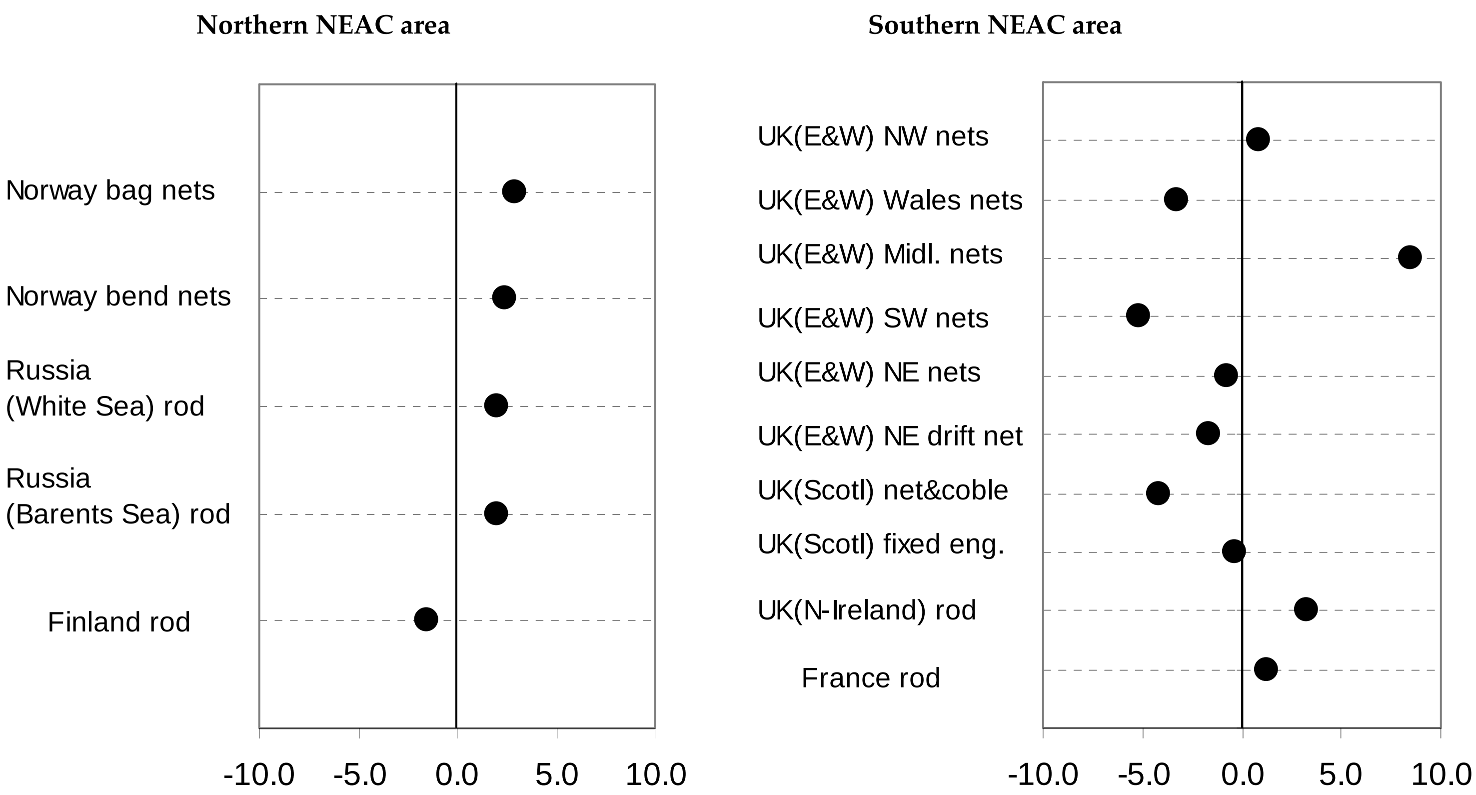


Figure 3.8.5.1 Proportional change (%) over years in cpue estimates in various rod and net fisheries in Northern and Southern NEAC areas.

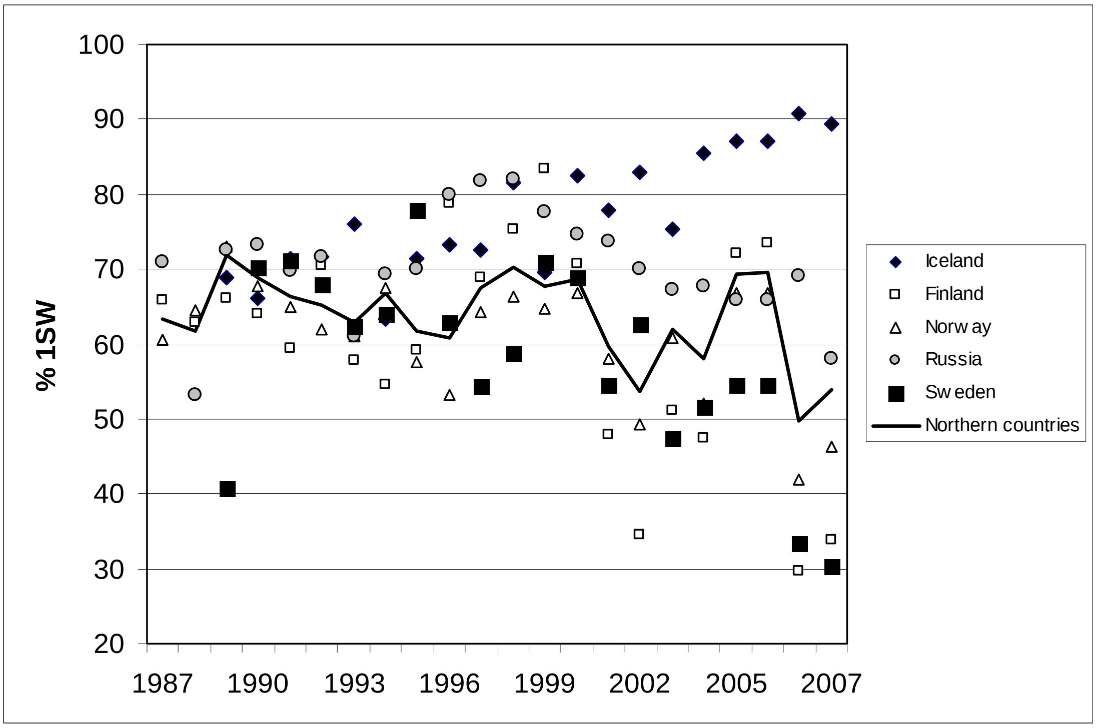


Figure 3.8.6.1 Percentage of 1SW salmon in the reported catch for Northern NEAC countries, 1987–2008. Solid line denotes mean value from catches in all NEAC Northern countries.

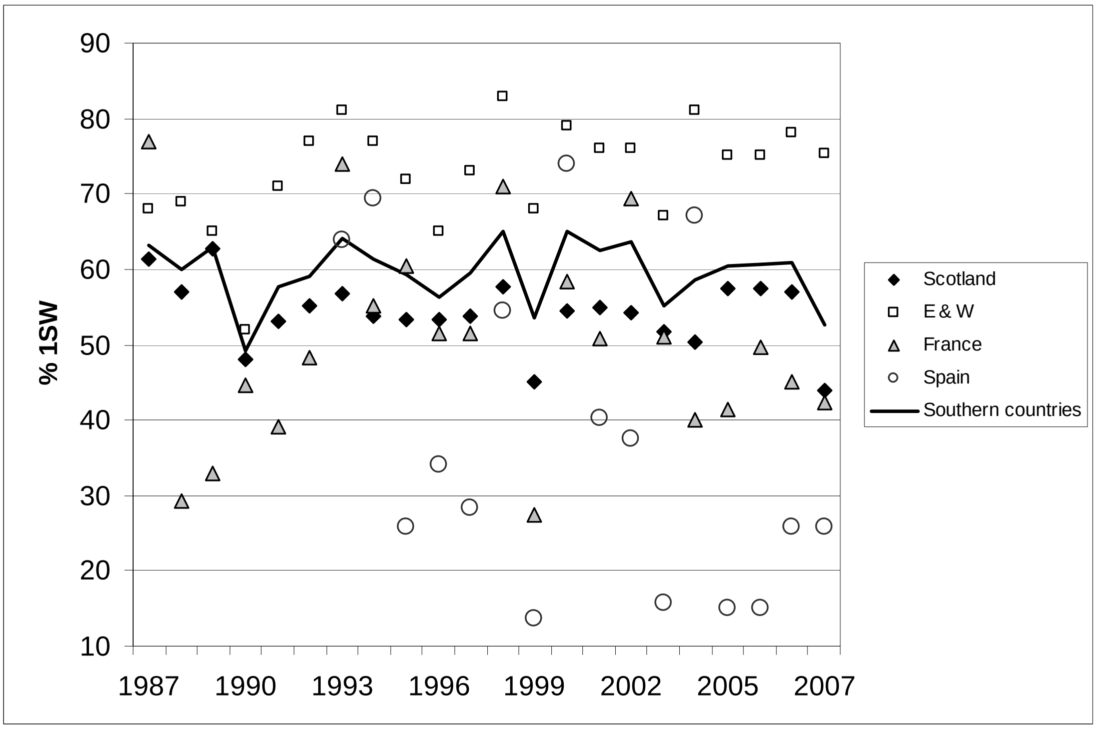


Figure 3.8.6.2 Percentage of 1SW salmon in the reported catch for Southern NEAC countries, 1987–2008. Solid line denotes mean value from catches in all NEAC Southern countries.

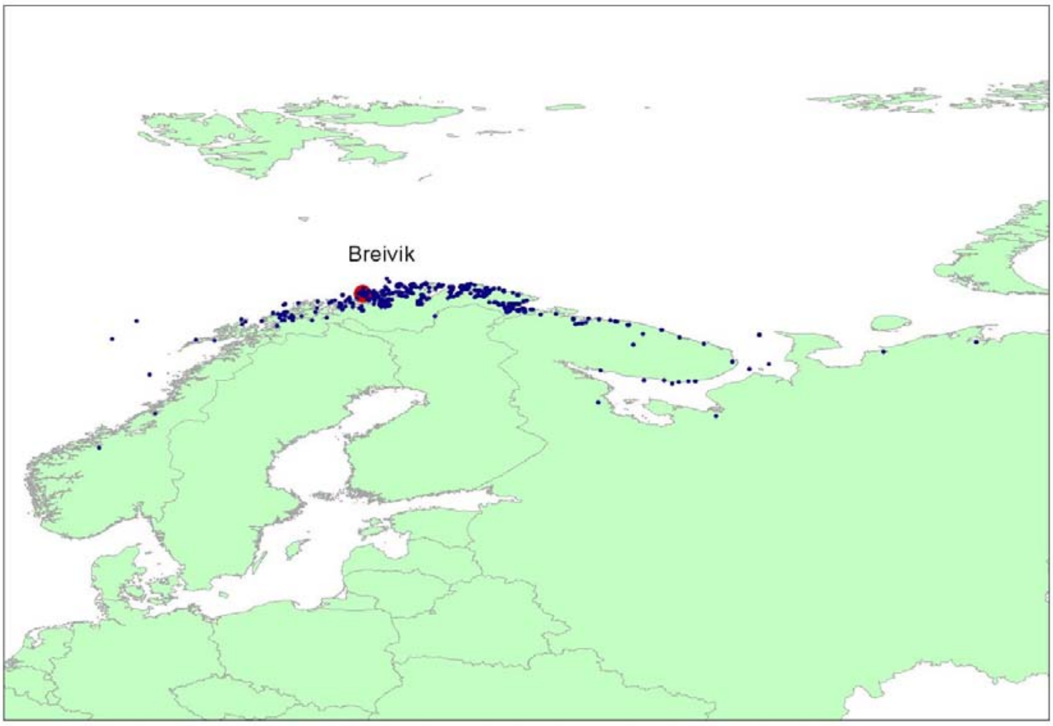


Figure 3.8.8.1 Distribution of recoveries of adult salmon tagged and released at Breivik.

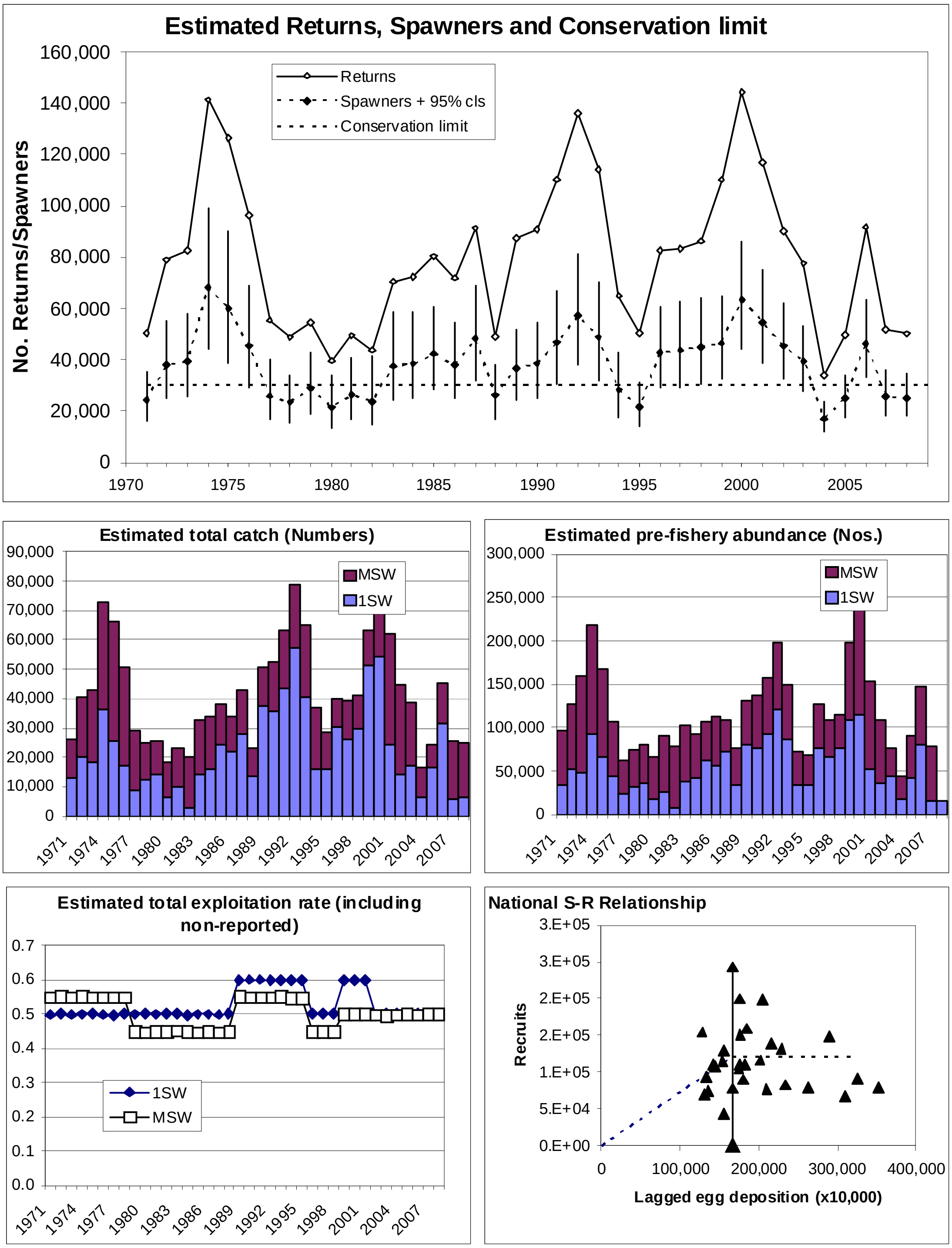


Figure 3.8.12.1a Summary of fisheries and stock description. R. Tana/Teno (Finland & Norway combined).

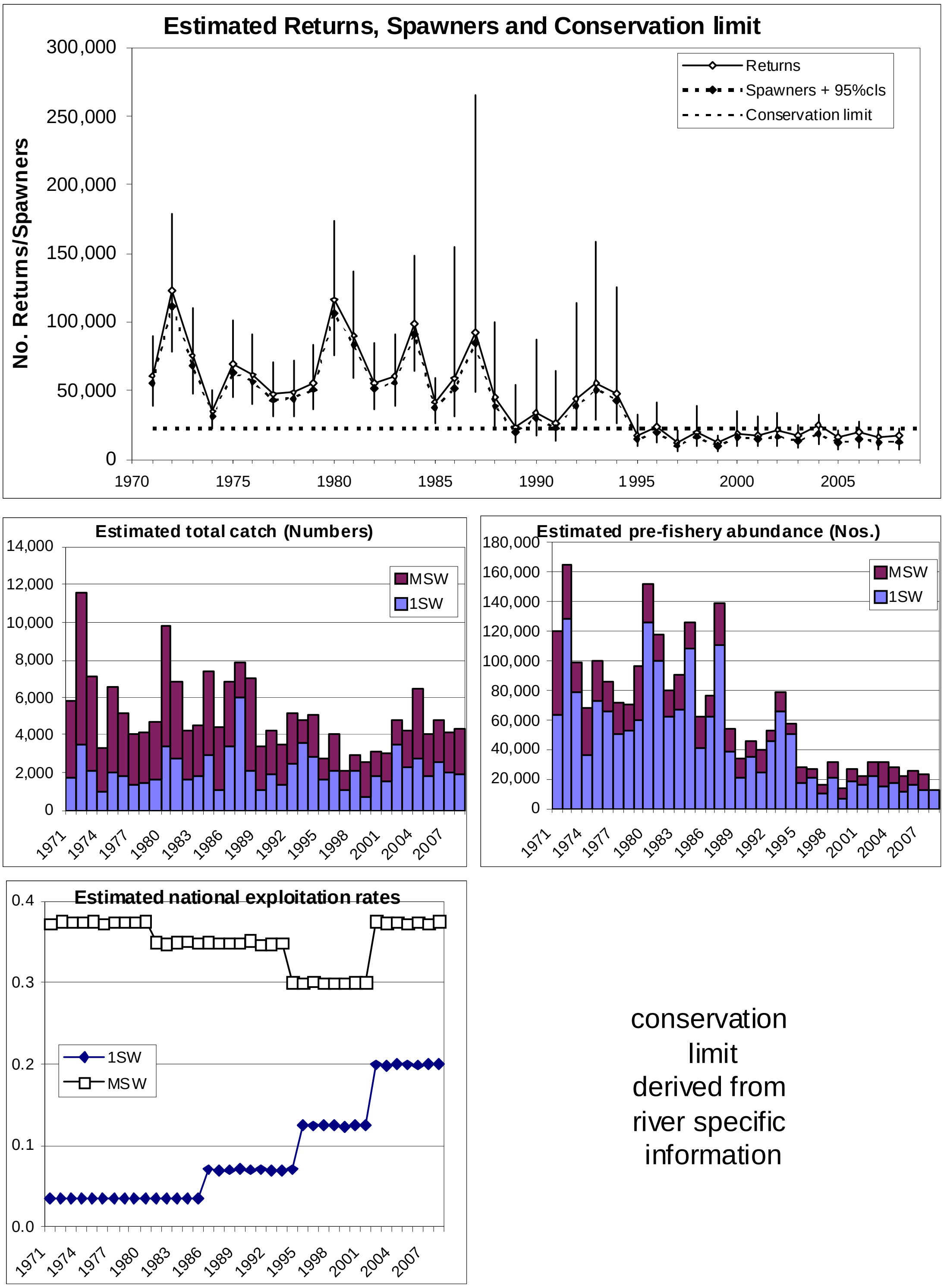


Figure 3.8.12.1b Summary of fisheries and stock description. France.

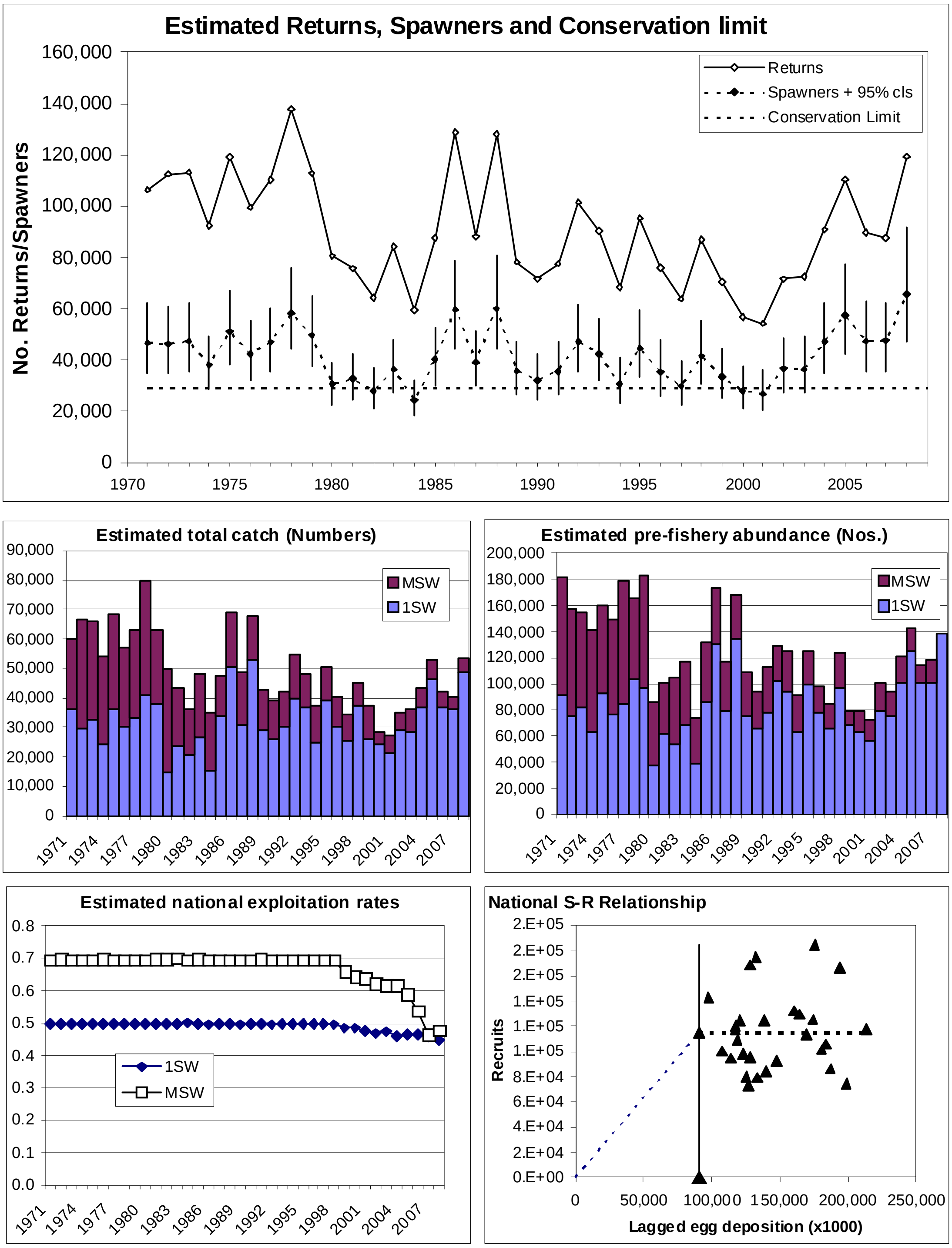
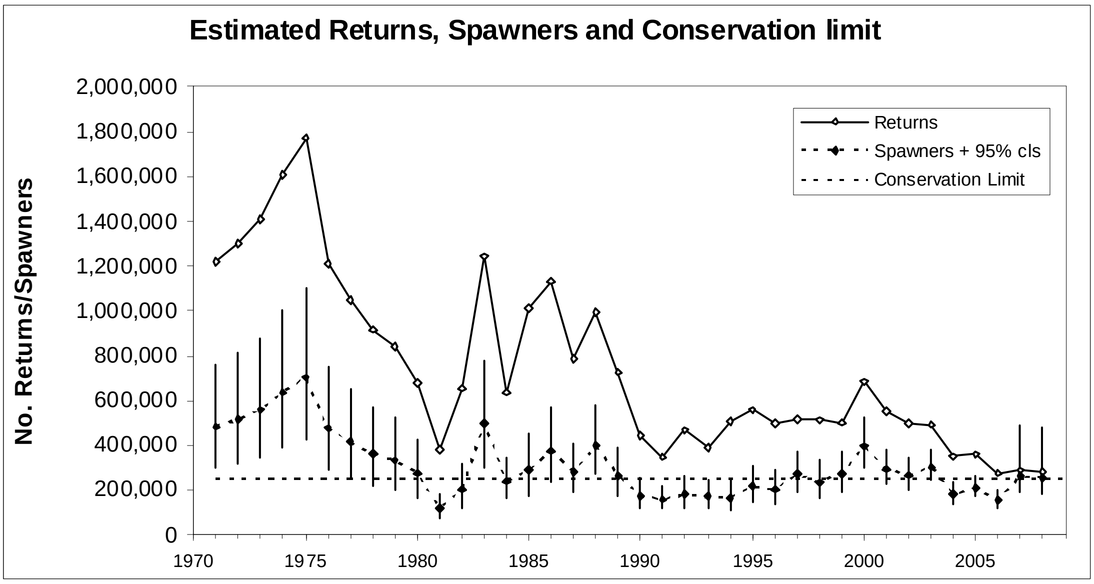
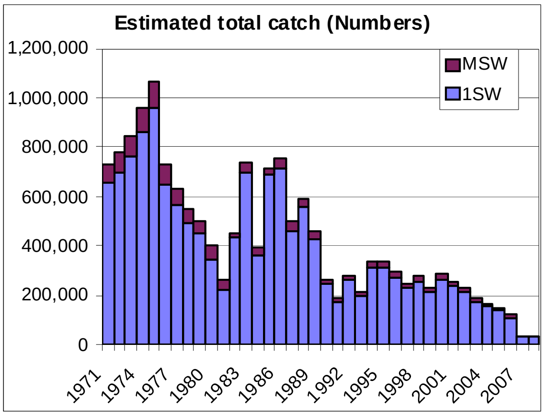
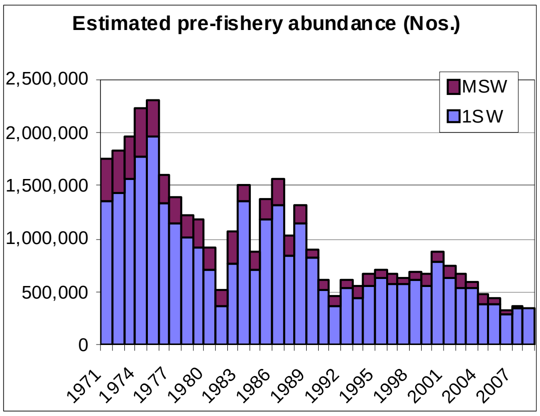
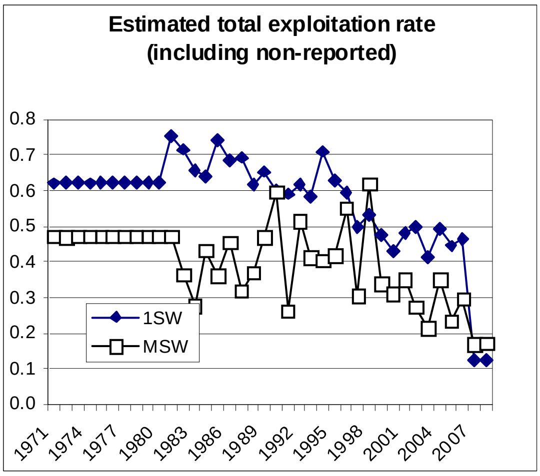


Figure 3.8.12.1c Summary of fisheries and stock description. Iceland.









conservation limit derived from river specific information

Figure 3.8.12.1d Summary of fisheries and stock description. Ireland.

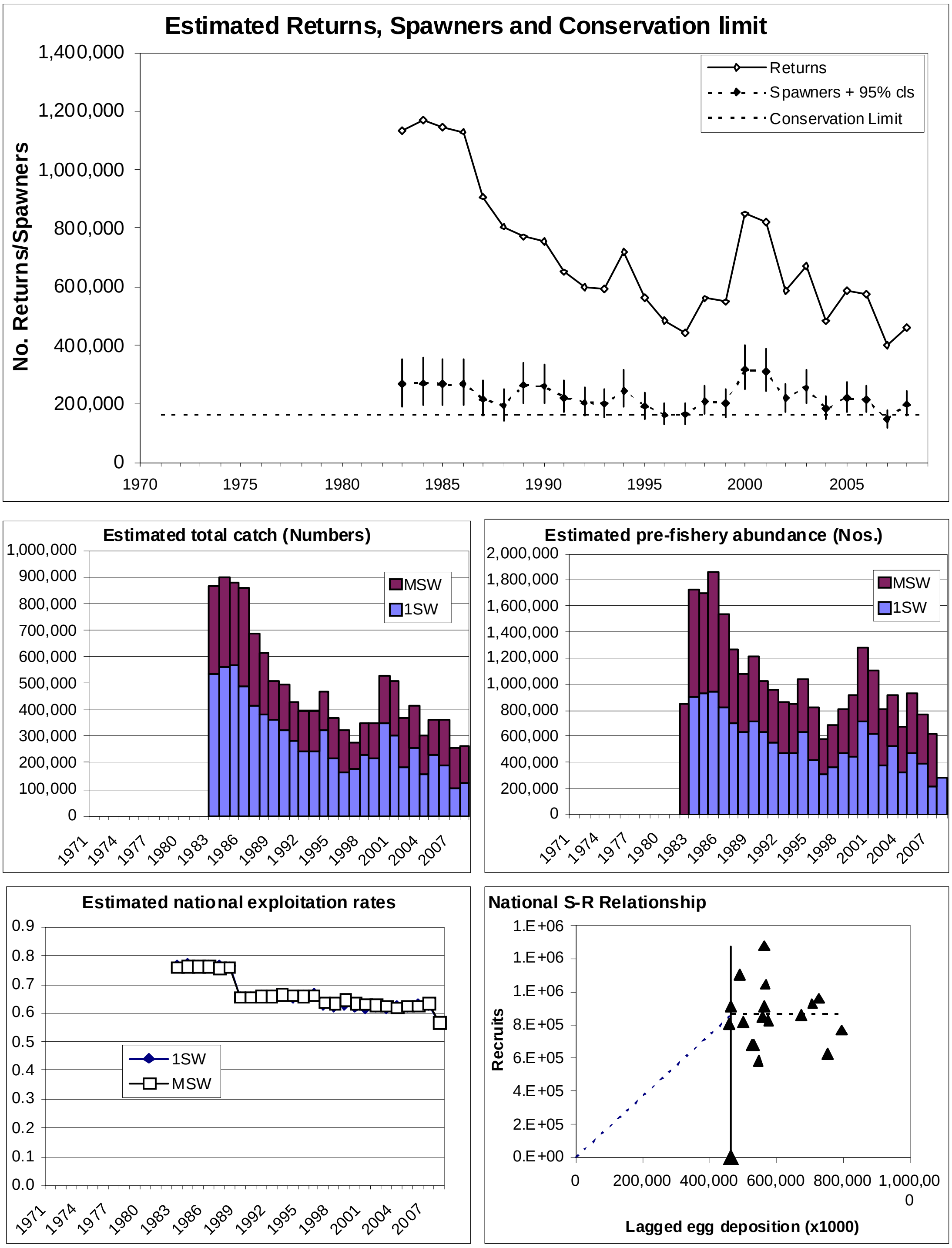


Figure 3.8.12.1e Summary of fisheries and stock description. Norway (minus Norwegian rod catches from the R. Teno).

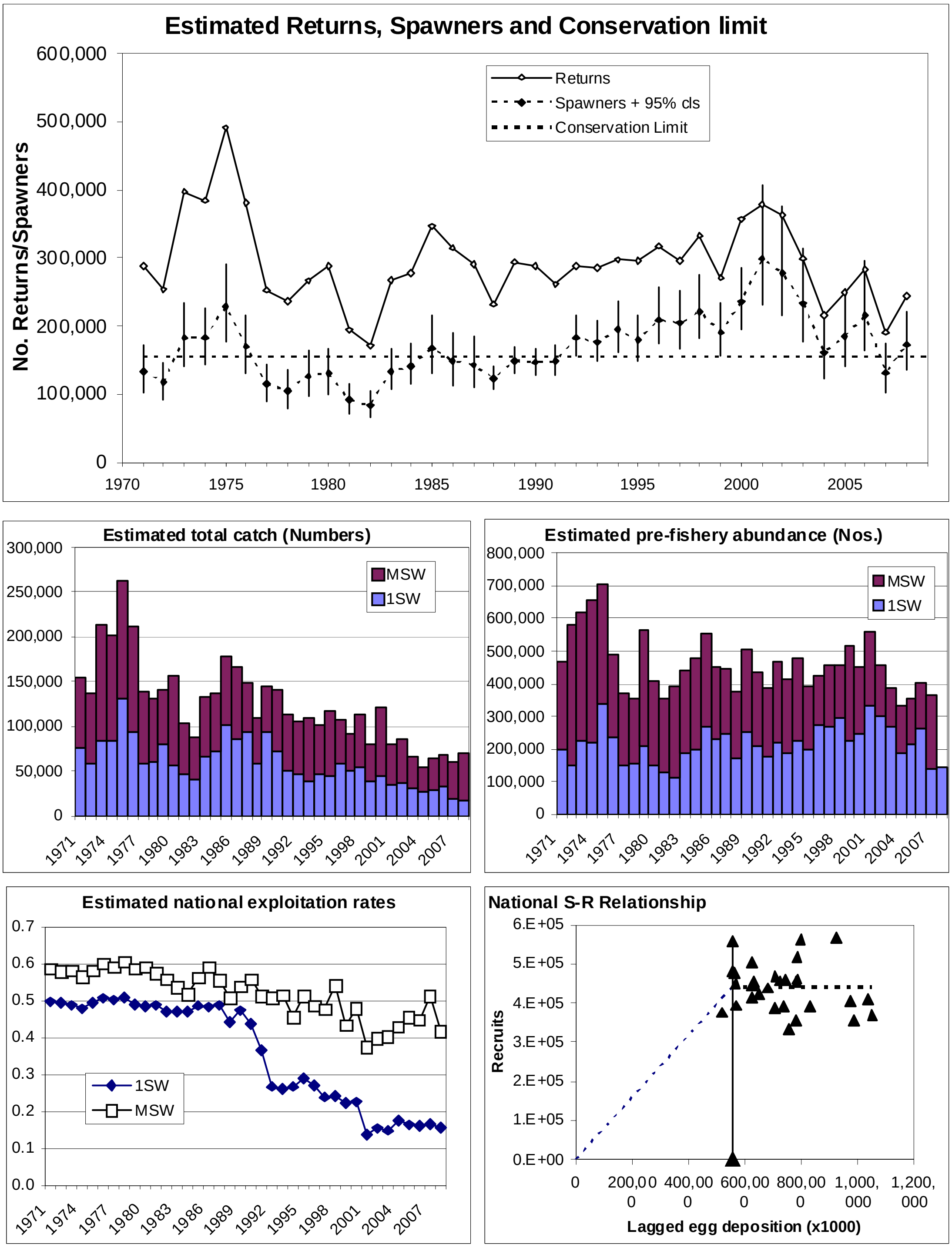


Figure 3.8.12.1f Summary of fisheries and stock description. Russia.

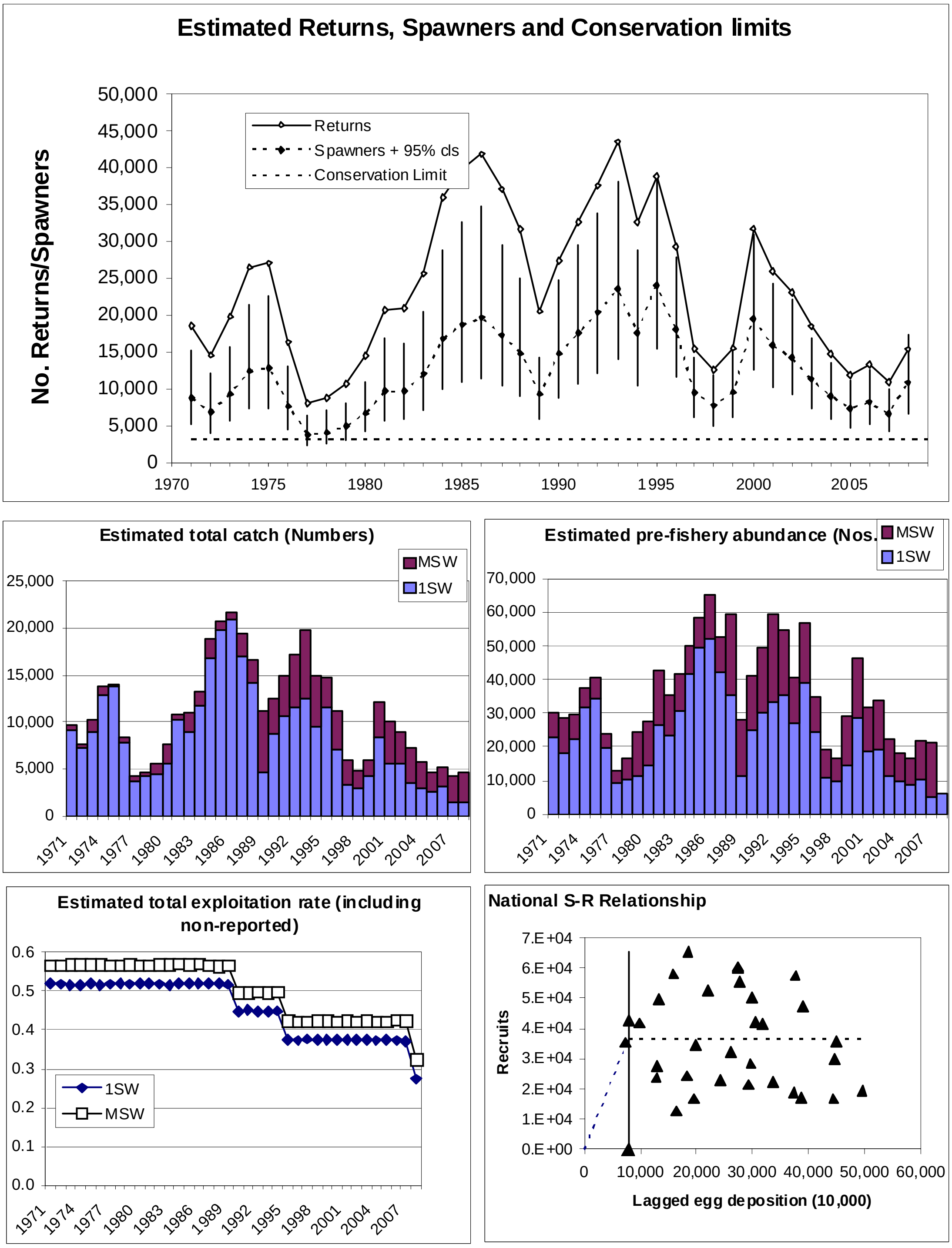


Figure 3.8.12.1g Summary of fisheries and stock description. Sweden.

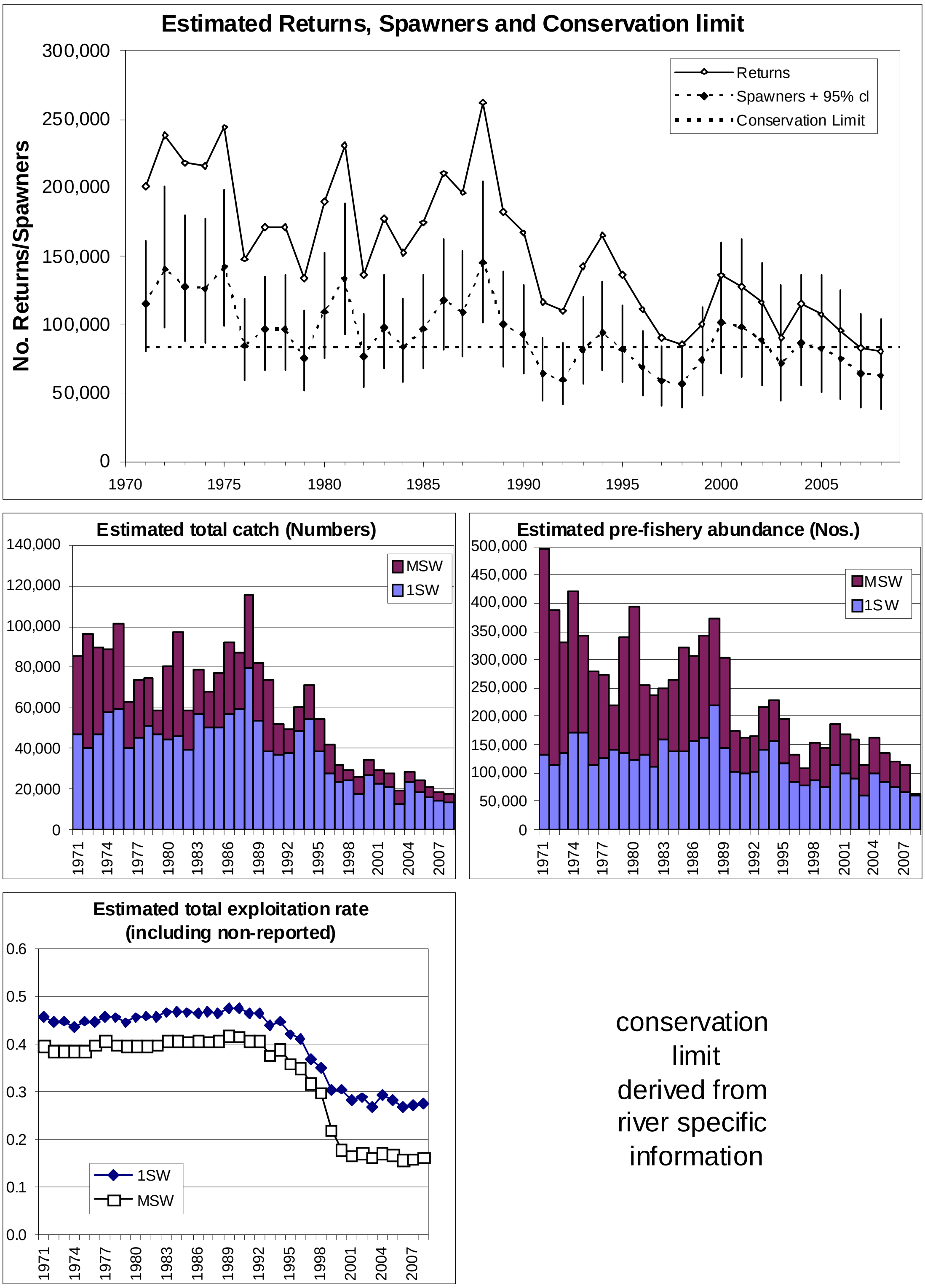


Figure 3.8.12.1h Summary of fisheries and stock description. UK (England & Wales).

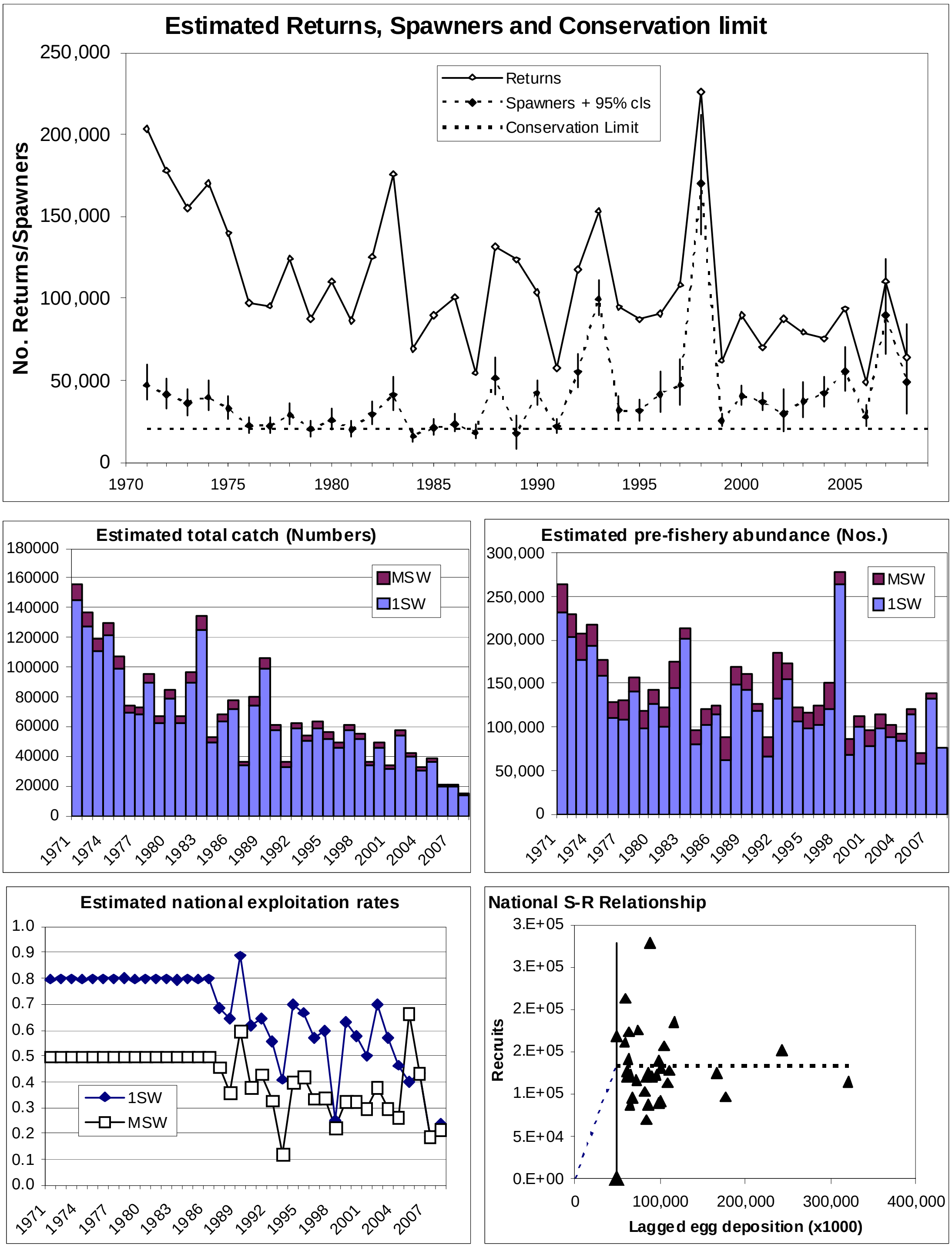


Figure 3.8.12.1i Summary of fisheries and stock description. UK (Northern Ireland).

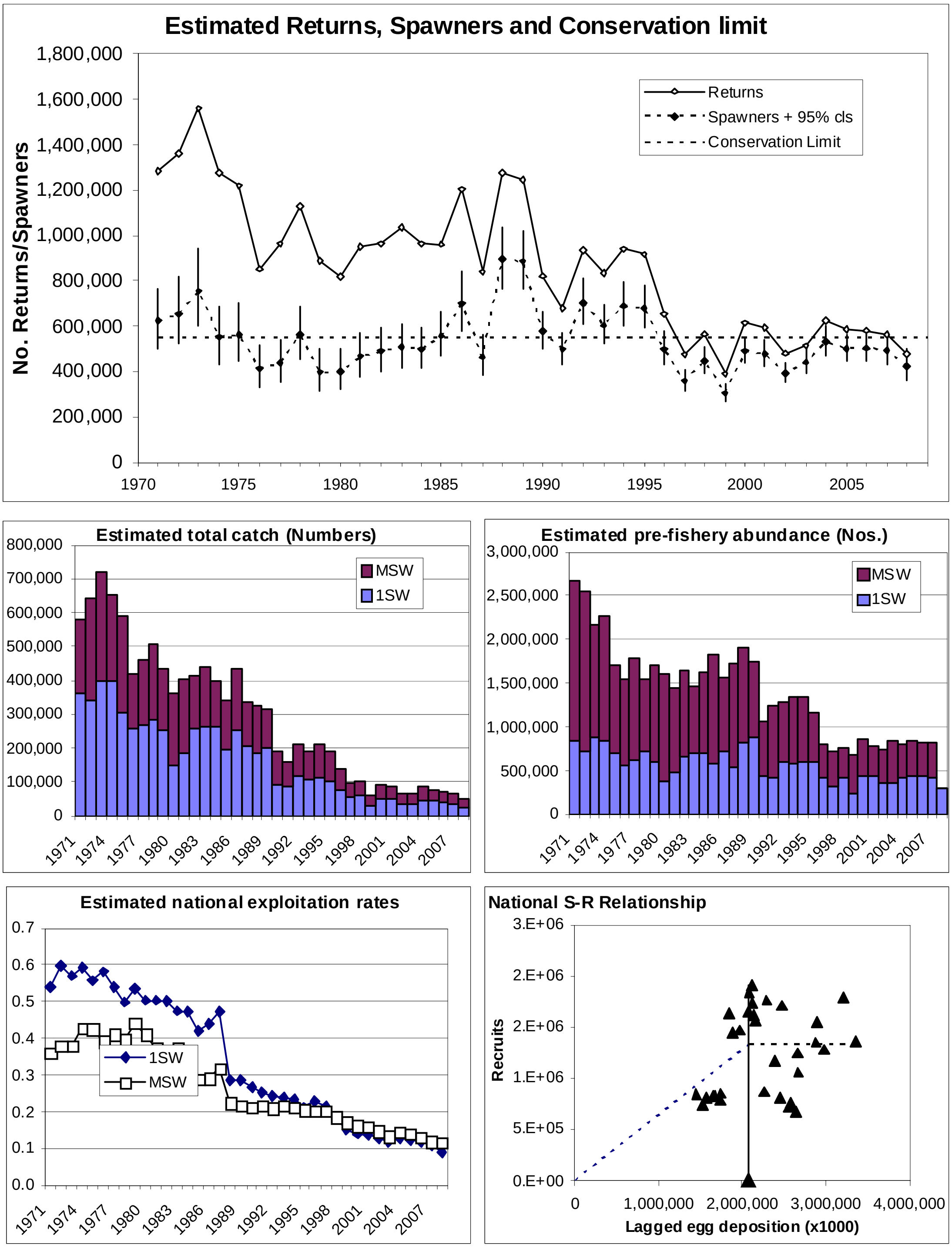


Figure 3.8.12.1j Summary of fisheries and stock description. UK (Scotland).

