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

26 March–4 April 2012

Copenhagen, Denmark

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International Council for the Exploration of the Sea
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Contents

Executive Summary

Working Group on North Atlantic Salmon [WGNAS], ICES HQ, 26 March–4 April 2012.

Chair: Gérald Chaput (Canada).

Number of participants: 25 representing twelve countries from North America and the Northeast Atlantic. Information was provided by correspondence from Greenland, Faroes, Denmark, Sweden, and Spain for use by the Working Group.

WGNAS met to consider questions posed to ICES by the North Atlantic Salmon Conservation Organization (NASCO). The terms of reference were addressed by reviewing working documents prepared ahead of the meeting as well as the development of documents and text for the report during the meeting.

The Report is structured by sections specific to the terms of reference of the WGNAS.

- In the North Atlantic, exploitation rates have declined and nominal catch of wild Atlantic salmon in 2011 was 1634 t, the fourth lowest in the time-series beginning in 1960.
- Three of the four NEAC stock complexes (Northern NEAC 1SW and MSW and Southern NEAC MSW) are considered to be at full reproductive capacity while the Southern NEAC 1SW is considered to be at risk of suffering reduced reproductive capacity. At a country level, stocks from several jurisdictions are below CLs.
- A worked example of the catch advice framework for the Faroes Fishery at the stock complex level is provided.
- Probabilities of meeting age and complex specific SERs in PFA years 2011 to 2015 are greater than 95% for the Northern NEAC stock complexes and greater than 80% for the Southern NEAC complexes. All stock complexes are expected to have a greater than 75% probability of achieving the individual stock complex SERs with a TAC at Faroes of less than 100 t in the 2012/13 season, a TAC of around 120 t in the 2013/14 season and a TAC of about 140 t in the 2014/15 season.
- North American 2SW spawner estimates were below their CLs in four of the six regions and within each of the geographic areas there are varying numbers of individual river stocks which are failing to meet CLs, particularly in the southern areas of Scotia-Fundy and the USA.
- There are no mixed-stock fishery options at West Greenland in 2012, 2013, and 2014 nor in NAC in 2012 to 2105 that would be consistent with a 75% chance or greater of simultaneously meeting the seven (for West Greenland) and six (for NAC) management objectives for 2SW salmon.
- A Framework of Indicator has been developed for the NAC and NEAC stocks which can be used in the interim years of the three-year catch advice cycle.
- Marine survival indices in the North Atlantic were improved in the most recent two years in some stocks but the declining trend has persisted and survival indices remain low. Factors other than marine fisheries, acting in freshwater and in the ocean in both NAC and NEAC (marine mortality, fish passage, water quality), are contributing to continued low abundance of wild Atlantic salmon.

1 Introduction

1.1 Main tasks

At its 2011 Statutory Meeting, ICES resolved (C. Res. 2011/2/ACOM09) that the **Working Group on North Atlantic Salmon** [WGNAS] (chaired by: Gérald Chaput, Canada) will meet at ICES HQ, 26 March–4 April 2012 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organization (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
i) provide an overview of salmon catches and landings, including unreported catches by country, catch and release, and production of farmed and ranched Atlantic salmon in 2011[1];	2.1 and 2.2 Annex 4
ii) report on significant new or emerging threats to, or opportunities for, salmon conservation and management[2];	2.3
iii) provide a review of examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations;	2.4
iv) provide a compilation of tag releases by country in 2011;	2.5
v) identify relevant data deficiencies, monitoring needs and research requirements. Where relevant suggest improvement for the revision of the DCF, to be taken into account by WKESDCF.	2.6 Annex 8

b) With respect to Atlantic salmon in the Northeast Atlantic Commission area:	Section 3
i) describe the key events of the 2011 fisheries[3];	3.1
ii) review and report on the development of age-specific stock conservation limits;	3.2
iii) describe the status of the stocks;	3.3
iv) provide catch options or alternative management advice for 2012-2015, 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[4];	3.4, 3.5, 3.7
v) further develop a risk-based framework for the provision of catch advice for the Faroese salmon fishery, providing a clear indication of the management decisions required for implementation;	3.6
vi) further develop a framework of indicators that could be used to identify any significant change in the assessments used in previously provided multi-annual management advice;	3.8
vii) provide advice on best practice for conducting monitoring surveys for the parasite *Gyrodactylus salaris*.	3.9

c) With respect to Atlantic salmon in the North American Commission area:	Section 4
i) describe the key events of the 2011 fisheries (including the fishery at St Pierre and Miquelon)[3];	4.1
ii) update age-specific stock conservation limits based on new information as available;	4.2
iii) describe the status of the stocks;	4.3
iv) provide catch options or alternative management advice for 2012-2015 with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding4	4.4, 4.5, 4.6, 4.7, 4.8

d) With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
i) describe the key events of the 2011 fisheries[3];	5.1
ii) Describe the status of the stocks[5];	5.3
iii) provide catch options or alternative management advice for 2012–2014 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[4];	5.2, 5.4, 5.5, 5.6, 5.7, 5.8
iv) update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice;	5.9
v) advise on possible explanations for the variations in fishing patterns (e.g. effort, licences and landings) observed in the Greenland fishery in recent years.	5.1.2

Notes:

1. With regard to question a) i, 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. Numbers of salmon caught and released in recreational fisheries should be provided.
2. With regard to question a) ii, ICES is requested to include reports on any significant advances in understanding of the biology of Atlantic salmon that is pertinent to NASCO, including information on any new research into the migration and distribution of salmon at sea and the potential implications of climate change for salmon management.
3. In the responses to questions b) i, c) i and d) i, ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality of the salmon gear used, 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.
4. In response to questions b) iv, c) iv and d) iii, provide a detailed explanation and critical examination of any changes to the models used to provide catch advice and report on any developments in relation to incorporating environmental variables in these models.
5. In response to question d) ii, ICES is requested to provide a brief summary of the status of North American and Northeast Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions b) iii and c) iii.

In response to the terms of reference, the Working Group considered 38 Working Documents submitted by participants (Annex 1); other references cited in the Report are given in Annex 2. A full address list for the participants is provided in Annex 3. A complete list of acronyms used within this document is provided in Annex 7.

1.2 Participants

Member	Country
• Chaput, G. (Chair)	Canada
• Dankel, D.	Norway
• Degerman, E.	Sweden (by correspondence)
• Dionne, M.	Canada
• Douglas, S.	Canada
• Ensing, D.	UK (N. Ireland)
• Erkinaro, J.	Finland

- Euzenat, G. France
- Fiske, P. Norway
- Gjøsæter, H. NorwayGudbergsson, G. Iceland
- Massiot-granier, F. France
- Meerburg, D. Canada
- Nygaard, R. Greenland (by correspondence)
- Ó Maoiléidigh, N. Ireland
- Orpwood, J. UK (Scotland)
- Potter, T. UK (England & Wales)
- Prusov, S. Russia
- Rivot, E. France
- Russell, I. UK (England & Wales)
- Sheehan, T. USA
- Smith, G. W. UK (Scotland)
- Trial, J. USA
- Ustyuzhinskiy, G. Russia
- Veinott, G. Canada
- Wennevik, V. Norway
- White, J. Ireland

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 Organization (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 in their own rivers, distant water salmon fisheries, such as those at Greenland and Faroes, which take salmon originating in rivers of another Party are regulated by NASCO under the terms of the Convention. NASCO now has six 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 organization as:

"To contribute through consultation and cooperation 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.

Atlantic salmon has characteristics of short-lived fish stocks; mature abundance is sensitive to annual recruitment because there are only a few age groups in the adult spawning stock. Incoming recruitment is often the main component of the fishable stock. For such fish stocks, the ICES MSY approach is aimed at achieving a target escapement (MSY $B_{escapement}$, the amount of biomass left to spawn). No catch should be allowed unless this escapement can be achieved. The escapement level should be set so there is a low risk of future recruitment being impaired, similar to the basis for estimating B_{pa} in the precautionary approach. In short-lived stocks, where most of the annual surplus production is from recruitment (not growth), MSY $B_{escapement}$ and B_{pa} might be expected to be similar.

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.

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 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.

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% of simultaneous attainment of management objectives (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 1960–2011 are given in Table 2.1.1.1. Catch statistics in the North Atlantic also include fish-farm escapees and, in some Northeast 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 2011 (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 2011 was 1634 t, just 23 t above the updated catch for 2010 (1611 t). The 2011 catch was only two tonnes above the average of the previous five years (1632 t), and over 400 t below the average of the last ten years (2053 t). Catches were below the previous five- and ten-year averages in the majority of Southern NEAC countries except UK (Scotland) where catches in 2011 were slightly above the previous five-year average and UK (England & Wales) where catches in 2011 were above the previous five- and ten-year means. Catches were below the previous five- and ten-year averages in the majority of Northern NEAC countries except Sweden and Denmark where catches in 2011 were above the previous five- and ten-year means.

Nominal catches in homewater fisheries were split, where available, by sea age or size category (Table 2.1.1.2 weight only). The data for 2011 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 recognizes 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 except for UK (England & Wales) where coastal catches increased considerably over two years after a period of steady decline.

Coastal, estuarine and riverine catch data aggregated by region are presented in Figure 2.1.1.3. In northern Europe catches in coastal fisheries have been in decline since 2001 and freshwater catches have been relatively constant. About half the catch has typically 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 has been a reduction in the proportion of the catch taken in coastal waters over the last five years and it now represents only one third of the total. In southern Europe, catches in all fishery areas have declined dramatically over the period. While coastal fisheries have historically made up the largest component of the catch, these fisheries have declined the most, reflecting widespread measures to reduce exploitation in a number of countries. In the last four years, the majority of the catch in this area has been taken in freshwater, though there was a slight increase in the proportion of the catch taken in coastal waters in 2010 and 2011.

In North America, the total catch has been fluctuating over the period 2001 to 2011, but has shown an upward trend over last five years. 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, 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 2011 for 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 2011 this ranged from 12% in Norway (this is a minimum figure) to 73% in UK (Scotland) reflecting varying management practices and angler attitudes among these countries. Catch and release rates have typically been highest in Russia (average of 84% in the five years 2004 to 2008) and are believed to have remained at this level. However, there were no obligations to report caught-and-released fish in Russia since 2009. Within countries, the percentage of fish released has tended to increase over time. There is also evidence from some countries that larger MSW fish are released in higher proportions than smaller fish. Overall, over 206 000 salmon were reported to have been released around the North Atlantic in 2011.

Summary information on how catch and release levels are incorporated into national assessments was provided to the Working Group in 2010 (ICES 2010b).

2.1.3 Unreported catches

Unreported catches by year (1987 to 2011) and Commission Area are presented in Table 2.1.3.1 and are presented relative to the 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). Detailed reports from different countries were also submitted to NASCO in 2007 in support of a special session on this issue. There have been no estimates of unreported catch for Russia since 2008 and for Canada in 2007 and 2008. Estimates for Canada in 2009 and 2010 were considered incomplete (information available for three of the four jurisdictions). There are also no estimates of unreported catch for Spain and St Pierre et Miquelon (NAC), where total catches are typically small. It has not been possible to separate the unreported catch into that taken in coastal, estuarine and riverine areas.

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 carcass tagging and logbook schemes).

The total unreported catch in NASCO areas in 2011 was estimated to be 421 t. The unreported catch in the Northeast Atlantic Commission Area in 2011 was estimated at 382 t, and that for the West Greenland and North American Commission Areas at 10 t and 29 t, respectively. The 2011 unreported catch by country is provided in Table 2.1.3.2. Information on unreported catches was not provided to enable these to be partitioned into coastal, estuarine and riverine areas.

In the past, salmon fishing by non-contracting parties is known to have taken place in international waters to the north of the Faroe Islands. Typically, a number of surveillance flights have taken place over this area in recent years. In 2011, there were 17 flights over the area by the Norwegian coastguard between April and October. As in past years there were no sightings of vessels fishing for salmon, although there have been extended periods over the winter period when no flights took place. This is a period when salmon fishing has previously been reported.

Summary information on how unreported catches are incorporated into national and international assessments was provided to the Working Group in 2010 (ICES 2010b).

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 2011 is 1273 kt, the third year in which production in this area has been in excess of one million tonnes. The 2011 total represents an 8% increase on 2010 and a 26% increase on the previous five-year mean (Table 2.2.1.1 and Figure 2.2.1.1) due to increased production in the majority of countries where farming occurs. Norway and UK (Scotland) continue to produce the majority of the farmed salmon in the North Atlantic (78% and 12% respectively). Farmed salmon production in 2011 was below the previous five-year average in Canada, USA and Iceland. The production of farmed salmon in Russia has increased dramatically over last two years.

Worldwide production of farmed Atlantic salmon has been over 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 2010 estimates for some countries in deriving a worldwide estimate for 2011. Noting this caveat, total production in 2011 is provisionally estimated at around 1604 kt (Table 2.2.1.1 and Figure 2.2.1.1), a 17% increase on 2010, recovering after the small decrease in production first noted in 2009 and reflecting an increase in production outside the North Atlantic. Production in this area is estimated to have accounted for 20% of the total in 2011 (up from 14% in 2010). Production outside the North Atlantic is still dominated by Chile.

The worldwide production of farmed Atlantic salmon in 2011 was over 980 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 2011 was 33 t, the majority of which (30 t) was taken by the Icelandic ranched rod fisheries (Table 2.2.2.1; Figure 2.2.2.1). Small catches of ranched fish from experimental projects were also recorded in Ireland; these data include catches in net, trap and rod fisheries. No estimate of ranched salmon production was made in Norway in 2011 where such catches have been very low in recent years (<1 t) and UK (N. Ireland) where the proportion of ranched fish was not assessed between 2008 and 2011 due to a lack of microtag returns.

It was noted that a high proportion of the fish caught in Sweden in the last ten years (29 t, 74% of the total catch in 2011) originated from hatchery-reared smolts released under programmes to mitigate for hydropower development schemes. However, these fish do not fall within the agreed definition of ranched fish and are not included in Figure 2.2.2.1.

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

2.3.1 Update on SALSEA

Over the past two decades, an increasing proportion of North Atlantic salmon are dying at sea during their oceanic feeding migration. The SALSEA-Merge programme was designed to advance our understanding of oceanic-scale, ecological and ecosystem processes. Through a partnership of nine European nations, the programme has provided new information on genetic stock identification techniques, new genetic marker development, fine scale estimates of marine growth on a weekly and monthly basis, the use of novel high seas pelagic trawling technology and estimates of food and feeding patterns. In addition it has provided fine scale migration and distribution models, merging hydrographic, oceanographic, genetic and ecological data.

Research cruises to designated areas in the Northeast Atlantic took place in 2008 and 2009. In total, 1728 post-smolts and 53 adult salmon were captured in 233 trawl tows. The tissues from these fish and associated environmental data collected at sea were combined with a subset of 1800 tissue samples selected from archival material. A unique, comprehensive biological and environmental database (SALSEA PGNAPES) was developed to facilitate any future analyses.

The SALSEA-Merge programme facilitated the development of a unique molecular assignment protocol; GRAASP: **G**enetically based **R**egional **A**ssignment of **A**tlantic **S**almon **P**rotocol, based on a suite of 14 microsatellite loci. The baseline database comprised 26 813 individuals from 467 locations, in 284 rivers, representing about 85% of non-Baltic European salmon production. A total of 3871 of the 4151 marine samples were assigned on a regional basis. Significant temporal and spatial heterogeneity in the distribution of the regional stock groups was found and fish of farm-origin identified, demonstrating the value and power of the tool.

Over 23 000 scales of Atlantic salmon from seven rivers, located in six countries, and smolt age and fine scale growth of 2242 sea caught post-smolts were analysed. The average rate of circuli formation in the marine zone of scales was estimated to be 6.3 days per circulus. Both the age structure and the number of marine circuli in the scales obtained during the post-smolt surveys suggest that the majority of the post-smolts originated in rivers in southern Europe. Marine growth rates varied among years, with highest growth rates in 2002, followed by 2003 and 2009. The lowest growth rates were in 2008. Growth rates during the first period at sea were lowest for salmon of southernmost origin. Historical growth indices from archival scale sets from Ireland, Norway, Finland and Iceland were linked to prevailing environmental and biological conditions. There was evidence that growth is linked to oceanic conditions for all rivers and to recruitment for Irish and possibly Icelandic rivers. The diet of salmon, herring and mackerel was studied for four years (2002, 2003, 2008 and 2009). Although the fish examined fed in close proximity in the ocean, the diet differed among the three species. Salmon showed differences in diet among years from 2002–2009. The condition factor of salmon decreased from 2002 to 2009.

While assignment to river of origin was possible for some stocks, the marine samples were assigned to 17 subregions of origin to provide an overview of the distribution and migrations of salmon at sea. This enabled the oceanic distribution of salmon at sea to be mapped providing unique insights into likely migration routes, timing and dispersal of salmon from different regions. Likely migration routes based entirely on genetic identification were assembled for two individual river stocks, the Loire Allier

(France) and the Bann River, UK (N. Ireland). The distribution of post-smolts was linked to ocean currents. South of 61.5°N, the post-smolts are not randomly distributed within the migration path, but are located in areas where the currents are stronger than average. A migration drift model for specific stocks of post-smolts was developed. When temperature and salinity preferences were included with active swimming behaviour, this proved to be an important mechanism for altering the migration routes and the post-smolt distribution pattern. Also, interannual variation in windfields, and thus the surface currents, also altered the migration pathways. Several key areas in the migration routes, where shifts in the migration direction may occur due to climate change, were also identified. A conceptual ecological model was developed, where the main factors relating to the survival of salmon at sea were identified and described. A full report of the SALSEA-Merge programme is available on the NASCO web page (**www.NASCO.int**).

2.3.2 Atlantic salmon genetics

2.3.2.1 New initiatives in relation to management of mixed-stock coastal fisheries in northern Norway

SALSEA-Merge, and other projects, have contributed towards the establishment of a comprehensive genetic baseline for salmon populations in northern Europe. Work continues to further develop this baseline for the salmon populations of northernmost Europe into a practical and useful tool for management of mixed-stock coastal fisheries in Norway and Russia. Two years ago, the Working Group reported (ICES 2010b) on a pilot project that expanded the baseline for a number of Russian rivers, and ongoing genetic analysis and assignment of samples from salmon caught in coastal fisheries in Norway. Power analysis of the genetic baseline developed indicated that with the present coverage, and number of genetic markers used, around 50% of the samples from coastal fisheries can be reliably (probability >90%) assigned to river. A total of 1900 samples from adult salmon caught in coastal fisheries in 2008 in Finnmark county, northern Norway, were genetically analysed and assigned to defined geographical regions of rivers in the baseline. The results demonstrated that the method applied can give reliable estimates of the proportion of Russian salmon in the catches as well as estimates of how salmon from different regions are exploited in the coastal fisheries (see Section 3.1.8).

However, it was also recognized that the spatial coverage of the baseline should be expanded, and additional sampling should be conducted in a number of rivers to improve the precision of the assignment of individuals. A further initiative to achieve this has been taken by Norway, Russia and Finland. In 2011 a new EU project "Trilateral cooperation on our common resource; the Atlantic salmon in the Barents region" (Kolarctic Salmon) was started. The project funding consists of both EU-funding (Kolarctic ENPI CBC) and national funding from Norway, Russian Federation and Finland. In the first year of the project the genetic baseline has been expanded both in terms of spatial coverage and completeness, and it now contains genetic data from over 110 salmon populations and the number of genetic markers are being upgraded to 31 microsatellite markers. Also, more than 8000 samples were collected from coastal fisheries in northern Norway and Russia in 2011, and analyses of these are now underway. Preliminary assignment of a subset of these samples has already provided valuable information of the composition of the catches in time and space, and interesting patterns of coastal migration of different populations and sea age groups are beginning to emerge. In 2012, additional samples will be collected both from rivers and coastal fisheries. Through the activities in this project, a foundation will be established on which a river-specific management regime for coastal and riverine fisheries for these northern populations can be implemented.

2.3.2.2 Steps towards an integrated and standardized genetic database in North America

Building on a SALSEA initiative to develop a compatible genetic database over the entire salmon distribution area, a North American project supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) has started. A Canadian genetic database is being constructed by expanding the river coverage for each province and standardizing genetic data from rivers already sampled. Standardization is done using a reference group of individuals analysed by all genetic laboratories and by using the same set of microsatellite loci. Combining, calibrating and integrating databases of all Canadian provinces and USA Atlantic salmon populations will provide a valuable tool for identifying the North American origin of salmon from the Greenland, the Labrador and the Saint-Pierre et Miquelon fisheries.

2.3.3 Recent studies on marine ecology of US origin Atlantic salmon

Stock status of the USA stock complex is well below CL and poor marine survival has been implicated as a primary driver (National Research Council 2004). As a result, research has focused on developing a better understanding of salmon's role in the marine ecosystem to understand the causal mechanisms of marine survival while looking for opportunities for management intervention. Ultrasonic telemetry, marine trawl surveys and modelling of environmental variables and salmon marine survival have all been used by both US and Canadian researchers to investigate USA salmon marine ecology.

Kocik *et al*. (2009) describes smolt migration on the Narraguagus River, Maine based on six years of monitoring (1997–1999 and 2002–2004). Migrating smolts were captured in the lower river, surgically tagged and released. Receivers were deployed throughout the lower river, estuary and nearshore environment to estimate smolt survival to the Gulf of Maine, map migration paths and document emigration timing for this population. Survival trajectories show higher losses in the estuary and inner bay areas and lower losses in the middle and outer bay areas. The data provided a comprehensive overview of smolt migration in the Narraguagus River. Simulations of overall survival indicated that for every 100 smolts exiting the river, 62–74 reached the Inner Bay, 41–54 reached the Middle Bay, and 36–47 reached the Outer Bay. While mortality decreased in the marine environment, analysis indicated that less than half the smolts survived the approximately 10-day period of migration from the river to the Gulf of Maine.

The migration pattern of Atlantic salmon through the Gulf of Maine was previously described based on a small number of Carlin tag returns (Meister 1984). A marine surface trawl survey targeting Atlantic salmon post-smolts in Canadian waters within the Bay of Fundy and the Gulf of Maine was conducted in 2001–2003 (Lacroix and Knox 2005). The majority of salmon captured were of Canadian origin, but subsequent tag and genetic analysis have identified a small number of US origin post-smolts (Lacroix *et al*. 2012). These data provided new information on the distribution, abundance and ecology of the early marine post-smolt USA salmon and have helped to identify the migration corridors used en route to the Labrador Sea.

Sheehan *et al*. (2011) reported on a Surface Trawl Survey (2001–2005) in Penobscot Bay, Maine USA and the nearshore Gulf of Maine waters that was conducted to investigate early marine dynamics of a hatchery dependant Atlantic salmon population from a severely modified river system. Hatchery reared smolts were released with location specific and time-specific marks, thus recaptures provided insights into the effect of stocking location, stocking time, migration distance and number of downstream dams on migration success. There were significant differences in the early migration success of the different stocking groups, but subsequent marine survival was independent of stocking group. The post-smolt population was primarily comprised of hatchery origin smolt, but other life-stage stocking strategies (i.e. parr stocking) represented a higher proportion of the population than previously assumed and their contribution to the post-smolt population were significantly affected by stocking practice. Migration pathways were identified and marine migration paths across the Gulf of Maine were hypothesized. The co-occurring species complex was described and any benefits of a predator refuge is considered minimal for emigrating post-smolts, given a mismatch in the size overlap among species and low abundance of other co-occurring diadromous populations. These results can be used to modify current management actions to optimize salmon recovery and inform future research initiatives.

The Surface Trawl Survey conducted in Maine (Sheehan *et al*. 2011) provided the opportunity for additional research into the marine ecology of Atlantic salmon. The trawl employed a modified codend aquarium for live capture, sampling and release. However, a small percentage (6.7%) of the post-smolts captured died during the capture and sampling. The diet analyses of these mortalities yielded insights into the feeding ecology of early marine phase post-smolts from different rearing origins (Renkawitz and Sheehan 2011). More than 50% of the diet was fish, although there were significant differences in diet quality (calories) and quantity (weight/volume) between different origin groups. Post-smolts that lived in the river longer (i.e. from naturally reared and parr-stocked origins) were smaller and consumed more fish than invertebrates compared to larger post-smolts that emigrated immediately post-stocking (i.e. from smolt-stocking, Figure 2.3.3.1). Stomach contents were converted to energy available (kilojoules) and scaled to body weight for each fish. Fish that had spent more time in the river ate more high quality energy rich food. In decreasing order, naturally reared fish that had lived within the river for two years had an improved diet over hatchery parr that had lived in the river for 20 months, hatchery parr in the river for eight months and finally hatchery reared smolts that were in the river for a matter of weeks prior to emigration.

To confirm that the surface trawl (Sheehan *et al*. 2011) was targeting the migratory habitat of post-smolts, Renkawitz *et al*. (2012) released 26 hatchery reared smolts into the lower Penobscot River implanted with ultrasonic depth tags. These tags measured and transmitted the tag’s current depth (m) along with its acoustic signal. The Penobscot River was used to take advantage of an existing network of linear detection arrays (Holbrook *et al*. 2011) through 44.2 km of the estuary and 45.5 km of the bay. In the bay, greater than 95% of all detections occurred in water depths of 5 m or less, thereby validating the assumption that post-smolts would be available to the surface trawl gear. Migration depths to 37 m were recorded as were differences in behaviour within estuarine and marine environment and between day and night conditions. Information on emigration speed and dynamics, migration path, and survival were also generated. Rapid emigration (i.e. approximately 1 km h^{-1}) and preferential surface orientation improved survival. Overall survival to the Gulf of Maine was 39% and was highest for smaller fish and those released earlier in the smolt run when river discharge was greater. These data provide valuable insights into the dynamics of the nearshore marine migration for post-smolts. Detailed emigration and behavioural data such as these allow scientists and managers to delineate areas of high mortality and to develop strategies to improve survival while providing marine spatial planners with information to minimize impacts of coastal-zone development.

More recently, pelagic ecosystem surveys were conducted in the Labrador Sea during 2008 and 2009 as part of SALSEA North America (Sheehan *et al.* 2012). A total of 107 Atlantic salmon were captured using a pelagic surface trawl and multi-panel surface gillnets. New information on the fish and macro-invertebrate communities located in the upper 10 m of the water column was obtained. Multiple smolt cohorts were captured indicating that post-smolts and returning adults from different rivers in North America occupy similar habitat. Information on diets, intestinal macroparasite loads, and the concurrent planktonic assemblage and oceanographic conditions were also quantified. The data collected have greatly expanded our knowledge of the ecology of Atlantic salmon in the Labrador Sea and are a valuable addition to the historical datasets. Further analyses related to genetic stock identification of captured salmon, disease, stable isotope, parasites, and lipid analyses are ongoing and will further contribute to our understanding of salmon marine ecology. A full exploration of the data presented, the historical datasets, and the parallel data collected during SALSEA Greenland and SALSEA-Merge will further our understanding of the ecology of marine-phase Atlantic salmon and inform investigations into stock-specific differences in marine productivity.

Friedland *et al.* (2012) indicates that the two Atlantic salmon continental stock complexes are governed by different mechanisms of recruitment control. European salmon are reported to be governed by factors affecting post-smolt growth whereas North American salmon are reported to be governed by variations in post-smolt predation pressure. To further investigate the causal mechanisms behind North American salmon recruitment, they investigated the interrelated nature of potential climate and biological effects due to changes in spring wind pseudo-stress and the distribution of piscivorous predator fields on post-smolt salmon migrating through the Gulf of Maine. They concluded that there has been a concurrent decline in marine survival for Penobscot River 2SW returns with change in the direction of spring winds, which has likely extended the migration of post-smolts into the western Gulf of Maine. Higher spring sea surface temperatures were also associated with shifting distributions of a range of fish species into the salmon migration corridor, some of which likely predate upon salmon post-smolts. Climate variation and shifting predator distributions in the Gulf of Maine are consistent with the predator hypothesis of recruitment control previously suggested for the stock complex.

2.3.4 Recent results from acoustic tracking investigations in Canada

The Working Group reviewed the results of ongoing projects, led by the Atlantic Salmon Federation (ASF), to assess estuarine and marine survival of tagged Atlantic salmon released in rivers of the Gulf of St Lawrence. A total of 274 smolts (50 St Jean, 45 Cascapedia, 99 Restigouche, 80 Miramichi) and 50 Miramichi kelts were sonically tagged between April and June 2011. The proportion of smolts detected (apparent survival) in 2011 from freshwater release points to the heads of tide was between 80–90% and similar to previous years. From the heads of tide to estuary exits, 40–60% of the tagged fish were detected, similar for each of the rivers to those that have been observed in previous years (Figures 2.3.4.1a and b) with the exception of the Riviere St Jean where survival decreased from above 80% in 2010 to slightly above 50% in

2011. The proportion of fish detected across the Gulf of St Lawrence to the Strait of Belle Isle (Figure 2.3.4.1c) was similar (25–45%) to 2010 for each of the rivers, with the exception of the Riviere St Jean where no post-smolts were detected at either the Strait of Belle Isle or at the partial detector array at Cabot Strait. Smolts tagged in the Cascapedia River again had the highest detection level at the Strait of Belle Isle with about 45% of the 45 smolts tagged crossing this array. Smolt travel rates across the Gulf of St Lawrence have ranged from 15–24 km per day (1.2–1.9 body lengths per second).

Although kelts arrived at the Strait of Belle Isle slightly in advance of smolts, there was again an overlap in 2011 of smolt and kelt movements past the array in late June through early July. Synchronized movements past the array were more pronounced for smolts from the three river systems. One Riviere St Jean kelt, tagged as an upstream migrating 2SW maiden adult in June 2010 was detected passing this detector array on July 9, 2011 and was subsequently captured 74 days later in the fishery at Nuuk Greenland on September 22.

There was a partial detector array functioning in the Cabot Strait (37 km northward from Cape Breton Island) exit of the Gulf of St Lawrence in 2011, but no tagged smolts were detected. It did however detect a kelt from the Miramichi River on June 10 that had been tagged in 2011. Of the 50 Miramichi River kelts tagged this year, six returned to the river as consecutive year spawners between July 9–26, fifteen passed the Strait of Belle Isle array between June 25–July 23 and at least one exited through Cabot Strait.

From these studies over the past few years, high (greater than 90%) kelt survival through the estuary has been noted with most mortality of the kelts likely occurring within the Gulf of St Lawrence. Kelts that are destined to return to the river as consecutive repeat spawners are spending about 55 days at sea while those destined to be alternate year repeat spawners are spending about 400 days at sea. Travel rates for these tagged kelts have ranged from 10–69 km per day. Overwinter survival of kelts has been demonstrated to be high with 69% (N=11) of kelts tracked into the river as consecutive year spawners surviving fisheries, spawning, the overwinter period and successfully migrating to sea the following spring.

2.3.5 Changing biological characteristics

The Working Group noted that various biological characteristics of salmon show continuing interesting trends, some of which have already been reported in the ICES SGBICEPS report such as decreasing mean fork lengths in returning adult 1SW fish in the River Bush in UK (N. Ireland) since 1973 (ICES 2010a). This same trend has been observed for 1SW returning adults on the River Bann in UK (N. Ireland). For the same time period the mean fork length of 2SW fish showed only a very small, but non-significant, decrease.

Also notable was the increase in both numbers of 2SW returns to the River Bush in UK (N. Ireland) as well as the increase in the relative proportion of 2SW vs. 1SW since 2003. Something similar was found in the Norwegian PFA estimates for 1SW, 2SW, and 3SW returning adults. From the 2006 smolt cohort onwards the estimates for the proportion returning as 1SW decreased from about 50% to about 30% and have remained at this lower plateau. PFA estimates for 2SW and 3SW returning adults for the same period have shown an opposite shift.

Data from Ireland however did not mirror the trends in increased numbers of MSW observed in Norway and UK (N. Ireland). Spring runs of salmon, which contain a high proportion of MSW fish did not show any clear trend in the percentage of the spring run relative to the total run. Data on three of 17 individual rivers showed a relative increase in spring run numbers, but the majority showed no trend at all.

Despite not all countries reporting increasing MSW salmon numbers and decreasing 1SW salmon numbers the above observations could indicate a shift in life-history strategy from 1SW to MSW in some Northern NEAC and Southern NEAC stocks possibly due to poor growth in the first season at sea.

2.3.6 Change in run timing and body wounds on the Miramichi River salmon

The run timing of Atlantic salmon to the Miramichi River has been previously characterized as bimodal, with the first mode occurring in summer (prior to August 31) and the second in the fall (after August 31) (Saunders 1967). Early and late runs of salmon to the Miramichi River were obvious from Department of Fisheries and Oceans (DFO) index trapnet catches in the early and mid 1990s but appears to have changed over time to a dominant summer mode. These changes in run timing have been consistent for both large and small salmon (Figure 2.3.6.1). The reduced late run of salmon to the Miramichi River is not believed to be related to the loss of a distinct fall run of fish but rather to a shift in behaviour where they enter the river during summer and no longer stage in Miramichi Bay until autumn. The reason for the change in behaviour is unknown but may lead to increased mortality from exposure to higher in-river water temperatures and longer exposure to angling exploitation.

Large and small salmon with significant wounds have been observed at the DFO index trapnets on both the Northwest and Southwest Miramichi rivers since 2009. Nearly 100% of the observations occurred during the months of June and July. The wounds are specific to salmon and none of the other 10+ species captured at these facilities show any signs of trauma. Many of the wounds are severe lacerations which expose the fish' flesh or body cavity. General patterns of wounds have emerged and have been roughly categorized as those specific to the caudal peduncle, severe mid-body gashes or irregularly shaped, lesser mid-body wounds with a scraping pattern, and single puncture wounds on the salmon's dorsal side. These wounds are observed at different stages of healing (from fresh to completely healed) which suggests they occurred at different times during their migration. Similar wounds on salmon, attributed to predators, have been reported from other locations in the North Atlantic particularly UK (Scotland) (Thompson and Mackay 1999).

2.3.7 ECOKNOWS progress

A working paper and presentations were made by two researchers involved in the EU 7th framework project called 'ECOKNOWS' (years 2010–2014). The partners in the project are 13 research organizations. The University of Helsinki (Finland) is leading the consortium. ECOKNOWS develops sophisticated models and algorithms in order to offer flexible and effective use of all types of relevant biological knowledge (e.g. data and prior knowledge) in fisheries science. The project is structured in a Bayesian environment which provides a sound framework for including information from multiple sources: ecological knowledge, survey and experimental data, knowledge from similar populations, knowledge from published papers, and observed fishery data. In order to demonstrate the applicability of the new generic assessment tools, the project applies them to case study stocks/fisheries. These include salmon in the Atlantic and Baltic Sea; herring in the Baltic and in the North Sea; European anchovy in the Western Mediterranean and the adjacent Atlantic; mixed-stock fisheries in the Mediterranean and Baltic Seas; northern Atlantic stock of European hake and Northern shrimp in Skagerrak and Norwegian Deep.

The objective of the Salmon Case Study is to further develop and harmonize the Atlantic salmon assessment and forecast models currently used in the management in the Baltic and North Atlantic areas. Three different salmon stock assessment methods are currently used in ICES; for the Northeast Atlantic area (Europe, Potter *et al*. 2004), the Northwest Atlantic area (North America, Chaput *et al*. 2005), and the Baltic area (Michielsens *et al*. 2008). For salmon in the Baltic Sea, the assessment is already embedded into a Bayesian life cycle modelling framework (Michielsens *et al*. 2008), but its flexibility to changes in data input and its predictive abilities need further improvement. For North Atlantic salmon, spawner variables and returns to regions are linked through an intermediate stage, the pre-fishery abundance or PFA, of interest to fisheries management. This is modelled in a Bayesian framework to forecast subsequent years 1SW and MSW returns following high seas catches, maturing rates and natural mortality.

A life cycle approach, following cohorts through river parr and smolt classes, sea ages and returns would provide a more appropriate structure for incorporating prior information on other variables, biotic and abiotic and hyper-priors from other ECOKNOWS stocks.

The proposed assessment models will be embedded into a full stage-structured life cycle model that incorporates the temporal dynamics of the recruitment process, including freshwater and marine survival (Figure 2.3.7.1). A hierarchical model structure would be applied whenever justified. For the North Atlantic, the model will be designed at the scale of the three stock complexes (Southern Northeast Atlantic, Northern Northeast Atlantic, North America) to capture the complex metapopulation structure stemming from homing behaviour for reproduction in freshwater. The multiscale approach will allow the exploration of long-term trends and climate influences on key population parameters shared by several population components, such as marine survival, together with time and spatial variability of region-specific life-history traits such as the ones characterizing the freshwater phase of the life cycle.

For both Baltic and North Atlantic salmon models, a major scientific challenge is to quantify the relative part of the mortality process that takes place in and during each of the freshwater and marine portions of the life cycle. This is an important issue not only in the scientific context of a better understanding of population dynamics but also as it relates to management. For instance in the North Atlantic, most of the decisions for managing Atlantic salmon are based on the hypothesis that the principal factor in the decline of abundance of adult Atlantic salmon is acting in the marine phase in the first year at sea. Although a large amount of information lends support to the hypothesis that mortality has increased in the marine phase, the freshwater juvenile phase is a critical stage in the life cycle. There is ample evidence from river-specific studies that spawning stock is an important conditioning variable of recruitment abundance expressed as a density-dependent response during the freshwater stages.

The ECOKNOWS project will compile available freshwater stock–recruit data and carry out a meta-analysis, the outcome of which could then be used as informative prior information about the freshwater phase. A crucial factor driving the salmon stock status is the marine survival of post-smolts. In both the Baltic and North Atlantic, there is precise, well-documented information on return rates of smolts to adults for a limited number of rivers. The time-series have demonstrated the important changes in marine survival. The use of abiotic (e.g. sea surface temperature) and biotic (e.g. abundance of predator and preys) environmental covariates potentially driving spatio-temporal patterns in survival will also be given special consideration. For instance, the plan is to link the estimates of herring year-class strength to the forecasts of Baltic salmon. High abundance of young herring seems to improve survival of salmon post-smolts, which are using young herring as their main prey species (Mäntyniemi *et al*. in press).

The work in the salmon case study is being carried out in close collaboration with the ICES WGNAS and WGBAST and one of the commitments of ECOKNOWS is to report regularly to ICES WGNAS and WGBAST on progress in model development and their application.

2.3.8 Update on Workshop on Age Determination of Salmon (WKADS)

A Workshop on Age Determination of Salmon (WKADS) was held in Galway, Ireland (January 18th to 20th, 2011) and attended by 26 representatives from six countries and eight laboratories. Objectives included reviewing, assessing, documenting and making recommendations on current methods of ageing Atlantic salmon. The Workshop primarily focused on digital scale reading to measure age and growth, with a view to standardization. Recommendations of the meeting were made (ICES 2011a) to parental groups (PGCCDBS and WGBAST, WGRECORDS, SSGEF) and a second meeting is now scheduled with the following ToR:

a) Investigate possible effects on age reading of scale deformation owing to scale and acetate slide rolling through jeweller's rollers.

b) Investigate potential differences in circuli number and spacings on scales taken from the 1984 recommended scale collection location against the highlighted improved scale collection location below the adipose fin.

c) Identify sources of age determination error in terms of bias and precision: i.e. analyse different validation techniques and describe the corresponding interpretational differences between readers and laboratories, and agree on a common ageing criteria.

d) Establish a database of digitized images of agreed-age scales with annotation corresponding to the agreed age structures in Web Services for Support of Growth and Reproductive Studies, an online resource.

e) Establish a protocol for Inter-lab calibration/ quality control including informal 'open checking and comparison' and a formal policy of sample exchange and checking.

f) Re-examine the relationships given in the ICES report No 188 (ICES 1992) concerning back calculated lengths.

g) Review and consider the process of salmon scale reading.

h) Review data collection with a view to formalizing data analyses to address questions raised on changes in salmon life styles.

i) Address the generic ToRs adopted for workshops on age calibration (see 'PGCCDBS Guidelines for Workshops on Age Calibration').

2.3.9 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). Although not the final host 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) remains unclear.

A number of regions within the NEAC stock complex observed a notable increase in the incidence of salmon with RVS during 2007 (ICES 2008a), but levels have been lower in some NEAC countries since 2008 (ICES 2009a; ICES 2010b). Trapping records for rivers in UK (England & Wales) and France suggest a further reduction in 2011. The incidence of *Anisakis simplex* was considered to be much lower in 2011 compared to the previous three to four years in Ireland. Within the NAC stock complex, RVS has previously been detected in the Scotia-Fundy (2008 and 2009) and Québec regions. In 2009 a monitoring programme was begun in Québec and results will be available in 2012.

There is no clear indication that RVS affects either the survival of the fish or their spawning success. 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. Recent results have also demonstrated that affected vents showed signs of progressive healing in freshwater, suggesting that the time when a fish is examined for RVS, relative to its period of in-river residence, is likely to influence perceptions about the prevalence of the condition. This is consistent with the lower incidence of RVS in fish sampled in tributaries or collected as broodstock compared with fish sampled in fish traps close to the head of tide.

2.3.10 Possible new salmon parasite

In 2011 *Paragnathia formica*, an estuarine crustacean isopod, was detected on 5% of salmon caught in the Scorff trap facility, France, located near the upper limit of the estuary. It is not clear whether this is a new infestation or one that has simply gone undetected until now. Symptoms include inflammation in the genital zone and on the fins and may be mistaken for sea lice bites or red vent syndrome. It is also possible that sea lice and *Paragnathia formica* are coexisting. It is not known whether this parasite could survive in freshwater.

2.3.11 Dumping of mine tailings in Norwegian fjords

There are plans for expansion of existing mining activities in many regions in Norway. Several of the existing and planned mining activities are located within National Salmon Fjords and close to National Salmon Rivers. The National Salmon Fjords and National Salmon Rivers were established as a means of protecting the most important salmon stocks in Norway from harmful impact from human activities.

Mining, and the industrial processes associated with it, can be harmful for salmonids in several ways. Run-off from mines containing sulphides and heavy metals to rivers and streams may affect freshwater production and survival, and dumping of mine tailings in fjords may have negative impacts on smolt survival, and the fjord ecosystems in general. The potential effects vary between different mining operations. In some operations the waste rock is relatively inert, while in others the waste contains high levels of heavy metals that gradually dissolve and leak into the environment. Large amounts of fine grain particles that may affect fish directly or indirectly through reduced production in the fjord systems are also considered a problem. Also, depending on the mineral or metal extracted, and the extraction process, various chemicals may be used that to a greater or lesser degree are released to the environment. Some of these chemicals have been demonstrated to have toxic effects on aquatic animals, and persist in the environment for a considerable time. The effects of these chemicals on salmonid fish, especially in the marine phase, are largely untested and thus unknown.

The increased development of the mining industry in Norway, and especially in the National Salmon Fjord areas, poses a potential serious threat to salmon populations, and further evaluation of the effects of mining waste disposal on both salmon and the ecosystem in the fjords should be conducted before expansion of this industry.

2.3.12 River classification in fisheries management

In 1999, a three year Atlantic salmon management plan in Newfoundland and Labrador incorporated a River Classification System. The River Classification System defined individual licence season bag limits by river category. The classification, and, therefore, the allowed retention assigned to a particular river was based on the size and apparent status of the individual salmon stock in that river. This was a major departure from managing salmon on a more regional or Salmon Fishing Area basis which set retention limits for larger areas. In 2011 the River Classification System was assessed to determine whether there were measurable changes in the catch and effort in the recreational fishery as a result of this management decision (Bourgeois and Veinott 2012). The analyses showed that during the first eleven years (1999–2009) of the implementation of the plan there was an overall decrease in the total number of small salmon harvested (about 6000 fewer salmon per year) compared with the eleven years prior to the plan's implementation. This decline in retained catch occurred although effort remained the same and the abundance of salmon in freshwater was at least similar during both periods and indeed may have been greater during the later period. However, the analyses also showed that all of the reductions in harvest occurred on rivers with the lowest allowable retention (Class II and III rivers; four and two fish per year). On rivers that allowed an annual retention of six fish (Class I rivers), the total harvest increased by approximately 2100 fish per year after the implementation of the plan. Therefore, effort and catch shifted from the lowest class rivers (Class II and III) to the highest class rivers (Class I). This was judged to be an acceptable outcome by managers and stakeholders to the implementation of the plan.

2.3.13 Environmental thresholds for managing Atlantic salmon fisheries

The Working Group was informed of a recent science review in Canada to consider environmental thresholds related to water temperature for the management of Atlantic salmon fisheries. Climate change projections for Atlantic Canada are for increases in air temperatures of 2–6°C within the next 100 years. These higher air temperatures will lead to increased water temperatures, alterations in streamflow, threats to Atlantic salmon in rivers, and pressures on resource users.

There is overwhelming evidence that incidental mortality from catch and release angling increases with water temperatures above 20°C. Mortality associated with any additional stress (besides temperature) resulting from displacement of salmon from cool water seeps, burst swimming, and general unease is expected to increase with increasing temperatures. During June to August, water temperatures in rivers in the southern Gulf of St Lawrence (Canada) can frequently exceed 25°C. The high temperatures are particularly important for the early run adult Atlantic salmon of the Miramichi River. Since 1962, there have been five inseason fishery closures in the Miramichi River; 1987, 1995, 1999, 2001 and 2010, corresponding to the years where discharge conditions were extremely low and water temperatures were high. Over the standard fishing season of May 15 to October 15, inseason fishery closures in 1995 for example represented a loss of 11% of the estimated 190 000 km-days of angling area and time available on the Miramichi River. The decision to intervene in season must be timely. To date, the criteria used for management intervention in the Miramichi River have been *ad hoc* and not predefined which leads to delays in management response and reduced benefits to the resource.

In fish, temperature governs metabolic processes such as cardio-vascular functions. The basal metabolic rate (BMR) is a measure of the energy expenditure required to sustain vital life supporting functions such cardiovascular activity. The BMR is an aerobic process and it increases non-linearly with increasing environmental temperature to a maximum level (AMR: active metabolic rate) (Figure 2.3.13.1). The difference between BMR and AMR is termed the aerobic scope which is the energy available for additional life cycle functions including swimming, feeding, and growth, among others. The aerobic scope is species and life stage specific, with the aerobic capacity and thermal tolerance in fish being lower for adults than juveniles.

When the metabolic rate requirements exceed the active metabolic rate capacity, anaerobic metabolism is used. Anaerobic metabolism is energetically costly and leads to the production of potentially damaging cellular metabolic by-products such as lactic acid. The use of anaerobic metabolism is time-limited and will lead to mortality by hypoxemia (inability of the cardio-vascular system to meet the oxygen demands of the tissues) if conditions persist. Only a return to conditions under which there is aerobic scope will allow the organism to breakdown the by-products of anaerobic metabolism.

The temperature thresholds proposed are based on the bioenergetics of salmonids. There is limited information on optimal temperatures and critical temperatures that define the aerobic scope for adult Atlantic salmon and inferences are made based on evidence on juvenile life stages of Atlantic salmon or borrowed from other species. Based on laboratory studies of wild fish, T_{crit} (where BMR=AMR and aerobic scope is null) for 2-year old juvenile Atlantic salmon was estimated to be 24°C (Breau *et al*. 2011). T_{crit} for adult Atlantic salmon is not known but the aerobic capacity and thermal tolerance of adults are lower than in juveniles. In studies of the recovery rate of adult Atlantic salmon acclimated and subjected to exercise to exhaustion at 18°C, 20°C and 23°C, it was shown that most of the physiological endpoints returned to pre-exhaustion (resting) levels after four hours or more of resting (Wilkie *et al*. 1996, 1997).

Temperature related stress in juvenile Atlantic salmon has been associated with behavioural changes including abandonment of feeding territories and the formation of schools at cool-water seeps (Breau *et al*. 2007, 2011). Juvenile and adult salmon have been observed aggregating at sources of cool water when the minimum night-time temperature exceeded 20°C for two consecutive nights.

The proposed temperature threshold consists of a temperature and a duration. The proposed closure trigger is: if the minimum water temperature (T_{min}) over each of two consecutive days equals or exceeds 20°C. The proposed opening trigger is: if the minimum water temperature (T_{min}) over each of two consecutive days is less than 20°C. The choice of two days as an indication of a physiologically stressful condition for Atlantic salmon is motivated by the studies on behavioural changes in juvenile Atlantic salmon. Although these juvenile aggregations generally breakdown overnight, a minimum water temperature that falls below 20ºC in two consecutive days following the physiologically stressful condition is proposed to ensure some minimum number of hours (at least one per day in two successive days) for physiological recovery. Dedicated research to determine T_{opt} and T_{crit} for adult Atlantic salmon is required to confirm whether 20°C is a good choice.

The performance of these opening and closing triggers was assessed by retrospective evaluation of the number of closures and the duration of the closures based on temperature data at two monitoring locations in the Miramichi River for the years 1992 to 2011. For the management procedure, it was assumed that one full day was required to communicate a closure and one full day is required to communicate a reopening. Monitoring for minimum temperatures is continuous and as a result the minimum closure once initiated is two days. Based on the temperature data from the Little Southwest Miramichi River, there would have been at least one closure in 14 of 19 years between 1992 and 2011. The number of closures annually ranged from one to five and the total number of days closed ranged from a low of 2 days to a high of 23 days.

Another performance measure examined was the duration between interventions within a year. The management interventions in 2005 and 2010 based on water temperature monitoring data from the Southwest Miramichi River station are shown in Figure 2.3.13.2. In 2005, there were four interventions initiated with a brief two day opening between successive closures in late July. In 2010, there were also four closures but with the exception of the first closure which lasted 18 days, the second and third closures were short (two days each) and spaced over six days apart. Criteria such as the number of interventions and the duration within and between interventions could be examined retrospectively to inform management if frequency of closures and duration are factors of interest.

The impacts of angling during warm-water events were considered by management because fishing is an activity which can be managed under regulations. Salmon are angled during warm-water temperature events and the mortality rate from catch and release angling increases sharply at temperatures above 20°C. Other human activities, including wading along and in streams, swimming in pools, boat traffic, as well as scientific activities, can displace fish and contribute to stress on Atlantic salmon during warm-water events.

A single temperature threshold value was proposed. Evidence from Pacific salmon populations migrating in the same river but at different times of the year indicate that run timing may be adaptive and associated with environmental temperatures that match population specific T_{opt} values (Farrell *et al*. 2008). The proposed20°C threshold for Atlantic salmon is a close match to the median temperature at migration for the Miramichi River. This threshold may be too high for salmon from the Restigouche

River for example whose median temperature during the migration period is 18°C. Population specific research on this topic would address this uncertainty.

2.4 NASCO has asked ICES to provide a review of examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations

The Working Group noted that a study group had been established by ICES to address this question. The Study Group on Effectiveness of Recovery Actions for Atlantic Salmon [SGERAAS] was set up and had intended to work by correspondence to make progress on this issue. The Study Group has not been able to address this question and there was no progress to report. The Working Group recognized that the issue of the restoration and rehabilitation of salmon stocks remained a concern, but that the issue could not be appropriately addressed by the Working Group during its annual meeting. The Working Group remains of the view that a study group is the best way to provide this review and anticipates progress on this term in the coming year.

2.5 NASCO has asked ICES to provide a compilation of tag releases by country in 2011 and advise on the utility of maintaining this compilation

2.5.1 Compilation of tag releases and fin clip data by ICES Member Countries in 2011

Data on releases of tagged, finclipped and otherwise marked salmon in 2011 were provided to the Working Group and are compiled as a separate report (ICES 2012). In summary (Table 2.5.1.1), about 4.07 million salmon were marked in 2011, a decrease from the 4.84 million fish marked in 2010. The adipose clip was the most commonly used primary mark (3.45 million), with coded wire microtags (0.56 million) the next most common primary mark and 45 267 fish were marked with external tags. Most marks were applied to hatchery-origin juveniles (3.98 million), while 68 002 wild juveniles and 10 245 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 listed in a separate column in Table 2.5.1.1. In 2011, 12 209 PIT tags, 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 Iceland, coded wire tags are being applied to about 5–10% of sea cage farm production in certain areas. In USA, the industry has 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. Genetic assignment has also been applied for hatchery juveniles that are released in two large rivers in Southwest of France.

2.6 NASCO has asked ICES to identify relevant data deficiencies, monitoring needs and research requirements. Where relevant suggest improvement for the revision of the DCF, to be taken into account by WKESDCF

Data deficiencies, monitoring needs, and research recommendations of the Working Group are detailed in Annex 8. The EU Data Collection Framework (DCF) (EU Council Regulation 199/2008) requires that Member States implement multi-annual programmes for collection, management and use of biological, technical, environmental and socio-economic data relating to commercial fisheries carried out by Community vessels. In 2007 the DCF was extended to include commercial fisheries for eels and salmon in inland waters. Since that time each Member State has been required to submit a programme of their planned salmon data collection under the framework and to report annually on the sampling and surveys that have been undertaken. In theory the data are also meant to be made available to the European Commission, although in practice the Commission is dependent upon the end-user of the data to indicate whether there are shortcomings in the information provided. ICES is the end-user of data on salmon, and the Working Group has been requested to report on the quality and completeness of data provided. However, the specific data requested for salmon under the DCF (outside the Baltic) are not entirely appropriate to support national and international assessments and the provision of advice to NASCO and the EU. In addition, the current required sampling varies among ICES areas and is not appropriate to the structure and distribution of salmon stocks.

The DCF is due to be reviewed in 2013, and so the opportunity has been taken to establish an ICES workshop (WKESDCF) to examine the data requirements for salmon (and eel) and make recommendations that can be taken into account in that review. The workshop will take place in Copenhagen from July 3 to July 6, 2012.

The Working Group discussed the data that is currently requested by NASCO as well as that required for the NEAC PFA run-reconstruction and forecast models and the NEAC national conservation limit model. It was recognized that while most Member States provided data to the Working Group, there was variation in the quality. Significant amounts of additional data (e.g. from index stocks) are also provided to the Working Group, but it is not clear that the best use is made of this information. It was noted that index river data are used in the Baltic salmon assessment, and that the collection of these data is covered by the DCF. It was suggested that the structure of the salmon data collection in the Baltic under the DCF might provide a good basis for the data collection in other areas.

The Working Group noted that the inclusion of anadromous and catadromous species under the reform of the EU Common Fisheries Policy might introduce additional data requirements and discussed the extent to which the data requirements for national assessments may either complement or conflict with the requirements for international assessments. It was recognized that it was necessary to develop a practical framework that provided sufficient flexibility to support collecting high quality data for a broad range of salmon management activities. The Working Group encouraged scientists from Member States to attend the workshop to ensure that they contribute to and fully support the recommendations that will go forward to the EU.

Table 2.1.1.1. Reported total nominal catch of salmon by country (in tonnes round fresh weight), 1960–2011. (2011 figures include provisional data).

	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
Year	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch (4)	Sweden (West)	Denmark	Finland	Ireland (5,6)	UK (E & W)	UK (N.Irl.) (6,7)	UK (Scotl.)	France (8)	Spain (9)	Faroes (10)	East Grld.	West Grld. (11)	Other (12)	Reported Nominal Catch	NASCO Areas (13)	International waters (14)
1960	1636	1	-	1659	1100	100	-	40	-	-	743	283	139	1443	-	33	-	-	60	-	7237	-	-
1961	1583	1	-	1533	790	127	-	27	-	-	707	232	132	1185	-	20	-	-	127	-	6464	-	-
1962	1719	1	-	1935	710	125	-	45	-	-	1459	318	356	1738	-	23	-	-	244	-	8673	-	-
1963	1861	1	-	1786	480	145	-	23	-	-	1458	325	306	1725	-	28	-	-	466	-	8604	-	-
1964	2069	1	-	2147	590	135	-	36	-	-	1617	307	377	1907	-	34	-	-	1539	-	10759	-	-
1965	2116	1	-	2000	590	133	-	40	-	-	1457	320	281	1593	-	42	-	-	861	-	9434	-	-
1966	2369	1	-	1791	570	104	2	36	-	-	1238	387	287	1595	-	42	-	-	1370	-	9792	-	-
1967	2863	1	-	1980	883	144	2	25	-	-	1463	420	449	2117	-	43	-	-	1601	-	11991	-	-
1968	2111	1	-	1514	827	161	1	20	-	-	1413	282	312	1578	-	38	5	-	1127	403	9793	-	-
1969	2202	1	-	1383	360	131	2	22	-	-	1730	377	267	1955	-	54	7	-	2210	893	11594	-	-
1970	2323	1	-	1171	448	182	13	20	-	-	1787	527	297	1392	-	45	12	-	2146	922	11286	-	-
1971	1992	1	-	1207	417	196	8	18	-	-	1639	426	234	1421	-	16	-	-	2689	471	10735	-	-
1972	1759	1	-	1578	462	245	5	18	-	32	1804	442	210	1727	34	40	9	-	2113	486	10965	-	-
1973	2434	3	-	1726	772	148	8	23	-	50	1930	450	182	2006	12	24	28	-	2341	533	12670	-	-
1974	2539	1	-	1633	709	215	10	32	-	76	2128	383	184	1628	13	16	20	-	1917	373	11877	-	-
1975	2485	2	-	1537	811	145	21	26	-	76	2216	447	164	1621	25	27	28	-	2030	475	12136	-	-
1976	2506	1	3	1530	542	216	9	20	-	66	1561	208	113	1019	9	21	40	<1	1175	289	9327	-	-
1977	2545	2	-	1488	497	123	7	10	-	59	1372	345	110	1160	19	19	40	6	1420	192	9414	-	-
1978	1545	4	-	1050	476	285	6	10	-	37	1230	349	148	1323	20	32	37	8	984	138	7682	-	-
1979	1287	3	-	1831	455	219	6	12	-	26	1097	261	99	1076	10	29	119	<0,5	1395	193	8118	-	-
1980	2680	6	-	1830	664	241	8	17	-	34	947	360	122	1134	30	47	536	<0,5	1194	277	10127	-	-
1981	2437	6	-	1656	463	147	16	26	-	44	685	493	101	1233	20	25	1025	<0,5	1264	313	9954	-	-
1982	1798	6	-	1348	364	130	17	25	-	54	993	286	132	1092	20	10	606	<0,5	1077	437	8395	-	-
1983	1424	1	3	1550	507	166	32	28	-	58	1656	429	187	1221	16	23	678	<0,5	310	466	8755	-	-
1984	1112	2	3	1623	593	139	20	40	-	46	829	345	78	1013	25	18	628	<0,5	297	101	6912	-	-
1985	1133	2	3	1561	659	162	55	45	-	49	1595	361	98	913	22	13	566	7	864	-	8108	-	-
1986	1559	2	3	1598	608	232	59	54	-	37	1730	430	109	1271	28	27	530	19	960	-	9255	315	-
1987	1784	1	2	1385	564	181	40	47	-	49	1239	302	56	922	27	18	576	<0,5	966	-	8159	2788	-
1988	1310	1	2	1076	420	217	180	40	-	36	1874	395	114	882	32	18	243	4	893	-	7737	3248	-
1989	1139	2	2	905	364	141	136	29	-	52	1079	296	142	895	14	7	364	-	337	-	5904	2277	-
1990	911	2	2	930	313	141	285	33	13	60	567	338	94	624	15	7	315	-	274	-	4925	1890	180-350

Table 2.1.1.1. Continued.

Table 2.1.1.2. Reported total nominal catch of salmon in home waters by country (in tonnes round fresh weight), 1960–2011. (2011 figures include provisional data). S = Salmon (2SW or MSW fish). G = Grilse (1SW fish). Sm = small. Lg = large; T = S + G or Lg + Sm.

	NAC Area				NEAC (N. Area)											NEAC (S. Area)										
								Russia	Iceland		Sweden					Ireland			UK	UK(N.I.)					Spain	
Year	Canada (1)			USA	Norway (2)			(3)	Wild	Ranch	(West)	Denmark	Finland			(4,5)			(E&W)	(4,6)	UK(Scotland)			France		Total
	Lg	Sm	T	T	S	G	T	T	T	T	T	T	S	G	T	S	G	T	T	T	S	G	T	T	T	T
1960	-	-	1636	1	-	-	1659	1100	100	-	40	-	-	-	-	-	-	743	283	139	971	472	1443	-	33	7177
1961	-	-	1583	1	-	-	1533	790	127	-	27	-	-	-	-	-	-	707	232	132	811	374	1185	-	20	6337
1962	-	-	1719	1	-	-	1935	710	125	-	45	-	-	-	-	-	-	1459	318	356	1014	724	1738	-	23	8429
1963	-	-	1861	1	-	-	1786	480	145	-	23	-	-	-	-	-	-	1458	325	306	1308	417	1725	-	28	8138
1964	-	-	2069	1	-	-	2147	590	135	-	36	-	-	-	-	-	-	1617	307	377	1210	697	1907	-	34	9220
1965	-	-	2116	1	-	-	2000	590	133	-	40	-	-	-	-	-	-	1457	320	281	1043	550	1593	-	42	8573
1966	-	-	2369	1	-	-	1791	570	104	2	36	-	-	-	-	-	-	1238	387	287	1049	546	1595	-	42	8422
1967	-	-	2863	1	-	-	1980	883	144	2	25	-	-	-	-	-	-	1463	420	449	1233	884	2117	-	43	10390
1968	-	-	2111	1	-	-	1514	827	161	1	20	-	-	-	-	-	-	1413	282	312	1021	557	1578	-	38	8258
1969	-	-	2202	1	801	582	1383	360	131	2	22	-	-	-	-	-	-	1730	377	267	997	958	1955	-	54	8484
1970	1562	761	2323	1	815	356	1171	448	182	13	20	-	-	-	-	-	-	1787	527	297	775	617	1392	-	45	8206
1971	1482	510	1992	1	771	436	1207	417	196	8	18	-	-	-	-	-	-	1639	426	234	719	702	1421	-	16	7575
1972	1201	558	1759	1	1064	514	1578	462	245	5	18	-	-	-	32	200	1604	1804	442	210	1013	714	1727	34	40	8357
1973	1651	783	2434	3	1220	506	1726	772	148	8	23	-	-	-	50	244	1686	1930	450	182	1158	848	2006	12	24	9768
1974	1589	950	2539	1	1149	484	1633	709	215	10	32	-	-	-	76	170	1958	2128	383	184	912	716	1628	13	16	9567
1975	1573	912	2485	2	1038	499	1537	811	145	21	26	-	-	-	76	274	1942	2216	447	164	1007	614	1621	25	27	9603
1976	1721	785	2506	1	1063	467	1530	542	216	9	20	-	-	-	66	109	1452	1561	208	113	522	497	1019	9	21	7821
1977	1883	662	2545	2	1018	470	1488	497	123	7	10	-	-	-	59	145	1227	1372	345	110	639	521	1160	19	19	7756
1978	1225	320	1545	4	668	382	1050	476	285	6	10	-	-	-	37	147	1082	1229	349	148	781	542	1323	20	32	6514
1979	705	582	1287	3	1150	681	1831	455	219	6	12	-	-	-	26	105	922	1027	261	99	598	478	1076	10	29	6341
1980	1763	917	2680	6	1352	478	1830	664	241	8	17	-	-	-	34	202	745	947	360	122	851	283	1134	30	47	8120
1981	1619	818	2437	6	1189	467	1656	463	147	16	26	-	-	-	44	164	521	685	493	101	844	389	1233	20	25	7352
1982	1082	716	1798	6	985	363	1348	364	130	17	25	-	49	5	54	63	930	993	286	132	596	496	1092	20	10	6275
1983	911	513	1424	1	957	593	1550	507	166	32	28	-	51	7	58	150	1506	1656	429	187	672	549	1221	16	23	7298
1984	645	467	1112	2	995	628	1623	593	139	20	40	-	37	9	46	101	728	829	345	78	504	509	1013	25	18	5883
1985	540	593	1133	2	923	638	1561	659	162	55	45	-	38	11	49	100	1495	1595	361	98	514	399	913	22	13	6668
1986	779	780	1559	2	1042	556	1598	608	232	59	54	-	25	12	37	136	1594	1730	430	109	745	526	1271	28	27	7744
1987	951	833	1784	1	894	491	1385	564	181	40	47	-	34	15	49	127	1112	1239	302	56	503	419	922	27	18	6615
1988	633	677	1310	1	656	420	1076	420	217	180	40	-	27	9	36	141	1733	1874	395	114	501	381	882	32	18	6595
1989	590	549	1139	2	469	436	905	364	141	136	29	-	33	19	52	132	947	1079	296	142	464	431	895	14	7	5201
1990	486	425	911	2	545	385	930	313	146	280	33	13	41	19	60	-	-	567	338	94	423	201	624	15	7	4333

Table 2.1.1.2. Continued.

	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
Year	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch (4)	Sweden (West)	Denmark	Finland	Ireland (5,6)	UK (E & W)	UK (N.Irl.) (6,7)	UK (Scotl.)	France (8)	Spain (9)	Faroes (10)	East Grld.	West Grld. (11)	Other (12)	Reported Nominal Catch	NASCO Areas (13)	International waters (14)
1991	711	1	1	876	215	129	346	38	3	70	404	200	55	462	13	11	95	4	472	-	4106	1682	25-100
1992	522	1	2	867	167	174	462	49	10	77	630	171	91	600	20	11	23	5	237	-	4119	1962	25-100
1993	373	1	3	923	139	157	499	56	9	70	541	248	83	547	16	8	23	-	-	-	3696	1644	25-100
1994	355	0	3	996	141	136	313	44	6	49	804	324	91	649	18	10	6	-	-	-	3945	1276	25-100
1995	260	0	1	839	128	146	303	37	3	48	790	295	83	588	10	9	5	2	83	-	3629	1060	-
1996	292	0	2	787	131	118	243	33	2	44	685	183	77	427	13	7	-	0	92	-	3136	1123	-
1997	229	0	2	630	111	97	59	19	1	45	570	142	93	296	8	4	-	1	58	-	2364	827	-
1998	157	0	2	740	131	119	46	15	1	48	624	123	78	283	8	4	6	0	11	-	2395	1210	-
1999	152	0	2	811	103	111	35	16	1	62	515	150	53	199	11	6	0	0	19	-	2247	1032	-
2000	153	0	2	1176	124	73	11	33	5	95	621	219	78	274	11	7	8	0	21	-	2912	1269	-
2001	148	0	2	1267	114	74	14	33	6	126	730	184	53	251	11	13	0	0	43	-	3069	1180	-
2002	148	0	2	1019	118	90	7	28	5	93	682	161	81	191	11	9	0	0	9	-	2654	1039	-
2003	141	0	3	1071	107	99	11	25	4	78	551	89	56	192	13	9	0	0	9	-	2457	847	-
2004	161	0	3	784	82	111	18	20	4	39	489	111	48	245	19	7	0	0	15	-	2157	686	-
2005	139	0	3	888	82	129	21	15	8	47	422	97	52	215	11	13	0	0	15	-	2156	700	-
2006	137	0	3	932	91	93	17	14	2	67	326	80	29	192	13	11	0	0	22	-	2029	670	-
2007	112	0	2	767	63	93	36	16	3	58	85	67	30	169	11	9	0	0	25	-	1546	475	-
2008	158	0	4	807	73	132	69	18	9	71	89	64	21	160	12	9	0	0	26	-	1720	443	-
2009	126	0	3	595	71	126	44	17	8	36	67	54	17	120	4	2	0	0	26	-	1317	327	-
2010	153	0	3	642	88	147	42	22	13	49	98	109	12	180	10	2	0	0	40	-	1609	367	-
2011	179	0	4	696	83	98	30	39	13	44	100	129	13	169	5	7	0	0	28	-	1635	421	-
Average																							
2006-2010	137	0	3	749	77	118	42	17	7	56	133	75	22	164	10	6	0	0	28	-	1644	456	-
2001-2010	142	0	3	877	89	109	28	21	6	66	354	102	40	192	11	8	0	0	23	-	2071	673	-

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).
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 available for Canada in 2007 and 2008. Data for Canada in 2009 and 2010 are incomplete. No unreported catch estimate available for Russia since 2008.
14. Estimates refer to season ending in given year.

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, 1991–2011. Figures for 2011 are provisional.

Year	Canada [4]		USA		Iceland		Russia [1]		UK (E&W)		UK (Scotland)		Ireland		UK (N Ireland) [2]		Denmark		Norway [3]	
	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch
1991	22167	28	239	50			3211	51												
1992	37803	29	407	67			10120	73												
1993	44803	36	507	77			11246	82	1448	10										
1994	52887	43	249	95			12056	83	3227	13	6595	8								
1995	46029	46	370	100			11904	84	3189	20	12151	14								
1996	52166	41	542	100	669	2	10745	73	3428	20	10413	15								
1997	50009	50	333	100	1558	5	14823	87	3132	24	10965	18								
1998	56289	53	273	100	2826	7	12776	81	4378	30	13464	18								
1999	48720	50	211	100	3055	10	11450	77	4382	42	14846	28								
2000	64482	56	0	-	2918	11	12914	74	5959	40	21072	32								
2001	59387	55	0	-	3611	12	16945	76	4869	41	27724	38								
2002	50924	52	0	-	5985	18	25248	80	5910	47	24058	42								
2003	53645	55	0	-	5361	16	33862	81	4943	53	29170	55								
2004	62316	57	0	-	7362	16	24679	76	11516	46	46279	50					255	19		
2005	63005	62	0	-	9224	17	23592	87	10554	54	46165	55	2553	12			606	27		
2006	60486	62	1	100	8735	19	33380	82	9955	55	47669	55	5409	22	302	18	794	65		
2007	41192	58	3	100	9691	18	44341	90	9942	53	55660	61	13125	40	470	16	959	57		
2008	54887	53	61	100	17178	20	41881	86	11918	54	53347	62	13312	37	648	20	2033	71	5512	5
2009	52151	59	0	-	17514	24	-	-	8397	57	48371	67	10265	37	847	21	1709	53	6696	6
2010	55895	53	0	-	21476	29	14585	56	13958	59	78267	70	15136	40	823	25	2512	60	15041	12
2011	77641	59	0	-	18593	32	-	-	13079	61	67989	73	11383	31	1197	32	2153	55	14303	12
5-yr mean 2006-2010	52922	57			14919	22			10834	55	56663	63	11449	35	715	22	1220	55		
% change on 5-year mean	+47	+3			+25	+45			+21	+9	+20	+16	-1	-12	+68	+46	+76	+1		

Key:

[1] No data were provided by the authorities for 2009 nor for 2011 and data for 2010 were incomplete, however catch-and-release is understood to have remained at similar high levels.

[2] Data for 2006-2009 is for the DCAL area only; the figure for 2010 is a total for N.Ireland.

[3] The statistics were collected on a voluntary basis, the numbers reported must be viewed as a minimum.

[4] Released fish in the kelt fishery of New Brunswick are not included in the totals for Canada.

Table 2.1.3.1. Estimates of unreported catches (tonnes round fresh weight) by various methods within national EEZs in the Northeast Atlantic, North American and West Greenland Commissions of NASCO, 1987–2011.

Year	North-East Atlantic	North America	West Greenland	Total
1987	2554	234	-	2788
1988	3087	161	-	3248
1989	2103	174	-	2277
1990	1779	111	-	1890
1991	1555	127	-	1682
1992	1825	137	-	1962
1993	1471	161	< 12	1644
1994	1157	107	< 12	1276
1995	942	98	20	1060
1996	947	156	20	1123
1997	732	90	5	827
1998	1108	91	11	1210
1999	887	133	13	1032
2000	1135	124	10	1269
2001	1089	81	10	1180
2002	946	83	10	1039
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
2009 **	317	16	10	343
2010 **	357	26	10	393
2011 ***	382	29	10	421
Mean 2006-2010	435		10	465

* No unreported catch estimate available for Canada in 2007 and 2008.
** Data for Canada in 2009 and 2010 are incomplete.
*** No unreported catch estimate available for Russia since 2008.
Unreported catch estimates not provided for Spain & St. Pierre et Miquelon

Table 2.1.3.2. Estimates of unreported catches by various methods in tonnes by country within national EEZs in the Northeast Atlantic, North American and West Greenland Commissions of NASCO, 2011.

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	6	0.3	31
NEAC	Finland	7	0.4	14
NEAC	Iceland	10	0.5	7
NEAC	Ireland	10	0.5	9
NEAC	Norway	298	15.1	30
NEAC	Sweden	4	0.2	9
NEAC	France	1	0.1	18
NEAC	UK (E & W)	23	1.2	15
NEAC	UK (N.Ireland)	0	0.0	2
NEAC	UK (Scotland)	23	1.2	12
NAC	USA	0	0.0	0
NAC	Canada	29	1.5	14
WGC	West Greenland	10	0.5	26
	Total Unreported Catch *	421	21.3	
	Total Reported Catch of North Atlantic salmon	1635		

* No unreported catch estimate available for Russia in 2011.
Unreported catch estimates not provided for Spain and St. Pierre et Miquelon

Table 2.2.1.1. Production of farmed salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980–2011.

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	4153	598	0	11	21	0	0	0	0	4783	0	0	0	0	0	0	0	4783
1981	8422	1133	0	21	35	0	0	0	0	9611	0	0	0	0	0	0	0	9611
1982	10266	2152	70	38	100	0	0	0	0	12626	0	0	0	0	0	0	0	12626
1983	17000	2536	110	69	257	0	0	0	0	19972	0	0	0	0	0	0	0	19972
1984	22300	3912	120	227	385	0	0	0	0	26944	0	0	0	0	0	0	0	26944
1985	28655	6921	470	359	700	0	91	0	0	37196	0	0	0	0	0	0	0	37196
1986	45675	10337	1370	672	1215	0	123	0	0	59392	0	0	0	20	0	0	0	59392
1987	47417	12721	3530	1334	2232	365	490	0	0	68089	3	0	0	50	0	0	53	68142
1988	80371	17951	3300	3542	4700	455	1053	0	0	111372	174	0	0	250	0	0	424	111796
1989	124000	28553	8000	5865	5063	905	1480	0	0	173866	1864	1100	1000	400	0	700	5064	178930
1990	165000	32351	13000	7810	5983	2086	2800	<100	5	229035	9500	700	1700	1700	0	800	14400	243435
1991	155000	40593	15000	9395	9483	4560	2680	100	0	236811	14991	2000	3500	2700	0	1400	24591	261402
1992	140000	36101	17000	10380	9231	5850	2100	200	0	220862	23769	4900	6600	2500	0	400	38169	259031
1993	170000	48691	16000	11115	12366	6755	2348	<100	0	267275	29248	4200	12000	4500	1000	400	51348	318623
1994	204686	64066	14789	12441	11616	6130	2588	<100	0	316316	34077	5000	16100	5000	1000	800	61977	378293
1995	261522	70060	9000	12550	11811	10020	2880	259	0	378102	41093	5000	16000	6000	1000	0	69093	447195
1996	297557	83121	18600	17715	14025	10010	2772	338	0	444138	69960	5200	17000	7500	1000	600	101260	545398
1997	332581	99197	22205	19354	14025	13222	2554	225	0	503363	87700	6000	28751	9000	1000	900	133351	636714
1998	361879	110784	20362	16418	14860	13222	2686	114	0	540325	125000	3000	33100	7068	1000	400	169568	709893
1999	425154	126686	37000	23370	18000	12246	2900	234	0	645590	150000	5000	38800	9195	0	500	203495	849085
2000	440861	128959	32000	33195	17648	16461	2600	250	0	671974	176000	5670	49000	12003	0	500	243173	915147
2001	436103	138519	46014	37606	23312	13202	2645	250	0	697651	200000	5443	68000	13815	0	500	287758	985409
2002	462495	145609	45150	42121	22294	6798	1471	250	0	726188	273000	5948	84200	14699	0	1000	378847	1105035
2003	509544	176596	52526	34550	16347	6007	3710	250	298	799828	261000	10329	65411	13324	0	1000	351064	1150892
2004	563914	158099	40492	35000	14067	8515	6620	250	203	827160	261000	6659	55646	14317	0	1000	338622	1165782
2005	586512	129588	18962	35000	13764	5263	6300	250	179	795818	385000	6123	63369	16827	0	1000	472319	1268137
2006	629888	131847	11905	47880	11000	4674	5745	250	229	843418	370000	5823	70181	22417	0	1000	469421	1312839
2007	744220	129930	22305	36511	9923	2715	1158	250	280	947292	371809	6261	70998	23982	0	1000	474050	1421342
2008	737694	128606	36000	39810	11000	9014	330	250	380	963084	393000	6261	73265	26173	0	1000	499699	1462783
2009	862908	144247	51500	40550	13000	6028	742	250	55	1119280	200000	7930	68670	32819	0	1000	310419	1429699
2010	916434	150004	45396	30585	13000	11127	1068	250	1400	1169264	81000	7930	70800	30264	0	1000	190994	1360258
2011	986850	157385	60500	31000	14000	5100	1083	250	8500	1264668	221000	8014	71000	30264	0	1000	331278	1595946
5-yr mean 2006-2010	778229	136927	33421	39067	11585	6712	1809	250	469	1008468	283162	6841	70783	27131	0	1000	388917	1397384
% change on 5-year mean	+27	+15	+81	-21	+21	-24	-40	0	+1713	+25	-22	+17	+0	+12		0	-15	+14

Notes: Data for 2011 are provisional for many countries.
Where production figures were not available for 2011, values as in 2010 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 2.2.2.1. Production of ranched salmon in the North Atlantic (tonnes round fresh weight), 1980–2011.

Year	Iceland (1)	Ireland (2)	UK (N.Ireland) River Bush (2,3)	Norway various facilities (2)	Total production
1980	8.0				8
1981	16.0				16
1982	17.0				17
1983	32.0				32
1984	20.0				20
1985	55.0	16.0	17.0		88
1986	59.0	14.3	22.0		95
1987	40.0	4.6	7.0		52
1988	180.0	7.1	12.0	4.0	203
1989	136.0	12.4	17.0	3.0	168
1990	285.1	7.8	5.0	6.2	304
1991	346.1	2.3	4.0	5.5	358
1992	462.1	13.1	11.0	10.3	497
1993	499.3	9.9	8.0	7.0	524
1994	312.8	13.2	0.4	10.0	336
1995	302.7	19.0	1.2	2.0	325
1996	243.0	9.2	3.0	8.0	263
1997	59.4	6.1	2.8	2.0	70
1998	45.5	11.0	1.0	1.0	59
1999	35.3	4.3	1.4	1.0	42
2000	11.3	9.3	3.5	1.0	25
2001	13.9	10.7	2.8	1.0	28
2002	6.7	6.9	2.4	1.0	17
2003	11.1	5.4	0.6	1.0	18
2004	18.1	10.4	0.4	1.0	30
2005	20.5	5.3	1.7	1.0	29
2006	17.2	5.8	1.3	1.0	25
2007	35.5	3.1	0.3	0.5	39
2008	68.6	4.4	-	0.5	74
2009	44.3	1.1	-	-	45
2010	42.3	2.5	-	-	45
2011	30.2	3.2	-	-	33
5-yr mean 2006-2010	41.6	3.4			46
% change on 5-year mean	-27	-5			-27

1 From 1990, catch includes fish ranched for both commercial and angling purposes.
2 Total yield in homewater fisheries and rivers.
3 The proportion of ranched fish was not assessed between 2008 and 2011 due to a lack of microtag returns.

Table 2.5.1.1. Summary of Atlantic salmon tagged and marked in 2011; '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	Other Internal[1]	Total
Canada	Hatchery Adult	0	1,034	1,031	881	2,946
	Hatchery Juvenile	0	6,975	419,996	525	427,496
	Wild Adult[2]	0	3,958	902	172	5,032
	Wild Juvenile[2]	0	13,667	9,240	648	23,555
	Total	**0**	**25,634**	**431,169**	**2,226**	**459,029**
Denmark	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	118,500	0	162,700	0	281,200
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**118,500**	**0**	**162,700**	**0**	**281,200**
France	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile[3]	0	0	525,380	0	525,380
	Wild Adult[3]	178	0	0	0	178
	Wild Juvenile	2,813	1,659	0	0	4,472
	Total	**2,991**	**1,659**	**525,380**	**0**	**530,030**
Germany	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	18,000	0	0	0	18,000
	Wild Adult	0	0	0	0	0
	Wild Juvenile	5,420	0	0	0	5,420
	Total	**23,420**	**0**	**0**	**0**	**23,420**
Iceland	Hatchery Adult	0	4	0	0	4
	Hatchery Juvenile	54,400		0	0	54,400
	Wild Adult		228	0	0	228
	Wild Juvenile	2,700		0	0	2,700
	Total	**57,100**	**232**	**0**	**0**	**57,332**
Ireland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	189,240	0	187,497	0	376,737
	Wild Adult	0	0	0	0	0
	Wild Juvenile	5,317	0	0	0	5,317
	Total	**194,557**	**0**	**187,497**	**0**	**382,054**
Norway	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	127,188	5,995	0	0	133,183
	Wild Adult	0	716	0	0	716
	Wild Juvenile	1,700	2,123		0	3,823
	Total	**128,888**	**8,834**	**0**	**0**	**137,722**
Russia	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	1,184,725	0	1,184,725
	Wild Adult	0	2,525	0	0	2,525
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**2,525**	**1,184,725**	**0**	**1,187,250**
Sweden	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	3000	164,544	0	167,544
	Wild Adult	0			0	0
	Wild Juvenile	0	500		0	500
	Total	**0**	**3,500**	**164,544**	**0**	**168,044**
UK (England & Wales)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	6,800	0	224,570	0	231,370
	Wild Adult		239	0	0	239
	Wild Juvenile	9,855	0	5,917	0	15,772
	Total	**16,655**	**239**	**230,487**	**0**	**247,381**
UK (N. Ireland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	17,809	0	32,089	0	49,898
	Wild Adult	0	0	0	0	0
	Wild Juvenile	1957	0	0	0	1,957
	Total	**19,766**	**0**	**32,089**	**0**	**51,855**
UK (Scotland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	25,000	1,280	26,280
	Wild Adult	0	594	0	0	594
	Wild Juvenile	2373	0	0	1,929	4,302
	Total	**2,373**	**594**	**25,000**	**3,209**	**31,176**
USA	Hatchery Adult	0	2,050	58	5,318	7,426
	Hatchery Juvenile	0	0	504,648	539	505,187
	Wild Adult	0	0	0	733	733
	Wild Juvenile	0	0	0	184	184
	Total	**0**	**2,050**	**504,706**	**6,774**	**513,530**
All Countries	Hatchery Adult	0	3,088	1,089	6,199	10,376
	Hatchery Juvenile	531,937	15,970	3,431,149	2,344	3,981,400
	Wild Adult	178	8,260	902	905	10,245
	Wild Juvenile	32,135	17,949	15,157	2,761	68,002
	Total	**564,250**	**45,267**	**3,448,297**	**12,209**	**4,070,023**

[1] Includes other internal tags (PIT, ultrasonic, radio, DST, etc.)
[2] May include hatchery fish.
[3] Includes external dye mark.

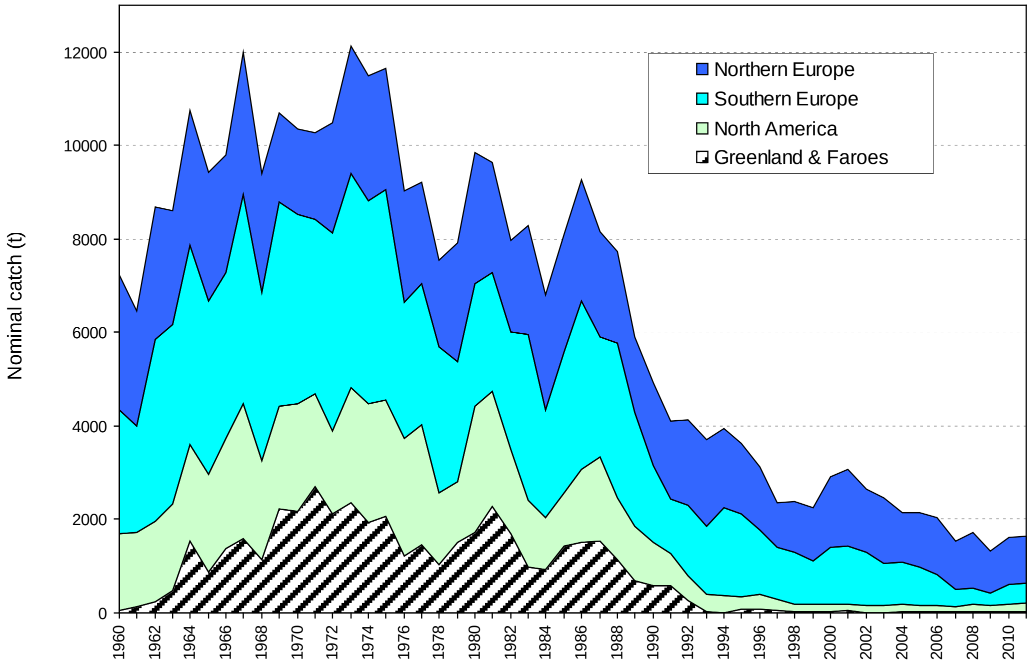


Figure 2.1.1.1. Reported total nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2011.

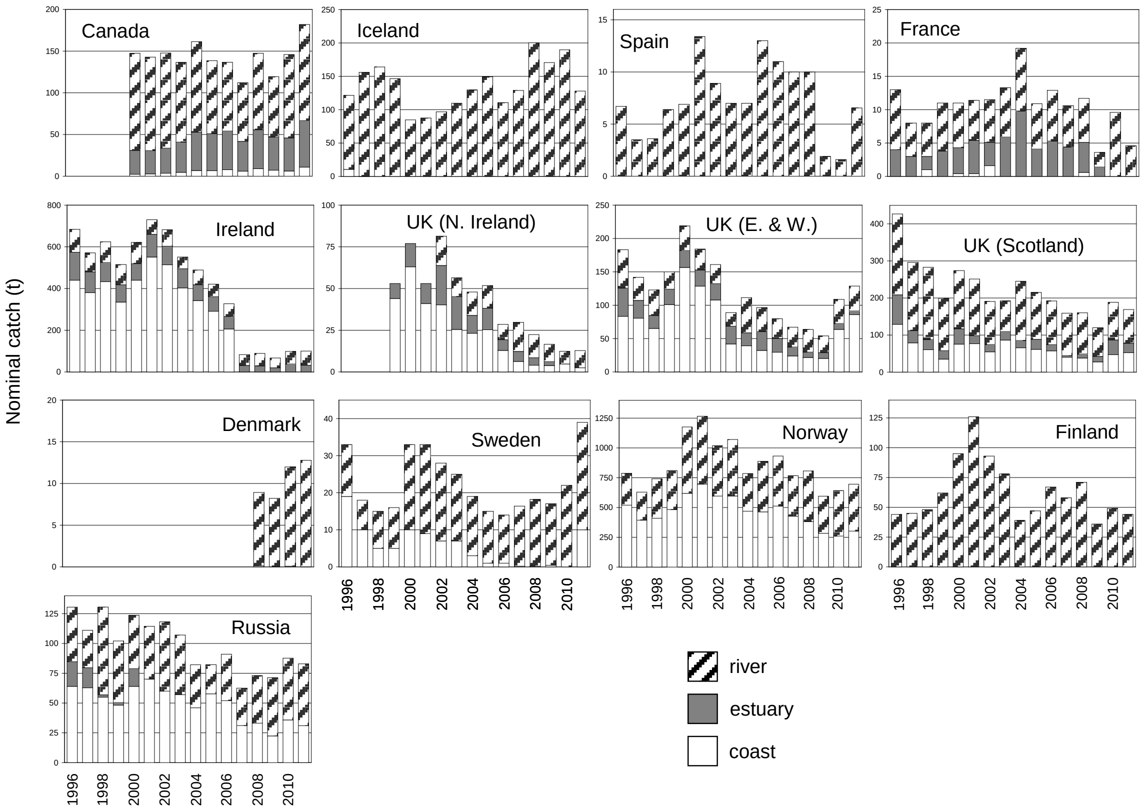


Figure 2.1.1.2. Nominal catch (tonnes) taken in coastal, estuarine and riverine fisheries by country. The way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries – see text for details. Note also that the y-axes scales vary.

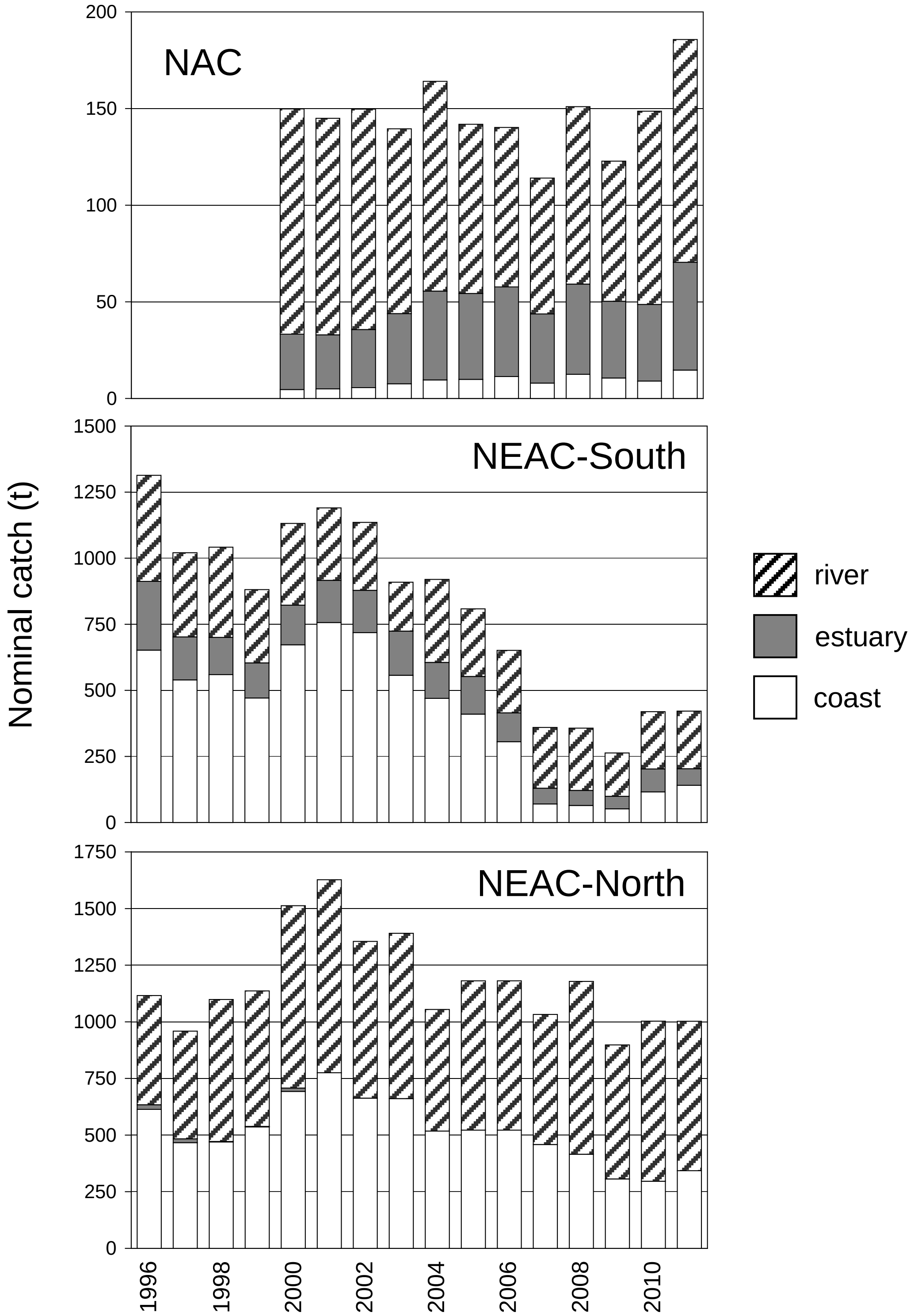


Figure 2.1.1.3. Nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area, and for the NEAC northern and southern areas. The way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries – see text for details. Note also that the y-axes scales vary.

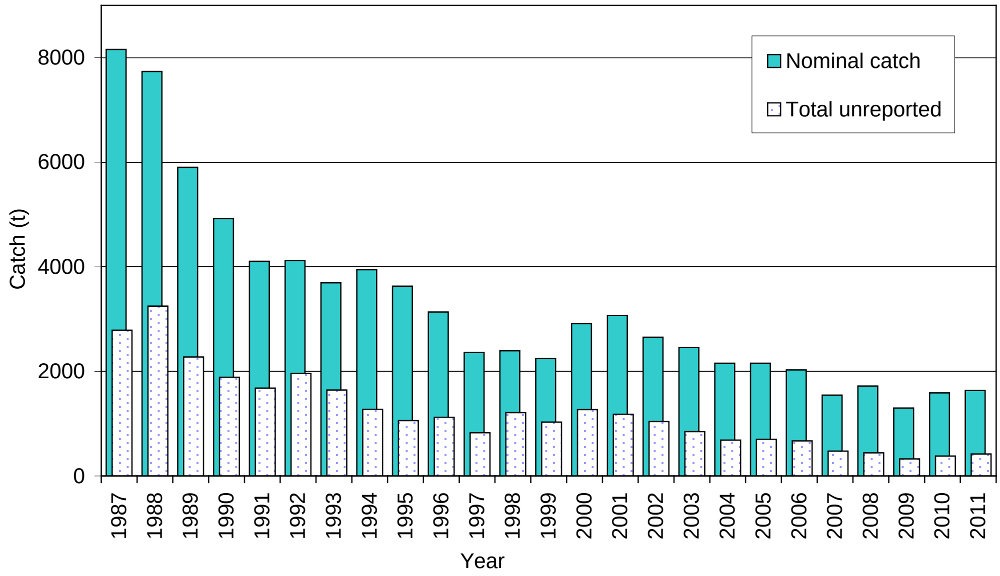


Figure 2.1.3.1. Nominal North Atlantic salmon catch and unreported catch in NASCO areas, 1987–2011. Unreported catch estimates for 2007 to 2010 are incomplete.

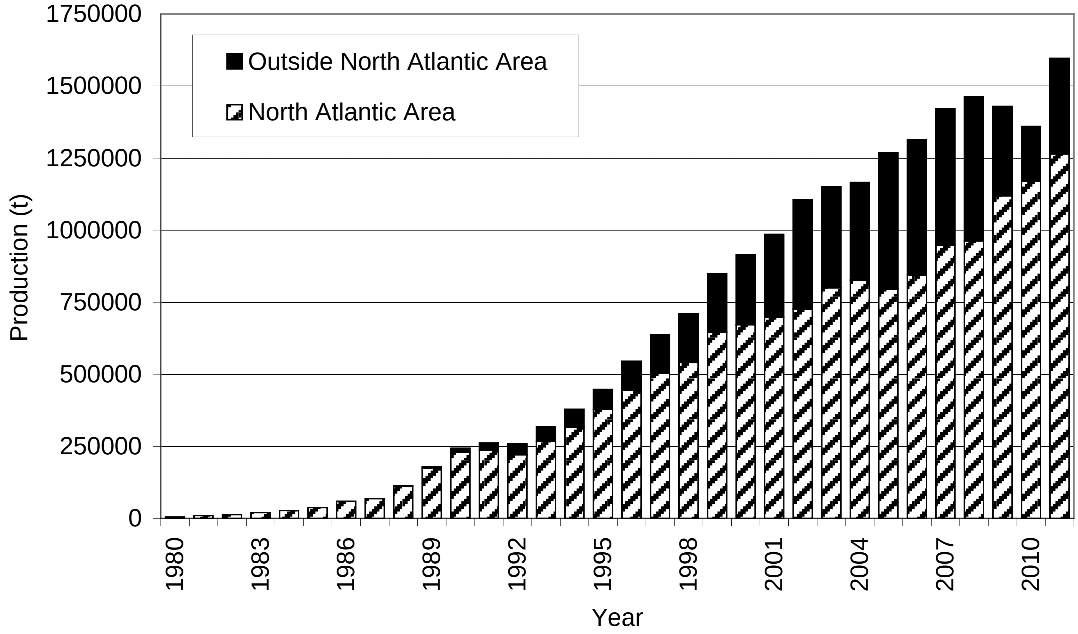


Figure 2.2.1.1. Worldwide production of farmed Atlantic salmon, 1980–2011.

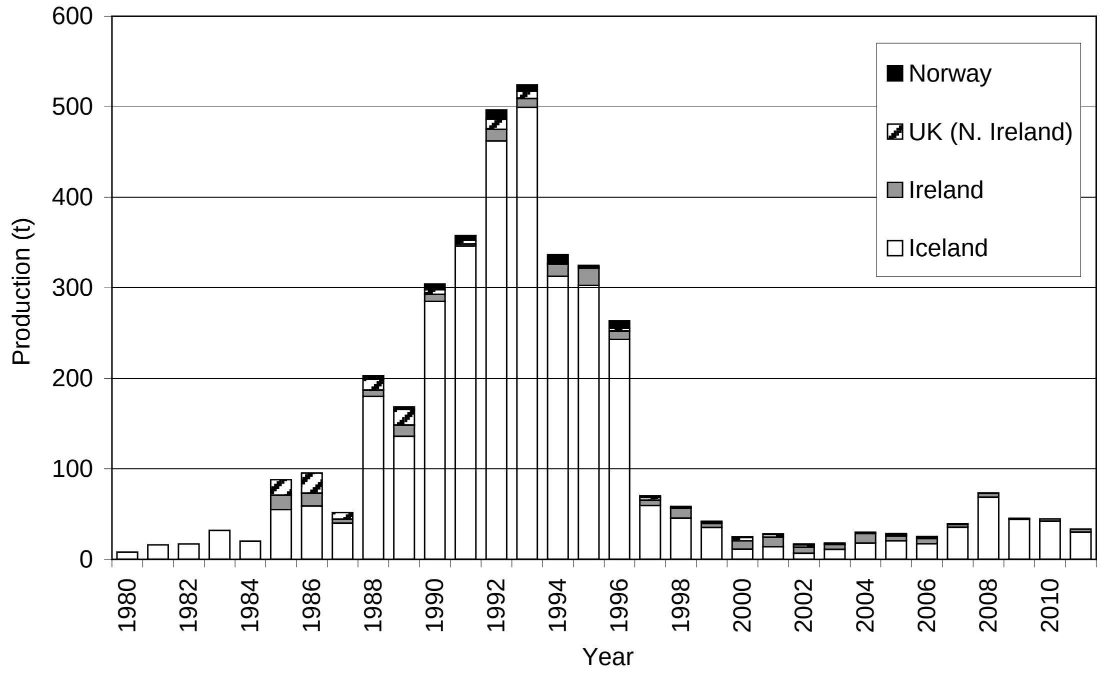


Figure 2.2.2.1. Production of ranched Atlantic salmon (tonnes round fresh weight) in the North Atlantic, 1980–2011.

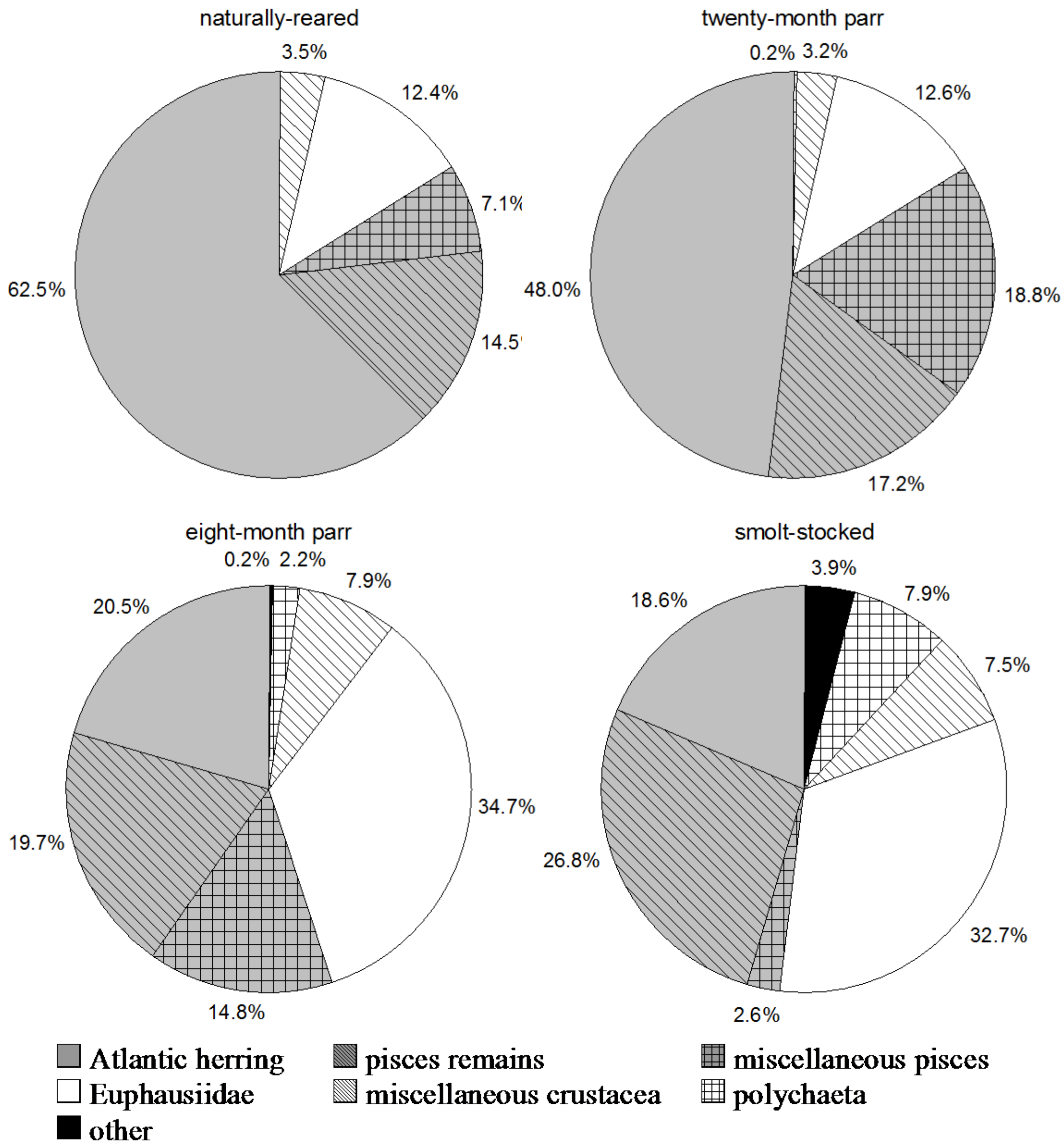


Figure 2.3.3.1. Dietary composition by wet weight (g) of Atlantic salmon postsmolts caught in Penobscot Bay, Maine from 2001–2005 grouped by four rearing origins: naturally reared, twenty-month parr, eight-month parr, and smolt stocking.

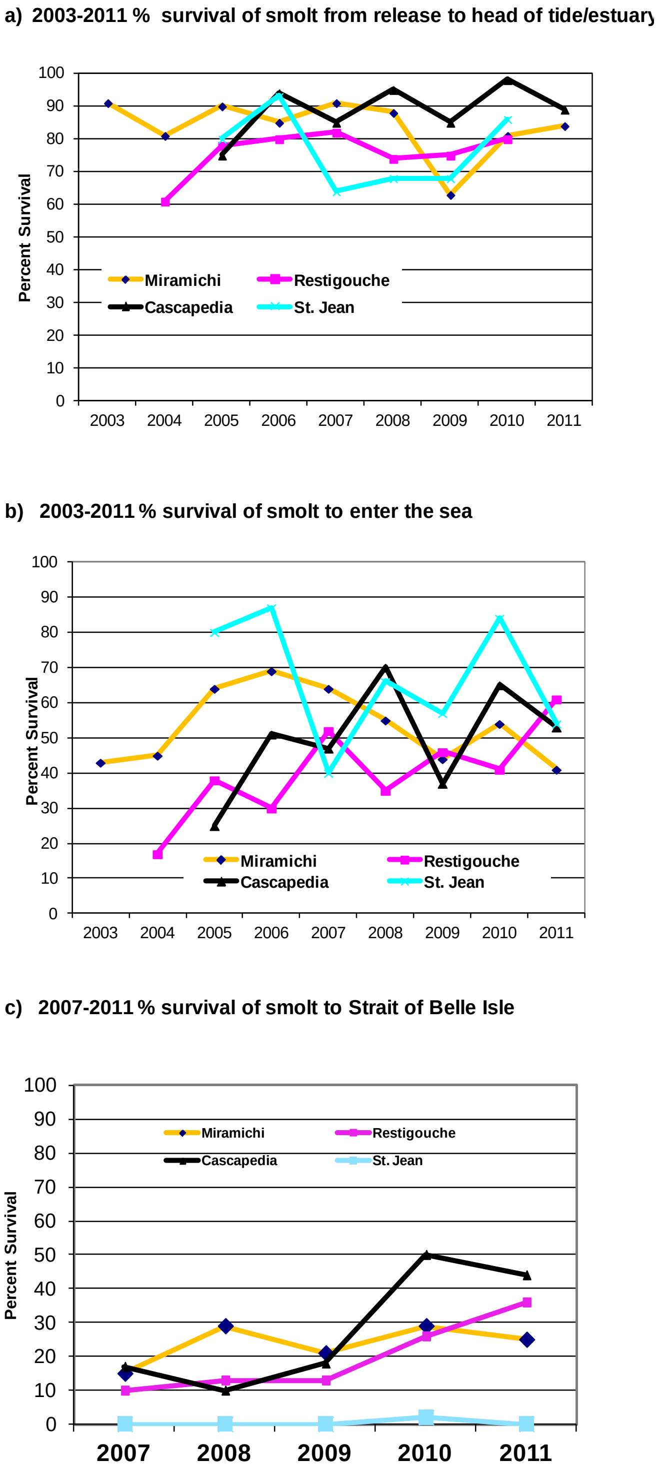


Figure 2.3.4.1. Survivals of smolts from freshwater release points to (a) the head of tide, (b) from the head of tide to estuary exits and (c) to the Strait of Belle Isle.

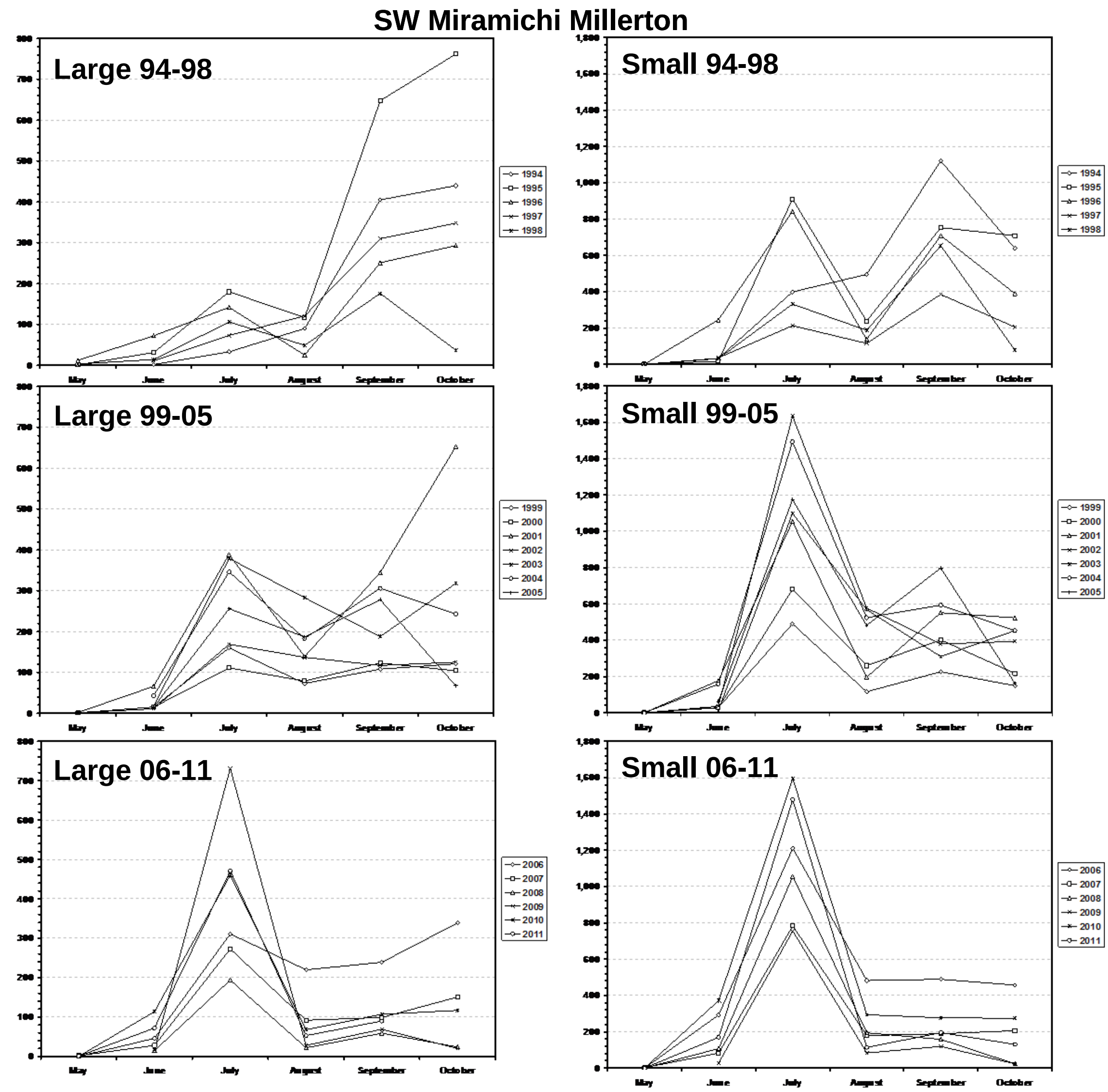


Figure 2.3.6.1. Run timing of large salmon and small salmon to estuary trapnets on the Southwest Miramichi River, 1994–2011.

