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

11–20 April 2007

ICES Headquarters

ICES
International Council for the Exploration of the Sea
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Contents

Executive Summary

- In the North Atlantic, exploitation remains low and nominal catch of Atlantic salmon in 2006 was the lowest in the time series
- Marine survival indices remain low
- The North American Commission 2SW stock complex is suffering reduced reproductive capacity. Factors other than fisheries (marine mortality, fish passage, water quality) are contributing to continued low adult abundance.
- Northern North-East Atlantic Commission stock complexes (1SW and MSW) are at full reproductive capacity prior to the commencement of distant water fisheries
- Southern North-East Atlantic Commission stock complexes (1SW and MSW) are at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries
- There are no catch options for the fishery at West Greenland (2007–2009) that would meet the management objectives
- There are no catch options for the fishery at the Faroes (2008–2010) that would meet precautionary management objectives

1 Introduction

1.1 Main Tasks

At its 2006 Statutory Meeting, ICES resolved (C. Res. 2006/ACFM14) that the Working Group on North Atlantic Salmon [WGNAS] (Chair: T. Sheehan, USA) will meet in Copenhagen, Denmark, from the 11–20th April 2007 to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO). The terms of reference were met and the sections of the report which provide the answers are below:

a)	With respect to Atlantic salmon in the North Atlantic Area:	Section 2
1)	provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and production of farmed and ranched Atlantic salmon in 2006;	2.1 and 2.2
2)	report on significant new or emerging threats to, or opportunities for salmon conservation and management;	2.3, 2.6 and 2.8
3)	provide a framework of indicators which would be used to identify any significant change in the previously provided multi-annual management advice fro each Commission area;	2.4
4)	examine associations between changes in biological characteristics of all life stages of Atlantic salmon and variations in marine survival[1];	2.5
5)	provide a compilation of tag releases by country in 2006;	2.7
6)	identify relevant data deficiencies, monitoring needs and research requirements[2].	Sec 6
b)	With respect to Atlantic salmon in the North-East Atlantic Commission area:	Section 3
1)	describe the key events of the 2006 fisheries and the status of the stocks[3];	3.8
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	3.9
3)	further develop the age-specific stock conservation limits where possible based upon individual river stocks;	3.3

4)	provide annual catch options or alternative management advice for 2008-2010, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding[4];	3.4 and 3.6
5)	provide estimates of by-catch and non-catch fishing mortality of salmon in pelagic fisheries with an assessment of impacts on returns to homewaters.	3.10
c)	With respect to Atlantic salmon in the North American Commission area:	Section 4
1)	describe the key events of the 2006 fisheries (including the fishery at St Pierre and Miquelon) and the status of the stocks[3];	4.9
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	4.10
3)	update age-specific stock conservation limits based on new information as available;	4.3
4)	provide annual catch options or alternative management advice for 2007-2010 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];	4.4 and 4.7
5)	provide a comprehensive description of coastal fisheries including timing and location of harvest, biological characteristics (size, age, origin) of the catch, and potential impacts on non-local salmon stocks.	4.9
d)	With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
1)	describe the events of the 2006 fisheries and the status of the stocks[3,5];	5.8
2)	provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;	5.10
3)	provide annual catch options or alternative management advice for 2007-2009 with an assessment of risk relative to the objective of exceeding stock conservation limits and advice on the implications of these options for stock rebuilding[4]	5.4

Notes:

1. *There is interest in determining if declines in marine survival coincide with changes in the biological characteristics of juveniles in fresh water or are modifying characteristics of adult fish (size at age, age at maturity, condition, sex ratio, growth rates, etc).*

2 *NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist in this task.*

3 *ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and on the by-catch of salmon in any existing and new fisheries for other species is also requested.*

4 *Provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.*

5 *ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to b1 and c1.*

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

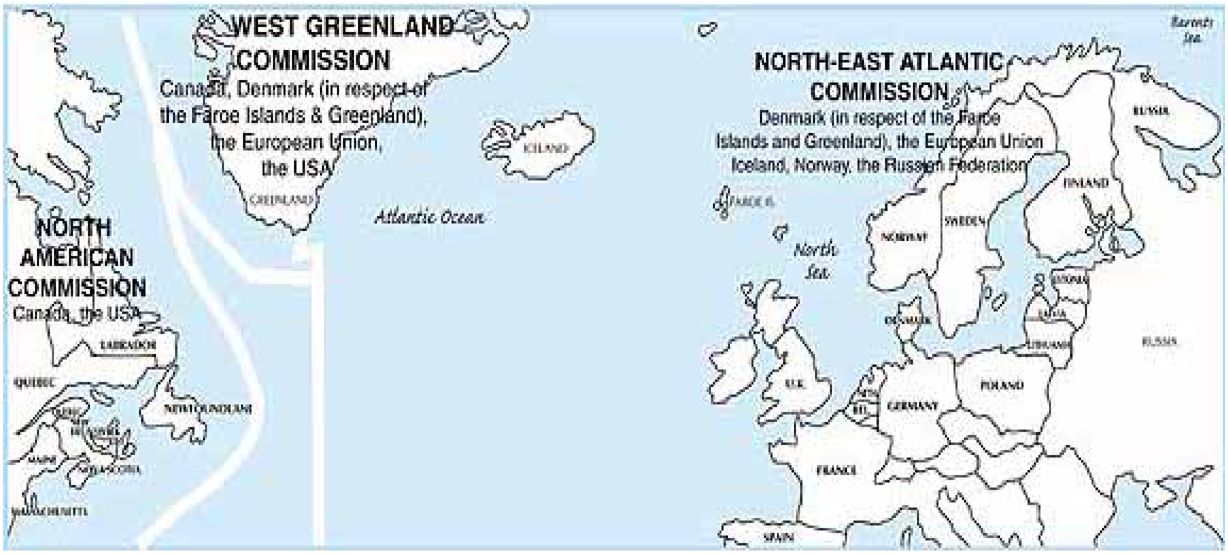
1.2 Participants

Sheehan, T. (Chair)	USA
Amiro, P.	Canada
Chaput, G.	Canada
Erkinaro, J.	Finland
Fiske, P.	Norway
Gibson, J.	Canada
Gudjosson, S.	Iceland
Hansen, L. P.	Norway
Holm, M.	Norway
Ingendahl, D.	Germany
Jacobsen, J	Faroe Islands
Karlsson, L.	Sweden
Kennedy, R.	UK (N. Ireland)
MacLean, J. C.	UK (Scotland)
Ó Maoiléidigh, N.	Ireland
Prusov, S.	Russia
Reddin, D. G.	Canada
Russell, I.	UK (England & Wales)
Smith, G. W.	UK (Scotland)
Trial, J.	USA
Wennevik, V.	Norway

1.3 Management framework for salmon in the North Atlantic

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

NASCO discharges these responsibilities via three Commission areas shown below:



1.4 Management objectives

NASCO has identified the primary management objective of that organisation as:

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

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks" and NASCOs Standing Committee on the Precautionary Approach interpreted this as being "to maintain both the productive capacity and diversity of salmon stocks" (NASCO, 1998).

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

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

1.5 Reference points and application of precaution

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

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

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

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

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

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

2 ATLANTIC SALMON IN THE NORTH ATLANTIC AREA

2.1 Catches of North Atlantic Salmon

2.1.1 Nominal catches of salmon

The nominal catch of a fishery is defined as the round, fresh weight of fish that are caught and retained. Total nominal catches of salmon reported by country in all fisheries for 1960–2006 are given in Table 2.1.1.1. Catch statistics in the North Atlantic also include fish farm escapees and, in some north-east Atlantic countries, relatively small numbers of ranched fish (see Section 2.2.2). Catch and release has become increasingly commonplace in some countries, but these fish do not appear in the nominal catches (see Section 2.1.2).

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

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

The provisional total nominal catch for 2006 was 2001 tonnes, 154 t below the updated catch for 2005 (2155 t) and the lowest in the time series. The 2006 catch was almost 500 t below the average of the last five years (2498 t), and over 550 t below the average of the last 10 years (2554 t). Catches were below the previous five- and ten-year averages in most countries, and were the lowest recorded in the time series in six countries, four of these in Southern Europe.

Nominal catches in homewater fisheries split, where available, by sea-age or size category are presented in Table 2.1.1.2 (weight only). The data for 2006 are provisional and, as in Table 2.1.1.1, include both wild and reared salmon and fish farm escapees in some countries. A more detailed breakdown, providing both numbers and weight for different sea-age groups for most countries, is provided at Annex 4. Countries use different methods to partition their catches by sea-age class (outlined in the footnotes to Annex 4). The composition of catches in different areas is discussed in more detail in Sections 3, 4, and 5.

ICES recognises that mixed stock fisheries present particular threats to stock status. These fisheries predominantly operate in coastal areas and NASCO specifically requests that the nominal catches in homewater fisheries be partitioned according to whether the catch is taken in coastal, estuarine or riverine areas. Figure 2.1.1.2 presents these data on a country-by-country basis. It should be noted, however, that the way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries. For example, in some countries these catches are split according to particular gear types and in other countries the split is based on whether fisheries operate inside or outside headlands. A more detailed description of how the catch in Labrador (Canada) is partitioned between coastal and estuarine areas is provided in Section 4.9.5. 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 some countries the entire catch is taken in freshwater, while in other countries the majority of the catch is taken in coastal waters; in many of these the coastal catch has declined markedly over the period.

Coastal, estuarine and riverine catch data aggregated by region are presented in Figure 2.1.1.3. In Northern Europe, catches have fluctuated over the period with no apparent trend. Typically about half the catch has been taken in rivers and half in coastal waters (although there are no coastal fisheries in Iceland and Finland), with estuarine catches representing a negligible component of the catch in this area. In Southern Europe, catches in all fishery areas have declined over the period and, while coastal fisheries make 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 North America, the total catch over the period 2000–2006 has been relatively constant. The majority of the catch in this area has been taken in riverine fisheries, while the catch in coastal fisheries has been relatively small in any year (11 t or less). Catches in coastal and estuarine fisheries, predominantly from aboriginal food fisheries, have increased slightly 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 2006 for nine countries that have records; catch and release may also be practiced in other countries while not being formally recorded (e.g. Norway). There are large differences in the percentage of the total rod catch that is released: in 2006 this ranged from 18% in Iceland to 82% in Russia, reflecting varying management practices and angler attitudes among these countries. Within countries, the percentage of fish released has tended to increase over time. Overall, almost 154 000 salmon were reported to have been released around the North Atlantic in 2006, about 3000 less than in 2005. There is also evidence from some countries that larger MSW fish are released in higher proportions than smaller MSW fish. Whilst the use of catch and release is likely to result in some fish dying through exhaustion or damage, studies have demonstrated that if fish are appropriately handled, mortality following capture is low and a large proportion of fish survive to spawn (Dempson *et al.*, 2002; Webb, 1998a, 1998b; Whoriskey *et al*., 2000).

2.1.3 Unreported catches

Unreported catches by year (1987–2006) and Commission Area are presented in Table 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). In practice, the derivation methods used by each country have remained relatively unchanged and thus comparisons over time may be appropriate. However, the estimation procedures vary markedly between countries. For example, some countries include only illegally caught fish in the unreported catch, while other countries include estimates of unreported catch by legal gear as well as illegal catches in their estimates. Over recent years efforts have been made to reduce the level of unreported catch in a number of countries (e.g. through improved reporting procedures and the introduction of carcase tagging and logbook schemes).

The total unreported catch in NASCO areas in 2006 was estimated to be 670 t, a decrease of 4% from 2005 (700 t). The unreported catch in the North East Atlantic Commission Area in 2006 was estimated at 604 t, that for the North American Commission Area 56 t, with 10 t estimated for the West Greenland Commission Area. The unreported catch, expressed as a percentage of the total North Atlantic catch (nominal and unreported), has fluctuated since 1987 (range 23–34%), but has remained fairly constant at around 25% in the last three years (Figure 2.1.3.1). Expressed as a percentage of the total North Atlantic catch, estimates by country range from 0 to 15% in 2006 (Table 2.1.3.2), and expressed as a percentage of national catches, unreported catches range between 1% and 50%.

In the past, salmon fishing by non-contracting parties is known to have taken place in international waters to the north of the Faroe Islands. Typically, a number of surveillance flights have taken place over this area in recent years. These have resulted in no sightings of vessels, although there have been extended periods over the winter period when no flights took place. This is the period when salmon fishing has previously been reported. No information was available regarding surveillance flights in 2006.

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 2006 is 817 100 t. This represents a small increase on 2005, but remains below the peak figure of 831 075 t reported for 2004 (Table 2.2.1.1 and Figure 2.2.1.1). Most of the North Atlantic production took place in Norway (73%) and UK (Scotland) (17%).

World-wide production of farmed Atlantic salmon has been in excess of one million tonnes since 2002. However, it is difficult to source reliable production figures for all countries outside the North Atlantic area and it has been necessary to use 2005 estimates for some countries in deriving a world-wide estimate for 2006. Noting this caveat, total production in 2006 is provisionally estimated at around 1 264 000 tonnes (Table 2.2.1.1 and Figure 2.2.1.1), a small increase on 2005 and the highest in the time series. Production outside the North Atlantic is dominated by Chile and is estimated to have accounted for 35% of the total in 2006. World-wide production of farmed Atlantic salmon in 2006 was thus over 630 times the reported nominal catch of Atlantic salmon in the North Atlantic. Farmed salmon therefore dominate world markets.

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 total harvest of ranched Atlantic salmon in countries bordering the North Atlantic in 2006 was 9 t, a slight increase on 2005 (Figure 2.2.2.1). Salmon ranching (smolt releases) ceased in Iceland in 1998. Small catches of ranched fish were recorded in each of the three other countries reporting such fish (Ireland, UK (N. Ireland) and Norway); the data includes catches in net, trap and rod fisheries.

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 Recovery potential of Bay of Fundy and Southern Upland salmon populations

The Working Group reviewed a model being used to assess how salmon populations are expected to respond to recovery activities in the Scotia-Fundy Region of Canada. The model is based on the idea that human activities may affect some part or parts of a population's life history. This in turn affects the population's productivity which then affects population size. The effects of an activity are evaluated by examining the expected change in population size in response to the activity.

An equilibrium modeling approach was used for this analysis. This kind of analysis begins by splitting the life cycle into two parts, and for a given set of life history parameters, determining the population size at which the rates in each part of the life cycle are balanced such that the population doesn't increase or decrease in size. In the analyses presented, the first part of the model gives the number of smolts produced as a function of egg deposition (Figure 2.3.1.1a), modeled using a Beverton-Holt function. This model has two parameters, the slope of the function at the origin and the carrying capacity of the river, which can be changed in response to human activities in freshwater. The second part, the egg-per-smolt relationship (Figure 2.3.1.1b), which gives the rate at which smolts were expected to produce eggs in their entire life, is calculated based on survival of juvenile salmon in the marine environment, age-at-maturity, fishing mortality, fecundity, and the number of times a fish spawns throughout its life. The population equilibrium is found by estimating the abundance at which the production of smolts by eggs equals the reciprocal of the production of eggs by smolts (Figure 2.3.1.1c). In the example, a decrease in smolt-to-adult survival shifts the equilibrium point to a smaller population size. If smolt-to-adult survival decreases far enough, the equilibrium population size goes to zero and the population will become extinct in the absence of human intervention or a change in one or more of the vital rates. However, an equilibrium population size greater than zero does not necessarily mean that a population will not go extinct, because no allowance is made for random variability in the life history parameters.

The Working Group examined four case studies, two of which are reproduced here. For two populations, such as the LaHave River, Nova Scotia, only a single threat was examined. Population specific data were available for this population. Freshwater production in this river appears good relative to some other rivers in the region. Return rates for this population averaged 2.37% (range: 1.09% to 4.33%) for 1SW salmon and 0.48% (range: 0.24% to 0.97%). for 2SW salmon for the 1996 to 2004 smolt year classes. The population equilibrium, based on average at-sea survival rates for the period, is just over 50% the conservation requirement (Figure 2.3.1.2.). At the lowest at-sea survival rates observed during this period, the population is not viable, whereas at the highest rates observed, the population equilibrium is well above the conservation requirement for this river.

Two of the case studies illustrated the cumulative effects of multiple threats. In the West River (Sheet Harbour, Nova Scotia) case study (Figure 2.3.1.3), little population specific data exists so the model was developed using a combination of data from the LaHave River and information about habitat specific to the river. Besides low at-sea survival, West River is also impacted by acidification. The model illustrates that a small population may be achieved in this river if marine survival improves, the population would be expected to remain below its conservation requirement and may be below a size at which the population would be viable in the long term. Both an increase in at-sea survival and pH recovery is needed to increase this population to levels above its conservation requirement.

The Working Group concluded that the approach was useful for evaluating the potential for recovery of salmon populations. Assuming that conditions in freshwater are not responsible for the low marine survival being experienced by Scotia-Fundy populations, the case studies illustrate the limiting effect that low marine survival can have on recovery actions focused only on improving freshwater habitat. However, at high at-sea survival rates the equilibrium population size is very sensitive to the amount of freshwater habitat. The LaHave River case study showed that in recent years, at-sea survival rates have in some years been high enough that if sustained, populations would be expected to increase to levels above the conservation spawner requirement given sufficient freshwater habitat. In these instances, recovery actions focused in freshwater may or may not be effective depending on the scope available for improvements in freshwater. The case studies also illustrated how freshwater habitat degradation such as acidification limits the potential for population growth in some rivers even if at-sea survival improves. The analyses reviewed could be extended to other populations and threats, however, within the Scotia-Fundy region, the extent of all threats is not fully quantified. For this reason, the expected population response throughout the region to an increase in at-sea survival is presently unknown.

2.3.2 Monitoring interactions between aquaculture and wild fisheries in Norway

Ongoing Research

A number of studies have been performed by the Institute of Marine Research (IMR), Norway to assess the impact of salmon farming in marine areas where important wild salmon populations may pass, and to enable appropriate actions to be taken to alleviate possible negative effects from the aquaculture activities. These studies clearly indicate that the impact from salmon lice infestations occurring in the migration areas of wild postsmolts may directly influence mortality rates but may also indirectly affect mortalities through reducing growth rates of fish surviving the first infestations (Skilbrei and Wennevik, 2006a).

Studies relevant to regulations and management

Experimental trawling for wild postsmolts and hatchery postsmolts placed in cages along a fjord have demonstrated that a combination of enforcement of aquaculture regulations, and a strict programme of sea lice monitoring in fish pens together with voluntary actions from the farmers appears to reduce the numbers of sea lice to stated tolerance levels (Boxaspen 2006; Finstad *et al.,* 2007). However, the continued increase in the number of fish farms and production of aquaculture highlight the importance of continued monitoring and surveillance.

Capture fisheries examined following simulated escapes of aquaculture salmon suggest a low probability of successful recapture after a major escape, unless the fisheries are operated immediately (within a few days) and with the effort spread over a large area. The study showed that escapees can be dispersed over several square kilometres in the course of just a few days (Skilbrei *et al.,* 2007). In addition, immediately after an “escape” the fish may be in the deeper water layers avoiding capture by many gear types. After the initial period, surface gears may be more effective as the fish may be present on the surface.

These behavioural patterns of the escapees suggest that recapture efforts should be regional rather than local. In one experiment, more than 50% of adult salmon tagged with acoustic tags were recovered in several recreational fisheries with most of them taken in the recreational net fisheries during the annual autumn fishery for escapees. Recoveries indicated that most of the tagged salmon were caught within a range of 20 kilometres from the release sites indicating that high recapture rates are possible in fjord regions if the fishing effort is high. In sparsely populated areas, the efforts and resources required to recapture escapee salmon may be large. This includes farm sites close to the open sea where the salmon are believed to spread even faster than in the fjords as well as after very large escape incidents (Skilbrei and Wennevik, 2006b; Skilbrei *et al.,* 2007).

Identification methods

Norwegian fish farmers are required to report escapes from their farms to the authorities. However, it may be some time before it is apparent that fish have escaped, and such events are often discovered by nearby fishermen who report sudden and unusually high numbers of salmon in their gear. Recently a Norwegian project (TRACES) aimed at investigating the origin of salmon from unreported escapes to their farm of origin, has made a major breakthrough in identifying the specific farm or cage of origin of escapee salmon by using a combination of genetic and chemical characteristics. In autumn 2006, substantial numbers of escaped salmon were observed in a fjord in Western Norway, although none of the fish farmers in the area had reported any escapes. The Institute of Marine Research was asked by the Directorate of Fisheries to investigate whether the source of the escaped fish could be traced. Samples were collected from all net cages in fish farms in the fjord and analyzed for 15 microsatellites. The DNA and chemical profiles of the escaped fish were then compared to the profiles of the different fish farms. The results showed with high probability that the escapees originated from one specific net cage. As this was the first time that DNA methodology had been used to trace the origin of escaped fish with such confidence that the Directorate of Fisheries in Norway proposes to apply similar procedures in similar cases in the future.

Research reports

The Working Group noted that the proceedings (Hutchinson, 2006) and the Conveners' report (Hansen and Windsor, 2006) from the ICES and NASCO Symposium on Interactions between aquaculture and wild stocks of Atlantic salmon and other diadromous fish species: Science and Management, Challenges and Solutions have been published.

2.3.3 Cessation of mixed stock fisheries in Irish coastal waters from 2007

In 2005, an Irish Government decision was taken to end the at sea mixed stock fisheries (predominantly drift nets) in 2007 and to operate fisheries only on single river stocks, which were shown to be meeting conservation limits. This was to align with best international practice, comply with scientific advice from ICES, meet NASCO objectives and to afford greater protection to stocks designated under the EU Habitats Directive (Council Directive 92/43/EC; http://ec.europa.eu/environment/nature/nature_conservation/eu_nature_legislation/habitats_directive/index_en.htm). In the absence of mixed stock fisheries at sea from 2007, the methodology used to provide status of river stocks and catch advice has been modified for 2007 and thereafter. The major differences are related to the provision of catch advice on a river specific basis as advised by the Standing Scientific Committee of the National Salmon Commission. In so doing, the status of stocks is related specifically to individual rivers rather than to district aggregations of stocks. In the absence of a drift net fishery (or any other net fishery) at sea, in-river measures of abundance have been used (i.e. fish counter data and rod catch data) to provide a primary measure of spawning stocks and attainment of conservation limits.

The process of estimating conservation limits remains unchanged, as does the assessment of whether the stock (in this case the river stocks rather than the district stock as calculated in previous years) is above or below its conservation limit. This eliminates the uncertainty associated with the previous assessment in assigning all fish in the district catch to rivers within that district.

In this manner fisheries will now only take place on single river stocks shown to be meeting conservation limits in 43 rivers with the catch level set to allow at least a 75% chance of meeting the conservation limit. There are also two estuarine fisheries identified where there is a catch option providing a 75% chance that the individual rivers entering the estuary will meet their conservation limits.

There are 34 rivers that do not have an identifiable surplus over the CL. Therefore, there are no harvest options available to allow a fishery to take place such that these stocks will meet their conservation limit. Where these rivers are meeting 65% or more of their conservation limit a directed catch and release fishery will be permitted, provided the regional fisheries authorities are satisfied that this will comply with set criteria and survival of released fish is within published limits.

There are 74 small rivers with no counter or an average rod catch of less than 10 salmon per annum. Given the tenuous state of many of the smaller rivers, general advice is that there should be no directed fishery (including catch and release) until other information is made available to indicate that these rivers are exceeding their CL and that there is a catch option that meets the management objectives.

2.3.4 Development of predictive models for returning salmon in Norway

A project to develop predictive models for the return of Norwegian salmon has recently been completed. The factors examined included hydrography, plankton production, the biomass and condition of pelagic marine fish species and salmon growth and survival indices (e.g. catches, estimated marine survival rates).

Models to forecast 1SW salmon were developed from environmental variables, plankton production, and condition factor and biomass of herring. This approach is based on the assumption that the smolt production is the same every year. To forecast PFA of 1SW salmon a multivariate regression method called PLS (Projection on Latent Structures, Martens and Martens, 2001) was applied. PLS models both the predictors and the response (1SW return) simultaneously to find the latent structures in the predictor space that best explain the response. These latent structures are similar to principal components. Models were developed for the whole of Norway, for the three regions (South-, Mid- and North-Norway) and for a single river (River Drammen). For all models, except South Norway, it was found that total stock biomass of herring was the most influential predictor.

Models were developed to forecast PFA of 2SW and 3SW salmon in years i+1 and i+2 based on the run of 1SW fish in year i. This approach is independent of smolt production and was based on observations of significant correlations between survival indices of 2SW and 3SW salmon from the same smolt cohorts.

The precision of the forecasts was variable, lowest in southern Norway and highest in northern Norway. This has been the first approach to forecast salmon runs to Norway, and work is continuing to further develop the models, including standardising data sampling so that the quality of appropriate time series will be less variable. It is hoped this will improve the ability to predict homewater PFA .

2.3.5 Human activities impacting on aquatic diversity

There are concerns about the movement and introduction of exotic fish (e.g. carp) to non-endemic watersheds and the impacts of these introductions on Atlantic salmon stocks. The inadvertent movement and introduction of aquatic diseases and organisms by human activities, including fishing, can also occur and potentially impact salmon populations and resource users. The Working Group was informed of the first confirmed occurrence of a presumably non-native freshwater algae in a salmon river of eastern Canada.

Didymosphenia geminata, commonly referred to as “didymo” or “rock-snot”, is a fresh water diatomous algae that attaches to rocks and grows on gelatinous stalks. It prefers waters of low nutrient levels. It can develop into large mats of yellow-brown colour, which can cover the bottom of rivers and lakes. The mats have the texture of wet wool and when dry have the appearance of toilet paper or parchment paper. Didymo is not toxic and its impacts are most important on the aesthetics of the rivers (including angling quality). More detailed information and references on the characteristics of didymo can be found at the website of the Invasive Species Specialist Group (ISSG) of IUCN Species Survival Commission (http://www.issg.org/database/species/ecology.asp?si=775&fr=1&sts=).

Since the late 1980s, didymo blooms have been reported in a number of northern hemisphere countries within Europe and North America. Recently, didymo was also introduced to New Zealand where its impact on rivers has been severe resulting in a strong and directed campaign by the government to control its further distribution (see http://www.biosecurity.govt.nz/didymo).