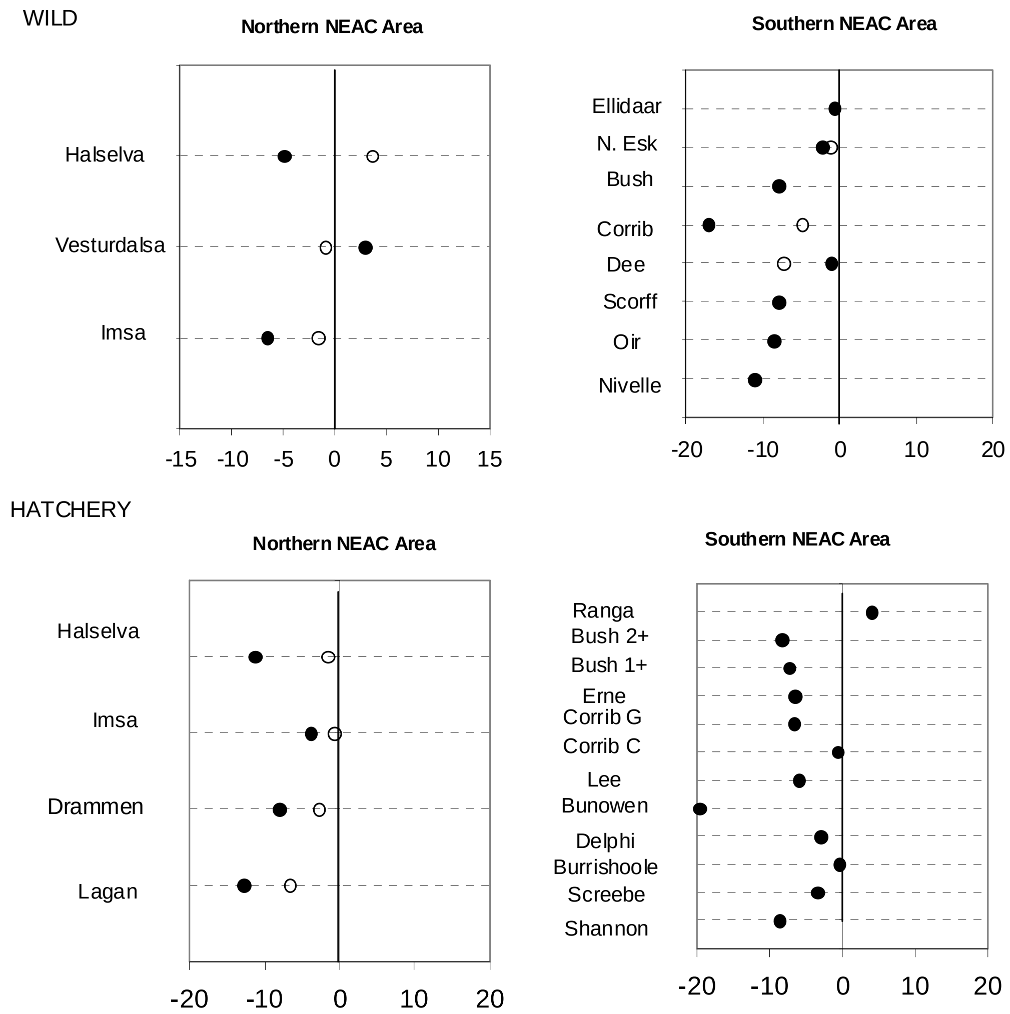


Figure 3.8.14.1 Annual rates of change (%) in marine survival indices of wild and hatchery smolts to adult returns to homewaters (prior to coastal fisheries) in different rivers in Northern and Southern NEAC areas. Filled circle = 1SW salmon; open circle = 2SW salmon. NB. The annual rates of change presented come from data sets of variable durations. Therefore comparisons between rivers are not appropriate.

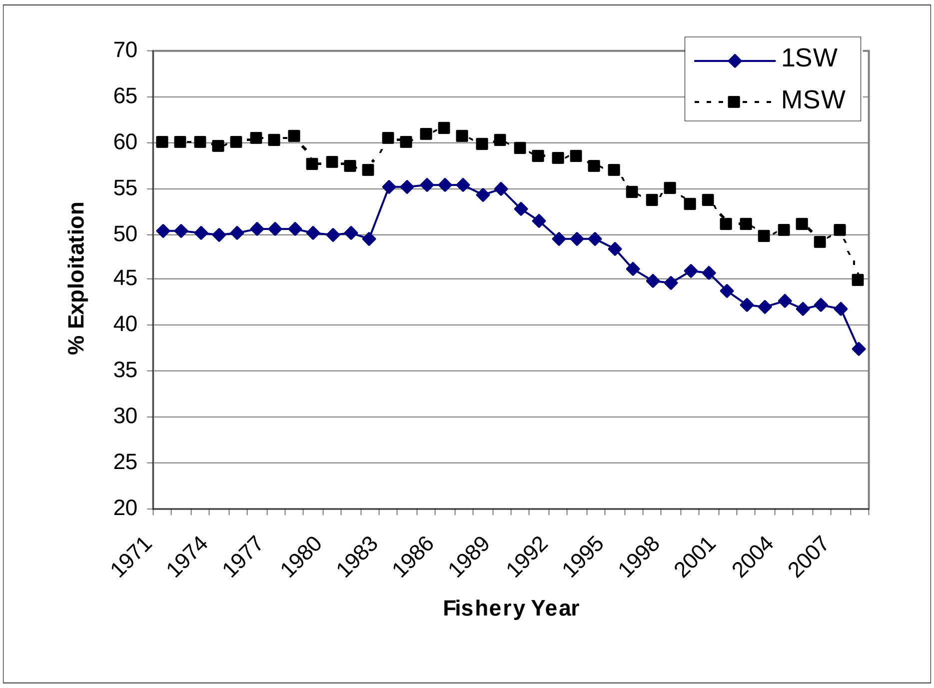


Figure 3.8.15.1 Exploitation rates of wild 1SW and MSW salmon by commercial and recreational fisheries in the Northern NEAC area from 1971–2008.

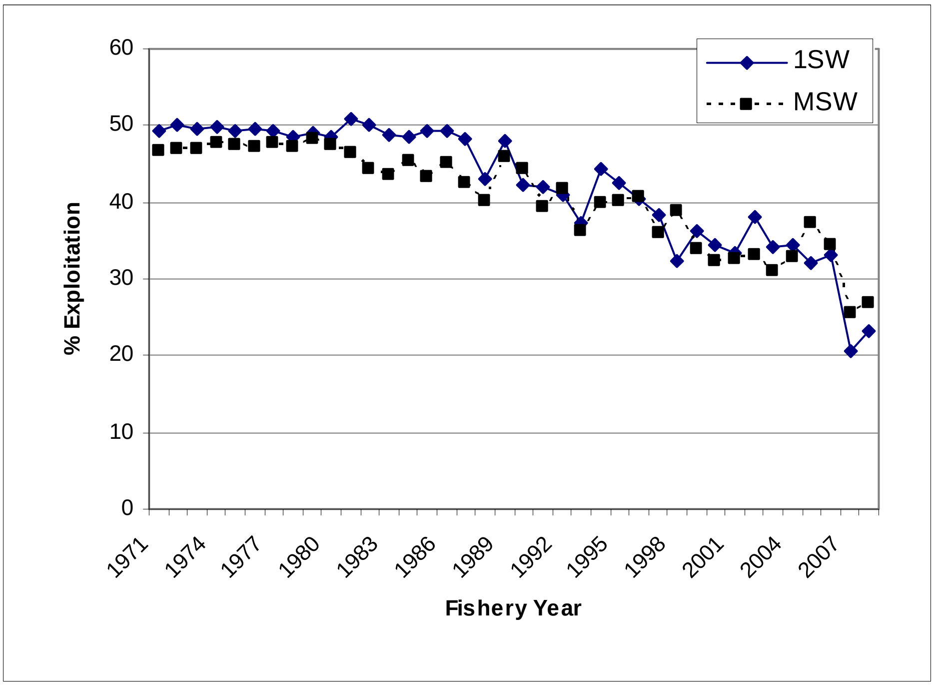


Figure 3.8.15.2 Exploitation rates of wild 1SW and MSW salmon by commercial and recreational fisheries in the Southern NEAC area from 1971–2008.

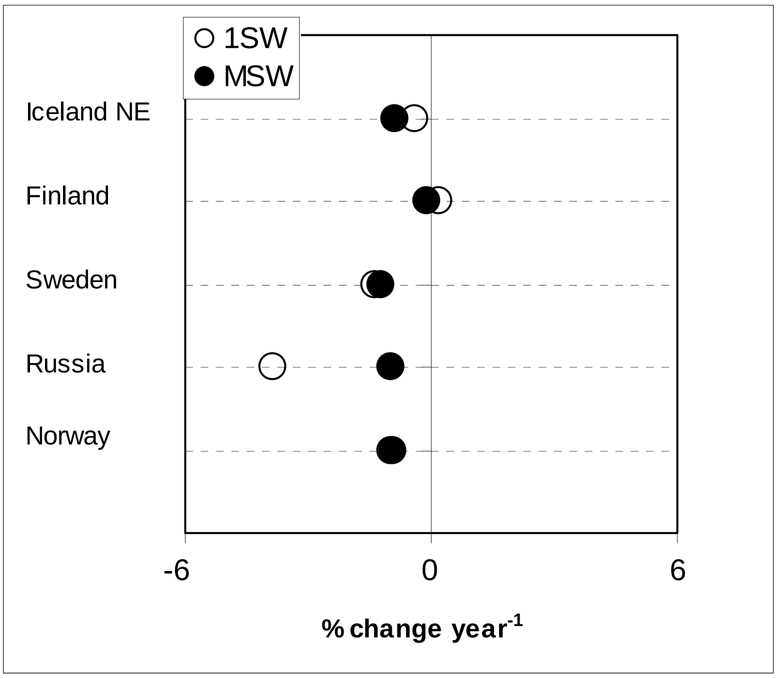


Figure 3.8.15.3 The rate of change of exploitation of 1SW and MSW salmon in northern NEAC countries.

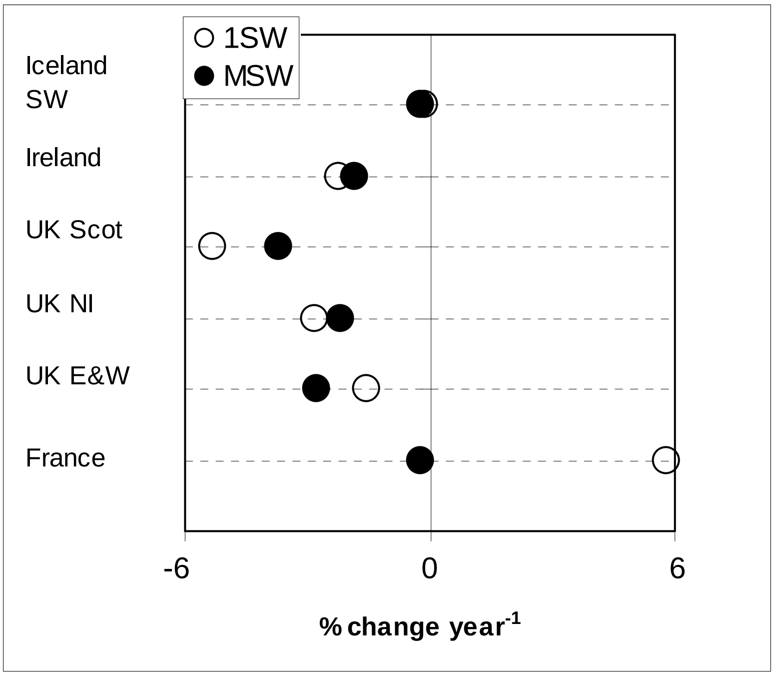


Figure 3.8.15.4 The rate of change of exploitation of 1SW and MSW salmon in southern NEAC countries.

4 North American commission

4.1 Status of stocks/exploitation

In 2008, 2SW spawner estimates for the six geographic areas indicated that all areas were below their conservation limit (Figure 4.9.7.2.3) and are suffering reduced reproductive capacity.

The estimated exploitation rate of North American origin salmon in North American fisheries has declined (Figure 4.9.6.1) from approximately 79% to 14% for 2SW salmon and from approximately 69% to 14% for 1SW salmon. In 2008, exploitation rates on 1SW and 2SW salmon remained among the lowest in the time-series.

The stock status is elaborated in Section 4.9.7.

4.2 Management objectives

Management objectives are included in Section 1.4.

4.3 Reference points

There are no changes recommended in the 2SW salmon CLs from those identified previously. CLs for 2SW salmon for Canada total 123 349 and for the USA, 29 199 for a combined total of 152 548.

Country and Comission Area	Stock Area	2SW spawner requirement
	Labrador	34 746
	Newfoundland	4022
	Gulf of St. Lawrence	30 430
	Québec	29 446
	Scotia-Fundy	24 705
Canada Total		123 349
USA		29 199
North American Total		152 548

4.4 Management advice

As the predicted number of 2SW salmon returning to North America in 2009 is substantially lower than the 2SW CL there are no catch options for the composite North American fisheries. Where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

Wild salmon populations are now critically low in extensive portions of North America and remnant populations require alternative conservation actions in addition to very restrictive fisheries regulation to maintain their genetic integrity and persistence and where necessary habitat restoration.

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

The management for all fisheries should be based upon assessments of the status of individual stocks. Fisheries on mixed stocks, particularly in coastal waters or on the high seas, pose particular difficulties for management as they cannot target only stocks that are at full reproductive capacity if there are stocks below conservation limit within the mixed stock being fished. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and especially rivers are more likely to meet this requirement.

4.6 Updated forecast of 2SW maturing fish for 2008

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

It is possible to provide catch options for the North American Commission area for four years. The updated forecast for 2009 for 2SW maturing fish is based on an updated forecast of the 2008 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2008 as 1SW non-maturing fish. The estimates for the 2010–2012 fisheries on maturing 2SW salmon are based on the pre-fishery abundance forecast for 2009–2011 from Section 4.9.10.

The updated forecast of the 2008 pre-fishery abundance for 2008 provides a PFA midpoint of 110 100, about 7% lower than the forecast provided in the 2007 assessment. The 2008 pre-fishery abundance of maturing 2SW salmon will be available in homewaters in 2009.

4.6.1 Catch options for 2009 fisheries on 2SW maturing salmon

As the predicted number of 2SW salmon returning to North America in 2009 is substantially lower than the 2SW CL, there are no catch options that would provide a high probability of achieving conservation limits. Catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to further restrict the harvest.

4.7 Pre-fishery abundance of 2SW salmon for 2009–2011

Previously, ICES 2007 used a two-phase regression between pre-fishery abundance (PFA_{NA}) and lagged spawners (LS_{NA}) to model the dynamics of PFA abundance and to provide forecasts (Chaput *et al*., 2005). This relationship was examined again in this assessment. With this model, the lagged spawner variable was informative for PFA_{NA} and the proportional model with the intercept through the origin was selected most often (91% of all models). An alternative model that considered regionally-disaggregated lagged spawners and returns of 2SW salmon for the six regions of North America was also examined by the Working Group (see Section 2.3).

	Median (95% credible interval range)	
Forecasts of PFA_{NA}	Spatially aggregated phase-shift model	Region-disaggregated random walk model
2008	110 100 (67 250–180 700)	137 500 (80 000–242 000)
2009	107 500 (59 600–193 500)	137 500 (66 000–294 000)
2010	107 300 (60 000–194 600)	140 000 (58 000–355 000)
2011	110 200 (61 300–199 500)	149 000 (55 000–430 000)

For the 2009 to 2011 forecasts of PFA_{NA}, the probability (runs/10 000) of being in lower productivity phase was over 99%. The phase-shift models forecast PFA abundances in the range of 110 000 fish over the next three years. Based on the Bayesian region-disaggregated model, the PFA_{NA} abundance during 2009 to 2011 is expected to be between 140 000 and 150 000 non-maturing 1SW salmon, a value within the range of PFA for the period 1996 to 2007. At the 25TH percentile range, abundance is expected to be just above 110 000 fish.

4.7.1 Catch options for 2010–2012 for non-maturing 1SW

As the number of 2SW salmon returning to North America in 2010 to 2012 predicted by both models is substantially lower than the 2SW CL, there are no catch options that would provide a high probability of achieving CLs. Catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to further restrict the harvest.

4.8 Comparison with previous assessment and advice

Updated forecasts of the pre-fishery abundance for 2008 and forecasts for 2009–2011 were provided using the model used by ICES in previous years and an alternate model based on a regionally-disaggregated productivity structure. There is no significant change in the interpretation of stock status or of expected abundance based on the updated data, and the models used. The catch advice remains unchanged from previous years.

4.9 NASCO has requested ICES to describe the key events of the 2008 fisheries

4.9.1 Key events of the 2008 fisheries

- The majority of harvest fisheries were directed to small salmon.
- Total harvest was approximately 64 000 salmon in 2008, a 7% increase from the previous five year mean (2003–2007).
- Catches remain very low relative to pre 1990 values.

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

Harvest histories (1972–2008) of salmon, expressed as 2SW salmon equivalents are provided in Table 4.9.2.1. 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. The Labrador commercial fishery has been closed since 1998. Harvests from the Aboriginal Peoples' fisheries in Labrador (since 1998) and the residents' food fishery in Labrador (since 2000) are both included. Mortalities in mixed stock and terminal fisheries areas in Canada were summed with those of USA to estimate total 2SW equivalent mortalities in North America. The terminal fisheries included coastal, estuarine and river catches of all areas, except Newfoundland and Labrador where only river catches were included. Harvest equivalents within North America peaked at about 363 000 in 1976 and are now about 11 200 2SW salmon equivalents (Table 4.9.2.1).

In the most recent year, the harvest of cohorts destined to be 2SW salmon in terminal fisheries of North America was 67% of the total catch. Harvest values ranged from 19 to 30% in 1972–1982 to 67–91% in 1996–2008 (Table 4.9.2.1). Percentages increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries. The number of 2SW salmon equivalents taken in the food fisheries in Labrador was 3723 fish in 2008.

4.9.3 Gear and effort

Canada

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

Three groups exploited salmon in Canada in 2008; Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in Canada in 2008.

In 2008, four subsistence fisheries harvested salmonids in Labrador: 1) Nunatsiavut Government (NG) members fishing in the northern Labrador communities of Rigolet, Makkovik, Hopedale, Postville, and Nain and in Lake Melville; 2) Innu Nation members fishing in Natuashish and in Lake Melville from the community of Sheshatshiu; 3) Labrador residents fishing in Lake Melville and coastal communities in southern Labrador from Cartwright to Cape St. Charles and, 4) LMN (Labrador Métis Nation) members fishing in southern Labrador from Fish Cove Point to Cape St. Charles. The NG, Innu, and LMN fisheries were jointly regulated by Aboriginal Fishery Guardians administered under the Aboriginal Fisheries Strategy Program with the Department of Fisheries and Oceans (DFO) as well as by DFO Fishery Officers and Guardian staff. The new Nunatsiavut Government is directly responsible through the Torngat Fisheries Board for regulating its fishery through its Conservation Officers. The fishing gear is multifilament gillnets of 15 fathoms in length of a stretched mesh size ranging from 3 to 4 inches. Although nets are mainly set in estuarine waters some nets are also set in coastal areas usually within bays. Catch statistics are based on log book reports and fisheries guardians.

Most catches (95%, Figure 2.1.1.2) in North America now take place in rivers or in estuaries. Fisheries are principally managed on a river-by-river basis and, in areas where retention of large salmon is allowed, it is closely controlled. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located close to river mouths and likely harvest few salmon from other than local rivers.

The following management measures were in effect in 2008;

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 in food fisheries have to be reported collectively by each Aboriginal user group. However, if reports are not available, the catches are estimated. In the Maritimes (SFAs 15 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2008. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries. Harvests that occurred both within and outside agreements were obtained directly from the Aboriginal peoples. In Labrador (SFAs 1 and 2), food fishery arrangements with the Nunatsiavut Government, the Innu First Nation, and the LMN, resulted in fisheries in estuaries and coastal areas. By agreement with First Nations there were no food fisheries for salmon on the island of Newfoundland in 2008. Harvest by Aboriginal peoples with recreational licenses is reported under the recreational harvest categories.

Resident food fisheries in Labrador

In 2008, a licensed food fishery for local residents took place, using gillnets, in Lake Melville (SFA 1) and in estuary and coastal areas of southern Labrador (SFA 2). Residents who requested a license were permitted to retain a maximum of four salmon of any size while fishing for trout and charr; four salmon tags accompanied each license. All licensees were requested to complete logbooks. DFO is responsible for regulating the Resident Fishery.

Recreational fisheries

Licenses are required for all persons fishing recreationally for Atlantic salmon. Gear is generally restricted to fly fishing and there are restrictive daily/seasonal bag limits. Recreational fisheries management in 2008 varied by area and large portions of the southern areas remained closed to all directed salmon fisheries. Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries.

USA

In the USA there was a one month spring catch and release recreational fishery for sea-run Atlantic salmon on a 2 km reach on one river. This followed two years of a one month fall fishery which re-opened in 2006 after closure from 1999 to 2005. A total of 177 licenses were sold, with about one third of the anglers complying with reporting requirements. The fishery had an estimated 790 angler trips of effort.

France (Islands of Saint-Pierre and Miquelon)

The Working Group received no information on the number of professional and recreational gillnet licenses issued in 2008 at Saint-Pierre and Miquelon. However, the number of licences was not expected to have increased in 2008 compared with previous years. The time-series of available data is in Table 4.9.3.1.

4.9.4 Catches in 2008

Canada

The provisional harvest of salmon in 2008 by all users was 148 t, about 32% higher than the 2007 harvest of 112 t (Table 2.1.1.1; Figure 4.9.4.1). The 2008 harvest was 52 362 small salmon and 11 737 large salmon, 41% more small salmon and 14% more large salmon, compared to 2007. The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998, and the closure of the Québec commercial fishery in 2000. These reductions were introduced as a result of declining abundance of salmon.

Aboriginal peoples' food fisheries

The total harvest by Aboriginal people in 2008 was 62.4 t (Table 4.9.4.1). Harvests (by weight) increased by 30% from 2007 and 14% higher than the previous 5-year average harvest.

Residents fishing for food in Labrador

The estimated catch for the fishery in 2008 was 2.2 t. In terms of numbers this is about 830 fish, 25% of which were large.

Recreational fisheries

Harvest in recreational fisheries in 2008 totalled 43 301 small and large salmon (approximately 83 t), 11% above the previous 5-year average, 45% above the 2007 harvest level, and remains among the lowest of the time-series (Figure 4.9.4.2). The small salmon harvest of 40 461 fish was 54% above 2007 and 15% above the previous 5-year mean. The large salmon harvest of 2840 fish was 29% below the previous five-year mean and 19% below 2007. 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. In 2008, about 58 004 salmon (about 22 891 large and 35 113 small) were caught and released (Table 4.9.4.2), representing about 57% of the total number caught (including retained fish). This was a 31% increase from the number released in 2007. There is some mortality on these released fish, which is accounted for in rivers assessed for their attainment of CLs.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2008 and the catch therefore was zero.

Unreported catches

There was no total unreported catch estimate available for Canada in 2008.

USA

There are no commercial fisheries for Atlantic salmon in USA and the catch therefore was zero. Unreported catches in the USA were estimated to be 0 t.

France (Islands of Saint-Pierre and Miquelon) harvests

The harvest of 3.54 t of salmon in 2008 was the second highest annual total in the time-series being exceeded only by the 2006 catch of 3.555 t (Table 4.9.3.1).

There are no unreported catch estimates for France (Islands of Saint-Pierre and Miquelon).

4.9.5 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. These fisheries have been closed. The Aboriginal Peoples' and resident food fisheries that exist in Labrador may intercept some salmon from other areas of North America; however, in 2008, there were no salmon tagged in other areas and reported from the food fisheries. Also none of the salmon sampled during the Food Fishery Sampling Program were tagged or marked.

Results of sampling program for Labrador subsistence fisheries

A sampling program was in place for the subsistence fisheries in Labrador in 2008. Landed fish were sampled opportunistically. Fish were measured (fork length to the nearest cm), weighed (gutted weight or whole weight if available to the nearest 1/10th of a kg) and if possible the sex was determined. Scales were taken for subsequent age analysis. Fish were also examined for the presence of external tags, brands or elastomer marks, and adipose fin clips. In southern Labrador, Aboriginal Fishery Guardians hired by the Labrador Metis Nation conducted the sampling. In northern Labrador, Conservation Officers of the Nunatsiavut Government conducted the sampling.

In total, 270 samples were collected from the subsistence fisheries. Scale reading indicated that the sample consisted of 81% 1SW, 12% 2SW and 7% previously spawned salmon. Small and large salmon based on a 2.7 kg cut off, similar to that used in the Aboriginal fishery, indicated small salmon were 97% 1SW, 1% 2SW and 2% previously spawned salmon and large salmon were 30% 1SW, 48% 2SW and 22% previously spawned salmon. The river ages (Figure 4.9.5.1) for the subsistence fisheries (for food social and ceremonial purposes (FSC)) samples were compared to ages from scales (1946 samples from north Labrador and 975 in south Labrador) obtained from assessment facilities.

There was a difference in river age distribution of adults from fisheries compared to returns to rivers in North (Chi square=31.83, P=<0.0001) but not in South Labrador (Chi square=3.89, P=0.56). Further, the freshwater age distribution did not differ (Chi square=2.32, P=0.80) between the two regions of Labrador. The absence of age 1 and rarity of age 2 smolts in the catches in 2008 suggests that these fisheries did not exploit southern North America stocks to any great extent. The presence of river age 5 to 7 years in the samples provides evidence that the fisheries are exploiting northern area (predominantly Labrador) stocks. However, the presence of a relatively higher number of river age 3 salmon compared to the freshwater samples suggests that salmon from other regions of Canada were exploited in northern Labrador in 2008.

The Working Group noted that the sampling program conducted in 2008 provided biological characteristics of the harvest and that the information may be useful for updating parameters used in the Run Reconstruction Model for North America. As well it provides material to assess the origin of salmon in this fishery. The Working Group recommended that sampling be continued and expanded in 2009 and future years.

4.9.6 Exploitation rates

Canada

In the Newfoundland recreational fishery, exploitation rates for retained small salmon ranged from a high of 14% on Conne River to a low of 4% on Terra Nova River. Overall, exploitation of small salmon in these rivers declined from 30% in 1986 to approximately 12% in 2008 which is one of the lowest rates of the past 25 years. In Labrador, at Sand Hill River, exploitation on small salmon was 2% and exploitation on large salmon was 0.4%.

In Quebec for 2008, the total fishing exploitation rate was around 19%; about the average of the five previous years. Native peoples' fishing exploitation rate was 6% of the total return. Recreational fishing exploitation rate was 13% on the total run, 21% for the small and 7% for the large salmon, up and down respectively from the previous five year average of 17% for small salmon and 10% for large salmon.

Exploitation trends for North American salmon fisheries

Annual exploitation rates of 1SW and 2SW salmon in North America for the 1970 to 2008 time period were calculated by dividing annual harvests in all North American fisheries by annual estimates of the returns to all six regions of North America. The fisheries included coastal, estuarine and river fisheries in all areas, as well as the commercial fisheries of Newfoundland and Labrador which harvested salmon from all regions in North America.

Exploitation rates of both 1SW and 2SW salmon fluctuated annually but remained relatively steady until 1984 when exploitation of 2SW salmon declined considerably with the introduction of the non-retention of large salmon in angling fisheries and reductions in commercial fisheries (Figure 4.9.6.1). Exploitation of 1SW declined substantially in North America after 1991 with the closure of the Newfoundland commercial fishery in 1992. Declines continued in the 1990s with continuing management controls put in place in all fisheries to reduce exploitation. In the last two years, exploitation rates on 1SW salmon have declined to the lowest in the time-series and 2SW are among the lowest. Exploitation rates across regions within North America are highly variable.

4.9.7 Elaboration on status of stocks

To date, 728 Atlantic salmon rivers have been identified in eastern Canada (DFO and MNRF 2008) and 21 rivers in eastern USA, where salmon are or were present within the last half century. The upward revision to that previously reported by ICES (2008) is attributable to a number of factors where, especially in Labrador, recent information on the presence of salmon has changed. Assessments were reported for 73 of these rivers in 2008.

4.9.7.1 Smolt and juvenile abundance

Canada

Wild smolt production was estimated in 14 rivers in 2008. Of these, ten rivers have at least ten years of information (Figure 4.9.7.1.1).

In 2008, smolt production increased (>10% change) from 2007 in two rivers, decreased in seven rivers and remained unchanged in five rivers (Figure 4.9.7.1.1). The relative smolt production, scaled to the size of the river using the conservation egg requirements, was highest in the rivers of Québec and low in the southern rivers of the Scotia Fundy and the USA river. In the ten rivers monitored over at least the past ten years, there has generally been no significant linear change in smolt production ($P>0.05$) with the exception of significant decreases in Narraguagus (US) and Trinité (Québec) and significant increases in Rocky and WAB (Newfoundland).

Juvenile salmon abundance has been monitored annually since 1971 in the Miramichi (SFA 16) and Restigouche (SFA 15) rivers and for shorter and variable time periods in a large number of other rivers in the Maritime Provinces. In the rivers of the southern Gulf of St. Lawrence, densities of young-of-the-year (age 0+) and parr (age 1+ and 2+) have increased since 1985 and densities of fry and parr in 2008 remained at high values. Rivers in SFAs 20 and 21 along the Atlantic coast of Nova Scotia are high in dissolved organics, have low productivity, and influenced by acid deposition. In the partially acidified St. Mary's River, fry and older parr densities remained among the lowest of record (1985–2008). Trends in densities of age 1+ and older parr in the outer Bay of Fundy (SFA 23) have varied since 1980, with densities in the Nashwaak River and Saint John River above Mactaquac Dam declining in response to reduced spawning escapements.

A region-wide electrofishing survey was conducted along the Atlantic coast of Nova Scotia in 2008 and compared to a survey in 2000. These surveys were similar in terms of total effort and coverage, although marginally more sites were completed in 2008 (143 *vs*. 128), but one less river was visited (51 rather than 52). Just under one third as many juvenile salmon were captured in 2008 (977 salmon) than in 2000 (3046 salmon). In 2000, juvenile Atlantic salmon were found in 54% of the rivers (28 of 52), but were only found in 39% (20 of 51) of the rivers in 2008. Where present in 2008, the observed densities of juvenile salmon from all year classes ranged from 0.3 to 33.9 fish per 100 m^2 (Figure 4.9.7.1.2). These densities were very low compared to densities of parr in the Gulf Region and other areas. Overall, the mean density of age 0 juveniles decreased from 5.0 to 1.9 fish per 100 m^2 between 2000 and 2008, while the mean density of age 1 and older parr decreased from 3.5 to 0.9 fish per 100 m^2. In six rivers in 2008, only one life stage was found (either fry or parr), but it is possible that additional effort or alternate site selection would have resulted in the capture of the other in the system. Of the sites surveyed in both years ($n = 74$), total juvenile density decreased in 43% ($n = 32$) and increased in 8% ($n = 6$). The remainder of the sites ($n = 36$) had densities of zero in both years. In addition, juvenile salmon were not found at 7 sites and 2 rivers in 2008 where they were found in 2000.

USA

Wild salmon smolt production has been estimated on the Narraguagus River for twelve years (Figure 4.9.7.1.1). Smolt production in 2008 was 17% below that of 2007 with a significantly ($P < 0.05$) decreasing trend since 1998. The estimated juvenile population in this river has also declined over the period.

4.9.7.2 Estimates of total adult abundance by geographic area

Returns of small (1SW), large, and 2SW salmon (a subset of large) to each region (Tables 4.9.7.2.1, 4.9.7.2.2 and 4.9.7.2.3; Figures 4.9.7.2.1, 4.9.7.2.2 and 4.9.7.2.3; and Annex 5) were originally estimated by the methods and variables developed by Rago *et al*., 1993b and reported in ICES, 1993. However, at the 2009 Working Group meeting there were some changes to the input variables and techniques used especially in the case of Labrador. The returns for individual river systems and management areas for both sea-age groups were derived from variety of methods. These methods included counts of salmon at monitoring facilities, population estimates from mark-recapture studies, and applying angling and commercial catch statistics, angling exploitation rates, and measurements of freshwater habitat. The 2SW component of the MSW returns was determined using the sea-age composition of one or more indicator stocks.

In Labrador, for the years, 1998–2001 there was no data available with which to estimate returns and spawners because the commercial fishery had closed and there were only one or two counting projects. Consequently, previous analyses for Labrador used raising factors estimated based on the proportion that Labrador small and 2SW salmon were to the total PFA during the years when Labrador estimates were available (Reddin, 1999). These factors (1.04 to 1.49 for small salmon and 1.05 to 1.27 for large salmon) were multiplied by the PFA in 1998–2001 to provide values for returns and spawners to Labrador. At the 2009 Working Group meeting, it was decided to re-examine the Labrador data to find a new method of determining returns and spawners for the 1998–2001 period that utilized data from Labrador rather than PFA as was described above. The basis for estimates of 2SW and 1SW salmon returns and spawners for Labrador (SFAs 1, 2 and 14B) prior to 1998 are catch data from angling and commercial fisheries. In 1998, the commercial fishery in Labrador was closed and the model for returns and spawners from commercial catch data could not be used. From 2002–2008, there were counting projects on four salmon rivers in Labrador. Because the same four out of about 100 rivers (one in SFA 1A, Northern Labrador and three in SFA 2) were monitored, the Working Group extrapolated from return rates per accessible drainage areas to the un-surveyed rivers in Labrador (ICES 2005). In order to provide new estimates of returns and spawners for Labrador for 1998–2001 two dataseries were examined one being angling catch data and the other the FSC landings. Since there were no FSC landings in 1998 and because of a perceived effect on landings of increasing effort in FSC fisheries in 1999–2001 compared to 2002 to present it was decided to use the angling data. The return estimates of small, large, and 2SW salmon for 2002 to 2008 were used to determine exploitation rates based on small retained fish and large retained and hooked-and-released in the angling fishery. The average of these exploitation rates for the years 2002–2008 were then applied to the angling catches in 1998–2001 to provide new estimates returns in those years. The spawners for Labrador were derived by subtracting the angling catches from the returns.

Returns are the number of salmon that returned to the geographic region, including fish caught by homewater commercial fisheries, except in the case of the Newfoundland and Labrador regions where returns do not include landings in commercial and food fisheries. This avoided double counting fish because commercial catches in Newfoundland and Labrador and food fisheries in Labrador were added to returns to create the PFA of North American salmon.

Total returns of salmon to USA rivers are the sum of trap catches and redd based estimates. Returns do not include aquaculture escapes in rivers where removal is possible. In the Magaguadavic River (SFA 23) 6 fish farm escapees were removed in 2008. A single aquaculture escapee was also intercepted on the St. Croix River.

Canada

Labrador

The mid-point of the estimated returns (201 069) of small salmon to Labrador rivers in 2008 is 5% higher than in 2007 and 26% above the previous five year mean return (Figure 4.9.7.2.1). The mid-point (17 785) of the estimated 2SW returns to Labrador rivers in 2008 was 19% higher than in 2007 and 38% higher than the recent 5-year average of 12 932 (Figure 4.9.7.2.3).

Newfoundland

The mid-point of the estimated returns (248 970) of small salmon to Newfoundland rivers in 2008 is 36% higher than in 2007 and 16% higher than the average small returns (214 103) for the past five years (Figure 4.9.7.2.1). The mid-point (4009) of the estimated 2SW returns to Newfoundland rivers in 2008 was 4% lower than in 2007 and 3% lower than the recent 5-year average of 4129 (Figure 4.9.7.2.3).

Québec

The mid-point of the estimated returns to Québec in 2008 of small salmon (36 017) is 59% above that estimated in 2007 and 27% above the previous five-year mean (Figure 4.9.7.2.1). The mid-point of the estimated returns of 2SW (29 123) salmon is 22% above that estimated for 2007 and 3% above the previous 5-year average (Figure 4.9.7.2.3).

Gulf of St. Lawrence, SFAs 15—18

The mid-point (52 209) of the estimated returns in 2008 of small salmon to the Gulf of St. Lawrence was 55% higher than 2007 and 10% above the previous five year mean return (Figure 4.4.7.2.1). The mid-point (177 340) of the estimate of 2SW returns in 2008 is 19% lower than for 2007 and 22% below the previous 5-year average return (Figure 4.9.7.2.3).

Scotia-Fundy, SFAs 19–23

The mid-point (15 344) of the estimated returns in 2008 of small salmon to Scotia-Fundy 99% higher than 2007, a 94% increase over the previous five year mean return, but low relative to the 1971–2007 time-series (Figure 4.9.7.2.1). The mid-point (3041) of the estimate of 2SW returns in 2008 is 121% higher than 2007 and 32% above the previous 5-year average return (Figure 4.9.7.2.3).

The model presently being used to extrapolate from the Nova Scotia Atlantic coast assessed rivers to total abundance (both returns and spawners) within the region is likely leading to an overestimation of current regional abundance. The model is based on the assumption that the LaHave River salmon count is a representative index of overall Scotia-Fundy abundance, an assumption that is likely invalid (see Section 4.9.7.1). The estimated range of MSW spawners produced by this model is 1912 to 2634 salmon, whereas counts of salmon in five rivers thought to contain a high (but unknown) proportion of the MSW spawners total 869. The bias on the estimate of 1SW spawners is likely greater. Because the model estimates are well below the regional conservation requirement and represent only a small fraction of the total abundance of salmon in North America, this issue is expected to have very little effect on the advice provided on overall status of salmon in North America, but does have implications for regional management.

USA

The returns in 2008 of 1SW (814) was 174% higher than 2007 and 151% above the previous five year mean return (Figure 4.9.7.2.1). The returns of 2SW (1764) was 85% higher than 2007 and 62% above the previous 5-year average return (Figure 4.9.7.2.3). Total return of salmon to USA rivers was 2613, a 108% increase from returns in 2007 (1255) and 24% above the long term average (1967–2007).

4.9.7.3 Estimates of spawning escapements

Updated estimates for small and large spawners were derived for the six geographic regions (Table 4.9.7.3.1 and Table 4.9.7.3.2). Estimates of 2SW spawners, 1971–2008 are provided in Table 4.9.7.3.3 and a comparison between the numbers of spawners, returns, and CLs for 2SW salmon in presented in Figure 4.9.7.2.1 and a comparison between the numbers of spawners and returns small salmon is presented in Figure 4.9.7.2.3.

Canada

Labrador

Spawner estimates for Labrador in 1998–2008 were developed, using the monitoring facilities for 2002–2008 and the new method based on angling exploitation rates for 1998–2001 (Section 4.9.7.2). The mid-point of the estimated numbers of 2SW spawners (17 559) was 38% above the previous year and was 50% of the total 2SW CL for Labrador (Figure 4.9.7.2.3). The 2SW spawner limit has only been exceeded once (1998) since 1971. The mid-point of the estimated numbers of small spawners (198 916) was 5% higher that estimated for 2007 (Figure 4.9.7.2.1).

Newfoundland

The mid-point of the estimated numbers of 2SW spawners (3945) in 2008 was 4% below that estimated in 2007 (4102) and was 98% of the total 2SW CL for all rivers. The 2SW CL has been met or exceeded in five years out of the last ten (Figure 4.9.7.2.3). The small spawner abundance (225 163) in 2008 was 26% higher than in 2007 (167 691, Figure 4.9.7.2.1). There was a general increase in both 2SW and 1SW spawners during the period 1992–96 and 1998–2000, which is consistent with the closure of the commercial fisheries in Newfoundland.

Québec

The mid-point of the estimated numbers of 2SW spawners (22 453) in 2008 was 30% above 2007, 10% above the previous five year mean, and was about 74% of the sum of the 2SW CL for all rivers (Figure 4.9.7.2.3). The mid-point of the estimated small spawner abundance in 2008 (25 447) was 34% above the value in 2007 (Figure 4.9.7.2.1) and 24% above the previous five-year average.

Gulf of St. Lawrence, SFAs 15−18

The mid-point of the estimated numbers of 2SW spawners in 2008 was 19% below 2007, and 23% below the previous five year mean, and was about 56% of the sum of the 2SW CL for all rivers (Figure 4.9.7.2.3). The mid-point of the estimated small spawner abundance in 2008 (37 740) was 32% above 2007 (Figure 4.9.7.2.1).

Scotia-Fundy, SFAs 19–23

Estimated numbers of 2SW spawning salmon in the Scotia Fundy area was about 2960 fish which was 55% higher than the previous five year mean, a 131% increase from 2007 and 12% of the 2SW CL for all rivers (Figure 4.9.7.2.3). Estimated small spawners was about 15 100, a 96% increase from the previous five year mean and a 50% increase from 2007 (Figure 4.9.7.2.1). As was the case with returns, these values may be overestimates.

USA

Pre-spawning adults were stocked into USA rivers, however, even with these, all age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2008 (3045 salmon) represented only 10% of the 2SW spawner requirements for all USA rivers combined (Figure 4.9.7.2.3).

4.9.7.4 Reconstructed spawning escapements

Lagged spawner estimates for each of the six geographic areas and overall for North America were derived using Monte Carlo simulations following the technique outlined in ICES (2005). Spawners in each geographic area were allocated (weighted forward) to the year of the non-maturing 1SW component in the Northwest Atlantic using the weighted smolt age proportions from each area (Table 4.9.7.4.1). The original USA smolt age distributions are used to allocate the USA spawners for years 1971–1989 and the new distribution for 1990 onward. The total spawners for a given recruitment year in each area is the sum of the lagged spawners. Because the smolt age distributions in North America range from one to six years and the time-series of estimated 2SW spawners to North America begins in 1971, the first recruiting year for which the total spawning stock size can be estimated is 1979 (although a value for 1978 was obtained by leaving out the 6-year old smolt contribution which represents 4% of the Labrador stock complex).

Spawning escapement of 2SW salmon to several stock complexes has been consistently below the 2SW CLs (Labrador, Scotia-Fundy, USA) over the entire time-series (Figure 4.9.7.4.1). The only regions to have frequently met or exceeded their CLs are Newfoundland and Gulf. Spawners have declined to less than the CLs for Quebec since 1991 and for Gulf since 1996. Regionally, the trends in lagged 2SW spawner abundance over the past ten years have been variable: decreased in Scotia-Fundy, no trend in USA and Quebec, highly variable abundance in Gulf, Newfoundland and Labrador. Overall for NAC, lagged spawners have declined from peak abundances of over 100 000 spawners in the late 1970s to just over 60 000 spawner equivalents over the past ten years.

The relative contributions of the stocks from these six geographic areas to the total spawning escapement of 2SW salmon has varied over time. The reduced potential contribution of Scotia-Fundy stocks and the increased proportion of the spawning stock from Labrador and Newfoundland to future recruitment are most noticeable.

4.9.8 Egg depositions in 2008

Egg depositions by all sea-ages combined in 2008 exceeded or equalled the river specific CLs in 33 of the 73 assessed rivers (45%) and were less than 50% of CLs in 22 other rivers (30%, Figure 4.9.8.1).

- In Newfoundland, 55% (11 of 20) of the rivers assessed met or exceeded the CLs and 15% (3 of 20) had egg depositions that were less than 50% of limits.
- In Labrador, the four assessed rivers exceeded their conservation requirements.
- The three assessed rivers in the Gulf exceeded 90% of their conservation requirement and 51% of the assessed rivers in Québec had egg depositions that equalled or exceeded CLs.
- Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia (SFA 19–23) where 8 of the 10 assessed rivers (80%) had egg depositions that were less than 50% of CLs. Abundance in most other rivers in this region is thought to be critically low.
- Large deficiencies in egg depositions were noted in the USA. On an individual river basis, the Penobscot River met 20% of its spawner requirement while all the other USA rivers were between 0.0–6.0% of their spawner requirements.

4.9.9 Marine survival rates

In 2008, return rate data were available from 11 wild and three hatchery populations from rivers distributed among Newfoundland, Québec, Scotia-Fundy and USA. In the 10 wild stocks with data in both 2007 and 2008, return rates to 1SW fish in 2008 increased greatly relative to 2007 (33% to 290%). A similar large increase was noted in two of the hatchery stocks (209% to 246%), whereas the return rates for the other stock declined by 25%.

In contrast, return rates in 2008 for 2SW salmon from the 2006 smolt class decreased relative to the 2005 smolt class for all five wild stocks (-3% to -59%) and one hatchery stock (-50%), but increased in the other two hatchery stocks (44% to 118%).

Time-series of return rates of smolts to 1SW and 2SW adults (Figure 4.9.9.1) and analysis of the rates of change (Figures 4.9.9.2) provide insights into spatial and temporal changes in marine survival of wild and hatchery 1SW and 2SW stocks. Specifically:

- 1SW return rates in Newfoundland in 2008 to many rivers were among the highest since the mid-1990s,
- Return rates in Scotia-Fundy increased over 2007, but remain at low levels,
- 1SW return rates in MSW salmon stocks (USA, Scotia-Fundy, Gulf, Quebec) are lower than those in predominantly 1SW salmon stocks of Newfoundland,
- 1SW return rates in MSW salmon stocks of the Scotia-Fundy and Gulf exceed those of 2SW salmon but 2SW returns rates are greater than 1SW return rates in Maine populations, and
- Return rates of wild stocks exceed those of hatchery stocks.

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

Origin	Age Group	Region	Return rate Mean (%)	Return rate Range[1] (%)	Number Of stocks
Wild	1SW	Maine (USA)	0.16	0.08 to 0.33	1
		Scotia-Fundy	4.00	0.74 to 12.73	3
		Gulf	3.44	1.90 to 6.40	2
		Québec	0.78	0.27 to 1.49	2
		Newfoundland	6.06	1.30 to 15.10	5
Wild	2SW	Maine (USA)	0..78	0.57 to 0.94	1
		Scotia-Fundy	0.77	0.11 to 1.58	3
		Gulf	1.47	0.80 to 2.20	1
		Québec	0.70	0.19 to 1.39	2
Hatchery	1SW	Maine (USA)	0.04	0.01 to 0.13	2
		Scotia-Fundy	0.51	0.24 to 0.83	2
Hatchery	2SW	Maine (USA)	0.14	0.05 to 0.24	2
		Scotia-Fundy	0.11	0.06 to 0.17	2

[1]among rivers and years

4.9.10 Pre-fisheries abundance

4.9.10.1 North American run-reconstruction model

The Working Group has used the "North American Run-Reconstruction Model" to estimate pre-fishery abundance, which serves as the basis of abundance forecasts used in the provision of catch advice. The catch statistics used to derive returns and spawner estimates have been updated from those used in ICES 2008. The run-reconstruction model is used to estimate the lagged 2SW spawners (Section 4.9.7.4) and the returns of 2SW salmon to each of the six regions in North America. Modifications were made to the model inputs, treatment of data, and the estimates of the returns and spawners were derived by Monte Carlo simulation (within "OpenBugs") following recommendations from ICES 2008. Maturing 1SW salmon as well as large salmon (containing all MSW age groups of salmon including repeat spawners) can be derived with the run-reconstruction model.

4.9.10.2 Non-maturing 1SW salmon

The non-maturing component of 1SW fish, destined to be 2SW returns (excluding 3SW and previous spawners) is represented by the pre-fishery abundance estimator for year i designated as [NN1(i)]. This annual pre-fishery abundance is the estimated number of salmon in West Greenland prior to the start of the fishery on August 1st. Definitions of the variables are given in Table 4.9.10.2.1. It is constructed by summing 2SW returns in year i+1 [NR2(i+1)], 2SW salmon catches in commercial and Aboriginal peoples' food fisheries in Canada [NC2(i+1)], and catches in year i from fisheries on non-maturing 1SW salmon in Canada [NC1(i)] and Greenland [NG1(i)] (Table 5.8.3.1). In Labrador, Aboriginal peoples' food harvests of small (AH_s) and large salmon (AH_l) were included in the reported catches for 1998–2008 (Table 4.9.10.2.2). 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 marine areas in the remainder of northern Labrador. Consequently, af_imm for the fraction of Aboriginal peoples' harvests that was non-maturing was set at 0.05 to 0.1 which is half of f_imm from commercial fishery samples. The full details and equations for calculating pre-fishery abundance are in ICES 2004. The model does not take into account non-catch fishing mortality in any of the fisheries. The West Greenland (1993 and 1994), Newfoundland (1992–2008), and Labrador commercial fishery (1998–2008), were closed in these years.

As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate of PFA is available is 2007. This is because pre-fishery abundance estimates for 2007 require 2SW returns to rivers in North America in 2008. The medians and 95% confidence interval ranges derived from Monte Carlo simulations for 2SW salmon by region and for NAC overall are shown in Figure 4.9.10.2.1. The estimated abundance of 2SW to rivers for NAC in 2008 abundance was about 73 000 fish (95% C.I. range 63 000 to 83 000). The median estimate in 2008 is within 10% of the estimated average abundance of the previous ten years (1998 to 2007) and among the lowest values of the time-series beginning in 1971.

The PFA estimates accounting for returns to rivers, fisheries at sea in North America, fisheries and West Greenland and corrected for natural mortality are shown in Figure 4.9.10.2.2. The median of the estimates of non-maturing 1SW salmon in 2008 was 116 000 fish (95% C.I. range 99 000 to 135 000). This value is within 10% of the previous ten-year average return and the PFA remains unchanged from estimates since 1997.

4.9.10.3 Maturing 1SW salmon

Maturing 1SW salmon are in some areas (particularly Newfoundland) a major component of salmon stocks, and their abundance when combined with that of the 2SW age group provides an index of the majority of an entire smolt cohort.

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, and 14B. Estimates of fractions of non-maturing salmon present in the Newfoundland and Labrador catch were presented in ICES 1991. The large category in SFAs 1–7 and 14B consists of 0.1–0.3 1SW salmon (Rago *et al*., 1993a; ICES, 1993). Salmon catches in SFAs 8–14A are mainly maturing salmon (Idler *et al*., 1981). These values were assumed to apply to the Aboriginal food fishery catches in marine coastal areas of northern Labrador. Catches used in the run-reconstruction model for the Newfoundland commercial fishery were set to zero for 1992–2006 and for Labrador for 1998–2006 to remain consistent with catches used in other years in these areas. Full details on the method used to calculate the numbers of maturing 1SW salmon are in ICES 2004.

The distributions of the region-specific estimates of returns of the 1SW maturing component to rivers of NAC are summarized in Figure 4.9.10.3.1. The abundance has oscillated between 300 000 and 600 000 over the period 1971 to 2008. Estimated abundance in 2008 was the second highest since 1988, with increases from 2007 noted in all regions. The large increases in the past four years have been driven by the large increases in estimated returns of small salmon to Labrador.