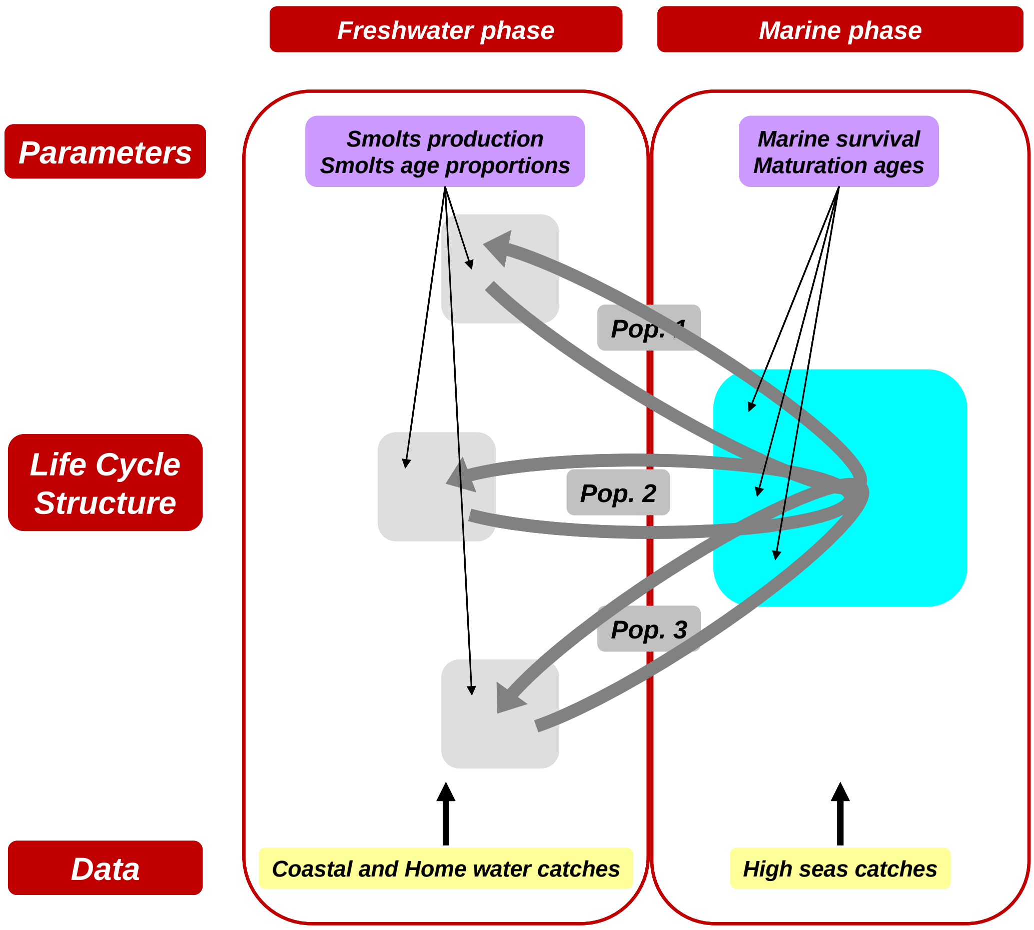


Figure 2.3.7.1. Schematic structure of stage-structured life cycle model that incorporates the temporal dynamics of the recruitment process, including freshwater and marine phase. The model captures the complex meta-population structure stemming from homing behaviour for reproduction in freshwater. Hierarchical structure will be used to capture time and spatial variability of region-specific parameters such as the ones characterizing the freshwater phase of the life cycle.

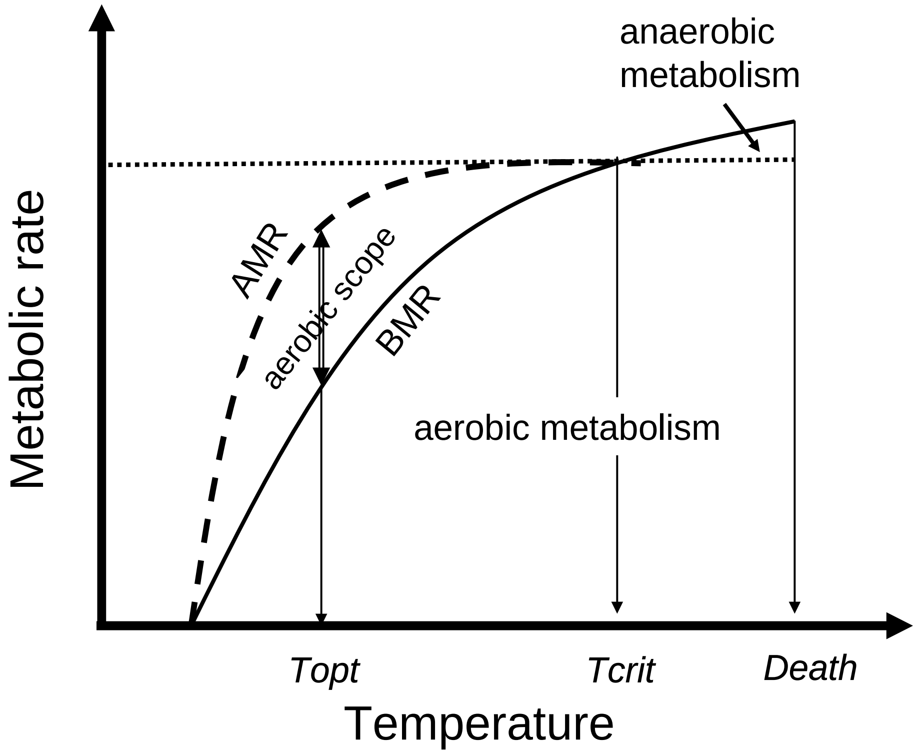


Figure 2.3.13.1. Simplified diagram of the relationship between basic metabolic rate (BMR), active metabolic rate (AMR), and aerobic scope relative to water temperature for fish. T_{opt} is the temperature at which the aerobic scope (AMR – BMR) is maximum. T_{crit} is the temperature at which AMR = BMR (aerobic scope is null). All metabolic energy requirements below maximum AMR can be attained by aerobic metabolism. All metabolic energy requirements above maximum AMR, when temperature is higher than T_{crit}, must be realized by anaerobic metabolism.

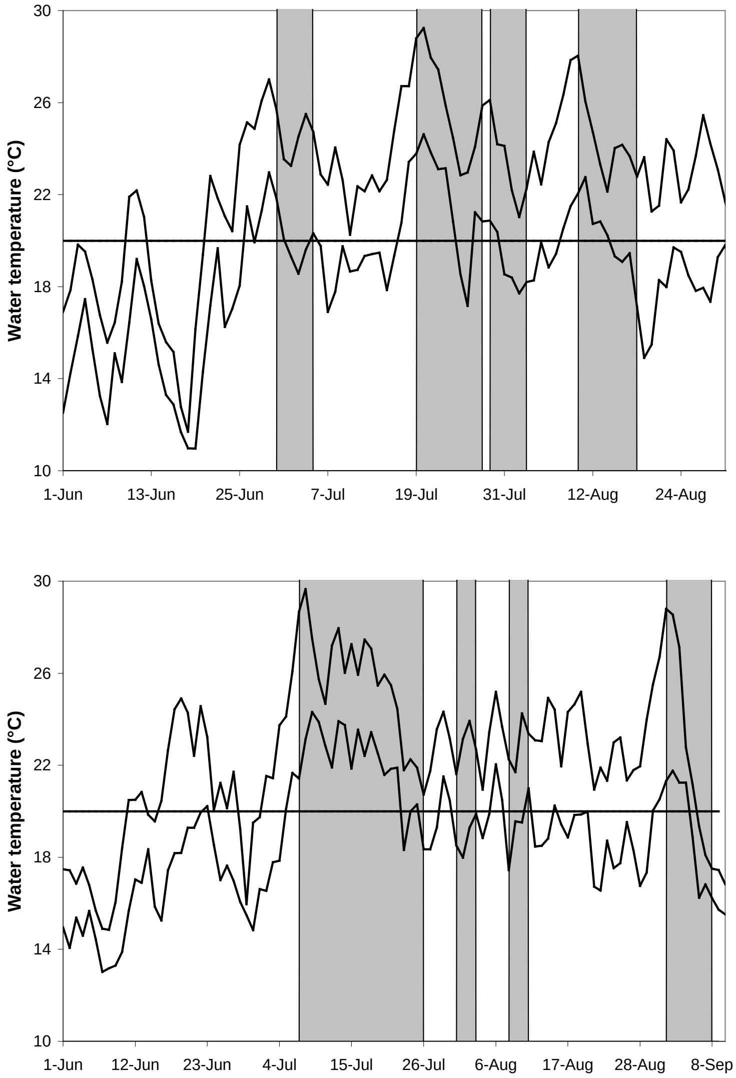


Figure 2.3.13.2. The daily minimum and maximum water temperatures at the Southwest Miramichi River (Doaktown) station for 2005 (upper panel) and 2010 (lower panel). The shaded areas represent the days when a management intervention would have taken place based on the closing and opening triggers defined in text. The solid line horizontal line is 20°C.

3 Northeast Atlantic Commission

3.1 NASCO has requested ICES to describe the key events of the 2011 fisheries

3.1.1 Fishing at Faroes in 2010/2011

No fishery for salmon has been prosecuted since 2000.

3.1.2 Significant events in NEAC homewater fisheries in 2011

There were no new significant events reported by NEAC countries in 2011.

3.1.3 Gear and effort

No significant changes in gear type used were reported for 2011, however, some changes in effort were recorded. The number of gear units licensed or authorized in several of the NEAC area countries provides a partial measure of effort (Table 3.1.3.1), 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 utilized or the time each licensee fished.

Trends in effort are shown in Figures 3.1.3.1 and 3.1.3.2 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.

The number of gear units licensed in UK (England & Wales) and reported in UK (Scotland) (Table 3.1.3.1) was among the lowest reported in the time-series. In Norway the numbers of bag nets and bendnets have decreased for the past 15–20 years and in 2011 they were close to the lowest levels in the time-series. The number of driftnet, draftnet, bag nets and boxes for UK (N. Ireland) for 2011 was similar to the previous year and also the lowest reported for the time-series.

Rod effort trends, where available, have varied for different areas across the time-series (Table 3.1.3.1). 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 are available for 2007–2011). In Finland, the numbers of anglers and fishing days showed a slight increase from the previous year, but remained close to the five-year average. In the Southern NEAC area, rod licence numbers have increased since 2001 in UK (England & Wales); there was a further small increase in 2011. In Ireland there was an apparent increase in rod fishing licences in the early 1990s due to the introduction of one day licences; licence numbers then remained stable for over a decade, before decreasing from 2002 due to fishery closures. In France, rod fishing effort has been fairly stable over the last ten years, but showed a slight increase from 2010 to 2011.

3.1.4 Catches

NEAC area catches are presented in Table 3.1.4.1. The provisional declared catch in the NEAC area in 2011 was 1424 tonnes, just 10 t above the updated catch for 2010 (1414 t), but representing an increase of around 23% on the 2009 catch (1158 t).

The provisional total nominal catch in Northern NEAC for 2011 (1003 t) was the same as the updated catch for 2010 (1003 t) but was 6% and 16% below the previous five and ten year averages, respectively. Catches in 2011 were below the long-term (ten year) means in most Northern NEAC countries with the exception of Sweden and Denmark.

In the Southern NEAC area, the provisional total nominal catch for 2011 (422 t) rose by 12 t on 2010 but was 3% above and 40% below the previous five and ten year averages, respectively. Despite a noticeable increase in 2010 and 2011 over 2009 (55% and 60% respectively), catches in Southern NEAC countries are still below the 10-year means in most countries, with the exception of UK (England & Wales) where catches increased noticeably in the last two years.

Figure 3.1.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2011. The catch in the Southern area has declined over the period from about 4500 t in 1972 to 1975 to below 1000 t since 2003 and was between 250–450 t over last five years. The catch showed marked declines in 1976 and in 1989 to 1991 and has continued to decline steadily in the last ten years. The catch in the Northern area also indicates an overall decline over the time-series, although this decrease has been 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, 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 and is now around 1000 t. 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.

3.1.5 Catch per unit of 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.

The CPUE data are presented in Tables 3.1.5.1–3.1.5.6. The CPUE for rod fisheries have been derived by relating the catch to rod days or angler seasons, 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 (England & Wales) and UK (Scotland) net fisheries (Figure 3.1.5.1). CPUE values for net fisheries were mostly lower than those in 2010, but above the previous 5-year averages (Table 3.1.5.3). The CPUE values for rod fisheries in UK (England &Wales) and France increased in 2011 and were the second highest in the reported time-series (Table 3.1.5.1 and 3.1.5.4). In contrast, CPUE for the rod fishery on the River Bush in UK (N. Ireland) was the lowest in the time-series, following an increase between 2002 and 2006 (Table 3.1.5.1).

In the Northern NEAC area, there has been an increasing trend in CPUE figures for the Russian rod fisheries in the White Sea rivers (Figure 3.1.5.1 and Table 3.1.5.2). A decreasing trend was noted for rod fisheries in Finland (River Teno). No trend was observed for the Norwegian net fisheries (Figure 3.1.5.1). Most 2011 CPUE values showed a decrease compared to both 2010 and the previous 5-year means (Tables 3.1.5.1, 3.1.5.3, 3.1.5.5 and 3.1.5.6).

3.1.6 Age composition of catches

The percentage of 1SW salmon in NEAC catches is presented in Table 3.1.6.1 and in Figures 3.1.6.1 (Northern NEAC) and 3.1.6.2 (Southern NEAC). The overall percentage of 1SW fish in the Northern NEAC area catch remained reasonably consistent in the period 1987 to 2000 (range 61 to 72%), but has fallen in more recent years (range 49 to 69%), when greater variability among countries has also been evident. In 2011, the percentage of 1SW fish in catches fell for Northern NEAC countries compared with 2010 (49% compared with 60% in 2010), was lower than the previous 5- and 10-year averages, and was the lowest value in the time-series. On average, 1SW fish comprise a higher percentage of the catch in Iceland, Finland and Russia than in the other Northern NEAC countries; the percentage of 1SW fish in Norway and Sweden remain the lowest among the Northern NEAC countries (Figure 3.1.6.1). The percentage of 1SW fish in catches in Iceland has been increasing in recent years. However, the percentage of 1SW fish is falling in other Northern NEAC countries with an overall decline for the stock complex (Figure 3.1.6.1).

In the Southern NEAC area, the overall percentage of 1SW fish in the catch (44%) was lower than the previous 5- and 10-year means (both 59%), and the lowest value in the time-series. Prior to 2011, the percentage of 1SW salmon in the Southern NEAC area remained reasonably consistent over the time-series (range 49 to 65%), although with considerable variability among individual countries (Figure 3.1.6.2). 1SW fish typically comprise a larger proportion of the catch in UK (England & Wales) than in the other Southern NEAC countries that provide data. However, there was a marked reduction in the percentage of 1SW fish in 2011 in all southern NEAC countries.

The percentage of 1SW salmon in 2011 was therefore the lowest in the time-series for both the Northern and Southern NEAC areas (49% and 44% respectively).

3.1.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2011 was again generally low in most countries, with the exception of Norway, Iceland and Sweden, and is similar to the values that have been reported in previous years (e.g. ICES 2009a). The occurrence of such fish is usually ignored in assessments of the status of national stocks (Section 3.3).

The estimated proportion of farmed salmon in Norwegian angling catches in 2011 was among the lowest on record (4%). In a Kolarctic sampling programme (Section 2.3.8) (8304 scale samples from 39 fishers, Svenning *et al*. unpublished) from the northern part of Norway (Northern-Nordland, Troms and Finnmark counties) 12% of the scales were from escaped farmed salmon. Samples from two coastal locations in the central and southern parts of Norway showed a higher proportion of farmed salmon (48%), whereas samples from three locations in fjords in central and southern Norway showed relatively lower proportions of escaped farmed salmon (13%). The number of farmed salmon that escaped from Norwegian farms in 2011 is reported to be 364 000 fish (provisional figure). An assessment of the likely effect of these fish on the output data from the PFA model has been reported previously (ICES 2001).

The release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching for rod fisheries in two Icelandic rivers continued into 2011. Icelandic catches have traditionally been split into two separate categories, wild and ranched, and in 2011, 30 t were reported as ranched salmon in contrast to 97 t harvested as wild.

Ranching occurs on a much smaller scale in other countries. Some of these operations are experimental and at others harvesting does not occur solely at the release site. In 2011, in Ireland less than one t was reported as ranched salmon and this has been included in the nominal catch.

3.1.8 National origin of catches

Catches of Russian salmon in Norway

Evidence of Russian origin salmon being caught in coastal mixed-stock fisheries in northernmost Norway have been reported in previous years (e.g. ICES 2009a). Norway has recently decreased fishing effort in coastal areas and available information shows a decline in the number of fishing days and in the number of fishers operating in marine waters of Finnmark County. However, there are still significant salmon fisheries operating in this coastal area, which are very likely to exploit Russian salmon.

In 2009, a joint project between Russia, Norway and Finland was initiated, the aims of which included establishing a genetic baseline for characterization of salmon populations, which could be used for estimating the composition of mixed-stock fisheries in the area (Section 2.3.6).

Analyses of 1900 salmon caught in the mixed-stock fisheries in 2008 showed that these catches consisted of a mix of salmon from a number of rivers in both countries, with the Russian component in Finnmark increasing from west to east (Svenning *et al.* 2011). On average, through the whole sampling period from May to August, and across all sampling localities, the proportion of Russian salmon in the catches was 20%. Between regions and seasons, the proportion varied, reaching levels of up to 70% Russian salmon in catches in the Varanger area, close to the Russian border, early in the season. There were also differences in regional and temporal distributions of different sea age groups. Through the season the proportion of Russian salmon decreased in all sampling areas. The results also demonstrated that bag and bendnets located near the coast catch fish from a higher number of stocks than nets located in the fjords.

This work is continuing under the Joint Russian–Norwegian Scientific Research Programme on Living Marine Resources in 2011 (Appendix 10 of the 40th Joint Russian–Norwegian Fishery Commission) and under the Kolarctic Salmon project (2011–2013 EU Kolarctic ENPI CBC programme) (Section 2.3.6).

3.1.9 Exploitation indices for NEAC stocks

Exploitation estimates have been plotted for 1SW and MSW salmon from the Northern NEAC (1983 to 2011) and Southern NEAC (1971 to 2011) areas (Figures 3.1.9.1 and 3.1.9.2).

National exploitation rates are an output of the NEAC PFA Run Reconstruction Model. These were combined as appropriate by weighting each individual country's exploitation rate to the reconstructed returns. Previously (e.g. ICES 2010b) the stock complex exploitation rates presented were not weighted by country.

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 per year) in exploitation rate over the time-series in Figure 3.1.9.3. This was derived from the slope of the linear regression between time and natural logarithm transformed exploitation rate.

The exploitation of 1SW salmon in both Northern NEAC and Southern NEAC areas has shown a general decline over the time-series (Figures 3.1.9.1 and 3.1.9.2), with a notable sharp decline in 2007 as a result of the closure of the Irish driftnet fisheries in the Southern NEAC area. Exploitation on Northern 1SW stocks is higher than on Southern 1SW and considerably higher for MSW stocks. The weighted exploitation rate on 1SW salmon in the Northern NEAC area was 39% in 2011 representing a decline from the previous 5-year (43%) and 10-year (44%) averages. Exploitation on 1SW fish in the Southern NEAC complex was 15% in 2011 indicating a decrease from both the previous 5-year (18%) and the 10-year (26%) averages. The current estimates for both stock complexes are among the lowest in the time-series.

The exploitation rate of MSW fish also exhibited an overall decline over the time-series in both Northern NEAC and Southern NEAC areas (Figures 3.1.9.1 and 3.1.9.2), with a notable sharp decline in 2008 as a result of significant changes in the Norwegian fisheries in the Northern NEAC area. Exploitation on MSW salmon in the Northern NEAC area was 44% in 2011, representing a decrease from the previous 5-year (52%) and 10-year averages (54%). Exploitation on MSW fish in Southern NEAC was 12% in 2011, a decrease from both the previous 5-year (13%) and 10-year (16%) averages.

The relative rate of change of exploitation over the entire time-series indicates an overall reduction of exploitation in most Northern NEAC countries for 1SW and MSW salmon (Figure 3.1.9.3). Exploitation 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 3.1.9.3) on both 1SW and MSW components. The greatest rate of decrease shown for both 1SW and MSW fish was in UK (Scotland) whilst Iceland (SW) showed relative stability in exploitation rates for both 1SW and MSW salmon during the time-series and France showed an increase for 1SW exploitation rates.

3.1.10 Bycatch of salmon in pelagic fisheries

The Icelandic Directorate of Fisheries (IDF) started a screening programme to investigate the incidence of salmon bycatch in mackerel/herring fisheries in 2010. In that year, the programme was limited to 1000–3000 t multi-gear vessels, which fished with a midwater trawl and landed their catch in processing factories and freezing plants (ICES 2011b). In 2011, the screening programme continued and included larger processing and factory vessels. The screening period lasted from early June to late September and was conducted by trained IDF inspectors. The Icelandic mackerel/herring fishery took place in northeastern and western areas with salmon caught as bycatch in all the areas. In 2010, 170 salmon were recovered from a total of 35 403 t of mackerel and herring, an average of 4.8 salmon/1000 t. In 2011, 38 153 t were screened and 233 salmon recovered (6.1 salmon/1000 t). Of the four tagged salmon caught in 2010, three were from Norway and one from Ireland. In 2011, one Norwegian and one Irish tagged salmon were caught. In these two years no Icelandic tags have been recovered. For each salmon, information has been recorded on the date and place (coordinates) of capture, along with the length, weight and sex of the fish, as well as details of any tags recovered. In 2011, additional samples were taken for sex and maturity determination, stomachs for diet examination and tissue for DNA analyses; the head of the fish was also retained. Further screening of salmon bycatch in the Icelandic pelagic fishery is planned for 2012, as well as further analyses of existing samples.

The Faroese Marine Research Institute also initiated a sampling programme in 2011 to investigate salmon bycatch in the mackerel fishery (pelagic pair-trawls). The screening was done in a land-based freezing plant. Salmon were only observed in May and June although the fishery lasted until September. A total of 76 salmon were observed in 31 315 t of fish that were screened (1.5 salmon/1000 t, on average). In total, 122 744 t of mackerel were landed.

The Working Group welcomed this opportunistic assessment of the incidence of salmon bycatch in pelagic fisheries and also the opportunity to collect samples from the salmon caught, as this provided new information on the temporal and spatial distribution of salmon in this area, as well as the biology of the fish. The occurrence of salmon in Icelandic waters, throughout the whole fishing area, was not previously known to the Working Group and it was noted that the bycatch rate at Iceland was higher than that observed at the Faroes.

The Working Group recommended that similar sampling should continue in order to provide further information on the bycatch of salmon in pelagic fisheries in these areas.

3.2 Management objectives and reference points

Management objectives are outlined in Sections 1.4 and 1.5 describes the derivation of reference points for these stocks and stock complexes.

The current status of the NEAC stock complexes is considered with respect to the following guidance from ICES. The conservation limits (CLs) have 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. 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).

ICES has also indicated that for the implementation of the risk framework for the provision of catch advice for the NEAC area, management objectives should be defined for each salmon management unit. Such management objectives have not yet been agreed to by NASCO, although ICES (2010b) proposed that there should be at least a 75% probability of all management units exceeding their SERs simultaneously, in line with the objective for the management units in the West Greenland and NAC areas.

3.2.1 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 been developed for estimating national CLs for countries that cannot provide one based upon river-specific estimates. This approach is based on establishing pseudo-stock–recruitment relationships for national salmon stocks in the NEAC area (Potter *et al*. 2004).

As described in 2002 (ICES 2002), the model provides a means for relating estimates of the numbers of recruits and spawners 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. This is 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 minimizes 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 2011 national stock–recruitment relationship assessment for countries where no river-specific CLs have been determined.

3.2.2 National conservation limits

The national CL model has been run for all countries (Section 3.3.3) and the CLs derived in this way are used for countries where the development of river-specific CLs has not been completed. Where river-specific estimates have been derived (France, Ireland, UK (England & Wales) and Norway) these are used to provide national estimates (Table 3.2.2.1). 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 3.3.4.1 for comparison with the estimated spawning escapement. The CLs have been calculated as:

- Northern NEAC 1SW spawners: 167 615;
- Northern NEAC MSW spawners: 128 778;
- Southern NEAC 1SW spawners: 599 197;
- Southern NEAC MSW spawners: 241 269.

Further comments on the changes to the CL estimates are provided in Section 3.7.1.

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 January) and return to homewaters) for maturing and non-maturing 1SW salmon from the Northern NEAC and Southern NEAC stock complexes. The SERs are shown in Figure 3.3.4.1 and Table 3.2.2.1. The Working Group considers the current SER levels may be less appropriate for evaluating the historical status of stocks (e.g. pre-1985), that in many cases have been estimated with less precision.

3.2.3 Progress with setting river-specific conservation limits

In Norway, conservation limits (CLs) have been developed for 439 rivers since 2007. The CLs are based on stock–recruitment relationships in nine rivers. In 2011, attainment of CLs was evaluated for 211 Norwegian rivers based on data from 1993 to 2010, and advice on exploitation was given both for river- and sea-fisheries. Work is now in progress to assess the attainment of CLs for the same 211 rivers based on data from 1993–2011.

In Iceland, progress has been made in setting CLs for salmon rivers. Information on productivity shows a wide range in salmon catch from 2.1 to 57.7 adult fish per ha wetted area. This wide range shows that there will be large differences in the spawning requirements among rivers. There are currently only a few rivers with available measurements of wetted area, but efforts 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 CLs between rivers of similar origin and character. It is noted, however, that this might take a few years (5–10) before being fully adopted. The salmon runs and catches have been high in most Icelandic rivers for the past few years and many rivers have shown record high catches. This good situation and the economic recession have slowed progress on setting river-specific CLs for Icelandic salmon rivers, although work continues.

In Ireland, river-specific salmon stock assessments have been conducted since 2006–2007 based upon the mean of the most recent five years catch, raised by estimated exploitation rates or counter data, in a Monte-Carlo simulation to predict probable returns for the next year. These are subsequently compared against river-specific CLs to determine the probability at the 75th percentile, of a surplus or deficit. New data has become available to calculate CLs and so it is opportune to update them and, in addition, include the variation about them into the river-specific forecast models.

The CLs are re-estimated based upon the following updates:

- Re-estimate from angling catch data collected between 2006 to 2011 including:
    - Weights of 1SW and 2SW fish with bimodal split at 4 kg, giving median and standard deviations, to establish normal distributions.
    - Ratio 1SW:2SW based upon the same split of 1SW and 2SW fish.
- Relationship between weight and fecundity estimated from stripped wild salmon in hatchery data 1992 to 2011.
- Fecundity of wild 1SW and 2SW salmon estimated from weights and fecundities, and their 95% confidence intervals.
- New river wetted areas (McGinnity *et al*. 2012).
- Lagged egg estimates in monitored rivers.
- Stock and recruitment (SR) analysis on monitored rivers: egg deposition/m^2 at MSY (Ricker stock–recruitment model) through Bayesian Hierarchical SR analysis (Prévost *et al*. 2003) of rivers with latitudes between 50 and 57 degrees North, in line with the latitudinal range of Irish rivers.
- Transport to non-monitored rivers by wetted area and latitude through Bayesian Hierarchical SR analysis (Prévost *et al*. 2003).

- Reconstruct egg depositions to achieve the CLs/m² raised to river wetted areas, to give the necessary number of 1SW and 2SW fish to deposit them, based on river-specific fecundities and proportions of 1SW to 2SW where sample sizes exceed 100 fish. Where sample sizes are not of this size, the national average fecundities and proportions 1SW:2SW are used.

In UK (N. Ireland) conservation limits have been determined for a number of important salmon rivers in the Department of Culture Arts and Leisure (DCAL) area, through the transport of optimal productivity metrics determined from the River Bush stock–recruitment study to measured habitat parameters for the other rivers. Habitat surveys were initiated on the Upper Bann and Moyola rivers in 2011 to facilitate the derivation of CLs for both these catchments. The Sixmile Water has been surveyed and a CL has been established. The Loughs Agency has established CLs and compliance monitoring for the two main rivers (Foyle and Roe) out of the total of five rivers.

3.3 NASCO has requested ICES to describe the status of stocks

3.3.1 Developments to the NEAC-PFA and CL 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 to 0.04) per month to be appropriate. A Monte Carlo simulation (10 000 trials) is used to estimate confidence intervals on the stock estimates produced from the model. Potter *et al*. (2004) provide full details of the basic model, and further modifications have been described in subsequent Working Group reports (e.g. ICES 2005).

The model has previously been run using 'Crystal Ball v7.2.1' in Excel (Decisioneering 1996). In 2011, the Working Group reported that it had developed an updated version of the model which runs in the 'R' software (R Development Core Team 2007). The objective is to provide a more flexible platform for the further development of the model and to allow its integration with the Bayesian forecast model for the development of catch options. In 2012, a full comparison was conducted between the outputs of the 'Crystal Ball' and 'R' programs to examine the approaches taken and validate the outputs, before deciding to run the full assessment using the R code.

The transfer of the model to the R software has provided the opportunity to review the current model and implement some minor changes. These are described in Section 3.7.1.

3.3.2 National input to the NEAC-PFA model

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

- Catch in numbers,

- Unreported catch levels (min and max), and
- Exploitation levels (min and max).

The model input data are provided in Annex 5. The model inputs have been described in detail (ICES 2002). Modifications are reported in the Working Group report in the year in which they are first implemented, and significant modifications undertaken in 2011 are indicated in Section 3.7.1.

For some countries, the data are provided in two or more regional blocks. In these instances, model output is provided for the regions and is also combined to provide a set of output variables for the whole 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.

With the implementation of the model in 'R', it has been agreed that where the above data are themselves derived from other data sources, the raw data should be included in the model. This will permit the uncertainty in these analyses to be incorporated into the modelling approach. Currently the model input data for UK (England & Wales) and Greenland have been modified in this way. For UK (England & Wales) the changes address the estimation of the catches of Scottish fish in the NE English coastal fishery, which are incorporated into the assessment for UK (Scotland). For Greenland, catch data are inputted in the form of harvests (reported and unreported) in weight along with data from the West Greenland Sampling Programme.

3.3.3 Description of national stocks as derived from the PFA model

The Working Group has previously noted that the NEAC PFA model provides the 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. A limitation with a single national status of stocks analysis is that it does not capture variations in status in individual rivers or small groups of rivers, although this has been addressed, in part, by the regional splits within some countries.

The model output for each country has been displayed as a summary sheet (Figures 3.3.3.1(a–j)) comprising the following:

- Estimated pre-fishery abundance (PFA) and SERs of maturing 1SW and non-maturing 1SW salmon.
- Estimated total returns and spawners (95% confidence intervals) and CLs for 1SW and MSW salmon.
- Total exploitation rate of 1SW and MSW salmon estimated from the total returns and total catches derived from the model.
- Estimated total catch (including unreported) of 1SW and MSW salmon.
- National pseudo stock–recruitment relationship (PFA against lagged egg deposition), with CL fitted by the method presented in ICES (2001). However, it should be noted that for the final assessment of stock status and provision of catch advice, national CLs derived from the sum of river-

specific values are used for France, Ireland, Norway, and UK (England & Wales).

3.3.4 Trends in the PFA for NEAC stocks

Tables 3.3.4.1–3.3.4.6 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 NEAC and Southern NEAC groups are shown in Figure 3.3.4.1.

The 95% confidence interals of the estimates (Figure 3.3.4.1) indicate the uncertainty in this assessment procedure. The Working Group recognized 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 the estimates of these parameters. It should be noted that the results for the full time-series can change when the assessment is re-run from year to year.

Recruitment patterns of maturing 1SW and of non-maturing 1SW recruits for Northern NEAC (Figure 3.3.4.1) demonstrate 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 numbers 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. The spawner estimates indicated that the 1SW and MSW stock complexes were both at full reproductive capacity in 2011, with the MSW complex showing a further improvement since 2010.

Recruitment patterns of maturing 1SW salmon and of non-maturing 1SW recruits for Southern NEAC (Figure 3.3.4.1) demonstrate 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 2009 and 2011, 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 much of the time period. It has been at risk of suffering reduced reproductive capacity before any fisheries took place in two (2006 and 2008) of the last five PFA years but has increased in the past two years.

Declining trends in spawner numbers are evident in the Southern NEAC stock complexes for both 1SW and MSW. 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. Thereafter the stock was either at risk of reduced reproductive capacity or suffering reduced reproductive capacity with the exception of 2004 and 2011 when the stock was at full reproductive capacity.

The status of these stock complexes, based on the NEAC run reconstruction model 1971 to 2011, prior to the commencement of distant-water fisheries with respect to the SER requirements is:

- Northern NEAC 1SW stock complex is considered to be at full reproductive capacity.

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

The status of stocks is summarized in Figure 3.3.4.1.

3.3.5 Compliance with river-specific conservation limits (CLs)

The national status of each country in the NEAC area with respect to the spawner attainment of CLs after homewater fisheries is given in Table 3.3.5.1 for 2011 (except Norway where the data relate to 2010). In the Northern stock complex there are five specific countries and two sea age classes assessed against attainment of conservation limits. Of the ten indices there are four which do not meet conservation limits. For the southern NEAC stock complex there are five countries and two sea age classes and there are four of these which are not meeting conservation limits.

The total number of rivers in each country and the number which can be assessed are also shown. Numerical evaluations can only be provided for seven countries where individual rivers are assessed for compliance with conservation limits. This ranges from 29% to 88%. In some instances conservation limits are in the process of being developed (UK (Scotland) and Iceland).

3.3.6 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) is presented in Figures 3.3.6.1 and 3.3.6.2. The survival indices are the percent change in return rate between five year averages for the periods (smolt years) 2001 to 2005 and 2006 to 2010 for 1SW salmon, and 2000 to 2004 and 2005 to 2009 for 2SW salmon. The annual survival indices for different rivers and experimental facilities are presented in Tables 3.3.6.1 and 3.3.6.2. Return rates of hatchery released fish, however, may not always be a reliable indicator of marine survival of wild fish.

The overall trend for hatchery smolts in Northern and Southern NEAC areas is generally indicative of a decline in marine survival. For the wild smolts this decline is also apparent for the Northern NEAC areas, however for the Southern NEAC areas data are more variable with some rivers showing an increase in survival whilst other rivers show a decrease. The percentage change between the means of the five-year periods varied from an 84% decline to a 138% increase in one river (Figure 3.3.6.1). However, the scale of change in some rivers is influenced by low total return numbers, where a change of just a few fish may have a significant effect. The survival indices for wild and hatchery smolts displayed a mixed picture with some rivers above and some below the previous 5- and 10-year averages (Tables 3.3.6.1 and 3.3.6.2). The return of wild 1SW salmon to the River Ellidaar in Iceland was higher than both the 5-year and 10-year averages, though slightly lower than the return in 2009. Also the returns of 2SW wild salmon to the River North Esk in UK (Scotland) were above the 5-year and 10-year averages. An increase in survival was also detected in Norway for hatchery reared 1SW and 2SW salmon on the Imsa River (Table 3.3.6.2).

Comparison of survival indices for the 2009 and 2010 smolt years show a general increase for 2010 compared to 2009 for wild smolts in Northern and Southern NEAC areas, with the exception of the rivers Halselva and Imsa in Norway, the Dee in UK (England & Wales), and the Nivelle and Bresle in France. The decrease in return rates of wild smolts to the River Bresle was perhaps not surprising as return rates were exceptionally high in 2010 (Table 3.3.6.1). Increased survival for 2SW returns from the 2009 smolt year compared to 2008 was also noted. Only the River Dee in UK (England & Wales) showed a decrease in survival of 2SW salmon in 2011 relative to the year before. Survival indices for hatchery smolts in the Northern NEAC area for the 2010 smolt year showed an increase relative to 2009. In the southern NEAC area, survival indices for hatchery smolts increased in the same period, except for the Irish River Erne, for which the survival indices were slightly lower.

Return rates for monitored rivers have been standardized to provide indices of survival for Northern and Southern 1SW and 2SW returning adult wild and hatchery salmon in the NEAC area (Figure 3.3.6.3). In summary:

- 1SW return rates of wild smolts to the Northern NEAC area (three river indices) although varying annually, have generally decreased since 1980 ($p<0.05$). However, a slight improvement has been noted in recent years. This declining trend is not evident for the 2SW wild component (three river indices) and recent return rates have shown an increase.
- Similarly, 1SW return rates of wild smolts (eleven river indices) to the Southern NEAC area have generally decreased since 1980 ($p<0.05$). Apart from return rates in 2010, seven of the previous nine years values were the lowest in the time-series indicating a persistent period of poor marine survival. While this declining trend is not evident for the 2SW wild component (five river indices), recent returns have been amongst the lowest in the time-series.
- 1SW return rates of hatchery smolts to the Northern NEAC area (four river indices) although varying annually, have generally decreased since 1980 ($p<0.05$). However, a slight improvement has been noted in recent years. This declining trend is not evident for the 2SW hatchery component (four river indices) and recent return rates have shown an increase.
- 1SW return rates of hatchery smolts to the Southern NEAC area (13 river indices) although varying annually, have generally decreased since 1980 ($p<0.05$). Six of the most recent years' values are amongst the lowest in the time-series and again indicate a persistent period of poor marine survival.

Results from these analyses are consistent with the information on estimated returns and spawners as derived from the PFA model (Section 3.3.4), and suggest that returns are strongly influenced by factors in the marine environment.

3.4 NASCO has asked ICES to provide catch options or alternative management advice for 2012–2015, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding

3.4.1 Catch advice for Faroes

The risk framework described in Section 3.6 has been used to evaluate catch options for the Faroes fishery in the 2012/13, 2013/14 and 2014/15 fishing seasons (e.g. the

2012/13 season would run from October 2012 to May 2013) based on the Northern and Southern NEAC stock complexes of maturing and non-maturing 1SW salmon. The Working Group was unable to run the risk framework at a national level due to lack of time to resolve problems with the PFA forecasts at this level of resolution. Other data inputs in the assessment are described in Section 3.6.4.

The probability of the stock complexes achieving their SERs (the overall abundance objective) for different catch options in the Faroes fishery (from 0 to 200 t) is indicated in Table 3.4.1.1 and Figure 3.4.1.1. This assumes that the full TAC is taken in the Faroes fishery and that homewater fisheries also take their catch allocation. The assessment indicates that all stock complexes are expected to have a greater than 75% probability of achieving their individual SERs with a TAC at Faroes of between 80 t and 100 t in the 2012/13 season, a TAC of around 120 t in the 2013/14 season and a TAC of about 140 t in the 2014/15 season. The flatness of the curves in the catch option figures is a function of the uncertainty in the estimates and the level of exploitation on the stocks in the Faroes fishery and in homewaters (Table 3.4.1.2 and Figure 3.4.1.2); more uncertain data and lower exploitation rates generate flatter profiles.

The surpluses to SER, at the 75% risk level, which have been forecast for 2012 to 2015 arise because a high productivity has been estimated for 2010; the model applies this value forward in forecasting the PFA in 2011 to 2015 (Section 3.5.2). Although the productivity increased in 2010 for both the Northern and Southern NEAC areas, both increases and decreases from previous years have been noted in the past. Improvements in return rates of wild and hatchery monitored stocks in the NEAC area in the past five years have been noted, however return rates remain below the levels noted in the 1990s. The returns of 1SW maturing salmon to NEAC countries in 2011, the first indication of the possible strength of the MSW returns to homewaters in 2012, were lower than in 2010 but at similar levels to 2009, a year when the non-maturing PFA age group were estimated to have been above SERs prior to any exploitation in high seas fisheries and in homewaters.

ICES (ICES 2010b, 2011b) has previously emphasized the problem of basing this form of risk analysis on management units comprising large numbers of river stocks. In providing catch advice at the age and stock complex levels for Northern and Southern NEAC, consideration should be given to the recent performance of the stocks within individual countries.

At present, insufficient data are available to the Working Group to assess performance of individual stocks in all countries in the NEAC area. In some instances CLs are in the process of being developed (UK (Scotland) and Iceland). The status of river stocks within each country in the NEAC area for which data are available with respect to the attainment of CLs before homewater fisheries is given in Table 3.4.1.3 for 2011 (except Norway where the data relate to 2010). The total number of rivers in each country and the number which can be assessed against river-specific CLs are also shown. Numerical evaluations can only be provided for four countries where individual rivers are assessed for compliance with these. In two countries in Northern NEAC with available information, 84% and 88% of the monitored rivers would have met their river-specific CLs before any homewater exploitation, whereas only 39% and 41% of assessed rivers met their CLs in two countries in Southern NEAC (Table 3.4.1.3).

Alternatively, the probability that the country-specific PFAs exceeded their SERs was assessed for the most recent five years (Table 3.4.1.4). The status was assessed based on whether there was a 75% or greater chance that the estimated PFA met or exceeded the SER by jurisdiction and maturing age group. In the Northern NEAC stock complex, there was less than 75% chance that the PFA was greater than the SER in one jurisdiction in four of the past five PFA years (Table 3.4.1.4). There were more frequent and geographically diverse failures to meet the SERs in the Southern NEAC stock complex. For the maturing 1SW age component, there were 3 to 4 of 6 jurisdictions for which there was a less than 75% chance that the PFA was greater than the SER in the past five years (Table 3.4.1.4). There were equally important failures to meet SERs in all years for the 1SW non-maturing age group, from two to four of six jurisdictions failed annually for the 2006 to 2010 PFA years.

So, despite the absence of a fishery at Faroes since 1999, and reduced exploitation at West Greenland on the MSW Southern NEAC component, the abundance at the PFA stage in several countries in NEAC have been below the country-specific SERs.

The Working Group recommends that further work be undertaken to permit the running of the risk framework based on management units defined at finer scales, to improve the data to attribute the historical Faroes catch to these management units, and to seek additional data to improve the quality of the assessment.

3.4.2 Relevant factors to be considered in management

The management of a fishery should ideally be based upon the status of all stocks exploited in the fishery. Fisheries on mixed-stocks pose particular difficulties for management, when they cannot target only stocks that are at full reproductive capacity. Management objectives would be best achieved if fisheries target stocks that are at full reproductive capacity. Fisheries in estuaries and especially rivers are more likely to meet this requirement.

The Working Group also emphasized that the national stock CLs are not appropriate for the management of homewater fisheries. This is because fisheries in homewaters usually target individual or smaller groups of river stocks and should therefore be managed on the basis of their expected impact on the status of these stocks. 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 at the level of the stock complexes.

As noted in previous years, the inclusion of farmed fish in the Norwegian catches could result in the stock status being overestimated (Potter and Hansen 2001).

3.4.3 Grouping of national stocks

National stocks and outputs of the NEAC PFA model have previously been 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 NEAC countries:	Northern NEAC countries:
France	Russia
Ireland	Finland
UK (N. Ireland)	Norway
UK (England & Wales)	Sweden
UK (Scotland)	Iceland (north/east regions)[1]
Iceland (south/west regions)[1]	

[1] The Iceland stock complex was split into two groups for stock assessment purposes in 2005. Prior to 2005, all regions of Iceland were considered part of the Northern NEAC stock complex.

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

However, ICES has noted (ICES 2010b and 2011b) that provision of catch advice for the distant water fisheries should be based on a larger number of smaller management units, similar to those used in the NAC area.

3.5 Pre-fishery abundance forecasts

The Working Group used a forecast model developed in a Bayesian framework (ICES 2011b) to estimate PFA for all four NEAC stock complexes.

3.5.1 Description of the forecast model

In 2012, the Working Group ran forecast models for the Southern NEAC and Northern NEAC complexes. The model was run for each stock complex independently.

The *PFA* is modelled using the summation of lagged eggs from 1SW and MSW fish (*LE*) for each year *t* and an exponential productivity parameter (*a*).

$$PFA_t = LE_t * exp(a_t)$$

The productivity parameter (*a*), is the proportionality coefficient between lagged eggs and PFA. This is forecasted one year at a time (a_{t+1}) in an auto correlated random walk, using the previous year's value (*a*) as the mean value in a normal distribution, with a common variance for the time-series of *a*.

$$a_{t+1} = a_t + \varepsilon; \quad \varepsilon \sim N(0, a.\sigma^2)$$

The maturing *PFA* (denoted *PFAm*) and the non maturing *PFA* (denoted *PFAnm*) recruitment streams are subsequently calculated from the proportion of *PFA* maturing (*p.PFAm*) for each year *t*. *p.PFAm* is forecast as an autocorrelated value from a normal distribution based on a logit scale, using the previous year's value as the mean and a common variance across the time-series of *p.PFAm*.

$$logit.p.PFAm_{t+1} \sim N(logit.p.PFAm_t, p.\sigma^2)$$
$$logit.p.PFAm_t = logit(p.PFAm_t)$$

Uncertainties in the lagged eggs were accounted for by assuming that the lagged eggs of 1SW and MSW fish were normally distributed with means and standard deviations derived from the Monte-Carlo run reconstruction at the scale of the stock complex. The uncertainties in the maturing and non-maturing PFA returns are derived in the Bayesian forecast models.

Catches of salmon at sea in the West Greenland fishery (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 34-year time-series of lagged eggs and returns (1978 to 2011). For Northern NEAC, data were available for a 21-year time-series, 1991 to 2011. The models were fitted and forecasts were derived in a consistent Bayesian framework.

For both Southern and Northern NEAC complexes, forecasts for maturing and non-maturing stocks were derived for five years, from 2011 to 2015. Risks were defined each year as the posterior probability that the PFA would be above the age and stock complex specific SER levels. For illustrative purposes, risk analyses were derived based on the probability that the maturing and non-maturing PFAs would be greater than or equal to the maturing and non-maturing Spawner Escapement Reserves (SERs) under the scenario of no exploitation, for both the northern and southern complexes. These were calculated for each of the five forecast years, 2011 to 2015.

3.5.2 Results of the NEAC Bayesian forecast models

The trends in the posterior estimates of PFA for both the Southern NEAC and Northern NEAC complexes closely match the PFA estimates derived from the run reconstruction model (Section 3.3.4).

For the Southern NEAC stock complex, maturing and non-maturing PFAs showed a general switch in 1988-1990 from a level of around 2 million maturing and 1.5 million non-maturing to lower levels, declining in the maturing component from around 1.5 million maturing in 1992–1995 to less than 1 million in 2009. The non-maturing component fell from around 1 million in 1990 to 1994 to a low of around 500 000. The maturing component has increased during 2009 to 2010 and the non-maturing component during 2008 to 2010. These increased levels of PFA are carried forward into the five forecast years 2011 to 2015, with initial small reductions in medians in the first three years followed by a slight increase in the last two years (2014 and 2015). Uncertainty increases as prediction year progresses.

The productivity parameter peaked in 1985 and 1986, and reached the lowest values in 1997 and 1999 (Figure 3.5.2.1). There was a sharp drop in the productivity parameter during 1989 to 1991 and the values post-1991 are all lower than during the previous time period. Between 2003 and 2009, productivity was declining. In 2010, however, productivity rose to the 2002 to 2003 level and the highest level since the 1989 to 1991 drop. The 2011 to 2015 values are projected from this 2010 high point, with increasing uncertainty as prediction years increase.

Over the entire time-series, the maturing proportions averaged about 0.6 with the lowest proportion in 1980 and the highest proportion in 1998 (Figure 3.5.2.1). An increasing trend in the proportion maturing (eight of 13 values below the average during 1978 to 1990 compared with four of 17 values between 1991 and 2007) is superseded by a decline in 2008 and 2009, with a small increase in the last fully accounted year 2010. The five forecast years 2011 to 2015 are projected from the 2010 value with increasing uncertainty as prediction years increase.

For the Northern NEAC complex, peak PFA abundances were estimated in the year 2000, (*ca.* 1.1 million maturing and 900 000 non-maturing) with the lowest values of the maturing series occurring between 2007 and 2009 at around 440 000 fish. The lowest abundance of the non-maturing age group was estimated during 1996 to 1998 (*ca.* 500 000). An increase in the year 2000 to 900 000 fish was followed by a period of decline and variation with an increase from 2008 (600 000) to 2010 (800 000) (Figure 3.5.2.2). The 2011 forecasts are predicted to be equal to 2010 values, with subsequent increases predicted in the forecasts for 2012 to 2015 and increasing error bounds as forecast years progress.

Lagged eggs of both maturing and non-maturing peaked in 2008 before declining to a minimum in 2010 (Figure 3.5.2.2). Lagged eggs from the maturing component are estimated to continue falling during 2011 to 2015, while non-maturing are predicted to increase to above the 1996 to 2000 levels by 2015.

The proportion maturing has varied around 0.55 over the time-series, but in 2007 there was an abrupt drop in the proportion maturing to below 0.37 (Figure 3.5.2.2). Some recovery occurred in 2008 to around 0.43; however 2009 and 2010 were consistent with the 0.40 level, and notably below the 1991 to 2006 levels (Figure 3.5.2.2).

The productivity continued to increase in 2010 in the Northern NEAC complex, becoming comparable to the pre-2004 values (Figure 3.5.2.2). An increase was also observed in the Southern complex in 2010, comparable to the highest level between 1989 and 2002, though still well below the pre 1989 level (Figure 3.5.2.1).

Forecasts from these models for the 2011 to 2015 years for the non-maturing and 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 as the productivity parameter values are set at the level of the last year with available data. The variability in the productivity parameters increased sequentially over the forecasts.

3.5.3 Probability of attaining PFA above SER

Probabilities of meeting age and complex specific SERs in PFA years 2011 to 2015 are greater than 80% although higher in the Northern NEAC complex than in the Southern NEAC complex (Table 3.5.3.1). For the Southern NEAC stock complex, the 25th percentiles of the posterior distributions of the forecasts are above the SER for both the maturing and non-maturing age components, while the lower bounds of the 95% confidence intervals are below (Figure 3.5.2.1).

The 25th percentile abundances of the Northern NEAC age components are both above the SERs, while the lower bounds of the 95% confidence intervals for the maturing component in forecast years 2014 to 2015 are below the SER, whereas for the non-maturing component the lower bounds remain above the SER (Figure 3.5.2.2).

3.5.4 Bayesian forecast models at the country level

The Bayesian NEAC inference and forecast model was run on country level data, for both Southern and Northern NEAC countries. This incorporated country specific catch proportions at Faroes, lagged eggs and returns of maturing and non-maturing components. The analyses for Finland, Norway, Russia, Sweden, UK (England & Wales) and UK (Scotland) appeared to be robust. In the instances of France, Iceland, Ireland and UK (N. Ireland), however, it was not possible to provide robust estimates of the proportion maturing parameter. The country level analyses are not presented here and further work is required to explore the issues.

3.6 NASCO has asked ICES to further develop a risk-based framework for the provision of catch advice for the Faroese salmon fishery, providing a clear indication of the management decisions required for implementation

3.6.1 Background to the risk framework model

For a number of years, NASCO has asked ICES to provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits for salmon in the NEAC area. In 2010, ICES (2010b) outlined a risk framework that could be used to provide and evaluate catch options for the Faroes fishery based on the method currently used to provide catch advice for the West Greenland fishery. The risk framework for the West Greenland fishery involves estimating the uncertainty in meeting defined management objectives at different catch levels (TAC options).

ICES (2010b) described the procedure for conducting such an assessment and noted issues that would require decisions by managers before full catch advice could be provided.

The approach would then involve estimating the probability of stocks achieving the management objective in each of the NEAC area Management Units. The catch advice would display the probability of the stock in each Management Unit achieving its management objective for different TAC options in the Faroes fishery and could be presented in tabular and graphic form.

In 2011, ICES (ICES 2011b) provided a more detailed evaluation of the choice of appropriate management units to be used in a risk based framework for the provision of catch advice for the Faroese salmon fishery, taking into account relevant biological and management considerations. ICES (2011b) noted that while breaking the stock complexes down to at least the national level was desirable, they were unable to achieve this at the current time because of uncertainties about the composition of the potential catch at Faroes. ICES therefore provided a worked example of catch advice based on the northern and southern 1SW and MSW stock complexes (ICES 2011b). Furthermore, ICES noted that management decisions were required on the following issues which were discussed in detail in the advice to NASCO:

- season (January to December or October to May) on which any TAC should apply;
- choice of management units for NEAC stocks;
- specification of management objectives; and
- share arrangement for the Faroes fishery.

These issues should ideally be decided by managers, but little feedback was provided by NASCO in 2010 and none in 2011. The Working Group has therefore had no basis for addressing any management concerns about the proposed framework.

The framework closely mirrors the system that has been in use for the provision of advice to NASCO for the West Greenland salmon fishery for a number of years, and so the Working Group did not believe there was any need to modify it. It was also noted that pragmatic choices could be made in relation to the above issues. The Working Group therefore decided to provide full catch advice for the 2012/13 to 2014/15 fishing seasons using the risk framework. The Working Group noted that a decision was still required by managers on the four issues outlined above.

3.6.2 Application of risk framework for provision of catch advice in 2012

The Working Group determined that in the absence of any further advice from NASCO they should apply the risk framework as described in Section 3.6.3. To do this, the Working Group made pragmatic choices regarding the four issues discussed above.

<u>Faroes fishing season:</u> ICES (2011b) noted that a decision was required on the period to which any TAC for the Faroes fishery would apply. The Faroes fishery has historically operated between October/November and May/June, but the historical TACs applied to a calendar year. This means that two different cohorts of salmon of each

age class (e.g. two cohorts of 1SW salmon, etc) were exploited under each TAC. ICES (2011b) recommended that NASCO manage any fishery on the basis of fishing seasons operating from October to June, and catch advice should be provided on this basis. This approach has been assumed in the catch advice provided.

Choice of management units: ICES (2010b) noted that the stock complexes currently used for the provision of NEAC catch advice (Southern NEAC and Northern NEAC) are significantly larger than each of the six management units used for North American salmon (2SW only) in the catch advice for the West Greenland fishery. Basing an assessment of stock status on these large units greatly increases the risks to individual NEAC river stocks or groups of stocks that are already in a more depleted state than the average. ICES (2011b) provided advice on the factors affecting the selection of management units but noted that the availability of information on the composition of the catch at Faroes constrained the selection of management units.

The Working Group examined the method used to estimate the composition of the catch at Faroes based on historical catch data and PFA estimates (Section 3.7.1). This has provided new estimates of the proportions of the catches expected to originate in different countries. The Working Group has used this new catch composition to run the risk framework using management units based on countries.

Management objectives: The management objectives provide the basis for determining the risks to stocks in each management unit associated with different catch options. The NASCO agreement on the adoption of a Precautionary Approach (NASCO 1998) calls for the 'formulation of pre-agreed management actions in the form of procedures to be applied over a range of stock conditions', indicating that the management objectives (e.g. the required probability of exceeding the CL) should be agreed to in advance of specific management proposals being considered. ICES (2011b) suggested that it would be appropriate to use the same management approach as for the West Greenland catch advice. The objective would therefore be that there should be a greater than 75% probability of all management units exceeding their CLs simultaneously.

Sharing agreement: The 'sharing agreement' establishes the proportion of any harvestable surplus within the NEAC area that could be made available to the Faroes fishery through the TAC. In effect, for any TAC option being evaluated for the Faroes, it is assumed that the total harvest would be the TAC divided by the Faroes share. In 2010, ICES (2010b) proposed using a share allocation derived using the same approach and baseline period (1986–1990) as for West Greenland. This gave a potential share allocation of 7.5% to Faroes. Following discussion within NASCO, one Party proposed an alternative baseline period of 1984–1988, which would give a share allocation of 8.4% to Faroes. In the absence of further advice from NASCO, the Working Group applied a value of 8.4%.

3.6.3 Modelling approach for the catch options risk framework

The process for assessing each catch option within the risk framework is described below. The only changes to the approach from the example provided to NASCO in 2011 relate to the way that the PFA forecasts derived in the Winbugs model are transferred to the risk framework model run in 'R'. In the revised approach, the estimates and distributions of the PFA estimates used in the risk framework are derived by taking the first 40 000 values from the Winbugs posterior forecast simulations.

Parameters in the following description that are marked with an '*' in the equations have uncertainty around them generated by means of 40 000 random draws from the annual values observed from the sampling programmes conducted in the Faroes fishery between the 1985/1986 and 1990/1991 seasons. They therefore contribute to the estimation of the probability density function around the potential total harvest arising from each TAC option.

The modelling procedure is as follows. The TAC option (T) is first divided by the mean weight (Wt*) of salmon caught in the Faroes fishery to give the number of fish (N) that would be caught; thus:

$$N = T / Wt^*$$

This value is converted to numbers of wild fish (Nw) by multiplying by one minus the proportion of fish-farm escapees in samples taken from the Faroes catch (pE*) observed in historical sampling programmes. A correction factor (C = 0.63) is applied to the proportion of fish-farm escapees to take account of reductions in the numbers of farm escapees over the past 20 years based on observations in Norwegian coastal waters:

$$Nw = N \times (1 - (pE^* \times C))$$

This value is split into numbers by sea age classes (1SW and MSW) according to the proportion of each age group (pAi*, where 'i' is 1SW or MSW) observed in historical catch sampling programmes at Faroes, and the discards that die (i.e. 80% of fish less than 60 cm TL) are added to the 1SW catch. Thus:

$$Nw1SW = Nwtotal \times pA1SW^* + (Nwtotal \times pD^* \times 0.8)$$

and

$$NwMSW = Nwtotal \times pAMSW^*$$

where pD* is the proportion of the total catch that is discarded (i.e. fish <60 cm TL).

Further corrections are made to the 1SW and MSW numbers to reduce the 1SW total to take account of the proportion that will not mature as grilse and to add the survivors from this group to the MSW fish in the following year. For the first catch advice year the number added to the MSW total is adjusted to the TAC of the current year (i.e. zero in 2012). Thus:

$$Nw1SW = Nw1SW \times pM^*$$

and

$$NwMSW = NwMSW + Nw1SW \times (1-pM^*) \times e^{-12M}$$

where '*pM*' is the proportion of 1SW salmon that are expected to mature in the same year (0.78) derived from experimental studies conducted in the 1980s (Youngson and Webb 1993) and '*M*' is the instantaneous monthly rate of mortality.

The numbers in each age group are then divided among the management units by multiplying by the appropriate proportions (pUij), where 'i' denotes the age groups and 'j' denotes the management units:

$$Nwij = Nwi \times pUij$$

The generation of pUij is described in Section 3.7.1.

Finally, each of these values is raised by the Faroes share allocation (S) to give the total potential harvest (Hij) of fish from each management unit and sea age group.

$$Hij = Nwij / S$$

These harvests are then subtracted from the stock forecasts (PFAij) for the management units and sea age groups and compared with the Spawner Escapement Reserves (SERij) to evaluate attainment of the management objective. In practice the attainment of the management objective is assessed by determining the probability that PFAij – Hij – SERij is greater than zero.

The SER is the number of fish that need to be alive at the time of the Faroes fishery to meet the CL when the fish return to homewaters; this equals the CL raised by the mortality over the intervening time. CLs and SERs are currently estimated without uncertainty.

3.6.4 Input data for the risk framework

The Working Group applied the risk framework model to the stock complexes previously used for the provision of catch advice. The assessment requires input data as described below. Some of these parameters (e.g. mean ages and weights, discard rates, etc.) apply to the catch that might occur at the Faroes if a TAC was allocated. In most cases the only data available to estimate these parameters comes from sampling programmes conducted in commercial and research fisheries in Faroese waters in the 1980s and 1990s. These data are summarized below. Efforts are being made to locate more detailed information from these surveys for future assessments.

<u>Mean weights:</u> Mean weights of salmon caught in the commercial and research fisheries operating in Faroese waters between 1983/1984 and 1995/1996 varied between 3.06 and 5.23 kg (Table 3.6.4.1) (ICES 1997). However, high values were observed at the beginning of the time-series when part of the catch was taken to the north of the Faroes Exclusive economic zone (EEZ), and the values for the latter part of the series are based on relatively small catches in a research fishery which may not be as representative of a full commercial fishery. As a result, mean weights have been drawn randomly from the observed values of the 1985/1986 to 1990/1991 fishing seasons.

<u>Proportion by sea age:</u> The age composition of catches in the Faroes fishery has been estimated from samples collected in the 1983/1984 to 1994/1995 fishing seasons (Table 3.6.4.2) (ICES 1996). The samples taken between 1991/1992 and 1994/1995 were from the research fishery and included potential discards but excluded farm escapees. As a result, values have been drawn from the observations between 1985/1986 and 1990/1991 to provide a probability distribution for this parameter. However, the age composition of the catches may be expected to be related to the mean weight. To take account of this relationship, the values of mean weight and age composition used in each sample run have been drawn from the same years.

<u>Discard rates:</u> In the past, there has been a requirement to discard any fish less than 60 cm total length caught in the Faroes fishery and discard rates have been estimated from the proportions of fish less than 60 cm in catch samples between the 1982/1983 and 1994/1995 seasons (ICES 1996) (Table 3.6.4.3); 80% of these fish were expected to die (ICES 1986). A probability distribution for the discard rate has been estimated by sampling at random from the annual values seen over the same period as for the other parameters above.

<u>Proportions of fish-farm escapees:</u> The proportion of fish-farm escapees in the catches at Faroes has also been estimated from samples taken in the 1980/1981 to 1994/1995 fishing season (ICES 1996). However, the Working Group is aware that there have been substantial changes in the production of farmed fish and in the incidence of escape events. Data were also available to the Working Group on the proportion of farm escapees in Norwegian coastal waters between 1989 and 2008; the proportion in

recent years (2002–2008) was 63% of the proportion during the period 1989/1990 to 1994/1995 when the sample time-series overlap (Table 3.6.4.4). The probability distributions of proportion of farm escapees used in the risk framework has therefore been generated by multiplying the rates observed in the Faroes fishery between 1988/1989 to 1994/1995 by 0.63 and then drawing sample values at random.

Proportions of catches by management unit: The origin of the stocks exploited at Faroes has previously been estimated from smolt and adult tagging studies and an approximate split between jurisdictions has been employed in the NEAC run reconstruction model (ICES 2010b). The Working Group reviewed this approach and proposed an alternative method for estimating the split of the catches (Section 3.7.1).

Other input parameters are shown in Table 3.6.4.5.

3.7 Changes to assessment models and input data

3.7.1 Changes to the NEAC PFA model and national conservation limit model

Provisional catch data for 2010 were updated where appropriate and the assessment extended to include data for 2011. In addition:

- Minor adjustments were made to the 1SW:MSW split in a small number of years for UK (England & Wales) to reflect updated estimates.
- Minor amendments to exploitation rates for both 1SW and MSW fish in France were made to better reflect observed estimates for the period 2002 to 2010.

With the implementation of the model in 'R' the following changes were made to the modelling approach and the input data:

- For countries split into regions, the Crystal Ball model has previously applied the national CL model to the total national estimates of lagged eggs and PFA. However, it was considered more appropriate to apply the national CL model to each region and then sum the resulting CL estimates to provide a national figure. This was therefore implemented in the R code.
- The assessment for UK (England & Wales) takes account of the catch of fish returning to UK (Scotland) rivers in the English NE coast fishery. This analysis has now been incorporated into the R code.
- The input data for the Greenland fishery are derived from the reported and unreported harvest in tonnes and the West Greenland Sampling Programme. For the Crystal Ball model, these values were analysed prior to being input into the model. For the 'R' model, the original data are input into the model, allowing uncertainties resulting from the sampling programme to be taken into account in the model.

Estimates of CLs for stock complexes in 2011 were markedly different from those reported in 2010. Much of this difference may be attributed to the replacement of the Crystal Ball (CB) run-reconstruction model to one run in R (Section 3.3.1). Although CLs derived from the CB and R based models were generally in close agreement at the country scale, larger differences were evident in those derived for Russia, UK (Scotland) and Sweden (Tables 3.7.1.1 and 3.7.1.2). As CLs derived for regions within Russia and UK (Scotland) were similar, the differences in CLs derived for these countries as a whole can be attributed to changes in the methods used to aggregate regional CLs between the two models. For countries with more than one region, the CB model derives CLs from the national CL model aggregated over all regions. In the R model, the method more closely matches how stock complex CLs are derived from regional data. In this model, CLs are estimated for each region separately and these are then summed to produce the overall country CL. The large differences between the CLs derived for 1SW salmon in Sweden between both models may be attributed to the relatively low and variable catch data available.

3.7.2 Allocation of Faroes catch by country

ICES (2011b) provided a detailed description of the proposed risk framework for the evaluation of catch options for the Faroes fishery. ICES indicated that the management units should ideally be considerably smaller than the stock complexes previously used for the provision of advice. It was suggested that they might be defined at the national scale or finer but that such a change would depend upon being able to estimate the proportions of the potential catch at Faroes among the salmon management units at the agreed scale.

The Working Group noted that work is underway to apply genetic stock identification to the scale samples collected from the Faroes fishery in the 1980s and 1990s, but that this work is yet to be completed. The Group therefore reviewed the available information on the national origins of the salmon caught at Faroes.

The Working Group reviewed the available data for tags recovered in the Faroes fishery from the smolt tagging programmes conducted by NEAC countries. The review was restricted to the period between 1984, when the fishery was restricted to the Faroes EEZ, and 1993, after which only limited fishing took place. Data were available from both the annual tagging summaries compiled by the Working Group and the tag recovery database completed by the workshops on historic tagging data (ICES 2007a, 2008b, 2009b). While large numbers of fish were tagged in some countries, others undertook no smolt tagging. Furthermore there were significant differences in the nature of the tagging programmes, including the origin of the smolts (i.e. wild and hatchery), the age at which they were released (i.e. parr and smolts), the types of tags used (i.e. external and CWTs) as well as the years in which tagging was undertaken.

The Working Group also considered data on recoveries in homewaters of adults tagged in the Faroes fishery between 1991 and 1993 (Hansen and Jacobsen 2003). Although this dataset is much smaller (~100 tag recoveries) than the smolt tagging dataset, it was considered to provide a more direct estimate of the composition of the Faroes catch. Furthermore an exercise had previously been conducted (ICES 1998) to correct the tag recoveries in homewaters to take account of expected exploitation rates and tag reporting rates in each country. The Working Group considered that this dataset provided the best estimate of the allocation of the Faroes catch between the northern and southern NEAC stock complexes, but considered that the division at the national level may be less reliable because of the relatively small numbers of tag recoveries.

The Working Group proposed that the proportions of the Faroese catch originating in the Northern and Southern NEAC stock complexes could be estimated for the years 1991–1993 (when the adult tagging programmes were undertaken) on the basis of the tag recoveries by sea age. These proportions could then be further divided to countries/regions within each stock complex on the basis of the proportion of the total PFA for the complex originating from the countries/regions. This would also allow the proportions to be adjusted according to the annual variations in PFA. The revised catch allocation for the Faroese fishery at the country scale is provided in Table 3.7.2.1 and these have been used in the PFA run-reconstruction (Section 3.3.4.), the Bayesian forecast model (Section 3.5.1) and the risk framework for evaluation of catch options (Section 3.6).

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

3.8.1 Background

In 2006, ICES (2006) 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 further developed at the Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance [SGEFISSA] in November 2006 (ICES 2007b).

The Working Group (ICES 2007c) developed a FWI for the Greenland fishery based on the seven contributing regions/stock complexes 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 datasets met the criteria for inclusion in the FWI. The Working Group (ICES 2007c) 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 update the multiyear catch advice.

In 2009 (ICES 2009a), the Working Group updated the NEAC datasets 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, because over the time-series the PFA estimates have predominately remained above the SER. The Working Group decided that these datasets would need to be re-evaluated for use in 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.

In 2010, the Working Group concluded that, as NEAC stocks remained close to their respective SERs, none of the available indicator datasets would meet the criteria for inclusion in the FWI and, additionally, as no alternative approaches had been proposed, the only indication of a change in the status of stocks would be provided by a full assessment of the NEAC stock complexes (ICES 2010b).

In 2011, the Working Group re-evaluated the approach for developing a FWI for the Faroese fishery. Since over the time-series the PFA estimates for the NEAC stock complexes have predominately remained above the SER, the Working Group suggested a different set of decision rules for this FWI. It was suggested that the status of stocks should be re-evaluated if the FWI suggests that the PFA estimates are deviating substantially from the median values from the forecast. Several criteria for when the PFA deviate substantially from the forecast were explored. It was suggested that the 95% confidence interval range of the mean of the indicator prediction relative to the median forecast value be used to compute those thresholds (Figure 3.8.1.1). The limits should be computed at the median values of the PFA forecasts in each of the years in a multiyear advice. In the event of a closed fishery, the indicators should be compared to the upper 95% confidence limits, and in the event of an open fishery they should be compared to both the upper and lower 95% confidence limits.

To be included in the FWIs an indicator must fulfil two criteria: it must be a reliable predictor of the relevant PFA (r^2 from the regression larger than 0.20), and the value of the indicator (or a preliminary value) must be available for inclusion in the FWI evaluation by mid-January.

A preliminary FWI spreadsheet was developed and tested for each of the four stock complexes in 2011.

3.8.2 Progress in 2012

In 2012, the Working Group further developed the FWIs for the NEAC area. Since, over the time-series, the PFA estimates for the NEAC stock complexes have predominantly remained above their SERs, the Working Group suggested a different set of decision rules for these FWIs than those used for NAC. As suggested in 2011, it was agreed that the status of stocks should be re-evaluated if the FWI suggests that the PFA estimates are deviating substantially from the median forecast values. Several criteria for assessing when the PFA deviates substantially from the forecast were explored.

In 2011, it was suggested that the 95% confidence interval range for the mean of the indicator prediction, relative to the median forecast value, be used to compute these thresholds (Figure 3.8.1.1). The limits should be computed at the median values of the PFA forecasts in each of the years in a multiyear advice. This criterion was re-examined in 2012 and another approach was agreed to, whereby the upper and lower 75% confidence limits of the individual predictions be used for comparison (Figure 3.8.2.1). The Working Group recognized that this was a relaxation of the decision rule suggested in 2011, and will lead to a larger interval, and thus a lower chance of a reassessment than the approach suggested in 2011. However, this was considered to be a more realistic confidence level given the relatively wide variability in the indicator datasets, and was also consistent with the approach adopted by NAC.

The Working Group further agreed that if the FWIs suggest that the forecasted PFA is either an underestimation or an overestimation of the realized PFA in any of the four stock complexes, then this should trigger a reassessment. This is also a change to the approach suggested in 2011, when it was suggested that the direction of the apparent discrepancy be taken into account, conditional on whether a fishery at Faroes was open or not.

Because of the relative scarcity of potential indicators when the stocks are divided into alternative, smaller management units, the Working Group recommended that the FWIs be regressed against the stock complexes that they belong to. For example, MSW indicators from Norway should be regressed against PFA MSW for Northern NEAC.

In 2012, the Working Group considered 50 possible indicator datasets, and 27 of them fulfilled the criteria for inclusion in the FWI (five for Northern NEAC 1SW PFA, four for Northern NEAC MSW PFA, five for Southern NEAC 1SW PFA and 13 for Southern NEAC MSW PFA) (Tables 3.8.2.1 and 3.8.2.2). The Working Group further developed the FWI spreadsheet started in 2011 to provide an automatic evaluation of the need for a reassessment once the new indicator values are available in January (Figure 3.8.2.2).

The following summarizes the main steps performed by the spreadsheet following updating of the relevant data for the variable of interest by adding the latest year's number:

- Regression analysis with the dataset *x* to determine its power to predict PFA in the forecasted years.
- Calculation of the 75% confidence intervals of individual predictions of the regression for dataset *x*. An indicator value below the 75% individual confidence interval (CI) is interpreted as indicative of an overestimation of the PFA, while a point above the 75% individual confidence interval is interpreted as indicative of an underestimation of PFA.
- A dataset is considered informative and should be kept as an indicator in the FWI if the following conditions are met: sample size (N) ≥ 10; $R^2 \geq 0.2$; dataset updated annually and new value available by January 15. Datasets that do not meet these criteria are discarded.
- Apply a binary score to each indicator value. Thus, for dataset *x*, if the current year's indicator value is outside the 75% individual regression point estimate CI (below or above) then that indicator receives a score of 1. If the indicator is within the 75% CI, then the indicator receives a score of -1. In the absence of an indicator data point for any year, a score of zero is applied. Whether the indicator value is above or below the upper and lower CI values is checked separately in two spreadsheet columns and a decision whether the indicator value is within the CI is assessed by combining the information in the two columns.
- Separate columns are used to sum the scores for all the indicator datasets within each stock complex; this is done separately for points that fall above the CI and those that fall below. If the sum of these columns is ≥ 0, then the spreadsheet signals "REASSESS"; if the sum is < 0, then it signals "No significant OVERestimation of PFA identified by indicators, do not reassess" for indicator values that fall below the CI, and "No significant UNDEREstimation of PFA identified by indicators, do not reassess" for indicator values that are above the CI.
- FWI results are generated for each stock complex (Northern NEAC maturing and non-maturing, and Southern NEAC maturing and non-maturing). A score of ≥ 0 for any of these stock complexes would signal a reassessment.

3.8.3 Worked example

To test the performance of the FWI, the Working Group applied the FWI as if it had been in place in January 2012. Thus, the FWI was applied using the forecasts that were made in 2011 (maturing 1SW PFA for 2011 and non-maturing PFA for 2010) and the various indicator values for the 2011 season (Figure 3.8.3.1). These indicators suggested that the forecasted PFAs were below realized PFA for Northern NEAC non-maturing salmon. For the other stock complexes the indicators did not suggest any substantial difference between the realized PFAs and the forecasted PFAs. However, since a change was indicated for one stock complex, then a re-assessment would have been recommended as a result of applying the FWIs in January 2012.

A comparison of the ratios of the median PFA values from the run-reconstruction model with the median PFA values from the forecasts made last year confirmed the underestimate in the forecast for the Northern non-maturing fish. The ratio was highest for the Northern NEAC non-maturing salmon and lower for the other stock complexes (ratios: Southern NEAC maturing 1.03; Southern NEAC non-maturing 1.30; Northern NEAC maturing 1.36; Northern NEAC non-maturing 1.50).

3.8.4 Next steps

The Working Group proposes that the same timeline and sequence of events be employed in implementing the FWI for NEAC as used for the existing NAC FWI (ICES 2007c) (Figure 3.8.4.1).

Assuming the new FWI is accepted by NASCO, the FWI for NEAC could be implemented for the 2013 and 2014 fishery years. Thus, the decision structure outlined in Figure 3.8.4.1 would be followed by NEAC starting in 2012. In this case, ICES provides multi-year catch advice and updated spreadsheets of FWIs for NEAC in 2012. Subsequently, in January 2013, the FWIs is applied for NEAC. If no significant change is indicated for any of the four stock complexes, then no re-assessment is necessary and the cycle continues to 2014. Further, if no significant change is detected in 2014, the cycle continues until 2015 when new assessments and multiyear catch advice will be required. However, if a significant change is detected in any year, then a reassessment would be recommended and this, and an update of the FWI, would be provided at the next Working Group meeting. If no re-assessment proved necessary in either 2013 or 2014, the FWI would automatically be updated in 2015, at the time of the next scheduled multiyear assessment.

3.9 NASCO has asked ICES to provide advice on best practice for conducting monitoring surveys for the parasite *Gyrodactylus salaris*

3.9.1 Background

When introduced to areas outside its native range in the Baltic, the parasite *Gyrodactylus salaris* has proven to be highly damaging to salmon populations that have not developed resistance, resulting in mortality rates of up to 100% on salmon fry and parr. In light of this, preventing further spread of the parasite to new areas is of high importance, and monitoring programmes should be developed in areas where risk of infection is high to ensure early detection of any *G. salaris* infection and to facilitate implementation of measures to control or eradicate the parasite.

Information was presented to the Working Group describing the practices for monitoring *G. salaris* in Russia, Sweden and Norway, and describing the national contingency plan developed in Ireland in the event of an outbreak of *G. salaris*.

3.9.2 Ongoing national monitoring programmes

Several countries have implemented monitoring programmes for *G. salaris*. These are described briefly below.

Norway

The Norwegian surveillance and control programme for *G. salaris* aims to detect occurrences of this parasite on salmon and rainbow trout (*Oncorhynchus mykiss*) in Norwegian rivers and hatcheries/fish farms. Systematic surveillance has been in place since 1980 and during the period 1975–2009 pathogenic strains of *G. salaris* have been detected on Atlantic salmon fingerlings/parr in 46 rivers, 13 hatcheries/fish farms with Atlantic salmon parr/smolts and 26 hatcheries/fish farms with rainbow trout. In addition, a non-pathogenic strain of *G. salaris* has been found on Arctic charr (*Salvelinus alpinus*) in several lakes (Hansen *et al*. 2011). The programme employs a risk-based approach for selecting rivers that should be prioritized for monitoring:

1) Large salmon rivers – the 25 biggest salmon rivers in Norway based on average catches in the last 3-year period.
2) Important rivers in counties - the three biggest salmon rivers in each county that are not included in the rivers mentioned above.
3) Infected regions – rivers that are considered to be at risk of infection through migration of salmon between river mouths in brackish water.
4) Adjacent catchment areas – rivers with catchment areas bordering those of infected rivers.
5) Previously treated rivers – all rivers where the parasite has previously been eradicated through rotenone treatment.

Sweden

The parasite was first discovered on the Swedish west coast in 1989. This was in the Kattegat area where salinities were in the range 10–20 Practical Salinity Units (PSU). In the Skagerrak area, with salinities above 20 PSU, no parasites have been detected on salmon parr in spite of ongoing investigations for the past 15 years. In 2001, a monitoring programme was established on the Swedish west coast, although screening for *G. salaris* had been going on since 1989. Today monitoring is done in selected infected rivers to follow the development of *G. salaris* and in all uninfected rivers annually.

Russia

In Northern Russia, *G. salaris* was found for the first time in the Keret River (Karelia, White Sea basin) in 1992, where it caused considerable damage to salmon stocks (e.g. parr density declined from 62 parr/100 sq. m in 1990 to 0.2 parr/100 sq. m in 1996). *G. salaris* was introduced into the river by aquaculture activities. The discovery of *G. salaris* in the Keret River resulted in the introduction of annual monitoring surveys on a number of salmon rivers in the Karelia Republic and the Murmansk Region; these have continued since 1993.

As a result of monitoring, the parasite was discovered in 2000–2002 in one more river in Karelia: the Pistajoki River. This river originates in Finland in Lake Jukajärvi where landlocked populations of salmon exist, but is part of the River Kem (White Sea basin) where anadromous Atlantic salmon also occur. In other rivers in the Republic of Karelia (i.e. Nilma, Pulonga, Gridina and Pondoma) *G. salaris* has not been detected.

Parasitological monitoring of the spread of *G. salaris* in the Murmansk Region was started in 1993. Six White Sea rivers located close to the Karelian boundary (Kovda, Virma, Kanda, Lubche-Savino, Niva and Luvenga) and three rivers of the Baltic Sea basin (Sallajoki, Kuolajoki and Tennijoki) have been checked repeatedly during monitoring activities. Among the Barents Sea water bodies, the Tuloma river basin, which has its headwaters in Finland where *G. salaris* was found in the adjacent Lake Inari, has been included in the programme. Results to date demonstrate that there has been no *G. salaris* in the reference salmon rivers of the White, Baltic and Barents Seas basins within the Murmansk region. Over the last years, the Kovda and Kanda rivers (White

Sea basin) and the Kola, Pack and Pecha rivers (Barents Sea basin) have been selected as index rivers.

No parasitological monitoring for infestation with *G. salaris* in Atlantic salmon has been carried out, to date, in the Arkhangelsk region.

Ireland

While, *G. salaris* has not been detected in Ireland, sampling programmes are in place annually to allow early detection for such an event. In general, 4–5 fish farms a year (i.e. 120–150 farmed fish) are sampled and five major different river catchments (150 fish). Sampling with specific reference to *G. salaris* follows the OIE Manual of Diagnostic Tests for Aquatic Animals 2010 (http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/2.3.03_Gyrodactylosis.pdf). In conjunction with regular sampling, a new Fish Disease Contingency Plan (Anon. 2012) for dealing with outbreaks of *G. salaris* in Ireland has been prepared. A separate but parallel contingency plan is in place for UK (N. Ireland). If *G. salaris* is suspected or confirmed anywhere on the island of Ireland, this contingency plan will be initiated and will involve enacting pre-agreed protocols with the appropriate authorities i.e. Marine Institute (MI) (Lead co-ordinator), Department of Agriculture, Food and the Marine (DAFM) and/or the Department of Agriculture and Rural Development (DARD) for UK (N. Ireland) for the purpose of preventing the spread of *G. salaris* throughout the island. Similarly, if *G. salaris* is suspected or confirmed in Great Britain, there is an agreed protocol for liaising with the appropriate authorities there, for the purpose of preventing the spread of *G. salaris* between Great Britain and Ireland. The overall policy objective in relation to fish disease is to maintain Ireland's high fish health status and in particular to obtain and maintain Category I disease free status under Directive 2006/88/EC in respect of the listed diseases as well as to retain disease free status for *G. salaris*, Spring Viraemia of Carp (SVC) and Bacterial Kidney Disease (BKD), diseases for which there are national measures under Article 43 of the Directive. In the event of identification of *G. salaris* in either farmed or wild freshwater fish stocks, the principal objective will therefore be to take action to contain and, if possible, eradicate the parasite.

Information giving rise to initial suspicion may come from:

- Observation of clinical signs or mortalities by MI Field Inspectors, anglers, fish farmers, Inland Fisheries Ireland (IFI) / Loughs Agency Inspectors, fish-farm veterinarians, fish health professionals or the public.
- Discovery of an illegal importation of susceptible / vector fish from a *G. salaris* affected country.
- Significant reduction in numbers of wild salmon, parr and smolts in rivers or a noted change in the fish behaviour.
- Samples sent to the National Reference Laboratory (NRL) by MI Field Inspectors / IFI personnel / Loughs Agency personnel / members of the public.
- Claims by external scientist(s) to have identified *G. salaris* in Ireland / UK (N. Ireland).

An initial Restriction Notice, the geographical extent of which will be based on previous knowledge of the water catchment, will be issued and an appropriate number of fish (N=30) will be sampled and examined. An epizootic investigation will be initiated in accordance with Article 29 of Directive 2006/88. No further action will be taken unless the strength of the evidence available suggests that *G. salaris* may be present.

UK (England & Wales) & UK (Scotland)

G. salaris has not been detected in the UK to date. In UK (England & Wales), a 5-year rolling programme is in place with targeted sampling in ten salmon catchments each year. Each sample consists of 30 salmon parr (or brown trout if salmon are not available). In the past five years, 40 river catchments have been tested.

In UK (Scotland), an annual wild fish disease surveillance programme has operated in previous years in which eleven sites were sampled for *G. salaris* per year, with every District Salmon Fishery Board catchment sampled once every five years in a rolling programme. In 2011, this was changed to a risk-based approach in which five sites were identified and sampled, but has now been further reduced and there is currently no targeted surveillance programme. However, there is still an active fish disease surveillance programme with all wild salmonids for diagnostic sampling from freshwater sites being routinely screened for *G. salaris*.

3.9.3 Advice on best practice

General considerations

Samples should be taken annually from hatcheries producing Atlantic salmon and/or rainbow trout. Sampling should include commercial hatcheries for the fish-farming industry and hatcheries that produce fish for supplementing natural stocks of salmon, or for rainbow trout fisheries. The number of fish analysed should be higher in rainbow trout samples than in samples from Atlantic salmon, since the prevalence and intensity of *G. salaris* is lower on rainbow trout (Malmberg and Malmberg 1987; Bakke *et al*. 1991) than on Atlantic salmon (Bakke *et al*. 1990), though different Atlantic salmon stocks show different host resistance to *G. salaris* (Bakke *et al*. 1990; Bakke *et al*. 2002).

Furthermore, there should be more extensive monitoring in rivers, and it is suggested that the rivers with highest risk of infection be prioritized. Thus, rivers that are considered important due to their size and production, economic contribution, life-history characteristics or other factors, should be monitored more closely. Such priority considerations may vary between countries and regions. In addition to this, it is suggested that a risk-based framework be applied to select the most appropriate rivers for monitoring and that the consequences of infection in the river be evaluated. A contingency plan should be in place in the case of new infestations.

Which rivers should be monitored?

1) Highest priority should be placed on rivers with reduced densities of salmon parr, observations of high numbers of dead parr, or where there are large reductions in adult salmon numbers or catches compared to other nearby rivers or previous years.

2) Most infections in Norwegian rivers have originally been caused by stocking fish from infected hatcheries and through further spread to nearby rivers in the same fjord systems (Johnsen and Jensen 1991). Therefore, rivers where salmon stocks are supplemented by hatchery fish or that have hatchery facilities for Atlantic salmon or rainbow trout draining into them should be surveyed on an annual basis.

3) The parasite may spread among rivers through movement of fish in brackish water (Johnsen and Jensen 1991; Soleng and Bakke 1997; Soleng *et al*. 1998; Jansen *et al*. 2007). The survival of *G. salaris* is negatively correlated with salinity above 7.5 parts per thousand (Soleng and Bakke 1997), so larger sea-areas with high salinity in between river outlets will probably reduce the risk of spread among the rivers by migrating salmonids. Therefore, rivers close to other rivers with *G. salaris* and/or with neighbouring catchment areas should also be surveyed on an annual basis.

4) Other rivers should be surveyed regularly (for example every fifth year).

What life stage should a sampling programme focus on?

In rivers infected with *G. salaris* the numbers of salmon parr show a rapid decline from pre-infection levels (Johnsen and Jensen 1991; Johnsen *et al*. 1999). Older life stages are often few in number, but show high prevalence of the parasite. Therefore, older salmon parr should be analysed if found, and the number of individuals should be complemented with 0+ fish to reach the designated number of fish (see recommendation below) if very few older fish are found.

When in the season should the survey take place?

The number of *G. salaris* per infected fish is generally highest in autumn (Johnsen and Jensen, 1992). Furthermore, in autumn the 0+ parr are larger and therefore easier to catch by electrofishing than earlier in the season. It is recommended that salmon should be sampled in the autumn, or directly after observations of high numbers of dead fish in the river. Prevalence of *G. salaris* tends to be lower at temperatures above 14°C.

Where in rivers should samples be taken?

Investigations have demonstrated that infections can spread rapidly throughout river systems (Johnsen and Jensen, 1988). However, in the early stages of infection in a river, levels of infections may show local variation, and it is recommended that samples be collected from lower, middle and upper reaches of the river. This is especially important in larger rivers. In the case of rivers with hatchery releases, samples should be taken close to the release sites. Where neighbouring river(s) are infected, samples should be taken close to the river mouth of the uninfected river because the most likely source of spread may be by direct entry of infected fish into the river. Generally, it is best to take samples as close as possible to the entry sites of the parasite or parasitized fish to detect infection at an early stage.

How many fish should be analysed per year per river?

In the Norwegian monitoring programme, 30 salmon parr have been sampled per river. In infested rivers, the parasite can normally be found on at least 40% of the older salmon parr (Johnsen and Jensen 1988), so except in the early stages of an infestation, a minimum of 30 fish should provide a high probability of discovery if the parasite is present in the river. Investigations in Sweden indicate that the dorsal and pectoral fins of infected fish have the highest frequencies of infection and are particularly important body areas to assess for screening purposes. In Sweden, sampling levels are based on the prevalence of the parasite, and 20 fish per site is generally considered to be sufficient.

Analysis of samples

Samples should be collected, preserved and analysed according to the guidelines in the Gyrodactylosis (*G. salaris*) chapter in the Manual of diagnostic tests for aquatic animals from the World Organization for Animal Health (OIE) http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/2.3.03_Gyrodactylosis.pdf.

Table 3.1.3.1. Number of gear units licensed or authorized by country and gear type (- indicates no information available).

	UK (England & Wales)					UK (Scotland)		UK (N. Ireland)			Norway			
Year	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	-	3080	800.0	142	305	18	4608	2421	26	8976
1972	308	224	315	76	-	3455	813.0	130	307	18	4215	2367	24	13448
1973	291	230	335	70	-	3256	891.0	130	303	20	4047	2996	32	18616
1974	280	240	329	69	-	3188	782.0	129	307	18	3382	3342	29	14078
1975	269	243	341	69	-	2985	773.0	127	314	20	3150	3549	25	15968
1976	275	247	355	70	-	2862	760.0	126	287	18	2569	3890	22	17794
1977	273	251	365	71	-	2754	684.0	126	293	19	2680	4047	26	30201
1978	249	244	376	70	-	2587	692.0	126	284	18	1980	3976	12	23301
1979	241	225	322	68	-	2708	754.0	126	274	20	1835	5001	17	23989
1980	233	238	339	69	-	2901	675.0	125	258	20	2118	4922	20	25652
1981	232	219	336	72	-	2803	655.0	123	239	19	2060	5546	19	24081
1982	232	221	319	72	-	2396	647.0	123	221	18	1843	5217	27	22520
1983	232	209	333	74	-	2523	667.5	120	207	17	1735	5428	21	21813
1984	226	223	354	74	-	2460	637.5	121	192	19	1697	5386	35	21210
1985	223	230	375	69	-	2010	528.5	122	168	19	1726	5848	34	20329
1986	220	221	368	64	-	1955	591.0	121	148	18	1630	5979	14	17945
1987	213	206	352	68	-	1679	564.0	120	119	18	1422	6060	13	17234
1988	210	212	284	70	-	1534	384.5	115	113	18	1322	5702	11	15532
1989	201	199	282	75	-	1233	352.5	117	108	19	1888	4100	16	0
1990	200	204	292	69	-	1282	339.5	114	106	17	2375	3890	7	0
1991	199	187	264	66	-	1137	295.0	118	102	18	2343	3628	8	0
1992	203	158	267	65	-	851	292.0	121	91	19	2268	3342	5	0
1993	187	151	259	55	-	903	263.5	120	73	18	2869	2783	-	0
1994	177	158	257	53	37278	749	245.5	119	68	18	2630	2825	-	0
1995	163	156	249	47	34941	729	221.5	122	68	16	2542	2715	-	0
1996	151	132	232	42	35281	643	200.5	117	66	12	2280	2860	-	0
1997	139	131	231	35	32781	680	194.0	116	63	12	2002	1075	-	0
1998	130	129	196	35	32525	542	150.5	117	70	12	1865	1027	-	0
1999	120	109	178	30	29132	406	131.5	113	52	11	1649	989	-	0
2000	110	103	158	32	30139	381	123.0	109	57	10	1557	982	-	0
2001	113	99	143	33	24350	387	94.5	107	50	6	1976	1081	-	0
2002	113	94	147	32	29407	426	101.5	106	47	4	1666	917	-	0
2003	58	96	160	57	29936	363	108.5	105	52	2	1664	766	-	0
2004	57	75	157	65	32766	450	117.5	90	54	2	1546	659	-	0
2005	59	73	148	65	34040	381	100.5	93	57	2	1453	661	-	0
2006	52	57	147	65	31606	364	85.5	107	49	2	1283	685	-	0
2007	53	45	157	66	32181	238	69.0	20	12	2	1302	669	-	0
2008	55	42	130	66	33900	181	76.5	20	12	2	957	653	-	0
2009	50	42	118	66	36461	162	63.5	20	12	2	978	631	-	0
2010	51	41	118	66	36159	178	65.5	2	1	2	760	493	-	0
2011	53	34	117	66	36479	210	83.0	2	1	2	767	506	-	0
Mean 2006-2010	52	45	134	66	34061	224	72.0	34	17	2	1056	626		0
% change [3]	2	-25	-13	0	7	-6	15	-94.1	-94.2	0.0	-27	-19		
Mean 2001-2010	66	66	143	58	32081	313	88.3	67	35	3	1359	722		0
% change [3]	-20	-49	-18	14	14	-33	-6	-97.0	-97.1	-23.1	-44	-30		

[1] Number of gear units expressed as trap months.
[2] Number of gear units expressed as crew months.
[3] (2011/mean - 1) * 100
[4] Dash means "no data"

Table 3.1.3.1. Cont'd. Number of gear units licensed or authorized 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	10566	-	-	-	-	-	-	-	-	-	-
1972	1156	678	197	9612	-	-	-	-	-	-	-	-	-	-
1973	1112	713	224	11660	-	-	-	-	-	-	-	-	-	-
1974	1048	681	211	12845	-	-	-	-	-	-	-	-	-	-
1975	1046	672	212	13142	-	-	-	-	-	-	-	-	-	-
1976	1047	677	225	14139	-	-	-	-	-	-	-	-	-	-
1977	997	650	211	11721	-	-	-	-	-	-	-	-	-	-
1978	1007	608	209	13327	-	-	-	-	-	-	-	-	-	-
1979	924	657	240	12726	-	-	-	-	-	-	-	-	-	-
1980	959	601	195	15864	-	-	-	-	-	-	-	-	-	-
1981	878	601	195	15519	16859	5742	677	467	-	-	-	-	-	-
1982	830	560	192	15697	19690	7002	693	484	4145	55	82	-	-	-
1983	801	526	190	16737	20363	7053	740	587	3856	49	82	-	-	-
1984	819	515	194	14878	21149	7665	737	677	3911	42	82	-	-	-
1985	827	526	190	15929	21742	7575	740	866	4443	40	82	-	-	-
1986	768	507	183	17977	21482	7404	702	691	5919	58 [3]	86	-	-	-
1987	768	507	183	17977	22487	7759	754	689	5724 [4]	87 [4]	80	-	-	-
1988	836	507	183	11539	21708	7755	741	538	4346	101	76	-	-	-
1989	801	507	183	16484	24118	8681	742	696	3789	83	78	-	-	-
1990	756	525	189	15395	19596	7677	728	614	2944	71	76	-	-	-
1991	707	504	182	15178	22922	8286	734	718	2737	78	71	1711	-	-
1992	691	535	183	20263	26748	9058	749	875	2136	57	71	4088	-	-
1993	673	457	161	23875	29461	10198	755	705	2104	53	55	6026	59	199
1994	732	494	176	24988	26517	8985	751	671	1672	14	59	8619	60	230
1995	768	512	164	27056	24951	8141	687	716	1878	17	59	5822	55	239
1996	778	523	170	29759	17625	5743	672	814	1798	21	69	6326	85	330
1997	852	531	172	31873	16255	5036	616	588	2953	10	59	6355	68	282
1998	874	513	174	31565	18700	5759	621	673	2352	16	63	6034	66	270
1999	874	499	162	32493	22935	6857	616	850	2225	15	61	7023	66	194
2000	871	490	158	33527	28385	8275	633	624	2037 [5]	16	35	7336	60	173
2001	881	540	155	32814	33501	9367	863	590	2080	18	42	8468	53	121
2002	833	544	159	35024	37491	10560	853	660	2082	18	43	9624	63	72
2003	877	549	159	31809	34979	10032	832	644	2048	18	38	11994	55	84
2004	831	473	136	30807	29494	8771	801	657	2158	15	38	13300	62	56
2005	877	518	158	28738	27627	7776	785	705	2356	16	37	20309	93	69
2006	875	533	162	27341	29516	7749	836	552	2269	12	37	13604	62	72
2007	0	335	100	19986	33664	8763	780	716	2431	13	37	n/a	82	53
2008	0	160	0	20061	31143	8111	756	694	2401	12	32	n/a	66	62
2009	0	146	38	18314	29641	7676	761	656	2421	12	30	n/a	79	72
2010	0	166	40	17983	30646	7814	756	615	2200	12	36	n/a	55	66
2011	0	154	91	17983	31269	7915	776	767	2540	12	18	n/a	78	52
Mean 2006-2010	175	268	68	20737	30922	8023	778	647	2344	12	34	13604	69	65
% change [6]	-100.0	-42.5	33.8	-13.3	1.1	-1.3	-0.2	18.6	8.3	-1.6	-47.7		13.4	-20.0
Mean 2001-2010	517	396	111	26288	31770	8662	802	649	2245	15	37	12883	67	73
% change [6]	-100.0	-61.2	-17.8	-31.6	-1.6	-8.6	-3.3	18.2	13.2	-17.8	-51.4		16.4	-28.5

[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] (2011/mean - 1) * 100
[7] Dash means "no data"

Table 3.1.4.1. Nominal catch of salmon in NEAC Area (in tonnes round fresh weight), 1960 to 2011 (2011 figures are provisional).

Year	Southern countries	Northern countries	Faroes (1)	Other catches in international waters	Total Reported Catch	Unreported catches NEAC Area (3)	Unreported catches International waters (2)
1960	2641	2899	-	-	5540	-	-
1961	2276	2477	-	-	4753	-	-
1962	3894	2815	-	-	6709	-	-
1963	3842	2434	-	-	6276	-	-
1964	4242	2908	-	-	7150	-	-
1965	3693	2763	-	-	6456	-	-
1966	3549	2503	-	-	6052	-	-
1967	4492	3034	-	-	7526	-	-
1968	3623	2523	5	403	6554	-	-
1969	4383	1898	7	893	7181	-	-
1970	4048	1834	12	922	6816	-	-
1971	3736	1846	-	471	6053	-	-
1972	4257	2340	9	486	7092	-	-
1973	4604	2727	28	533	7892	-	-
1974	4352	2675	20	373	7420	-	-
1975	4500	2616	28	475	7619	-	-
1976	2931	2383	40	289	5643	-	-
1977	3025	2184	40	192	5441	-	-
1978	3102	1864	37	138	5141	-	-
1979	2572	2549	119	193	5433	-	-
1980	2640	2794	536	277	6247	-	-
1981	2557	2352	1025	313	6247	-	-
1982	2533	1938	606	437	5514	-	-
1983	3532	2341	678	466	7017	-	-
1984	2308	2461	628	101	5498	-	-
1985	3002	2531	566	-	6099	-	-
1986	3595	2588	530	-	6713	-	-
1987	2564	2266	576	-	5406	2554	-
1988	3315	1969	243	-	5527	3087	-
1989	2433	1627	364	-	4424	2103	-
1990	1645	1775	315	-	3735	1779	180-350
1991	1145	1677	95	-	2917	1555	25-100
1992	1523	1806	23	-	3352	1825	25-100
1993	1443	1853	23	-	3319	1471	25-100
1994	1896	1684	6	-	3586	1157	25-100
1995	1775	1503	5	-	3283	942	-
1996	1392	1358	-	-	2750	947	-
1997	1112	962	-	-	2074	732	-
1998	1120	1099	6	`	2225	1108	-
1999	934	1139	0	-	2073	887	-
2000	1210	1518	8	-	2736	1135	-
2001	1242	1634	0	-	2876	1089	-
2002	1135	1360	0	-	2495	946	-
2003	908	1394	0	-	2302	719	-
2004	919	1058	0	-	1977	575	-
2005	810	1189	0	-	1999	605	-
2006	651	1217	0	-	1868	604	-
2007	372	1036	0	-	1407	465	-
2008	354	1179	0	-	1533	433	-
2009	264	893	0	-	1158	317	-
2010	410	1003	0	-	1414	357	-
2011	422	1003	0	-	1424	382	
Means							
2006-2010	410	1065	0	-	1476	435	-
2001-2010	707	1196	0	-	1903	611	-

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 since 2008.

Table 3.1.5.1. The CPUE for salmon rod catches in Finland (Teno and Naatamo), France and UK (N. Ireland; River Bush).

Year	Finland (R. Teno)		Finland (R. Naatamo)		France	UK (N.Ireland) River 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
	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
2009	2.3	0.6	0.7	0.1	0.50	0.136
2010	3.0	0.8	1.3	0.2	0.87	0.226
2011	2.4	0.6	1.0	0.2	1.65	0.122
Mean 2006-10	3.2	0.9	1.2	0.2	0.8	0.4

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

Table 3.1.5.2. The CPUE for salmon rod catches in the Barents Sea and White Sea basins in Russia.

Year	Barents Sea Basin, catch per angler day					White Sea Basin, catch per angler day			
	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			
2009						5.72			
2010						4.78			
2011						4.01			
Mean 2006-10	0.95	1.14	1.46	1.31		5.70	2.23		0.73

Table 3.1.5.3. The CPUE data for net and fixed engine fisheries by Region in UK (England & Wales). Data expressed as catch per licence-tide, except for the Northeast, for which the data are expressed as catch per licence-day.

Year	North East drift nets	Region (aggregated data, various methods)				
		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	0.07	0.63
1998	5.92	3.81	1.25	0.42	0.08	0.46
1999	8.06	4.88	0.79	0.72	0.02	0.52
2000	13.06	8.11	1.01	0.66	0.18	1.05
2001	10.34	6.83	0.71	0.79	0.16	0.71
2002	8.55	5.59	1.03	1.39	0.23	0.90
2003	7.13	4.82	1.24	1.13	0.11	0.62
2004	8.17	5.88	1.17	0.46	0.11	0.69
2005	7.23	4.13	0.60	0.97	0.09	1.28
2006	5.60	3.20	0.66	0.97	0.09	0.82
2007	7.24	4.17	0.33	1.26	0.05	0.75
2008	5.41	3.59	0.63	1.33	0.06	0.34
2009	4.76	3.08	0.53	1.67	0.04	0.51
2010	17.03	8.56	0.99	0.26	0.09	0.47
2011	19.25	9.93	0.63	0.14	0.10	0.34
Mean 2006-10	8.01	4.52	0.63	1.10	0.07	0.58

[1] series updated from that presented in 2009 WG report

Table 3.1.5.4. Catch per unit of effort (CPUE) for salmon rod fisheries by Region in UK (England & Wales), 1997–2011, expressed as number of salmon (including released fish) caught per 100 days fished.

Year	Region							England & Wales
	NE	Thames	Southern	SW	Midlands	Wales	NW	
1997	5.0	0.6	3.1	5.2	1.7	2.6	5.3	4.0
1998	6.5	0.0	5.9	7.5	1.3	3.9	8.6	6.0
1999	7.4	0.3	3.1	6.3	2.1	3.5	7.4	5.5
2000	9.2	0.0	5.2	8.8	4.9	4.4	11.7	7.9
2001	11.3	0.0	11.0	6.6	5.4	5.5	15.4	8.7
2002	9.4	0.0	18.3	6.0	3.5	3.6	10.0	6.8
2003	9.7	0.0	8.8	4.7	5.2	2.9	8.3	5.7
2004	14.7	0.0	18.8	9.6	5.5	6.6	17.4	11.4
2005	12.4	0.0	12.7	6.2	6.6	4.5	13.9	9.0
2006	14.2	0.0	15.6	8.7	6.6	5.9	13.3	10.1
2007	11.7	0.0	18.0	8.7	5.7	6.0	14.2	9.6
2008	12.7	0.0	21.8	10.9	5.8	7.3	15.3	10.5
2009	9.5	0.0	13.7	5.7	3.6	3.6	9.3	6.6
2010	16.7	2.8	17.1	9.9	4.3	6.5	14.1	10.2
2011	17.7	0.0	13.8	9.5	6.2	6.1	11.7	10.8
Mean (2006-2010)	13.0	0.6	17.2	8.8	5.2	5.9	13.2	9.4

Table 3.1.5.5. The CPUE data for UK (Scotland) net fisheries, expressed as numbers of fish per unit effort.

Year	Fixed engine	Net and coble	Year	Fixed engine	Net and coble
	Catch/trap month [1]	Catch/crew month		Catch/trap month [1]	Catch/crew month
1952	33.9	156.4	1982	61.3	180.2
1953	33.1	121.7	1983	55.8	203.6
1954	29.3	162.0	1984	58.9	155.3
1955	37.1	201.8	1985	49.6	148.9
1956	25.7	117.5	1986	75.2	193.4
1957	32.6	178.7	1987	61.8	145.6
1958	48.4	170.4	1988	50.6	198.4
1959	33.3	159.3	1989	71.0	262.4
1960	30.7	177.8	1990	33.2	146.0
1961	31.0	155.2	1991	35.9	106.4
1962	43.9	242.0	1992	59.6	153.7
1963	44.2	182.9	1993	52.8	125.2
1964	57.9	247.1	1994	92.1	123.7
1965	43.7	188.6	1995	75.6	142.3
1966	44.9	210.6	1996	57.5	110.9
1967	72.6	329.8	1997	33.0	57.8
1968	47.0	198.5	1998	36.0	68.7
1969	65.5	327.6	1999	21.9	58.8
1970	50.3	241.9	2000	54.4	105.5
1971	57.2	231.6	2001	61.0	77.4
1972	57.5	248.0	2002	35.9	67.0
1973	73.7	240.6	2003	68.3	66.8
1974	63.4	257.1	2004	42.9	54.5
1975	53.6	235.7	2005	45.8	80.9
1976	42.9	150.8	2006	45.8	73.3
1977	45.6	188.7	2007	47.6	91.5
1978	53.9	196.1	2008	56.1	52.5
1979	42.2	157.2	2009	42.2	73.3
1980	37.6	158.6	2010	77.0	179.3
1981	49.6	183.9	2011	64.3	77.6
			Mean 2006-10	53.7	94.0

[1] Excludes catch and effort for Solway Region

Table 3.1.5.6. The CPUE for the marine fisheries in Norway, expressed as numbers of salmon caught per net day in bag nets and bendnets partitioned by salmon weight.

Year	Bagnet			Bendnet		
	< 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
2009	0.73	0.92	0.31	0.44	0.78	0.32
2010	1.46	1.13	0.39	0.82	1.00	0.38
2011	1.30	1.98	0.35	0.71	1.02	0.36
Mean 2006-10	0.94	1.08	0.34	0.62	0.91	0.38

Table 3.1.6.1. Percentage of 1SW salmon in catches from countries in the Northeast Atlantic, 1987 to 2011.

Year	Iceland	Finland	Norway	Russia	Sweden	**Northern countries**
1987		66	61	71		**63**
1988		63	64	53		**62**
1989	69	66	73	73	41	**72**
1990	66	64	68	73	70	**69**
1991	71	59	65	70	71	**66**
1992	72	70	62	72	68	**65**
1993	76	58	61	61	62	**63**
1994	63	55	68	69	64	**67**
1995	71	59	58	70	78	**62**
1996	73	79	53	80	63	**61**
1997	73	69	64	82	54	**68**
1998	82	75	66	82	59	**70**
1999	70	83	65	78	71	**68**
2000	82	71	67	75	69	**69**
2001	78	48	58	74	55	**60**
2002	83	34	49	70	63	**54**
2003	75	51	61	67	47	**62**
2004	86	47	52	68	52	**58**
2005	87	72	67	66	55	**69**
2006	84	73	54	77	56	**60**
2007	91	30	42	69	33	**50**
2008	90	34	46	58	30	**54**
2009	91	62	49	63	34	**59**
2010	82	50	56	58	41	**60**
2011	85	61	41	58	32	**49**
Means						
2006-2010	88	50	49	65	39	57
2001-2010	85	50	53	67	46	59

Year	UK (Scotland)	UK (E&W)	France (1)	Spain (2)		**Southern countries**
1987	61	68	77			**63**
1988	57	69	29			**60**
1989	63	65	33			**63**
1990	48	52	45			**49**
1991	53	71	39			**58**
1992	55	77	48			**59**
1993	57	81	74	64		**64**
1994	54	77	55	69		**61**
1995	53	72	60	26		**59**
1996	53	65	51	34		**56**
1997	54	73	51	28		**60**
1998	58	82	71	54		**65**
1999	45	68	27	14		**54**
2000	54	79	58	74		**65**
2001	55	75	51	40		**62**
2002	54	76	69	38		**64**
2003	52	66	51	16		**55**
2004	51	81	40	67		**59**
2005	58	76	41	15		**61**
2006	57	78	50	15		**61**
2007	57	78	45	26		**61**
2008	48	76	42	11		**55**
2009	49	72	42	30		**54**
2010	55	78	67	32		**63**
2011	36	57	33	2		**44**
Means						
2006-2010	53	76	49	23		59
2001-2010	54	76	50	29		59

1. No data provided for France for 2009. Data from 2008 used.
2. Based on catches in Asturias (~90 % of the Spanish catch).