The first important occurrence in eastern Canada was confirmed in the Matapedia River (Quebec) in 2006. The proliferation occurred in a high use prime angling stretch of the river and raised alarms in the local community. From water samples obtained in November 2006, cells of didymo were identified from seven of thirteen sampled rivers within Quebec, although the only important proliferation was reported from the Matapedia River.

In Iceland, didymo was not identified from aquatic surveys dating back to 1940´s but it was subsequently identified in samples from 1994 from several rivers (Jonsson *et al.*, 2000). In some rivers, blooms of didymo were reported and the algae spread to many rivers in the following years. It seems that shortly after it first arrives in a river or to an area in a river it can have very dense growth, but generally retreats after a few years although it still persists. It is now spread around the entire coast of Iceland, though not in all rivers. There have been no documented impacts on salmon or trout populations in Iceland.

Didymo can be transferred between watersheds through various vectors including fishing gear and more specifically the felt soles on waders. The increased spread of didymo in the last two decades is hypothesized to be the result of increasing global travel of recreational water users, including anglers.

The inadvertent transfer of didymo and other aquatic biota can be easily controlled through cleaning of gear using readily available detergents followed by drying equipment. Information campaigns to educate all water resource users have developed in eastern Canada. It is primarily through increased awareness and directed effort by all users that the spread of didymo and other aquatic invasive species can be controlled.

The Working Group notes that the impacts of non-indigenous species on Atlantic salmon populations are not fully understood and that the incidence of exotic species in aquatic habitats appears to be increasing.

2.3.6 Timing and nature of density dependence in Atlantic Province salmon populations

The Working Group examined a paper on the timing and nature of density dependence in Atlantic Province (Eastern Canada) salmon populations. Density dependence is the regulatory mechanism that prevents populations from increasing without bound or routinely extirpating. Analyses of density dependence are an important step in model development for reference point estimation, assessment of extinction risk and evaluating the effectiveness of proposed recovery activities as used in Section 2.3.1. Density-dependent survival within freshwater was analysed using electrofishing data from nine populations in the Maritime Provinces and smolt-to-adult return-rate data from 15 populations in eastern Canada was used to evaluate whether density-dependence is important in the marine environment. As illustrated with data and fits for three of the populations in Figure 2.3.6.1, three spawner-recruit models, a Beverton-Holt, a Ricker and a one-parameter density-independent model, were fit to each data series using maximum likelihood. Model fits were compared using likelihood ratio tests.

Within fresh water, no single, unequivocal pattern was evident with respect to the timing of density dependence. Density dependence was detected in three of six egg-to-age-0 transitions, in six of nine age-0-to-age-1 transitions, and in three of the nine age-1-to-age-2 comparisons. Overcompensation was not detected in these data. Carrying capacity for age-1 salmon was found to be highly variable among populations. Using a mixed-effects model, the median carrying capacity was estimated to be 24.8 parr/100 m^2 with 95% of the probability density falling between 3.8 and 165.9 parr/100 m^2 (Figure 2.3.6.2).

In the marine environment, density dependence was potentially detected in three of the 15 populations for 1SW salmon, but these three series were either short or highly variable. Density dependence was not detected in any of nine 2SW salmon populations.

The variability in both the timing of density dependence and carrying capacity for parr highlights the need for population-specific data for establishing reference points or when planning recovery or enhancement activities. The three populations with the lowest estimated age-1 carrying capacity are located in the outer Bay of Fundy and Southern Upland, are in the southern half of the range of the included populations and are populations with low at-sea survival. Assuming these estimates are correct, freshwater production has the potential to limit population growth in these populations even if at-sea survival improves.

2.3.7 Autumn downstream migration of juvenile Atlantic salmon in the UK - possible implications for the assessment and management of stocks

Downstream movement of juvenile Atlantic salmon during the autumn has previously been recorded for populations in both North America and the UK (Youngson, *et al*., 1983; Riley *et al*., 2002). Although Cunjak and Chadwick (1989) reported a significant migration into tidal rearing habitats, the function of this movement, the physiological status of these fish and whether such fish make an early entry into the marine environment remains unclear. The Working Group received new information from a study undertaken in the River Frome (Pinder *et al*., in press), which sought to quantify the size of the autumn migration and determine the physiological status of both migrants and non-migrants in this catchment.

Large numbers of 0+ salmon parr were tagged in the Frome during September in both 2004 and 2005 with Passive Integrated Transponder (PIT) tags; the majority of salmon leave this river as one-year-old smolts. The subsequent movements of the tagged fish were monitored at a number of trapping facilities and by means of a full river PIT antenna detector array (Ibbotson *et al*., 2004) located 4 km above the head of tide. The number of autumn migrants passing the antenna array between October 2005 and January 2006 was estimated at 2480 fish. This compares with a three-year mean smolt run estimate for the river (2004–06) of 9400. Electrofishing at low water in tidal sections of the river in February and March subsequently confirmed the presence of autumn migrating parr in the estuary.

Elevated total thyroxine levels (T3 and T4) in the autumn migrants were indicative of the fish making a directed migration. Further, increased numbers of filament chloride cells and higher percentage cover of the gill epithelium by these cells in the estuarine resident fish compared with freshwater residents, also suggested increased salinity tolerance and ability to osmoregulate. However, this was not sufficient for the estuarine residents to survive a saltwater challenge test (performed in February/ March). Neither the autumn migrants, estuarine resident parr nor river residents displayed a significant increase in gill or kidney Na^+, K^+ -ATPase activity, as was evident for smolts in the springtime (Figure 2.3.7.1).

It was concluded that the component of the population that migrated downstream in the autumn was not physiologically adapted to survive early entry into saltwater and was expected to remain in the lower river/estuary at least until the following spring. It is not clear whether the downstream migration reflects displacement from upstream areas or is a specific life history strategy. It is also not known whether marine survival varies between autumn and spring migrants. Future returns of PIT-tagged adult salmon to the Frome should provide new information in this context.

The extent to which autumn migration might vary between catchments or over time, for example in response to climate change, is unclear. However, the implications from this study, that a sizeable proportion of the parr population over winters in the estuary, highlights the importance of regarding estuarine environments as habitats utilised by juvenile salmon and of managing such habitats accordingly. Further, the findings may have implications for stock assessment programmes, as autumn migrants are likely to be excluded from most current smolt run estimates and estimates of marine survival.

2.4 NASCO has asked ICES to provide a framework of indicators which would be used to identify any significant change in the previously provided multi-annual management advice for each Commission area.

2.4.1 Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance

In 2006, ICES provided multi-annual management advice for all three NASCO Commission Areas and presented a preliminary framework (Framework of Indicators) which would indicate if any significant change in the previously provided multi-annual management advice in subsequent years had occurred. The advice and Framework of Indicators (FWI) formed the basis for the multi-annual (3 year) regulatory measures, which were agreed upon in the West Greenland (salmon fishery in the waters off West Greenland; NASCO, 2006a) and North-East Atlantic Commissions (salmon fishery in Faroese waters; NASCO, 2006b). The second and third year of the regulatory measures for both fisheries is dependant on ICES providing, and the Parties to each Commission Area accepting, a finalized Framework of Indicators.

ICES formed the Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance (SGEFISSA, ICES, 2007a) which met in 2006. The SGEFISSA further developed the FWI, which was originally presented by ICES (ICES, 2006). The FWI defined a significant change in management advice as an unforeseen increase in stock abundance to a level that would allow a fishery. The SGEFISSA developed a generalized FWI that can be applied to each NASCO Commission Area. Further, the SGEFISSA developed a FWI for the Greenland fishery based on the seven contributing stock complexes with direct links to the three management objectives established by NASCO for that fishery. This FWI assesses if there is an expectation that the previously provided management advice for the Greenland fishery is likely to change in subsequent years. The SGEFISSA provided a spreadsheet template FWI (*Greenland Fishery Framework of Indicators.xls*) in which the underlying variable of interest/ indicator dataset relationships and decision rules are summarized and collated according to the specific management objectives for each fishery. To apply the FWI, a user must enter the indicator values for the most recent year and the required fields are automatically calculated, displayed, summarized in a stock-specific fashion and an overall recommendation is determined.

The SGEFISSA was unable to develop a spreadsheet FWI for the Faroese fishery for a number of different reasons. Among them is the lack of quantitative catch advice, the absence of specific management objectives for the fishery, the absence of a sharing agreement for this fishery, and that none of the available indicator datasets met the criteria for inclusion in the FWI. In addition, the stock complex that is currently limiting this fishery (Southern NEAC non-maturing complex) has fluctuated around its Spawner Escapement Reserve in recent years.

The Working Group 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, the Working Group recommends that annual assessments be conducted to verify the multi-year catch advice.

2.4.2 Update of the Framework of Indicators for the 2007 to 2009 multi-year catch advice at West Greenland

The Working Group updated the FWI for the Greenland fishery. The update consisted of:

- Adding the values of the indicator variables for the most recent year,
- 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 variables of interest data series for the six geographic areas of North America and for the southern NEAC MSW complex are presented in Table 2.4.2.1. The management objectives for the development of the catch options for the West Greenland fishery are presented in Table 2.4.2.2.

A total of 82 indicator variables were updated and analysed using the objective function spreadsheet. These variables included returns of 1SW or small salmon, 2SW or large salmon, and return rates as 1SW and 2SW salmon of wild and hatchery origin fish.

For the North American Commission area, the indicator variable data sets originated from 38 rivers distributed from the US to Labrador (Figure 2.4.2.1).

Based on the objective function spreadsheet and the criteria established by the SGEFISSA, a total of 32 indicator variables were retained (see below). Of these, four were return rate indicators of hatchery fish, while the remainder were of wild 2SW or large salmon (N = 15) and wild 1SW or small salmon (N = 13) returns to rivers.

SUMMARY OF INDICATOR VARIABLES RETAINED FROM NORTH AMERICA							
Origin	Wild	Wild	Wild	Wild	Hatchery	Hatchery	
TYPE OF DATA	Return	Return	Survival	Survival	Survival	Survival	
SIZE/AGE GROUP	Small/1SW	Large/2SW/ MSW	Small/1SW	Large/2SW	Small/1SW	Large/2SW	**Total**
Labrador							0
Newfoundland	1						1
Quebec	6	8					14
Gulf	1	1					2
Scotia-Fundy	4	4			1	1	10
US[1]	1	2[2]			1	1	5
Total	13	15			2	2	**32**

[1] for US, returns include both wild and hatchery origin fish
[2] in one river (Narraguagus), returns are of age/size groups combined

Summaries of the indicator variables retained for the 2007 to 2009 multi-year catch advice indicator framework are provided in Table 2.4.2.3. No indicator variables were retained for the Labrador area and for southern NEAC non-maturing complex. All the retained indicator variables had a probability of identifying a true low state or a true high state of at least 80% (Figure 2.4.2.2). For the Quebec area, two indicator variables met the criteria for retention as described in SGEFISSA but the probability of identifying either a true low state or a true high state was less than 80% and the Working Group recommended that these indicators not be included in the framework.

The Working Group modified the FWI from a one-way test to a two-way test in order to evaluate the over-estimation of stock abundance by the forecast model.

2.4.3 Application of the framework indicator spreadsheet for signalling whether a significant change in management advice may occur for the fisheries in 2008 and 2009.

The FWI spreadsheet is shown in Figure 2.4.3.1. The framework provides one of two conclusions for the user:

1) no significant change identified by the indicators
2) reassess

If no significant change has been identified by the indicators, then the multi-year catch advice for the year of interest could be retained. If a significant change is signalled by the indicators, the response is to reassess.

The framework spreadsheet is designed to capture both fishing and non-fishing scenarios:

- multi-year advice provides no catch options greater than zero but indicators are suggesting that the management objectives may be met (conclusion: Reassess),
- multi-year advice provides catch options greater than zero but the indicators suggest the management objectives may not be met (conclusion: Reassess).

The FWI spreadsheet will be updated with the returns or return rate data for 2007 to evaluate the appropriateness of the 2008 advice, and with the returns or return rate data for 2008 to evaluate the appropriateness of the 2009 advice. It is anticipated that the data for the indicator variables to populate the framework would be available in January of the year of interest. The framework will be updated whenever a new set of multi-year catch advice is provided. Figure 2.4.3.2 illustrates the timeline of how the FWI would operate.

Applying the framework

There are two steps required by the user to run the framework. The first step in the framework evaluation is to enter the catch advice option for the West Greenland fishery (t). This feature provides the two way evaluation of whether a change in management advice may be expected and a reassessment would be required. The second step is to enter the values for the indicator variables in the framework for the year of interest. The spreadsheet evaluation update is automated and the conclusion is shown in the row underneath “Overall Recommendation”.

Framework features

The framework spreadsheet contains a number of cells with quantities used to evaluate the indicator variables and the attainment of management objectives. This information could be used to evaluate in a qualitative sense the state of the river-specific salmon stocks relative to the threshold values, which would infer that the management objectives would be met or not met for the geographic area. An understanding of these variables is not required to run the framework spreadsheet, as they are locked and not available to the user.

The conclusions from the framework evaluation are based on whether there is simultaneous achievement of the management objectives in the six stock areas of North America and the southern NEAC non-maturing complex (Figure 2.4.3.1). If there are no indicator variables for a geographic area, the attainment of the management objectives is evaluated as unknown and that area or complex is not used in the decision structure of the framework.

Within the geographic areas for which indicator variables are retained, all the available indicators are used to assess the indicator score. If an update value for an indicator variable is not available for the year of interest evaluation, the indicator variable is not used to quantify the indicator score for that area.

The indicator variables within a geographic area may be in different indicator states relative to the achievement of the management objective for the area. For example, in Figure 2.4.3.1 for the Quebec area, the indicator variable defined as the large salmon returns to River Bonaventure suggests that the management objective for Quebec may be met (indicator score = +1) but the next indicator variable (large returns to Grande Riviere) suggests that the management objective will not be met (indicator score = -1).

The overall indicator score for the geographic area is used to determine if the management objectives could be met. Multiple indicators within the stock complex groupings are combined by arithmetic average of the product of the indicator value (-1, +1) and the probability of a correct assignment corresponding to the true low or true high states. An average geographic area or stock complex score equal to or greater than zero would suggest there is a likelihood of meeting the management objective for that grouping based on the historic relation between the variable of interest (adult returns to a geographic area or PFA) and the indicators evaluated. An indicator variable with a very strong power of resolution for a true low or true high state (for example geographic area Scotia-Fundy, LaHave River large salmon returns, probability of true low = 100%, 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 Rate for hatchery, probability of true low = 81%, probability of true high = 87%) (Figure 2.4.3.1).

2.5 NASCO has asked ICES to examine associations between changes in biological characteristics of all life-stages of Atlantic salmon and variations in marine survival

The purpose of examining these associations is to determine whether declines in marine survival coincide with changes in the biological characteristics of juveniles in fresh water or are related to characteristics of adult fish (size at age, age at maturity, condition, sex ratio, growth rates, etc.). Changes in the sea age composition and run timing of salmon have been widely reported for populations throughout the North Atlantic, commonly involving a progressive reduction in the proportion of older fish and an associated shift in run timing from spring-summer to summer-autumn. In addition, the Working Group noted that there was also increasing evidence for changes in other biological characteristics, for example the size and growth of parr and the mean smolt age.

The Working Group received new information on changes in the size and growth of 1SW fish in the North East Atlantic and in biological characteristics from two index rivers in Quebec, but were unable to consider this topic in depth in the time available. The Working Group recommends that co-ordinated efforts are made to collate information on biological characteristics throughout the geographic range, to include issues such as:

- Juvenile size at age (freshwater growth)
- Smolt age composition
- Smolt run timing (and autumn parr movements)
- Post-smolt growth
- Sea-age composition
- Size at return (marine growth)
- Adult run timing
- Sex ratios

2.5.1 Small grilse size and growth during the first summer at sea in Scottish and Norwegian salmon populations.

Sample data from three Scottish net fisheries suggest that, over a wide area of Scotland and in each month of the season where data were available, grilse returning in 2006 were both substantially shorter and lighter than previous baseline data. Samples from river fisheries in Southern Norway show a similar pattern, while in mid and northern Norway the grilse sizes in 2006 were closer to the average in the period 1989–2005. The Scottish data show that the existence of "small grilse" was the result of a general decline in the size of returning fish as a whole. Reports of small grilse were simply the most obvious manifestations of a sharp decline in the general size of fish returning in 2006 compared to previous years.

Analysis of the back-calculated lengths of fish from scale samples from the North Esk net & coble fishery provides strong evidence for a substantial decline in the growth of the 2006 grilse either in the short period in freshwater before smolt emigration or, more likely, in the post-smolt phase of their life in 2005. Back-calculated lengths of first year growth of grilse from rivers in the South Western part of Norway also show that the growth of the 2005 smolt cohort had declined substantially compared to the growth of previous cohorts.

Analysis of the time series data for all six Scottish net fisheries indicates that both median fork length and fresh round weight of returning grilse show distinct declines over a 40-year time period, albeit with shorter time-scale variations also evident within the data set. Data for 2006 show a sharp decline, particularly in July and August. In rivers in the southern parts of Norway the mean weight of grilse (fish smaller than 3 kg) had varied since 1989, with 2006 showing the lowest values in the whole time series. For Norway the data prior to 1989 is probably biased because of the size selective drift net fishery that mainly targeted large grilse and smaller MSW salmon.

Grilse weight and grilse catches were positively correlated in rivers in southern Norway and mid Norway, suggesting that cohorts with reduced growth suffered reduced survival. However, in rivers in the northern part of Norway a similar pattern was not observed. Furthermore, the mean weight of grilse in the River Drammen was positively correlated to survival estimates from hatchery smolts released in the same river.

The Working Group also received information from Sweden that the grilse in 2006 were also small and lean, with a mean weight in the sport fishery 17% less than that in 2005, although MSW salmon were of normal size. Quite a few of the fish caught by anglers in Sweden were reported to be extremely thin and this raised concerns among fishermen about the future. Together with evidence of significantly smaller grilse from parts of UK (England & Wales), and ad hoc reports from Ireland, it was apparent that reduced grilse size in 2006 was a phenomenon, which affected more southerly areas of Europe.

2.6 Tracking and tagging studies

2.6.1 Acoustic tracking of migrating Atlantic salmon kelts from the LaHave River, Nova Scotia, Canada

The Working Group reviewed the results of an acoustic tagging experiment in the LaHave River. Salmon kelts were captured in early April by seining, angling, and at a downstream assessment facility 25 km above tide head. Thirty kelts were implanted with acoustic tags, including 5 tags that transmit depth data. A total of 26 continuous recording acoustic receivers were placed in the river 15 km above head of tide to 24 km below tide at the outer limits of the estuary to monitor the passage of tagged fish from April to October (Figure 2.6.1.1). The outward migration of 30 kelts and subsequent return of one consecutive spawning salmon was successfully documented using this method. All kelts left the estuary by the middle of May.

The mortality rate of kelts to migration past the outer array was 10%. Location and duration of residency was recorded and environmental variables were compared to behaviour.

The results indicated that capture by angling was the most successful method and that kelts tolerated handling and surgery well. No mortalities due to capture, holding or surgery occurred. The data on migration rate, diving behaviour and high survival rate were new and important information for this stock, which is experiencing increased mortality to repeat spawning. Only one salmon, a post-spawned 2SW female salmon returned to the estuary after 79 days, spent four days in the estuary and after entering the river reached the assessment facility in one day. This consecutive repeat spawning salmon had increased its weight by 50%. Based on past external (Carlin) tagging experiments the remaining 26 salmon that successfully migrated past the outer array are expected to reach the Labrador Sea within three months and possibly farther north within five months similar to that expected for smolts. If the mortality rate that was measured for salmon exiting the estuary continued for the expected 14 month migration about five salmon could be expected to return in July 2007. However, based on recent observations of the proportions of repeat spawning salmon, fewer salmon may be expected.

The Working Group noted that based on the low mortality rate of kelts migrating past the outer arrays, the expected ocean migration and the large size of kelts, tagging experiments utilizing this stage of salmon, particularly with newly evolving advanced technology tags, could provide critical insights into the migration, behaviour and possibly survival rates to northern geographic areas.

2.6.2 Monitoring smolt migration in the River Rhine, Germany

The downstream migration of Atlantic salmon smolts was monitored in the River Rhine in 2006 and 2007 using the NEDAP Trail system (Breukelaar *et al*., 1998). Overall, 88 tagged fish were released into two tributaries of the River Rhine about 350 km from the sea. The smolts (hatchery 2^+, weight > 150 g) were tagged with a transponder (length 3.5 cm, weight 11.5 g) by implantation into the body cavity, and allowed to recover for a period of several days in the hatchery before release to the river. The tagged fish were detected by fixed antenna arrays when leaving the tributary and during their migration through the Rhine delta to the sea. The NEDAP trail system is based on inductive coupling between an antenna loop on the river bottom and a ferrite rod antenna within the transponders. When the fish passes each detection station the unique ID-number of the transponder is recorded.

To April 2007, 64 fish have been detected leaving the tributary of release (5 in 2006 and 59 in 2007, respectively) and 24 (1 in 2006 and 23 in 2007, respectively) have been recorded reaching the sea after passing through the Rhine delta. The study aims to investigate the success of downstream migration and the migration routes in relation to the obstructions within the partly dammed Rhine delta, and particularly the Haringvliet sluices. The study will be repeated after re-opening of the Haringvliet dam. This is scheduled to occur by the end of 2008, aimed specifically at improving conditions for migratory fish species during their passage from freshwater to the sea and vice versa.

2.6.3 Data Storage Tags and tagging studies in Iceland

Hatchery reared smolts with implanted data storage tags (DST) were released in 2005 and 2006 in an Icelandic river. The first returns (5 salmon) were obtained in 2006. The DST tags recorded temperature and depth for the whole ocean cycle of these salmon. The salmon stayed in the surface layers throughout most of their ocean stay and all showed similar temperature profiles. The research provides new information on the conditions salmon experience at sea. Further analyses of these data as well as tags still to be recovered will provide a considerable input to the understanding of the behaviour of salmon at sea.

2.7 Compilation of tag releases and fin clip data by ICES member countries in 2006

Data on releases of tagged, fin-clipped and otherwise marked salmon in 2006 were provided to the Working Group and are compiled as a separate report (ICES, 2007b). In summary (Table 2.7.1), about 3.96 million salmon were marked in 2006, a decrease from the 5.64 million fish marked in 2005. The adipose clip was the most commonly used primary mark (3.02 million), with microtags (0.84 million) the next most common primary mark. Most marks were applied to hatchery-origin juveniles (3.85 million), while 94 713 wild juveniles and 21 013 adults were also marked. The use of PIT (Passive Integrated Transponder) as well as other implanted tags for marking Atlantic salmon has increased in the later years and are now listed in a separate column in Table 2.7.1. In 2006, 6305 PIT tagged salmon, Data Storage Tags (DSTs), radio and/or sonic transmitting tags (pingers) were also used.

From 2003, the Working Group has recorded information on marks being applied to farmed salmon. These may help trace the origin of farmed salmon captured in the wild in the case of escape events. At this time, two jurisdictions (USA-Maine, and Iceland) require that some or all of the sea-cage farmed fish reared in their area be marked. In Maine, some firms have opted for a genetic “marking” procedure. The broodstock of these firms has been screened with molecular genetic techniques, which makes it feasible to trace an escaped farmed salmon back to its hatchery of origin through analysis of its DNA. One company has applied ventral fin clip, but has not reported numbers for reasons of commercial confidentiality. In Iceland, coded wire tags are being applied to about 10% of sea-cage farm production. The Icelandic data are included in ICES (2007b), but the USA numbers are not included.

2.8 Summary of the Workshop on the Development and Use of Historical Salmon Tagging Information from Oceanic Areas (WKDUHSTI)

Results from the Workshop on the Development and Use of Historical Salmon Tagging Information from Oceanic Areas (WKDUHSTI) were presented to the Working Group. Data were provided from a number of countries, including tag recoveries in oceanic areas from smolt tagging in home waters, and recoveries in oceanic areas as well as in home waters of salmon tagged at sea. A framework for analyses of data was developed, and a standard format for recording tag recoveries was agreed. Using GIS as a tool, examples of geographical distribution of recaptured salmon originating from different areas were provided, demonstrating the potential for the use of this tool. A number of hypotheses relating to oceanic migration and distribution, which could be tested using tagging and recapture material, were discussed and developed. Tag recovery information could be complemented by genetic analyses of time series of available scale or tissue samples in relation to salmon life-history information derived from scale pattern analyses of freshwater and marine growth characteristics.

The Workshop concluded that there is great potential to analyse standardised datasets, but it remains to develop detailed statistical methods and models to analyse the material and test appropriate hypotheses. There is still a large amount of material available, but this has to be standardised and converted to the same format, as agreed in WKDUHSTI. An EXCEL file with the appropriate form was developed and should be made available to tagging agencies in the different countries. The workshop recommended that this framework be used for future contributions to the tag recovery data set. Each tagging agency should utilize the framework to prepare data for analysis at the next Workshop. It was recommended that agencies coordinate their efforts to ensure that datasets are not duplicated.

It was recommended that a similar Workshop be held sometime in 2007 or 2008 to complete compilation of available data and analyses of the resulting distributions of salmon at sea. In this regard, the Workshop considered that the integration of historical tagging data for NEAC and NAC provides a significant opportunity to advance the state of knowledge of the marine distribution and migration of salmon. It was recommended that this Workshop should include oceanographers to assist with describing salmon distributions and relating them to the ocean environment.

Table 2.1.1.1. Nominal catch of salmon by country (in tonnes round fresh weight), 1960–2006. (2006 figures include provisional data).

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

Table 2.1.1.1. Continued.