The reconstructed distributions of the abundance of the 1SW maturing cohort of North American origin are shown in Figure 4.9.10.2.2 The PFA of the maturing component in 2008 was at the highest level since 1992 but remains at about half the values estimated in the early and late 1980s (over 850 000 fish).

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

The pre-fishery abundance of 1SW maturing salmon for the 1971–2008 and 1SW non-maturing salmon from North America for 1971–2007 were combined to give total recruits of 1SW salmon (Figure 4.9.10.2.2). The maturing 1SW salmon in 2008 has increased to the highest level since 1996, but the overall abundance of the 1SW cohort remains below 600,000 fish in the northwest Atlantic. Over the time-series, 1971 to 2008, the PFA_{NA} abundance of the 1SW cohort has declined by 72%.

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

Previously, ICES 2007 used a two-phase regression between PFA_{NA} and lagged spawners (LS_{NA}) to model the dynamics of PFA abundance and provide forecasts (Chaput *et al*., 2005). This relationship was examined again in this assessment. As described previously (ICES 2007), a number of models were examined including two models without phase shifts, plus five models with phase shifts and with eight possible break year points (1986–1993) for each model (Table 4.9.10.5.1). 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 PFA_{NA} years of interest. Simulation methods, in the software package SAS (SAS Institute, 1996), were used to generate the probability density function of PFA_{NA}.

For phase shift models, the probability of being in either phase was based on changes in PFA_{NA} from year t relative to year t-2. The two-year lag is used because current year PFA (i.e. 2008) is not available due to its dependence upon 2SW returns in the next year. The approach taken in 2009 was identical to the method used in previous years and as described by Chaput *et al.*, 2005.

Although 42 combinations of models and break years (8 years * 5 regressions + 2 regressions without break years) were possible that could be represented in estimating the distribution of PFA_{NA}, the model selected most often was model 6 and break years 1989 and 1991 (Table 4.9.10.5.1). The lagged spawner variable was informative for PFA_{NA} in 97% of the simulated data sets. The proportional model with the intercept through the origin was selected most often (91% of all models).

Following on new modelling approaches proposed by the Study Group on Salmon Stock Assessment and Forecasting (SGSSAFE), the estimates of the pre-fishery abundance for the non-maturing 1SW salmon (PFA) were obtained within a Bayesian framework which incorporates the estimates of lagged spawners and works through the fisheries at sea to determine the corresponding returns of 2SW salmon, conditioned by fisheries removals and natural mortality at sea. The model structure used to develop these estimates of the PFA is shown in Figure 2.3.1.1.

An alternative model that considered regionally-disaggregated lagged spawners and returns of 2SW salmon for the six regions of North America was also examined by the Working Group (see Section 2.3). $PFA_{i,k}$ is assumed to be proportional to lagged-spawners ($LS_{i,k}$), with independent and identically distributed (i.i.d.) lognormal errors, and is modelled separately for each region (k = 6; Labrador, Newfoundland, Quebec, Gulf, Scotia-Fundy, USA).

$$PFA_{i,k} = LogN(\mu.PFA_{i,k}\ ,\ \sigma.PFA^2)$$
$$\mu.PFA_{i,k} = \log(LS_{i,k}) + a_{i,k}$$

The proportionality (log) coefficient $a_{i,k}$ between LSi,k and PFAi,k for each region is modelled dynamically as a random walk with the addition of a regionally common annually varying parameter (e.yi).

$$a_{i+1,k} = a_{i,k} + e.y_{i+1} + \omega_{i+1,k} \qquad with \quad \omega_{i,k} \overset{i.i.d}{\sim} N(0, a.\sigma_k^2)$$
$$e.y_i \overset{i.i.d}{\sim} N(0, \sigma.y^2)$$

The common yearly variation (e.yi) accounts for the fact that the fish share a common marine environment during part of their life cycle. The interaction term (αi,k) can be interpreted as accounting for regional specificities in the freshwater and / or the marine coastal environment. The model was fitted and forecasts were derived in a single consistent Bayesian framework under the OpenBUGS 3.0.3 software (http://mathstat.helsinki.fi/openbugs/; Lunn *et al.*, 2000). Region-specific PFA and recruitment rate estimates are provided by the model (Figure 4.9.10.5.1).

For the 2008 forecast of PFA_{NA}, the probability (runs/10 000) of being in lower productivity phase was over 99% (Table 4.9.10.5.1). Updated estimates for 2008 were 110 100 fish based on the phase-shift model compared to 137,500 fish from the regionally disaggregated random walk model (Table 4.9.10.5.2).

	Median (95% credible interval range)	
Forecasts of PFA_{NA}	Spatially aggregated phase-shift model	Region-disaggregated random walk model
2008	110 100 (67 250–180 700)	137 500 (80 000–242 000)
2009	107 500 (59 600–193 500)	137 500 (66 000–294 000)
2010	107 300 (60 000–194 600)	140 000 (58 000–355 000)
2011	110 200 (61 300–199 500)	149 000 (55 000–430 000)

The phase-shift models forecast PFA abundances in the range of 110 000 fish over the next three years. Based on the Bayesian region-disaggregated model, the PFA_{NA} abundance during 2009 to 2011 is expected to be between 140 000 and 150 000 non-maturing 1SW salmon (Figure 4.9.10.5.1), a value within the range of PFA for the period 1996 to 2007. At the 25th percentile range, abundance is expected to be just above 110 000 fish. The PFA_{NA} values over the most recent 15 year period (1993–2007) have declined by 39%. Over the past 30 years, 1971 to 2007, the PFA_{NA} abundance has declined by 93%.

Region-specific PFA estimates show similar patterns of decline for the time-series 1978 to 2007 (Figure 4.9.10.5.1 Over the past 30 years, the steepest declines in estimated abundance have been in Scotia-Fundy (98%) and USA (96%), followed by Quebec (90%), Labrador (87%), and Gulf (85%) with the lowest decline in Newfoundland (56%). The recruitment rate ($\alpha_{i,k}$**)** was highest during 1978 to 1988 and declined rapidly for the southern regions (USA and Scotia-Fundy) and for Gulf during 1989 to 2001 (Figure 4.9.10.5.2). The recruitment rates for Quebec and Labrador are the highest of all the regions. There has been a moderate improvement in the recruitment rates since 2004 and all regions have PFA to lagged spawner ratios which are greater than one (ranging between 1.04-2.63 PFA value per lagged spawner).

4.9.10.6 Pre-fishery abundance forecasts comparison

Two models were used to predict PFA for the North American Stock Complex: the Bayesian regionally-disaggregated model and the phase-shift model. A comparison of the model structure and mechanics is provided in Section 2.3.1.

Median values of the forecasted PFA in all three years are all at or less than 110 000 fish based on the phase-shift model and below 150 000 fish based on the Bayesian regionally-disaggregated model (Figure 4.9.10.6.1). The phase-shift model median estimates all fall within the 95% credible interval range produced by the Bayesian regionally-disaggregated model. Both models predict that the number of 2SW salmon returning to North America in 2009 to 2012 will be substantially lower than the 2SW CL and therefore the conclusion of there being no catch options that would provide a high probability of achieving CLs is identical.

4.9.11 Summary on status of stocks

In 2008, the midpoints of the spawner abundance estimates for six geographic areas indicated that all areas were below their CL for 2SW salmon and are suffering reduced reproductive capacity.

Estimates of pre-fishery abundance suggest continued low abundance of North American adult salmon. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has oscillated around a generally declining trend since the 1970s with a period of persistent low abundance since the early 1990s. During 1993 to 2008, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. The maturing 1SW salmon in 2008 has increased to the highest level since 1989 although it has declined by 39% over the time-series. The non-maturing has declined by 93% and the total abundance of 1SW salmon has declined 72%.

The returns of 2SW fish in 2008 increased from 2007 in Labrador, Québec, Scotia-Fundy, and USA, but decreased in Newfoundland and the Gulf. In most areas, returns remain close to the lower end of the 38-year time-series (1971–2008). Returns in 2008 of 1SW salmon relative to 2007 increased in all areas. Increases ranged from a low of 5% in Labrador to a maximum increase of 174% in USA.

The rank of the estimated returns in the 1971–2008 time-series and the proportions of the 2SW CL achieved in 2008 for six regions in North America are shown below:

	Rank of 2008 returns in 1971–2008, (38=lowest)		Rank of 2008 returns in 1999–2008 (10=lowest)		Mid-point estimate of 2SW spawners as percentage of conservation limit (S_{LIM})
Region	1SW	2SW	1SW	2SW	(%)
Labrador	3	11	3	1	50
Newfoundland	3	16	1	6	98
Québec	13	33	2	6	74
Gulf	25	33	3	7	56
Scotia-Fundy	27	31	1	4	12
USA	7	20	1	1	8

Egg depositions by all sea-ages combined in 2008 exceeded or equalled the river specific CLs in 33 of the 73 assessed rivers (45%) and were less than 50% of CLs in 22 other rivers (30%, Figure 4.9.8.1).

Return rates to 1SW and 2SW salmon remain variable and low for most areas. Return rates to 1SW fish for wild stocks (n=10) in 2008 increased relative to 2007 (33% to 290%). Two hatchery stock return rates increased (209% to 246%), whereas a single monitored hatchery stock declined by 25%. In contrast, return rates in 2008 for 2SW salmon from the 2006 smolt class decreased relative to the 2005 smolt class for all five wild stocks (-3% to -59%) and one hatchery stock (-50%), but increased in the other two hatchery stocks (44% to 118%).

An additional concern is that all salmon stocks are suffering reduced reproductive capacity, with particular deficits in the Bay of Fundy, Atlantic coast and USA. Despite major changes in fisheries management 18 to 25 years ago and increasingly more restrictive fisheries measures since, returns have remained near historic lows and many populations are currently threatened with extirpation.

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

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

Table 4.9.2.1. Catches expressed as 2SW salmon equivalents in North American salmon fisheries, 1972–2008. Only mid-points of the estimated values have been used (Comm = commercial catch).

	CANADA																
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i						USA						
Year i	NF-LAB Comm 1SW (Year i-1) (a)	Year i % 1SW of total 2SW equivalents	Year i NF-LAB Comm 2SW (a)	Year i NF-Lab comm total	Labrador rivers	Nfld rivers	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total		North American Total	Terminal Fisheries as a % of NA Total	Greenland Total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic	Exploitatio in North A 1SW
1972	20,857	9	153,775	174,632	314	593	27,417	19,444	5,608	228,008	346	228,353	24	206,814	435,168	52	0.622
1973	17,971	6	219,175	237,146	719	776	32,751	15,948	6,215	293,554	327	293,881	19	144,348	438,230	67	0.688
1974	24,564	7	235,910	260,475	593	503	47,631	19,273	13,047	341,522	247	341,769	24	173,615	515,384	66	0.611
1975	24,181	7	237,598	261,779	241	496	41,097	14,847	12,519	330,978	389	331,367	21	158,583	489,950	68	0.580
1976	35,801	10	256,586	292,388	618	377	42,139	16,625	11,122	363,269	191	363,459	20	200,464	563,924	64	0.567
1977	27,519	8	241,217	268,736	954	780	42,301	30,042	13,454	356,267	1,355	357,622	25	112,077	469,700	76	0.585
1978	27,836	11	157,299	185,135	580	534	37,421	20,680	9,372	253,721	894	254,615	27	136,386	391,002	65	0.540
1979	14,086	10	92,058	106,144	469	124	25,234	6,298	3,837	142,107	433	142,540	26	85,446	227,986	63	0.544
1980	20,894	6	217,209	238,103	646	636	53,567	27,744	17,370	338,065	1,533	339,597	30	143,829	483,426	70	0.571
1981	34,486	11	201,336	235,822	384	437	44,375	15,104	12,850	308,972	1,267	310,239	24	135,157	445,396	70	0.519
1982	34,341	14	134,417	168,757	473	395	35,204	21,898	8,919	235,646	1,413	237,059	29	163,718	400,777	59	0.517
1983	25,701	13	111,562	137,263	313	421	34,472	18,150	12,290	202,909	386	203,295	32	139,985	343,280	59	0.561
1984	19,432	14	82,807	102,238	379	185	24,408	3,923	3,970	135,104	675	135,778	25	23,897	159,675	85	0.508
1985	14,650	11	78,760	93,410	219	14	27,483	987	4,930	127,044	645	127,688	27	27,978	155,666	82	0.513
1986	19,832	12	104,890	124,723	340	35	33,846	1,774	2,824	163,542	606	164,147	24	100,098	264,245	62	0.496
1987	25,163	13	132,208	157,371	457	18	33,807	1,969	1,370	194,992	300	195,292	19	123,472	318,764	61	0.550
1988	32,081	21	81,130	113,211	514	23	34,262	1,315	1,373	150,697	248	150,945	25	124,868	275,813	55	0.457
1989	22,197	16	81,355	103,551	337	7	28,901	1,219	265	134,280	397	134,677	23	83,947	218,624	62	0.520
1990	19,577	18	57,359	76,937	261	19	27,986	1,161	593	106,958	696	107,654	29	43,634	151,287	71	0.441
1991	12,048	14	40,433	52,481	66	12	29,277	814	1,331	83,982	231	84,213	38	52,560	136,773	62	0.461
1992	9,979	15	25,108	35,087	581	54	30,016	1,129	1,114	67,982	167	68,149	49	79,571	147,720	46	0.216
1993	3,229	8	13,273	16,502	378	0	23,153	577	1,110	41,719	166	41,885	61	30,091	71,976	58	0.191
1994	2,139	5	11,938	14,077	455	0	24,052	675	756	40,016	1	40,017	65	0	40,017	100	0.277
1995	1,242	4	8,677	9,918	408	0	23,331	550	330	34,537	0	34,537	71	0	34,537	100	0.209
1996	1,075	3	5,646	6,721	334	0	22,413	802	766	31,036	0	31,036	78	15,343	46,379	67	0.179
1997	969	4	5,390	6,360	158	0	18,574	796	581	26,468	0	26,468	76	15,776	42,244	63	0.180
1998	1,155	8	1,872	3,027	231	0	11,256	442	322	15,277	0	15,277	80	12,088	27,365	56	0.145
1999	179	2	894	1,073	320	0	9,032	717	450	11,592	0	11,592	91	2,175	13,767	84	0.141
2000	152	1	1,115	1,267	262	0	9,425	603	193	11,750	0	11,750	89	3,863	15,613	75	0.138
2001	286	2	1,380	1,666	338	0	10,104	845	255	13,207	0	13,207	87	4,005	17,213	77	0.155
2002	263	3	1,185	1,448	207	0	7,297	526	179	9,657	0	9,657	85	6,982	16,639	58	0.195
2003	312	3	1,794	2,106	222	0	8,870	643	189	12,030	0	12,030	82	1,617	13,647	88	0.151
2004	355	3	3,049	3,403	259	0	8,756	741	105	13,265	0	13,265	74	1,914	15,179	87	0.174
2005	470	4	2,323	2,793	291	0	7,803	815	91	11,793	0	11,793	76	2,755	14,548	81	0.134
2006	563	5	2,549	3,112	227	0	7,147	789	137	11,412	0	11,412	73	2,635	14,047	81	0.136
2007	564	5	2,188	2,751	233	0	6,704	799	95	10,582	0	10,582	74	3,421	14,003	76	0.119
2008	499	4	3,224	3,723	0	0	6,671	745	83	11,222	0	11,222	67	4,736	15,957	70	0.135

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 1998, there was no commercial fishery in Labrador; numbers reflect size of aboriginal fish harvest in 1998-2006 and resident food fishery harvest in 2000-2006

Table 4.9.3.1. The number of professional and recreational gillnet licenses issued at St. Pierre and Miquelon and landings, 1995–2008.

	Number of licences		Reported Landings (tonnes)		
Year	Professional	Recreational	Professional	Recreational	Total
1990			1.146	0.734	1.880
1991			0.632	0.530	1.162
1992			1.295	1.024	2.319
1993			1.902	1.041	2.943
1994			2.633	0.790	3.423
1995	12	42	0.392	0.445	0.837
1996	12	42	0.951	0.617	1.568
1997	6	36	0.762	0.729	1.491
1998	9	42	1.039	1.268	2.307
1999	7	40	1.182	1.140	2.322
2000	8	35	1.134	1.133	2.267
2001	10	42	1.544	0.611	2.155
2002	12	42	1.223	0.729	1.952
2003	12	42	1.620	1.272	2.892
2004	13	42	1.499	1.285	2.784
2005	14	52	2.243	1.044	3.287
2006	14	48	1.730	1.825	3.555
2007	13	53	0.970	0.977	1.947
2008	na	na	na	na	3.540

Table 4.9.4.1. Harvests in 2008 (by weight) and the percent large by weight and number in the Aboriginal Peoples' Food Fisheries in Canada including the Resident Food Fishery in Labrador.

Aboriginal peoples' food fisheries			
Year	Harvest (t)	% large	
		by weight	by number
1990	31.9	78	
1991	29.1	87	
1992	34.2	83	
1993	42.6	83	
1994	41.7	83	58
1995	32.8	82	56
1996	47.9	87	65
1997	39.4	91	74
1998	47.9	83	63
1999	45.9	73	49
2000	45.7	68	41
2001	42.1	72	47
2002	46.3	68	43
2003	44.3	72	49
2004	60.8	66	44
2005	56.7	57	34
2006	61.4	60	39
2007	48.0	62	40
2008	62.4	66	44

Table 4.9.4.2. Numbers of salmon hooked and-released in Eastern Canadian salmon angling fisheries. Data for years prior to 1997 are incomplete.

Year	Newfoundland			Nova Scotia			New Brunswick					Prince Edward Island			Quebec			CANADA*		
	Small	Large	Total	Small	Large	Total	Small Kelt	Small Bright	Large Kelt	Large Bright	Total	Small	Large	Total	Small	Large	Total	**SMALL**	**LARGE**	**TOTAL**
1984				939	1,655	2,594	661	851	1,020	14,479	17,011							**2,451**	**17,154**	**19,605**
1985		315	315	1,323	6,346	7,669	1,098	3,963	3,809	17,815	26,685			67				**6,384**	**28,285**	**34,669**
1986		798	798	1,463	10,750	12,213	5,217	9,333	6,941	25,316	46,807							**16,013**	**43,805**	**59,818**
1987		410	410	1,311	6,339	7,650	7,269	10,597	5,723	20,295	43,884							**19,177**	**32,767**	**51,944**
1988		600	600	1,146	6,795	7,941	6,703	10,503	7,182	19,442	43,830	767	256	1,023				**19,119**	**34,275**	**53,394**
1989		183	183	1,562	6,960	8,522	9,566	8,518	7,756	22,127	47,967							**19,646**	**37,026**	**56,672**
1990		503	503	1,782	5,504	7,286	4,435	7,346	6,067	16,231	34,079			1,066				**13,563**	**28,305**	**41,868**
1991		336	336	908	5,482	6,390	3,161	3,501	3,169	10,650	20,481	1,103	187	1,290				**8,673**	**19,824**	**28,497**
1992	5,893	1,423	7,316	737	5,093	5,830	2,966	8,349	5,681	16,308	33,304			1,250				**17,945**	**28,505**	**46,450**
1993	18,196	1,731	19,927	1,076	3,998	5,074	4,422	7,276	4,624	12,526	28,848							**30,970**	**22,879**	**53,849**
1994	24,442	5,032	29,474	796	2,894	3,690	4,153	7,443	4,790	11,556	27,942	577	147	724				**37,411**	**24,419**	**61,830**
1995	26,273	5,166	31,439	979	2,861	3,840	770	4,260	880	5,220	11,130	209	139	348		922	922	**32,491**	**15,188**	**47,679**
1996	34,342	6,209	40,551	3,526	5,661	9,187						472	238	710		1,718	1,718	**38,340**	**13,826**	**52,166**
1997	25,316	4,720	30,036	713	3,363	4,076	3,457	4,870	3,786	8,874	20,987	210	118	328	182	1,643	1,825	**34,748**	**22,504**	**57,252**
1998	31,368	4,375	35,743	688	2,476	3,164	3,154	5,760	3,452	8,298	20,664	233	114	347	297	2,680	2,977	**41,500**	**21,395**	**62,895**
1999	24,567	4,153	28,720	562	2,186	2,748	3,155	5,631	3,456	8,281	20,523	192	157	349	298	2,693	2,991	**34,405**	**20,926**	**55,331**
2000	29,705	6,479	36,184	407	1,303	1,710	3,154	6,689	3,455	8,690	21,988	101	46	147	445	4,008	4,453	**40,501**	**23,981**	**64,482**
2001	22,348	5,184	27,532	527	1,199	1,726	3,094	6,166	3,829	11,252	24,341	202	103	305	809	4,674	5,483	**33,146**	**26,241**	**59,387**
2002	23,071	3,992	27,063	829	1,100	1,929	1,034	7,351	2,190	5,349	15,924	207	31	238	852	4,918	5,770	**33,344**	**17,580**	**50,924**
2003	21,379	4,965	26,344	626	2,106	2,732	1,555	5,375	1,042	7,981	15,953	240	123	363	1,238	7,015	8,253	**30,413**	**23,232**	**53,645**
2004	23,430	5,168	28,598	828	2,339	3,167	1,050	7,517	4,935	8,100	21,602	135	68	203	1,291	7,455	8,746	**34,251**	**28,065**	**62,316**
2005	33,129	6,598	39,727	933	2,617	3,550	1,520	2,695	2,202	5,584	12,001	83	83	166	1,116	6,445	7,561	**39,476**	**23,529**	**63,005**
2006	30,491	5,694	36,185	1,014	2,408	3,422	1,071	4,186	2,638	5,538	13,433	128	42	170	1,091	6,185	7,276	**37,981**	**22,505**	**60,486**
2007	17,719	4,607	22,326	896	1,520	2,416	1,164	2,963	2,067	7,040	13,234	63	41	104	951	5,392	6,343	**23,756**	**20,667**	**44,423**
2008	25,226	5,007	30,233	1,016	2,061	3,077	1,146	6,361	1,971	6,130	15,608	3	9	12	1,361	7,713	6,343	**35,113**	**22,891**	**58,004**

Table 4.9.7.2.1. Estimated numbers of small salmon returns in North America by geographic regions, 1971–2008.

	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	83,158	154,444	14,969	22,453	40,566	59,067	15,159	22,545	32	186,850	373,924	280,387
1972	24,675	86,362	76,862	144,262	12,470	18,704	51,202	74,499	13,418	20,498	18	178,644	344,344	261,494
1973	5,399	18,897	111,333	208,320	16,585	24,877	50,721	75,608	19,643	29,171	23	203,704	356,897	280,300
1974	27,034	94,619	83,594	157,464	16,791	25,186	80,504	116,123	35,227	51,959	55	243,205	445,406	344,305
1975	53,660	187,809	104,961	197,004	18,071	27,106	72,498	104,196	28,882	38,854	84	278,156	555,054	416,605
1976	37,540	131,391	109,649	207,436	19,959	29,938	105,483	152,043	43,906	61,873	186	316,723	582,866	449,795
1977	33,409	116,931	109,743	209,507	18,190	27,285	36,921	55,643	38,337	53,985	75	236,675	463,427	350,051
1978	16,155	56,542	95,574	183,214	16,971	25,456	34,211	47,992	13,892	17,718	155	176,958	331,077	254,018
1979	21,943	76,800	104,239	199,562	21,683	32,524	56,905	87,748	39,654	58,031	250	244,673	454,915	349,794
1980	49,670	173,845	119,658	225,111	29,791	44,686	50,213	76,248	59,516	81,733	818	309,665	602,441	456,053
1981	55,046	192,662	155,926	295,123	41,667	62,501	75,714	137,190	48,030	70,748	1,130	377,514	759,354	568,434
1982	38,136	133,474	139,312	262,065	23,699	35,549	86,938	155,613	29,430	42,711	334	317,849	629,746	473,798
1983	23,732	83,061	107,771	205,588	17,987	26,981	27,536	46,861	18,583	26,660	295	195,904	389,445	292,674
1984	12,283	42,991	137,546	275,145	21,566	30,894	41,194	67,362	33,938	51,545	598	247,125	468,535	357,830
1985	22,732	79,563	129,871	261,176	22,771	33,262	61,238	111,123	37,440	57,469	392	274,444	542,985	408,714
1986	34,270	119,945	133,240	267,244	33,758	46,937	115,573	207,162	38,643	59,846	758	356,243	701,892	529,068
1987	42,938	150,283	92,379	178,517	37,816	54,034	86,813	157,374	40,627	61,928	1,128	301,701	603,263	452,482
1988	39,892	139,623	145,452	289,199	43,943	62,193	123,078	221,439	40,890	62,834	992	394,248	776,281	585,264
1989	27,113	94,896	72,376	142,818	34,568	48,407	73,665	131,725	43,181	66,078	1,258	252,162	485,182	368,672
1990	15,853	55,485	113,129	191,534	39,962	54,792	83,676	150,270	43,291	67,215	687	296,599	519,983	408,291
1991	12,849	44,970	82,095	129,133	31,488	42,755	60,558	109,025	22,803	33,640	310	210,102	359,832	284,967
1992	17,993	62,094	155,288	302,715	35,257	48,742	154,086	231,215	27,317	40,673	1,194	391,135	686,634	538,884
1993	25,186	80,938	183,650	347,411	30,645	42,156	78,239	193,998	20,907	30,509	466	339,094	695,479	517,286
1994	18,159	56,888	104,322	217,777	29,667	40,170	51,745	82,698	8,924	12,003	436	213,253	409,971	311,612
1995	25,022	76,453	124,160	283,817	23,851	32,368	48,824	73,625	16,662	23,331	213	238,732	489,806	364,269
1996	51,867	153,553	197,996	428,647	32,008	42,558	41,518	70,193	26,027	37,549	651	350,067	733,152	541,610
1997	66,972	169,030	129,217	224,747	24,300	33,018	21,179	39,845	7,918	10,842	365	249,952	477,847	363,900
1998	98,293	209,289	153,928	213,635	24,495	34,301	28,793	45,741	18,021	22,713	403	323,933	526,082	425,007
1999	95,953	204,800	166,497	236,033	25,880	36,679	27,334	40,838	9,470	11,694	419	325,553	530,462	428,008
2000	118,509	253,290	197,203	260,373	24,129	35,070	39,788	57,948	10,944	13,758	270	390,843	620,708	505,775
2001	95,189	204,373	136,762	175,804	16,939	24,452	33,221	48,867	4,828	5,989	266	287,204	459,751	373,478
2002	60,294	143,864	126,583	184,656	28,609	39,275	55,571	82,937	8,681	10,989	450	280,188	462,170	371,179
2003	46,644	123,683	220,721	264,226	23,142	31,892	31,831	46,712	5,121	6,538	237	327,696	473,289	400,492
2004	67,633	121,486	168,695	251,606	30,423	43,266	56,150	86,218	7,287	9,475	319	330,507	512,370	421,438
2005	153,375	279,426	120,294	322,744	20,685	29,531	32,482	51,962	6,451	8,495	319	333,606	692,477	513,042
2006	127,084	292,083	167,898	257,696	24,925	34,641	37,239	62,567	8,839	11,658	450	366,435	659,096	512,765
2007	126,727	256,341	124,419	242,735	18,520	26,698	25,564	41,992	6,642	8,778	297	302,169	576,840	439,505
2008	137,472	264,665	188,780	309,161	30,219	41,815	37,373	67,045	13,186	17,502	814	407,844	701,003	554,424

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

Table 4.9.7.2.2. Estimated numbers of large salmon returns in North America by geographic regions, 1971–2008.

	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	6,907	35,522	5,627	19,510	47,354	71,031	36,754	44,123	13,406	18,346	653	110,047	188,531	149,289
1972	5,937	30,535	5,985	19,338	61,773	92,660	44,147	68,010	16,350	21,618	1,383	135,575	233,544	184,560
1973	8,303	42,700	7,668	26,994	68,171	102,256	42,345	65,609	12,809	16,707	1,427	140,723	255,694	198,209
1974	8,184	42,091	10,033	18,498	91,455	137,182	61,996	95,778	25,325	31,807	1,394	198,387	326,750	262,569
1975	7,635	39,264	12,793	24,016	77,664	116,497	41,101	61,604	27,090	34,148	2,331	168,615	277,860	223,238
1976	8,769	45,099	11,518	21,768	77,212	115,818	38,259	60,353	25,001	32,591	1,317	162,077	276,947	219,512
1977	7,799	40,107	10,452	18,748	91,017	136,525	70,548	107,139	33,284	42,873	1,998	215,098	347,391	281,244
1978	6,098	31,362	8,945	13,747	81,953	122,930	36,297	52,191	19,806	24,720	4,208	157,308	249,158	203,233
1979	3,483	17,910	4,967	9,428	45,197	67,796	14,513	21,314	11,036	14,587	1,942	81,138	132,977	107,057
1980	8,330	42,842	9,553	14,546	107,461	161,192	53,176	76,848	37,852	49,617	5,796	222,168	350,841	286,504
1981	7,489	38,515	20,190	37,537	84,428	126,642	30,266	49,504	24,187	32,244	5,601	172,162	290,043	231,103
1982	5,550	28,540	8,751	14,448	74,870	112,305	40,586	70,373	20,632	26,693	6,056	156,444	258,415	207,429
1983	4,014	20,644	9,579	15,327	61,488	92,232	31,982	51,267	17,470	23,736	2,155	126,688	205,360	166,024
1984	2,880	14,812	4,045	20,724	61,180	81,041	20,748	45,640	20,114	28,901	3,222	112,189	194,340	153,264
1985	2,266	11,655	3,094	18,793	62,899	84,192	25,629	63,493	26,929	41,092	5,529	126,346	224,754	175,550
1986	3,904	20,079	4,805	19,795	75,561	99,397	38,605	98,701	21,657	34,408	6,176	150,708	278,557	214,632
1987	5,278	27,144	3,430	13,446	72,190	93,650	26,856	64,878	13,700	21,463	3,081	124,536	223,662	174,099
1988	3,307	17,005	4,813	21,142	77,904	103,269	31,055	74,678	12,563	20,085	3,286	132,928	239,466	186,197
1989	3,183	16,369	2,709	11,115	70,762	91,871	24,625	59,170	14,255	22,548	3,197	118,731	204,270	161,500
1990	1,832	9,424	4,975	15,576	68,851	90,893	32,371	79,757	12,322	19,503	5,051	125,403	220,205	172,804
1991	898	4,617	3,962	11,175	64,166	83,184	32,407	81,362	12,357	18,832	2,647	116,437	201,816	159,127
1992	3,986	18,714	7,793	55,294	64,271	83,953	45,315	73,624	11,343	17,100	2,459	135,167	251,144	193,155
1993	6,199	22,173	8,113	26,113	50,717	63,677	27,912	99,255	8,416	11,576	2,231	103,589	225,025	164,307
1994	9,080	29,659	8,310	26,415	51,649	64,630	27,565	54,090	5,376	7,200	1,346	103,326	183,340	143,333
1995	19,973	53,959	7,642	30,466	59,939	74,227	36,607	58,406	6,220	8,709	1,748	132,128	227,515	179,821
1996	14,725	40,004	15,375	42,471	53,990	68,282	26,890	53,335	9,042	12,584	2,407	122,429	219,082	170,755
1997	14,637	32,901	14,432	41,534	44,442	56,187	23,192	45,863	4,730	6,374	1,611	103,045	184,470	143,757
1998	7,374	19,486	16,365	54,169	33,368	43,605	19,190	34,749	3,378	4,291	1,526	81,200	157,826	119,513
1999	8,827	23,328	16,214	47,984	34,815	46,178	18,639	31,439	4,431	5,428	1,168	84,094	155,525	119,810
2000	12,052	31,850	16,363	37,626	33,312	46,565	20,437	34,125	2,496	3,231	533	85,193	153,930	119,562
2001	12,744	33,677	11,420	24,299	35,016	48,490	29,895	45,762	4,083	5,215	788	93,946	158,232	126,089
2002	9,076	24,769	9,475	24,146	25,635	35,801	15,531	27,260	1,380	1,773	511	61,608	114,261	87,934
2003	6,676	21,689	13,024	35,903	39,435	52,413	26,805	46,475	3,059	3,950	1,192	90,191	161,623	125,907
2004	10,964	23,092	10,187	34,175	34,796	45,488	25,896	46,057	2,689	3,472	1,283	85,815	153,567	119,691
2005	11,159	30,796	10,640	46,181	33,728	43,831	23,737	43,561	1,729	2,277	984	81,978	167,630	124,804
2006	12,414	29,783	21,825	49,564	30,922	40,811	23,026	40,849	2,538	3,399	1,023	91,747	165,429	128,588
2007	11,887	31,913	14,966	44,245	27,987	37,520	23,309	40,556	1,372	1,782	954	80,475	156,970	118,723
2008	14,700	37,677	14,550	43,786	33,156	46,634	16,694	33,461	2,770	3,739	1,764	83,635	167,061	125,348

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

Table 4.9.7.2.3. Estimated numbers of 2SW salmon returns in North America by geographic regions, 1971–2008.

	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	1,366	5,802	34,568	51,852	31,843	38,432	11,275	15,751	653	83,363	141,116	112,239
1972	3,706	25,168	1,531	5,935	45,094	67,642	38,441	58,874	13,613	18,361	1,383	103,770	177,364	140,567
1973	5,183	35,196	1,758	7,479	49,765	74,647	37,617	58,709	11,127	14,695	1,427	106,876	192,153	149,514
1974	5,003	34,148	1,877	5,403	66,762	100,143	53,396	83,098	23,893	30,351	1,394	152,325	254,537	203,431
1975	4,772	32,392	2,629	7,773	56,695	85,042	34,761	52,747	25,368	32,375	2,331	126,555	212,661	169,608
1976	5,519	37,401	2,165	6,549	56,365	84,547	31,507	49,919	22,881	30,385	1,317	119,754	210,118	164,936
1977	4,867	33,051	1,908	5,189	66,442	99,663	64,447	98,381	27,741	36,846	1,998	167,404	275,129	221,267
1978	3,864	26,147	2,309	4,865	59,826	89,739	29,865	43,415	16,497	21,073	4,208	116,570	189,446	153,008
1979	2,231	15,058	852	2,630	32,994	49,491	9,766	14,369	8,946	12,086	1,942	56,732	95,577	76,154
1980	5,190	35,259	2,526	5,274	78,447	117,670	48,350	70,119	33,150	44,183	5,796	173,458	278,302	225,880
1981	4,734	32,051	3,563	10,488	61,633	92,449	18,724	30,982	19,688	26,738	5,601	113,945	198,309	156,127
1982	3,491	23,662	1,908	4,422	54,655	81,982	31,068	55,147	14,240	19,224	6,056	111,418	190,493	150,955
1983	2,538	17,181	2,297	5,105	44,886	67,329	24,363	39,848	13,796	19,192	2,155	90,035	150,809	120,422
1984	1,806	12,252	1,093	5,629	44,661	59,160	18,326	41,565	17,464	25,481	3,222	86,572	147,308	116,940
1985	1,448	9,779	722	4,762	45,916	61,460	20,348	51,621	23,302	35,818	5,529	97,265	168,970	133,118
1986	2,470	16,720	1,104	5,419	55,159	72,560	31,727	82,533	16,515	26,009	6,176	113,152	209,416	161,284
1987	3,289	22,341	807	3,898	52,699	68,365	20,121	50,186	10,598	16,562	3,081	90,595	164,432	127,514
1988	2,068	14,037	1,066	5,795	56,870	75,387	24,249	59,633	9,038	14,361	3,286	96,577	172,499	134,538
1989	2,018	13,653	526	2,849	51,656	67,066	15,823	39,275	11,295	17,833	3,197	84,514	143,872	114,193
1990	1,148	7,790	1,031	4,349	50,261	66,352	20,851	52,014	9,016	14,178	5,051	87,359	149,734	118,547
1991	548	3,740	909	3,208	46,841	60,724	19,703	50,849	10,249	15,728	2,647	80,898	136,896	108,897
1992	2,515	15,548	1,705	14,630	46,917	61,285	27,970	46,820	9,466	14,398	2,459	91,033	155,141	123,087
1993	3,858	18,234	1,597	7,121	37,023	46,484	18,382	67,406	6,839	9,241	2,231	69,930	150,717	110,324
1994	5,653	24,396	1,680	6,403	37,703	47,180	19,858	39,798	4,423	5,870	1,346	70,664	124,991	97,827
1995	12,368	44,205	1,085	6,609	43,755	54,186	29,953	47,887	5,657	7,932	1,748	94,566	162,567	128,567
1996	9,113	32,759	2,105	9,226	39,413	49,846	18,581	38,549	7,675	10,621	2,407	79,294	143,408	111,351
1997	8,919	26,674	2,307	9,735	32,443	41,017	14,624	31,161	3,909	5,198	1,611	63,813	115,395	89,604
1998	4,424	13,835	2,068	10,841	24,358	31,832	9,592	19,443	2,288	2,903	1,526	44,257	80,380	62,318
1999	5,296	16,563	2,291	10,278	25,415	33,710	10,126	18,606	3,783	4,581	1,168	48,079	84,905	66,492
2000	7,231	22,613	2,858	9,890	24,317	33,992	10,915	19,821	2,060	2,682	533	47,916	89,532	68,724
2001	7,646	23,911	1,027	3,978	25,562	35,398	19,632	31,206	3,751	4,776	788	58,406	100,056	79,231
2002	5,446	17,586	901	3,953	18,714	26,135	8,799	16,645	861	1,068	511	35,231	65,899	50,565
2003	4,006	15,399	1,192	5,566	28,787	38,262	16,713	30,854	2,891	3,726	1,192	54,781	94,998	74,889
2004	6,578	16,395	1,054	5,585	25,401	33,207	15,863	30,310	2,352	3,006	1,283	52,532	89,787	71,159
2005	6,695	21,865	1,115	7,718	24,622	31,996	16,034	30,672	1,455	1,902	984	50,905	95,138	73,022
2006	7,448	21,146	2,154	8,585	22,573	29,792	15,567	28,859	2,170	2,890	1,023	50,935	92,295	71,615
2007	7,132	22,658	1,314	7,008	20,431	27,390	15,613	28,039	1,203	1,545	954	46,647	87,594	67,121
2008	8,820	26,751	1,217	6,800	24,204	34,042	11,360	24,107	2,590	3,492	1,764	49,956	96,956	73,456

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

Table 4.9.7.3.1. Estimated numbers of small spawners in North America by geographic regions, 1971–2008.

	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	56,492	127,778	9,338	14,007	23,561	41,681	8,462	15,848	29	126,914	310,791	218,852
1972	21,728	83,415	52,460	119,860	8,213	12,320	28,756	51,647	6,889	13,969	17	118,063	281,228	199,646
1973	0	11,405	75,851	172,838	10,987	16,480	33,536	57,669	13,539	23,067	13	133,927	281,472	207,699
1974	24,533	92,118	57,109	130,979	10,067	15,100	58,592	93,755	24,751	41,483	40	175,092	373,476	274,284
1975	49,688	183,837	71,571	163,614	11,606	17,409	51,703	82,951	21,182	31,154	67	205,817	479,032	342,424
1976	31,814	125,665	75,186	172,973	12,979	19,469	67,202	112,795	31,768	49,735	151	219,101	480,788	349,944
1977	28,815	112,337	75,391	175,155	12,004	18,006	15,873	33,675	24,316	39,964	54	156,454	379,192	267,823
1978	13,464	53,851	66,955	154,595	11,447	17,170	16,136	29,417	7,113	10,939	127	115,242	266,099	190,671
1979	17,825	72,682	73,070	168,393	15,863	23,795	35,105	64,323	27,356	45,733	247	169,465	375,172	272,318
1980	45,870	170,045	83,809	189,262	20,817	31,226	31,121	55,909	38,473	60,690	722	220,812	507,853	364,333
1981	49,855	187,471	109,256	248,453	30,952	46,428	40,519	99,542	28,901	51,619	1,009	260,492	634,522	447,507
1982	34,032	129,370	97,441	220,194	16,877	25,316	55,819	122,561	17,776	31,057	290	222,234	528,788	375,511
1983	19,360	78,689	75,351	173,168	12,030	18,045	14,261	33,230	10,785	18,862	255	132,041	322,248	227,145
1984	9,348	40,056	98,215	235,814	16,316	24,957	9,196	34,467	23,948	41,555	540	157,564	377,389	267,477
1985	19,631	76,462	93,319	224,624	15,608	25,140	36,043	83,999	26,188	46,217	363	191,153	456,806	323,979
1986	30,806	116,481	95,744	229,748	22,230	33,855	77,900	166,553	28,912	50,115	660	256,252	597,412	426,832
1987	37,572	144,917	67,897	154,035	25,789	40,481	55,942	123,447	30,470	51,771	1,087	218,757	515,737	367,247
1988	34,369	134,100	105,611	249,358	28,582	44,815	79,790	174,623	31,186	53,130	923	280,462	656,950	468,706
1989	22,429	90,212	53,914	124,356	24,710	37,319	41,297	97,468	32,097	54,994	1,080	175,528	405,429	290,479
1990	12,544	52,176	83,162	161,567	26,594	39,826	52,152	116,483	32,105	56,029	617	207,174	426,698	316,936
1991	10,526	42,647	61,566	108,604	20,582	30,433	42,980	89,510	16,858	27,695	235	152,747	299,123	225,935
1992	15,229	59,331	131,606	279,033	21,754	33,583	122,314	196,893	19,610	32,966	1,124	311,637	602,930	457,283
1993	22,499	78,251	157,317	321,078	17,493	27,444	55,891	169,495	15,732	25,222	444	269,376	621,934	445,655
1994	15,242	53,971	73,021	186,476	16,758	25,642	30,454	59,240	7,626	10,638	427	143,528	336,394	239,961
1995	22,199	73,630	91,351	251,008	14,409	21,548	36,799	60,586	14,537	21,206	213	179,508	428,190	303,849
1996	48,924	150,610	159,499	390,151	18,923	27,805	27,185	50,094	22,485	33,974	651	277,668	653,285	465,477
1997	64,389	166,446	104,085	199,615	14,724	22,210	13,431	28,672	6,888	9,803	365	203,882	427,111	315,497
1998	95,786	206,782	128,499	188,206	16,743	25,730	19,309	33,224	17,593	22,260	403	278,333	476,606	377,469
1999	93,436	202,283	141,611	211,147	18,969	28,808	17,283	28,398	9,091	11,309	419	280,810	482,364	381,587
2000	115,239	250,020	173,134	236,304	16,444	25,865	25,862	40,923	10,603	13,392	270	341,551	566,773	454,162
2001	92,676	201,860	114,014	153,056	10,836	16,989	22,855	35,675	4,525	5,657	266	245,172	413,503	329,338
2002	57,718	141,288	103,868	161,941	17,070	25,625	37,726	60,448	8,412	10,687	450	225,245	400,439	312,842
2003	44,040	121,079	197,850	241,355	15,445	23,187	22,639	34,791	4,898	6,291	237	285,108	426,939	356,024
2004	65,228	119,081	147,003	229,914	20,513	32,081	38,289	63,064	7,062	9,217	319	278,414	453,676	366,045
2005	150,656	276,707	95,824	298,274	14,295	22,278	22,515	38,176	6,287	8,305	319	289,897	644,060	466,978
2006	124,847	289,846	146,036	235,835	17,305	25,893	25,108	45,821	8,647	11,416	450	322,393	609,260	465,827
2007	124,501	254,115	108,533	226,849	13,031	20,395	18,826	32,137	6,481	8,579	297	271,669	542,372	407,021
2008	135,319	262,512	164,973	285,354	20,278	30,616	25,527	49,953	12,991	17,278	814	359,901	646,527	503,214

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

Table 4.9.7.3.2. Estimated numbers of large spawners in North America by geographic regions, 1971–2008.

	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	6,421	35,036	4,025	17,908	16,194	24,292	8,281	15,373	9,238	14,178	490	44,650	107,276	75,963
1972	5,513	30,111	4,605	17,958	31,727	47,590	21,852	44,762	14,706	19,974	1,038	79,441	161,432	120,437
1973	7,294	41,691	5,745	25,071	32,279	48,419	24,224	46,545	11,099	14,997	1,100	81,741	177,823	129,782
1974	7,381	41,288	8,820	17,285	39,256	58,884	39,508	72,139	22,228	28,710	1,147	118,341	219,453	168,897
1975	7,308	38,937	11,552	22,775	32,627	48,940	23,711	43,674	24,596	31,654	1,942	101,736	187,923	144,830
1976	7,939	44,269	10,467	20,717	31,032	46,548	18,663	39,701	20,056	27,646	1,126	89,284	180,007	134,645
1977	6,513	38,821	7,697	15,993	44,660	66,990	37,909	73,234	27,571	37,160	643	124,992	232,841	178,917
1978	5,331	30,595	7,382	12,184	40,944	61,416	11,914	26,894	16,419	21,333	3,314	85,305	155,736	120,521
1979	2,874	17,301	4,406	8,867	17,543	26,315	5,540	12,027	9,397	12,948	1,509	41,268	78,968	60,118
1980	7,441	41,953	7,631	12,624	48,758	73,137	23,103	45,728	29,578	41,343	4,263	120,774	219,049	169,911
1981	6,969	37,995	18,821	36,168	35,798	53,697	6,812	25,275	15,500	23,557	4,334	88,234	181,024	134,629
1982	4,929	27,919	7,503	13,200	36,290	54,435	12,421	41,640	14,388	20,449	4,643	80,174	162,287	121,230
1983	3,586	20,216	8,197	13,945	23,710	35,565	8,675	27,459	6,654	12,920	1,769	52,590	111,873	82,232
1984	2,370	14,302	3,534	20,213	30,610	44,739	16,053	40,905	16,083	24,870	2,547	71,197	147,576	109,387
1985	1,972	11,361	3,063	18,762	28,312	43,482	24,417	62,160	21,451	35,614	4,884	84,099	176,263	130,181
1986	3,437	19,612	4,725	19,715	32,997	49,232	36,551	96,423	18,519	31,270	5,570	101,800	221,822	161,811
1987	4,645	26,511	3,389	13,405	29,758	43,462	24,247	62,112	12,178	19,941	2,781	76,998	168,212	122,605
1988	2,597	16,295	4,753	21,082	34,781	52,524	29,443	72,884	11,038	18,560	3,038	85,649	184,384	135,016
1989	2,722	15,908	2,691	11,097	34,268	49,185	22,766	57,168	13,961	22,254	2,800	79,208	158,411	118,810
1990	1,475	9,067	4,925	15,525	33,454	49,615	30,667	77,922	11,663	18,844	4,356	86,540	175,330	130,935
1991	805	4,524	3,929	11,141	27,341	39,797	31,121	79,935	10,878	17,353	2,416	76,490	155,166	115,828
1992	3,204	17,932	7,652	55,153	26,489	39,497	43,545	71,688	10,105	15,862	2,292	93,288	202,423	147,855
1993	5,812	21,786	7,949	25,949	21,609	29,353	26,971	98,227	8,416	11,576	2,065	72,823	188,955	130,889
1994	8,591	29,170	7,842	25,946	21,413	28,968	26,637	53,031	5,376	7,200	1,344	71,202	145,660	108,431
1995	19,514	53,500	7,176	30,000	30,925	39,320	35,930	57,637	6,220	8,709	1,748	101,513	190,913	146,213
1996	14,342	39,621	14,803	41,899	26,042	34,824	25,868	52,050	9,042	12,584	2,407	92,503	183,384	137,944
1997	14,423	32,686	14,017	41,118	21,275	28,466	22,057	44,485	4,730	6,374	1,611	78,113	154,741	116,427
1998	7,061	19,174	16,009	53,813	19,506	26,629	18,482	33,875	3,378	4,291	1,526	65,963	139,308	102,635
1999	8,414	22,915	15,892	47,662	23,631	32,618	17,384	30,064	4,431	5,428	1,168	70,920	139,854	105,387
2000	11,646	31,443	15,860	37,123	22,094	31,960	19,397	32,965	2,496	3,231	1,587	73,079	138,310	105,695
2001	12,259	33,192	11,049	23,928	22,871	32,954	28,681	44,412	4,083	5,215	1,491	80,434	141,192	110,813
2002	8,771	24,464	9,173	23,845	17,079	24,366	14,672	26,298	1,380	1,773	511	51,586	101,257	76,422
2003	6,321	21,334	12,660	35,540	28,409	39,137	25,883	45,383	3,059	3,950	1,192	77,524	146,536	112,030
2004	10,553	22,681	9,822	33,810	23,920	32,374	24,800	44,772	2,689	3,472	1,283	73,068	138,392	105,730
2005	10,739	30,376	10,109	45,651	24,012	32,168	22,631	42,261	1,729	2,277	1,088	70,308	153,821	112,064
2006	12,074	29,443	21,369	49,108	22,171	29,983	21,947	39,596	2,538	3,399	1,419	81,517	152,946	117,232
2007	11,530	31,556	14,627	43,907	19,707	27,432	22,189	39,288	1,372	1,782	1,189	70,615	145,154	107,884
2008	14,355	37,332	14,189	43,426	24,957	36,557	15,673	32,281	2,770	3,739	2,196	74,140	155,530	114,835

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

Table 4.9.7.3.3. Estimated numbers of 2SW spawners in North America by geographic regions, 1971–2008.