Table 3.2.2.1. 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	13741	16555			13741	16555
Iceland (north & east)	6779	1556			6779	1556
Norway			78729	70947	78729	70947
Russia	66808	38494			66808	38494
Sweden	1558	1226			1558	1226
			Conservation limit		167615	128778
			Spawner Escapement Reserve		212986	218259

	National Model CLs		River Specific CLs		Conservation limit used	
	1SW	MSW	1SW	MSW	1SW	MSW
Southern Europe						
France			17400	5100	17400	5100
Iceland (south & west)	20219	1299			20219	1299
Ireland			236044	15334	236044	15334
UK (E&W)			54491	29605	54491	29605
UK (NI)	19047	1778			19047	1778
UK (Sco)	251996	188153			251996	188153
			Conservation limit		599197	241269
			Spawner Escapement Reserve		758477	406436

Table 3.3.4.1. Estimated number (median values) of returning maturing 1SW salmon by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	25953	9380	NA	153978	17518				49951	62399	1047720	99142	181738	621783	1820087	**2075405**	2421886			
1972	40690	8601	NA	117689	13842				99469	50655	1124645	86278	158550	542017	1800457	**2077862**	2431727			
1973	36844	10333	NA	173183	17160				60818	54297	1225744	100281	138752	651501	1947942	**2245749**	2639360			
1974	72773	10280	NA	172442	24655				28169	38603	1396899	124205	151783	619618	2048122	**2369503**	2807846			
1975	51010	12572	NA	264200	26560				56637	60146	1546952	126197	124461	505698	2081935	**2431033**	2893787			
1976	35033	12649	NA	184164	14960				51985	47260	1046795	83901	86470	434473	1516375	**1760245**	2083491			
1977	17932	17500	NA	117446	7051				40180	48642	901231	94334	85237	452822	1419683	**1630716**	1913450			
1978	24351	17832	NA	118659	8060				41271	63514	790748	105623	110988	519919	1441950	**1642086**	1894690			
1979	28557	17043	NA	164220	8504				46816	58808	728227	100086	78064	428077	1266413	**1449592**	1686861			
1980	12803	2585	NA	117388	10861				98652	26651	551386	92842	98902	267100	1003527	**1148375**	1325463			
1981	19807	13328	NA	96864	19534				77967	34383	291265	96434	77326	329299	825397	**916283**	1019815			
1982	5794	6158	NA	85201	17226				48026	35389	604726	82416	111982	472942	1222231	**1363123**	1529254			
1983	28511	9025	697279	141949	22821	796070	**902321**	1037776	51388	44686	1066285	118516	156951	483720	1711139	**1930426**	2202176	2583204	**2837339**	3132673
1984	31951	3288	727967	152453	32192	837034	**951133**	1094487	84773	27447	558742	103089	61704	510920	1216867	**1356916**	1519728	2125806	**2312553**	2521634
1985	48097	22606	742188	209092	38181	944989	**1065580**	1204832	31429	44550	926820	102938	80023	421486	1427300	**1614782**	1854120	2450755	**2685595**	2954791
1986	43901	28198	645904	178857	40469	843407	**940736**	1060211	48176	73218	1038625	117550	89951	523884	1685714	**1911067**	2189205	2608219	**2855966**	3149374
1987	56031	16617	543859	190520	32873	756291	**844372**	947387	86018	45478	670980	122041	49085	404243	1222116	**1401089**	1630179	2044843	**2248604**	2498039
1988	26719	24020	497577	132010	27490	637998	**709503**	793250	29547	81711	908973	166315	115925	611928	1710246	**1925735**	2190785	2409891	**2638371**	2915890
1989	62595	12951	548691	196753	8768	747059	**831395**	940221	16057	45675	651367	109572	111655	669760	1447068	**1614861**	1816247	2248853	**2450523**	2675688
1990	59226	9688	492613	163165	19495	669405	**746003**	838368	26812	41940	406987	79488	92200	321060	875737	**978057**	1102536	1591900	**1727901**	1878906
1991	72059	14100	429288	138608	23538	609292	**680273**	764984	19507	46410	291136	77140	51493	318797	729976	**812325**	909549	1382514	**1495196**	1622785
1992	95418	26584	361503	171095	25794	618878	**684651**	760162	35634	53058	421813	79938	104374	464907	1052134	**1173289**	1313802	1716773	**1860049**	2018052
1993	67194	21756	363477	147463	27753	572442	**631107**	696395	51414	51992	343334	109638	122200	416824	1000755	**1111860**	1250361	1616318	**1744687**	1892599
1994	26668	6946	490775	173376	21057	641925	**722366**	821100	39933	42695	440331	121332	83947	444696	1066204	**1188586**	1331712	1759943	**1913835**	2086939
1995	26287	20073	320305	155863	30784	501638	**556566**	619096	13421	58153	490525	93070	77764	436003	1055393	**1174917**	1317991	1599258	**1733914**	1886126
1996	61037	10703	244574	211954	19071	498563	**550840**	610792	16538	50006	458286	67132	80523	312906	884388	**992754**	1120790	1422351	**1544597**	1685618
1997	51977	14625	282977	208474	8659	513821	**570116**	633448	8450	36600	456765	61029	95395	225412	789881	**888243**	1012596	1342871	**1460231**	1597379
1998	59956	24953	368632	227213	7681	623348	**692406**	773012	16543	49952	479189	68141	208437	307510	1023926	**1137785**	1280722	1693971	**1832644**	1994978
1999	86139	12739	341979	176954	11296	570818	**632138**	700842	5517	40804	446746	55762	54230	151775	665923	**758759**	877785	1278065	**1392678**	1528092
2000	90513	13367	564110	192941	22475	795507	**887439**	990442	14287	36122	619164	84102	78669	294900	1002266	**1135124**	1302008	1860343	**2026386**	2221496
2001	40938	12095	486721	259939	14643	718792	**820605**	948345	12390	32409	492472	74316	62155	290146	883548	**972079**	1075886	1651534	**1796671**	1958158
2002	28672	20967	297779	236491	14987	526008	**604055**	709556	27771	40345	429813	69834	123165	233559	850914	**935828**	1035950	1421362	**1544248**	1685767
2003	33982	11127	412337	211408	9093	596220	**682849**	786739	18456	48420	421867	49573	80263	266894	815673	**895747**	986837	1456155	**1581203**	1718795
2004	13141	30007	250081	148097	7889	399362	**452566**	518709	22309	48381	310797	83740	71732	315938	786044	**864941**	954370	1220205	**1319586**	1428419
2005	33382	26637	370319	168264	6691	540017	**610446**	695225	14312	71483	309886	70421	91414	342862	832979	**911387**	995920	1414083	**1523189**	1645314
2006	63082	28269	299758	203598	8113	537706	**607160**	698969	20190	50328	237001	65629	58278	333185	702956	**775832**	856382	1279845	**1385731**	1504811
2007	11758	20854	167930	110356	3866	278549	**316907**	364946	15920	57718	269724	62244	94738	326445	729276	**843311**	1073333	1038437	**1164157**	1395202
2008	12115	19133	210032	114530	4982	319800	**364360**	417723	15662	69783	265886	60641	56382	281401	650063	**769474**	992133	1004916	**1136361**	1361749
2009	24765	30758	168651	108905	5265	301256	**340848**	389050	5660	79148	221626	37559	42991	241498	543805	**644368**	830079	876155	**987505**	1176962
2010	23037	24529	250021	141513	8754	396791	**451243**	516606	19021	81126	282917	74736	39482	439893	803886	**968202**	1237749	1243986	**1421917**	1696368
2011	28160	21076	175808	141744	7391	328852	**375830**	433721	13320	57197	268157	46721	32807	247786	564987	**684202**	925505	929356	**1063674**	1308654
10yr Av.	27209	23336	260272	158490	7703	422456	480627	553125	17262	60393	301767	62110	69125	302946	728058	**829329**	988826	1188450	**1312757**	1492204

Table 3.3.4.2. Estimated number (median values) of returning non-maturing 1SW salmon by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	23858	9670		132481	1060				10812	24414	157530	109227	21934	568017	782501	**896249**	1041014			
1972	37289	15087		134531	744				21607	37403	168715	162096	19171	732600	999503	**1146933**	1336036			
1973	44495	14083		222414	2580				13198	33768	183224	122805	16733	801780	1020514	**1177435**	1380640			
1974	66379	13370		210146	1669				6155	29121	207433	88906	18271	568016	800120	**924158**	1077701			
1975	74386	14748		225263	403				12268	31061	230725	119892	15022	628679	904981	**1045632**	1221800			
1976	60902	12161		195197	1210				9001	26725	160897	63189	10445	391204	578114	**667063**	776295			
1977	37031	16978		134470	906				6916	26116	139686	79197	10279	428907	604147	**693883**	808898			
1978	23660	21909		115946	693				7122	33738	120724	64860	13415	533793	673384	**778010**	909008			
1979	25420	14416		101728	2020				8169	21577	108565	31643	9392	395115	497140	**577580**	683278			
1980	26423	20136		169148	3526				16967	30394	120071	102700	11895	483270	675603	**770425**	892371			
1981	29206	7029		96567	1024				11666	20287	88545	142506	9318	519171	696009	**794960**	922390			
1982	37971	8070		85208	3693				7170	14338	51534	55232	13482	420561	493747	**562629**	657235			
1983	41555	6157	427482	124199	2524	539667	**604145**	681264	7737	23931	151188	61542	18924	452376	612475	**731322**	963671	1196801	**1339948**	1580930
1984	39323	7948	438177	123722	3550	548960	**615037**	695150	12786	20285	76498	49644	7434	376776	482879	**546782**	627106	1067377	**1163803**	1275070
1985	30800	5120	405564	135030	1493	518305	**580649**	651561	9550	14709	83561	73337	9643	463474	577899	**657523**	753677	1133558	**1239653**	1356979
1986	26887	13935	485819	133966	1434	589645	**664117**	748946	9678	12295	94487	97595	10842	594535	720020	**825550**	955019	1357587	**1492393**	1646369
1987	33537	14465	367203	99503	4292	466706	**521336**	585199	5131	10906	117202	78322	5545	387425	534617	**609327**	698885	1037138	**1132583**	1241323
1988	21500	9303	306844	99766	4169	398619	**443009**	494291	14135	12420	84718	100668	15655	603282	730887	**835018**	963460	1162053	**1279089**	1414900
1989	24264	7912	219576	97202	11641	328129	**362055**	401602	6533	11072	77710	79834	12405	525142	631637	**717112**	820158	986379	**1080029**	1189313
1990	30587	8324	260120	124674	7427	392148	**432832**	480366	6680	11002	37193	99332	11327	438649	534815	**608823**	696069	954530	**1042735**	1140349
1991	36955	5788	219936	122150	8537	359066	**394892**	437337	6070	10942	56028	42480	5821	332317	401581	**456296**	521774	784450	**852708**	929725
1992	39410	8593	239446	116390	11029	378107	**416299**	460682	7651	12351	43065	32215	13315	443539	486374	**554081**	639028	890358	**972117**	1067754
1993	45336	9714	229291	137663	15127	403679	**439441**	479091	3606	6064	41950	35288	31398	365260	425141	**489103**	561657	854589	**929313**	1011959
1994	37816	8246	224276	121756	10992	369469	**405609**	444631	7683	9828	67597	49262	11040	440150	518846	**588631**	675568	914020	**995541**	1089608
1995	23269	5739	240639	138720	7699	381455	**417936**	459852	3652	11087	65293	50131	9343	408083	484302	**550350**	632829	891352	**969713**	1060672
1996	20593	7523	241576	104502	9801	350974	**385833**	425607	6477	7140	43707	49919	10224	311603	378912	**432433**	498838	752459	**819890**	896672
1997	29902	4233	159328	85270	6463	260721	**287029**	316278	3330	8029	56597	31384	12729	215589	287927	**333363**	386668	567392	**621107**	682190
1998	25078	6159	191273	105439	4722	305340	**334576**	367760	2832	4957	32843	20963	17499	227332	272521	**308534**	354173	596206	**644018**	700635
1999	23662	7090	204368	93035	4054	300944	**333597**	371271	6128	9694	50876	45076	7969	175131	255812	**305118**	371877	578205	**640065**	716404
2000	52481	4162	282957	162160	8859	468486	**512840**	563870	4250	2631	64052	47850	10621	224351	313857	**359192**	418066	805500	**873436**	950168
2001	75599	4779	333814	114999	10707	489330	**542433**	599126	4943	4623	57014	51849	7832	213387	297759	**346353**	409728	815159	**889921**	976057
2002	60596	4502	288914	125087	7836	442559	**488829**	543541	4600	5013	66001	46395	9294	174935	268849	**311978**	366397	737758	**802663**	875847
2003	42905	4738	255732	87340	9012	364107	**401782**	444876	6659	7980	69057	55471	6025	218518	317928	**370916**	437725	706252	**774031**	851906
2004	20564	4646	231460	67228	6463	298374	**331664**	371236	12338	6475	38006	43449	5401	281868	339869	**393892**	461122	662617	**727226**	801755
2005	16001	5762	213570	80578	4917	290720	**321544**	356989	7640	5697	49313	49017	6882	222333	299810	**346715**	407602	610440	**669486**	737160
2006	27867	5530	270598	77266	4942	350644	**387432**	428537	7692	4710	35625	41590	4387	231274	282592	**333210**	395413	656287	**721801**	794265
2007	39785	5319	229850	80441	6765	332153	**363355**	398626	7261	2909	15942	39822	6042	221741	253972	**299439**	356725	605711	**663559**	729753
2008	37751	6841	264956	125960	9692	402952	**448361**	500790	8071	3334	24023	42883	3656	248978	284500	**336813**	405546	714368	**787077**	871155
2009	17651	5501	207952	106973	8793	313696	**348958**	390768	4200	5159	26912	32657	4793	208124	240553	**287019**	344375	575505	**637533**	708153
2010	27869	7815	228838	136486	10893	372495	**415079**	464097	3535	10661	17426	48095	4379	277017	306752	**367937**	450438	706697	**784202**	878406
2011	21892	8915	318462	136540	14043	448345	**502022**	564978	9239	4001	18041	76923	10958	333421	380759	**463423**	573368	864110	**967232**	1093152
10yr Av.	31288	5957	251033	102390	8336	361604	**400903**	446444	7123	5594	36035	47630	6182	241821	297558	**351134**	419871	683974	**753481**	834155

Table 3.3.4.3. Estimated pre-fishery abundance (median values) of maturing 1SW salmon (potential 1SW returns) by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	33017	11939		NA	22965				64039	79531	1336003	127529	231590	785565	2246686	**2642715**	3159368			
1972	51763	10947		152309	18226				127107	64473	1432179	110895	202412	684566	2220061	**2642770**	3168941			
1973	46804	13125		223378	22452				78009	69126	1557038	128619	177299	820748	2402318	**2851656**	3442788			
1974	92965	13122		221482	31782				36422	49079	1777789	158786	193745	781478	2525595	**3010439**	3648429			
1975	64817	15969		339942	34049				72373	76546	1964053	161101	158652	637576	2573847	**3085977**	3762824			
1976	44589	16087		237641	19326				66541	60170	1332046	107398	110311	548416	1873699	**2237184**	2712415			
1977	22849	22295		151123	9110				51199	61797	1147060	120318	108622	570748	1743215	**2069867**	2489086			
1978	31059	22689		153015	10473				52899	80922	1006432	134923	141573	656071	1777096	**2084772**	2475250			
1979	36307	21700		212000	11020				59799	74952	924715	127534	99649	539589	1561459	**1842132**	2198122			
1980	16343	3293		151585	14365				125956	33956	702747	119136	126362	338403	1244310	**1462537**	1740303			
1981	25251	16963		127276	26247				100767	43759	373931	125506	99879	420132	1024824	**1175958**	1345236			
1982	7362	7840		110717	22635				61848	45011	768684	106450	143042	597902	1503486	**1733308**	2008655			
1983	36288	11509	896506	184977	30513	994664	**1163910**	1367963	66728	56970	1357452	153875	201293	614308	2120385	**2463408**	2893361	3193609	**3631612**	4143157
1984	40640	4182	928727	196330	41359	1037407	**1215165**	1439771	108197	34933	710441	131906	78932	645048	1495274	**1723724**	1990509	2612312	**2942223**	3325476
1985	61316	28889	948898	270595	49287	1176129	**1363916**	1589674	40593	56795	1180526	132313	102592	532895	1762742	**2056417**	2425397	3023275	**3425540**	3899312
1986	55835	35926	824055	230511	51929	1043200	**1203925**	1397222	61869	93210	1323097	150256	114970	660633	2078965	**2427963**	2858717	3199542	**3634831**	4157813
1987	71288	21162	692349	245332	41981	933436	**1078773**	1247266	109797	57971	851365	156116	62688	509458	1512435	**1782332**	2124455	2515567	**2863831**	3276223
1988	34093	30649	636773	170260	35472	791088	**909142**	1047775	38352	103850	1155735	212610	148025	773442	2110128	**2449397**	2863115	2964469	**3360598**	3839387
1989	79715	16476	701048	252260	11685	923233	**1063926**	1240282	20868	58099	827847	140298	142433	844915	1778609	**2050817**	2374957	2763195	**3116975**	3528759
1990	75346	12316	627570	208368	25155	823989	**952083**	1101769	34304	53338	517699	101511	117518	405702	1075839	**1244086**	1441830	1947727	**2199730**	2477978
1991	91797	17951	547161	178294	30088	752199	**868607**	1006172	25076	59092	369646	98791	65696	402359	896240	**1032013**	1191626	1693219	**1902071**	2143710
1992	121549	33803	460298	218528	32890	761214	**872649**	1000421	45541	67504	536435	101745	132895	585497	1292046	**1487662**	1718196	2100553	**2361442**	2651311
1993	85574	27769	462991	188710	35383	704454	**803860**	918061	65594	66226	436650	139722	155552	525296	1232169	**1411419**	1633064	1978499	**2218019**	2498937
1994	33969	8851	624670	222796	26783	793466	**921898**	1079421	50700	54335	559006	154778	106955	560248	1306760	**1506405**	1743568	2151727	**2431150**	2745942
1995	33458	25502	408452	200046	39262	620643	**710266**	818288	17221	74119	622589	118860	99042	549666	1296228	**1489834**	1727660	1957933	**2203555**	2490148
1996	77591	13649	311652	272170	24388	613840	**703325**	811029	21134	63603	582110	85561	102445	394195	1087101	**1259488**	1464441	1737367	**1964662**	2226534
1997	66227	18594	359292	267368	11008	630783	**726169**	838251	10736	46564	579293	77816	121475	283729	969389	**1128051**	1322634	1644462	**1856909**	2108231
1998	76428	31756	468021	292231	9777	768464	**883656**	1019374	21045	63531	608334	86819	264510	386717	1253294	**1442384**	1674795	2068309	**2327773**	2631096
1999	109415	16185	434397	226204	14390	702637	**804926**	923538	6995	51895	565934	70908	68843	191149	817391	**962393**	1143232	1564307	**1769526**	2011304
2000	115243	16967	717225	247272	28563	979218	**1130060**	1304006	18131	45982	786874	107069	99914	371185	1230462	**1438265**	1697258	2269351	**2575130**	2924131
2001	52106	15412	618665	333197	18663	888755	**1046605**	1243983	15749	41249	627581	94616	78950	365299	1074897	**1233134**	1415642	2022238	**2284743**	2582503
2002	36491	26644	378661	303750	19103	650853	**771945**	930497	35281	51397	546825	88899	156644	294083	1038794	**1187228**	1360564	1740044	**1962554**	2228358
2003	43286	14114	524011	269848	11547	738990	**869096**	1033879	23442	61485	535803	63136	102174	335511	995334	**1133924**	1298456	1778983	**2006098**	2267396
2004	16753	38168	317719	189929	10049	493365	**577567**	682639	28375	61776	395390	106820	91408	398839	961214	**1096141**	1253134	1489227	**1676376**	1885535
2005	42493	33911	471031	215702	8506	667171	**778790**	916506	18126	91081	394263	89818	116103	431818	1016676	**1153303**	1307737	1724138	**1934578**	2169722
2006	80495	35985	381014	260624	10322	661843	**774744**	916925	25739	64092	301910	83584	73971	419680	862071	**981868**	1122377	1565185	**1756716**	1985668
2007	14983	26532	213523	140559	4924	344446	**403529**	477515	20253	73577	343823	79107	120509	412035	898161	**1073366**	1383858	1273570	**1483719**	1814720
2008	15399	24306	267104	146322	6333	394666	**463601**	548360	19853	88844	338369	76895	71570	354392	804049	**977270**	1280732	1236602	**1447654**	1769649
2009	31523	39257	214145	137704	6684	370734	**432470**	506550	7207	100668	282800	47605	54594	304099	670357	**817778**	1067970	1074081	**1254647**	1529087
2010	29385	31210	317984	179407	11147	487920	**572955**	672935	24189	103439	359413	95151	50284	554347	992322	**1225349**	1594190	1528303	**1804849**	2198409
2011	35803	26922	223085	179083	9375	405861	**477454**	564031	16995	72796	340567	59165	41715	312454	697491	**867503**	1186267	1140947	**1351895**	1691318
10yr Av.	34661	29705	330828	202293	9799	521585	612215	724984	21946	76916	383916	79018	87897	381726	893647	1051373	1285528	1455108	1667909	1953986

Table 3.3.4.4. Estimated pre-fishery abundance (median values) of non-maturing 1SW salmon (potential MSW returns) by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	63137	26034		265888	7303				55559	63444	396707	388650	31912	1725628	2216230	**2678268**	3250411			
1972	74959	24345		421923	10262				36017	57185	392601	291937	27861	1715313	2072861	**2535279**	3129730			
1973	111504	22843		390276	6917				19423	49157	403953	206126	30412	1198672	1569859	**1916110**	2374454			
1974	124904	25411		427122	5760				30674	52569	453466	266735	25080	1335999	1770476	**2177685**	2692288			
1975	102226	20878		361428	5926				26941	45219	338590	176731	17391	960383	1309100	**1574554**	1907449			
1976	62443	28733		250259	4127				18612	44057	277072	176300	17155	906217	1181728	**1448739**	1786526			
1977	39935	36826		212800	3307				18878	56789	243101	151591	22320	1076175	1274728	**1577828**	1957916			
1978	42806	24526		199144	6383				18735	36534	215762	84960	15695	810518	960459	**1187113**	1481494			
1979	44620	34544		344162	13016				35580	51699	255085	221693	19800	1040261	1334617	**1633434**	2008613			
1980	49130	13217		250099	12687				25955	35373	208863	291138	15540	1118558	1394577	**1708696**	2089524			
1981	63417	14847		225773	16387				17779	25373	141053	136422	22503	926374	1044301	**1275568**	1559830			
1982	69796	11302	876602	276258	12137	1026289	**1249859**	1524521	17681	41017	297026	139550	31518	937184	1178370	**1503390**	1990184	2258690	**2764175**	3413023
1983	65972	13936	836073	254336	10929	970723	**1183517**	1451017	23409	34571	150283	102023	12391	724655	856199	**1051601**	1302315	1862691	**2238186**	2694368
1984	51483	9231	787568	274983	7758	930343	**1134453**	1385839	17568	25206	160601	140211	16073	861498	991668	**1226106**	1526465	1962990	**2359084**	2853761
1985	45289	24220	949184	281557	9033	1073741	**1311170**	1602414	21257	21398	199934	201491	18101	1172056	1330625	**1642480**	2041856	2451160	**2960571**	3572027
1986	56258	24970	737477	218168	13207	865588	**1054184**	1287207	12363	18997	229618	161060	9237	790516	1004117	**1227638**	1514742	1905845	**2283504**	2743747
1987	36039	16011	577757	198350	10252	688857	**839801**	1024617	28240	21213	173094	202167	26075	1147099	1296797	**1606764**	1992005	2023426	**2450239**	2963250
1988	40945	13780	449366	198464	23546	600780	**728273**	881483	16241	19067	167450	171050	20787	1044344	1176391	**1445067**	1775249	1805161	**2176447**	2617282
1989	51364	14296	494640	237846	15314	667799	**814867**	990937	12762	18770	77252	182860	18877	800932	896935	**1116639**	1392836	1594664	**1931685**	2342275
1990	61928	9902	403124	224587	16037	587767	**718054**	871537	10964	18509	101582	79120	9702	592984	657622	**815331**	1020081	1267636	**1534343**	1857932
1991	66014	14511	418684	206515	19527	594755	**727958**	889816	14880	20786	85206	67884	22200	807193	817615	**1021561**	1279683	1441400	**1751216**	2125873
1992	76066	16353	399786	242552	26226	628164	**763819**	929055	7369	10251	79260	68634	52315	653264	703377	**877856**	1104778	1356382	**1643459**	1996381
1993	63193	13886	391704	219264	19220	582687	**710537**	866349	12895	16547	115478	86328	18459	753249	800296	**1006674**	1272001	1408995	**1718941**	2098378
1994	39069	9713	422261	247125	13841	601963	**733799**	897173	6162	18671	111515	87845	15586	699387	748330	**942987**	1194040	1377859	**1679067**	2046968
1995	34432	12690	418589	187498	17213	552690	**672540**	823273	11275	12034	77308	89386	17155	543388	601611	**754865**	955112	1178716	**1429559**	1743588
1996	50029	7075	266370	147656	10824	396182	**484990**	594355	5919	13408	96507	56051	21370	372293	453194	**571300**	725985	868688	**1058586**	1292724
1997	42112	10301	319865	181164	7945	461655	**563474**	691359	4903	8281	55577	36900	29444	387932	420733	**526373**	663272	901355	**1090465**	1323907
1998	39586	11827	340127	162281	6790	457407	**561917**	692737	10291	16153	85646	78023	13288	297464	394371	**516987**	682811	875319	**1080744**	1336906
1999	87459	6932	471368	280406	14840	708764	**863840**	1056059	7181	4391	107197	83128	17713	380034	478922	**606880**	773447	1216501	**1472826**	1790981
2000	126622	7983	556031	200056	17977	741296	**911670**	1124097	8689	7712	97737	91725	13056	370884	468621	**600333**	771299	1241623	**1516069**	1853560
2001	101401	7531	481478	218080	13169	670742	**823924**	1017287	7907	8377	111303	81296	15532	299582	419150	**533399**	682042	1115475	**1359474**	1659891
2002	71722	7931	426679	153415	15095	551599	**677185**	831896	11396	13334	116807	97212	10112	374167	495636	**634188**	811969	1072266	**1312332**	1602425
2003	34446	7748	386156	117685	10849	452607	**557338**	690979	20746	10784	63723	74806	9067	477166	524718	**665683**	850814	1001779	**1224574**	1505026
2004	26695	9649	356095	141087	8262	441813	**543228**	667362	12847	9517	82939	85088	11480	377667	459900	**586982**	754255	922864	**1132332**	1389929
2005	46779	9279	449967	134560	8279	532268	**650437**	799586	12954	7884	59936	72329	7329	391740	439965	**563411**	727301	995562	**1214405**	1488140
2006	66414	8908	382729	138323	11381	499214	**608855**	747101	12241	4864	27341	69151	10060	376616	393335	**507964**	656917	915675	**1118658**	1373612
2007	63017	11435	442276	220699	16258	613096	**757408**	933767	13583	5579	40740	74559	6117	422685	441600	**572062**	743534	1084316	**1331222**	1631691
2008	29517	9154	346468	185341	14693	477572	**588566**	727442	7078	8598	45501	56870	7949	351461	371811	**485391**	634434	873059	**1074610**	1324231
2009	46536	13131	381348	238634	18226	565949	**700591**	867517	5944	17811	29442	83398	7335	470439	474597	**624157**	818303	1073874	**1326996**	1640385
2010	36648	14943	531213	238093	23481	683744	**846905**	1054257	15570	6695	30794	133893	18370	567824	593701	**786246**	1056289	1317582	**1638495**	2041292
10yr Av.	52318	9971	418441	178592	13969	548860	675444	833719	12027	9344	60852	82860	10335	410935	461441	595948	773586	1037245	1273310	1565662

Table 3.3.4.5. Estimated number (median values) of 1SW spawners by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	12970	4678		NA	8325				48211	31139	389315	51585	36397	213701	574195	**782215**	1071326			
1972	20376	4293		72109	6523				95989	25322	420759	45252	31849	168111	576080	**804042**	1106092			
1973	18419	5167		78306	8119				58688	27156	460165	52472	27822	203417	599172	**843855**	1178180			
1974	36231	5130		93725	11615				27179	19239	525524	65088	30414	173890	586537	**852155**	1218289			
1975	25561	6294		111915	12489				54657	30122	580593	66144	24952	155072	640948	**921867**	1315651			
1976	17576	6346		109491	7057				50165	23541	390238	43242	17320	160026	498175	**692969**	971844			
1977	8964	8727		74353	3319				38780	24337	334075	48096	17046	139646	439357	**609596**	852527			
1978	12166	8912		58855	3794				39836	31694	293691	53997	22241	187999	477006	**639877**	859311			
1979	14250	8504		74899	3991				45171	29420	272577	52278	15626	124904	398437	**549822**	751717			
1980	6390	1290		73544	5132				95222	13320	205181	47886	19765	82388	353796	**476776**	635811			
1981	9924	6667		53850	9227				75247	17147	70553	49601	15565	99031	259996	**337115**	425914			
1982	2901	3087		49858	8124				46346	17708	168602	42685	22393	170764	363347	**477734**	614247			
1983	14244	4495	160807	64831	10673	193907	**256865**	332697	49588	22318	361420	60767	31425	149861	516672	**684706**	898173	757674	**945989**	1173253
1984	15961	1644	163585	80593	15155	211500	**278656**	361148	81813	13702	196774	52152	12373	189200	440110	**558854**	694078	699259	**840360**	997199
1985	23988	11266	171789	92737	18000	250656	**319902**	401440	30329	22297	235713	51727	16068	177442	397890	**541989**	725149	695730	**864911**	1064493
1986	21975	14078	152609	102389	19094	251035	**312684**	386156	44776	36599	323505	59608	18005	224465	549126	**727590**	952146	846285	**1042421**	1277403
1987	27908	8312	127214	95728	15527	223213	**276905**	338661	80005	22739	202016	62387	15296	168804	431555	**576671**	781327	697352	**855602**	1062549
1988	13364	12022	116707	86618	13026	197833	**244417**	297024	27484	40861	344416	85330	41301	384645	769036	**938597**	1148381	1005641	**1184733**	1397595
1989	25027	6474	184117	96397	4142	261382	**316958**	391434	14933	22813	222141	55653	12481	439757	641648	**780622**	944088	945062	**1102646**	1280467
1990	23622	4838	165401	97004	10702	252167	**303865**	365901	24926	20932	159778	40663	35060	197891	406174	**489608**	592408	691043	**796157**	913392
1991	28598	7063	143510	83180	12878	230971	**277697**	335529	18145	23244	116736	39877	18289	215083	370578	**440301**	523083	631904	**719969**	819131
1992	38008	13339	121739	115894	14171	260617	**306134**	359107	33144	26496	159843	41290	45987	333029	550885	**653872**	774951	845952	**961708**	1092832
1993	26867	10859	120820	113853	15231	246187	**290358**	339398	47833	26014	142112	60223	72147	274853	540200	**639116**	766890	821941	**930515**	1063155
1994	10633	3468	165495	115965	11520	255243	**309188**	379048	37123	21296	125747	66375	25245	298584	486292	**590707**	715760	778236	**902632**	1044724
1995	10544	10033	107729	121066	19269	230902	**270991**	316259	11752	29124	176790	54081	25728	298748	505287	**605380**	724709	767387	**877137**	1002928
1996	30492	5356	80704	138066	11967	231195	**269120**	310394	14475	24920	183863	39586	34839	227338	444781	**533446**	638523	704607	**803963**	917092
1997	25955	7302	105223	158589	5397	260805	**304877**	351968	7390	18275	226633	37897	38233	158751	412861	**493591**	596351	704323	**799772**	910822
1998	29938	12475	138545	163135	4816	299341	**350715**	409039	14478	24949	220663	44289	156572	233828	605630	**704846**	826832	942726	**1056706**	1191010
1999	34343	6662	127730	162542	7045	290580	**340918**	397186	4827	20820	232738	38069	20111	107709	353311	**429003**	527472	677820	**771441**	883688
2000	36192	6973	214124	141384	13993	346912	**415471**	495363	12495	18371	351139	56887	33041	218473	587402	**699031**	842030	981669	**1118169**	1279014
2001	16391	6414	186223	198251	9144	347959	**419577**	504673	10846	16896	255707	52201	31040	221446	508481	**596791**	699966	899333	**1018558**	1149204
2002	14288	11322	112065	210771	9404	294882	**360075**	436359	24272	20947	215008	49015	70272	179835	487124	**570829**	669247	823267	**932640**	1056421
2003	17018	6006	156468	198614	5657	315928	**386905**	471797	16140	25182	247425	37051	41052	228499	527002	**605703**	695893	880758	**995431**	1116936
2004	6599	16485	93845	146112	4954	222115	**270240**	326139	19504	25178	156887	60485	40925	266829	504157	**582085**	669441	759301	**852949**	956899
2005	16692	14845	140198	132716	4178	255950	**311125**	373930	12498	37251	171960	51741	55748	293141	555981	**633548**	717649	848804	**945004**	1049870
2006	31507	15607	111163	162022	5050	270477	**327760**	396610	17642	26130	126576	49257	38461	287295	484984	**557120**	637119	790385	**886331**	989564
2007	5846	11658	61938	123254	2405	169121	**206674**	254372	13916	30585	248977	47868	75135	285302	605046	**718114**	948697	804082	**928208**	1162187
2008	6045	11094	87879	93538	3609	168600	**203760**	244270	13691	36827	243730	46826	43442	251181	535698	**655273**	877607	732992	**860806**	1085521
2009	12373	18424	71733	101263	3810	173105	**209819**	253000	4959	41176	205319	28964	34737	218314	448816	**549342**	734561	651110	**761314**	948519
2010	11537	14669	116118	109502	6320	215742	**261203**	316193	16614	43008	260809	57530	32142	391582	668853	**832871**	1102823	921866	**1096496**	1368426
2011	14032	12858	80047	116242	4080	189464	**229503**	279211	11643	30245	243640	34865	27203	218776	465703	**584324**	825846	686266	**816811**	1058997
10yr Av.	13594	13297	103145	139403	4947	227538	276706	335188	15088	31653	212033	46360	45912	262075	528336	628921	787888	789883	907599	1079334

Table 3.3.4.6. Estimated number (median values) of MSW spawners by NEAC country or region and year.

Year	Northern NEAC								Southern NEAC									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	10673	2913		NA	445				6752	7322	82641	70128	10974	307799	389055	**495387**	620254			
1972	16722	4541		58785	316				13487	11144	88384	104823	9589	390824	493041	**630450**	792750			
1973	19931	4215		65917	1085				8228	10126	96054	79976	8383	434079	505012	**647808**	824658			
1974	29753	4001		98473	704				3845	8695	109178	57648	9153	283211	369779	**481828**	617317			
1975	33610	4402		86772	170				7648	9364	120682	77361	7514	311736	420211	**547606**	703685			
1976	27389	3650		86547	508				5621	7978	84434	40529	5229	225126	294777	**375493**	473191			
1977	16690	5111		71674	382				4316	7838	73110	50547	5147	209875	276526	**358321**	456724			
1978	10637	6604		50519	290				4457	10068	63384	41487	6726	287527	327226	**420506**	535111			
1979	14001	4318		44364	853				5114	6428	56668	20351	4707	202457	230279	**301079**	392851			
1980	14477	6076		47919	1492				10597	9123	63060	66080	5957	242687	315032	**406105**	517270			
1981	16101	2105		66084	430				7586	6079	46321	91501	4665	255800	326209	**421422**	534541			
1982	20796	2420		40560	1558				4650	4307	32548	35482	6747	240003	261534	**327376**	412671			
1983	22878	1846	100707	49190	1062	137699	**177808**	225630	5037	7165	108468	39422	9454	243081	315502	**428537**	659968	485548	**608240**	844438
1984	21580	2390	103589	62178	1499	152168	**193348**	242382	8346	6077	43183	31498	3719	223799	260891	**319802**	394613	440230	**515295**	603055
1985	16996	1536	96050	51091	626	130524	**167800**	209663	6220	4409	53442	46693	4832	295894	341302	**415048**	504823	497505	**583310**	681454
1986	14796	4163	114756	52230	605	144061	**188379**	238773	6278	3698	50818	62149	5424	380948	418857	**515869**	636516	593728	**705864**	837232
1987	18502	4354	89900	53442	1809	133163	**170564**	212632	3325	3276	79197	50147	3000	244177	318606	**388008**	471651	479894	**559796**	652401
1988	11825	2793	72872	44911	1755	106750	**135717**	168503	9171	3723	52967	64150	10020	444929	490446	**589574**	709612	622536	**725341**	851027
1989	10905	2387	77648	50905	4947	123459	**148170**	176846	4251	3311	41051	50900	4966	390411	416848	**499273**	599642	560532	**648138**	752266
1990	13829	2498	91272	48012	3728	131855	**160893**	194517	4348	3296	14875	63593	7018	310473	336406	**408357**	493037	490187	**570511**	659642
1991	16702	1745	76650	60424	4264	134189	**161135**	192451	3945	3271	41162	27109	3319	250276	279373	**331796**	395742	432718	**494033**	564942
1992	17812	2572	84631	58343	5549	141379	**170512**	203206	4980	3702	20913	20672	8918	344372	339964	**405698**	489095	503516	**577812**	666177
1993	20328	2906	78104	55763	7589	138675	**166799**	198395	2352	1826	24348	23658	27626	275923	299202	**361234**	432633	458982	**528751**	605766
1994	17074	2473	76737	65364	5469	141037	**168613**	198279	5393	2952	40240	32824	6631	333698	357377	**424869**	509368	519730	**594350**	683715
1995	10407	1720	83665	64293	4395	137178	**165967**	198625	2557	3340	37984	35030	5418	306107	329168	**393010**	473764	487732	**560096**	647294
1996	11324	2258	82950	63365	5615	138431	**167075**	198551	4534	2148	19678	35066	6787	240644	260265	**312347**	376562	418027	**480566**	552064
1997	16479	1268	57715	52790	3713	109857	**133614**	159768	2329	2407	39314	22813	8411	164723	200861	**245961**	298603	328620	**380020**	438691
1998	13722	1834	69711	41907	2701	107384	**131439**	158194	1986	1481	12528	15701	13610	180826	193106	**228409**	272931	316918	**360431**	412739
1999	11836	2481	72191	54592	2316	118477	**144031**	173291	4297	3110	33418	36716	5406	133299	177758	**226420**	292805	313680	**371325**	442895
2000	26140	1503	103058	58849	5077	162291	**195951**	233912	2973	895	44164	40612	7185	175895	232327	**277170**	335403	415057	**473856**	541928
2001	37804	1820	123128	89485	6139	216250	**260046**	308207	3454	1527	37081	44495	5491	167106	217911	**266190**	328952	459221	**527321**	605821
2002	30306	1799	106537	74481	4487	182682	**219710**	263004	3220	1761	47912	39848	5312	139337	200346	**243250**	297487	404460	**464585**	530867
2003	21371	2229	95940	63323	5206	157933	**189994**	226035	4668	2553	54195	49025	3077	185115	252732	**305733**	372216	433014	**496528**	570739
2004	10242	2090	87448	48191	3706	126031	**153337**	185891	8606	2146	24720	38000	3083	238444	267875	**321498**	388091	414631	**475730**	547897
2005	8025	2649	79502	36490	2823	106744	**130103**	157364	5329	1989	37718	43135	4196	188144	239968	**286406**	346789	362244	**417179**	481171
2006	13861	3041	101089	46547	2839	138786	**168586**	202896	5384	1639	25084	36972	2896	199048	228779	**278899**	340831	388347	**448537**	516620
2007	19915	3406	83594	39834	3883	125746	**151799**	180612	5079	990	14256	35779	4792	193217	214686	**259826**	316809	357950	**412186**	474758
2008	18817	3766	126063	47310	6516	168113	**203724**	246425	5661	1438	21264	38494	2786	218591	242227	**294219**	362490	432203	**499626**	576926
2009	8831	3511	100229	70246	5928	157803	**191020**	230126	2937	1917	23389	29306	3875	185361	205984	**252095**	309299	385716	**444344**	512839
2010	13938	4832	122966	64488	7364	180159	**215303**	257234	2473	3725	15110	43264	3565	243610	257564	**318481**	400973	462838	**535379**	625670
2011	10916	5892	178593	76808	7021	231971	**280829**	337447	6454	1596	15147	67946	9091	291665	320598	**402834**	512128	584162	**684883**	807010
10yr Av.	15622	3322	108196	56772	4977	157597	190440	228703	4981	1975	27880	42177	4267	208253	243076	296324	364711	422556	487898	564450

Table 3.3.5.1. Status of national stocks and compliance with river-specific conservation limits for individual river stocks, after homewater fisheries, by jurisdiction in the NEAC area in 2011 (except Norway where data are for 2010).

Country	Meeting National 1SW CL	Meeting National MSW CL	Total number of rivers	Number with established CL	Number assessed for compliance	Number meeting CL	% meeting CL
Northern NEAC							
Russia	Yes	Yes	112	80	8	7	88
Finland/Norway (Tana/Teno)	No	No	1	1	1	0	0
Norway (2010)	Yes	Yes	450	439	211	162	77
Sweden	No	No	23	17	0		
Iceland	Yes	Yes	100	0			
Southern NEAC							
France	No	No	28	28	28	11	39
Ireland	Yes	No	141	141	141	58	41
UK (N. Ireland)	Yes	Yes	15	7	7	2	29
UK (England &Wales)	No	Yes	64	64	64	41	64
UK (Scotland)	Yes	Yes	383	0			

Table 3.3.6.1. Estimated survival of wild smolts (%) to return to homewaters (prior to coastal fisheries) for various monitored rivers in the Northeast Atlantic area.

Smolt	Iceland[1]			Norway[2]				Ireland	
migration	Ellidaar	R.Vesturdalsa[4]		R. Halselva		R. Imsa		R. Corrib	
year	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1975	20.8								
1980								17.9	1.1
1981						17.3	4.0	9.2	3.8
1982						5.3	1.2	20.9	3.3
1983						13.5	1.3	10.0	1.8
1984						12.1	1.8	26.2	2.0
1985	9.4					10.2	2.1	18.9	1.8
1986						3.8	4.2		
1987				2.0	0.3	17.3	5.6	16.6	0.7
1988	12.7			5.8	0.7	13.3	1.1	14.6	0.7
1989	8.1			2.1	1.0	8.7	2.2	6.7	0.7
1990	5.4			3.9	1.6	3.0	1.3	5.0	0.6
1991	8.8			2.1	0.3	8.7	1.2	7.3	1.3
1992	9.6			2.1	0.4	6.7	0.9	7.3	
1993	9.8			2.1	0.0	15.6		10.8	0.1
1994	9.0			0.6	0.4			9.8	1.4
1995	9.4		1.5	0.9	0.0	1.8	1.5	8.4	0.1
1996	4.6	2.5	0.4	2.8	0.0	3.5	0.9	6.3	1.2
1997	5.3	1.0	1.5	0.8	0.0	1.7	0.3	12.7	0.8
1998	5.3	1.5	1.0	1.5	0.6	7.2	1.0	5.5	1.1
1999	7.7	1.3	1.2	1.3	0.0	4.2	2.2	6.4	0.9
2000	6.3	1.1	0.7	0.4	1.1	12.5	1.7	9.4	0.0
2001	5.1	3.4	1.3	1.3	1.3	3.6	2.2	7.2	1.1
2002	4.4	1.1	2.3	0.8	0.5	5.5	0.9	6.0	0.5
2003	9.1	5.5	0.6	4.3	0.9	3.5	0.7	8.3	2.1
2004	7.7	5.7	0.6	3.1	1.2	5.9	1.4	6.3	0.8
2005	6.4	2.5	0.9	2.5	0.0	3.7	1.8		0.0
2006	7.1	1.8	1.0	0.0	0.0	0.8	5.3	1.2	0.9
2007	19.3	0.9	0.3	0.3	0.0	0.9	0.6	0.9	0.0
2008	14.9	2.6	1.1	0.2	0.2	1.1	2.3	1.7	1.0
2009	14.2	1.3	1.6	1.1	0.6	2.5	3.1	-[6]	
2010	0.0	2.0		0.4		1.8			
Mean									
(5-year)	12.4	1.8	0.8	0.8	0.3	1.8	2.3	1.3	0.5
(10-year)	9.4	2.6	1.0	1.4	0.5	4.0	1.9	5.1	0.7

[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.
[8] France data based on retruns to freshwater

Table 3.3.6.1 (continued). Estimated survival of wild smolts (%) to return to homewaters (prior to coastal fisheries) for various monitored rivers in the Northeast Atlantic area.

Smolt	UK (Scotland)[2]		UK (NI)[7]	UK (E & W)						France[8]			
migration	North Esk		R. Bush	R. Dee		R. Tamar		R. Frome		Nivelle[5]	Scorff	Oir	Bresle
year	1SW	MSW	1SW[3]	1SW	MSW	1SW	MSW	1SW	MSW	All ages	All ages	All ages	All ages
1975													
1980													
1981	8.2	3.8											
1982	11.2	5.0											
1983													
1984	6.0	4.0											
1985	13.6	5.4											
1986			31.3										
1987	10.4	3.9	35.1										
1988			36.2										
1989	6.6	4.2	25.0										
1990	6.0	3.1	34.7										
1991	7.6	3.1	27.8										
1992	10.9	6.5	29.0							6.83		5.30	
1993	14.5	6.1		6.3	2.5					4.80		17.00	5.80
1994	10.9	3.6	27.1	1.3	1.2					5.37		3.54	3.60
1995	8.4	3.8		2.7	0.4					3.77	11.75	4.99	
1996	5.9	2.7	31.0	4.8	2.1					2.42	15.06	4.83	
1997	7.2	4.2	19.8	6.2	3.4					2.09	5.76	14.01	4.70
1998	2.6	1.4	13.4	2.3	3.7					2.27	6.73	6.58	*2.20*
1999	6.8	3.8	16.5	5.0	12.4					2.49	15.93		
2000	6.0	2.8	10.1	2.0	0.9					3.08	10.58	2.38	
2001	4.7	2.9	12.4	4.3	0.0					0.37	6.15	3.68	
2002	2.2	2.0	11.3	2.9	0.7	3.6	1.4	5.6	1.7	0.80	22.62	3.12	
2003			6.8	2.6	0.4	6.1	1.8	4.8	0.9	1.23	12.02	5.70	2.99
2004			6.8	4.5	1.0	6.0	1.5	5.3	2.9	1.07	6.47	4.00	4.43
2005	6.7	2.8	5.9	5.1	0.5	6.4	1.2			0.99	8.50	6.60	3.09
2006	3.3	3.4	14.0	4.3	1.5	3.5	2.4	5.1	2.2	2.59	7.36	5.30	3.48
2007	5.0	4.0		1.3	0.7	3.5	3.4	5.7	1.3	2.14	4.42	4.00	3.47
2008	6.4			2.5	1.3	1.7	0.9	3.1	1.6	2.85	3.03		1.92
2009	9.0	8.7		4.8	1.1	8.2	1.9	7.7	2.6	0.92	6.78		17.5
2010				1.9		3.4		8.6					4.90
Mean													
(5-year)	6.1	3.4		3.6	1.0	4.7	1.9	5.4	2.0	1.9	6.0		5.9
(10-year)	5.4	3.1		3.4	1.9	4.9	1.8	5.3	1.8	1.6	8.8		5.3

[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.
[8] France data based on retruns to freshwater

Table 3.3.6.2. Estimated survival of hatchery smolts (%) to return to homewaters (prior to coastal fisheries) for monitored rivers and experimental facilities in the Northeast Atlantic area.

Smolt migration year	Iceland[1]		Norway[2]						Sweden[2]	
	R. Ranga		R. Halselva		R. Imsa		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1981					10.1	1.3				
1982					4.2	0.6				
1983					1.6	0.1				
1984					3.8	0.4	3.5	3.0	11.8	1.1
1985					5.8	1.3	3.4	1.9	11.8	0.9
1986					4.7	0.8	6.1	2.2	7.9	2.5
1987			1.5	0.4	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	3.3	0.3	2.5	1.1		
2002	0.4		1.4	0.0	4.5	0.8	1.2	0.8		
2003	0.2		0.5	0.3	2.6	0.7	0.3	0.6		
2004	0.6		0.2	0.1	3.6	0.7	0.4	0.4		
2005	1.0		1.2	0.2	2.8	1.2	0.3	0.7		
2006	1.0		0.0	0.1	1.0	1.8	0.1	0.6		
2007	1.9		0.3	0.0	0.5	0.7	0.2	0.1		
2008	2.4		0.1	0.0	1.8	2.1	0.1	0.3		
2009	0.0		0.0	0.0	1.5	3.2	0.0	0.0		
2010	0.5		0.8		2.3		0.0			
Mean										
(5-year)	1.3		0.3		1.5	1.3	0.1	0.4		
(10-year)	0.9		0.7		3.0	1.0	0.6	0.7		

[1] Microtagged.

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

Table 3.3.6.2 (continued). Estimated survival of hatchery smolts (%) to return to homewaters (prior to coastal fisheries) for monitored rivers and experimental facilities in the Northeast Atlantic area.

Smolt migration year	Ireland									UK (N. Ireland)[3]		Iceland
	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	Ranga 1SW
1980	8.6		5.6			8.3	0.9					
1981	2.8		8.1			2.0	1.5					
1982	4.0		11.0			16.3	2.7	0.4				
1983	3.9		4.6				2.8			1.9	8.1	
1984	5.0	10.4	27.1			2.3	5.2		9.4	13.3		
1985	17.8	12.3	31.1			15.7	1.4		8.2	15.4	17.5	
1986	2.1	0.4	9.4			16.4			10.8	2.0	9.7	
1987	4.7	8.4	14.1			8.8			7.0	6.5	19.4	
1988	4.9	9.2	17.2			5.5	4.5		2.9	4.9	6.0	
1989	5.0	1.8	10.5			1.7	6.0		1.2	8.1	23.2	1.6
1990	1.3		11.4	0.2		2.5	0.2	16.1	2.6	5.6	5.6	0.8
1991	4.2	0.3	13.6	6.2		0.8	4.9	4.1	1.3	5.4	8.8	0.0
1992	4.4	1.3	7.4	1.7	4.2		0.9	13.2		6.0	7.8	0.4
1993	2.9	3.4	12.0	6.5	5.4		1.0	14.5		1.1	5.8	0.7
1994	5.2	1.9	14.3	2.7	10.8			7.7		1.6		1.2
1995	3.6	4.1	6.6	1.7	3.5		2.4	2.2		3.1	2.4	1.1
1996	2.9	1.8	5.3	6.7	3.4					2.0	2.3	0.2
1997	6.0	0.4	13.3	5.6	5.3	7.0		4.8	7.7		4.1	0.3
1998	3.1	1.3	4.9	3.1	2.9	4.9	3.3	2.3	2.6	2.3	4.5	0.5
1999	1.0	2.8	8.2	8.2	2.0			4.0	3.3	2.7	5.8	0.4
2000	1.2	3.8	11.8	13.2	5.4	3.55	6.7		4.0	2.8	4.4	0.9
2001	2.0	2.5	9.7	7.4	3.2	1.95	3.4		6.0	1.1	2.2	0.4
2002	1.0	4.1	9.2	4.9	2.0	1.93		5.3	1.9	0.7	3.1	0.4
2003	1.2		6.0	1.5	1.6	4.31			1.0	2.5	1.9	0.2
2004	0.4	1.8	9.4	2.3	1.8	2.23			3.1	0.7	1.9	0.6
2005	0.6	3.4	4.9		1.0	0.96			0.9	1.8	1.7	1.0
2006	0.3	1.3	5.2	1.5	0.0	0.19	0.4	2.9	0.9	2.0	3.8	1.0
2007	0.5	0.8	7.1	3.6				3.6	0.7			1.9
2008		0.2	1.3	1.4		0.05						2.4
2009	0.3	0.2	2.3	1.5		0.07			1.1			0.0
2010	0.4	0.4	2.8	3.6		0.13		2.0	0.9			0.5
Mean												
(5-year)	0.4	1.2	4.2	2.0	0.5	0.3	0.4	3.2	0.9	1.9	2.7	1.3
(10-year)	0.8	2.0	6.7	4.1	2.1	1.7	3.5	3.9	2.2	1.6	2.7	0.9

[1] Return rates to rod fishery with constant effort.
[2] Different release sites
[3] Microtagged.
[4] Delphi fish released at Burrishoole

Table 3.4.1.1. Probability (%) of 1SW and MSW salmon abundance in Northern and Southern NEAC areas being at or above the SERs for different catch options in Faroes for the 2012/2013, 2013/2014, and 2014/2015 fishing seasons.

2012/2013	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	97.6	99.7	80.7	87.2
20	97.5	99.3	80.4	84.9
40	97.4	98.9	80.3	82.3
60	97.3	98.2	80.1	79.5
80	97.2	97.4	79.9	76.6
100	97.1	96.2	79.6	73.7
120	96.9	94.8	79.5	70.8
140	96.8	93.2	79.2	67.9
160	96.7	91.2	79.0	65.0
180	96.5	88.8	78.8	62.1
200	96.3	86.1	78.6	59.2

2013/2014	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	96.4	99.3	83.9	88.5
20	96.2	98.8	83.8	86.5
40	96.1	98.1	83.7	84.3
60	96.0	97.2	83.5	82.2
80	95.8	96.2	83.3	80.0
100	95.7	95.0	83.2	77.7
120	95.5	93.4	83.0	75.4
140	95.4	91.5	82.9	73.1
160	95.2	89.4	82.7	70.7
180	95.0	87.0	82.6	68.3
200	94.9	84.3	82.4	65.9

2014/2015	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	95.2	98.8	84.4	88.5
20	95.0	98.1	84.3	86.7
40	94.9	97.3	84.2	84.8
60	94.7	96.4	84.1	83.0
80	94.6	95.1	84.0	81.1
100	94.4	93.7	83.9	79.1
120	94.3	92.0	83.8	77.1
140	94.0	90.2	83.6	75.1
160	93.9	88.1	83.5	73.0
180	93.7	86.0	83.4	71.1
200	93.5	83.7	83.2	69.0

Table 3.4.1.2. Exploitation rates (%) on 1SW and MSW salmon from the Northern and Southern NEAC areas for different catch options in Faroes for the 2012/2013, 2013/2014, and 2014/2015 fishing seasons.

2012/2013	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	0.0	0.0	0.0	0.0
20	0.4	3.3	0.2	3.1
40	0.7	6.6	0.4	6.1
60	1.1	9.9	0.6	9.2
80	1.5	13.2	0.8	12.2
100	1.9	16.6	1.0	15.3
120	2.2	19.9	1.2	18.4
140	2.6	23.2	1.4	21.4
160	3.0	26.5	1.6	24.5
180	3.3	29.8	1.8	27.6
200	3.7	33.1	2.0	30.6

2013/2014	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	0.0	0.0	0.0	0.0
20	0.3	3.1	0.2	2.6
40	0.7	6.2	0.3	5.2
60	1.0	9.3	0.5	7.8
80	1.4	12.4	0.7	10.4
100	1.7	15.5	0.9	13.0
120	2.1	18.6	1.0	15.6
140	2.4	21.7	1.2	18.2
160	2.8	24.8	1.4	20.8
180	3.1	27.9	1.5	23.4
200	3.5	31.0	1.7	26.0

2014/2015	NEAC-North		NEAC- South	
Catch option (t)	1SW	MSW	1SW	MSW
0	0.0	0.0	0.0	0.0
20	0.3	2.9	0.2	2.3
40	0.7	5.8	0.3	4.6
60	1.0	8.8	0.5	6.9
80	1.3	11.7	0.6	9.2
100	1.6	14.6	0.8	11.5
120	2.0	17.5	0.9	13.8
140	2.3	20.4	1.1	16.1
160	2.6	23.3	1.2	18.4
180	2.9	26.3	1.4	20.7
200	3.3	29.2	1.5	23.0

Table 3.4.1.3. Status of national stocks and compliance with river-specific conservation limits for individual river stocks, before homewater fisheries, within each jurisdiction in the NEAC area in 2011 (except Norway where data are for 2010). NA = not available.

Country	75% chance that returns met or exceeded CLs		Number of rivers	Number with CL	Number assessed for compliance	Number meeting CL	% meeting CL
	1SW	MSW					
Northern NEAC							
Russia	Yes	Yes	112	80	8	7	88
Finland/Norway (Tana/Teno)	Yes	No	1	1	NA	NA	NA
Norway (2010)	Yes	Yes	450	439	192	162	84
Sweden	Yes	Yes	23	17	NA	NA	NA
Iceland (N & E)	Yes	Yes	68	0	NA	NA	NA
Southern NEAC							
France	No	No	28	28	28	11	39
Ireland	No	No	141	141	141	58	41
UK (N. Ireland)	Yes	Yes	15	7	NA	NA	NA
UK (England & Wales)	No	No	78	64	NA	NA	NA
UK (Scotland)	No	Yes	383	0	NA	NA	NA
Iceland (S & W)	Yes	Yes	52	0	NA	NA	NA

Table 3.4.1.4. Attainment of Spawning Escapement Reserve by country for the previous five PFA years. Instances where the probability of meeting SER was less than 75% (failure) are indicated by "X" and summed by stock complex for each PFA year.

	Maturing 1SW					Non-maturing 1SW				
	PFA Year					PFA Year				
Jurisdiction	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010
Russia	√	√	√	√	√	√	√	√	√	√
Finland	X	X	√	√	√	√	√	X	√	X
Norway	√	√	√	√	√	√	√	√	√	√
Sweden	√	√	√	√	√	√	√	√	√	√
Iceland (N & E)	√	√	√	√	√	√	√	√	√	√
France	X	X	X	X	X	X	X	X	X	X
Ireland	X	X	X	X	X	X	√	√	X	X
UK (N. Ireland)	√	√	√	√	√	√	√	√	√	√
UK (England & Wales)	X	X	X	X	X	X	X	X	√	X
UK (Scotland)	√	X	X	√	X	X	√	X	√	√
Iceland (S & W)	√	√	√	√	√	√	√	√	√	√
Number of annual failures										
Northern-NEAC (of 5)	1	1	0	0	0	0	0	1	0	1
Southern-NEAC (of 6)	3	4	4	3	4	4	2	3	2	3

Table 3.5.3.1. Probability that the forecast PFA for 1SW maturing and 1SW non-maturing will be greater than the age specific Spawner Escapement Reserve (SER) for the PFA years 2011 to 2015 for the Southern NEAC complex (upper table) and the Northern NEAC complex (lower table).

Southern NEAC		
	1SW maturing	1SW non-maturing
Spawning Escapement Reserve (SER)	758 477	406 436
PFA Year	Probability PFA greater than or equal to SER	
2011	0.939	0.976
2012	0.869	0.926
2013	0.805	0.873
2014	0.838	0.885
2015	0.844	0.884

Northern NEAC		
	1SW maturing	1SW non-maturing
Spawning Escapement Reserve (SER)	212 986	218 259
PFA Year	Probability PFA greater than or equal to SER	
2011	0.999	1.000
2012	0.988	0.999
2013	0.976	0.997
2014	0.964	0.993
2015	0.952	0.988

Table 3.6.4.1. Catch in weight (t) and numbers, mean weights and mean age on catch in the 1983/1984 to 1995/1996 fishing seasons.

	Season	Catch (t)	Catch (number)	Mean wt (kg)	Mean sea age
Commercial fishery	**1983/84**	651	124509	5.23	2.07
	1984/85	598	135777	4.40	2.07
	1985/86	545	154554	3.53	2.02
	1986/87	539	140304	3.84	2.05
	1987/88	208	65011	3.20	1.96
	1988/89	309	93496	3.30	2.04
	1989/90	364	111515	3.26	2.04
	1990/91	202	57441	3.52	2.07
Research fishery	**1991/92**	31	8464	3.66	2.09
	1992/93	22	5415	4.06	2.14
	1993/94	7	2072	3.38	2.03
	1994/95	6	1963	3.06	1.98
	1995/96	1	282	3.55	

Table 3.6.4.2. Catch in numbers and percentages by sea age and mean age in the Faroes salmon fishery in the 1983/1984 to 1994/1995 seasons.

Fishery	Season	1SW	2SW	3SW	MSW	%1SW	%2SW	%3SW	Mean Age
Commercial fishery	1983/84	5142	135718	16401	152178	3.3%	86.3%	10.4%	2.07
	1984/85	381	138375	11358	149733	0.3%	92.2%	7.6%	2.07
	1985/86	2021	169461	5671	175219	1.1%	95.7%	3.2%	2.02
	1986/87	71	124628	6621	131324	0.1%	94.9%	5.0%	2.05
	1987/88	5833	55726	3450	59176	9.0%	85.7%	5.3%	1.96
	1988/89	1351	110717	5728	116445	1.1%	94.0%	4.9%	2.04
	1989/90	2155	102800	6473	109273	1.9%	92.3%	5.8%	2.04
	1990/91	632	52419	4390	56809	1.1%	91.3%	7.6%	2.07
Research fishery	1991/92	248	4686	743	5429	4.4%	82.5%	13.1%	2.09
	1992/93	521	2646	1120	3766	12.2%	61.7%	26.1%	2.14
	1993/94	320	1288	376	1664	16.1%	64.9%	19.0%	2.03
	1994/95	206	1585	166	1751	10.5%	81.0%	8.5%	1.98
	Totals	18881	900049	62497	962767	1.9%	91.7%	6.4%	2.04

1991/92 to 1994/95 include discards and exclude reared fish.

Table 3.6.4.3. Estimation of discard rates in the Faroes fishery in the 1982/1983 to 1994/1995 fishing seasons.

	Season	Number of samples	Number sampled	Number < 60 cm TL	Discard rate (%)	Range %
Commercial fishery	**1982/83**	7	6820	472	6.9%	0.0% - 10.4%
	1983/84	5	4467	176	3.9%	-
	1984/85	12	9546	1289	13.5%	3.0% - 32.0%
	1985/86	7	14654	286	2.0%	0.6% - 13.8%
	1986/87	13	39758	2849	7.2%	0.0% - 71.3%
	1987/88	2	1499	235	15.7%	-
	1988/89	9	17235	1804	10.5%	0.4% - 31.9%
	1989/90	5	16375	1533	9.4%	3.6% - 18.5%
	1990/91	3	4615	681	14.8%	9.9% - 17.5%
Research fishery	**1991/92**	6	9350	825	8.8%	2.4% - 15.9%
	1992/93	3	9099	853	9.4%	5.1% - 32.3%
	1993/94	4	3035	436	14.4%	1.5% - 48.6%
	1994/95	5	4187	634	15.1%	5.0% - 39.7%

* Proprtion wild has been assessed for catches by calendar year.

Table 3.6.4.4. Percentages of farm escapees observed in catch samples taken in the Faroes fishery (1981/1982 to 1995/1996) and the Norwegian coastal fisheries (1989 to 2008).

Year	Norway coastal fisheries	Season	Faroes fishery (ICES 1996)
1981		1981/82	2
1982		1982/83	2
1983		1983/84	1
1984		1984/85	4
1985		1985/86	7
1986		1986/87	4
1987		1987/88	1
1988		1988/89	8
1989	45	1989/90	17
1990	48	1990/91	43
1991	49	1991/92	42
1992	44	1992/93	37
1993	47	1993/94	27
1994	34	1995/95	17
1995	42	1995/96	19
1996	54		
1997	47		
1998	45		
1999	35		
2000	31		
2001	27		
2002	33		
2003	21		
2004	27		
2005	23		
2006	33		
2007	32		
2008	26		

Table 3.6.4.5. Additional parameter values used in the example catalog advice for the Faroes fishery.

Minimum TAC option (t)	0
Maximum TAC option (t)	200
TAC steps (t)	20
Faroes share allocation	0.084
TAC in current year (t)	0
Proportion of 1SW salmon not maturing	0.22
Mortality of discards	0.8
Monthly rate of natural mortality	0.03

Table 3.7.1.1. Comparison of Conservation Limits estimates derived from the "Crystal Ball" (CB) and "R" based run reconstruction models for the Northern NEAC complex.

Country	Region	CB model	R model	% difference
1SW maturing (1SW)				
Russia		108 122	67 428	-37.6%
	Pechora River	349	349	0.0%
	Archangelsk & Karelia	4 585	4 690	2.3%
	Kola Peninsula; Barents Sea Basin	21 010	20 029	-4.7%
	Kola peninsula; White Sea Basin	42 481	42 360	-0.3%
Finland		13 612	13 810	1.5%
Norway[1]		67 323		NA
Sweden		1291	1558	20.6%
Iceland	North & East	6 426	6 784	5.6%
1SW non-maturing (MSW)				
Russia		44 521	40 282	-9.5%
	Pechora River	8 189	8 860	8.2%
	Archangelsk & Karelia	14 024	14 109	0.6%
	Kola Peninsula; Barents Sea Basin	7 128	7 088	-0.6%
	Kola peninsula; White Sea Basin	10 449	10 225	-2.1%
Finland		15 656	16 625	6.2%
Norway[1]		70 619		NA
Sweden		1298	1229	-5.3%
Iceland	North & East	1603	1556	-2.9%

[1] countries where river-specific Conservation Limits have been derived and are not estimated by run reconstruction.

Table 3.7.1.2. Comparison of Conservation Limits estimates derived from the "Crystal Ball" (CB) and "R" based run reconstruction models for the Southern NEAC complex.

Country	Region	CB model	R model	% difference
1SW maturing (1SW)				
France [1]		17 400		NA
Ireland [1]		236 044		NA
UK (N. Ireland)		19 324	19 022	-1.6%
	FCB area	6 082	5 869	-3.5%
	Foyle Fisheries area	13 198	13 153	-0.3%
UK (England & Wales) [1]		54 491		NA
UK (Scotland)		264 274	252 225	-4.6%
	East	172 359	172 030	-0.2%
	West	80 038	80 194	0.2%
Iceland	South & West	20 214	20 228	0.1%
1SW non- maturing (MSW)				
France [1]		5 100		NA
Ireland [1]		15 334		NA
UK (N. Ireland)		1670	1777	6.4%
	FCB area	557	546	-2.0%
	Foyle Fisheries area	1239	1231	-0.6%
UK (England & Wales) [1]		29 605		NA
UK (Scotland)		209 778	188 231	-10.3%
	East	126 002	125 336	-0.5%
	West	63 236	62 895	-0.5%
Iceland	South & West	1258	1299	3.3%

[1] countries where river-specific Conservation Limits have been derived and are not estimated by run reconstruction.

Table 3.7.2.1. Revised estimation of composition (proportion) of catch at Faroes by complex and country/region.

Complex	Country	Maturing 1SW	Non-maturing 1SW
Northern NEAC	Russia	0.116	0.163
	Finland	0.059	0.050
	Norway	0.290	0.295
	Sweden	0.019	0.016
	Iceland-NE	0.016	0.011
	Subtotal	0.500	0.535
Southern NEAC	France	0.018	0.005
	Ireland	0.173	0.043
	UK(N.Ireland)	0.046	0.014
	UK(England & Wales)	0.044	0.034
	UK(Scotland)	0.195	0.337
	Iceland-SW	0.025	0.007
	Subtotal	0.500	0.440
Other	Canada, Spain, Denmark	0.000	0.2060
Total		1.000	1.000

Table 3.8.2.1. Candidate indicator data examined and results of the analyses of suitability of indicator data for inclusion in the Framework of Indicators (FWI) for the Northern NEAC complex.

Northern NEAC Stock Complex Indicators					
Candidate indicator dataset	N	R2	Significant (p<= 0.05)	R2 > 0.2	Comment
1SW					
Returns all 1SW Norway (PFA)	23	0.92	significant	yes	
Survival W 1SW Imsa Norway	29	0.42	significant	yes	
Counts all Nausta Norway	14	0.39	significant	yes	
Counts all Øyensåa Norway	13	0.34	significant	yes	
Survival H 1SW Imsa Norway	28	0.26	significant	yes	
Catch all 1SW Finland	28	0.12	not significant	no	
Counts 1SW Tuloma Russia	26	0.06	not significant	no	
MSW					
PFA MSW Coast Norway	23	0.72	significant	yes	
Survival H 2SW Drammen Norway	25	0.59	significant	yes	No data collected after 2010
Counts all Orkla Norway	17	0.58	significant	yes	
Counts all Nausta Norway	14	0.37	significant	yes	
Counts all Målselv Norway	21	0.23	significant	yes	
Counts MSW Tuloma Russia	25	0.08	not significant	no	
Catch W 2SW Finland	25	0.04	not significant	no	

Table 3.8.2.2. Candidate indicator data examined and results of the analyses of suitability of indicator data for inclusion in the Framework of Indicators (FWI) for the Southern NEAC complex.

Southern NEAC Stock Complex Indicators					
Candidate indicator dataset	N	R2	Significant (p<= 0.05)	R2 > 0.2	Comment
1SW					
Ret. W 1SW Bush UK(N.I.)	18	0.61	significant	yes	
Ret. W 1SW North Esk UK(Sc.)	31	0.52	significant	yes	
Ret. W 1SW Itchen UK(E&W)	24	0.34	significant	yes	
Ret. W 1SW Frome UK(E&W)	39	0.30	significant	yes	
Ret. Freshw 1SW Bush UK(N.I.)	37	0.23	significant	yes	
Survey coast 1SW Dee UK(E&W)	18	0.18	not significant	no	
Ret. W 1SW Test UK(E&W)	23	0.14	not significant	no	
Ret. W 1SW Dee UK(E&W)	20	0.13	not significant	no	
Ret. W 1SW Tamar UK(E&W)	15	0.06	not significant	no	
Count 1SW Lune UK(E&W)	15	0.01	not significant	no	
Count 1SW Fowey UK(E&W)	15	0.01	not significant	no	
MSW					
Ret. W MSWItchen UK(E&W)	24	0.70	significant	yes	
Ret. W 1SW Bush UK(N.I.)	18	0.68	significant	yes	
Catch W MSW Ellidaar Iceland	40	0.55	significant	yes	
Ret. W 2SW Baddoch UK(Sc.)	24	0.45	significant	yes	
Ret. W MSW Frome UK(E&W)	39	0.44	significant	yes	
Ret. W 1SW Tamar UK(E&W)	14	0.43	significant	yes	
Ret. W 1SW Frome UK(E&W)	38	0.37	significant	yes	
Ret. W 1SW North Esk UK(Sc.)	30	0.36	significant	yes	
Count MSW Lune UK(E&W)	15	0.34	significant	yes	
Ret. W 1SW Itchen UK(E&W)	23	0.25	significant	yes	
Ret. Freshw 2SW Bush UK(N.I.)	36	0.25	significant	yes	
Count MSW Fowey UK(E&W)	15	0.23	not significant	yes	
Ret. W 2SW North Esk UK(Sc.)	31	0.20	significant	yes	
Ret. W 2SW Girnoch UK(Sc.)	40	0.20	significant	no	
Ret. W MSW Test UK(E&W)	23	0.16	not significant	no	
Count 1SW Fowey UK(E&W)	14	0.12	not significant	no	
Ret. W 1SW Dee UK(E&W)	19	0.10	not significant	no	
Ret. W All West water UK(Sc.)	21	0.10	not significant	no	
Ret. W 1SW Test UK(E&W)	23	0.07	not significant	no	
Survey coast 1SW Dee UK(E&W)	17	0.04	not significant	no	
Ret. W All West water UK(Sc.)	21	0.04	not significant	no	
Ret. W MSW Dee UK(E&W)	20	0.01	not significant	no	
Ret. W MSW Tamar UK(E&W)	15	0.00	not significant	no	
Count 1SW Lune UK(E&W)	14	0.00	not significant	no	
Survival coast MSW Dee UK(E&W)	17	0.00	not significant	no	

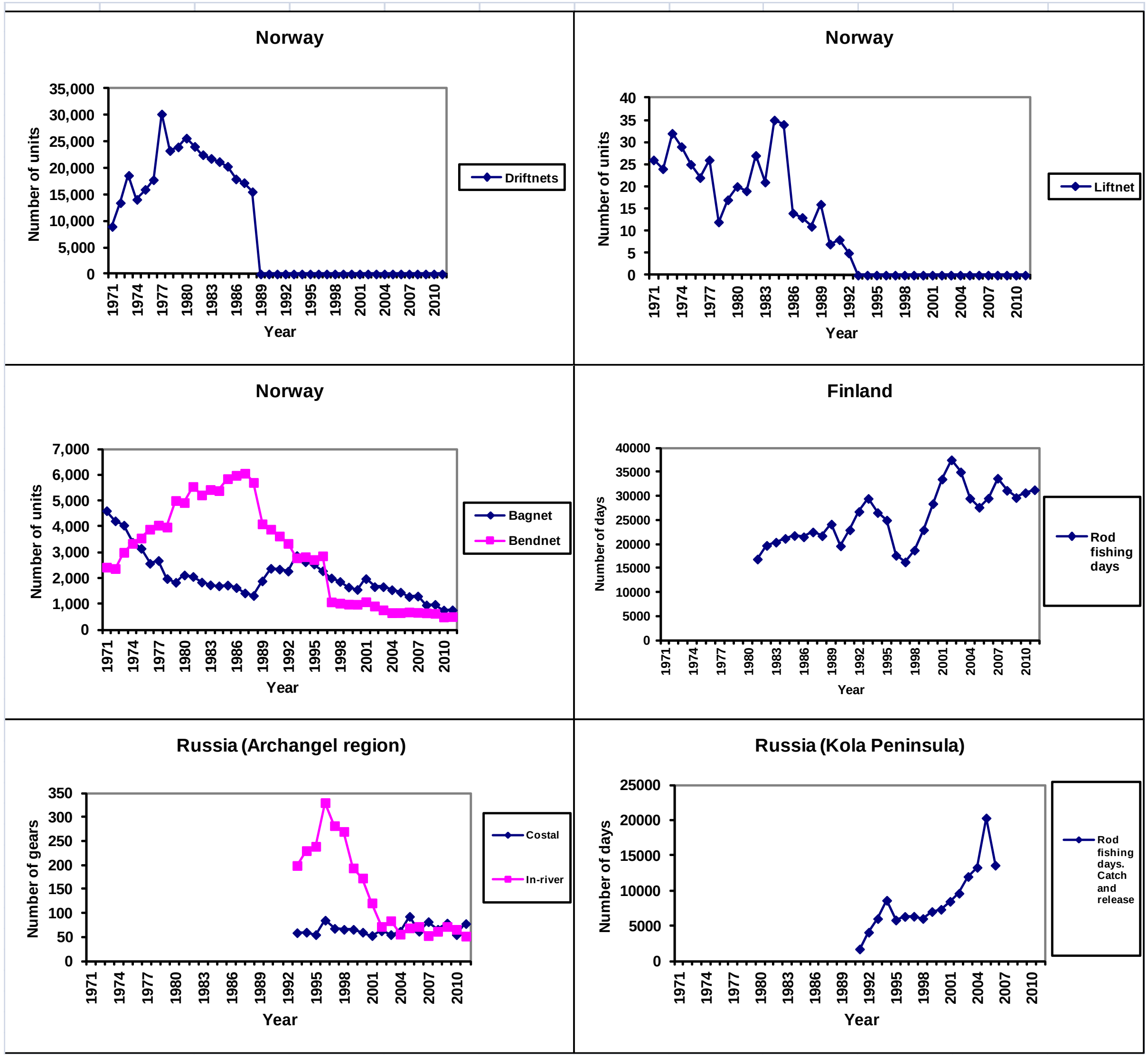


Figure 3.1.3.1. Overview of effort as reported for various fisheries and countries 1971 to 2011 in the Northern NEAC area.

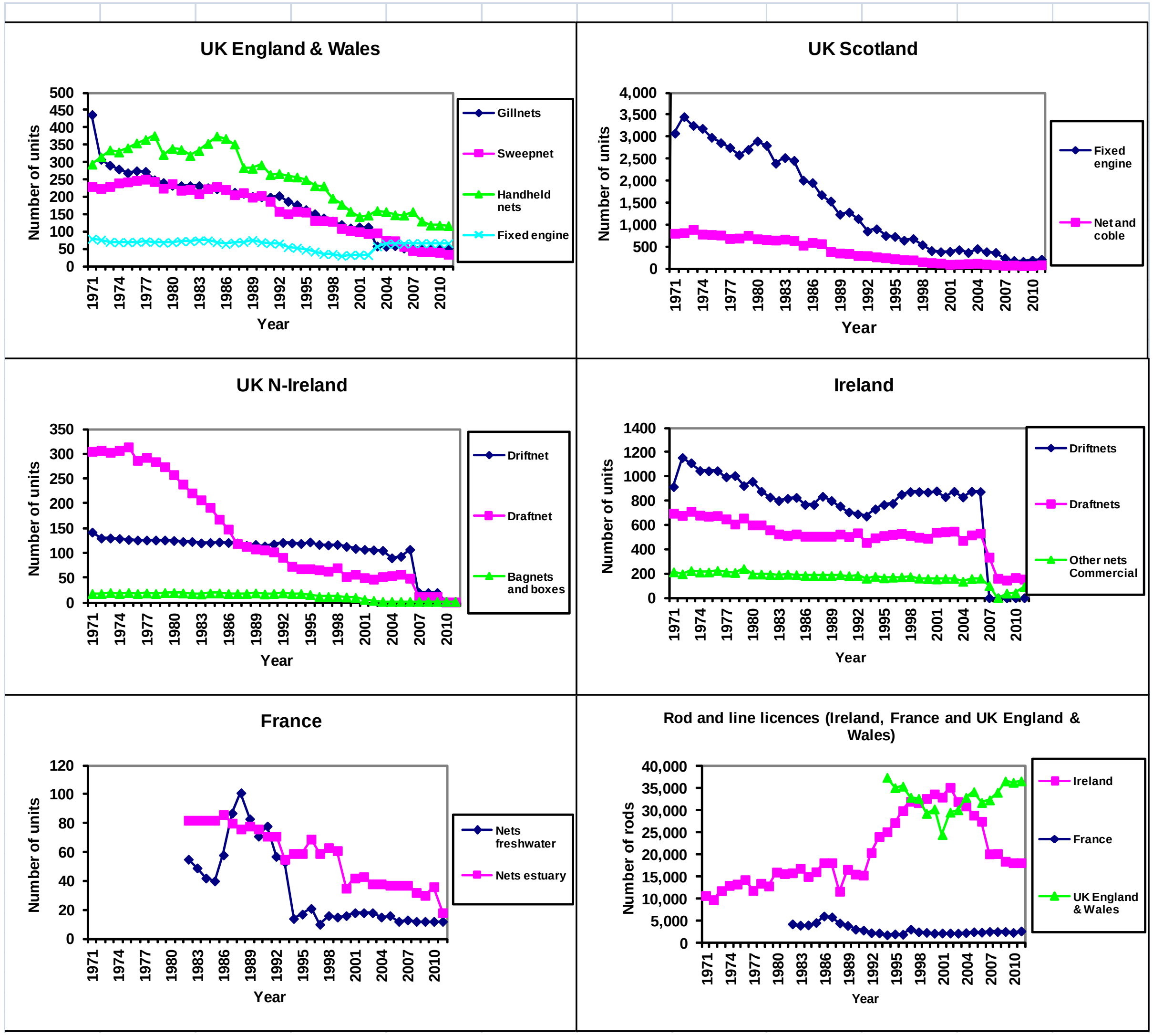


Figure 3.1.3.2. Overview of effort as reported for various fisheries and countries 1971 to 2011 in the Southern NEAC area.

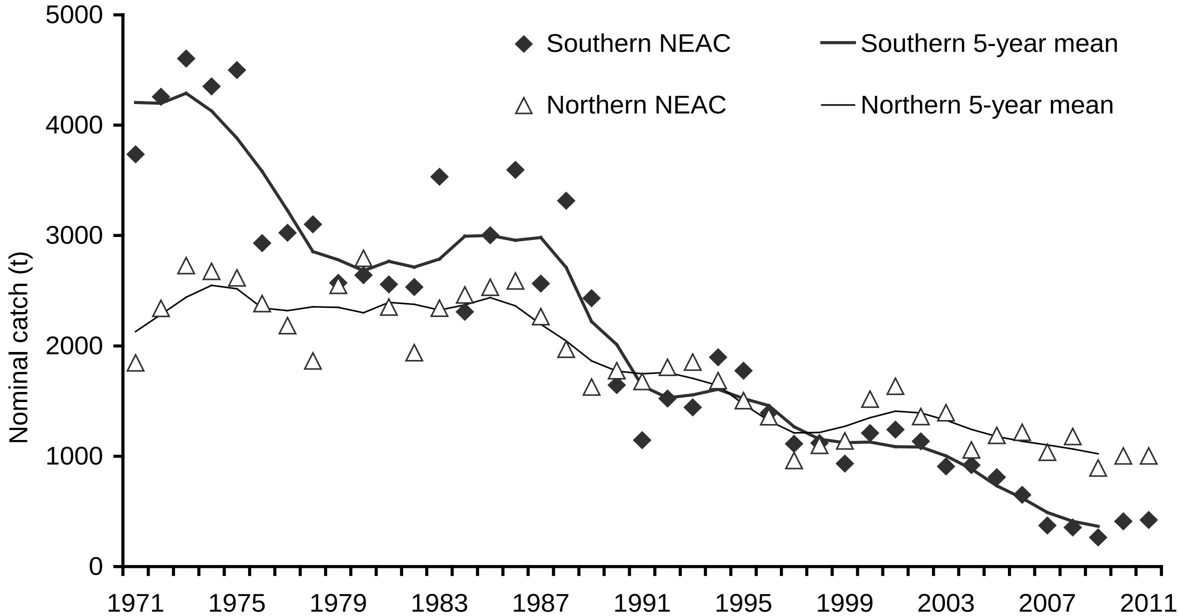


Figure 3.1.4.1. Nominal catch of salmon and 5-year running means in the Southern NEAC and Northern NEAC areas, 1971 to 2011.

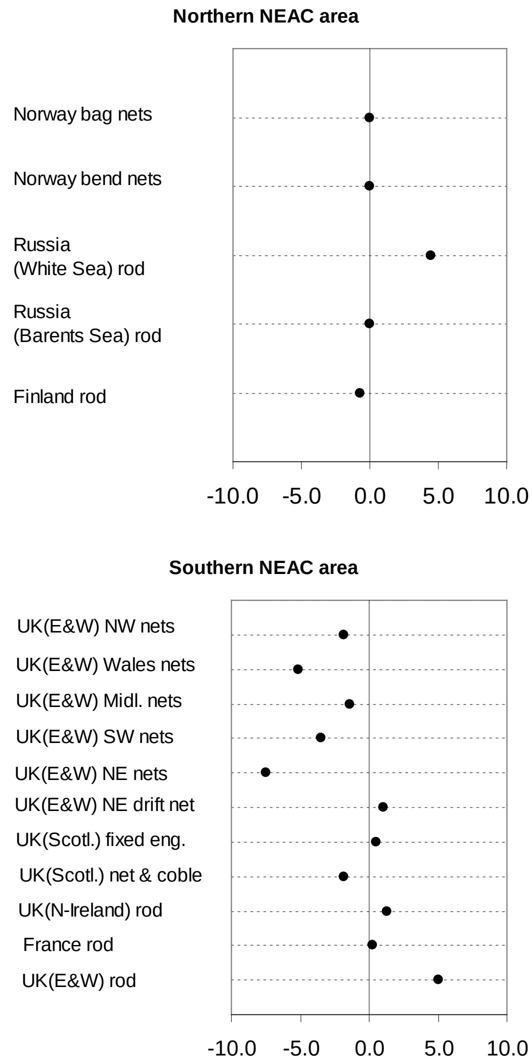


Figure 3.1.5.1. Proportional change (%) over years (for the length of each available time-series) in CPUE estimates in various rod and net fisheries in Northern NEAC and Southern NEAC areas.

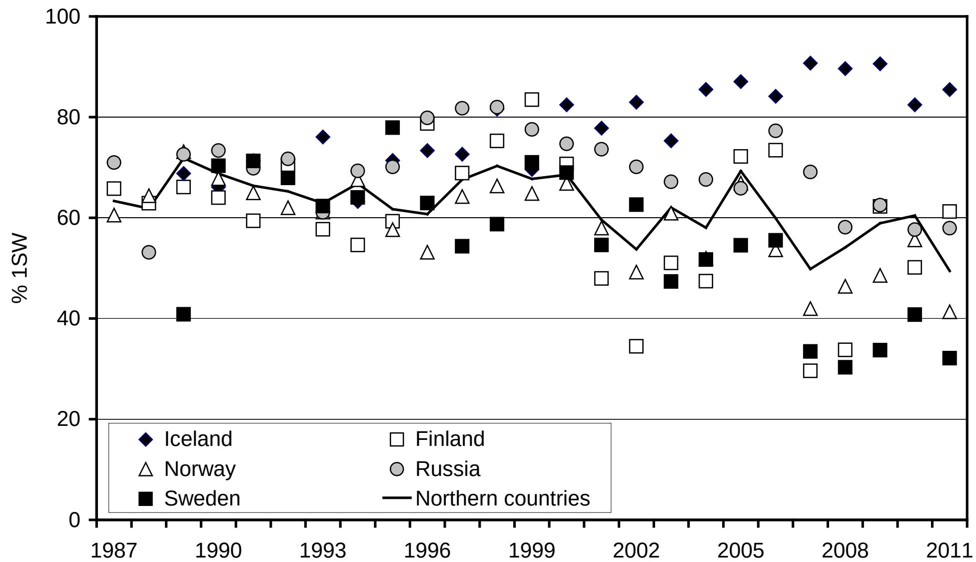


Figure 3.1.6.1. Percentage of 1SW salmon in the reported catch for Northern NEAC countries, 1987 to 2011. Solid line denotes mean value from catches in all Northern NEAC countries.

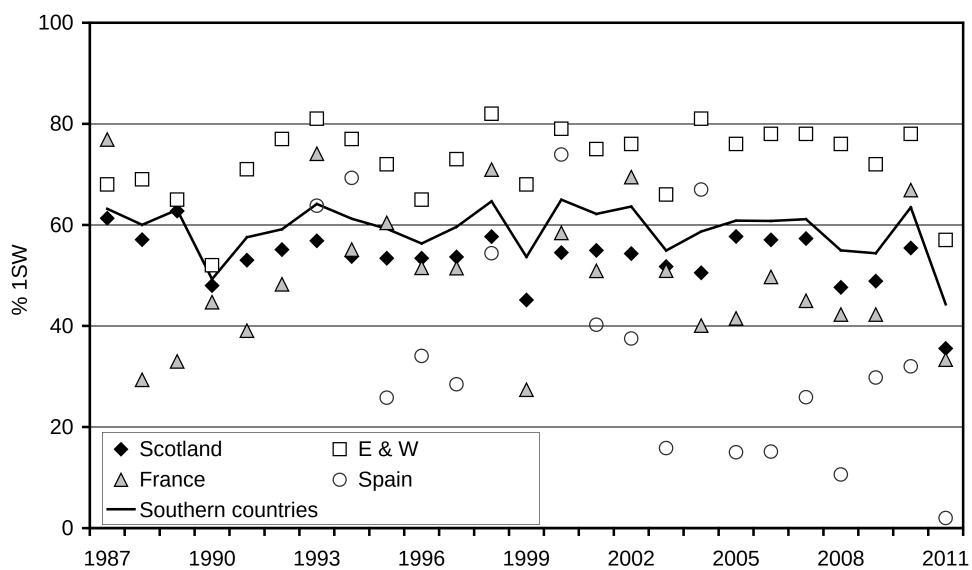


Figure 3.1.6.2. Percentage of 1SW salmon in the reported catch for Southern NEAC countries, 1987 to 2011. Solid line denotes mean value from catches in all Southern NEAC countries.

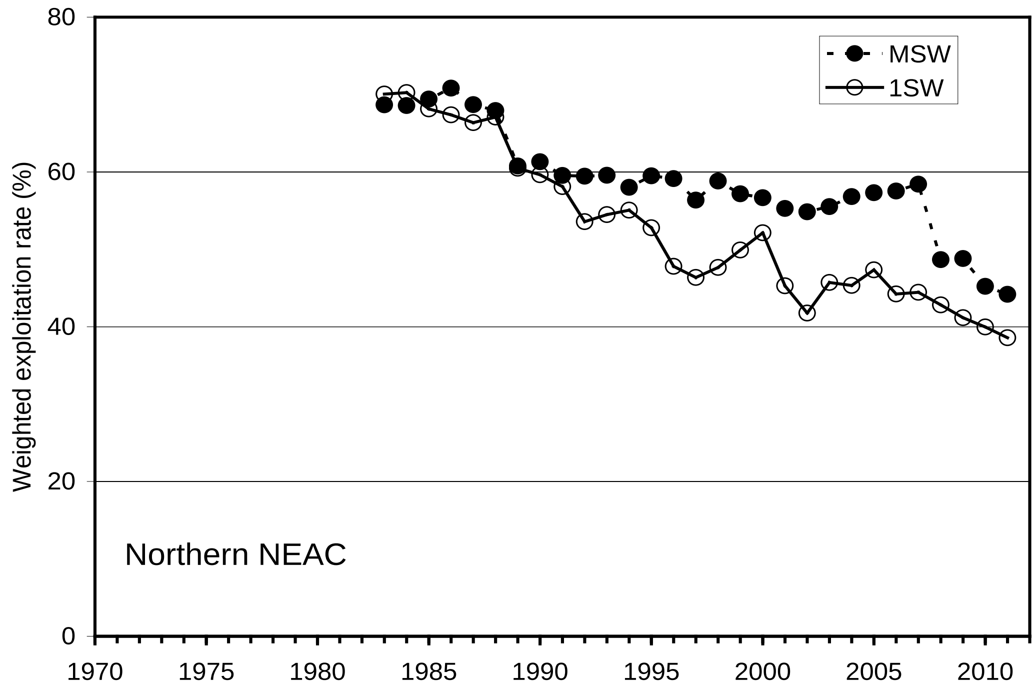


Figure 3.1.9.1. Mean annual exploitation rate (%) of wild 1SW and MSW salmon by commercial and recreational fisheries in Northern NEAC countries from 1983 to 2011.

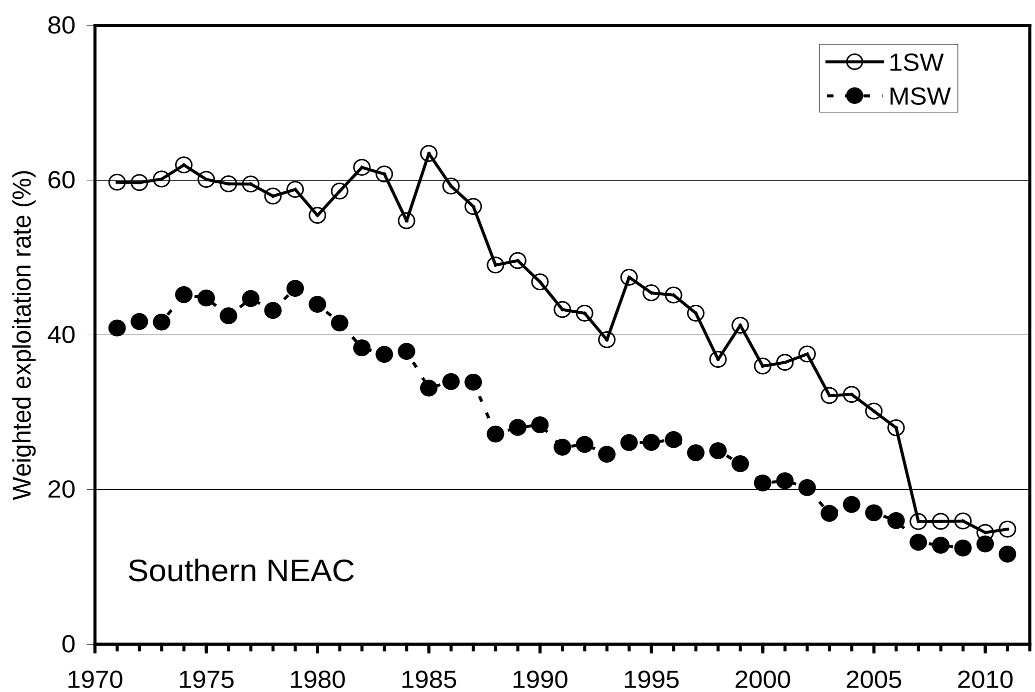


Figure 3.1.9.2. Mean annual exploitation rate (%) of wild 1SW and MSW salmon by commercial and recreational fisheries in the Southern NEAC countries from 1971 to 2011.

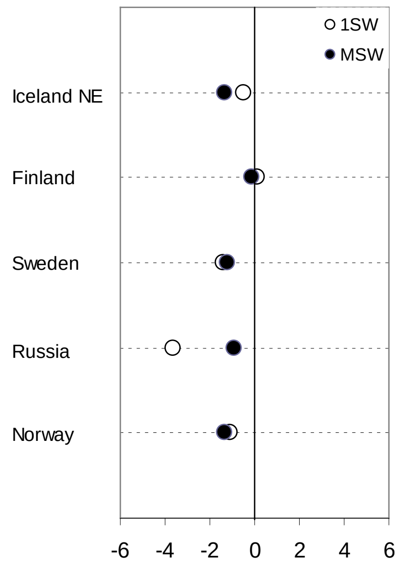


Figure 3.1.9.3. The rate of change (%) per year of exploitation rates of 1SW and MSW salmon in Northern NEAC (left) and Southern NEAC (right) countries.

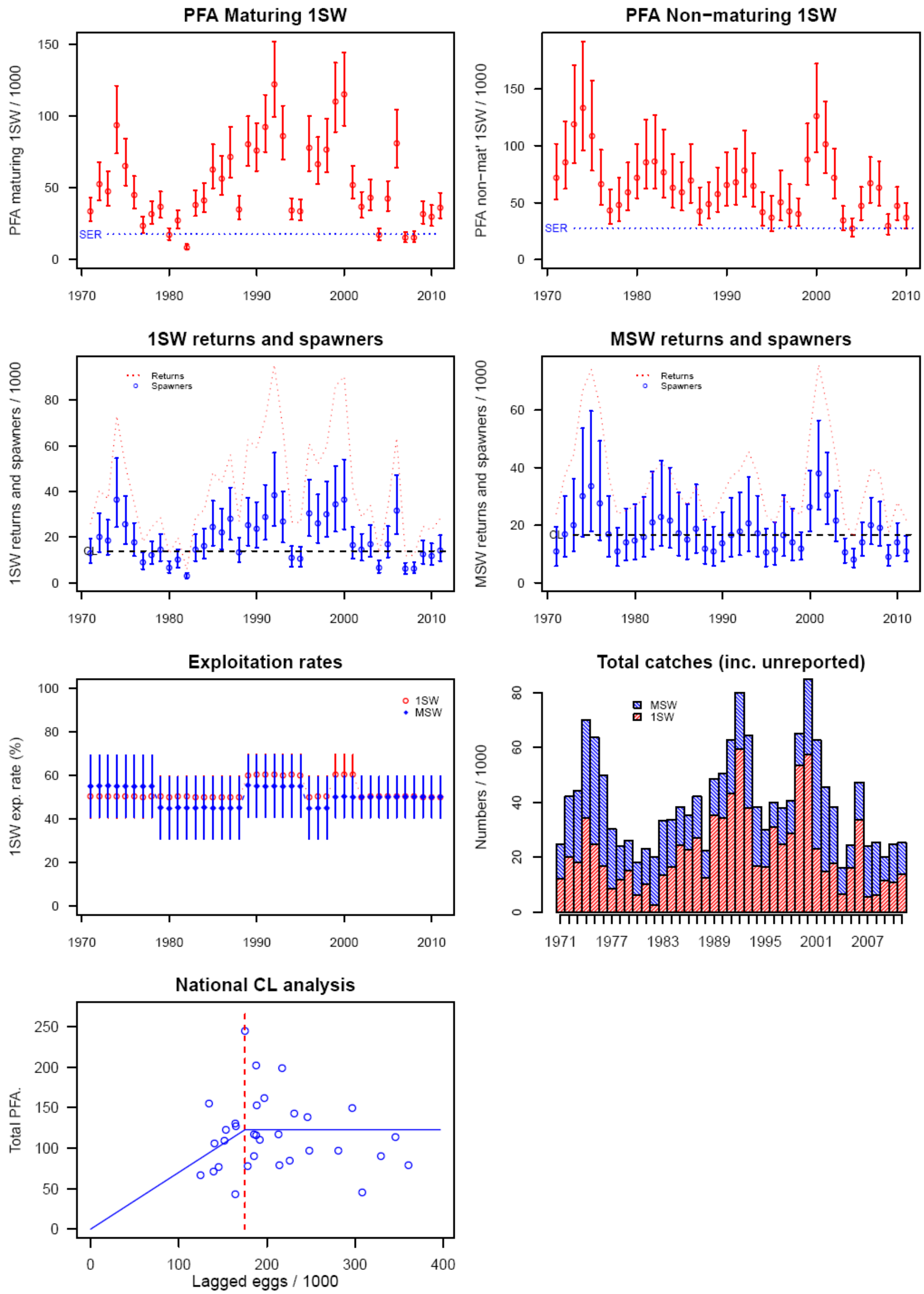


Figure 3.3.3.1a. Summary of fisheries and stock description, R. Tana/Teno (Finland and Norway combined).

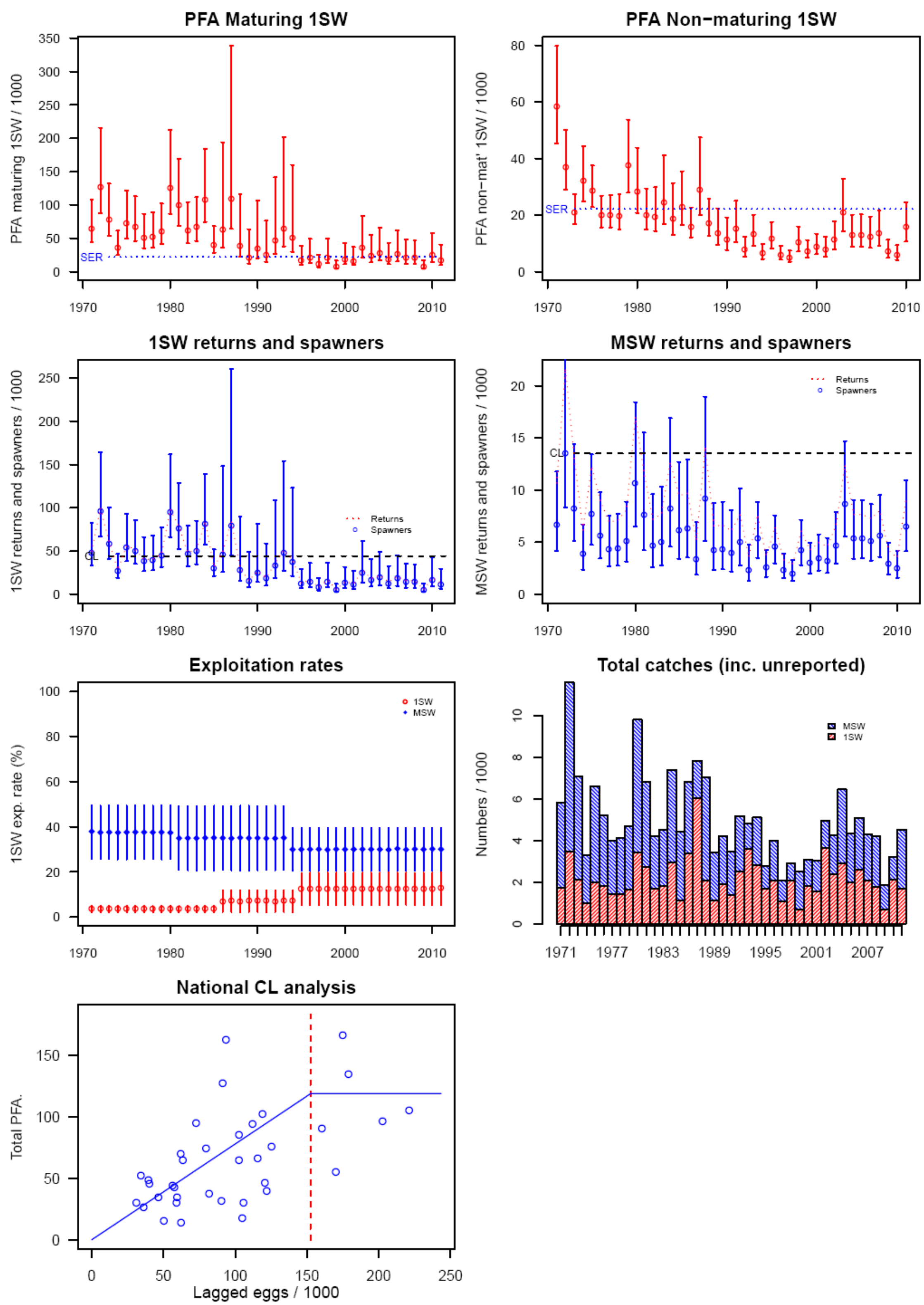


Figure 3.3.3.1b. Summary of fisheries and stock description, France.

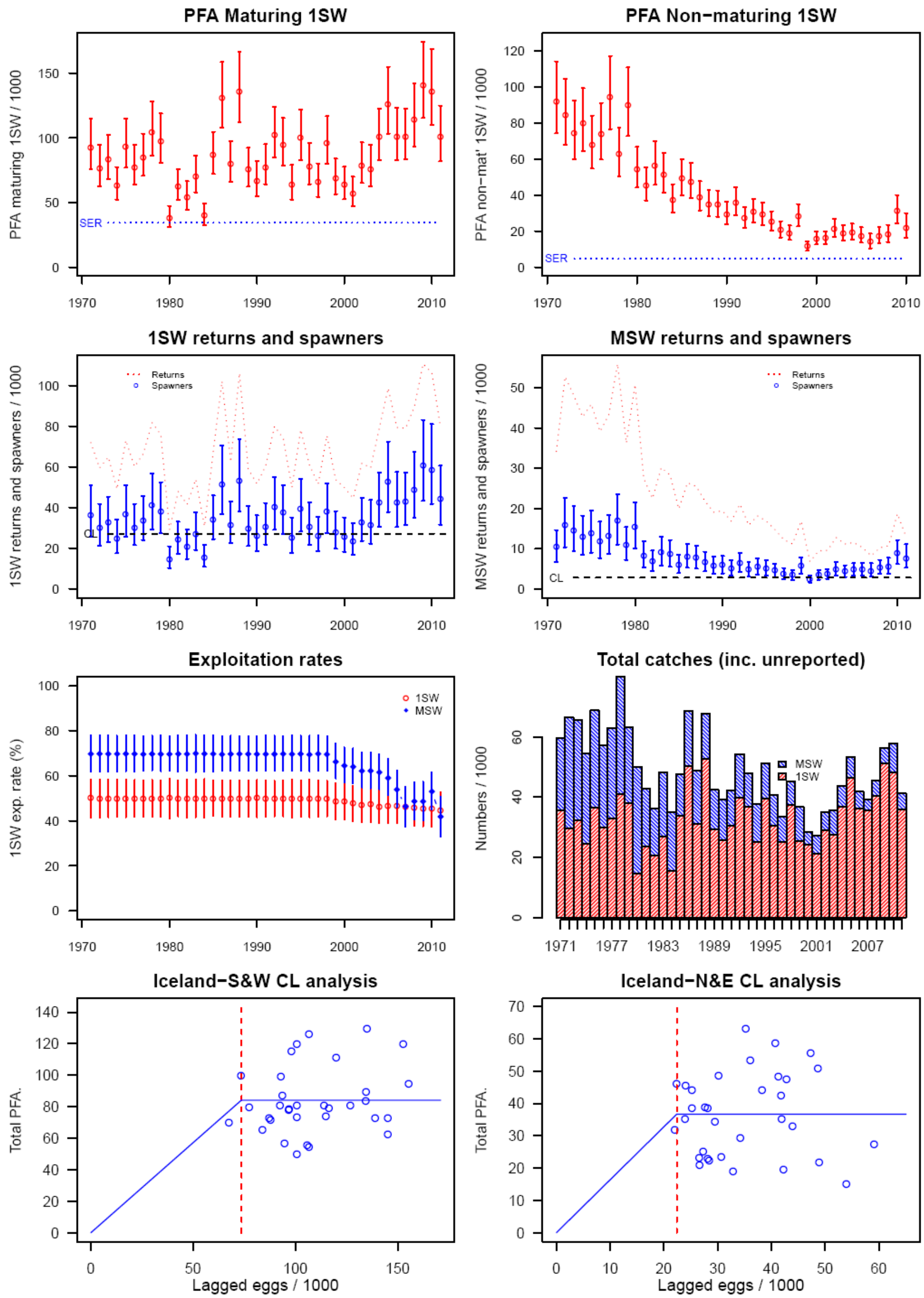


Figure 3.3.3.1c. Summary of fisheries and stock description, Iceland.

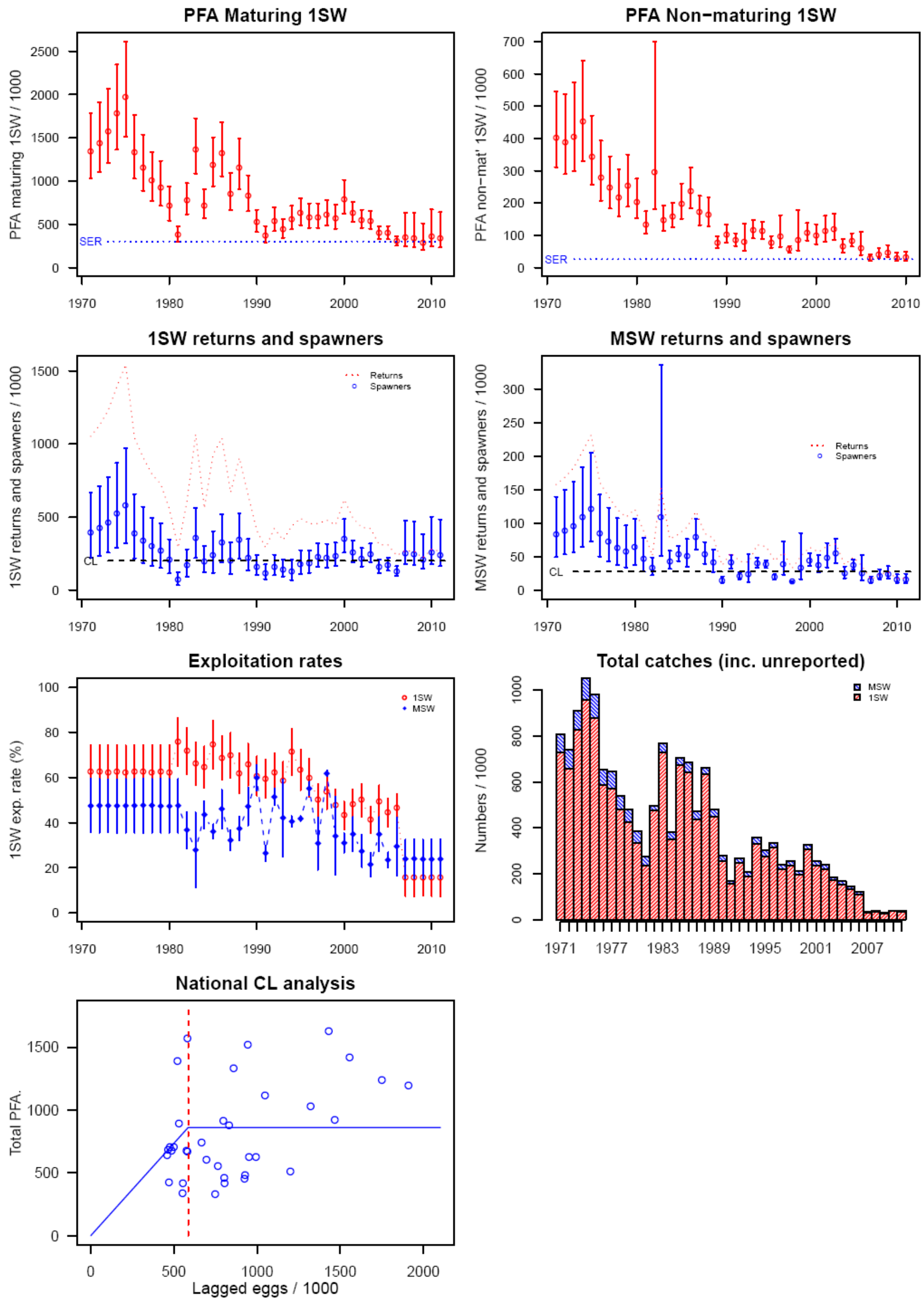


Figure 3.3.3.1d. Summary of fisheries and stock description, Ireland.