Year	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Den.	Finland	Ireland (4,5)	UK (E & W)	UK (N.Irl.) (5,6)	UK (Scotl.)	France (7)	Spain (8)	Faroes (9)	East Grld.	West Grld. (10)	Other (11)	Reported Nominal Catch	NASCO Areas	International waters (12)
1991	711	1	1	876	215	130	345	38	3	70	404	200	55	462	13	11	95	4	472	-	4,106	1,682	25-100
1992	522	1	2	867	167	175	461	49	10	77	630	171	91	600	20	11	23	5	237	-	4,119	1,962	25-100
1993	373	1	3	923	139	160	496	56	9	70	541	248	83	547	16	8	23	-	-	-	3,696	1,644	25-100
1994	355	0	3	996	141	141	308	44	6	49	804	324	91	649	18	10	6	-	-	-	3,945	1,276	25-100
1995	260	0	1	839	128	150	298	37	3	48	790	295	83	588	10	9	5	2	83	-	3,629	1,060	-
1996	292	0	2	787	131	122	239	33	2	44	685	183	77	427	13	7	-	0	92	-	3,135	1,123	-
1997	229	0	2	630	111	106	50	19	1	45	570	142	93	296	8	3	-	1	58	-	2,364	827	-
1998	157	0	2	740	131	130	34	15	1	48	624	123	78	283	8	4	6	0	11	-	2,396	1,210	-
1999	152	0	2	811	103	120	26	16	1	62	515	150	53	199	11	6	0	0	19	-	2,246	1,032	-
2000	153	0	2	1,176	124	83	2	33	5	95	621	219	78	274	11	7	8	0	21	-	2,913	1,269	-
2001	148	0	2	1,267	114	88	0	33	6	126	730	184	53	251	11	13	0	0	43	-	3,069	1,180	-
2002	148	0	2	1,019	118	97	0	28	5	93	682	161	81	191	11	9	0	0	9	-	2,654	1,039	-
2003	141	0	3	1,071	107	110	0	25	4	78	551	89	56	192	13	7	0	0	9	-	2,456	847	-
2004	161	0	3	784	82	130	0	19	4	39	489	111	48	245	19	7	0	0	15	-	2,156	686	-
2005	139	0	3	888	82	149	0	15	8	47	422	97	52	215	11	13	0	0	14	-	2,155	700	-
2006	132	0	4	932	91	121	0	14	3	67	326	79	25	164	11	11	0	0	21	-	2,001	670	-
Average																							
2001-2005	147	0	3	1,006	101	115	0	24	5	77	575	128	58	219	13	10	0	0	18	-	2,498	890	-
1996-2005	172	0	2	917	110	114	35	24	4	68	589	146	67	257	12	8	2	0	29	-	2,554	991	-

Key:

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

Table 2.1.1.2. Nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2006. (2006 figures include provisional data).
S = Salmon (2SW or MSW fish). G = Grilse (1SW fish). Sm = small. Lg = large; for definitions, see Section 4.1. T = S + G or Lg + Sm.

	NAC Area				NEAC (N. Area)											NEAC (S. Area)										
Year	Canada (1)			USA	Norway (2)			Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK(N.I.) (4,6)	UK(Scotland)			France	Spain	Total
	Lg	Sm	T	T	S	G	T	T	T	T	T	T	S	G	T	S	G	T	T	T	S	G	T	T	T	T
1960	-	-	1,636	1	-	-	1,659	1,100	100	-	40	-	-	-	-	-	-	743	283	139	971	472	1,443	-	33	7,177
1961	-	-	1,583	1	-	-	1,533	790	127	-	27	-	-	-	-	-	-	707	232	132	811	374	1,185	-	20	6,337
1962	-	-	1,719	1	-	-	1,935	710	125	-	45	-	-	-	-	-	-	1,459	318	356	1,014	724	1,738	-	23	8,429
1963	-	-	1,861	1	-	-	1,786	480	145	-	23	-	-	-	-	-	-	1,458	325	306	1,308	417	1,725	-	28	8,138
1964	-	-	2,069	1	-	-	2,147	590	135	-	36	-	-	-	-	-	-	1,617	307	377	1,210	697	1,907	-	34	9,220
1965	-	-	2,116	1	-	-	2,000	590	133	-	40	-	-	-	-	-	-	1,457	320	281	1,043	550	1,593	-	42	8,573
1966	-	-	2,369	1	-	-	1,791	570	104	2	36	-	-	-	-	-	-	1,238	387	287	1,049	546	1,595	-	42	8,422
1967	-	-	2,863	1	-	-	1,980	883	144	2	25	-	-	-	-	-	-	1,463	420	449	1,233	884	2,117	-	43	10,390
1968	-	-	2,111	1	-	-	1,514	827	161	1	20	-	-	-	-	-	-	1,413	282	312	1,021	557	1,578	-	38	8,258
1969	-	-	2,202	1	801	582	1,383	360	131	2	22	-	-	-	-	-	-	1,730	377	267	997	958	1,955	-	54	8,484
1970	1,562	761	2,323	1	815	356	1,171	448	182	13	20	-	-	-	-	-	-	1,787	527	297	775	617	1,392	-	45	8,206
1971	1,482	510	1,992	1	771	436	1,207	417	196	8	18	-	-	-	-	-	-	1,639	426	234	719	702	1,421	-	16	7,575
1972	1,201	558	1,759	1	1,064	514	1,578	462	245	5	18	-	-	-	32	200	1,604	1,804	442	210	1,013	714	1,727	34	40	8,357
1973	1,651	783	2,434	3	1,220	506	1,726	772	148	8	23	-	-	-	50	244	1,686	1,930	450	182	1,158	848	2,006	12	24	9,768
1974	1,589	950	2,539	1	1,149	484	1,633	709	215	10	32	-	-	-	76	170	1,958	2,128	383	184	912	716	1,628	13	16	9,567
1975	1,573	912	2,485	2	1,038	499	1,537	811	145	21	26	-	-	-	76	274	1,942	2,216	447	164	1,007	614	1,621	25	27	9,603
1976	1,721	785	2,506	1	1,063	467	1,530	542	216	9	20	-	-	-	66	109	1,452	1,561	208	113	522	497	1,019	9	21	7,821
1977	1,883	662	2,545	2	1,018	470	1,488	497	123	7	10	-	-	-	59	145	1,227	1,372	345	110	639	521	1,160	19	19	7,756
1978	1,225	320	1,545	4	668	382	1,050	476	285	6	10	-	-	-	37	147	1,082	1,229	349	148	781	542	1,323	20	32	6,514
1979	705	582	1,287	3	1,150	681	1,831	455	219	6	12	-	-	-	26	105	922	1,027	261	99	598	478	1,076	10	29	6,341
1980	1,763	917	2,680	6	1,352	478	1,830	664	241	8	17	-	-	-	34	202	745	947	360	122	851	283	1,134	30	47	8,120
1981	1,619	818	2,437	6	1,189	467	1,656	463	147	16	26	-	-	-	44	164	521	685	493	101	844	389	1,233	20	25	7,352
1982	1,082	716	1,798	6	985	363	1,348	364	130	17	25	-	49	5	54	63	930	993	286	132	596	496	1,092	20	10	6,275
1983	911	513	1,424	1	957	593	1,550	507	166	32	28	-	51	7	58	150	1,506	1,656	429	187	672	549	1,221	16	23	7,298
1984	645	467	1,112	2	995	628	1,623	593	139	20	40	-	37	9	46	101	728	829	345	78	504	509	1,013	25	18	5,883
1985	540	593	1,133	2	923	638	1,561	659	162	55	45	-	38	11	49	100	1,495	1,595	361	98	514	399	913	22	13	6,668
1986	779	780	1,559	2	1,042	556	1,598	608	232	59	54	-	25	12	37	136	1,594	1,730	430	109	745	526	1,271	28	27	7,744
1987	951	833	1,784	1	894	491	1,385	564	181	40	47	-	34	15	49	127	1,112	1,239	302	56	503	419	922	27	18	6,615
1988	633	677	1,310	1	656	420	1,076	420	217	180	40	-	27	9	36	141	1,733	1,874	395	114	501	381	882	32	18	6,595
1989	590	549	1,139	2	469	436	905	364	141	136	29	-	33	19	52	132	947	1,079	296	142	464	431	895	14	7	5,201
1990	486	425	911	2	545	385	930	313	146	280	33	13	41	19	60	-	-	567	338	94	423	201	624	15	7	4,333
1991	370	341	711	1	535	342	876	215	130	345	38	3	53	17	70	-	-	404	200	55	285	177	462	13	11	3,534
1992	323	199	522	1	566	301	867	167	175	461	49	10	49	28	77	-	-	630	171	91	361	238	599	20	11	3,851
1993	214	159	373	1	611	312	923	139	160	496	56	9	53	17	70	-	-	541	248	83	320	227	547	16	8	3,670
1994	216	139	355	0	581	415	996	141	141	308	44	6	38	11	49	-	-	804	324	91	400	248	648	18	10	3,935
1995	153	107	260	0	590	249	839	128	150	298	37	3	37	11	48	-	-	790	295	83	364	224	588	10	9	3,538
1996	154	138	292	0	571	215	787	131	122	239	33	2	24	20	44	-	-	685	183	77	267	160	427	13	7	3,042
1997	126	103	229	0	389	241	630	111	106	50	19	1	30	15	45	-	-	570	142	93	182	114	296	8	3	2,303
1998	70	87	157	0	445	296	740	131	130	34	15	1	29	19	48	-	-	624	123	78	162	121	283	8	4	2,376
1999	64	88	152	0	493	318	811	103	120	26	16	1	29	33	62	-	-	515	150	53	142	57	199	11	6	2,225
2000	58	95	153	0	673	504	1,176	124	83	2	33	5	56	39	95	-	-	621	219	78	160	114	274	11	7	2,881
2001	61	86	148	0	850	417	1,267	114	88	0	33	6	105	21	126	-	-	730	184	53	150	101	251	11	13	3,024
2002	49	99	148	0	770	249	1,019	118	97	0	28	5	81	12	93	-	-	682	161	81	118	73	191	11	9	2,643
2003	60	81	141	0	708	363	1,071	107	110	0	25	4	63	15	78	-	-	551	89	56	122	70	192	13	7	2,444
2004	68	94	161	0	577	207	784	82	130	0	19	4	32	7	39	-	-	489	111	48	158	87	245	19	7	2,138
2005	56	83	139	0	581	307	888	82	149	0	15	8	31	16	47	-	-	422	97	52	125	90	215	11	13	2,138
2006	54	77	132	0	671	261	932	91	121	0	14	3	38	29	67	-	-	326	79	25	101	62	164	11	11	1,975
Average																										
2001-2005	59	89	147	0	697	309	1006	101	115	0	24	5	62	14	77	-	-	575	128	58	135	84	219	13	10	2477
1996-2005	77	95	172	0	606	312	917	110	114	35	24	4	48	20	68	-	-	589	146	67	159	99	257	12	8	2521

1. Includes estimates of some local sales, and, prior to 1984, by-catch.
2. Before 1966, sea trout and sea charr included (5% of total).
3. Figures from 1991 to 2000 do not include catches of the recently developed recreational (rod) fishery.
4. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and log books from 2002.
6. Angling catch (derived from carcase tagging and log books) first included in 2002.

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, 1991–2006. Figures for 2006 are provisional.

Year	Canada		USA		Iceland		Russia		UK (E&W)		UK (Scotland)		Ireland		UK (N Ireland) [1]		Denmark	
	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch
1991	28,497	33	239	50			3,211	51										
1992	46,450	34	407	67			10,120	73										
1993	53,849	41	507	77			11,246	82	1,448	10								
1994	61,830	39	249	95			12,056	83	3,227	13	6,595	8						
1995	47,679	36	370	100			11,904	84	3,189	20	12,151	14						
1996	52,166	33	542	100	669	2	10,745	73	3,428	20	10,413	15						
1997	57,252	49	333	100	1,558	5	14,823	87	3,132	24	10,965	18						
1998	62,895	53	273	100	2,826	7	12,776	81	5,365	31	13,464	18						
1999	55,331	50	211	100	3,055	10	11,450	77	5,447	44	14,846	28						
2000	64,482	55	0	-	2,918	11	12,914	74	7,470	42	21,072	32						
2001	59,387	55	0	-	3,607	12	16,945	76	6,143	43	27,724	38						
2002	50,924	52	0	-	5,985	18	25,248	80	7,658	50	24,058	42						
2003	53,645	55	0	-	5,361	16	33,862	81	6,425	56	29,160	56						
2004	62,316	55	0	-	7,294	16	24,679	76	13,211	48	46,279	50					255	19
2005	63,005	62	0	-	9,224	17	23,592	87	11,983	56	45,970	55	2,553	12			606	27
2006	49,279	58	1	100	8,261	18	33,380	82	10,550	56	45,759	57	5,409	22	306	23	794	55

Key: [1] Data for FCB area only

Table 2.1.3.1. Estimates of unreported catches (tonnes round fresh weight) by various methods within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 1987–2006.

Year	North-East Atlantic	North-America	West Greenland	Total
1987	2,554	234	-	2,788
1988	3,087	161	-	3,248
1989	2,103	174	-	2,277
1990	1,779	111	-	1,890
1991	1,555	127	-	1,682
1992	1,825	137	-	1,962
1993	1,471	161	< 12	1,644
1994	1,157	107	< 12	1,276
1995	942	98	20	1,060
1996	947	156	20	1,123
1997	732	90	5	827
1998	1,108	91	11	1,210
1999	887	133	12.5	1,032
2000	1,135	124	10	1,269
2001	1,089	81	10	1,180
2002	946	83	10	1,039
2003	719	118	10	847
2004	575	101	10	686
2005	605	85	10	700
2006	604	56	10	670
Mean 2001-2005	787	94	10	890

Table 2.1.3.2. Estimates of unreported catches (tonnes round fresh weight) by various methods by country within national EEZs in the North East Atlantic, North American and West Greenland Commissions of NASCO, 2006.

Commission Area	Country	Unreported Catch t	Unreported as % of Total North Atlantic Catch (Unreported + Reported)	Unreported as % of Total National Catch (Unreported + Reported)
NEAC	Denmark	3	0.1	50
NEAC	Finland	16	0.6	19
NEAC	Iceland	14	0.5	10
NEAC	Ireland	33	1.2	9
NEAC	Norway	402	15.1	30
NEAC	Russia	87	3.3	49
NEAC	Sweden	2	0.1	10
NEAC	France	3	0.1	21
NEAC	UK (E & W)	25	0.9	24
NEAC	UK (N.Ireland)	0.2	0.0	1
NEAC	UK (Scotland)	19	0.7	10
NAC	Canada	56	2.1	30
NAC	USA	0	0.0	0
WGC	West Greenland	10	0.4	32
	Total Unreported Catch	670	25.1	
	Total Reported Catch of North Atlantic salmon	2,001		

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

Table 2.2.1.1 Production of farmed Atlantic salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980–2006.

Year	North Atlantic Area										Outside the North Atlantic Area							World-wide
	Norway	UK (Scot.)	Faroes	Canada	Ireland	USA	Iceland	UK (N.Ire.)	Russia	Total	Chile	West Coast USA	West Coast Canada	Australia	Turkey	Other	Total	Total
1980	4,153	598	0	11	21	0	0	0	0	4,783	0	0	0	0	0	0	0	4,783
1981	8,422	1,133	0	21	35	0	0	0	0	9,611	0	0	0	0	0	0	0	9,611
1982	10,266	2,152	70	38	100	0	0	0	0	12,626	0	0	0	0	0	0	0	12,626
1983	17,000	2,536	110	69	257	0	0	0	0	19,972	0	0	0	0	0	0	0	19,972
1984	22,300	3,912	120	227	385	0	0	0	0	26,944	0	0	0	0	0	0	0	26,944
1985	28,655	6,921	470	359	700	0	91	0	0	37,196	0	0	0	0	0	0	0	37,196
1986	45,675	10,337	1,370	672	1,215	0	123	0	0	59,392	0	0	0	20	0	0	0	59,392
1987	47,417	12,721	3,530	1,334	2,232	365	490	0	0	68,089	3	0	0	50	0	0	53	68,142
1988	80,371	17,951	3,300	3,542	4,700	455	1,053	0	0	111,372	174	0	0	250	0	0	424	111,796
1989	124,000	28,553	8,000	5,865	5,063	905	1,480	0	0	173,866	1,864	1,100	1,000	400	0	700	5,064	178,930
1990	165,000	32,351	13,000	7,810	5,983	2,086	2,800	<100	5	229,035	9,500	700	1,700	1,700	0	800	14,400	243,435
1991	155,000	40,593	15,000	9,395	9,483	4,560	2,680	100	0	236,811	14,991	2,000	3,500	2,700	0	1,400	24,591	261,402
1992	140,000	36,101	17,000	10,380	9,231	5,850	2,100	200	0	220,862	23,769	4,900	6,600	2,500	0	400	38,169	259,031
1993	170,000	48,691	16,000	11,115	12,366	6,755	2,348	<100	0	267,275	29,248	4,200	12,000	4,500	1,000	400	51,348	318,623
1994	204,686	64,066	14,789	12,441	11,616	6,130	2,588	<100	0	316,316	34,077	5,000	16,100	5,000	1,000	800	61,977	378,293
1995	261,522	70,060	9,000	12,550	11,811	10,020	2,880	259	0	378,102	41,093	5,000	16,000	6,000	1,000	0	69,093	447,195
1996	297,557	83,121	18,600	17,715	14,025	10,010	2,772	338	0	444,138	69,960	5,200	17,000	7,500	1,000	600	101,260	545,398
1997	332,581	99,197	22,205	19,354	14,025	13,222	2,554	225	0	503,363	87,700	6,000	28,751	9,000	1,000	900	133,351	636,714
1998	361,879	110,784	20,362	16,418	14,860	13,222	2,686	114	0	540,325	125,000	3,000	33,100	7,068	1,000	400	169,568	709,893
1999	425,154	126,686	37,000	23,370	18,000	12,246	2,900	234	0	645,590	150,000	5,000	38,800	9,195	0	500	203,495	849,085
2000	440,861	128,959	32,000	33,195	17,648	16,461	2,600	250	0	671,974	176,000	5,670	39,300	12,003	0	500	233,473	905,447
2001	436,103	138,519	46,014	37,606	23,312	13,202	2,645	250	0	697,651	200,000	5,443	58,000	13,815	0	500	277,758	975,409
2002	462,495	145,609	45,150	42,131	22,294	6,798	1,471	250	0	726,198	273,000	5,000	71,600	14,699	0	1,000	365,299	1,091,497
2003	509,544	176,596	52,526	39,760	16,347	6,007	3,710	250	298	805,038	261,000	4,000	55,600	13,324	0	1,000	334,924	1,139,962
2004	563,815	158,099	40,492	39,014	14,067	8,515	6,620	250	203	831,075	261,000	4,000	49,800	14,317	0	1,000	330,117	1,161,192
2005	586,512	129,588	18,962	44,090	13,764	5,263	6,300	250	179	804,908	385,000	4,000	50,000	16,827	0	1,000	456,827	1,261,735
2006	598,000	137,018	11,905	46,504	13,764	3,580	5,850	250	229	817,100	370,000	4,000	50,000	22,140	0	1,000	447,140	1,264,240
5-yr mean 2001-2005	511,694	149,682	40,629	40,520	17,957	7,957	4,149	250	136	772,974	276,000	4,489	57,000	14,596	0	900	352,985	1,125,959
% change on 5-year mean	+17	-8	-71	+15	-23	-55	+41	0		+6	+34	-11	-12	+52		+11	+27	+12

Notes: Data for 2006 are provisional for many countries.
Where production figures were not available for 2006, values as in 2005 were assumed.
West Coast USA = Washington State.
West Coast Canada = British Columbia.
Australia = Tasmania.
Source of production figures for non-Atlantic areas: miscellaneous fishing publications & Government reports (including Kjønhaug, 2007).
'Other' includes South Korea & China.

Table 2.4.2.1. Returns (25th percentile) of 2SW salmon to six geographic areas of NAC and the southern NEAC MSW PFA. For NAC geographic areas, the 25th percentile is calculated from the minimum and maximum ranges for each area, except for US where the values are point estimates.

Smolt year	Year of 1SW return or PFA	Year of 2SW return	USA	Scotia-Fundy	Gulf	Quebec	NFLD	LAB	Southern NEAC MSW PFA
1968	1969	1970		15,436					
1969	1970	1971	653	12,493	33,799	38,889	4,021	10,553	
1970	1971	1972	1,383	15,454	41,691	50,731	4,134	9,072	2,439,783
1971	1972	1973	1,427	11,468	41,045	55,985	5,128	12,686	2,332,524
1972	1973	1974	1,394	23,694	57,638	75,107	3,104	12,289	1,865,795
1973	1974	1975	2,331	25,832	36,333	63,782	3,660	11,677	2,047,236
1974	1975	1976	1,317	23,785	34,788	63,410	3,675	13,489	1,493,197
1975	1976	1977	1,998	31,258	69,277	74,748	2,946	11,913	1,385,834
1976	1977	1978	4,208	18,350	35,685	67,304	3,092	9,435	1,540,209
1977	1978	1979	1,942	9,964	10,067	37,118	1,727	5,438	1,117,932
1978	1979	1980	5,796	35,129	50,985	88,253	3,769	12,707	1,558,872
1979	1980	1981	5,601	21,315	20,675	69,337	5,597	11,563	1,645,157
1980	1981	1982	6,056	19,183	36,482	61,487	4,439	8,534	1,206,740
1981	1982	1983	2,155	15,921	33,464	50,497	3,996	6,199	1,399,266
1982	1983	1984	3,222	20,428	23,865	48,286	3,440	4,418	996,176
1983	1984	1985	5,529	26,827	28,125	49,802	1,483	3,531	1,153,589
1984	1985	1986	6,176	21,852	44,677	59,509	2,515	6,033	1,561,910
1985	1986	1987	3,081	13,817	28,751	56,615	2,110	8,052	1,180,312
1986	1987	1988	3,286	12,735	31,992	61,499	2,440	5,060	1,497,714
1987	1988	1989	3,197	14,409	21,686	55,509	1,098	4,927	1,364,708
1988	1989	1990	5,051	12,404	30,297	54,284	2,110	2,809	1,068,726
1989	1990	1991	2,647	12,431	25,528	50,312	1,648	1,346	758,465
1990	1991	1992	2,459	11,447	37,764	50,509	4,972	5,773	951,621
1991	1992	1993	2,231	7,728	32,567	39,389	2,397	7,452	828,076
1992	1993	1994	1,346	5,016	26,204	40,073	2,428	10,339	922,647
1993	1994	1995	1,748	6,158	35,134	46,363	3,566	20,327	874,965
1994	1995	1996	2,407	8,540	22,631	42,021	4,431	15,025	690,337
1995	1996	1997	1,611	4,357	20,359	34,586	4,736	13,358	531,032
1996	1997	1998	1,526	2,562	13,022	26,227	5,414	29,043	483,593
1997	1998	1999	1,168	4,259	12,293	27,488	4,365	11,499	490,894
1998	1999	2000	533	2,142	13,079	26,736	4,523	13,429	594,570
1999	2000	2001	788	3,926	21,239	28,021	3,169	14,992	575,098
2000	2001	2002	511	816	10,207	20,569	2,400	8,481	521,322
2001	2002	2003	1,192	3,015	20,164	31,156	2,788	6,854	570,701
2002	2003	2004	1,283	2,142	20,253	27,352	2,715	9,033	600,892
2003	2004	2005	984	1,507	19,917	26,465	2,468	9,336	505,336
2004	2005	2006	1,023	2,338	19,722	24,408	3,264	10,675	413,478
2005	2006	2007							

Table 2.4.2.2. Management objectives and equivalent number of fish relevant to the development of catch options at West Greenland for the six geographic areas in NAC and the southern NEAC non-maturing complex.

AREA	OBJECTIVE	NUMBER OF FISH
US	25% increase from 2SW returns during 1992 to 1996	2,548
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	4,022
Labrador	2SW conservation limit	34,746
Southern NEAC non-maturing complex	Spawner escapement reserve	455,413

Table 2.4.2.3. 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 considered were incorporated into the framework.

Age / size group	Indicator type	Wild / Hatc	River name	First Year of PFA	End year of PFA	Number of years	Average returns 1996-2005	Decision rule based on objective function	Indicator low (True low)	Indicator high (True high)
			USA							
2SW	Return	W & H	Penobscott	1970	2005	36	727	1,415	100% (23)	92% (13)
	Survival	H	Penobscott	1970	2005	36	0.12%	0.24%	100% (16)	60% (20)
1SW	Return	W & H	Penobscott	1970	2005	36	290	495	82% (28)	89% (9)
	Survival	H	Penobscott	1971	2005	35	0.05%	0.09%	85% (26)	67% (12)
All SW	Return	W	Narraguagus	1972	2005	35	22	100	94% (17)	61% (18)
			Scotia-Fundy							
Large	Return	Wild	Saint John	1970	2005	36	458	2 309	100% (13)	91% (23)
Large	Return	Wild	Lahave	1979	2005	27	148	301	100% (14)	100% (13)
Large	Return	Wild	North	1983	2005	23	245	509	93% (15)	100% (8)
Large	Return	Wild	St. Mary's	1973	2005	33	91	221	100% (11)	82% (22)
Small	Return	Wild	Saint John	1970	2005	36	725	2 276	81% (16)	90% (20)
Small	Return	Wild	Lahave	1979	2005	27	870	1 931	92% (13)	86% (14)
Small	Return	Wild	St. Mary's	1974	2005	32	857	1 583	92% (13)	84% (19)
Small	Return	Wild	North	1984	2005	22	137	216	92% (12)	70% (10)
2SW	Survival	Hatc	Saint John	1975	2005	31	0.113	0.222	87% (15)	88% (16)
1SW	Survival	Hatc	Saint John	1975	2005	31	0.514	0.745	81% (16)	87% (15)
			Gulf							
2SW	Return	Wild	Miramichi	1970	2005	36	9 634	18 119	95% (21)	100% (15)
1SW	Return	Wild	Miramichi	1971	2005	35	30 699	33 610	92% (12)	61% (23)

Table 2.4.2.3 cont'd. Indicator variables retained from the North American geographic area. First year of PFA and end year of PFA refer to the start and end years of the indicator variable scaled to a common life stage, the PFA (equals smolt year + 1). Number of years refers to the number of usable observations. All indicators considered were incorporated into the framework.