	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	892	5,064	11,822	17,733	7,366	13,482	5,030	9,090	490	29,613	74,740	52,177
1972	3,435	24,812	1,062	5,218	23,160	34,741	19,546	38,881	8,088	12,671	1,038	56,329	117,361	86,845
1973	4,565	34,376	1,148	6,537	23,564	35,346	22,315	42,115	4,998	8,395	1,100	57,690	127,868	92,779
1974	4,490	33,475	1,481	4,794	28,657	42,985	34,964	62,985	11,001	17,149	1,147	81,740	162,534	122,137
1975	4,564	32,119	2,239	7,170	23,818	35,726	20,395	37,419	12,974	19,732	1,942	65,931	134,108	100,020
1976	4,984	36,701	1,872	6,088	22,653	33,980	15,489	32,688	12,006	19,015	1,126	58,131	129,598	93,865
1977	4,042	31,969	1,318	4,218	32,602	48,902	35,232	67,512	14,572	23,107	643	88,409	176,352	132,381
1978	3,361	25,490	1,897	4,210	29,889	44,834	9,844	22,076	7,294	11,531	3,314	55,599	111,456	83,527
1979	1,823	14,528	762	2,473	12,807	19,210	3,645	7,893	5,191	8,167	1,509	25,736	53,780	39,758
1980	4,633	34,525	2,036	4,493	35,594	53,390	21,307	41,674	16,193	26,399	4,263	84,026	164,745	124,385
1981	4,403	31,615	3,228	9,949	26,132	39,199	4,004	15,496	7,273	13,453	4,334	49,374	114,046	81,710
1982	3,081	23,127	1,604	3,934	26,492	39,738	9,669	32,749	5,633	9,993	4,643	51,122	114,185	82,653
1983	2,267	16,824	1,976	4,585	17,308	25,963	6,647	21,264	2,047	6,361	1,769	32,014	76,766	54,390
1984	1,478	11,822	949	5,403	22,345	32,659	14,578	37,465	13,696	21,309	2,547	55,594	111,206	83,400
1985	1,258	9,530	711	4,745	20,668	31,742	19,412	50,584	18,646	30,614	4,884	65,579	132,100	98,839
1986	2,177	16,334	1,076	5,376	24,088	35,939	30,055	80,658	13,848	23,028	5,570	76,815	166,904	121,860
1987	2,895	21,821	793	3,876	21,723	31,727	18,221	48,149	9,304	15,116	2,781	55,716	123,469	89,593
1988	1,625	13,452	1,048	5,767	25,390	38,343	23,014	58,238	7,742	12,912	3,038	61,857	131,750	96,803
1989	1,727	13,270	520	2,840	25,016	35,905	14,664	37,995	11,045	17,554	2,800	55,771	110,363	83,067
1990	923	7,493	1,016	4,325	24,422	36,219	19,748	50,795	8,456	13,552	4,356	58,919	116,740	87,830
1991	491	3,665	900	3,193	19,959	29,052	18,949	49,974	8,992	14,323	2,416	51,708	102,623	77,165
1992	2,012	14,889	1,663	14,564	19,337	28,833	26,912	45,620	8,413	13,222	2,292	60,630	119,420	90,025
1993	3,624	17,922	1,558	7,059	15,774	21,428	17,842	66,792	5,785	8,075	2,065	46,648	123,341	84,994
1994	5,347	23,992	1,561	6,213	15,631	21,147	19,239	39,067	3,726	5,055	1,344	46,848	96,818	71,833
1995	12,083	43,828	977	6,436	22,575	28,703	29,443	47,296	5,344	7,586	1,748	72,170	135,597	103,883
1996	8,878	32,448	1,976	9,018	19,010	25,421	17,885	37,642	6,955	9,809	2,407	57,111	116,744	86,928
1997	8,785	26,497	2,196	9,559	15,531	20,780	13,924	30,270	3,359	4,587	1,611	45,406	93,304	69,355
1998	4,237	13,614	1,991	10,716	14,240	19,439	9,209	18,943	1,984	2,563	1,526	33,186	66,800	49,993
1999	5,049	16,269	2,232	10,178	17,250	23,811	9,451	17,846	3,342	4,122	1,168	38,492	73,395	55,943
2000	6,987	22,325	2,737	9,696	16,128	23,331	10,353	19,178	1,877	2,480	1,587	39,670	78,596	59,133
2001	7,355	23,567	981	3,888	16,696	24,056	18,840	30,309	3,512	4,505	1,491	48,875	87,815	68,345
2002	5,263	17,370	868	3,889	12,467	17,787	8,309	16,083	695	876	511	28,113	56,516	42,315
2003	3,793	15,147	1,146	5,475	20,738	28,570	16,134	30,147	2,713	3,526	1,192	45,716	84,056	64,886
2004	6,332	16,104	1,005	5,490	17,462	23,633	15,194	29,497	2,255	2,893	1,283	43,531	78,899	61,215
2005	6,443	21,567	1,053	7,596	17,529	23,482	15,296	29,781	1,372	1,804	1,088	42,781	85,318	64,050
2006	7,244	20,904	2,098	8,476	16,185	21,887	14,847	28,000	2,045	2,742	1,419	43,838	83,429	63,633
2007	6,918	22,405	1,274	6,929	14,386	20,026	14,869	27,184	1,117	1,442	1,189	39,754	79,174	59,464
2008	8,613	26,505	1,174	6,716	18,218	26,687	10,679	23,298	2,514	3,403	2,196	43,395	88,805	66,100

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

Table 4.9.7.4.1. Smolt age distributions in six stock areas of North America used to weight forward the spawning escapement in the current year to the year of the non-maturing 1SW component in the Northwest Atlantic.

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

Table 4.9.10.2.1. Definitions of key variables used in continental run-reconstruction models for North American salmon.

i	Index for PFA year corresponding to the 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 month
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 (PFA) 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
T2	Time between the start of the fishery at West Greenland (August 1) and return to the coast of North America = 10 months
S2	Survival of 2SW salmon between August 1 (at West Greenland) and return to the coast of North America {exp-M * t2}
MN1(i)	Pre-fishery abundance of maturing 1SW salmon in year i

Table 4.9.10.2.2. Run reconstruction data inputs for harvests in North America used to estimate pre-fishery abundance of maturing and non-maturing 1SW salmon (FSC = food social and ceremonial purposes).

	Commercial catches of large (number of fish)				Commercial catches of small (number of fish)			
	Labrador		Newfoundland		Labrador		Newfoundland	
Year	Commercial	FSC catches	SFA3 to 7	SFA 8 to 14A	Commercial	FSC catches	SFA3 to 7	SFA 8 to 14A
1970	82826				36363			
1971	118024		81152		47378		111518	70936
1972	101455		43041	42861	35462		107770	111141
1973	141875		85904	43627	7759		180966	176907
1974	122765		73961	85714	56321		135874	153278
1975	114521		100504	72814	111791		190557	91935
1976	131540		79318	95714	78209		143557	118779
1977	116980		114413	63449	69602		150491	57472
1978	91473		64073	37653	33656		68747	38180
1979	52238		29936	29122	45714		140844	62622
1980	124955		86941	54307	103479		186648	94291
1981	112334		98672	38663	114680		174222	60668
1982	83243		46076	35055	79449		143445	77017
1983	60212		48218	28215	49441		116592	55683
1984	43202		44540	15135	25590		98184	52813
1985	33995		36975	24383	47359		131360	79275
1986	58565		48996	22036	71396		151275	91912
1987	79170		67072	19241	89454		192308	82401
1988	49598		36449	14763	83109		115375	74620
1989	47743		37576	15577	56486		116375	60884
1990	27487		31847	11639	33027		71761	46053
1991	13465		25792	10259	26768		62331	42721
1992	32341		0	0	24249		0	0
1993	17096		0	0	17074		0	0
1994	15377		0	0	8640		0	0
1995	11176		0	0	7980		0	0
1996	7272		0	0	7849		0	0
1997	6943		0	0	9753		0	0
1998	0	2269	0	0	0	2988	0	0
1999	0	1084	0	0	0	2739	0	0
2000	0	1352	0	0	0	5323	0	0
2001	0	1673	0	0	0	4789	0	0
2002	0	1437	0	0	0	5806	0	0
2003	0	2175	0	0	0	6477	0	0
2004	0	3696	0	0	0	8385	0	0
2005	0	2817	0	0	0	10436	0	0
2006	0	3090	0	0	0	10377	0	0
2007	0	2652	0	0	0	9208	0	0
2008	0	3909	0	0	0	9834	0	0

Table 4.9.10.5.1. Summary of model and break year selections for forecasting PFA for 2009–2011 based on 10 000 simulations. Break year refers to last year in high phase.

		Break year							
Model	Phase	1987	1988	1989	1990	1991	1992	1993	Models
2	High								
	Low					254	54		308
3	High								
	Low		121	21		253	2		397
4	High		1	1					2
	Low		42	19		138	20		219
5	High						1		1
	Low		1						1
6	High					1			1
	Low		811	4317	180	3544	219		9071
Phase	High								4
	Low		976	4358	180	4190	296		9996

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

PFA_{NA} = PFA for North America (1978 to 2005)

LS_{NA} = Lagged spawners (1978 to 2005)

Ph = Phase (indicator variable representing two time periods)

α β γ δ = coefficients of the slope and intercept variables

ξ = residual error normal

phase shift periods: ranging from 1978–1985 and 1986–2005 to 1978–1993 and 1994–2005

Table 4.9.10.5.2. Comparison of PFA$_{NA}$ forecast and reconstructed distributions for year of PFA, 2007 to 2011 based on previous models and alternate random walk model.

			Posterior distribution descriptors				
PFANA year	Source	Model	5th	25th	Median	75th	95th
2007	Pseudo-observation	Run reconstruction	98 850	109 500	115 900	122 600	135 100
	Predicted in 2007	Phase-shift model	53 000	86 900	113 100	147 100	248 600
2008	Predicted in 2007	Phase-shift model	56 400	92 000	118 000	151 400	274 500
	Updated in April 2009	Phase-shift model	67 250	90 050	110 100	133 800	180 700
	Predicted in April 2009	Bayesian model	80 000	114 500	137 500	165 800	242 100
2009	Predicted in 2007	Phase-shift model	52 400	88 600	114 200	146 900	268 000
	Updated in April 2009	Phase-shift model	59 600	87 300	107 500	131 100	193 500
	Predicted in April 2009	Bayesian model	66 300	107 000	137 000	175 900	293 500
2010	Predicted in April 2009	Phase-shift model	60 000	87 900	107 300	132 300	194 600
	Predicted in April 2009	Bayesian model	58 300	104 200	140 100	189 800	355 200
2011	Predicted in April 2009	Phase-shift model	61 300	89 800	110 200	135 000	199 500
	Predicted in April 2009	Bayesian model	54 600	106 000	149 300	211 100	429 700

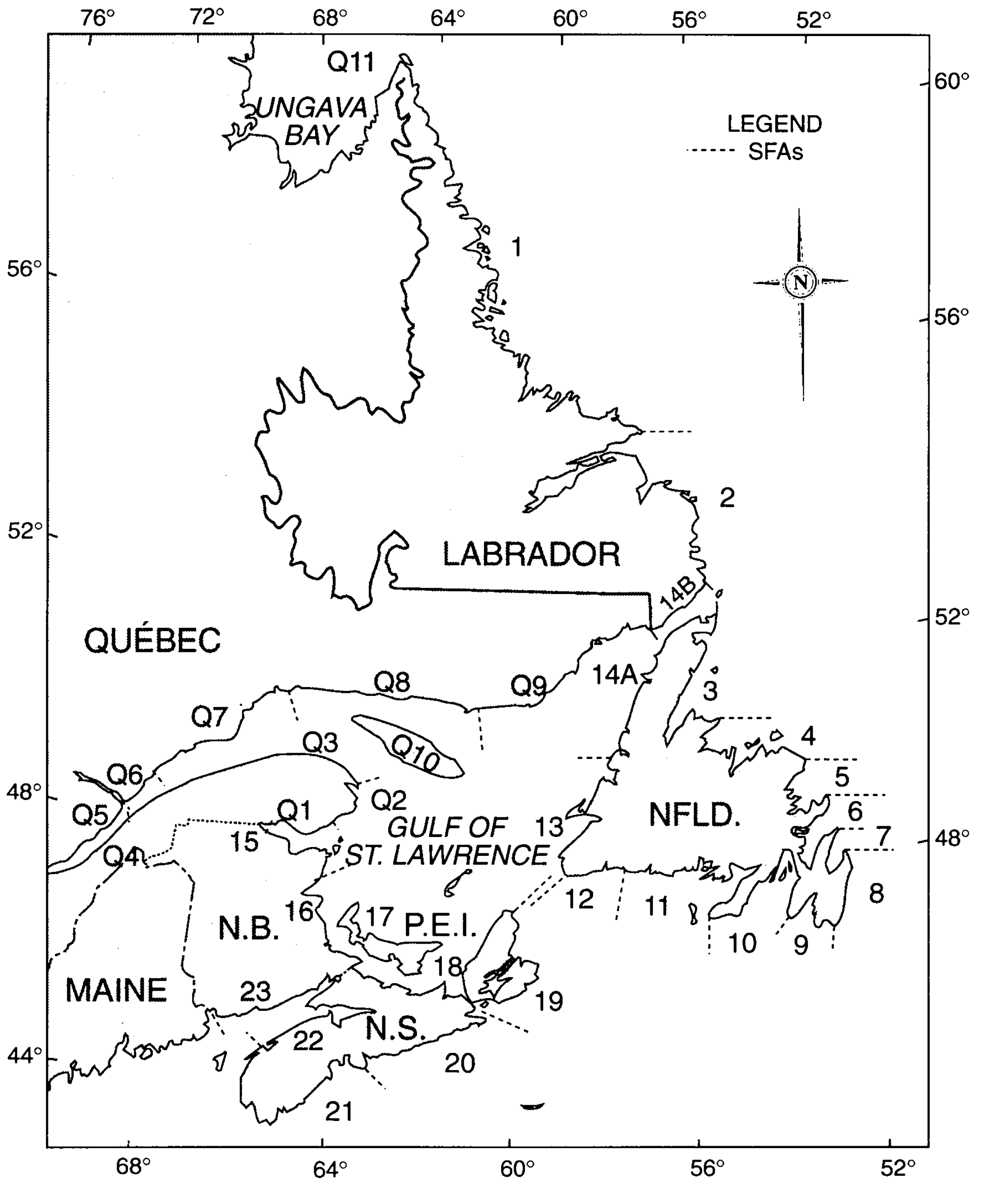


Figure 4.9.3.1. Map of Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada.

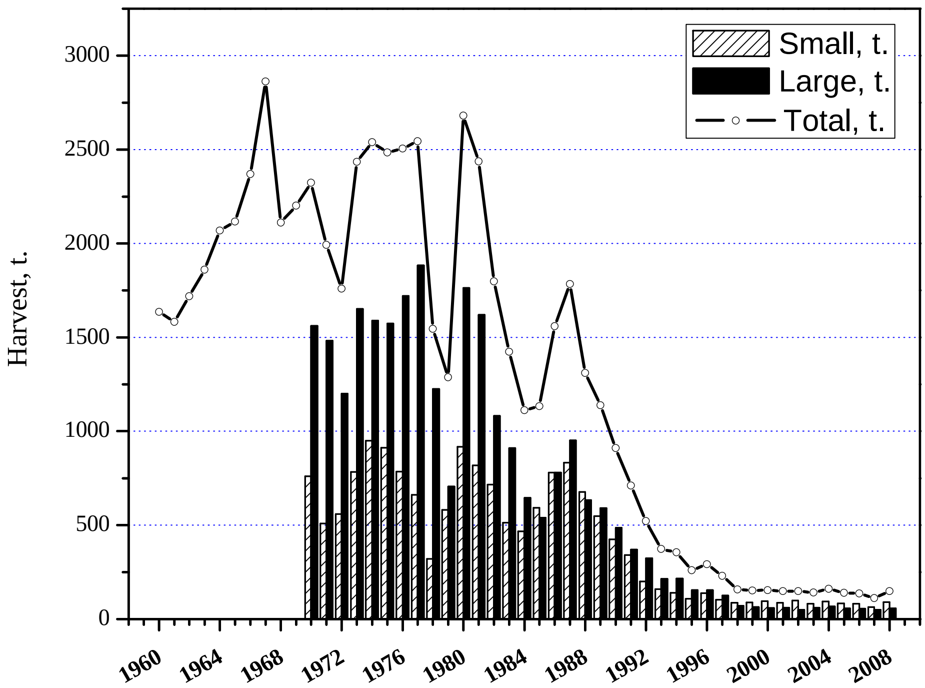


Figure 4.9.4.1. Harvest (t) of small salmon, large salmon and combined for Canada, 1960–2008 by all users.

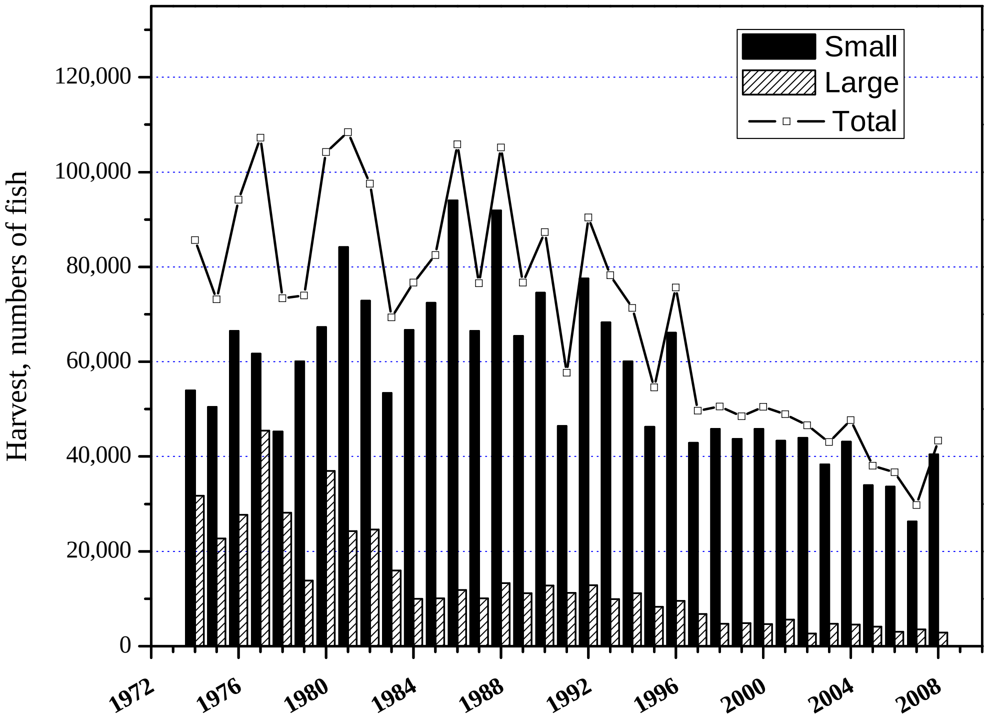


Figure 4.9.4.2. Harvest (number) of small salmon, large salmon and both sizes combined in the recreational fisheries of Canada, 1974–2008.

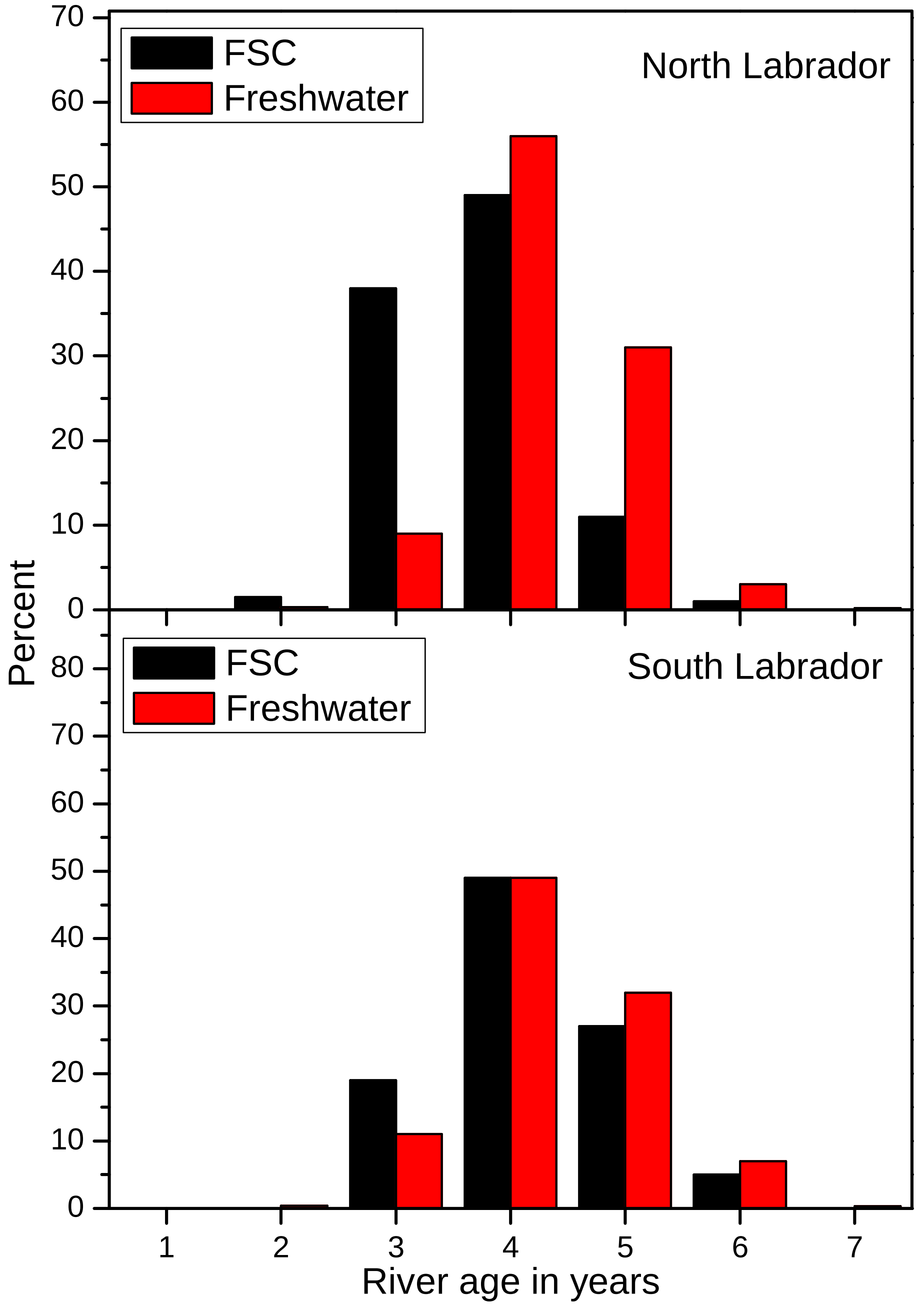


Figure 4.9.5.1. A comparison of the river age distribution of salmon from FSC (food social and ceremonial purposes) fisheries in North and South Labrador in 2007 to those at assessment facilities in 2000–2005.

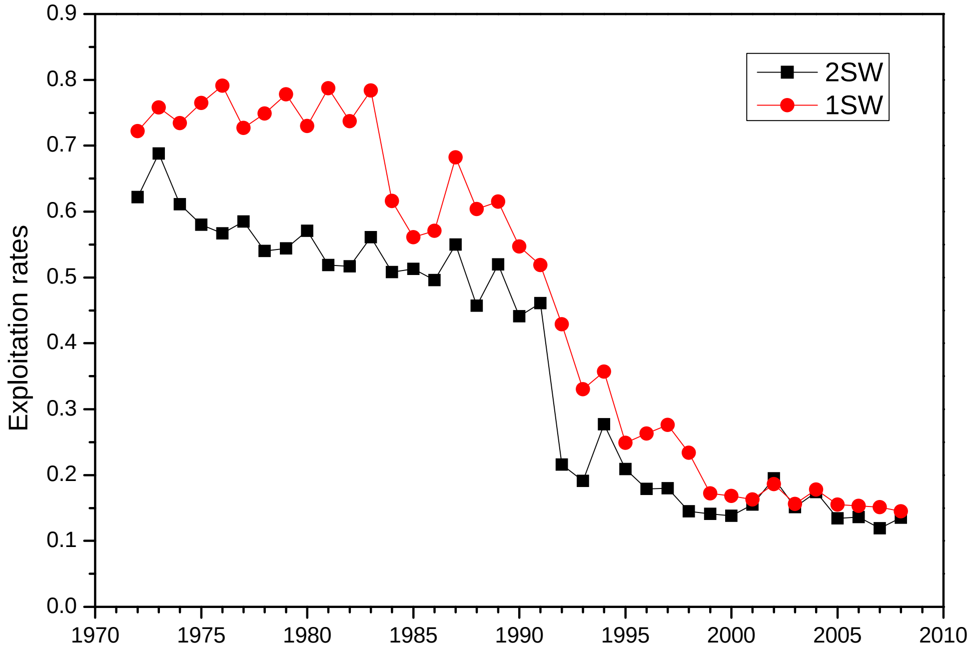


Figure 4.9.6.1. Exploitation rates in North America on the North American stock complex of 1SW and 2SW salmon.

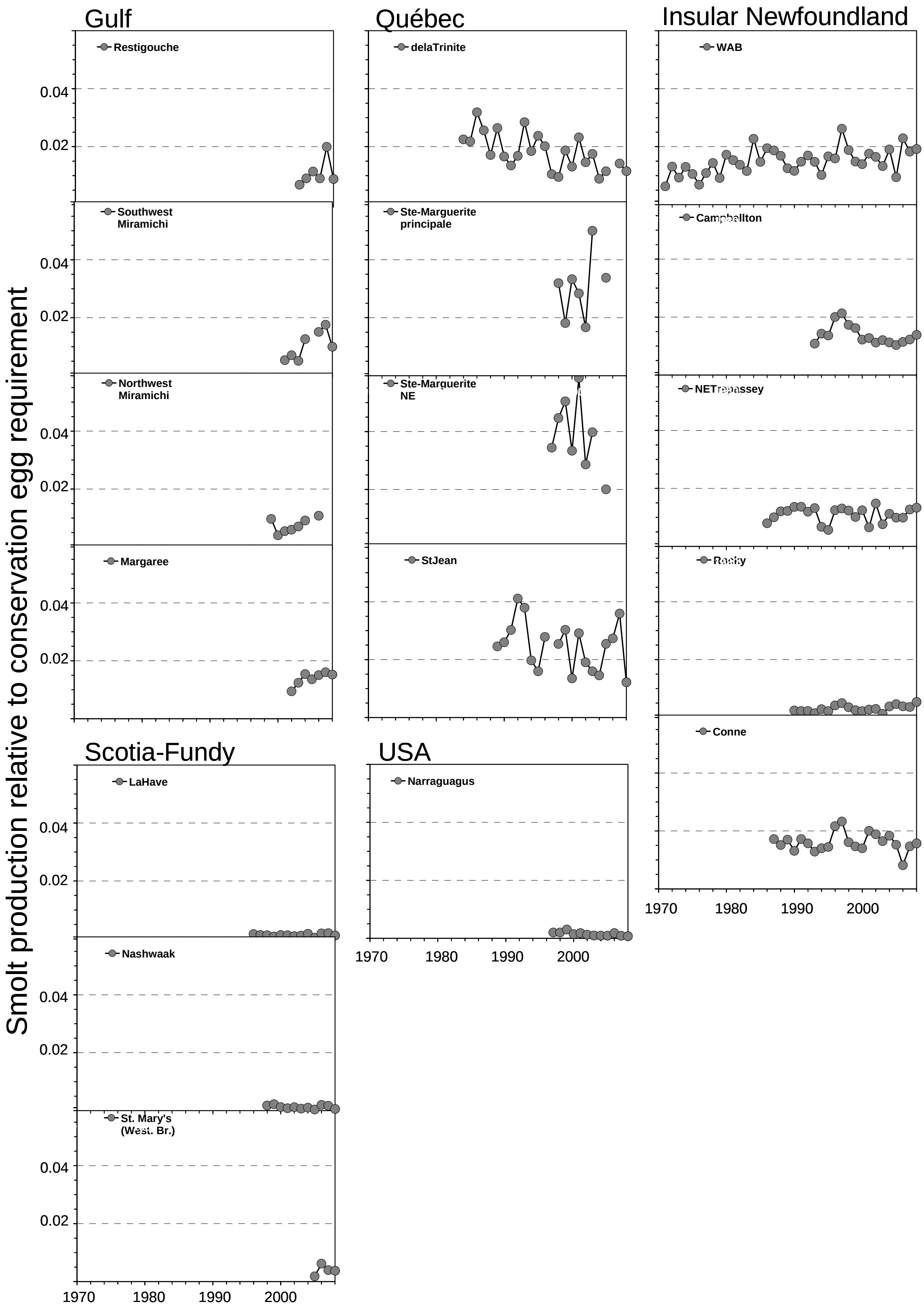


Figure 4.9.7.1.1. Time-series of wild smolt production from sixteen monitored rivers in eastern Canada and one river of eastern USA, 1970–2008. Smolt production is expressed relative to the conservation egg requirements of the river.

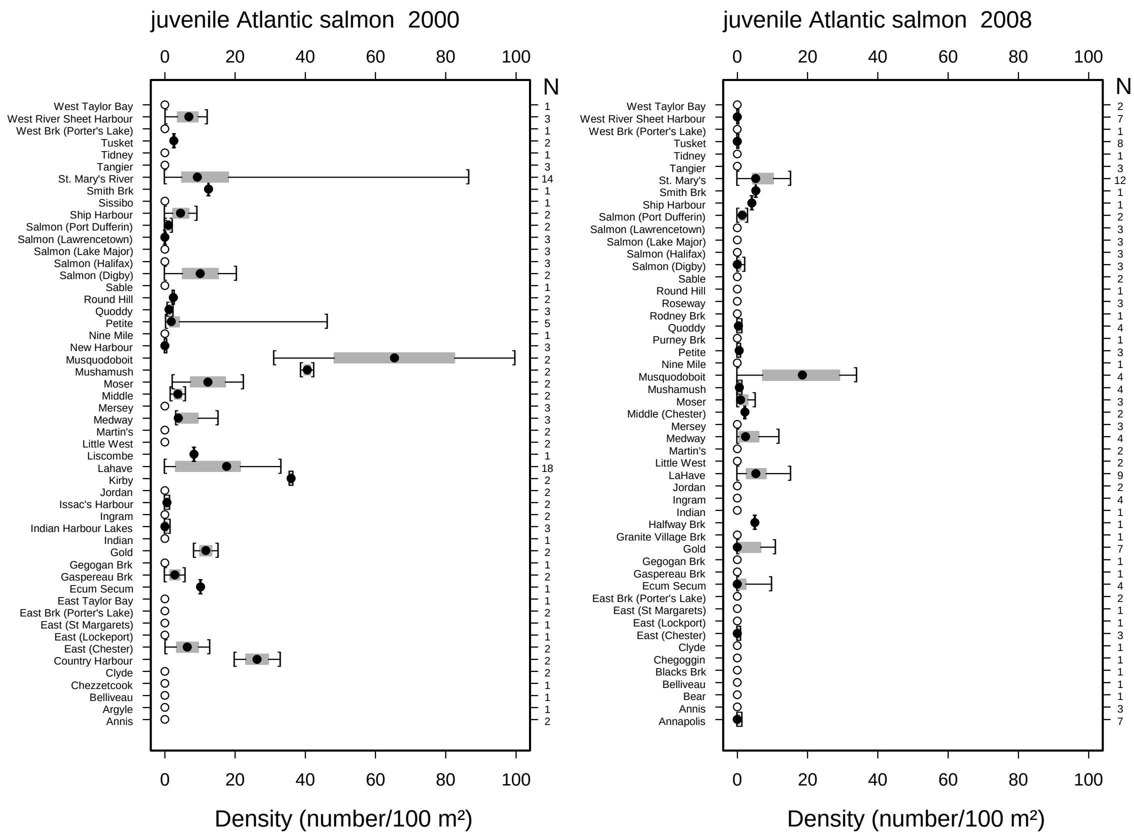


Figure 4.9.7.1.2. Box plots showing the density of Atlantic salmon in Southern Upland rivers based on electrofishing during 2000 and 2008. The dot shows the median density and the box shows the inter-quartile spread. Open dots indicate that no salmon were captured in the river. The whiskers are drawn to the minimum and maximum. "N" is the number of sites that were electrofished in each river.

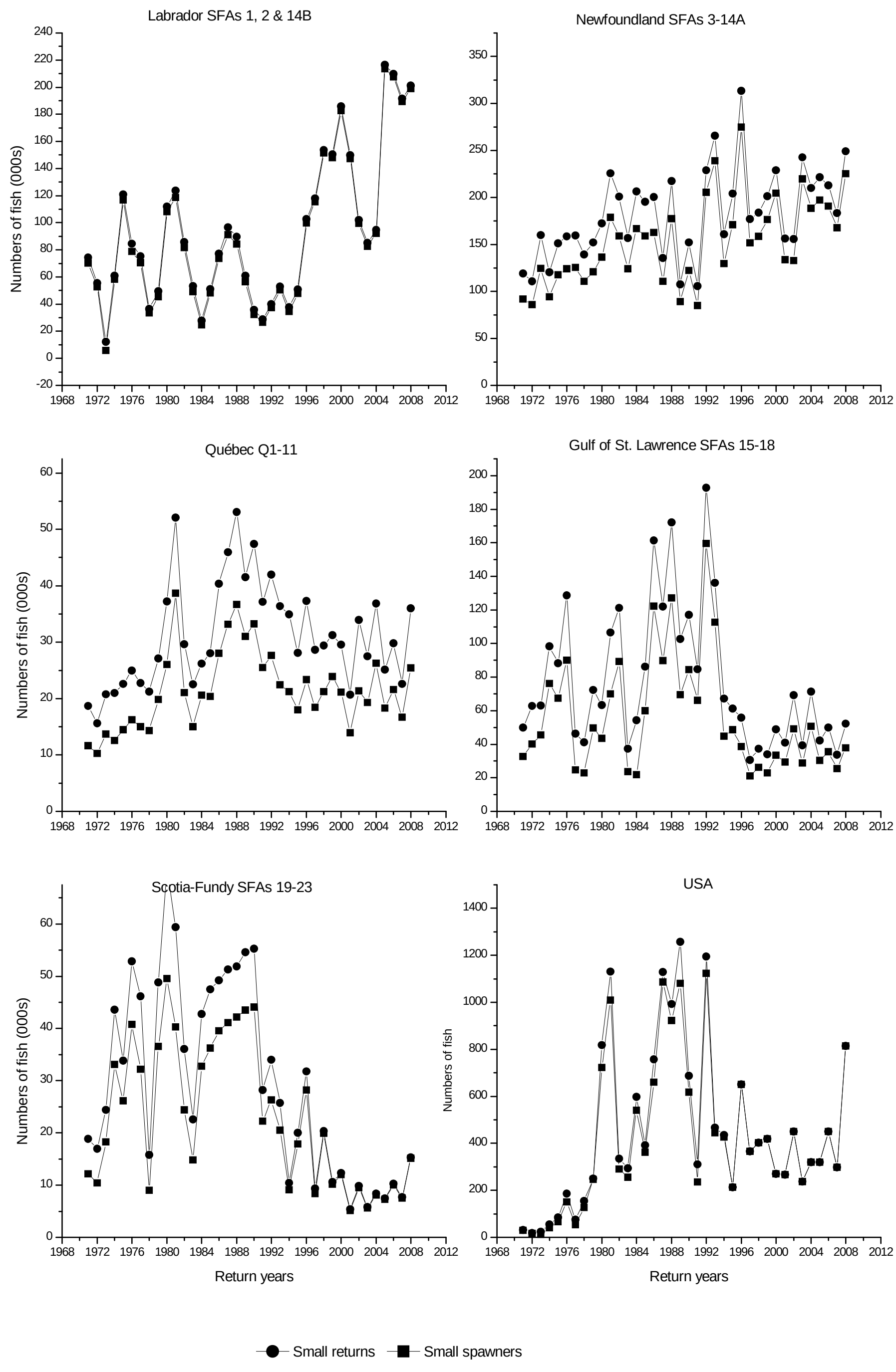


Figure 4.9.7.2.1. Comparison of estimated mid-points of small returns to and small spawners in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Note the difference in scale for USA.

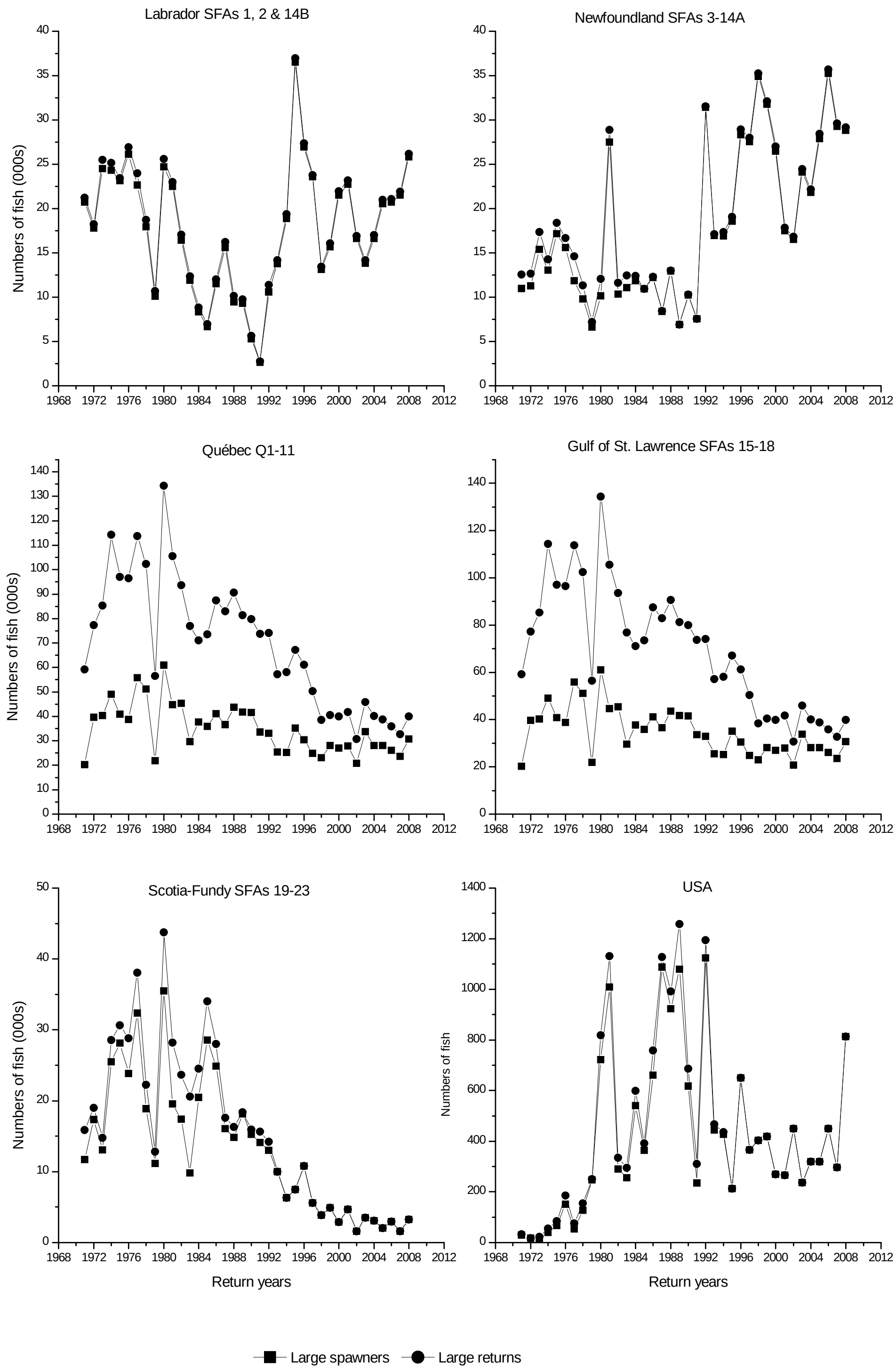


Figure 4.9.7.2.2. Comparison of estimated mid-points of large returns to and large spawners in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Note the difference in scale for USA.

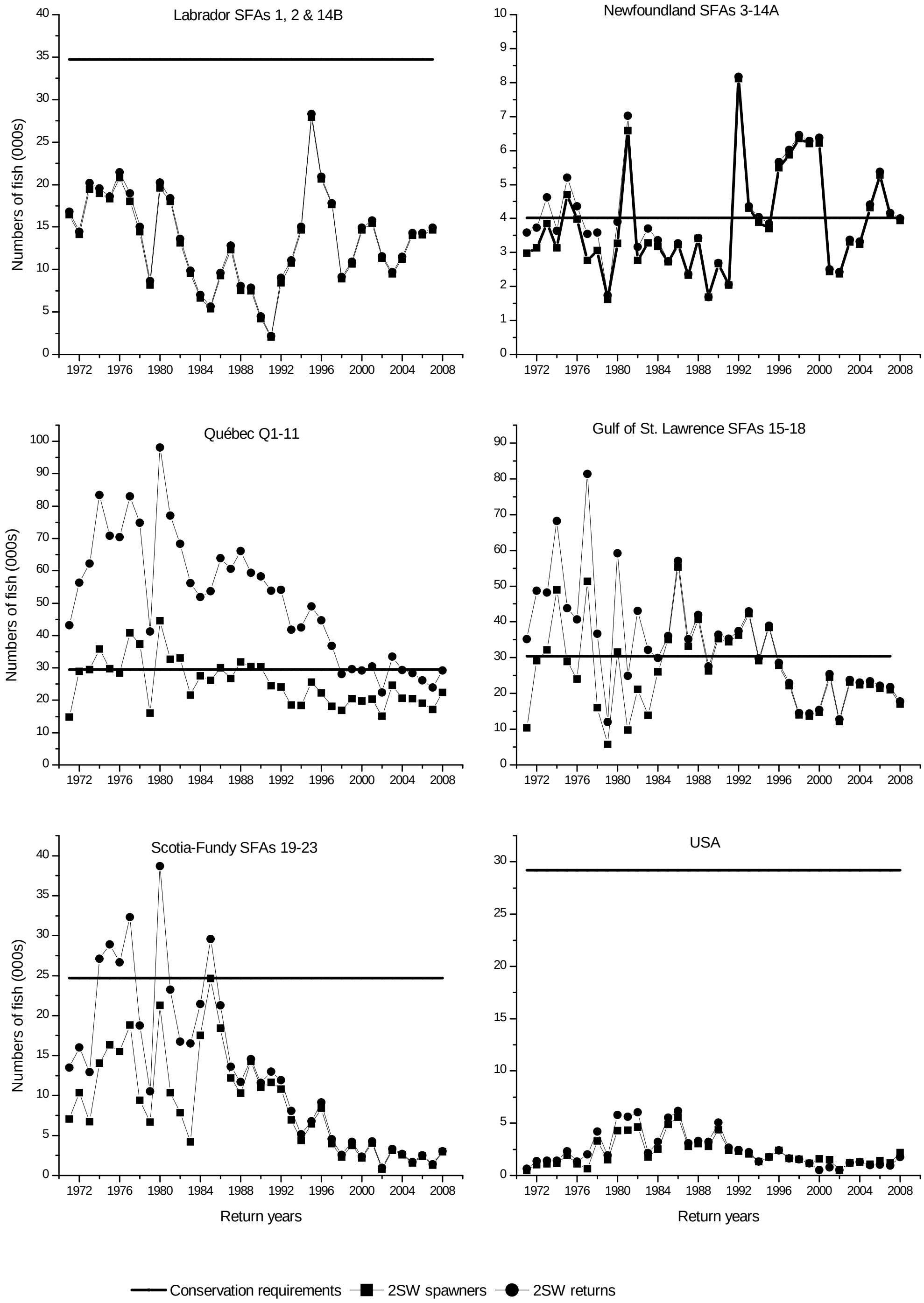


Figure 4.9.7.2.3. Comparison of estimated mid-points of 2SW returns to and 2SW spawners in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Note the difference in scale for USA.

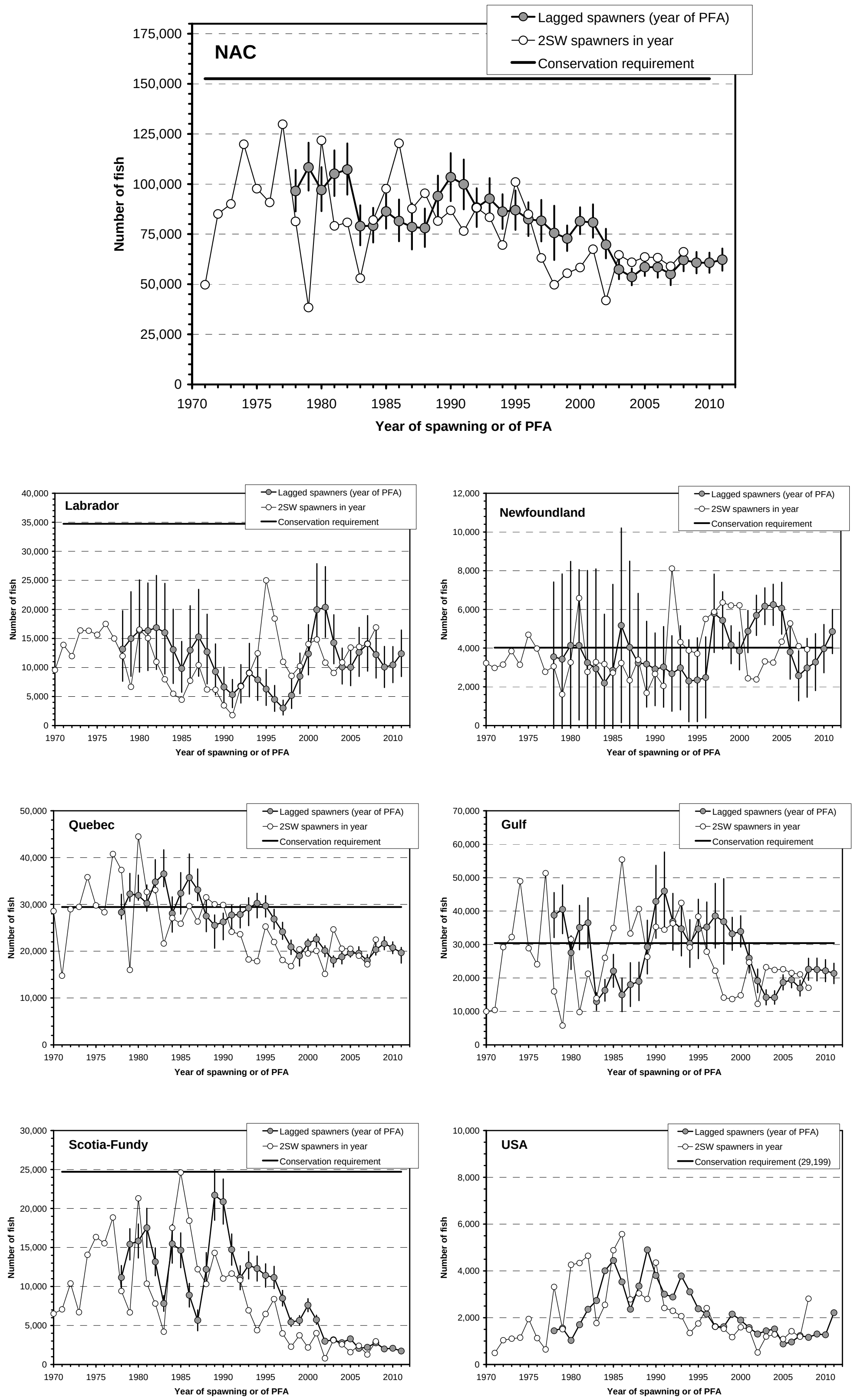


Figure 4.9.7.4.1. Lagged spawners (solid circles; medians and 95% C.I. ranges) and estimated annual spawners (open circles) as contribution to potential recruitment in the year of prefishery abundance (PFA) for six geographic areas of North America. The horizontal line represents the spawning requirement (in terms of 2SW fish) in each geographic area.

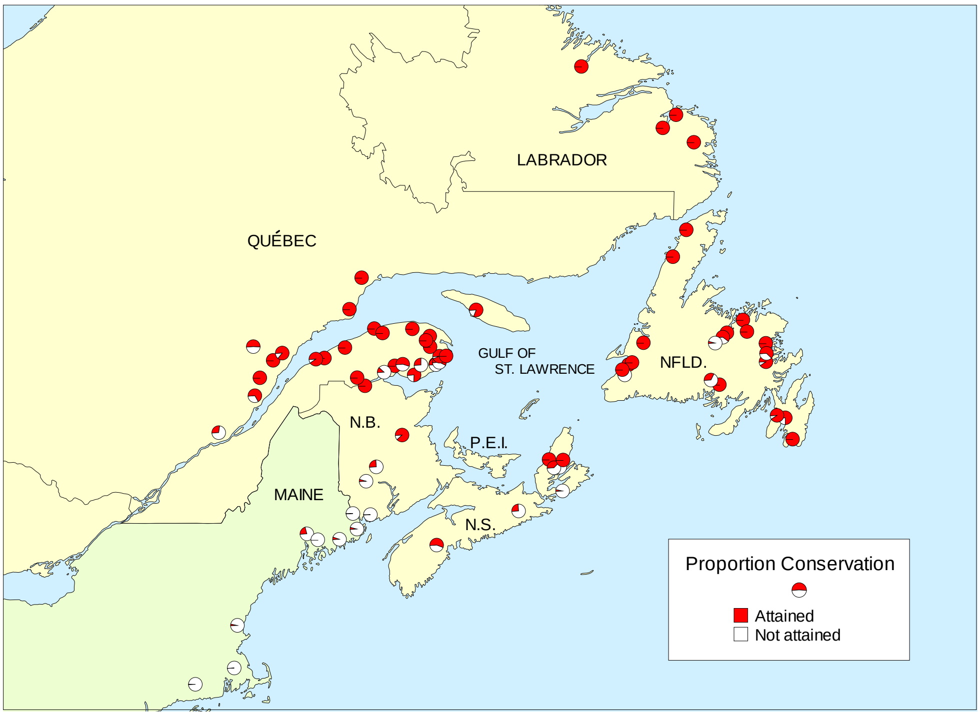


Figure 4.9.8.1. Proportion of the conservation requirement attained in assessed rivers of the North American Commission in 2008.

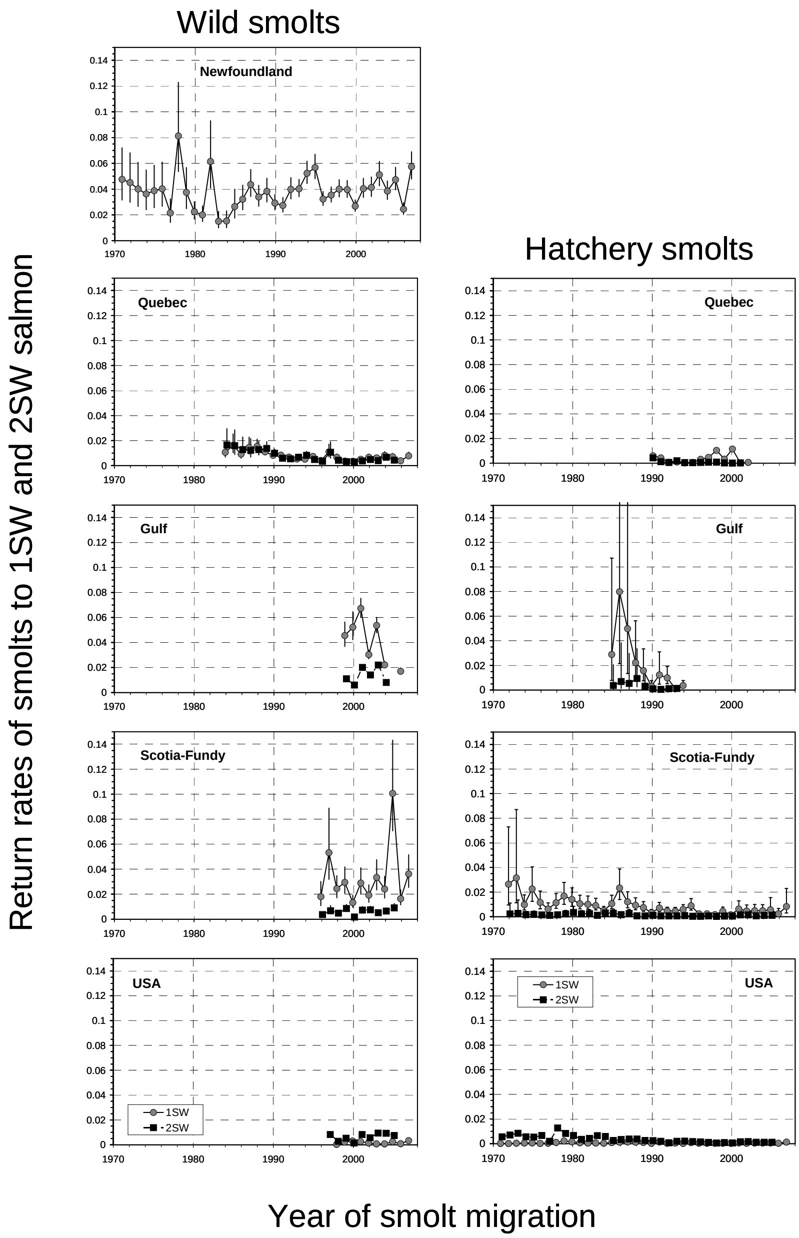


Figure 4.9.9.1. Standardized mean (one standard error bars) annual return rates of wild and hatchery origin smolts to 1SW and 2SW salmon to the geographic areas of North America. The standardized values are annual means derived from a general linear model analysis of rivers in a region. Survival rates were log transformed prior to analysis.