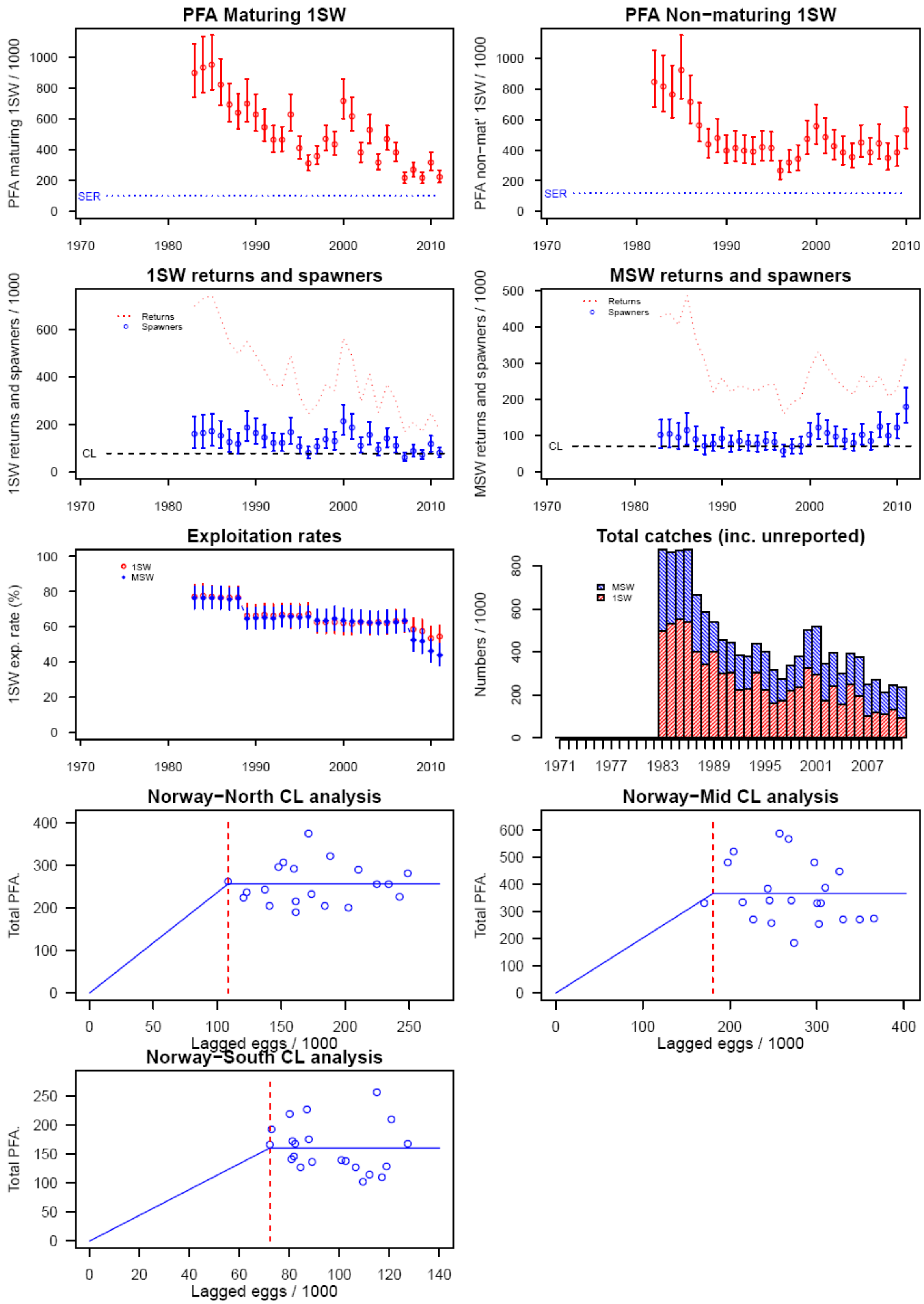


Figure 3.3.3.1e. Summary of fisheries and stock description, Norway (minus Norwegian catches from the R. Teno).

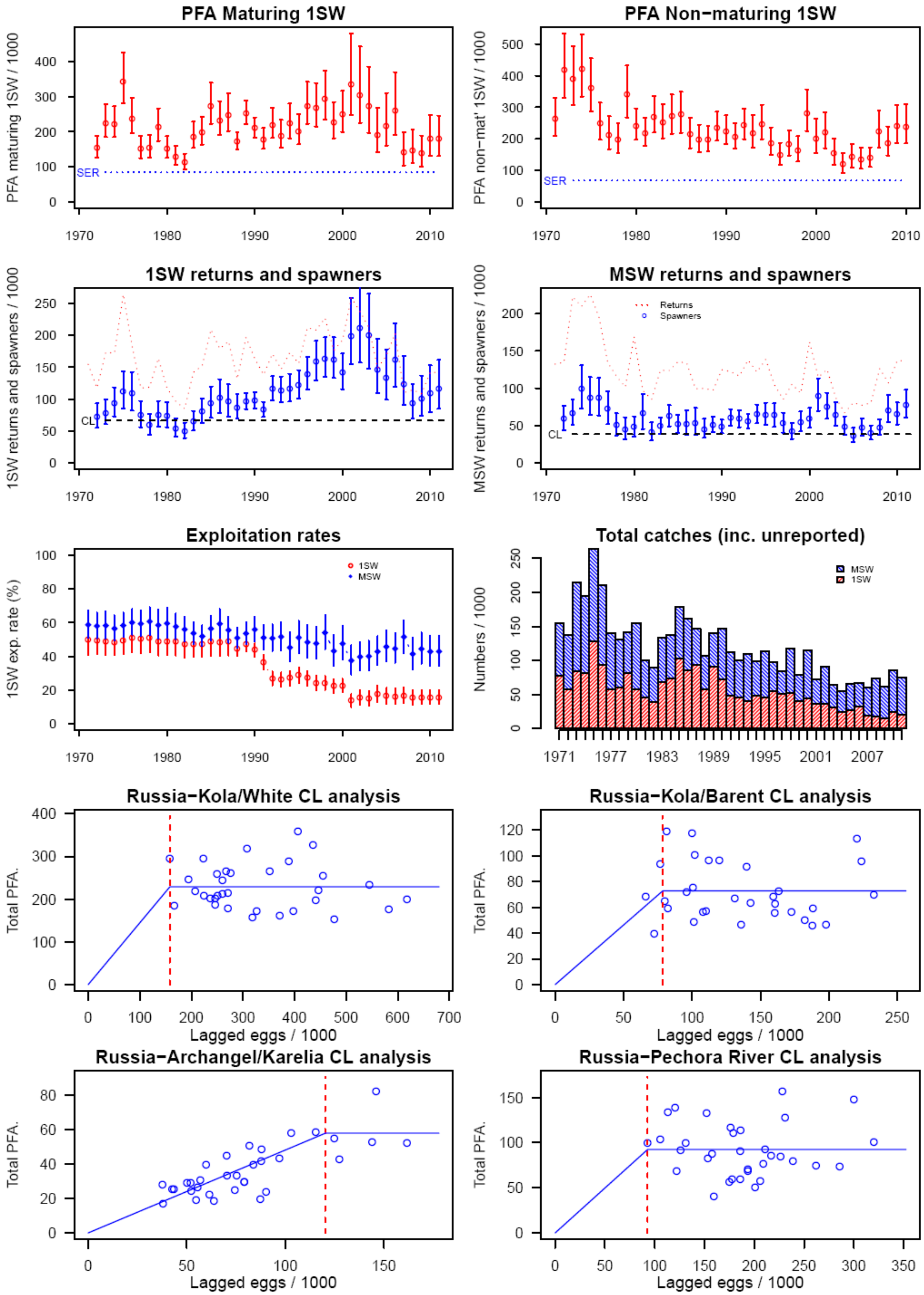


Figure 3.3.3.1f. Summary of fisheries and stock description, Russia.

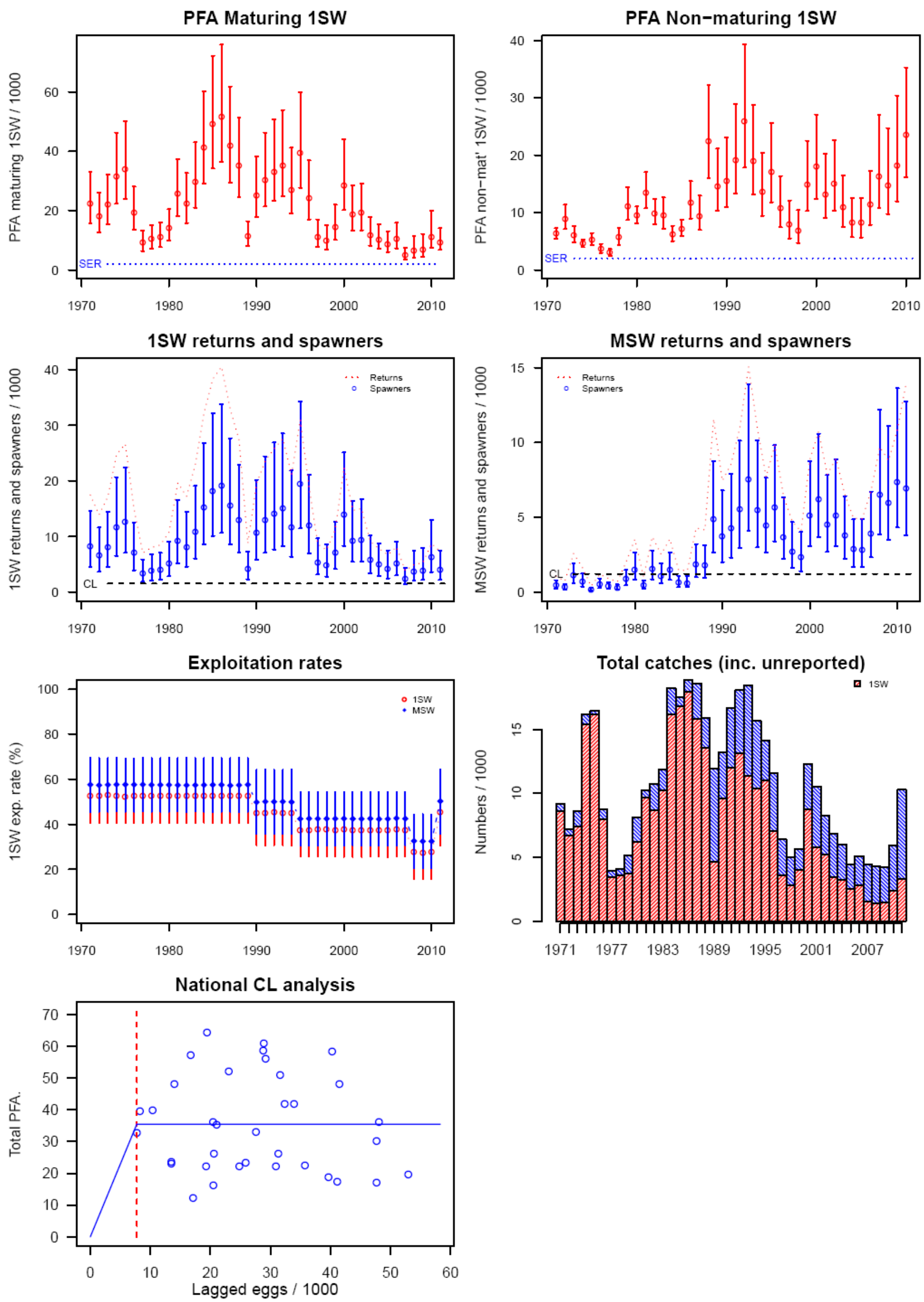


Figure 3.3.3.1g. Summary of fisheries and stock description, Sweden.

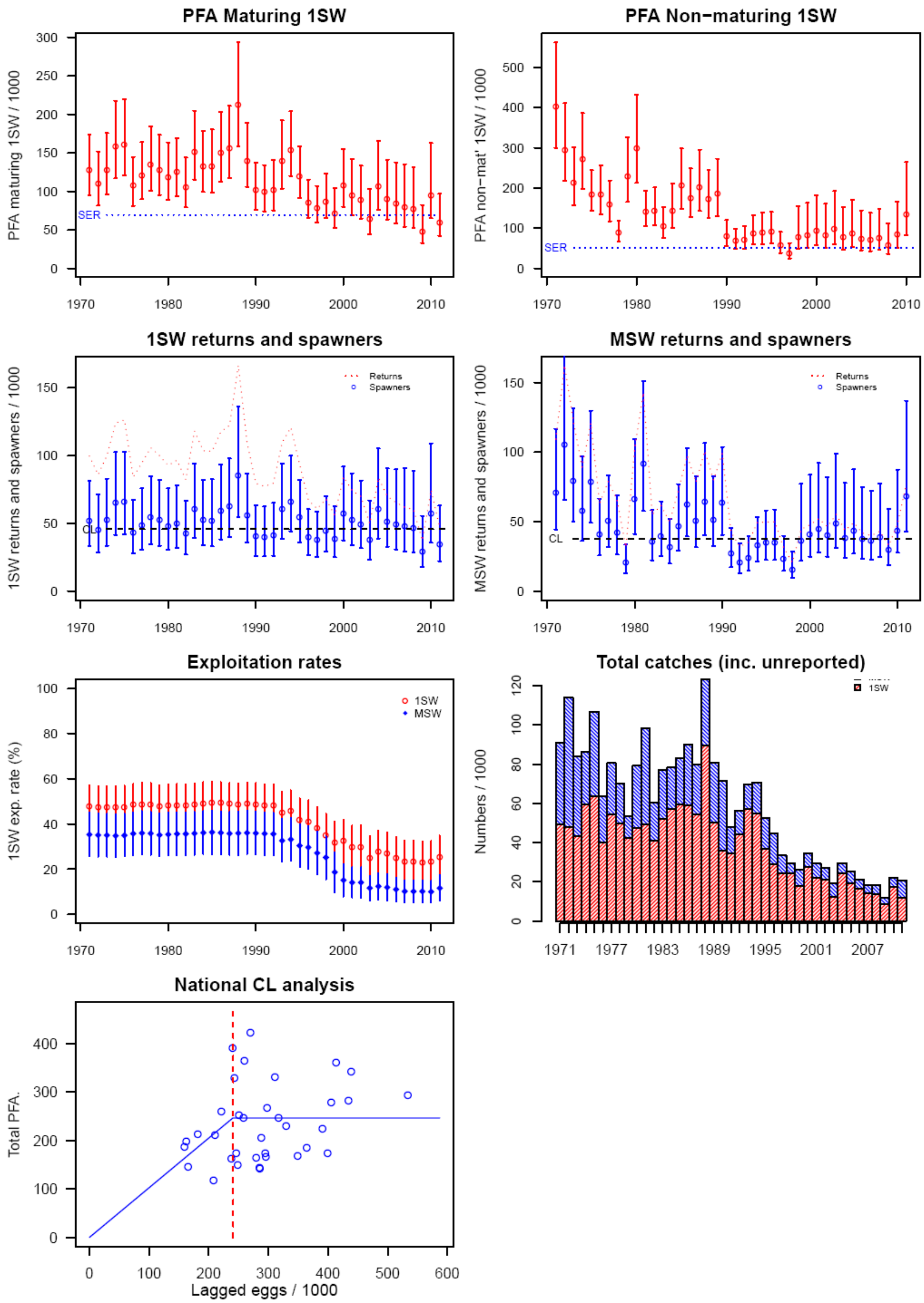


Figure 3.3.3.1h. Summary of fisheries and stock description, UK (England & Wales).

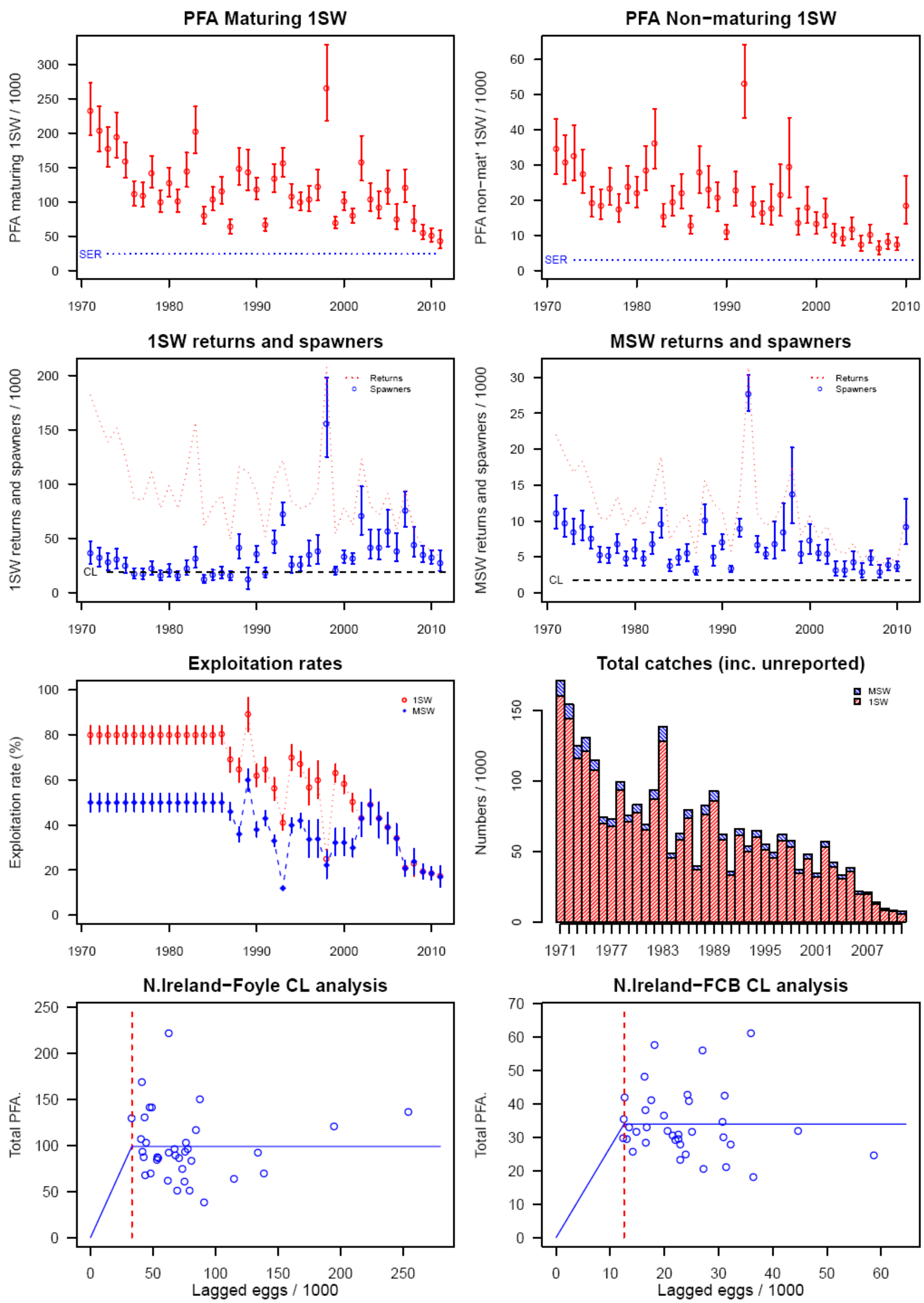


Figure 3.3.3.1i. Summary of fisheries and stock description, UK (N. Ireland).

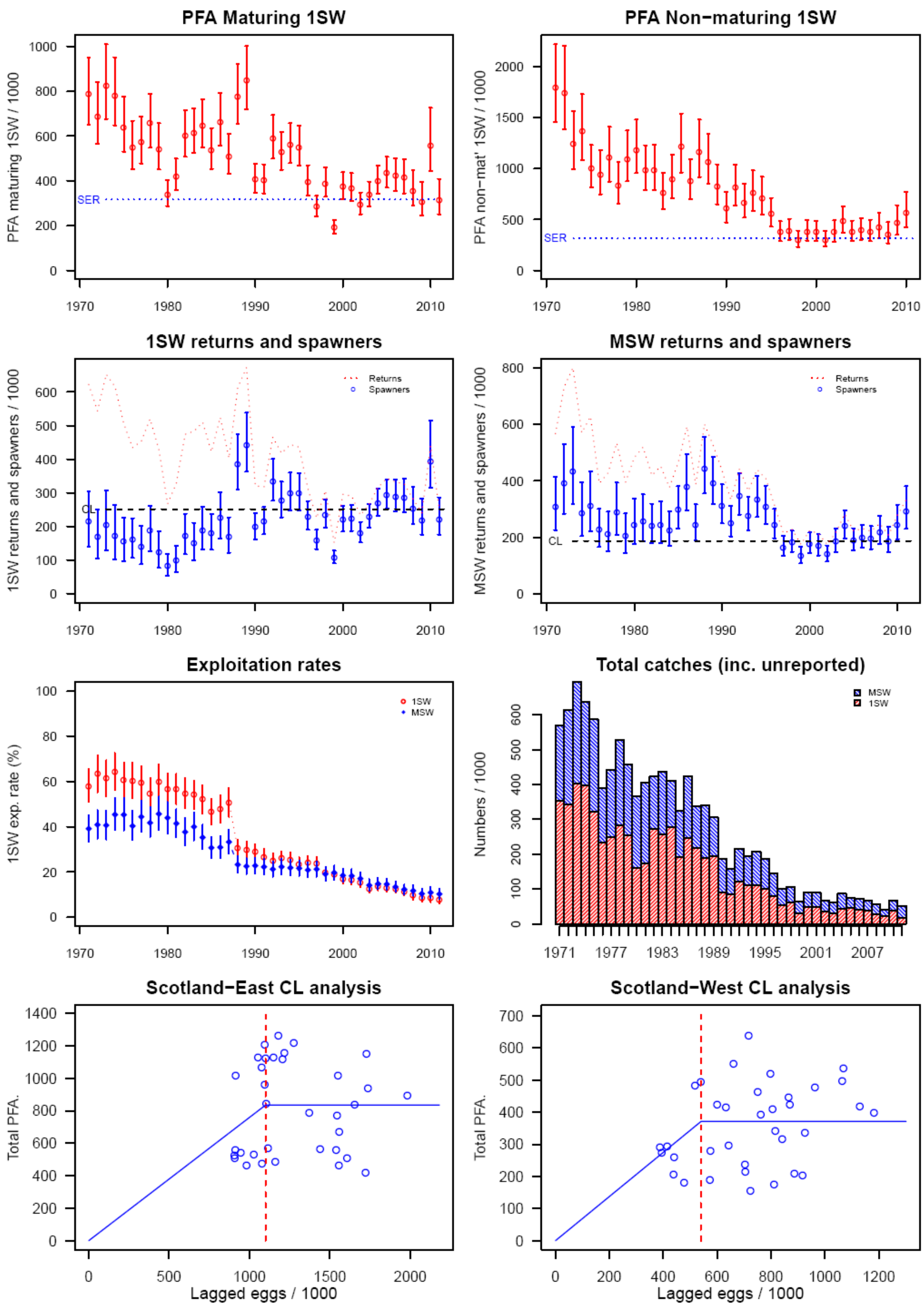


Figure 3.3.3.1j. Summary of fisheries and stock description, UK (Scotland).

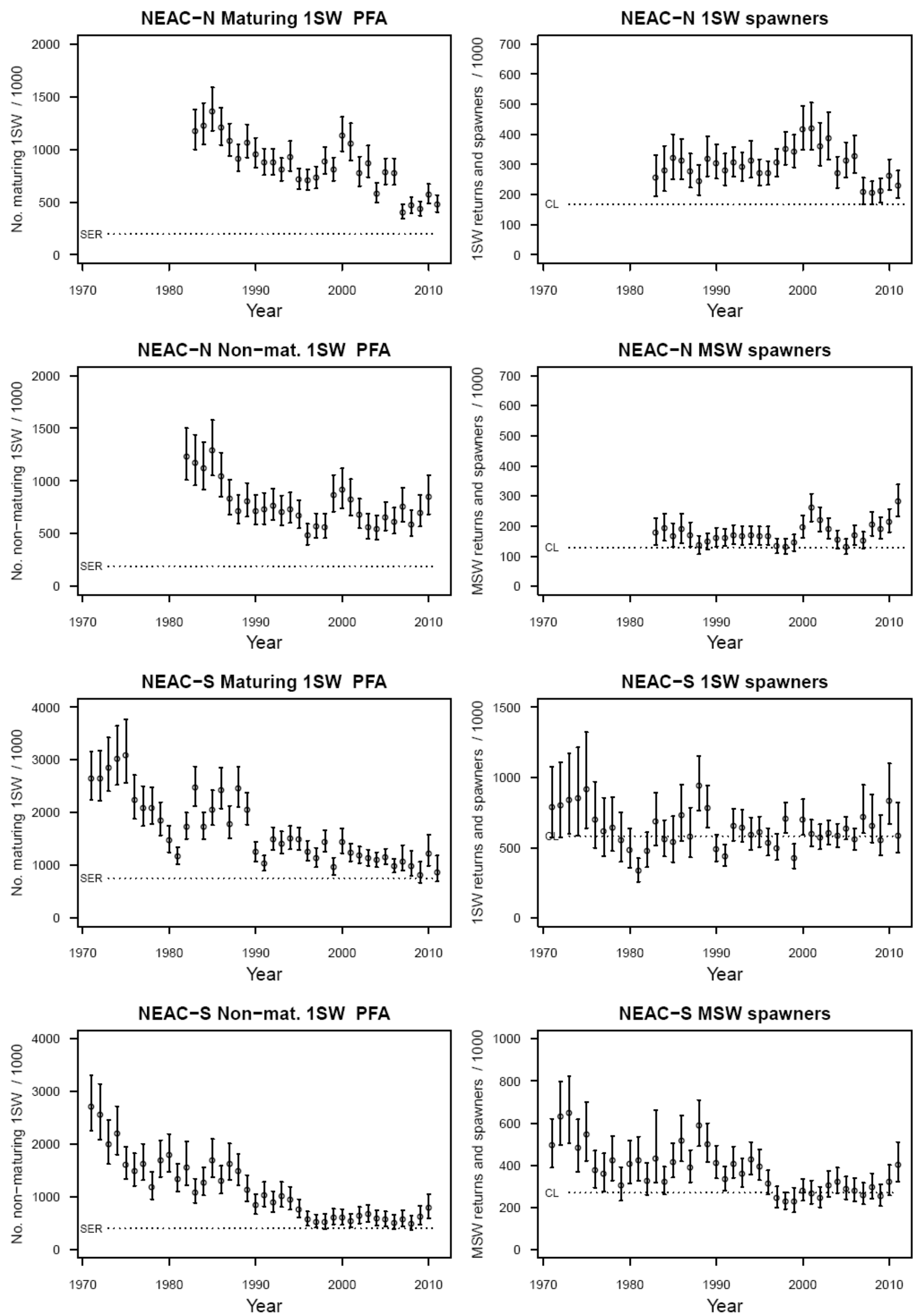
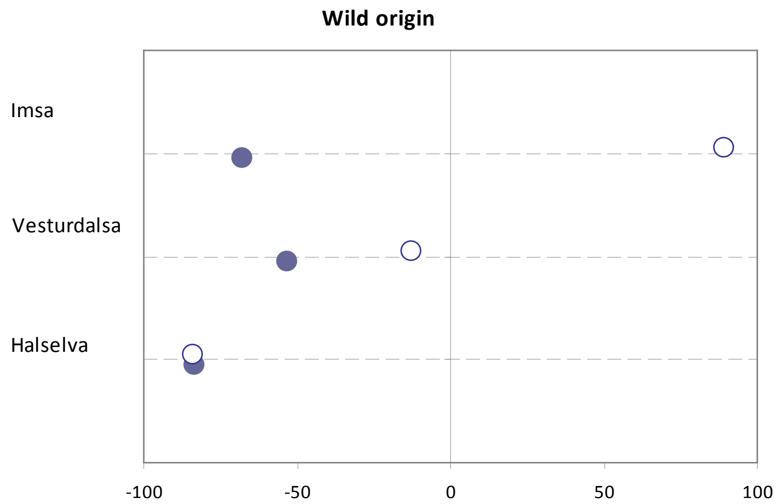


Figure 3.3.4.1. Estimated PFA (recruits; left panels) and spawning escapement (right panels) with 95% confidence limits, for maturing 1SW (1SW) and non-maturing 1SW (MSW) salmon in Northern Europe (NEAC-N) and Southern Europe (NEAC-S).



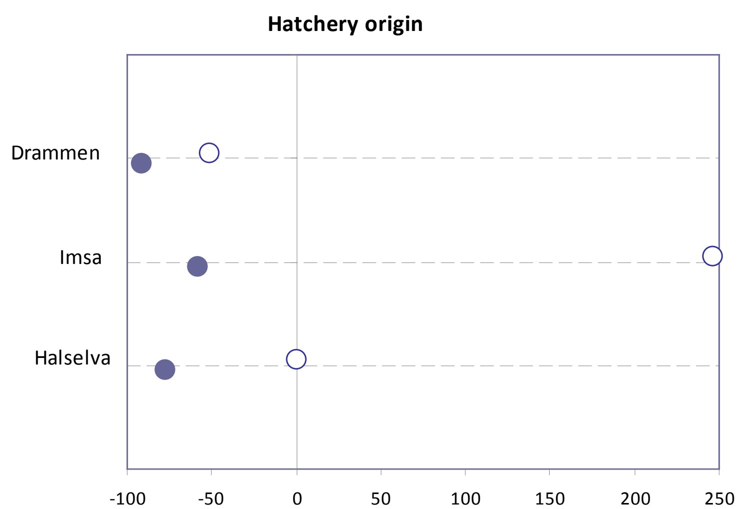
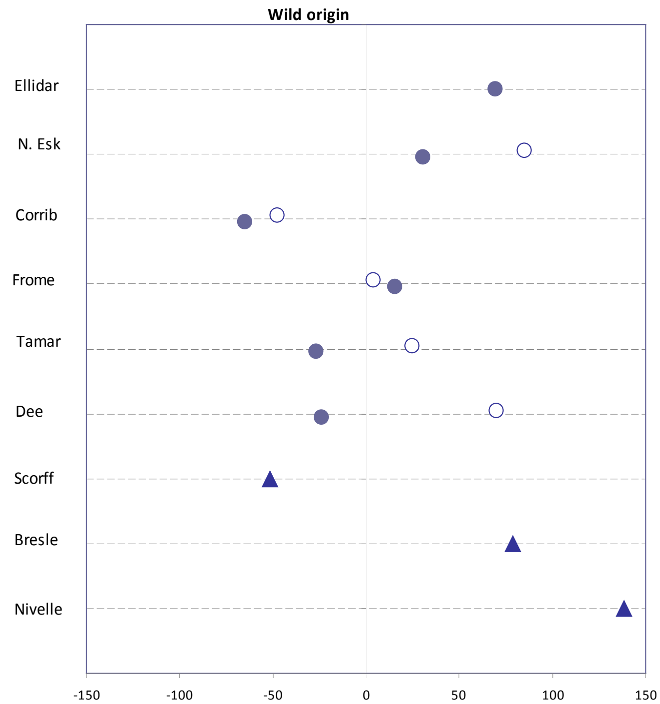


Figure 3.3.6.1. Comparison of the percent change in the five-year mean return rates for 1SW (filled circles) and 2SW (open circles) salmon from wild (top) and hatchery (lower) salmon smolts to rivers of the Northern NEAC area for the 2001 to 2005 and 2006 to 2010 smolt years (2000 to 2004 and 2005 to 2009 for 2SW salmon). Populations with at least three data points in each of the two time periods were included in the analysis.



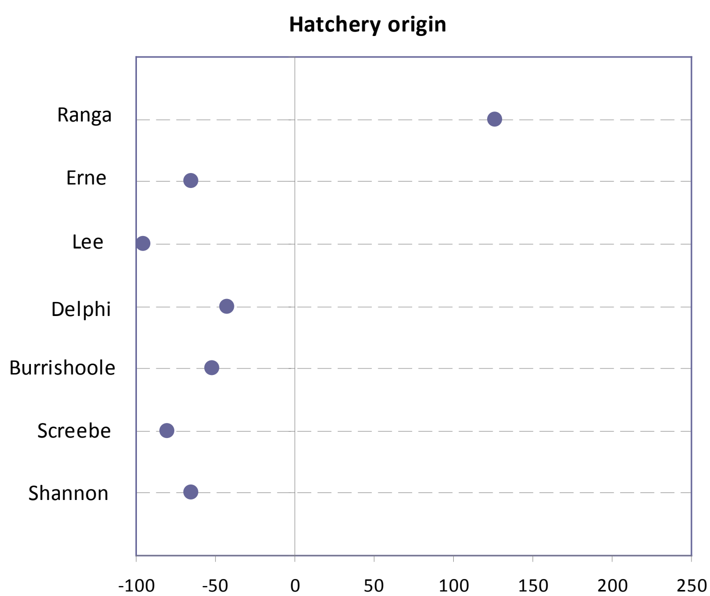


Figure 3.3.6.2. Comparison of the percent change in the five-year mean return rates for 1SW (filled circles) and 2SW (open circles) salmon from wild (top) and hatchery (lower) salmon smolts to rivers of the Southern NEAC area for the 2001 to 2005 and 2006 to 2010 smolt years (2000 to 2004 and 2005 to 2009 for 2SW salmon). Triangles indicate all ages without separation into 1SW and 2SW adult returns. Populations with at least three datapoints in each of the two time periods were included in the analysis.

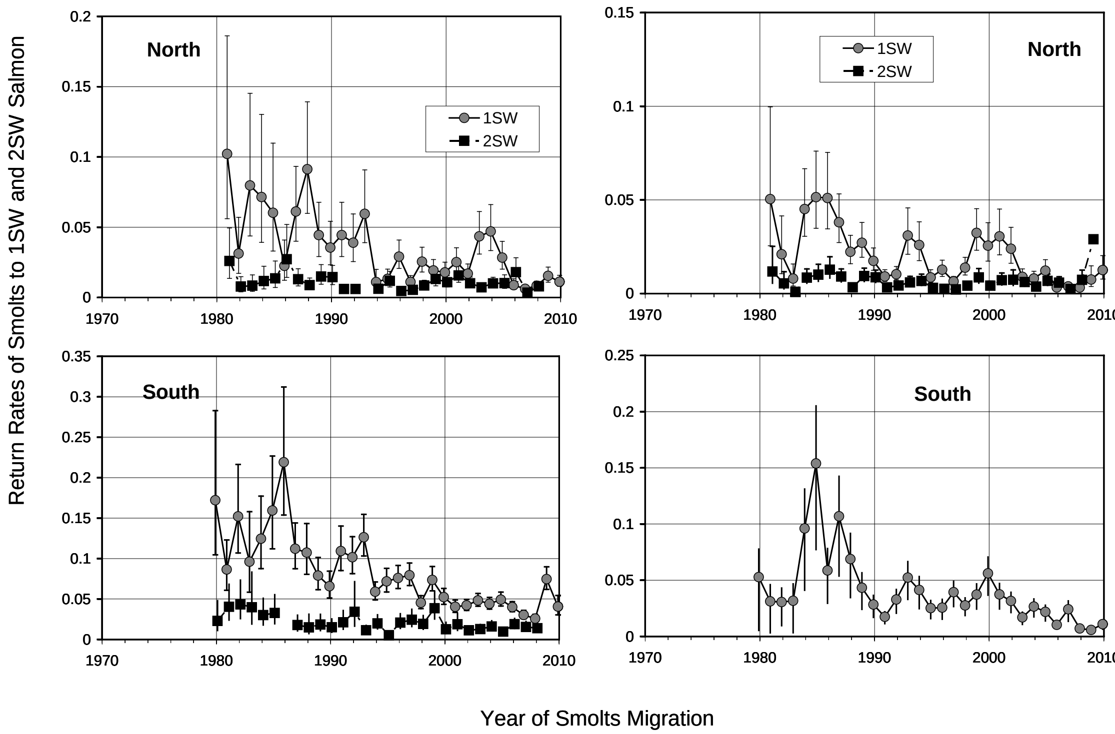


Figure 3.3.6.3. Standardized mean (one standard error bars) annual return rates (proportion) of wild and hatchery origin smolts to 1SW and 2SW adult salmon to Northern and Southern NEAC areas. The standardized values are annual means derived from a general linear model analysis of rivers in a region. Survival rates were log transformed prior to analysis. Note y-scale differences among panels. Left hand panels are wild salmon return rates, right hand panels are hatchery salmon return rates.

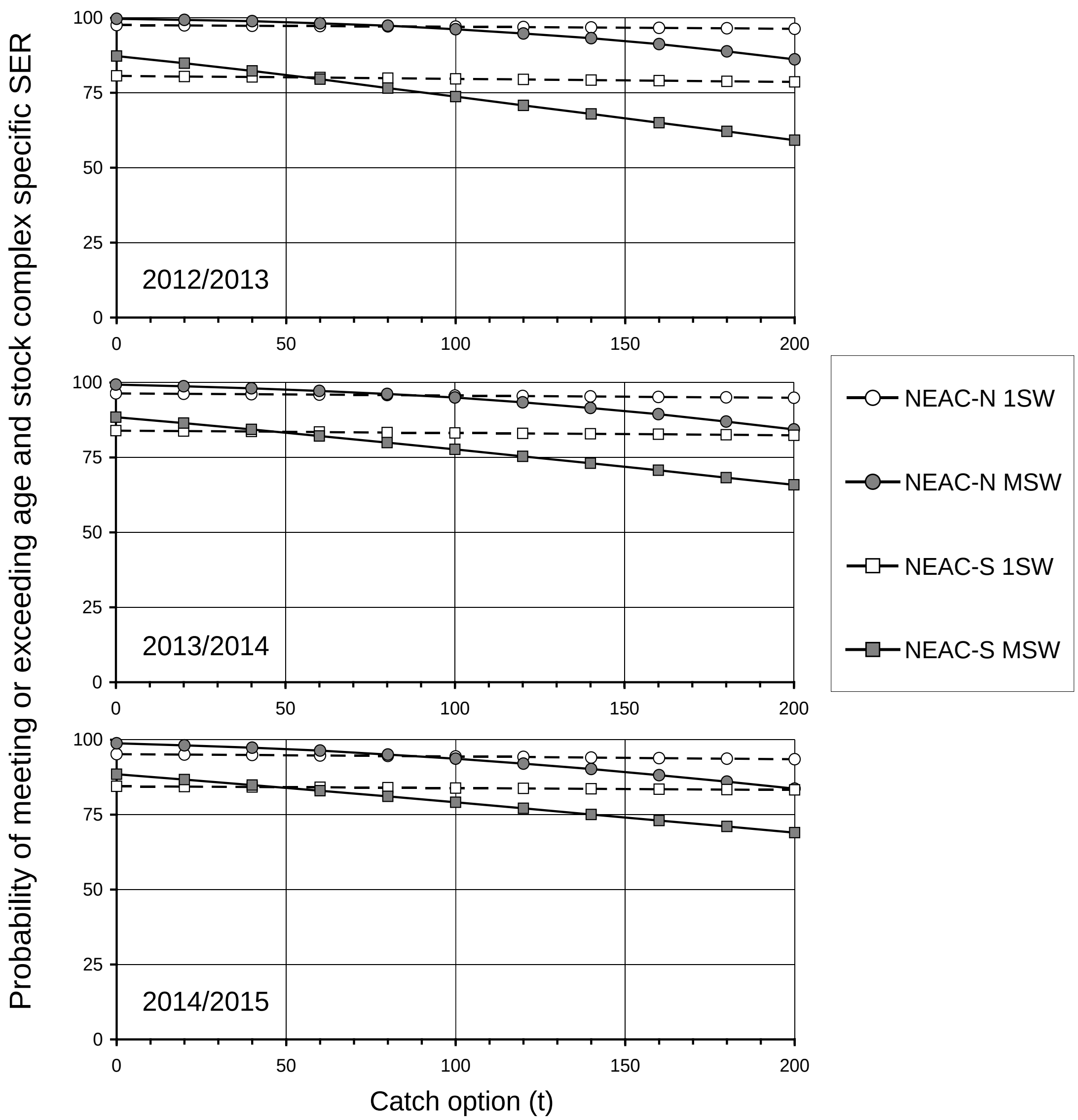


Figure 3.4.1.1. Probability (%) of 1SW and MSW salmon abundance in Northern and Southern NEAC areas being at or above their Spawning Escapement Reserves (SER) for different catch options in Faroes for the 2012/2013, 2013/2014, and 2014/2015 fishing seasons.

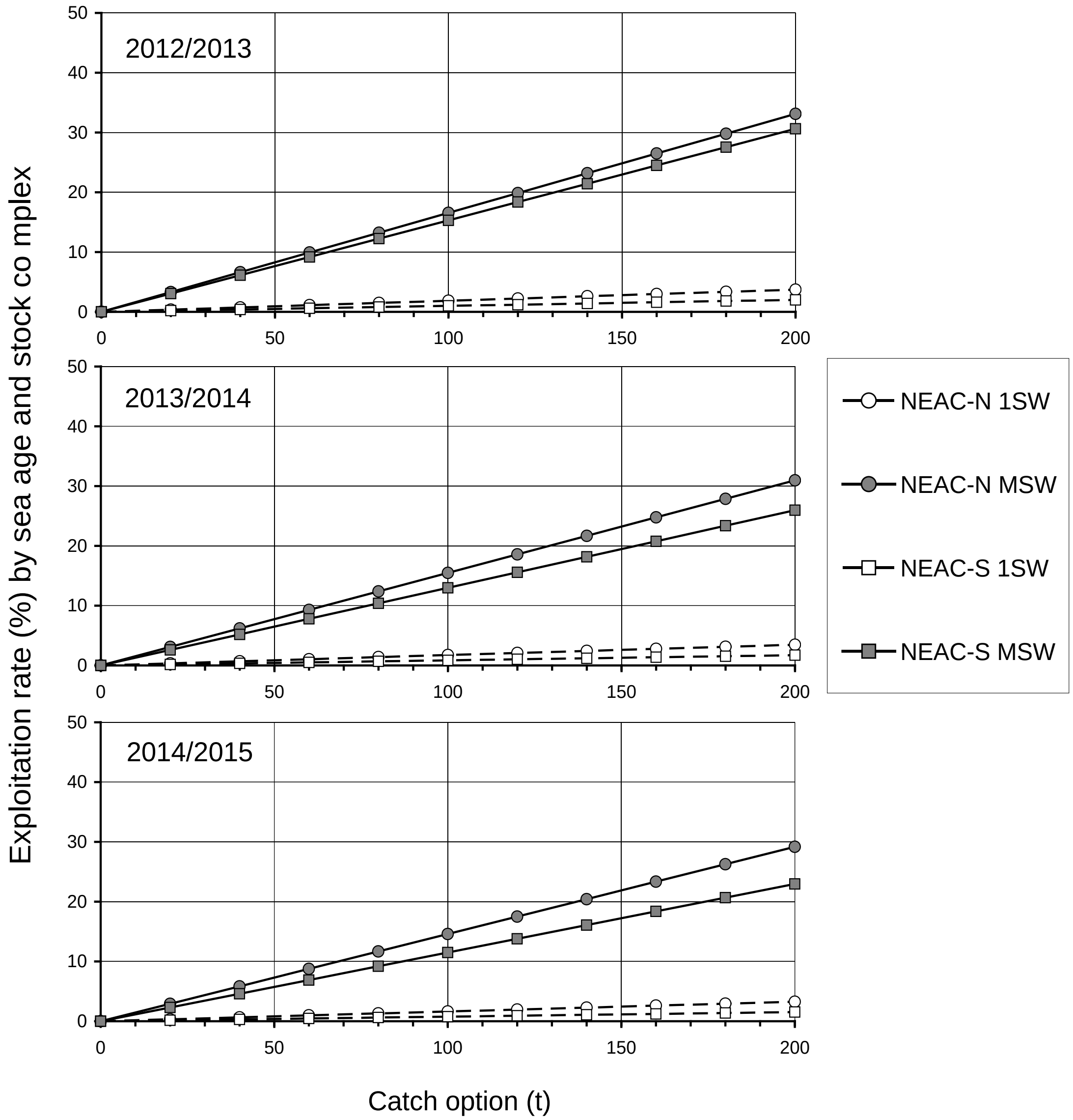


Figure 3.4.1.2. Forecast exploitation rate (%) of 1SW and MSW salmon in Northern and Southern NEAC areas for different catch options in Faroes for the 2012/2013, 2013/2014, and 2014/2015 fishing seasons.

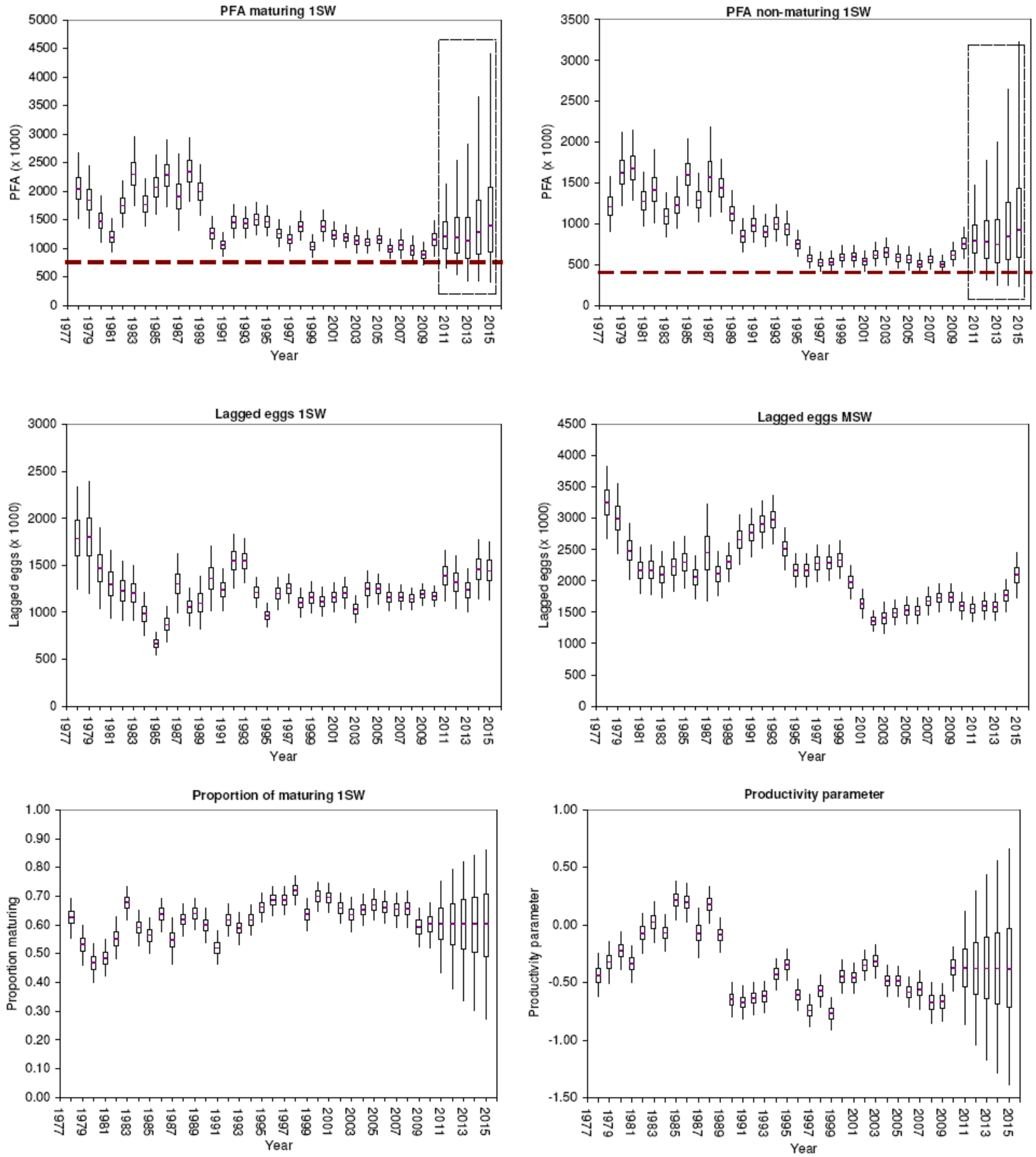


Figure 3.5.2.1. Southern NEAC PFA maturing and non-maturing, lagged eggs from 1SW and MSW, proportion 1SW maturing, and the productivity parameter values for PFA years 1978 to 2015. The last five years (2011 to 2015) are forecasts in all cases. The dashed horizontal lines in the upper panels are the age-specific SER values.

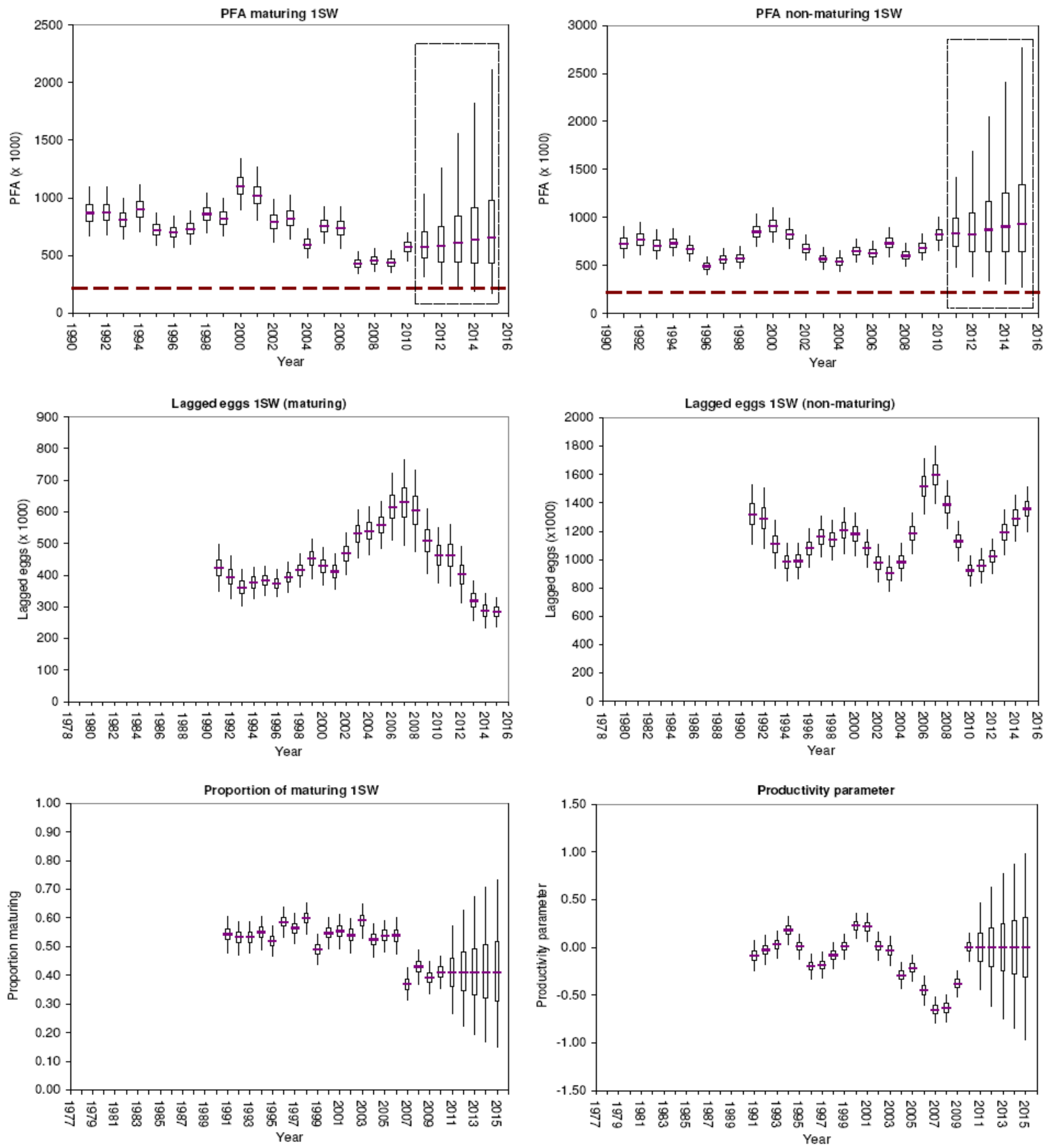


Figure 3.5.2.2. Northern NEAC PFA maturing and non-maturing, lagged eggs from 1SW and MSW, proportion 1SW maturing, and the productivity parameter values for PFA years 1991 to 2015. The last five years (2011 to 2015) are forecasts in all cases. The dashed horizontal lines in the upper panels are the age-specific SER values.

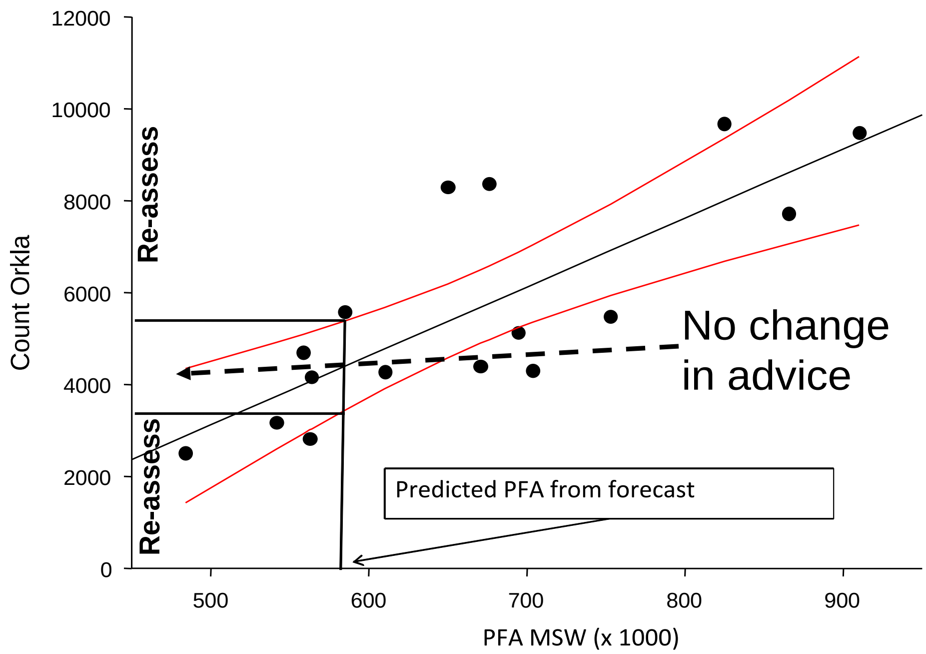


Figure 3.8.1.1. An example of how the reassessment intervals for the indicators was proposed to be computed in 2011 (ICES 2011b). The values of an indicator (counts) are plotted against the PFA. The regression line is shown in black and 95% confidence limits are shown in red. From the forecasted PFA in the year in question the values of the indicator corresponding to the upper and lower 95% confidence interval are estimated. If the indicator value falls outside these limits a reassessment is recommended by this particular indicator.

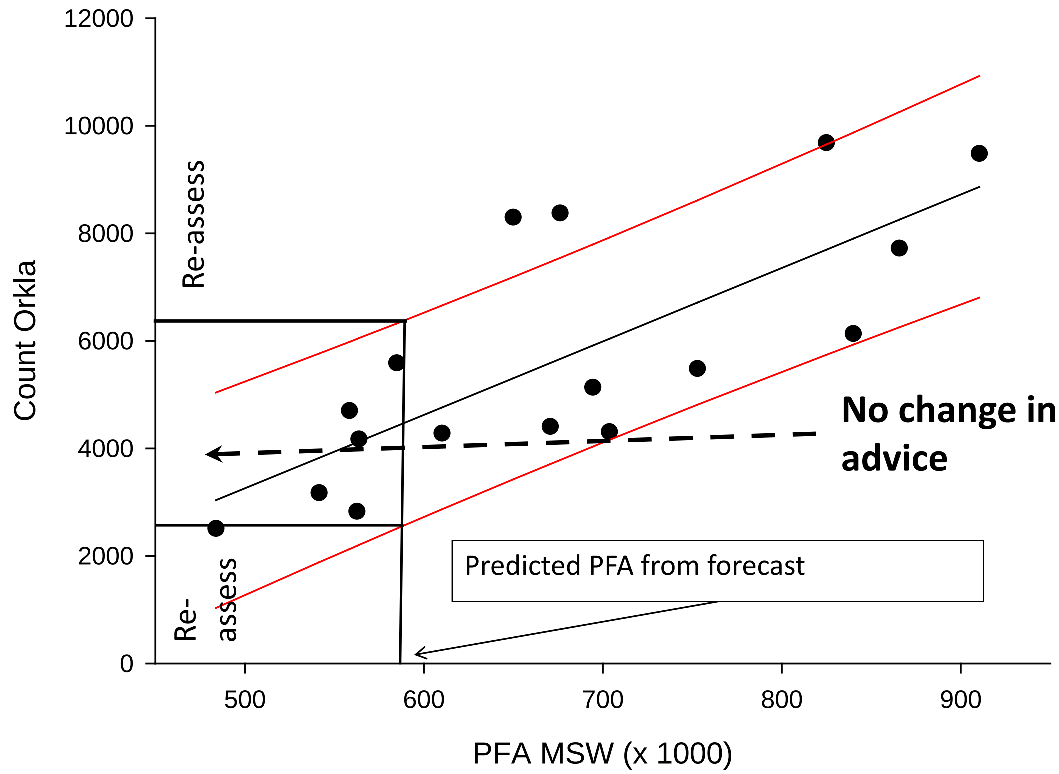


Figure 3.8.2.1. Example of how the reassessment intervals for the indicators are computed. The values of an indicator (counts) are plotted against the PFA. The regression line is shown in black and 75% confidence limits for the individual estimates are shown in red. From the forecasted PFA in the year in question the values of the indicator corresponding to the upper and lower 75% confidence interval are estimated. If the indicator value falls outside these limits a reassessment is recommended by this particular indicator.

FWI NEAC	2013	Indicators suggest:	REASSESS

Indicators for Northern NEAC 1SW PFA

		Insert data from 2012 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Reassess in year 2013? Outside 75% conf.lim. below	above	Outside 75% confidence limits below	above
1	Returns all 1SW NO PFA est		23	0.536108	-73170.20	0.91	577600	194219.71	278751.74	0	0	Uninformative	Uninformative
2	Survivals W 1SW NO Imsa		28	0.000012	-4.14	0.42	577600	-1.59	7.56	0	0	Uninformative	Uninformative
3	Survivals H 1SW NO Imsa		29	0.000006	-1.11	0.26	577600	-0.75	5.47	0	0	Uninformative	Uninformative
4	Counts all NO Øyensåa (1SW)		13	0.002703	256.13	0.33	577600	708.37	2926.92	0	0	Uninformative	Uninformative
5	Counts all NO Nausta (1SW)		14	0.002486	-490.54	0.39	577600	2.84	1888.12	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation. REASSESS	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Northern NEAC MSW PFA

		Insert data from 2012 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Reassess in year 2013? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1	PFA-MSW-CoastNorway		23	0.344433	-12251.11	0.71	824900	240360.77	303382.23	0	0	Uninformative	Uninformative
2	Orkla counts		17	0.013484	-3478.47	0.57	824900	5669.61	9619.69	0	0	Uninformative	Uninformative
3	Målselv counts		21	0.003871	14.46	0.22	824900	2126.89	4289.14	0	0	Uninformative	Uninformative
4	Counts all NO Nausta		14	0.004249	-1647.46	0.36	824900	865.86	2849.54	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation. REASSESS	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Southern NEAC 1SW PFA

		Insert data from 2012 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Reassess in year 2013? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1	Ret. W 1SW UK(E&W) Itchen M		24	0.000330	-106.71	0.34	1187000	80.15	489.51	0	0	Uninformative	Uninformative
2	Ret. W 1SW UK(E&W) Frome M		39	0.000497	65.49	0.31	1187000	103.51	1206.63	0	0	Uninformative	Uninformative
3	Ret. W 1SW UK(Sc.) North Esk M		31	0.006129	5122.42	0.52	1187000	9092.67	15701.63	0	0	Uninformative	Uninformative
4	Ret. W 1SW UK(NI) Bush M		18	0.004420	-2435.32	0.61	1187000	1028.93	4593.43	0	0	Uninformative	Uninformative
5	Ret. Freshw 1SW UK(NI) Bush		37	0.000673	478.23	0.23	1187000	477.32	2078.00	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation. REASSESS	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Southern NEAC MSW PFA

		Insert data from 2012 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Reassess in year 2013? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1	Ret. W 2SW UK(Sc.) Baddoch NM		24	0.000034	3.23	0.45	781000	15.75	43.05	0	0	Uninformative	Uninformative
2	Ret. W 2SW UK(Sc.) North Esk NM		31	0.003676	4605.52	0.21	781000	4124.05	10828.88	0	0	Uninformative	Uninformative
3	Ret. W 1SW UK(Sc.) North Esk NM		30	0.006340	8457.39	0.35	781000	9640.38	17176.92	0	0	Uninformative	Uninformative
4	Ret. W MSW UK(E&W) Itchen NM		24	0.000289	-96.89	0.70	781000	60.20	198.12	0	0	Uninformative	Uninformative
5	Ret. W 1SW UK(E&W) Itchen NM		23	0.000426	-2.64	0.25	781000	108.40	551.24	0	0	Uninformative	Uninformative
6	Ret. W MSW UK(E&W) Frome NM		39	0.000737	104.10	0.44	781000	157.03	1202.63	0	0	Uninformative	Uninformative
7	Ret. W 1SW UK(E&W) Frome NM		38	0.000720	119.80	0.37	781000	151.71	1212.30	0	0	Uninformative	Uninformative
8	Catch W MSW Ice Ellidaar NM		40	0.000092	-22.38	0.55	781000	-8.28	107.53	0	0	Uninformative	Uninformative
9	Ret. Freshw 2SW UK(NI) Bush		36	0.000157	41.30	0.24	781000	25.26	302.32	0	0	Uninformative	Uninformative
10	Ret. W 1SW UK(NI) Bush NM		18	0.005612	-802.38	0.66	781000	1940.95	5220.71	0	0	Uninformative	Uninformative
11	Ret. W 1SW UK(E&W) Tamar NM		14	0.009158	-1853.33	0.44	781000	4034.89	6563.82	0	0	Uninformative	Uninformative
12	Count MSW UK(E&W) Lune NM		15	0.003815	-1088.59	0.36	781000	1290.37	2491.09	0	0	Uninformative	Uninformative
13	Count MSW UK(E&W) Fowey NM		15	0.000200	-45.65	0.24	781000	68.31	152.17	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation. REASSESS	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Figure 3.8.2.2. FWI spreadsheet at the stock complex level for NEAC. In January 2012 the values of the indicators should be put into this spreadsheet to determine if a reassessment in 2013 is recommended. The advice provided will be automatically updated when data are entered. The conclusion of the spreadsheet in this illustration is irrelevant in the absence of data.

FWI NEAC 2012

Indicators suggest: **REASSESS**

An example

Indicators for Northern NEAC 1SW PFA

Reassess in year 2012?

		Insert data from 2011 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Outside 75% conf.lim. below	Outside 75% conf.lim. above	Outside 75% confidence limits below	Outside 75% confidence limits above
1	Returns all 1SW NO PFA est	171994	22	0.530320	-68503.69	0.91	366400	79749.32	171861.94	-1	1	NO	YES
2	Survivals W 1SW NO Imsa	1.8	27	0.000012	-4.13	0.40	366400	-4.52	5.27	-1	-1	NO	NO
3	Survivals H 1SW NO Imsa	2.3	28	0.000006	-1.21	0.26	366400	-2.31	4.35	-1	-1	NO	NO
4	Counts all NO Øyensåa (1SW)	1446	12	0.002637	316.65	0.29	366400	-28.89	2594.93	-1	-1	NO	NO
5	Counts all NO Nausta (1SW)	1824	13	0.002934	-903.82	0.51	366400	-771.96	1114.67	-1	1	NO	YES
								Sum of scores		-5	-1	Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

Indicators for Northern NEAC MSW PFA

Reassess in year 2012?

		Insert data from 2011 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Outside 75% conf.lim. below	Outside 75% conf.lim. above	Outside 75% conf.lim. below	Outside 75% conf.lim. above
1	PFA-MSW-Coast Norway	285788	22	0.340604	-9302.74	0.70	575800	155137.47	218496.75	-1	1	NO	YES
2	Orkla counts	6131	16	0.015027	-4373.19	0.62	575800	2401.72	6156.64	-1	-1	NO	NO
3	Målselv counts	2899	20	0.004227	-196.54	0.24	575800	1147.60	3326.79	-1	-1	NO	NO
4	Counts all NO Nausta	1824	13	0.004430	-1755.77	0.35	575800	-224.55	1814.61	-1	1	NO	YES
								Sum of scores		-4	0	Indicators do not suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Southern NEAC 1SW PFA

Reassess in year 2012?

		Insert data from 2011 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Outside 75% conf.lim. below	Outside 75% conf.lim. above	Outside 75% conf.lim. below	Outside 75% conf.lim. above
1	Ret. W 1SW UK(E&W) Itchen M	474	23	0.000372	-171.97	0.43	842600	-58.54	340.89	-1	1	NO	YES
2	Ret. W 1SW UK(E&W) Frome M	675	38	0.000507	47.11	0.31	842600	-93.23	1041.10	-1	-1	NO	NO
3	Ret. W 1SW UK(Sc.) North Esk M	8103	30	0.005915	5535.57	0.50	842600	7125.86	13913.14	-1	-1	NO	NO
4	Ret. W 1SW UK(NI) Bush M	2578	17	0.004451	-2473.57	0.61	842600	-641.31	3195.82	-1	-1	NO	NO
5	Ret. Freshw 1SW UK(NI) Bush	471	36	0.000634	559.00	0.21	842600	275.86	1910.38	-1	-1	NO	NO
								Sum of scores		-5	-3	Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

Indicators for Southern NEAC MSW PFA

Reassess in year 2012?

		Insert data from 2011 here	N reg	Slope	Intercept	r^2	Median PFA	12.5%ile	87.5%ile	Outside 75% conf.lim. below	Outside 75% conf.lim. above	Outside 75% conf.lim. below	Outside 75% conf.lim. above
1	Ret. W 2SW UK(Sc.) Baddoch NM	40	23	0.000033	2.78	0.46	613000	9.57	37.00	-1	1	NO	YES
2	Ret. W 2SW UK(Sc.) North Esk NM	16215	30	0.003880	4121.60	0.31	613000	3708.32	9291.16	-1	1	NO	YES
3	Ret. W 1SW UK(Sc.) North Esk NM	16832	29	0.006428	8249.22	0.37	613000	8413.37	15965.65	-1	1	NO	YES
4	Ret. W MSW UK(E&W) Itchen NM	223	23	0.000288	-99.96	0.73	613000	10.38	142.47	-1	1	NO	YES
5	Ret. W 1SW UK(E&W) Itchen NM	613	22	0.000411	-5.05	0.26	613000	32.79	460.48	-1	1	NO	YES
6	Ret. W MSW UK(E&W) Frome NM	731	38	0.000727	109.23	0.44	613000	19.68	1090.22	-1	-1	NO	NO
7	Ret. W 1SW UK(E&W) Frome NM	730	38	0.000707	128.83	0.37	613000	27.72	1096.76	-1	-1	NO	NO
8	Catch W MSW Ice Ellidaar NM	11	39	0.000091	-20.32	0.55	613000	-22.79	93.39	-1	-1	NO	NO
9	Ret. Freshw 2SW UK(NI) Bush	178	35	0.000156	41.08	0.24	613000	-5.01	278.28	-1	-1	NO	NO
10	Ret. W 1SW UK(NI) Bush NM	2578	17	0.005636	-831.45	0.67	613000	942.10	4305.27	-1	-1	NO	NO
11	Count MSW UK(E&W) Fowey NM	65	14	0.000477	-200.69	0.65	613000	66.46	116.94	1	-1	YES	NO
								Sum of scores		-9	-1	Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an overestimation.

Figure 3.8.3.1. Output of the spreadsheet for the test of FWIs for NEAC for 2012 based on the values of the indicators from 2011. Because the indicators suggest that the forecast for Northern NEAC MSW was an underestimate, the overall advice from the spreadsheet is reassess.

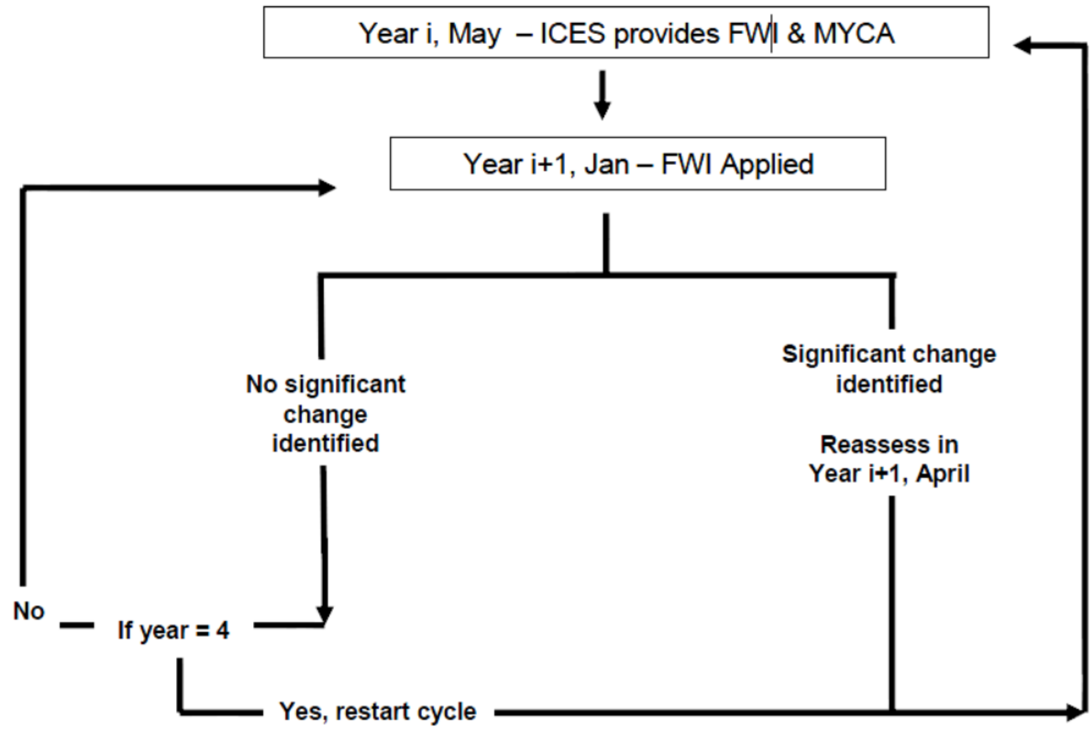


Figure 3.8.4.1. Suggested timeline for employment of the Framework of Indicators (FWI). In Year i, ICES provides multi-year catch advice (MYCA) and an updated FWI which reevaluates the updated datasets and is summarized in an Excel worksheet. In January of Year i+1 the FWI is applied and two options 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 four.

4 North American commission

4.1 NASCO has requested ICES to describe the key events of the 2011 fisheries

4.1.1 Key events of the 2011 fisheries

- There were no new significant events reported for 2011 in the NAC area.
- The majority of harvest fisheries were directed to small salmon.
- The 2011 harvest was 63 851 small salmon and 13 668 large salmon, 9% more small salmon and 25% more large salmon compared to 2010.
- Overall, catches remain very low relative to pre-1990 values.

4.1.2 Gear and effort

Canada

The 23 areas for which the Department of Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Québec, the management is delegated to the Ministère des Ressources Naturelles et de la Faune and the fishing areas are designated by Q1 through Q11 (Figure 4.1.2.1). Harvests (fish which were 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 2011; Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in Canada in 2011.

In 2011, four subsistence fisheries harvested salmon 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) NunatuKavut Community Council (NCC) members fishing in southern Labrador from Fish Cove Point to Cape St Charles and, 4) Labrador residents fishing in Lake Melville and various coastal communities. The NG, Innu, and NCC fisheries were monitored by Aboriginal Fishery Guardians jointly administered by the Aboriginal groups and the DFO, as well as, by DFO Fishery Officers and Guardian staff. The 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 (27.4 m) in length of a stretched mesh size ranging from 3 to 4 inches (7.6 to 10.2 cm). Although nets are mainly set in estuarine waters some nets are also set in coastal areas usually within bays. Catch statistics are based on logbook reports.

Most catches (94%, Figure 2.1.1.3) in Canada 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, are closely controlled. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located in bays generally inside the headlands. Sampling of this fishery occurred in 2011 with the intent of using genetic markers to identify the origin of harvested salmon.

The following management measures were in effect in 2011.

Aboriginal peoples' food, social, and ceremonial (FSC) fisheries

In Québec, Aboriginal peoples' fisheries took place subject to agreements or through permits issued to the bands. There are ten 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 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), FSC agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2011. 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), fishery arrangements with the Nunatsiavut Government, the Innu First Nation, and the NCC, resulted in fisheries in estuaries and coastal areas. By agreement with First Nations, there were no FSC fisheries for salmon on the island of Newfoundland in 2011. Harvest by Aboriginal peoples with recreational licences is reported under the recreational harvest categories.

Resident food fisheries in Labrador

The DFO is responsible for regulating the Resident Fishery. In 2011, a licensed subsistence trout fishery for local residents took place, using gillnets, in Lake Melville (SFA 1) and in estuary and coastal areas of Labrador (SFA 1 and 2). Residents who requested a licence were permitted to retain a seasonal bycatch of three (down from four in previous years) salmon of any size while fishing for trout and charr; three salmon tags accompanied each licence. When the bycatch of three salmon was caught the resident fishers were required to remove their net from the water. If bycatch during a single gillnet set exceeded three salmon, resident fishers were required to discard the excess fish. All licensees were requested to complete logbooks.

Recreational fisheries

Licences are required for all persons fishing recreationally for Atlantic salmon. Gear is restricted to fly fishing and there are daily and seasonal bag limits (Figure 4.1.3.2). Recreational fisheries management in 2011 varied by area and large portions of the southern areas remained closed to all directed salmon fisheries. Large salmon were no longer permitted to be retained in Labrador in 2011. Except for 44 rivers in Québec, only small salmon could be retained in the recreational fisheries.

USA

There were no recreational or commercial fisheries for anadromous Atlantic salmon in the USA in 2011.

France (Islands of Saint-Pierre et Miquelon)

Nine professional and 56 recreational gillnet licences were issued in 2011, a decrease of one recreational licence from 2010. Professional licences have a maximum authorization of three nets of 360 metres maximum length whereas the recreational licence is restricted to one net of 180 metres. The time-series of available data is in Table 4.1.2.1.

4.1.3 Catches in 2011

Canada

The provisional harvest of salmon in 2011 by all users was 179 t, about 17% higher than the 2010 harvest of 153 t (Table 2.1.1.2; Figure 4.1.3.1). The 2011 harvest was 63 851 small salmon and 13 668 large salmon, 9% more small salmon and 25% more large salmon compared to 2010. Although this is the largest catch since 1997, there has been a dramatic decline in harvested tonnage since 1988 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.

Aboriginal peoples' FSC fisheries

The total harvest by Aboriginal people in 2011 was 70.4 t (Table 4.1.3.1). Harvest (by weight) increased by 19% from 2010 and is the highest of the period 1990–2011.

Residents fishing for food in Labrador

The estimated catch for the fishery in 2011 was 2.1 t. This represents approximately 800 fish, 37% of which were large (Table 4.1.3.2).

Recreational fisheries

Harvest in recreational fisheries in 2011 totalled 54 169 small and large salmon (approximately 106 t), was 11% above the 2010 harvest level, but remains at low levels similar to the previous decade (Figure 4.1.3.2). The small salmon harvest of 50 028 fish was 10% higher than the 2010 harvest. The large salmon harvest of 4141 fish was 29% higher the 2010 harvest and occurred only in Québec. The small salmon size group has contributed 88% on average of the total recreational 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 2011, approximately 77 600 salmon (about 41 200 small and 36 400 large) were caught and released (Table 4.1.3.3), representing about 59% of the total number caught (including retained fish). There is some mortality on these released fish, which is accounted for in the spawner estimates.

Recreational catch statistics for Atlantic salmon are not collected regularly in Canada and there is no mechanism in place that requires anglers to report their catch statistics, except in Québec. The last recreational angler survey for New Brunswick was conducted in 1997 and the catch rates for the Miramichi from that survey have been used to estimate catches (both harvest and catch and release) for all subsequent years. The reliability of recreational catch statistics could be improved in all areas of Canada.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2011 and the catch therefore was zero.

Unreported catches

The unreported catch estimate for Canada is complete and totalled 29 t in 2011, a higher number than that reported for 2010 either to the working group last year (15 t) or to NASCO (26 t) by Canada. The majority of this unreported catch is illegal fisheries directed at salmon (Tables 2.1.3.1, 2.1.3.2).

USA

There are no commercial or recreational fisheries for Atlantic salmon in USA and the catch therefore was zero. Unreported catches in the USA were estimated to be 0 t however illegal fishing activities on salmon were noted in 2011.

France (Islands of Saint-Pierre et Miquelon)

A total harvest of 3.8 t was reported in the professional and recreational fisheries in 2011, up from 2.8 t in 2010 and similar to the higher levels of 2008 and 2009 and the highest of the time-series (Table 4.1.2.1).

There are no unreported catch estimates.

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

Harvest histories (1972 to 2011) of salmon, expressed as 2SW salmon equivalents are provided in Table 4.1.3.4. 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 and excluding Saint-Pierre et Miquelon. Harvest equivalents within North America peaked at about 363 000 in 1976 and have remained below 14 000 2SW salmon equivalents since 1999 (Table 4.1.3.4).

In the most recent year, the harvest of cohorts destined to be 2SW salmon in terminal fisheries of North America was 69% of the total North American catch of 2SW salmon. The percentages of harvests occurring in terminal fisheries ranged from 19 to 32% during 1972 to 1990 and 61 to 89% during 1993 to 2011 (Table 4.1.3.4). Percentages increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed-stock fisheries.

4.1.5 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. The Aboriginal Peoples' and resident food fisheries that occur in Labrador may intercept salmon from other areas of North America; however, in 2009 to 2011, 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 Programme in those years were carrying a tag or mark. No tags were reported from the fishery in Saint-Pierre et Miquelon. No tagged salmon of USA origin were reported in Canadian fisheries in 2011.

Results of sampling programme for Labrador subsistence fisheries

A sampling programme of the subsistence fisheries in Labrador continued in 2011, conducted by sampling monitors hired by the NunatuKavut Community Council and by the Conservation Officers and summer students of the Nunatsiavut Government. Landed fish were sampled opportunistically for fork length, weighed (gutted weight or whole weight if available) and where 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 2011, a total of 353 samples were collected from the subsistence fisheries, 132 from northern Labrador (SFA 1) and 171 samples from southern Labrador and 50 salmon from the Eagle River (SFA 2, Figure 4.1.3.1). Analyses of the 2011 samples are in progress.

The Working Group noted that this sampling programme provides 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 (tissue and scale samples) to assess the origin of salmon in this fishery.

Results of sampling programme for Saint-Pierre et Miquelon

In 2011, 75 salmon were sampled from the fishery for continuing genetic work. The tissue samples were analysed by a laboratory in France for 15 microsatellite markers commonly used for Atlantic salmon. The genetic characterization of the samples was compared to baseline populations which included four Canadian populations (Tobique River New Brunswick and the Sainte Marguerite, Sainte Anne, and Malbaie rivers from Québec), two populations from the USA (Narraguagus and Penobscot) and 28 populations from the NEAC area.

In 2010, none of the fish sampled were genetically identified as belonging to the NEAC stocks. With the limited baselines available, three of the fish were assigned to the USA and the remaining 47 to Canadian rivers. The 2011 samples were assigned to these three areas in similar proportions.

The Working Group welcomed the efforts to sample the catches at Saint-Pierre et Miquelon to estimate stock contributions to the harvest and recommends that sampling be continued in the future. However, the Working Group identified a number of issues with the sampling programme that if corrected, would greatly increase the value of the data. First, more extensive sampling should be conducted at both spatial and temporal scales during the fishing season. Second, the use of baselines from Canadian and USA salmon populations was very small. Extensive baselines of Canadian and USA salmon populations exist and should be considered. Finally, the working group would welcome additional quality checks that demonstrate if DNA extraction, amplification, and scoring efforts were effective and that no alleles were dropped. French and Canadian researchers plan to collaborate in the future to ensure that the gaps in the geographic coverage of baseline populations are filled and adequate samples are collected (see Section 2.3.2.2).

Recommendations for future activities

The Working Group recommends that sampling of the Labrador and Saint-Pierre et Miquelon fisheries be continued and expanded (i.e. sample size, geographic coverage, tissue samples, seasonal distribution of the samples) in future years in order to improve the information on biological characteristics and stock origin of salmon harvested in these mixed-stock fisheries.

4.1.6 Exploitation rates

Canada

In the Newfoundland recreational fishery, exploitation rates for retained small salmon ranged from a high of 21% on Torrent River to a low of 5% on Terra Nova River. Overall, exploitation rates of small salmon in these rivers declined from 30% in 1986 to approximately 9% in 2011 which is one of the lowest rates of the past 25 years. In Sand Hill River, Labrador, exploitation rate on small salmon was 1.5% and no large salmon were reported as retained in 2011.

In Québec, the 2011 total fishing exploitation rate was around 18%; slightly lower than the average of the five previous years. Native peoples' fishing exploitation rate was 5% of the total return. Recreational fishing exploitation rate was 13% on the total run, 19% for the small and 8% for the large salmon, representing an increase or a similar rate from the previous five year average of 17% for small salmon and 8% for large salmon.

USA

There was no exploitation of anadromous USA salmon in homewaters.

Exploitation trends for North American salmon fisheries

Annual exploitation rates of small salmon (mostly 1SW) and large salmon (mostly MSW) in North America for the 1971 to 2011 time period were calculated by dividing annual harvests in all North American fisheries by annual estimates of the returns to North America prior to any fisheries in 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 small and large salmon fluctuated annually but remained relatively steady until 1984 when exploitation of large salmon declined sharply with the introduction of the non-retention of large salmon in angling fisheries and reductions in commercial fisheries (Figure 4.1.5.1). Exploitation of small salmon declined steeply in

North America with the closure of the Newfoundland commercial fishery in 1992. Declines continued in the 1990s with continuing management controls in all fisheries to reduce exploitation. In the last few years, exploitation rates on small salmon and large salmon have remained at the lowest in the time-series, average of 15% for both small salmon and large salmon over the past ten years. However, exploitation rates across regions within North America are highly variable.

4.2 Management objectives and reference points

Management objectives are described in Section 1.4.

There were no changes to the 2SW salmon Conservation Limits (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

4.3 Status of stocks

To date, 1082 Atlantic salmon rivers have been identified in eastern Canada and 21 rivers in eastern USA, where salmon are or were present within the last half century. Assessments were reported for 74 of these rivers in 2011.

4.3.1 Smolt abundance

Canada

Wild smolt production was estimated in twelve rivers in 2011. Of these, four rivers have between six and nine years of information and eight have data for over 15 years (Figure 4.3.1.1).

In 2011, smolt production increased (>110%) from 2010 in four rivers, decreased (<90%) in two rivers and remained unchanged in five rivers. There was no 2010 estimate for one of the twelve rivers. The relative smolt production, scaled to the size of the river using the conservation egg requirements, was highest in the rivers of Québec and lowest in the southern rivers of the Scotia-Fundy region (Figure 4.3.1.1). For most of the twelve rivers there has not been a significant linear trend in smolt production ($P>0.05$) over the years data were available with the exception of: 1) significant decreases in St Jean and de la Trinite (Québec) and 2) significant increases in Rocky and Western Arm Brook (WAB Newfoundland) and Northwest Miramichi (Gulf).

USA

Wild salmon smolt production has been estimated on the Narraguagus River for 15 years (Figure 4.3.1.1). Smolt production in 2011 was 35% below that of 2010, with the overall trend since 1997 remaining negative ($P < 0.05$).

4.3.2 Estimates of total adult abundance by geographic area

Returns of small (1SW), large, and 2SW salmon (a subset of large) to each region (Figures 4.3.2.1, 4.3.2.2 and 4.3.2.3; and Annex 6) were originally estimated by the methods and variables developed by Rago *et al*. (1993) and reported by ICES (1993). At the 2011 Working Group meeting there were some changes to the input variables used. The returns for individual river systems and management areas for both sea age groups were derived from a 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 large returns was determined using the sea age composition of one or more indicator stocks.

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

Canada

Labrador

The median of the estimated returns of small salmon in 2011 to Labrador (271 200) was 196% higher than the previous year and 71% higher than the previous 5-year mean (158 588, Figure 4.3.2.1). The median of the estimated 2SW returns in 2011 to Labrador (28 380) was 218% higher than the previous year and 78% higher than the previous 5-year mean (15 944, Figure 4.3.2.3).

Labrador regional estimates are generated from data collected at four counting facilities (one in SFA 1 and three in SFA 2, Figure 4.1.3.1). The production area in SFA 1 is approximately equal to the production area in SFA 2. The current method to estimate Labrador returns assumes that the total returns to the northern area are represented by returns at the single monitoring facility in SFA 1 and returns in the southerly areas (SFA2 and 14b) are represented by returns at the monitoring facilities in SFA 2. Further work is needed to understand the best use of these data in describing stock status and the Working Group recommends that additional data be considered in Labrador to better estimate salmon returns in that region.

Newfoundland

Finalized angling information from 2010 was used to update estimates of salmon returns in that year. The median of the estimated returns of small salmon in 2011 to Newfoundland (267 400) was approximately equal to the previous year and 18% higher than the previous 5-year mean (226 860, Figure 4.3.2.1). The median (5422) of the estimated 2SW returns in 2011 to Newfoundland was 16% higher than the previous year and 19% higher than the previous 5-year mean (4539, Figure 4.3.2.3).

Québec

The median of the estimated returns of small salmon in 2011 to Québec (38 360) was 37% higher than the previous year and 37% higher than the previous 5-year mean (28 050, Figure 4.3.2.1). The median of the estimated returns of 2SW in 2011 to Québec (37 340) was 28% higher than the previous year and 38% higher than the previous 5-year mean (27 004, Figure 4.3.2.3).

Gulf of St Lawrence

The median of the estimated returns of small salmon in 2011 to the Gulf (73 390) was 6% lower than the previous year and 42% higher than the previous 5-year mean (51 712, Figure 4.3.2.1). The median of the estimate of 2SW returns in 2011 to the Gulf (61 740) was 198% higher than the previous year and 184% higher than the previous 5-year mean (21 742, Figure 4.3.2.3).

Scotia–Fundy

The median of the estimated returns of small salmon in 2011 to Scotia-Fundy (9468) was 36% lower than the previous year and 10% lower than the previous 5-year mean (10 494, Figure 4.3.2.1). The median of the estimated 2SW returns in 2011 to Scotia-Fundy (4660) was 131% higher than the previous year and 100% higher than the previous 5-year mean (2335, Figure 4.3.2.3).

The model currently being used to extrapolate for the Nova Scotia Atlantic coast assessed rivers to total abundance (both returns and spawners) within SFAs 19–21 is likely leading to an overestimation of this portion of the regional abundance. The model is based on the assumption that the LaHave River salmon count is a representative index of this portion, an assumption that is likely invalid (ICES 2010b). 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 estimated returns of small salmon in 2011 to USA (1080) were 106% higher than the previous year and 132% higher than the previous 5-year mean (465, Figure 4.3.2.1). The estimated returns of 2SW in 2011 to USA (3045) were 182% higher than the previous year and 121% higher than the previous 5-year mean (1378, Figure 4.3.2.3).

4.3.3 Estimates of spawning escapements

Updated estimates for small, large and 2SW spawners (1971 to 2011) were derived for the six geographic regions. A comparison between the numbers of small and large returns and spawners is presented in Figures 4.3.2.1 and 4.3.2.2. A comparison between the numbers of 2SW returns, spawners, and CLs is presented in Figure 4.3.2.3.

Canada

Labrador

The median of the estimated numbers of 2SW spawners (28 310) was 223% higher than the previous year and 80% higher than the previous 5-year mean (15 707). The 2011 2SW spawners achieved 81% of the 2SW CL for Labrador (Figure 4.3.2.3). The 2SW CL has not been met during the time-series. The median of the estimated numbers of small spawners (270 100) was 201% higher than the previous year and 73% higher than the previous 5-year mean (156 444, Figure 4.3.2.1).

Newfoundland

Finalized angling information from 2010 was used to update estimates of salmon spawners in that year. The median of the estimated numbers of 2SW spawners (5342) was 17% higher than the previous year and 20% higher than the previous 5-year mean (4456). The 2011 2SW spawners achieved 133% of the 2SW CL for Newfoundland. The 2SW CL has been met or exceeded in six out of the last ten years (Figure 4.3.2.3). The median of the estimated number of small spawners (237 800) was 1% higher than the previous year and 18% higher than the previous 5-year mean (201 740, Figure 4.3.2.1). There was a general increase in both 2SW and 1SW spawners during the period 1992 to 1996 and 1998 to 2000, which is consistent with the closure of the commercial fisheries in Newfoundland.

Québec

The median of the estimated numbers of 2SW spawners (29 350) was 26% higher than the previous year and 43% higher than the previous 5-year mean (20 472). The 2011 2SW spawners achieved 96% of the 2SW CL for Québec (Figure 4.3.2.3). The median of the estimated number of small spawners (27 780) was 35% higher than the previous year and 37% higher than the previous 5-year mean (20 350, Figure 4.3.2.1).

Gulf of St Lawrence

The median of the estimated numbers of 2SW spawners (60 200) was 203% higher than the previous year and 188% higher than the previous 5-year mean (20 908). The 2011 2SW spawners achieved 204% of the 2SW CL for the Gulf (Figure 4.3.2.3). This is the first time that the 2SW CL has been exceeded in the Gulf in the past 15 years. The median of the estimated number of small spawners (47 490) was 6% lower than the previous year and 42% higher than the previous 5-year mean (33 368, Figure 4.3.2.1).

Scotia–Fundy

The median of the estimated numbers of 2SW spawners (4558) was 142% higher than the previous year and 106% higher than the previous 5-year mean (2212). The 2011 2SW spawners achieved 18% of the 2SW CL for Scotia-Fundy (Figure 4.3.2.3). The median of the estimated number of small spawners (9365) was 37% lower than the previous year and 9% lower than the previous 5-year mean (10 312, Figure 4.3.2.1). As was the case with returns, these values may be overestimates (see Section 4.3.2).

USA

The estimated numbers of 2SW spawners (3872) was 161% higher than the previous year and 111% higher than the previous 5-year mean (1838). The 2011 2SW spawners achieved 13% of the 2SW CL for USA (Figure 4.3.2.3). The estimated number of small spawners (1080) was 106% higher than the previous year and 132% higher than the previous 5-year mean (465, Figure 4.3.2.1).

4.3.4 Egg depositions in 2011

Egg depositions by all sea ages combined in 2011 exceeded or equalled the river-specific CLs in 45 of the 74 assessed rivers (61%) and were less than 50% of CLs in 15 rivers (20%) (Figure 4.3.4.1).

- All four assessed rivers in Labrador exceeded their CLs.
- In Newfoundland, 53% (eight of 15) of the rivers assessed met or exceeded their CLs and only two locations (upper Exploits River and Little River) had egg depositions that were less than 50% of their CLs.
- All three assessed rivers in the Gulf exceeded their CLs.
- In Québec, 77% (30 of 39) of assessed rivers had egg depositions that equalled or exceeded their CLs. Three rivers were below 50% of their CLs.
- Abundance in the six assessed rivers of the Maritimes region (SFA 19–23) was insufficient to meet any of the CLs and egg depositions were less than 50% of CLs in three of the six assessed rivers.
- Large deficiencies in egg depositions were noted in the USA and none of the seven assessed rivers met their CLs. On an individual river basis, the Penobscot River met 35% (compared to 13% in 2010) of its CL while the other six USA rivers were at 0.0 to 29.0% of their CLs.

4.3.5 Marine survival rates

In 2011, return rate data were available from ten wild and four hatchery populations from rivers distributed among Newfoundland, Québec, Scotia-Fundy, and USA. In the ten wild stocks with data for both years, return rates to 1SW fish in 2011 increased relative to 2010 (8% to 257%) for five stocks and decreased for five (11% to 55%). Increases were noted in 1SW return rates for two of the hatchery stocks (>70%) from 2010 to 2011, with a decrease in rate (92%) in the third.

Return rates in 2011 for wild 2SW salmon from the 2009 smolt class increased relative to the 2008 smolt class on all the rivers (1% to 214%). Similarly return rates for 2SW salmon increased for three USA hatchery stocks and decreased for the single monitored hatchery stock in Canada (19%).

- Analyses of time-series of return rates of smolts to 1SW and 2SW adults by area (Figure 4.3.5.1) and analysis of the rates of change for individual rivers (Figure 4.3.5.2) provide insights into spatial and long and short-term temporal changes in marine survival of wild and hatchery stocks. Return rates of wild stocks exceed those of hatchery stocks.

Comparing the last two years:

- 1SW return rates in 2011 to all areas and rivers were higher than in 2010 for half the monitored wild (five of ten) and two of three of the monitored hatchery stocks.
- Return rates of 2SW salmon increased from 2010 for all six wild stocks, and three of four hatchery populations.

Comparing the two most recent five-year averages (Figure 4.3.5.2):

- Five-year average return rates for 1SW wild salmon smolts returning to rivers of Newfoundland in 2007 to 2011 were similar to the averages for the previous period (2002 to 2006).
- Five-year average return rates for 1SW wild and hatchery salmon smolts returning to rivers of eastern North America in 2007 to 2011 were lower compared to the previous period (2002 to 2006) for all but three of the ten MSW rivers monitored.
- Five-year average return rates for 2SW wild and hatchery salmon smolts returning to rivers of eastern North America in 2006 to 2010 improved compared to the previous period (2001 to 2005) for six of the ten MSW rivers monitored.

Trends based on standardized return rates from the period 1970 to 2011 (Figure 4.3.5.1) include:

- 1SW return rates of wild smolts to insular Newfoundland, although varying annually, have increased over the period 1970 to 2011 ($p<0.05$).
- 1SW and 2SW return rates of wild smolts to Québec, although varying annually, have no linear trend ($p<0.05$) over the periods for which data were available; in part due to increases in the last five years.
- 1SW and 2SW return rates of wild smolts to the Gulf although varying annually have both declined ($p<0.05$) over the periods for which data were available.
- 1SW and 2SW return rates of wild smolts to the Scotia-Fundy and USA, although varying annually, have no significant temporal trend over the period 1970 to 201 ($p>0.05$).
- In Scotia Fundy and USA, hatchery smolt return rates to 2SW salmon have decreased over the period 1970 to 2011 ($p<0.05$). 1SW return rates for Scotia Fundy stocks also declined for the period ($p<0.05$), while for USA there has been no significant trend ($p>0.05$).

Spatial trends include:

- 1SW return rates in MSW salmon stocks in USA and Québec are lower than those in 1SW salmon stocks of Newfoundland.
- 1SW return rates in MSW salmon stocks in Gulf and Scotia-Fundy are within the range of those in 1SW salmon stocks of Newfoundland.
- 1SW return rates in MSW salmon stocks of the Scotia-Fundy, Québec, and Gulf exceed those of 2SW salmon within a smolt cohort.
- 2SW return rates in MSW salmon stocks in USA exceed those of 1SW salmon within a smolt cohort.

4.3.6 Pre-fisheries abundance

4.3.6.1 North American run-reconstruction model

The run-reconstruction model developed by Rago *et al*. (1993) and described in previous Working Group reports (ICES 2008a, 2009a) and in the primary literature (Chaput *et al*. 2005) was used to estimate returns and spawners by size (small salmon, large salmon) and sea age group (2SW salmon) to the six geographic regions of NAC. The input data were similar in structure to the data used previously by the Working Group (ICES 2009a). Following on the recommendations from ICES (2008a), the run-reconstruction model for 2009 was developed using Monte Carlo simulation (OpenBUGS) similar to the approach applied for the NEAC area (Section 3.3.1). Estimates of returns and spawners to regions were provided for the time-series to 2011. The full set of data inputs and the summary output tables of catches, returns and spawners by sea age or size group are provided in Annex 6.

4.3.6.2 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 PFANAC1SW. This annual pre-fishery abundance is the estimated number of salmon in the North Atlantic on August 1st of the second summer at sea. 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 2010. This is because pre-fishery abundance estimates for 2011 require 2SW returns to rivers in North America in 2012. The medians derived from Monte Carlo simulations for 2SW salmon by region and for NAC overall are shown in Figure 4.3.2.3. The estimated abundance of 2SW to rivers for NAC in 2011 was about 140 700 fish (95% C.I. range 107 100 to 174 500). The median estimate for 2011 is 111% higher than the previous year, 93% higher than the previous five year average (72 934) and 96% higher than the previous ten year average (71 795). The 2011 estimate is the 11th highest in the time-series and the highest value from the previous ten years.

The PFA estimates accounting for returns to rivers, fisheries at sea in North America, fisheries at West Greenland, and corrected for natural mortality are shown in Figure 4.3.6.2.1. The median of the estimates of non-maturing 1SW salmon in 2010 was 213 850 fish (95% C.I. range 164 250 to 268 100). This value is 100% higher than the previous year (107 150) and 91% higher than the previous 10-year average. The estimated non-maturing 1SW salmon in 2010 is the highest since 1992 but lower than all values prior to 1992.

4.3.6.3 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.

The medians of the region-specific estimates of returns of the 1SW maturing component to rivers of NAC are summarized in Figure 4.3.2.1. The NAC total maturing 1SW salmon abundance has oscillated between 250 000 and 574 000 since 1971. Estimated abundance in 2011 (661 400) was 38% higher than the previous year's estimate (480 800) and was 39% higher than the previous 5-year mean (476 200). While there was no change to the levels of 1SW returns to Newfoundland in 2011 relative to 2010, increases were realized in Québec (37%), Labrador (196%) and USA (106%) and decreases noted in Gulf (6%) and Scotia-Fundy (36%) in 2011. Returns of maturing 1SW salmon have generally increased over the time-series for the NAC, mainly a result of the commercial fishery closures in Canada and increased returns over time to Labrador and Newfoundland.

The reconstructed distributions of the abundance of the 1SW maturing cohort of North American origin are shown in Figure 4.3.6.2.1. The estimated PFA of the maturing component in 2011 was 694 150 fish, 37% higher than the previous year and 48% above the previous ten year average (469 500). Maximum abundance of the maturing cohort was estimated at over 910 000 fish in 1981 and the recent estimate is the 10th highest since 1971 and the highest since 1988.

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

The pre-fishery abundance of 1SW maturing salmon and 1SW non-maturing salmon from North America from 1971–2010 (2011 PFA requires 2SW returns in 2012) were combined to give total recruits of 1SW salmon (Figure 4.3.6.2.1). The overall abundance of the 1SW cohort, estimated in 2010, was 720 250 fish, 47% higher than previous year's estimate, 23% higher than the previous ten year average. The abundance of the 1SW cohort has declined by 70% over the time-series from a peak of 1 705 000 in 1975.

4.3.7 Summary on status of stocks

In 2011, the midpoints of the spawner abundance estimates for Newfoundland and Gulf were above the CLs for 2SW salmon, and for Québec marginally below. The midpoints of the spawner abundance estimates for Labrador, Scotia-Fundy, USA, and the North American Commission overall were below their respective CLs for 2SW salmon.

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 2011 has increased 37% from the 2010 value and remains among the low end of the time-series. The non-maturing estimate increased by 100% over the 2009 estimate and but remains among the lowest in the time-series.

The returns of 2SW fish in 2011 increased in all six geographic areas relative to 2010 (range 16 to 218%) and the previous 5-year mean (19 to 184%). Returns in 2011 of 1SW salmon relative to 2010 increased in Labrador (196%), Québec (37%) and USA (106%), decreased in Gulf (6%) and Scotia-Fundy (36%), and remained the same in Newfoundland. Returns of 1SW salmon were also above (18 to 132%) the previous 5-year mean (2006 to 2010) in all regions except for Scotia Fundy (10% decrease).

The rank of the estimated returns in the 1971 to 2011 time-series and the proportions of the 2SW CLs achieved in 2011 for six regions in North America are shown below:

Region	Rank of 2011 returns in 1971 to 2011, (41=LOWEST)		Rank of 2011 returns in 2002 to 2011 (10=LOWEST)		Median estimate of 2SW spawners as percentage of Conservation Limit
	1SW	2SW	1SW	2SW	(%)
Labrador	1	1	1	1	81
Newfoundland	3	8	2	1	133
Québec	8	27	1	1	96
Gulf	17	3	3	1	204
Scotia-Fundy	34	27	5	1	18
USA	5	12	1	1	13

Egg depositions by all sea ages combined in 2011 exceeded or equalled the river-specific CLs in 45 of the 74 assessed rivers (61%) and were less than 50% of CLs in 15 other rivers (20%, Figure 4.3.4.1).

For insular Newfoundland smolt production has increased in one of four monitored rivers, while over the same period (1970 to 2011) return rates of these smolts to 1SW salmon, although varying annually, have a significant increasing temporal trend. Returns to Newfoundland, where rivers are primarily 1SW stocks, have increased over the period, reflecting improved survivals at sea and sustained smolt production.

Smolt production has declined since the mid to late 1980s in two monitored Québec rivers with data extending to 2010. Over the last five year period return rates of these smolts to 1SW and 2SW salmon have increased compared to the previous five years. Increasing return rates in the monitored rivers resulted in higher 2SW returns and spawners and these rivers have met their CLs.

For the Gulf, smolt production has increased in monitored rivers from the early 2000s to 2011. Return rates of these smolts to 1SW and 2SW salmon both declined for monitored rivers over the same period. As a consequence, over the period 1980 to 2011, returns of 1SW and 2SW to the Gulf declined from above CLs to below CLs.

Smolt production has remained relatively constant since the late 1990s in monitored Scotia-Fundy rivers with data extending to 2011. Similarly, return rates of these smolts to 1SW and 2SW salmon, although varying annually, are low and have no significant temporal trend over the same period. Low smolt output and low return rates resulted in declining returns and spawners of 1SW and 2SW to Scotia-Fundy over the period, and CLs not being met.

Smolt production on the Narraguagus River in USA declined over the period 1997 to 2011, and return rates of wild smolts to 1SW and 2SW salmon, although varying annually, have no significant temporal trend over the same period. For hatchery smolts, a large component of smolt production in USA, return rates to 2SW salmon have declined from 1970 to 2011. Declining wild smolt output and declining return rates to 2SW salmon for hatchery smolts resulted in declining returns and spawners of 1SW and 2SW salmon since the late 1980s.

Despite major changes in fisheries, returns to southern regions (Scotia-Fundy and USA) have remained near historical lows and many populations are currently threatened with extirpation. In 2011, the estimated PFA of 1SW maturing salmon ranked 10th out of the

41-year time-series and the estimated PFA of 1SW non-maturing salmon ranked 23rd out of the 40-year time-series. The continued low abundance of salmon stocks across North America, despite significant fishery reductions, further strengthens the conclusions that factors other than fisheries are constraining production.

4.4 Management advice

As the predicted number of 2SW salmon returning to North America in 2012 is substantially lower than the 2SW CL there are no catch options for the composite stock in the North American fisheries. Where river-specific spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

Wild salmon populations are now critically low in the southern regions (Scotia-Fundy, USA) of North America and the remnant populations require alternative conservation actions including habitat restoration in some areas in addition to very restrictive fisheries regulation in order to maintain the genetic integrity of the stocks and improve their chances of persistence.

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 target all stocks present, whether or not they are meeting their individual CLs. Conservation would be best achieved if fisheries target stocks that have been shown to be meeting CLs. Fisheries in estuaries and especially rivers are more likely to meet this requirement.

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. 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.

4.6 Updated forecast of 2SW maturing fish for 2012

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

It is possible to provide catch options for the North American Commission area for four years. The updated forecast for 2012 for 2SW maturing fish is based on an up-dated forecast of the 2011 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador as 1SW non-maturing fish in 2011. The updated forecast of the 2011 pre-fishery abundance has a PFA mid-point of 174 900 fish, 17% above the forecast PFA value provided in the 2009 assessment (149 300) (ICES 2009a). The 2011 pre-fishery abundance of maturing 2SW salmon will be available in homewaters in 2012.

4.6.1 Catch options for 2012 fisheries on 2SW maturing salmon

As the 25th percentiles of the predicted numbers of 2SW salmon returning to North America in 2012 are lower than the 2SW management objectives for Labrador, Gulf, and Scotia-Fundy areas and overall for North America, there are no catch options on 2SW salmon in mixed-stock fisheries in North America in 2012 that would allow the attainment of region-specific management objectives (Table 4.6.1.1). A limited catch option may be available in Newfoundland and Québec as well as on individual rivers where spawning requirements are being achieved; in these circumstances, there are no biological reasons to further restrict the harvest. The expected returns to the USA, if realized, will contribute to stock rebuilding objectives.

4.7 Pre-fishery abundance of 2SW salmon for 2012–2014

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

ICES (2009a) developed estimates of the pre-fishery abundance for the non-maturing 1SW salmon (PFA) using a Bayesian framework that 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. This model considered regionally-disaggregated lagged spawners and returns of 2SW salmon for the six regions of North America. Dataseries were finalized for 2010 in some regions and updated for past years in some regions.

Annually varying and regionally specific Pre-Fishery Abundance estimates ($PFA_{i,k}$; in year i and region k) are assumed to be proportional to lagged-spawners ($LS_{i,k}$), with independent and identically distributed (i.i.d.) lognormal errors. These are modelled separately for each region (k = 6; Labrador, Newfoundland, Québec, Gulf, Scotia-Fundy, USA). The proportionality (log) coefficient $\alpha_{i,k}$ between $LS_{i,k}$ and $PFA_{i,k}$, referred to as the productivity, for each region is modelled dynamically as a random walk.

$$PFA_{k,i} \sim Lognormal(\mu.PFA_{k,i}, \sigma^{PFA})$$
$$\mu.PFA_{k,i} = \alpha_{k,i} + \log(LS_{k,i})$$

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

$$\alpha_{k,i} \sim Normal(u.\alpha_{k,i}, \sigma_k^{\alpha})$$
$$\mu.\alpha_{k,i} = \alpha_{k,i-1} + \gamma_i$$
$$\gamma_i \overset{iid}{\sim} Normal(0, \sigma^{\gamma})$$

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

North American and region-specific PFA and productivity value inferences are provided by the model (Figures 4.7.1.1 to 4.7.1.4).

Lagged spawners, overall to North America and to each region, are shown in Figure 4.7.1.1. Lagged spawner 2SW abundance has generally declined for North America from 1978 to 2003 PFA years with a slight upturn into 2014 (Figure 4.7.1.1). Spawner abundance in 2011 in North America was estimated to be at the highest level of the time-series, due to increases from previous years in all regions and especially for Labrador, Québec and Gulf regions (Figure 4.7.1.1). These spawning escapements will be reflected in the lagged spawners beginning in 2015 to 2018 PFA years.

As indicated in Section 4.3.6.2, the estimated abundance of the 1SW non-maturing salmon in 2010 increased from 2009 and recent years. The median value of the PFA in 2010 is at the highest level since 1995 but remains at about 20% of the peak PFA value of 822 000 fish estimated in 1979 (Figure 4.7.1.2). Estimated PFA in 2010 was highest in Labrador, Québec and Gulf, followed by Newfoundland, low in Scotia-Fundy, and least in USA (Figure 4.7.1.3). The sum of the medians of the PFA abundances by region are less than the median of the total estimated PFA for North America because of asymmetry in the distributions of the estimated values by region, i.e. the sum of medians does not equal the median of sums. In the past decade, PFA estimates have been very low relative to the first dozen years of the time-series (1978 to 1989) in all regions with the exception of Newfoundland (Figure 4.7.1.3).

The derived productivity in 2010 increased to a median value of 1.04 (equivalent to 2.84 fish at the PFA stage per lagged spawner), the highest value since 1991, but still below the peak productivity value of over 2.0 (7.4 fish at the PFA stage per lagged spawner) in 1980 (Figure 4.7.1.2). Productivity in 2010 was highest and greater than 1.0 (median value, equivalent to 2.72 fish at the PFA stage per lagged spawner) in USA, Scotia-Fundy and Labrador, at about 1.0 for Québec, and at 0.89 for Newfoundland and 0.70 for Gulf regions (Figure 4.7.1.4). Productivity increased since 2000 in Labrador, Newfoundland, Scotia-Fundy and USA, but not for Québec and Gulf. In all regions, the productivity over the past decade remains low compared to values estimated during 1978 to 1990. The lowest estimated productivities have occurred in the Scotia-Fundy region for the 2001 PFA and the USA for the 1999 PFA year (Figure 4.7.1.4).

Following on the estimated improvements in productivity for 2010 and the sustained or improved estimates of lagged eggs in 2011 to 2014 PFA years, the medians of the PFAs overall and to the regions are predicted to remain high or increase over the 2011 to 2014 period (Figure 4.7.1.2, 4.7.1.3). The forecasts have very high uncertainty and the uncertainties increase as the forecasts move farther forward in time.

4.7.2 Catch options for non-maturing 1SW salmon

Catch options on non-maturing 1SW salmon in North America in 2012 to 2014 and on surviving 2SW salmon in 2013 to 2015 are presented relative to the probability that the region specific PFA estimates for 2012 to 2014 will meet or exceed the 2SW management objectives for the regions, in the absence of any mixed-stock fisheries exploitation at sea. The management objectives, corrected to the PFA time period for eleven months of natural mortality of 0.03 per month, are provided in Table 4.7.2.1. The 25th percentiles of the predicted PFA abundances by region are predicted to be below the management objectives for Labrador, Gulf, and Scotia-Fundy for all years 2012 to 2014 therefore there are no mixed-stock fishery options on 1SW non-maturing salmon in 2012 to 2014 or on 2SW salmon in 2013 to 2015 which would provide a greater than 75% chance of meeting the management objectives. The forecast model suggests improvements in abundance for the USA region and PFA values above management objectives for Québec and Newfoundland regions (Table 4.7.2.1) but the expected surpluses (forecast values minus management objectives) are small and less than a few thousand fish annually.