AGE / SIZE GROUP	INDICATOR TYPE	WILD / HATC	RIVER NAME	FIRST YEAR OF PFA	END YEAR OF PFA	NUMBER OF YEARS	AVERAGE RETURNS 1996-2005	DECISION RULE BASED ON OBJECTIVE FUNCTION	INDICATOR LOW (TRUE LOW)	INDICATOR HIGH (TRUE HIGH)
			Quebec							
Large	Return	Wild	Bonaventure	1983	2005	23	1 497	1 479	75% (8)	87% (15)
Large	Return	Wild	Grande Rivière	1983	2005	23	371	437	100% (8)	100% (15)
Large	Return	Wild	Saint-Jean	1983	2005	23	716	736	83% (6)	82% (17)
Large	Return	Wild	Dartmouth	1983	2005	23	643	756	73% (11)	100% (12)
Large	Return	Wild	Sainte-Anne	1983	2005	23	356	413	88% (8)	93% (15)
Large	Return	Wild	Mitis	1983	2005	23	364	369	71% (7)	81% (16)
Large	Return	Wild	Godbout	1985	2005	21	469	584	80% (10)	100% (11)
Large	Return	Wild	De la Trinite	1983	2005	23	286	385	73% (11)	100% (12)
Small	Return	Wild	York	1984	2005	22	417	380	50% (12)	80% (10)
Small	Return	Wild	Dartmouth	1984	2005	22	298	284	55% (11)	82% (11)
Small	Return	Wild	Madeleine	1984	2005	22	468	432	71% (7)	80% (15)
Small	Return	Wild	Sainte-Anne	1984	2005	22	205	159	71% (7)	80% (15)
Small	Return	Wild	Godbout	1986	2005	20	425	508	89% (9)	100% (11)
Small	Return	Wild	De la Trinite	1979	2005	27	373	399	88% (8)	95% (19)
Large[1]	Return	Wild	Cap-chat	1983	2005	23	182	159	56% (9)	79% (14)
Small[1]	Return	Wild	Cap-chat	1984	2005	22	115	77	50% (10)	75% (12)
			Newfoundland							
Small	Return	Wild	Middle Brook	1978	2005	28	1 640	1 751	86% (22)	83% (6)

[1] Indicators are not used in the framewok because probability of a true low or true high is < 80%

Table 2.7.1. Summary of Atlantic salmon tagged and marked in 2006 – 'Hatchery' and 'Wild' refer to smolts and parr; 'Adults' relates to both wild and hatchery-origin fish.

		Primary Tag or Mark				
Country	Origin	Microtag	External mark	Adipose clip	Pit tag/Internal tags[3]	Total
Belgium	Hatchery	2,383	0	0	0	2,383
	Wild	0	0	0	0	0
	Adult	0	0	0	0	0
	Total	2,383	0	0	0	2,383
Canada	Hatchery	0	3,223	923,607	0	926,830
	Wild	0	19,768	7,216	280	27,264
	Adult	0	5,421	1,189	47	6,657
	Total	0	28,412	932,012	327	960,751
Germany	Hatchery	82,612	5480	136816	0	224,908
	Wild	0	0	0	0	0
	Adult	0	191	0	0	191
	Total	82,612	5,671	136,816	0	225,099
Iceland [1]	Hatchery	146,653	0	0	300	146,953
	Wild	2,658	0	0	0	2,658
	Adult	0	2,344	0	0	2,344
	Total	149,311	2,344	0	300	151,955
Ireland	Hatchery	258,012	0	0	0	258,012
	Wild	7,077	0	0	0	7,077
	Adult	0	0	0	0	0
	Total	265,089	0	0	0	265,089
Norway	Hatchery	12,299	41,170	0	0	53,469
	Wild	1,416	2,103	0	0	3,519
	Adult	0	2,110	0	0	2,110
	Total	13,715	45,383	0	0	59,098
Russia	Hatchery	0	0	754,985	0	754,985
	Wild	0	0	0	0	0
	Adult	0	2,568	0	0	2,568
	Total	0	2,568	754,985	0	757,553
Spain	Hatchery	189,195	0	339,588	0	528,783
	Wild	0	0	0	0	0
	Adult	0	0	0	0	0
	Total	189,195	0	339,588	0	528,783
Sweden	Hatchery	0	3,000	170,355	0	173,355
	Wild	0	400	0	0	400
	Adult	0	0	0	0	0
	Total	0	3,400	170,355	0	173,755
UK (England & Wales)	Hatchery	54,826	0	148,535	0	203,361
	Wild	16,778	0	16,749	0	33,527
	Adult	0	2,907	0	0	2,907
	Total	71,604	2,907	165,284	0	239,795
UK (N. Ireland)	Hatchery	17,751	3,904	54,004		75,659
	Wild	1832	0	0	0	1,832
	Adult	0	0	0	0	0
	Total	19,583	3,904	54,004	0	77,491
UK (Scotland)[2]	Hatchery	30,070	0	0	0	30,070
	Wild	9,634	2,598	0	5,678	17,910
	Adult	0	1,375	0	0	1,375
	Total	39,704	3,973	0	5,678	49,355
USA	Hatchery	1,530	60	468,873	0	470,463
	Wild	526	0	0	0	526
	Adult	1,604	1,257	0	0	2,861
	Total	3,660	1,317	468,873	0	473,850
All Countries	Hatchery	795,331	56,837	2,996,763	300	3,849,231
	Wild	39,921	24,869	23,965	5,958	94,713
	Adult	1,604	18,173	1,189	47	21,013
	Total	836,856	99,879	3,021,917	6,305	3,964,957

[1] The number of microtagged hatchery fish in Iceland includes 18,326 fish reared in sea-pens.

[2] Pit tagged juvenile in Scotland also adipose finclipped.

[3] Includes all larger internal tags

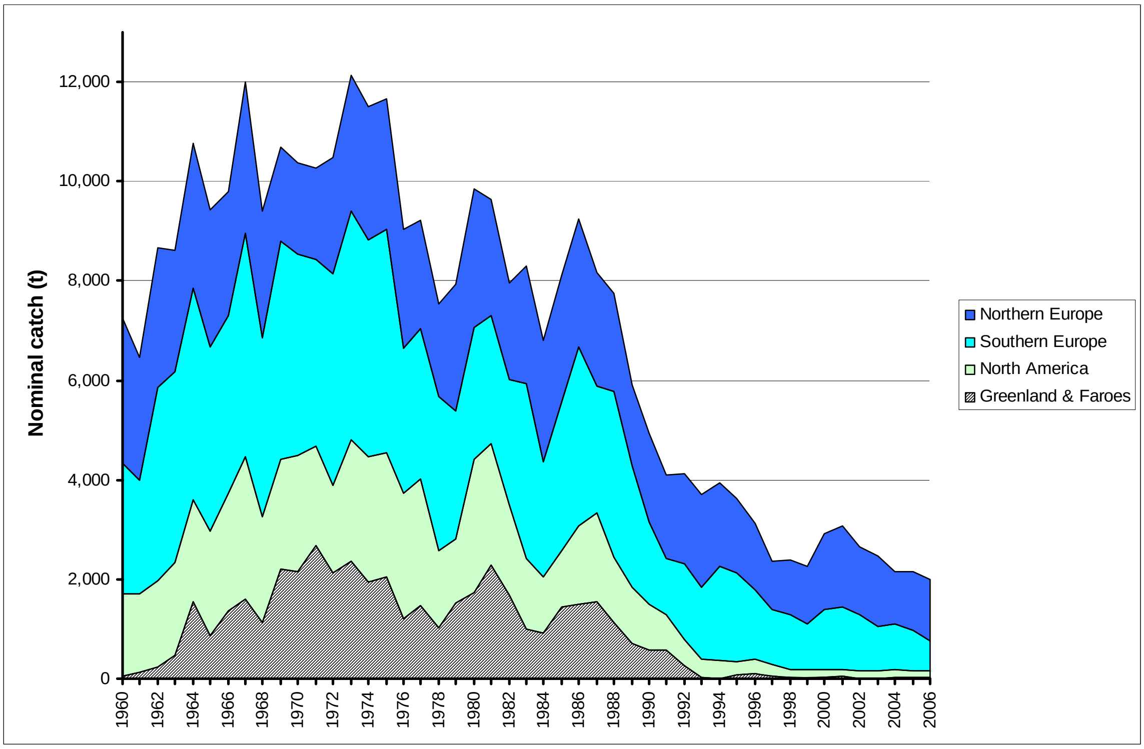


Figure 2.1.1.1. Nominal catches of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2006.

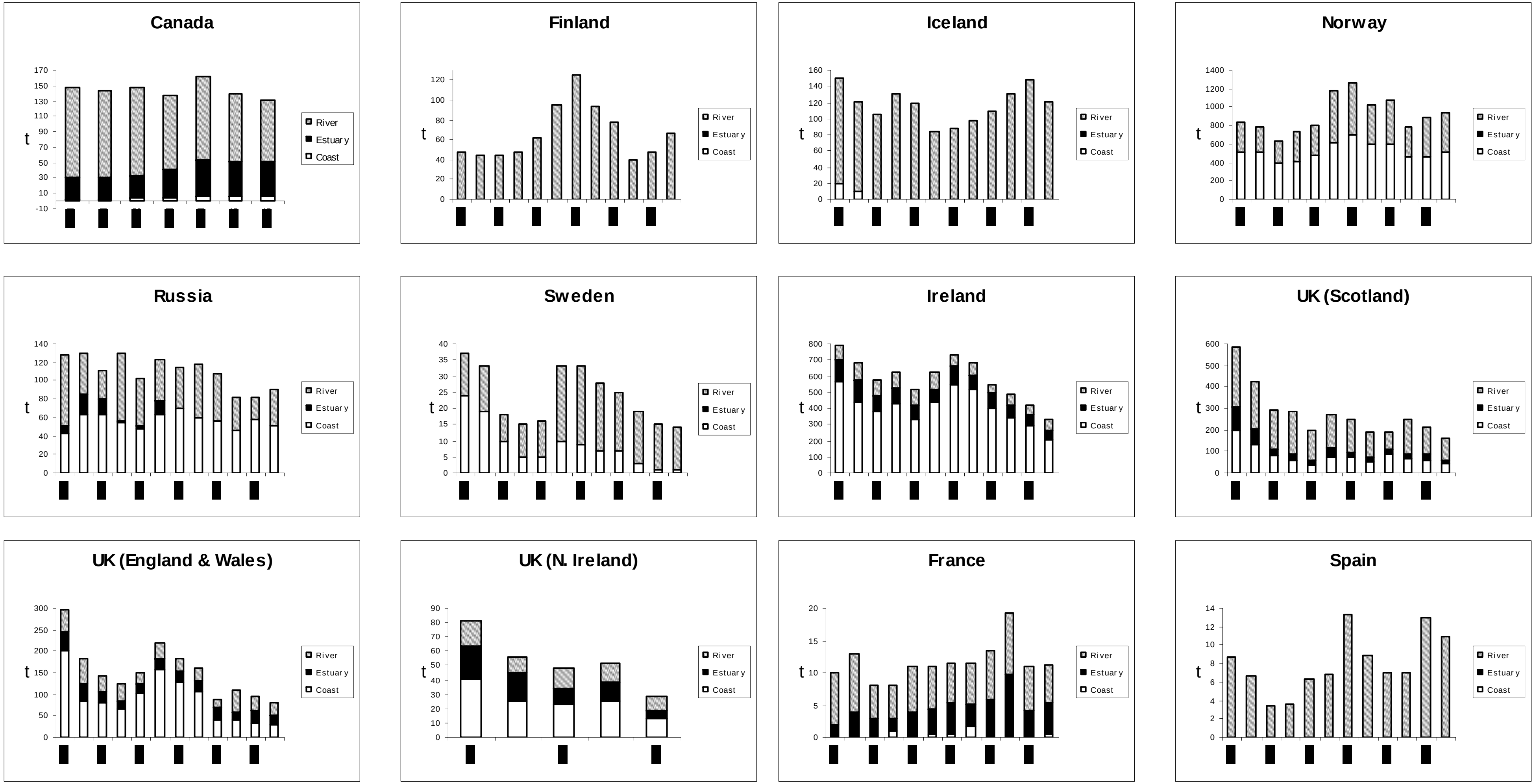


Figure 2.1.1.2. Nominal catch (tonnes) taken in coastal, estuarine and riverine fisheries by country. Note that time series and y-axes vary.

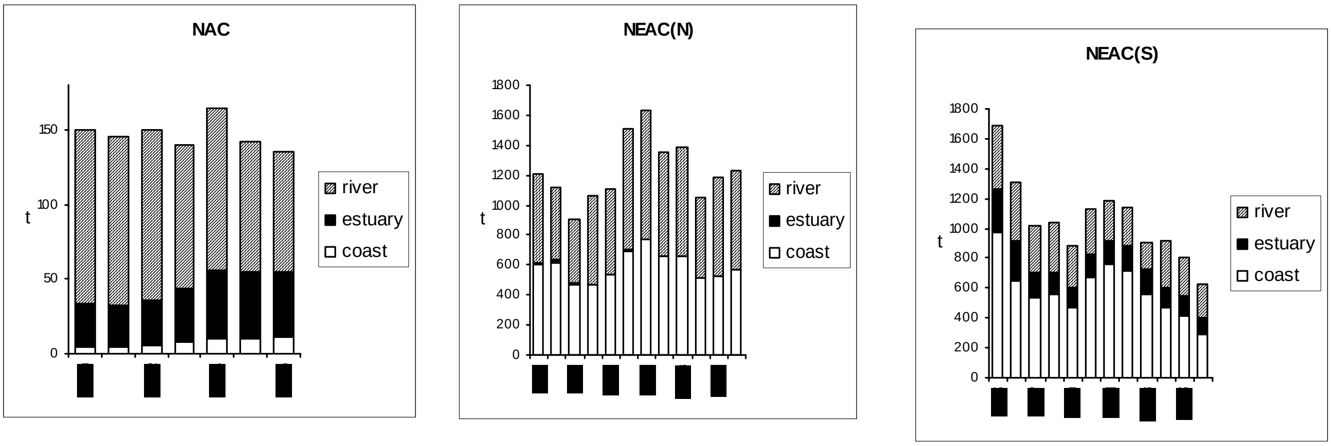


Figure 2.1.1.3. Nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area, and for the NEAC northern and southern areas. Note that time series and y-axes vary.

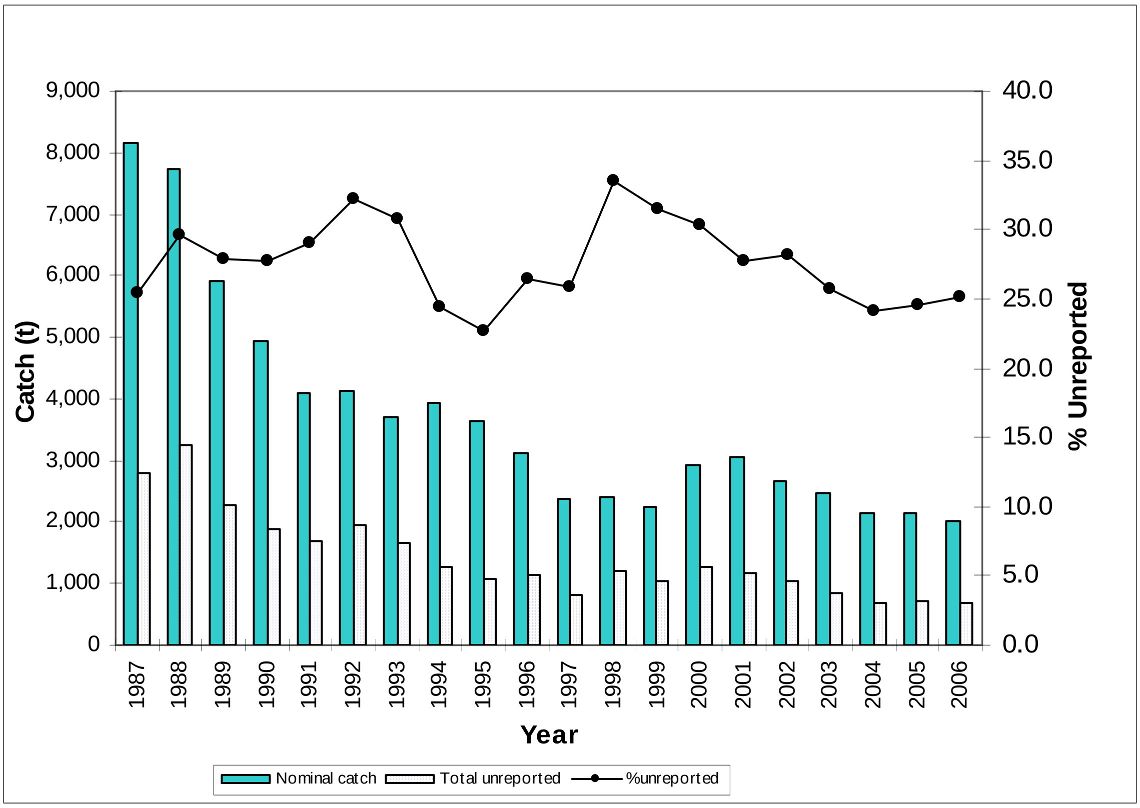


Figure 2.1.3.1. Nominal North Atlantic salmon catch, unreported catch and percentage unreported (expressed as % of total catch – nominal + unreported) in NASCO areas, 1987–2006.

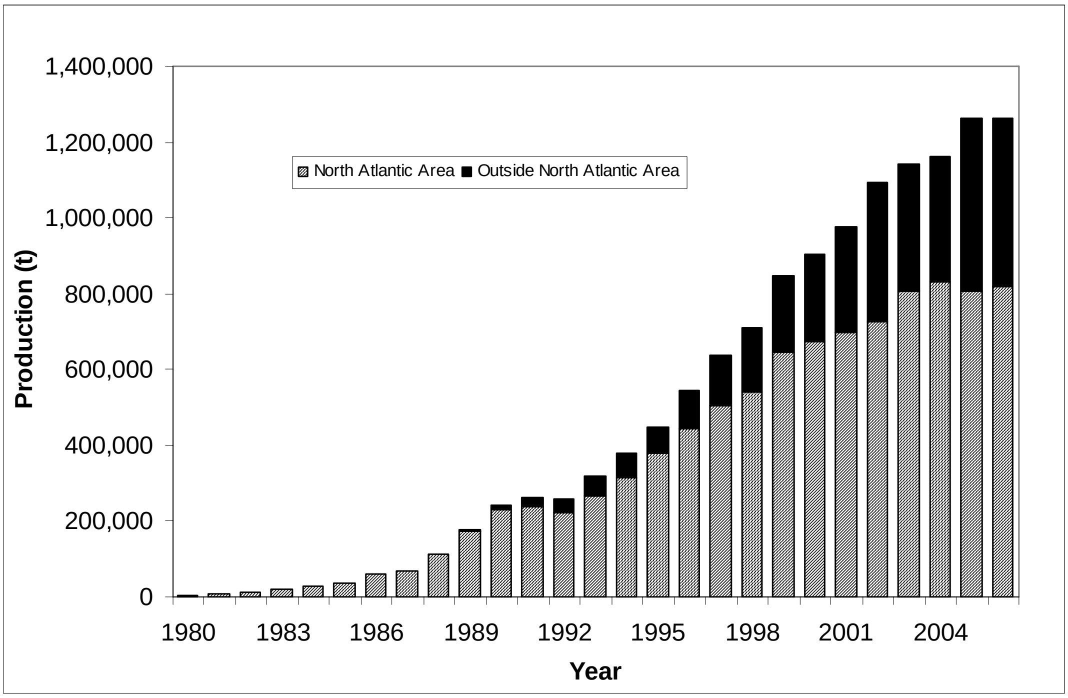


Figure 2.2.1.1. World-wide production of farmed Atlantic salmon, 1980–2006.

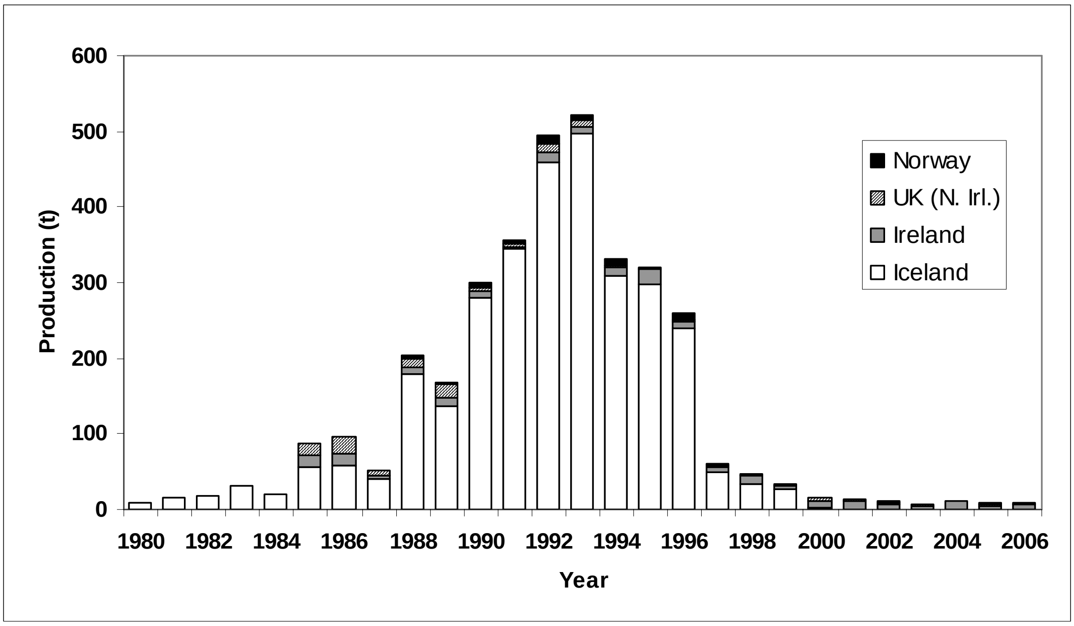


Figure 2.2.2.1. Production of ranched Atlantic salmon (tonnes round fresh weight) as harvested at ranching facilities in the North Atlantic, 1980–2006.

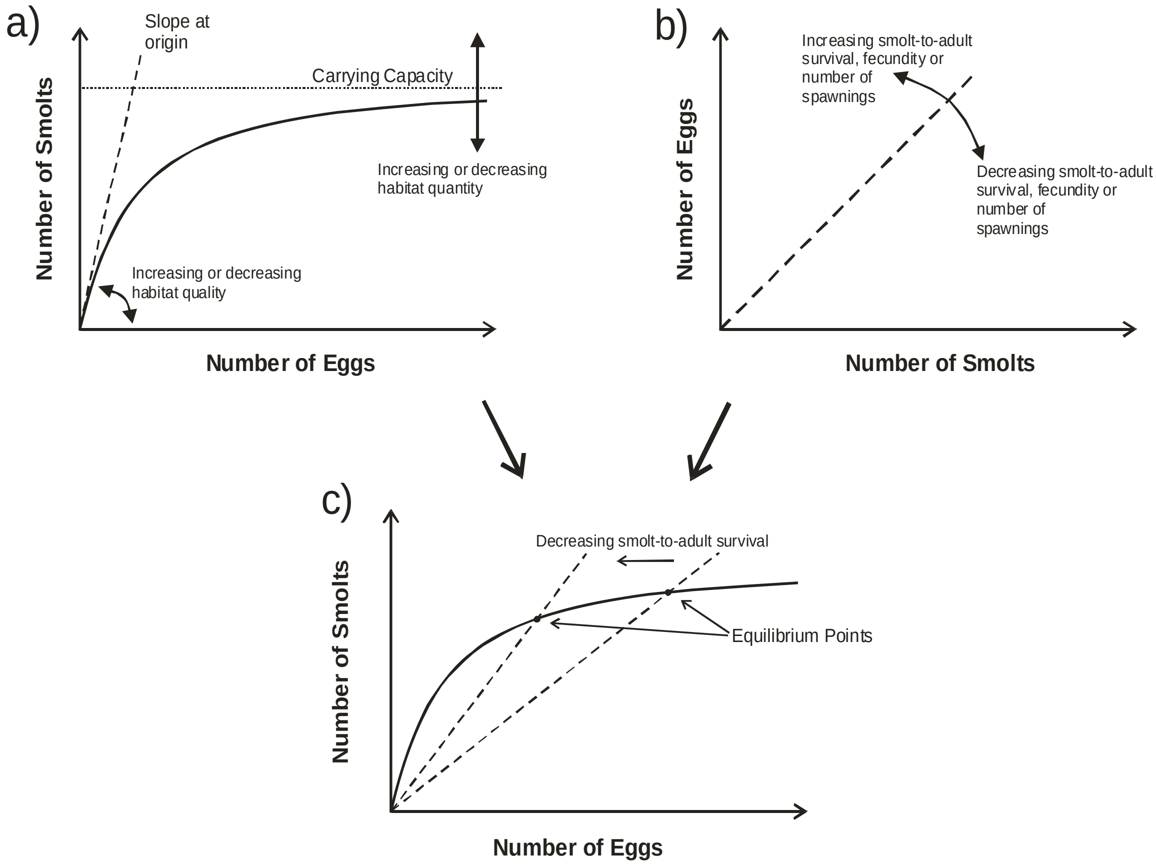


Figure 2.3.1.1. An equilibrium model linking habitat quality and quantity to fish population dynamics. A Beverton-Holt model is used to model the density-dependent relationship for survival from eggs to smolt (a). The slope at the origin of this model, which is the maximum number of smolts produced per egg in the absence of density dependent effects, changes as habitat quality changes, whereas changes in the amount of habitat change the carrying capacity. The number of eggs produced per smolt (b) throughout its life, changes with smolt-to-adult survival, fecundity, age-at-maturity or the number of times a fish spawns throughout its life. The population equilibrium occurs at the population size where the production of smolts by eggs is in balance with the production of eggs by smolts throughout their lives, and is the size at which the population will stabilize if all rates and the carrying capacity remain unchanged (c). The population equilibrium changes as the vital rates change and can be used to assess how a population is expected to change in response to human activities.