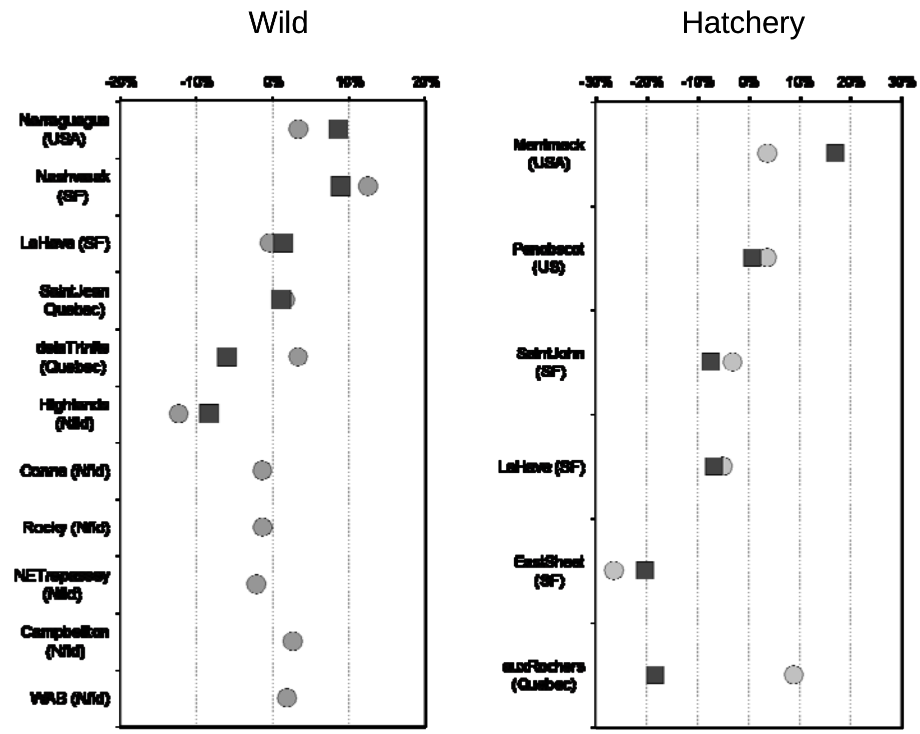


Figure 4.9.9.2 Annual rate of change (%) of return rates to 1SW and 2SW salmon by wild (left) and hatchery (right) salmon smolts to rivers of eastern North America over the last 15 years. Grey circles are for 1SW and dark squares are for 2SW data series. Populations with 8 or more data points in the last 15 years are included in th analysis.

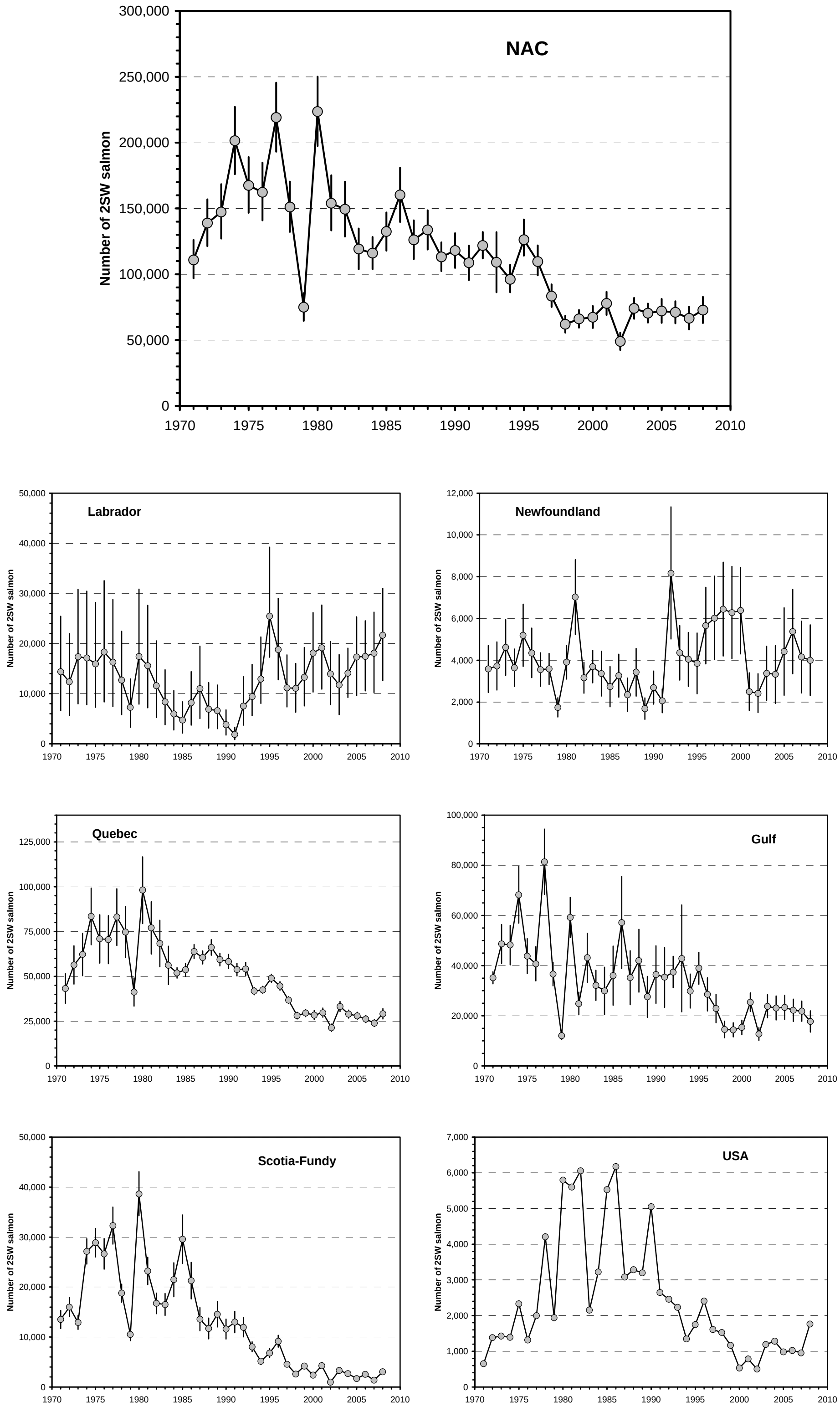


Figure 4.9.10.2.1. Region-specific and overall NAC estimates of 2SW salmon returns, 1971 to 2008. Median and 95% CI interval ranges derived from Monte Carlo simulations are shown.

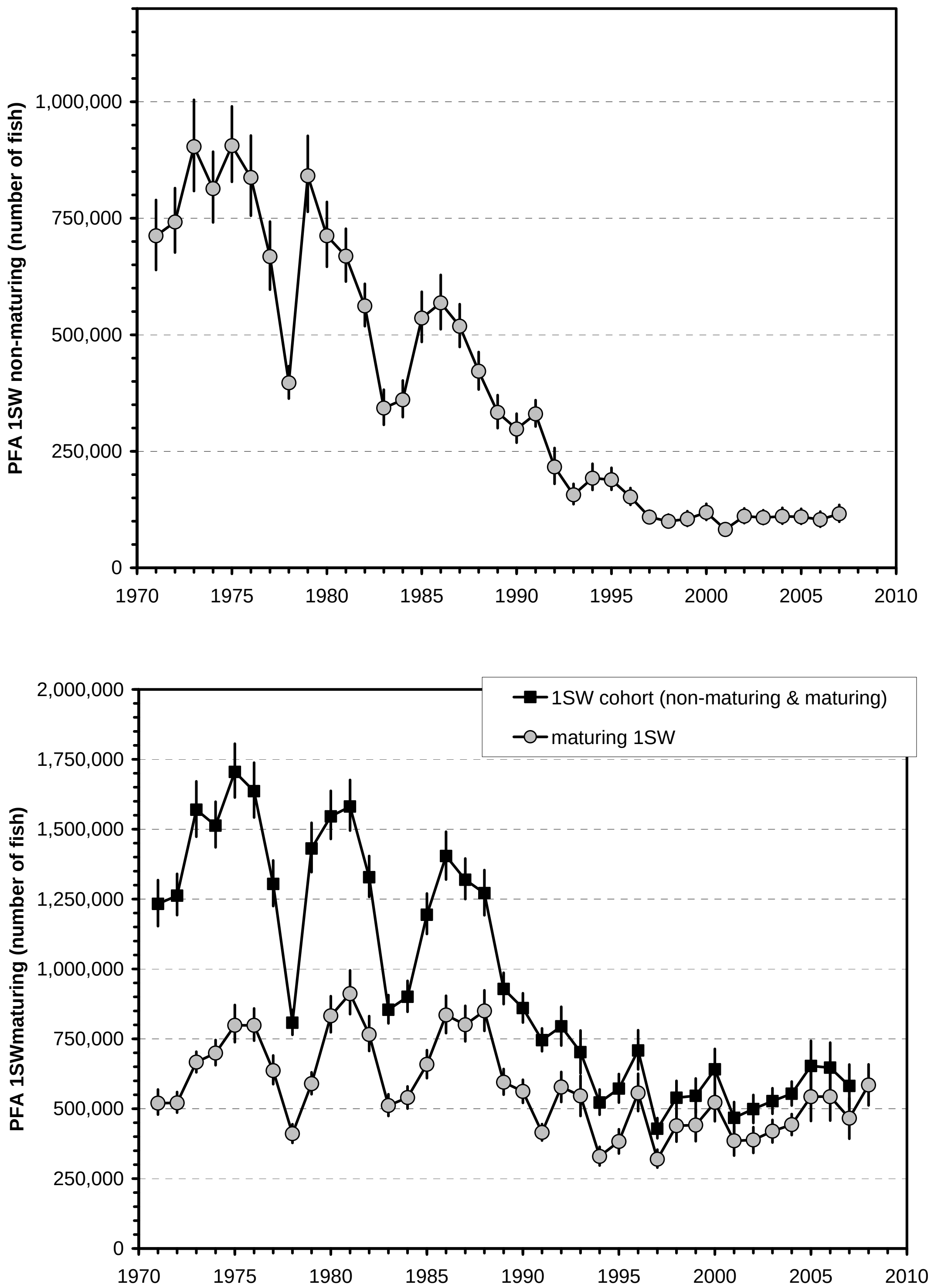


Figure 4.9.10.2.2.Estimates of PFA for 1SW non-maturing (upper panel) and 1SW maturing salmon and total cohort of 1SW salmon (lower panel) based on the Monte Carlo simulations of the run-reconstruction model for NAC. Median and 95% CI interval ranges derived from Monte Carlo simulations are shown.

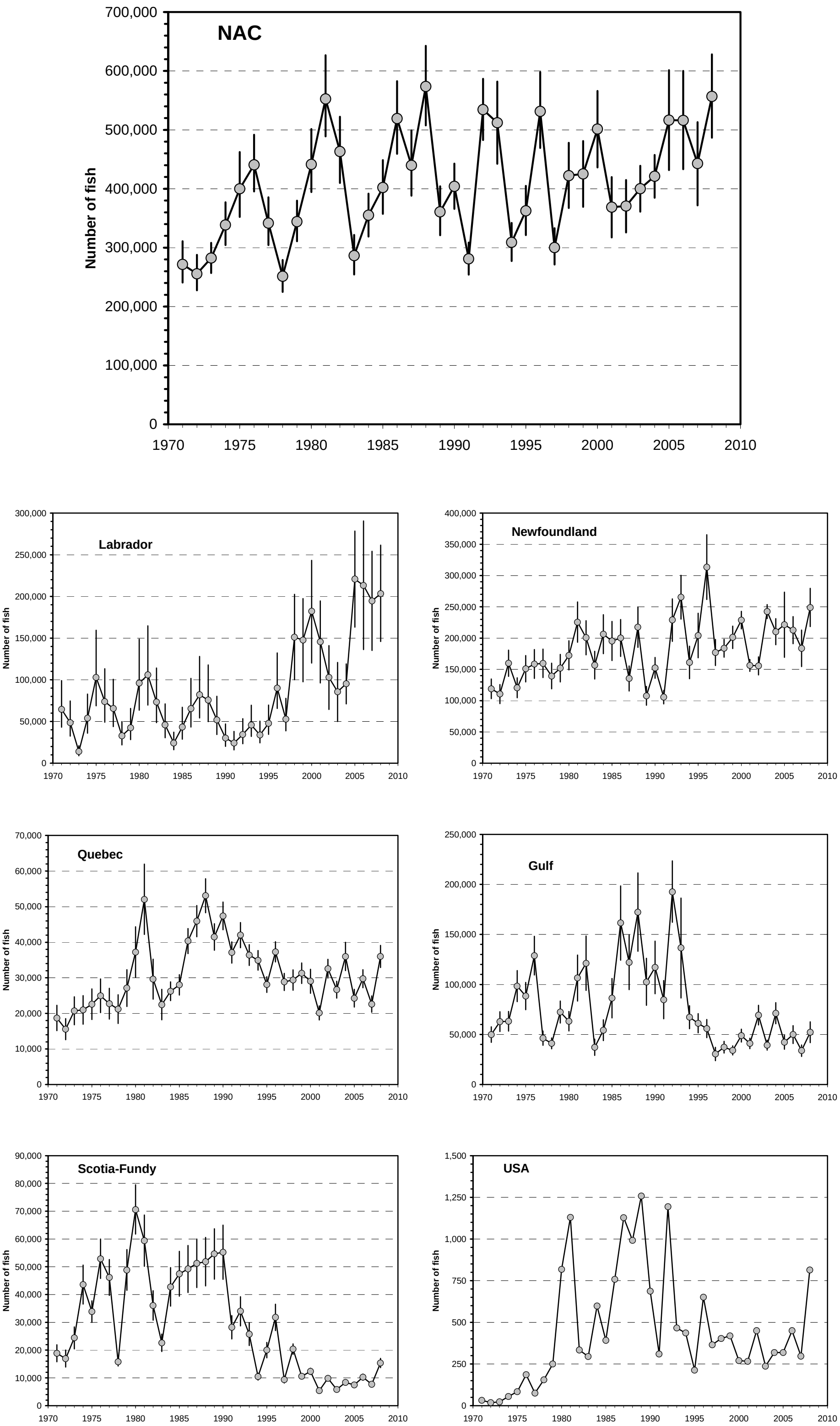


Figure 4.9.10.3.1. Region-specific and overall NAC estimates of small (1SW maturing) salmon returns, 1971 to 2008. Median and 95% CI interval ranges derived from Monte Carlo simulations are shown.

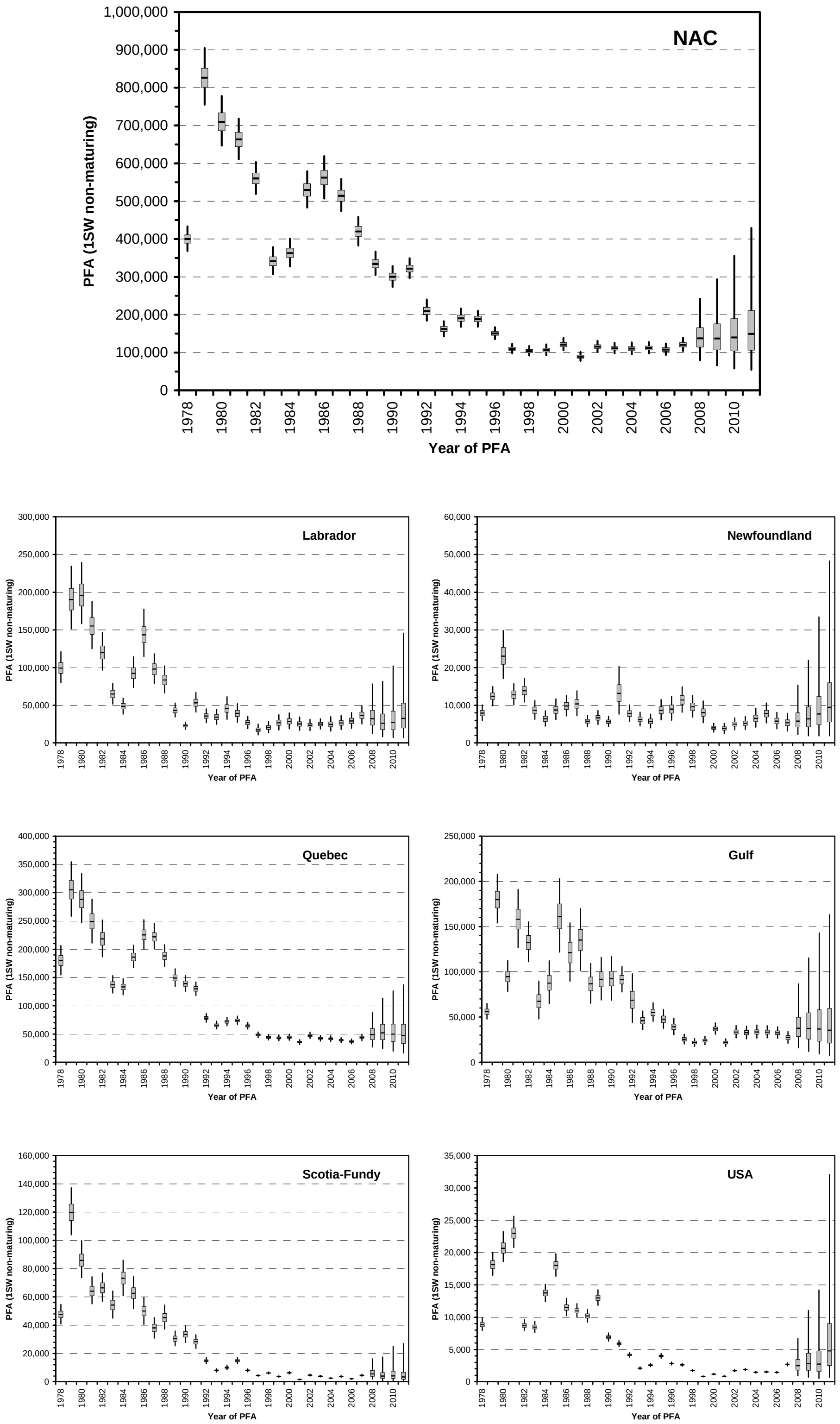


Figure 4.9.10.5.1. Region-specific and overall NAC estimates and forecasts of PFA abundance of 1SW non-maturing salmon for the PFA years 1978 to 2011, based on the Bayesian random walk model. The posterior distributions are summarized by box plots showing median value (horizontal line), the inter-quartile range (box) and the 95% credibility interval range (vertical lines).

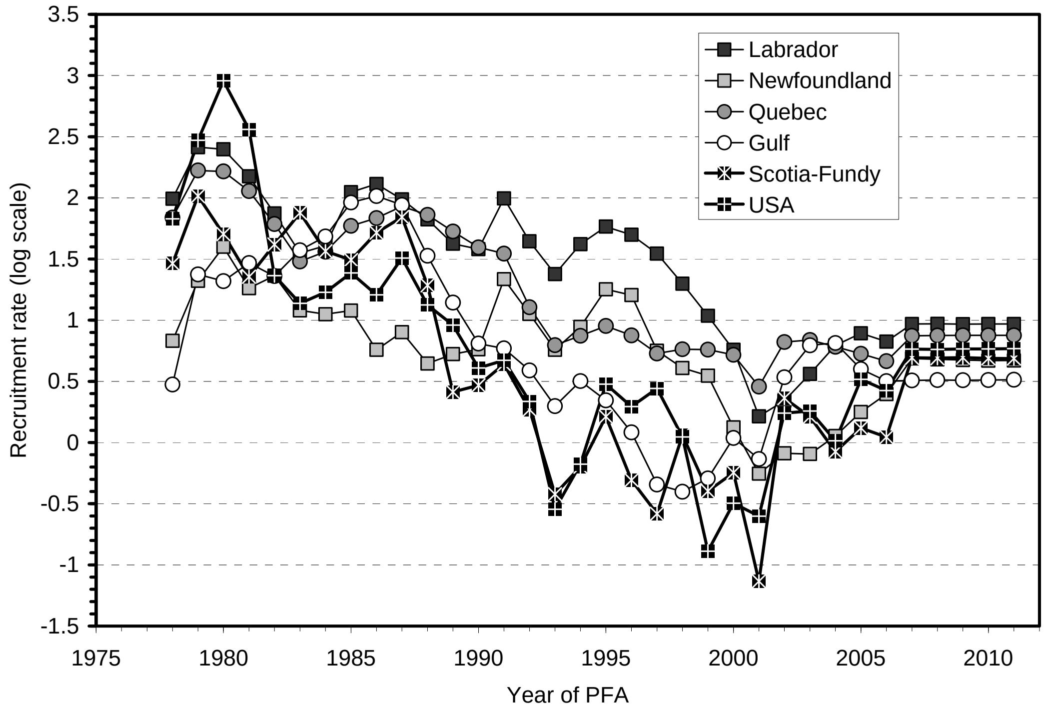


Figure 4.9.10.5.2. Region-specific recruitment rate (αi,k; log scale, median) estimates for PFA years 1978 to 2011.

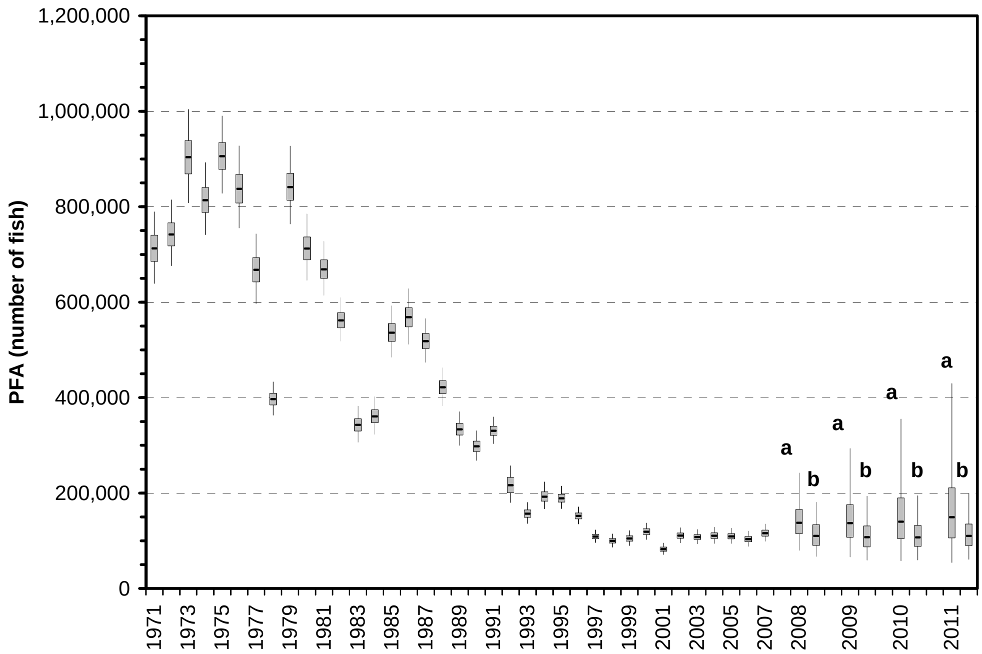


Figure 4.9.10.6.1. Run reconstructed PFA (1971 to 2007) and forecasts of PFA for 2008 to 2011 based on models of lagged 2SW spawners and 2SW returns to six regions of North America. The box plots labelled "a" are from the regionally disaggregated random walk model presented in 2009. The box plots labelled "b" are outputs from the phase shift model previously used by ICES for providing catch advice for West Greenland fisheries.

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 conservation limits and thus suffering reduced reproductive capacity.

In European and North American areas, the overall status of stocks contributing to the West Greenland fishery is among the lowest recorded, and as a result, the abundance of salmon within the West Greenland area is thought to be extremely low compared to historical levels. Status of stocks in the NEAC and NAC areas are presented in the relevant commission sections (Sections 3 and 4).

The Working Group noted that an exploitation rate for North American non-maturing 1SW fish at West Greenland can be calculated by dividing the recorded harvest of 1SW salmon at West Greenland by the PFA estimate for the corresponding year for North American salmon. These exploitation rates in the most recent five years have averaged around 3.7% with an increase noted in the most recent two years where data were available (Figure 5.1.1).

5.2 Management objectives

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

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

Although not a formal management objective, ICES also provides the probability of returns to North America being equal or less than the previous five-year average.

5.3 Reference points

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

Conservation limits for the West Greenland fishery for North America are limited to 2SW salmon and southern European stocks are limited to MSW fish because fish at West Greenland are primarily (> 90%) 1SW non-maturing salmon destined to mature as either 2SW or 3SW salmon. The 2SW spawner limits of salmon stocks from North America total 152 548 fish, with 123 349 required in Canadian rivers and 29 199 in USA rivers (see Section 4.3). The current conservation limit estimate for Southern European MSW stocks is approximately 261 000 fish (see Section 3.3.2). There is still considerable uncertainty in the conservation limits for European stocks and estimates may change from year to year as the input of new data affects the pseudo-stock-recruitment relationship.

Spawner escapement reserve (SER) is the number of salmon at West Greenland required to ensure that returns to a region the following year achieve region-specific conservation requirements. To calculate SER, expected losses from natural mortality over the migration time from West Greenland to home rivers (8 months for Southern Europe and 11 months for North America) are added to regional conservation limits (Table 5.3.1).

5.4 Management advice

The management advice for the West Greenland fishery for 2009 is based on the models used by the Working Group since 2003. The Working Group followed the process developed in previous years for providing management advice and catch options for West Greenland using the PFA and conservation limits of the NAC and NEAC areas. The risks of the Greenland fishery to NAC and NEAC stock complexes are developed in parallel and combined into a single catch option table (Table 5.4.1.1).

5.4.1 Catch options for West Greenland

None of the stated management objectives which would allow a fishery at West Greenland would be met in 2009, 2010, or 2011.

In the absence of any marine fishing mortality, there is a very low probability (<2% to 3 %) that the returns of 2SW salmon to North America in 2010, 2011, and 2012 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 5.4.1.1). There is essentially no chance (near zero probability) that the returns in the southern regions (Scotia-Fundy and USA) will be greater than the returns observed in the 1992–1996 base period in any of the three years. Lastly, in the absence of a fishery, the probability that returns in all regions of North America will decline further from the average of the period 2004 to 2008 is 0.45 for 2009, 0.45 for 2010, and 0.42 for 2011 (Table 5.4.1.2).

In the absence of any fisheries, there is only a 54% chance that the MSW conservation limit for southern Europe will be met in 2009 (Table 5.4.1.1). For 2010 and 2011, the probability that the MSW returns for southern Europe will meet or exceed the conservation limit in the absence of fisheries declines to 0.49 and 0.36, respectively (Tables 5.4.1.1).

5.5 Relevant factors to be considered in management

The management for all fisheries should be based upon assessments of the status of individual stocks. Fisheries on mixed stocks, particularly in coastal waters or on the high seas, pose particular difficulties for management as they cannot target only stocks that are at full reproductive capacity if there are stocks below conservation limits within the mixed stock being fished. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and especially rivers are more likely to meet this requirement.

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

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 2SW fish. The primary MSW European stocks contributing to the fishery in West Greenland are thought to originate from the southern stock complex, although low numbers may originate from other stock complexes. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland. Previous spawners, including salmon that spawned first as 1SW and 2SW salmon also contribute to the fishery.

5.6 Prefishery abundance forecasts 2009, 2010, 2011

Two forecasts for each area (NEAC Section 3.6 and NAC Section 4.9) are presented; one based on the previous models used by the Working Group (the regression forecast model for NEAC and the phase shift model for NAC) and one on the newly developed Bayesian forecast models (Section 2.3). Further details on the models used and their application are in Section 5.9. The PFA forecasts for the West Greenland stock complex are among the lowest in the time-series (Figures 4.9.10.6 and 3.6.3.3).

5.6.1 North American stock complex

The PFA_{NA} forecast for 2009 from the phase shift model has a median value of 107 500 (Table 4.9.10.5.2). For 2010 and 2011, the PFA_{NA} forecasts remain among the lowest in the time-series. For 2010, the median value is 107 300 fish and is highly unlikely to meet the 2SW spawner reserve of 212 189 salmon to North America. For 2011, the median forecast value is 110 200, also highly unlikely to meet the 2SW spawner reserve to North America (Table 4.9.10.5.2). These values are all below the spawning escapement reserve for North America.

5.6.2 Southern European MSW stock complx

The southern European PFA forecast for 2009 has a median value of 431 220 (Table 3.6.1.2). The spawning escapement to southern Europe MSW stocks has not exceeded conservation limits throughout most of the time period (Figure 3.1.1). The PFA for the NEAC MSW southern stock complex is expected to decline in 2010 and 2011 (Figure 3.6.3.3.). For 2010, the median value is 419 733 fish and for 2011, the median forecast value is 392 235 fish. It is unlikely that spawner escapement reserves (501 086) will be met in either year.

5.7 Comparison with previous assessment and advice

The management advice for the West Greenland fishery for 2009 is based on the models previously used by the Working Group. The current modelling approach has provided stable comparisons of the previous year predictions. For 2009, the median value of the updated analysis from the phase shift model for NAC has decreased to 107 500 fish from the 114 200 predicted in the 2007 assessment analysis. The variability of the two predictions was similar. The revised forecast from the regression model of the southern NEAC MSW PFA for 2009 provides a PFA mid-point of 483 700. This is close to the value forecast last year at this time of 489 000.

The forecasts for 2009 to 2011 for NAC based on the regionally disaggregated Bayesian model (Section 2.3; Section 4.9.10.5) are more optimistic in terms of the median expectations (Figure 3.6.3.3 and Table 4.9.10.5.2) but the 25th percentile of the Bayesian credible intervals from this model remain below 110 000 fish. The 25th percentile of the distribution in the posterior forecast predictions represents the 75% threshold for evaluating stock status relative to conservation limits.

For the southern NEAC, the 25th percentile of the posterior distributions of the forecasts of an alternate Bayesian model are below the SER for 2009 to 2011 (Figure 3.6.33.3). The working group noted that, while the levels of uncertainty are greater in the Bayesian model, both the regression forecast model and the Bayesian forecast model provide similar predictions of the lower bound of the forecast values in the three years of interest.

5.8 NASCO has requested ICES to describe the events of the 2008 fishery and status of the stocks

International Sampling Program

The international sampling program for landings at West Greenland initiated by NASCO in 2001 was continued in 2008. The sampling teams from Canada, Ireland, UK (Scotland), UK (England & Wales), and USA were in place at the start of the fishery and continued through October. Additionally, staff from the Greenland Institute of Natural Resources assisted with the overall coordination of the program and sampling in Nuuk.

In addition to the Baseline Sampling Program described above, an 'Enhanced Sampling Program' (SALSEA West Greenland) was developed to conduct broader and more detailed sampling on a fixed number of fish harvested from the waters off West Greenland. It was designed to be integrated within the baseline sampling program. Individual fishermen were to be contracted to provide an agreed number of fresh whole fish on a reliable schedule in support of this program.

Both baseline sampling and enhanced sampling were to be conducted on these fish. The enhanced samples to be collected were:

- Counts and preservation of sea lice
- Preserved gill, pyloric caeca, spleen, kidney tissue samples for disease analysis
- Preserved muscle tissue for lipid content analysis
- Preserved liver, dorsal muscle, caudal fin and scales samples for stable isotope analysis
- Preserved ovaries for sea age-at-maturity
- Preserved stomachs for feeding ecology studies

- Preserved intestines, pyloric caeca, gill arch, liver, spleen, kidney for parasite analysis
- Preserved otoliths for elemental analysis

Concerns were raised by the North Atlantic Salmon Fund, the Atlantic Salmon Federation and the Organization of Fishermen and Hunters in Greenland that the Enhanced Sampling Program could result in an increased harvest for the internal use only fishery. They were concerned that these activities would counteract their efforts to reduce the annual harvest of salmon in Greenland under the North Atlantic Salmon Conservation Agreement. A solution to this disagreement was not reached prior to the 2008 sampling program and unfortunately no samples were collected under the Enhanced Sampling Program. Efforts are underway to develop a workable solution to ensure that the Enhanced Sampling Program can be implemented in 2009 with the full cooperation of all participating parties.

5.8.1 Catch and effort in 2008

A total of 26 t of salmon were reported during the 2008 fishery (Table 5.8.1.1). Catches were distributed among the six NAFO divisions on the western coast of Greenland (Figure 5.8.1.1), with approximately 60% of the catches coming from Divisions 1B–1E (Table 5.8.1.2). There is presently no quantitative approach for estimating the unreported catch but the 2008 value is likely to have been at the same level proposed in recent years (10 t).

Seasonal distribution of catches has previously been reported through ICES. However, data to support this breakdown are no longer available as the fishing date is not required and some reported landings represent catches occurring on multiple days. As such, the seasonal distribution of reported landings is no longer provided.

In total, 259 reports were received by the Fisheries license office in 2008. Reports were provided by 143 people with 4 of these reporting 0 catch. The number of fishermen reporting catches has steadily increased from a low of 41 in 2002 to its current level. These levels remain well below the 400–600 people reporting landings in the commercial fishery from 1987 to 1991. Since October 2006, the Greenland Home Rule License Office has broadcast TV requests that catch reports be submitted for the season. Thus, it is possible that the increase in the number of people reporting catches, and hence the increased reported landings, reflect changes in reporting practices versus increased harvest.

The Working Group recommends that in addition to the information currently requested, fishermen also be requested to provide information on catch site, catch date, numbers of nets, net dimensions, and numbers of hours the nets were fishing when submitting their catch logs. These data will help characterize the nature and extent of the current fishery.

5.8.2 Biological characteristics of the catches

Tissue and biological samples were collected from three landing sites: Sisimiut (NAFO Div. 1B), Nuuk (NAFO Div. 1D), and Qaqortoq (NAFO Division 1F, Figure 5.8.1.1). In total 2086 salmon were inspected for the presence of tags, representing 29 % by weight of the reported landings. Of these, 1866 were measured for fork length and weight (Table 5.8.2.1). Scales samples were taken from 1866 salmon for age and origin determination and tissue was removed from 1865 for DNA analysis, 1853 samples of which were subsequently used for assignment to continent of origin. The broad geographic distribution of the subsistence fishery caused practical problems for the sampling teams. However, temporal coverage was adequate to assess the fishery.

As in previous years, the Working Group needed to adjust the total landings by replacing the reported catch with the weight of fish sampled for use in assessment calculations (Table 5.8.2.2). In 2008 this adjustment was necessary in two NAFO Divisions (1D and 1F) and represented an increase of 2.5 t.

The average weight of fish from the 2008 catch was 3.08 kg across all ages, with North American 1SW fish averaging 64.6 cm and 3.04 kg whole weight and European 1SW salmon averaging 63.9 cm and 3.03 kg (Table 5.8.2.3). The mean lengths and mean weights for the 2008 samples are an increase over the 2007 values, but remain close to the previous 10 year mean. It should be noted that the size data is not adjusted for standard week and may not represent a true increase.

North American salmon up to river age 6 were caught at West Greenland in 2008 (Table 5.8.2.4), with 25.1%, 51.9% and 16.8% being river ages 2, 3 and 4 respectively. The river ages of European salmon ranged from 1 to 4 (Table 5.8.2.4). Almost three-quarters (72.8%) of the European fish in the catch were river-age 2 and 19.3% were river age 3. The percentage of the European origin river age 1 salmon was 7.0%, the same as in 2007 and the second lowest in the time-series (Table 5.8.2.4).

In 2008, the North American samples were 97.4 % 1SW salmon, 0.5% 2SW and 2.2% previous spawners (Table 5.8.2.5). The European samples were 98.8% 1SW salmon, 0.5% 2SW and 1.9% previous spawners (Table 5.8.2.5).

5.8.3 Continent of origin of catches at West Greenland

Of the 1865 samples collected for genetic characterization, most (1853) were genotyped at between seven and ten microsatellites and assigned to a continent of origin. In total, 86% of the salmon sampled from the 2008 fishery were of North American origin and 14% fish were of European origin.

The division-specific and overall continent of origin assignments for the samples collected in 2008 are listed below. The Working Group recommends a broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery.

	North America		Europe	
NAFO division	Number	%	Number	%
1B	483	85%	84	15%
1D	660	87%	97	13%
1F	450	85%	79	15%
Total	1593	86%	260	14%

Applying the continental percentages for the NAFO division catches resulted in estimates of 24.6 t of North American origin and 4.0 t of European origin fish (8000 and 1300 rounded to the nearest 100 fish, respectively) landed in West Greenland in 2008 (Table 5.8.3.1).

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

MSW stocks from North America and southern Europe contribute to the fishery at West Greenland. The percentage of North American salmon in the West Greenland catch has averaged approximately 70% from 2000–2008 (Table 5.8.3.1).

5.8.4.1 North American stock

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has declined since the 1970s (Figure 4.9.10.2.2). During 1994–2007, the total population of 1SW and 2SW Atlantic salmon was about 500 000–600 000 fish, about half of the average abundance during 1972–1990. The decline from earlier higher levels of abundance has been more severe for the 2SW salmon component than for the small salmon (maturing 1SW salmon) age group.

In most regions, the returns of 2SW fish in 2008 increased from 2007, however, they are still less than the median of the recent 30-year time-series (1979–2008). In 2008, the estimated overall spawning escapement was below the conservation limit for the stock complex. Specifically 2SW spawners in the regions are:

- **Newfoundland:** suffering reduced reproductive capacity (98% of 2SW CL)
- **Labrador**: suffering reduced reproductive capacity (50% of 2SW CL)
- **Québec**: suffering reduced reproductive capacity (74% of 2SW CL)
- **Gulf of St. Lawrence**: suffering reduced reproductive capacity (56% of 2SW CL)
- **Scotia-Fundy:** suffering reduced reproductive capacity (12% of 2SW CL)
- **United States:** suffering reduced reproductive capacity (7% of 2SW CL)

5.8.4.2 Southern European stock

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

- **Southern European stock complex:** at risk of suffering reduced reproductive capacity (102% of MSW CL)

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

5.9.1 Run-reconstruction models

The run-reconstruction models 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 follow the same structure as used since 2003 (ICES, 2003, 2004, 2005, 2006) but incorporated the recommendations from ICES 2008 to improve the models. Specifically, unreported catch at West Greenland is used only when provided. As well, returns, spawners, lagged spawners and PFA abundance distributions are constructed with Monte Carlo simulations. Additional details are provided in Sections 4.9.10 and 3.8.9.

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

The forecast models to estimate pre-fishery abundance of non-maturing 1SW salmon from the southern NEAC complex and for the NAC area used by ICES since 2002 were used again in this assessment. The overall approach for the southern NEAC model is to select the best model by adding variables (e.g. spawners, habitat, PFA of maturing 1SW salmon and year) until addition of any other parameter was not significant. See Section 3.6 for details.

The forecast models used to estimate pre-fishery abundance of non-maturing 1SW salmon (potential MSW) for North America were the same as those used since 2004. The overall approach of modelling the natural log transformed PFA_{NA} and LS_{NA} using linear regression and the Monte Carlo method used to derive the probability density for the PFA_{NA} forecast was also retained from previous years. See Section 4.9.10 for details.

In addition, the Working Group reviewed alternate models for both the NAC and southern NEAC areas. For NAC, a regionally-disaggregated random walk model for 2SW salmon was developed whereas a combined 1SW cohort model was developed and used for the southern NEAC complex. Details of the model structures and the differences between these new models and those previously used by the Working Group are provided in Section 2.3.

The alternate models examined by the Working Group are based on established approaches and a consistent Bayesian framework, which allows complex dynamics to be modelled, uncertainties accounted for and learning from previous experience, or use of other prior information. The forecasts from these alternate models provided higher median estimates of PFA but the conclusions on the probabilities of meeting the management objectives for both the NAC and southern NEAC 1SW non-maturing complex are similar to those from the ICES models; there are no catch options which provide a 75% chance of attaining the management objectives.

5.9.3 Development and risk assessment of catch options

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

The risk assessment for the two stock complexes in the West Greenland fishery is developed in parallel and then combined at the end of the process into a single summary plot or catch options table (Figure 5.9.3.1). The primary inputs to the risk analysis for the complex at West Greenland are:

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

The uncertainty in the PFA_{NA} and PFA_{NEAC} is accounted for in the approaches described below. 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 2009 to 2011 fisheries, it was assumed that the parameters for $Wt1SW_{NA}$ (2.89–3.19 kg), $Wt1SW_{E}$ (2.87–3.33 kg), $prop_{NA}$ (0.69–0.86), and the ACF (1.0245–1.0985) could vary uniformly within the values observed in the past five years.

For a level of fishery under consideration, the weight of the catch is converted to fish of each continent's origin and subtracted from one of the simulated forecast values of PFA_{NA} and PFA_{NEAC}. The fish that escape the Greenland fishery are immediately discounted by the fixed sharing fraction (Fna) historically used in the negotiations of the West Greenland fishery. The sharing fraction chosen is the 40:60 West Greenland:North America split. The same sharing arrangement was assumed for NEAC stocks. Any sharing fraction can be considered and incorporated at this stage of the risk assessment. After the fishery, fish returning to home waters are discounted for natural mortality from the time they leave West Greenland to the time they return to rivers. For North America this is a total of 11 months at a rate of M = 0.03 (equates to 28.1% mortality). For Southern European stocks this is a total of 8 months at a rate of M = 0.03 (equates to 21% mortality). The fish that survive to North American homewaters are then distributed among the regions and the total fish escaping to each region are 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, 2004 to 2008. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and USA are compared to the objective of achieving an increase of 10% and 25% relative to average returns of the base period, 1992–1996.

5.9.4 Critical evaluation

Changes to the run-reconstruction and pre-fishery abundance forecast models have been critically examined in Sections 3.8 and 4.9. There were no changes to the risk assessment of the catch options model. However, the Working Group examined alternate models for both the NAC and NEAC areas in order to improve information leading to management advice and to begin exploring hypotheses of recruitment dynamics of Atlantic salmon. The alternate models examined by the Working Group are fitted and forecasts derived in a single consistent Bayesian framework that allows complex dynamics to be modelled, incorporating uncertainties and learning from previous experience or use of other prior information.

At this time, the models used by the Working Group and the alternate models examined during this assessment provide a similar characterization of the status and expectations for Atlantic salmon in the north Atlantic. Compared to the models used to date by the Working Group, the Bayesian models provide more flexibility, are consistent with the emerging emphasis on such approaches in natural resource assessment, and can provide management advice consistent with the probability of achieving management objectives. These models and approaches will continue to be an area of development and application at ICES.

5.10 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

NASCO management is directed at reducing exploitation to allow river specific conservation limits to be achieved. The first measurable outcome of management at West Greenland is that the exploitation in the fishery has declined (Figure 5.1.1). The other measures relate to increasing spawning escapement in homewaters. Although influenced by measures taken in homewaters, it is possible to directly evaluate the extent to which management at West Greenland successfully achieved the objectives (Table 5.10.1).

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

5.11 NASCO has asked ICES to update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

In 2007, ICES developed and presented to NASCO a framework of indicators (FWI) which could be used in interim years to determine if there is an expectation that the previously provided management advice for the Greenland fishery is likely to change in subsequent years (Figure 5.11.1). A significant change in management advice would be an unforeseen increase in stock abundance to a level that would allow a fishery in the case where no catch had been previously advised or a decrease in stock abundance when catch options had been chosen. The finalized FWI was accepted by NASCO in June 2007 and applied in January 2008 to determine if a re-assessment for the 2008 fishing year was advised given the information from indicator stocks.

As the 2009 assessment begins the cycle of forecasting and catch advice for the 2009 to 2011 fishing years, ICES has been asked to update the FWI in support of the multi-year catch advice and the potential approval of multi-year regulatory measures. Under the current management agreement, if the output from the FWI is accepted at the 2009 NASCO meeting it will be applied for January 2010 for the 2010 fishery and January 2011 for the 2011 fishery.

5.11.1 Update of the Framework of Indicators for the 2009 to 2011 multi-year catch advice at West Greenland

The Working Group updated the FWI in support of the West Greenland fishery management. The update consisted of:

- Adding the values of the indicator variables for the most recent years
- Running the objective function spreadsheet for each indicator variable and the variable of interest relative to the management objectives
- Quantifying the threshold value for the indicator variables and the probabilities of a true high state and a true low state for those indicator variables retained for the framework
- Revising/adding the indicator variables and the functions for evaluating the indicator score to the framework spreadsheet
- Providing the spreadsheet for doing the framework of indicators assessment.

The variables of interest data series for the six geographic areas of North America and for the southern NEAC MSW complex are presented in Table 5.11.1.1. The management objectives for the development of the catch options for the West Greenland fishery are presented in Table 5.11.1.2.

Based on the objective function spreadsheet and the criteria established by the Working Group, a total of 35 indicator variables, represented by 23 different rivers, were retained for the North American Commission area. Of these, six were return rate indicators of hatchery fish, while the remainder were of wild 2SW or large salmon (N = 19), wild 1SW or small salmon (N = 15) or all (N = 1) returns to rivers (see below).

Summary of indicator variables retained from North America							
Origin	Wild	Wild	Wild	Wild	Hatchery	Hatchery	
Type of data	Return	Return	Survival	Survival	Survival	Survival	
Size/age group	Small/1SW	Large/2SW/ MSW	Small/1SW	Large/2SW	Small/1SW	Large/2SW	Total
Labrador							0
Newfoundland	5						5
Quebec		9					9
Gulf	1	2					3
Scotia-Fundy	5	4			2	2	13
US[1]	1	2[2]			1	1	5
Total	12	17			3	3	35

[1] for US, returns include both wild and hatchery origin fish

[2] in one river (Narraguagus), returns are of all age/size groups combined

Summaries of the indicator variables retained for the 2009 to 2011 multi-year catch advice indicator framework are provided in Table 5.11.1.3. No indicator variables were retained for the Labrador area and for southern NEAC non-maturing complex. All the retained indicator variables had a probability of identifying a true low state or a true high state of at least 80% (Figure 5.11.1.1), as recommended by the Working Group.

5.11.2 Application of the framework indicator spreadsheet for signalling whether a significant change in management advice may occur for the fisheries in 2010 and 2011

The updated FWI spreadsheet is shown in Figure 5.11.2.1. The framework provides one of two conclusions for the user:

1) no significant change identified by the indicators;

2) reassess.

If no significant change has been identified by the indicators, then the multi-year catch advice for the year of interest could be retained. If a significant change is signalled by the indicators, the response is to reassess.

The framework spreadsheet is designed to capture both fishing and non-fishing scenarios, i.e.:

- multi-year advice provides no catch options greater than zero but indicators are suggesting that the management objectives may be met (conclusion: Reassess),
- multi-year advice provides catch options greater than zero but the indicators suggest the management objectives may not be met (conclusion: Reassess).

The FWI spreadsheet will be updated with the returns or return rate data for 2009 to evaluate the appropriateness of the 2010 advice, and with the returns or return rate data for 2010 to evaluate the appropriateness of the 2011 advice. It is anticipated that the data for the indicator variables to populate the framework would be available in January of the year of interest. The framework will be updated whenever a new set of multi-year catch advice is provided. Figure 5.11.1 illustrates the timeline of how the FWI would operate.

Applying the framework

There are two steps required by the user to run the framework. The first step in the framework evaluation is to enter the catch advice option for the West Greenland fishery (t). This feature provides the two way evaluation of whether a change in management advice may be expected and a reassessment would be required. The second step is to enter the values for the indicator variables in the framework for the year of interest. The spreadsheet evaluation update is automated and the conclusion is shown in the row underneath "Overall Recommendation".

Framework features

The framework spreadsheet contains a number of cells with quantities used to evaluate the indicator variables and the attainment of management objectives. This information could be used to evaluate in a qualitative sense the state of the river-specific salmon stocks relative to the threshold values, which would infer that the management objectives would be met or not met for the geographic area. An understanding of these variables is not required to run the framework spreadsheet, as they are locked and not available to the user.

The conclusions from the framework evaluation are based on whether there is simultaneous achievement of the management objectives in the six stock areas of North America and the southern NEAC non-maturing complex (Figure 5.11.2.1). If there are no indicator variables for a geographic area, the attainment of the management objectives is evaluated as unknown and that area or complex is not used in the decision structure of the framework.

Within the geographic areas for which indicator variables are retained, all the available indicators are used to assess the indicator score. If an update value for an indicator variable is not available for the year of interest evaluation, the indicator variable is not used to quantify the indicator score for that area.

The indicator variables within a geographic area may be in different indicator states relative to the achievement of the management objective for the area. For example, in Figure 5.11.2.1 for the Quebec area, the indicator variable defined as the large salmon returns to River de la Trinité suggests that the management objective for Quebec may be met (indicator score = +1) but another indicator variable (large returns to Cascapédia) suggests that the management objective will not be met (indicator score = -1).