4.8 Comparison with previous assessment and advice

The inference values from the previous assessment conducted by ICES (2009a) with forecasts for 2009 to 2011 were compared to the inference values of the model applied to the updated time-series and for which PFA estimates have been realized for the 2009 and 2010 PFA years (Figure 4.8.1). There is no change in the PFA values for the 1978 to 2008 time period, values from the 2009 runs and this year's assessment runs are identical (Figure 4.8.1). The predicted values of the PFA for 2009 and 2010 are very close to the realized values based on the assessment data and there is little change (+17%) in the PFA prediction for the 2011 PFA from the 2009 assessment to the present (Figure 4.8.1). The previous advice provided by ICES (2009a) indicated that there were no mixed-stock fishery catch options on the 1SW non-maturing salmon component for the 2009 to 2011 PFA years and this year's assessment confirms that advice.

Table 4.1.2.1. The number of professional and recreational gillnet licences issued at Saint-Pierre et Miquelon and reported landings.

	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	9	55	Na	Na	3.54
2009	8	50	1.87	1.59	3.46
2010	9	57	1.00	1.78	2.78
2011	9	56	1.76	1.99	3.75

Table 4.1.3.1. Harvests (by weight) and the percent large by weight and number in the Aboriginal Peoples' Food, Social, and Ceremonial (FSC) fisheries in Canada.

Aboriginal Peoples' FSC 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
2009	51.1	65	45
2010	59.3	59	38
2011	70.4	63	41

Table 4.1.3.2. Harvests (by weight) and the percent large by weight and number in the Resident Food Fishery in Labrador, Canada.

Labrador resident food fishery			
Year	Harvest (t)	% large	
		by weight	by number
2000	3.5	30	18
2001	4.6	33	23
2002	6.1	27	15
2003	6.7	32	21
2004	2.2	40	26
2005	2.7	32	20
2006	2.6	39	27
2007	1.7	23	13
2008	2.3	46	25
2009	2.9	42	28
2010	2.3	38	26
2011	2.1	51	37

Table 4.1.3.3. Numbers of salmon hooked and-released in Eastern Canadian salmon angling fisheries. Blank cells indicate no data.

	Newfoundland			Nova Scotia			New Brunswick [1]					Prince Edward Island			Quebec			Canada [2]		
Year	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	1655	2594	661	851	1020	14479	15330							1790	16134	17924
1985		315	315	1323	6346	7669	1098	3963	3809	17815	21778			67				5286	24476	29762
1986		798	798	1463	10750	12213	5217	9333	6941	25316	34649							10796	36864	47660
1987		410	410	1311	6339	7650	7269	10597	5723	20295	30892							11908	27044	38952
1988		600	600	1146	6795	7941	6703	10503	7182	19442	29945	767	256	1023				12416	27093	39509
1989		183	183	1562	6960	8522	9566	8518	7756	22127	30645							10080	29270	39350
1990		503	503	1782	5504	7286	4435	7346	6067	16231	23577			1066				9128	22238	31366
1991		336	336	908	5482	6390	3161	3501	3169	10650	14151	1103	187	1290				5512	16655	22167
1992	5893	1423	7316	737	5093	5830	2966	8349	5681	16308	24657			1250				14979	22824	37803
1993	18196	1731	19927	1076	3998	5074	4422	7276	4624	12526	19802							26548	18255	44803
1994	24442	5032	29474	796	2894	3690	4153	7443	4790	11556	18999	577	147	724				33258	19629	52887
1995	26273	5166	31439	979	2861	3840	770	4260	880	5220	9480	209	139	348		922	922	31721	14308	46029
1996	34342	6209	40551	3526	5661	9187						472	238	710		1718	1718	38340	13826	52166
1997	25316	4720	30036	713	3363	4076	3457	4870	3786	8874	13744	210	118	328	182	1643	1825	31291	18718	50009
1998	31368	4375	35743	688	2476	3164	3154	5760	3452	8298	14058	233	114	347	297	2680	2977	38346	17943	56289
1999	24567	4153	28720	562	2186	2748	3155	5631	3456	8281	13912	192	157	349	298	2693	2991	31250	17470	48720
2000	29705	6479	36184	407	1303	1710	3154	6689	3455	8690	15379	101	46	147	445	4008	4453	37347	20526	64482
2001	22348	5184	27532	527	1199	1726	3094	6166	3829	11252	17418	202	103	305	809	4674	5483	30052	22412	59387
2002	23071	3992	27063	829	1100	1929	1034	7351	2190	5349	12700	207	31	238	852	4918	5770	32310	15390	50924
2003	21379	4965	26344	626	2106	2732	1555	5375	1042	7981	13356	240	123	363	1238	7015	8253	28858	22190	53645
2004	23430	5168	28598	828	2339	3167	1050	7517	4935	8100	15617	135	68	203	1291	7455	8746	33201	23130	62316
2005	33129	6598	39727	933	2617	3550	1520	2695	2202	5584	8279	83	83	166	1116	6445	7561	37956	21327	63005
2006	30491	5694	36185	1014	2408	3422	1071	4186	2638	5538	9724	128	42	170	1091	6185	7276	36910	19867	60486
2007	17719	4607	22326	896	1520	2416	1164	2963	2067	7040	10003	63	41	104	951	5392	6343	22592	18600	41192
2008	25226	5007	30233	1016	2061	3077	1146	6361	1971	6130	12491	3	9	12	1361	7713	9074	33967	20920	54887
2009	26681	4272	30953	670	2665	3335	1338	2387	1689	8174	10561	6	25	31	1091	6180	7271	30835	21316	52151
2010	27256	5458	32714	717	1966	2683	463	5730	1920	5660	11390	42	27	69	1356	7683	9039	35101	20794	55895
2011	31004	6822	37826	1800	6514	8314		6537		12466	19003	46	46	92	1861	10545	12406	41248	36393	77641

[1] For New Brunswick, total excludes values from the kelt fishery

[2] Totals for all years prior to 1997 are incomplete and are considered minimal estimates

Table 4.1.3.4. Reported harvests expressed as 2SW salmon equivalents in North American salmon fisheries. Only midpoints of the estimated values have been used.

	MIXED STOCK					CANADA TERMINAL FISHERIES IN (Year i)													
Year (i)	NF-LAB Comm 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-LAB Comm 2SW (Year i) (a)	NF-Lab comm total (Year i)	Saint-Pierre and Miquelon (Year i)	Labrador	Newfoundland	Quebec	Gulf	Scotia - Fundy	Canadian total	USA	North American Total	Terminal Fisheries as a % of NA Total	Greenland Total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rates in North America on 2SW equivalents
1972	20115	0.12	153816	173931	0	460	594	27500	20220	5610	54384	345	228660	24	197560	426220	54	302400	0.76
1973	17441	0.07	219224	236665	0	1040	777	32800	15450	6213	56280	327	293272	19	148098	441370	66	377100	0.78
1974	23717	0.09	235915	259633	0	800	499	47620	18200	13050	80169	247	340049	24	186489	526537	65	449600	0.76
1975	23460	0.09	237565	261025	0	270	494	41150	14050	12510	68474	389	329888	21	154640	484529	68	416700	0.79
1976	35024	0.12	256586	291610	323	860	381	42200	16140	11110	70691	191	362815	20	194469	557284	65	431500	0.84
1977	26744	0.10	241253	267997	0	1270	781	42340	29180	13460	87031	1355	356383	25	112943	469325	76	473500	0.75
1978	26981	0.15	157309	184290	0	780	534	37460	20360	9364	68498	894	253682	27	142706	396388	64	317400	0.80
1979	13494	0.13	92056	105550	0	585	126	25250	6252	3843	36056	433	142039	26	103741	245780	58	172100	0.83
1980	20603	0.09	217186	237789	0	890	640	53530	25320	17380	97760	1533	337082	29	141844	478925	70	451800	0.75
1981	33724	0.14	201367	235092	0	540	436	44350	14621	12830	72777	1267	309136	24	120923	430059	72	365500	0.85
1982	33582	0.20	134407	167989	0	580	400	35220	20690	8925	65815	1413	235217	29	161183	396399	59	291100	0.81
1983	25241	0.18	111601	136842	323	440	422	34470	17280	12286	64898	386	202449	32	145870	348318	58	237300	0.85
1984	19039	0.19	82808	101847	323	527	189	24840	3450	3960	32966	675	135811	25	26830	162641	84	204900	0.66
1985	14333	0.15	78761	93095	323	328	9	27820	1020	5070	34247	645	128310	27	32445	160755	80	218000	0.59
1986	19580	0.16	104905	124486	269	448	39	34190	1810	2950	39437	606	164798	24	99068	263865	62	273500	0.60
1987	24787	0.16	132175	156962	215	650	18	34210	1980	1440	38298	300	195775	20	123439	319214	61	266200	0.74
1988	31564	0.28	81129	112694	215	686	20	34610	1290	1450	38056	248	151213	25	123799	275012	55	221400	0.68
1989	21896	0.21	81352	103248	215	446	5	29350	1170	350	31321	397	135182	23	84905	220087	61	200700	0.67
1990	19276	0.25	57363	76639	205	352	22	28430	1140	640	30584	695	108122	29	43631	151754	71	180800	0.60
1991	11835	0.23	40438	52273	129	96	12	29650	820	1390	31968	231	84602	38	52208	136810	62	153600	0.55
1992	9838	0.28	25105	34943	248	806	0	30480	1100	1160	33546	167	68904	49	79585	148488	46	151400	0.46
1993	3109	0.19	13276	16385	312	356	0	23530	680	1158	25724	166	42587	61	29814	72401	59	126400	0.34
1994	2077	0.15	11936	14013	366	510	0	24580	690	773	26553	2	40934	65	1891	42825	96	111600	0.37
1995	1183	0.12	8677	9860	86	440	0	23700	520	363	25023	0	34969	72	1891	36859	95	139300	0.25
1996	1033	0.15	5646	6679	172	340	0	22700	790	823	24653	0	31504	78	19181	50685	62	118900	0.26
1997	943	0.15	5391	6334	161	250	0	18600	790	604	20244	0	26739	76	19332	46071	58	96880	0.28
1998	1130	0.39	1761	2891	248	189	0	11290	480	331	12290	0	15429	80	13048	28477	54	67430	0.23
1999	175	0.17	842	1016	250	300	0	9170	800	459	10729	0	11995	89	4322	16317	74	70390	0.17
2000	150	0.13	1050	1200	244	200	0	8890	590	200	9880	0	11324	87	6442	17766	64	72260	0.16
2001	284	0.18	1336	1620	232	290	0	9660	930	262	11142	0	12994	86	5932	18926	69	83120	0.16
2002	261	0.19	1078	1339	210	200	0	6180	520	183	7083	0	8632	82	8606	17238	50	53010	0.16
2003	309	0.15	1689	1998	311	191	0	8510	780	209	9690	0	11999	81	3224	15222	79	80440	0.15
2004	351	0.11	2870	3221	300	250	0	8400	810	117	9577	0	13097	73	3474	16571	79	78940	0.17
2005	463	0.17	2187	2651	354	230	0	7450	950	106	8736	0	11740	74	4339	16079	73	79500	0.15
2006	559	0.19	2399	2957	383	250	0	7140	780	153	8323	0	11663	71	4181	15844	74	76550	0.15
2007	558	0.21	2059	2617	210	200	0	6690	820	110	7820	0	10647	73	4934	15581	68	71940	0.15
2008	494	0.14	3035	3529	381	260	0	6450	830	0	7540	0	11450	66	6616	18066	63	78260	0.15
2009	539	0.17	2596	3135	372	310	0	6510	910	0	7730	0	11237	69	7549	18786	60	92030	0.12
2010	439	0.13	2892	3331	299	162	0	5870	830	0	6862	0	10493	65	6671	17163	61	72030	0.15
2011	539	0.13	3456	3995	404	70	0	7990	1540	0	9600	0	13999	69	8764	22763	61	149000	0.09
2012	611																		

Variations in numbers from previous assessments is due to stochastic variation from Monte Carlo simulation

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) (excludes Saint-Pierre and Miquelon and NF-Lab Comm fisheries)

a - starting in 1998, there was no commercial fishery in Labrador; numbers reflect size of aboriginal fish harvest in 1998-2010 and resident food fishery harvest in 2000-2010

Table 4.6.1.1. Updated forecast, expressed as the 25th percentile, for 2012 of returns of 2SW salmon to regions and overall in North America, relative to the management objectives for the regions.

Region	25th percentile	Management objective
Labrador	16 990	34 746
Newfoundland	5655	4022
Québec	29 470	29 446
Gulf	22 530	30 430
Scotia-Fundy	2572	10 976
US	3627	2548
North America	92 980	112 168

Table 4.7.2.1. Predicted abundance (25th percentile upper table; median value lower table) of the 1SW non-maturing salmon at the PFA stage by region of North America for the 2012 to 2014 PFA years relative to the management objectives for the regions. The management objectives are adjusted for natural mortality for the eleven months between the PFA stage and returns to homewaters in North America.

Region	Objective (corrected for M)	25th percentile of regional PFA		
		2012	2013	2014
Labrador	48 331	29 950	29 600	32 690
Newfoundland	5594	7190	6032	6061
Québec	40 958	39 080	40 140	41 020
Gulf	42 327	28 910	26 650	27 680
Scotia-Fundy	15 267	4512	4691	3484
US	3544	5305	3553	5381
North America	156 021	139 100	138 800	151 800

Region	Objective (corrected for M)	Median of regional PFA		
		2012	2013	2014
Labrador	48 331	44 620	47 160	54 910
Newfoundland	5594	10 790	9652	10 280
Québec	40 958	50 160	53 750	57 130
Gulf	42 327	42 550	42 500	45 960
Scotia-Fundy	15 267	7236	8504	6672
US	3544	8444	6286	10 560
North America	156 021	176 700	186 500	213 600

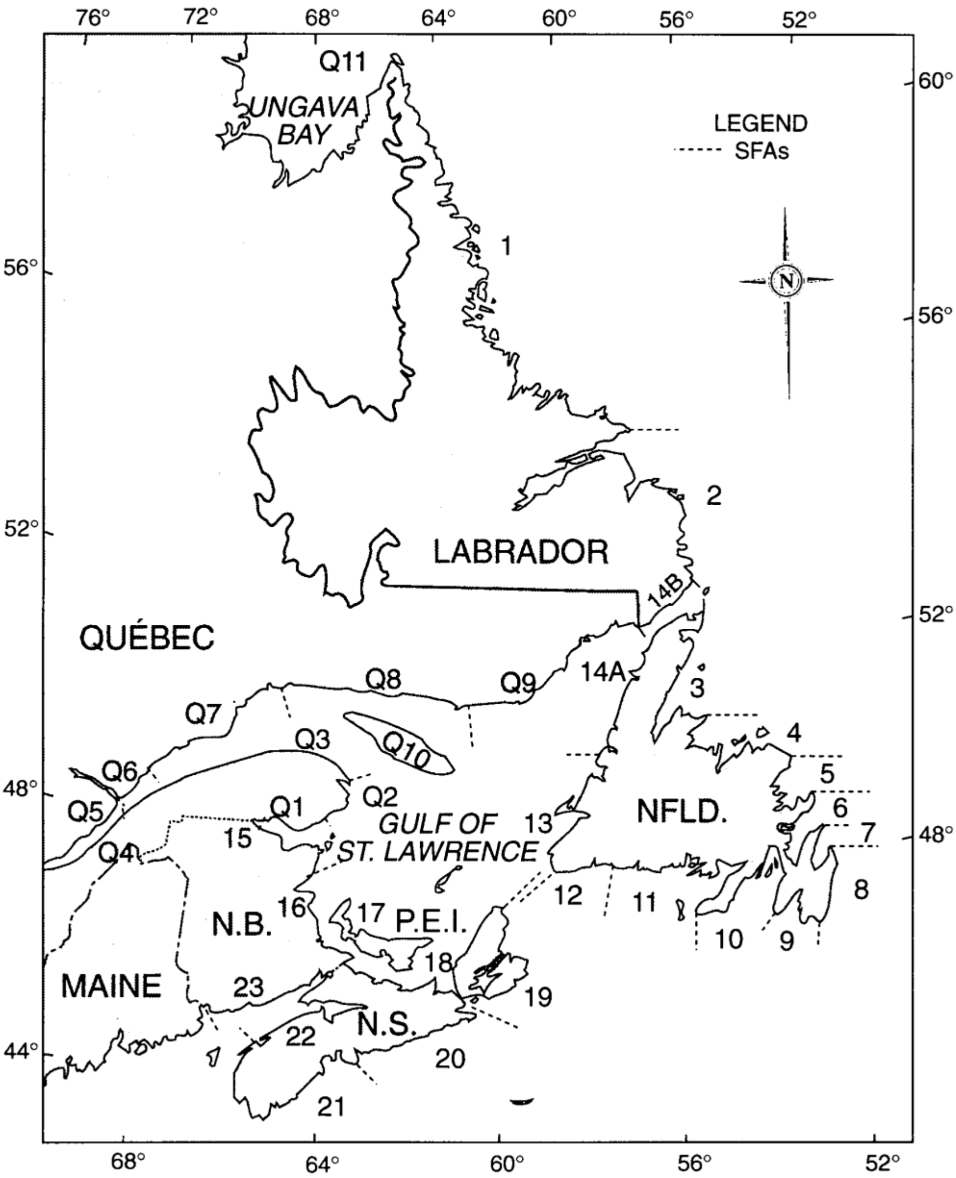


Figure 4.1.2.1. Map of Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada.

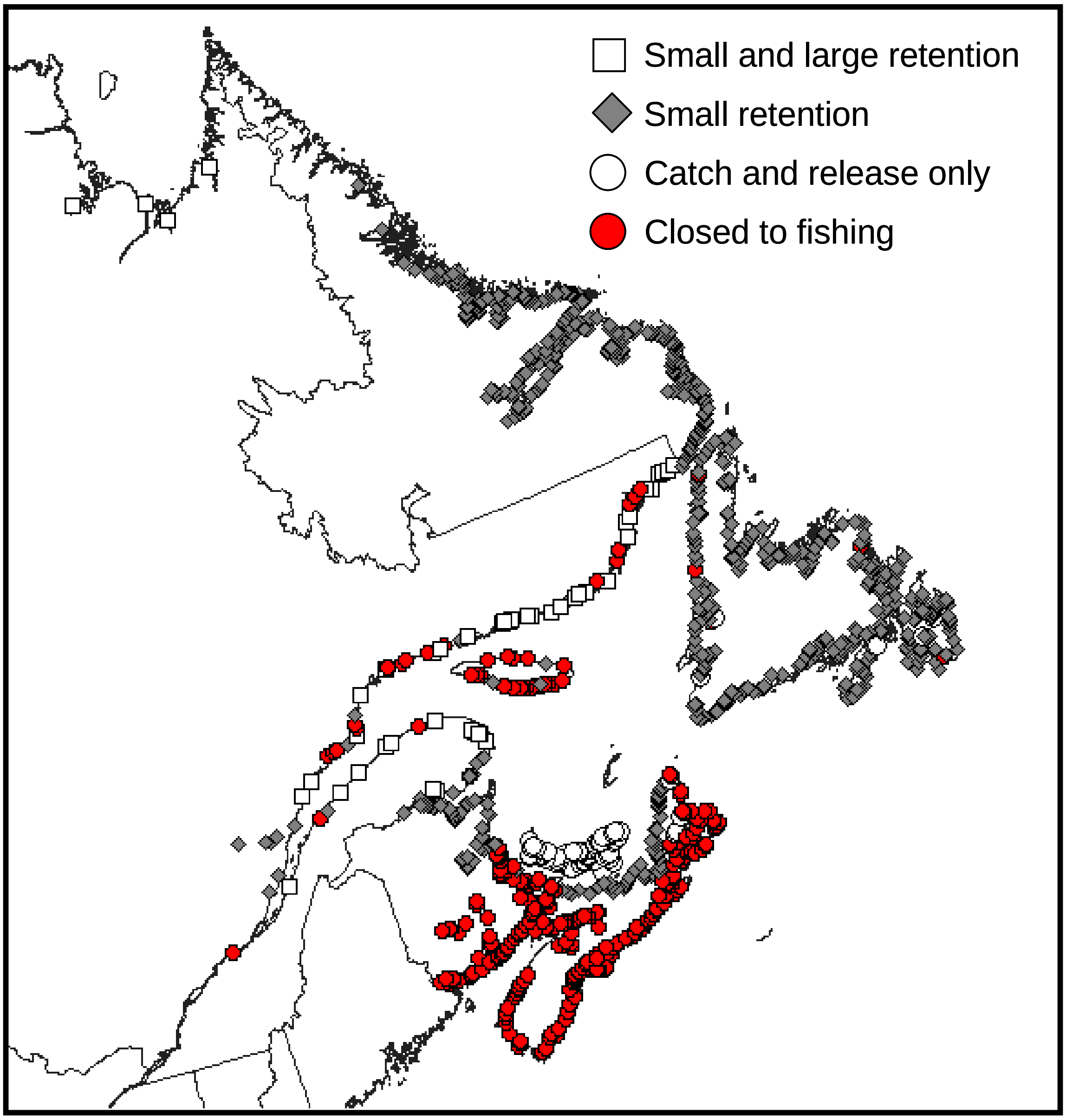


Figure 4.1.2.2. Summary of recreational fisheries management measures in Canada in 2011.

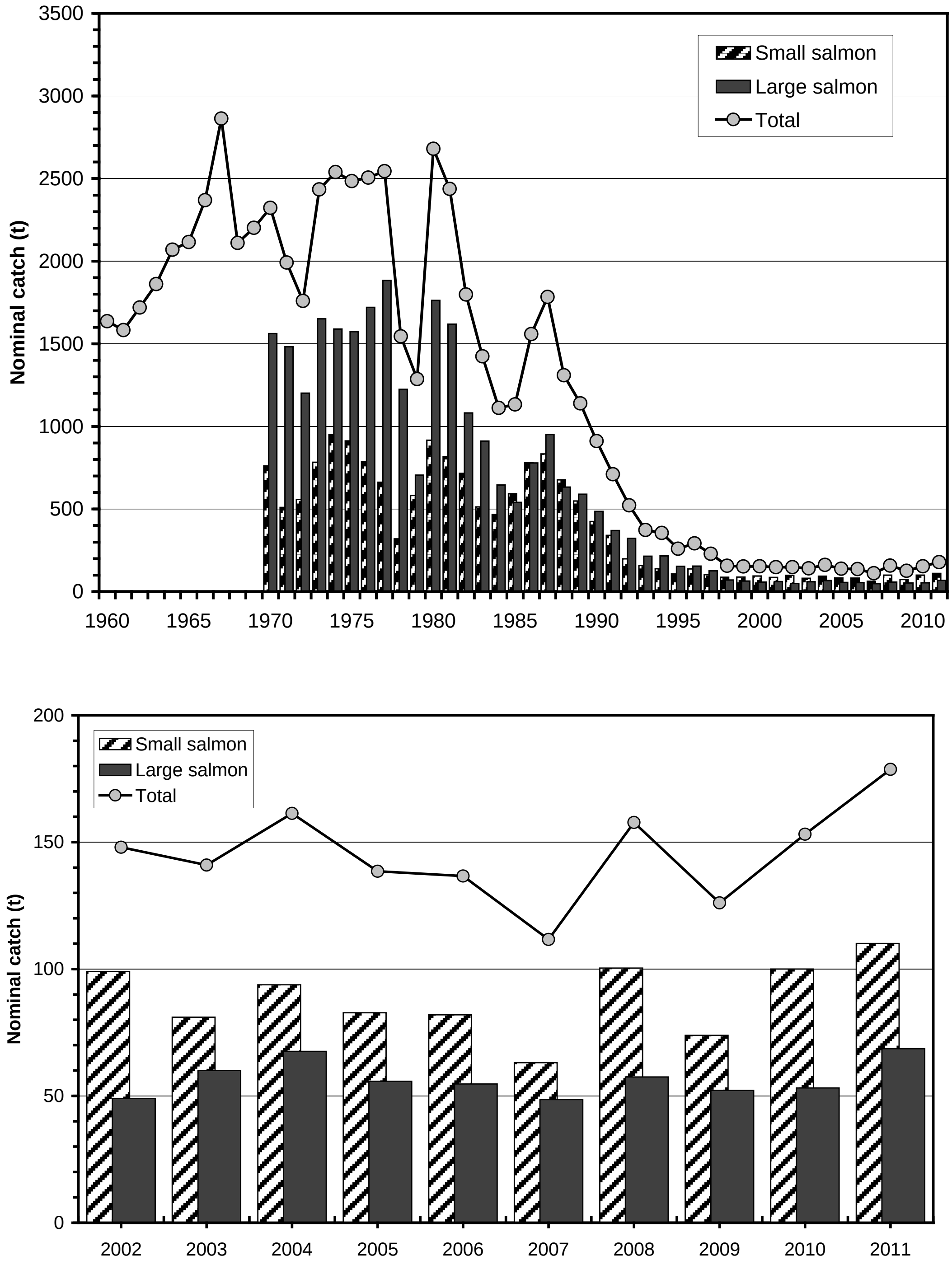


Figure 4.1.3.1. Harvest (t) of small salmon, large salmon and combined for Canada, 1960 to 2011 (top panel) and 2002 to 2011 (bottom panel) by all users.

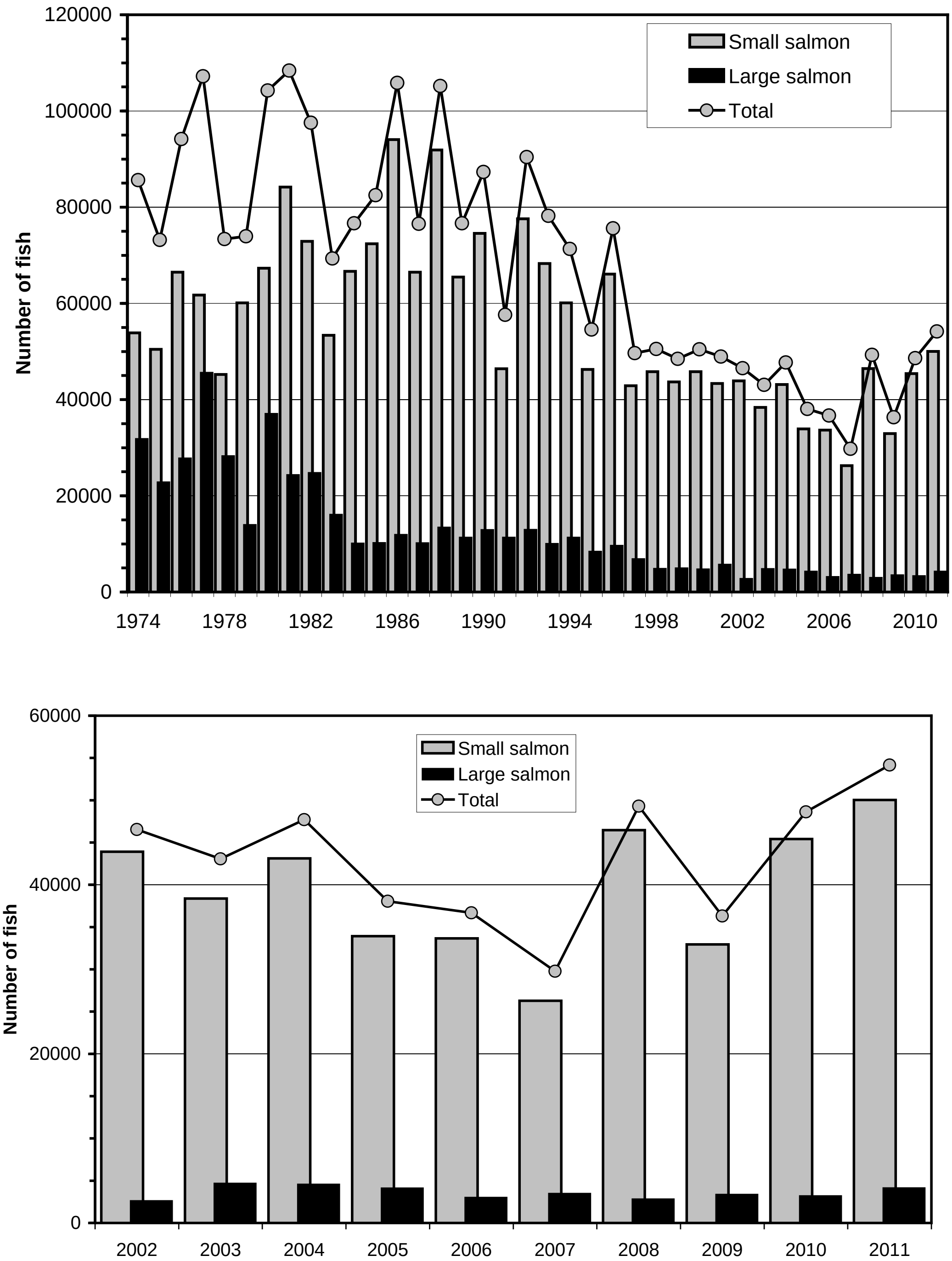


Figure 4.1.3.2. Harvest (number) of small salmon, large salmon and both sizes combined in the recreational fisheries of Canada, 1974 to 2011 (top panel) and 2002 to 2011 (bottom panel).

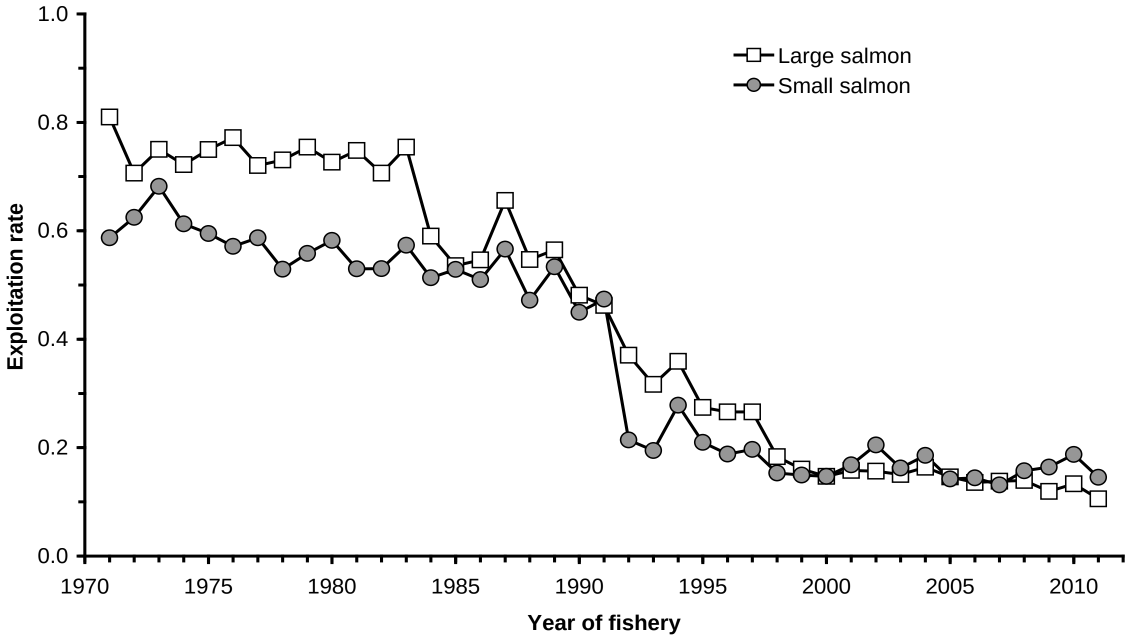


Figure 4.1.5.1. Exploitation rates in North America on the North American stock complex of small and large salmon.

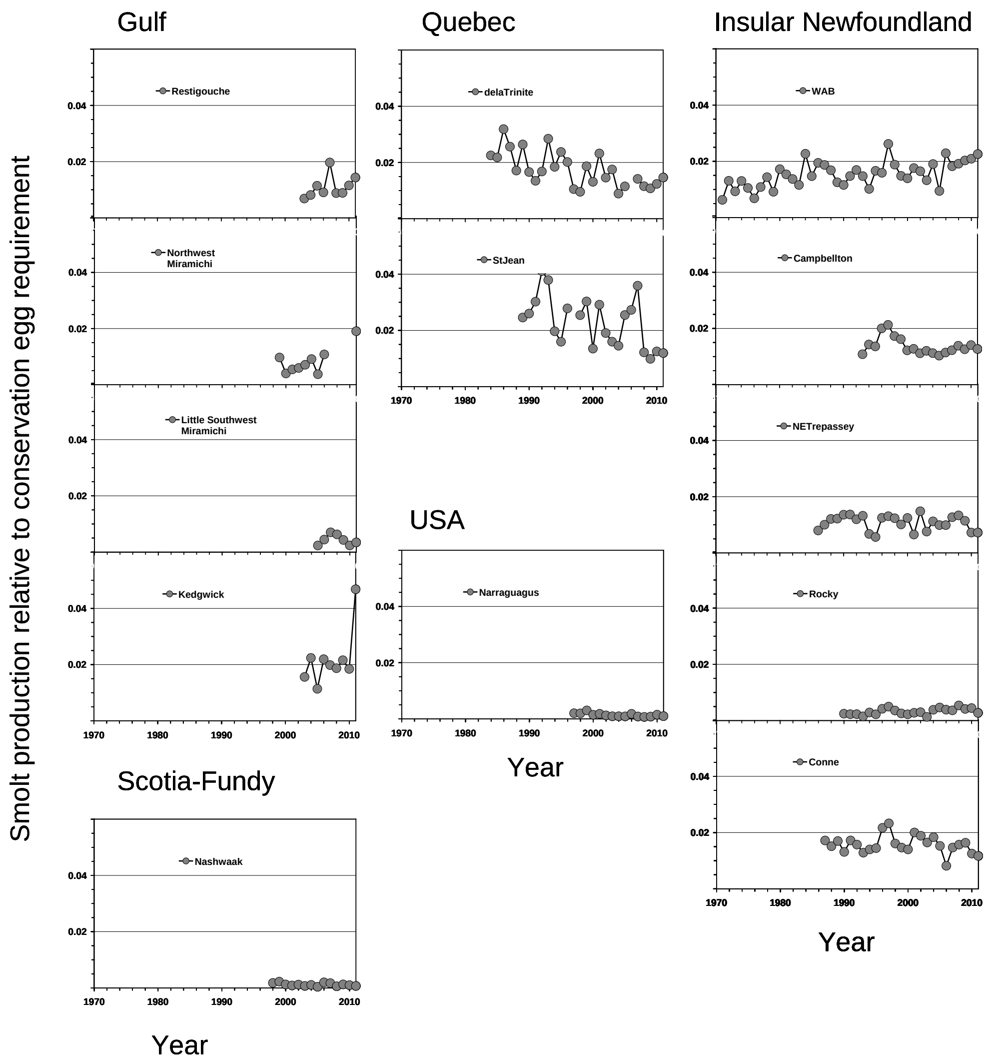


Figure 4.3.1.1 Time-series of wild smolt production from twelve monitored rivers in eastern Canada and one river in eastern USA 1970 to 2011. Smolt production is expressed as a proportion of the conservation egg requirements for the river.

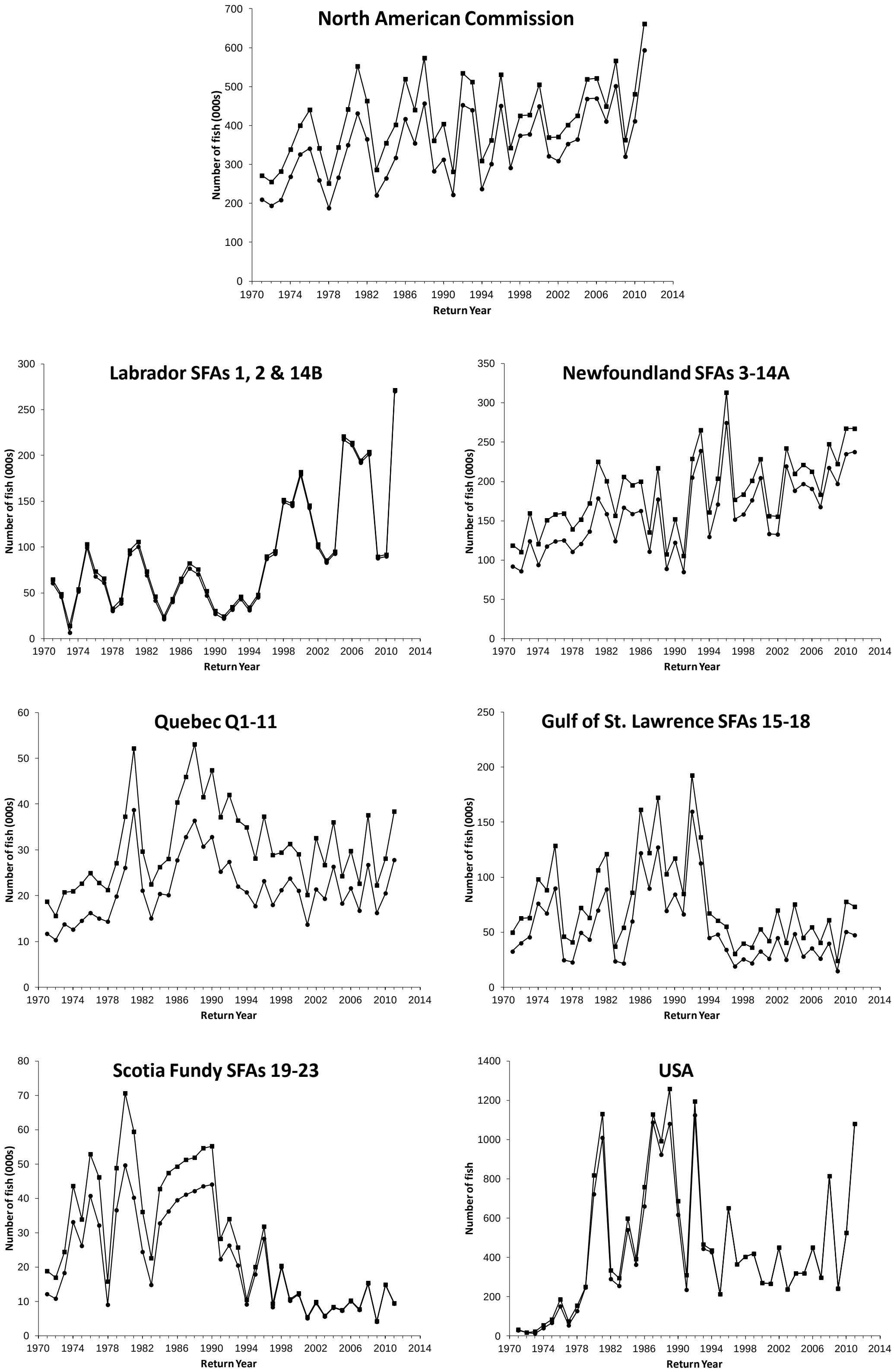


Figure 4.3.2.1. Comparison of estimated medians of small returns (squares) to and small spawners (circles) in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Note the difference in scale for USA.

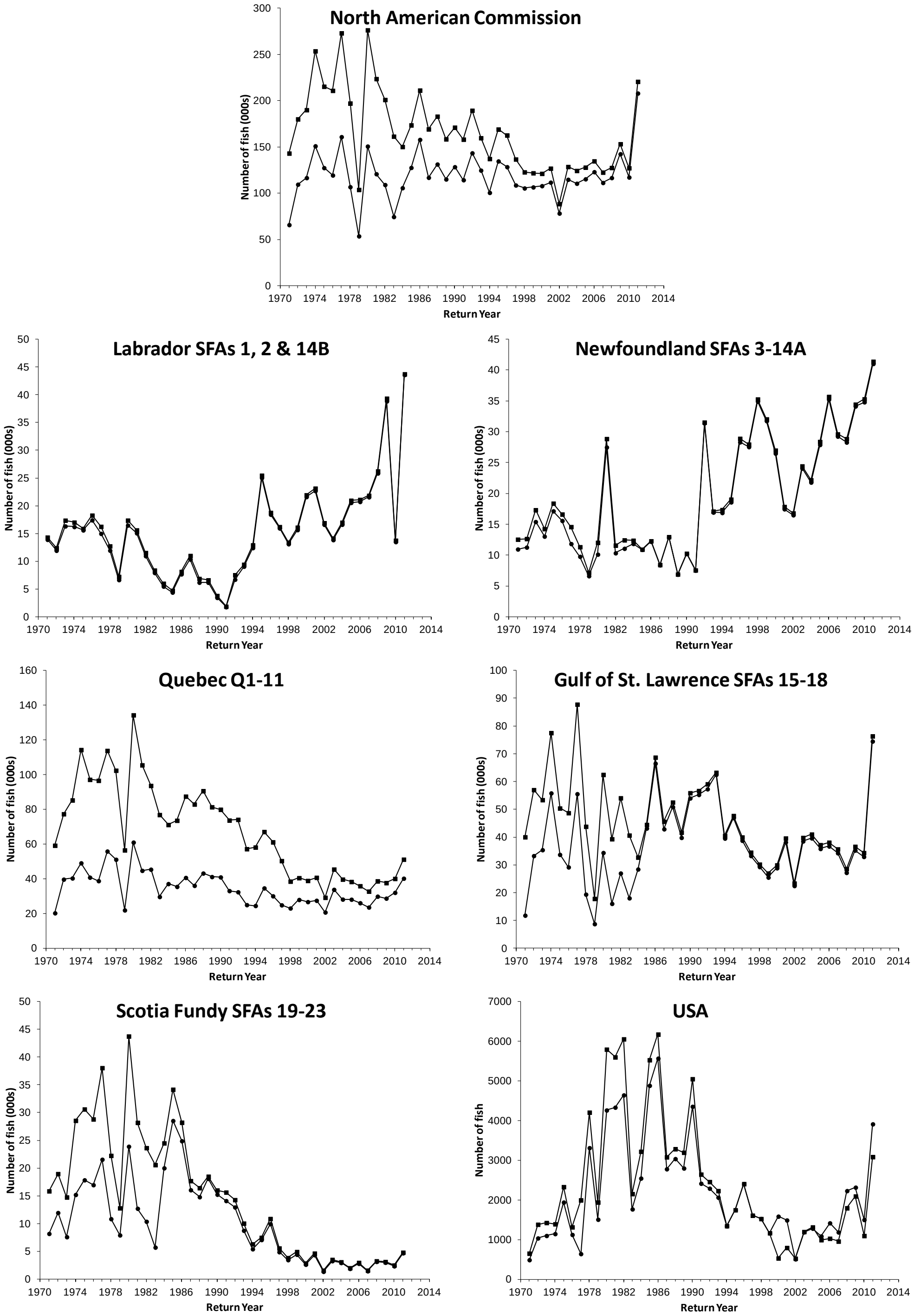


Figure 4.3.2.2. Comparison of estimated medians of large returns (squares) to and large spawners (circles) in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. For USA, estimated spawners exceed the estimated returns due to adult stocking restoration efforts. Also, note the difference in scale for USA and the concern detailed in Section 4.3.2 when interpreting the large increase in estimated 2009 Labrador large and 2SW return and spawners.

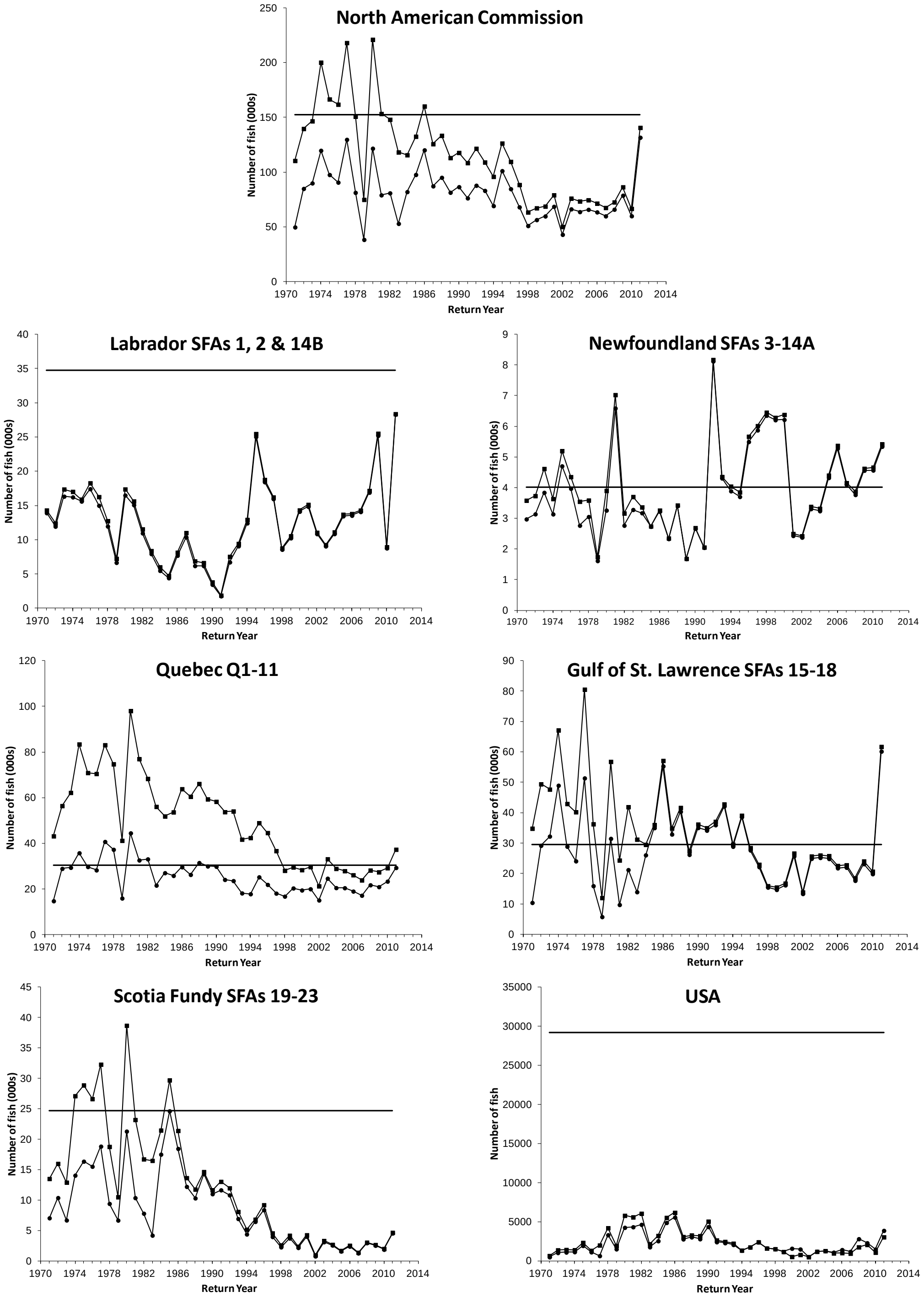


Figure 4.3.2.3. Comparison of the 2SW conservation limits to the estimated medians of 2SW returns (squares) and 2SW spawners (circles) in six geographic areas of North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. For USA, estimated spawners exceed the estimated returns due to adult stocking restoration efforts. Also, note the difference in scale for USA and the concern detailed in Section 4.3.2 when interpreting the large increase in estimated 2009 Labrador large and 2SW return and spawners.

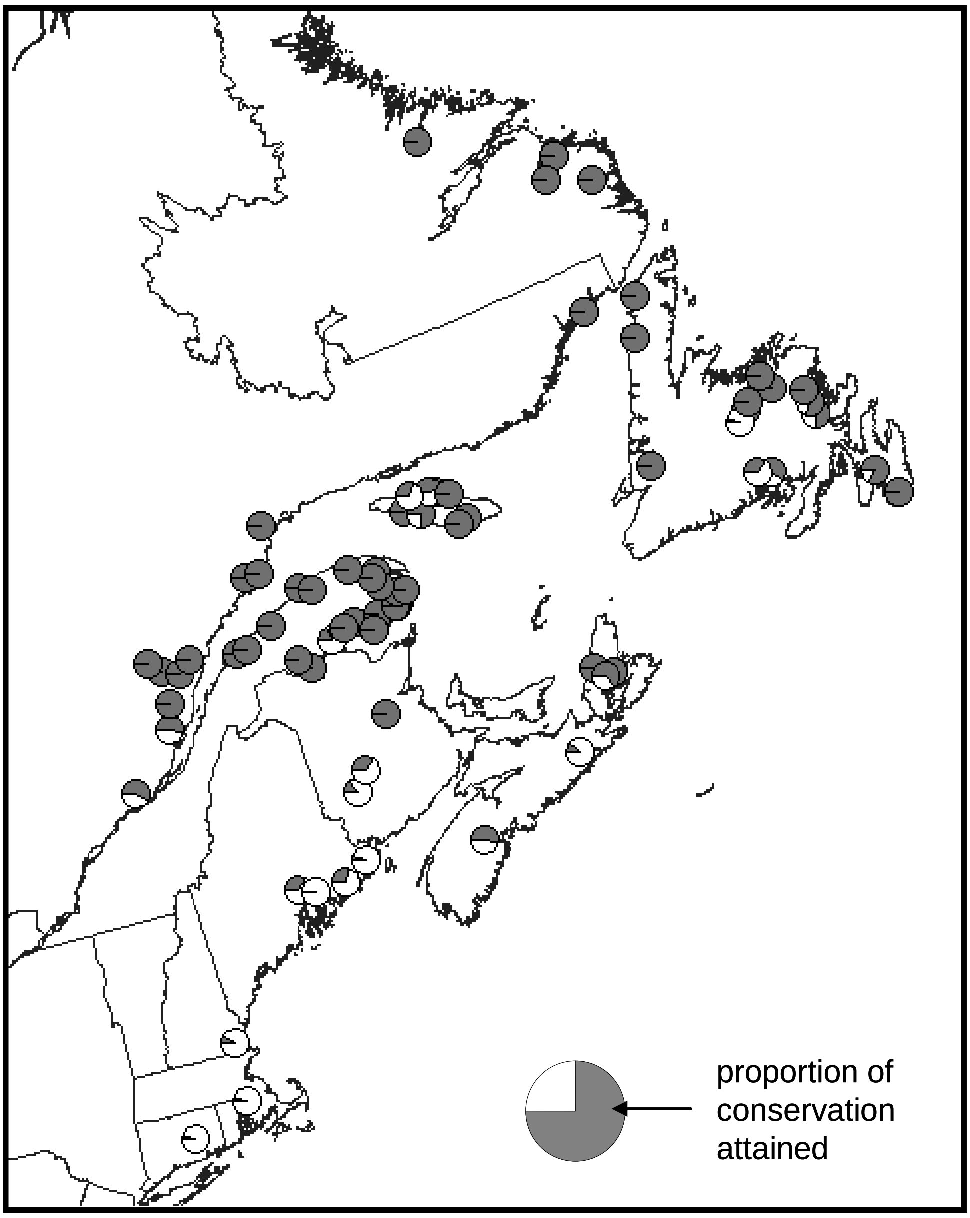


Figure 4.3.4.1. Proportion of the conservation requirement attained in the 74 assessed rivers of the North American Commission area in 2011.

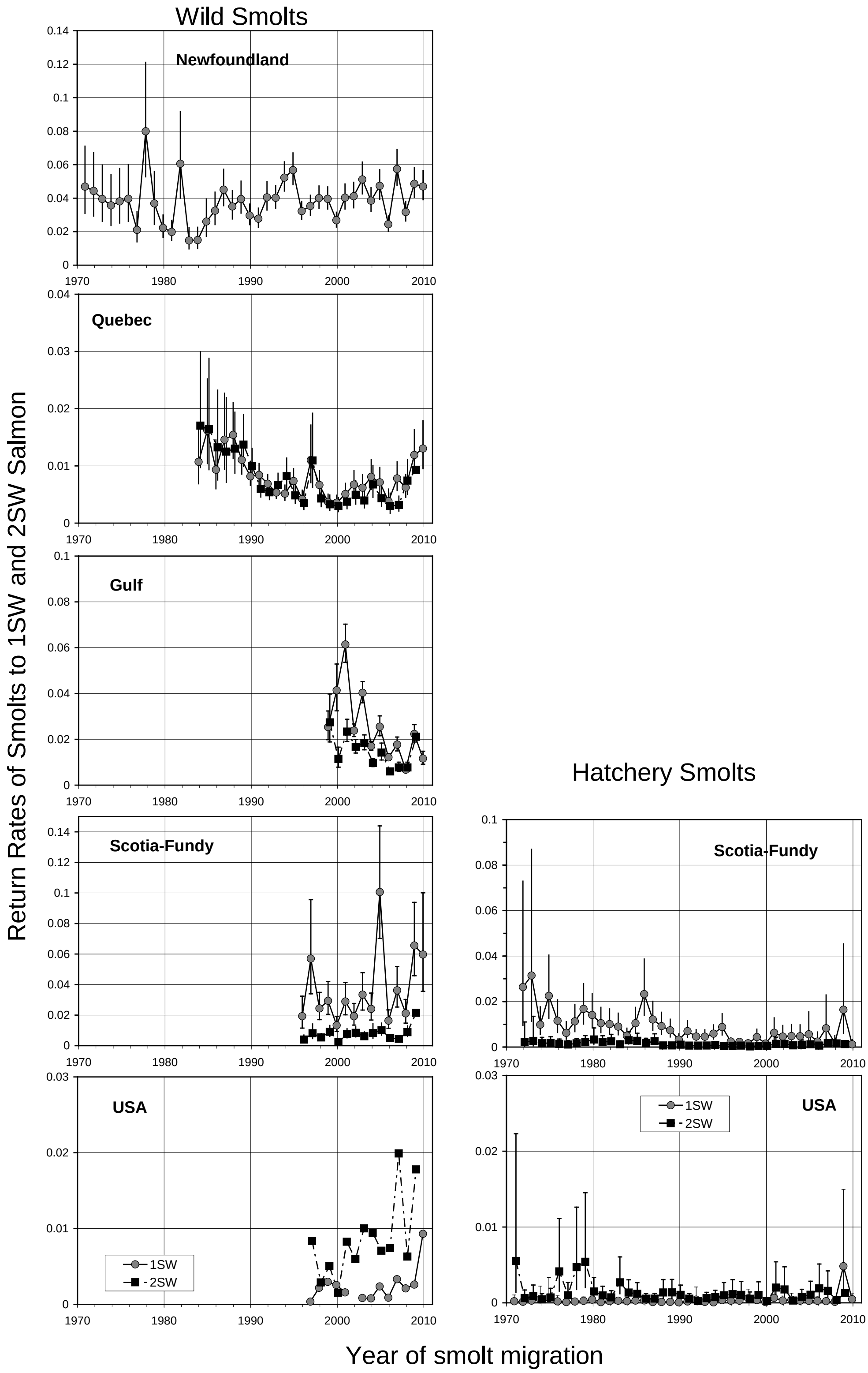


Figure 4.3.5.1 Standardized mean (one standard error bars) annual return rates of wild and hatchery origin smolts to 1SW and 2SW salmon to the geographic areas of North America. The standardized values are annual means derived from a general linear model analysis of rivers in a region. Survival rates were log transformed prior to analysis. Note y-scale differences among panels. Error bars are not included for estimates based on a single population.

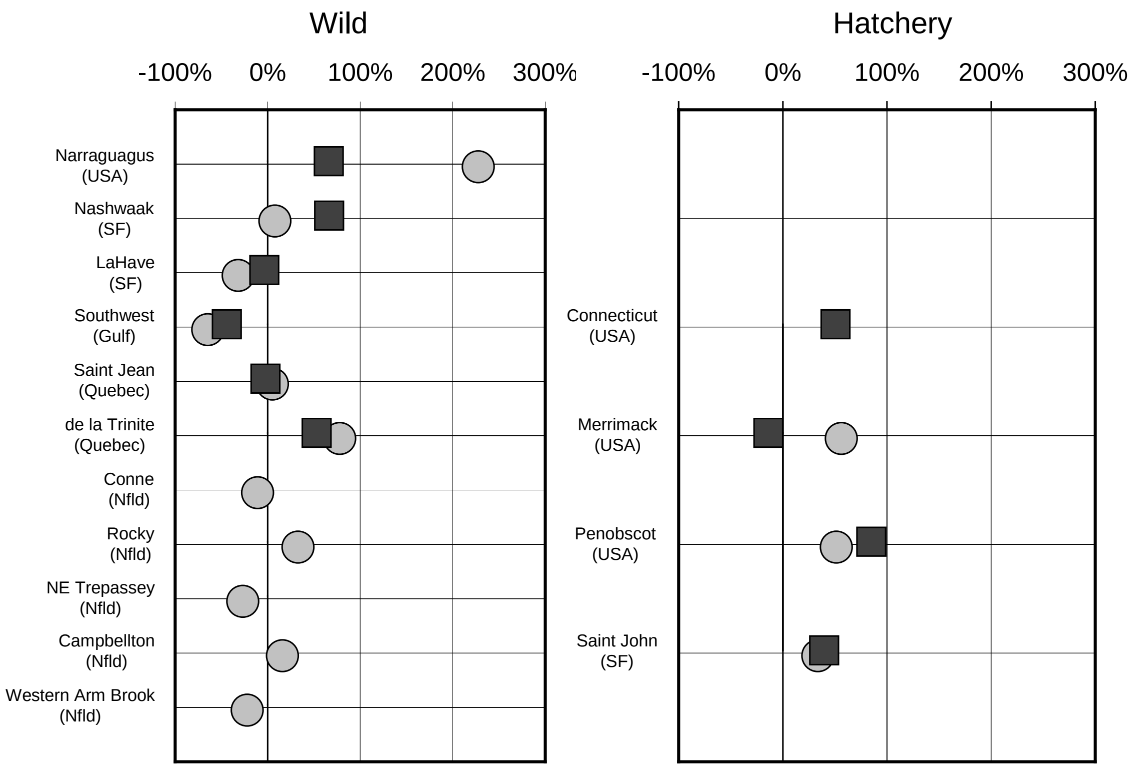


Figure 4.3.5.2 The percent change in the five-year mean return rates for 1SW and 2SW salmon smolts returning to rivers of eastern North America in 2007 to 2011 compared to the previous period (2002 to 2006). Grey circles are for 1SW and dark squares are for 2SW dataseries. Populations with at least three datapoints in each of the two time periods are included in the analysis.

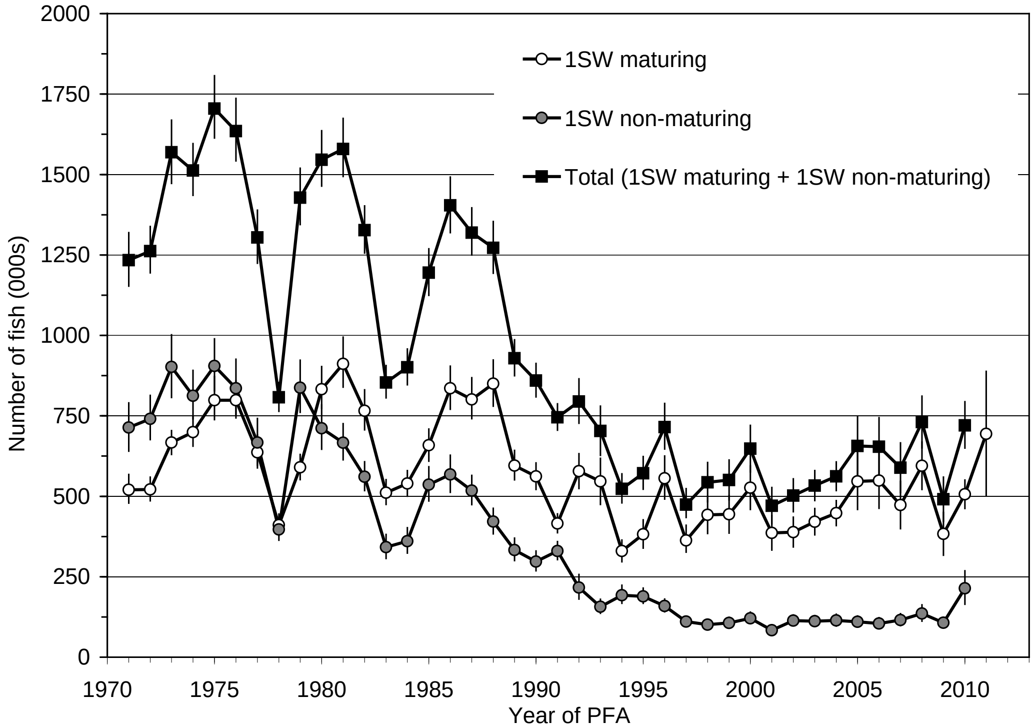


Figure 4.3.6.2.1 Estimates of PFA for 1SW maturing salmon, 1SW non-maturing salmon, and the total cohort of 1SW salmon based on the Monte Carlo simulations of the run-reconstruction model for NAC. Median and 95% CI interval ranges derived from Monte Carlo simulations are shown.

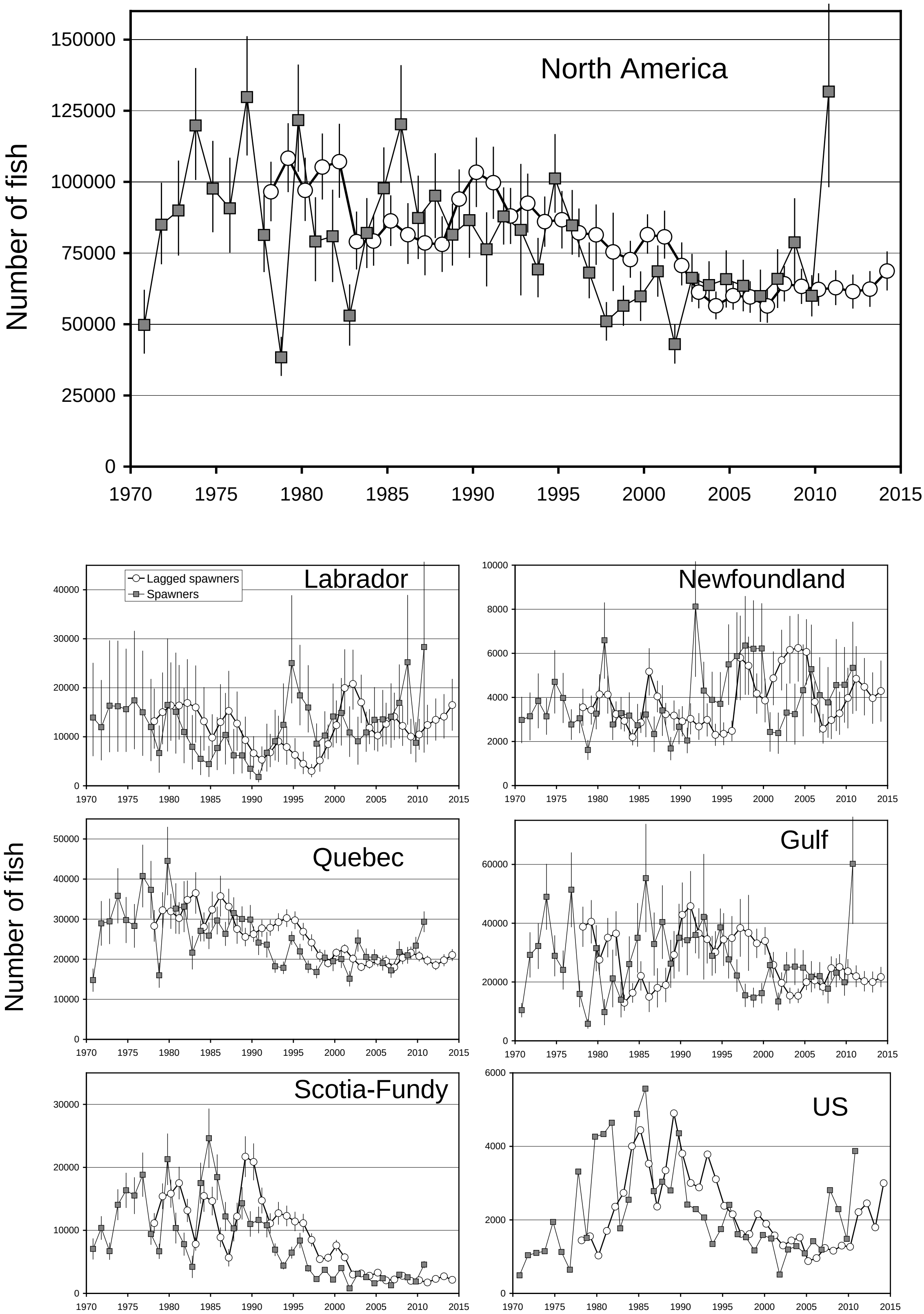


Figure 4.7.1.1. Estimated (median, 95% Confidence Interval) 2SW spawners and 2SW lagged spawners for North America and to regions. The year axis is for the year of spawning escapement for spawners and the year of PFA for lagged spawners.

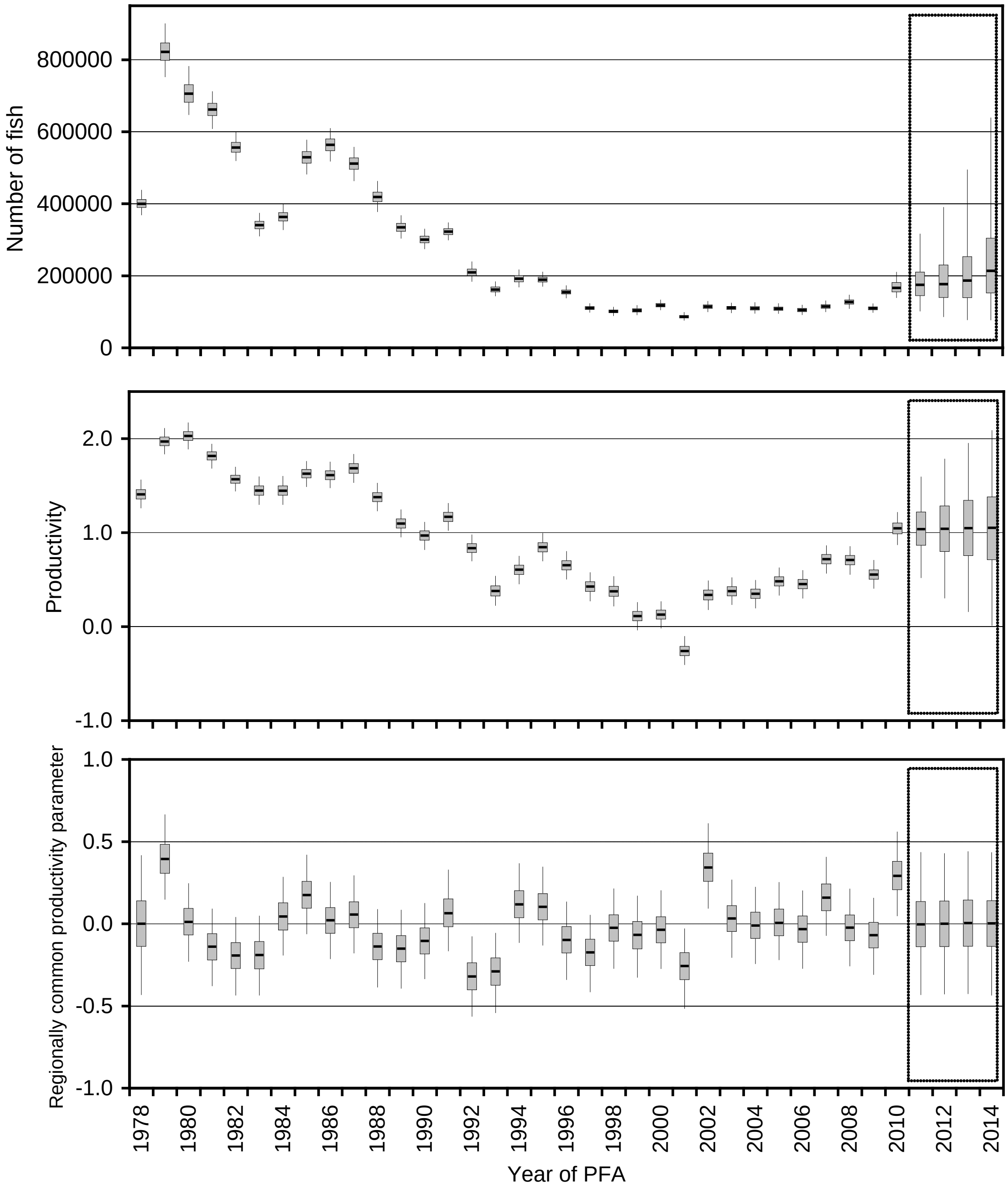


Figure 4.7.1.2. Estimated Pre-Fishery Abundance (PFA; upper panel) and overall productivity (on the log scale; PFA per LS; middle panel), and regionally common time varying productivity shift for the North America 2SW salmon complex. The distributions for years 2011 to 2014, shown in the dotted rectangle, are predicted values.

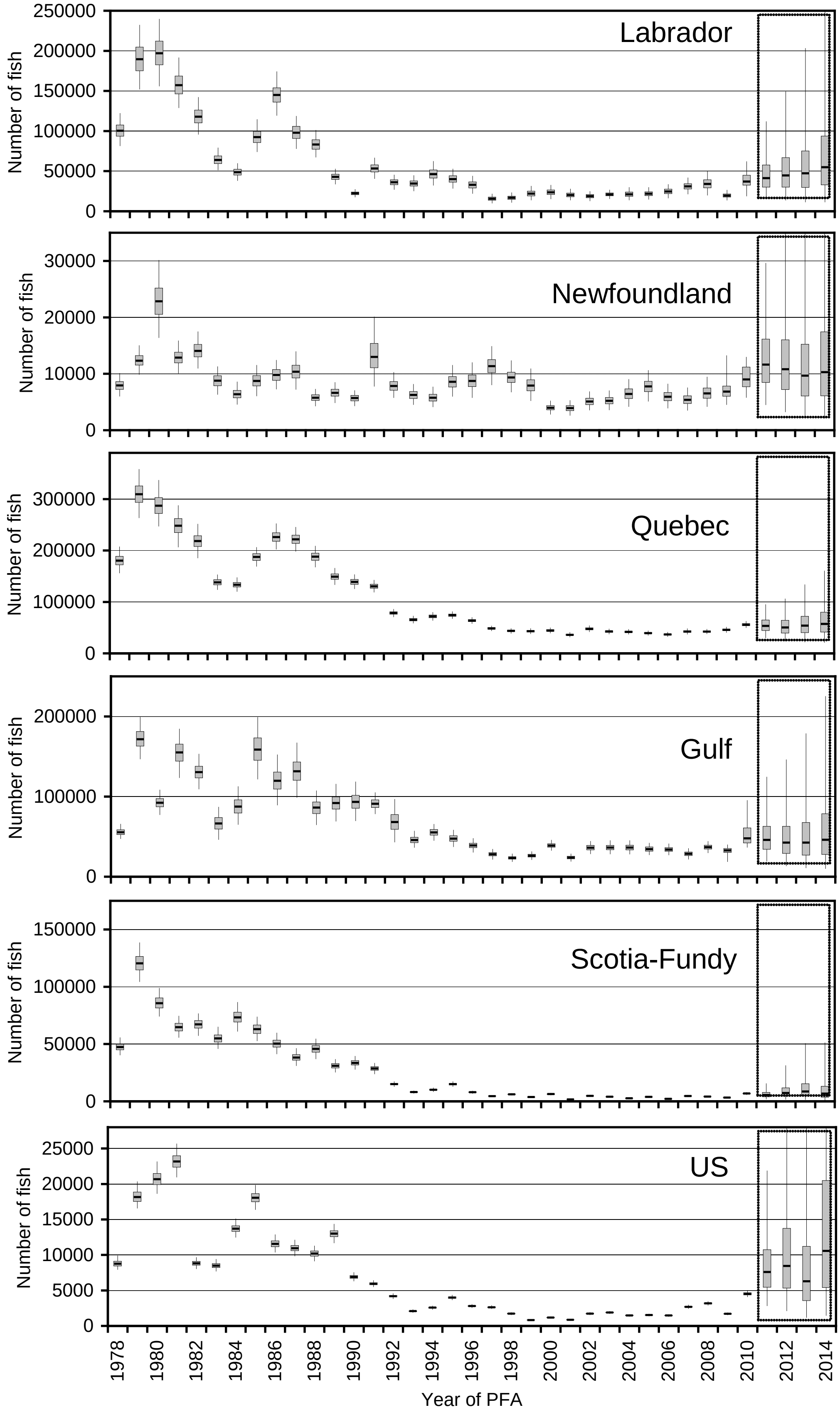


Figure 4.7.1.3. Estimated Pre-Fishery Abundance (PFA; number of fish) for the six regions of North America by year of Pre-Fishery Abundance (PFA). The distributions for years 2011 to 2014, shown in the dotted rectangle, are predicted values.

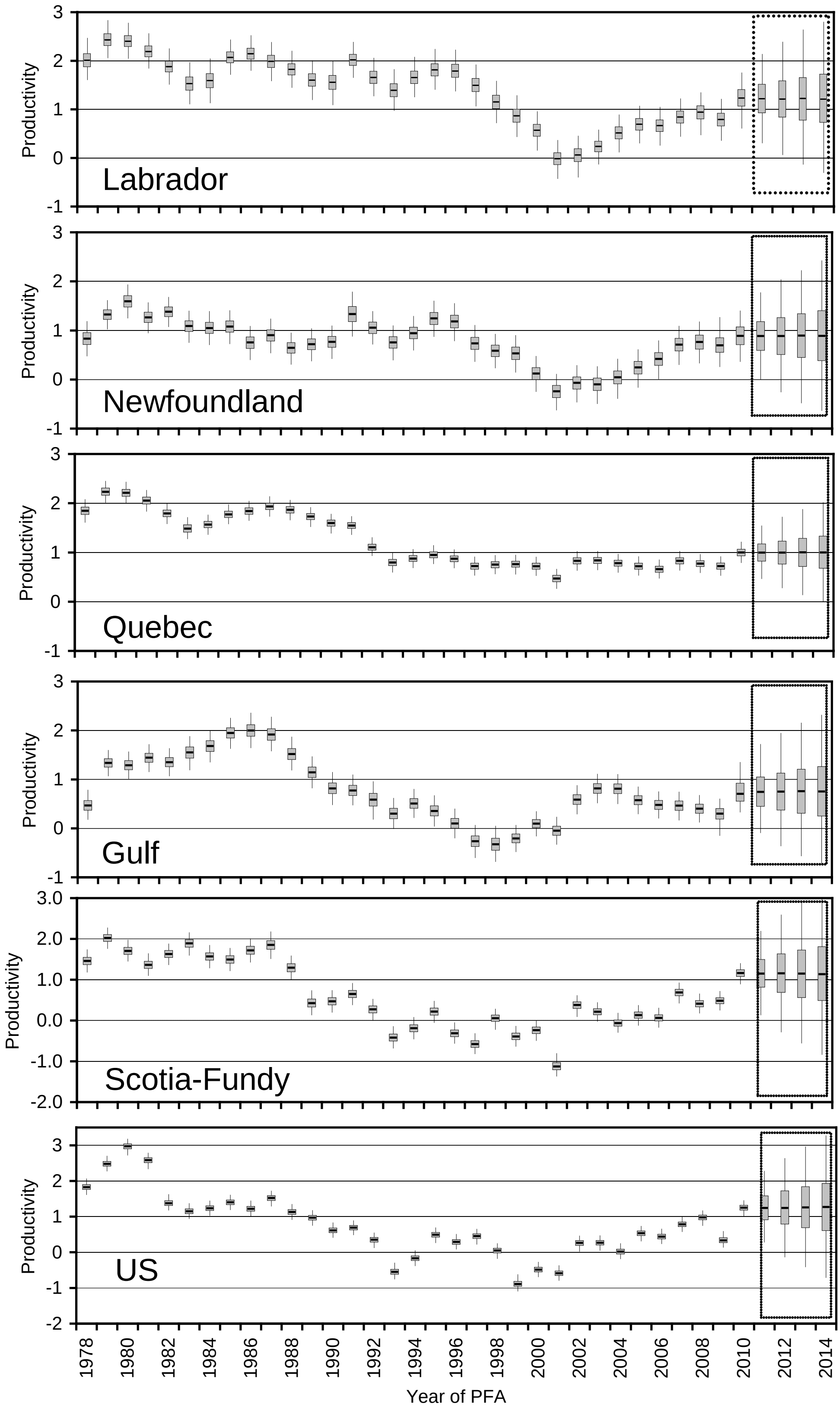


Figure 4.7.1.4. Estimated productivity (on the log scale; PFA per LS) for the six regions of North America by year of Pre-Fishery Abundance (PFA). The distributions for years 2011 to 2014, shown in the dotted rectangle, are predicted values.

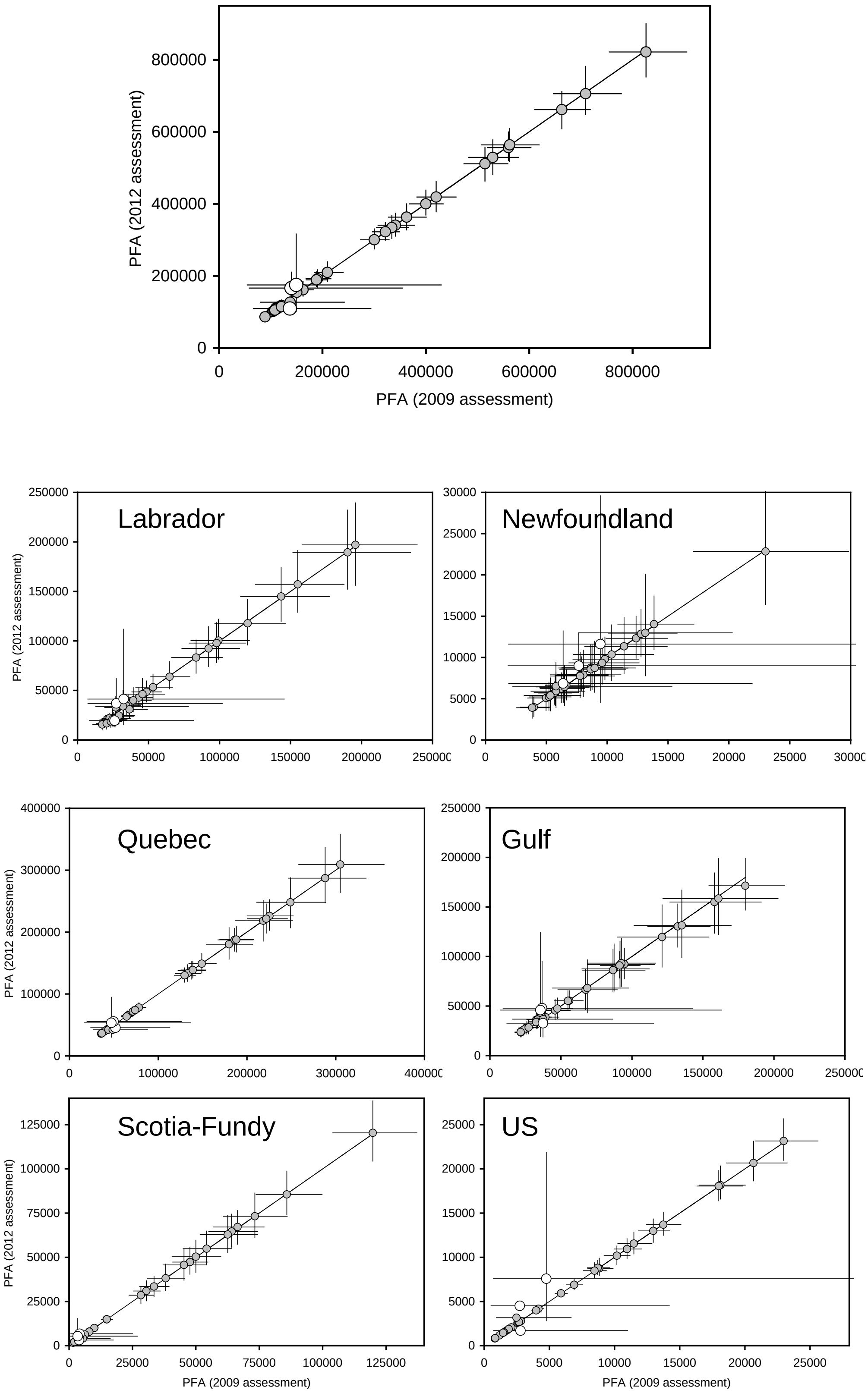


Figure 4.8.1. Comparison of predicted PFA for North America (upper panel) and by region based on the previous assessment (ICES 2009) and the assessment in 2012. The values shown are the median estimates (with 95% confidence interval range). The three white symbols are the forecast values from the 2009 assessment relative to the estimated values from the 2012 assessment. The diagonal line is the 1:1 line.

5 Atlantic salmon in the West Greenland Commission

5.1 NASCO has requested ICES to describe the events of the 2011 fishery and status of the stock

5.1.1 Catch and effort in 2011

An extant exploitation rate for NAC and NEAC 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 each complex. Exploitation rates are available for the 1971 to 2010 PFA years (Figure 5.1.1.1). The most recent estimate of exploitation available is for the 2010 fishery as the 2011 exploitation rate estimates are dependent on the 2012 returns of 2SW to NAC or returns of MSW to Southern NEAC. NAC PFA estimates are provided for August of the PFA year and NEAC PFA estimates are provided for January of the PFA year, the latter adjusted by eight months (January to August) of natural mortality at 0.03 per month. The 2010 NAC exploitation rate was 5.7% and is a decrease from the previous year's estimate (8.7%), the previous five-year mean (7.2%), and remains among the lowest in the time-series. NAC exploitation rate peaked in 1971 at 38.5%. The 2010 NEAC exploitation rate was 0.5% and is an increase from the previous year's estimate (0.2%), equal to the previous five-year mean (0.5%), and also remains among the lowest in the time-series. NEAC exploitation rate peaked in 1975 at 29.4%.

The Atlantic salmon fishery is currently regulated according to The Government of Greenland Executive Order no. 21 of August 10, 2002. Only hook, fixed gillnets and driftnets are allowed to target salmon directly and the minimum mesh size has been 140 mm stretched since 1985. Fishing seasons have varied from year to year, but in general the season has started in August and continued until the quota was met or until a specified date later in the season. As in recent years, the 2011 season was August 1 to October 31.

The catch data were collated from fisher reports. The reports were screened for errors and missing values. Catches were assigned to NAFO/ICES area based on the reporting community. Reports which contained only the total number of salmon caught or the total catch weight without the number of salmon, were corrected using an average of 2.75 kg gutted weight per salmon. Since 2005 it has been mandatory to report gutted weights, and these have been converted to whole weight using a conversion multiplier of 1.11.

Catches of Atlantic salmon decreased until the closure of the export commercial fishery in 1998, but the subsistence fishery has been increasing in recent years. In 2011, catches were distributed among the six NAFO Divisions on the west coast of Greenland and in ICES Division XIV (East Greenland) (Table 5.1.1.2; Figure 5.1.1.2). A total catch of 27.5 t of salmon was reported for the 2011 fishery compared to 40 t of salmon in the 2010 fishery, a decrease of 31% on 2010 (Table 5.1.1.2). A harvest of 0.1 t was reported from East Greenland in 2011, accounting for approximately 0.4% of the total reported catch at Greenland. Harvest reported for east Greenland is not included in assessments of the contributing stock complexes.

There is currently no quantitative approach for estimating the unreported catch but the 2011 value is likely to have been at the same level proposed in recent years (10 t).

Of the total catch, 16.5 t was reported as commercial and 11.0 t was reported as being for private consumption. However, 4.9 t of the private consumption catch was reported by licensed fishers.

In recent years there seems to have been almost no transport of salmon from the settlements to the cities and instead, the fisheries have been conducted in close proximity to the cities. Additionally, commercial catches are highest in the cities and lowest around settlements where the private fishery is more prevalent.

The seasonal distribution of catches has previously been reported to ICES (2002). However since 2002, this has not been possible although fishers are required to report their catch immediately after fishing. Comparisons of summed reported catch and number of returned catch reports reveals that a large number of fishers report their total catch in only one report for the entire season.

The Greenland Authorities received 234 reports of salmon catches from 117 fishers in 2011 compared to 309 reports from 208 fishers in 2010 (Table 5.1.1.3). The decreases from 2010 to 2011 are due mainly to decreases in licences and reports from Division 1A. The total number of fishers reporting catches from all areas has increased from a low of 41 in 2002 to its current level. These levels remain well below the 400 to 600 people reporting landings in the commercial export fishery from 1987 to 1991.

The fluctuations in the numbers of people reporting catches as well as the catches in each of the NAFO Divisions suggest that there are inconsistencies in the catch data and highlight the need for better data. In 2011, a voluntary reporting system was initiated by the Greenlandic Authorities. Logbooks were provided to each fisher with their licence, and approximately half of the logbooks were returned with varying levels of information by the end of the fishing season.

The logbook instructions requested that fishers provide more detailed information related to their salmon fishing activities than required under their licence conditions. Logbooks were only provided to commercial fishers holding commercial licences, and not to private fishers. The data requested were:

- Date;
- Fishing place;
- Number of salmon;
- Weight in kg;
- Number of nets;
- Number of fishing hours;
- Catch sold/Community catch sold in;
- Notes.

These data will allow for a more accurate characterization of the nature and extent of the fishery than is currently available. Logbook data may provide catch and effort statistics (CPUE) that will allow a more detailed assessment based on time and location of fishing activities. More detailed information on the nature and extent of the fishery will allow for a better estimation of the impacts on this resource. Catch per unit of effort (CPUE) statistics represent indirect measure of the abundance and trends. Increasing CPUE values may be indicative of increasing abundance, decreasing CPUE values may be indicative of decreasing abundance, and constant CPUE values may be indicative of stable abundance.

The Working Group recommends that the reporting system continues and that logbooks be provided to all fishers. Efforts should continue to encourage compliance with this voluntary system.

5.1.2 NASCO has requested ICES to advise on possible explanations for the variations in fishing patterns (e.g. effort, licences and landings) observed in the Greenland fishery in recent years

The harvest of salmon at Greenland is among the lowest on record and is far below the maximum reported harvest of 2689 t in 1971. However, the last commercial export fishery occurred in 2001 and resulted in 43 t of reported landings. There have been no commercial export fisheries since 2001 and reported landings from the internal use only fishery in 2002 were 9 t. Since that time, landings have risen steadily to a maximum of 40 t in 2010. The 2010 value was a large increase over the 2009 value and was primarily due to an increase in effort and reported landings in NAFO Division 1A (Tables 5.1.1.2 and 5.1.1.3). The increase and annual variation in effort and fishing patterns is of concern, especially given that there has not been an export commercial fishery for Atlantic salmon in Greenland since 2001 and the landings are from the internal use only fishery, which in the past has been estimated at 20 tons annually.

The mean adjusted harvest for the period 2001–2010 is 24.7 t (ICES 2011b). The Working Group interprets the 2011 harvest level as approaching a more normal expected level of harvest of salmon at Greenland. Over the past ten years, reported harvests have mostly remained within the 15–25 t range and this range may well represent the internal market in Greenland within the salmon season. Landings of Atlantic salmon to factories are banned and freezing salmon for shipping to other communities is illegal, so only local harvest is available for local consumption.

The increase in landings in 2010 could have been due to an increase in abundance of salmon, especially in NAFO Division 1A. If this is true, then more salmon were available to a larger part of the population, which may have resulted in the increased effort (Table 5.1.1.3) and reported landings (Table 5.1.1.2). PFA estimates for the West Greenland stock complex in recent years have been increasing (see Sections 4.3.6 and 3.3.4) and the abundance of salmon at Greenland is also assumed to be increasing, although still well below historical levels.

Considering the regulations preventing the exporting of salmon for sale or the freezing of salmon for shipping to other communities, it is assumed that all salmon harvested in Greenland is consumed in Greenland. As such, there is likely an internal market limit for salmon in Greenland. Continued and increased participation in the logbook programme will allow the Working Group to better assess the causes of annual variation in reported harvest as well as annual variations in fishing patterns.

5.1.3 Biological characteristics of the catches

The international sampling programme for the fishery at West Greenland agreed by the parties at NASCO continued in 2011. The sampling was undertaken by participants from Canada, Ireland, UK (Scotland), UK (England & Wales), and USA. Sampling began in August and continued through October. Additionally, staff from the Greenland Institute of Natural Resources assisted with the overall coordination of the programme and sampling in Nuuk.

Samplers were stationed in four different communities (Figure 5.1.1.2) representing four different NAFO Divisions: Ilulissat (NAFO Division 1A), Sisimiut (1B), Nuuk (1D), and Qaqortoq (1F). As in previous years no sampling occurred in the fishery in

East Greenland. In the Baseline Sampling Programme, tissue and biological samples were collected.

In total 970 individual salmon were sampled representing 12% by weight of the reported landings. Of these, 967 fork lengths were measured (Table 5.1.3.1) and 964 gutted weights were taken. Scale samples were taken from 965 salmon for age determination and 964 tissue samples were collected for DNA analysis and continent of origin assignment.

A total of 15 adipose fin clipped fish recovered, none carried tags. In addition, a total of six tags were also recovered during the sampling season: three tags were recovered by the sampling programme and three tags were returned directly to the Nature Institute. Two of the tags came from fish harvested in 2010 and they were both from salmon of Canadian origin (smolts tagged and released in the Miramichi and Restigouche rivers in 2009). The remaining tags were from the 2011 fishery. There were three Canadian origin fish (two from adults tagged and released in the Miramichi River in 2010 and one acoustically tagged adult released in the Riviere St Jean). One Passive Integrated Transponder tag was also recovered but the origin of the fish is to date unknown.

Access to fish in support of the Baseline Sampling Programme in 2011 was once again compromised in Nuuk. Sampling generally took place at the local market, the centralized location where harvested salmon were present and available. The sampler would obtain the appropriate permissions before conducting the sampling. The arrangement was successful for the first Nuuk sampler in 2011. In mid-September, however, the second Nuuk sampler was prevented from sampling unless a fee was paid to the fishers. No solution was agreed to during the rest of the sampling season and consequentially the Nuuk samplers were unable to collect any additional Baseline Samples. This same problem has occurred in previous years, but only in Nuuk. The ability to collect Enhanced Samples was not compromised as these fish were purchased directly from the fishers. If this situation cannot be resolved, the sampling programme may decide to not conduct sampling in Nuuk in 2012.

The small catch levels and the broad geographic and temporal coverage of the internal use only fishing caused severe practical problems for the sampling teams. Despite these constraints, the sampling programme successfully sampled the Greenland catch, both temporally and spatially. The need to obtain samples from fish landed in Nuuk, especially in the future once the Enhanced Sampling Programme is completed, should be reconsidered. Nuuk accounted for 22% of the adjusted landings for the period 2002–2011 (range 12–38%) and 29% in 2011. Not being able to sample fish landed in Nuuk will compromise the sampling programme's ability to collect the samples needed to accurately describe the biological characteristics of the salmon harvest at West Greenland. The Working Group recommends that arrangements be made to enable sampling in Nuuk as a significant amount of salmon is landed in this community on an annual basis.

In all years since 2002, except for 2006 and in 2011, non-reporting of harvest was evident based on a comparison of reported landings to the sample data. In at least one of the divisions where international samplers were present, the sampling team observed more fish than were reported as being landed. When there is this type of weight discrepancy, the reported landings are adjusted according to the total weight of the fish identified as being landed during the sampling effort and these adjusted landings are carried forward for all future assessments. The time-series of reported landings and subsequent adjusted landings for 2002–2011 are presented in Table 5.1.3.2.

Biological characteristics (length, weight, and age) were recorded for all sampled fish. Overall, the mean sampled fork length was 66.4 cm and the mean gutted weight was 3.00 kg across all sea ages. The mean length and weight of North American 1SW salmon was 66.2 cm and 3.56 kg weight and the mean for European 1SW salmon was 63.5 cm and 3.17 kg (Table 5.1.3.3). The North American whole weight estimate is a slight increase from 2010 while the European estimate is a slight decrease, but both values are greater than the ten year means. The North American fork length estimate is a slight increase over the 2010 estimate and the ten year mean. The European value is a slight decrease from the 2010 and the ten year mean values.

The Working Group has previously examined the changing weights and condition factors of 1SW non-maturing salmon at West Greenland (ICES 2011c). Over the period of sampling (1969 to 2010) the mean weight of these fish seemed to decline from high values in the 1970s to the lowest mean weights of the time-series in 1990 to 1995, before increasing subsequently to 2010. However, these mean weight trends are unadjusted for the period of sampling and it is known that salmon grow quickly during the period of sampling in the fishery from August to October.

The analysis of condition of salmon over the period 2002 to 2010 (time period of data available) contrasts with the interpretation of salmon size at West Greenland based entirely on weights or lengths unadjusted for the period of sampling or for the length of the fish (ICES 2011b). With few exceptions, there was no apparent change in condition of 1SW non-maturing salmon at West Greenland. The trend in increasing weights from the samples can be attributed to both increasing length and variations in sampling period.

The Working Group recommends that the longer time-series of sampling data from West Greenland should be analysed in a similar way to assess the extent of the variations in condition over the time period corresponding to the large variations in productivity as identified by the NAC and NEAC assessment and forecast models. The Working Group is aware that efforts to compile these data have been complicated by recent personnel changes, but that progress is being made and the full dataset should be available for analysis prior to the 2013 Working Group meeting.

North American salmon up to river age five years were sampled from the fishery at West Greenland (Table 5.1.3.4), comprised predominantly of two year old (36.1%), three year old (44.5%) and four year old (15.1%) smolts. The river ages of European salmon ranged from one to four years (Table 5.1.3.5). Of these, 17.2% were river age one, 53.4% were river age two, and 27.6% were river age three years.

As expected, the 1SW age group dominated the 2011 sample collection for both the North American and European origin fish (93.8% and 82.8% respectively, Table 5.1.3.6). Both values are a decrease from the 2010 values of 98.2% and 97.5%, respectively.

As part of the sampling programme sex was determined by gonadal examination of 431 salmon. They were comprised of 11.8% males and 88.2% females.

In addition to the Baseline Sampling Programme described above, an Enhanced Sampling Programme (SALSEA Greenland) was developed to conduct broader and more detailed sampling of fish harvested from the waters off West Greenland. The Enhanced Sampling was designed to be integrated within the Baseline Sampling Programme's infrastructure. Fresh whole fish were purchased directly from individual fishers. These fish were included in the Baseline Sampling Programme but in addition, a more detailed sampling was undertaken (Enhanced Sampling). The SALSEA

Greenland Programme is an integral part of the larger SALSEA research programme (Section 2.3.1).

The following information and tissues were collected from each fish:

- 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 stomachs for feeding ecology studies;
- Preserved intestines, pyloric caeca, gill arch, liver, spleen, heart, kidney for parasite analysis;
- Preserved otoliths for elemental analysis;
- Preserved kidney samples for ISAv;
- Vent samples for Red Vent Syndrome.

The Enhanced Sampling Programme was successfully undertaken in 2011. A total of 430 fresh whole fish were purchased directly from individual fishers. All carcasses, post sampling, were donated for consumption to the communities where the sampling took place.

Overall, the Enhanced Sampling programme was considered successful. This was the third and final year of sampling and 1200 samples were collected across four NAFO Divisions (Table 5.1.3.7). Samples were obtained from male and female salmon, of North American and European origin. Sample processing is ongoing and at various states of completeness for the different sample types. Tight coordination across all the researchers involved in the SALSEA Greenland effort is essential to maximize the benefit gained from this research effort.

5.1.4 Continent of origin of catches at West Greenland

A total of 964 samples were collected from four communities representing four NAFO Divisions: Ilulissat (NAFO Division 1A, n=55), Sisimiut (1B, n=272), Nuuk (1D, n=386), and Qaqortoq (1F, n=251). Only 692 were available for processing as of the Working Group meeting. The Sisimiut (1B) samples were inadvertently packaged in a box of Enhanced Sampled samples which were transported back to the USA via marine transport. These samples are still en route and therefore not available for processing. These samples will be processed in 2012 and all sampling data will be updated during the next Working Group Meeting.

DNA isolation and the subsequent microsatellite analysis were performed (King *et al*. 2001) on the 692 useable genetic samples. As in previous years, a database of approximately 5000 Atlantic salmon genotypes of known origin was used as a baseline to assign these individuals to continent of origin. In total, 91.5% of the salmon sampled were of North American origin and 8.5% were determined to be of European origin. The NAFO Division-specific continent of origin assignments are presented in Table 5.1.4.1.

These data show the high proportion of North American origin individuals contributing to the fishery over the recent past (Table 5.1.4.2). The variability in the recent continental representation among divisions (Table 5.1.4.1) underscores the need to sample multiple NAFO Divisions to achieve the most accurate estimate of the contribution of fish from each continent to the mixed-stock fishery.

The estimated weighted proportions of North American and European salmon since 1982 and the weighted numbers of North American and European Atlantic salmon caught at West Greenland (excluding the reported harvest from ICES area XIV) are provided in Table 5.1.4.2. Approximately 6800 (25 t) North American origin fish and approximately 600 (2 t) European origin fish were harvested in 2011. These remain among the lowest in the time-series.

The Working Group recommends a continuation and expansion of the broad geographic sampling programme (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed-stock fishery.

5.2 Management objectives and reference points

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

- Meeting the conservation limits in the four northern regions of North America: Labrador, Newfoundland, Québec, 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 to rebuild the stocks. In 2004, ICES established 1992–1996 as the range of years to define a rebuilding baseline for the Scotia-Fundy and USA regions. 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.

The reference points for West Greenland catch options are the conservation limits (CL) for North American and Southern NEAC stock complexes. NASCO has adopted region specific CLs (NASCO 1998). 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). These regional CLs 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 defined in terms of 2SW salmon and for southern NEAC 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 requirement for North America totals 152 548 fish, with 123 349 required in Canadian rivers and 29 199 in USA rivers (see Section 4.2). The CL for the Southern NEAC MSW stock complex is approximately 241 269 fish (see Section 3.2.2). There is still considerable uncertainty in the conservation limits for NEAC stocks and estimates change slightly from year to year with the input of new data and changes in biological characteristics.

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 (0.03 per month) over the migration time from West Greenland to home rivers (eight months for Southern Europe and eleven months for North America) are added to regional CLs (see Sections 4.2 and Section 3.2).

5.3 NASCO has requested ICES to describe the status of the stocks

The stock complexes exploited at West Greenland are below conservation limits. In European and North American areas, the overall abundance of stocks contributing to the West Greenland fishery has recently increased, however the abundance of salmon within the West Greenland area remains low relative to historical levels. A more detailed overview of status of stocks in the NEAC and NAC areas is presented in the relevant commission sections (Sections 3 and 4).

5.3.1 North American stock complex

North American 2SW spawner estimates were below their CLs in four of the six regions (Figure 4.3.2.3) in 2011. Within each of the geographic areas there are varying numbers of individual river stocks which are failing to meet CLs, particularly in the southern areas of Scotia-Fundy and the USA. The estimated exploitation rate of North American origin salmon in North American fisheries has declined (Figure 4.1.5.1) from approximately 68% in 1973 to 14.5% in 2011 for 1SW salmon and over 84% in 1981 to 9.4% in 2011 for 2SW salmon (Table 4.1.3.4). The 2011 exploitation rates on 1SW and 2SW salmon both declined from the 2010 estimates (18.8% and 15% respectively) and remained among the lowest in the time-series.

5.3.2 Southern European stock complex

The status of stocks in the four Northeast Atlantic stock complexes is assessed with respect to abundance relative to spawning escapement reserve and prior to the commencement of distant water fisheries. Three of the four stock complexes (Northern NEAC 1SW and MSW and Southern NEAC MSW) are considered to be at full reproductive capacity while the Southern NEAC 1SW is considered to be at risk of suffering reduced reproductive capacity (Figure 3.3.4.1). However, at a country level, stocks from several jurisdictions are below CLs. Stocks from countries in Northern NEAC area are generally above their CLs while stocks from countries in Southern NEAC are below their CLs (Table 3.4.1.3; Figures 3.3.3.1.a–j). Further, within all countries there are individual river stocks that are not meeting CLs (Table 3.4.1.3). Exploitation rates on these stocks are currently at their lowest level (Figures 3.1.9.1 and 3.1.9.2). Exploitation rate on 1SW salmon in the Northern and Southern NEAC area was 39% and 15% in 2011; both representing declines from the previous 5-year averages (43% and 18% respectively). Exploitation on MSW salmon in the Northern and Southern NEAC areas was 44% and 12% in 2011; both representing declines from the previous 5-year averages (52% and 13% respectively). These current estimates for both stock complexes are among the lowest in the time-series.

5.4 NASCO has requested ICES to provide catch options or alternative management advice for 2012–2014 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

The management advice for the West Greenland fishery for 2012 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).

5.4.1 Catch options for West Greenland

None of the stated management objectives would allow a mixed-stock fishery at West Greenland to take place in 2012, 2013, or 2014.

- In the absence of any marine fishing mortality at Greenland and North America, the lowest probability that the returns of 2SW salmon to North America will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Québec, and Gulf) is estimated to be 0.45 for Labrador, 0.48 for Labrador, and 0.55 for Gulf for the years 2012, 2013, and 2014, respectively (Table 5.4.1).
- In the absence of any marine fishing mortality at Greenland and North America, there is a low probability (from 0.15 to 0.25) that the returns in the southern region of Scotia-Fundy will be sufficient to meet the stock rebuilding objective during the period 2012 to 2014 (Table 5.4.1). The probability of meeting or exceeding the stock rebuilding objective of the USA region is estimated to be greater than 75% in all three years, based on the assumption of improved productivity and increasing lagged spawner abundances for this area.
- In the absence of any marine fishing mortality at Greenland and in NEAC, there is a 98% chance that the MSW conservation limit for southern NEAC will be met in 2012 (Table 5.4.1). For 2013 and 2014, the probabilities that the MSW returns for southern NEAC will meet or exceed the conservation limit in the absence of fisheries are 95% and 94%, respectively.
- In the absence of any fishing mortality on these stocks, there is a 6% to 8% probability of meeting or exceeding the seven management objectives simultaneously in 2012 to 2014 (Table 5.4.1).

5.5 Relevant factors to be considered in management

The management of 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 target all stocks present, whether or not they are meeting their individual CLs. Conservation would be best achieved if fisheries target stocks that have been shown to be meeting CLs. Fisheries in estuaries and especially rivers are more likely to meet this requirement.

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, most of which are destined to return to homewaters in Europe or North America as 2SW fish. The primary MSW European stocks contributing to the fishery in West Greenland are thought to originate in the southern stock complex, although low numbers may originate in 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, but in generally low (< 5%) proportions (Table 5.1.3.6).

5.6 Pre-fishery abundance forecasts 2012, 2013, 2014

PFA forecasts for each area (NEAC Section 3.6 and NAC Section 4.7) were developed using a Bayesian framework. A random walk productivity parameter linking lagged spawners or lagged eggs to PFA was developed and applied in the most recent assessments (2009 for NAC and 2011 for NEAC; ICES 2009a, 2011b). The PFA forecasts for the West Greenland stock complex although improved from the lowest value estimated in 2001 remain among the lowest in the time-series (Figures 4.7.1.2, 3.5.2.1).

5.6.1 North American stock complex

The PFA_{NA} forecasts for 2012 to 2014 increase from a median value of 176 700 fish to 213 600 fish but remain low relative to the earliest decade of the time-series (Figure 4.7.1.2; Table 4.7.2.1). The regional PFA forecasts increase from 2012 to 2014 for Labrador and Québec, vary for the other regions, but remain low relative to the earliest time period (Figure 4.7.1.3; Table 4.7.2.1).

5.6.2 Southern NEAC MSW stock complex

The southern NEAC 1SW non-maturing (MSW) PFA forecast for 2012 has a median value of 781 000 fish (Figure 3.5.2.1). The spawning escapement of southern NEAC MSW stocks has generally not exceeded conservation limits since 1997 (Figure 3.3.4.1). The PFA for the southern NEAC MSW complex is expected to decline slightly in 2013 but increase in 2014, median forecast values of 748 700 fish and 851 100 fish for 2013 and 2014, respectively (Figure 3.5.2.1). There is a high probability that the spawner escapement reserve (406 436 fish) will be met in 2012 to 2014 (Table 3.5.3.1).

5.7 Comparison with previous assessment and advice

The management advice for the West Greenland fishery for 2012 to 2014 is based on the models previously used by the Working Group. The current modelling approach for the NAC stock complex has provided stable comparisons of the previous year predictions (Figure 4.8.1). In the previous assessment for the mixed-stock fishery at West Greenland, ICES (2009a) advised that there were no catch options at West Greenland in 2009, 2010, and 2011 that would be consistent with a 75% chance or greater of meeting region specific management objectives. The assessment this year confirmed the validity of that advice.

5.8 Critical examination of changes to the models used to provide catch options

5.8.1 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) and incorporated the recommendations from ICES (2008a) to improve the models. Additional details are provided in Sections 4.4 and 3.7.1.

5.8.2 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 have been used by ICES since 2009 and were used again in this assessment. The forecast models used to estimate pre-fishery abundance of non-maturing 1SW salmon (potential MSW) for North America and for the southern NEAC MSW salmon were the same as those used in the previous assessment in 2009 for NAC and 2011 for southern NEAC (ICES 2009a, 2011b). For NAC, a regionally disaggregated 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 ICES (2009a, 2011b). The models are based on a consistent Bayesian framework that allows complex dynamics to be modelled, incorporating uncertainties and learning from previous experience or use of other prior information.

5.8.3 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 assessments for the two stock complexes in the West Greenland fishery are developed in parallel and then combined at the end of the process into a single summary plot or catch options table (Figure 5.8.3.1). 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); and
- Conservation spawning limits or alternate management objectives.

The uncertainty in the PFA_{NA} and PFA_{NEAC} is accounted for in the approaches described below. The number of 1SW non-maturing 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 ($Wt_{Allages}$), and by the proportion 1SW non-maturing in the respective continent of origin catches. For the 2012 to 2014 fisheries, $prop_{NA}$ (and $prop_{NEAC}$ as 1 – $prop_{NA}$) were drawn randomly from observed values of the past five years taking account of uncertainty due to sample sizes. For the other parameters, it was assumed that the parameters for $Wt_{Allages}$ (2.98–3.69 kg) and the proportion non-maturing 1SW in the catch by continent of origin ($prop1SW_{NA}$: 0.934–0.982; $prop1SW_{NEAC}$: 0.828–0.988) 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 (F_{na}) historically used in the negotiations of the West Greenland fishery. The sharing fraction chosen is the 40:60 West Greenland:North America split. The same sharing arrangement was used for NEAC stocks (ICES 2003). 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 eleven months at a rate of M = 0.03 (equates to 28.1% mortality). For Southern NEAC stocks this is a total of eight 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 management objectives.

The final step in the risk analysis of the catch options involves combining the conservation requirement or alternate management objectives with the probability distribution of the returns to North America for different catch options. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Québec, and Gulf. Estimated returns for Scotia-Fundy and USA are compared to the objective of achieving an increase of 25% relative to average returns of the base period, 1992–1996.

5.8.4 Critical evaluation

Changes to the run-reconstruction and pre-fishery abundance forecast models have been critically examined in ICES (2009a, 2011b). There were no changes to the risk assessment of the catch options model. The Working Group used models that are fitted and forecasts derived in a single consistent Bayesian framework.

At this time, the models used by the Working Group provide consistent characterization of the status and expectations for Atlantic salmon in the North Atlantic. Compared to the previous models used by the Working Group prior to 2009, 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.

5.9 NASCO has requested 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 (Framework of Indicators) to be used in interim years to determine if there is an expectation that the previously provided mulit-year management advice for the Greenland fishery is likely to change in subsequent years (ICES 2007c, Figure 5.9.1). 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 Framework of Indicators (FWI) was accepted by NASCO in June 2007 and applied for the 2008 fisheries at West Greenland to determine if a re-assessment was advised given the information from indicator stocks. In 2009 the FWI was updated for application for the 2010 to 2011 fisheries (ICES 2009a). The updated framework was applied in January 2010 and 2011 to determine if a re-assessment was advised.

The 2012 assessment begins the cycle of forecasting and catch advice for the 2012 to 2014 fishing years. ICES has been asked to update the FWI in support of the multi-year catch advice and the potential approval of multiyear regulatory measures.

5.9.1 Update of the Framework of Indicators for the 2012 to 2014 multiyear 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; and
- Providing the spreadsheet for doing the framework of indicators assessment.

The management objectives for the development of the catch options for the West Greenland fishery are presented in Table 5.9.1.1.

Based on the results from the objective function spreadsheet and the criteria established by the Working Group, a total of 40 indicator variables, represented by 22 different rivers, were retained for the North American Commission area (Table 5.9.1.2, Figure 5.9.1.1). Of these, eight were return or survival rate indicators of hatchery fish, while the remainder were of wild 2SW or large salmon (N = 18), wild 1SW or small salmon (N = 13) or all (N = 1) returns to rivers or survival rate.