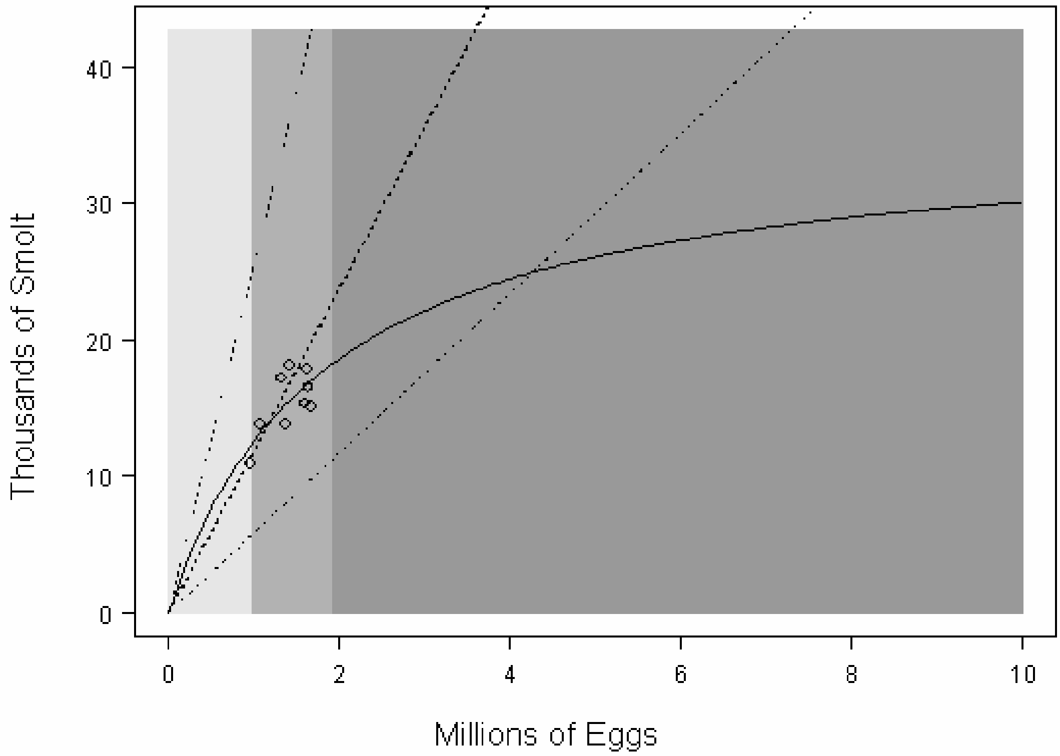


Figure 2.3.1.2. Dynamics of the LaHave River (above Morgan Falls) salmon population. The points are the observed egg depositions and smolt production for the 1994 to 2001 cohort years. The solid line is a Beverton Holt model obtained by fitting these data to the population spawning above Morgan Falls. The dashed lines show the replacement lines calculated using the minimum, average and maximum smolt to adult return rates observed for this population between 1996 and 2004. Shading indicates the status relative to the conservation egg requirement: dark shading is above the requirement, the medium shading is between 50% and 100% of the egg requirement and the light shading is below the requirement.

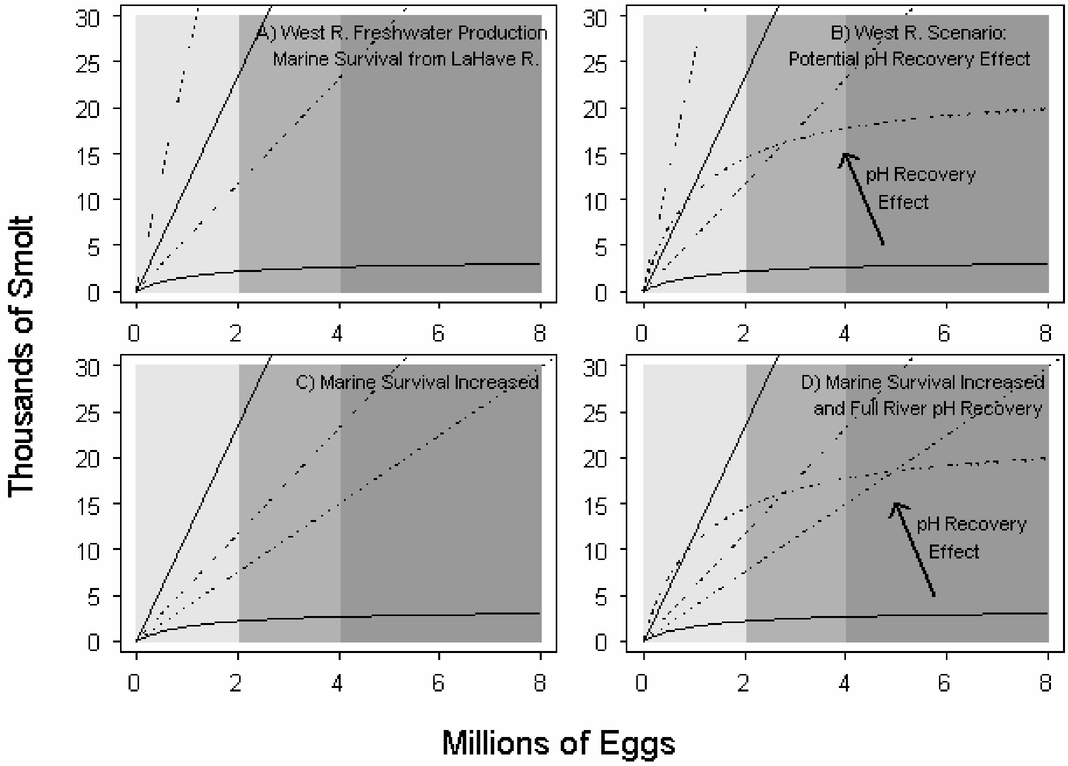


Figure 2.3.1.3. Equilibrium analysis of the recovery potential of salmon in West River (Sheet Harbour, NS). The upper left panel shows the present dynamic in which populations aren't viable as a result of low marine survival and reduced freshwater production due to acidification. The slopes of replacement lines are calculated using the mean, minimum and maximum return rates for LaHave River salmon for the 1996 to 2004 return rates. The upper right panel shows the expected change in freshwater production if the acidification problem was addressed in the entire river. The lower left panel shows the dynamics if freshwater production remains unchanged and at-sea survival rates are the mean and maximum returns rates from the LaHave River, together with a hypothesized return rate increase to 6% for 1SW and 2% for 2SW salmon. The lower right panel shows a combined increased freshwater production and increased marine survival scenario in which the conservation egg requirement is reached. Shading indicates the status relative to the conservation egg requirement: dark shading is above the requirement, the medium shading is between 50% and 100% the egg requirement and the light shading is below the requirement.

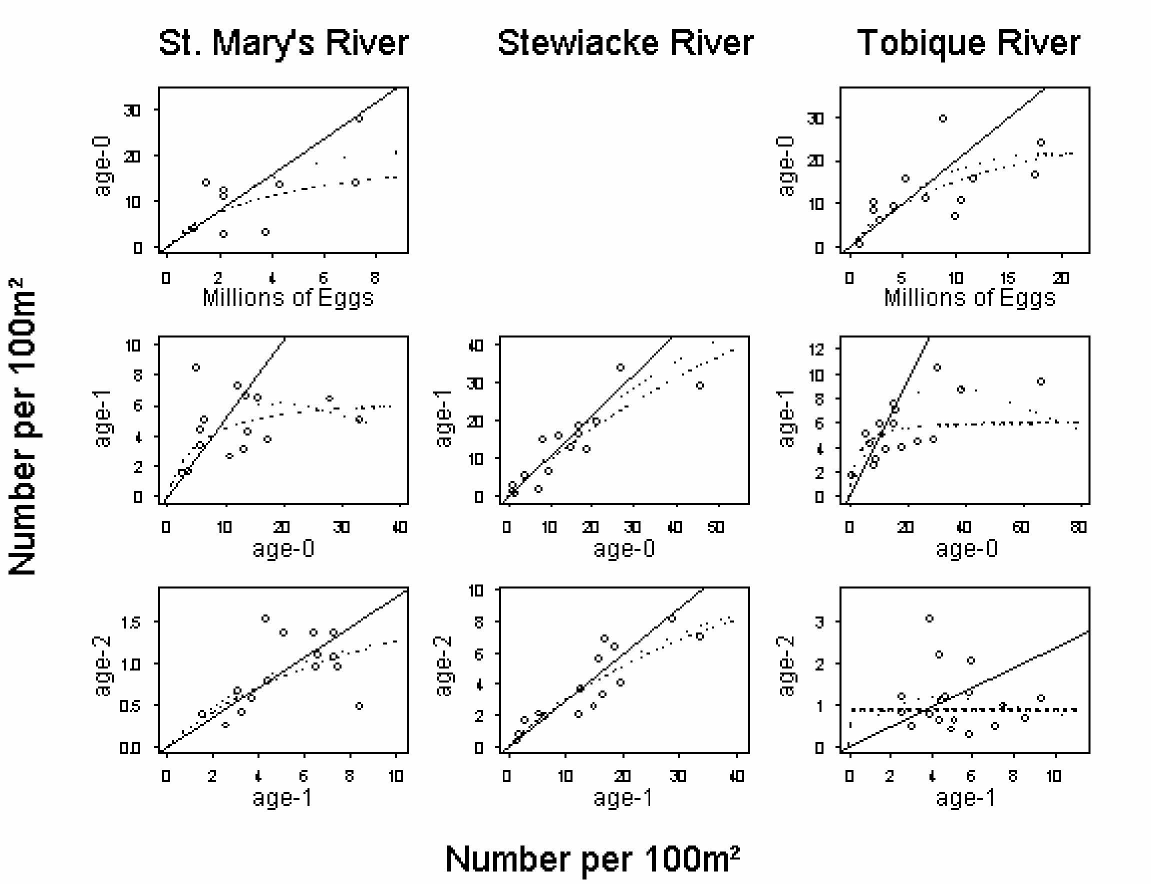


Figure 2.3.6.1. Observed (points) and predicted (lines) densities of Atlantic salmon obtained by fitting three models to the data. The data are the observed abundance or density within a cohort by age. The solid line is a one-parameter model that shows the fit obtained based on the assumption that survival is density independent. The dashed and dotted lines show the fits obtained from two-parameter Beverton-Holt and Ricker models respectively. Note: egg deposition time series not available for the Stewiacke River.

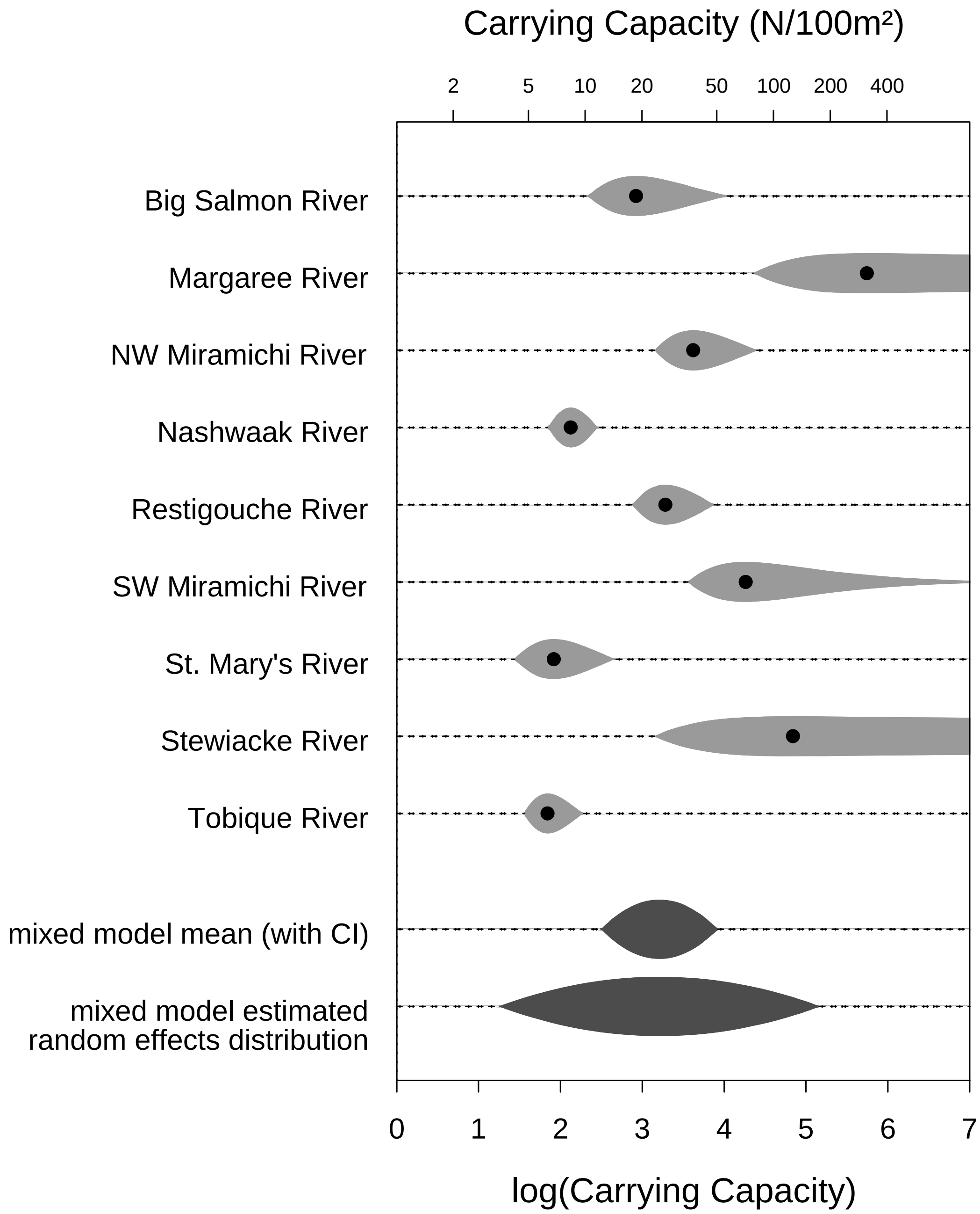


Figure 2.3.6.2. A meta-analytic summary of the habitat carrying capacity for age-1 parr for nine salmon populations. The light grey shaded regions are individual fits that depict the profile likelihood for carrying capacity, truncated to show the 95% confidence interval. The height of the profile is used to gauge the relative plausibility of different values (greater height is more plausible). The black dot is the maximum likelihood estimate for each parameter. The dark grey shaded regions show summaries of the mixed model fits. The "mixed model mean" represents the estimated mean of the logarithm of carrying capacity for these rivers with a 95% confidence interval. The "mixed model estimated random effects distribution" is the normal distribution for the logarithm of carrying capacity based on its mean and variance and shows the distribution expected for the region.

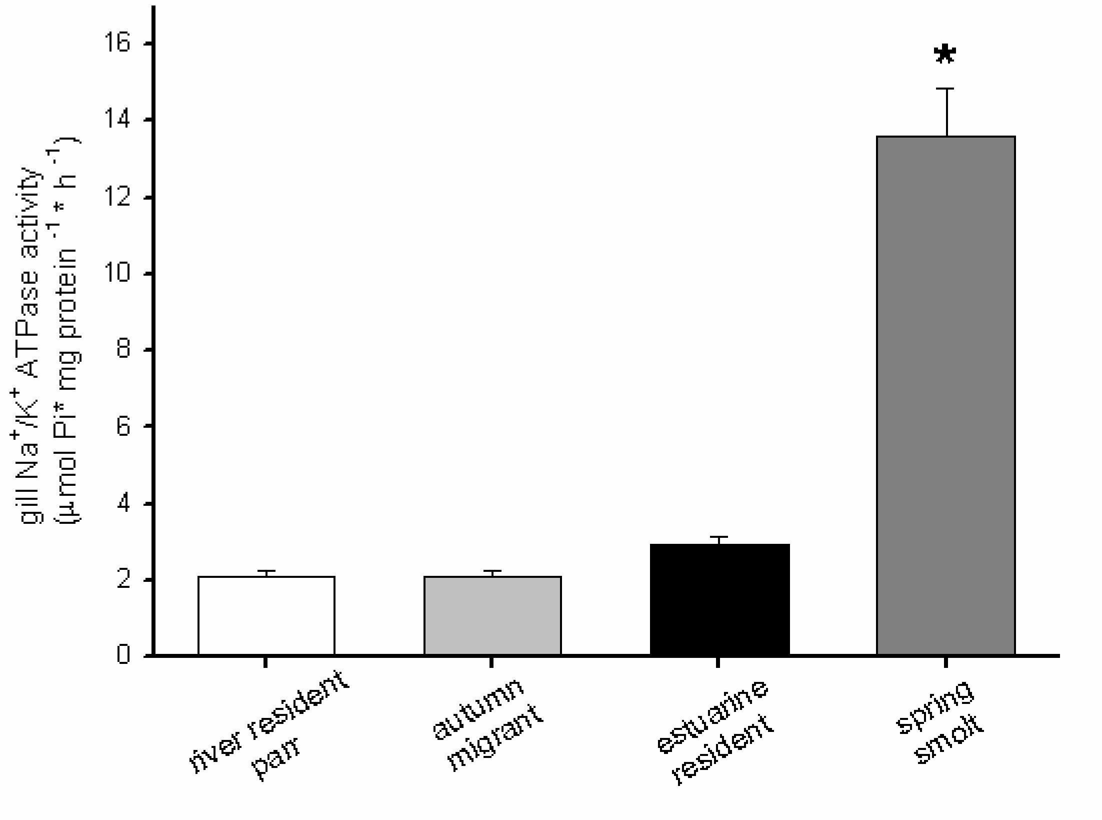


Figure 2.3.7.1 Gill Na^+, K^+-ATPase activity for river resident parr (sampled in November and January), autumn migrants (sampled in October and November), estuarine residents (sampled in December and February) and smolts (sampled in April) on the River Frome in 2005/06 (* denotes significantly elevated levels).

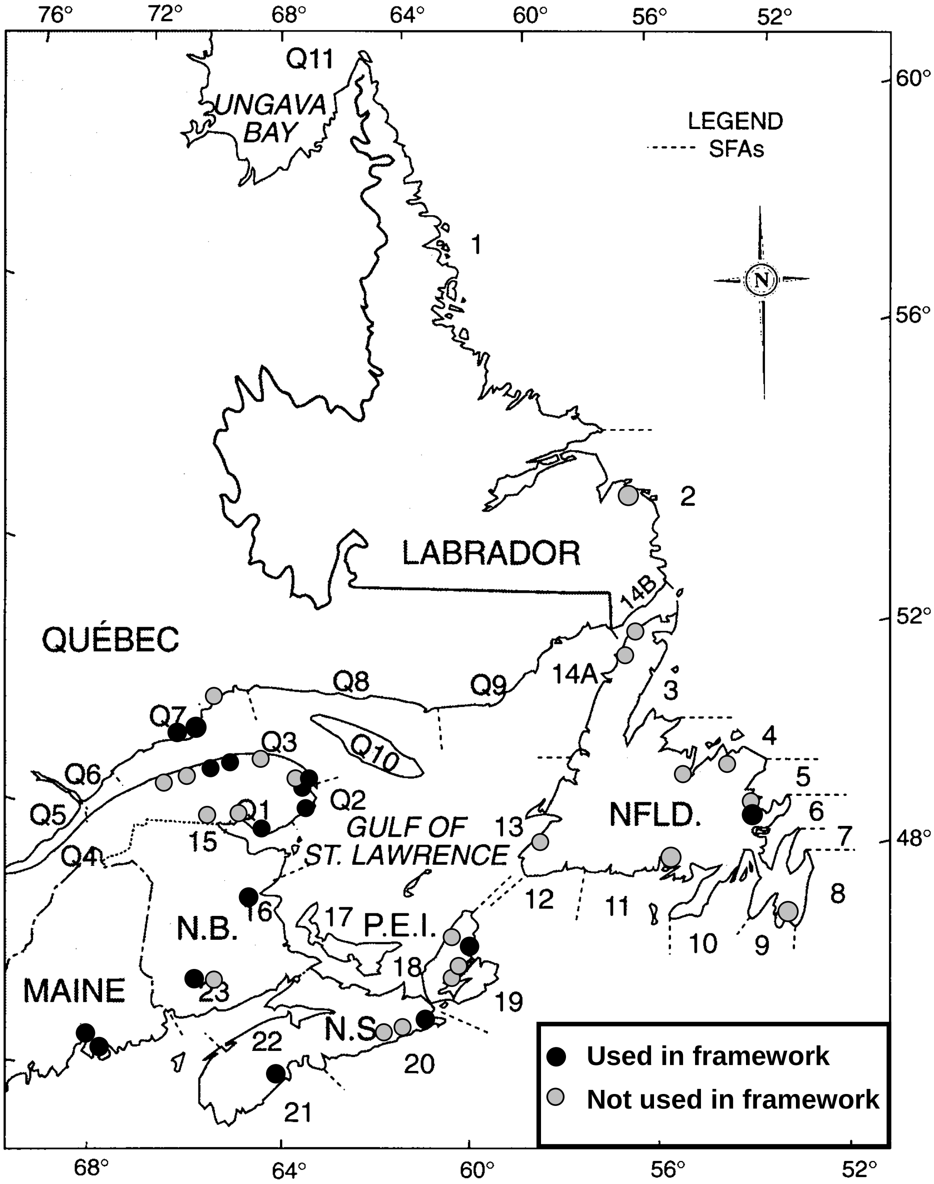


Figure 2.4.2.1. Geographic position of all indicator rivers where data sets originated from and were considered for inclusion into the Framework of Indicators from North American Commission area. Black bullets identify rivers where the data were incorporated in the framework and grey bullets identify rivers for which the indicator variables were not used.

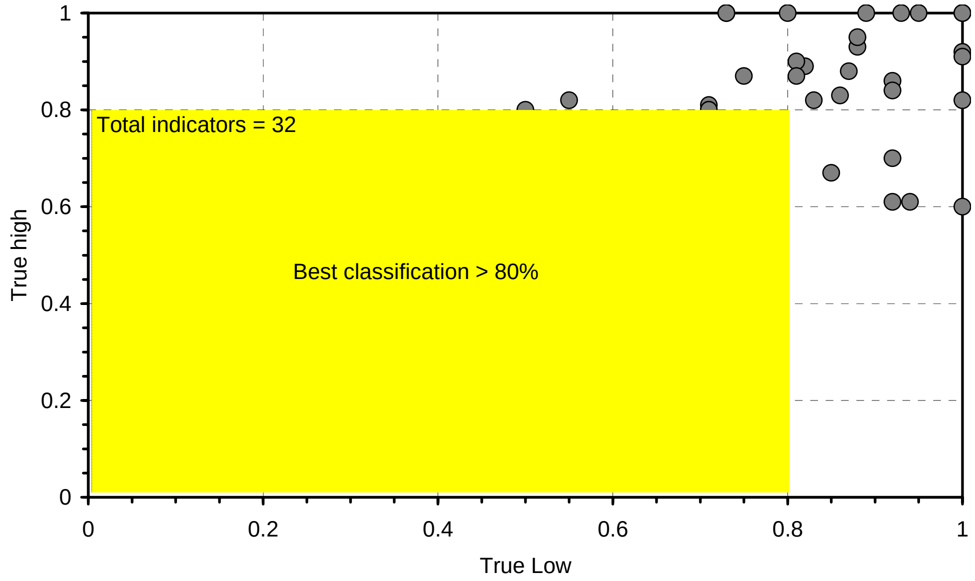


Figure 2.4.2.2. Comparative performance of the retained indicators (N = 32) at identifying a true low (i.e. management objective will not be met) and a true high (i.e. management objective will be met) for the West Greenland multi-year catch advice framework.

Derived multi-year catch advice	
Catch option (t)	0

Overall Recommendation

No Significant Change Identified by Indicators

Geographic Area	River/ Indicator	2008 Value	Ratio Value to Threshold	Threshold	True Low	True High	Indicator State	Probability of Correct Assignment	Indicator Score	Management Objective Met?
USA	Penobscot 2SW Returns	727	51%	1415	100%	92%	-1	1	-1	
	Penobscot 2SW Rate (%)	0.12	50%	0.24	100%	60%	-1	1	-1	
	Penobscot 1SW Returns	290	59%	495	82%	89%	-1	0.82	-0.82	
	Penobscot 1SW Rate (%)	0.05	56%	0.09	85%	67%	-1	0.85	-0.85	
	Narraguagus Returns	22	22%	100	94%	61%	-1	0.94	-0.94	
	possible range				*-0.92*	*0.74*				
	Average		48%						**-0.92**	**No**
Scotia-Fundy	Saint John Return Large	458	20%	2,309	100%	91%	-1	1	-1	
	Lahave Return Large	148	49%	301	100%	100%	-1	1	-1	
	North Return Large	245	48%	509	93%	100%	-1	0.93	-0.93	
	St. Mary's Return Large	91	41%	221	100%	82%	-1	1	-1	
	Saint John Return Small	725	32%	2,276	81%	90%	-1	0.81	-0.81	
	Lahave Return Small	870	45%	1931	92%	86%	-1	0.92	-0.92	
	St. Mary's Return Small	857	54%	1583	92%	84%	-1	0.92	-0.92	
	North Return Small	137	63%	216	92%	70%	-1	0.92	-0.92	
	Saint John 2SW Rate (Hatchery %)	0.113	51%	0.222	87%	88%	-1	0.87	-0.87	
	Saint John 1SW Rate (Hatchery %)	0.514	69%	0.745	81%	87%	-1	0.81	-0.81	
	possible range				*-0.92*	*0.88*				
	Average		44%						**-0.92**	**No**
Gulf	Miramichi 2SW	9634	53%	18,119	95%	100%	-1	0.95	-0.95	
	Miramichi 1SW	30699	91%	33,610	92%	61%	-1	0.92	-0.92	
	possible range				*-0.94*	*0.81*				
	Average		72%						**-0.94**	**No**
Quebec	Bonaventure Large	1497	101%	1479	75%	87%	1	0.87	0.87	
	Grande Rivière Large	371	85%	437	100%	100%	-1	1	-1	
	Saint-Jean Large	716	97%	736	83%	82%	-1	0.83	-0.83	
	Dartmouth Large	643	85%	756	73%	100%	-1	0.73	-0.73	
	Sainte-Anne Large	356	86%	413	88%	93%	-1	0.88	-0.88	
	Mitis Large	364	99%	369	71%	81%	-1	0.71	-0.71	
	Godbout Large	469	80%	584	80%	100%	-1	0.8	-0.8	
	De la Trinite Large	286	74%	385	73%	100%	-1	0.73	-0.73	
	York Small	417	110%	380	50%	80%	1	0.8	0.8	
	Dartmouth Small	298	105%	284	55%	82%	1	0.82	0.82	
	Madeleine Small	468	108%	432	71%	80%	1	0.8	0.8	
	Sainte-Anne Small	205	129%	159	71%	80%	1	0.8	0.8	
	Godbout Small	425	84%	508	89%	100%	-1	0.89	-0.89	
	De la Trinite Small	373	93%	399	88%	95%	-1	0.88	-0.88	
	possible range				*-0.76*	*0.90*				
	Average		88%						**-0.24**	**No**
Newfoundland	Middle Brook Small	1640	94%	1,751	86%	83%	-1	0.86	-0.86	
	possible range				*-0.86*	*0.83*				
	Average		94%						**-0.86**	**No**
Labrador										
	possible range									
	Average								**NA**	**Unknown**
Southern NEAC										
	possible range									
	Average								**NA**	**Unknown**

Figure 2.4.3.1. Framework of indicators spreadsheet for the West Greenland fishery. For illustrative purposes, the average of the most recent ten years of returns or return rates for the 32 retained indicators is entered in the cells corresponding to the annual indicator variable values.