The overall indicator score for the geographic area is used to determine if the management objectives could be met. Multiple indicators within the stock complex groupings are combined by arithmetic average of the product of the indicator value (-1, +1) and the probability of a correct assignment corresponding to the true low or true high states. An average geographic area or stock complex score equal to or greater than zero would suggest there is a likelihood of meeting the management objective for that grouping based on the historic relation between the variable of interest (adult returns to a geographic area or PFA) and the indicators evaluated. An indicator variable with a very strong power of resolution for a true low or true high state (for example geographic area Scotia-Fundy, Saint John River large salmon returns, probability of true low = 100%, probability of a true high = 96%) will have more weight in the derivation of the area score than an indicator variable of lower resolving power (for example geographic area Scotia-Fundy, Saint John 2SW Survival for hatchery, probability of true low = 82%, probability of true high = 88%) (Figure 5.11.2.1).

Table 5.3.1. A – Lagged spawners achieved, 2SW conservation limits and the PFA number of fish required to meet region specific conservation limits if the returns to the regions are in proportion to the average lagged spawner distributions of 2002 to 2006. B – 2SW returns to the regions of North America for two time periods, 1992–1996, 2002–2006. C – Management objectives for the NAC area used to develop the risk analysis of catch options for the 2007 to 2009 fisheries.

Achieved lagged spawners by PFA year

PFA Year	Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
	Region						
2004	10100	6243	18800	14140	2792	1518	53590
2005	10030	6060	19610	18680	3284	878	58540
2006	12620	3798	19560	19430	2063	960	58430
2007	14080	2577	17990	16970	2203	1234	55060
2008	12220	2976	20340	22590	2777	1159	62050
Average	11810	4331	19260	18362	2624	1150	57534
Prop. of total	0.205	0.075	0.335	0.319	0.046	0.020	
			2SW Conservation Limit				
Number of fish	34,746	4,022	29,446	30,430	24,705	29,199	152,548
Prop. of NA	0.228	0.026	0.193	0.199	0.162	0.191	
Spawner Reserve corrected for 11 months of M at 0.03 per month							212,189
PFA required to meet regional 2SW requirements based on average spawner distribution from 2004 to 2008	235,449	72,125	118,736	128,705	731,252	1,972,303	

2SW Returns to regions

		Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
	1992-1996	14,828	5,217	46,380	35,504	8,781	2,038	112,748
B	2004-2008	17,722	4,255	27,222	21,638	2,261	1,202	74,300

Management objectives for NAC area

	Region				Region		
	Labrador	**Newfoundland**	**Quebec**	**Gulf**	**Scotia-Fundy**	**US**	
	2SW Conservation Limit (number of fish)				**Average returns**		
C					Base years 1992-1996		
	34,746	4,022	29,446	30,430	8,781	2,038	
	2SW Conservation Limit				**Increase relative to base years**		
					9,659	**2,242**	**+10%**
	98,644				**10,976**	**2,548**	**+25%**

Table 5.4.1.1. Catch options (t) for West Greenland harvest in 2009, 2010, and 2011 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2009				
West Greenland	Simultaneous	Improvement (SF, USA)		Conservation
Harvest	Conservation	of Returns		MSW Salmon
(t)	(Lab, NF, Queb, Gulf)	> 10%	> 25%	Southern NEAC
0	0.021	0.000	0.000	0.539
5	0.019	0.000	0.000	0.534
10	0.016	0.000	0.000	0.530
15	0.015	0.000	0.000	0.525
20	0.013	0.000	0.000	0.520
25	0.011	0.000	0.000	0.514
30	0.010	0.000	0.000	0.509
35	0.008	0.000	0.000	0.505
40	0.007	0.000	0.000	0.499
45	0.006	0.000	0.000	0.495
50	0.006	0.000	0.000	0.488
100	0.003	0.000	0.000	0.438
2010				
West Greenland	Simultaneous	Improvement (SF, USA)		Conservation
Harvest	Conservation	of Returns		MSW Salmon
(t)	(Lab, NF, Queb, Gulf)	> 10%	> 25%	Southern NEAC
0	0.023	0.000	0.000	0.490
5	0.021	0.000	0.000	0.486
10	0.018	0.000	0.000	0.480
15	0.015	0.000	0.000	0.475
20	0.013	0.000	0.000	0.472
25	0.012	0.000	0.000	0.466
30	0.010	0.000	0.000	0.460
35	0.010	0.000	0.000	0.455
40	0.008	0.000	0.000	0.450
45	0.007	0.000	0.000	0.444
50	0.007	0.000	0.000	0.440
100	0.003	0.000	0.000	0.395

Cont.

Table 5.4.1.1. Continued. Catch options (t) for West Greenland harvest in 2009, 2010, and 2011 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2011				
West Greenland	Simultaneous	Improvement (SF, USA)		Conservation
Harvest	Conservation	of Returns		MSW Salmon
(t)	(Lab, NF, Queb, Gulf)	> 10%	> 25%	Southern NEAC
0	0.027	0.000	0.000	0.356
5	0.024	0.000	0.000	0.353
10	0.022	0.000	0.000	0.349
15	0.019	0.000	0.000	0.345
20	0.018	0.000	0.000	0.342
25	0.016	0.000	0.000	0.336
30	0.014	0.000	0.000	0.333
35	0.012	0.000	0.000	0.329
40	0.011	0.000	0.000	0.324
45	0.010	0.000	0.000	0.320
50	0.009	0.000	0.000	0.315
100	0.003	0.000	0.000	0.274

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

(SF, USA) = Scotia-Fundy and USA

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

Table 5.4.1.2. Probability of 2SW returns in 2009, 2010, and 2011 being less than the previous five-year average (2004–2008) returns to regions of North America, relative to catch options at West Greenland.

West Greenland Harvest	2009	2010	2011
Tons	Probability	Probability	Probability
0	0.453	0.451	0.418
5	0.490	0.488	0.452
10	0.526	0.528	0.491
15	0.558	0.562	0.528
20	0.593	0.596	0.563
25	0.626	0.630	0.595
30	0.659	0.657	0.626
35	0.689	0.686	0.655
40	0.717	0.712	0.683
45	0.743	0.737	0.708
50	0.766	0.760	0.734
100	0.918	0.915	0.905

Table 5.8.1.1 Nominal catches of salmon, West Greenland 1971–2008 (metric tons round fresh weight).

Year	Total	Quota	Comments
1971	2689	-	
1972	2113	1100	
1973	2341	1100	
1974	1917	1191	
1975	2030	1191	
1976	1175	1191	
1977	1420	1191	
1978	984	1191	
1979	1395	1191	
1980	1194	1191	
1981	1264	1265	Quota set to a specific opening date for the fishery
1982	1077	1253	Quota set to a specific opening date for the fishery
1983	310	1191	
1984	297	870	
1985	864	852	
1986	960	909	
1987	966	935	
1988	893	840	Quota for 1988–90 was 2520 t with an opening date of August 1. Annual catches were not to exceed an annual average (840 t) by more than 10%. Quota adjusted to 900 t in 1989 and 924 t in 1990 for later opening dates.
1989	337	900	
1990	274	924	
1991	472	840	
1992	237	258	Quota set by Greenland authorities
1993		895	The fishery was suspended
1994		137	The fishery was suspended and the quotas were bought out
1995	83	77	
1996	92	174	Quota set by Greenland authorities
1997	58	57	
1998	11	206	
1999	19	206	
2000	21	206	
2001	43	114	Final quota calculated according to the *ad hoc* management system
2002	9	55	Quota bought out, quota represented the maximum allowable catch (no factory landing allowed), and higher catch figures based on sampling programme information are used for the assessments
2003	9		Quota set to nil (no factory landing allowed), fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information are used for the assessments
2004	15		same as previous year
2005	15		same as previous year

Year	Total	Quota	Comments
2006	22		Quota set to nil (no factory landing allowed) and fishery restricted to catches used for internal consumption in Greenland
2007	25		Quota set to nil (no factory landing allowed), fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information are used for the assessments
2008	26		same as previous year

Table 5.8.1.2 Distribution of nominal catches (rounded to nearest metric ton) by Greenland vessels (1977-2008).

	NAFO Division							West	East	Total
Year	1A	1B	1C	1D	1E	1F	NK	Greenland	Greenland	Greenland
1977	201	393	336	207	237	46	-	1 420	6	1426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1 395	+	1395
1980	52	275	404	231	158	74	-	1 194	+	1194
1981	105	403	348	203	153	32	20	1 264	+	1264
1982	111	330	239	136	167	76	18	1 077	+	1077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993 [1]	-	-	-	-	-	-	-	-	-	-
1994 [1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	5	-	15	-	15
2006	6	2	3	4	2	4	-	22	-	22
2007	2	5	6	4	5	2	-	25	-	25
2008	5	2	10	2	2	5	-	26	-	26

[1] The fishery was suspended

+ Small catches <0.5 t

- No catch

Table 5.8.2.1. 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 2002–2008).

		Sample Size			Continent of origin (%)			
Source		Length	Scales	Genetics	NA	(95%CI)[1]	E	(95%CI)[1]
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	501	68		32	
	2003	1743	1743	1779	68		32	
	2004	1639	1639	1688	73		27	
	2005	767	767	767	76		24	
	2006	1209	1209	1193	72		28	
	2007	1116	1110	1123	82		18	
	2008	1854	1866	1853	86		14	

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

[2] During 1978 Fishery

[3] Research samples after 1978 fishery closed

Table 5.8.2.2. Reported landings provided by the Home Rule Government at West Greenland Atlantic salmon fisheries (kg) by NAFO Division for the 2002–2008 and adjusted landings for divisions where the sampling teams observed more fish landed than were reported.

Year		NAFO Division						
		1A	1B	1C	1D	1E	1F	Total
2002	Reported	14	78	2100	3752	1417	1661	9022
	Adjusted						2408	9769
2003	Reported	619	17	1621	648	1274	4516	8694
	Adjusted			1782	2709		5912	12 312
2004	Reported	3476	611	3516	2433	2609	2068	14 712
	Adjusted				4929			17 209
2005	Reported	1294	3120	2240	756	2937	4956	15 303
	Adjusted				2730			17 276
2006	Reported	5427	2611	3424	4731	2636	4192	23 021
	Adjusted							
2007	Reported	2019	5089	6148	4470	4828	2093	24 647
	Adjusted						2252	24 806
2008	Reported				1595		4979	26 147
	Adjusted				3577		5478	28 627

Table 5.8.2.3. Annual mean whole weights (kg) and fork lengths (cm) of Atlantic salmon caught at West Greenland 1969–1992 and 1995–2008. NA = North America; E = Europe.

	Whole weight (kg) Sea age & origin									Fork length (cm) Sea age & origin					
	1SW		2SW		PS		All sea ages		TOTAL	1SW		2SW		PS	
	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	6.90	2.63	2.84	2.71	62.3	63.6	85.7	84.0	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	-	4.20	-	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	3.00	63.1	63.7	81.7	79.1	75.3	72.1
2002	2.84	2.92	7.12	-	5.00	-	2.89	2.92	2.90	62.6	62.1	83.0	-	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	88.0
2005	3.19	3.33	7.05	4.19	4.31	2.89	3.31	3.33	3.31	65.9	66.4	83.3	75.5	73.7	62.3
2006	3.10	3.25	9.72		5.05	3.67	3.25	3.26	3.24	65.3	65.3	90.0		76.8	69.5
2007	2.89	2.87	6.19	6.47	4.94	3.57	2.98	2.99	2.98	63.5	63.3	80.9	80.6	76.7	71.3
2008	3.04	3.03	6.35	7.47	3.82	3.39	3.08	3.07	3.08	64.6	63.9	80.1	85.5	71.1	73.0

Table 5.8.2.4. River age distribution (%) and mean river age for all North American and European origin salmon caught at West Greenland 1968–1992 and 1995–2008.

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	2,0	40,8	34,7	18,4	2,0	2,0	0	0
1974	0,9	36	36,6	12,0	11,7	2,6	0,3	0
1975	0,4	17,3	47,6	24,4	6,2	4,0	0	0
1976	0,7	42,6	30,6	14,6	10,9	0,4	0,4	0
1977	-	-	-	-	-	-	-	-
1978	2,7	31,9	43,0	13,6	6,0	2,0	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	19,0	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	47,0	32,6	12,7	3,7	0,8	0,1	0
1984	4,8	51,7	28,9	9,0	4,6	0,9	0,2	0
1985	5,1	41,0	35,7	12,1	4,9	1,1	0,1	0
1986	2,0	39,9	33,4	20,0	4,0	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	0,1	0
1989	7,9	39,0	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
1993	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-
1995	2,4	19,0	45,4	22,6	8,8	1,8	0,1	0
1996	1,7	18,7	46,0	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	4,0	35,1	37,0	16,5	6,1	1,1	0,1	0
1999	2,7	23,5	50,6	20,3	2,9	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	32,0	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	21,0	7,6	1,1	0	0
2004	1,9	19,1	51,9	22,9	3,7	0,5	0	0
2005	2,7	21,4	36,3	30,5	8,5	0,5	0	0
2006	0,6	13,9	44,6	27,6	12,3	1,0	0	0
2007	1,6	27,7	34,5	26,2	9,2	0,9	0	0
2008	0,9	25,1	51,9	16,8	4,7	0,6	0	0
Overall Mean	**2,8**	**31,8**	**39,0**	**18,2**	**6,9**	**1,2**	**0,1**	**0,0**

Table 5.8.2.4. cont. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland 1968–1992 and 1995–2008.

YEAR	1	2	3	4	5	6	7	8
					European			
1968	21,6	60,3	15,2	2,7	0,3	0	0	0
1969	0	83,8	16,2	0	0	0	0	0
1970	0	90,4	9,6	0	0	0	0	0
1971	9,3	66,5	19,9	3,1	1,2	0	0	0
1972	11,0	71,2	16,7	1,0	0,1	0	0	0
1973	26,0	58,0	14,0	2,0	0	0	0	0
1974	22,9	68,2	8,5	0,4	0	0	0	0
1975	26,0	53,4	18,2	2,5	0	0	0	0
1976	23,5	67,2	8,4	0,6	0,3	0	0	0
1977	-	-	-	-	-	-	-	-
1978	26,2	65,4	8,2	0,2	0	0	0	0
1979	23,6	64,8	11,0	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	18,0	61,7	17,4	2,7	0,3	0	0	0
1990	15,9	56,3	23,0	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
1993	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-
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	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	16,0	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	58,0	22,1	3,0	0,8	0	0	0
2004	18,3	57,7	20,5	3,2	0,2	0	0	0
2005	19,2	60,5	15,0	5,4	0	0	0	0
2006	17,7	54,0	23,6	3,7	0,9	0	0	0
2007	7,0	48,5	33,0	10,5	1,0	0	0	0
2008	7,0	72,8	19,3	0,8	0,0	0	0	0
Overall Mean	**18,1**	**61,1**	**17,8**	**2,7**	**0,3**	**0,0**	**0,0**	**0,0**

1 1995-1997 new percent based on scale characteristics from DNA database
2 1999 & 2001 new percent based on DNA database and scale database if DNA origins not known.
3 2002 - 2006 based on DNA only

Table 5.8.2.5. Sea-age composition (%) of samples from fishery landings at West Greenland, 1985–2008 by continent of origin.

	North American			European		
Year	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	96.8	0.5	2.7	99.4	0.0	0.6
1999	96.8	1.2	2.0	100.0	0.0	0.0
2000	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	2.6	0.5	97.8	2.0	0.3
2002	97.3	0.9	1.8	100.0	0.0	0.0
2003	96.7	1.0	2.3	98.9	1.1	0.0
2004	97.0	0.5	2.5	97.0	2.8	0.2
2005	92.4	1.2	6.4	96.7	1.1	2.2
2006	93.0	0.8	5.6	98.8	0.0	1.2
2007	96.5	1.0	2.5	95.6	2.5	1.5
2008	97.4	0.5	2.2	98.8	0.5	1.9

Table 5.8.3.1. The catch weighted numbers of North American (NA) and European (E) Atlantic salmon caught at West Greenland 1982-1992 and 1995-2008, the proportion of the catch by weight, and the PFA for non-maturing 1SW fish for North American and Southern European stock complexes. Numbers are rounded to the nearest hundred fish.

YEAR	NUMBERS OF			PROPORTION WEIGHTED	
	Salmon caught			bycatch in number	
	NA	E		NA	E
1971	291 166	565 204		34	66
1972	221 128	393 116		36	64
1973	274 423	285 624		49	51
1974	230 254	305 221		43	57
1975	286 282	364 359		44	56
1976	166 201	220 313		43	57
1977	199 065	243 302		45	55
1978	126 304	167 427		43	57
1979	208 832	208 832		50	50
1980	192 820	177 988		52	48
1981	235 256	163 483		59	41
1982	130 900	204 700		57	43
1983	314 900	302 500		40	60
1984	229 000	425 300		54	46
1985	291 200	56 5300		47	53
1986	221 200	393 200		59	41
1987	274 500	285 700		59	41
1988	230 300	305 300		43	57
1989	286 300	364 400		55	45
1990	166 300	220 400		74	26
1991	199 100	243 400		63	37
1992	126 400	167 500		45	55
1993	-	-	-	-	-
1994	-	-	-	-	-
1995	22 100	10 400		67	33
1996	23 400	8700		70	30
1997	17 200	4300		85	15
1998	3200	900		79	21
1999	5600	700		91	9
2000	5800	2500		65	35
2001	9900	4500		67	33
2002	2300	1100		72	28
2003	2800	1300		65	35
2004	4000	1500		72	28
2005	3700	1200		76	24
2006	4000	1800		69	31
2007	6100	1900		76	24
2008	8000	1300		86	14

Table 5.10.1. Assessing the objectives of management of the West Greenland fishery.

Country	Objective	Introduced	Assessment period	Measure Taken	Assessment	Outcome/extent achieved	Further consideration
West Greenland	Reduce harvest and exploitation.	1972	Annually	Quota for the commercial fishery is negotiated, and since 2002 has been zero. Consequently, the fishery at West Greenland has been restricted to that amount used for internal subsistence consumption in Greenland. 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.	Assessment, reported and unreported landings compared to negotiated catch quotas for the fishery.	There in no Commercial Fishery (quota set at nil). The internal consumption fishery has no quota.	Reporting rate for the internal consumption fishery and reported catch increased in 2008. Estimates of unreported catch are unchanged.
	75% chance of meeting the conservation limits simultaneously in the four northern regions of North America:Labrador, Newfoundland, Quebec, and Gulf.	2001	Annually	As above	Assessment of returns to North America. Run reconstruction to estimate overall returns (Sec. 4.9) related to estimated spawning escapement reserve at West Greenland.	This objective has not been achieved.	Fisheries should be further restricted where they take salmon from stocks which are below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc.
	75% chance of achieving increases in returns relative to 1992-1996 with the hope that this leads to the rebuilding Scotia-Fundy and USA stocks.	2004	Annually	As above	Assessment of returns to North America. Run reconstruction to estimate overall returns (Sec. 4.9). Improvements of greater than 10% and greater than 25% relative to returns are evaluated (Sec 4.9)	This objective has not been achieved.	Fisheries should be further restricted where they take salmon from stocks which are below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc. Recovery plans developed for the stocks listed as endangered/ at risk.
	75% chance of meeting spawner escapement requirement for the Southern NEAC MSW complex.	2005	Annually	As above	Assessment of returns to Southern NEAC. Run reconsruction to estimate overall returns (Sec. 3.3) related to estimated spawning escapement reserve at West Greenland.	This objective has not been achieved.	Fisheries should be further restricted where they take salmon from stocks which are below Conservation Limits. Examine other biologically limiting factors such as causes of increased or high marine mortality, habitat quality, by-catch, predators etc.

Table 5.11.1.1. Returns (25th percentile) of 2SW salmon to six geographic areas of NAC and the southern NEAC MSW PFA. For NAC geographic areas, the 25th percentile is calculated from the minimum and maximum ranges for each area, except for US where the values are point estimates.

Smolt year	Year of 1SW return	Year of 2SW return	USA	Scotia-Fundy	Gulf	Quebec	NFLD	LAB	Southern NEAC MSW PFA
1968	1969	1970		17,130	60,340	75,410	4,128	10,120	
1969	1970	1971	653	13,520	35,160	43,210	3,588	14,380	2,569,385
1970	1971	1972	1,383	15,990	48,650	56,360	3,728	12,380	2,415,144
1971	1972	1973	1,427	12,910	48,240	62,260	4,618	17,380	1,850,806
1972	1973	1974	1,394	27,130	68,210	83,470	3,641	17,140	2,079,825
1973	1974	1975	2,331	28,880	43,760	70,940	5,194	15,960	1,508,743
1974	1975	1976	1,317	26,640	40,710	70,530	4,347	18,320	1,401,511
1975	1976	1977	1,998	32,280	81,350	83,120	3,552	16,280	1,532,410
1976	1977	1978	4,208	18,790	36,630	74,720	3,592	12,710	1,104,456
1977	1978	1979	1,942	10,510	12,060	41,210	1,741	7,281	1,555,101
1978	1979	1980	5,796	38,630	59,190	98,160	3,908	17,420	1,657,324
1979	1980	1981	5,601	23,210	24,830	77,120	7,026	15,590	1,209,370
1980	1981	1982	6,056	16,740	43,150	68,370	3,165	11,590	1,407,884
1981	1982	1983	2,155	16,500	32,120	56,190	3,696	8,382	998,011
1982	1983	1984	3,222	21,490	29,940	51,920	3,365	5,985	1,166,790
1983	1984	1985	5,529	29,570	36,010	53,700	2,740	4,742	1,562,306
1984	1985	1986	6,176	21,280	57,140	63,860	3,263	8,192	1,178,603
1985	1986	1987	3,081	13,560	35,210	60,520	2,349	11,030	1,491,455
1986	1987	1988	3,286	11,710	42,000	66,150	3,430	6,912	1,359,297
1987	1988	1989	3,197	14,560	27,580	59,380	1,688	6,630	1,077,917
1988	1989	1990	5,051	11,600	36,430	58,310	2,694	3,825	759,722
1989	1990	1991	2,647	12,990	35,400	53,780	2,059	1,872	940,486
1990	1991	1992	2,459	11,940	37,380	54,110	8,159	7,531	817,418
1991	1992	1993	2,231	8,038	42,820	41,760	4,360	9,420	931,868
1992	1993	1994	1,346	5,148	29,840	42,440	4,051	12,930	884,618
1993	1994	1995	1,748	6,794	38,940	48,970	3,854	25,460	697,268
1994	1995	1996	2,407	9,147	28,540	44,620	5,659	18,800	532,513
1995	1996	1997	1,611	4,549	22,910	36,730	6,013	11,180	485,724
1996	1997	1998	1,526	2,595	14,550	28,090	6,443	11,083	498,768
1997	1998	1999	1,168	4,183	14,380	29,560	6,280	13,285	598,129
1998	1999	2000	533	2,372	15,370	28,380	6,382	18,105	576,471
1999	2000	2001	788	4,264	25,400	29,710	2,499	19,165	520,887
2000	2001	2002	504	965	12,730	21,320	2,415	13,950	572,003
2001	2002	2003	1,192	3,307	23,750	33,180	3,377	11,744	602,584
2002	2003	2004	1,283	2,679	23,090	28,950	3,328	14,090	522,035
2003	2004	2005	984	1,679	23,330	27,950	4,416	17,325	503,688
2004	2005	2006	1,023	2,531	22,210	26,180	5,375	17,440	448,788
2005	2006	2007	954	1,373	21,820	23,910	4,160	18,080	464,440
2006	2007	2008	1,764	3,042	17,740	29,120	3,997	21,675	

Table 5.11.1.2. Management objectives and equivalent number of fish relevant to the development of catch options at West Greenland for the six geographic areas in NAC and the southern NEAC non-maturing complex.

Area	Objective	Number of fish
US	25% increase from 2SW returns during 1992 to 1996	2548
Scotia-Fundy	25% increase from 2SW returns during 1992 to 1997	10 976
Gulf	2SW conservation limit	30 430
Quebec	2SW conservation limit	29 446
Newfoundland	2SW conservation limit	4022
Labrador	2SW conservation limit	34 746
Southern NEAC non-maturing complex	Spawner escapement reserve	501 188

Table 5.11.1.3. Indicator variables retained from the North American geographic area. First year of PFA and end year of PFA refer to the start and end years of the indicator variable scaled to a common life stage (the PFA equals smolt year + 1). Number of years refers to the number of usable observations. All indicators with a true low or a true high >80% were incorporated into the framework.

Origin	Age group	Area	River	Unit	PFA start year	PFA end year	Number of years	2008 value	Decision rule based on objective function	Indicator low (true low)	Indocator high (true high)
W & H	2SW	US	Penobscot	Number	1970	2007	38	1377	1415	1	0.92
W & H	1SW	US	Penobscot	Number	1970	2008	39	736	495	0.83	0.88
H	2SW	US	Penobscot	%	1970	2007	38	0.24	0.24	1	0.6
H	1SW	US	Penobscot	%	1970	2007	38	0.12	0.07	0.85	0.73
W & H	All	US	Narraguagus	Number	1971	2008	38	23	100	0.95	0.61
W	Large	SF	Saint John	Number	1969	2007	39	143	2309	1	0.96
W	Large	SF	LaHave	Number	1972	2007	36	192	301	0.65	0.92
W	Large	SF	St. Mary's	Number	1973	2007	35	65	221	1	0.86
W	Large	SF	Baddeck	Number	1982	2007	26	127	220	0.7	0.83
W	Large	SF	North	Number	1983	2007	25	404	467	0.88	1
H	2SW	SF	Saint John	%	1975	2007	33	0.05	0.22	0.82	0.88
H	2SW	SF	LaHave	%	1973	2004	32	0.4	0.24	0.9	0.82
H	1SW	SF	Saint John	%	1975	2008	34	0.7	0.75	0.92	0.81
H	1SW	SF	LaHave	%	1973	2004	32	0.72	1.44	1	0.82
W	1SW	SF	Saint John	Number	1970	2008	39	796	2275	0.83	0.9
W	1SW	SF	LaHave	Number	1979	2008	30	1158	1931	0.93	0.86
W	1SW	SF	St. Mary's	Number	1974	2008	35	656	1583	0.93	0.84
W	1SW	SF	North	Number	1984	2008	25	153	169	0.93	0.7
W	2SW	Gulf	Miramichi	Number	1970	2005	36	11500	17060	0.93	0.83
W	1SW	Gulf	Miramichi	Number	1971	2006	36	25580	43170	0.83	0.84
W	Small	Gulf	Margaree	Number	1984	2006	23	1311	899	0.83	0.58
W	Large	Quebec	Cascapedia	Number	1983	2007	25	1119	1367	0.83	0.84
W	Large	Quebec	Bonaventure	Number	1983	2007	25	753	1090	0.83	0.84

Table 5.11.1.3 cont'd. Indicator variables retained from the North American geographic area. First year of PFA and end year of PFA refer to the start and end years of the indicator variable scaled to a common life stage, the PFA (equals smolt year + 1). Number of years refers to the number of usable observations. All indicators with a true low or a true high >80% were incorporated into the framework.

Origin	Age group	Area	River	Unit	PFA start year	PFA end year	Number of years	2008 value	Decision rule based on objective function	Indicator low (true low)	Indocator high (true high)
W	Large	Quebec	Grande Rivière	Number	1983	2007	25	337	414	0.89	1
W	Large	Quebec	Saint-Jean	Number	1983	2007	25	605	687	0.86	0.89
W	Large	Quebec	Dartmouth	Number	1983	2007	25	348	566	0.86	0.89
W	Large	Quebec	Madeleine	Number	1983	2007	25	623	653	0.7	0.93
W	Large	Quebec	Sainte-Anne	Number	1983	2007	25	584	433	0.67	0.88
W	Large	Quebec	Mitis	Number	1983	2007	25	464	345	0.71	0.83
W	Large	Quebec	de la Trinité	Number	1983	2007	25	328	250	0.71	0.83
W	Small	NFLD	Terra Nova	Number	1978	2008	31	3575	2099	0.87	0.67
W	Small	NFLD	Exploits	Number	1978	2008	31	31823	21713	0.77	0.88
W	Small	NFLD	Middle Brook	Number	1978	2008	31	2167	1751	0.71	0.83
W	Small	NFLD	Gander	Number	1989	2008	20	22442	14,078	0.7	0.89
W	Small	NFLD	Torrent	Number	1984	2008	25	5847	3955	0.85	0.82

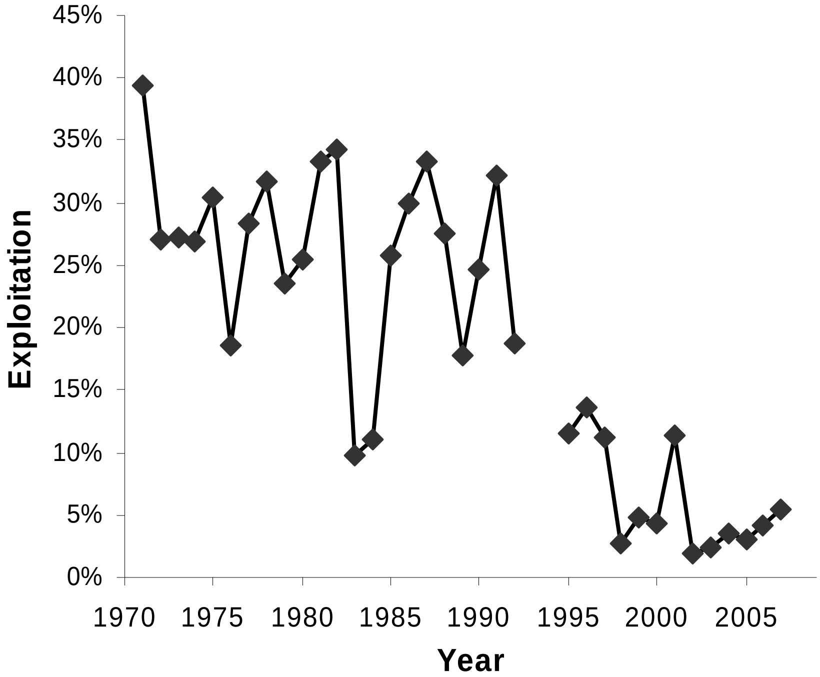


Figure 5.1.1. Exploitation rate for non-maturing 1SW Atlantic salmon at West Greenland, estimated from harvest and PFA of North American non-maturing 1SW salmon.

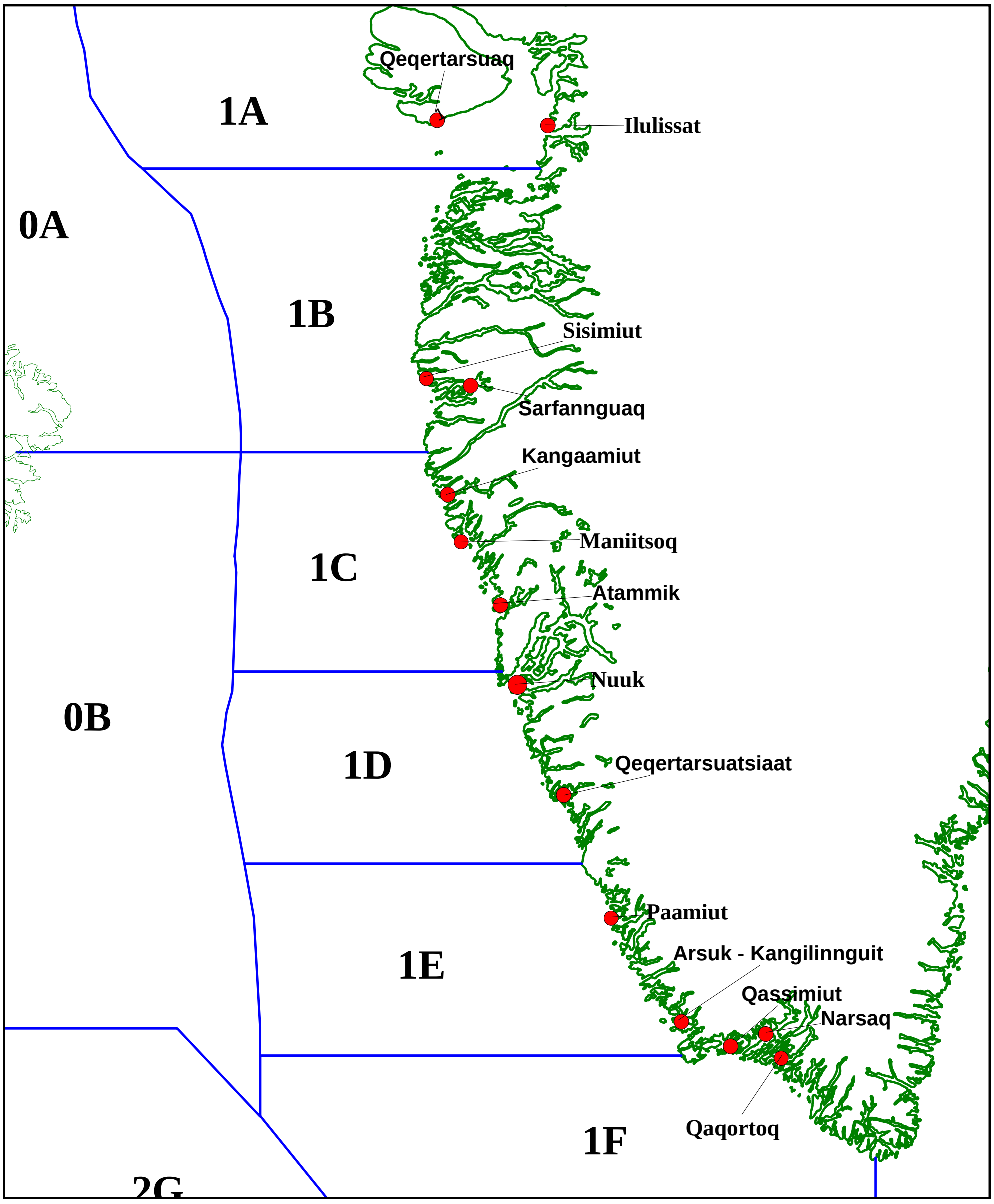


Figure 5.8.1.1. Location of NAFO divisions along the coast of West Greenland.

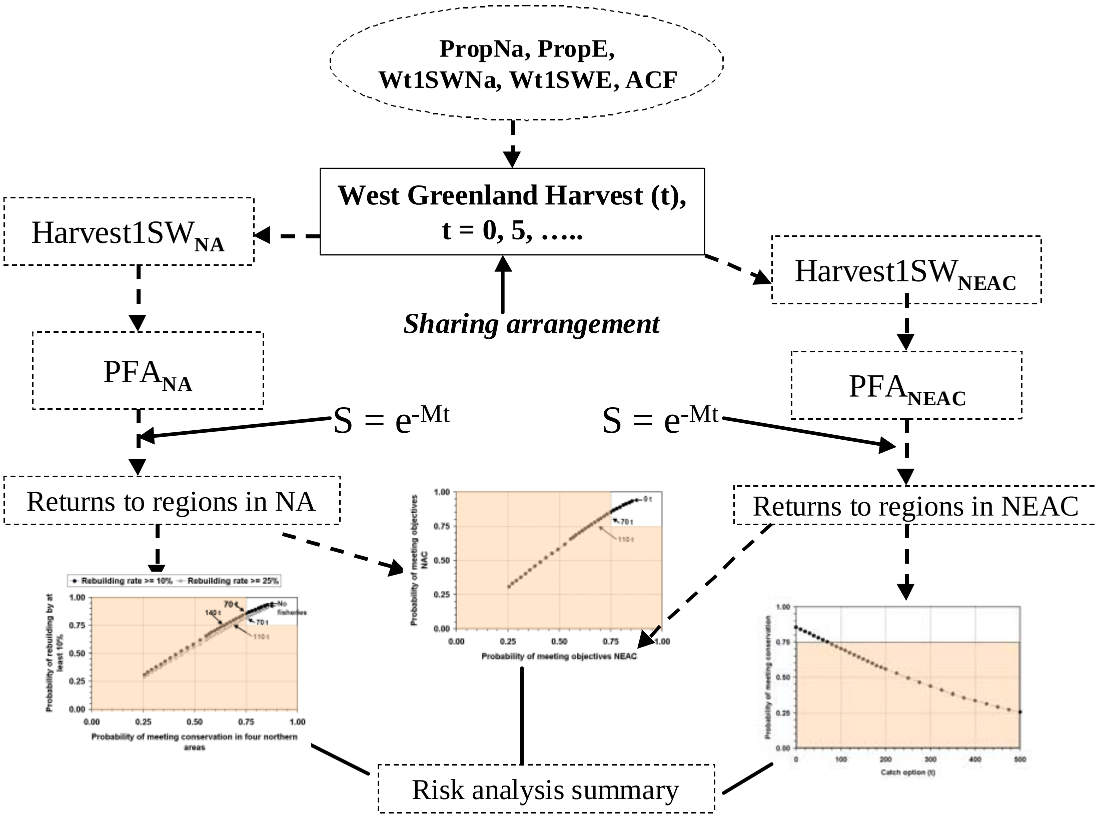


Figure 5.9.3.1. Flowchart, risk analysis for catch options at West Greenland using the PFA$_{NA}$ and the PFA$_{NEAC}$ predictions for the year of the fishery. Inputs with solid borders are considered known without error. Estimated inputs with observation error that is incorporated in the analysis have dashed borders. Solid arrows are functions that introduce or transfer without error whereas dashed arrows transfer errors through the components.

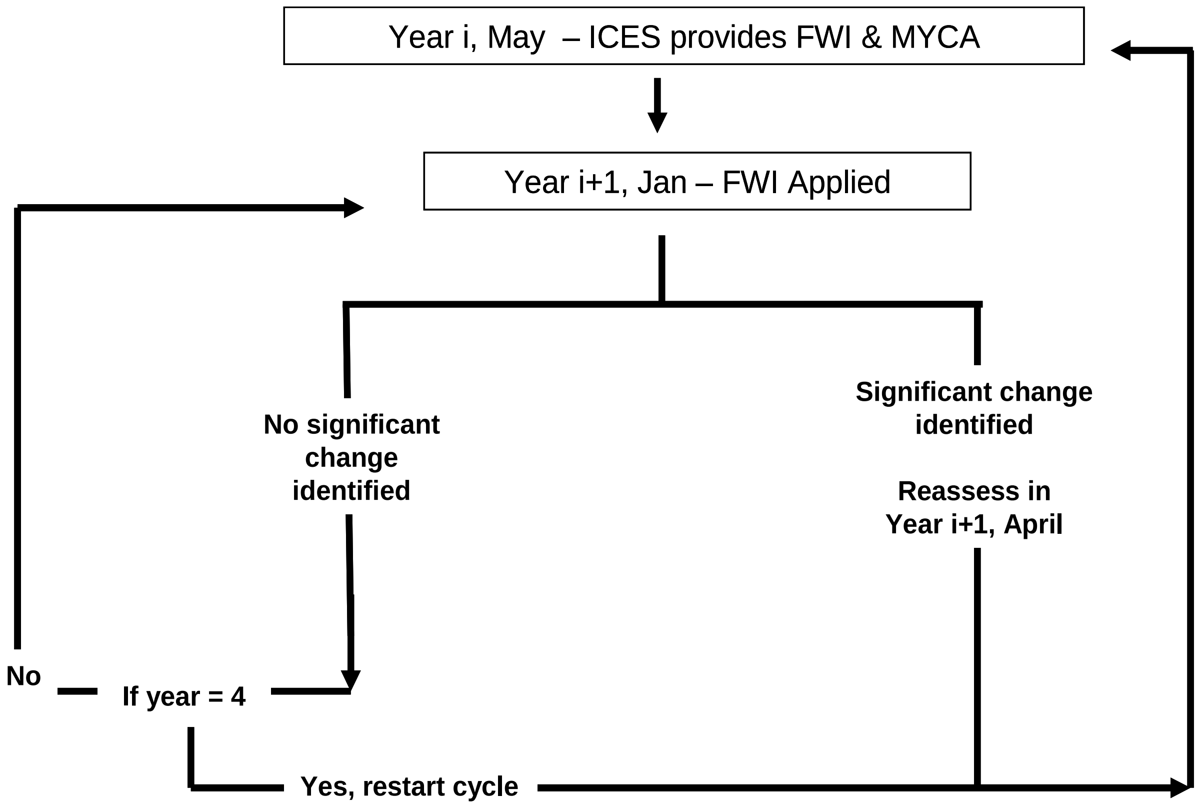


Figure 5.11.1. Suggested timeline for employment of the Framework of Indicators (FWI). In Year i, ICES provides multi-year catch advice (MYCA) and an updated FWI which re-evaluates the updated datasets and is summarized in an Excel worksheet. In January of Year i+1 the FWI is applied and two options are available depending on the results. If no significant change is detected, no reassessment is necessary and the cycle continues to Year i+2. If no significant change is detected in Year i+2, the cycle continues to Year i+3. If a significant change is detected in any year, then reassessment is recommended. In that case, ICES would provide an updated FWI the following May. ICES would also provide an updated FWI if year equals 4.

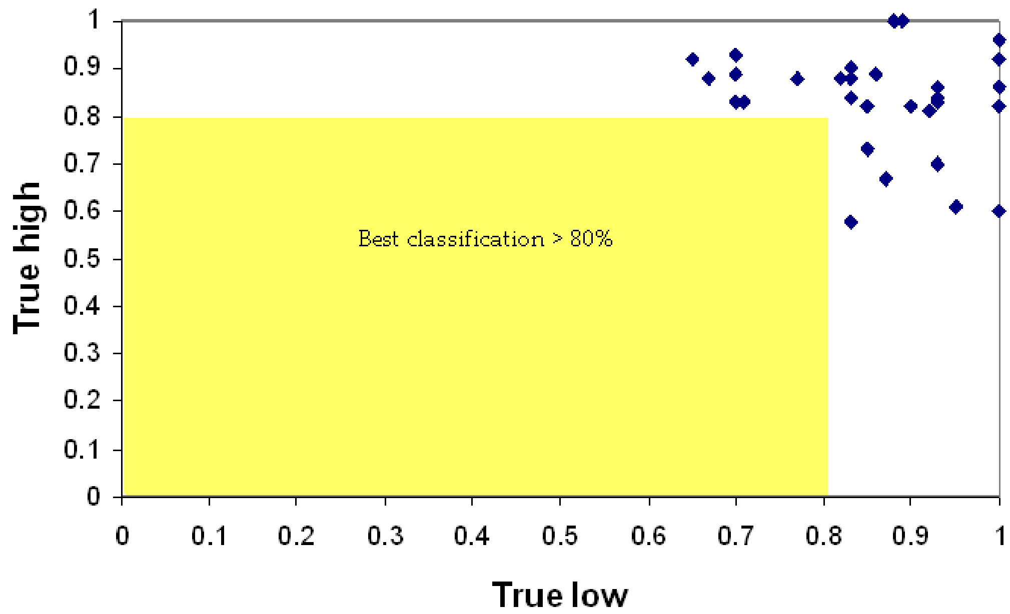


Figure 5.11.1.1. Comparative performance of the retained indicators (N = 35) at identifying a true low (i.e. management objective will not be met) and a true high (i.e. management objective will be met) for the West Greenland multi-year catch advice framework.

Catch Advice	Catch option > 0 (Yes = 1, No = 0)	0

Overall Recommendation
No Significant Change Identified by Indicators

Geographic Area	River/ Indicator	2008 Value	Ratio Value to Threshold	Threshold	True Low	True High	Indicator State	Probability of Correct Assignment	Indicator Score	Management Objective Met?
USA	Penobscot 2SW Returns	1377	97%	1,415	100%	92%	-1	1	-1	
	Penobscot 1SW Returns	736	149%	495	83%	88%	1	0.88	0.88	
	Penobscot 2SW Survival	0.24	100%	0.24	100%	60%	1	0.6	0.6	
	Penobscot 1SW Survival	0.12	171%	0.07	85%	73%	1	0.73	0.73	
	Narraguagus Returns	23	23%	100	95%	61%	-1	0.95	-0.95	
	possible range				*-0.93*	*0.75*				
	Average		108%						**0.05**	**Yes**
Scotia-Fundy	Saint John Return Large	143	6%	2,309	100%	96%	-1	1	-1	
	Lahave Return Large	192	64%	301	65%	92%	-1	0.65	-0.65	
	St. Mary's Return Large	65	29%	221	100%	86%	-1	1	-1	
	Baddeck Return Large	127	58%	220	70%	83%	-1	0.7	-0.7	
	North Return Large	404	87%	467	88%	100%	-1	0.88	-0.88	
	Saint John Survival 2SW	0.05	23%	0.22	82%	88%	-1	0.82	-0.82	
	Lahave Survival 2SW	0.40	167%	0.24	90%	82%	1	0.82	0.82	
	Saint John Survival 1SW	0.70	93%	0.75	92%	81%	-1	0.92	-0.92	
	Lahave Survival 1SW	0.72	50%	1.44	100%	82%	-1	1	-1	
	Saint John Return 1SW	796.00	35%	2,275	83%	90%	-1	0.83	-0.83	
	LaHave Return 1SW	1158.00	60%	1,931	93%	86%	-1	0.93	-0.93	
	St. Mary's Return 1SW	656.00	41%	1,583	93%	84%	-1	0.93	-0.93	
	North Return 1SW	153.00	91%	169	93%	70%	-1	0.93	-0.93	
	possible range				*-0.88*	*-0.86*				
	Average		62%						**-0.75**	**No**
Gulf	Miramichi Return 2SW	11500	67%	17,060	93%	83%	-1	0.93	-0.93	
	Miramichi Return 1SW	25580	59%	43,170	83%	84%	-1	0.83	-0.83	
	Margaree Return Small	1311	146%	899	83%	58%	1	0.58	0.58	
	possible range				*-0.86*	*-0.75*				
	Average		63%						**-0.39**	**No**
Quebec	Cascapédia Return Large	1119	82%	1,367	83%	84%	-1	0.83	-0.83	
	Bonaventure Return Large	753	69%	1,090	83%	84%	-1	0.83	-0.83	
	Grande Rivière Return Large	337	81%	414	89%	100%	-1	0.89	-0.89	
	Saint-Jean Return Large	605	88%	687	86%	89%	-1	0.86	-0.86	
	Dartmouth Return Large	348	61%	566	86%	89%	-1	0.86	-0.86	
	Madeleine Return Large	623	95%	653	70%	93%	-1	0.7	-0.7	
	Sainte-Anne Return Large	584	135%	433	67%	88%	1	0.88	0.88	
	Mitis Return Large	464	134%	345	71%	83%	1	0.83	0.83	
	De la Trinite Return Large	328	131%	250	71%	83%	1	0.83	0.83	
	possible range				*-0.78*	*-0.88*				
	Average		100%						**-0.27**	**No**
Newfoundland	Terra Nova Return Small	3575	170%	2,099	87%	67%	1	0.67	0.67	
	Exploits Return Small	31823	147%	21,713	77%	88%	1	0.88	0.88	
	Middle Brook Return Small	2167	124%	1,751	71%	83%	1	0.83	0.83	
	Gander Return Small	22442	159%	14,078	70%	89%	1	0.89	0.89	
	Torrent Return Small	5847	148%	3,955	85%	82%	1	0.82	0.82	
	Western Arm Brook Survival Small	11.6	262%	4.43	80%	57%	1	0.57	0.57	
	possible range				*-0.78*	*-0.78*				
	Average		262%						**0.82**	**Yes**
Labrador										
	possible range									
	Average								**NA**	**Unknown**
Southern NEAC										
	possible range									
	Average								**NA**	**Unknown**

Figure 5.11.2.1. Framework of indicators spreadsheet for the West Greenland fishery. For illustrative purposes, the average of the most recent ten years of returns or return rates for the 32 retained indicators is entered in the cells corresponding to the annual indicator variable values.

6 NASCO has requested ICES to identify relevant data deficiencies, monitoring needs and research requirements

The Working Group recommends that it should meet in 2010 to address questions posed by ICES, including those posed by NASCO. The Working Group intends to convene in the headquarters of the ICES in Copenhagen, Denmark from 7th April to 16th April 2010.

List of recommendations

1) The Working Group acknowledges progress on the development of pre-fishery abundance (PFA) modeling approaches inclusive of both NAC and NEAC areas. The Working Group recommends that the Study Group on Salmon Stock Assessment and Forecasting (SGSSAFE) meet to continue the efforts to develop the models formulated for the NAC and NEAC areas, particularly with regard to combining sea age classes and in the spatial disaggregation below the stock complex level. The Study Group will report back to the WGNAS in April 2010.

2) The Working Group recognised the work undertaken by the Study Group on the Identification of Biological Characteristics for use as Predictors of Salmon Abundance (SGBICEPS). The Working Group recommends that a further study group is held to collate additional data from stocks throughout the biogeographical range of Atlantic salmon and to continue with development of hypothesis and subsequent data analysis. Further investigations into the potential associations between biological characteristics of all life stages of salmon, environmental data, marine survival, and measures of abundance should be developed. The Study Group will report back to the WGNAS in April 2010.

3) The Working Group advises that additional information be requested from fishers in West Greenland. These data will help characterize the nature and extent of the current fishery and should include reference to catch site, catch date, numbers of nets, net dimensions, and numbers of hours the nets were fished.

4) The Working Group recommends the continuation of the broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery at West Greenland. The Enhanced Sampling Programme designed for the 2008 fishery should be applied in 2009.

5) The Working Group noted that the sampling program conducted in the Labrador subsistence fishery during 2008 provided biological characteristics of the harvest and that the information may be useful for updating parameters used in the Run Reconstruction Model for North America. As well it provides material to assess the origin of salmon in this fishery. The Working Group recommended that sampling be continued and expanded in 2009 and future years.

6) The Working Group recognises that river specific, regional and international management requires extensive monitoring and recommends expanded monitoring programmes across all stock complexes.

7) The Working Group recommends that specific management objectives for NEAC be developed in accordance with Section 3.6 to enable the Working Group to develop quantitative catch advice.

Annex 1: Working documents submitted to the Working Group on North Atlantic Salmon, 2009

1) Erkinaro, J., M. Länsman, J. Kuusela, E. Niemelä, M. Kylmäaho and P. Orell. National report for Finland: salmon fishing season in 2008.

2) Kennedy, R., W. Crozier and P. Boylan. Summary of salmon fisheries and status of stocks in Northern Ireland for 2008.

3) Trial, J., Sweka, J., Kocik, J., and Sheehan, T. National Report for the United States, 2008.

4) Gibson, J., R. Jones, H. Bowlby, P. Amiro, D. Sam, L. Anderson and T. Goff. Status of Atlantic Salmon in Canada's Maritimes Region (Salmon Fishing Areas 19 to 23).

5) Hansen, L.P., P. Fiske, A.J. Jensen, H. Sægrov, V. Wennevik, N.A. Hvidsten and N. Jonsson. Atlantic salmon; national report for Norway 2008.