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	3						3
Québec	4	10	1	2			17
Gulf	1	1					2
Scotia-Fundy	3	4			2	4	13
USA[1]	1	2[2]			1	1	5
Total	12	17	1	2	3	5	40

[1] for USA, 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 2012 to 2014 multiyear catch advice indicator framework are provided in Table 5.9.1.2. No indicator variables were retained for the Labrador area or for southern NEAC 1SW 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 5.9.1.2), as recommended by the Working Group.

5.9.2 Application of the framework indicator spreadsheet for signalling whether a significant change in management advice may occur for the fisheries in 2013 and 2014

The updated FWI spreadsheet is shown in Figure 5.9.1.1. 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 multiyear 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:

- Multiyear advice provides no catch options greater than zero but indicators are suggesting that the management objectives may be met (conclusion: Reassess);
- Multiyear 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 2012 to evaluate the appropriateness of the 2013 advice, and with the returns or return rate data for 2013 to evaluate the appropriateness of the 2014 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 multiyear catch advice is provided. Figure 5.9.1 illustrates the timeline of how the FWI would operate.

5.9.2.1 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 (i.e. tonnes of catch) for the West Greenland fishery. 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".

5.9.2.2 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 1SW non-maturing complex (Figure 5.9.1.1). 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, 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 5.9.1.1 for the Québec area, the indicator variable defined as the large salmon returns to Cascapédia River suggests that the management objective for Québec may be met (indicator score = +1) but another indicator variable (large returns to De la Trinité) 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 mean 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 = 96%, probability of a true high = 100%) 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 1SW Survival for hatchery, probability of true low = 86%, probability of true high = 73%, Figure 5.9.1.1).

Table 5.1.1.1. Nominal catches of salmon at West Greenland since 1971 (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		89	The fishery was suspended. NASCO adopt a new quota allocation model.
1994		137	The fishery was suspended and the quotas were bought out.
1995	83	77	Quota advised by NASCO
1996	92	174	Quota set by Greenland authorities
1997	58	57	Private (non-commercial) catches to be reported from now
1998	11	20	Fishery restricted to catches used for internal consumption in Greenland
1999	19	20	
2000	21	20	
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

Year	Total	Quota	Comments
2005	15		same as previous year
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
2009	26		same as previous year
2010	40		same as previous year
2011	28		same as previous year

Table 5.1.1.2. Distribution of nominal catches (metric tons) by Greenland vessels since 1977. NAFO Division are represented by 1A–1F.

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
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	3	5	0	26	-	26
2009 *	0.2	6	7	3	4	5	0	26	1	26
2010 *	17	5	2	3	7	4	0	38	2	40
2011 *	2	4	5	8	4	5	0	28	+	28

[1] The fishery was suspended.

+ Small catches <5 t.

- No catch.

*** Corrected from gutted weight to total weight (factor 1.11).**

Table 5.1.1.3. Number of people (licensed and unlicensed) reporting catches of Atlantic salmon in Greenland fishery and total number of issued licences and presented in NAFO (1A-1F)/ICES Divisions. Reports received by fish plants prior to1997 and to the Licence Office from 1998 to present.

Year	1A	1B	1C	1D	1E	1F	ICES	Unk.	Licences	Total
1987	78	67	74		99	233				579
1988	63	46	43	53	78	227				516
1989	30	41	98	46	46	131				393
1990	32	15	46	52	54	155				362
1991	53	39	100	41	54	123				410
1992	3	9	73	9	36	82				212
1993										
1994										
1995	0	17	52	21	24	31				145
1996	1	8	74	15	23	42				163
1997	0	16	50	7	2	6				80
1998	16	5	8	7	3	30				69
1999	3	8	24	18	21	29				102
2000	1	1	5	12	2	25				43
2001	2	7	13	15	6	37			452	76
2002	1	1	9	13	9	8			479	41
2003	11	1	4	4	12	10			150	42
2004	20	2	8	4	20	12			155	66
2005	11	7	17	5	17	18			185	75
2006	43	14	17	20	17	30			159	141
2007	29	12	26	10	33	22			260	132
2008	44	8	41	10	16	24			260	143
2009	19	11	35	15	25	31	9		294	145
2010	86	17	19	16	30	27	13		309	208
2011	25	9	20	15	20	23	5		234	117

Table 5.1.3.1. Size of biological samples and percentage (by number) of North American and European salmon in research vessel catches at West Greenland (1969 to 1982), from commercial samples (1978 to 1992, 1995 to 1997, and 2001) and from local consumption samples (1998 to 2000, and 2002 to present).

		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, 38)	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	13 272	2917		50	(53, 46)	50	(52, 34)
	1986	20 394	3509		57	(66, 48)	43	(52, 34)
	1987	13 425	2960		59	(63, 54)	41	(46, 37)
	1988	11 047	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	(75, 65)	32	(35, 28)
	1996	3341	1397		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)

		Sample Size			Continent of Origin (%)			
Source		Length	Scales	Genetics	NA	(95% CI)[1]	E	(95% CI)[1]
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	
	2009	1662	1683	1671	91		9	
	2010	1261	1265	1240	80		20	
	2011	967	965	964	91		9	

[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 5.1.3.2. Reported landings (kg) for the West Greenland Atlantic salmon fishery from 2002 by NAFO Division as reported by the Home Rule Government and the division-specific adjusted landings where the sampling teams observed more fish landed than were reported.

Year		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	4882	2210	10024	1595	2457	4979	26 147
	Adjusted				3577		5478	28 627
2009	Reported	195	6151	7090	2988	4296	4777	25 496
	Adjusted				5466			27 975
2010	Reported	17 263	4558	2363	2747	6766	4252	37 949
	Adjusted		4824		6566		5274	43 056
2011	Reported	1858	3662	5274	7977	4021	4613	27 407
	Adjusted							

Table 5.1.3.3. Annual mean whole weights (kg) and fork lengths (cm) by sea age and origin of Atlantic salmon caught at West Greenland 1969 to 1992 and 1995 to present (NA = North America and E = Europe).

	Whole weight (kg)									Fork Length (cm)					
	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
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.9	2.63	2.84	2.71	62.3	63.6	85.7	84.0	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	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
2009	3.28	3.40	7.59	6.54	5.25	4.28	3.48	3.67	3.50	64.9	65.5	84.6	81.7	75.9	73.5
2010	3.44	3.24	6.40	5.45	4.17	3.92	3.47	3.28	3.42	66.7	65.2	80.0	75.0	72.4	70.0

	Whole weight (kg)									Fork Length (cm)					
	1SW		2SW		PS		All sea ages		Total	1SW		2SW		PS	
	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
2011	3.56	3.24	5.48	5.18	4.53	5.11	3.67	3.82	3.69	66.2	65.0	75.6	76.3	72.5	76.3
10-yr mean	3.14	3.13	7.21	5.76	4.58	4.16	3.23	3.27	3.23	64.7	64.6	83.0	78.7	74.4	73.0
Overall mean	2.85	3.16	6.62	6.30	4.09	4.73	3.00	3.26	3.12	63.3	65.3	81.9	81.5	71.7	76.1

Table 5.1.3.4. River age distribution (%) and mean river age for all North American origin salmon caught at West Greenland 1968 to 1992 and 1995 to present. Continent of origin assignments were based on scale characteristics until 1995, scale characteristics and DNA based assignments until 2001 and DNA based assignments only from 2001 on.

YEAR	1	2	3	4	5	6	7	8
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

YEAR	1	2	3	4	5	6	7	8
2008	0.9	25.1	51.9	16.8	4.7	0.6	0	0
2009	2.6	30.7	47.3	15.4	3.7	0.4	0	0
2010	1.6	21.7	47.9	21.7	6.3	0.8	0	0
2011	1.5	36.1	44.5	15.1	2.8	0	0	0
10-yr mean	1.8	25.2	44.4	21.1	6.8	0.7	0	0
Overall Mean	2.7	31.6	39.6	18.1	6.7	1.1	0.1	0.0

Table 5.1.3.5. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland 1968 to 1992 and 1995 to present. Continent of origin assignments were based on scale characteristics until 1995, scale characteristics and DNA based assignments until 2001 and DNA based assignments only from 2001 on.

YEAR	1	2	3	4	5	6	7	8
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
2009	14.3	59.5	23.8	2.4	0.0	0	0	0
2010	11.3	57.1	27.3	3.4	0.8	0	0	0
2011	19.0	51.7	27.6	1.7	0	0	0	0
10-yr mean	13.9	58.3	23.2	4.2	0.4	0	0	0
Overall Mean	17.8	60.7	18.4	2.7	0.3	0.0	0.0	0.0

Table 5.1.3.6. Sea age composition (%) of samples from fishery landings at West Greenland from 1985 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	0.8	0.4
2009	93.4	2.8	3.8	89.4	7.6	3.0
2010	98.2	0.4	1.4	97.5	1.7	0.8
2011	93.8	1.5	4.7	82.8	12.1	5.2

Table 5.1.3.7. Inventory of 2009–2011 SALSEA Greenland (Enhanced Sampled) fish by year, NAFO Division, and continent of origin.

	2009			
	European	North American	Unk.	Total
1B	4	75		79
1D	12	188	5	205
1F	26	102		128
Total	42	365	5	412
	2010			
1B	12	73		85
1D	39	161	2	202
1F	13	57	1	71
Total	64	291	3	358
	2011			
1A	2	18		20
1B			87	87
1D	14	159		173
1F	18	131	1	150
	34	308	88	430
	Grand Total			
1A	2	18		20
1B	16	148	87	251
1D	65	508	7	580
1F	57	290	2	349
Total	140	964	96	1200

Table 5.1.4.1. The number of samples and continent of origin of Atlantic salmon by NAFO Division sampled at West Greenland in 2011. NA = North America, E = Europe. Division 1B samples were not processed and are not included in the total.

		Numbers			Percentages	
NAFO Div	Sample dates	NA	E	Totals	NA	E
1A	September 23–October 9	52	2	55	96.4	3.6
1B	September 1–26	-	-	(272)	-	-
1D	August 12–September 28	365	21	386	94.6	5.4
1F	August 22–September 13	215	36	251	85.7	14.3
Total		633	59	692	91.5	8.5

Table 5.1.4.2. The numbers of North American (NA) and European (E) Atlantic salmon caught at West Greenland 1971 to 1992 and 1995 to present and the proportion by continent of origin, based on NAFO Division continent of origin weighted by catch (weight) in each division. Numbers are rounded to the nearest hundred fish.

	Proportion by continent weighted by catch in number		Numbers of salmon by continent	
	NA	E	NA	E
1982	57	43	192 200	143 800
1983	40	60	39 500	60 500
1984	54	46	48 800	41 200
1985	47	53	143 500	161 500
1986	59	41	188 300	131 900
1987	59	41	171 900	126 400
1988	43	57	125 500	168 800
1989	55	45	65 000	52 700
1990	74	26	62 400	21 700
1991	63	37	111 700	65 400
1992	45	55	46 900	38 500
1995	67	33	21 400	10 700
1996	70	30	22 400	9700
1997	85	15	18 000	3300
1998	79	21	3100	900
1999	91	9	5700	600
2000	65	35	5100	2700
2001	67	33	9400	4700
2002	69	31	2300	1000
2003	64	36	2600	1400
2004	72	28	3900	1500
2005	74	26	3500	1200
2006	69	31	4000	1800
2007	76	24	6100	1900
2008	86	14	8000	1300
2009	90	10	7000	800
2010	81	19	10 000	2600
2011	92	8	6800	600

Table 5.4.1. Catch options tables for mixed-stock fishery at West Greenland by year of PFA, 2012 to 2014.

2012 Catch option	Probability of meeting or exceeding region-specific management objectives							
	LAB	NFLD	QC	GULF	SF	USA	S-NEAC	ALL
0	0.45	0.86	0.71	0.50	0.15	0.89	0.98	0.06
10	0.42	0.84	0.67	0.48	0.14	0.88	0.98	0.05
20	0.40	0.83	0.63	0.45	0.13	0.87	0.98	0.05
30	0.38	0.81	0.59	0.42	0.12	0.85	0.98	0.04
40	0.36	0.78	0.54	0.40	0.12	0.83	0.98	0.04
50	0.34	0.76	0.50	0.38	0.11	0.81	0.98	0.03
60	0.32	0.73	0.46	0.36	0.10	0.79	0.98	0.03
70	0.30	0.70	0.42	0.33	0.09	0.77	0.98	0.03
80	0.28	0.67	0.39	0.31	0.08	0.74	0.98	0.03
90	0.26	0.64	0.35	0.29	0.08	0.72	0.97	0.02
100	0.24	0.60	0.32	0.27	0.07	0.68	0.97	0.02
2013 Catch option	**Probability of meeting or exceeding region-specific management objectives**							
	LAB	NFLD	QC	GULF	SF	USA	S-NEAC	ALL
0	0.48	0.78	0.73	0.50	0.25	0.75	0.95	0.08
10	0.46	0.76	0.70	0.48	0.24	0.73	0.95	0.07
20	0.44	0.75	0.67	0.46	0.23	0.72	0.95	0.06
30	0.42	0.73	0.63	0.44	0.22	0.70	0.95	0.06
40	0.41	0.70	0.60	0.42	0.21	0.68	0.95	0.06
50	0.39	0.68	0.56	0.40	0.20	0.66	0.94	0.05
60	0.37	0.65	0.53	0.38	0.19	0.64	0.94	0.05
70	0.35	0.63	0.50	0.36	0.18	0.62	0.94	0.05
80	0.33	0.60	0.47	0.34	0.17	0.59	0.94	0.04
90	0.31	0.57	0.44	0.32	0.16	0.57	0.94	0.04
100	0.30	0.54	0.41	0.31	0.15	0.55	0.94	0.04
2014 Catch option	**Probability of meeting or exceeding region-specific management objectives**							
	LAB	NFLD	QC	GULF	SF	USA	S-NEAC	ALL
0	0.56	0.78	0.75	0.55	0.20	0.86	0.94	0.08
10	0.55	0.77	0.73	0.53	0.20	0.85	0.94	0.08
20	0.53	0.75	0.70	0.51	0.19	0.84	0.94	0.07
30	0.52	0.73	0.67	0.49	0.18	0.83	0.94	0.07
40	0.50	0.71	0.64	0.47	0.17	0.82	0.94	0.06
50	0.48	0.69	0.62	0.46	0.17	0.81	0.94	0.06
60	0.46	0.67	0.59	0.44	0.16	0.79	0.94	0.06
70	0.45	0.65	0.56	0.42	0.16	0.77	0.94	0.05
80	0.43	0.63	0.54	0.41	0.15	0.76	0.94	0.05
90	0.42	0.61	0.51	0.39	0.14	0.74	0.94	0.05
100	0.40	0.59	0.49	0.38	0.14	0.72	0.94	0.05

Table 5.9.1.1. 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 5.9.1.3. 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.

Type	Origin	Age group	Area	River	Unit	PFA start year	PFA end year	Number of years	2011 value*	Decision rule based on objective function	Indicator low (true low)	Indocator high (true high)
Return	W & H	2SW	USA	Penobscott	Number	1970	2010	41	2368	1415	1	0.87
Return	W & H	1SW	USA	Penobscott	Number	1970	2010	41	741	377	0.83	0.73
Return	H	2SW	USA	Penobscott	%	1970	2010	41	0.39	0.23	1	0.57
Survival	H	1SW	USA	Penobscott	%	1970	2010	41	0.12	0.09	0.83	0.73
Return	W & H	All	USA	Narraguagus	Number	1971	2010	40	196	100	0.95	0.63
Return	W	Large	SF	LaHave	Number	1972	2010	39	146	285	0.77	0.85
Return	W	1SW	SF	LaHave	Number	1979	2010	32	565	1679	0.94	0.67
Return	W	Large	SF	North	Number	1983	2010	28	1193	712	0.95	0.67
Return	W	Large	SF	Saint John	Number	1969	2010	42	294	3329	0.96	1
Return	W	1SW	SF	Saint John	Number	1970	2010	41	582	2276	0.86	0.8
Return	W	Large	SF	St. Mary's	Number	1973	2010	38	14	221	1	0.73
Return	W	1SW	SF	St. Mary's	Number	1974	2010	37	331	2038	0.95	0.93
Survival	H	2SW	SF	East Sheet Harbour	%	1975	2000	25	0.005	0.02	0.67	0.82
Survival	H	2SW	SF	LaHave	%	1973	2004	32	0.88	0.24	0.81	0.81
Survival	H	1SW	SF	LaHave	%	1973	2004	31	0.72	1.44	0.92	0.78
Survival	H	2SW	SF	Liscomb	%	1979	1996	18	0.03	0.05	0.86	0.91
Survival	H	2SW	SF	Saint John	%	1975	2010	36	0.13	0.22	0.95	0.81
Survival	H	1SW	SF	Saint John	%	1975	2010	36	0.12	0.76	0.86	0.73
Return	W	2SW	Gulf	Miramichi	Number	1970	2010	41	28 977	15 800	1	0.85
Return	W	1SW	Gulf	Miramichi	Number	1971	2010	40	45 880	41 790	0.89	0.67

Type	Origin	Age group	Area	River	Unit	PFA start year	PFA end year	Number of years	2011 value*	Decision rule based on objective function	Indicator low (true low)	Indocator high (true high)
Return	W	Large	Quebec	Cascapedia	Number	1983	2010	28	3815	2280	0.69	0.92
Return	W	Large	Quebec	Bonaventure	Number	1983	2010	28	1259	1479	0.75	0.81
Return	W	Large	Quebec	Grande Rivière	Number	1983	2010	28	533	442	1	0.94
Return	W	Large	Quebec	Saint-Jean	Number	1983	2010	28	688	758	0.86	0.89
Return	W	Large	Quebec	Dartmouth	Number	1983	2010	28	1171	756	0.86	0.89
Return	W	Large	Quebec	Madeleine	Number	1983	2010	28	996	653	0.7	0.93
Return	W	Large	Quebec	Sainte-Anne	Number	1983	2010	28	871	433	0.67	0.88
Return	W	Large	Quebec	Godbout	Number	1985	2010	26	694	641	0.86	1
Return	W	Large	Quebec	de la Trinité	Number	1983	2010	28	317	385	0.75	1
Return	W	Large	Quebec	York	Number	1983	2010	28	1585	1405	0.63	0.83
Return	W	Small	Quebec	Grande Rivière	Number	1984	2010	27	237	199	0.59	0.8
Return	W	Small	Quebec	Saint-Jean	Number	1981	2010	30	343	394	0.53	0.82
Return	W	Small	Quebec	Godbout	Number	1986	2010	25	623	508	0.85	0.92
Return	W	Small	Quebec	Trinité	Number	1979	2010	32	949	399	0.89	0.83
Survival	W	Large	Quebec	Trinité	%	1985	2010	25	0.76	0.49	0.88	0.96
Survival	W	Small	Quebec	Trinité	%	1985	2010	25	2.54	1.49	0.63	0.89
Survival	W	Large	Quebec	Saint-Jean	%	1990	2010	20	1.86	0.72	1	0.64
Return	W	Small	NFLD	Exploits	Number	1978	2010	33	34 085	24 924	0.83	0.56
Return	W	Small	NFLD	Middle Brook	Number	1978	2010	33	2642	1868	0.84	0.63
Return	W	Small	NFLD	Torrent	Number	1984	2010	27	2784	4154	0.94	0.64

*** 2011 value: or if not available, the latest value of the time-series.**

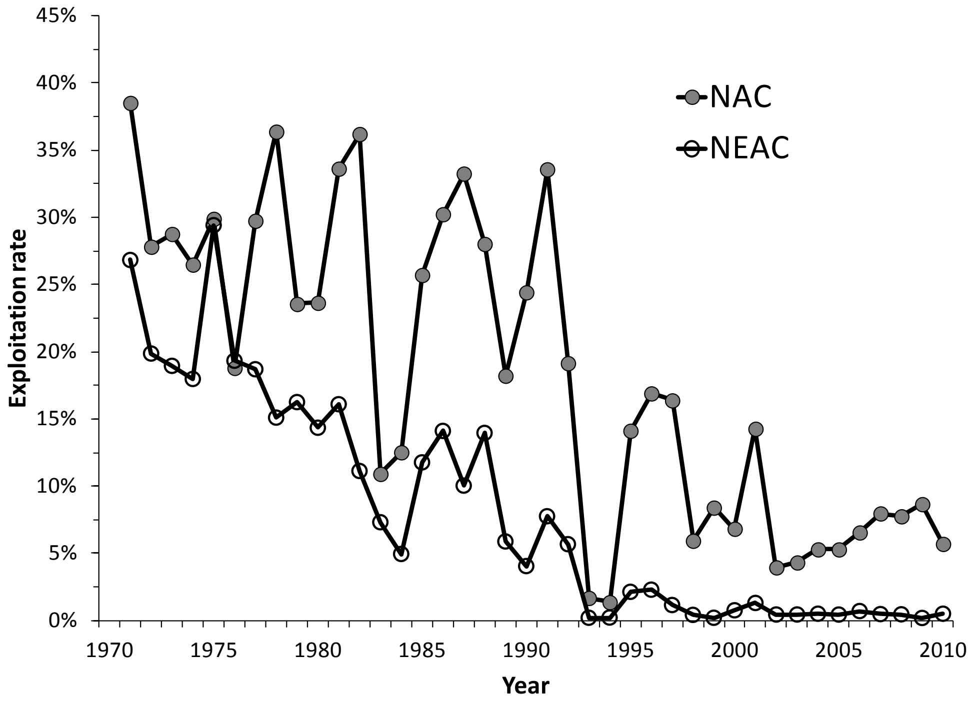


Figure 5.1.1.1. Exploitation rate (%) for NAC 1SW non-maturing and southern NEAC non-maturing Atlantic salmon at West Greenland, 1971–2010. Exploitation rate estimates are only available to 2010, as 2011 exploitation rates are dependent 2012 2SW NAC or MSW (NEAC) returns.

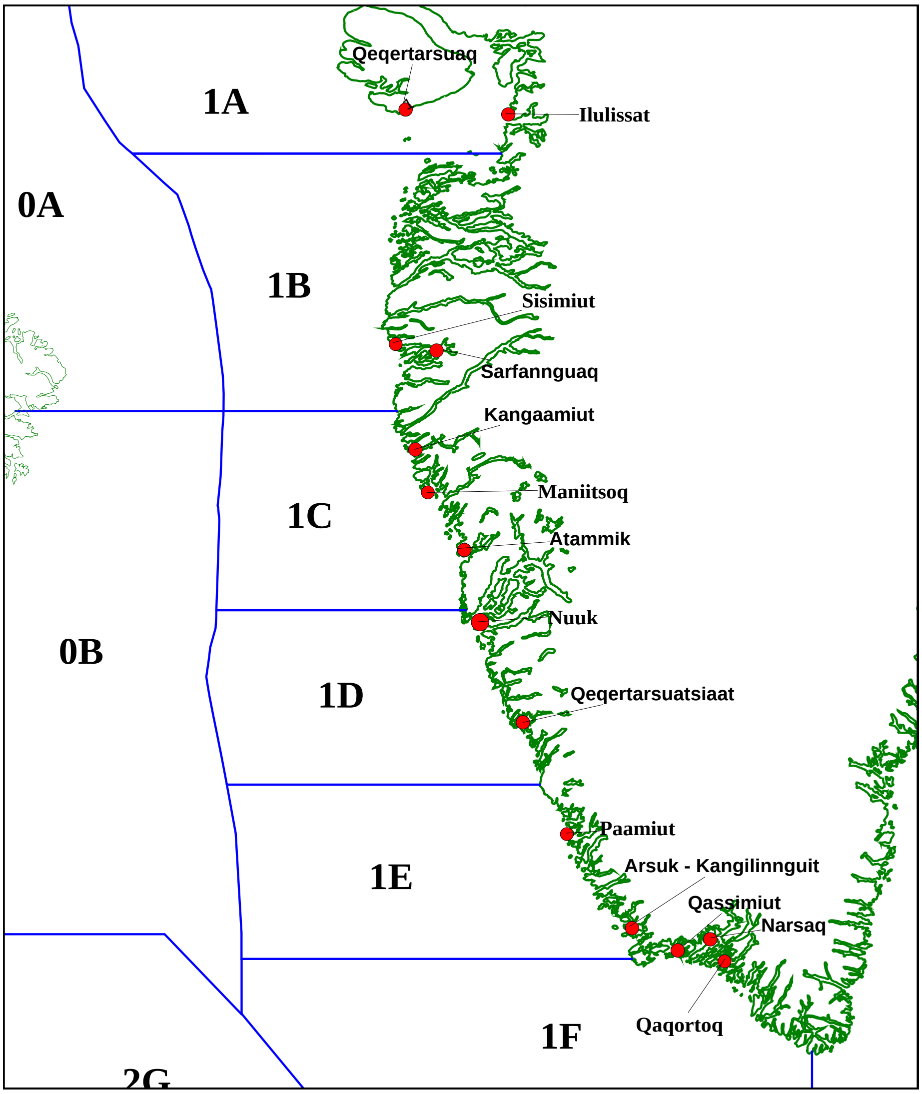


Figure 5.1.1.2. Location of NAFO divisions along the coast of West Greenland.

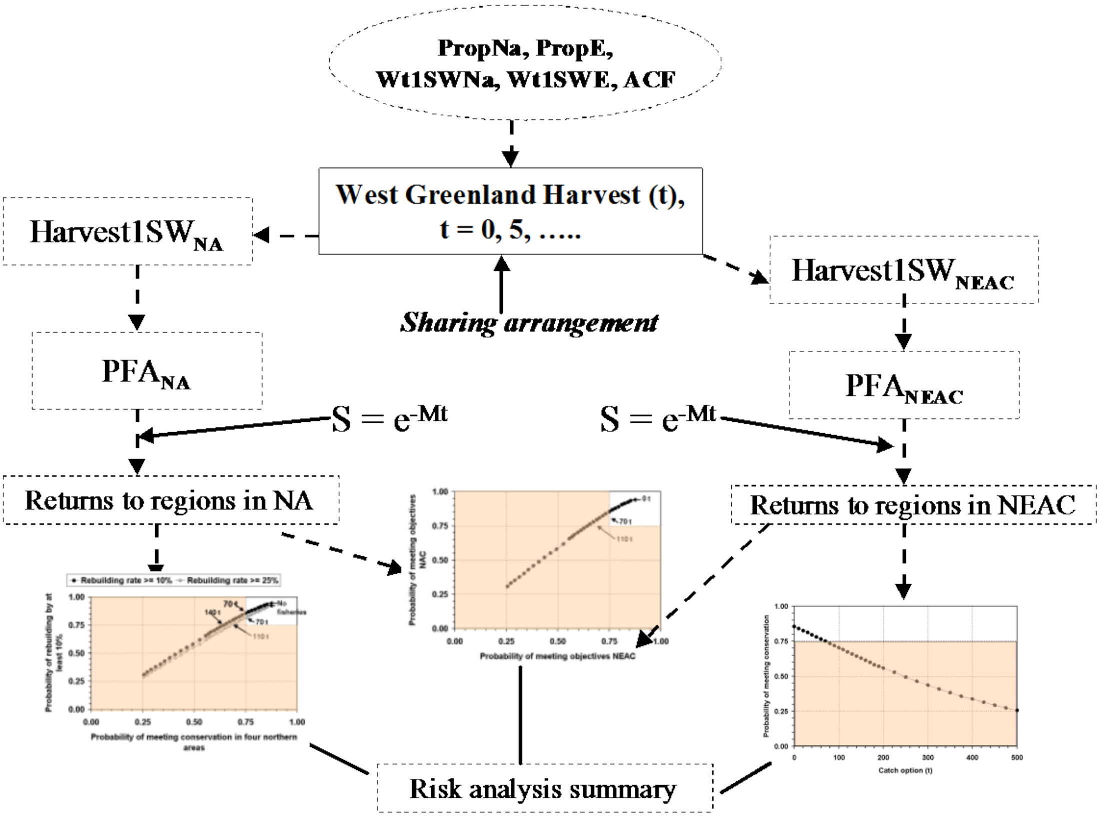


Figure 5.8.3.1. Flowchart, risk analysis for catch options at West Greenland using the PFA$_{NA}$ and the PFA$_{NEAC}$ predictions for the year of the fishery. Inputs with solid borders are considered known without error. Estimated inputs with observation error that is incorporated in the analysis have dashed borders. Solid arrows are functions that introduce or transfer without error whereas dashed arrows transfer errors through the components.

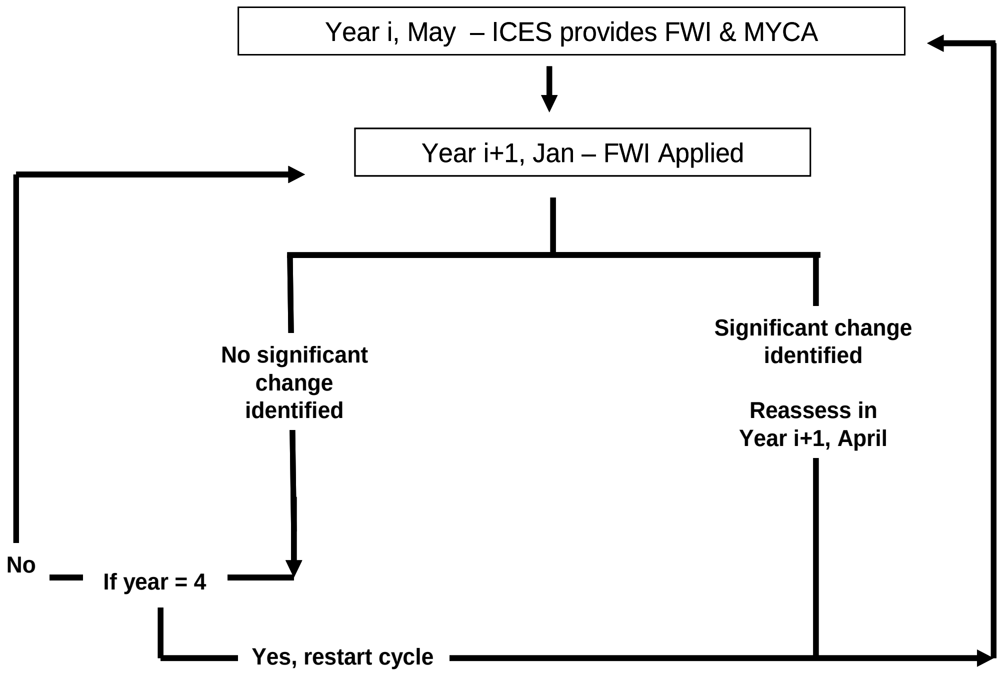


Figure 5.9.1. Suggested timeline for employment of the Framework of Indicators (FWI). In Year i, ICES provides multiyear catch advice (MYCA) and an updated FWI which re-evaluates the updated datasets and is summarized in an Excel worksheet. In January of Year i+1 the FWI is applied and two options are 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 four.

Catch Advice	Catch option > 0 (Yes = 1, No = 0)	0

Overall Recommendation

No Significant Change Identified by Indicators

Geographic Area	River/ Indicator	2011 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	2368	167%	1415	100%	92%	1	0.92	0.92	
	Penobscot 1SW Returns	741	197%	377	83%	88%	1	0.88	0.88	
	Penobscot 2SW Survival (%)	0.39	170%	0.23	100%	60%	1	0.6	0.6	
	Penobscot 1SW Survival (%)	0.12	133%	0.09	85%	73%	1	0.73	0.73	
	Narraguagus Returns	196	196%	100	95%	61%	1	0.61	0.61	
	possible range				*-0.93*	*0.75*				
	Average		173%						**0.75**	**Yes**
Scotia-Fundy	Saint John Return Large	294	9%	3 329	96%	100%	-1	0.96	-0.96	
	Lahave Return Large	146	51%	285	77%	85%	-1	0.77	-0.77	
	St. Mary's Return Large	14	6%	221	100%	73%	-1	1	-1	
	North Return Large	1 193	168%	712	95%	67%	1	0.67	0.67	
	Saint John Return 1SW	582	26%	2 276	86%	80%	-1	0.86	-0.86	
	LaHave Return 1SW	565	34%	1 679	94%	67%	-1	0.94	-0.94	
	St. Mary's Return 1SW	331	16%	2 038	95%	93%	-1	0.95	-0.95	
	Saint John Survival 2SW (%)	0.13	59%	0.22	95%	81%	-1	0.95	-0.95	
	Lahave Survival 2SW (%)	0.88	367%	0.24	81%	81%	1	0.81	0.81	
	Saint John Survival 1SW (%)	0.12	16%	0.76	86%	73%	-1	0.86	-0.86	
	Lahave Survival 1SW (%)	0.72	50%	1.44	92%	78%	-1	0.92	-0.92	
	Liscomb Survival 2SW (%)	0.03	60%	0.05	86%	91%	-1	0.86	-0.86	
	East Sheet Harbour Survival 2SW (%)	0.005	25%	0.02	67%	82%	-1	0.67	-0.67	
	possible range				*-0.88*	*0.81*				
	Average		68%						**-0.64**	**No**
Gulf	Miramichi Return 2SW	28 977	183%	15 800	100%	85%	1	0.85	0.85	
	Miramichi Return 1SW	45 880	110%	41 790	89%	67%	1	0.67	0.67	
	possible range				*-0.95*	*0.76*				
	Average		147%						**0.76**	**Yes**
Quebec	Cascapédia Return Large	3 815	167%	2 280	69%	92%	1	0.92	0.92	
	Bonaventure Return Large	1 259	85%	1 479	75%	81%	-1	0.75	-0.75	
	Grande Rivière Return Large	533	121%	442	100%	94%	1	0.94	0.94	
	Saint-Jean Return Large	688	91%	758	86%	89%	-1	0.86	-0.86	
	Dartmouth Return Large	1 171	155%	756	86%	89%	1	0.89	0.89	
	Madeleine Return Large	996	153%	653	70%	93%	1	0.93	0.93	
	Sainte-Anne Return Large	871	201%	433	67%	88%	1	0.88	0.88	
	Godbout Return Large	694	108%	641	86%	100%	1	1	1	
	De la Trinite Return Large	317	82%	385	75%	100%	-1	0.75	-0.75	
	York Return Return Large	1 585	113%	1405	63%	83%	1	0.83	0.83	
	Grande Rivière Return Small	237	119%	199	59%	80%	1	0.8	0.8	
	Saint-Jean Return Small	343	87%	394	53%	80%	-1	0.53	-0.53	
	Godbout Return Small	623	123%	508	85%	92%	1	0.92	0.92	
	De la Trinite Return Small	949	238%	399	89%	83%	1	0.83	0.83	
	De la Trinite Survival Large (%)	0.76	155%	0.49	88%	96%	1	0.96	0.96	
	De la Trinite Survival Small (%)	2.54	170%	1.49	63%	89%	1	0.89	0.89	
	Saint-Jean Survival Small (%)	1.86	258%	0.72	100%	64%	1	0.64	0.64	
	possible range				*-0.77*	*0.88*				
	Average		143%						**0.50**	**Yes**
Newfoundland	Exploits Return Small	34 085	137%	24 924	83%	56%	1	0.56	0.56	
	Middle Brook Return Small	2 642	141%	1 868	84%	63%	1	0.63	0.63	
	Torrent Return Small	2 784	67%	4 154	94%	64%	-1	0.94	-0.94	
	possible range				*-0.87*	*0.61*				
	Average		115%						**0.08**	**Yes**
Labrador										
	possible range									
	Average								**NA**	**Unknown**
Southern NEAC										
	possible range									
	Average								**NA**	**Unknown**

Figure 5.9.1.1. Framework of indicators spreadsheet for the West Greenland fishery. For illustrative purposes, the 2011 value of returns or survival rates for the 40 retained indicators is entered in the cells corresponding to the annual indicator variable values.

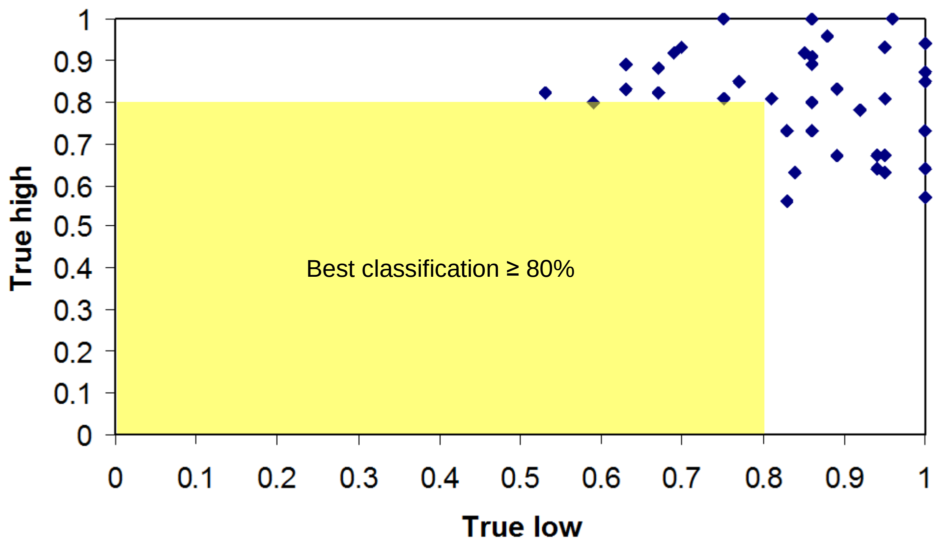


Figure 5.9.1.2. Comparative performance of the retained indicators (N = 40) at identifying a true low (i.e. management objective will not be met) and a true high (i.e. management objective will be met) for the West Greenland multiyear catch advice framework.

Annex 1: Working documents submitted to the Working Group on North Atlantic Salmon, March 26–April 4, 2012

Number	author(s)	title
1	Sheehan, T.F., Assuncao, M., Chisholm, N., Deschamps, D., Dixon, H., Renkawitz, M., Rogan, G., Nygaard, R., Robertson, M.J., and King, T.L.	The International Sampling Programme, Continent of Origin and Biological Characteristics of Atlantic Salmon Collected at West Greenland in 2011
2	Watson, D.S. and Sheehan, T.F.	Archived Documents of the International Council for the Exploration of the Sea (ICES) Working Group on North Atlantic Salmon (WGNAS)
3	Douglas,S., Chaput, G., Breau, C., Cairns, D., and Cameron, P.	Stock Status of Atlantic Salmon In Canada's Gulf Region (SFAs 15–18)
4	Gjøsæter, H., Fiske, P., Jensen, A.J., Johnsen, B.O., Wennevik, V., and Dankel, D.J.	Monitoring surveys for the parasite *Gyrodactylus salaris* in Norway
5	Fiske, P., Hansen, L.P., Jensen, A.J., Sægrov, H., Wennevik, V., Gjøsæter, H., Dankel, D.J., Hvidsten, N.A., and Jonsson, N.	Atlantic salmon; National Report for Norway 2011
6	Ó Maoiléidigh, N., Cullen, A., Bond, N., McLaughlin, D., O'Higgins, K.,Rogan,G., Cotter, D., White, J., Gargan, P. and Roche. W.	National Report for Ireland - the 2011 Salmon Season
7	Trial, J., Sweka, J., Kocik, J., Sheehan, T., Gephart, S., and Sprankle, K.	National Report for the United States, 2011
8	Veinott, G.I. and Reddin, D.G.	Atlantic salmon return and spawner estimates for Insular Newfoundland 1969–2011
9	Reddin, D.G. and Poole, R.	Estimates of returns and spawners for Labrador, 2011
10	Veinott, G. and Bourgeois, C.	River classification system in NFLD
11	Meerburg, D.	Sonic Tracking of Atlantic Salmon Smolts and Kelts to Sea
12	Erkinaro, J., Orell, P., Länsman, M., Falkegård, M., Kuusela, J., Kylmäaho, M., Niemelä, E., and Heggberget, T.G.	Status of Atlantic salmon stocks in the rivers Teno/Teno and Näätämöjoki/Neidenelva
13	Gudbergsson, G., Antonsson, T., and Jonsson, I.R.	National Report for Iceland: The 2011 Salmon Season
14	Prusov, S. and Ustyuzhinskiy, G.	Atlantic Salmon Fisheries and Status of Stocks in Russia. National Report for 2011
15	Dionne, M., Skinner, B., Cauchon, C., and Fournier, D.	Status of Atlantic Salmon Stocks in Québec in 2011
16	Dionne, M., Cauchon, C., and Fournier, D.	Smolt production, freshwater and sea survival on two index rivers in Québec, the Saint-Jean and the Trinité
17	Anon	National Report for UK (England & Wales)
18	de la Hoz Regules, J.	Catch data for Spain
19	Jacobsen, J.A.	Status of the fisheries for Atlantic salmon and production of farmed salmon in 2011 for the Faroe Islands

Number	author(s)	title
20	Jacobsen, J.A., and Joensen, G.	Bycatch estimates of salmon in the Faroese pelagic fisheries in 2011
21	Rasmussen, G.	Catch data for Denmark
22	MacLean, J.C., Smith, G.W., Glover, R., and Orpwood, J.E.	National Report for UK (Scotland): 2011 Season
23	Ensing, D., Kennedy, R., Crozier, W.W., and Boylan, P.	Summary of Salmon Fisheries and Status of Stocks in Northern Ireland for 2011
24	Kennedy, R.J., Ensing, D., Moffet, I., and Crozier, W.W.	The Assessment of Salmon Stocks in the Lower Bann/Lough Neagh Catchment in 2011
25	Breau, C.	The use of fish physiology to set water temperature threshold to close the recreational fishery of Atlantic salmon (*Salmo salar*) during warm-water events
26	Lefevre, M., Hardie, D.C., Gibson, A.J.F., Levy, A..L., Jones, R.A., and Bowlby, H.D.	Status of Atlantic Salmon in Canada's Maritimes Region (Salmon Fishing Areas 19 to 23)
27	Chaput, G., Breau, C., Cairns, D., Cameron, P., Dionne, M., Douglas, S., Hardie, D., Jones, R., Poole, R., and Veinott, G.	Catch Statistics and Aquaculture Production Values for Canada: preliminary 2011, final 2010
28	Nygaard, R.	The Salmon Fishery in Greenland 2011
29	Degerman, E., Jacobsen, P.-E., Karlsson, L., and Lettevall, E.	*Gyrodactylus salaris* monitoring - experiences from Sweden
30	Degerman, E., Persson, J., and Sers, B.	Fisheries, Management and Status of Atlantic Salmon Stocks in Sweden: National Report for 2011
31	Breau, C., Chaput, G., and Caissie, D.	Temperature Threshold to Define Management Strategies for Atlantic Salmon (*Salmo salar*) Fisheries under Environmentally Stressful Conditions
32	White, J., O'Maoileidigh, N., de Eyto, E., McGinnity, P., Gargan, P., Roche, W., O'Higgins, K., and Doherty, D.	Development of the Conservation Limits and Assessment Methodology of the Irish Salmon Standing Scientific Committee (Updating Irish stock assessment why and how)
33	Romakkaniemi, A., White, J., Massiot-Granier, F., Rivot, E., Prévost, E., Chaput, G., and Pulkkinen, H.	ECOKNOWS Effective use of ecosystems and biological knowledge in fisheries. Improving fisheries assessment methods by integrating new sources of biological knowledge
34	White, J.	Age Determination of Salmon (WKADS) I and II Overview
35	Sheehan, T.	Recent studies on marine ecology of US origin Atlantic salmon
36	Karasev, A. and Prusov, S.	Monitoring Surveys For Parasite *Gyrodactylus Salaris* on Salmon Rivers in the Russian Federation.
37	Dankel, D.J., Gjøsæter, H., Fiske, P., White, J., Chaput, G., and Russel, I.	On the Framework of Indicators for Atlantic Salmon in the Northeast Atlantic Commission Area
38	Euzenat, G.	National Report for France 2011

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Annex 4: Reported catch of Atlantic salmon in numbers and weight (tonnes round fresh weight) by sea age class. Catches reported for 2011 may be provisional. Methods used for estimating age composition given in footnotes

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	315532	-	17810	-	-	-	-	-	-	-	-	-	2688	-	336030	1077
	1983	90500	-	8100	-	-	-	-	-	-	-	-	-	1400	-	100000	310
	1984	78942	-	10442	-	-	-	-	-	-	-	-	-	630	-	90014	297
	1985	292181	-	18378	-	-	-	-	-	-	-	-	-	934	-	311493	864
	1986	307800	-	9700	-	-	-	-	-	-	-	-	-	2600	-	320100	960
	1987	297128	-	6287	-	-	-	-	-	-	-	-	-	2898	-	306313	966
	1988	281356	-	4602	-	-	-	-	-	-	-	-	-	2296	-	288254	893
	1989	110359	-	5379	-	-	-	-	-	-	-	-	-	1875	-	117613	337
	1990	97271	-	3346	-	-	-	-	-	-	-	-	-	860	-	101477	274
	1991	167551	415	8809	53	-	-	-	-	-	-	-	-	743	4	177103	472
	1992	82354	217	2822	18	-	-	-	-	-	-	-	-	364	2	85540	237
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	31241	-	558	-	-	-	-	-	-	-	-	-	478	-	32277	83
	1996	30613	-	884	-	-	-	-	-	-	-	-	-	568	-	32065	92
	1997	20980	-	134	-	-	-	-	-	-	-	-	-	124	-	21238	58
	1998	3901	-	17	-	-	-	-	-	-	-	-	-	88	-	4006	11
	1999	6124	18	50	0	-	-	-	-	-	-	-	-	84	1	6258	19
	2000	7715	21	0	0	-	-	-	-	-	-	-	-	140	0	7855	21
	2001	14795	40	324	2	-	-	-	-	-	-	-	-	293	1	15412	43
	2002	3344	10	34	0	-	-	-	-	-	-	-	-	27	0	3405	10
	2003	3933	12	38	0	-	-	-	-	-	-	-	-	73	0	4044	12
	2004	4488	14	51	0	-	-	-	-	-	-	-	-	88	0	4627	15
	2005	3120	13	40	0	-	-	-	-	-	-	-	-	180	1	3340	14
	2006	5746	20	183	1	-	-	-	-	-	-	-	-	224	1	6153	22
	2007	6037	24	82	0	6	0	-	-	-	-	-	-	144	1	6263	25
	2008	9311	26	47	0	0	0	-	-	-	-	-	-	177	1	9535	26
	2009	7442	27	268	1	0	0	-	-	-	-	-	-	328	1	8038	29
	2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11747	40
	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8396	28
Canada	1982	358000	716	-	-	-	-	-	-	-	-	240000	1082	-	-	598000	1798
	1983	265000	513	-	-	-	-	-	-	-	-	201000	911	-	-	466000	1424
	1984	234000	467	-	-	-	-	-	-	-	-	143000	645	-	-	377000	1112
	1985	333084	593	-	-	-	-	-	-	-	-	122621	540	-	-	455705	1133
	1986	417269	780	-	-	-	-	-	-	-	-	162305	779	-	-	579574	1559
	1987	435799	833	-	-	-	-	-	-	-	-	203731	951	-	-	639530	1784
	1988	372178	677	-	-	-	-	-	-	-	-	137637	633	-	-	509815	1310
	1989	304620	549	-	-	-	-	-	-	-	-	135484	590	-	-	440104	1139
	1990	233690	425	-	-	-	-	-	-	-	-	106379	486	-	-	340069	911
	1991	189324	341	-	-	-	-	-	-	-	-	82532	370	-	-	271856	711
	1992	108901	199	-	-	-	-	-	-	-	-	66357	323	-	-	175258	522
	1993	91239	159	-	-	-	-	-	-	-	-	45416	214	-	-	136655	373
	1994	76973	139	-	-	-	-	-	-	-	-	42946	216	-	-	119919	355
	1995	61940	107	-	-	-	-	-	-	-	-	34263	153	-	-	96203	260
	1996	82490	138	-	-	-	-	-	-	-	-	31590	154	-	-	114080	292
	1997	58988	103	-	-	-	-	-	-	-	-	26270	126	-	-	85258	229
	1998	51251	87	-	-	-	-	-	-	-	-	13274	70	-	-	64525	157
	1999	50901	88	-	-	-	-	-	-	-	-	11368	64	-	-	62269	152
	2000	55263	95	-	-	-	-	-	-	-	-	10571	58	-	-	65834	153
	2001	51225	86	-	-	-	-	-	-	-	-	11575	61	-	-	62800	147
	2002	53464	99	-	-	-	-	-	-	-	-	8439	49	-	-	61903	148
	2003	46768	81	-	-	-	-	-	-	-	-	11218	60	-	-	57986	141
	2004	54253	94	-	-	-	-	-	-	-	-	12933	68	-	-	67186	162
	2005	47368	83	-	-	-	-	-	-	-	-	10937	56	-	-	58305	139
	2006	46747	82	-	-	-	-	-	-	-	-	11248	55	-	-	57995	137
	2007	37075	63	-	-	-	-	-	-	-	-	10311	49	-	-	47386	112
	2008	58386	100	-	-	-	-	-	-	-	-	11736	57	-	-	70122	158
	2009	42943	74	-	-	-	-	-	-	-	-	11226	52	-	-	54169	126
	2010	58531	100	-	-	-	-	-	-	-	-	10972	53	-	-	69503	153
	2011	63851	110	-	-	-	-	-	-	-	-	13668	69	-	-	77519	179

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	-	1206	-	5	-	-	-	-	-	-	-	21	-	1265	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
	2009	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2010	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2011	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
Faroe Islands	1982/83	9086	-	101227	-	21663	-	448	-	29	-	-	-	-	-	132453	625
	1983/84	4791	-	107199	-	12469	-	49	-	-	-	-	-	-	-	124508	651
	1984/85	324	-	123510	-	9690	-	-	-	-	-	-	-	1653	-	135177	598
	1985/86	1672	-	141740	-	4779	-	76	-	-	-	-	-	6287	-	154554	545
	1986/87	76	-	133078	-	7070	-	80	-	-	-	-	-	-	-	140304	539
	1987/88	5833	-	55728	-	3450	-	0	-	-	-	-	-	-	-	65011	208
	1988/89	1351	-	86417	-	5728	-	0	-	-	-	-	-	-	-	93496	309
	1989/90	1560	-	103407	-	6463	-	6	-	-	-	-	-	-	-	111436	364
	1990/91	631	-	52420	-	4390	-	8	-	-	-	-	-	-	-	57449	202
	1991/92	16	-	7611	-	837	-	-	-	-	-	-	-	-	-	8464	31
	1992/93	-	-	4212	-	1203	-	-	-	-	-	-	-	-	-	5415	22
	1993/94	-	-	1866	-	206	-	-	-	-	-	-	-	-	-	2072	7
	1994/95	-	-	1807	-	156	-	-	-	-	-	-	-	-	-	1963	6
	1995/96	-	-	268	-	14	-	-	-	-	-	-	-	-	-	282	1
	1996/97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1997/98	339	-	1315	-	109	-	-	-	-	-	-	-	-	-	1763	6
	1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1999/00	225	-	1560	-	205	-	-	-	-	-	-	-	-	-	1990	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
	2009/10	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2010/11	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2011/12	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	2598	5	-	-	-	-	-	-	-	-	5408	49	-	-	8006	54
	1983	3916	7	-	-	-	-	-	-	-	-	6050	51	-	-	9966	58
	1984	4899	9	-	-	-	-	-	-	-	-	4726	37	-	-	9625	46
	1985	6201	11	-	-	-	-	-	-	-	-	4912	38	-	-	11113	49
	1986	6131	12	-	-	-	-	-	-	-	-	3244	25	-	-	9375	37
	1987	8696	15	-	-	-	-	-	-	-	-	4520	34	-	-	13216	49
	1988	5926	9	-	-	-	-	-	-	-	-	3495	27	-	-	9421	36
	1989	10395	19	-	-	-	-	-	-	-	-	5332	33	-	-	15727	52
	1990	10084	19	-	-	-	-	-	-	-	-	5600	41	-	-	15684	60
	1991	9213	17	-	-	-	-	-	-	-	-	6298	53	-	-	15511	70
	1992	15017	28	-	-	-	-	-	-	-	-	6284	49	-	-	21301	77
	1993	11157	17	-	-	-	-	-	-	-	-	8180	53	-	-	19337	70
	1994	7493	11	-	-	-	-	-	-	-	-	6230	38	-	-	13723	49
	1995	7786	11	-	-	-	-	-	-	-	-	5344	38	-	-	13130	49
	1996	12230	20	1275	5	1424	12	234	4	19	1	-	-	354	3	15536	44
	1997	10341	15	2419	10	1674	15	141	2	22	1	-	-	418	3	15015	45
	1998	11792	19	1608	7	1660	16	147	3	-	-	-	-	460	3	15667	48
	1999	18830	33	1528	8	1579	16	129	2	6	0	-	-	490	3	22562	62
	2000	20817	39	5152	24	2379	25	110	2	-	-	-	-	991	6	56000	95
	2001	13296	21	6286	32	5369	57	103	2	-	-	-	-	2372	13	27426	125
	2002	6427	12	5227	20	4048	43	145	2	11	0	-	-	2496	16	18354	93
	2003	8130	15	1828	7	3599	35	161	3	6	0	-	-	2204	15	15928	75
	2004	3849	7	1425	6	1152	11	251	3	6	1	-	-	1404	11	8087	39
	2005	9216	16	1027	5	1575	16	66	1	48	1	-	-	837	8	12769	47
	2006	17758	29	4166	18	1369	13	66	1	-	-	-	-	770	5	24129	67
	2007	3250	6	5329	21	2423	23	19	1	6	-	-	-	1255	8	12282	59
	2008	3347	6	1848	8	4394	41	235	4	-	-	-	-	1901	11	11725	71
	2009	6727	-	1531	-	1408	-	262	-	-	-	-	-	876	-	10804	36
	2010	6361	-	3687	-	1345	-	322	-	12	-	-	-	957	-	12684	49
	2011	7782	-	2078	-	1725	-	190	-	22	-	-	-	911	-	12708	44
Iceland	1991	29601	-	11892	-	-	-	-	-	-	-	-	-	-	-	41493	130
	1992	38538	-	15312	-	-	-	-	-	-	-	-	-	-	-	53850	175
	1993	36640	-	11541	-	-	-	-	-	-	-	-	-	-	-	48181	160
	1994	24224	59	14088	76	-	-	-	-	-	-	-	-	-	-	38312	135
	1995	32767	90	13136	56	-	-	-	-	-	-	-	-	-	-	45903	145
	1996	26927	66	9785	52	-	-	-	-	-	-	-	-	-	-	36712	118
	1997	21684	56	8178	41	-	-	-	-	-	-	-	-	-	-	29862	97
	1998	32224	81	7272	37	-	-	-	-	-	-	-	-	-	-	39496	119
	1999	22620	59	9883	52	-	-	-	-	-	-	-	-	-	-	32503	111
	2000	20270	49	4319	24	-	-	-	-	-	-	-	-	-	-	24589	73
	2001	18538	46	5289	28	-	-	-	-	-	-	-	-	-	-	23827	74
	2002	25277	64	5194	26	-	-	-	-	-	-	-	-	-	-	30471	90
	2003	24738	61	8119	37	-	-	-	-	-	-	-	-	-	-	32857	99
	2004	32600	84	6128	28	-	-	-	-	-	-	-	-	-	-	38728	111
	2005	39980	101	5941	28	-	-	-	-	-	-	-	-	-	-	45921	129
	2006	29857	71	5635	23	-	-	-	-	-	-	-	-	-	-	35492	93
	2007	31899	74	3262	15	-	-	-	-	-	-	-	-	-	-	35161	89
	2008	44391	106	5129	26	-	-	-	-	-	-	-	-	-	-	49520	132
	2009	43981	103	4561	24	-	-	-	-	-	-	-	-	-	-	48542	126
	2010	43457	105	9251	43	-	-	-	-	-	-	-	-	-	-	52708	147
	2011	28550	74	4854	24	-	-	-	-	-	-	-	-	-	-	33404	98

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
Sweden	1990	7428	18	-	-	-	-	-	-	-	-	3133	15	-	-	10561	33
	1991	8987	20	-	-	-	-	-	-	-	-	3620	18	-	-	12607	38
	1992	9850	23	-	-	-	-	-	-	-	-	4656	26	-	-	14506	49
	1993	10540	23	-	-	-	-	-	-	-	-	6369	33	-	-	16909	56
	1994	8304	18	-	-	-	-	-	-	-	-	4661	26	-	-	12965	44
	1995	9761	22	-	-	-	-	-	-	-	-	2770	14	-	-	12531	36
	1996	6008	14	-	-	-	-	-	-	-	-	3542	19	-	-	9550	33
	1997	2747	7	-	-	-	-	-	-	-	-	2307	12	-	-	5054	19
	1998	2421	6	-	-	-	-	-	-	-	-	1702	9	-	-	4123	15
	1999	3573	8	-	-	-	-	-	-	-	-	1460	8	-	-	5033	16
	2000	7103	18	-	-	-	-	-	-	-	-	3196	15	-	-	10299	33
	2001	4634	12	-	-	-	-	-	-	-	-	3853	21	-	-	8487	33
	2002	4733	12	-	-	-	-	-	-	-	-	2826	16	-	-	7559	28
	2003	2891	7	-	-	-	-	-	-	-	-	3214	18	-	-	6105	25
	2004	2494	6	-	-	-	-	-	-	-	-	2330	13	-	-	4824	19
	2005	2122	5	-	-	-	-	-	-	-	-	1770	10	-	-	3892	15
	2006	2211	4	-	-	-	-	-	-	-	-	1772	10	-	-	3983	14
	2007	1228	3	-	-	-	-	-	-	-	-	2442	13	-	-	3670	16
	2008	1197	3	-	-	-	-	-	-	-	-	2752	16	-	-	3949	18
	2009	1269	3	-	-	-	-	-	-	-	-	2495	14	-	-	3764	17
	2010	2109	5	-	-	-	-	-	-	-	-	3066	17	-	-	5175	22
	2011	2726	7	-	-	-	-	-	-	-	-	5759	32	-	-	8485	39
Norway	1981	221566	467	-	-	-	-	-	-	-	-	213943	1189	-	-	435509	1656
	1982	163120	363	-	-	-	-	-	-	-	-	174229	985	-	-	337349	1348
	1983	278061	593	-	-	-	-	-	-	-	-	171361	957	-	-	449422	1550
	1984	294365	628	-	-	-	-	-	-	-	-	176716	995	-	-	471081	1623
	1985	299037	638	-	-	-	-	-	-	-	-	162403	923	-	-	461440	1561
	1986	264849	556	-	-	-	-	-	-	-	-	191524	1042	-	-	456373	1598
	1987	235703	491	-	-	-	-	-	-	-	-	153554	894	-	-	389257	1385
	1988	217617	420	-	-	-	-	-	-	-	-	120367	656	-	-	337984	1076
	1989	220170	436	-	-	-	-	-	-	-	-	80880	469	-	-	301050	905
	1990	192500	385	-	-	-	-	-	-	-	-	91437	545	-	-	283937	930
	1991	171041	342	-	-	-	-	-	-	-	-	92214	535	-	-	263255	877
	1992	151291	301	-	-	-	-	-	-	-	-	92717	566	-	-	244008	867
	1993	153407	312	62403	284	35147	327	-	-	-	-	-	-	-	-	250957	923
	1994	-	415	-	319	-	262	-	-	-	-	-	-	-	-	-	996
	1995	134341	249	71552	341	27104	249	-	-	-	-	-	-	-	-	232997	839
	1996	110085	215	69389	322	27627	249	-	-	-	-	-	-	-	-	207101	786
	1997	124387	241	52842	238	16448	151	-	-	-	-	-	-	-	-	193677	630
	1998	162185	296	66767	306	15568	139	-	-	-	-	-	-	-	-	244520	741
	1999	164905	318	70825	326	18669	167	-	-	-	-	-	-	-	-	254399	811
	2000	250468	504	99934	454	24319	219	-	-	-	-	-	-	-	-	374721	1177
	2001	207934	417	117759	554	33047	295	-	-	-	-	-	-	-	-	358740	1266
	2002	127039	249	98055	471	33013	299	-	-	-	-	-	-	-	-	258107	1019
	2003	185574	363	87993	410	31099	298	-	-	-	-	-	-	-	-	304666	1071
	2004	108645	207	77343	371	23173	206	-	-	-	-	-	-	-	-	209161	784
	2005	165900	307	69488	320	27507	261	-	-	-	-	-	-	-	-	262895	888
	2006	142218	261	99401	453	23529	218	-	-	-	-	-	-	-	-	265148	932
	2007	78165	140	79146	363	28896	264	-	-	-	-	-	-	-	-	186207	767
	2008	89228	170	69027	314	34124	322	-	-	-	-	-	-	-	-	192379	807
	2009	73045	135	53725	241	23663	219	-	-	-	-	-	-	-	-	150433	595
	2010	98490	184	56260	250	22310	208	-	-	-	-	-	-	-	-	177060	642
	2011	71597	140	81351	374	20270	183	-	-	-	-	-	-	-	-	173218	696

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
Russia	1987	97242	-	27135	-	9539	-	556	-	18	-	-	-	2521	-	137011	564
	1988	53158	-	33395	-	10256	-	294	-	25	-	-	-	2937	-	100065	420
	1989	78023	-	23123	-	4118	-	26	-	0	-	-	-	2187	-	107477	364
	1990	70595	-	20633	-	2919	-	101	-	0	-	-	-	2010	-	96258	313
	1991	40603	-	12458	-	3060	-	650	-	0	-	-	-	1375	-	58146	215
	1992	34021	-	8880	-	3547	-	180	-	0	-	-	-	824	-	47452	167
	1993	28100	-	11780	-	4280	-	377	-	0	-	-	-	1470	-	46007	139
	1994	30877	-	10879	-	2183	-	51	-	0	-	-	-	555	-	44545	141
	1995	27775	62	9642	50	1803	15	6	0	0	0	-	-	385	2	39611	129
	1996	33878	79	7395	42	1084	9	40	1	0	0	-	-	41	1	42438	131
	1997	31857	72	5837	28	672	6	38	1	0	0	-	-	559	3	38963	110
	1998	34870	92	6815	33	181	2	28	0	0	0	-	-	638	3	42532	130
	1999	24016	66	5317	25	499	5	0	0	0	0	-	-	1131	6	30963	102
	2000	27702	75	7027	34	500	5	3	0	0	0	-	-	1853	9	37085	123
	2001	26472	61	7505	39	1036	10	30	0	0	0	-	-	922	5	35965	115
	2002	24588	60	8720	43	1284	12	3	0	0	0	-	-	480	3	35075	118
	2003	22014	50	8905	42	1206	12	20	0	0	0	-	-	634	4	32779	107
	2004	17105	39	6786	33	880	7	0	0	0	0	-	-	529	3	25300	82
	2005	16591	39	7179	33	989	8	1	0	0	0	-	-	439	3	25199	82
	2006	22412	54	5392	28	759	6	0	0	0	0	-	-	449	3	29012	91
	2007	12474	30	4377	23	929	7	0	0	0	0	-	-	277	2	18057	62
	2008	13404	28	8674	39	669	4	8	0	0	0	-	-	312	2	23067	73
	2009	13580	30	7215	35	720	5	36	0	0	0	-	-	173	1	21724	71
	2010	14834	33	9821	48	844	6	49	0	0	0	-	-	186	1	25734	88
	2011	13779	31	9030	44	747	5	51	0	0	0	-	-	171	1	23778	82
Ireland	1980	248333	745	-	-	-	-	-	-	-	-	39608	202	-	-	287941	947
	1981	173667	521	-	-	-	-	-	-	-	-	32159	164	-	-	205826	685
	1982	310000	930	-	-	-	-	-	-	-	-	12353	63	-	-	322353	993
	1983	502000	1506	-	-	-	-	-	-	-	-	29411	150	-	-	531411	1656
	1984	242666	728	-	-	-	-	-	-	-	-	19804	101	-	-	262470	829
	1985	498333	1495	-	-	-	-	-	-	-	-	19608	100	-	-	517941	1595
	1986	498125	1594	-	-	-	-	-	-	-	-	28335	136	-	-	526460	1730
	1987	358842	1112	-	-	-	-	-	-	-	-	27609	127	-	-	386451	1239
	1988	559297	1733	-	-	-	-	-	-	-	-	30599	141	-	-	589896	1874
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	330558	1079
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188890	567
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	135474	404
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235435	631
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200120	541
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286266	804
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288225	790
	1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	249623	685
	1997	-	-	-	-	-	-	-	-	-	-	-	-	-	-	209214	570
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	237663	624
	1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180477	515
	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228220	621
	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270963	730
	2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	256808	682
	2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	204145	551
	2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180953	489
	2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156308	422
	2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120834	326
	2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30946	84
	2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33200	89
	2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25170	68
	2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36508	99
	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37098	100

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	1985	62815	-	-	-	-	-	-	-	-	-	32716	-	-	-	95531	361
(England & Wales)	1986	68759	-	-	-	-	-	-	-	-	-	42035	-	-	-	110794	430
	1987	56739	-	-	-	-	-	-	-	-	-	26700	-	-	-	83439	302
	1988	76012	-	-	-	-	-	-	-	-	-	34151	-	-	-	110163	395
	1989	54384	-	-	-	-	-	-	-	-	-	29284	-	-	-	83668	296
	1990	45072	-	-	-	-	-	-	-	-	-	41604	-	-	-	86676	338
	1991	36671	-	-	-	-	-	-	-	-	-	14978	-	-	-	51649	200
	1992	34331	-	-	-	-	-	-	-	-	-	10255	-	-	-	44586	171
	1993	56033	-	-	-	-	-	-	-	-	-	13144	-	-	-	69177	248
	1994	67853	-	-	-	-	-	-	-	-	-	20268	-	-	-	88121	324
	1995	57944	-	-	-	-	-	-	-	-	-	22534	-	-	-	80478	295
	1996	30352	-	-	-	-	-	-	-	-	-	16344	-	-	-	46696	183
	1997	30203	-	-	-	-	-	-	-	-	-	11171	-	-	-	41374	142
	1998	30641	-	-	-	-	-	-	-	-	-	6276	-	-	-	36917	123
	1999	27944	-	-	-	-	-	-	-	-	-	13150	-	-	-	41094	150
	2000	48153	-	-	-	-	-	-	-	-	-	12800	-	-	-	60953	219
	2001	38993	-	-	-	-	-	-	-	-	-	12314	-	-	-	51307	184
	2002	34708	-	-	-	-	-	-	-	-	-	10961	-	-	-	45669	161
	2003	14878	-	-	-	-	-	-	-	-	-	7328	-	-	-	22206	89
	2004	24753	-	-	-	-	-	-	-	-	-	5806	-	-	-	30559	111
	2005	19622	-	-	-	-	-	-	-	-	-	6541	-	-	-	26162	97
	2006	16983	-	-	-	-	-	-	-	-	-	5073	-	-	-	22056	80
	2007	15540	-	-	-	-	-	-	-	-	-	4383	-	-	-	19923	67
	2008	14277	-	-	-	-	-	-	-	-	-	4759	-	-	-	19036	64
	2009	10015	-	-	-	-	-	-	-	-	-	3895	-	-	-	13910	54
	2010	25502	-	-	-	-	-	-	-	-	-	7193	-	-	-	32695	109
	2011	19982	-	-	-	-	-	-	-	-	-	15074	-	-	-	35056	129
UK (Scotland)	1982	208061	496	-	-	-	-	-	-	-	-	128242	596	-	-	336303	1092
	1983	209617	549	-	-	-	-	-	-	-	-	145961	672	-	-	355578	1221
	1984	213079	509	-	-	-	-	-	-	-	-	107213	504	-	-	320292	1013
	1985	158012	399	-	-	-	-	-	-	-	-	114648	514	-	-	272660	913
	1986	202838	525	-	-	-	-	-	-	-	-	148197	744	-	-	351035	1269
	1987	164785	419	-	-	-	-	-	-	-	-	103994	503	-	-	268779	922
	1988	149098	381	-	-	-	-	-	-	-	-	112162	501	-	-	261260	882
	1989	174941	431	-	-	-	-	-	-	-	-	103886	464	-	-	278827	895
	1990	81094	201	-	-	-	-	-	-	-	-	87924	423	-	-	169018	624
	1991	73608	177	-	-	-	-	-	-	-	-	65193	285	-	-	138801	462
	1992	101676	238	-	-	-	-	-	-	-	-	82841	361	-	-	184517	600
	1993	94517	227	-	-	-	-	-	-	-	-	71726	320	-	-	166243	547
	1994	99479	248	-	-	-	-	-	-	-	-	85404	400	-	-	184883	648
	1995	89971	224	-	-	-	-	-	-	-	-	78511	364	-	-	168482	588
	1996	66465	160	-	-	-	-	-	-	-	-	57998	267	-	-	124463	427
	1997	46866	114	-	-	-	-	-	-	-	-	40459	182	-	-	87325	296
	1998	53503	121	-	-	-	-	-	-	-	-	39264	162	-	-	92767	283
	1999	25255	57	-	-	-	-	-	-	-	-	30694	143	-	-	55949	199
	2000	44033	114	-	-	-	-	-	-	-	-	36767	161	-	-	80800	275
	2001	42586	101	-	-	-	-	-	-	-	-	34926	150	-	-	77512	251
	2002	31385	73	-	-	-	-	-	-	-	-	26403	118	-	-	57788	191
	2003	29598	71	-	-	-	-	-	-	-	-	27588	122	-	-	57091	192
	2004	37631	88	-	-	-	-	-	-	-	-	36856	159	-	-	74033	245
	2005	39093	91	-	-	-	-	-	-	-	-	28666	126	-	-	67117	215
	2006	36668	75	-	-	-	-	-	-	-	-	27620	118	-	-	63848	192
	2007	32335	71	-	-	-	-	-	-	-	-	24098	100	-	-	56433	171
	2008	23431	51	-	-	-	-	-	-	-	-	25745	110	-	-	49176	161
	2009	18189	37	-	-	-	-	-	-	-	-	19027	83	-	-	37216	120
	2010	33426	69	-	-	-	-	-	-	-	-	26874	111	-	-	60300	180
	2011	16704	35	-	-	-	-	-	-	-	-	30294	134	-	-	46998	169

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
France	1987	6013	18	-	-	-	-	-	-	-	-	1806	9	-	-	7819	27
	1988	2063	7	-	-	-	-	-	-	-	-	4964	25	-	-	7027	32
	1989	1124	3	1971	9	311	2	-	-	-	-	-	-	-	-	3406	14
	1990	1886	5	2186	9	146	1	-	-	-	-	-	-	-	-	4218	15
	1991	1362	3	1935	9	190	1	-	-	-	-	-	-	-	-	3487	13
	1992	2490	7	2450	12	221	2	-	-	-	-	-	-	-	-	5161	21
	1993	3581	10	987	4	267	2	-	-	-	-	-	-	-	-	4835	16
	1994	2810	7	2250	10	40	1	-	-	-	-	-	-	-	-	5100	18
	1995	1669	4	1073	5	22	0	-	-	-	-	-	-	-	-	2764	10
	1996	2063	5	1891	9	52	0	-	-	-	-	-	-	-	-	4006	13
	1997	1060	3	964	5	37	0	-	-	-	-	-	-	-	-	2061	8
	1998	2065	5	824	4	22	0	-	-	-	-	-	-	-	-	2911	8
	1999	690	2	1799	9	32	0	-	-	-	-	-	-	-	-	2521	11
	2000	1792	4	1253	6	24	0	-	-	-	-	-	-	-	-	3069	11
	2001	1544	4	1489	7	25	0	-	-	-	-	-	-	-	-	3058	11
	2002	2423	6	1065	5	41	0	-	-	-	-	-	-	-	-	3529	11
	2003	1598	5	-	-	-	-	-	-	-	-	1540	8	-	-	3138	13
	2004	1927	5	-	-	-	-	-	-	-	-	2880	14	-	-	4807	19
	2005	1236	3	-	-	-	-	-	-	-	-	1771	8	-	-	3007	11
	2006	1763	3	-	-	-	-	-	-	-	-	1785	9	-	-	3548	13
	2007	1378	3	-	-	-	-	-	-	-	-	1685	9	-	-	3063	12
	2008	1471	3	-	-	-	-	-	-	-	-	1931	9	-	-	3402	12
	2009	487	1	-	-	-	-	-	-	-	-	975	4	-	-	1462	5
	2010	1658	4	-	-	-	-	-	-	-	-	821	4	-	-	2479	7
	2011	1845	4	-	-	-	-	-	-	-	-	2126	9	-	-	3971	13
Spain (2)	1993	1589	-	827	-	75	-	-	-	-	-	-	-	-	-	2491	8
	1994	1658	5	-	-	-	-	-	-	-	-	735	4	-	-	2393	9
	1995	389	1	-	-	-	-	-	-	-	-	1118	6	-	-	1507	7
	1996	349	1	-	-	-	-	-	-	-	-	676	3	-	-	1025	4
	1997	169	0	-	-	-	-	-	-	-	-	425	2	-	-	594	3
	1998	481	1	-	-	-	-	-	-	-	-	403	2	-	-	884	3
	1999	157	0	-	-	-	-	-	-	-	-	986	5	-	-	1143	6
	2000	1227	3	-	-	-	-	-	-	-	-	433	3	-	-	1660	6
	2001	1129	3	-	-	-	-	-	-	-	-	1677	9	-	-	2806	12
	2002	651	2	-	-	-	-	-	-	-	-	1085	6	-	-	1736	8
	2003	210	1	-	-	-	-	-	-	-	-	1116	6	-	-	1326	6
	2004	1195	3	-	-	-	-	-	-	-	-	589	3	-	-	1784	6
	2005	412	1	-	-	-	-	-	-	-	-	2336	11	-	-	2748	12
	2006	335	1	-	-	-	-	-	-	-	-	1879	9	-	-	2214	10
	2007	520	1	-	-	-	-	-	-	-	-	1487	7	-	-	2007	9
	2008	520	1	-	-	-	-	-	-	-	-	1487	7	-	-	1966	9
	2009	138	1	-	-	-	-	-	-	-	-	324	1	-	-	462	2
	2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	371	2
	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1251	7

1. MSW includes all sea ages >1, when this cannot be broken down.
Different methods are used to separate 1SW and MSW salmon in different countries:
- Scale reading: Faroe Islands, Finland (1996 onwards), France, Russia, USA and West Greenland.
- Size (split weight/length): Canada (2.7 kg for nets; 63cm for rods), Finland up until 1995 (3 kg),
Iceland (various splits used at different times and places), Norway (3 kg), UK Scotland (3 kg in some places and 3.7 kg in others),
All countries except Scotland report no problems with using weight to catergorise catches into sea age classes; mis-classification may be very high in some years.
In Norway, catches shown as 3SW refer to salmon of 3SW or greater.
2. Based on catches in Asturias (80-90% of total catch). No data for 2008, previous year data is used.

Annex 5: Input data for run reconstruction of Atlantic salmon in the NEAC area

Annex 5.i. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – R. Tana/Teno (Finland/Norway).

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	8,422	8,538	35	5	35	5	50	10	55	15
1972	13,160	13,341	35	5	35	5	50	10	55	15
1973	11,969	15,958	35	5	35	5	50	10	55	15
1974	23,709	23,709	35	5	35	5	50	10	55	15
1975	16,527	26,417	35	5	35	5	50	10	55	15
1976	11,323	21,719	35	5	35	5	50	10	55	15
1977	5,807	13,227	35	5	35	5	50	10	55	15
1978	7,902	8,452	35	5	35	5	50	10	55	15
1979	9,249	7,390	35	5	35	5	50	10	45	15
1980	4,792	8,938	25	5	25	5	50	10	45	15
1981	7,386	9,835	25	5	25	5	50	10	45	15
1982	2,163	12,826	25	5	25	5	50	10	45	15
1983	10,680	13,990	25	5	25	5	50	10	45	15
1984	11,942	13,262	25	5	25	5	50	10	45	15
1985	18,039	10,339	25	5	25	5	50	10	45	15
1986	16,389	9,028	25	5	25	5	50	10	45	15
1987	20,950	11,290	25	5	25	5	50	10	45	15
1988	10,019	7,231	25	5	25	5	50	10	45	15
1989	28,091	10,011	25	5	25	5	60	10	55	15
1990	26,646	12,562	25	5	25	5	60	10	55	15
1991	32,423	15,136	25	5	25	5	60	10	55	15
1992	42,965	16,158	25	5	25	5	60	10	55	15
1993	30,197	18,720	25	5	25	5	60	10	55	15
1994	12,016	15,521	25	5	25	5	60	10	55	15
1995	11,801	9,634	25	5	25	5	60	10	55	15
1996	22,799	6,956	25	5	25	5	50	10	45	15
1997	19,481	10,083	25	5	25	5	50	10	45	15
1998	22,460	8,497	25	5	25	5	50	10	45	15
1999	38,687	8,854	25	5	25	5	60	10	50	10
2000	40,654	19,707	25	5	25	5	60	10	50	10
2001	18,372	28,337	25	5	25	5	60	10	50	10
2002	10,757	22,717	25	5	25	5	50	10	50	10
2003	12,699	16,093	25	5	25	5	50	10	50	10
2004	4,912	7,718	25	5	25	5	50	10	50	10
2005	12,499	5,969	25	5	25	5	50	10	50	10
2006	23,727	10,473	25	5	25	5	50	10	50	10
2007	4,407	14,878	25	5	25	5	50	10	50	10
2008	4,539	14,165	25	5	25	5	50	10	50	10
2009	9,260	6,600	25	5	25	5	50	10	50	10
2010	8627	10434	25	5	25	5	50	10	50	10
2011	10554	8204	25	5	25	5	50	10	50	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.ii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – France.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	1,740	4,060					3.5	1.5	37.5	12.5
1972	3,480	8,120					3.5	1.5	37.5	12.5
1973	2,130	4,970					3.5	1.5	37.5	12.5
1974	990	2,310					3.5	1.5	37.5	12.5
1975	1,980	4,620					3.5	1.5	37.5	12.5
1976	1,820	3,380					3.5	1.5	37.5	12.5
1977	1,400	2,600					3.5	1.5	37.5	12.5
1978	1,435	2,665					3.5	1.5	37.5	12.5
1979	1,645	3,055					3.5	1.5	37.5	12.5
1980	3,430	6,370					3.5	1.5	37.5	12.5
1981	2,720	4,080					3.5	1.5	35	15
1982	1,680	2,520					3.5	1.5	35	15
1983	1,800	2,700					3.5	1.5	35	15
1984	2,960	4,440					3.5	1.5	35	15
1985	1,100	3,330					3.5	1.5	35	15
1986	3,400	3,400					7	5	35	15
1987	6,013	1,806					7	5	35	15
1988	2,063	4,964					7	5	35	15
1989	1,124	2,282					7	5	35	15
1990	1,886	2,332					7	5	35	15
1991	1,362	2,125					7	5	35	15
1992	2,490	2,671					7	5	35	15
1993	3,581	1,254					7	5	35	15
1994	2,810	2,290					7	5	30	10
1995	1,669	1,095					12.5	7.5	30	10
1996	2,063	1,943					12.5	7.5	30	10
1997	1,060	1,001					12.5	7.5	30	10
1998	2,065	846					12.5	7.5	30	10
1999	690	1,831					12.5	7.5	30	10
2000	1,792	1,277					12.5	7.5	30	10
2001	1,544	1,489					12.5	7.5	30	10
2002	2,423	1,065	30	10	23	8	13	8	30	10
2003	1,598	1,540	30	10	23	8	13	8	30	10
2004	1,927	2,880	30	10	23	8	13	8	30	10
2005	1,256	1,771	30	10	23	8	13	8	30	10
2006	1,763	1,785	30	10	23	8	13	8	30	10
2007	1,378	1,685	30	10	23	8	13	8	30	10
2008	1,365	1,865	30	10	23	8	13	8	30	10
2009	487	975	30	10	23	8	13	8	30	10
2010	1658	821	30	10	23	8	13	8	30	10
2011	1162	2142	30	10	23	8	13	8	30	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.iii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Iceland (West & South).

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	30,618	16,749	2	1	2	1	50	10	70	10
1972	24,832	25,733	2	1	2	1	50	10	70	10
1973	26,624	23,183	2	1	2	1	50	10	70	10
1974	18,975	20,017	2	1	2	1	50	10	70	10
1975	29,428	21,266	2	1	2	1	50	10	70	10
1976	23,233	18,379	2	1	2	1	50	10	70	10
1977	23,802	17,919	2	1	2	1	50	10	70	10
1978	31,199	23,182	2	1	2	1	50	10	70	10
1979	28,790	14,840	2	1	2	1	50	10	70	10
1980	13,073	20,855	2	1	2	1	50	10	70	10
1981	16,890	13,919	2	1	2	1	50	10	70	10
1982	17,331	9,826	2	1	2	1	50	10	70	10
1983	21,923	16,423	2	1	2	1	50	10	70	10
1984	13,476	13,923	2	1	2	1	50	10	70	10
1985	21,822	10,097	2	1	2	1	50	10	70	10
1986	35,891	8,423	2	1	2	1	50	10	70	10
1987	22,302	7,480	2	1	2	1	50	10	70	10
1988	40,028	8,523	2	1	2	1	50	10	70	10
1989	22,377	7,607	2	1	2	1	50	10	70	10
1990	20,584	7,548	2	1	2	1	50	10	70	10
1991	22,711	7,519	2	1	2	1	50	10	70	10
1992	26,006	8,479	2	1	2	1	50	10	70	10
1993	25,479	4,155	2	1	2	1	50	10	70	10
1994	20,985	6,736	2	1	2	1	50	10	70	10
1995	25,371	6,777	12.5	2.5	12.5	2.5	50	10	70	10
1996	21,913	4,364	12.5	2.5	12.5	2.5	50	10	70	10
1997	16,007	4,910	12.5	2.5	12.5	2.5	50	10	70	10
1998	21,900	3,037	12.5	2.5	12.5	2.5	50	10	70	10
1999	17,448	5,757	12.5	2.5	12.5	2.5	49	10	68	10
2000	15,502	1,519	12.5	2.5	12.5	2.5	49	10	66	10
2001	13,586	2,707	12.5	2.5	12.5	2.5	48	10	67	10
2002	16,952	2,845	13	3	13	3	48	10	65	10
2003	20,271	4,751	13	3	13	3	48	10	68	10
2004	20,319	3,784	13	3	13	3	48	10	67	10
2005	29,969	3,241	13	3	13	3	48	10	65	10
2006	21,153	2,689	13	3	13	3	48	10	65	10
2007	23,728	1,679	13	3	13	3	47	9	66	10
2008	28,774	1,659	13	3	13	3	47	10	57	10
2009	33,190	2,838	13	3	13	3	48	10	63	10
2010	33318	6061	13	3	13	3	47	10	65	10
2011	23583	2102	13	3	13	3	47	10	60	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.iv. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation - Iceland (North & East).

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	4,610	6,625	2	1	2	1	50	10	70	10
1972	4,223	10,337	2	1	2	1	50	10	70	10
1973	5,060	9,672	2	1	2	1	50	10	70	10
1974	5,047	9,176	2	1	2	1	50	10	70	10
1975	6,152	10,136	2	1	2	1	50	10	70	10
1976	6,184	8,350	2	1	2	1	50	10	70	10
1977	8,597	11,631	2	1	2	1	50	10	70	10
1978	8,739	14,998	2	1	2	1	50	10	70	10
1979	8,363	9,897	2	1	2	1	50	10	70	10
1980	1,268	13,784	2	1	2	1	50	10	70	10
1981	6,528	4,827	2	1	2	1	50	10	70	10
1982	3,007	5,539	2	1	2	1	50	10	70	10
1983	4,437	4,224	2	1	2	1	50	10	70	10
1984	1,611	5,447	2	1	2	1	50	10	70	10
1985	11,116	3,511	2	1	2	1	50	10	70	10
1986	13,827	9,569	2	1	2	1	50	10	70	10
1987	8,145	9,908	2	1	2	1	50	10	70	10
1988	11,775	6,381	2	1	2	1	50	10	70	10
1989	6,342	5,414	2	1	2	1	50	10	70	10
1990	4,752	5,709	2	1	2	1	50	10	70	10
1991	6,900	3,965	2	1	2	1	50	10	70	10
1992	12,996	5,903	2	1	2	1	50	10	70	10
1993	10,689	6,672	2	1	2	1	50	10	70	10
1994	3,414	5,656	2	1	2	1	50	10	70	10
1995	8,776	3,511	12.5	2.5	12.5	2.5	50	10	70	10
1996	4,681	4,605	12.5	2.5	12.5	2.5	50	10	70	10
1997	6,406	2,594	12.5	2.5	12.5	2.5	50	10	70	10
1998	10,905	3,780	12.5	2.5	12.5	2.5	50	10	70	10
1999	5,326	4,030	12.5	2.5	12.5	2.5	48	10	65	10
2000	5,595	2,324	12.5	2.5	12.5	2.5	48	10	64	10
2001	4,976	2,587	12.5	2.5	12.5	2.5	47	10	62	10
2002	8,437	2,366	13	3	13	3	46	10	60	10
2003	4,478	2,194	13	3	13	3	46	10	53	10
2004	11,823	2,239	13	3	13	3	45	10	55	10
2005	10,297	2,726	13	3	13	3	44	10	54	10
2006	11,082	2,179	13	3	13	3	45	10	45	10
2007	8,046	1,672	13	3	13	3	44	10	36	10
2008	7,021	2,693	13	3	13	3	42	10	45	10
2009	10,779	1,735	13	3	13	3	40	10	36	10
2010	8621	2602	13	3	13	3	40	10	38	10
2011	7204	2645	13	3	13	3	39	10	34	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.v. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Ireland.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Net catch		Catch & Release		Spawner numbers - small rivers		Spawner numbers - closed rivers	
	1SW	MSW	est	error	est	error	est	error	est	error	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
1971	409,965	46,594	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1972	437,089	49,863	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1973	476,131	54,008	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1974	542,124	60,976	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1975	598,524	68,260	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1976	407,018	47,358	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1977	351,745	41,256	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1978	307,569	35,708	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1979	282,700	32,144	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1980	215,116	35,447	37.5	7.5	37.5	7.5	62.5	12.5	47.5	12.5								
1981	137,366	26,101	37.5	7.5	37.5	7.5	75.7	11.4	47.5	12.5								
1982	269,847	11,754	37.5	7.5	37.5	7.5	71.9	10.8	36.7	8.3								
1983	437,751	26,479	37.5	7.5	37.5	7.5	66.1	9.9	27.9	17.5								
1984	224,872	20,685	37.5	7.5	37.5	7.5	64.6	9.7	43.5	6.5								
1985	430,315	18,830	37.5	7.5	37.5	7.5	74.6	11.2	36.1	3.4								
1986	443,701	27,111	37.5	7.5	37.5	7.5	68.7	10.3	46.0	9.0								
1987	324,709	26,301	30	10	30	10	69.8	10.5	32.2	4.7								
1988	391,475	22,067	30	10	30	10	62.0	9.3	37.4	5.6								
1989	297,797	25,447	30	10	30	10	65.7	9.9	47.2	8.8								
1990	172,098	15,549	30	10	30	10	60.7	9.1	59.9	6.1								
1991	120,408	10,334	30	10	30	10	59.5	8.9	26.5	3.5								
1992	182,255	15,456	30	10	30	10	62.1	9.3	51.5	3.8								
1993	150,274	13,156	25	10	25	10	58.6	8.8	42.0	18.0								
1994	234,126	20,506	25	10	25	10	71.4	10.7	40.5	2.5								
1995	232,480	20,454	25	10	25	10	63.5	9.5	41.8	1.2								
1996	203,920	18,021	25	10	25	10	59.9	9.0	55.1	3.2								
1997	170,774	14,724	25	10	15	5	50.1	7.5	30.8	12.2								
1998	191,868	17,269	25	10	15	5	53.7	8.1	61.9	1.4								
1999	158,818	14,801	25	10	15	5	47.8	7.2	34.1	18.1								
2000	199,827	16,848	25	10	15	5	43.2	6.5	31.0	4.5								
2001	218,715	18,436	7.5	2.5	7.5	2.5	48	7.2	35	8								
2002	198,719	16,702	8	3	8	3	50	7	28	8								
2003	161,270	13,745	8	3	8	3	41	6	22	6								
2004	142,251	12,299	8	3	8	3	50	8	35	8								
2005	127,371	10,716	8	3	8	3	45	7	24	4								
2006	101,938	9,740	8	3	8	3	47	7	30	14								
2007	30,418	2,477	8	3	8	3	16	8	24	9	8334	679	12137	988	9548	777	40255	3278
2008	30,257	3,935	8	3	8	3	16	8	24	9	8253	650	10485	1492	12206	961	34382	4580
2009	24,184	4,756	8	3	8	3	16	8	24	9	6264	493	9799	1623	0	0	46570	4964
2010	33211	3297	8	3	8	3	16	8	24	9	13125	1034	13903	1255	0	0	35804	1504
2011	32298	3680	8	3	8	3	16	8	24	9	10032	857	10295	1088	0	0	31424	616
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16										
M(max)=	0.040				1SW(max)	9	MSW(max)	18										
Note:	Net catch and spawner numbers from 2007 only (zero values for spawner numbers in small rivers 2009-2011 as these included in closed rivers).																	

Annex 5.vi. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Norway – Southeast.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971										
1972										
1973										
1974										
1975										
1976										
1977										
1978										
1979										
1980										
1981										
1982										
1983	9,039	9,004	50	10	50	10	70	10	65	10
1984	11,402	11,527	50	10	50	10	70	10	65	10
1985	18,699	11,883	50	10	50	10	70	10	65	10
1986	23,089	12,077	50	10	50	10	70	10	65	10
1987	19,601	14,179	50	10	50	10	70	10	65	10
1988	17,520	9,443	50	10	50	10	70	10	65	10
1989	23,965	12,254	50	10	50	10	65	10	60	10
1990	25,792	11,502	50	10	50	10	65	10	60	10
1991	21,064	10,753	50	10	50	10	65	10	60	10
1992	26,044	15,332	50	10	50	10	65	10	60	10
1993	23,070	12,596	40	10	40	10	65	10	60	10
1994	23,987	9,988	40	10	40	10	65	10	60	10
1995	21,847	11,630	40	10	40	10	65	10	60	10
1996	20,738	13,538	40	10	40	10	65	10	60	10
1997	21,121	7,756	35	10	35	10	60	10	60	10
1998	32,586	10,396	35	10	35	10	60	10	60	10
1999	23,904	6,664	35	10	35	10	60	10	60	10
2000	43,151	14,261	35	10	35	10	60	10	60	10
2001	47,339	19,210	35	10	35	10	60	10	60	10
2002	33,087	14,400	35	10	35	10	60	10	60	10
2003	33,371	20,648	30	10	30	10	60	10	60	10
2004	28,506	15,948	30	10	30	10	60	10	60	10
2005	40,628	14,628	30	10	30	10	60	10	60	10
2006	30,979	21,192	30	10	30	10	60	10	60	10
2007	15,735	18,130	30	10	30	10	60	10	60	10
2008	15,696	16,678	30	10	30	10	55	10	50	10
2009	15,584	11,995	30	10	30	10	55	10	50	10
2010	22139	12175	30	10	30	10	50	10	40	10
2011	15773	28589	30	10	30	10	50	10	40	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.vii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Norway – Southwest.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971										
1972										
1973										
1974										
1975										
1976										
1977										
1978										
1979										
1980										
1981										
1982										
1983	31,845	28,601	50	10	50	10	80	10	80	10
1984	23,428	27,641	50	10	50	10	80	10	80	10
1985	29,857	25,515	50	10	50	10	80	10	80	10
1986	29,894	30,769	50	10	50	10	80	10	80	10
1987	30,005	26,623	50	10	50	10	80	10	80	10
1988	36,976	28,255	50	10	50	10	80	10	80	10
1989	19,183	13,041	50	10	50	10	70	10	65	10
1990	18,490	14,423	50	10	50	10	70	10	65	10
1991	9,759	8,323	50	10	50	10	70	10	65	10
1992	6,448	8,832	50	10	50	10	70	10	65	10
1993	11,433	10,239	40	10	40	10	70	10	65	10
1994	18,597	10,961	40	10	40	10	70	10	65	10
1995	10,863	13,122	40	10	40	10	70	10	65	10
1996	7,048	12,546	40	10	40	10	70	10	65	10
1997	10,279	7,194	35	10	35	10	60	10	60	10
1998	5,726	6,583	35	10	35	10	60	10	60	10
1999	7,357	3,219	35	10	35	10	60	10	60	10
2000	11,538	7,961	35	10	35	10	60	10	60	10
2001	12,109	10,716	35	10	35	10	60	10	60	10
2002	6,000	7,145	35	10	35	10	60	10	60	10
2003	8,269	7,602	30	10	30	10	60	10	60	10
2004	7,180	6,420	30	10	30	10	60	10	60	10
2005	10,370	7,334	30	10	30	10	60	10	60	10
2006	5,173	9,381	30	10	30	10	60	10	60	10
2007	2,630	6,011	30	10	30	10	60	10	60	10
2008	3,143	4,807	30	10	30	10	55	10	50	10
2009	3,069	3,792	30	10	30	10	55	10	50	10
2010	3450	2447	30	10	30	10	50	10	35	10
2011	2888	4409	30	10	30	10	45	10	30	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.viii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Norway – Mid.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971										
1972										
1973										
1974										
1975										
1976										
1977										
1978										
1979										
1980										
1981										
1982										
1983	121,221	74,648	50	10	50	10	75	10	75	10
1984	94,373	67,639	50	10	50	10	75	10	75	10
1985	114,613	56,641	50	10	50	10	75	10	75	10
1986	106,921	77,225	50	10	50	10	75	10	75	10
1987	83,669	62,216	50	10	50	10	75	10	75	10
1988	80,111	45,609	50	10	50	10	75	10	75	10
1989	94,897	30,862	50	10	50	10	65	10	65	10
1990	78,888	40,174	50	10	50	10	65	10	65	10
1991	67,370	30,087	50	10	50	10	65	10	65	10
1992	51,463	33,092	50	10	50	10	65	10	65	10
1993	58,326	28,184	40	10	40	10	65	10	65	10
1994	113,427	33,520	40	10	40	10	65	10	65	10
1995	57,813	42,696	40	10	40	10	65	10	65	10
1996	28,925	31,613	40	10	40	10	65	10	65	10
1997	43,127	20,565	35	10	35	10	60	10	60	10
1998	63,497	26,817	35	10	35	10	60	10	60	10
1999	60,689	28,792	35	10	35	10	60	10	60	10
2000	109,278	42,452	35	10	35	10	60	10	60	10
2001	88,096	52,031	35	10	35	10	60	10	60	10
2002	42,669	52,774	35	10	35	10	60	10	60	10
2003	91,118	46,963	30	10	30	10	60	10	60	10
2004	38,286	49,760	30	10	30	10	60	10	60	10
2005	63,749	37,941	30	10	30	10	60	10	60	10
2006	46,495	47,691	30	10	30	10	60	10	60	10
2007	26,608	33,106	30	10	30	10	60	10	60	10
2008	31,936	34,869	30	10	30	10	55	10	45	10
2009	26,267	30,715	30	10	30	10	55	10	45	10
2010	37557	30524	30	10	30	10	50	10	45	10
2011	20932	37272	30	10	30	10	50	10	45	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.ix. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Norway – North.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971										
1972										
1973										
1974										
1975										
1976										
1977										
1978										
1979										
1980										
1981										
1982										
1983	104,040	49,413	50	10	50	10	80	10	80	10
1984	150,372	58,858	50	10	50	10	80	10	80	10
1985	118,841	58,956	50	10	50	10	80	10	80	10
1986	84,150	63,418	50	10	50	10	80	10	80	10
1987	72,370	34,232	50	10	50	10	80	10	80	10
1988	53,880	32,140	50	10	50	10	80	10	80	10
1989	42,010	13,934	50	10	50	10	70	10	70	10
1990	38,216	17,321	50	10	50	10	70	10	70	10
1991	42,888	21,789	50	10	50	10	70	10	70	10
1992	34,593	19,265	50	10	50	10	70	10	70	10
1993	51,440	39,014	40	10	40	10	70	10	70	10
1994	37,489	33,411	40	10	40	10	70	10	70	10
1995	36,283	26,037	40	10	40	10	70	10	70	10
1996	40,792	36,636	40	10	40	10	70	10	70	10
1997	39,930	30,115	35	10	35	10	70	10	70	10
1998	46,645	34,806	35	10	35	10	70	10	70	10
1999	46,394	46,744	35	10	35	10	70	10	70	10
2000	61,854	51,569	35	10	35	10	70	10	70	10
2001	46,331	54,023	35	10	35	10	70	10	70	10
2002	38,101	43,100	35	10	35	10	70	10	70	10
2003	44,947	35,972	30	10	30	10	70	10	70	10
2004	34,640	28,077	30	10	30	10	70	10	70	10
2005	45,530	33,334	30	10	30	10	70	10	70	10
2006	48,688	39,508	30	10	30	10	70	10	70	10
2007	28,748	44,550	30	10	30	10	70	10	70	10
2008	34,338	40,553	30	10	30	10	65	10	65	10
2009	22,511	28,241	30	10	30	10	65	10	65	10
2010	29836	28611	30	10	30	10	65	10	55	10
2011	26813	27233	30	10	30	10	65	10	55	10
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.x. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Russia – Archangelsk & Karelia.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	134	16,592	10	5	10	5	60	20	60	20
1972	116	14,434	10	5	10	5	60	20	60	20
1973	169	20,924	10	5	10	5	60	20	60	20
1974	170	21,137	10	5	10	5	60	20	60	20
1975	140	17,398	10	5	10	5	60	20	60	20
1976	111	13,781	10	5	10	5	60	20	60	20
1977	78	9,722	10	5	10	5	60	20	60	20
1978	82	10,134	10	5	10	5	60	20	60	20
1979	112	13,903	10	5	10	5	60	20	60	20
1980	156	19,397	10	5	10	5	60	20	60	20
1981	68	8,394	10	5	10	5	60	20	60	20
1982	71	8,797	10	5	10	5	60	20	60	20
1983	48	11,938	10	5	10	5	60	20	60	20
1984	21	10,680	10	5	10	5	60	20	60	20
1985	454	11,183	10	5	10	5	60	20	60	20
1986	12	12,291	10	5	10	5	60	20	60	20
1987	647	8,734	10	5	10	5	60	20	60	20
1988	224	9,978	10	5	10	5	60	20	60	20
1989	989	10,245	10	5	10	5	60	20	60	20
1990	1,418	8,429	15	5	15	5	60	20	60	20
1991	421	8,725	20	5	20	5	60	20	60	20
1992	1,031	3,949	25	5	25	5	60	20	60	20
1993	196	4,251	30	5	30	5	60	20	60	20
1994	334	5,631	35	5	35	5	60	20	60	20
1995	386	5,214	45	5	45	5	60	20	60	20
1996	231	3,753	55	5	55	5	60	20	60	20
1997	721	3,351	55	5	55	5	60	20	60	20
1998	585	4,208	55	5	55	5	60	20	60	20
1999	299	3,101	55	5	55	5	60	20	60	20
2000	514	3,382	55	5	55	5	60	20	60	20
2001	363	2,348	55	5	55	5	60	20	60	20
2002	1,676	2,439	55	5	55	5	60	20	60	20
2003	893	2,041	55	5	55	5	60	20	60	20
2004	990	3,761	55	5	55	5	60	20	60	20
2005	1,349	4,915	55	5	55	5	60	20	60	20
2006	2,183	2,841	55	5	55	5	60	20	60	20
2007	1,618	2,621	55	5	55	5	60	20	60	20
2008	332	2,496	55	5	55	5	60	20	60	20
2009	252	2,214	55	5	55	5	60	20	60	20
2010	397	3823	55	5	55	5	60	20	60	20
2011	397	3823	55	5	55	5	60	20	60	20
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	19		
M(max)=	0.040				1SW(max)	8	MSW(max)	21		

Annex 5.xi. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Russia – Kola Peninsula: Barents Sea Basin.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	4,892	5,979	15	5	15	5	45	5	45	5
1972	7,978	9,750	15	5	15	5	45	5	45	5
1973	9,376	11,460	15	5	15	5	40	5	40	5
1974	12,794	15,638	15	5	15	5	40	5	40	5
1975	13,872	13,872	15	5	15	5	45	5	45	5
1976	11,493	14,048	15	5	15	5	55	5	55	5
1977	7,257	8,253	15	5	15	5	50	5	50	5
1978	7,106	7,113	15	5	15	5	55	5	55	5
1979	6,707	3,141	15	5	15	5	40	5	40	5
1980	6,621	5,216	15	5	15	5	40	5	40	5
1981	4,547	5,973	15	5	15	5	40	5	40	5
1982	5,159	4,798	15	5	15	5	35	5	35	5
1983	8,504	9,943	15	5	15	5	35	5	35	5
1984	9,453	12,601	15	5	15	5	35	5	35	5
1985	6,774	7,877	15	5	15	5	35	5	35	5
1986	10,147	5,352	15	5	15	5	40	5	40	5
1987	8,560	5,149	15	5	15	5	40	5	40	5
1988	6,644	3,655	15	5	15	5	35	5	35	5
1989	13,424	6,787	15	5	15	5	40	5	40	5
1990	16,038	8,234	15	5	15	5	40	5	40	5
1991	4,550	7,568	15	5	15	5	30	5	30	5
1992	11,394	7,109	15	5	15	5	30	5	30	5
1993	8,642	5,690	15	5	15	5	30	5	30	5
1994	6,101	4,632	15	5	15	5	30	5	30	5
1995	6,318	3,693	15	5	15	5	30	5	30	5
1996	6,815	1,701	20	5	20	5	25	5	25	5
1997	3,564	867	25	5	25	5	15	5	15	5
1998	1,854	280	35	5	35	5	12.5	2.5	12.5	2.5
1999	1,510	424	40	5	40	5	7.5	2.5	7.5	2.5
2000	805	323	50	5	50	5	6	2	6	2
2001	591	241	60	5	60	5	3.5	1.5	3.5	1.5
2002	1,436	2,478	50	10	50	10	10	5	20	5
2003	1,938	1,095	50	10	50	10	10	5	20	5
2004	1,095	850	50	10	50	10	10	5	20	5
2005	859	426	60	10	60	10	10	5	20	5
2006	1,372	844	60	10	60	10	10	5	20	5
2007	784	707	60	10	60	10	10	5	20	5
2008	1,446	997	60	10	60	10	15	5	20	5
2009	2,882	1,080	60	10	60	10	15	5	20	5
2010	3884	1486	60	10	60	10	15	5	20	5
2011	3884	1486	60	10	60	10	15	5	20	5
M(min)=	0.020		Return time (m)=		1SW(min)	6	MSW(min)	17		
M(max)=	0.040				1SW(max)	8	MSW(max)	20		

Annex 5.xii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Russia - Kola Peninsula: White Sea Basin.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Catch (numbers) previous year	
	1SW	MSW	est	error	est	error	est	error	est	error	1SW	MSW
1971	67,845	29,077	0	0	3	2	3	2	50	10	60	10
1972	45,837	19,644	0	0	3	2	3	2	50	10	60	10
1973	68,684	29,436	0	0	3	2	3	2	50	10	60	10
1974	63,892	27,382	0	0	3	2	3	2	50	10	60	10
1975	109,038	46,730	0	0	3	2	3	2	50	10	60	10
1976	76,281	41,075	0	0	3	2	3	2	50	10	60	10
1977	47,943	32,392	0	0	3	2	3	2	50	10	60	10
1978	49,291	17,307	0	0	3	2	3	2	50	10	60	10
1979	69,511	21,369	0	0	3	2	3	2	50	10	60	10
1980	46,037	23,241	0	0	3	2	3	2	50	10	60	10
1981	40,172	12,747	0	0	3	2	3	2	50	10	60	10
1982	32,619	14,840	0	0	3	2	3	2	50	10	60	10
1983	54,217	20,840	0	0	3	2	3	2	50	10	60	10
1984	56,786	16,893	0	0	3	2	3	2	50	10	60	10
1985	87,274	16,876	0	0	3	2	3	2	50	10	60	10
1986	72,102	17,681	0	0	3	2	3	2	50	10	60	10
1987	79,639	12,501	0	0	3	2	3	2	50	10	50	10
1988	44,813	18,777	0	0	3	2	3	2	45	5	45	5
1989	53,293	11,448	0	0	7.5	2.5	7.5	2.5	45	5	45	5
1990	44,409	11,152	0	0	12.5	2.5	12.5	2.5	45	5	45	5
1991	31,978	6,263	0	0	17.5	2.5	17.5	2.5	35	5	35	5
1992	23,827	3,680	0	0	22.5	2.5	22.5	2.5	25	5	25	5
1993	20,987	5,552	0	0	25	5	25	5	25	5	25	5
1994	25,178	3,680	0	0	30	5	30	5	25	5	15	5
1995	19,381	2,847	0	0	35	5	35	5	25	5	15	5
1996	27,097	2,710	0	0	35	5	35	5	25	5	15	5
1997	27,695	2,085	0	0	35	5	35	5	25	5	15	5
1998	32,693	1,963	0	0	35	5	35	5	25	5	15	5
1999	22,330	2,841	0	0	35	5	35	5	25	5	15	5
2000	26,376	4,396	0	0	35	5	35	5	25	5	15	5
2001	20,483	3,959	0	0	35	5	35	5	15	5	15	5
2002	19,174	3,937	0	0	35	5	35	5	15	5	15	5
2003	15,687	3,734	0	0	35	5	25	5	15	5	15	5
2004	10,947	1,990	0	0	35	5	35	5	15	5	15	5
2005	13,172	2,388	1212	878	35	5	35	5	15	5	15	5
2006	15,004	2,071	3852	399	35	5	35	5	15	5	15	5
2007	7,807	1,404	2264	852	35	5	35	5	15	5	15	5
2008	8,447	4,711	3175	832	35	5	35	5	15	5	15	5
2009	5,351	3,105	5130	1710	35	5	35	5	15	5	15	5
2010	6731	4158	3684	1228	35	5	35	5	15	5	15	5
2011	6731	4158	3684	1228	35	5	35	5	15	5	15	5
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	18				
M(max)=	0.040				1SW(max)	10	MSW(max)	21				

Annex 5.xiii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation - Russia – Pechora River.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	605	17,728	20	10	20	10	65	15	65	15
1972	825	24,175	20	10	20	10	65	15	65	15
1973	1,705	49,962	20	10	20	10	65	15	65	15
1974	1,320	38,680	20	10	20	10	65	15	65	15
1975	1,298	38,046	20	10	20	10	65	15	65	15
1976	991	34,394	20	10	20	10	65	15	65	15
1977	589	20,464	20	10	20	10	65	15	65	15
1978	759	26,341	20	10	20	10	65	15	65	15
1979	421	14,614	20	10	20	10	65	15	65	15
1980	1,123	39,001	20	10	20	10	65	15	65	15
1981	126	20,874	20	10	20	10	65	15	65	15
1982	54	13,546	20	10	20	10	65	15	65	15
1983	598	16,002	20	10	20	10	65	15	65	15
1984	1,833	15,967	20	10	20	10	65	15	65	15
1985	2,763	29,738	20	10	20	10	65	15	65	15
1986	66	32,734	20	10	20	10	65	15	65	15
1987	21	21,179	20	10	20	10	65	15	65	15
1988	3,184	12,816	20	10	20	10	65	15	65	15
	Estimated numbers of adult returns to fresh water		Input data for analysis of total adult returns to homewaters				Input data for spawner abundance analysis			
			Marine unreported as % of adult returns to freshwater				Freshwater unreported as % of adult returns to freshwater			
			1SW		MSW		1SW		MSW	
	1SW	MSW	est	error	est	error	est	error	est	error
1989	24596	27404	10	5	10	5	65	15	65	15
1990	50	49950	10	5	10	5	65	15	65	15
1991	7975	47025	10	5	10	5	65	15	65	15
1992	550	54450	10	5	10	5	65	15	65	15
1993	68	67932	10	5	10	5	65	15	65	15
1994	3900	48100	10	5	10	5	65	15	65	15
1995	9280	70720	10	5	10	5	65	15	65	15
1996	8664	48336	10	5	10	5	65	15	65	15
1997	1440	38560	10	5	10	5	65	15	65	15
1998	780	59220	10	5	10	5	65	15	65	15
1999	2120	37880	10	5	10	5	65	15	65	15
2000	84	83916	10	5	10	5	65	15	65	15
2001	2244	41756	10	5	10	5	65	15	65	15
2002	405	44595	10	5	10	5	65	15	65	15
2003	1650	31350	10	5	10	5	65	15	65	15
2004	6075	20925	10	5	10	5	65	15	65	15
2005	2852	28148	10	5	10	5	65	15	65	15
2006	1472	30528	10	5	10	5	65	15	65	15
2007	817	42183	10	5	10	5	65	15	65	15
2008	300	49700	10	5	10	5	65	15	65	15
2009	1116	47385	10	5	10	5	65	15	65	15
2010	1096	53704	10	5	10	5	65	15	65	15
2011	1096	53704	10	5	10	5	65	15	65	15
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	19		
M(max)=	0.040				1SW(max)	8	MSW(max)	21		

Annex 5.xiv. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Sweden.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	6,330	420	30	15	30	15	52.5	12.5	57.5	12.5
1972	5,005	295	30	15	30	15	52.5	12.5	57.5	12.5
1973	6,210	1,025	30	15	30	15	52.5	12.5	57.5	12.5
1974	8,935	660	30	15	30	15	52.5	12.5	57.5	12.5
1975	9,620	160	30	15	30	15	52.5	12.5	57.5	12.5
1976	5,420	480	30	15	30	15	52.5	12.5	57.5	12.5
1977	2,555	360	30	15	30	15	52.5	12.5	57.5	12.5
1978	2,917	275	30	15	30	15	52.5	12.5	57.5	12.5
1979	3,080	800	30	15	30	15	52.5	12.5	57.5	12.5
1980	3,920	1,400	30	15	30	15	52.5	12.5	57.5	12.5
1981	7,095	407	30	15	30	15	52.5	12.5	57.5	12.5
1982	6,230	1,460	30	15	30	15	52.5	12.5	57.5	12.5
1983	8,290	1,005	30	15	30	15	52.5	12.5	57.5	12.5
1984	11,680	1,410	30	15	30	15	52.5	12.5	57.5	12.5
1985	13,890	590	30	15	30	15	52.5	12.5	57.5	12.5
1986	14,635	570	30	15	30	15	52.5	12.5	57.5	12.5
1987	11,860	1,700	30	15	30	15	52.5	12.5	57.5	12.5
1988	9,930	1,650	30	15	30	15	52.5	12.5	57.5	12.5
1989	3,180	4,610	30	15	30	15	52.5	12.5	57.5	12.5
1990	7,430	3,135	15	10	15	10	45	15	50	15
1991	8,990	3,620	15	10	15	10	45	15	50	15
1992	9,850	4,655	15	10	15	10	45	15	50	15
1993	10,540	6,370	15	10	15	10	45	15	50	15
1994	8,035	4,660	15	10	15	10	45	15	50	15
1995	9,761	2,770	15	10	15	10	37.5	12.5	42.5	12.5
1996	6,008	3,542	15	10	15	10	37.5	12.5	42.5	12.5
1997	2,747	2,307	15	10	15	10	37.5	12.5	42.5	12.5
1998	2,421	1,702	15	10	15	10	37.5	12.5	42.5	12.5
1999	3,573	1,460	15	10	15	10	37.5	12.5	42.5	12.5
2000	7,103	3,196	15	10	15	10	37.5	12.5	42.5	12.5
2001	4,634	3,853	15	10	15	10	37.5	12.5	42.5	12.5
2002	4,733	2,826	15	10	15	10	38	13	43	13
2003	2,891	3,214	15	10	15	10	38	13	43	13
2004	2,494	2,330	15	10	15	10	38	13	43	13
2005	2,122	1,770	15	10	15	10	38	13	43	13
2006	2,585	1,772	15	10	15	10	38	13	43	13
2007	1,228	2,442	15	10	15	10	38	13	43	13
2008	1,197	2,752	13	8	13	8	28	13	33	13
2009	1,269	2,495	13	8	13	8	28	13	33	13
2010	2109	3066	13	8	13	8	28	13	33	13
2011	2726	5759	18	8	18	8	45	15	50	15
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.xv. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (England & Wales).