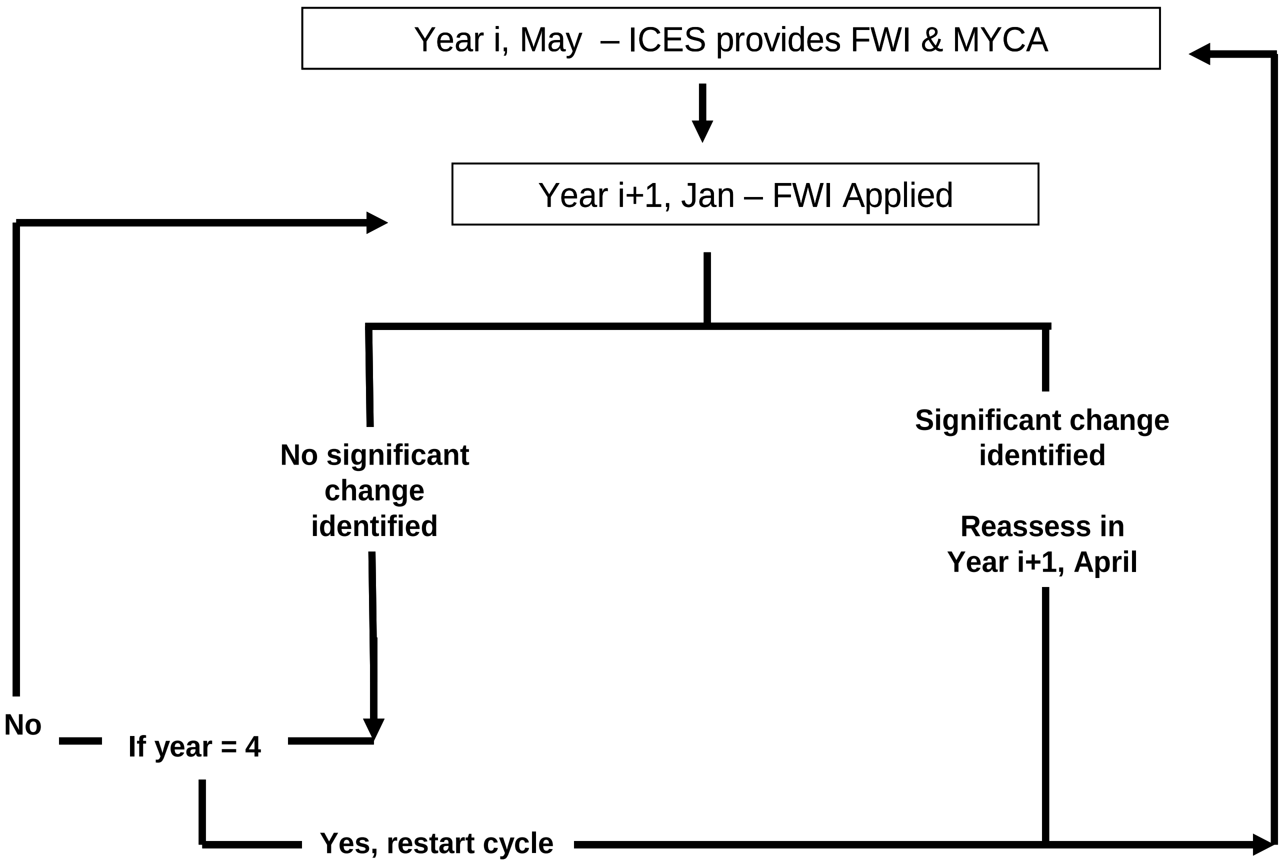


Figure 2.4.3.2. Suggested timeline for employment of the Framework of Indicators (FWI). In Year i, ICES provides multi-year catch advice (MYCA) and an updated FWI which re-evaluates the updated datasets and is summarized in an Excel worksheet. In January of Year i+1 the FWI is applied and two options are available depending on the results. If no significant change is detected, no re-assessment is necessary and the cycle continues to Year i+2. If no significant change is detected in Year i+2, the cycle continues to Year i+3. If a significant change is detected in any year, then reassessment is recommended. In that case, ICES would provide an updated FWI the following May. ICES would also provide an updated FWI if year equals 4.

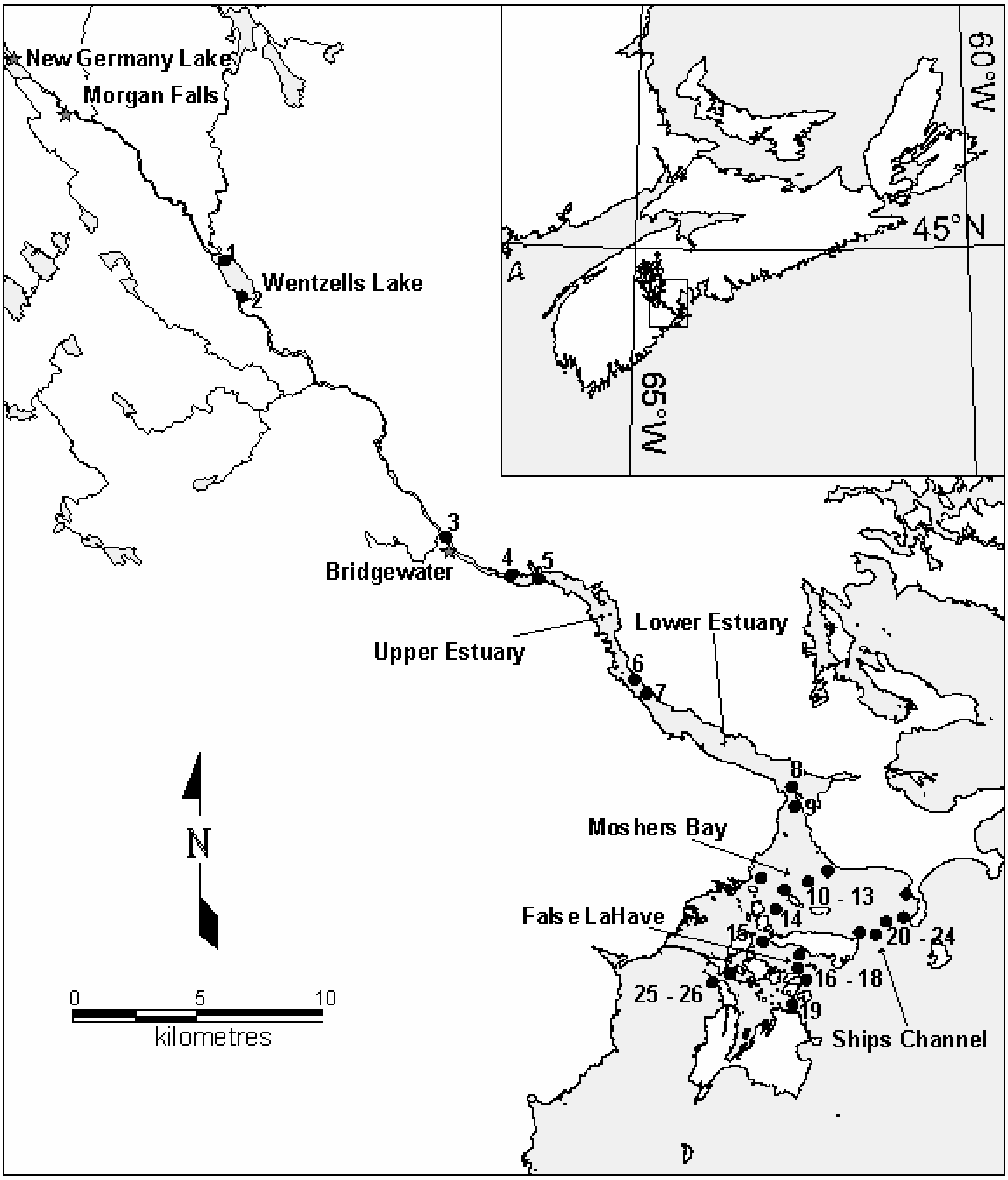


Figure 2.6.1.1. Location and map of the LaHave River, and estuary, Nova Scotia, Canada, indicating the capture site of Atlantic salmon kelts at New Germany Lake and release site at Morgan Falls, and the head of tide at the town of Bridgewater (stars), also shown are the location of acoustic receivers 1 - 26 (black circles).

3 North-East Atlantic Commission

3.1 Status of stocks/exploitation

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

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

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

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

Justification for these groupings is provided in Section 3.5.

The status of these stock complexes prior to the commencement of distant water fisheries with respect to the SER requirements is:

- Northern European 1SW stocks are considered to be at full reproductive capacity.
- Northern European MSW stocks are considered to be at full reproductive capacity.
- Southern European 1SW stocks are considered to be at risk of suffering reduced reproductive capacity.
- Southern European MSW stocks are considered to be at risk of suffering reduced reproductive capacity.

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

Estimated exploitation rates have generally been decreasing over the time period for both 1SW and MSW stocks in Northern and Southern NEAC areas (Figure 3.8.15.1 and Figure 3.8.15.2). Exploitation on Northern 1SW stocks is higher than on Southern 1SW and considerably higher for MSW stocks. There has been a slight increase in exploitation on 1SW and 2SW northern stocks since 2002. However, the current estimates for both stock complexes are amongst the lowest in the time series.

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

3.2 Management objectives

Management objectives are outlined in Section 1.4.

3.3 Reference points

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

3.3.1 Description of the national conservation limits model

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

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

ICES currently defines the conservation limit for salmon as the stock size that will result in the maximum sustainable yield (MSY) in the long term. However, it is not straightforward to estimate this point on the national stock-recruitment relationships because the replacement line (i.e. the line on which ‘stock’ equals ‘recruits’) is not known for the pseudo-stock-recruitment relationships established by the national model because the stock is expressed as eggs, while the recruits are expressed as adult salmon. In 2001 the Working Group adopted a method for setting biological reference points from the national pseudo-stock-recruitment datasets (ICES, 2001). This model assumes that there is a critical spawning stock level below which recruitment decreases linearly towards zero, and above which recruitment is constant. The position of the critical stock level is determined by searching for the value that minimises the residual sum of squares. This point is a proxy for S_{lim} and is therefore defined as the conservation limit for salmon stocks. This approach was again applied to the 2006 national stock-recruitment relationship assessment for countries where no river-specific conservation limits have been determined.

3.3.2 National conservation limits

The national CL model has been run for all countries (see Section 3.8.12) and the conservation limits are used for countries where no river specific conservation limits have been developed. Where river-specific estimates have been derived (ie. France, Ireland and UK (England & Wales)) they are used to provide national estimates (Table 3.3.2.1).

The Working Group has previously noted that outputs from the national model are only designed to provide a provisional guide to the status of stocks in the NEAC area. The estimated national conservation limits have been summed for Northern and Southern Europe and are given in Figure 3.1.1 for comparison with the estimated spawning escapement. The conservation limits have been calculated as:

- Northern NEAC 1SW spawners – 271 111
- Northern NEAC MSW spawners – 140 230
- Southern NEAC 1SW spawners – 624 221
- Southern NEAC MSW spawners – 269 237

The conservation limits have also been used to estimate the SERs (i.e. the CL increased to take account of natural mortality between the recruitment date (1st Jan) and return to home waters) for maturing and non-maturing 1SW salmon from the Northern and Southern Europe stock complexes. The SERs are shown in Figure 3.1.1 and Table 3.3.2.1. The Working Group also considers the current SER levels may be less appropriate for evaluating the historic status of stocks (e.g. pre-1985), that in many cases have been estimated with less precision.

3.3.3 Progress with setting river-specific conservation limits

Most NEAC countries have not developed river-specific conservation limits (CLs). In 2006, progress with setting river-specific CLs and associated compliance assessment was reported for Iceland, UK (Scotland) and Norway.

In Iceland work is progressing on several rivers to derive river specific CLs. Several datasets and techniques (catch data, counter data, habitat mapping, wetted area and juvenile surveys) are being used to estimate salmon production, run size and spawning escapement. To date work has indicated highly variable spawning reference levels. The next stage of the work will explore if and how CLs can be transported to recipient rivers.

In UK (Scotland) work has begun to develop procedures for setting river specific CLs. GIS applications, in conjunction with field based observation and a literature review of salmon distribution, have been used to develop a map based useable wetted area model for salmon which can be used to transport CLs among catchments. A CL has been derived for the North Esk and this has been transported to several recipient rivers. Methods to determine spawning escapement values in these rivers are now being investigated.

In Norway work is in progress to set conservation limits in 80 rivers. This work is based on stock recruitment relationships in nine rivers, and further transportation to data poor rivers based on similarities in productivity and stock age structure. Productivity is mostly based on catch statistics, and scale samples used to access the river- and sea age structure in a sub set of the populations. To derive the conservation limits, wetted area has been computed for the rivers based on digital maps and knowledge of how far salmon can migrate in the rivers. This work is planned to be reported to the Directorate for Nature Management during the summer of 2007.

3.4 Management Advice

ICES uses the catch advice presented in this section to determine whether or not stock complexes are at full reproductive capacity. The Working Group is unable to provide quantitative catch options for most stock complexes at this stage. To do so requires predictive estimates of PFA which have not yet been developed for all stock complexes. Initial attempts to develop forecast models for the Northern maturing 1SW, the Northern non-maturing 1SW and the Southern maturing 1SW stock complexes did not have sufficient predictive power to prove useful. The Working Group recommends further attempts to develop predictive models for all NEAC stock complexes. A quantitative prediction of PFA for Southern European MSW stocks is again provided. The Working Group considers that the following qualitative catch advice is appropriate based upon the PFA data and estimated SERs shown in Figure 3.1.1. In the evaluation of the status of stocks, PFA or recruitment values should be assessed against the SER values while the spawner numbers should be compared with the CLs.

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

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

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

3.4.1 Northern European maturing 1SW stocks

- The lower bound of the PFA estimate has been above the SER throughout the series indicating an exploitable surplus and this stock is currently **at full reproductive capacity** prior to the commencement of distant water fisheries.
- The lower bound of the spawner estimate has fluctuated around the CL throughout most of the time series. In 2006, the lower bound of the spawner estimate was above the CL and this stock complex is currently **at full reproductive capacity** after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity.

3.4.2 Northern European non-maturing 1SW stocks

- The lower bound of the PFA estimate has been above the SER throughout the series indicating an exploitable surplus and this stock is currently **at full reproductive capacity** prior to the commencement of distant water fisheries.
- The lower bound of the spawner estimate has fluctuated around the CL throughout most of the time series. In 2006, the lower bound of the spawner estimate was above the CL and this stock complex is currently **at full reproductive capacity** after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on non-maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity.

3.4.3 Southern European maturing 1SW stocks

- The lower bound of the PFA estimate fell below the SER for the first time in the series in 2006. This stock complex is currently **at risk of suffering reduced reproductive capacity** prior to the commencement of distant water fisheries.
- The mid-point and the lower bound of the spawner estimate has fluctuated around the CL throughout most of the time series. In 2006, both the mid-point and the upper bound of the spawner estimate were below the CL and this stock complex **is suffering reduced reproductive capacity** after homewater fisheries have taken place.
- In the absence of specific management objectives for this stock complex the precautionary approach is to fish only on maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. The Working Group considers that reductions in exploitation are required for as many stocks as possible, to increase the probability of the complex meeting conservation limits. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.

3.4.4 Southern European non-maturing 1SW stocks

- The lower bound of the PFA estimate has been above the SER throughout most of the series but is currently below. Thus this stock complex is currently **at risk of suffering reduced reproductive capacity** prior to the commencement of distant water fisheries.
- The mid-point and the lower bound of spawner estimate have been close to or below the CL since 1997. This stock complex **is suffering reduced reproductive capacity** after homewater fisheries have taken place**.**

- The quantitative forecast of PFA for 2007 indicates that this stock complex is expected to continue to decline from the previous year. In the absence of any fisheries on this stock complex there is a less than 64% probability that the CL will be achieved in 2008 (see Section 5.4). The PFA forecast for 2007–2010 predicts values below the SER and therefore there should be no fishing on this complex at West Geenland or Faroes. In the absence of specific management objectives for this stock complex, with the exception of the West Greenland fishery, the precautionary approach is to fish only on non-maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity. The Working Group considers that reductions in exploitation are required for as many stocks as possible, to increase the probability of the complex meeting conservation limits. Furthermore, due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status.

3.5 Relevant factors to be considered in management

The Working Group reiterated its concerns about harvesting salmon in mixed stock fisheries, particularly for fisheries exploiting individual river stocks and sub-river populations that are at risk or suffering reduced reproductive capacity. Annual adjustments in quotas or effort regulations based on changes in the status of the stock complexes are unlikely to provide adequate protection to the individual river stocks that are most heavily exploited by the fishery or are in the weakest condition.

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

It should be noted that the inclusion of farmed fish in the Norwegian data would result in the stock status being overestimated. Since very few of these salmon have been caught outside homewater fisheries in Europe, even when fisheries were operating in the Norwegian Sea, management of maturing 1SW salmon should be based upon local assessments of the status of river or sub-river stocks.

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

3.5.1 Grouping of national stocks

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

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

3.6 Pre-Fishery Abundance Forecast for 2006–2010 for the Southern NEAC stock complex

The Working Group has previously considered the development of a model to forecast the PFA of non-maturing (potential MSW) salmon from the Southern European stock group (ICES, 2002, 2003). The model has been used to provide such forecasts (ICES, 2006) which are used as one of the inputs to the risk analysis of the catch options for the Greenland fishery (see Section 5). The full model takes the form

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

where *Spawners* are expressed as lagged egg numbers, *PFAm* refers to pre-fishery abundance of maturing 1SW salmon (derived from NEAC PFA model – see Section 3.8.9) and the habitat term is the same as that previously used in the North American model (ICES, 2003). As updated data for the *Habitat* parameter have not been available to the Working Group since 2003, however, the term was not included in the parameter selection process in 2007.

Provision of 3-year management advice for the Faroese fishery requires that PFA forecasts be extended to 2010, one year further than has previously been made available. The number of years for which forecasts may be provided is limited by the *Spawner* (lagged egg) parameter within the model. The time series for this parameter extends only as far as those lagged eggs assigned to 1-year old smolts from the most recent available spawning year, currently lagged eggs for 2009 derived from 2006 spawner estimates. To allow PFA forecasts for 2010, lagged egg production assigned to 1-year old smolts for 2010 for each home water country was estimated by taking the average of the previous 5 years.

In previous years (ICES, 2004), parameter selection was achieved by adding variables (Spawners, PFAm and Year) until the addition of others did not result in an increase in the explanatory power of the model. The model was fitted to data from 1978 to 2005 (Table 3.6.1.1) and, as in previous years, the parameters selected were *Spawners* and *Year*. The final model took the form

$\text{Log}(PFA/Spawners) = -1.30\log(Spawners) + 118.5 - 0.050\,Year$

which is equivalent to:

$\text{PFA}=Spawners^{-0.30} \text{ x } e^{118.5-0.050\,Year}$.

The PFA forecasts (Figure 3.6.1.1, Table 3.6.1.2) indicate that for 2006 and 2007, the Southern NEAC stock complex is at risk of suffering reduced reproductive capacity while from 2008 to 2010, the stock complex will be suffering reduced reproductive capacity. No forecasts are available for other stock components or complexes in the NEAC area.

3.7 Comparison with previous assessment

3.7.1 National PFA model and national conservation limit model

Provisional catch data for 2005 were updated where appropriate. In addition, changes were made to the input data from Iceland. Exploitation rates were reduced in recent years to take into account the increasing practice of catch and release in the rod fishery. Changes were also made to non-reporting rates to better reflect current knowledge.

3.7.2 PFA forecast model

The midpoints of updated forecasts of the southern NEAC MSW PFA for the years 2006 to 2008 were 484 000, 455 000 and 434 000 respectively. All were between 1% and 2% lower than the forecasts (489 000, 461 000 and 440 000) provided last year.

3.8 NASCO has requested ICES to describe the key events of the 2006 fisheries and the status of the stocks

3.8.1 Fishing at Faroes in 2005/2006

No fishery for salmon has been carried out since 2000. No buyout arrangement has been in force since 1999.

3.8.2 Significant events in NEAC homewater fisheries in 2006

Ireland

Since 2002, salmon fishing effort in Ireland has been affected by the imposition of a commercial fishery TAC. An initial commercial TAC of 219 619 fish was imposed for the 2002 season, followed by reduced TACs of 182 000 fish for 2003 and 162 000 fish in 2004 and 139 900 in 2005. A TAC of 91 000 salmon was applied for the 2006 fishery based on the recommendations of the National Salmon Commission.

Mandatory catch and release operated from the 1st of September in 8 of the 17 total fishery districts which were assessed as being below their conservation limits.

UK (England & Wales)

Progress to phase out various net fisheries continued in 2006. A previously agreed phase out of both trammel and seine net fisheries on the River Dee (North Wales) was accelerated with compensation payments agreed with four fishermen. Reductions in effort were also introduced for two rivers in south west England, the Dart and Teign, where the number of seine net licences was reduced to 3 on each river from 13 and 6, respectively. These reductions were also facilitated by compensation payments to the netsmen.

3.8.3 Gear and effort

In 2006 no significant changes in the type of gear used for salmon fishing were reported in the NEAC area.

The number of gear units licensed or authorised in several of the NEAC area countries provides a partial measure of effort (Table 3.8.3.1), but does not take into account other restrictions, for example, closed seasons. In addition, there is no indication from these data of the actual number of licences utilised or the time each licencee fished.

Trends in effort are shown in Figures 3.8.3.1 and 3.8.3.2 for the Northern and Southern NEAC countries respectively. In the Northern NEAC area, drift net effort in Norway accounted for the majority of the effort expended in the early part of the time-series. However, this fishery closed in 1989, reducing the overall effort substantially. The two remaining methods, bagnets and bendnets, show contrasting patterns of effort until the early 1990s when both show downward trends until the end of the time-series. In the Archangel region of Russia, the effort in the river commercial fishery shows a decline while the effort in the coastal fishery shows no trend for the time series reported. In the Southern NEAC countries, net effort data show a downward trend of various degrees for UK (England & Wales), UK (Northern Ireland), Ireland, France and UK (Scotland).

Rod effort, where available, show both upward and downward trends for the period reported. In the Northern NEAC area the catch and release rod fishery in the Kola Peninsula in Russia has increased from 1711 fishing days in 1991 to 13 604 in 2006. In Finland the number of fishing days has shown an increase throughout the time period. In the Southern NEAC area rod fishing effort decreased in 2006 in UK (England & Wales). In Ireland there has been an apparent increase in rod fishing effort due to the introduction of one day licences in the early 1990s and has remained stable over the past decade. In France the effort has been fairly stable over last 10 years.

3.8.4 Catches

NEAC area catches are presented in Table 3.8.4.1. The provisional declared catch in the NEAC area in 2006 was 1846 tonnes, slightly lower that in 2005 (1995 t). The NEAC catch represents 92% of the total North Atlantic nominal catch in 2006. The catch in the NEAC Southern area (618 t) fell by 23% on 2005 and was the lowest in the time series. The catch in the NEAC Northern area (1228 t) was 3% higher than the catch in 2005, but was 12% below the recent 5-year mean and among the lowest in the time series.

Figure 3.8.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2006. The catch in the Southern area has declined over the period from about 4500 t in 1972–75 to below 1500 t since 1986, and is now well below 1000 t. The catch declined particularly sharply in 1976 and again in 1989–91. The catch in the Northern area also shows an overall decline over the time series, but this is less steep than for the Southern area. The catch in the Northern area varied between 1850 and 2700 t from 1971 to 1986, fell to a low of 962 t in 1997, and then increased to over 1500 t in 2001. The catch has shown a downward trend again since this time. Thus, the catch in the Southern area, which comprised around two-thirds of the NEAC total in the early 1970s, has been lower than that in the Northern area since 1999.

3.8.5 Catch per unit effort (CPUE)

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

The CPUE data are presented in Tables 3.8.5.1–3.8.5.5. The CPUE for rod fisheries have been collected by relating the catch to rod days or angler season, and that of net fisheries was calculated as catch per licence-day, trap month or crew month.

In the Southern NEAC area, CPUE show a general decrease in UK (Scotland) and UK (England & Wales) net fisheries. CPUE for the net fishery showed mostly lower figures compared to 2005 and the previous 5-year averages (Table 3.8.5.3). In UK (Northern Ireland), the river Bush rod fishery CPUE has increased after 2002, which was the lowest level in recent years, and the 2006 figure was higher than that of the previous year and the 5-year mean (Table 3.8.5.1).

In the Northern NEAC area, there has been an increasing trend in the CPUE figures for Norwegian net fisheries and Russian rod fisheries in Barents Sea rivers. A decreasing trend was noted for rod fisheries in Finland (River Teno) and Russian White Sea rivers. In comparison with the previous year, most CPUE values were up and higher than the previous 5-year means (Tables 3.8.5.1, 3.8.5.2, and 3.8.5.5).

3.8.6 Age composition of catches

The percentage of 1SW salmon in NEAC catches is presented in Table 3.8.6.1 and in Figures 3.8.6.1 (Northern area) and 3.8.6.2 (Southern area). Since 1987, the proportion of 1SW fish has varied between 54 and 72% in the Northern area and between 49 and 65% in the Southern area. In the Northern area, there has been greater variability in the proportion of 1SW fish among countries in recent years (since 1994) than prior to this time. The proportion of 1SW fish in the catch decreased in Norway and Iceland and increased in Russia in 2006, for the other countries the proportions were relatively similar to the 2005 levels.

The percentage of 1SW fish in the Northern area was 60% in 2006, a little below the 5- and 10-year means. On average, 1SW fish comprise a higher proportion of the catch (around 75–85%) in Iceland and Russia than in the other Northern countries (Figure 3.8.6.1). In the Southern European countries (Figure 3.8.6.2), the overall percentage of 1SW fish in the catch (59%) was close to the 5- and 10-year mean (60%). On average, 1SW fish comprise a higher proportion of the catch (70–80%) in UK (England & Wales) than in the other countries of Southern NEAC.