6) Reddin,D.G., G. Chaput, P. LeBlanc, M. Dionne and D. Cairns. Catch, Catch-and-Released, and Unreported Catch Estimates for Atlantic Salmon in Canada, 2007–2008.

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

8) Reddin, D. G. A summary of the impacts of hook and release angling.

9) Reddin, D.G., and G. I. Veinott. Return and Spawner Estimates Of Atlantic Salmon For Insular Newfoundland.

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11) Reddin, D.G., P.B. Short, T. Schlossek and R. Kemuksigak. Results of the Labrador coastal fisheries sampling program, 2008.

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18) Prusov S. and D. Kuzmin. Capture rate of gill-hooked Atlantic salmon in catch-and-release fishery on some rivers of the Kola Peninsula, Russia.

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21) Prevost, E., G. Chaput, M. Dionne, D. Reddin. Atlantic salmon Pre-Fishery Abundance (PFA) and Catch Advice Model, 1978–2010 (West Greenland fishery years).

22) Rivot, E., E. Prevost, G. Smith, G. Chaput. Bayesian modelling of PFA abundance and forecasting for Southern NEAC and northern NEAC complexes.

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24) Gudbergsson, G. and E.S. Einarsson. Study on the frequency of multiple recapture and the effects of catch and release on catch statistics and the estimated spawning stock size.

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Annex 3: List of participants

NAME	ADDRESS	PHONE/FAX	EMAIL
Laurent Beaulaton	Office National de l'Eau et des Milieux Aquatiques 5 square Félix Nadar FR- 94300 Vincennes France	TEL: +33 1 45 14 36 34	Laurent.beaulaton@onema.fr
Gérald Chaput	Dept. of Fisheries & Oceans P.O. Box 5030 Moncton NB E1C 9B6 Canada	TEL: +1 506 851 2022 FAX: +1 506 851 2147	chaputg@dfo-mpo.gc.ca
Mélanie Dionne	Ministére des Ressources naturelles et de la Faune du Québec 880, Chemin Sainte-Foy, 2e étage Québec G1S 4X4 Canada	TEL: +1 418 627 8694 poste 7468 FAX: +1 418 646 6863	Melanie.Dionne@mrnf.gouv.qc.ca
Jaakko Erkinaro Chair	Finnish Game and Fisheries Research Institute Tutkijantie 2 FIN-90570 Oulu Finland	TEL: +358 205 751 871 FAX: +358 205 751 879	jaakko.erkinaro@rktl.fi
Peder Fiske	Norwegian Institute for Nature Research NO-7485 Trondheim Norway	TEL: +47 73 80 1400 FAX: +47 73 80 14 01	peder.fiske@nina.no
Jamie A. Gibson	Fisheries and Oceans Canada Bedford Institute of Oceanography P.O. Box 1006 Dartmouth NS B2Y 4A2 Canada	TEL: +1 902 426 3136 FAX: +1 902 426 1506	GibsonAJF@mar.dfo-mpo.gc.ca
Gudni Gudbergsson	Institute of Freshwater Fisheries Keldnaholti 112 Reykjavik Iceland	TEL: +354 580 6300 FAX: +354 580 6301	gudni.gudbergsson @veidimal.is
Lars Petter Hansen	Norwegian Institute for Nature Research Gaustadalléen 21 NO-0349 Oslo Norway	TEL: +47 73 80 1713 FAX: +47 22 60 0424	l.p.hansen@nina.no
Detlev Ingendahl	Landesamt für Umwelt und Verbraucherschutz Nordrhein-Westfalen Fachbereich 26 Wanderfischprogramm Heinsberger Str. 53 D-57399 Kirchhundem-Albaum Germany	TEL: +49 2723 779 40 FAX: +49 2723 775 77	detlev.ingendahl@lanuv.nrw.de

Name	Address	Phone/Fax	Email
Lars Karlsson	Swedish Board of Fisheries Institute of Freshwater Research Brobacken SE-814 94 Älvkarleby Sweden	TEL: +46 26 825 03 FAX: +46 26 825 15	lars.karlsson@fiskeriverket.se
Richard Kennedy	River Bush Salmon Station 21 Church Street BT57 8QJ Bushmills Co Antrim United Kingdom	TEL: +44 28 20731435	richard.kennedy@afbini.gov.uk
Julian C. MacLean	Marine Scotland FL, Field Station Inchbraoch House South Quay, Ferryden Montrose Angus DD10 9SL United Kingdom	TEL: +44 1674 677070 FAX: +44 1674 672604	j.c.maclean@marlab.ac.uk
Niall Ó Maoiléidigh	The Marine Institute Newport Co. Mayo Ireland	TEL: +353 98 42300 FAX: +353 98 42340	niall.omaoileidigh@marine.ie
Rasmus Nygaard	Greenland Institute for Natural Resources P.O. Box 570 GL-3900 Nuuk Greenland	TEL: +299 361200 Office +299 361248 FAX: +299 361212	rany@natur.gl
Sergey Prusov	Polar Research Institute of Marine Fisheries and Oceanography (PINRO) 6, Knipovitch Street 183763 Murmansk Russia	TEL: +7 8152 473658 FAX: +7 8152 473331	prusov@pinro.ru
Dave Reddin	Dept. of Fisheries & Oceans Northwest Atlantic Fisheries Centre P.O. Box 5667 St John's, Nfld A1C 5X1 Canada	TEL: +1 709 772 4484 FAX: +1 709 772 3578	reddind@dfo-mpo.gc.ca
Ian Russell	Cefas Lowestoft Laboratory Lowestoft Suffolk NR33 0HT United Kingdom	TEL: +44 1502 524330 FAX: +44 1502 513865	ian.russell@cefas.co.uk
Timothy Sheehan	Northeast Fisheries Science Center NMFS/NOAA 166 Water Street Woods Hole MA 02543-1026 USA	TEL: +1 508 495 2215 FAX: +1 508 495 2393	tim.sheehan@noaa.gov

Name	Address	Phone/Fax	Email
Gordon Smith	Marine Scotland FL Field Station Inchbraoch House South Quay, Ferryden Montrose Angus DD10 9SL United Kingdom	TEL: + 44 1674 677070 FAX: + 44 1674 672604	g.w.smith@marlab.ac.uk
Joan Trial	Maine Department of Marine Resources Bureau of Sea Run Fisheries and Habitat Bangor Regional Office 650 State Street Bangor, Maine 04401 USA	TEL: +1 207 941 4452 FAX: +1 207 941 4443	Joan.Trial@Maine.gov
Gennady Ustyuzhinskiy	Northern Affiliate of the Knipovich Polar Research Institute of Marine Fisheries and Oceanography PINRO 17 Uritskogo St. 163002 Archangelsk Russia	TEL: +7 8182 661646 FAX: +7 8182 661650	gena@sevpinro.ru
Vincent Vauclin	Office National de l'Eau et des Milieux Aquatiques 3, avenue Claude Guillemin 36009 Orleans France	TEL: +33 2 38643423 FAX: +33 2 38643217	vincent.vauclin@onema.fr
Geoff Veinott	Fisheries and Oceans Canada DFO Science Branch PO Box 5667 St. John's NL A1C 5X1 Canada	TEL: +1 709 772 7989 FAX: 1-709-772-3578	Geoff.Veinott@dfo-mpo.gc.ca
Vidar Wennevik	Institute of Marine Research P.O. Box 1870 N-5817 Bergen Norway	TEL: +47 55 23 63 78/ +47 90 66 23 94	vidar.wennevik@imr.no

Annex 4: Reported catch of salmon in numbers and weight (tonnes round fresh weight) by sea-age class. Catches reported for 2008 may be provisional. Methods used for estimating age composition given in footnote

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
West Greenland	1982	315,532	-	17,810	-	-	-	-	-	-	-	-	-	2,688	-	336,030	1,077
	1983	90,500	-	8,100	-	-	-	-	-	-	-	-	-	1,400	-	100,000	310
	1984	78,942	-	10,442	-	-	-	-	-	-	-	-	-	630	-	90,014	297
	1985	292,181	-	18,378	-	-	-	-	-	-	-	-	-	934	-	311,493	864
	1986	307,800	-	9,700	-	-	-	-	-	-	-	-	-	2,600	-	320,100	960
	1987	297,128	-	6,287	-	-	-	-	-	-	-	-	-	2,898	-	306,313	966
	1988	281,356	-	4,602	-	-	-	-	-	-	-	-	-	2,296	-	288,254	893
	1989	110,359	-	5,379	-	-	-	-	-	-	-	-	-	1,875	-	117,613	337
	1990	97,271	-	3,346	-	-	-	-	-	-	-	-	-	860	-	101,477	274
	1991	167,551	415	8,809	53	-	-	-	-	-	-	-	-	743	4	177,103	472
	1992	82,354	217	2,822	18	-	-	-	-	-	-	-	-	364	2	85,540	237
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	31,241	-	558	-	-	-	-	-	-	-	-	-	478	-	32,277	83
	1996	30,613	-	884	-	-	-	-	-	-	-	-	-	568	-	32,065	92
	1997	20,980	-	134	-	-	-	-	-	-	-	-	-	124	-	21,238	58
	1998	3,901	-	17	-	-	-	-	-	-	-	-	-	88	-	4,006	11
	1999	6,124	18	50	0	-	-	-	-	-	-	-	-	84	1	6,258	19
	2000	7,715	21	0	0	-	-	-	-	-	-	-	-	140	0	7,855	21
	2001	14,795	40	324	2	-	-	-	-	-	-	-	-	293	1	15,412	43
	2002	3,344	10	34	0	-	-	-	-	-	-	-	-	27	0	3,405	10
	2003	3,933	12	38	0	-	-	-	-	-	-	-	-	73	0	4,044	12
	2004	4,488	14	51	0	-	-	-	-	-	-	-	-	88	0	4,627	15
	2005	3,120	13	40	0	-	-	-	-	-	-	-	-	180	1	3,340	14
	2006	5,746	20	183	1	-	-	-	-	-	-	-	-	224	1	6,153	22
	2007	6,037	24	82	0	6	0	-	-	-	-	-	-	144	1	6,263	25
	2008	9,311	26	47	0	0	0	-	-	-	-	-	-	177	1	9,535	27
Canada	1982	358,000	716	-	-	-	-	-	-	-	-	240,000	1,082	-	-	598,000	1,798
	1983	265,000	513	-	-	-	-	-	-	-	-	201,000	911	-	-	466,000	1,424
	1984	234,000	467	-	-	-	-	-	-	-	-	143,000	645	-	-	377,000	1,112
	1985	333,084	593	-	-	-	-	-	-	-	-	122,621	540	-	-	455,705	1,133
	1986	417,269	780	-	-	-	-	-	-	-	-	162,305	779	-	-	579,574	1,559
	1987	435,799	833	-	-	-	-	-	-	-	-	203,731	951	-	-	639,530	1,784
	1988	372,178	677	-	-	-	-	-	-	-	-	137,637	633	-	-	509,815	1,310
	1989	304,620	549	-	-	-	-	-	-	-	-	135,484	590	-	-	440,104	1,139
	1990	233,690	425	-	-	-	-	-	-	-	-	106,379	486	-	-	340,069	911
	1991	189,324	341	-	-	-	-	-	-	-	-	82,532	370	-	-	271,856	711
	1992	108,901	199	-	-	-	-	-	-	-	-	66,357	323	-	-	175,258	522
	1993	91,239	159	-	-	-	-	-	-	-	-	45,416	214	-	-	136,655	373
	1994	76,973	139	-	-	-	-	-	-	-	-	42,946	216	-	-	119,919	355
	1995	61,940	107	-	-	-	-	-	-	-	-	34,263	153	-	-	96,203	260
	1996	82,490	138	-	-	-	-	-	-	-	-	31,590	154	-	-	114,080	292
	1997	58,988	103	-	-	-	-	-	-	-	-	26,270	126	-	-	85,258	229
	1998	51,251	87	-	-	-	-	-	-	-	-	13,274	70	-	-	64,525	157
	1999	50,901	88	-	-	-	-	-	-	-	-	11,368	64	-	-	62,269	152
	2000	55,263	95	-	-	-	-	-	-	-	-	10,571	58	-	-	65,834	153
	2001	51,225	86	-	-	-	-	-	-	-	-	11,575	61	-	-	62,800	147
	2002	53,464	99	-	-	-	-	-	-	-	-	8,439	49	-	-	61,903	148
	2003	46,768	81	-	-	-	-	-	-	-	-	11,218	60	-	-	57,986	141
	2004	54,253	94	-	-	-	-	-	-	-	-	12,933	68	-	-	67,186	162
	2005	47,368	83	-	-	-	-	-	-	-	-	10,937	56	-	-	58,305	139
	2006	46,747	82	-	-	-	-	-	-	-	-	11,248	55	-	-	57,995	137
	2007	37,540	64	-	-	-	-	-	-	-	-	10,256	48	-	-	47,796	112
	2008	52,362	90	-	-	-	-	-	-	-	-	11,737	148	-	-	64,099	238

Annex 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
	2005	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2006	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2007	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2008	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
Faroe Islands	1982/83	9,086	-	101,227	-	21,663	-	448	-	29	-	-	-	-	-	132,453	625
	1983/84	4,791	-	107,199	-	12,469	-	49	-	-	-	-	-	-	-	124,508	651
	1984/85	324	-	123,510	-	9,690	-	-	-	-	-	-	-	1,653	-	135,177	598
	1985/86	1,672	-	141,740	-	4,779	-	76	-	-	-	-	-	6,287	-	154,554	545
	1986/87	76	-	133,078	-	7,070	-	80	-	-	-	-	-	-	-	140,304	539
	1987/88	5,833	-	55,728	-	3,450	-	0	-	-	-	-	-	-	-	65,011	208
	1988/89	1,351	-	86,417	-	5,728	-	0	-	-	-	-	-	-	-	93,496	309
	1989/90	1,560	-	103,407	-	6,463	-	6	-	-	-	-	-	-	-	111,436	364
	1990/91	631	-	52,420	-	4,390	-	8	-	-	-	-	-	-	-	57,449	202
	1991/92	16	-	7,611	-	837	-	-	-	-	-	-	-	-	-	8,464	31
	1992/93	-	-	4,212	-	1,203	-	-	-	-	-	-	-	-	-	5,415	22
	1993/94	-	-	1,866	-	206	-	-	-	-	-	-	-	-	-	2,072	7
	1994/95	-	-	1,807	-	156	-	-	-	-	-	-	-	-	-	1,963	6
	1995/96	-	-	268	-	14	-	-	-	-	-	-	-	-	-	282	1
	1996/97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1997/98	339	-	1,315	-	109	-	-	-	-	-	-	-	-	-	1,763	6
	1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1999/00	225	-	1,560	-	205	-	-	-	-	-	-	-	-	-	1,990	8
	2000/01	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2001/02	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2002/03	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2003/04	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2004/05	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2005/06	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2006/07	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2007/08	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2008/09	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0

Annex 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	13,296	21	6,286	32	5,369	57	103	2	0	0	-	-	2,372	13	27,426	125
	2002	6,427	12	5,227	20	4,048	43	145	2	11	0	-	-	2,496	16	18,354	93
	2003	8,130	15	1,828	7	3,599	35	161	3	6	0	-	-	2,204	15	15,928	75
	2004	3,849	7	1,425	6	1,152	11	251	3	6	1	-	-	1,404	11	8,087	39
	2005	9,263	16	1,027	5	1,571	16	66	1	48	1	-	-	833	8	12,808	47
	2006	17,345	29	4,168	18	1,324	13	63	1	0	0	-	-	720	5	23,620	67
	2007	3,857	6	5,628	21	2,284	23	24	1	0	0	-	-	1,232	8	13,025	59
	2008	4,424	6	2,236	8	4,216	41	239	4					1,992	11	13,107	71
Iceland	1991	29,601	-	11,892	-	-	-	-	-	-	-	-	-	-	-	41,493	130
	1992	38,538	-	15,312	-	-	-	-	-	-	-	-	-	-	-	53,850	175
	1993	36,640	-	11,541	-	-	-	-	-	-	-	-	-	-	-	48,181	160
	1994	24,224	59	14,088	76	-	-	-	-	-	-	-	-	-	-	38,312	135
	1995	32,767	90	13,136	56	-	-	-	-	-	-	-	-	-	-	45,903	145
	1996	26,927	66	9,785	52	-	-	-	-	-	-	-	-	-	-	36,712	118
	1997	21,684	56	8,178	41	-	-	-	-	-	-	-	-	-	-	29,862	97
	1998	32,224	81	7,272	37	-	-	-	-	-	-	-	-	-	-	39,496	119
	1999	22,620	59	9,883	52	-	-	-	-	-	-	-	-	-	-	32,503	111
	2000	20,270	49	4,319	24	-	-	-	-	-	-	-	-	-	-	24,589	73
	2001	18,538	46	5,289	28	-	-	-	-	-	-	-	-	-	-	23,827	74
	2002	25,277	64	5,194	26	-	-	-	-	-	-	-	-	-	-	30,471	90
	2003	24,738	61	8,119	37	-	-	-	-	-	-	-	-	-	-	32,857	99
	2004	32,600	84	6,128	28	-	-	-	-	-	-	-	-	-	-	38,728	111
	2005	39,980	101	5,941	28	-	-	-	-	-	-	-	-	-	-	45,921	129
	2006	29,857	71	5,635	23	-	-	-	-	-	-	-	-	-	-	35,492	93
	2007	31,899	74	3,262	15	-	-	-	-	-	-	-	-	-	-	35,161	89
	2008	42,725	100	5,090	25	-	-	-	-	-	-	-	-	-	-	47,815	125
Sweden	1990	7,428	18	-	-	-	-	-	-	-	-	3,133	15	-	-	10,561	33
	1991	8,987	20	-	-	-	-	-	-	-	-	3,620	18	-	-	12,607	38
	1992	9,850	23	-	-	-	-	-	-	-	-	4,656	26	-	-	14,506	49
	1993	10,540	23	-	-	-	-	-	-	-	-	6,369	33	-	-	16,909	56
	1994	8,304	18	-	-	-	-	-	-	-	-	4,661	26	-	-	12,965	44
	1995	9,761	22	-	-	-	-	-	-	-	-	2,770	14	-	-	12,531	36
	1996	6,008	14	-	-	-	-	-	-	-	-	3,542	19	-	-	9,550	33
	1997	2,747	7	-	-	-	-	-	-	-	-	2,307	12	-	-	5,054	19
	1998	2,421	6	-	-	-	-	-	-	-	-	1,702	9	-	-	4,123	15
	1999	3,573	8	-	-	-	-	-	-	-	-	1,460	8	-	-	5,033	16
	2000	7,103	18	-	-	-	-	-	-	-	-	3,196	15	-	-	10,299	33
	2001	4,634	12	-	-	-	-	-	-	-	-	3,853	21	-	-	8,487	33
	2002	4,733	12	-	-	-	-	-	-	-	-	2,826	16	-	-	7,559	28
	2003	2,891	7	-	-	-	-	-	-	-	-	3,214	18	-	-	6,105	25
	2004	2,494	6	-	-	-	-	-	-	-	-	2,330	13	-	-	4,824	19
	2005	2,122	5	-	-	-	-	-	-	-	-	1,770	10	-	-	3,892	15
	2006	2,211	4	-	-	-	-	-	-	-	-	1,772	10	-	-	3,983	14
	2007	1,228	3	-	-	-	-	-	-	-	-	2,442	13	-	-	3,670	16
	2008	1,197	3	-	-	-	-	-	-	-	-	2,752	15	-	-	3,949	18

Annex 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
	2005	165,900	307	69,488	320	27,507	261	-	-	-	-	-	-	-	-	262,895	888
	2006	142,218	261	99,401	453	23,529	218	-	-	-	-	-	-	-	-	265,148	932
	2007	78,165	140	79,146	363	28,896	264	-	-	-	-	-	-	-	-	186,207	767
	2008	89,228	170	69,027	314	34,124	322	-	-	-	-	-	-	-	-	192,379	807
Russia	1987	97,242	-	27,135	-	9,539	-	556	-	18	-	-	-	2,521	-	137,011	564
	1988	53,158	-	33,395	-	10,256	-	294	-	25	-	-	-	2,937	-	100,065	420
	1989	78,023	-	23,123	-	4,118	-	26	-	0	-	-	-	2,187	-	107,477	364
	1990	70,595	-	20,633	-	2,919	-	101	-	0	-	-	-	2,010	-	96,258	313
	1991	40,603	-	12,458	-	3,060	-	650	-	0	-	-	-	1,375	-	58,146	215
	1992	34,021	-	8,880	-	3,547	-	180	-	0	-	-	-	824	-	47,452	167
	1993	28,100	-	11,780	-	4,280	-	377	-	0	-	-	-	1,470	-	46,007	139
	1994	30,877	-	10,879	-	2,183	-	51	-	0	-	-	-	555	-	44,545	141
	1995	27,775	62	9,642	50	1,803	15	6	0	0	0	-	-	385	2	39,611	129
	1996	33,878	79	7,395	42	1,084	9	40	0.5	0	0	-	-	41	1	42,438	131
	1997	31,857	72	5,837	28	672	6	38	0.5	0	0	-	-	559	3	38,963	110
	1998	34,870	92	6,815	33	181	2	28	0.3	0	0	-	-	638	3	42,532	130
	1999	24,016	66	5,317	25	499	5	0	0	0	0	-	-	1,131	6	30,963	102
	2000	27,702	75	7,027	34	500	5	3	0.1	0	0	-	-	1,853	9	37,085	123
	2001	26,472	61	7,505	39	1,036	10	30	0.4	0	0	-	-	922	5	35,965	115
	2002	24,588	60	8,720	43	1,284	12	3	0	0	0	-	-	480	3	35,075	118
	2003	22,014	50	8,905	42	1,206	12	20	0.3	0	0	-	-	634	4	32,779	107
	2004	17,105	39	6,786	33	880	7	0	0.0	0	0	-	-	529	3	25,300	82
	2005	16,591	39	7,179	33	989	8	1	0.0	0	0	-	-	439	3	25,199	82
	2006	22,412	54	5,392	28	759	6	0	0.0	0	0	-	-	449	3	29,012	91
	2007	12,474	30	4,377	23	929	7	0	0.0	0	0	-	-	277	2	18,057	62
	2008	13,404	28	8,674	39	669	4	8	0	0	0	-	-	312	2	23,067	73

Annex 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	488
	2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156,308	422
	2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120,834	326
	2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31,469	85
	2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33,140	88
UK	1985	62,815	-	-	-	-	-	-	-	-	-	32,716	-	-	-	95,531	361
(England & Wales)	1986	68,759	-	-	-	-	-	-	-	-	-	42,035	-	-	-	110,794	430
	1987	56,739	-	-	-	-	-	-	-	-	-	26,700	-	-	-	83,439	302
	1988	76,012	-	-	-	-	-	-	-	-	-	34,151	-	-	-	110,163	395
	1989	54,384	-	-	-	-	-	-	-	-	-	29,284	-	-	-	83,668	296
	1990	45,072	-	-	-	-	-	-	-	-	-	41,604	-	-	-	86,676	338
	1991	36,671	-	-	-	-	-	-	-	-	-	14,978	-	-	-	51,649	200
	1992	34,331	-	-	-	-	-	-	-	-	-	10,255	-	-	-	44,586	171
	1993	56,033	-	-	-	-	-	-	-	-	-	13,144	-	-	-	69,177	248
	1994	67,853	-	-	-	-	-	-	-	-	-	20,268	-	-	-	88,121	324
	1995	57,944	-	-	-	-	-	-	-	-	-	22,534	-	-	-	80,478	295
	1996	30,352	-	-	-	-	-	-	-	-	-	16,344	-	-	-	46,696	183
	1997	30,203	-	-	-	-	-	-	-	-	-	11,171	-	-	-	41,374	142
	1998	30,641	-	-	-	-	-	-	-	-	-	6,276	-	-	-	36,917	123
	1999	27944	-	-	-	-	-	-	-	-	-	13,150	-	-	-	41,094	150
	2000	48,153	-	-	-	-	-	-	-	-	-	12,800	-	-	-	60,953	219
	2001	38993	-	-	-	-	-	-	-	-	-	12,314	-	-	-	51,307	184
	2002	34708	-	-	-	-	-	-	-	-	-	10,961	-	-	-	45,669	161
	2003	14,878	-	-	-	-	-	-	-	-	-	7,328	-	-	-	22,206	89
	2004	24,753	-	-	-	-	-	-	-	-	-	5,806	-	-	-	30,559	111
	2005	19,622	-	-	-	-	-	-	-	-	-	6,541	-	-	-	26,162	97
	2006	16,983	-	-	-	-	-	-	-	-	-	5,073	-	-	-	22,056	80
	2007	15,540	-	-	-	-	-	-	-	-	-	4,383	-	-	-	19,923	71
	2008	14,075	-	-	-	-	-	-	-	-	-	4,692	-	-	-	18,767	68

Annex 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	37,288	87	-	-	-	-	-	-	-	-	36,745	158	-	-	74,033	245
	2005	38,602	90	-	-	-	-	-	-	-	-	28,515	125	-	-	67,117	215
	2006	36,355	75	-	-	-	-	-	-	-	-	27,493	117	-	-	63,848	192
	2007	31,805	70	-	-	-	-	-	-	-	-	24,009	99	-	-	55,814	169
	2008	18,959	42	-	-	-	-	-	-	-	-	24,150	104	-	-	43,109	146
France	1987	6,013	18	-	-	-	-	-	-	-	-	1,806	9	-	-	7,819	27
	1988	2,063	7	-	-	-	-	-	-	-	-	4,964	25	-	-	7,027	32
	1989	1,124	3	1,971	9	311	2	-	-	-	-	-	-	-	-	3,406	14
	1990	1,886	5	2,186	9	146	1	-	-	-	-	-	-	-	-	4,218	15
	1991	1,362	3	1,935	9	190	1	-	-	-	-	-	-	-	-	3,487	13
	1992	2,490	7	2,450	12	221	2	-	-	-	-	-	-	-	-	5,161	21
	1993	3,581	10	987	4	267	2	-	-	-	-	-	-	-	-	4,835	16
	1994	2,810	7	2,250	10	40	1	-	-	-	-	-	-	-	-	5,100	18
	1995	1,669	4	1,073	5	22	0	-	-	-	-	-	-	-	-	2,764	10
	1996	2,063	5	1,891	9	52	0	-	-	-	-	-	-	-	-	4,006	13
	1997	1,060	3	964	5	37	0	-	-	-	-	-	-	-	-	2,061	8
	1998	2,065	5	824	4	22	0	-	-	-	-	-	-	-	-	2,911	8
	1999	690	2	1,799	9	32	0	-	-	-	-	-	-	-	-	2,521	11
	2000	1,792	4	1,253	6	24	0	-	-	-	-	-	-	-	-	3,069	11
	2001	1,544	4	1,489	7	25	0	-	-	-	-	-	-	-	-	3,058	11
	2002	2,423	6	1,065	5	41	0	-	-	-	-	-	-	-	-	3,529	11
	2003	1,598	5	-	-	-	-	-	-	-	-	1,540	8	-	-	3,138	13
	2004	1,927	5	-	-	-	-	-	-	-	-	2,880	14	-	-	4,807	19
	2005	1,236	3	-	-	-	-	-	-	-	-	1,771	8	-	-	3,007	11
	2006	1,763	3	-	-	-	-	-	-	-	-	1,785	9	-	-	3,548	13
	2007	1,378	2	-	-	-	-	-	-	-	-	1,685	9	-	-	3,063	11
	2008	1,471	3	-	-	-	-	-	-	-	-	1,931	9	-	-	3,402	12

Annex 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
Spain (2)	1993	1,589	-	827	-	75	-	-	-	-	-	-	-	-	-	2,491	8
	1994	1,658	5	-	-	-	-	-	-	-	-	735	4	-	-	2,393	9
	1995	389	1	-	-	-	-	-	-	-	-	1,118	6	-	-	1,507	7
	1996	349	1	-	-	-	-	-	-	-	-	676	3	-	-	1,025	4
	1997	169	0	-	-	-	-	-	-	-	-	425	2	-	-	594	3
	1998	481	1	-	-	-	-	-	-	-	-	403	2	-	-	884	3
	1999	157	0	-	-	-	-	-	-	-	-	986	5	-	-	1,143	6
	2000	1,227	3	-	-	-	-	-	-	-	-	433	3	-	-	1,660	6
	2001	1,129	3	-	-	-	-	-	-	-	-	1,677	9	-	-	2,806	12
	2002	651	2	-	-	-	-	-	-	-	-	1,085	6	-	-	1,736	8
	2003	210	1	-	-	-	-	-	-	-	-	1,116	6	-	-	1,326	6
	2004	1,195	3	-	-	-	-	-	-	-	-	589	3	-	-	1,784	6
	2005	412	1	-	-	-	-	-	-	-	-	2,336	11	-	-	2,748	12
	2006	335	1	-	-	-	-	-	-	-	-	1,879	9	-	-	2,214	10
	2007	520	1	-	-	-	-	-	-	-	-	1,487	7	-	-	2,007	9
	2008	520	1	-	-	-	-	-	-	-	-	1,487	7	-	-	2,007	9

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

2. Based on catches in Asturias (80-90% of total catch). No data for 2008, previous year data is used.

Annex 5: Estimated numbers of salmon returns, recruits and spawners

(i) Estimated numbers of small salmon returns, recruits and spawners for Labrador.

Year	Commercial Small Catch	Grilse Recruits SFA 1, 2 & 14B +Nfld Min	Max	Grilse to rivers SFA 1,2&14B Min	Max	Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B 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	101404	212664	98293	209289	95786	206782
1999	0	98685	207684	95953	204800	93436	202283
2000	0	123728	258738	118509	253290	115239	250020
2001	0	99940	209371	95189	204373	92676	201860
2002	0	65982	149798	60294	143864	57718	141288
2003	0	53058	130423	46644	123683	44040	121079
2004	0	76044	130397	67633	121486	65228	119081
2005	0	163628	290142	153375	279426	150656	276707
2006	0	137313	302798	127084	292083	124847	289846
2007	0	135792	265829	126727	256341	124501	254115
2008	0	147284	275025	137472	264665	135319	262512

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-1.55

Returns in 1998-2001 were estimated from regression

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

Year	Commercial Large Catch	Labrador 2SW Recruits,NF & Greenland SFAs 1,2 &14B Min	Max	Labrador a Greenland	Labrador salmon Totals Min	Max	Labrador 2SW to rivers in SFAs 1,2 &14B Min	Max	Labrador 2SW spawners in SFAs 1,2 &14B Angling catch subtracted 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	5786	15446	3990	9776	19436	4424	13835	4237	13614
1999	0	5947	17332	506	6453	17838	5296	16563	5049	16269
2000	0	8043	23573	873	8915	24446	7231	22613	6987	22325
2001	0	8650	25099	1232	9882	26331	7646	23911	7355	23567
2002	0	6308	18606	2958	9265	21564	5446	17586	5263	17370
2003	0	5311	16943	387	5698	17331	4006	15399	3793	15147
2004	0	8796	19019	554	9350	19573	6578	16395	6332	16104
2005	0	8386	23865	727	9112	24592	6695	21865	6443	21567
2006	0	9302	23340	1016	10318	24356	7448	21146	7244	20904
2007	0	8723	24541	1362	10086	25903	7132	22658	6918	22405
2008	0	11165	29526	1669	12834	31195	8820	26751	8613	26505

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 to present are from counting fence returns and drainage areas

(iii) Atlantic salmon returns to freshwater, total recruits prior to the commercial fishery and spawners summed for Salmon Fishing Areas 3–14A, insular Newfoundland.

	Small catch	Small returns to river		Small recruits		Small spawners		Large returns to river		Large recruits		Large catch	Large spawners		2SW returns to river	
Year	Retained	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Retained	Min	Max	Min	Max
1969	34944	108936	202649	217871	675496	73992	167705	7803	25935	26009	259346	2310	5493	23625	1969	7811
1970	30437	94934	176266	189868	587552	64497	145829	6822	22911	22739	229112	2138	4684	20774	1657	6606
1971	26666	83158	154444	166316	514815	56492	127778	5627	19510	18755	195095	1602	4025	17908	1366	5802
1972	24402	76862	144262	153724	480874	52460	119860	5985	19338	19950	193379	1380	4605	17958	1531	5935
1973	35482	111333	208320	222667	694400	75851	172838	7668	26994	25560	269943	1923	5745	25071	1758	7479
1974	26485	83594	157464	167189	524881	57109	130979	10033	18498	33445	184978	1213	8820	17285	1877	5403
1975	33390	104961	197004	209922	656681	71571	163614	12793	24016	42645	240163	1241	11552	22775	2629	7773
1976	34463	109649	207436	219298	691452	75186	172973	11518	21768	38394	217681	1051	10467	20717	2165	6549
1977	34352	109743	209507	219487	698356	75391	175155	10452	18748	34841	187481	2755	7697	15993	1908	5189
1978	28619	95574	183214	191148	610713	66955	154595	8945	13747	29816	137465	1563	7382	12184	2309	4865
1979	31169	104239	199562	208477	665206	73070	168393	4967	9428	16556	94283	561	4406	8867	852	2630
1980	35849	119658	225111	239315	750370	83809	189262	9553	14546	31842	145460	1922	7631	12624	2526	5274
1981	46670	155926	295123	311852	983742	109256	248453	20190	37537	67301	375367	1369	18821	36168	3563	10488
1982	41871	139312	262065	278623	873550	97441	220194	8751	14448	29170	144478	1248	7503	13200	1908	4422
1983	32420	107771	205588	215542	685292	75351	173168	9579	15327	31929	153270	1382	8197	13945	2297	5105
1984	39331	137546	275145	196495	687863	98215	235814	4045	20724	10111	138163	511	3534	20213	1093	5629
1985	36552	129871	261176	185530	652940	93319	224624	3094	18793	7735	125287	0	3063	18762	722	4762
1986	37496	133240	267244	190343	668111	95744	229748	4805	19795	12013	131968	0	4725	19715	1104	5419
1987	24482	92379	178517	131970	446293	67897	154035	3430	13446	8576	89639	0	3389	13405	807	3898
1988	39841	145452	289199	207789	722997	105611	249358	4813	21142	12032	140947	0	4753	21082	1066	5795
1989	18462	72376	142818	103395	357044	53914	124356	2709	11115	6773	74101	0	2691	11097	526	2849
1990	29967	113129	191534	161613	478834	83162	161567	4975	15576	12437	103839	0	4925	15525	1031	4349
1991	20529	82095	129133	117278	322832	61566	108604	3962	11175	9906	74498	0	3929	11141	909	3208
1992	23118	155288	302715	155288	302715	131606	279033	7793	55294	7793	55294	0	7652	55153	1705	14630
1993	24693	183650	347411	183650	347411	157317	321078	8113	26113	8113	26113	0	7949	25949	1597	7121
1994	29225	104322	217777	104322	217777	73021	186476	8310	26415	8310	26415	0	7842	25946	1680	6403
1995	30512	124160	283817	124160	283817	91351	251008	7642	30466	7642	30466	0	7176	30000	1085	6609
1996	35440	197996	428647	197996	428647	159499	390151	15375	42471	15375	42471	0	14803	41899	2105	9226
1997	22819	129217	224747	129217	224747	104085	199615	14432	41534	14432	41534	0	14017	41118	2307	9735
1998	22668	153928	213635	153928	213635	128499	188206	16365	54169	16365	54169	0	16009	53813	2068	10841
1999	22870	166497	236033	166497	236033	141611	211147	16214	47984	16214	47984	0	15892	47662	2291	10278
2000	21808	197203	260373	197203	260373	173134	236304	16363	37626	16363	37626	0	15860	37123	2858	9890
2001	20977	136762	175804	136762	175804	114014	153056	11420	24299	11420	24299	0	11049	23928	1027	3978
2002	20913	126583	184656	126583	184656	103868	161941	9475	24146	9475	24146	0	9173	23845	901	3953
2003	21226	220721	264226	220721	264226	197850	241355	13024	35903	13024	35903	0	12660	35540	1192	5566
2004	19946	168695	251606	168695	251606	147003	229914	10187	34175	10187	34175	0	9822	33810	1054	5585
2005	21869	120294	322744	120294	322744	95824	298274	10640	46181	10640	46181	0	10109	45651	1115	7718
2006	19394	167898	257696	167898	257696	146036	235835	21825	49564	21825	49564	0	21369	49108	2154	8585
2007	14577	124419	242735	124419	242735	108533	226849	14966	44245	14966	44245	0	14627	43907	1314	7008
2008	21802	188780	309161	188780	309161	164973	285354	14550	43786	14550	43786	0	14189	43426	1217	6800

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.

(iv) Large and 2SW return and spawner estimates for SFA 15.

	Large Salmon				Restigouche		SFA 15		SFA 15		Returns to SFA 15		Returns to SFA 15		Spawners to SFA 15		Spawners to SFA 15	
	Pre-commercial		Total	Prop.	2SW Salmon		Large Salmon		2SW Salmon		Large salmon		2SW salmon		Large salmon		2SW salmon	
Year	Restigouche	SFA 15	SFA 15	2SW	Return	Spawner	Return Pre-comm	Spawner	Return	Spawner	Min	Max	Min	Max	Min	Max	Min	Max
1970	4290	4903	14027	0.65	3187	9118	14027	16032	9118	10421	12681	16270	8243	10576	1779	5003	1156	3252
1971	1893	2163	6112	0.65	1230	3973	6112	6986	3973	4541	5518	7102	3587	4616	785	2207	510	1434
1972	9675	11058	11477	0.59	5708	6771	11477	13117	6771	7739	8441	16536	4980	9756	4011	11282	2367	6656
1973	9365	10704	11332	0.74	6930	8385	11332	12951	8385	9584	8393	16229	6211	12009	3883	10920	2873	8081
1974	11963	13672	13703	0.73	8733	10003	13703	15662	10003	11433	9950	19959	7264	14570	4960	13949	3620	10183
1975	5532	6323	7223	0.79	4370	5706	7223	8255	5706	6522	5510	10028	4353	7922	2239	6297	1769	4975
1976	11327	12945	13128	0.76	8608	9978	13128	15005	9978	11404	9596	18969	7293	14416	4644	13063	3530	9928
1977	13032	14895	15106	0.83	10817	12538	15106	17265	12538	14330	11053	21779	9174	18077	5315	14949	4412	12408
1978	8562	9785	9941	0.75	6421	7456	9941	11362	7456	8522	7277	14332	5458	10749	3496	9833	2622	7375
1979	2641	3018	3689	0.51	1347	1881	3689	4216	1881	2150	2886	4971	1472	2535	1033	2906	527	1482
1980	10509	12011	12020	0.81	8512	9736	12020	13738	9736	11128	8768	17340	7102	14045	4248	11947	3440	9677
1981	7291	8333	11980	0.47	3427	5631	11980	13693	5631	6435	9729	15652	4572	7357	2935	8256	1380	3880
1982	4205	4806	8604	0.59	2481	5076	8604	9834	5076	5802	7311	10700	4314	6313	1679	4723	991	2786
1983	3963	4529	7051	0.59	2338	4160	7051	8059	4160	4755	5852	8950	3453	5280	1535	4317	906	2547
1984	4393	5021	5556	0.79	3470	4389	5556	6350	4389	5017	4214	7711	3329	6092	3362	6838	2656	5402
1985	9149	10456	10456	0.63	5764	6587	10456	11951	6587	7529	7627	15080	4805	9500	7164	14571	4514	9180
1986	12339	14102	14102	0.76	9377	10718	14102	16118	10718	12250	10305	20267	7831	15403	9577	19479	7279	14804
1987	8924	10199	10199	0.64	5711	6527	10199	11657	6527	7460	7556	14255	4836	9123	6441	13099	4122	8383
1988	11874	13571	13571	0.72	8549	9771	13571	15511	9771	11168	9933	19441	7152	13998	9141	18592	6582	13386
1989	9171	10481	10481	0.57	5227	5974	10481	11979	5974	6828	7701	14898	4390	8492	6919	14072	3944	8021
1990	7576	8659	8659	0.68	5152	5888	8659	9897	5888	6730	6362	12307	4326	8369	5715	11623	3886	7903
1991	5705	6520	6520	0.50	2852	3260	6520	7452	3260	3726	4773	9335	2387	4668	4386	8920	2193	4460
1992	8852	10117	10117	0.54	4780	5463	10117	11563	5463	6244	7411	14420	4002	7787	6738	13704	3639	7400
1993	4154	4747	4747	0.40	1661	1899	4747	5426	1899	2170	3487	6711	1395	2684	3099	6302	1239	2521
1994	7920	9052	9052	0.60	4752	5431	9052	10346	5431	6208	6600	12908	3960	7745	6065	12334	3639	7401
1995	5017	5734	5734	0.65	3263	3730	5734	6554	3730	4263	4171	8199	2713	5333	3873	7877	2519	5124
1996	7268	8307	8307	0.65	4724	5399	8307	9494	5399	6171	6026	11929	3917	7754	5674	11541	3688	7502
1997	4596	5253	5253	0.65	2987	3414	5253	6004	3414	3902	3828	7535	2488	4898	3563	7247	2316	4710
1998	3127	3573	3573	0.65	2032	2323	3573	4084	2323	2655	2595	5015	1687	3260	2326	4732	1512	3076
1999	3277	3746	3746	0.65	2130	2435	3746	4281	2435	2783	2738	5269	1780	3425	2433	4948	1581	3217
2000	4187	4786	4786	0.65	2722	3111	4786	5470	3111	3555	3493	6785	2270	4410	3165	6437	2057	4184
2001	6987	7986	7986	0.65	4542	5191	7986	9128	5191	5933	5815	11449	3779	7442	5417	11018	3521	7161
2002	4307	4923	4923	0.65	2800	3200	4923	5627	3200	3657	3592	6985	2335	4540	3261	6633	2120	4312
2003	7297	8340	8340	0.65	4743	5421	8340	9533	5421	6196	6072	11966	3947	7778	5666	11525	3683	7491
2004	5550	6343	6343	0.65	3607	4123	6343	7250	4123	4712	4623	9055	3005	5886	4261	8666	2770	5633
2005	6325	7229	7229	0.65	4111	4699	7229	8262	4699	5370	5265	10346	3422	6725	4884	9934	3175	6457
2006	4707	5380	5380	0.65	3060	3497	5380	6149	3497	3997	3924	7651	2551	4973	3583	7288	2329	4737
2007	7892	9020	9020	0.65	5130	5863	9020	10310	5863	6701	6565	12957	4267	8422	6145	12498	3994	8124
2008	4772	5455	5455	0.65	3102	3545	5455	6234	3545	4052	3978	7760	2586	5044	3635	7394	2363	4806

(v) Small return and spawner estimates for SFA 15.

Year	Small Salmon Pre-commercial Restigouche	Small Salmon Pre-commercial SFA 15	Small Salmon Total SFA 15	Prop. 1SW	Restigouche 1SW Salmon Return	Restigouche 1SW Salmon Spawner	SFA 15 Small Salmon Return Pre-comm	SFA 15 Small Salmon Spawner	SFA 15 1SW Salmon Return	SFA 15 1SW Salmon Spawner	Returns to SFA 15 Small salmon Min	Returns to SFA 15 Small salmon Max	Spawners to SFA 15 Small salmon Min	Spawners to SFA 15 Small salmon Max
1970	3350	4126	4126	1.00	4126	4126	3727	4591	3727	4591	2834	6279	1417	4396
1971	2498	3076	3076	1.00	2498	3076	2779	3423	2779	3423	2113	4681	1056	3277
1972	2445	3011	3127	1.00	2445	3127	2836	3480	2836	3480	2185	4699	1034	3208
1973	3558	4382	4382	1.00	3558	4382	3958	4875	3958	4875	3010	6668	1505	4668
1974	2595	3196	3227	1.00	2595	3227	2918	3591	2918	3591	2226	4895	1098	3405
1975	2828	3483	3483	1.00	2828	3483	3146	3875	3146	3875	2393	5298	1195	3707
1976	5876	7237	10931	1.00	5876	10931	10231	12162	10231	12162	8667	14696	2480	7692
1977	5852	7207	8339	1.00	5852	8339	7642	9278	7642	9278	6085	12084	2467	7653
1978	3328	4099	5630	1.00	3328	5630	5234	6264	5234	6264	4350	7749	1398	4337
1979	5059	6231	6316	1.00	5059	6316	5714	7027	5714	7027	4378	9495	2104	6528
1980	7117	8765	10733	1.00	7117	10733	9886	11942	9886	11942	7994	15278	2996	9293
1981	7545	9293	12287	1.00	7545	12287	11389	13671	11389	13671	9380	17119	3183	9874
1982	6665	8209	9110	1.00	6665	9110	8316	10135	8316	10135	6541	13383	3038	9027
1983	1863	2294	3441	1.00	1863	3441	3219	3829	3219	3829	2723	4638	820	2486
1984	3759	4629	13452	1.00	3759	13452	13005	14967	13005	14967	12003	15867	1620	4971
1985	8278	10195	10195	1.00	8278	10195	9210	11343	9210	11343	7003	15516	3557	10936
1986	12776	15736	15736	1.00	12776	15736	14215	17508	14215	17508	10813	23926	5589	16990
1987	11365	13998	13998	1.00	11365	13998	12645	15575	12645	15575	9630	21220	4867	14920
1988	15553	19156	19156	1.00	15553	19156	17304	21313	17304	21313	13168	29092	6664	20468
1989	7486	9220	9220	1.00	7486	9220	8329	10259	8329	10259	6357	13900	3191	9741
1990	9293	11445	11445	1.00	9293	11445	10339	12734	10339	12734	7880	17314	3996	12190
1991	5248	6463	6463	1.00	5248	6463	5838	7191	5838	7191	4441	9828	2215	6872
1992	10465	12889	12889	1.00	10465	12889	11643	14340	11643	14340	8853	19614	4426	13728
1993	6835	8419	8419	1.00	6835	8419	7605	9367	7605	9367	5783	12812	2891	8968
1994	10823	13331	13331	1.00	10823	13331	12042	14832	12042	14832	9136	20208	4554	14125
1995	3451	4251	4251	1.00	3451	4251	3840	4729	3840	4729	2902	6429	1451	4501
1996	7210	8880	8880	1.00	7210	8880	8021	9880	8021	9880	6034	13370	3017	9359
1997	6879	8472	8472	1.00	6879	8472	7653	9426	7653	9426	5797	12845	2899	8991
1998	7459	9187	9187	1.00	7459	9187	8298	10221	8298	10221	6288	13932	3144	9752
1999	5869	7229	7229	1.00	5869	7229	6530	8043	6530	8043	4936	10929	2465	7646
2000	8852	10902	10902	1.00	8852	10902	9848	12130	9848	12130	7459	16520	3727	11560
2001	5882	7244	7244	1.00	5882	7244	6544	8060	6544	8060	4947	10953	2470	7663
2002	13887	17104	17104	1.00	13887	17104	15450	19030	15450	19030	11719	25958	5857	18166
2003	3722	4584	4584	1.00	3722	4584	4141	5100	4141	5100	3119	6904	1557	4829
2004	14327	17646	17646	1.00	14327	17646	15940	19633	15940	19633	12091	26783	6043	18744
2005	4902	6037	6037	1.00	4902	6037	5454	6717	5454	6717	4117	9116	2056	6377
2006	10347	12744	12744	1.00	10347	12744	11512	14179	11512	14179	8724	19322	4359	13522
2007	5069	6244	6244								4259	9430	2127	6597
2008	14974	18443	18443								12639	27996	6317	19593

(vi) Large return and spawner estimates for SFA 16.

Year	SFA 16 inriver returns		SFA 16 total returns Large salmon		Prop.	SFA 16 total Returns 2SW Salmon		Miramichi spawners Large salmon		SFA 16 spawners Large salmon		Miramichi spawners 2SW salmon		SFA 16 spawners 2SW salmon	
	Min	Max	Min	Max	2SW	Min	Max	5th	95th	5th	95th	5th	95th	5th	95th
1970	5,790	8,926	46,462	49,599	0.92	42,901	45,798	5,205	8,025	5,790	8,926	4806	7410	5,346	8,242
1971	9,311	14,355	28,365	33,409	0.918	26,038	30,669	6,585	11,119	7,324	12,369	6044	10207	6,724	11,354
1972	27,578	42,519	30,146	45,087	0.965	29,092	43,510	15,866	29,298	17,648	32,589	15311	28273	17,031	31,450
1973	26,775	41,280	27,771	42,276	0.958	26,599	40,492	18,094	31,134	20,126	34,632	17330	29820	19,277	33,170
1974	42,324	65,254	43,249	66,179	0.908	39,270	60,090	30,883	51,497	34,352	57,282	28042	46759	31,192	52,012
1975	28,571	44,049	29,826	45,305	0.868	25,889	39,325	19,198	33,113	21,355	36,834	16664	28742	18,536	31,972
1976	22,285	34,358	23,943	36,016	0.854	20,448	30,758	12,466	23,320	13,867	25,940	10646	19915	11,842	22,152
1977	45,704	70,464	52,673	77,434	0.947	49,881	73,330	29,071	51,331	32,337	57,097	27530	48610	30,623	54,071
1978	14,014	21,606	22,653	30,245	0.861	19,504	26,041	7,307	14,133	8,128	15,720	6292	12168	6,998	13,535
1979	7,515	11,586	9,435	13,507	0.689	6,501	9,306	3,915	7,575	4,355	8,426	2697	5219	3,000	5,806
1980	25,830	39,823	37,014	51,008	0.95	35,163	48,457	16,719	29,299	18,597	32,590	15883	27834	17,667	30,961
1981	7,733	19,912	16,708	28,887	0.667	11,144	19,268	3,224	14,173	3,586	15,765	2150	9453	2,392	10,515
1982	15,854	40,825	26,504	51,475	0.809	21,442	41,643	9,354	31,803	10,405	35,376	7567	25728	8,418	28,619
1983	9,520	24,515	20,309	35,304	0.805	16,349	28,419	6,160	19,640	6,852	21,846	4959	15810	5,516	17,586
1984	12,940	33,320	12,941	33,321	0.944	12,216	31,455	11,094	29,416	12,341	32,721	10473	27769	11,650	30,889
1985	16,793	43,242	16,798	43,247	0.87	14,614	37,625	14,486	38,264	16,114	42,563	12603	33290	14,019	37,030
1986	25,325	65,211	25,342	65,228	0.853	21,617	55,640	21,718	57,576	24,157	64,044	18525	49112	20,606	54,630
1987	15,713	40,462	15,734	40,483	0.796	12,524	32,224	12,891	35,140	14,340	39,088	10261	27971	11,414	31,114
1988	17,549	45,189	17,627	45,267	0.816	14,384	36,938	15,205	40,053	16,913	44,553	12407	32683	13,801	36,355
1989	13,877	35,734	13,955	35,812	0.653	9,113	23,385	11,656	31,305	12,965	34,822	7611	20442	8,466	22,739
1990	23,057	59,372	23,164	59,479	0.616	14,269	36,639	19,948	52,595	22,190	58,504	12288	32399	13,669	36,039
1991	24,191	62,291	24,273	62,373	0.605	14,685	37,736	21,101	55,354	23,472	61,572	12766	33489	14,200	37,251
1992	34,545	49,658	34,573	49,686	0.618	21,381	30,728	30,191	43,778	33,583	48,697	18672	27075	20,770	30,116
1993	22,448	87,253	22,602	87,407	0.689	15,579	60,246	19,434	76,397	22,109	86,914	13395	52658	15,239	59,907
1994	18,055	32,949	18,098	32,992	0.754	13,652	24,887	15,635	28,727	17,787	32,682	11794	21670	13,418	24,653
1995	30,311	44,081	30,324	44,094	0.844	25,593	37,215	26,377	38,481	30,007	43,778	22262	32478	25,326	36,949
1996	16,262	27,980	16,317	28,035	0.682	11,126	19,117	13,848	24,056	15,755	27,367	9443	16404	10,743	18,662
1997	14,711	24,521	14,711	24,521	0.581	8,545	14,244	12,267	20,812	13,955	23,677	7125	12089	8,106	13,754
1998	13,709	21,251	13,728	21,270	0.414	5,680	8,801	11,747	18,317	13,364	20,838	4860	7579	5,529	8,622
1999	13,743	19,772	13,777	19,806	0.487	6,705	9,639	11,316	16,569	12,874	18,849	5507	8063	6,265	9,173
2000	14,915	21,183	14,915	21,183	0.474	7,069	10,040	12,518	17,978	14,241	20,453	5933	8521	6,750	9,695
2001	21,729	27,201	21,729	27,201	0.646	14,029	17,562	18,425	23,192	20,961	26,384	11896	14974	13,534	17,035
2002	10,238	15,085	10,238	15,085	0.502	5,141	7,576	8,564	12,787	9,743	14,547	4301	6422	4,893	7,305
2003	17,418	24,471	17,418	24,471	0.585	10,192	14,320	14,913	21,057	16,966	23,956	8727	12322	9,928	14,019
2004	17,656	25,927	17,656	25,927	0.570	10,064	14,778	14,942	22,147	16,999	25,196	8517	12624	9,690	14,361
2005	15,449	24,198	15,449	24,198	0.665	10,274	16,092	13,008	20,629	14,798	23,468	8650	13718	9,841	15,606
2006	16,200	24,425	16,200	24,425	0.665	10,773	16,243	13,652	20,817	15,531	23,682	9078	13843	10,328	15,749
2007	14,755	21,445	14,755	21,445	0.665	9,812	14,261	12,393	18,220	14,099	20,728	8242	12117	9,376	13,784
2008	9,696	16,086	9,696	16,086	0.665	6,448	10,697	7,986	13,553	9,086	15,418	5311	9013	6,042	10,253

(vii) Small return and spawner estimates for SFA 16.