Year	Total catch (numbers)	Prop'n 1SW in catch	NE coast catch				Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		NE - unrep	Proportion Scottish in:		
			Total	Drift nets	T/J nets	Prop'n 1SW - NE	est	error	est	error	est	error	est	error		Total	Drift	T/J
1971	109,861	0.55	60,353			0.55	38.5	9.5	38.5	9.5	48	10	35	10	32.6	0.95		
1972	108,074	0.42	51,681			0.42	39	10	39	10	47	10	35	10	32.6	0.95		
1973	114,786	0.53	62,842			0.53	38.5	9.5	38.5	9.5	47	10	35	10	32.6	0.95		
1974	104,325	0.65	52,756			0.65	39	10	39	10	47	10	35	10	32.6	0.95		
1975	113,062	0.59	53,451			0.59	38.5	9.5	38.5	9.5	47	10	35	10	32.6	0.95		
1976	54,294	0.64	15,701			0.64	37	9	37	9	48	10	36	10	32.6	0.94		
1977	94,282	0.62	52,888			0.62	39	10	39	10	49	10	36	10	32.6	0.93		
1978	93,125	0.69	51,630			0.69	38.5	9.5	38.5	9.5	49	10	36	10	32.6	0.92		
1979	75,386	0.81	43,464			0.81	38.5	9.5	38.5	9.5	48	10	35	10	32.6	0.91		
1980	90,218	0.55	45,780			0.55	39	10	39	10	48	10	36	10	32.6	0.9		
1981	121,039	0.48	69,113			0.48	38.5	9.5	38.5	9.5	48	10	36	10	32.6	0.89		
1982	80,289	0.67	50,167			0.67	38.5	9.5	38.5	9.5	48	10	36	10	32.6	0.88		
1983	116,995	0.72	77,277			0.72	37	9	37	9	49	10	36	10	32.7	0.87		
1984	94,271	0.74	59,295			0.74	36.5	9.5	36.5	9.5	49	10	36	10	32.6	0.86		
1985	95,531	0.66	57,356			0.66	39	10	39	10	49	10	36	10	32.6	0.85		
1986	110,794	0.62	63,425			0.62	37.5	9.5	37.5	9.5	49	10	36	10	32.6	0.84		
1987	83,439	0.68	36,143			0.68	38.5	9.5	38.5	9.5	49	10	36	10	32.6	0.83		
1988	110,163	0.69		47,465	3,384	0.69	40	10	40	10	48	10	36	10	32.6		0.82	0.5
1989	83,668	0.65		36,236	5,217	0.65	37	9	37	9	49	10	36	10	32.6		0.81	0.5
1990	86,676	0.52		48,219	3,311	0.52	37	9	37	9	49	10	36	10	31.6		0.8	0.5
1991	51,649	0.71		22,463	2,966	0.71	37.5	9.5	37.5	9.5	48	10	36	10	29.3		0.79	0.5
1992	44,586	0.77		17,574	2,570	0.77	40	10	40	10	48	10	36	10	26.9		0.78	0.5
1993	69,177	0.81		39,224	2,576	0.81	37.5	9.5	37.5	9.5	45	10	33	10	24.6		0.77	0.5
1994	88,121	0.77		41,298	5,256	0.77	24	6	24	6	45	10	33	10	22.4		0.76	0.5
1995	80,478	0.72		48,005	5,205	0.72	22.5	5.5	22.5	5.5	42	10	30	10	20.1		0.75	0.5
1996	46,696	0.65		15,172	3,409	0.65	20.5	5.5	20.5	5.5	41	10	30	10	17.9		0.75	0.5
1997	41,374	0.73		19,241	2,681	0.73	19	5	19	5	38	10	27	10	15.7		0.75	0.5
1998	36,917	0.82		17,328	937	0.82	19	5	19	5	35	10	25	10	15.7		0.75	0.5
1999	41,094	0.68		24,812	2,021	0.68	17.5	4.5	17.5	4.5	32	10	18	9	14.7		0.75	0.5
2000	60,953	0.79		40,059	3,295	0.79	15	4	15	4	32	10	15	8	6		0.75	0.5
2001	51,307	0.75		32,374	3,741	0.75	14.5	3.5	14.5	3.5	30	10	14	7	6		0.75	0.5
2002	45,669	0.76		27,685	3,295	0.76	15	4	15	4	30	10	14	7	6		0.75	0.5
2003	22,206	0.66		5,511	4,924	0.66	18	5	18	5	25	10	12	6	15		0.75	0.5
2004	30,559	0.81		5,921	5,096	0.81	18	5	18	5	28	10	12	6	15		0.75	0.5
2005	26,162	0.76		5,607	3,380	0.76	18	5	18	5	27	10	12	6	15		0.75	0.5
2006	22,056	0.78		4,040	3,526	0.78	18	5	18	5	25	10	11	5	15		0.75	0.5
2007	19,923	0.78		4,894	2,197	0.78	18	4	18	4	23	10	10	5	15		0.75	0.5
2008	19,036	0.76		3,649	2,592	0.76	18	4	18	4	23	10	10	5	15		0.75	0.5
2009	13,910	0.72		2,590	2,805	0.72	11	3	11	3	23	10	10	5	5		0.75	0.5
2010	32695	0.78		12,214	7,768	0.78	11	3	11	3	23	10	10	5	5		0.75	0.5
2011	35056	0.57		16,038	8,808	0.57	11	3	11	3	25	10	12	6	5		0.75	0.5
M(min)=	0.020					Return time (m)=	1SW(min)	7			MSW(min)	17						
M(max)=	0.040						1SW(max)	9			MSW(max)	19						

Annex 5.xvi. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (N. Ireland) – Foyle Fisheries Area.

Year	Reported net catch (numbers)		Rod catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	1SW	MSW	est	error	est	error	est	error	est	error
1971	78,037	5,874			21.5	11.5	21.5	11.5	80	5	50	5
1972	64,663	4,867			21.5	11.5	21.5	11.5	80	5	50	5
1973	57,469	4,326			21.5	11.5	21.5	11.5	80	5	50	5
1974	72,587	5,464			21.5	11.5	21.5	11.5	80	5	50	5
1975	51,061	3,843			21.5	11.5	21.5	11.5	80	5	50	5
1976	36,206	2,725			21.5	11.5	21.5	11.5	80	5	50	5
1977	36,510	2,748			21.5	11.5	21.5	11.5	80	5	50	5
1978	44,557	3,354			21.5	11.5	21.5	11.5	80	5	50	5
1979	34,413	2,590			21.5	11.5	21.5	11.5	80	5	50	5
1980	45,777	3,446			21.5	11.5	21.5	11.5	80	5	50	5
1981	32,346	2,435			21.5	11.5	21.5	11.5	80	5	50	5
1982	55,946	4,211			21.5	11.5	21.5	11.5	80	5	50	5
1983	77,424	5,828			21.5	11.5	21.5	11.5	80	5	50	5
1984	27,465	2,067			21.5	11.5	21.5	11.5	80	5	50	5
1985	37,685	2,836			21.5	11.5	21.5	11.5	80	5	50	5
1986	43,109	3,245			21.5	11.5	21.5	11.5	80	5	50	5
1987	17,189	1,294			21.5	11.5	21.5	11.5	69	7	46	5
1988	43,974	3,310			21.5	11.5	21.5	11.5	64.5	6.5	36	4
1989	60,288	4,538			23.5	13.5	23.5	13.5	89	9	60	6
1990	39,875	3,001			13.5	3.5	13.5	3.5	62	6	38	4
1991	21,709	1,634			13.5	3.5	13.5	3.5	64.5	6.5	43	4
1992	39,299	2,958			16.5	6.5	16.5	6.5	56	6	33	3
1993	35,366	2,662			13.5	3.5	13.5	3.5	41	4	12	1
1994	36,144	2,720			19	9	19	9	70	7	40	4
1995	33,398	2,514			13.5	3.5	13.5	3.5	67	7	42	4
1996	28,406	2,138			15	5	15	5	57	10	34	10
1997	40,886	3,077			10	5	10	5	60	10	34	10
1998	37,154	2,797			10	5	10	5	25	5	23	8
1999	21,660	1,630			10	5	10	5	63	5	33	8
2000	30,385	2,287			10	5	10	5	58	5	33	8
2001	21,368	1,608			5	5	5	5	50	5	30	5
2002	37,914	2,854	9,163	690	3	2	3	3	15	3	15	3
2003	30,441	2,291	4,576	344	1	0	1	0	15	3	15	3
2004	20,730	1,560	4,570	344	1	0	1	0	15	3	15	3
2005	23,746	1,787	7,079	533	1	0	1	0	15	3	15	3
2006	11,324	852	4,886	368	1	0	1	0	15	3	15	3
2007	5,050	322	9,530	608	1	1	1	1	15	3	15	3
2008	3,880	292	4,755	304	1	0	1	0	15	3	15	3
2009	1,743	194	3,640	405	1	0	1	0	15	3	15	3
2010	0	0	4257	473	1	0	1	0	15	3	15	3
2011	0	0	3770	1256	1	0	1	0	15	5	15	5
M(min)=	0.020				Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040						1SW(max)	9	MSW(max)	18		

[1] Catch numbers are net catches only for the period 1971 to 2001; rod catches only available 2002 to 2011.

Annex 5.xvii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation - UK (N. Ireland) – DCAL Area.

Year	Reported net catch (numbers)		Rod catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	1SW	MSW	est	error	est	error	est	error	est	error
1971	35,506	2,673			21.5	11.5	21.5	11.5	80	5	50	5
1972	34,550	2,601			21.5	11.5	21.5	11.5	80	5	50	5
1973	29,229	2,200			21.5	11.5	21.5	11.5	80	5	50	5
1974	22,307	1,679			21.5	11.5	21.5	11.5	80	5	50	5
1975	26,701	2,010			21.5	11.5	21.5	11.5	80	5	50	5
1976	17,886	1,346			21.5	11.5	21.5	11.5	80	5	50	5
1977	16,778	1,263			21.5	11.5	21.5	11.5	80	5	50	5
1978	24,857	1,871			21.5	11.5	21.5	11.5	80	5	50	5
1979	14,323	1,078			21.5	11.5	21.5	11.5	80	5	50	5
1980	15,967	1,202			21.5	11.5	21.5	11.5	80	5	50	5
1981	15,994	1,204			21.5	11.5	21.5	11.5	80	5	50	5
1982	14,068	1,059			21.5	11.5	21.5	11.5	80	5	50	5
1983	20,845	1,569			21.5	11.5	21.5	11.5	80	5	50	5
1984	11,109	836			21.5	11.5	21.5	11.5	80	5	50	5
1985	12,369	931			21.5	11.5	21.5	11.5	80	5	50	5
1986	13,160	991			21.5	11.5	21.5	11.5	80	5	50	5
1987	9,240	695			21.5	11.5	21.5	11.5	69	7	46	5
1988	14,320	1,078			21.5	11.5	21.5	11.5	64.5	6.5	36	4
1989	15,081	1,135			23.5	13.5	23.5	13.5	89	9	60	6
1990	9,499	715			13.5	3.5	13.5	3.5	62	6	38	4
1991	6,987	526			13.5	3.5	13.5	3.5	64.5	6.5	43	4
1992	9,346	703			16.5	6.5	16.5	6.5	56	6	33	3
1993	7,906	595			13.5	3.5	13.5	3.5	41	4	12	1
1994	11,206	843			19	9	19	9	70	7	40	4
1995	11,637	876			13.5	3.5	13.5	3.5	67	7	42	4
1996	10,383	781			15	5	15	5	57	10	34	10
1997	10,479	789			10	5	10	5	60	10	34	10
1998	9,375	706			10	5	10	5	25	5	23	8
1999	9,011	678			10	5	10	5	63	5	33	8
2000	10,598	798			10	5	10	5	58	5	33	8
2001	8,104	610			5	5	5	5	50	5	30	5
2002	3,315	249	2,218	167	3	3	3	3	14	9	14	9
2003	2,236	168	1,884	141	3	3	3	3	12	7	12	7
2004	2,411	181	3,053	230	1	1	1	1	18	10	18	10
2005	3,012	227	1,791	135	1	1	1	1	12	7	12	7
2006	2,288	172	1,289	97	1	1	1	1	12	8	12	8
2007	2,533	162	2,427	155	1	1	1	1	11	4	11	4
2008	1,825	116	2,444	156	1	0	1	0	14	7	14	7
2009	1,383	154	1,457	162	1	0	1	0	10	3	10	3
2010	1723	191	1327	147	1	0	1	0	15	3	15	3
2011	857	285	953	317	1	0	1	0	15	5	15	5
M(min)=	0.020					Return time (m)=	1SW(min)	7	MSW(min)	16		
M(max)=	0.040						1SW(max)	9	MSW(max)	18		

[1] Catch numbers are net catches only for the period 1971 to 2001; rod catches only available 2002 to 2011.

Annex 5.xviii. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (Scotland) – East.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	216,873	135,527	25	10	25	10	75	13	50	10
1972	220,106	183,872	25	10	25	10	77	13	51	10
1973	259,773	204,825	25	10	25	10	75	12	50	10
1974	245,424	158,951	25	10	25	10	82	14	56	11
1975	181,940	180,828	25	10	25	10	80	13	55	11
1976	150,069	92,179	25	10	25	10	77	13	51	10
1977	154,306	118,645	25	10	25	10	81	14	56	11
1978	158,859	139,763	25	10	25	10	76	13	51	10
1979	160,796	116,559	25	10	25	10	78	13	54	11
1980	101,665	155,646	17.5	7.5	17.5	7.5	77	13	52	10
1981	129,690	156,683	17.5	7.5	17.5	7.5	76	13	51	10
1982	175,374	113,198	17.5	7.5	17.5	7.5	71	12	45	9
1983	170,843	126,104	17.5	7.5	17.5	7.5	77	13	49	10
1984	175,675	90,829	17.5	7.5	17.5	7.5	70	12	44	9
1985	133,119	95,044	17.5	7.5	17.5	7.5	62	10	39	8
1986	180,292	128,651	17.5	7.5	17.5	7.5	59	10	38	8
1987	139,252	88,519	17.5	7.5	17.5	7.5	65	11	41	8
1988	118,614	91,151	17.5	7.5	17.5	7.5	40	7	29	6
1989	143,049	85,385	10	5	10	5	38	6	28	6
1990	63,318	73,971	10	5	10	5	40	7	29	6
1991	53,860	53,693	10	5	10	5	37	6	27	5
1992	79,883	67,968	10	5	10	5	32	5	26	5
1993	73,396	60,496	10	5	10	5	35	6	27	5
1994	80,429	72,758	10	5	10	5	33	6	26	5
1995	72,973	69,051	10	5	10	5	31	5	25	5
1996	56,627	50,365	10	5	10	5	29	5	24	5
1997	37,448	34,850	10	5	10	5	31	5	25	5
1998	44,952	32,231	10	5	10	5	24	4	23	5
1999	20,907	27,011	10	5	10	5	25	4	23	5
2000	36,871	31,280	10	5	10	5	22	4	22	4
2001	36,646	30,470	10	5	10	5	20	3	22	5
2002	26,616	21,740	10	5	10	5	19	3	21	4
2003	25,871	24,270	10	5	10	5	17	3	19	4
2004	31,667	30,773	10	5	10	5	17	3	19	4
2005	31,597	23,676	10	5	10	5	17	3	19	4
2006	30,739	22,954	10	5	10	5	15	3	17	4
2007	26,015	19,444	10	5	10	5	14	3	15	4
2008	18,586	20,757	10	5	10	5	11	3	14	4
2009	14,863	15,042	10	5	10	5	10	3	13	4
2010	28252	22908	10	5	10	5	10	3	13	4
2011	13341	25799	10	5	10	5	9	3	13	4
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	17		
M(max)=	0.040				1SW(max)	8	MSW(max)	18		

Annex 5.xix. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – UK (Scotland) – West.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	est	error	est	error	est	error	est	error
1971	45,287	26,074	35	10	35	10	38	6	25	5
1972	31,358	34,151	35	10	35	10	38	6	26	5
1973	33,317	33,095	35	10	35	10	37	6	25	5
1974	43,992	29,372	35	10	35	10	41	7	28	6
1975	40,424	27,150	35	10	35	10	40	7	28	6
1976	38,409	22,367	35	10	35	10	38	6	25	5
1977	39,952	20,335	35	10	35	10	41	7	28	6
1978	45,611	23,191	35	10	35	10	38	6	25	5
1979	26,440	15,950	35	10	35	10	39	7	27	5
1980	19,776	16,942	27.5	7.5	27.5	7.5	38	6	26	5
1981	21,048	18,038	27.5	7.5	27.5	7.5	38	6	26	5
1982	32,687	15,044	27.5	7.5	27.5	7.5	36	6	23	5
1983	38,774	19,857	27.5	7.5	27.5	7.5	39	6	25	5
1984	37,404	16,384	27.5	7.5	27.5	7.5	35	6	22	4
1985	24,861	19,571	27.5	7.5	27.5	7.5	31	5	19	4
1986	22,546	19,546	27.5	7.5	27.5	7.5	30	5	19	4
1987	25,533	15,475	27.5	7.5	27.5	7.5	32	5	20	4
1988	30,484	21,011	27.5	7.5	27.5	7.5	20	3	15	3
1989	31,892	18,501	20	5	20	5	19	3	14	3
1990	17,776	13,953	20	5	20	5	20	3	14	3
1991	19,748	11,500	20	5	20	5	18	3	14	3
1992	21,793	14,873	20	5	20	5	16	3	13	3
1993	21,121	11,230	20	5	20	5	18	3	13	3
1994	18,234	12,304	20	5	20	5	17	3	13	3
1995	16,831	9,137	20	5	20	5	15	3	13	3
1996	9,542	7,463	20	5	20	5	14	2	12	2
1997	9,059	5,504	20	5	20	5	15	3	13	3
1998	8,369	6,150	20	5	20	5	12	2	11	2
1999	4,147	3,587	20	5	20	5	12	2	12	2
2000	6,974	5,301	20	5	20	5	11	2	11	2
2001	5,603	4,191	20	5	20	5	10	2	11	2
2002	4,691	4,548	20	5	20	5	10	2	11	2
2003	3,536	3,061	20	5	20	5	5	1	5	1
2004	5,836	6,024	20	5	20	5	7	1	8	2
2005	7,428	4,913	20	5	20	5	7	1	8	2
2006	5,767	4,403	20	5	20	5	7	1	8	2
2007	6,178	4,470	20	5	20	5	7	1	8	2
2008	4,740	4,853	20	5	20	5	7	1	8	2
2009	3,250	3,937	20	5	20	5	6	1	7	2
2010	5107	3938	20	5	20	5	6	1	7	2
2011	3347	4455	20	5	20	5	6	1	6	2
M(min)=	0.020		Return time (m)=		1SW(min)	7	MSW(min)	16		
M(max)=	0.040				1SW(max)	9	MSW(max)	18		

Annex 5.xx. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – Faroes.

Year	Catch (numbers)		Unreported as % of total 1SW		Unreported as % of total 1SW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Prop'n wild	Stock composition		
	1SW	MSW	est	error	est	error	est	error	est	error		Country	1SW	MSW
												NNEAC		
1971	2,620	105,796	10	5	0	0	100	100	100	100	1	Finland	0.0591	0.05
1972	2,754	111,187	10	5	0	0	100	100	100	100	1	Iceland-NE	0.0157	0.0109
1973	3,121	126,012	10	5	0	0	100	100	100	100	1	Norway	0.2903	0.2954
1974	2,186	88,276	10	5	0	0	100	100	100	100	1	Russia	0.1155	0.1629
1975	2,798	112,984	10	5	0	0	100	100	100	100	1	Sweden	0.0194	0.0158
1976	1,830	73,900	10	5	0	0	100	100	100	100	1			
1977	1,291	52,112	10	5	0	0	100	100	100	100	1	**SNEAC**		
1978	974	39,309	10	5	0	0	100	100	100	100	1	France	0.0176	0.0054
1979	1,736	70,082	10	5	0	0	100	100	100	100	1	Iceland-SW	0.0248	0.0072
1980	4,523	182,616	10	5	0	0	100	100	100	100	1	Ireland	0.1732	0.0426
1981	7,443	300,542	10	5	0	0	100	100	100	100	0.98	UK(England	0.0437	0.034
1982	6,859	276,957	10	5	0	0	100	100	100	100	0.98	UK(N.Ireland	0.0456	0.0141
1983	15,861	215,349	10	5	0	0	100	100	100	100	0.98	UK(Scotland	0.1951	0.3367
1984	5,534	138,227	10	5	0	0	100	100	100	100	0.96			
1985	378	158,103	10	5	0	0	100	100	100	100	0.92	Other	0	0.025
1986	1,979	180,934	10	5	0	0	100	100	100	100	0.96			
1987	90	166,244	10	5	0	0	100	100	100	100	0.97	Total	1	1
1988	8,637	87,629	10	5	0	0	100	100	100	100	0.92			
1989	1,788	121,965	10	5	0	0	100	100	100	100	0.82			
1990	1,989	140,054	10	5	0	0	100	100	100	100	0.54			
1991	943	84,935	10	5	0	0	100	100	100	100	0.54			
1992	68	35,700	10	5	0	0	100	100	100	100	0.62			
1993	6	30,023	10	5	0	0	100	100	100	100	0.69			
1994	15	31,672	10	5	0	0	100	100	100	100	0.72			
1995	18	34,662	10	5	0	0	100	100	100	100	0.8			
1996	101	28,381	10	5	0	0	100	100	100	100	0.75			
1997	0	0	15	5	0	0	100	100	100	100	0.8			
1998	339	1,424	15	5	0	0	100	100	100	100	0.8			
1999	0	0	15	5	0	0	100	100	100	100	0.8			
2000	225	1,765	15	5	0	0	100	100	100	100	0.8			
2001	0	0	15	5	0	0	100	100	100	100	0.8			
2002	0	0	15	5	0	0	100	100	100	100	0.8			
2003	0	0	15	5	0	0	100	100	100	100	0.8			
2004	0	0	15	5	0	0	100	100	100	100	0.8			
2005	0	0	15	5	0	0	100	100	100	100	0.8			
2006	0	0	15	5	0	0	100	100	100	100	0.8			
2007	0	0	15	5	0	0	100	100	100	100	0.8			
2008	0	0	15	5	0	0	100	100	100	100	0.8			
2009	0	0	15	5	0	0	100	100	100	100	0.8			
2010	0	0	15	5	0	0	100	100	100	100	0.8			
2011	0	0	15	5	0	0	100	100	100	100	0.8			
M(min)=	0.020		Return time (m)=		1SW(min)	0	MSW(min)	13						
M(max)=	0.040				1SW(max)	1	MSW(max)	14						
			Proportion of 1SW returning as grilse =				min	0.730						
							max	0.830						

Annex 5.xxi. Input data for NEAC Pre Fishery Abundance analysis using Monte Carlo simulation – West Greenland.

Year	Catch (t)	Unreported catch (t)	Mean weight (kg)	Proportion NAC		Proportion 1SW		Sample size		Stock composition	
				min	max	NAC	NEAC	NAC	NEAC	Country	MSW
1971	2,689	0	3.14	0.28	0.4	0.95	0.96	0	0	France	0.027
1972	2,113	0	3.44	0.34	0.37	0.95	0.96	0	0	Finland	0.001
1973	2,341	0	4.18	0.39	0.59	0.95	0.96	0	0	Iceland	0.001
1974	1,917	0	3.58	0.39	0.46	0.95	0.96	0	0	Ireland	0.147
1975	2,030	0	3.12	0.4	0.48	0.95	0.96	0	0	Norway	0.027
1976	1,175	0	3.04	0.38	0.48	0.95	0.96	0	0	Russia	0
1977	1,420	0	3.2125	0.38	0.57	0.95	0.96	0	0	Sweden	0.003
1978	984	0	3.35	0.47	0.57	0.95	0.96	0	0	UK (E&W)	0.149
1979	1,395	0	3.34	0.48	0.52	0.95	0.96	0	0	UK (NI)	0
1980	1,194	0	3.22	0.45	0.51	0.95	0.96	0	0	UK (Sc)	0.645
1981	1,264	0	3.17	0.58	0.61	0.95	0.96	0	0		
1982	1,077	0	3.11	0.6	0.64	0.95	0.96	0	0	Other	
1983	310	0	3.1	0.38	0.41	0.95	0.96	0	0		
1984	297	0	3.11	0.47	0.53	0.95	0.96	0	0	Total	1.00
1985	864	0	2.87	0.46	0.53	0.93	0.95	0	0		
1986	960	0	3.03	0.48	0.66	0.95	0.98	0	0		
1987	966	0	3.16	0.54	0.63	0.96	0.98	0	0		
1988	893	0	3.18	0.38	0.49	0.97	0.98	0	0		
1989	337	0	2.87	0.52	0.6	0.92	0.96	0	0		
1990	274	0	2.69	0.7	0.79	0.96	0.96	0	0		
1991	472	0	2.65	0.61	0.69	0.96	0.93	0	0		
1992	237	0	2.81	0.5	0.57	0.92	0.98	0	0		
1993	0	12	2.725	0.5	0.76	0.95	0.96	0	0		
1994	0	12	2.725	0.5	0.76	0.95	0.96	0	0		
1995	83	20	2.56	0.65	0.72	0.97	0.97	0	0		
1996	92	20	2.88	0.71	0.76	0.94	0.96	0	0		
1997	58	5	2.71	0.75	0.84	0.98	0.99	0	0		
1998	11	11	2.78	0.73	0.84	0.97	0.99	0	0		
1999	19	13	3.08	0.84	0.97	0.97	1.00	0	0		
2000	21	10	2.57	0	0	0.97	1.00	344	146		
2001	43	10	3	0.67	0.71	0.98	0.98	1	1		
2002	10	10	3	0	0	0.97	1.00	338	163		
2003	12	10	3	0	0	0.97	0.99	1212	567		
2004	17	10	3	0	0	0.97	0.97	1192	447		
2005	17	10	3	0	0	0.92	0.97	585	182		
2006	23	10	3	0	0	0.93	0.99	857	326		
2007	25	10	3	0	0	0.97	0.96	917	206		
2008	29	10	3	0	0	0.97	0.99	1593	260		
2009	28	10	4	0	0	0.93	0.89	1483	138		
2010	43	10	3	0	0	0.98	0.98	991	249		
2011	27	10	4	0	0	0.94	0.48	633	59		
M(min)=	0.020			1SW(min)	7	MSW(min)	8				
M(max)=	0.040			1SW(max)	8	MSW(max)	10				

Annex 6: Input data for run-reconstruction of Atlantic salmon in the NAC area, program code (Winbugs) used to do the run-reconstruction, and estimates of returns and spawners by size group and age group for North America

Annex 6.i. Input data for the fishery at West Greenland used in the run reconstruction model.

				Genetic samples		Scale discrimination analysis		Proportion 1SW salmon in catch	
Year of the fishery	Reported harvest (t)	Unreported harvest estimate (t)	Mean weight of salmon all age groups (kg)	NAC origin	NEAC origin	Prop. NAC min	Prop. NAC max	NAC	NEAC
1970									
1971	2689	0	3.14			0.28	0.40	0.945	0.964
1972	2113	0	3.44			0.34	0.37	0.945	0.964
1973	2341	0	4.18			0.39	0.59	0.945	0.964
1974	1917	0	3.58			0.39	0.46	0.945	0.964
1975	2030	0	3.12			0.40	0.48	0.945	0.964
1976	1175	0	3.04			0.38	0.48	0.945	0.964
1977	1420	0	*3.21*			0.38	0.57	0.945	0.964
1978	984	0	3.35			0.47	0.57	0.945	0.964
1979	1395	0	3.34			0.48	0.52	0.945	0.964
1980	1194	0	3.22			0.45	0.51	0.945	0.964
1981	1264	0	3.17			0.58	0.61	0.945	0.964
1982	1077	0	3.11			0.60	0.64	0.945	0.964
1983	310	0	3.10			0.38	0.41	0.945	0.964
1984	297	0	3.11			0.47	0.53	0.945	0.964
1985	864	0	2.87			0.46	0.53	0.925	0.950
1986	960	0	3.03			0.48	0.66	0.951	0.975
1987	966	0	3.16			0.54	0.63	0.963	0.980
1988	893	0	3.18			0.38	0.49	0.967	0.981
1989	337	0	2.87			0.52	0.60	0.923	0.955
1990	274	0	2.69			0.70	0.79	0.957	0.963
1991	472	0	2.65			0.61	0.69	0.956	0.934
1992	237	0	2.81			0.50	0.57	0.919	0.975
1993	0	12	2.73			0.50	0.76	0.95	0.96
1994	0	12	2.73			0.50	0.76	0.95	0.96
1995	83	20	2.56			0.65	0.72	0.968	0.973
1996	92	20	2.88			0.71	0.76	0.941	0.961
1997	58	5	2.71			0.75	0.84	0.982	0.993
1998	11	11	2.78			0.73	0.84	0.968	0.994
1999	19	12.5	3.08			0.84	0.97	0.968	1.000
2000	21	10	2.57	344	146			0.974	1.000
2001	43	10	3.00	1	1	0.67	0.71	0.982	0.978
2002	9.8	10	2.90	338	163			0.973	1.000
2003	12.3	10	3.04	1212	567			0.967	0.989
2004	17.2	10	3.18	1192	447			0.970	0.970
2005	17.3	10	3.31	585	182			0.924	0.967
2006	23.0	10	3.24	857	326			0.930	0.988
2007	24.8	10	2.98	917	206			0.965	0.956
2008	28.6	10	3.08	1593	260			0.974	0.988
2009	28.0	10	3.50	1483	138			0.934	0.894
2010	43.1	10	3.42	991	249			0.982	0.975
2011	27.4	10	3.69	633	59	0	0	0.938	0.483
Winbugs labels	WGHarv[]	WGUnHarv[]	WGMeanWt[]	WGSampleNAC[]	WGSampleNEAC[]	WGPropNACMin[]	WGPropNACMax[]	WGProp1SWNAC[]	WGProp1SWNEAC[]

Annex 6.ii. Input data for sea fisheries on large salmon and small salmon from Newfoundland and Labrador used in the run reconstruction model. Labrador represents harvests from Labrador in aboriginal fisheries for food, social and ceremonial purposes and the resident food fishery beginning in 1998.

Year of the fishery	Catches of large salmon			Catches of small salmon		
	SFA 1 to 7	SFA 8 to 14A	Labrador	SFA 1 to 7	SFA 8 to 14A	Labrador
1970	0	0	0	0	0	0
1971	199176	0	0	158896	70936	0
1972	144496	42861	0	143232	111141	0
1973	227779	43627	0	188725	176907	0
1974	196726	85714	0	192195	153278	0
1975	215025	72814	0	302348	91935	0
1976	210858	95714	0	221766	118779	0
1977	231393	63449	0	220093	57472	0
1978	155546	37653	0	102403	38180	0
1979	82174	29122	0	186558	62622	0
1980	211896	54307	0	290127	94291	0
1981	211006	38663	0	288902	60668	0
1982	129319	35055	0	222894	77017	0
1983	108430	28215	0	166033	55683	0
1984	87742	15135	0	123774	52813	0
1985	70970	24383	0	178719	79275	0
1986	107561	22036	0	222671	91912	0
1987	146242	19241	0	281762	82401	0
1988	86047	14763	0	198484	74620	0
1989	85319	15577	0	172861	60884	0
1990	59334	11639	0	104788	46053	0
1991	39257	10259	0	89099	42721	0
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	0	2269	0	0	2988
1999	0	0	1084	0	0	2739
2000	0	0	1352	0	0	5323
2001	0	0	1721	0	0	4789
2002	0	0	1389	0	0	5806
2003	0	0	2175	0	0	6477
2004	0	0	3696	0	0	8385
2005	0	0	2817	0	0	10436
2006	0	0	3090	0	0	10377
2007	0	0	2652	0	0	9208
2008	0	0	3909	0	0	9834
2009	0	0	3344	0	0	7988
2010	0	0	3725	0	0	9867
2011	0	0	4451	0	0	11138
Winbugs labels	Nlg_LBandNF1to7[]	Nlg_NF8to14a[]	Nlg_LBFSC[]	Nsm_LBandNF1to7[]	Nsm_NF8to14a[]	Nsm_LBFSC[]

Annex 6.iii. Input data for sea fisheries on large salmon and small salmon from St-Pierre & Miquelon used in the run reconstruction model.

Year of the fishery	Reported harvest (kg)	Small salmon (number)	Large salmon (number)	All salmon (number)
1970	0	0	0	0
1971	0	0	0	0
1972	0	0	0	0
1973	0	0	0	0
1974	0	0	0	0
1975	0	0	0	0
1976	3000	1331	333	998
1977	0	0	0	0
1978	0	0	0	0
1979	0	0	0	0
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	3000	1331	333	998
1984	3000	1331	333	998
1985	3000	1331	333	998
1986	2500	1109	277	832
1987	2000	887	222	665
1988	2000	887	222	665
1989	2000	887	222	665
1990	1900	843	211	632
1991	1200	532	133	399
1992	2300	1020	255	765
1993	2900	1287	322	965
1994	3400	1508	377	1131
1995	800	355	89	266
1996	1600	710	177	532
1997	1500	665	166	499
1998	2300	1020	255	765
1999	2322	1030	258	773
2000	2267	1006	251	754
2001	2155	956	239	717
2002	1952	866	217	650
2003	2892	1283	321	962
2004	2784	1235	309	926
2005	3287	1458	365	1094
2006	3555	1577	394	1183
2007	1947	864	216	648
2008	3540	1571	393	1178
2009	3460	1535	384	1151
2010	2780	1233	308	925
2011	3757	1667	417	1250
Winbugs labels	SPMHarv[]	Nall_StP&M	SPMNLarge[]	SPMNSmall[]

Annex 6.iv. Input data for large salmon for Labrador used in the run reconstruction.

	Commercial harvest			Proportion Labrador origin						Exploitation rate		Prop. 2SW		Returns to Labrador rivers		Angling catches	
Year of	SFA 1	SFA 2	SFA 14B	SFA 1		SFA 2		SFA 14B		All SFAs				Large		Large	
fishery				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Retained	Released
1970	17633	45479	9595	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	562	0
1971	25127	64806	13673	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	486	0
1972	21599	55708	11753	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	424	0
1973	30204	77902	16436	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	1009	0
1974	13866	93036	15863	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	803	0
1975	28601	71168	14752	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	327	0
1976	38555	77796	15189	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	830	0
1977	28158	70158	18664	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	1286	0
1978	30824	48934	11715	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	767	0
1979	21291	27073	3874	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	609	0
1980	28750	87067	9138	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	889	0
1981	36147	68581	7606	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	520	0
1982	24192	53085	5966	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	621	0
1983	19403	33320	7489	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	428	0
1984	11726	25258	6218	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	510	0
1985	13252	16789	3954	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	294	0
1986	19152	34071	5342	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	467	0
1987	18257	49799	11114	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	633	0
1988	12621	32386	4591	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	710	0
1989	16261	26836	4646	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	461	0
1990	7313	17316	2858	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	357	0
1991	1369	7679	4417	0.60	0.80	0.60	0.80	0.60	0.80	0.70	0.90	0.70	0.90	0	0	93	0
1992	9981	19608	2752	0.60	0.80	0.60	0.80	0.60	0.80	0.58	0.83	0.70	0.90	0	0	781	10
1993	3825	9651	3620	0.60	0.80	0.60	0.80	0.60	0.80	0.38	0.62	0.70	0.90	0	0	378	91
1994	3464	11056	857	0.60	0.80	0.60	0.80	0.60	0.80	0.29	0.50	0.70	0.90	0	0	455	347
1995	2150	8714	312	0.60	0.80	0.60	0.80	0.60	0.80	0.14	0.25	0.70	0.90	0	0	408	508
1996	1375	5479	418	0.60	0.80	0.60	0.80	0.60	0.80	0.13	0.23	0.70	0.90	0	0	334	489
1997	1393	5550	263	0.64	0.72	0.88	0.95	0.60	0.80	0.17	0.30	0.70	0.90	0	0	158	566
1998	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	7374	19486	231	814
1999	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	8827	23328	320	931
2000	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	12052	31850	262	1446
2001	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	12744	33677	338	1468
2002	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	9076	24769	207	978
2003	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	6676	21689	222	1326
2004	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	10964	23092	259	1519
2005	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	11159	30796	291	1290
2006	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	12414	29783	227	1133
2007	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	11887	31913	235	1222
2008	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.71	14700	37677	200	1461
2009	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.70	18643	60062	216	1219
2010	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.70	7498	20099	197	1080
2011	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.17	0.30	0.60	0.70	8994	78695	0	2114
Winbugs labels	LB_SFA1_Lg_Comm[]	LB_SFA2_Lg_Comm[]	LB_SFA14B_Lg_Comm[]	pLB_SFA1_Lg_L[]	pLB_SFA1_Lg_H[]	pLB_SFA2_Lg_L[]	pLB_SFA2_Lg_H[]	pLB_SFA14B_Lg_L[]	pLB_SFA14B_Lg_H[]	ER_LB_Lg_L[]	ER_LB_Lg_H[]	p2SW_L[]	p2SW_H[]	LB_Lg_L[]	LB_Lg_H[]	LB_Ang_Lg_Ret[]	LB_Ang_Lg_Rel[]

Annex 6.iv (continued). Input data for small salmon for Labrador used in the run reconstruction.

Year of fishery	Commercial harvest			Proportion Labrador origin						Exploitation rate		Returns to Labrador rivers		Angling catches all Labrador	
	SFA 1	SFA 2	SFA 14B	SFA 1		SFA 2		SFA 14B		All SFAs		Small		Small	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Retained	Released
1970	14666	29441	8605	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4013	0
1971	19109	38359	11212	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3934	0
1972	14303	28711	8392	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	2947	0
1973	3130	6282	1836	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	7492	0
1974	9848	37145	9328	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	2501	0
1975	34937	57560	19294	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3972	0
1976	17589	47468	13152	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	5726	0
1977	17796	40539	11267	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4594	0
1978	17095	12535	4026	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	2691	0
1979	9712	28808	7194	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4118	0
1980	22501	72485	8493	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3800	0
1981	21596	86426	6658	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	5191	0
1982	18478	53592	7379	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4104	0
1983	15964	30185	3292	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4372	0
1984	11474	11695	2421	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	2935	0
1985	15400	24499	7460	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3101	0
1986	17779	45321	8296	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3464	0
1987	13714	64351	11389	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	5366	0
1988	19641	56381	7087	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	5523	0
1989	13233	34200	9053	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	4684	0
1990	8736	20699	3592	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	3309	0
1991	1410	20055	5303	0.60	0.80	0.60	0.80	0.60	0.80	0.30	0.50	0	0	2323	0
1992	9588	13336	1325	0.60	0.80	0.60	0.80	0.60	0.80	0.22	0.39	0	0	2738	251
1993	3893	12037	1144	0.60	0.80	0.60	0.80	0.60	0.80	0.13	0.25	0	0	2508	1793
1994	3303	4535	802	0.60	0.80	0.60	0.80	0.60	0.80	0.10	0.19	0	0	2549	3681
1995	3202	4561	217	0.60	0.80	0.60	0.80	0.60	0.80	0.07	0.13	0	0	2493	3302
1996	1676	5308	865	0.60	0.80	0.60	0.80	0.60	0.80	0.04	0.07	0	0	2565	3776
1997	1728	8025	332	0.36	0.42	0.75	0.85	0.60	0.80	0.05	0.08	0	0	2365	2187
1998	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	97408	205197	2131	3758
1999	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	94894	199901	2076	4407
2000	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	117063	246602	2561	7095
2001	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	93660	197301	2049	4640
2002	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	62321	142951	2071	5052
2003	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	48256	122813	2112	4924
2004	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	69808	120244	1808	5968
2005	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	160038	281401	2007	7120
2006	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	132205	294669	1656	5815
2007	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	131895	257360	1762	4641
2008	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	142851	264694	1936	5917
2009	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	38031	140890	1355	3396
2010	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	55949	127622	1477	4704
2011	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	0.05	0.08	78531	466737	1569	5549
Winbugs labels	LB_SFA1_Sm_Comm[]	LB_SFA2_Sm_Comm[]	LB_SFA14B_Sm_Comm[]	pLB_SFA1_Sm_L[]	pLB_SFA1_Sm_H[]	pLB_SFA2_Sm_L[]	pLB_SFA2_Sm_H[]	pLB_SFA14B_Sm_L[]	pLB_SFA14B_Sm_H[]	ER_LB_Sm_L[]	ER_LB_Sm_H[]	LB_Sm_L[]	LB_Sm_H[]	LB_Ang_Sm_Ret[]	LB_Ang_Sm_Rel[]

Annex 6.v. Input data for returns of small salmon and large salmon for Salmon Fishing Areas 3 to 8 in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 3				Salmon Fishing Area 4				Salmon Fishing Area 5				Salmon Fishing Area 6				Salmon Fishing Area 7				Salmon Fishing Area 8			
	Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	2613	5227	155	737	16163	32327	957	4559	7420	14840	439	2093	280	560	17	79	67	133	4	19	62	123	4	17
1971	2473	4947	146	698	12610	25220	746	3557	5600	11200	331	1579	183	367	11	52	133	267	8	38	83	167	5	24
1972	1660	3320	98	468	11480	22960	679	3238	6317	12633	374	1782	397	793	23	112	203	407	12	57	93	187	6	26
1973	3960	7920	234	1117	22367	44733	1324	6308	7040	14080	417	1986	833	1667	49	235	437	873	26	123	313	627	19	88
1974	2797	5593	322	645	17910	35820	2065	4131	5457	10913	629	1258	1010	2020	116	233	443	887	51	102	170	340	20	39
1975	3690	7380	520	1041	19810	39620	2794	5587	6627	13253	935	1869	313	627	44	88	133	267	19	38	290	580	41	82
1976	3157	6313	380	760	22277	44553	2683	5365	6327	12653	762	1524	823	1647	99	198	100	200	12	24	267	533	32	64
1977	5100	10200	482	964	27987	55973	2645	5290	15387	30773	1454	2908	1337	2673	126	253	260	520	25	49	270	540	26	51
1978	2527	5053	150	299	29247	58493	1731	3461	9527	19053	564	1128	987	1973	58	117	330	660	20	39	147	293	9	17
1979	6800	13600	390	779	26753	53507	1533	3067	4437	8873	254	509	813	1627	47	93	417	833	24	48	333	667	19	38
1980	5810	11620	261	522	31380	62760	1410	2819	9007	18013	405	809	1067	2133	48	96	340	680	15	31	400	800	18	36
1981	7860	15720	1045	2090	45120	90240	5998	11996	11627	23253	1546	3091	2017	4033	268	536	410	820	55	109	257	513	34	68
1982	8780	17560	212	424	33243	66487	802	1604	8110	16220	196	391	960	1920	23	46	517	1033	12	25	283	567	7	14
1983	5390	10780	247	495	29847	59693	1370	2740	7857	15713	361	721	987	1973	45	91	463	927	21	43	137	273	6	13
1984	3532	7526	55	540	34933	74436	548	5337	9538	20323	150	1457	1101	2346	17	168	339	722	5	52	279	594	4	43
1985	4772	9879	72	683	44408	91931	671	6352	12692	26275	192	1816	1563	3235	24	224	408	845	6	58	375	777	6	54
1986	2826	5898	70	413	34015	70993	840	4977	14835	30963	366	2170	1629	3400	40	238	373	779	9	55	505	1054	12	74
1987	2218	4458	57	318	21485	43175	556	3078	6556	13175	170	939	540	1085	14	77	110	222	3	16	169	340	4	24
1988	6624	13644	159	956	37171	76566	892	5367	15715	32370	377	2269	1618	3333	39	234	483	995	12	70	298	614	7	43
1989	3004	6114	90	461	15409	31367	461	2365	5767	11740	172	885	1001	2038	30	154	269	547	8	41	403	820	12	62
1990	6750	11816	236	920	22244	38934	776	3033	9485	16602	331	1293	1312	2297	46	179	193	337	7	26	338	591	12	46
1991	5650	9281	193	750	21005	34499	718	2788	8793	14443	301	1167	799	1312	27	106	155	254	5	21	47	78	2	6
1992	11418	22836	416	4095	38670	77339	1408	13867	14189	28377	516	5088	1681	3363	61	603	292	585	11	105	0	0	0	0
1993	11793	22699	415	1614	45610	87791	1605	6242	16661	32071	586	2280	2574	4954	91	352	462	890	16	63	422	813	15	58
1994	13082	28738	769	3268	29401	64585	1729	7343	9740	21395	573	2433	539	1183	32	135	64	141	4	16	111	243	7	28
1995	10205	24587	609	2665	31439	75745	1877	8211	11108	26762	663	2901	386	931	23	101	233	560	14	61	185	446	11	48
1996	19519	43650	1439	4273	52515	117438	3870	11497	17384	38875	1281	3806	643	1438	47	141	151	338	11	33	224	500	16	49
1997	11763	21437	1226	3970	24074	43872	2509	8125	6468	11786	674	2183	235	429	25	79	60	110	6	20	60	110	6	20
1998	19617	27571	1956	6992	52347	73573	5219	18658	11863	16673	1183	4228	538	756	54	192	249	350	25	89	161	227	16	58
1999	13981	20350	1286	4196	62141	90450	5717	18651	10474	15245	964	3143	405	589	37	122	69	100	6	21	151	220	14	45
2000	19313	26033	1466	3728	37551	50618	2850	7248	12414	16734	942	2396	1128	1520	86	218	159	214	12	31	106	143	8	20
2001	11754	15383	907	2104	39901	52218	3080	7143	10007	13095	773	1791	296	387	23	53	53	69	4	9	20	26	2	4
2002	10500	15736	684	2006	34310	51418	2234	6556	3870	5799	252	739	241	361	16	46	0	0	0	0	72	108	5	14
2003	21615	26166	1092	3485	74615	90328	3768	12032	6583	7970	332	1062	458	555	23	74	104	126	5	17	52	63	3	8
2004	7992	12452	396	1686	49598	77280	2455	10464	8385	13065	415	1769	180	281	9	38	0	0	0	0	41	64	2	9
2005	6421	18899	487	2678	36753	108180	2790	15329	5309	15627	403	2214	114	336	9	48	0	0	0	0	26	76	2	11
2006	10757	17194	1251	3239	42745	68322	4971	12872	8571	13700	997	2581	69	110	8	21	0	0	0	0	172	275	20	52
2007	10422	21117	1182	3828	36934	74834	4188	13567	8734	17696	990	3208	78	157	9	28	129	262	15	47	17	35	2	6
2008	13901	23285	1062	3396	63476	106328	4851	15508	11459	19195	876	2800	330	552	25	81	84	141	6	21	196	329	15	48
2009	13313	24903	787	5088	59555	111403	3518	22760	10610	19847	627	4055	485	908	29	185	0	0	0	0	135	252	8	52
2010	21058	26262	1610	4596	79694	99392	6094	17393	23093	28801	1766	5040	997	1243	76	218	211	263	16	46	110	137	8	24
2011	19639	27194	1554	5663	78938	109304	6245	22763	16658	23066	1318	4804	1101	1524	87	317	136	188	11	39	390	539	31	112
Winbugs labels	SFA3S m_L[]	SFA3S m_H[]	SFA3Lg _L[]	SFA3Lg _H[]	SFA4S m_L[]	SFA4S m_H[]	SFA4Lg _L[]	SFA4Lg _H[]	SFA5S m_L[]	SFA5S m_H[]	SFA5Lg _L[]	SFA5Lg _H[]	SFA6S m_L[]	SFA6S m_H[]	SFA6Lg _L[]	SFA6Lg _H[]	SFA7S m_L[]	SFA7S m_H[]	SFA7Lg _L[]	SFA7Lg _H[]	SFA8S m_L[]	SFA8S m_H[]	SFA8Lg _L[]	SFA8Lg _H[]

Annex 6.v (continued). Input data for returns of small salmon and large salmon for Salmon Fishing Areas 9 to 14A in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 9				Salmon Fishing Area 10				Salmon Fishing Area 11				Salmon Fishing Area 12				Salmon Fishing Area 13				Salmon Fishing Area 14A			
	Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	6310	12620	373	1780	2003	4007	119	565	16760	33520	992	4727	2497	4993	148	704	25942	38282	3251	5060	14817	29633	365	2571
1971	5400	10800	320	1523	3093	6187	183	872	13533	27067	801	3817	1513	3027	90	427	26011	40151	2678	4750	12523	25047	308	2173
1972	3797	7593	225	1071	1890	3780	112	533	16350	32700	968	4611	3093	6187	183	872	23526	37589	3107	5169	8057	16113	198	1398
1973	7200	14400	426	2031	5950	11900	352	1678	16187	32373	958	4565	2153	4307	127	607	27287	40227	3303	5200	17607	35213	433	3055
1974	4980	9960	574	1149	4040	8080	466	932	14920	29840	1720	3441	2193	4387	253	506	19274	28824	2913	4257	10400	20800	902	1805
1975	6240	12480	880	1760	1423	2847	201	401	15003	30007	2116	4232	1700	3400	240	479	33671	54424	4497	7424	16060	32120	507	1015
1976	5410	10820	651	1303	2433	4867	293	586	13880	27760	1671	3343	990	1980	119	238	29382	46902	3378	5488	24603	49207	1437	2874
1977	3600	7200	340	680	3657	7313	346	691	13653	27307	1290	2581	1860	3720	176	352	17610	25240	2877	3598	19023	38047	666	1331
1978	4343	8687	257	514	5317	10633	315	629	13320	26640	788	1576	1220	2440	72	144	17807	27681	4716	5289	10803	21607	266	532
1979	5680	11360	326	651	2830	5660	162	324	11433	22867	655	1311	2443	4887	140	280	20372	31829	1183	1862	21927	43853	233	467
1980	7930	15860	356	712	5080	10160	228	456	16897	33793	759	1518	2733	5467	123	246	26538	38871	5236	5913	12477	24953	694	1388
1981	6207	12413	825	1650	4390	8780	584	1167	23540	47080	3129	6258	3533	7067	470	939	31359	45989	5148	7452	19607	39213	1090	2180
1982	6083	12167	147	293	4187	8373	101	202	24460	48920	590	1180	5183	10367	125	250	31628	46698	3442	3831	15877	31753	3094	6189
1983	7677	15353	352	705	3800	7600	174	349	15897	31793	730	1460	2223	4447	102	204	20828	31701	4465	5100	12667	25333	1704	3407
1984	7989	17023	125	1221	5141	10955	81	785	24767	52774	389	3784	6782	14451	106	1036	26184	37852	2296	3710	16962	36143	266	2591
1985	6375	13198	96	912	4831	10000	73	691	21213	43914	320	3034	3996	8273	60	572	16028	25505	1375	2508	13209	27345	199	1890
1986	8411	17555	208	1231	5619	11727	139	822	20300	42368	501	2970	3433	7166	85	502	22881	36916	2079	3649	18411	38426	455	2694
1987	3416	6865	88	489	1690	3397	44	242	15087	30317	391	2162	3274	6580	85	469	19629	32325	1546	3022	18203	36580	471	2608
1988	5179	10668	124	748	4308	8873	103	622	18985	39106	456	2741	5330	10979	128	770	26162	43480	1950	3917	23580	48570	566	3405
1989	5352	10895	160	821	3655	7440	109	561	12047	24524	360	1849	2279	4640	68	350	10154	16156	849	1565	13036	26537	390	2001
1990	7332	12834	256	1000	3281	5743	115	447	17470	30578	610	2382	3363	5887	117	459	21518	31183	1778	3084	19843	34732	693	2706
1991	2404	3949	82	319	988	1622	34	131	7956	13068	272	1056	2765	4542	95	367	16225	20945	1709	2433	15307	25141	523	2031
1992	5044	10088	184	1809	1791	3582	65	642	16615	33231	605	5958	4671	9342	170	1675	25990	44119	3087	8928	34927	69854	1271	12525
1993	11402	21948	401	1560	5578	10736	196	763	24574	47301	865	3363	5936	11426	209	812	27523	46889	2618	4746	31116	59893	1095	4258
1994	3007	6607	177	751	2544	5588	150	635	7649	16803	450	1910	2761	6066	162	690	22103	37166	3476	5879	13321	29263	783	3327
1995	5321	12821	318	1390	4371	10532	261	1142	10757	25916	642	2809	2294	5527	137	599	27022	49781	1843	5096	20840	50209	1244	5443
1996	6015	13450	443	1317	8245	18438	608	1805	18938	42350	1396	4146	5025	11238	370	1100	36576	67672	3479	7132	32761	73263	2415	7172
1997	3636	6627	379	1227	5071	9242	528	1712	16648	30339	1735	5619	4556	8303	475	1538	31402	46494	4240	8521	25241	45998	2630	8519
1998	4694	6597	468	1673	7821	10992	780	2788	8467	11900	844	3018	2360	3318	235	841	21816	27955	3194	7080	23995	33724	2392	8552
1999	4015	5844	369	1205	5113	7443	470	1535	9643	14036	887	2894	1139	1658	105	342	32407	40858	3878	7739	26960	39241	2480	8091
2000	7850	10582	596	1515	7639	10297	580	1475	17260	23266	1310	3332	2634	3551	200	509	54330	67784	5519	10048	36819	49632	2795	7107
2001	2043	2674	158	366	2924	3826	226	523	9396	12296	725	1682	2201	2880	170	394	37393	45761	3749	6510	20775	27188	1604	3719
2002	1917	2873	125	366	3713	5565	242	709	9011	13505	587	1722	2321	3478	151	443	34070	46011	3452	6469	26558	39801	1729	5075
2003	2229	2699	113	359	3771	4565	190	608	14208	17201	718	2291	5917	7163	299	954	50367	57997	4421	8434	40802	49395	2061	6579
2004	1926	3001	95	406	3697	5760	183	780	13762	21443	681	2903	3131	4879	155	661	49924	66549	4308	9118	30057	46833	1488	6341
2005	1948	5734	148	813	2779	8180	211	1159	6260	18425	475	2611	2686	7905	204	1120	40658	88340	4595	12966	17340	51040	1316	7232
2006	4355	6960	506	1311	5344	8542	622	1609	11033	17634	1283	3322	3460	5530	402	1042	53311	74546	8499	15058	28081	44883	3266	8456
2007	2377	4817	270	873	3497	7086	397	1285	5650	11449	641	2076	2808	5689	318	1031	33808	59140	4691	10959	19966	40454	2264	7334
2008	3944	6606	301	963	4786	8016	366	1169	11136	18654	851	2721	2610	4373	200	638	51933	75122	3901	9668	25802	43220	1972	6304
2009	3445	6443	203	1316	5137	9608	303	1963	7536	14097	445	2880	1746	3266	103	667	36368	55458	3722	10806	21146	39555	1249	8081
2010	6597	8227	504	1440	8168	10187	625	1783	8024	10008	614	1751	2999	3740	229	654	57930	67116	5798	11067	31675	39504	2422	6913
2011	4692	6497	371	1353	10340	14318	818	2982	8740	12102	691	2520	3294	4562	261	950	52575	64108	6093	12366	31394	43471	2484	9053
Winbugs labels	SFA9S m_L[]	SFA9S m_H[]	SFA9Lg _L[]	SFA9Lg _H[]	SFA10S m_L[]	SFA10S m_H[]	SFA10L g_L[]	SFA10L g_H[]	SFA11S m_L[]	SFA11S m_H[]	SFA11L g_L[]	SFA11L g_H[]	SFA12S m_L[]	SFA12S m_H[]	SFA12L g_L[]	SFA12L g_H[]	SFA13S m_L[]	SFA13S m_H[]	SFA13L g_L[]	SFA13L g_H[]	SFA14A Sm_L[]	SFA14A Sm_H[]	SFA14A Lg_L[]	SFA14A Lg_H[]

Annex 6.vi. Input data for spawners of small salmon and large salmon for Salmon Fishing Areas 3 to 8 in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 3				Salmon Fishing Area 4				Salmon Fishing Area 5				Salmon Fishing Area 6				Salmon Fishing Area 7				Salmon Fishing Area 8			
	Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	1829	4443	154	736	11314	27478	910	4512	5194	12614	404	2058	196	476	14	76	47	113	3	18	43	105	0	13
1971	1731	4205	135	687	8827	21437	688	3499	3920	9520	293	1541	128	312	10	51	93	227	8	38	58	142	0	15
1972	1162	2822	98	468	8036	19516	655	3214	4422	10738	354	1762	278	674	23	112	142	346	12	57	65	159	6	26
1973	2772	6732	232	1115	15657	38023	1275	6259	4928	11968	405	1974	583	1417	49	235	306	742	26	123	219	533	15	84
1974	1958	4754	318	641	12537	30447	1983	4049	3820	9276	608	1237	707	1717	115	232	310	754	49	100	119	289	20	39
1975	2583	6273	520	1041	13867	33677	2628	5421	4639	11265	912	1846	219	533	43	87	93	227	19	38	203	493	41	82
1976	2210	5366	379	759	15594	37870	2495	5177	4429	10755	697	1459	576	1400	97	196	70	170	12	24	187	453	32	64
1977	3570	8670	478	960	19591	47577	1559	4204	10771	26157	1410	2864	936	2272	107	234	182	442	24	48	189	459	26	51
1978	1769	4295	149	298	20473	49719	1229	2959	6669	16195	536	1100	691	1677	51	110	231	561	19	38	103	249	9	17
1979	4760	11560	390	779	18727	45481	1206	2740	3106	7542	234	489	569	1383	45	91	292	708	24	48	233	567	19	38
1980	4067	9877	224	485	21966	53346	903	2312	6305	15311	376	780	747	1813	34	82	238	578	14	30	280	680	18	36
1981	5502	13362	1042	2087	31584	76704	5637	11635	8139	19765	1511	3056	1412	3428	239	507	287	697	53	107	180	436	34	68
1982	6146	14926	124	336	23270	56514	544	1346	5677	13787	143	338	672	1632	6	29	362	878	2	15	198	482	0	5
1983	3773	9163	245	493	20893	50739	1073	2443	5500	13356	191	551	691	1677	35	81	324	788	0	9	96	232	1	8
1984	2531	6525	55	540	25033	64536	533	5322	6835	17620	149	1456	789	2034	12	163	243	626	1	48	200	515	4	43
1985	3462	8569	72	683	32218	79741	671	6352	9208	22791	192	1816	1134	2806	24	224	296	733	6	58	272	674	6	54
1986	2054	5126	70	413	24722	61700	840	4977	10782	26910	366	2170	1184	2955	40	238	271	677	9	55	367	916	12	74
1987	1655	3895	57	318	16032	37722	556	3078	4892	11511	170	939	403	948	14	77	82	194	3	16	126	297	4	24
1988	4868	11888	159	956	27317	66712	892	5367	11549	28204	377	2269	1189	2904	39	234	355	867	12	70	219	535	7	43
1989	2266	5376	90	461	11623	27581	461	2365	4350	10323	172	885	755	1792	30	154	203	481	8	41	304	721	12	62
1990	5032	10098	236	920	16583	33273	776	3033	7071	14188	331	1293	978	1963	46	179	144	288	7	26	252	505	12	46
1991	4334	7965	193	750	16113	29607	718	2788	6745	12395	301	1167	613	1126	27	106	119	218	5	21	36	67	2	6
1992	9844	21262	415	4094	33228	71898	1407	13866	12175	26363	516	5088	1450	3132	61	603	252	545	11	105	0	0	0	0
1993	10054	20961	400	1599	39162	81344	1590	6226	14370	29779	576	2270	2243	4623	90	351	404	831	16	63	369	760	15	58
1994	9146	24802	749	3247	20576	55760	1644	7259	6855	18510	560	2420	381	1026	30	133	46	122	4	16	79	212	6	27
1995	7409	21791	580	2636	22872	67179	1801	8135	8122	23776	642	2880	287	831	23	100	173	501	14	60	135	397	11	48
1996	15729	39860	1412	4247	42346	107268	3757	11383	14095	35586	1263	3787	522	1317	46	139	124	311	11	33	180	457	16	48
1997	9422	19095	1209	3954	19309	39107	2467	8083	5228	10547	668	2177	190	384	24	79	49	99	6	20	48	98	6	20
1998	16390	24345	1933	6969	43559	64785	5160	18599	9943	14753	1155	4201	455	673	53	191	212	313	25	88	135	201	16	57
1999	11804	18173	1279	4189	52390	80698	5650	18583	8832	13603	947	3126	343	528	37	121	58	90	6	21	119	188	14	45
2000	17003	23723	1449	3711	32879	45946	2803	7201	10897	15217	923	2377	993	1386	84	217	140	195	12	31	88	125	8	20
2001	9861	13489	892	2089	33365	45682	3023	7086	8344	11433	767	1786	250	342	23	53	42	59	4	9	17	23	2	4
2002	8620	13856	671	1994	28099	45208	2175	6498	3194	5124	250	737	199	319	15	45	0	0	0	0	55	91	5	14
2003	19386	23938	1085	3478	67026	82739	3738	12001	5926	7312	331	1060	412	508	23	74	94	116	5	17	47	58	3	8
2004	6942	11402	390	1680	43104	70785	2430	10438	7307	11987	412	1766	158	259	9	38	0	0	0	0	35	58	2	9
2005	5056	17534	473	2664	28896	100323	2695	15235	4200	14518	394	2205	92	314	8	47	0	0	0	0	18	69	2	11
2006	9402	15839	1228	3216	37156	62732	4925	12825	7495	12623	969	2554	61	102	8	20	0	0	0	0	141	244	20	52
2007	9147	19842	1171	3818	32243	70143	4122	13501	7641	16603	978	3196	68	148	8	28	112	245	12	45	15	33	2	6
2008	11799	21183	1045	3379	53591	96443	4745	15402	9669	17405	867	2791	274	497	22	78	69	125	4	18	159	292	15	48
2009	11205	22795	779	5080	49881	101728	3491	22732	8828	18065	622	4049	412	834	28	185	0	0	0	0	111	228	7	51
2010	18364	23569	1595	4581	69075	88772	6006	17304	20114	25822	1754	5028	874	1120	76	217	183	235	16	46	93	120	8	24
2011	17114	24668	1533	5642	69014	99380	6153	22671	14534	20942	1298	4784	963	1387	87	317	117	169	10	39	329	479	31	112
Winbugs labels	SFA3SS m_L[]	SFA3SS m_H[]	SFA3SL g_L[]	SFA3SL g_H[]	SFA4SS m_L[]	SFA4SS m_H[]	SFA4SL g_L[]	SFA4SL g_H[]	SFA5SS m_L[]	SFA5SS m_H[]	SFA5SL g_L[]	SFA5SL g_H[]	SFA6SS m_L[]	SFA6SS m_H[]	SFA6SL g_L[]	SFA6SL g_H[]	SFA7SS m_L[]	SFA7SS m_H[]	SFA7SL g_L[]	SFA7SL g_H[]	SFA8SS m_L[]	SFA8SS m_H[]	SFA8SL g_L[]	SFA8SL g_H[]

Annex 6.vi (continued). Input data for spawners of small salmon and large salmon for Salmon Fishing Areas 9 to 14A in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 9				Salmon Fishing Area 10				Salmon Fishing Area 11				Salmon Fishing Area 12				Salmon Fishing Area 13				Salmon Fishing Area 14A			
	Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon		Small salmon		Large salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	4417	10727	361	1768	1402	3406	112	558	11732	28492	918	4653	1748	4244	69	625	16203	28543	1608	3417	10372	25188	134	2340
1971	3780	9180	301	1504	2165	5259	166	855	9473	23007	736	3752	1059	2573	74	411	16489	30629	1633	3705	8766	21290	0	1850
1972	2658	6454	217	1063	1323	3213	108	529	11445	27795	882	4525	2165	5259	163	852	15125	29188	2004	4066	5640	13696	83	1283
1973	5040	12240	406	2011	4165	10115	310	1636	11331	27517	923	4530	1507	3661	102	582	17019	29959	1911	3808	12325	29931	91	2713
1974	3486	8466	565	1140	2828	6868	452	918	10444	25364	1682	3403	1535	3729	240	493	12085	21635	1997	3341	7280	17680	789	1692
1975	4368	10608	874	1754	996	2420	192	392	10502	25506	2076	4192	1190	2890	220	459	21668	42421	3611	6538	11242	27302	417	925
1976	3787	9197	639	1291	1703	4137	283	576	9716	23596	1629	3301	693	1683	114	233	18999	36519	2752	4862	17222	41826	1337	2774
1977	2520	6120	331	671	2560	6216	341	686	9557	23211	1272	2563	1302	3162	128	304	10898	18528	1828	2549	13316	32340	194	859
1978	3040	7384	240	497	3722	9038	273	587	9324	22644	770	1558	854	2074	52	124	12518	22392	3861	4434	7562	18366	194	460
1979	3976	9656	311	636	1981	4811	154	316	8003	19437	648	1304	1710	4154	130	270	14363	25820	1070	1749	15349	37275	174	408
1980	5551	13481	295	651	3556	8636	201	429	11828	28724	715	1474	1913	4647	94	217	18625	30958	4243	4920	8734	21210	514	1208
1981	4345	10551	773	1598	3073	7463	555	1138	16478	40018	3088	6217	2473	6007	453	922	22059	36689	4485	6789	13725	33331	953	2043
1982	4258	10342	114	260	2931	7117	91	192	17122	41582	537	1127	3628	8812	110	235	22062	37132	2847	3236	11114	26990	2987	6082
1983	5374	13050	281	634	2660	6460	95	270	11128	27024	703	1433	1556	3780	94	196	14491	25364	3855	4490	8867	21533	1635	3338
1984	5725	14759	120	1216	3684	9498	79	783	17748	45755	374	3769	4860	12529	38	968	18413	30081	1987	3401	12155	31336	179	2504
1985	4625	11448	96	912	3505	8674	73	691	15390	38091	320	3034	2899	7176	57	569	10726	20203	1349	2482	9583	23719	197	1887
1986	6113	15257	208	1231	4084	10192	139	822	14754	36822	501	2970	2495	6228	81	499	15535	29570	2013	3583	13381	33396	445	2683
1987	2549	5998	88	489	1261	2968	44	242	11258	26488	391	2162	2443	5749	82	466	13611	26307	1512	2988	13583	31960	467	2604
1988	3806	9295	124	748	3166	7731	103	622	13952	34073	456	2741	3917	9566	126	767	17945	35263	1909	3877	17329	42319	549	3388
1989	4037	9580	160	821	2757	6542	109	561	9087	21564	360	1849	1719	4080	67	349	6980	12982	836	1552	9833	23334	385	1996
1990	5466	10968	256	1000	2446	4908	115	447	13024	26132	610	2382	2507	5031	114	456	14866	24531	1744	3051	14793	29682	679	2692
1991	1844	3389	82	319	758	1392	34	131	6103	11215	272	1056	2121	3898	93	365	11037	15757	1689	2413	11742	21576	512	2020
1992	4334	9378	183	1809	1496	3287	65	642	14239	30854	605	5958	3985	8657	162	1667	20506	38635	2992	8833	30096	65023	1234	12488
1993	9956	20502	400	1559	4809	9967	194	761	21423	44150	861	3359	5176	10666	207	810	22341	41708	2544	4673	27010	55787	1058	4221
1994	2124	5723	172	746	1804	4848	144	630	5295	14449	430	1891	1949	5253	154	681	15381	30444	3207	5611	9385	25327	742	3286
1995	3887	11386	304	1376	3218	9378	253	1133	7770	22930	625	2792	1689	4922	130	592	20570	43329	1607	4860	15218	44587	1187	5385
1996	4868	12304	431	1304	6687	16880	592	1789	15226	38638	1362	4113	4082	10295	358	1088	29056	60152	3199	6852	26584	67085	2357	7115
1997	2927	5918	372	1221	4086	8257	519	1702	13304	26995	1718	5602	3655	7401	464	1527	25508	40599	3985	8266	20359	41117	2578	8467
1998	3937	5840	458	1663	6606	9777	771	2779	7024	10457	836	3009	1968	2925	225	831	18279	24417	3031	6918	19992	29721	2347	8507
1999	3401	5230	359	1195	4313	6642	455	1520	8086	12478	881	2889	958	1477	102	339	28647	37098	3760	7621	22659	34941	2402	8013
2000	6913	9645	581	1501	6664	9322	534	1429	14895	20901	1288	3310	2291	3208	195	504	48055	61508	5250	9779	32314	45127	2731	7044
2001	1709	2339	151	359	2436	3338	215	513	7804	10704	714	1671	1818	2497	162	386	31037	39405	3536	6297	17331	23744	1559	3674
2002	1562	2518	118	360	3049	4901	231	699	7347	11840	581	1716	1896	3053	147	439	28083	40025	3313	6330	21764	35007	1668	5013
2003	1985	2454	109	355	3368	4162	185	603	12701	15693	703	2276	5282	6528	288	943	45027	52657	4206	8218	36597	45189	1988	6506
2004	1674	2749	91	402	3210	5273	177	774	11863	19544	660	2882	2704	4452	149	655	43889	60513	4074	8883	26116	42892	1429	6282
2005	1478	5264	130	794	2171	7572	194	1142	4827	16992	456	2591	2062	7282	191	1107	33349	81031	4320	12691	13676	47376	1246	7163
2006	3791	6397	498	1302	4627	7824	602	1590	9554	16155	1271	3310	2986	5056	392	1032	46296	67532	8247	14807	24532	41334	3210	8400
2007	2063	4502	263	867	3047	6636	387	1275	4907	10706	636	2071	2442	5323	314	1027	29402	54734	4511	10780	17446	37934	2222	7293
2008	3285	5948	293	955	3971	7202	351	1154	9314	16832	841	2711	2178	3940	193	631	43277	66465	3580	9346	21887	39305	1915	6246
2009	2835	5834	198	1311	4193	8665	298	1957	6203	12763	442	2877	1450	2970	100	664	31106	50196	3526	10610	17820	36229	1200	8032
2010	5703	7334	496	1432	7062	9081	616	1774	6859	8842	604	1742	2606	3347	226	651	49703	58889	5478	10747	27468	35298	2358	6848
2011	4017	5821	365	1347	8894	12872	796	2959	7501	10863	682	2511	2858	4125	257	947	45523	57055	5865	12138	27340	39416	2415	8984
Winbugs	SFA9SS	SFA9SS	SFA9SL	SFA9SL	SFA10S	SFA10S	SFA10S	SFA10S	SFA11S	SFA11S	SFA11S	SFA11S	SFA12S	SFA12S	SFA12S	SFA12S	SFA13S	SFA13S	SFA13S	SFA13S	SFA14AS	SFA14AS	SFA14A	SFA14A
labels	m_L[]	m_H[]	g_L[]	g_H[]	Sm_L[]	Sm_H[]	Lg_L[]	Lg_H[]	Sm_L[]	Sm_H[]	Lg_L[]	Lg_H[]	Sm_L[]	Sm_H[]	Lg_L[]	Lg_H[]	Sm_L[]	Sm_H[]	Lg_L[]	Lg_H[]	Sm_L[]	Sm_H[]	SLg_L[]	SLg_H[]

Annex 6.vii. Input data for 2SW salmon returns and spawners for Salmon Fishing Areas 3 to 8 in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 3				Salmon Fishing Area 4				Salmon Fishing Area 5				Salmon Fishing Area 6				Salmon Fishing Area 7				Salmon Fishing Area 8			
	Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	15	147	15	147	96	912	91	902	44	419	40	412	2	16	1	15	0	4	0	4	0	3	0	3
1971	15	140	14	137	75	711	69	700	33	316	29	308	1	10	1	10	1	8	1	8	0	5	0	3
1972	10	94	10	94	68	648	66	643	37	356	35	352	2	22	2	22	1	11	1	11	1	5	1	5
1973	23	223	23	223	132	1262	127	1252	42	397	40	395	5	47	5	47	3	25	3	25	2	18	1	17
1974	32	129	32	128	207	826	198	810	63	252	61	247	12	47	12	46	5	20	5	20	2	8	2	8
1975	52	208	52	208	279	1117	263	1084	93	374	91	369	4	18	4	17	2	8	2	8	4	16	4	16
1976	38	152	38	152	268	1073	249	1035	76	305	70	292	10	40	10	39	1	5	1	5	3	13	3	13
1977	48	193	48	192	264	1058	156	841	145	582	141	573	13	51	11	47	2	10	2	10	3	10	3	10
1978	15	60	15	60	173	692	123	592	56	226	54	220	6	23	5	22	2	8	2	8	1	3	1	3
1979	39	156	39	156	153	613	121	548	25	102	23	98	5	19	4	18	2	10	2	10	2	8	2	8
1980	26	104	22	97	141	564	90	462	40	162	38	156	5	19	3	16	2	6	1	6	2	7	2	7
1981	104	418	104	417	600	2399	564	2327	155	618	151	611	27	107	24	101	5	22	5	21	3	14	3	14
1982	21	85	12	67	80	321	54	269	20	78	14	68	2	9	1	6	1	5	0	3	1	3	0	1
1983	25	99	25	99	137	548	107	489	36	144	19	110	5	18	4	16	2	9	0	2	1	3	0	2
1984	6	108	6	108	55	1067	53	1064	15	291	15	291	2	34	1	33	1	10	0	10	0	9	0	9
1985	7	137	7	137	67	1270	67	1270	19	363	19	363	2	45	2	45	1	12	1	12	1	11	1	11
1986	7	83	7	83	84	995	84	995	37	434	37	434	4	48	4	48	1	11	1	11	1	15	1	15
1987	6	64	6	64	56	616	56	616	17	188	17	188	1	15	1	15	0	3	0	3	0	5	0	5
1988	16	191	16	191	89	1073	89	1073	38	454	38	454	4	47	4	47	1	14	1	14	1	9	1	9
1989	9	92	9	92	46	473	46	473	17	177	17	177	3	31	3	31	1	8	1	8	1	12	1	12
1990	24	184	24	184	78	607	78	607	33	259	33	259	5	36	5	36	1	5	1	5	1	9	1	9
1991	19	150	19	150	72	558	72	558	30	233	30	233	3	21	3	21	1	4	1	4	0	1	0	1
1992	42	819	42	819	141	2773	141	2773	52	1018	52	1018	6	121	6	121	1	21	1	21	0	0	0	0
1993	42	323	40	320	161	1248	159	1245	59	456	58	454	9	70	9	70	2	13	2	13	1	12	1	12
1994	46	457	45	455	104	1028	99	1016	34	341	34	339	2	19	2	19	0	2	0	2	0	4	0	4
1995	37	373	35	369	113	1150	108	1139	40	406	39	403	1	14	1	14	1	9	1	8	1	7	1	7
1996	86	598	85	595	232	1610	225	1594	77	533	76	530	3	20	3	19	1	5	1	5	1	7	1	7
1997	74	556	73	554	151	1138	148	1132	40	306	40	305	1	11	1	11	0	3	0	3	0	3	0	3
1998	117	979	116	976	313	2612	310	2604	71	592	69	588	3	27	3	27	1	12	1	12	1	8	1	8
1999	77	587	77	586	343	2611	339	2602	58	440	57	438	2	17	2	17	0	3	0	3	1	6	1	6
2000	88	522	87	520	171	1015	168	1008	57	335	55	333	5	30	5	30	1	4	1	4	0	3	0	3
2001	39	196	38	194	132	664	130	659	33	167	33	166	1	5	1	5	0	1	0	1	0	0	0	0
2002	29	187	29	185	96	610	94	604	11	69	11	69	1	4	1	4	0	0	0	0	0	1	0	1
2003	47	324	47	323	162	1119	161	1116	14	99	14	99	1	7	1	7	0	2	0	2	0	1	0	1
2004	17	157	17	156	106	973	104	971	18	165	18	164	0	4	0	4	0	0	0	0	0	1	0	1
2005	21	249	20	248	120	1426	116	1417	17	206	17	205	0	4	0	4	0	0	0	0	0	1	0	1
2006	54	301	53	299	214	1197	212	1193	43	240	42	237	0	2	0	2	0	0	0	0	1	5	1	5
2007	51	356	50	355	180	1262	177	1256	43	298	42	297	0	3	0	3	1	4	1	4	0	1	0	1
2008	46	316	45	314	209	1442	204	1432	38	260	37	260	1	7	1	7	0	2	0	2	1	4	1	4
2009	34	473	33	472	151	2117	150	2114	27	377	27	377	1	17	1	17	0	0	0	0	0	5	0	5
2010	69	427	69	426	262	1618	258	1609	76	469	75	468	3	20	3	20	1	4	1	4	0	2	0	2
2011	67	527	66	525	269	2117	265	2108	57	447	56	445	4	30	4	29	0	4	0	4	1	10	1	10
Winbugs labels	SFA3R2_L[]	SFA3R2_H[]	SFA3S2_L[]	SFA3S2_H[]	SFA4R2_L[]	SFA4R2_H[]	SFA4S2_L[]	SFA4S2_H[]	SFA5R2_L[]	SFA5R2_H[]	SFA5S2_L[]	SFA5S2_H[]	SFA6R2_L[]	SFA6R2_H[]	SFA6S2_L[]	SFA6S2_H[]	SFA7R2_L[]	SFA7R2_H[]	SFA7S2_L[]	SFA7S2_H[]	SFA8R2_L[]	SFA8R2_H[]	SFA8S2_L[]	SFA8S2_H[]

Annex 6.vii (continued). Input data for 2SW salmon returns and spawners for Salmon Fishing Areas 9 to 14A in Newfoundland used in the run reconstruction.

	Salmon Fishing Area 9				Salmon Fishing Area 10				Salmon Fishing Area 11				Salmon Fishing Area 12				Salmon Fishing Area 13				Salmon Fishing Area 14A			
	Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners		Returns		Spawners	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1970	37	356	36	354	12	113	11	112	99	945	92	931	15	141	7	125	1300	3036	643	2050	36	514	13	468
1971	32	305	30	301	18	174	17	171	80	763	74	750	9	85	7	82	1071	2850	653	2223	31	435	0	370
1972	22	214	22	213	11	107	11	106	97	922	88	905	18	174	16	170	1243	3101	802	2439	20	280	8	257
1973	43	406	41	402	35	336	31	327	96	913	92	906	13	121	10	116	1321	3120	764	2285	43	611	9	543
1974	57	230	57	228	47	186	45	184	172	688	168	681	25	101	24	99	1165	2554	799	2005	90	361	79	338
1975	88	352	87	351	20	80	19	78	212	846	208	838	24	96	22	92	1799	4454	1445	3923	51	203	42	185
1976	65	261	64	258	29	117	28	115	167	669	163	660	12	48	11	47	1351	3293	1101	2917	144	575	134	555
1977	34	136	33	134	35	138	34	137	129	516	127	513	18	70	13	61	1151	2159	731	1530	67	266	19	172
1978	26	103	24	99	31	126	27	117	79	315	77	312	7	29	5	25	1886	3173	1544	2660	27	106	19	92
1979	33	130	31	127	16	65	15	63	66	262	65	261	14	56	13	54	473	1117	428	1049	23	93	17	82
1980	36	142	30	130	23	91	20	86	76	304	71	295	12	49	9	43	2094	3548	1697	2952	69	278	51	242
1981	83	330	77	320	58	233	55	228	313	1252	309	1243	47	188	45	184	2059	4471	1794	4073	109	436	95	409
1982	15	59	11	52	10	40	9	38	59	236	54	225	13	50	11	47	1377	2298	1139	1941	309	1238	299	1216
1983	35	141	28	127	17	70	10	54	73	292	70	287	10	41	9	39	1786	3060	1542	2694	170	681	163	668
1984	13	244	12	243	8	157	8	157	39	757	37	754	11	207	4	194	918	2226	795	2041	27	518	18	501
1985	10	182	10	182	7	138	7	138	32	607	32	607	6	114	6	114	550	1505	540	1489	20	378	20	377
1986	21	246	21	246	14	164	14	164	50	594	50	594	8	100	8	100	832	2190	805	2150	45	539	44	537
1987	9	98	9	98	4	48	4	48	39	432	39	432	8	94	8	93	618	1813	605	1793	47	522	47	521
1988	12	150	12	150	10	124	10	124	46	548	46	548	13	154	13	153	780	2350	764	2326	57	681	55	678
1989	16	164	16	164	11	112	11	112	36	370	36	370	7	70	7	70	339	939	334	931	39	400	39	399
1990	26	200	26	200	11	89	11	89	61	476	61	476	12	92	11	91	711	1851	698	1830	69	541	68	538
1991	8	64	8	64	3	26	3	26	27	211	27	211	9	73	9	73	684	1460	676	1448	52	406	51	404
1992	18	362	18	362	7	128	6	128	60	1192	60	1192	17	335	16	333	1235	5357	1197	5300	127	2505	123	2498
1993	40	312	40	312	20	153	19	152	86	673	86	672	21	162	21	162	1047	2848	1018	2804	110	852	106	844
1994	11	105	10	104	9	89	9	88	27	267	26	265	10	97	9	95	1390	3528	1283	3366	47	466	44	460
1995	19	195	18	193	16	160	15	159	39	393	38	391	8	84	8	83	737	3058	643	2916	75	762	71	754
1996	27	184	26	183	36	253	35	250	84	580	82	576	22	154	22	152	1391	4279	1280	4111	145	1004	141	996
1997	23	172	22	171	32	240	31	238	104	787	103	784	28	215	28	214	1696	5113	1594	4960	158	1193	155	1185
1998	28	234	27	233	47	390	46	389	51	422	50	421	14	118	13	116	1278	4248	1212	4151	144	1197	141	1191
1999	22	169	22	167	28	215	27	213	53	405	53	404	6	48	6	48	1551	4643	1504	4573	149	1133	144	1122
2000	36	212	35	210	35	206	32	200	79	466	77	463	12	71	12	71	2208	6029	2100	5867	168	995	164	986
2001	7	34	7	33	10	49	9	48	31	156	31	155	7	37	7	36	697	2324	658	2248	69	346	67	342
2002	5	34	5	33	10	66	10	65	25	160	25	160	6	41	6	41	642	2309	616	2260	74	472	72	466
2003	5	33	5	33	8	57	8	56	31	213	30	212	13	89	12	88	822	3011	782	2934	89	612	85	605
2004	4	38	4	37	8	73	8	72	29	270	28	268	7	61	6	61	801	3255	758	3171	64	590	61	584
2005	6	76	6	74	9	108	8	106	20	243	20	241	9	104	8	103	855	4629	804	4531	57	673	54	666
2006	22	122	21	121	27	150	26	148	55	309	55	308	17	97	17	96	1581	5376	1534	5286	140	786	138	781
2007	12	81	11	81	17	119	17	119	28	193	27	193	14	96	13	95	872	3912	839	3849	97	682	96	678
2008	13	90	13	89	16	109	15	107	37	253	36	252	9	59	8	59	726	3451	666	3337	85	586	82	581
2009	9	122	9	122	13	183	13	182	19	268	19	268	4	62	4	62	692	3858	656	3788	54	752	52	747
2010	22	134	21	133	27	166	26	165	26	163	26	162	10	61	10	61	1078	3951	1019	3837	104	643	101	637
2011	16	126	16	125	35	277	34	275	30	234	29	234	11	88	11	88	1133	4415	1091	4333	107	842	104	836
Winbugs labels	SFA9R2_L[]	SFA9R2_H[]	SFA9S2_L[]	SFA9S2_H[]	SFA10R2_L[]	SFA10R2_H[]	SFA10S2_L[]	SFA10S2_H[]	SFA11R2_L[]	SFA11R2_H[]	SFA11S2_L[]	SFA11S2_H[]	SFA12R2_L[]	SFA12R2_H[]	SFA12S2_L[]	SFA12S2_H[]	SFA13R2_L[]	SFA13R2_H[]	SFA13S2_L[]	SFA13S2_H[]	SFA14AR2_L[]	SFA14AR2_H[]	SFA14AS2_L[]	SFA14AS2_H[]

Annex 6.viii. Input data for small salmon returns to Québec by category of data used in the run reconstruction.

	Minimum small salmon returns								Maximum small salmon returns							
	Data reliability category						FN	Other	Data reliability category						FN	Other
Year	C1	C2	C3	C4	C5	C6	Harvest	rivers	C1	C2	C3	C4	C5	C6	Harvest	rivers
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	3830	5434	2955	460	1670	5160	267	31	4085	5639	6053	792	2784	8599	445	52
1985	5266	2271	1767	210	5449	4384	267	40	5869	2336	3586	352	9224	7307	445	67
1986	8648	5193	2396	63	6719	5133	267	77	9471	5321	4895	107	11198	8555	445	129
1987	10043	4775	3852	327	8396	5501	267	71	10869	4910	7875	546	13993	9168	445	118
1988	11190	5968	4404	468	8440	6423	267	85	12244	6133	8962	780	14067	10705	445	142
1989	10121	4743	2924	301	6744	5622	267	68	10910	4878	5940	503	11240	9369	445	113
1990	12245	7332	4377	694	7096	2976	377	77	13278	7511	8917	1158	11826	4960	628	129
1991	9554	5851	3776	349	5009	2001	256	57	10249	5987	7679	584	8348	3336	426	95
1992	9188	6928	4567	428	5131	3462	243	70	9847	7144	9297	715	8552	5770	405	117
1993	8143	6325	3973	1029	4315	1447	525	55	8883	6517	8075	1717	7192	2412	875	92
1994	8707	5928	3840	1051	4011	437	408	30	9442	6129	7828	1753	6686	729	681	50
1995	6943	3439	2697	1017	3853	434	184	30	7538	3527	5471	1696	6422	723	306	50
1996	15010	1809	3600	477	4666	500	120	5	16122	1923	7370	797	7816	833	200	8
1997	11491	201	3457	292	3529	462	58	563	12089	242	7049	487	5882	770	97	938
1998	11285	1183	3578	328	5121	1127	58	0	11849	1406	7347	555	8536	1878	97	0
1999	10877	708	3194	1868	5401	1429	0	0	11556	741	6536	3098	9002	2382	0	0
2000	11886	429	1116	602	7399	633	0	0	12635	458	2284	1004	14050	1055	0	0
2001	8050	185	2632	266	3225	728	0	0	8588	228	5392	443	5374	1213	0	0
2002	14599	31	3189	689	4333	1448	0	0	15494	36	6530	1149	7222	2414	0	0
2003	11362	0	3203	721	3566	1512	0	0	11903	0	6538	1201	5944	2520	0	0
2004	13747	107	6526	284	4889	1639	0	0	14177	127	13104	474	8149	2731	0	0
2005	8771	0	3689	794	3353	1508	0	0	9188	0	7485	1323	5588	2513	0	0
2006	12762	0	3736	1800	2944	1455	0	0	13369	0	7584	2999	4907	2426	0	0
2007	8515	0	3758	1710	1830	1024	0	0	8964	0	7631	2850	3051	1707	0	0
2008	16445	0	5542	2266	3144	1401	0	0	17350	0	11261	3776	5240	2336	0	0
2009	8872	0	3601	903	1907	1056	0	0	9315	0	7306	1505	3178	1759	0	0
2010	12889	0	4801	993	1675	1081	0	0	13538	0	9746	1655	2792	1802	0	0
2011	17955	0	5119	1365	3685	1694	0	0	18859	0	10384	2275	6142	2824	0	0
Winbugs labels	QCSmC 1_L[]	QCSmC 2_L[]	QCSmC 3_L[]	QCSmC 4_L[]	QCSmC 5_L[]	QCSmC 6_L[]	QCSmF n_L[]	QCSmO _L[]	QCSmC 1_H[]	QCSmC 2_H[]	QCSmC 3_H[]	QCSmC 4_H[]	QCSmC 5_H[]	QCSmC 6_H[]	QCSmF n_H[]	QCSmO _H[]

Annex 6.viii (continued). Input data for large salmon returns to Québec by category of data used in the run reconstruction.

	Minimum large salmon returns								Maximum large salmon returns							
	Data reliability category						FN	Other	Data reliability category						FN	Other
Year	C1	C2	C3	C4	C5	C6	Harvest	rivers	C1	C2	C3	C4	C5	C6	Harvest	rivers
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	14119	9501	2922	3407	3712	5071	329	108	15631	9788	6035	6477	6187	8452	548	181
1985	14015	7028	3836	345	9215	3351	329	76	15611	7281	7809	577	15827	5586	548	127
1986	18589	8598	6152	35	5877	4971	329	89	20602	8839	12596	61	9795	8284	548	149
1987	17574	6715	5178	273	6335	3012	329	82	19017	6889	10575	458	10558	5019	548	137
1988	21445	6432	7540	346	6789	4781	329	98	22979	6618	15336	576	11315	7969	548	164
1989	20278	8503	5530	278	5718	4567	329	106	21906	8736	11252	465	9531	7611	548	176
1990	17098	10803	8164	1365	5179	2424	442	112	18222	11041	16613	2276	8631	4040	737	187
1991	19112	6988	7183	696	3856	357	242	101	20443	7192	14602	1161	6427	595	403	168
1992	18392	7360	7930	372	2687	1503	461	76	19578	7560	16149	622	4478	2505	769	127
1993	14578	10133	2866	373	2649	333	423	52	15454	11463	5849	624	4414	555	705	87
1994	16538	9172	2644	506	2853	145	427	60	17594	10241	5411	845	4755	242	712	100
1995	21658	9598	1926	813	4390	154	246	31	22968	10936	3915	1358	7317	256	410	52
1996	22679	5822	3843	577	2486	135	113	4	24117	6941	7844	964	4155	225	189	7
1997	18106	4221	2816	333	2865	138	48	9	19154	5154	5768	553	4775	229	80	15
1998	13180	4927	2861	347	2790	291	48	0	13891	5962	5907	592	4649	485	80	0
1999	16912	842	2554	3661	3870	492	0	0	17700	995	5232	6103	6450	838	0	0
2000	14568	619	3901	560	6420	563	0	0	15300	669	7947	933	10700	949	0	0
2001	17837	633	5320	241	3988	556	0	0	18889	879	10914	402	6647	926	0	0
2002	12335	8	4515	339	2103	345	0	0	13001	9	9277	565	3505	575	0	0
2003	21853	0	5787	269	4889	384	0	0	22893	0	11779	449	8148	641	0	0
2004	18369	107	4870	357	4432	401	0	0	19043	126	9170	595	7387	668	0	0
2005	19154	0	3204	734	4815	351	0	0	20066	0	6515	1223	8025	585	0	0
2006	16704	0	3387	901	3945	403	0	0	17500	0	6904	1502	6575	672	0	0
2007	14832	0	3638	1301	3171	305	0	0	15604	0	7406	2168	5285	508	0	0
2008	15216	0	5187	1328	5423	390	0	0	16002	0	10595	2213	9038	649	0	0
2009	18479	0	3727	950	4556	275	0	0	19412	0	7589	1584	7594	458	0	0
2010	21375	0	4488	1047	3656	338	0	0	22454	0	9157	1744	6093	564	0	0
2011	26977	0	4656	1571	5574	483	0	0	28373	0	9444	2619	9290	805	0	0
Winbugs labels	QCLgC1_L[]	QCLgC2_L[]	QCLgC3_L[]	QCLgC4_L[]	QCLgC5_L[]	QCLgC6_L[]	QCLgFn_L[]	QCLgO_L[]	QCLgC1_H[]	QCLgC2_H[]	QCLgC3_H[]	QCLgC4_H[]	QCLgC5_H[]	QCLgC6_H[]	QCLgFn_H[]	QCLgO_H[]

Annex 6.viii (continued). Input data for small salmon spawners to Québec by category of data used in the run reconstruction.

	Minimum small salmon spawners						Maximum small salmon spawners					
	Data reliability category						Data reliability category					
Year	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	3061	4342	1915	415	1264	5160	3316	4547	5013	747	2378	8599
1985	3960	1622	1025	209	4241	4384	4563	1687	2844	351	8016	7307
1986	6337	3827	1499	63	5151	5133	7160	3955	3998	107	9630	8555
1987	7493	3489	2365	291	6411	5501	8319	3624	6388	510	12008	9168
1988	8173	4188	2738	419	6432	6423	9227	4353	7296	731	12059	10705
1989	7779	3810	1878	273	5149	5622	8568	3945	4894	475	9645	9369
1990	8735	5757	2822	604	5437	2976	9768	5936	7362	1068	10167	4960
1991	7247	4551	2465	316	3827	2001	7942	4687	6368	551	7166	3336
1992	5989	4841	2937	370	3957	3462	6648	5057	7667	657	7378	5770
1993	4852	4311	2524	747	3339	1447	5592	4503	6626	1435	6216	2412
1994	5506	3996	2501	894	3089	437	6241	4197	6489	1596	5764	729
1995	5348	2835	1760	877	2956	434	5943	2923	4534	1556	5525	723
1996	10636	1330	2260	372	3678	500	11748	1444	6030	692	6828	833
1997	8238	142	2250	266	3074	462	8836	178	5842	461	5426	770
1998	7734	995	2347	289	4229	1124	8298	1218	6116	516	7643	1875
1999	8155	509	2495	1653	4581	1426	8834	542	5837	2883	8182	2379
2000	8291	372	693	519	5900	583	9040	401	1861	921	12551	1005
2001	5329	143	1870	263	2579	658	5867	186	4140	440	4729	1137
2002	9296	31	2231	658	3405	1448	10191	36	5572	1118	6294	2414
2003	8180	0	2269	661	2826	1509	8721	0	5604	1141	5204	2517
2004	9030	29	5574	278	3962	1639	9460	49	12152	468	7222	2731
2005	6339	0	3025	716	2709	1506	6756	0	6821	1245	4945	2511
2006	8628	0	3159	1691	2372	1455	9235	0	7007	2890	4335	2426
2007	5768	0	3226	1511	1501	1024	6217	0	7099	2651	2722	1707
2008	10562	0	4882	1756	2522	1401	11467	0	10601	3266	4618	2336
2009	6293	0	3115	764	1633	1056	6736	0	6820	1366	2904	1759
2010	8860	0	4289	914	1311	1080	9509	0	9234	1576	2428	1801
2011	12109	0	4495	1116	3036	1688	13013	0	9760	2026	5493	2818
Winbugs labels	QCSSm C1_L[]	QCSSm C2_L[]	QCSSm C3_L[]	QCSSm C4_L[]	QCSSm C5_L[]	QCSSm C6_L[]	QCSSm C1_H[]	QCSSm C2_H[]	QCSSm C3_H[]	QCSSm C4_H[]	QCSSm C5_H[]	QCSSm C6_H[]

Annex 6.viii (continued). Input data for large salmon spawners to Quebec by category of data used in the run reconstruction.

	Minimum large salmon spawners						Maximum large salmon spawners					
	Data reliability category						Data reliability category					
Year	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	10421	7648	1861	2357	2815	5071	11933	7935	4974	5427	5290	8452
1985	9985	4991	2125	340	7214	3351	11581	5244	6098	572	13826	5586
1986	13659	5804	3695	35	4498	4971	15672	6045	10139	61	8416	8284
1987	13432	4791	3025	246	4830	3012	14875	4965	8422	431	9053	5019
1988	15535	4258	4381	312	5172	4781	17069	4444	12177	542	9698	7969
1989	14645	6742	3239	253	4375	4567	16273	6975	8961	440	8188	7611
1990	12398	8463	4557	1228	3950	2424	13522	8701	13006	2139	7402	4040
1991	14061	5019	3970	596	2940	357	15392	5223	11389	1061	5511	595
1992	12850	4819	4492	325	2044	1503	14036	5019	12711	575	3835	2505
1993	9848	6936	1809	282	2038	333	10724	8266	4792	533	3803	555
1994	10468	5920	1693	448	2173	145	11524	6989	4460	787	4075	242
1995	16562	8323	1321	781	3367	154	17872	9661	3310	1326	6294	256
1996	16431	4417	2389	394	1924	135	17869	5536	6390	781	3593	225
1997	13433	3393	1744	308	2237	138	14481	4326	4696	528	4147	229
1998	10402	4429	1849	302	2213	290	11113	5464	4895	547	4073	484
1999	14169	747	1962	3100	2956	491	14957	900	4640	5542	5536	837
2000	11937	570	3322	491	5096	363	12669	620	7368	864	9376	749
2001	14527	505	4281	239	2980	348	15579	751	8986	400	5639	717
2002	10843	8	4071	313	1500	344	11509	9	8833	539	2902	574
2003	18832	0	5164	267	3763	383	19872	0	11156	447	7022	640
2004	15558	107	4231	355	3268	401	16232	126	8531	593	6223	668
2005	16485	0	2901	719	3556	351	17397	0	6212	1208	6766	585
2006	14977	0	3055	872	2863	403	15773	0	6572	1473	5493	672
2007	12470	0	3203	1287	2444	303	13242	0	6971	2154	4558	506
2008	13725	0	4676	1266	4296	390	14511	0	10084	2151	7911	649
2009	16489	0	3188	849	3588	275	17422	0	7050	1483	6626	458
2010	16489	0	3188	849	3588	275	17422	0	7050	1483	6626	458
2011	19170	0	3926	1023	3017	338	20249	0	8595	1720	5454	564
Winbugs labels	QCSLg C1_L[]	QCSLg C2_L[]	QCSLg C3_L[]	QCSLg C4_L[]	QCSLg C5_L[]	QCSLg C6_L[]	QCSLg C1_H[]	QCSLg C2_H[]	QCSLg C3_H[]	QCSLg C4_H[]	QCSLg C5_H[]	QCSLg C6_H[]

Annex 6.viii (continued). Year specific harvest data (1984 to 2009) and returns and spawners data for Québec for years when category splits are not available (1970 to 1983) used in the run reconstruction.