3.8.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2006 was again generally low (<2% in most countries) and is similar to the values that have been reported in previous reports (eg. ICES, 2006). Thus, the occurrence of such fish is usually ignored in assessments of the status of national stocks (Section 3.8.12). However, in Norway farmed salmon continue to form a large proportion of the catch in coastal (33% in 2006), fjordic (19% in 2006) and rod fisheries (7% in 2006). An assessment of the likely effect of these fish on the output data from the PFA model has been reported previously (ICES, 2001).

3.8.8 National origin of catches

In the course of collecting coded wire tagged salmon from Irish tagging programmes, tags are also recovered from salmon that originate from other countries where coded wire tagging takes place. In 2006, 31 tags originating from fish released from five other countries were recovered in Irish fisheries: 15 from UK (Northern Ireland), 9 from UK (England & Wales), 2 from Spain and 5 from Germany.

Due to the large difference in the number of tagged salmon being released by each country and the consistency of tagging programmes, tag recoveries are expressed as recapture rates per 1,000 fish released (raised to the total fishery and including an estimate of unreported catch) to provide the relative contribution of tagged salmon by each country to the Irish fishery (Table 3.8.8.1). Tag release information is derived from information reported annually to ICES (Reports of the ICES Compilation of Microtags, Finclips and External Tag Releases, 1985 to 2006). For UK (England and Wales) tagged parr have comprised a large proportion of the fish tagged in some years, and these are generally regarded as contributing to returns two years after release, but this is known to vary. Similarly, by combining the indices at a country level important regional differences may be obscured. Noting these caveats, highest average recapture rates for tagged salmon released in areas other than Ireland are UK (N. Ireland), UK (Scotland), Denmark, France, UK (England and Wales), Spain, Germany and Norway respectively.

River-specific models based on the run reconstruction approach were presented for a number of English and Welsh stocks (ICES, 2004); the inclusion of confidence limits on the estimates of exploitation marked a further advance on earlier models, and Table 3.8.8.2 provides updated estimates. Prior to 1997, exploitation rates in the Irish fishery were estimated at about 1% for stocks from the north east of England, higher (13 to 17%) for two rivers in Wales, but highest (28%) for the River Test in southern England. New management measures were introduced in the Irish fishery in 1997 and since 2002 the fishery has been regulated by quotas, which have reduced each year. Exploitation rate estimates since 1997 indicate a reduction in exploitation of English and Welsh stocks, with average values of 0.5% for the Tyne (data for one year only), 2 to 8% for Welsh rivers and 12% for the River Test. While it was not possible to use the modelling approach to estimate exploitation rates for other stocks, the overall pattern of tag recapture rates has been consistent with this regional pattern of exploitation. Recent estimates for the River Tamar in south west England (2003–05 only) indicate a current exploitation rate in Ireland of about 2% for this stock.

The Working Group recognised that exploitation rates varied considerably from year-to-year and that exploitation rates on particular stocks may still be relatively high in some years and negligible in others. For stocks below their conservation limit, the Working Group noted that even low levels of exploitation may represent an impediment to stock recovery, particularly for those rivers designated as Special Areas of Conservation (Section 3.9).

3.8.9 The NEAC-PFA model

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

3.8.10 Sensitivity of the PFA model

The sensitivity of the PFA and spawner estimates for the Northern and Southern European stock complexes was carried out using the tools within Crystal Ball. The relative contribution of model parameters to variance in the estimates of recruits (maturing and non-maturing 1SW) and spawner numbers (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES Working Group in 2007 (catch data for 2006). PFA estimates are particularly sensitive to the marine mortality parameter. This is due both to the range (0.02–0.04) attributed to marine mortality in the Monte Carlo simulation and also to the time over which stocks are raised using the variable. Given a fixed value for M, parameters which have accounted for at least 5% of the variance of a given variable are shown in Table 3.8.10.1. Taking both stock complexes together these account for 11 (9%) of the 117 parameters used to estimate PFA and 19 (26%) of the 72 parameters used to estimate spawner numbers.

The sensitivity of forecast variables to these parameters has been shown to be remarkably consistent between years (ICES, 2006) and analysis of the data presented to the 2007 Working Group gave results which were similar to previous years.

3.8.11 National input to the NEAC-PFA model

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

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

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

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

Descriptions of how the model input has been derived were presented in detail at the Working Group meeting in 2002 (ICES, 2002). Modifications are reported in the year in which they are first implemented and significant modifications undertaken in 2007 are indicated in Section 3.7.1.

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

3.8.12 Description of national stocks as derived from the PFA model

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

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

The model output for each country has been displayed as a summary sheet (Figures 3.8.12.1(a–j)) comprising the following:

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

3.8.13 Trends in the PFA for NEAC stocks

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

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

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

Trends in spawner number for the Northern stock complexes for both 1SW and MSW are similar. Throughout most of the time series, both 1SW and MSW spawners have been either at full reproductive capacity (as in 2006) or at risk of reduced reproductive capacity. This is broadly consistent with the general pattern of decline in marine survival of 1SW and 2SW returns in most monitored stocks in the area (Section 3.8.14).

Recruitment patterns of maturing 1SW salmon and of non-maturing 1SW recruits for Southern Europe (Figure 3.1.1) show broadly similar declining trends over the time period. The maturing 1SW stock complex has been at full reproductive capacity over the time period with the exception of 2006 when it is at risk of suffering reduced reproductive capacity after homewater fisheries have taken place. The non-maturing 1SW stock has been at full reproductive capacity over most of the time period but has been at risk of suffering reduced reproductive capacity after homewater fisheries have taken place in five of the nine years since 1996.

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

3.8.14 Survival indices for NEAC stocks

An overview of the trends of marine survival for wild and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) for the 2005 and 2004 smolt year classes (returning 1SW and 2SW salmon, respectively) is presented in Figure 3.8.14.1. The survival indices presented are the annual rates of change in marine survival. The original survival indices for different rivers and experimental facilities are presented in Tables 3.8.14.1 and 3.8.14.2.

An overall trend in both Northern and Southern NEAC areas, both wild and hatchery smolts, show a decline in marine survival with the annual decline varying between 1% and 13% (Figure 3.8.14.1). Most of the survival indices for wild smolts were lower than those of previous year but higher or at the 5- and 10-year averages. Most of the survival indices for the hatchery-reared smolts were below the 5- and 10-year averages, although many figures were at or higher than those of the previous year (Table 3.8.14.2). Return rates of hatchery released fish, however, may not always be a reliable indicator of marine survival of wild fish.

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

3.8.15 Exploitation indices for NEAC stocks

Exploitation estimates have been charted for 1SW and MSW salmon from the northern and southern NEAC areas for the period 1971–2006 (1983–2006 for Norway) and are displayed in Figures 3.8.15.1 and 3.8.15.2. These figures have been collated from the NEAC pre-fishery abundance model and represent an estimate of total national exploitation rates inclusive of both commercial and recreational fisheries (catches at Faroes and West Greenland are not included). Data gathered prior to the 1980's represent estimates of national exploitation rates whilst post 1980's 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 relative change (% change per year) in exploitation rate over the time series. This was derived from the slope of the linear regression between time and natural logarithm transformed exploitation rate (Figures 3.8.15.3 and 3.8.15.4).

The exploitation of 1SW salmon in both northern and southern NEAC areas has shown a general decline over the time series (Figure 3.8.15.1 and 3.8.15.2). Exploitation rates on 1SW salmon were 41% and 29% respectively in 2006 representing a decrease on the previous 10 year averages of 43% and 35% in northern and southern areas. The exploitation rate of MSW fish also exhibited an overall decline over the time series in both northern and southern areas (Figure 3.8.15.1 and 3.8.15.2). The area averages for north and south NEAC regions was 48% and 34% in 2006 reflecting a decrease on the previous 10 year averages of 52% and 35% respectively.

The rate of change of exploitation in the northern NEAC area is charted in Figure 3.8.15.3 and shows an overall reduction of exploitation in all countries for MSW fish with the greatest decrease measured in Norway. Exploitation of 1SW fish in Finland has been relatively stable over the time period whilst the largest rate of reduction has been for 1SW salmon in Russia. The southern NEAC countries (Figure 3.8.15.4) have also shown a general decrease in exploitation rate on both 1SW and MSW salmon with the greatest rate of decrease measured for both 1SW and MSW fish in UK (Scotland). A fairly large rate of decrease of exploitation in 1SW salmon was also noted in UK (Northern Ireland) whilst the only positive change indicative of increasing exploitation was detected on 1SW fish in France (Figure 3.8.12.1b).

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

In 2005, the Working Group noted the implications for salmon stocks arising from the implementation of Council Directive 92/43/EEC (on the conservation of natural habitats and of wild flora and fauna). States are obliged to take measures to ensure that the exploitation of salmon stocks is compatible with their being maintained at a favourable conservation status. Under the terms of the Directive, every 6 years member states are obliged to submit a report detailing the conservation status of their salmon stocks. The first such report is due to be submitted in 2007.

The Working Group notes that salmon management in European Member States is becoming increasingly linked with the Water Framework Directive (Directive 2000/60/EC) (WFD), and its 6 year planning cycle. The WFD aims to protect and enhance the water environment, 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.

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

Summary of country inputs

Most management measures introduced in recent years in relation to international, national and local objectives have aimed to reduce levels of exploitation on NEAC stocks, to increase freshwater escapement and in some countries specifically to meet river specific CLs. Although some local measures have had notable success (Table 3.9.1), the two southern NEAC stock complexes are currently suffering reduced reproductive capacity after homewater fisheries have taken place.

3.10 NASCO has requested ICES to provide estimates of by-catch and non-catch fishing mortality of salmon in pelagic fisheries with an assessment of impacts on returns to homewaters

3.10.1 SGBYSAL

Disaggregated pelagic fisheries data (eg. by weeks, gear types, etc.) are generally available from most countries who have important fisheries in the Nordic Seas. In contrast, there have not been any dedicated investigations on distribution of postsmolts and salmon since 2005 in this area. Therefore, without data on salmon distribution or regularly occurring reliable reports on by-catches, it is not possible to provide updated estimates of by-catch. Consequently the Study Group on the Bycatch of Salmon in Pelagic Fisheries (SGBYSAL) was dissolved by ICES in 2006 and will only be reconvened when new and relevant information becomes available. However, the WGNAS continues to collate reports on salmon taken in commercial or research fisheries in order to document any increases in the frequencies of such reports and these are provided below. The above records do not supply enough information to allow an assessment of the effect of non-targeted fisheries on salmon abundance.

3.10.2 Bycatch of salmon in non-targeted catches in 2006

Norwegian research vessels have registered a bycatch of 46 post-smolts from one single haul and 7 larger salmon from three separate cruises (Figure 3.10.2). No salmon surveys were carried out in the Norwegian Sea in 2006.

Norwegian bycatch observers have not reported any salmon by-catches during routine screening of commercial catches.

Records were obtained of a by-catch of 12 larger salmon (from 1 to 12 kg) from a commercial trawl fishery for cod north east of Bear Island during August and September 2006

Russian commercial catches screening reported a total of 9 salmon as follows:

In 2006 the screening program was carried out in the Norwegian Sea by FV M-0011 “Boris Syromyatnikov” while pelagic fishing for mackerel, blue whiting and herring from June 19 to September 16.

Four post-smolts (WT – 127-170 g) were found in a single catch of 40 tonnes of mackerel taken in international waters on the 27th June. On July 2nd, one post-smolt (WT – 120 g) was found in a catch of 35 tonnes of mackerel. All post-smolts were caught when surface trawling at a depth of 0–50 meters. One adult salmon (female, FL – 54 cm, WT – 3.5 kg) was caught while fishing for herring

Two other commercial vessels reported Atlantic salmon by-catch while fishing for mackerel. One post-smolt (WT – 130 g) was found on the 7th of July. One adult salmon (male, FL – 52 cm, WT – 2.0 kg) was reported in the catch of another ship the same day. A third commercial vessel registered a Norwegian Carlin tagged postsmolt (FL-286 mm) in a herring catch on August 15 (Figure 3.10.2).

The above records do not supply enough information to allow an assessment of the effect of non-targeted fisheries on salmon abundance.

Table 3.3.2.1. Conservation limits for NEAC stock groups estimated from national lagged egg deposition model and from river specific values (where available).

	National Model CLs		River Specific CLs		Conservation limit used	
	1SW	MSW	1SW	MSW	1SW	MSW
Northern Europe						
Finland	18,773	15,519			18,773	15,519
Iceland (north & east)	6,070	1,676			6,070	1,676
Norway[1]	127,828	82,657			127,828	82,657
Russia	116,305	39,181			116,305	39,181
Sweden	2,134	1,196			2,134	1,196
			Conservation limit		271,111	140,230
			Spawner Escapement Reserve		342,448	236,527

[1]Norwegian conservation limits calculated on data from 1983

	National Model CLs		River Specific CLs		Conservation limit used	
	1SW	MSW	1SW	MSW	1SW	MSW
Southern Europe						
France			17,400	5,100	17,400	5,100
Iceland (south & west)	25,893	2,157			25,893	2,157
Ireland			236,044	15,334	236,044	15,334
UK (E&W)			54,491	29,605	54,491	29,605
UK (NI)	17,331	2,458			17,331	2,458
UK (Sco)	273,061	214,673			273,061	214,673
			Conservation limit		624,221	269,327
			Spawner Escapement Reserve		793,540	455,413

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

Model Parameters			Southern NEAC non-maturing PFA
Year	Spawner (lagged eggs)	PFAm	
1978	5,296,870	2,150,128	1,212,866
1979	4,985,416	1,906,472	1,685,037
1980	4,072,023	1,504,783	1,781,100
1981	3,587,207	1,221,949	1,301,268
1982	3,612,093	1,785,878	1,537,563
1983	3,471,737	2,536,303	1,079,884
1984	3,350,874	1,791,991	1,255,596
1985	3,225,103	2,111,389	1,690,405
1986	3,217,491	2,489,687	1,276,761
1987	3,888,331	1,814,163	1,624,959
1988	3,389,333	2,498,638	1,479,374
1989	3,603,326	2,081,566	1,163,080
1990	4,208,449	1,278,076	825,988
1991	4,156,577	1,054,765	1,034,916
1992	4,579,898	1,507,625	904,160
1993	4,641,706	1,461,366	1,010,191
1994	3,871,763	1,551,324	958,885
1995	3,256,638	1,547,079	752,665
1996	3,399,394	1,274,554	581,168
1997	3,603,825	1,157,705	527,389
1998	3,488,890	1,473,376	540,527
1999	3,613,637	1,014,093	649,497
2000	3,197,495	1,527,809	630,641
2001	2,824,408	1,305,604	572,127
2002	2,654,737	1,170,942	627,408
2003	2,515,917	1,124,611	658,315
2004	2,934,726	1,087,080	554,824
2005	2,965,166	1,126,870	458,751
2006	2,783,168		
2007	2,877,185		
2008	2,854,931		
2009	2,832,998		
2010	2,457,319		

Table 3.6.1.2. Predictions and 95% confidence limits of PFA non-maturing salmon and the associated SERs for Southern NEAC using Spawners (Eggs) and Year for the years 2006 to 2010.

Year	PFA	lower	upper	SER
2006	483,733	319,960	731,333	455,413
2007	455,415	300,621	689,913	455,413
2008	434,060	285,640	659,602	455,413
2009	413,701	271,349	630,733	455,413
2010	410,542	267,052	631,130	455,413

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

Year	England & Wales					UK (Scotland)		UK (N. Ireland)			Norway			
	Gillnet licences	Sweepnet	Hand-held net	Fixed engine	Rod & Line	Fixed engine[1]	Net and coble[2]	Driftnet	Draftnet	Bagnets and boxes	Bagnet	Bendnet	Liftnet	Driftnet (No. nets)
1971	437	230	294	79	-	3,069	802	142	305	18	4,608	2,421	26	8,976
1972	308	224	315	76	-	3,437	810	130	307	18	4,215	2,367	24	13,448
1973	291	230	335	70	-	3,241	884	130	303	20	4,047	2,996	32	18,616
1974	280	240	329	69	-	3,182	777	129	307	18	3,382	3,342	29	14,078
1975	269	243	341	69	-	2,978	768	127	314	20	3,150	3,549	25	15,968
1976	275	247	355	70	-	2,854	756	126	287	18	2,569	3,890	22	17,794
1977	273	251	365	71	-	2,742	677	126	293	19	2,680	4,047	26	30,201
1978	249	244	376	70	-	2,572	691	126	284	18	1,980	3,976	12	23,301
1979	241	225	322	68	-	2,698	747	126	274	20	1,835	5,001	17	23,989
1980	233	238	339	69	-	2,892	670	125	258	20	2,118	4,922	20	25,652
1981	232	219	336	72	-	2,704	647	123	239	19	2,060	5,546	19	24,081
1982	232	221	319	72	-	2,415	647	123	221	18	1,843	5,217	27	22,520
1983	232	209	333	74	-	2,530	669.5	120	207	17	1,735	5,428	21	21,813
1984	226	223	354	74	-	2,443	653	121	192	19	1,697	5,386	35	21,210
1985	223	230	375	69	-	2,196	551	122	168	19	1,726	5,848	34	20,329
1986	220	221	368	64	-	1,996	618.5	121	148	18	1,630	5,979	14	17,945
1987	213	206	352	68	-	1,762	577	120	119	18	1,422	6,060	13	17,234
1988	210	212	284	70	-	1,577	402	115	113	18	1,322	5,702	11	15,532
1989	201	199	282	75	-	1,235	355.5	117	108	19	1,888	4,100	16	0
1990	200	204	292	69	-	1,280	339.5	114	106	17	2,375	3,890	7	0
1991	199	187	264	66	-	1,136	289	118	102	18	2,343	3,628	8	0
1992	203	158	267	65	-	850	292.5	121	91	19	2,268	3,342	5	0
1993	187	151	259	55	-	900	263.5	120	73	18	2,869	2,783	-	0
1994	177	158	257	53	37,278	752	243.5	119	68	18	2,630	2,825	-	0
1995	163	156	249	47	34,941	729	221.5	122	68	16	2,542	2,715	-	0
1996	151	132	232	42	35,281	644	200.5	117	66	12	2,280	2,860	-	0
1997	139	131	231	35	32,781	688	190	116	63	12	2,002	1,075	-	0
1998	130	129	196	35	32,525	545	143.5	117	70	12	1,865	1,027	-	0
1999	120	109	178	30	29,132	384	128.5	113	52	11	1,649	989	-	0
2000	110	103	158	32	30,139	385	119	109	57	10	1,557	982	-	0
2001	113	99	143	33	24,350	387	95	107	50	6	1,976	1,081	-	0
2002	113	94	147	32	29,407	427	101	106	47	4	1,666	917	-	0
2003	58	96	160	57	29,936	363	109	105	52	2	1,664	766	-	0
2004	57	75	157	65	32,766	409	96	90	54	2	1,546	659	-	0
2005	59	73	148	65	34,040	382	101	93	57	2	1,453	661	-	0
2006	52	57	147	65	27,102	285	62	107	49	2	1,283	685	-	0
Mean 2001-2005	80	87	151	50	30,100	394	100 ##	100	52	3 ##	1,661	817		0
% change [3]	-35.0	-34.8	-2.6	29.0	-10.0	-27.6	-38.2 ##	6.8	-5.8	-37.5 ##	-22.8	-16.1		
Mean 1996-2005	105	104	175	43	31036	461	128 ##	107	57	7 ##	1766	1102		0
% change [3]	-50.5	-45.2	-16.0	52.6	-12.7	-38.2	-51.7 ##	-0.3	-13.7	-72.6 ##	-27.3	-37.8		

[1] Number of gear units expressed as trap months.
[2] Number of gear units expressed as crew months.
[3] (2005/mean - 1) * 100

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

	Ireland				Finland				France			Russia		
					The Teno River			R. Näätämö				Kola Peninsula	Archangel region	
	Driftnets No.	Draftnets	Other nets Commercial	Rod	Recreational fishery Tourist anglers		Local rod and net fishery	Recreational fishery	Rod and line licences in freshwater	Com. nets in freshwater[1a]	Drift net Licences in estuary[1b,2]	Catch-and-release Fishing days	Commercial, number of gears	
Year					Fishing days	Fishermen	Fishermen	Fishermen					Coastal	In-river
1971	916	697	213	10,566	-	-	-	-	-	-	-	-	-	-
1972	1,156	678	197	9,612	-	-	-	-	-	-	-	-	-	-
1973	1,112	713	224	11,660	-	-	-	-	-	-	-	-	-	-
1974	1,048	681	211	12,845	-	-	-	-	-	-	-	-	-	-
1975	1,046	672	212	13,142	-	-	-	-	-	-	-	-	-	-
1976	1,047	677	225	14,139	-	-	-	-	-	-	-	-	-	-
1977	997	650	211	11,721	-	-	-	-	-	-	-	-	-	-
1978	1,007	608	209	13,327	-	-	-	-	-	-	-	-	-	-
1979	924	657	240	12,726	-	-	-	-	-	-	-	-	-	-
1980	959	601	195	15,864	-	-	-	-	-	-	-	-	-	-
1981	878	601	195	15,519	16,859	5,742	677	467	-	-	-	-	-	-
1982	830	560	192	15,697	19,690	7,002	693	484	4,145	55	82	-	-	-
1983	801	526	190	16,737	20,363	7,053	740	587	3,856	49	82	-	-	-
1984	819	515	194	14,878	21,149	7,665	737	677	3,911	42	82	-	-	-
1985	827	526	190	15,929	21,742	7,575	740	866	4,443	40	82	-	-	-
1986	768	507	183	17,977	21,482	7,404	702	691	5,919	58 [3]	86	-	-	-
1987	-	-	-	-	22,487	7,759	754	689	5,724 [4]	87 [4]	80	-	-	-
1988	836	-	-	11,539	21,708	7,755	741	538	4,346	101	76	-	-	-
1989	801	-	-	16,484	24,118	8,681	742	696	3,789	83	78	-	-	-
1990	756	525	189	15,395	19,596	7,677	728	614	2,944	71	76	-	-	-
1991	707	504	182	15,178	22,922	8,286	734	718	2,737	78	71	1,711	-	-
1992	691	535	183	20,263	26,748	9,058	749	875	2,136	57	71	4,088	-	-
1993	673	457	161	23,875	29,461	10,198	755	705	2,104	53	55	6,026	59	199
1994	732	494	176	24,988	26,517	8,985	751	671	1,672	14	59	8,619	60	230
1995	768	512	164	27,056	24,951	8,141	687	716	1,878	17	59	5,822	55	239
1996	778	523	170	29,759	17,625	5,743	672	814	1,798	21	69	6,326	85	330
1997	852	531	172	31,873	16,255	5,036	616	588	2,953	10	59	6,355	68	282
1998	874	513	174	31,565	18,700	5,759	621	673	2,352	16	63	6,034	66	270
1999	874	499	162	32,493	22,935	6,857	616	850	2,225	15	61	7,023	66	194
2000	871	490	158	33,527	28,385	8,275	633	624	2,037 [5]	16	35	7,336	60	173
2001	881	540	155	32,814	33,501	9,367	863	590	2,080	18	42	8,468	53	121
2002	833	544	159	32,814	37,491	10,560	853	660	2,082	18	43	9,624	63	72
2003	877	549	159	32,725	34,979	10,032	832	644	2,048	18	38	11,898	55	84
2004	831	473	136	31,809	29,494	8,771	801	657	2,158	15	38	13,300	62	56
2005	877	518	158	28,738	27,627	7,776	785	705	2,356	16	37	20,309	93	69
2006	875	533	162	27,337	30,618	8,732	836	552	n/a	n/a	n/a	13,604	62	72
Mean 2001-2005	860	525	153	31780	32618	9301	827	651	2145	17	40	12720	65	80
% change [3]	1.8	1.6	5.6	-14.0	-6.1	-6.1	1.1	-15.2				7.0	-4.9	-10.4
Mean 1996-2005	855	518	160	31812	26699	7818	729	681	2209	16	49	9667	67	165
% change [3]	2.4	2.9	1.1	-14.1	14.7	11.7	14.6	-18.9				40.7	-7.6	-56.4

[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] (2005/mean - 1) * 100

Table 3.8.4.1. Nominal catch of salmon in NEAC Area (in tonnes round fresh weight), 1960–2006 (2006 figures are provisional).

Year	Southern countries	Northern countries	Faroes (1)	Other catches in international waters	Total Reported Catch	Unreported catches NEAC Area	Unreported catches International waters (2)
1960	2,641	2,899	-	-	5,540	-	-
1961	2,276	2,477	-	-	4,753	-	-
1962	3,894	2,815	-	-	6,709	-	-
1963	3,842	2,434	-	-	6,276	-	-
1964	4,242	2,908	-	-	7,150	-	-
1965	3,693	2,763	-	-	6,456	-	-
1966	3,549	2,503	-	-	6,052	-	-
1967	4,492	3,034	-	-	7,526	-	-
1968	3,623	2,523	5	403	6,554	-	-
1969	4,383	1,898	7	893	7,181	-	-
1970	4,048	1,834	12	922	6,816	-	-
1971	3,736	1,846	-	471	6,053	-	-
1972	4,257	2,340	9	486	7,092	-	-
1973	4,604	2,727	28	533	7,892	-	-
1974	4,352	2,675	20	373	7,420	-	-
1975	4,500	2,616	28	475	7,619	-	-
1976	2,931	2,383	40	289	5,643	-	-
1977	3,025	2,184	40	192	5,441	-	-
1978	3,102	1,864	37	138	5,141	-	-
1979	2,572	2,549	119	193	5,433	-	-
1980	2,640	2,794	536	277	6,247	-	-
1981	2,557	2,352	1,025	313	6,247	-	-
1982	2,533	1,938	606	437	5,514	-	-
1983	3,532	2,341	678	466	7,017	-	-
1984	2,308	2,461	628	101	5,498	-	-
1985	3,002	2,531	566	-	6,099	-	-
1986	3,595	2,588	530	-	6,713	-	-
1987	2,564	2,266	576	-	5,406	2,554	-
1988	3,315	1,969	243	-	5,527	3,087	-
1989	2,433	1,627	364	-	4,424	2,103	-
1990	1,645	1,775	315	-	3,735	1,779	180-350
1991	1,145	1,677	95	-	2,917	1,555	25-100
1992	1,523	1,806	23	-	3,352	1,825	25-100
1993	1,443	1,853	23	-	3,319	1,471	25-100
1994	1,896	1,685	6	-	3,587	1,157	25-100
1995	1,775	1,503	5	-	3,283	942	-
1996	1,392	1,358	-	-	2,750	947	-
1997	1,112	962	-	-	2,074	732	-
1998	1,120	1,099	6	-	2,225	1,108	-
1999	934	1,139	0	-	2,073	887	-
2000	1,210	1,518	8	-	2,736	1,135	-
2001	1,242	1,634	0	-	2,876	1,089	-
2002	1,135	1,360	0	-	2,495	946	-
2003	908	1,394	0	-	2,302	719	-
2004	919	1,058	0	-	1,977	575	-
2005	806	1,189	0	-	1,995	605	-
2006	618	1,228	0	-	1,846	604	-
Means							
2001-2005	1,083	1,393	2	-	2,477	893	-
1996-2005	1,175	1,303	2	-	2,479	908	-

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

Table 3.8.5.1. CPUE for salmon rod catches in Finland (Teno and Naatamo), France and UK (N.Ireland)(Bush).