Year	SFA 16 inriver returns Small Salmon Min	SFA 16 inriver returns Small Salmon Max	SFA 16 total returns Small Salmon Min	SFA 16 total returns Small Salmon Max	Prop. 1SW	SFA 16 total returns 1SW Salmon Min	SFA 16 total returns 1SW Salmon Max	Miramichi spawners Small salmon 5th	Miramichi spawners Small salmon 95th	SFA 16 spawners Small salmon 5th	SFA 16 spawners Small salmon 95th	Miramichi spawners 1SW Salmon 5th	Miramichi spawners 1SW Salmon 95th	SFA 16 spawners 1SW salmon 5th	SFA 16 spawners 1SW salmon 95th
1970	47,771	67,689	47,779	67,697	1.00	47,779	67,697	23,336	41,243	25,958	45,876	23336	41243	25958	45876
1971	37,732	53,465	38,388	54,120	1.000	38,388	54,120	20,194	34,338	22,463	38,195	20194	34338	22463	38195
1972	48,886	69,270	48,886	69,270	1.000	48,886	69,270	24,848	43,172	27,639	48,023	24848	43172	27639	48023
1973	47,117	66,763	47,190	66,835	1.000	47,190	66,835	28,501	46,163	31,703	51,349	28501	46163	31703	51349
1974	77,657	110,036	78,091	110,470	1.000	78,091	110,470	51,581	80,690	57,376	89,755	51581	80690	57376	89755
1975	68,233	96,683	69,993	98,443	1.000	69,993	98,443	45,344	70,920	50,438	78,888	45344	70920	50438	78888
1976	94,984	134,588	96,504	136,107	1.000	96,504	136,107	58,009	93,613	64,526	104,130	58009	93613	64526	104130
1977	28,943	41,011	30,621	42,689	1.000	30,621	42,689	11,930	22,779	13,270	25,338	11930	22779	13270	25338
1978	24,328	34,471	29,783	39,927	1.000	29,783	39,927	13,206	22,325	14,689	24,833	13206	22325	14689	24833
1979	48,079	68,125	50,667	70,714	1.000	50,667	70,714	28,615	46,636	31,829	51,876	28615	46636	31829	51876
1980	41,136	58,288	41,687	58,839	1.000	41,687	58,839	24,984	40,404	27,791	44,943	24984	40404	27791	44943
1981	61,803	106,751	63,278	108,226	1.000	63,278	108,226	31,845	72,253	35,423	80,370	31845	72253	35423	80370
1982	75,761	130,860	78,072	133,171	1.000	78,072	133,171	46,140	95,675	51,324	106,423	46140	95675	51324	106423
1983	23,027	39,774	24,585	41,332	1.000	24,585	41,332	11,955	27,011	13,298	30,045	11955	27011	13298	30045
1984	28,713	49,594	28,714	49,595	1.000	28,714	49,595	6,643	25,415	7,389	28,271	6643	25415	7389	28271
1985	53,393	92,224	53,393	92,224	1.000	53,393	92,224	29,015	63,924	32,275	71,106	29015	63924	32275	71106
1986	103,214	178,279	103,230	178,295	1.000	103,230	178,295	64,654	132,138	71,918	146,983	64654	132138	71918	146983
1987	74,469	128,628	74,485	128,644	1.000	74,485	128,644	44,924	93,613	49,971	104,131	44924	93613	49971	104131
1988	107,019	184,852	107,071	184,904	1.000	107,071	184,904	64,699	134,670	71,967	149,800	64699	134670	71967	149800
1989	66,038	114,066	66,069	114,097	1.000	66,069	114,097	33,888	77,065	37,696	85,724	33888	77065	37696	85724
1990	73,005	126,100	73,020	126,115	1.000	73,020	126,115	42,165	89,897	46,902	99,996	42165	89897	46902	99996
1991	53,451	92,325	53,453	92,327	1.000	53,453	92,327	35,644	70,591	39,648	78,522	35644	70591	39648	78522
1992	142,380	204,672	142,416	204,708	1.000	142,416	204,708	104,875	160,875	116,657	178,949	104875	160875	116657	178949
1993	69,966	174,972	70,090	175,096	1.000	70,090	175,096	45,752	138,052	52,050	157,056	45752	138052	52050	157056
1994	41,717	59,832	41,773	59,888	1.000	41,773	59,888	22,545	38,468	25,649	43,764	22545	38468	25649	43764
1995	44,318	63,414	44,357	63,453	1.000	44,357	63,453	30,458	47,243	34,650	53,746	30458	47243	34650	53746
1996	32,062	45,990	32,067	45,995	1.000	32,067	45,995	19,866	29,615	22,600	33,692	19866	29615	22600	33692
1997	14,377	24,122	14,377	24,122	1.000	14,377	24,122	8,867	15,688	10,087	17,848	8867	15688	10087	17848
1998	21,263	28,373	21,283	28,393	1.000	21,283	28,393	13,724	18,701	15,613	21,276	13724	18701	15613	21276
1999	21,342	26,701	21,368	26,727	1.000	21,368	26,727	12,574	16,325	14,305	18,572	12574	16325	14305	18572
2000	31,456	38,635	31,456	38,635	1.000	31,456	38,635	19,066	24,091	21,691	27,408	19066	24091	21691	27408
2001	27,088	34,175	27,088	34,175	1.000	27,088	34,175	17,400	22,362	19,796	25,440	17400	22362	19796	25440
2002	42,708	53,254	42,708	53,254	1.000	42,708	53,254	27,507	34,890	31,294	39,692	27507	34890	31294	39692
2003	27,304	35,677	27,304	35,677	1.000	27,304	35,677	17,880	23,741	20,341	27,009	17880	23741	20341	27009
2004	42,844	55,085	42,844	55,085	1.000	42,844	55,085	27,879	36,448	31,717	41,465	27879	36448	31717	41465
2005	27,361	39,579	27,361	39,579	1.000	27,361	39,579	17,624	26,177	20,051	29,781	17624	26177	20051	29781
2006	27,463	39,670	27,463	39,670	1.000	27,463	39,670	17,855	26,400	20,313	30,034	17855	26400	20313	30034
2007	20,592	29,841	20,592	29,841	1.000	20,592	29,841	14,414	20,889	16,398	23,764	14414	20889	16398	23764
2008	23,618	34,471	23,618	34,471	1.000	23,618	34,471	16,532	24,130	18,808	27,451	16532	24130	18808	27451

(viii) Small, large, and 2SW return and spawner estimates for SFA 17.

	Small recruits		Small spawners		Large recruits		Large spawners		2SW recruits		2SW spawners	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1969	10	19	6	15	19	36	11	28	19	36	11	28
1970	0	0	0	0	31	60	18	47	31	60	18	47
1971	0	0	0	0	29	29	0	0	29	29	0	0
1972	0	0	0	0	385	385	0	0	385	385	0	0
1973	5	9	3	7	206	206	0	0	206	206	0	0
1974	0	0	0	0	386	386	0	0	386	386	0	0
1975	0	0	0	0	345	345	0	0	345	345	0	0
1976	14	28	8	22	575	578	1	4	575	578	1	4
1977	0	0	0	0	606	606	0	0	606	606	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	2	5	1	4	459	463	3	7	459	463	3	7
1980	12	23	7	18	1699	1702	1	4	1699	1702	1	4
1981	259	498	151	390	257	294	36	73	257	294	36	73
1982	175	336	102	263	432	447	8	23	432	447	8	23
1983	17	32	10	25	343	358	15	30	343	358	15	30
1984	17	32	10	25	59	72	13	26	59	72	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	361	694	210	543	53	103	53	102	53	103	53	102
2003	697	1339	406	1048	91	175	87	171	91	175	87	171
2004	213	409	124	320	42	80	41	79	42	80	41	79
2005	275	529	160	414	44	85	42	83	44	85	42	83
2006	252	484	147	379	40	78	39	76	40	78	39	76
2007	47	89	27	70	7	14	6	13	7	14	6	13
2008	23	43	13	34	4	7	4	7	4	7	4	7

(ix) Total returns and spawners of small, large and 2SW salmon 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	264	1,073	167	842	7,059	8,755	395	1,824	5,435	7,617	304	1,587
1971	65	265	41	208	2,842	3,584	173	797	2,188	3,118	133	694
1972	131	530	82	416	5,174	6,002	193	891	3,984	5,222	148	775
1973	516	2,095	325	1,645	5,975	6,898	215	992	4,601	6,001	165	863
1974	187	757	118	595	8,411	9,255	196	908	6,476	8,052	151	790
1975	112	454	71	357	5,421	5,926	118	544	4,174	5,156	91	473
1976	299	1,212	188	951	4,144	4,790	151	694	3,191	4,167	116	604
1977	215	871	135	684	6,216	7,320	257	1,187	4,786	6,369	198	1,033
1978	78	316	49	248	6,368	7,614	290	1,340	4,903	6,625	223	1,166
1979	1,857	7,536	1,170	5,915	1,733	2,373	149	688	1,335	2,064	115	598
1980	520	2,108	327	1,655	5,695	6,799	257	1,187	4,385	5,915	198	1,033
1981	2,797	11,348	1,762	8,908	3,572	4,671	255	1,181	2,751	4,064	196	1,027
1982	2,150	8,722	1,354	6,847	6,339	7,752	329	1,519	4,881	6,744	253	1,322
1983	212	858	133	674	5,479	6,655	273	1,264	4,218	5,790	210	1,100
1984	460	1,867	177	1,200	3,534	4,535	337	1,320	2,721	3,946	259	1,148
1985	730	3,167	145	1,788	1,196	5,150	1,131	5,010	921	4,481	871	4,359
1986	965	3,854	63	1,729	2,953	13,195	2,811	12,889	2,274	11,479	2,164	11,213
1987	1,557	5,316	439	2,679	3,500	10,012	3,400	9,798	2,695	8,711	2,618	8,524
1988	1,296	4,481	259	2,035	3,399	9,785	3,293	9,555	2,617	8,513	2,535	8,313
1989	838	2,958	178	1,400	2,819	8,172	2,732	7,986	2,171	7,110	2,104	6,948
1990	934	3,303	180	1,525	2,561	7,427	2,479	7,250	1,972	6,461	1,909	6,308
1991	1,088	3,843	198	1,745	3,173	9,292	3,075	9,082	2,443	8,084	2,368	7,901
1992	943	3,295	139	1,398	3,236	9,336	3,129	9,104	2,492	8,123	2,409	7,921
1993	1,090	3,637	205	1,550	1,800	5,094	1,741	4,968	1,386	4,432	1,341	4,322
1994	626	2,217	134	1,059	2,698	7,880	2,619	7,708	2,078	6,855	2,016	6,706
1995	508	1,829	113	898	2,027	5,959	1,969	5,832	1,561	5,184	1,516	5,074
1996	2,256	8,253	830	4,890	4,389	13,021	4,285	12,795	3,380	11,328	3,299	11,132
1997	521	1,947	163	1,103	4,622	13,748	4,509	13,503	3,559	11,960	3,472	11,748
1998	587	2,195	181	1,240	2,788	8,312	2,715	8,156	2,147	7,231	2,091	7,096
1999	651	2,454	293	1,610	2,101	6,319	2,057	6,225	1,618	5,497	1,584	5,416
2000	569	2,209	267	1,498	1,974	6,049	1,936	5,968	1,520	5,263	1,491	5,192
2001	758	2,915	339	1,927	2,294	7,002	2,248	6,902	1,766	6,091	1,731	6,005
2002	783	3,031	366	2,046	1,648	5,087	1,615	5,016	1,269	4,426	1,243	4,364
2003	711	2,793	335	1,905	3,225	9,864	3,163	9,731	2,483	8,581	2,436	8,466
2004	1,002	3,940	406	2,535	3,575	10,995	3,499	10,831	2,753	9,566	2,694	9,423
2005	729	2,738	248	1,604	2,979	8,932	2,906	8,776	2,294	7,771	2,238	7,635
2006	801	3,091	290	1,886	2,861	8,695	2,793	8,549	2,203	7,565	2,151	7,438
2007	666	2,632	274	1,707	1,981	6,140	1,939	6,049	1,525	5,342	1,493	5,262
2008	1,094	4,535	389	2,874	3,016	9,608	2,949	9,462	2,323	8,359	2,270	8,232

(x) Total small returns and spawners for SFAs 19, 20, 21, and 23.

	RETURNS						TOTAL RETURNS		SPAWNERS						SFA 19-23 TOTAL 1SW SPAWNERS	
	SFA 19-21		Comm-ercial	SFA 23			SFAs 19,20,21,23		angled	Spawners 19-21		SFA 23 H+W rtns		Harvest		
Year	MIN	MAX	19-21	Wild MIN	Wild MAX	Hatch	MIN	MAX	19-21	MIN	MAX	MIN	MAX		MIN	MAX
1970	16,177	24,106	2,644	5,206	7,421	100	21,483	31,627	3,609	9,429	17,358	5,306	7,521	1,420	13,315	23,459
1971	11,911	18,004	2,607	2,883	4,176	365	15,159	22,545	2,761	7,246	13,339	3,248	4,541	2,032	8,462	15,848
1972	11,587	17,992	4,337	1,546	2,221	285	13,418	20,498	2,917	7,616	14,021	1,831	2,506	2,558	6,889	13,969
1973	14,169	22,159	4,206	3,509	5,047	1,965	19,643	29,171	3,604	9,502	17,492	5,474	7,012	1,437	13,539	23,067
1974	25,032	39,058	8,841	6,204	8,910	3,991	35,227	51,959	6,340	16,680	30,706	10,195	12,901	2,124	24,751	41,483
1975	10,860	15,753	9,311	11,648	16,727	6,374	28,882	38,854	2,227	5,819	10,712	18,022	23,101	2,659	21,182	31,154
1976	21,071	33,009	5,893	13,761	19,790	9,074	43,906	61,873	5,404	14,196	26,134	22,835	28,864	5,263	31,768	49,735
1977	24,599	37,314	9,169	6,746	9,679	6,992	38,337	53,985	5,841	15,120	27,835	13,738	16,671	4,542	24,316	39,964
1978	7,621	10,023	6,796	3,227	4,651	3,044	13,892	17,718	1,113	2,857	5,259	6,271	7,695	2,015	7,113	10,939
1979	24,298	37,514	2,291	11,529	16,690	3,827	39,654	58,031	5,428	15,716	28,932	15,356	20,517	3,716	27,356	45,733
1980	34,377	50,250	9,171	14,346	20,690	10,793	59,516	81,733	7,253	18,876	34,749	25,139	31,483	5,542	38,473	60,690
1981	31,204	48,945	4,438	11,199	16,176	5,627	48,030	70,748	8,163	21,096	38,837	16,826	21,803	9,021	28,901	51,619
1982	17,619	27,075	5,803	8,773	12,598	3,038	29,430	42,711	4,361	11,244	20,700	11,811	15,636	5,279	17,776	31,057
1983	9,313	14,068	2,977	7,706	11,028	1,564	18,583	26,660	2,047	5,653	10,408	9,270	12,592	4,138	10,785	18,862
1984	18,382	29,867		14,105	20,227	1,451	33,938	51,545	4,724	13,658	25,143	15,556	21,678	5,266	23,948	41,555
1985	24,384	39,541		11,038	15,910	2,018	37,440	57,469	6,360	18,024	33,181	13,056	17,928	4,892	26,188	46,217
1986	24,369	39,663		13,412	19,321	862	38,643	59,846	6,182	18,187	33,481	14,274	20,183	3,549	28,912	50,115
1987	27,269	44,266		10,030	14,334	3,328	40,627	61,928	7,056	20,213	37,210	13,358	17,662	3,101	30,470	51,771
1988	24,509	39,750		15,131	21,834	1,250	40,890	62,834	6,384	18,125	33,366	16,381	23,084	3,320	31,186	53,130
1989	25,602	41,557		16,240	23,182	1,339	43,181	66,078	6,629	18,973	34,928	17,579	24,521	4,455	32,097	54,994
1990	29,471	48,039		12,287	17,643	1,533	43,291	67,215	7,391	22,080	40,648	13,820	19,176	3,795	32,105	56,029
1991	9,762	15,955		10,602	15,246	2,439	22,803	33,640	2,399	7,363	13,556	13,041	17,685	3,546	16,858	27,695
1992	13,754	22,269		11,340	16,181	2,223	27,317	40,673	3,629	10,125	18,640	13,563	18,404	4,078	19,610	32,966
1993	13,297	21,681		7,610	8,828		20,907	30,509	3,327	9,970	18,354	5,762	6,868		15,732	25,222
1994	3,154	5,393		5,770	6,610		8,924	12,003	493	2,661	4,900	4,965	5,738		7,626	10,638
1995	8,397	13,873		8,265	9,458		16,662	23,331	1,885	6,512	11,988	8,025	9,218		14,537	21,206
1996	13,120	22,293		12,907	15,256		26,027	37,549	2,211	10,909	20,082	11,576	13,892		22,485	33,974
1997	3,410	5,863		4,508	4,979		7,918	10,842	493	2,917	5,370	3,971	4,433		6,888	9,803
1998	8,818	11,912		9,203	10,801		18,021	22,713	0	8,818	11,912	8,775	10,348		17,593	22,260
1999	3,962	5,328		5,508	6,366		9,470	11,694	67	3,895	5,261	5,196	6,048		9,091	11,309
2000	6,148	8,305		4,796	5,453		10,944	13,758	0	6,148	8,305	4,455	5,087		10,603	13,392
2001	2,315	3,127		2,513	2,862		4,828	5,989	0	2,315	3,127	2,210	2,530		4,525	5,657
2002	5,180	6,998		3,501	3,991		8,681	10,989	0	5,180	6,998	3,232	3,689		8,412	10,687
2003	2,829	3,822		2,292	2,716		5,121	6,538	0	2,829	3,822	2,069	2,469		4,898	6,291
2004	3,833	5,178		3,454	4,297		7,287	9,475	0	3,833	5,178	3,229	4,039		7,062	9,217
2005	2,854	3,855		3,597	4,640		6,451	8,495	0	2,854	3,855	3,433	4,450		6,287	8,305
2006	5,119	6,915		3,720	4,743		8,839	11,658	0	5,119	6,915	3,528	4,501		8,647	11,416
2007	4,176	5,642		2,466	3,136		6,642	8,778	0	4,176	5,642	2,305	2,937		6,481	8,579
2008	7,262	9,811		5,924	7,691		13,186	17,502	0	7,262	9,811	5,729	7,467		12,991	17,278

SFAs 19, 20, 21: Escapement (spawners) were estimated by liklihood profiles of the ratio of the counted escapement in the LaHave River to the reported recreatioanl catch in the LaHave and then to SFA 19-21(Amiro et al 2008) and from reported harvests in the commercial fishery (Cutting MS 1984).

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, 1993-2008, 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.

(xi) Total 2SW returns and spawners for SFAs 19, 20, 21, and 23.

					SFA 23				SFA 19-23		SFA 19-23		SFA 23	
	Returns		*SPAWNERS*		*RETURNS*		*REMOVALS*		*Returns*		*TOTAL 2SW*		*Total 2SW*	
	SFA 19-21		SFAs (19-21)						*SFA 19-23*		*SPAWNERS*		*SPAWNERS*	
Year	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1970	5,600	7,447	2,388	4,234	8,540	12,674	7,004	7,828	14,140	20,121	3,924	9,080	1,536	4,846
1971	4,120	5,215	1,418	2,513	7,155	10,536	3,543	3,960	11,275	15,751	5,030	9,090	3,612	6,576
1972	5,744	6,993	1,616	2,865	7,869	11,368	1,397	1,562	13,613	18,361	8,088	12,671	6,472	9,806
1973	6,922	8,659	2,246	3,984	4,205	6,036	1,454	1,625	11,127	14,695	4,998	8,395	2,752	4,412
1974	13,138	15,363	2,878	5,103	10,755	14,988	2,632	2,942	23,893	30,351	11,001	17,149	8,123	12,046
1975	12,261	13,797	1,987	3,523	13,107	18,578	2,120	2,369	25,368	32,375	12,974	19,732	10,987	16,209
1976	8,607	10,104	1,935	3,432	14,274	20,281	4,203	4,698	22,881	30,385	12,006	19,015	10,071	15,583
1977	10,872	12,851	2,559	4,539	16,869	23,995	4,856	5,427	27,741	36,846	14,572	23,107	12,013	18,568
1978	8,272	9,779	1,948	3,455	8,225	11,294	2,879	3,218	16,497	21,073	7,294	11,531	5,346	8,076
1979	3,781	4,879	1,419	2,517	5,165	7,207	1,393	1,557	8,946	12,086	5,191	8,167	3,772	5,650
1980	14,094	17,318	4,170	7,394	19,056	26,865	7,033	7,860	33,150	44,183	16,193	26,399	12,023	19,005
1981	8,662	11,471	3,631	6,439	11,026	15,267	7,384	8,253	19,688	26,738	7,273	13,453	3,642	7,014
1982	4,458	5,353	1,158	2,053	9,782	13,871	5,307	5,932	14,240	19,224	5,633	9,993	4,475	7,939
1983	4,134	5,356	1,579	2,800	9,662	13,836	9,194	10,275	13,796	19,192	2,047	6,361	468	3,561
1984	1,758	2,854	1,416	2,512	15,706	22,627	3,426	3,829	17,464	25,481	13,696	21,309	12,280	18,798
1985	6,761	11,990	6,761	11,990	16,541	23,828	4,656	5,204	23,302	35,818	18,646	30,614	11,885	18,624
1986	6,624	11,748	6,624	11,748	9,891	14,261	2,667	2,981	16,515	26,009	13,848	23,028	7,224	11,280
1987	3,676	6,519	3,676	6,519	6,922	10,043	1,294	1,446	10,598	16,562	9,304	15,116	5,628	8,597
1988	4,322	7,664	4,322	7,664	4,716	6,697	1,296	1,449	9,038	14,361	7,742	12,912	3,420	5,248
1989	4,735	8,396	4,735	8,396	6,560	9,437	250	279	11,295	17,833	11,045	17,554	6,310	9,158
1990	3,530	6,260	3,530	6,260	5,486	7,918	560	626	9,016	14,178	8,456	13,552	4,926	7,292
1991	2,912	5,165	2,912	5,165	7,337	10,563	1,257	1,405	10,249	15,728	8,992	14,323	6,080	9,158
1992	2,588	4,589	2,588	4,589	6,878	9,809	1,052	1,176	9,466	14,398	8,413	13,222	5,826	8,633
1993	2,493	4,421	2,493	4,421	4,345	4,820	1,054	1,166	6,839	9,241	5,785	8,075	3,291	3,654
1994	1,339	2,375	1,339	2,375	3,084	3,495	697	815	4,423	5,870	3,726	5,055	2,387	2,680
1995	2,218	3,934	2,218	3,934	3,439	3,998	313	346	5,657	7,932	5,344	7,586	3,126	3,652
1996	2,946	5,224	2,946	5,224	4,729	5,397	720	812	7,675	10,621	6,955	9,809	4,009	4,585
1997	1,140	2,022	1,140	2,022	2,769	3,176	550	611	3,909	5,198	3,359	4,587	2,219	2,565
1998	915	1,261	915	1,261	1,372	1,642	304	340	2,288	2,903	1,984	2,563	1,068	1,302
1999	1,409	1,941	1,409	1,941	2,375	2,640	441	459	3,783	4,581	3,342	4,122	1,934	2,181
2000	1,072	1,477	1,072	1,477	988	1,206	183	202	2,060	2,682	1,877	2,480	805	1,004
2001	1,812	2,497	1,812	2,497	1,938	2,279	239	271	3,751	4,776	3,512	4,505	1,699	2,008
2002	378	521	378	521	483	548	166	192	861	1,068	695	876	317	356
2003	1,834	2,528	1,834	2,528	1,056	1,198	178	200	2,891	3,726	2,713	3,526	878	998
2004	1,017	1,401	1,017	1,401	1,335	1,605	97	113	2,352	3,006	2,255	2,893	1,238	1,492
2005	646	890	646	890	809	1,012	83	99	1,455	1,902	1,372	1,804	726	914
2006	1,248	1,720	1,248	1,720	922	1,171	126	148	2,170	2,890	2,045	2,742	796	1,023
2007	587	809	587	809	616	736	86	103	1,203	1,545	1,117	1,442	530	633
2008	1,778	2,450	1,778	2,450	812	1,042	76	89	2,590	3,492	2,514	3,403	736	953
2009														

(xii)Estimated numbers of salmon returns and spawners for Quebec.

	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
1969	25,355	38,032	16,313	24,470	74,653	111,979	25,532	38,299	54,496	81,745	18,639	27,958
1970	18,904	28,356	11,045	16,568	82,680	124,020	31,292	46,937	60,356	90,534	22,843	34,264
1971	14,969	22,453	9,338	14,007	47,354	71,031	16,194	24,292	34,568	51,852	11,822	17,733
1972	12,470	18,704	8,213	12,320	61,773	92,660	31,727	47,590	45,094	67,642	23,160	34,741
1973	16,585	24,877	10,987	16,480	68,171	102,256	32,279	48,419	49,765	74,647	23,564	35,346
1974	16,791	25,186	10,067	15,100	91,455	137,182	39,256	58,884	66,762	100,143	28,657	42,985
1975	18,071	27,106	11,606	17,409	77,664	116,497	32,627	48,940	56,695	85,042	23,818	35,726
1976	19,959	29,938	12,979	19,469	77,212	115,818	31,032	46,548	56,365	84,547	22,653	33,980
1977	18,190	27,285	12,004	18,006	91,017	136,525	44,660	66,990	66,442	99,663	32,602	48,902
1978	16,971	25,456	11,447	17,170	81,953	122,930	40,944	61,416	59,826	89,739	29,889	44,834
1979	21,683	32,524	15,863	23,795	45,197	67,796	17,543	26,315	32,994	49,491	12,807	19,210
1980	29,791	44,686	20,817	31,226	107,461	161,192	48,758	73,137	78,447	117,670	35,594	53,390
1981	41,667	62,501	30,952	46,428	84,428	126,642	35,798	53,697	61,633	92,449	26,132	39,199
1982	23,699	35,549	16,877	25,316	74,870	112,305	36,290	54,435	54,655	81,982	26,492	39,738
1983	17,987	26,981	12,030	18,045	61,488	92,232	23,710	35,565	44,886	67,329	17,308	25,963
1984	21,566	30,894	16,316	24,957	61,180	81,041	30,610	44,739	44,661	59,160	22,345	32,659
1985	22,771	33,262	15,608	25,140	62,899	84,192	28,312	43,482	45,916	61,460	20,668	31,742
1986	33,758	46,937	22,230	33,855	75,561	99,397	32,997	49,232	55,159	72,560	24,088	35,939
1987	37,816	54,034	25,789	40,481	72,190	93,650	29,758	43,462	52,699	68,365	21,723	31,727
1988	43,943	62,193	28,582	44,815	77,904	103,269	34,781	52,524	56,870	75,387	25,390	38,343
1989	34,568	48,407	24,710	37,319	70,762	91,871	34,268	49,185	51,656	67,066	25,016	35,905
1990	39,962	54,792	26,594	39,826	68,851	90,893	33,454	49,615	50,261	66,352	24,422	36,219
1991	31,488	42,755	20,582	30,433	64,166	83,184	27,341	39,797	46,841	60,724	19,959	29,052
1992	35,257	48,742	21,754	33,583	64,271	83,953	26,489	39,497	46,917	61,285	19,337	28,833
1993	30,645	42,156	17,493	27,444	50,717	63,677	21,609	29,353	37,023	46,484	15,774	21,428
1994	29,667	40,170	16,758	25,642	51,649	64,630	21,413	28,968	37,703	47,180	15,631	21,147
1995	23,851	32,368	14,409	21,548	59,939	74,227	30,925	39,320	43,755	54,186	22,575	28,703
1996	32,008	42,558	18,923	27,805	53,990	68,282	26,042	34,824	39,413	49,846	19,010	25,421
1997	24,300	33,018	14,724	22,210	44,442	56,187	21,275	28,466	32,443	41,017	15,531	20,780
1998	24,495	34,301	16,743	25,730	33,368	43,605	19,506	26,629	24,358	31,832	14,240	19,439
1999	25,880	36,679	18,969	28,808	34,815	46,178	23,631	32,618	25,415	33,710	17,250	23,811
2000	24,129	35,070	16,444	25,865	33,312	46,565	22,094	31,960	24,317	33,992	16,128	23,331
2001	16,939	24,452	10,836	16,989	35,016	48,490	22,871	32,954	25,562	35,398	16,696	24,056
2002	28,609	39,275	17,070	25,625	25,635	35,801	17,079	24,366	18,714	26,135	12,467	17,787
2003	23,142	31,892	15,445	23,187	39,435	52,413	28,409	39,137	28,787	38,262	20,738	28,570
2004	30,423	43,266	20,513	32,081	34,796	45,488	23,920	32,374	25,401	33,207	17,462	23,633
2005	20,685	29,531	14,295	22,278	33,728	43,831	24,012	32,168	24,622	31,996	17,529	23,482
2006	24,925	34,641	17,305	25,893	30,922	40,811	22,171	29,983	22,573	29,792	16,185	21,887
2007	18,520	26,698	13,031	20,395	27,987	37,520	19,707	27,432	20,431	27,390	14,386	20,026
2008	30,219	41,815	20,278	30,616	33,156	46,634	24,957	36,557	24,204	34,042	18,218	26,687

Annex 6. Glossary of acronyms used in this report

1SW *(One-Sea-Winter)* Maiden adult salmon that has spent one winter at sea.

2SW *(Two-Sea-Winter)* Maiden adult salmon that has spent two winters at sea.

BCI *(Bayesian Credible Interval)* The Bayesian equivalent of a confidence interval. If the 90% BCI for a parameter A is 10 to 20, there is a 90% probability that A falls between 10 and 20.

BHSRA *(Bayesian Hierarchical Stock and Recruitment Approach)* Models for the analysis of a group of related stock–recruit datasets. Hierarchical modelling is a statistical technique that allows the modelling of the dependence among parameters that are related or connected through the use of a hierarchical model structure. Hierarchical models can be used to combine data from several independent sources.

C&R *(Catch and Release)* Catch and release is a practice within recreational fishing intended as a technique of conservation. After capture, the fish are unhooked and returned to the water before experiencing serious exhaustion or injury. Using barbless hooks, it is often possible to release the fish without removing it from the water (a slack line is frequently sufficient).

CL, i.e. S_{lim} *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that undesirable levels are avoided.

CPUE *(Catch Per Unit Effort)* A derived quantity obtained from the independent values of catch and effort.

CWT *(Coded Wire Tag)* The CWT is a length of magnetized stainless steel wire 0.25 mm in diameter. The tag is marked with rows of numbers denoting specific batch or individual codes. Tags are cut from rolls of wire by an injector that hypodermically implants them into suitable tissue. The standard length of a tag is 1.1 mm.

DFO *(Department of Fisheries and Oceans)* DFO and its Special Operating Agency, the Canadian Coast Guard, deliver programs and services that support sustainable use and development of Canada’s waterways and aquatic resources.

DST *(Data Storage Tag)* A miniature data logger with sensors including salinity, temperature, and depth that is attached to fish and other marine animals.

EU DCR *(The EU Data Collection Regulation)* DCR established a community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy.

FV *(Fishing Vessel)* A vessel that undertakes cruise for commercial fishing purposes.

GIS *(Geographic Information Systems)* A computer technology that uses a geographic information system as an analytic framework for managing and integrating data.

GSI *(Genetic Stock Identification)* Methods used to 'genetically type' salmon from particular regions and rivers across Atlantic.

ICPR *(The International Commission for the Protection of the River Rhine)* ICPR coordinates the ecological rehabilitation programme involving all countries bordering the river Rhine. This programme was initiated in response to catastrophic river pollution in Switzerland in 1986 which killed hundreds of thousands of fish. The programme aims to bring about significant ecological improvement of the Rhine and its tributaries allowing the re-establishment of migratory fish species such as salmon.

ISAV *(Infectious Salmon Anemia Virus)* ISA is a highly infectious disease of Atlantic salmon caused by an enveloped virus.

MHC *(The Major Histocompatibility Complex)* MHC is a large genomic region or gene family found in most vertebrates. It is the most polymorphic region of the mammalian genome and plays an important role in the immune system, autoimmunity, and reproductive success. The proteins encoded by the MHC are expressed on the surface of cells in all jawed vertebrates, and display both self antigens (peptide fragments from the cell itself) and nonself antigens (e.g. fragments of invading microorganisms) to a type of white blood cell called a T cell that has the capacity to kill or coordinate the killing of pathogens and infected or malfunctioning cells.

MSY *(Maximum Sustainable Yield)* The largest average annual catch that may be taken from a stock continuously without affecting the catch of future years; a constant long term MSY is not a reality in most fisheries, where stock sizes vary with the strength of year classes moving through the fishery.

MSW *(Multi-Sea-Winter)* An adult salmon which has spent two or more winters at sea or a repeat spawner.

NLO *(Net Limitation Order)* NLO came into force in UK (England and Wales) to reduce netting effort and phase out various net fisheries

PFA *(Pre-Fishery Abundance)* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time.

PGA *(The Probabilistic-based Genetic Assignment model)* An approach to partition the harvest of mixed-stock fisheries into their finer origin parts. PGA uses Monte Carlo sampling to partition the reported and unreported catch estimates to continent, country and within country levels.

PIT *(Passive Integrated Transponder)* PIT tags use radio frequency identification technology. PIT tags lack an internal power source. They are energized on encountering an electromagnetic field emitted from a transceiver. The tag's unique identity code is programmed into the microchip's nonvolatile memory.

Q Areas for which the Ministère des Ressources naturelles et de la Faune manages the salmon fisheries in Québec.

RT-PCR *(Reverse Transcription-Polymerase Chain Reaction)* is the most sensitive technique for mRNA detection and quantitation currently available. Compared with the two other commonly used techniques for quantifying mRNA levels, Northern blot analysis and RNase protection assay, RT-PCR can be used to quantify mRNA levels from much smaller samples.

RV *(Research Vessel)* A vessel that undertakes cruises to conduct scientific research.

RVS *(Red Vent Syndrome)* The condition, known as RVS, has been noted since 2005, and has been linked to the presence of a nematode worm, *Anisakis simplex*. This is a common parasite of marine fish and is also found in migratory species. The larval nematode stages in fish are usually found spirally coiled on the mesenteries, internal organs and less frequently in the somatic muscle of host fish.

RW *(The Random Walk)* In the RW hypothesis, the recruitment rates are modelled as a first order time varying parameter following a simple random walk with a flat prior on the first value of the time-series. The model can be used both for retrospective analysis and forecasts.

SAC *(Special Areas of Conservation)* To comply with the EU Habitats Directive (92/43/EEC) on Conservation of Natural Habitat and of Wild Fauna and Flora, which stipulates that member states maintain or restore habitats and species to favourable conservation status, a number of rivers in the NEAC area that support important populations of vulnerable qualifying species have been designated SACs. Where salmon is a "qualifying species", additional protection measures specifically for salmon are required.

SER *(Spawning Escapement Reserve)* The CL increased to take account of natural mortality between the recruitment date (1st January) and return to home waters.

SL *(The Shifting Level)* The shifting level model supposes that the recruitment rate remains constant for periods of time, with abrupt shifts in the levels between periods. By contrast with the RW model, it is highly flexible because the number of periods, their duration and the corresponding levels of recruitment rates do not need to be specified a priori.

SFA *(Salmon Fishing Areas)* Areas for which the Department of Fisheries and Oceans (DFO) Canada manages the salmon fisheries.

SGBICEPS *(The Study Group on the Identification Of Biological Characteristics For Use As Predictors Of Salmon Abundance)* The ICES Study Group established to complete a review of the available information on the life-history strategies of salmon and changes in the biological characteristics of the fish in relation to key environmental variables.

SGBYSAL *(Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries).* The ICES Study Group that was established in 2005 to study Atlantic salmon distribution at sea and fisheries for other species with a potential to intercept salmon.

SGEFISSA (Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance) A Study Group established by ICES and met in November 2006.

SGSSAFE (*Study Group on Salmon Stock Assessment and Forecasting*). The Study Group established to work on the development of new and alternative models for forecasting Atlantic salmon abundance and for the provision of catch advice.

S_{lim}, i.e. CL *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that the undesirable levels are avoided.

TAC *(Total Allowable Catch)* The quantity of fish that can be taken from each stock each year.

VHSV *(Viral Haemorrhagic Septicaemia Virus)* VHS is a highly infectious virus disease caused by the virus family *Rhabdoviridae*, genus *Novirhabdovirus*.

VIE *(Visual Implant Elastomer)* The VIE tags consist of fluorescent elastomer material which is subcutaneously injected as a liquid into transparent or translucent tissue via a hand-held injector.

WFD *(Water Framework Directive)* Directive 2000/60/EC (WFD) aims to protect and enhance the water environment, updates all existing relevant European legislation, and promotes a new approach to water management through river-based planning. The Directive requires the development of River Basin Management Plans (RBMP) and Programmes of Measures (PoM) with the aim of achieving Good Ecological Status or, for artificial or more modified waters, Good Ecological Potential.

WKDUHSTI (Workshop on the Development and Use of Historical Salmon Tagging Information from Oceanic Areas) The Workshop established by ICES was held in February 2007.

WKSHINI (*Workshop on Salmon historical information-new investigations from old tagging data*) The Workshop is set to meet from 18–20 September 2008 in Halifax, Canada.

WKLUSTRE *(Workshop on Learning from Salmon Tagging Records)* The ICES Workshop established to complete compilation of available data and analyses of the resulting distributions of salmon at sea. WKLUSTRE will report by 30 November 2009 for the attention of the WGNAS.

This glossary has been extracted from various sources, but chiefly the EU SALMODEL report (Crozier *et al*., 2003).

Annex 7: Technical minutes from the North Atlantic Salmon Group

- RGNAS
- 21–22 April 2009 at ICES, Copenhagen, Denmark
- Participants:
    - External Reviewers: K. Friedland (USA), K. Leonardsson (Sweden)
    - J. Erkinaro (Chair of WGNAS, Finland), M. Azevedo (Chair of review Group, Portugal), A. Romakkaniemi (Chair of WGBAST, Finland), S. Pedersen (Denmark), N. Ó Maoiléidigh (Ireland)
- Working Group: WGNAS

General Comments

The Review Group (RG) received the Working Group (WG) report two business days before the start of the Review Group meeting; one of those days was a travel day. As a result, the Reviewers did not have the time to give the Report the attention such a large body of work deserves. The RG suggests that ACOM explore the possibility of circulating the Report draft to the Reviewers with adequate time for a more comprehensive and timely review.

The results of stock status are consistent overall with previous reports and our understanding of general trends for these stocks.

The information and analyses provided follow the assessment procedures developed in past years and, as such, this Report amounts more to an update of the assessment using the latest data from 2008. In some cases, updates were also made to data from previous years, as appropriate.

This Report goes a long way in responding to the Terms of Reference and in laying out the progress made in advancing special studies and research aiming at elucidating the science questions requiring attention (such as modelling procedures, disease issues, and restoration, among other issues). Overall, the WG report was very well written and carefully prepared.

The RG suggests that the WG add a section to the Report next year that outlines how they dealt with the Technical Minutes arising from the deliberations of the RG. It is not intended that this be an extensive section, but rather a vehicle to facilitate the efficient use of constructive criticism provided by the RG. It will also be useful to the RG as a means of judging how its advice is being used and what types of advice is proving to be most effective.

Executive Summary

Considering the continued decline of salmon stocks on both sides of the North Atlantic Basin, the Executive Summary seems to be a dramatic understatement of the events and findings of the report. The WG may want to consider the scope and impact of their findings in the context of the conservation and management of Atlantic salmon and try to touch upon the broader range of issues these data address.

2.1.3 Unreported catches

There continues to be large differences in the amount of unreported catch between countries and national fisheries, with little explanation of why these differences are occurring. The WG is encouraged to compare the nature of reporting systems, estimation procedures and the fisheries themselves to try to explain why these dramatic differences in unreported catch exist.

2.3 Development of forecast models

The RG supports the innovation of the WG to develop forecast models using Bayesian statistics to describe the error structure of models and forecasts. This work should continue, but the RG was concerned that the higher priority work of the WG should be implementing biologically relevant forecast models that utilize the best available information on recruitment of the species. The RG has a series of comments that will be relevant to the formulations of models described in this section and in other parts of the Report (for example Sections 3.4, 4.7 and 4.9.10.5 of the WG report).

Though there are a number of model variants used in the report, one feature common to all of them is the reliance on a spawning stock size independent variable, referred to a lagged spawners. When the WG began building forecast models, it did so by testing models with variables intended to represent the best available information on the environmental effects on the recruitment process along with variables representative of the effect of stock size on recruitment. Because these models were first formulated, a number of changes have occurred with our knowledgebase on the recruitment process of Atlantic salmon. In general, a spawning stock size indicator is a good candidate predictor variable of recruitment when a stock is under a relatively constant exploitation regime and the dominant source of mortality is fishing mortality. Under these circumstances, natural mortality is of secondary importance to the recruitment process and higher recruitments are usually realized when spawning increases. In Atlantic salmon, with the decline in exploitation, a realized increase in spawning in many rivers and ancillary data that demonstrates that natural mortality, patterned by climate variation, is the main source of mortality defining the recruitment pattern, it is not clear that the lagged spawner variable has any predictive value. The lagged spawner variable is correlated with recruitment because they are the both patterned by the same autocorrelated climate forcing function. The RG believes this variable should be of secondary importance in any model formulation for Atlantic salmon.

At the heart of the issue: what is the recruitment mechanism for Atlantic salmon, is it the same for both stock complexes and do logical candidate predictor variables follow on from these mechanisms? The WG has been made aware of these new data, but continues to be unable to utilize the wide breadth of information on the recruitment mechanisms of the stock complexes.

Retrospective growth analyses support the hypothesis that post-smolt survival of the European stock complex, in particular the southern component, is governed by post-smolt growth (Friedland *et al*., 2000; 2009; Peyronnet *et al*., 2007; McCarthy *et al*., 2008). Further, it would appear that summer growth governs the survival, most likely a consequence of growth mediated predation (McCarthy *et al*., 2008; Friedland *et al*., 2009). Environmental factors, such as SST, and foodweb parameters have been shown to correlate with recruitment and thus provide a rich candidate list of predictor variables (Beuagrand and Reid, 2003; Peyronnet *et al*., 2008; Friedland *et al*., 2009). These reports support a growth-mortality hypothesis of recruitment control in Atlantic salmon in the NE Atlantic. The WG should liaise with non-WG members from their individual countries and encourage them to develop working papers addressing the Terms of Reference for the meeting. This could greatly expand the scope of information presented to address the questions posed by NASCO.

In contrast, the North American stock complex appears to be governed by a different recruitment mechanism. Growth analyses suggest independence between post-smolt growth and survival (Friedland *et al*., 2005; Friedland *et al*., in press). Coupled with reports on environmental effects on recruitment of North American stocks (Friedland *et al*., 2003a; b) it would appear recruitment in North America is governed by spring environmental conditions and predation pressure. These data also provide many potential predictor variables. The WG should explore the utility of including environmental forcing variables in future model development. Along this front, the WG is encouraged to consider the ideas contained in Cooperative Research Report 282 (ICES 2006, Incorporation of Process Information into Stock–Recruitment Models).

Finally, the forecasting done by the WG was reported without model diagnostics or any evaluation of the predictive capability of the models. The WG should strive to develop an evaluation framework to support model selection.

The RG is sensitive to the demands on the WG to fulfill its task to answer its term of reference, which leaves little time to take on new concepts within the framework of the WG meeting and work schedule. The RG suggests one approach may be to expand the remit of the SGSSAFE (see comment on Section 6).

3.1 Status of stocks/exploitation

The RG encourages the WG to revisit the issue of finding a satisfactory estimation procedure that can be used to reconstitute the missing PFA data for Norway.

3.6 Pre-fishery abundance forecasts

The WG continues to utilize year as an independent variable. This variable needs to be removed from model formulations unless there is some evidence to suggest there is an underlying trend of monotonic increase or decrease in the abundance trends.

3.6.3 Results of the NEAC Bayesain forecast models

The RG noticed a reciprocal shift in the forecast trajectories for maturing and non-maturing salmon and suspect it may be because of an anomalously low parameter value used in the model (in this case it appears to be the maturation parameter). The model appears to be very sensitive to single values in the latter portion of the time-series. The RG suggests the WG investigate the sensitivity of models to individual observations of model parameters and determine if these influences are acceptable in model forecasts.

3.6.4 Comparisons with the regression forecast model

The RG would expect the regression model formulation is in part responsible for the variance between models, with neither formulation offering any possibility of realistic forecasts reflecting survival factors.

3.8.13 Trends in the PFA for NEAC stocks

This section of the Report provides an example of how the WG is failing to incorporate contemporary data in their analyses of stock status (see discussion of Section 2.3). The trends in NE Atlantic salmon abundances are discussed with no linkage to contemporary findings on the causes and mechanisms associated with these trends. The RG encourages the WG to consider findings made in other scientific outlets. This comment extends to other parts of the WG report.

3.9 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

In addition to the concern that the indicators are not sufficient to justify multi-annual management advice, given climate change effects on the stocks and the current status of the stock complex, the RG feels continued annual assessment seems like a reasonable course of action.

4.5 Relevant factors to be considered in management

There are many examples of where management regimes of diadromous species have failed, because they do not consider shifting productivity as a consequence of ocean survival effects. Clearly, ocean climate effects are impacting the productivity of both European and North American stock complexes. If management is not conditioned on what is occurring with changes in ocean climate, it is at risk of failure before it is even instituted.

Figures 4.9.9.1 (Standardized mean (one standard error bars) annual return rates of wild and hatchery origin smolts to 1SW and 2SW salmon to the geographic areas of North America. The standardized values are annual means derived from a general linear model analysis of rivers in a region. Survival rates were log transformed prior to analysis**) and 4.9.9.2 (**Annual rate of change (%) of return rates to 1SW and 2SW salmon by wild (left) and hatchery (right) salmon smolts to rivers of eastern North America over the last 15 years. Grey circles are for 1SW and dark squares are for 2SW dataseries. Populations with 8 or more data points in the last 15 years are included in th analysis**)**

The survival data of monitored stocks is one of the most important elements of the assessment. These two figures are intended to complement each other, however, the time-series plots should have each y-axis ranges representative of the data being plotted. The WG is encouraged to review how these data are presented to ensure the salient features of the time-series can be communicated to scientific and management audiences.

4.9.10.2.2 Non-maturing 1SW salmon

The RG noted that the PFA of non-maturing fish in North American has been relatively constant for the past 12 years or so. It was not clear to the RG if this is a consequence of methodology or a natural phenomenon, ether of which should be of interest to the WG.

5.10 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 SG appreciates the intent of the framework of indicators to provide a mechanism to ensure adequate advice is provided each year to manage the fisheries, while at the same time reducing the annual workload of the WG to allow for increased time and resources that can be applied to topical subjects critical to understanding the status of the stocks and on issues of potential value in assessment procedures. The RG wonders if the framework is creating more work than it is saving and encourages the parties to consider making strategic decisions on which classes of data are needed annually and which are not. The precarious state of the stock complexes suggests that the assessment be monitored closely.

6 NASCO has requested ICES to identify relevant data deficiencies, monitoring needs and research requirements

The RG supports the recommendation that the SGSSAFE meet in the coming year to continue its work on modelling and forecasting salmon stock abundance. However, the RG feels the remit of the group should be expanded to include work on the incorporation of physical and biological variables into the models that will allow prediction of salmon survival and thus provide a more realistic simulation of the recruitment process. The RG suggests that the evaluation of variables to incorporate in the model is a high priority issue for the WG and thus the SG, especially in light of the continued depressed condition of the stock complexes.

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