	Harvests in various fisheries not in the other inputs						These data are specific to the 1970 to 1983 period when detailed returns by river category are not available.							
	Small salmon			Large salmon			Small returns		Large returns		Small spawners		Large spawners	
Year	Sport	FN	Commercial	Sport	FN	Commercial	Min	Max	Min	Max	Min	Max	Min	Max
1970	0	0	0	0	0	0	18904	28356	82680	124020	11045	16568	31292	46937
1971	0	0	0	0	0	0	14969	22453	47354	71031	9338	14007	16194	24292
1972	0	0	0	0	0	0	12470	18704	61773	92660	8213	12320	31727	47590
1973	0	0	0	0	0	0	16585	24877	68171	102256	10987	16480	32279	48419
1974	0	0	0	0	0	0	16791	25186	91455	137182	10067	15100	39256	58884
1975	0	0	0	0	0	0	18071	27106	77664	116497	11606	17409	32627	48940
1976	0	0	0	0	0	0	19959	29938	77212	115818	12979	19469	31032	46548
1977	0	0	0	0	0	0	18190	27285	91017	136525	12004	18006	44660	66990
1978	0	0	0	0	0	0	16971	25456	81953	122930	11447	17170	40944	61416
1979	0	0	0	0	0	0	21683	32524	45197	67796	15863	23795	17543	26315
1980	0	0	0	0	0	0	29791	44686	107461	161192	20817	31226	48758	73137
1981	0	0	0	0	0	0	41667	62501	84428	126642	30952	46428	35798	53697
1982	0	0	0	0	0	0	23699	35549	74870	112305	16877	25316	36290	54435
1983	0	0	0	0	0	0	17987	26981	61488	92232	12030	18045	23710	35565
1984	3492	357	794	8561	4530	13053	0	0	0	0	0	0	0	0
1985	4046	273	2093	9883	3623	16619	0	0	0	0	0	0	0	0
1986	6266	372	3707	11643	4519	20889	0	0	0	0	0	0	0	0
1987	7443	366	2992	9740	4466	22745	0	0	0	0	0	0	0	0
1988	8663	397	4760	12980	4747	19750	0	0	0	0	0	0	0	0
1989	6080	196	2615	11040	2905	18175	0	0	0	0	0	0	0	0
1990	8581	108	3425	12132	2900	16092	0	0	0	0	0	0	0	0
1991	6271	265	3282	11194	4335	16372	0	0	0	0	0	0	0	0
1992	8263	120	3849	12291	4550	15851	0	0	0	0	0	0	0	0
1993	8319	7	3627	9798	3976	11242	0	0	0	0	0	0	0	0
1994	7655	161	3861	10932	4496	10424	0	0	0	0	0	0	0	0
1995	4187	353	3915	7892	6194	10038	0	0	0	0	0	0	0	0
1996	7265	72	4532	9618	6113	7454	0	0	0	0	0	0	0	0
1997	5075	35	3531	6771	4875	7202	0	0	0	0	0	0	0	0
1998	5867	35	1068	4702	4875	1038	0	0	0	0	0	0	0	0
1999	4428	710	814	4407	3683	471	0	0	0	0	0	0	0	0
2000	5553	821	0	4297	3818	0	0	0	0	0	0	0	0	0
2001	4213	770	0	5558	3574	0	0	0	0	0	0	0	0	0
2002	7206	1672	0	2484	3164	0	0	0	0	0	0	0	0	0
2003	4898	972	0	4610	3541	0	0	0	0	0	0	0	0	0
2004	6633	1158	0	4412	3558	0	0	0	0	0	0	0	0	0
2005	3767	909	0	3973	3062	0	0	0	0	0	0	0	0	0
2006	5366	1117	0	3032	3512	0	0	0	0	0	0	0	0	0
2007	3787	869	0	3419	2932	0	0	0	0	0	0	0	0	0
2008	7604	1171	0	3038	2971	0	0	0	0	0	0	0	0	0
2009	3444	1141	0	3338	2752	0	0	0	0	0	0	0	0	0
2010	4917	1057	0	3166	2362	0	0	0	0	0	0	0	0	0
2011	7298	1205	0	4295	3216	0	0	0	0	0	0	0	0	0
Winbugs labels	QCSportSm[]	QCFnSm[]	QCCmSm[]	QCSportLg[]	QCFnLg[]	QCCmLg[]	QCSm_L[]	QCSm_H[]	QCLg_L[]	QCLg_H[]	QCSSm_L[]	QCSSm_H[]	QCSLg_L[]	QCSLg_H[]

Annex 6.ix. Input data for 2SW salmon returns to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Returns of 2SW												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	8243	10576	42901	45798	31	60	4744	6836	5600	7447	8540	12674	0
1971	3587	4616	26038	30669	29	29	1891	2782	4120	5215	7155	10536	653
1972	4980	9756	29092	43510	402	402	4693	6024	5744	6993	7869	11368	1383
1973	6211	12009	26599	40492	206	206	4140	5481	6922	8659	4205	6036	1427
1974	7264	14570	39270	60090	386	386	5481	6928	13138	15363	10755	14988	1394
1975	4353	7922	25889	39325	345	345	3452	4340	12261	13797	13107	18578	2331
1976	7293	14416	20448	30758	575	578	2755	3674	8607	10104	14274	20281	1317
1977	9174	18077	49881	73330	606	606	3985	5463	10872	12851	16869	23995	1998
1978	5458	10749	19504	26041	0	0	4585	6265	8272	9779	8225	11294	4208
1979	1472	2535	6501	9306	459	463	1290	2014	3781	4879	5165	7207	1942
1980	7102	14045	35163	48457	2	5	3732	5177	14094	17318	19056	26865	5796
1981	4572	7357	11144	19268	40	77	2490	3769	8662	11471	11026	15267	5601
1982	4314	6313	21442	41643	16	31	4135	5901	4458	5353	9782	13871	6056
1983	3453	5280	16349	28419	17	32	3733	5241	4134	5356	9662	13836	2155
1984	3329	6092	12216	31455	13	26	2391	3573	1758	2854	15706	22627	3222
1985	4805	9500	14614	37625	8	15	921	4481	6894	12124	16541	23828	5529
1986	7831	15403	21617	55640	5	11	2274	11479	6755	11878	9891	14261	6176
1987	4836	9123	12524	32224	66	128	2611	8323	3748	6591	6922	10043	3081
1988	7152	13998	14384	36938	96	185	2533	8149	4393	7735	4716	6697	3286
1989	4390	8492	9113	23385	149	287	2108	6867	4808	8469	6560	9437	3197
1990	4326	8369	14269	36639	284	545	1893	6136	3591	6320	5486	7918	5051
1991	2387	4668	14685	37736	188	361	2350	7688	2960	5213	7337	10563	2647
1992	4002	7787	21381	30728	95	183	2374	7648	2633	4634	6878	9809	2459
1993	1395	2684	15579	60246	22	43	1341	4246	2542	4470	4345	4820	2231
1994	3960	7745	13652	24887	169	310	1981	6463	1360	2396	3084	3495	1346
1995	2713	5333	25593	37215	384	576	1498	4919	2253	3969	3439	3998	1748
1996	3917	7754	11126	19117	394	591	3247	10786	3000	5278	4729	5397	2407
1997	2488	4898	8545	14244	387	581	3421	11382	1163	2045	2769	3176	1611
1998	1687	3260	6029	11061	385	577	2055	6835	924	1270	1372	1642	1526
1999	1780	3425	6777	11217	383	575	1557	5267	1419	1951	2375	2640	1168
2000	2270	4410	7393	12041	378	566	1467	5032	1078	1483	988	1206	533
2001	3779	7442	14389	19296	376	564	1689	5790	1822	2506	1938	2279	788
2002	2335	4540	5318	9170	372	557	1228	4238	382	525	483	548	504
2003	3947	7778	10831	17389	371	557	2380	8151	1854	2548	1056	1198	1192
2004	3005	5886	10842	19681	367	550	2639	9101	1028	1413	1335	1605	1283
2005	3422	6725	10902	20018	373	560	2217	7421	662	906	809	1012	984
2006	2551	4973	9714	17659	392	587	2114	7195	1263	1734	922	1171	1023
2007	4267	8422	9404	16069	412	618	1463	5010	603	825	616	736	954
2008	2848	5572	5521	12092	429	644	2189	7686	1793	2465	812	1042	1764
2009	3948	7781	10834	17986	402	602	1378	5210	827	1135	1485	1886	2069
2010	2978	5831	8239	13449	439	658	2151	7680	934	1277	829	992	1078
2011	7265	14445	22251	61511	653	980	3618	12720	1508	2064	2486	3259	3045
Winbugs labels	SF15R2_L[]	SF15R2_H[]	SF16R2_L[]	SF16R2_H[]	SF17R2_L[]	SF17R2_H[]	SF18R2_L[]	SF18R2_H[]	SF19_21R2_L[]	SF19_21R2_H[]	SF23R2_L[]	SF23R2_H[]	USAR2[]

Annex 6.ix (continued). Input data for large salmon returns to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Returns of large salmon												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	12681	16270	46462	49599	31	60	6161	7858	7273	9671	9691	13945	0
1971	5518	7102	28365	33409	29	29	2456	3198	5350	6773	8056	11573	653
1972	8441	16536	30146	45087	402	402	6095	6924	7460	9082	8890	12536	1383
1973	8393	16229	27771	42276	206	206	5376	6299	8049	10069	4760	6638	1427
1974	9950	19959	43249	66179	386	386	7119	7963	13138	15363	12187	16444	1394
1975	5510	10028	29826	45305	345	345	4483	4989	12261	13797	14829	20351	2331
1976	9596	18969	23943	36016	575	578	3578	4223	8873	10416	16128	22175	1317
1977	11053	21779	52673	77434	606	606	5175	6280	14119	16690	19165	26183	1998
1978	7277	14332	22653	30245	0	0	5954	7201	10471	12378	9335	12342	4208
1979	2886	4971	9435	13507	459	463	1676	2315	5180	6684	5856	7903	1942
1980	8768	17340	37014	51008	2	5	4846	5951	16388	20137	21464	29480	5796
1981	9729	15652	16708	28887	40	77	3234	4332	11706	15501	12481	16743	5601
1982	7311	10700	26504	51475	16	31	5370	6783	9485	11390	11147	15303	6056
1983	5852	8950	20309	35304	17	32	4848	6024	6562	8501	10908	15235	2155
1984	4214	7711	12941	33321	13	26	3105	4107	2408	3909	17706	24992	3222
1985	7627	15080	16798	43247	8	15	1196	5150	8512	14968	18582	26289	5529
1986	10305	20267	25342	65228	5	11	2953	13195	10722	18854	11142	15761	6176
1987	7556	14255	15734	40483	66	128	3391	9566	5950	10462	7865	11116	3081
1988	9933	19441	17627	45267	96	185	3289	9366	7321	12891	5360	7312	3286
1989	7701	14898	13955	35812	149	287	2738	7894	6969	12275	7393	10380	3197
1990	6362	12307	23164	59479	284	545	2458	7053	6191	10897	6235	8710	5051
1991	4773	9335	24273	62373	188	361	3052	8837	4112	7240	8312	11659	2647
1992	7411	14420	34573	49686	95	183	3083	8790	3657	6437	7749	10726	2459
1993	3487	6711	22602	87407	22	43	1742	4881	3218	5658	5260	5980	2231
1994	6600	12908	18098	32992	169	310	2573	7429	1743	3071	3659	4155	1346
1995	4171	8199	30324	44094	384	576	1946	5654	2532	4460	3728	4289	1748
1996	6026	11929	16317	28035	394	591	4217	12398	3571	6283	5535	6365	2407
1997	3828	7535	14711	24521	387	581	4443	13083	1550	2726	3210	3678	1611
1998	2595	5015	14570	26731	385	577	2669	7856	1359	1867	2032	2437	1526
1999	2738	5269	13925	23049	383	575	2022	6054	1709	2350	2734	3090	1168
2000	3493	6785	15597	25404	378	566	1905	5784	1315	1809	1189	1430	533
2001	5815	11449	22287	29886	376	564	2194	6655	1980	2724	2113	2501	797
2002	3592	6985	10589	18259	372	557	1595	4871	749	1029	639	752	526
2003	6072	11966	18510	29716	371	557	3091	9369	1952	2682	1128	1289	1199
2004	4623	9055	19022	34528	367	550	3427	10461	1302	1789	1402	1698	1316
2005	5265	10346	16394	30102	373	560	2879	8530	860	1177	890	1121	994
2006	3924	7651	18680	33959	392	587	2746	8270	1559	2141	997	1276	1030
2007	6565	12957	15939	27235	412	618	1900	5759	701	959	689	841	958
2008	4382	8572	9859	21593	429	644	2843	8834	1928	2650	858	1105	1799
2009	6074	11970	17474	29010	402	602	1789	5989	1034	1418	1678	2158	2095
2010	4581	8972	16155	26371	439	658	2793	8827	1061	1451	1117	1398	1098
2011	11177	22223	26177	72366	653	980	4699	14621	1524	2085	2603	3426	3087
Winbugs labels	SF15Lg_L[]	SF15Lg_H[]	SF16Lg_L[]	SF16Lg_H[]	SF17Lg_L[]	SF17Lg_H[]	SF18Lg_L[]	SF18Lg_H[]	SF19_21Lg_L[]	SF19_21Lg_H[]	SF23Lg_L[]	SF23Lg_H[]	USALg[]

Annex 6.ix (continued). Input data for small salmon returns to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Returns of small salmon												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	2834	6279	47779	67697	0	0	264	1073	16177	24106	5306	7521	0
1971	2113	4681	38388	54120	0	0	65	265	11911	18004	3248	4541	32
1972	2185	4699	48886	69270	0	0	131	530	11587	17992	1831	2506	18
1973	3010	6668	47190	66835	5	9	516	2095	14169	22159	5474	7012	23
1974	2226	4895	78091	110470	0	0	187	757	25032	39058	10195	12901	55
1975	2393	5298	69993	98443	0	0	112	454	10860	15753	18022	23101	84
1976	8667	14696	96504	136107	14	28	299	1212	21071	33009	22835	28864	186
1977	6085	12084	30621	42689	0	0	215	871	24599	37314	13738	16671	75
1978	4350	7749	29783	39927	0	0	78	316	7621	10023	6271	7695	155
1979	4378	9495	50667	70714	2	5	1857	7536	24298	37514	15356	20517	250
1980	7994	15278	41687	58839	12	23	520	2108	34377	50250	25139	31483	818
1981	9380	17119	63278	108226	259	498	2797	11348	31204	48945	16826	21803	1130
1982	6541	13383	78072	133171	175	336	2150	8722	17619	27075	11811	15636	334
1983	2723	4638	24585	41332	17	32	212	858	9313	14068	9270	12592	295
1984	12003	15867	28714	49595	17	32	460	1867	18382	29867	15556	21678	598
1985	7003	15516	53393	92224	113	217	730	3167	24384	39541	13056	17928	392
1986	10813	23926	103230	178295	566	1088	965	3854	24369	39663	14274	20183	758
1987	9630	21220	74485	128644	1141	2194	1646	5713	27269	44266	13358	17662	1128
1988	13168	29092	107071	184904	1542	2963	1381	4833	24509	39750	16381	23084	992
1989	6357	13900	66069	114097	400	770	893	3208	25602	41557	17579	24521	1258
1990	7880	17314	73020	126115	1842	3539	983	3528	29471	48039	13820	19176	687
1991	4441	9828	53453	92327	1576	3028	1160	4166	9762	15955	13041	17685	310
1992	8853	19614	142416	204708	1873	3599	994	3531	13754	22269	13563	18404	1194
1993	5783	12812	70090	175096	1277	2454	1146	3892	13297	21681	7610	8828	466
1994	9136	20208	41773	59888	210	385	671	2425	3154	5393	5770	6610	436
1995	2902	6429	44357	63453	658	987	543	1985	8397	13873	8265	9458	213
1996	6034	13370	32067	45995	710	1065	2431	8958	13120	22293	12907	15256	651
1997	5797	12845	14377	24122	517	776	561	2134	3410	5863	4508	4979	365
1998	6288	13932	22250	33001	508	762	633	2419	8833	11927	9203	10801	403
1999	4936	10929	22210	30083	413	620	705	2681	3971	5337	5508	6366	419
2000	7459	16520	33220	44505	395	593	615	2428	6155	8312	4796	5453	270
2001	4947	10953	26758	36689	415	622	822	3205	2326	3138	2513	2862	266
2002	11719	25958	41297	55950	390	585	844	3319	5197	7015	3501	3991	450
2003	3119	6904	26940	39192	515	773	773	3088	2844	3837	2292	2716	237
2004	12091	26783	42947	62810	330	495	1092	4339	3847	5192	3454	4297	319
2005	4117	9116	27281	45006	343	514	781	3015	2870	3871	3597	4640	319
2006	8724	19322	28737	47600	331	497	869	3406	5144	6940	3720	4743	450
2007	4259	9430	22810	40364	275	413	718	2820	4198	5664	2466	3136	297
2008	13601	30129	25063	44630	298	447	1508	6890	7282	9831	5924	7691	814
2009	5169	11445	9527	19408	233	350	363	1889	2066	2788	1603	2027	241
2010	8187	18132	49545	75028	258	387	839	3490	3686	4975	9114	11994	525
2011	10234	22668	40671	67565	291	436	985	4038	3630	4893	4466	5943	1080
Winbugs labels	SF15Sm_L[]	SF15Sm_H[]	SF16Sm_L[]	SF16Sm_H[]	SF17Sm_L[]	SF17Sm_H[]	SF18Sm_L[]	SF18Sm_H[]	SF19_21Sm_L[]	SF19_21Sm_H[]	SF23Sm_L[]	SF23Sm_H[]	USASm[]

Annex 6.ix (continued). Input data for 2SW salmon spawners to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Spawners of 2SW												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	1156	3252	5346	8242	18	47	304	1587	2388	4234	1536	4846	0
1971	510	1434	6724	11354	0	0	133	694	1418	2513	3612	6576	490
1972	2367	6656	17031	31450	0	0	148	775	1616	2865	6472	9806	1038
1973	2873	8081	19277	33170	0	0	165	863	2246	3984	2752	4412	1100
1974	3620	10183	31192	52012	0	0	151	790	2878	5103	8123	12046	1147
1975	1769	4975	18536	31972	0	0	91	473	1987	3523	10987	16209	1942
1976	3530	9928	11842	22152	1	4	116	604	1935	3432	10071	15583	1126
1977	4412	12408	30623	54071	0	0	198	1033	2559	4539	12013	18568	643
1978	2622	7375	6998	13535	0	0	223	1166	1948	3455	5346	8076	3314
1979	527	1482	3000	5806	3	7	115	598	1419	2517	3772	5650	1509
1980	3440	9677	17667	30961	1	4	198	1033	4170	7394	12023	19005	4263
1981	1380	3880	2392	10515	36	73	196	1027	3631	6439	3642	7014	4334
1982	991	2786	8418	28619	8	23	253	1322	1158	2053	4475	7939	4643
1983	906	2547	5516	17586	15	30	210	1100	1579	2800	468	3561	1769
1984	2656	5402	11650	30889	13	26	259	1148	1416	2512	12280	18798	2547
1985	4514	9180	14019	37030	8	15	871	4359	6761	11990	11885	18624	4884
1986	7279	14804	20606	54630	5	11	2164	11213	6624	11748	7224	11280	5570
1987	4122	8383	11414	31114	66	128	2534	8136	3676	6519	5628	8597	2781
1988	6582	13386	13801	36355	96	185	2451	7949	4322	7664	3420	5248	3038
1989	3944	8021	8466	22739	149	287	2042	6705	4735	8396	6310	9158	2800
1990	3886	7903	13669	36039	284	545	1829	5982	3530	6260	4926	7292	4356
1991	2193	4460	14200	37251	188	361	2275	7505	2912	5165	6080	9158	2416
1992	3639	7400	20770	30116	95	183	2291	7446	2588	4589	5826	8633	2292
1993	1239	2521	15239	59907	22	43	1296	4136	2493	4421	3291	3654	2065
1994	3639	7401	13418	24653	166	307	1920	6314	1339	2375	2387	2680	1344
1995	2519	5124	25326	36949	380	576	1453	4809	2218	3934	3126	3652	1748
1996	3688	7502	10743	18662	388	591	3166	10590	2946	5224	4009	4585	2407
1997	2316	4710	8106	13754	385	581	3334	11170	1140	2022	2219	2565	1611
1998	1512	3076	5837	10823	382	577	2000	6700	915	1261	1068	1302	1526
1999	1581	3217	6271	10671	379	575	1523	5185	1409	1941	1934	2181	1168
2000	2057	4184	7096	11702	376	566	1438	4962	1072	1477	805	1004	1587
2001	3521	7161	13819	18681	374	564	1654	5704	1812	2497	1699	2008	1491
2002	2120	4312	5081	8898	371	557	1203	4176	378	521	317	356	511
2003	3683	7491	10434	16933	368	557	2333	8036	1834	2528	878	998	1192
2004	2770	5633	10388	19147	365	550	2581	8958	1017	1401	1238	1492	1283
2005	3175	6457	10350	19384	371	560	2162	7286	646	890	726	914	1088
2006	2329	4737	9271	17145	390	587	2062	7068	1248	1720	796	1023	1419
2007	3994	8124	8916	15522	409	618	1431	4931	587	809	530	633	1189
2008	2618	5325	5089	11601	429	644	2131	7546	1778	2450	736	953	2809
2009	3684	7494	10313	17401	401	602	1335	5107	811	1118	1391	1774	2292
2010	2743	5580	7766	12930	438	658	2100	7556	910	1253	726	877	1482
2011	6902	14038	21470	60378	652	980	3499	12431	1467	2023	2430	3196	3872
Winbugs labels	SF15S2_L[]	SF15S2_H[]	SF16S2_L[]	SF16S2_H[]	SF17S2_L[]	SF17S2_H[]	SF18S2_L[]	SF18S2_H[]	SF19_21S2_L[]	SF19_21S2_H[]	SF23S2_L[]	SF23S2_H[]	USAS2[]

Annex 6.ix (continued). Input data for large salmon spawners to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Spawners of large salmon												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	1779	5003	5790	8926	18	47	395	1824	3101	5499	1451	5705	0
1971	785	2207	7324	12369	0	0	173	797	1841	3264	3888	7405	490
1972	4011	11282	17648	32589	0	0	193	891	2099	3721	7246	10892	1038
1973	3883	10920	20126	34632	0	0	215	992	2612	4632	3050	4928	1100
1974	4960	13949	34352	57282	0	0	196	908	2878	5103	9090	13347	1147
1975	2239	6297	21355	36834	0	0	118	544	1987	3523	12335	17857	1942
1976	4644	13063	13867	25940	1	4	151	694	1995	3538	11183	17230	1126
1977	5315	14949	32337	57097	0	0	257	1187	3324	5895	13452	20470	643
1978	3496	9833	8128	15720	0	0	290	1340	2466	4373	5948	8955	3314
1979	1033	2906	4355	8426	3	7	149	688	1944	3448	4217	6264	1509
1980	4248	11947	18597	32590	1	4	257	1187	4849	8598	13190	21206	4263
1981	2935	8256	3586	15765	36	73	255	1181	4907	8702	3794	8056	4334
1982	1679	4723	10405	35376	8	23	329	1519	2464	4369	4903	9059	4643
1983	1535	4317	6852	21846	15	30	273	1264	2506	4445	92	4419	1769
1984	3362	6838	12341	32721	13	26	337	1320	1940	3441	13675	20961	2547
1985	7164	14571	16114	42563	8	15	1131	5010	8347	14803	13104	20811	4884
1986	9577	19479	24157	64044	5	11	2811	12889	10515	18647	8004	12623	5570
1987	6441	13099	14340	39088	66	128	3291	9352	5835	10347	6343	9594	2781
1988	9141	18592	16913	44553	96	185	3183	9137	7203	12773	3835	5787	3038
1989	6919	14072	12965	34822	149	287	2652	7707	6862	12168	7099	10086	2800
1990	5715	11623	22190	58504	284	545	2376	6876	6087	10793	5576	8051	4356
1991	4386	8920	23472	61572	188	361	2955	8627	4045	7173	6833	10180	2416
1992	6738	13704	33583	48697	95	183	2976	8558	3594	6374	6511	9488	2292
1993	3099	6302	22109	86914	22	43	1683	4754	3156	5596	4026	4746	2065
1994	6065	12334	17787	32682	166	307	2493	7257	1717	3045	2827	3273	1344
1995	3873	7877	30007	43778	380	576	1887	5528	2492	4420	3362	3923	1748
1996	5674	11541	15755	27367	388	591	4112	12173	3507	6219	4688	5497	2407
1997	3563	7247	13955	23677	385	581	4330	12839	1520	2696	2565	3028	1611
1998	2326	4732	14106	26158	382	577	2597	7701	1346	1854	1675	2074	1526
1999	2433	4948	12885	21927	379	575	1979	5960	1697	2338	2251	2601	1168
2000	3165	6437	14971	24689	376	566	1867	5703	1307	1801	975	1216	1587
2001	5417	11018	21404	28935	374	564	2148	6556	1970	2714	1831	2210	1491
2002	3261	6633	10117	17718	371	557	1562	4800	741	1021	442	542	511
2003	5666	11525	17831	28936	368	557	3029	9237	1931	2661	919	1074	1192
2004	4261	8666	18225	33591	365	550	3351	10297	1287	1774	1287	1574	1283
2005	4884	9934	15563	29149	371	560	2807	8374	839	1156	791	1012	1088
2006	3583	7288	17830	32971	390	587	2678	8124	1541	2123	847	1113	1419
2007	6145	12498	15113	26308	409	618	1858	5668	683	941	586	726	1189
2008	4028	8192	9088	20716	429	644	2768	8673	1912	2634	767	1007	2231
2009	5668	11529	16635	28067	401	602	1734	5870	1014	1398	1565	2034	2318
2010	4221	8584	15228	25352	438	658	2727	8685	1034	1424	996	1275	1502
2011	10619	21597	25259	71032	652	980	4544	14288	1482	2043	2537	3358	3914
Winbugs labels	SF15SLg_L[]	SF15SLg_H[]	SF16SLg_L[]	SF16SLg_H[]	SF17SLg_L[]	SF17SLg_H[]	SF18SLg_L[]	SF18SLg_H[]	SF19_21SLg_L[]	SF19_21SLg_H[]	SF23SLg_L[]	SF23SLg_H[]	USASLg[]

Annex 6.ix (continued). Input data for small salmon spawners to Salmon Fishing Areas 15 to 23 for Canada and for USA used in the run reconstruction.

Year of return to rivers	Spawners of small salmon												
	SFA 15		SFA 16		SFA 17		SFA 18		SFA 19-21		SFA 23		USA
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Point estimate
1970	1417	4396	25958	45876	0	0	167	842	9429	17358	3886	6101	0
1971	1056	3277	22463	38195	0	0	41	208	7246	13339	1216	2509	29
1972	1034	3208	27639	48023	0	0	82	416	7616	14021	0	1	17
1973	1505	4668	31703	51349	3	7	325	1645	9502	17492	4037	5575	13
1974	1098	3405	57376	89755	0	0	118	595	16680	30706	8071	10777	40
1975	1195	3707	50438	78888	0	0	71	357	5819	10712	15363	20442	67
1976	2480	7692	64526	104130	8	22	188	951	14196	26134	17572	23601	151
1977	2467	7653	13270	25338	0	0	135	684	15120	27835	9196	12129	54
1978	1398	4337	14689	24833	0	0	49	248	2857	5259	4256	5680	127
1979	2104	6528	31829	51876	1	4	1170	5915	15716	28932	11640	16801	247
1980	2996	9293	27791	44943	7	18	327	1655	18876	34749	19597	25941	722
1981	3183	9874	35423	80370	151	390	1762	8908	21096	38837	7805	12782	1009
1982	3038	9027	51324	106423	102	263	1354	6847	11244	20700	6532	10357	290
1983	820	2486	13298	30045	10	25	133	674	5653	10408	5132	8454	255
1984	1620	4971	7389	28271	10	25	177	1200	13658	25143	10290	16412	540
1985	3557	10936	32275	71106	66	170	145	1788	18024	33181	8164	13036	363
1986	5589	16990	71918	146983	330	852	63	1729	18187	33481	10725	16634	660
1987	4867	14920	49971	104131	665	1718	527	3075	20213	37210	10257	14561	1087
1988	6664	20468	71967	149800	899	2320	344	2388	18125	33366	13061	19764	923
1989	3191	9741	37696	85724	233	603	232	1650	18973	34928	13124	20066	1080
1990	3996	12190	46902	99996	1074	2771	229	1750	22080	40648	10025	15381	617
1991	2215	6872	39648	78522	919	2371	271	2068	7363	13556	9495	14139	235
1992	4426	13728	116657	178949	1092	2818	189	1634	10125	18640	9485	14326	1124
1993	2891	8968	52050	157056	745	1922	261	1805	9970	18354	5762	6868	444
1994	4554	14125	25649	43764	118	292	179	1266	2661	4900	4965	5738	427
1995	1451	4501	34650	53746	250	375	148	1055	6512	11988	8025	9218	213
1996	3017	9359	19511	29260	258	387	1005	5596	10909	20082	11576	13892	651
1997	2899	8991	8702	15524	256	384	203	1290	2917	5370	3971	4433	365
1998	3144	9752	14196	21721	255	382	228	1464	8818	11912	8775	10348	403
1999	2465	7646	12695	18206	253	380	347	1837	3895	5261	5196	6048	419
2000	3727	11560	19745	27645	252	378	314	1717	6148	8305	4455	5087	270
2001	2470	7663	15886	22838	250	376	403	2217	2315	3127	2210	2530	266
2002	5857	18166	26064	36321	249	373	426	2334	5180	6998	3232	3689	450
2003	1557	4829	16014	24590	248	371	396	2201	2829	3822	2069	2469	237
2004	6043	18744	27218	41123	246	369	496	2934	3833	5178	3229	4039	319
2005	2056	6377	16253	28660	246	368	300	1881	2854	3855	3433	4450	319
2006	4359	13522	18410	31613	247	370	358	2201	5119	6915	3528	4501	450
2007	2127	6597	14261	26548	248	372	326	1894	4176	5642	2305	2937	297
2008	6798	21086	15837	29535	249	373	726	5048	7252	9801	5729	7467	814
2009	2581	8007	4962	11879	233	350	166	1425	2051	2773	1472	1864	241
2010	4090	12688	31502	49340	256	384	349	2334	3674	4963	9032	11901	525
2011	5114	15864	26076	44902	290	435	196	2176	3601	4864	4391	5867	1080
Winbugs labels	SF15SSm_L[]	SF15SSm_H[]	SF16SSm_L[]	SF16SSm_H[]	SF17SSm_L[]	SF17SSm_H[]	SF18SSm_L[]	SF18SSm_H[]	SF19_21SSm_L[]	SF19_21SSm_H[]	SF23SSm_L[]	SF23SSm_H[]	USASSm[]

Annex 6.x. Estimated SMALL salmon returns for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	49,290	32,900	75,640	135,600	117,600	153,500	23,630	19,140	28,120	62,960	53,100	72,810	26,580	22,420	30,700				299,000	268,650	333,600
1971	64,490	43,070	99,040	118,800	103,000	134,400	18,700	15,160	22,260	49,860	42,090	57,550	18,860	15,780	21,930	32	32	32	271,500	240,350	310,900
1972	48,600	32,510	74,610	110,600	95,340	125,700	15,590	12,620	18,550	62,820	52,980	72,700	16,960	13,880	20,030	18	18	18	255,450	227,500	288,050
1973	13,920	8,945	20,890	159,800	138,800	180,600	20,740	16,790	24,670	63,190	53,360	72,960	24,410	20,440	28,390	23	23	23	282,300	256,750	307,900
1974	53,840	36,030	82,760	120,600	104,400	136,600	20,970	17,000	24,970	98,300	82,830	113,800	43,620	36,620	50,570	55	54	56	338,700	304,150	377,150
1975	103,100	68,900	159,000	151,000	130,000	172,100	22,630	18,300	26,880	88,400	74,720	102,000	33,870	29,990	37,730	84	83	85	400,200	352,250	462,600
1976	73,420	49,270	113,300	158,500	135,800	181,400	24,930	20,200	29,690	128,800	109,500	148,100	52,880	45,800	59,960	186	184	188	440,550	395,150	492,250
1977	65,690	43,930	100,900	159,600	136,800	182,400	22,780	18,420	27,050	46,310	39,140	53,460	46,170	39,690	52,640	75	74	76	341,800	304,850	385,150
1978	32,770	21,960	50,000	139,400	119,100	159,800	21,230	17,190	25,250	41,100	35,650	46,570	15,810	14,310	17,300	155	154	157	251,450	225,100	279,150
1979	42,370	28,210	65,600	151,900	130,100	173,800	27,100	21,950	32,240	72,290	61,300	83,330	48,820	41,490	56,160	250	248	252	344,100	311,100	379,350
1980	96,100	63,630	149,000	172,400	149,200	195,700	37,250	30,170	44,300	63,240	53,500	73,020	70,600	61,770	79,470	818	810	826	441,700	394,250	502,000
1981	105,600	69,700	164,800	225,500	193,300	257,800	52,130	42,200	61,970	106,500	83,410	129,400	59,390	50,110	68,630	1,130	1,119	1,141	552,450	489,650	625,900
1982	73,410	48,550	113,900	200,700	173,400	228,100	29,640	23,990	35,260	121,300	94,200	148,400	36,060	30,790	41,380	334	331	337	463,350	409,900	521,600
1983	46,010	30,520	70,990	156,700	134,800	178,700	22,480	18,220	26,760	37,180	29,110	45,280	22,610	19,480	25,780	295	292	298	286,400	254,550	321,500
1984	24,130	16,160	37,030	206,200	175,200	237,300	26,240	23,590	28,860	54,280	43,840	64,710	42,750	35,850	49,670	598	592	604	355,050	318,900	391,550
1985	43,240	28,780	66,940	195,400	164,100	226,900	28,020	25,160	30,860	86,180	66,520	105,900	47,410	39,360	55,520	392	388	396	402,100	357,050	448,500
1986	65,430	43,350	101,500	200,200	170,600	229,800	40,340	36,870	43,860	161,500	124,400	198,600	49,260	40,730	57,720	758	751	765	519,650	459,350	582,750
1987	82,190	54,250	127,900	135,500	115,500	155,500	45,930	41,550	50,310	122,200	94,850	149,700	51,250	42,530	60,020	1,128	1,117	1,139	440,150	388,250	499,550
1988	75,610	49,860	117,900	217,300	185,600	249,200	53,050	48,290	57,840	172,500	133,500	211,400	51,870	43,150	60,570	992	983	1,001	573,700	508,750	642,500
1989	51,800	34,380	80,420	107,600	92,510	122,600	41,500	37,780	45,200	102,900	79,210	126,400	54,620	45,510	63,720	1,258	1,246	1,270	361,200	321,400	404,200
1990	30,300	20,090	47,050	152,300	135,700	168,800	47,390	43,460	51,280	117,300	90,770	143,400	55,230	45,480	64,970	687	681	694	404,100	365,700	442,900
1991	24,280	15,910	38,070	105,700	94,770	116,400	37,120	34,130	40,120	85,000	66,000	104,000	28,230	23,980	32,490	310	307	313	281,400	254,550	309,250
1992	34,320	23,310	53,100	229,100	195,200	263,000	42,010	38,440	45,540	192,800	162,100	223,600	34,000	28,760	39,230	1,194	1,183	1,205	534,600	483,250	586,900
1993	45,750	32,080	69,560	265,700	230,300	301,200	36,410	33,490	39,320	136,500	86,320	186,200	25,720	21,610	29,800	466	462	470	512,100	442,900	581,750
1994	33,930	24,310	50,320	161,000	135,100	187,000	34,920	32,160	37,660	67,350	55,860	78,780	10,470	9,232	11,690	436	432	440	309,250	277,350	342,150
1995	47,840	34,660	69,650	204,000	168,400	239,600	28,110	25,910	30,320	60,690	51,140	70,170	20,010	17,230	22,750	213	211	215	362,200	320,700	405,000
1996	89,770	65,490	132,300	313,500	261,900	365,200	37,270	34,420	40,140	55,330	46,050	64,530	31,810	27,070	36,500	651	645	657	530,950	468,500	597,850
1997	95,340	71,780	135,100	177,000	156,100	198,000	28,860	26,450	31,280	30,600	23,970	37,140	9,380	8,159	10,600	365	362	369	342,550	307,100	388,150
1998	151,300	100,000	202,500	183,800	169,400	198,100	29,400	26,530	32,270	39,890	32,680	47,120	20,380	18,530	22,240	403	399	407	425,250	369,500	480,850
1999	147,600	97,510	197,200	201,300	183,500	219,100	31,270	28,390	34,180	36,280	30,780	41,780	10,590	9,723	11,460	419	415	423	427,450	371,200	483,300
2000	181,900	120,400	243,300	228,800	214,700	242,800	29,030	25,660	32,440	52,870	44,890	60,830	12,350	11,220	13,500	270	267	273	505,250	439,900	570,500
2001	145,200	96,230	194,600	156,300	146,800	165,800	20,140	18,160	22,130	42,190	35,820	48,610	5,422	4,958	5,880	266	264	269	369,550	318,150	421,250
2002	102,800	64,350	140,900	155,600	141,200	169,900	32,570	29,940	35,210	70,030	58,740	81,320	9,854	8,911	10,800	450	446	454	371,050	326,300	416,150
2003	85,460	50,090	121,000	242,500	231,400	253,500	26,670	24,300	29,030	40,630	33,990	47,280	5,844	5,278	6,408	237	235	239	401,450	361,900	441,000
2004	95,020	71,100	119,000	210,200	189,200	231,000	36,010	32,030	39,960	75,410	61,890	89,000	8,396	7,540	9,253	319	316	322	425,350	387,800	463,000
2005	220,800	163,100	278,400	221,400	169,400	273,400	24,260	21,780	26,750	45,110	35,710	54,470	7,489	6,695	8,281	319	316	322	519,150	434,550	603,900
2006	213,700	136,300	290,700	212,800	191,200	234,400	29,750	27,220	32,280	54,680	43,040	66,410	10,270	9,172	11,380	450	446	454	521,550	437,750	605,150
2007	194,400	135,000	254,200	183,500	154,600	212,700	22,610	20,340	24,890	40,590	31,280	49,880	7,731	6,888	8,574	297	294	300	449,250	378,300	520,350
2008	203,700	146,000	261,700	247,800	218,300	277,100	37,570	34,160	41,000	61,240	46,910	75,640	15,360	13,680	17,050	814	806	822	566,500	495,400	637,650
2009	89,480	40,580	138,400	222,500	190,200	254,900	22,230	20,080	24,350	24,190	17,850	30,590	4,240	3,793	4,688	241	239	243	362,900	298,700	427,450
2010	91,660	57,690	125,800	267,700	254,400	281,100	28,090	25,410	30,730	77,860	63,690	92,180	14,870	13,220	16,540	525	520	530	480,800	438,300	523,450
2011	271,200	88,330	456,800	267,400	247,700	287,000	38,360	35,100	41,630	73,390	57,810	89,130	9,468	8,407	10,530	1,080	1,070	1,090	661,400	475,250	849,450

Annex 6.xi. Estimated SMALL salmon spawners for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	45,120	28,820	71,670	105,100	87,300	123,000	13,810	11,180	16,430	39,350	29,600	49,070	18,380	14,260	22,530						
1971	60,520	39,120	94,980	92,110	76,400	107,700	11,670	9,460	13,890	32,620	24,980	40,260	12,140	9,093	15,220	29	29	29	209,900	178,800	249,200
1972	45,620	29,550	71,560	86,100	70,980	101,200	10,280	8,316	12,220	40,190	30,440	50,000	10,820	7,781	13,860	17	17	17	194,000	166,300	226,500
1973	6,470	1,443	13,430	124,300	103,500	145,400	13,730	11,120	16,350	45,620	35,940	55,270	18,290	14,320	22,270	13	13	13	208,800	183,600	234,000
1974	51,470	33,560	80,210	94,070	78,060	110,000	12,590	10,200	14,980	76,200	60,760	91,620	33,110	26,110	40,130	40	40	40	268,700	234,500	306,900
1975	99,200	65,000	155,100	117,600	96,540	138,700	14,510	11,750	17,270	67,290	53,720	80,900	26,170	22,270	30,040	67	66	68	326,000	278,500	388,000
1976	67,970	43,560	107,400	124,100	101,000	147,100	16,210	13,140	19,300	89,990	70,780	109,200	40,730	33,650	47,830	151	150	152	340,900	295,700	392,200
1977	61,020	39,280	96,270	125,300	102,400	148,100	15,010	12,150	17,860	24,780	17,870	31,620	32,130	25,670	38,610	54	53	55	259,600	222,600	302,700
1978	30,190	19,280	47,320	110,700	90,440	131,200	14,330	11,590	17,030	22,780	17,460	28,090	9,026	7,521	10,520	127	126	128	188,100	162,100	215,700
1979	38,340	24,030	61,400	120,800	98,920	142,800	19,830	16,060	23,600	49,700	39,080	60,370	36,560	29,190	43,860	247	245	249	266,500	234,000	301,900
1980	92,290	59,980	145,400	136,600	113,300	159,800	26,060	21,070	30,970	43,490	34,090	52,930	49,630	40,720	58,480	722	715	729	349,900	303,200	409,800
1981	100,300	64,470	159,400	178,800	146,500	211,300	38,700	31,330	46,030	69,970	47,450	92,580	40,210	31,010	49,500	1,009	999	1,019	431,300	368,700	504,700
1982	69,120	44,560	109,700	158,800	131,600	186,100	21,090	17,080	25,110	89,160	62,330	116,000	24,420	19,120	29,720	290	287	293	365,000	312,000	423,000
1983	41,500	26,180	66,640	124,300	102,400	146,200	15,030	12,180	17,900	23,740	15,700	31,780	14,820	11,670	17,980	255	253	257	220,800	189,100	255,800
1984	21,220	13,200	34,180	167,000	136,000	197,900	20,380	17,750	23,010	21,810	11,550	32,120	32,750	25,820	39,680	540	535	545	264,500	228,400	300,900
1985	40,050	25,670	63,800	158,900	127,800	190,200	20,110	17,270	22,940	60,050	40,680	79,280	36,220	28,130	44,280	363	360	367	317,200	272,000	363,500
1986	62,030	39,980	98,100	162,800	133,200	192,300	27,710	24,280	31,130	122,100	85,450	158,900	39,480	31,060	47,980	660	654	666	416,900	356,700	479,500
1987	76,530	48,880	122,500	111,000	90,940	131,100	32,790	28,410	37,140	89,850	63,000	116,900	41,110	32,390	49,870	1,087	1,077	1,097	354,500	303,100	413,700
1988	70,190	44,450	112,300	177,400	145,700	209,300	36,370	31,640	41,100	127,300	88,940	165,900	42,130	33,440	50,880	923	914	932	456,800	391,600	525,600
1989	47,060	29,710	75,750	89,130	74,100	104,300	30,710	27,010	34,390	69,580	46,240	92,910	43,540	34,460	52,690	1,080	1,070	1,090	282,800	242,700	325,900
1990	26,970	16,730	43,690	122,400	105,800	139,000	32,800	28,980	36,630	84,490	58,430	110,500	44,060	34,350	53,790	617	611	623	312,400	274,200	351,100
1991	21,930	13,590	35,710	85,050	74,230	95,840	25,230	22,280	28,160	66,430	47,620	85,320	22,280	18,060	26,510	235	233	237	222,100	195,100	249,600
1992	31,580	20,520	50,440	205,300	171,200	239,200	27,370	23,860	30,850	159,800	129,300	190,100	26,290	21,070	31,570	1,124	1,113	1,135	452,700	401,200	505,200
1993	43,110	29,370	66,810	239,200	204,000	274,600	21,990	19,160	24,860	112,800	62,840	162,800	20,480	16,420	24,540	444	440	448	439,600	370,900	509,300
1994	30,980	21,390	47,390	129,800	103,800	155,700	20,730	18,060	23,400	44,960	34,110	55,900	9,134	7,918	10,340	427	423	431	237,100	205,400	269,600
1995	45,040	31,760	66,860	171,100	135,500	206,800	17,700	15,570	19,860	48,110	38,730	57,470	17,880	15,110	20,640	213	211	215	301,300	259,800	344,400
1996	86,980	62,650	129,400	274,800	223,400	326,200	23,180	20,410	25,950	34,190	27,340	41,050	28,270	23,520	32,960	651	645	657	450,600	388,600	517,200
1997	92,510	69,120	132,400	151,800	130,800	172,800	17,970	15,630	20,330	19,130	14,070	24,170	8,339	7,127	9,566	365	362	369	291,400	256,100	336,600
1998	148,900	97,640	199,900	158,400	144,000	172,700	21,190	18,350	24,050	25,570	20,070	31,100	19,920	18,100	21,770	403	399	407	374,300	318,900	429,700
1999	144,900	94,950	194,800	176,400	158,500	194,300	23,740	20,870	26,610	21,910	17,690	26,150	10,200	9,332	11,070	419	415	423	377,600	321,400	433,400
2000	178,700	116,900	240,200	204,700	190,700	218,800	21,060	17,700	24,420	32,700	26,510	38,860	11,990	10,860	13,130	270	267	273	449,500	384,200	514,400
2001	142,700	93,700	192,200	133,500	124,000	143,000	13,670	11,900	15,430	26,040	21,190	30,890	5,089	4,637	5,542	266	264	269	321,300	270,100	372,800
2002	99,760	61,700	138,400	132,900	118,600	147,300	21,360	18,800	23,900	44,910	36,080	53,750	9,548	8,615	10,490	450	446	454	309,000	265,100	353,300
2003	83,010	47,530	118,400	219,600	208,500	230,700	19,320	16,980	21,660	25,090	20,250	29,960	5,593	5,037	6,151	237	235	239	352,800	313,800	391,800
2004	92,680	68,660	116,600	188,500	167,600	209,300	26,310	22,350	30,250	48,580	38,200	59,010	8,143	7,298	8,986	319	316	322	364,500	328,200	400,900
2005	217,300	160,300	275,700	197,100	144,700	248,900	18,280	15,810	20,750	28,070	21,300	34,840	7,295	6,510	8,079	319	316	322	468,600	383,800	552,900
2006	211,400	134,100	288,300	190,900	169,300	212,700	21,610	19,110	24,090	35,550	26,730	44,330	10,030	8,945	11,120	450	446	454	469,700	386,700	553,100
2007	192,100	132,900	251,900	167,800	138,600	196,700	16,710	14,470	18,960	26,160	19,440	32,940	7,530	6,697	8,365	297	294	300	410,600	340,300	481,700
2008	201,200	143,400	259,100	217,600	188,100	247,100	26,700	23,330	30,050	39,840	28,720	51,020	15,130	13,450	16,790	814	806	822	501,400	430,900	571,600
2009	87,740	38,910	136,700	197,200	164,800	229,600	16,220	14,120	18,320	14,820	9,949	19,620	4,080	3,642	4,518	241	239	243	320,400	256,500	384,400
2010	89,780	55,830	123,900	235,200	221,900	248,600	20,510	17,900	23,120	50,470	39,920	60,990	14,790	13,140	16,440	525	520	530	411,300	370,800	452,200
2011	270,100	86,370	454,800	237,800	218,000	257,300	27,780	24,570	31,000	47,490	35,880	59,220	9,365	8,298	10,420	1,080	1,070	1,090	593,600	407,200	780,300

Annex 6.xii. Estimated LARGE salmon returns for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	10,120	4,651	17,930	14,880	11,300	18,440	103,300	83,710	123,000	69,560	66,770	72,340	20,290	17,680	22,910				218,500	195,800	241,500
1971	14,320	6,591	25,520	12,560	9,573	15,550	59,180	47,970	70,430	40,050	37,330	42,780	15,870	13,900	17,840	653	647	659	143,100	126,300	160,900
1972	12,410	5,675	21,940	12,660	9,673	15,660	77,320	62,550	91,870	57,020	47,930	66,100	18,980	16,890	21,070	1,383	1,370	1,396	180,100	158,700	201,800
1973	17,380	7,923	30,720	17,330	13,150	21,510	85,250	69,050	101,400	53,410	44,570	62,200	14,760	13,240	16,270	1,427	1,413	1,441	190,000	165,700	215,100
1974	17,030	7,799	30,290	14,270	12,420	16,100	114,300	92,620	136,000	77,530	64,520	90,700	28,570	26,020	31,120	1,394	1,381	1,407	253,600	222,800	284,800
1975	15,890	7,275	28,200	18,400	15,730	21,070	97,150	78,670	115,500	50,410	42,280	58,530	30,620	27,740	33,490	2,331	2,309	2,353	215,300	189,700	241,300
1976	18,290	8,369	32,390	16,640	14,280	19,000	96,580	78,190	114,900	48,720	40,360	57,120	28,820	25,690	31,910	1,317	1,304	1,330	210,900	184,800	237,700
1977	16,270	7,443	28,750	14,600	12,680	16,520	113,800	92,140	135,400	87,780	73,610	101,900	38,060	34,220	41,910	1,998	1,979	2,017	273,000	241,800	304,700
1978	12,750	5,843	22,520	11,340	10,190	12,490	102,400	82,960	121,900	43,830	38,110	49,540	22,260	20,350	24,180	4,208	4,168	4,248	197,200	173,500	221,200
1979	7,254	3,324	12,860	7,196	6,151	8,240	56,490	45,770	67,210	17,860	15,400	20,320	12,810	11,420	14,200	1,942	1,924	1,960	103,800	90,710	117,100
1980	17,390	7,937	30,840	12,050	10,950	13,150	134,300	108,800	159,900	62,480	53,620	71,310	43,760	39,080	48,400	5,796	5,741	5,851	276,300	244,000	309,100
1981	15,630	7,155	27,670	28,870	24,760	32,970	105,500	85,480	125,600	39,340	32,160	46,500	28,210	25,080	31,350	5,601	5,548	5,654	223,600	197,300	250,600
1982	11,550	5,280	20,550	11,600	9,923	13,280	93,630	75,820	111,400	54,090	41,930	66,250	23,650	21,250	26,070	6,056	5,998	6,113	201,000	174,700	227,300
1983	8,387	3,844	14,810	12,450	11,090	13,820	76,850	62,230	91,480	40,670	33,070	48,230	20,600	18,110	23,080	2,155	2,135	2,175	161,400	141,800	180,900
1984	6,020	2,755	10,630	12,390	8,612	16,140	71,120	67,060	75,180	32,730	22,650	42,800	24,510	20,850	28,160	3,222	3,191	3,253	150,200	136,500	164,000
1985	4,747	2,169	8,362	10,940	7,169	14,700	73,560	68,560	78,550	44,500	30,530	58,550	34,170	28,670	39,680	5,529	5,476	5,582	173,600	156,300	191,100
1986	8,152	3,728	14,450	12,300	8,994	15,610	87,460	82,020	92,950	68,710	46,980	90,200	28,220	23,220	33,250	6,176	6,117	6,235	211,200	186,800	235,800
1987	11,020	5,035	19,500	8,445	6,128	10,750	82,920	77,890	87,920	45,630	32,110	59,070	17,710	14,680	20,730	3,081	3,052	3,110	169,200	151,600	186,900
1988	6,886	3,155	12,240	12,970	9,363	16,600	90,590	84,570	96,540	52,550	37,130	68,020	16,440	13,410	19,470	3,286	3,255	3,317	183,000	164,400	201,600
1989	6,638	3,051	11,750	6,910	5,121	8,725	81,330	76,480	86,170	41,710	29,570	53,900	18,510	15,250	21,760	3,197	3,167	3,227	158,500	143,600	173,600
1990	3,815	1,749	6,788	10,280	8,016	12,530	79,880	74,470	85,310	55,910	37,740	73,910	16,020	13,180	18,850	5,051	5,003	5,099	171,100	150,800	191,300
1991	1,880	860	3,314	7,572	5,922	9,222	73,670	68,830	78,490	56,700	37,750	75,510	15,650	13,140	18,170	2,647	2,622	2,672	158,100	137,700	178,600
1992	7,541	3,732	13,380	31,540	20,610	42,530	74,110	69,090	79,130	59,120	49,720	68,540	14,290	12,050	16,520	2,459	2,436	2,482	189,400	172,600	206,400
1993	9,437	5,625	15,850	17,100	13,220	20,980	57,190	54,420	59,970	63,260	32,580	94,270	10,060	8,768	11,340	2,231	2,210	2,252	159,700	127,400	192,300
1994	12,940	8,060	21,320	17,360	13,230	21,500	58,140	55,350	60,900	40,540	31,610	49,460	6,314	5,581	7,045	1,346	1,333	1,359	137,200	124,600	150,400
1995	25,480	17,320	39,250	19,050	13,940	24,110	67,080	64,010	70,190	47,710	40,070	55,290	7,502	6,491	8,519	1,748	1,731	1,765	169,100	154,900	185,900
1996	18,780	12,770	29,040	28,910	22,860	34,980	61,150	57,850	64,400	39,990	31,520	48,460	10,890	9,442	12,320	2,407	2,384	2,430	162,600	149,000	177,500
1997	16,220	11,140	24,770	27,980	22,040	33,950	50,320	47,650	52,970	34,520	27,070	42,010	5,585	4,926	6,239	1,611	1,596	1,626	136,700	124,600	149,700
1998	13,420	7,678	19,180	35,290	26,220	44,320	38,490	35,970	41,000	30,220	23,160	37,240	3,847	3,492	4,203	1,526	1,511	1,540	122,800	108,800	136,800
1999	16,120	9,193	22,960	32,060	23,890	40,320	40,490	37,730	43,250	27,010	21,590	32,420	4,942	4,549	5,333	1,168	1,157	1,179	121,800	108,500	135,200
2000	21,950	12,550	31,350	27,000	22,270	31,740	38,890	35,430	42,350	29,950	24,120	35,780	2,873	2,582	3,161	533	528	538	121,200	107,600	134,800
2001	23,150	13,270	33,150	17,850	14,720	21,010	40,700	37,210	44,240	39,610	33,820	45,410	4,660	4,214	5,105	797	789	805	126,800	113,400	140,200
2002	16,920	9,455	24,370	16,810	13,180	20,440	29,180	26,440	31,950	23,410	18,600	28,250	1,585	1,427	1,742	526	521	531	88,450	77,570	99,350
2003	14,160	7,036	21,310	24,440	18,630	30,300	45,440	41,560	49,280	39,820	32,080	47,590	3,526	3,157	3,894	1,199	1,188	1,210	128,600	115,100	142,300
2004	17,010	11,270	22,790	22,190	16,110	28,230	39,660	36,580	42,700	41,040	31,680	50,340	3,096	2,791	3,402	1,316	1,303	1,329	124,300	110,500	138,000
2005	20,970	11,650	30,320	28,390	19,230	37,530	38,290	35,530	41,060	37,230	28,900	45,500	2,024	1,810	2,237	994	985	1,003	127,900	110,800	145,000
2006	21,120	12,860	29,350	35,690	28,990	42,400	35,850	33,170	38,520	38,080	29,460	46,740	2,988	2,646	3,326	1,030	1,020	1,040	134,700	119,500	150,000
2007	21,860	12,400	31,400	29,630	22,420	36,780	32,740	30,190	35,310	35,710	28,380	42,980	1,595	1,434	1,756	958	949	967	122,500	107,200	137,900
2008	26,250	15,290	37,090	28,860	21,600	36,140	38,680	34,980	42,380	28,600	21,110	36,010	3,273	2,879	3,662	1,799	1,782	1,816	127,500	110,500	144,300
2009	39,350	19,690	59,070	34,450	22,390	46,440	37,640	34,740	40,520	36,630	29,290	43,980	3,144	2,808	3,483	2,095	2,075	2,115	153,200	126,700	179,800
2010	13,770	7,811	19,790	35,310	27,680	43,030	40,060	37,080	43,050	34,370	27,510	41,280	2,515	2,252	2,774	1,098	1,088	1,108	127,200	114,100	140,400
2011	43,740	10,760	76,970	41,400	30,740	52,060	51,150	47,570	54,770	76,350	52,050	100,900	4,820	4,279	5,360	3,087	3,058	3,116	220,600	173,300	268,200

Annex 6.xiii. Estimated LARGE salmon spawners for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	9,551	4,068	17,380	12,710	9,161	16,260	39,130	31,690	46,550	11,890	9,288	14,490	7,880	5,269	10,490						
1971	13,920	6,093	25,040	10,970	7,999	13,970	20,250	16,390	24,090	11,840	9,161	14,490	8,202	6,230	10,170	490	485	495	65,820	54,710	78,850
1972	11,950	5,253	21,540	11,280	8,310	14,270	39,660	32,120	47,190	33,280	24,530	42,090	11,970	9,884	14,070	1,038	1,028	1,048	109,500	93,630	126,000
1973	16,340	6,913	29,620	15,420	11,220	19,550	40,320	32,690	48,010	35,410	26,830	43,910	7,612	6,096	9,126	1,100	1,090	1,110	116,600	98,730	135,700
1974	16,230	6,998	29,540	13,050	11,190	14,910	49,060	39,760	58,390	55,840	43,020	68,560	15,220	12,660	17,770	1,147	1,136	1,158	151,000	129,400	173,500
1975	15,620	6,970	27,910	17,160	14,480	19,830	40,790	33,040	48,540	33,720	25,700	41,670	17,860	14,980	20,730	1,942	1,924	1,960	127,400	110,100	145,800
1976	17,430	7,528	31,560	15,590	13,240	17,930	38,770	31,420	46,160	29,210	21,170	37,160	16,980	13,850	20,080	1,126	1,115	1,137	119,400	102,000	138,700
1977	15,000	6,165	27,520	11,850	9,918	13,770	55,840	45,230	66,450	55,570	41,820	69,320	21,570	17,730	25,420	643	637	649	160,900	138,000	184,500
1978	11,970	5,087	21,750	9,781	8,637	10,940	51,110	41,450	60,900	19,410	13,960	24,810	10,860	8,951	12,800	3,314	3,283	3,346	106,800	91,480	122,900
1979	6,669	2,716	12,250	6,635	5,594	7,685	21,910	17,760	26,100	8,781	6,416	11,160	7,931	6,553	9,316	1,509	1,495	1,523	53,620	46,050	61,700
1980	16,500	7,067	30,000	10,130	9,033	11,210	60,990	49,370	72,540	34,400	25,900	42,960	23,910	19,270	28,590	4,263	4,222	4,303	150,700	129,900	172,300
1981	15,090	6,624	27,120	27,500	23,360	31,620	44,710	36,230	53,240	16,080	9,086	23,020	12,730	9,590	15,880	4,334	4,293	4,375	120,800	103,600	139,100
1982	10,970	4,666	19,900	10,350	8,676	12,030	45,380	36,760	53,980	27,020	14,950	39,130	10,390	8,003	12,810	4,643	4,599	4,687	109,100	89,780	128,600
1983	7,947	3,396	14,380	11,080	9,713	12,450	29,630	24,000	35,260	18,070	10,600	25,560	5,734	3,247	8,221	1,769	1,752	1,786	74,490	61,900	87,470
1984	5,493	2,246	10,130	11,860	8,114	15,620	37,100	33,580	40,590	28,460	18,410	38,520	20,020	16,370	23,650	2,547	2,523	2,571	105,700	92,100	119,300
1985	4,419	1,865	8,067	10,910	7,155	14,670	35,450	30,980	39,890	43,190	29,270	57,240	28,540	23,040	34,040	4,884	4,838	4,930	127,600	110,400	144,900
1986	7,704	3,263	13,960	12,210	8,886	15,520	40,630	35,970	45,290	66,530	44,930	87,980	24,890	19,920	29,920	5,570	5,517	5,623	157,900	133,500	181,900
1987	10,370	4,412	18,890	8,391	6,081	10,720	36,060	32,060	40,060	42,910	29,500	56,310	16,070	13,030	19,090	2,781	2,755	2,807	116,900	99,880	134,500
1988	6,200	2,446	11,550	12,920	9,318	16,540	43,170	37,890	48,450	50,890	35,530	66,220	14,810	11,770	17,830	3,038	3,009	3,067	131,300	113,100	149,500
1989	6,192	2,588	11,290	6,883	5,089	8,690	41,130	36,890	45,370	39,820	27,660	51,920	18,110	14,830	21,350	2,800	2,773	2,827	115,100	100,400	129,900
1990	3,463	1,392	6,419	10,230	7,985	12,490	40,930	35,990	45,830	54,010	35,960	72,150	15,260	12,440	18,090	4,356	4,315	4,397	128,400	108,400	148,500
1991	1,784	766	3,233	7,539	5,882	9,185	33,050	28,940	37,180	55,280	36,360	74,100	14,120	11,620	16,650	2,416	2,393	2,439	114,300	94,110	134,300
1992	6,735	2,956	12,600	31,400	20,450	42,330	32,360	28,070	36,630	57,310	47,910	66,700	12,970	10,760	15,210	2,292	2,270	2,314	143,400	126,700	160,200
1993	9,081	5,229	15,450	16,950	13,050	20,830	24,960	22,870	27,060	62,500	31,600	93,350	8,765	7,482	10,050	2,065	2,045	2,085	124,700	92,360	157,100
1994	12,430	7,580	20,840	16,880	12,770	21,010	24,460	22,430	26,490	39,570	30,640	48,440	5,432	4,717	6,148	1,344	1,331	1,357	100,600	88,310	113,800
1995	25,040	16,880	38,830	18,600	13,510	23,720	34,610	32,390	36,840	46,950	39,350	54,580	7,098	6,086	8,108	1,748	1,731	1,765	134,600	120,600	151,300
1996	18,440	12,410	28,700	28,330	22,270	34,400	30,050	27,510	32,570	38,780	30,420	47,210	9,959	8,525	11,390	2,407	2,384	2,430	128,400	115,200	143,200
1997	15,970	10,940	24,560	27,560	21,610	33,480	24,840	22,760	26,900	33,290	25,900	40,630	4,903	4,250	5,557	1,611	1,596	1,626	108,600	96,790	121,500
1998	13,130	7,363	18,880	34,930	25,810	43,980	23,030	20,960	25,100	29,310	22,350	36,240	3,474	3,122	3,829	1,526	1,511	1,540	105,400	91,410	119,300
1999	15,670	8,781	22,550	31,760	23,630	39,950	27,930	25,390	30,460	25,530	20,150	30,930	4,443	4,054	4,833	1,168	1,157	1,179	106,500	93,230	119,800
2000	21,620	12,150	30,950	26,500	21,760	31,230	26,710	23,440	29,990	28,890	23,090	34,660	2,650	2,358	2,941	1,587	1,572	1,602	107,900	94,380	121,400
2001	22,700	12,750	32,670	17,480	14,350	20,620	27,460	24,500	30,440	38,210	32,450	43,960	4,362	3,918	4,804	1,491	1,477	1,505	111,700	98,480	125,000
2002	16,620	9,161	24,060	16,510	12,850	20,150	20,710	18,170	23,280	22,500	17,710	27,310	1,374	1,221	1,526	511	506	516	78,250	67,400	89,020
2003	13,870	6,693	20,950	24,090	18,230	29,970	33,780	30,090	37,460	38,550	30,920	46,200	3,293	2,925	3,662	1,192	1,181	1,203	114,800	101,400	128,100
2004	16,640	10,870	22,370	21,810	15,790	27,860	28,160	25,300	31,000	39,630	30,430	48,850	2,961	2,658	3,263	1,283	1,271	1,295	110,500	96,860	124,100
2005	20,570	11,230	29,890	27,900	18,710	37,080	28,090	25,480	30,690	35,830	27,600	44,020	1,899	1,689	2,110	1,088	1,078	1,098	115,300	98,460	132,400
2006	20,740	12,510	29,010	35,250	28,510	41,950	26,070	23,620	28,530	36,720	28,180	45,320	2,811	2,475	3,148	1,419	1,406	1,432	123,000	107,900	138,200
2007	21,580	12,040	31,050	29,260	22,060	36,440	23,570	21,160	25,990	34,280	27,030	41,570	1,468	1,310	1,624	1,189	1,178	1,200	111,300	96,040	126,600
2008	25,870	14,930	36,770	28,300	20,980	35,650	29,840	26,240	33,420	27,230	19,940	34,650	3,159	2,772	3,548	2,231	2,210	2,252	116,600	99,790	133,600
2009	38,850	19,320	58,670	34,150	22,110	46,200	28,710	25,960	31,490	35,260	28,000	42,480	3,005	2,674	3,335	2,318	2,296	2,340	142,400	116,000	168,900
2010	13,510	7,495	19,470	34,820	27,150	42,420	32,030	29,130	34,930	32,960	26,120	39,770	2,364	2,104	2,624	1,502	1,488	1,516	117,200	104,100	130,300
2011	43,610	10,570	76,690	41,040	30,320	51,650	40,200	36,750	43,660	74,500	50,350	98,760	4,710	4,170	5,248	3,914	3,877	3,951	208,000	160,500	255,200

Annex 6.xiv. Estimated 2SW salmon returns for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	10,120	4,651	17,930	4,133	2,930	5,339	75,420	61,110	89,810	59,590	57,210	61,960	17,130	14,770	19,500				166,700	149,300	184,600
1971	14,320	6,591	25,520	3,584	2,462	4,709	43,200	35,020	51,420	34,830	32,410	37,230	13,510	11,700	15,320	653	647	659	110,500	96,540	125,800
1972	12,410	5,675	21,940	3,734	2,573	4,887	56,450	45,660	67,070	49,430	41,650	57,190	15,990	14,080	17,900	1,383	1,370	1,396	139,700	122,000	157,600
1973	17,380	7,923	30,720	4,619	3,282	5,958	62,230	50,400	74,030	47,700	39,810	55,560	12,910	11,520	14,290	1,427	1,413	1,441	146,700	126,600	167,900
1974	17,030	7,799	30,290	3,637	2,750	4,532	83,430	67,610	99,300	67,180	55,860	78,500	27,110	24,580	29,660	1,394	1,381	1,407	200,300	175,100	226,200
1975	15,890	7,275	28,200	5,199	3,716	6,691	70,920	57,430	84,300	42,960	36,000	49,960	28,870	26,030	31,730	2,331	2,309	2,353	166,700	145,800	188,100
1976	18,290	8,369	32,390	4,354	3,170	5,546	70,500	57,080	83,860	40,250	33,460	47,050	26,630	23,560	29,720	1,317	1,304	1,330	161,900	140,400	184,300
1977	16,270	7,443	28,750	3,549	2,754	4,347	83,100	67,260	98,840	80,570	67,540	93,520	32,290	28,580	36,000	1,998	1,979	2,017	218,200	192,200	244,600
1978	12,750	5,843	22,520	3,587	2,840	4,332	74,770	60,560	88,990	36,300	31,620	41,030	18,780	16,980	20,600	4,208	4,168	4,248	150,900	131,900	170,200
1979	7,254	3,324	12,860	1,742	1,282	2,201	41,240	33,420	49,070	12,020	10,410	13,640	10,520	9,281	11,750	1,942	1,924	1,960	74,950	64,700	85,520
1980	17,390	7,937	30,840	3,902	3,105	4,696	98,050	79,420	116,700	56,820	48,810	64,840	38,680	34,290	43,050	5,796	5,741	5,851	221,200	195,100	247,900
1981	15,630	7,155	27,670	7,027	5,248	8,799	76,990	62,400	91,690	24,370	19,920	28,830	23,200	20,450	25,970	5,601	5,548	5,654	153,400	132,800	174,700
1982	11,550	5,280	20,550	3,168	2,428	3,903	68,350	55,350	81,300	41,920	32,110	51,660	16,730	14,670	18,790	6,056	5,998	6,113	148,100	127,400	169,100
1983	8,387	3,844	14,810	3,705	2,925	4,478	56,100	45,430	66,780	31,230	25,270	37,250	16,490	14,300	18,690	2,155	2,135	2,175	118,300	103,100	133,800
1984	6,020	2,755	10,630	3,364	2,290	4,430	51,920	48,950	54,880	29,530	20,110	38,970	21,470	18,080	24,870	3,222	3,191	3,253	115,700	103,500	128,000
1985	4,747	2,169	8,362	2,743	1,781	3,698	53,700	50,050	57,340	36,040	24,210	47,750	29,700	24,800	34,560	5,529	5,476	5,582	132,600	118,100	147,000
1986	8,152	3,728	14,450	3,263	2,235	4,286	63,850	59,870	67,850	57,140	38,810	75,480	21,400	17,700	25,070	6,176	6,117	6,235	160,200	139,700	181,000
1987	11,020	5,035	19,500	2,351	1,553	3,150	60,530	56,860	64,180	34,900	24,180	45,630	13,650	11,330	15,960	3,081	3,052	3,110	125,800	111,400	140,900
1988	6,886	3,155	12,240	3,428	2,283	4,577	66,130	61,740	70,480	41,680	29,270	54,170	11,770	9,672	13,860	3,286	3,255	3,317	133,400	118,700	148,300
1989	6,638	3,051	11,750	1,686	1,176	2,202	59,370	55,830	62,900	27,400	19,280	35,450	14,650	12,090	17,180	3,197	3,167	3,227	113,100	102,500	124,000
1990	3,815	1,749	6,788	2,691	1,906	3,483	58,310	54,360	62,280	36,190	24,750	47,630	11,650	9,647	13,670	5,051	5,003	5,099	117,800	104,700	131,000
1991	1,880	860	3,314	2,058	1,488	2,620	53,780	50,250	57,300	35,010	23,260	46,810	13,040	10,900	15,170	2,647	2,622	2,672	108,500	95,530	121,400
1992	7,541	3,732	13,380	8,173	5,003	11,330	54,100	50,430	57,770	37,080	30,960	43,250	11,980	10,050	13,900	2,459	2,436	2,482	121,600	111,900	131,800
1993	9,437	5,625	15,850	4,358	3,049	5,673	41,750	39,720	43,780	42,810	21,530	64,080	8,094	7,100	9,076	2,231	2,210	2,252	109,100	86,270	132,000
1994	12,940	8,060	21,320	4,045	2,741	5,341	42,440	40,410	44,460	29,590	22,900	36,280	5,166	4,590	5,746	1,346	1,333	1,359	95,940	86,200	107,000
1995	25,480	17,320	39,250	3,854	2,405	5,303	48,970	46,730	51,240	39,110	32,780	45,450	6,826	5,913	7,748	1,748	1,731	1,765	126,400	114,400	141,800
1996	18,780	12,770	29,040	5,670	3,822	7,508	44,640	42,230	47,010	28,470	22,010	34,900	9,206	8,008	10,400	2,407	2,384	2,430	109,600	99,270	121,900
1997	16,220	11,140	24,770	6,016	4,022	8,034	36,730	34,780	38,670	22,980	17,460	28,460	4,578	4,066	5,087	1,611	1,596	1,626	88,490	79,550	98,910
1998	8,773	4,980	12,880	6,453	4,209	8,686	28,100	26,260	29,930	15,940	12,020	19,820	2,604	2,364	2,844	1,526	1,511	1,540	63,400	56,780	70,080
1999	10,550	5,959	15,460	6,286	4,082	8,485	29,560	27,550	31,570	15,500	12,200	18,790	4,192	3,878	4,505	1,168	1,157	1,179	67,220	60,350	74,240
2000	14,330	8,130	21,040	6,381	4,312	8,442	28,390	25,860	30,910	16,780	13,340	20,200	2,378	2,133	2,623	533	528	538	68,770	60,400	77,460
2001	15,140	8,604	22,270	2,500	1,603	3,402	29,710	27,160	32,300	26,670	22,550	30,780	4,271	3,869	4,676	788	781	796	79,100	70,290	88,170
2002	11,060	6,140	16,370	2,425	1,496	3,354	21,300	19,300	23,320	13,880	10,920	16,850	969	887	1,052	504	499	509	50,150	43,430	57,000
2003	9,262	4,595	14,270	3,384	2,079	4,683	33,170	30,340	35,970	25,700	20,360	31,010	3,328	2,981	3,676	1,192	1,181	1,203	76,060	67,700	84,390
2004	11,120	7,258	15,370	3,321	1,935	4,710	28,950	26,710	31,170	26,030	19,850	32,220	2,691	2,435	2,946	1,283	1,271	1,295	73,410	65,210	81,700
2005	13,690	7,560	20,330	4,404	2,324	6,496	27,950	25,940	29,970	25,830	19,840	31,790	1,694	1,521	1,869	984	975	993	74,560	64,730	84,610
2006	13,800	8,308	19,730	5,373	3,346	7,400	26,170	24,220	28,120	22,580	17,310	27,860	2,546	2,262	2,828	1,023	1,013	1,033	71,490	62,640	80,500
2007	14,290	8,039	21,100	4,158	2,446	5,874	23,900	22,040	25,780	22,820	18,070	27,560	1,390	1,255	1,524	954	945	963	67,520	58,560	76,690
2008	17,170	9,908	24,950	3,874	2,257	5,498	28,230	25,540	30,930	18,520	13,560	23,430	3,056	2,693	3,418	1,764	1,747	1,781	72,580	62,520	82,890
2009	25,520	12,750	39,180	4,625	2,532	6,703	27,470	25,360	29,580	24,080	19,170	28,960	2,666	2,391	2,942	2,069	2,049	2,089	86,410	71,630	101,700
2010	8,938	5,042	13,150	4,663	2,932	6,404	29,250	27,070	31,420	20,710	16,220	25,170	2,017	1,816	2,214	1,078	1,068	1,088	66,670	59,630	73,760
2011	28,380	6,992	50,800	5,422	3,334	7,530	37,340	34,730	39,980	61,740	41,270	82,240	4,660	4,142	5,178	3,045	3,016	3,074	140,700	107,100	174,500

Annex 6.xv. Estimated 2SW salmon spawners for the six North American regions and North American total from the run reconstruction model.

Return	Labrador			Newfoundland			Quebec			Gulf			Scotia-Fundy			USA			NAC		
year	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile	Median	2.5%ile	97.5%ile
1970	9,551	4,068	17,380	3,234	2,156	4,316	28,570	23,140	33,980	9,981	7,888	12,060	6,501	4,471	8,537						
1971	13,920	6,093	25,040	2,975	1,941	4,014	14,790	11,960	17,590	10,430	8,086	12,760	7,056	5,425	8,683	490	485	495	49,750	39,900	61,890
1972	11,950	5,253	21,540	3,140	2,066	4,210	28,950	23,450	34,450	29,210	21,620	36,830	10,380	8,557	12,210	1,038	1,028	1,048	84,940	71,300	99,490
1973	16,340	6,913	29,620	3,842	2,614	5,076	29,430	23,860	35,050	32,250	24,550	39,870	6,697	5,380	8,016	1,100	1,090	1,110	89,970	74,340	107,300
1974	16,230	6,998	29,540	3,138	2,321	3,958	35,810	29,020	42,630	48,980	37,880	60,070	14,060	11,670	16,480	1,147	1,136	1,158	119,800	100,900	139,800
1975	15,620	6,970	27,910	4,705	3,284	6,127	29,770	24,120	35,440	28,910	22,030	35,780	16,360	13,610	19,100	1,942	1,924	1,960	97,630	82,500	114,200
1976	17,430	7,528	31,560	3,973	2,852	5,098	28,300	22,940	33,700	24,110	17,520	30,630	15,520	12,640	18,380	1,126	1,115	1,137	90,690	75,340	108,300
1977	15,000	6,165	27,520	2,768	2,085	3,450	40,760	33,020	48,500	51,390	38,720	63,980	18,830	15,380	22,300	643	637	649	129,800	109,500	151,000
1978	11,970	5,087	21,750	3,053	2,392	3,718	37,310	30,260	44,450	15,940	11,530	20,370	9,416	7,753	11,070	3,314	3,283	3,346	81,340	68,520	95,220
1979	6,669	2,716	12,250	1,616	1,180	2,056	15,990	12,960	19,050	5,768	4,226	7,313	6,677	5,511	7,849	1,509	1,495	1,523	38,360	32,070	45,400
1980	16,500	7,067	30,000	3,262	2,566	3,962	44,520	36,040	52,950	31,500	23,750	39,240	21,300	17,250	25,330	4,263	4,222	4,303	121,700	103,800	141,000
1981	15,090	6,624	27,120	6,591	4,861	8,296	32,640	26,450	38,870	9,749	5,421	14,090	10,370	7,969	12,760	4,334	4,293	4,375	79,060	65,340	94,440
1982	10,970	4,666	19,900	2,768	2,080	3,453	33,130	26,830	39,400	21,230	11,500	30,910	7,805	6,029	9,592	4,643	4,599	4,687	80,910	65,030	97,090
1983	7,947	3,396	14,380	3,283	2,567	4,002	21,630	17,520	25,740	13,950	8,071	19,860	4,204	2,477	5,928	1,769	1,752	1,786	53,000	42,700	63,790
1984	5,493	2,246	10,130	3,175	2,134	4,217	27,080	24,510	29,630	26,080	16,640	35,430	17,510	14,300	20,700	2,547	2,523	2,571	82,050	69,930	94,100
1985	4,419	1,865	8,067	2,734	1,776	3,692	25,880	22,610	29,120	35,020	23,280	46,770	24,630	19,970	29,290	4,884	4,838	4,930	97,710	83,480	111,900
1986	7,704	3,263	13,960	3,224	2,210	4,248	29,660	26,260	33,060	55,330	37,080	73,680	18,450	14,860	22,010	5,570	5,517	5,623	120,200	99,890	140,800
1987	10,370	4,412	18,890	2,333	1,535	3,124	26,320	23,400	29,240	32,920	22,240	43,550	12,210	9,955	14,460	2,781	2,755	2,807	87,290	73,090	102,000
1988	6,200	2,446	11,550	3,408	2,266	4,542	31,520	27,660	35,370	40,390	27,950	52,800	10,320	8,296	12,360	3,038	3,009	3,067	95,110	80,500	109,900
1989	6,192	2,588	11,290	1,681	1,164	2,190	30,020	26,930	33,120	26,230	18,100	34,250	14,300	11,760	16,820	2,800	2,773	2,827	81,440	70,840	92,160
1990	3,463	1,392	6,419	2,669	1,888	3,451	29,880	26,280	33,460	35,050	23,630	46,500	11,010	9,037	12,990	4,356	4,315	4,397	86,540	73,510	99,580
1991	1,784	766	3,233	2,046	1,483	2,613	24,130	21,120	27,140	34,190	22,410	46,010	11,650	9,579	13,720	2,416	2,393	2,439	76,290	63,500	89,140
1992	6,735	2,956	12,600	8,122	4,949	11,290	23,620	20,490	26,740	35,980	29,860	42,110	10,820	8,940	12,700	2,292	2,270	2,314	87,840	78,200	97,870
1993	9,081	5,229	15,450	4,309	3,009	5,603	18,220	16,690	19,750	42,130	20,930	63,460	6,936	5,970	7,885	2,065	2,045	2,085	83,130	60,330	106,100
1994	12,430	7,580	20,840	3,890	2,615	5,150	17,860	16,380	19,340	28,900	22,260	35,580	4,393	3,850	4,932	1,344	1,331	1,357	69,230	59,680	80,150
1995	25,040	16,880	38,830	3,706	2,271	5,134	25,270	23,640	26,890	38,590	32,260	44,910	6,463	5,560	7,372	1,748	1,731	1,765	101,200	89,390	116,600
1996	18,440	12,410	28,700	5,497	3,672	7,301	21,940	20,080	23,770	27,680	21,300	34,060	8,383	7,211	9,558	2,407	2,384	2,430	84,700	74,640	96,970
1997	15,970	10,940	24,560	5,875	3,898	7,850	18,130	16,620	19,640	22,190	16,750	27,610	3,974	3,482	4,465	1,611	1,596	1,626	68,110	59,340	78,540
1998	8,584	4,782	12,660	6,353	4,133	8,585	16,810	15,300	18,320	15,460	11,600	19,320	2,273	2,047	2,500	1,526	1,511	1,540	51,010	44,450	57,610
1999	10,250	5,699	15,150	6,208	4,022	8,392	20,390	18,530	22,240	14,700	11,440	17,980	3,733	3,423	4,042	1,168	1,157	1,179	56,450	49,630	63,370
2000	14,130	7,885	20,800	6,219	4,182	8,259	19,500	17,110	21,900	16,190	12,780	19,590	2,178	1,940	2,418	1,587	1,572	1,602	59,790	51,350	68,360
2001	14,850	8,271	21,930	2,434	1,552	3,316	20,050	17,890	22,220	25,740	21,680	29,800	4,009	3,614	4,402	1,491	1,477	1,505	68,580	59,870	77,500
2002	10,860	5,953	16,160	2,380	1,457	3,296	15,120	13,270	16,990	13,360	10,420	16,300	786	712	860	511	506	516	42,990	36,400	49,800
2003	9,071	4,366	14,030	3,309	2,021	4,609	24,660	21,970	27,350	24,920	19,700	30,130	3,119	2,776	3,461	1,192	1,181	1,203	66,270	58,040	74,540
2004	10,870	6,995	15,070	3,241	1,873	4,611	20,550	18,470	22,630	25,220	19,070	31,310	2,574	2,325	2,822	1,283	1,271	1,295	63,750	55,610	71,920
2005	13,460	7,295	20,080	4,323	2,247	6,392	20,500	18,600	22,400	24,880	18,970	30,760	1,588	1,420	1,756	1,088	1,078	1,098	65,830	56,070	75,740
2006	13,550	8,091	19,500	5,280	3,287	7,287	19,030	17,240	20,820	21,800	16,600	27,030	2,393	2,118	2,670	1,419	1,406	1,432	63,500	54,730	72,440
2007	14,090	7,818	20,850	4,103	2,398	5,810	17,210	15,450	18,970	22,000	17,310	26,690	1,280	1,151	1,409	1,189	1,178	1,200	59,860	51,010	68,980
2008	16,910	9,681	24,710	3,770	2,186	5,364	21,780	19,150	24,390	17,690	12,810	22,570	2,959	2,600	3,318	2,809	2,782	2,836	65,940	55,900	76,150
2009	25,210	12,520	38,890	4,561	2,485	6,632	20,960	18,950	22,990	23,170	18,320	28,000	2,547	2,279	2,815	2,292	2,270	2,314	78,740	64,030	94,070
2010	8,776	4,844	12,940	4,568	2,867	6,273	23,380	21,260	25,500	19,880	15,430	24,320	1,883	1,688	2,079	1,482	1,468	1,496	59,960	52,940	67,030
2011	28,310	6,828	50,520	5,342	3,269	7,418	29,350	26,830	31,870	60,200	39,840	80,410	4,558	4,042	5,075	3,872	3,835	3,909	131,700	98,350	165,300

Annex 6.xvi. North American pre-fishery abundance (PFA) estimates from the run reconstruction model.

node	PFANAC1SW			PFANACSm			PFANAC1SWcohort		
description	PFA 1SW non-maturing			PFA 1SW maturing			PFA total (1SW non-maturing + maturing)		
Year	**Median**	**2.5%ile**	**97.5%ile**	**Median**	**2.5%ile**	**97.5%ile**	**Median**	**2.5%ile**	**97.5%ile**
1970									
1971	713,450	640,050	790,000	520,050	478,900	567,800	1,234,000	1,153,000	1,319,000
1972	740,600	675,800	813,550	521,000	486,250	559,750	1,262,000	1,194,000	1,338,500
1973	901,750	807,150	1,001,500	666,850	630,300	704,100	1,569,000	1,472,000	1,669,000
1974	812,100	740,750	891,100	699,200	655,750	746,850	1,512,000	1,435,000	1,596,000
1975	904,950	827,900	989,100	798,550	738,100	871,950	1,705,000	1,613,000	1,807,000
1976	835,700	754,450	925,750	798,300	743,500	858,750	1,635,000	1,542,000	1,736,500
1977	667,250	596,800	741,600	636,300	587,950	690,450	1,304,000	1,224,000	1,389,000
1978	396,650	363,500	432,800	410,700	378,450	444,650	807,750	764,050	853,300
1979	837,550	760,950	922,850	589,750	552,000	629,900	1,428,000	1,344,000	1,519,500
1980	711,400	646,100	783,800	832,700	773,600	903,250	1,545,500	1,464,000	1,636,000
1981	666,750	613,300	725,700	911,400	839,100	994,800	1,579,000	1,494,000	1,674,000
1982	560,450	517,450	607,450	765,850	706,250	830,550	1,327,000	1,256,000	1,402,000
1983	342,050	306,550	381,200	511,300	474,450	551,850	853,750	805,750	906,000
1984	360,500	323,400	402,250	539,800	500,150	579,800	900,650	846,600	957,500
1985	535,950	485,100	591,950	658,600	609,350	709,100	1,195,000	1,124,500	1,269,000
1986	567,850	512,000	627,350	835,800	770,200	904,600	1,404,000	1,319,000	1,492,000
1987	517,750	473,700	564,650	800,900	741,100	868,400	1,319,000	1,250,000	1,396,000
1988	421,450	383,000	462,750	849,750	779,900	923,550	1,272,000	1,193,000	1,354,000
1989	333,150	299,850	370,200	595,050	551,050	642,700	928,800	874,550	986,150
1990	297,350	268,250	329,700	562,150	521,050	604,000	859,700	808,600	912,900
1991	329,700	303,200	359,000	415,500	386,500	445,500	745,300	705,300	787,400
1992	216,550	180,350	257,200	577,800	524,200	632,500	794,550	726,650	865,050
1993	156,350	136,150	179,800	546,100	474,700	618,250	702,750	626,800	779,900
1994	192,700	167,350	223,550	329,750	296,700	363,950	522,850	479,250	569,800
1995	188,900	167,350	214,300	382,200	339,200	426,550	571,500	521,800	623,600
1996	159,100	141,300	180,450	555,600	491,100	624,950	715,150	646,850	788,250
1997	110,800	97,990	125,250	362,950	326,100	410,200	474,250	433,850	523,800
1998	101,300	87,870	116,300	442,100	384,550	499,700	543,600	482,900	604,700
1999	106,650	91,475	123,800	443,850	385,750	501,800	550,800	488,950	612,900
2000	120,850	104,300	139,750	526,600	458,950	594,150	647,650	575,500	720,400
2001	83,885	72,300	97,040	386,200	333,100	439,800	470,450	414,250	527,050
2002	113,450	97,860	131,000	388,600	342,300	435,300	502,300	451,650	554,000
2003	111,850	96,480	129,100	421,050	379,950	462,150	533,100	486,800	579,900
2004	114,000	96,855	133,150	447,700	408,650	486,750	561,850	517,750	606,750
2005	109,900	94,120	127,750	546,100	458,850	633,650	656,300	566,700	746,450
2006	104,750	89,230	122,450	548,700	462,400	635,350	653,650	564,250	743,900
2007	115,500	98,235	135,150	472,600	399,200	546,050	588,550	511,550	665,850
2008	135,400	111,650	162,700	594,700	521,250	668,400	730,550	650,500	811,300
2009	107,150	93,485	122,350	383,100	316,900	449,700	490,500	421,800	559,300
2010	213,850	164,250	268,100	506,250	462,100	550,550	720,250	650,000	793,750
2011				694,150	502,000	888,250			

Annex 7: 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.

ACOM *(Advisory Committee)* of ICES. The Committee works on the basis of scientific analysis prepared in the ICES expert groups and the advisory process include peer review of the analysis before it can be used as basis for the advice. The Advisory Committee has one member from each member country under the direction of an independent chair appointed by the Council.

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.

COSEWIC *(Committee on the Status of Endangered Wildlife in Canada).* COSEWIC is the organization that assesses the status of wild species, subspecies, varieties, or other important units of biological diversity, considered to be at risk of extinction in Canada. COSEWIC uses scientific, Aboriginal traditional and community knowledge provided by experts from governments, academia and other organizations. Summaries of assessments on Atlantic salmon are currently available to the public on the COSEWIC website (www.cosewic.gc.ca)

Cpue *(Catch Per Unit of 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.

DNA *(Deoxyribonucleic Acid).* DNA is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms (with the exception of RNA- Ribonucleic Acid viruses). The main role of DNA molecules is the long-term storage of information. DNA is often compared to a set of blueprints, like a recipe or a code, since it contains the instructions needed to construct other components of cells, such as proteins and RNA molecules.

DST *(Data Storage Tag).* A miniature data logger with sensors including salinity, temperature, and depth that is attached to fish and other marine animals.

ECOKNOWS *(Effective use of Ecosystems and biological Knowledge in fisheries).* The general aim of the ECOKNOWS project is to improve knowledge in fisheries science and management. The lack of appropriate calculus methods and fear of statistical over partitioning in calculations, because of the many biological and environmental influences on stocks, has limited reality in fisheries models. This reduces the biological credibility perceived by many stakeholders. ECOKNOWS will solve this technical estimation problem by using an up-to-date methodology that supports more effective use of data. The models will include important knowledge of biological processes.

ENPI CBC *(European Neighbourhood and Partnership Instrument Cross-Border Cooperation).* ENPI CBC is one of the financing instruments of the European Union. The ENPI programmes are being implemented on the external borders of the EU. It is designed to target sustainable development and approximation to EU policies and standards - supporting the agreed priorities in the European Neighbourhood Policy Action Plans, as well as the Strategic Partnership with Russia.

FWI *(Framework of Indicators).* FWI indicate if any significant change in the status of stocks used to inform the previously provided multi-annual management advice had occurred.

GRAASP *(Genetically based Regional Assignment of Atlantic Salmon Protocol).* GRAASP based on a suite of 14 microsatellite loci was developed and validated by twelve European genetic research laboratories. Existing and new genetic data were calibrated and integrated in a purpose built electronic database to create the assignment baseline. The unique database created initially encompassed 32 002 individuals from 588 rivers. The baseline data for the microsatellite-based GRAASP was used to identify the natural evolutionary regional stock groupings for assignment.

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 enabling the re-establishment of migratory fish species such as salmon.

ISAV *(Infectious Salmon Anemia Virus).* ISAV is a highly infectious disease of Atlantic salmon caused by an enveloped virus.

LE *(Lagged Eggs)* The summation of lagged eggs from 1 and 2 sea winter fish is used for the first calculation of PFA.

LMN *(Labrador Métis Nation).* LMN is one of four subsistence fisheries harvested salmonids in Labrador. LMN members are fishing in southern Labrador from Fish Cove Point to Cape St Charles.

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).* MSW salmon is an adult salmon which has spent two or more winters at sea or a repeat spawner.

NG *(Nunatsiavut Government).* NG is one of four subsistence fisheries harvested salmonids in Labrador. NG members are fishing in the northern Labrador communities.

NSERC *(the Natural Sciences and Engineering Research Council of Canada).* NSERC is a Canadian government agency that provides grants for research in the natural sciences and in engineering. Its mandate is to promote and assist research. Council supports a project to develop a standardized genetic database for North America.

OSPAR is the mechanism by which fifteen Governments of the west coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the Northeast Atlantic. It started in 1972 with the Oslo Convention against dumping. It was broadened to cover land-based sources and the offshore industry by the Paris Convention of 1974. These two conventions were unified, updated and extended by the 1992 OSPAR Convention. The new annex on biodiversity and ecosystems was adopted in 1998 to cover non-polluting human activities that can adversely affect the sea.

PFA *(Pre-Fishery Abundance).* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time. In the previous version of the stock complex Bayesian PFA forecast model two productivity parameters are calculated, for the *maturing* (PFAm) and *non-maturing* (PFAnm) components of the PFA**.** In the updated version only one productivity parameter is calculated, and used to calculate total PFA, which is then split into PFAm and PFAnm based upon the *proportion of PFAm* (p.PFAm).

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.

PGCCDBS *(The Planning Group on Commercial Catches, Discards and Biological Sampling).*

PGNAPES *(Planning Group on Northeast Atlantic Pelagic Ecosystem Surveys).* PGNAPES coordinates international pelagic surveys in the Norwegian Sea and to the West of the British Isles, directed in particular towards Norwegian Spring-spawning Herring and Blue Whiting. In addition, these surveys collect environmental information. The work in the group has progressed as planned.

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.

PSU *(Practical Salinity Units).* PSU are used to describe salinity: a salinity of 35‰ equals 35 PSU.

Q Areas for which the Ministère des Ressources naturelles et de la Faune manages the salmon fisheries in Québec.

RR model *(Run-Reconstruction model).* RR model is used to estimate PFA and national CLs.

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.

SALSEA (Salmon at Sea). SALSEA is an international programme of co-operative research designed to improve understanding of the migration and distribution of salmon at sea in relation to feeding opportunities and predation. It differentiates between tasks which can be achieved through enhanced coordination of existing ongoing research, and those involving new research for which funding is required.

SARA *(Species At Risk Act).* SARA is a piece of Canadian federal legislation which became law in Canada on December 12, 2002. It is designed to meet one of Canada's key commitments under the International Convention on Biological Diversity. The goal of the Act is to protect endangered or threatened organisms and their habitats. It also manages species which are not yet threatened, but whose existence or habitat is in jeopardy. SARA defines a method to determine the steps that need to be taken in order to help protect existing relatively healthy environments, as well as recover threatened habitats. It identifies ways in which governments, organizations, and individuals can work together to preserve species at risk and establishes penalties for failure to obey the law.

SCICOM *(Science Committee)* of ICES. SCICOM is authorized to communicate to third-parties on behalf of the Council on science strategic matters and is free to institute structures and processes to ensure that inter alia science programmes, regional considerations, science disciplines, and publications are appropriately considered.

SER *(Spawning Escapement Reserve).* The CL increased to take account of natural mortality between the recruitment date (1st January) and return to homewaters.

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*). SGEFISSA is a study group established by ICES and met in November 2006.

SGERAAS *(Study Group on Effectiveness of Recovery Actions for Atlantic Salmon).* SGERASS had been established by ICES. The task of the study group is to provide a review of examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations.

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.

SSGEF *(SCICOM Steering Group on Understanding Ecosystem Functioning).* SSGEF is one of five Steering Groups of SCICOM (Science Committee of ICES). Chair: Graham Pierce (UK); term of office: January 2012–December 2014.

SST (*Sea surface temperatures*). SST is the water temperatures close to the surface. In practical terms, the exact meaning of surface varies according to the measurement method used. A satellite infrared radiometer indirectly measures the temperature of a very thin layer of about 10 micrometres thick of the ocean which leads to the phrase skin temperature. A microwave instrument measures subskin temperature at about 1 mm. A thermometer attached to a moored or drifting buoy in the ocean would measure the temperature at a specific depth, (e.g. at one meter below the sea surface). The measurements routinely made from ships are often from the engine water intakes and may be at various depths in the upper 20 m of the ocean. In fact, this temperature is often called sea surface temperature, or foundation temperature.

SVC *(Spring Viraemia of Carp).* SVC is a contagious and potentially fatal viral disease affecting fish. As its name implies, SVC may be seen in carp in spring. However, SVC may also be seen in other seasons (especially in the fall) and in other fish species including goldfish and the European wells catfish. Until recently, SVC had only been reported in Europe and the Middle East. The first cases of SVC reported in the United States were in spring 2002 in cultivated ornamental common carp (Koi) and wild common carp. The number of North American fish species susceptible to SVC is not yet known.

TAC *(Total Allowable Catch).* TAC is the quantity of fish that can be taken from each stock each year.

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.

WGBAST *(Baltic Salmon and Trout Assessment Working Group).* WGBAST had in 2012 taken place in Uppsala, Sweden, 15–23 March. Working group chaired by Johan Dannewitz (Sweden). Main tasks of group are: address generic ToRs for Fish Stock Assessment Working Groups; evaluate estimates of salmon misreporting by Poland based on new data from Poland, from the EC inspections, logbooks, VMS and other relevant data sources; evaluate the possible reasons for the low at-sea survival of salmon stocks, including new information from the 2011 Salmon Summit; prepare for a benchmark assessment of the salmon stocks in the autumn of 2012 and others.

WGF *(West Greenland Fishery).* Regulatory measures for WGF have been agreed by the West Greenland Commission of NASCO for most years since NASCO's establishment. These have resulted in greatly reduced allowable catches in the WGF, reflecting declining abundance of the salmon stocks in the area.

WGRECORDS *(Working Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species).* WGRECORS was reconstituted as a Working Group from Transition Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species (TGRECORDS).

WKADS *(Workshop on Age Determination of Salmon).* WKADS had recently taken place in Galway, Ireland (January 18th to 20th, 2011) with the objectives of reviewing, assessing, documenting and making recommendations on current methods of ageing Atlantic salmon. The Workshop had primarily focused on digital scale reading to measure age and growth, with a view to standardization.

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 8: NASCO has requested ICES to identify relevant data deficiencies, monitoring needs and research requirements

The Working Group recommends that it should meet in 2013 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 3 to 12 April 2013.

List of recommendations

1) The Working Group recommends that further work be undertaken to address the issues raised by the Workshop on Age Determination of Salmon regarding protocols, inter-laboratory calibration and quality control as they relate to the interpretation of age and calculation of growth and other features from scales. A second Workshop has been convened for September 2012 to undertake this work.
2) The Working Group recommends that efforts to convene a study group be reinitiated in order to address the question from NASCO for examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations.
3) The Working Group welcomed the opportunistic assessment of the incidence of salmon bycatch in pelagic mackerel fisheries at Iceland and Faroes in 2010 and 2011. The sampling effort provided new information on the temporal and spatial distribution of salmon in this area, as well as the biology of the fish. The Working Group recommends that similar sampling should continue in order to provide further information on the bycatch of salmon in pelagic fisheries in these areas.
4) The Working Group recommends that further work be undertaken to check the appropriateness of the various data inputs used in the catch advice framework for the Faroese fishery, including seeking original datasets from the sampling programmes of the fishery in the historical time period.
5) The Working Group recommends that further work be undertaken to permit the running of the risk framework based on management units defined at the country level, to improve the allocation of the Faroes catch to national management units and to seek additional data to improve the quality of the assessment.
6) The Working Group recommends that sampling of the Labrador subsistence fisheries and Saint-Pierre et Miquelon mixed-stock fisheries be continued and expanded (i.e. sample size, geographic coverage, tissue samples, seasonal distribution of the samples) in future years. The sampling programme conducted in 2010 and 2011 in Labrador and Saint-Pierre et Miquelon provided data on biological characteristics of the harvest and this information is useful for updating parameters used in the Run Reconstruction Model for North America. The sampling also provided material (tissue samples from scales) to assess the origin of salmon in these fisheries.
7) The Working Group welcomed the efforts to sample the catches at Saint-Pierre et Miquelon and Labrador for genetic stock identification and recommend that sampling be continued in the future. However, the Working

Group identified a number of issues with the sampling programme that if corrected, would greatly increase the value of the data.

8) The Working Group recommends that additional data from the recreational fisheries be examined to better estimate salmon returns and stock status in Labrador.

9) The Working Group supports the efforts of the Greenlandic authorities for the expansion of the logbook reporting system as a condition of the licensing system for the salmon fishery at West Greenland.

10) The Working Group recommends a continuation and expansion of the broad geographic sampling programme (multiple NAFO divisions) to more accurately estimate continent of origin and biological characteristics of the salmon in the West Greenland mixed-stock fishery. The Working Group recommends that arrangements be made to enable sampling in Nuuk as an important proportion of the catch is landed in this community on an annual basis.

11) In support of the management objective from NASCO to ensure that individual river stocks meet their conservation limits, the Working Group recommends that additional monitoring data or analyses of existing monitoring data (catches, juvenile surveys, short-term count data), be considered to augment the river-specific data used to develop the stock status and to improve management advice in both NAC and NEAC areas.

Annex 9: Response of WGNAS 2012 to Technical Minutes of the Review Group (ICES 2011b)

As per the request of the ICES Review Group (RG) this section is the response of the Working Group North Atlantic Salmon (WGNAS) to the Technical Minutes of the RG provided in Annex 10 of ICES (2011b).

As stated in the general comments, the Review group indicates that its concerns continue to be with the structure of the model and absence of environmental covariates in the inference and catch advice model used for the West Greenland and Faroes fisheries.

> "Our concerns continue to be with the mechanistic underpinnings of the forecast model used to estimate stock abundances in both North America and Europe. These concerns center on the issue of representing stock effects on recruitment as a compensatory function and adding environmental indices to model the effects of environment on post-smolt survival. Both of these concepts can be supported with data presented in the WG report and from the peer review literature."

The two main criticisms of the Review Group are in terms of the proportional link between the lagged spawners or lagged eggs and the abundance of salmon at the PFA stage (comments related to Section 3.5.1), and the absence of narrative of hypotheses of factors that are modifying abundance of salmon at sea (comments related to Section 3.5.1 and 4.7.1).

In terms of the lack of a compensatory parameter for spawning stock influence on the recruitment dynamic, we agree with the review group that development of inference and forecast models at the subcomplex stage for both NAC and NEAC will provide a more appropriate spatial scale on which to explore recruitment dynamics other than the simple proportional relationship currently used. The Working Group emphasizes that such alternative modelling considerations must include objective criteria for including additional parameters in the model, such as the compensatory parameters in Ricker, Bev–Holt or power functions.

The Working Group disagrees with the suggestion of the Review Group that freshwater production has been independent of spawning stock over the time-series, as might be expected for populations where stocks have been at freshwater carrying capacity. As stated in the comments of the Working Group in ICES (2011b), smolt production in monitored stocks in both the NAC and NEAC areas is highly variable annually, and is described by contradictory trends in smolt output; some stocks in NAC show declines in smolt production, others show increases whereas others show no trend. The length of many of these time-series are relatively short and do not include the period of much higher productivity in the 1970s and early 1980s (see Section 4.3.1 of this report). The Working Group reiterates that spawning stock is an essential component of PFA production and that realized abundance at the PFA stage is the result of a large number of interacting, synergistic or compensatory factors acting during the egg deposition to the first winter at sea stage.

As to the issue of incorporating environmental variables in the inference and forecast models for catch advice, the question is best considered in two parts: the portion of the modelling exercise which attempts to improve on the inferences or improving the fit of predicted to observed values, vs. the variables which can be included and provide improvements in the model prediction and reductions in uncertainty of the forecasts.

The Review Group proposes two examples, one for NEAC (Annex 10 of ICES 2011b, Section 3.6.1 comments) and one for NAC (Annex 10 of ICES 2011b, Section 4.5.6 comments), of potential environmental variables that are correlated with NEAC and NAC PFA. The examples provided by the Review Group are of the types of relationships which have been previously commented on by the Working Group specifically in response to comments from the Review Group(ICES 2009a, Annex 7): "Indeed any model which constructs absolute abundance or catches as a function of temperature alone (as was done in previous WG reports at the beginning of the modelling exercises) is biologically unrealistic: there is a point where, regardless of temperature, absolute abundance will fall to zero if spawning stock goes to zero."

As stated previously by the Working Group, the inclusion of purely physical variables and biological variables in inference and forecast models must consider how these variables modify rates (be they mortality, maturation schedules and other transitions in life-history stages) and not absolute abundances. As the intermediary steps between the environmental variables and the life-stage abundance being modelled become very large (as in the case of temperature, NAO or AMO for example), the chances of spurious associations increases dramatically.

The Working Group will continue to improve model structure and data inputs in order to develop models of the appropriate life-history scales which will allow consideration and testing of factors hypothesized as determinants of the dynamics of Atlantic salmon. The ongoing work in the ECOKNOWS project which involves in part the assembling and analyses of data specific to the freshwater life stage in a hierarchical Bayesian framework is an example of the initiatives being undertaken in collaboration with several active members of the Working Group, to facilitate the exploration of environmental and biological covariates specific to the temporal and spatial scales at stock specific and age specific stages of Atlantic salmon. The extensive work of the SALSEA-Merge project as described in Section 2.3.1 and the various research activities of government, academic, and NGO scientists as reported in Sections 2.3.3, 2.3.4, and 2.3.7 are examples of the investments being made to improve the understanding of salmon ecology.

The "failure" of the Working Group, as stated by the Review Group, in making progress on incorporating environmental variables in the modelling exercise is not a reflection of an absence of time or interest by the Working Group. The interpretation by the Working Group is that the factors hypothesized to determine abundance of salmon at sea and that differ between NAC and NEAC areas remain speculative.

The Working Group welcomes all contributions which can assist it in improved analyses of stock status and in the development of quantitative models to provide multi-year management advice on high seas fisheries. To date, the models used by the Working Group have very adequately described the state of salmon stocks in the continental complexes. The advice provided by ICES over the past decade and a half, that precluded any mixed-stock fisheries due to low stock abundance, has subsequently been confirmed with assessments of realized abundances. The real test of the adequacy and relevance of these simple models would be if productivity was to dramatically increase to levels estimated in the late 1970s and salmon stocks were to increase to levels which would permit options for mixed-stock high seas fisheries. The Working Group, and fisheries managers, would welcome such an opportunity.

Annex 10: Technical minutes of the Salmon Review Group

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

- RGSalmon
- Participants: Carmen Fernández (Chair), Johan Dannewitz, Kjell Leonardsson (external reviewer), Stig Pedersen, Atso Rommakaniemi, Marc Trudel (external reviewer), Gérald Chaput (WG Chair), Henrik Sparholt (Secretariat)
- 24–27 April 2012
- Working Group: WGNAS

The Review Group (RG) acknowledges the effort expended by WGNAS on producing a clearly written and informative report on the status and trends of Atlantic salmon abundance and productivity in Northern Europe, Southern Europe and North America. WGNAS also evaluated different management options for 2012–2015 using Bayesian-based stock assessment models and region-specific reference points (i.e. conservation limits, CLs), further developed the risk-based framework to be used in the provision of catch advice, as well as a Framework of Indicators (FWI) to be used for monitoring a potential need for reassessment within a multiannual advice cycle. The main conclusions of the report were:

- Although catch increased in 2011 relative to 2010, it was still the fourth lowest in the time-series since 1960. The low returns and decline observed during the last two decades appeared to be constrained by low marine survival, though poor freshwater survival may also contribute to the poor status of depressed stocks.
- Three of the four NEAC stock complexes were considered at full reproductive capacity: only the 1SW from the NEAC-south complex was at risk of suffering reduced reproductive capacity. However, it is important to note that stocks were often below the conservation limits at the country level, especially in the NEAC-south complex (i.e. France, Ireland, UK (England & Wales), and UK (Scotland)).
- Probabilities of meeting age and complex-specific Spawner Escapement Reserves (SER) in 2011–2015 in the absence of fishing exceeded 80% for the northern and southern NEAC complexes.
- Simulations indicated that a Total Allowable Catch (TAC) of 80–100 t in 2012/2013, 120 t in 2013/2014 and 140 t in 2014/2015 in the Faroes fishery had a 75% probability of meeting the SER in all the NEAC stock complexes. The interpretation of how the risk assessment was performed was discussed during the RG-meeting, and a summary of this discussion is presented later under Section 3.
- North American 2SW spawner estimates were below their conservation limits in four of the six regions. This was particularly apparent for the southern areas of Scotia-Fundy and the United States.
- Simulations indicated that no fishery options at West Greenland would achieve region-specific management objectives for the North American 2SW salmon at the 75% probability level.

Overall, the report was well written and was substantiated with appropriate analyses. The models used to evaluate different management options appeared reasonable and the Bayesian framework used in run reconstruction appeared to be robust, though the RG did not have the time to examine the models and computer code used to implement the models in full detail. The RG welcomes the fact that some of the stock-assessment models were migrated to 'R', as this will make the analyses more transparent and repeatable. The RG would like to raise the following issues for consideration by WG members:

- In terms of report structure, it would help reviewers as well as communication with the general public if a stock annex was provided, detailing the methodology used to conduct stock assessment and to provide catch advice (similarly to how it is done in other ICES assessment WG reports).

Section 3: Northeast Atlantic Commission

- Two assumptions used in the NEAC model were a bit surprising: (1) the use of a constant mortality rate of 0.03 per month for non-mature 1SW, and (2) constant maturation rate for 1SW of 78% (Table 3.6.4.5). The percentage of 1SW in the reported catch for the northern and southern NEAC countries varied among years and reached the lowest value in 2011 for both regions (Figures 3.1.6.1 and 3.1.6.2), which suggests that mortality rates of immature 1SW fish or maturation rate (or both) changed during the time period, possibly in monotonic fashion. The effects of violating these assumptions should be evaluated.
- The pseudo-stock–recruitment relationship (hockey-stick) between Pre-fishery Abundance (PFA) and lagged-egg (used for the derivation of provisional national conservation limits) is assumed to be static over time. Is this a reasonable assumption given the observed declining trends in marine survival? It was also unclear from the WG report whether or not the lagged-egg deposition accounted for in-river mortality associated with catch-and-release. A table presenting the model parameters would be useful.
- It seems surprising that retention fisheries still occurred in some countries despite the fact that returns and spawner abundance were lower than the conservation limits set by these countries (e.g. Figures 3.3.3.1b and 3.3.3.1h). Presumably this is because the target escapement was met for some river systems, even if not for the country as a whole. It would be useful if the WG report could be more explicit concerning this point.
- The RG understood that the run reconstruction model was run for each country (or region within country, e.g. in Russia or in UK(Scotland)) separately. In this way, a PFA was estimated for each country (or region within country), and the national PFAs were subsequently added to obtain a PFA estimate at the stock complex level. In the Monte Carlo procedure applied to estimate PFA for each country (or region within country), uncertainty in natural mortality was incorporated by simulating its value in each iteration from a Uniform(0.02,0.04) distribution. If the intention of WG experts is that natural mortality in a given year should be the same for all countries, even if its value is uncertain, then the same value of natural mortality should be used in the same iteration for all countries. The RG understood that this is not done at present, treating each country separately in the run reconstruction model. This will probably lead to underestimating the un-

certainty of PFA estimates at the stock complex level (because when adding up the PFAs of each iteration across countries, some countries will have a low value and other countries a high value of natural mortality in that iteration, hence cancelling the effects of a low or high natural mortality for all countries), potentially affecting conclusions about the stock complex status and ensuing management recommendations.

- To determine if significant changes occurred in previously provided multi-annual management advice, the WGNAS developed a Framework of Indicators (FWI). Within this FWI, a dataset was considered informative and kept when sample size was greater than or equal to 10 and R^2 was greater than or equal to 20%. It is unclear how a R^2 of 20% would be considered informative? Prairie (1996. Evaluating the predictive power of regression models. Can. J. Fish. Aquat. Sci. 53: 490–492) developed a simple method to assess the predictive power of regression model based on the R^2 of the model. His analysis indicates that we could start distinguishing two groups when the R^2 exceeded approximately 60%. Hence, the likelihood of arriving at a different conclusion using the current criteria of the FWI appears to be low, simply because a R^2 of 20% is not very informative.

  Consideration should be given to weighting the indicators taking their predictive ability into account, for example, based on the R^2 of the relationship and averaging the weighted indicator states.

- Given that mixed stocked fisheries can lead to the extirpation of weak stocks (Ricker. 1958. J.Fish. Res. Board Can. 15: 991–1006), alternative management options that minimize fishery impacts on weak stocks should be evaluated. A possibility could be assessing the spatio-temporal distribution of weak stocks in the Faroes Islands and West Greenland using DNA analyses. This may help to determine periods and areas that can be fished to avoid weak stocks in near real time (for instance, see Shaklee *et al*., 1999. Fish. Res. 43: 45–78).
- Management objectives should be clarified for mixed stocks fisheries, which take catch from different stocks. For a given probability "p" (e.g. p=0.95), the objective (a) that "all stocks taken by the fishery are above conservation limits with probability p" is less stringent than the objective (b) "that there is a probability p that all stocks taken by the fishery are *simultaneously* above conservation limits". Depending on the degree of correlation between the status of different stocks caught in the mixed fishery, the two potential management objectives can be quite different. Thinking for the sake of argument in an equilibrium situation, objective (b) essentially means that there is at most a proportion 1- p of years where some stocks may fail to reach conservation limits, whereas objective (a) allows for some stocks to be below conservation limits in all years provided that the proportion of years below conservation limits does not exceed 1- p for any stock. Management objectives for individual stocks have often been expressed as 95% probabilities (i.e. using p=0.95). However, requiring 95% for objectives expressed *simultaneously* for a collection of stocks can be much more stringent. It is important that this issue is understood and clarified as appropriate.

  The RG noted that for the West Greenland Commission, NASCO has agreed to a 75% chance of simultaneously meeting or exceeding the management objectives. The use of the word "simultaneous", although not new in the way ICES has provided advice for the salmon fishery at West Greenland, is new in the context of stock assessments for other species. In a mixed stock fishery, even if advice is provided based on a probability p (e.g. p=0.95) that each individual stock is above its conservation limit, it is nevertheless also informative to examine what this implies in terms of the probability that all stocks are simultaneously above conservation limits. The latter probability will decrease as the number of stocks exploited by the fishery increases. Hence, reducing the number of stocks exploited by the mixed fishery (e.g. by considering area and time specific management, if such information is available) is a way to increasing probability of the simultaneous event.

Section 4: North American Commission

- In the NEAC assessment all the data that were used in the figures were readily available in tables. Although this increased the length of the chapter, it made it easier to compare the numbers presented in the text with those presented in the figures. The RG recommends that a similar approach be adopted for the North American assessment. In the latter, results were generally presented only as figures or tables, but not as both.
- Some of the information presented in Section 4.3.6 was already presented in previous sections (i.e. Section 4.3.2). Was this repetition necessary?
- In the management advice (Section 4.4), WGNAS recommended habitat restoration in some areas as an alternative conservation action for wild populations that are critically low (Scotia-Fundy and USA). Although this is a common practice in several systems with stocks of conservation concerns, these measures have often failed to re-establish natural runs due to poor marine survival. Before recommending any costly restoration activities, it would be beneficial to estimate by how much freshwater survival/smolt output need to increase to achieve the target escapement goals. And then ask if these levels can be realistically attained?
- The Bayesian inference and forecast model used to provide PFA forecasts (and used in the risk framework for the provision of catch advice) assumes heritability of age at maturity. Hence, the lagged eggs used in the model for the 2SW stock complex arose exclusively from 2SW spawners. The opposite approach appears to have been used in the Northeast Atlantic, where lagged eggs arose from both 1SW and MSW spawners. Clarification on why different assumptions are made for NEAC and NAC areas would be useful.
- In the Bayesian inference and forecast model used to provide PFA forecasts, a time-varying productivity parameter to go from lagged eggs (or lagged spawners) to PFA is used. The actual modelling details are a bit different for NEAC (where each stock complex is modelled as a single unit) and NAC, where six management units are distinguished within the complex and this is taken into account in the specification of the productivity parameter. Nevertheless, the essential modelling mechanism is a random walk over time for productivity in both cases. In the forecasts, the uncertainty associated with productivity quickly increases as a consequence of the random walk assumption, which translates into large uncertainty in the PFA forecasts. Alternative modelling assumptions on productivity might lead to lower uncertainty in the forecasts, although it is not clear

what alternatives might exist to the currently used random walk. Some alternative models may reduce uncertainty at the cost of increasing bias. Hence, if alternative models are developed, their performance relative to the currently used random walk should be explored. This could be done by applying each model in forecasts starting from some year back in the past and checking their relative performance based on the currently estimated PFA values for those past years.

A way to reduce the uncertainty in the productivity parameter would be by incorporating an auxiliary variable that can explain the annual variations in the productivity value. This is not obvious in the present structure that integrates the freshwater portion of the life cycle, where density dependence is expressed, and the first year (post-smolt) survival at sea. The RG noted the proposed approach by ECOKNOWS to develop a full life-cycle model that would separate these two phases of the life cycle and allow then an exploration of physical and biological covariates that could provide some correlation with variations in productivity. Although potentially useful in an inference sense, such covariates would only be useful for forecasting if the state of the covariates in the forecast years was known or could be equally forecasted. In that case the RG agrees with WGNAS that the models should appropriately incorporate the uncertainties associated with the covariates and the Bayesian framework developed for these models is the appropriate approach.

Section 5: West Greenland Commission

- WGNAS documented that there were some issues in obtaining samples from Nuuk and argued that the Enhance Sampling Programme was compromised as >20% of the fish harvested in West Greenland are landed in Nuuk. Although the RG agrees that obtaining unbiased samples from this area is desirable, the WGNAS should run a series of simulations to determine how critical this information is for their assessment. In particular, how precise do they need to be before it becomes a serious impediment to the interpretation of the data?
- Based on the run reconstruction, it was concluded that none of the stated management objectives would be met in a mixed fishery off West Greenland, primarily because there was a low probability of achieving the conservation limits for most regions in North America (there were no issue for reaching the conservation limits of the southern NEAC stock complex). Are there alternative management scenarios that should be considered? For instance, is there a way to target this fishery on NEAC stocks, and thereby reducing the fishing pressure on North American stocks? This strategy was used successfully in the Chinook salmon fishery off western Canada (i.e. Beacham *et al.*, 2008. North American Journal of Fisheries Management 28: 849–855).
- For the MSW Southern NEAC stock complex, a discrepancy was detected between the probabilities presented in Table 3.4.1.1 under no fishing (87.2%, 88.5%, 88.5%) and in Table 5.4.1 under no fishing (0.978, 0.949, 0.944). Upon checking by the WG chair, it was found that the values in Table 5.4.1 were incorrect, due to having used a wrong SER value; a corrected table was provided for use in the ICES advice sheet. Please ensure that values are correct in future years and cross-check results between different tables and figures in the WG report. Additionally, it would help to clarify

in Table 3.4.1.1 that e.g. the 2012/2013 Faroes fishing season corresponds to PFA in 2013 (2014 returns), whereas in Table 5.4.1 the 2012 catch year corresponds to the PFA in 2012 (2013 returns). A modified version of Table 3.4.1.1 was provided by the WG chair, clarifying the PFA year. This is useful for outside readers, so please make sure that this clarification remains in place in future years. Finally, the WG chair also explained that some minor numerical differences remained because the Faroes fishery risk analysis employed the PFA results from the WinBUGS run directly, whereas the West Greenland fishery risk analysis employed a (log-normal) approximation to the PFA distribution. It would be good if consistency could be gained between the two analyses, presumably by using the results from the WinBUGS run in both cases.