	Finland (R. Teno)		Finland (R. Naatamo)		France	UK(N.Ire.)(R.Bush)
	Catch per angler season	Catch per angler day	Catch per angler season	Catch per angler day	Catch per angler season	Catch per rod day
Year	kg	kg	kg	kg	Number	Number
1974		2.8				
1975		2.7				
1976		-				
1977		1.4				
1978		1.1				
1979		0.9				
1980		1.1				
1981	3.2	1.2				
1982	3.4	1.1				
1983	3.4	1.2				0.248
1984	2.2	0.8	0.5	0.2		0.083
1985	2.7	0.9	n/a	n/a		0.283
1986	2.1	0.7	n/a	n/a		0.274
1987	2.3	0.8	n/a	n/a	0.39	0.194
1988	1.9	0.7	0.5	0.2	0.73	0.165
1989	2.2	0.8	1.0	0.4	0.55	0.135
1990	2.8	1.1	0.7	0.3	0.71	0.247
1991	3.4	1.2	1.3	0.5	0.60	0.396
1992	4.5	1.5	1.4	0.3	0.94	0.258
1993	3.9	1.3	0.4	0.2	0.88	0.341
1994	2.4	0.8	0.6	0.2	2.31	0.205
1995	2.7	0.9	0.5	0.1	1.15	0.206
1996	3.0	1.0	0.7	0.2	1.57	0.267
1997	3.4	1.0	1.1	0.2	0.44 [1]	0.338
1998	3.0	0.9	1.3	0.3	0.67	0.569
1999	3.7	1.1	0.8	0.2	0.76	0.273
2000	5.0	1.5	0.9	0.2	1.06	0.259
2001	5.9	1.7	1.2	0.3	0.97	0.444
2002	3.1	0.9	0.7	0.2	0.84	0.184
2003	2.6	0.7	0.8	0.2	0.76	0.238
2004	1.4	0.4	0.9	0.2	1.01	0.252
2005	2.7	0.8	1.3	0.2	0.68	0.323
2006	3.4	1.0	1.9	0.4		0.457
Mean 2001-05	3.1	0.9	1.0	0.2	0.9	0.3

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

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

	Barents Sea Basin, catch per angler day				White Sea Basin, catch per angler day			
Year	Rynda	Kharlovka	Varzina	Iokanga	Ponoy	Varzuga	Kitsa	Umba
1991					2.79	1.87		1.33
1992	2.37	1.45	1.07	0.14	3.49	2.26	1.21	1.37
1993	1.18	1.46	0.49	0.65	2.88	1.28	1.43	2.72
1994	0.71	0.85	0.55	0.33	2.33	1.60	1.59	1.44
1995	0.49	0.78	1.22	0.72	3.46	2.52	1.78	1.20
1996	0.70	0.85	1.50	1.40	3.50	1.44	1.76	0.93
1997	1.20	0.71	0.61	1.41	5.33	2.36	2.48	1.46
1998	1.01	0.55	0.44	0.87	4.54	2.28	2.78	0.98
1999	0.95	0.64	0.43	1.19	3.30	1.71	1.66	0.76
2000	1.35	0.77	0.57	2.28	3.49	1.53	3.02	1.25
2001	1.16	1.27	0.89	0.73	4.20	1.86	1.81	1.04
2002	2.39	0.99	0.80	2.82	5.81	1.44	2.11	0.36
2003	1.61	1.14	0.79	2.01	6.32	1.17	1.61	0.36
2004	1.07	0.75	0.65	1.00	3.44	1.14	1.10	0.36
2005	1.18	1.81	0.46	0.88	2.29	0.57	0.89	0.28
2006	1.09	1.31	1.35		4.69	2.23		0.73
Mean 2001-05	1.48	1.19	0.72	1.49	4.41	1.24	1.50	0.48

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

		Region (aggregated data, various methods)					
Year	North East drift nets	North East	Southern	South West	Midlands	Wales	North West
1988		5.49	10.15			-	-
1989		4.39	16.80			0.90	0.82
1990		5.53	8.56			0.78	0.63
1991		3.20	6.40			0.62	0.51
1992		3.83	5.00			0.69	0.40
1993	8.23	6.43	No fishing			0.68	0.63
1994	9.02	7.53	-			1.02	0.71
1995	11.18	7.84	-			1.00	0.79
1996	4.93	3.74	-			0.73	0.59
1997	6.48	4.40	-	0.56	0.48	0.31	0.63
1998	5.92	3.81	-	0.99	0.42	0.51	0.46
1999	8.06	4.88	-	0.63	0.72	0.44	0.52
2000	13.06	8.11	-	1.05	0.66	0.33	1.05
2001	10.34	6.83	-	0.61	0.79	0.45	0.71
2002	8.55	5.59	-	0.82	1.39	0.57	0.90
2003	7.13	4.82	-	1.06	1.13	0.41	0.62
2004	8.17	5.88		0.95	0.46	0.45	0.69
2005	7.23	4.13		0.49	0.97	0.41	1.28
2006	5.60	3.20		0.44	0.97	0.35	0.82
Mean 2001-05	8.28	5.45		0.79	0.95	0.46	0.84

Table 3.8.5.4. CPUE data for Scottish net fisheries. Catch in numbers of fish per unit effort.

Year	Fixed engine	Net and coble CPUE
	Catch/trap month [1]	Catch/crew month
1952	33.9	156.4
1953	33.1	121.7
1954	29.3	162.0
1955	37.1	201.8
1956	25.7	117.5
1957	32.6	178.7
1958	48.4	170.4
1959	33.3	159.3
1960	30.7	177.8
1961	31.0	155.2
1962	43.9	242.0
1963	44.2	182.9
1964	57.9	247.1
1965	43.7	188.6
1966	44.9	210.6
1967	72.6	329.8
1968	47.0	198.5
1969	65.5	327.6
1970	50.3	241.9
1971	57.2	231.6
1972	57.5	248.0
1973	73.7	240.6
1974	63.4	257.1
1975	53.6	235.7
1976	42.9	150.8
1977	45.6	188.7
1978	53.9	196.1
1979	42.2	157.2
1980	37.6	158.6
1981	49.6	183.9
1982	61.3	180.2
1983	55.8	203.6
1984	58.9	155.3
1985	49.6	148.9
1986	75.2	193.4
1987	61.8	145.6
1988	50.6	198.4
1989	71.0	262.4
1990	33.2	146.0
1991	35.9	106.4
1992	59.6	153.7
1993	52.8	125.2
1994	92.1	123.7
1995	75.6	142.3
1996	57.5	110.9
1997	33.0	57.8
1998	36.0	68.7
1999	21.9	58.8
2000	53.7	105.2
2001	60.3	76.1
2002	43.8	67.3
2003	67.3	66.5
2004	51.1	66.5
2005	55.1	80.9
2006	50.5	71.0
Mean 2001-05	55.5	71.5

[1] Excludes catch and effort for Solway Region

Table 3.8.5.5. CPUE for the marine fishery in Norway. The CPUE is expressed as numbers of salmon caught per net day in bagnets and bendnets partitioned by salmon weight.

	Bagnet			Bendnet		
Year	< 3kg	3-7 kg	>7 kg	< 3kg	3-7 kg	>7 kg
1998	0.88	0.66	0.12	0.80	0.56	0.13
1999	1.16	0.72	0.16	0.75	0.67	0.17
2000	2.01	0.90	0.17	1.24	0.87	0.17
2001	1.52	1.03	0.22	1.03	1.39	0.36
2002	0.91	1.03	0.26	0.74	0.87	0.32
2003	1.57	0.9	0.26	0.84	0.69	0.28
2004	0.89	0.97	0.25	0.59	0.60	0.17
2005	1.17	0.81	0.27	0.72	0.73	0.33
2006	1.02	1.33	0.27	0.72	0.86	0.29
Mean 2001-05	1.21	0.95	0.25	0.78	0.86	0.29

Table 3.8.6.1. Percentage of 1SW salmon in catches from countries in the North East Atlantic, 1987-2006.

Year	Iceland	Finland	Norway	Russia	Sweden	**Northern countries**	UK (Scot)	UK (E&W)	France	Spain (1)	**Southern countries**
1987		66	61	71		**63**	61	68	77		**63**
1988		63	64	53		**62**	57	69	29		**60**
1989	69	66	73	73	41	**72**	63	65	33		**63**
1990	66	64	68	73	70	**69**	48	52	45		**49**
1991	72	59	65	70	71	**66**	53	71	39		**58**
1992	72	70	62	72	68	**65**	55	77	48		**59**
1993	76	58	61	61	62	**63**	57	81	74	64	**64**
1994	64	55	68	69	64	**67**	54	77	55	69	**61**
1995	72	59	58	70	78	**62**	53	72	60	26	**59**
1996	74	79	53	80	63	**61**	53	65	51	34	**56**
1997	73	69	64	82	54	**68**	54	73	51	28	**60**
1998	82	75	66	82	59	**70**	58	83	71	54	**65**
1999	71	83	65	78	71	**68**	45	68	27	14	**54**
2000	84	71	67	75	69	**69**	54	79	58	74	**65**
2001	81	48	58	74	55	**60**	55	76	51	40	**63**
2002	84	34	49	70	63	**54**	54	76	69	38	**64**
2003	76	51	61	67	47	**62**	52	67	51	16	**55**
2004	85	47	52	68	52	**58**	50	81	40	67	**59**
2005	88	72	67	66	55	**70**	58	75	40	15	**60**
2006	81	71	54	77	56	**60**	55	77	38	15	**59**
Means											
2001-2005	83	51	57	69	54	**61**	54	75	50	35	**60**
1996-2005	80	63	60	74	59	**64**	53	74	51	38	**60**

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

Table 3.8.8.1. Recapture rate per 1000 fish released for coded wire tagged salmon taken in Irish fisheries.

	Countries of Origin								
Fishing year	**Ireland**	**N. Ireland**	**England/ Wales**	**Scotland**	**France**	**Spain**	**Norway**	**Denmark**	**Germany**
1985	**180**		0.5	21.5					
1986	**433**		1.2	59.4					
1987	**157**	22	0.8	16.0					
1988	**190**	31	3.1	19.2					
1989	**144**	23	1.6	2.5					
1990	**83**	16	0.9	12.4	2.0				
1991	**71**	23	0.4	4.2					
1992	**50**	23	1.8	0.2	0.4				
1993	**100**	21	0.6	0.1	0.1	0.5	0.08		
1994	**70**	17	1.0	0.3			0.04		
1995	**90**	15	1.8	0.5	11.4	0.1			
1996	**58**	7	1.6	1.5		0.1			
1997	**68**	11	0.5			0.1			
1998	**92**	11	0.4	0.5		1.6		2.0	
1999	**46**	4	2.6		0.2	0.5		3.8	0.4
2000	**80**	17	3.8	0.2		0.8			0.3
2001	**83**	24	1.8			0.4			
2002	**69**	8	1.8	0.5					0.5
2003	**80**	17	1.1	0.0		3.2			
2004	**83**	24	0.3	0.8		0.6			
2005	**69**	8	0.3	0.0		0.3			0.5
2006	**37**	7	0.4	0.0		3.2			0.8
AVERAGE	**106.1**	**17.0**	**1.3**	**9.3**	**2.8**	**0.5**	**0.1**	**2.9**	**0.5**

Table 3.8.8.2. Average exploitation rates in Ireland for selected English and Welsh salmon stocks, based on aggregated data for the periods before and after the introduction of management measures in the Irish fishery in 1997.

River	Pre 1997			Post 1997		
	Years	Expl. Rate (%)	95% CL	Years	Expl. Rate (%)	95% CL
Tyne - NE England	1986-96	1.3	± 0.4	1997	0.5	± 0.7
Wear - NE England	1986-96	0.9	± 0.2	1997	0	
Dee - N. Wales	1992-96	16.8	± 5.7	1997-2005	2.1	± 0.95
Taff - S. Wales	1991-96	13.4	± 4.6	1997-2005	8.2	± 3.5
Tamar - SW England		No data		2003-2005	1.6	± 1.3
Test - S. England	1991-96	28.4	± 5.9	1997-2000	12.0	± 4.2

Note: Pre 1997 data for the River Taff have been updated.

Table 3.8.10.1. Summary of the results of a sensitivity analysis of the NEAC run-reconstruction model. The relative contribution of model parameters to the variance in the predictions of the number of recruits (maturing and non-maturing 1SW) and spawners (1SW and MSW) for both Northern and Southern NEAC stock complexes were estimated using the data presented to the ICES Working Group in 2007 (2006 catches). Parameters which have accounted for at least 5% of the variance of a given forecast variable in one or more years are indicated by X.

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	8,422	8,538	30	40	30	40	40	60	40	70
1972	13,160	13,341	30	40	30	40	40	60	40	70
1973	11,969	15,958	30	40	30	40	40	60	40	70
1974	23,709	23,709	30	40	30	40	40	60	40	70
1975	16,527	26,417	30	40	30	40	40	60	40	70
1976	11,323	21,719	30	40	30	40	40	60	40	70
1977	5,807	13,227	30	40	30	40	40	60	40	70
1978	7,902	8,452	30	40	30	40	40	60	40	70
1979	9,249	7,390	30	40	30	40	40	60	30	60
1980	4,792	8,938	20	30	20	30	40	60	30	60
1981	7,386	9,835	20	30	20	30	40	60	30	60
1982	2,163	12,826	20	30	20	30	40	60	30	60
1983	10,680	13,990	20	30	20	30	40	60	30	60
1984	11,942	13,262	20	30	20	30	40	60	30	60
1985	18,039	10,339	20	30	20	30	40	60	30	60
1986	16,389	9,028	20	30	20	30	40	60	30	60
1987	20,950	11,290	20	30	20	30	40	60	30	60
1988	10,019	7,231	20	30	20	30	40	60	30	60
1989	28,091	10,011	20	30	20	30	50	70	40	70
1990	26,646	12,562	20	30	20	30	50	70	40	70
1991	32,423	15,136	20	30	20	30	50	70	40	70
1992	42,965	16,158	20	30	20	30	50	70	40	70
1993	30,197	18,720	20	30	20	30	50	70	40	70
1994	12,016	15,521	20	30	20	30	50	70	40	70
1995	11,801	9,634	20	30	20	30	50	70	40	70
1996	22,799	6,956	20	30	20	30	40	60	30	60
1997	19,481	10,083	20	30	20	30	40	60	30	60
1998	22,460	8,497	20	30	20	30	40	60	30	60
1999	38,687	8,854	20	30	20	30	50	70	40	60
2000	40,654	19,707	20	30	20	30	50	70	40	60
2001	18,372	28,337	20	30	20	30	50	70	40	60
2002	10,757	22,717	20	30	20	30	40	60	40	60
2003	12,699	16,093	20	30	20	30	40	60	40	60
2004	4,912	7,718	20	30	20	30	40	60	40	60
2005	12,499	5,969	20	30	20	30	40	60	40	60
2006	23,727	10,473	20	30	20	30	40	60	40	60
2007			20	30	20	30	40	60	40	60
2008			20	30	20	30	40	60	40	60
2009			20	30	20	30	40	60	40	60
2010			20	30	20	30	40	60	40	60

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
	Non-reporting included in exploitation rates until 2002									
1971	1,740	4,060	0	0	0	0	2	5	25	50
1972	3,480	8,120	0	0	0	0	2	5	25	50
1973	2,130	4,970	0	0	0	0	2	5	25	50
1974	990	2,310	0	0	0	0	2	5	25	50
1975	1,980	4,620	0	0	0	0	2	5	25	50
1976	1,820	3,380	0	0	0	0	2	5	25	50
1977	1,400	2,600	0	0	0	0	2	5	25	50
1978	1,435	2,665	0	0	0	0	2	5	25	50
1979	1,645	3,055	0	0	0	0	2	5	25	50
1980	3,430	6,370	0	0	0	0	2	5	25	50
1981	2,720	4,080	0	0	0	0	2	5	20	50
1982	1,680	2,520	0	0	0	0	2	5	20	50
1983	1,800	2,700	0	0	0	0	2	5	20	50
1984	2,960	4,440	0	0	0	0	2	5	20	50
1985	1,100	3,330	0	0	0	0	2	5	20	50
1986	3,400	3,400	0	0	0	0	2	12	20	50
1987	6,000	1,800	0	0	0	0	2	12	20	50
1988	2,100	5,000	0	0	0	0	2	12	20	50
1989	1,100	2,300	0	0	0	0	2	12	20	50
1990	1,900	2,300	0	0	0	0	2	12	20	50
1991	1,400	2,100	0	0	0	0	2	12	20	50
1992	2,500	2,700	0	0	0	0	2	12	20	50
1993	3,600	1,300	0	0	0	0	2	12	20	50
1994	2,800	2,300	0	0	0	0	2	12	20	40
1995	1,669	1,095	0	0	0	0	5	20	20	40
1996	2,063	1,942	0	0	0	0	5	20	20	40
1997	1,060	1,001	0	0	0	0	5	20	20	40
1998	2,065	846	0	0	0	0	5	20	20	40
1999	690	1,831	0	0	0	0	5	20	20	40
2000	1,792	1,277	0	0	0	0	5	20	20	40
2001	1,544	1,489	0	0	0	0	5	20	20	40
2002	2,423	1,065	20	40	15	30	10	30	20	55
2003	1,598	1,540	20	40	15	30	10	30	20	55
2004	1,927	2,880	20	40	15	30	10	30	20	55
2005	1,236	1,878	20	40	15	30	10	30	20	55
2006	1,359	2,187	20	40	15	30	10	30	20	55
2007			20	40	15	30	10	30	20	55
2008			20	40	15	30	10	30	20	55
2009			20	40	15	30	10	30	20	55
2010			20	40	15	30	10	30	20	55

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	30,618	16,749	1	3	1	3	40	60	60	80
1972	24,832	25,733	1	3	1	3	40	60	60	80
1973	26,624	23,183	1	3	1	3	40	60	60	80
1974	18,975	20,017	1	3	1	3	40	60	60	80
1975	29,428	21,266	1	3	1	3	40	60	60	80
1976	23,233	18,379	1	3	1	3	40	60	60	80
1977	23,802	17,919	1	3	1	3	40	60	60	80
1978	31,199	23,182	1	3	1	3	40	60	60	80
1979	28,790	14,840	1	3	1	3	40	60	60	80
1980	13,073	20,855	1	3	1	3	40	60	60	80
1981	16,890	13,919	1	3	1	3	40	60	60	80
1982	17,331	9,826	1	3	1	3	40	60	60	80
1983	21,923	16,423	1	3	1	3	40	60	60	80
1984	13,476	13,923	1	3	1	3	40	60	60	80
1985	21,822	10,097	1	3	1	3	40	60	60	80
1986	35,891	8,423	1	3	1	3	40	60	60	80
1987	22,302	7,480	1	3	1	3	40	60	60	80
1988	40,028	8,523	1	3	1	3	40	60	60	80
1989	22,377	7,607	1	3	1	3	40	60	60	80
1990	20,584	7,548	1	3	1	3	40	60	60	80
1991	22,711	7,519	1	3	1	3	40	60	60	80
1992	26,006	8,479	1	3	1	3	40	60	60	80
1993	25,479	4,155	1	3	1	3	40	60	60	80
1994	20,985	6,736	1	3	1	3	40	60	60	80
1995	25,371	6,777	10	15	10	15	40	60	60	80
1996	21,913	4,364	10	15	10	15	40	60	60	80
1997	16,007	4,910	10	15	10	15	40	60	60	80
1998	21,900	3,037	10	15	10	15	40	60	60	80
1999	17,448	5,757	10	15	10	15	36.99868	56.99868	57.60876	77.60876
2000	15,502	1,519	10	15	10	15	37.00475	57.00475	54.68394	74.68394
2001	13,586	2,707	10	15	10	15	36.30257	56.30257	56.24184	76.24184
2002	16,952	2,845	10	15	10	15	35.28669	55.28669	51.79848	71.79848
2003	20,271	4,751	10	15	10	15	36	56	57	77
2004	20,319	3,784	10	15	10	15	37	57	55	75
2005	29,969	3,241	10	15	10	15	37	57	53	73
2006	22,258	2,980	10	15	10	15	37	57	54	74
2007			10	15	10	15	40	60	50	70
2008			10	15	10	15	40	60	50	70
2009			10	15	10	15	40	60	50	70
2010			10	15	10	15	40	60	50	70

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	4,610	6,625	1	3	1	3	40	60	60	80
1972	4,223	10,337	1	3	1	3	40	60	60	80
1973	5,060	9,672	1	3	1	3	40	60	60	80
1974	5,047	9,176	1	3	1	3	40	60	60	80
1975	6,152	10,136	1	3	1	3	40	60	60	80
1976	6,184	8,350	1	3	1	3	40	60	60	80
1977	8,597	11,631	1	3	1	3	40	60	60	80
1978	8,739	14,998	1	3	1	3	40	60	60	80
1979	8,363	9,897	1	3	1	3	40	60	60	80
1980	1,268	13,784	1	3	1	3	40	60	60	80
1981	6,528	4,827	1	3	1	3	40	60	60	80
1982	3,007	5,539	1	3	1	3	40	60	60	80
1983	4,437	4,224	1	3	1	3	40	60	60	80
1984	1,611	5,447	1	3	1	3	40	60	60	80
1985	11,116	3,511	1	3	1	3	40	60	60	80
1986	13,827	9,569	1	3	1	3	40	60	60	80
1987	8,145	9,908	1	3	1	3	40	60	60	80
1988	11,775	6,381	1	3	1	3	40	60	60	80
1989	6,342	5,414	1	3	1	3	40	60	60	80
1990	4,752	5,709	1	3	1	3	40	60	60	80
1991	6,900	3,965	1	3	1	3	40	60	60	80
1992	12,996	5,903	1	3	1	3	40	60	60	80
1993	10,689	6,672	1	3	1	3	40	60	60	80
1994	3,414	5,656	1	3	1	3	40	60	60	80
1995	8,776	3,511	10	15	10	15	40	60	60	80
1996	4,681	4,605	10	15	10	15	40	60	60	80
1997	6,406	2,594	10	15	10	15	40	60	60	80
1998	10,905	3,780	10	15	10	15	40	60	60	80
1999	5,326	4,030	10	15	10	15	36	56	53	73
2000	5,595	2,324	10	15	10	15	35	55	51	71
2001	4,976	2,587	10	15	10	15	33	53	47	67
2002	8,437	2,366	10	15	10	15	31	51	43	63
2003	4,478	2,194	10	15	10	15	32	52	29	49
2004	11,823	2,239	10	15	10	15	30	50	33	53
2005	10,297	2,726	10	15	10	15	27	47	31	51
2006	7,227	3,300	10	15	10	15	27	47	21	41
2007			10	15	10	15	40	60	50	70
2008			10	15	10	15	40	60	50	70
2009			10	15	10	15	40	60	50	70
2010			10	15	10	15	40	60	50	70

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	409,965	46,594	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1972	437,089	49,863	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1973	476,131	54,008	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1974	542,124	60,976	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1975	598,524	68,260	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1976	407,018	47,358	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1977	351,745	41,256	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1978	307,569	35,708	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1979	282,700	32,144	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1980	215,116	35,447	30.00	45.00	30.00	45.00	50.00	75.00	35.00	60.00
1981	137,366	26,101	30.00	45.00	30.00	45.00	64.38	87.10	35.00	60.00
1982	269,847	11,754	30.00	45.00	30.00	45.00	61.08	82.64	28.34	44.99
1983	437,751	26,479	30.00	45.00	30.00	45.00	56.14	75.96	10.34	45.41
1984	224,872	20,685	30.00	45.00	30.00	45.00	54.91	74.28	37.02	50.00
1985	430,315	18,830	30.00	45.00	30.00	45.00	63.39	85.76	32.75	39.45
1986	443,701	27,111	30.00	45.00	30.00	45.00	58.40	79.01	36.95	55.00
1987	324,709	26,301	20.00	40.00	20.00	40.00	59.34	80.28	27.50	36.86
1988	391,475	22,067	20.00	40.00	20.00	40.00	52.73	71.34	31.85	43.00
1989	297,797	25,447	20.00	40.00	20.00	40.00	55.85	75.56	38.35	56.00
1990	172,098	15,549	20.00	40.00	20.00	40.00	51.62	69.84	53.85	66.00
1991	120,408	10,334	20.00	40.00	20.00	40.00	50.55	68.39	23.00	30.00
1992	182,255	15,456	20.00	40.00	20.00	40.00	52.75	71.36	47.66	55.26
1993	150,274	13,156	15.00	35.00	15.00	35.00	49.85	67.44	24.00	60.00
1994	234,126	20,506	15.00	35.00	15.00	35.00	60.70	82.12	38.06	43.00
1995	232,480	20,454	15.00	35.00	15.00	35.00	53.94	72.98	40.65	43.00
1996	203,920	18,021	15.00	35.00	15.00	35.00	50.90	68.87	51.93	58.28
1997	170,774	14,724	15.00	35.00	10.00	20.00	42.59	57.62	18.51	43.00
1998	191,868	17,269	15.00	35.00	10.00	20.00	45.66	61.78	60.47	63.25
1999	158,818	14,801	15.00	35.00	10.00	20.00	40.60	54.92	16.00	52.29
2000	199,827	16,848	15.00	35.00	10.00	20.00	36.75	49.72	26.51	35.48
2001	218,715	18,436	5	10	5	10	40.80	55.20	27	43.00
2002	198,719	16,702	5	10	5	10	42.41	57.37	20	35.00
2003	161,270	13,745	5	10	5	10	35.13	47.52	16	27.00
2004	142251	12299	5	10	5	10	42	57	27	43
2005	127371	10716	5	10	5	10	38	51	20	27
2006	101938	9740	5	10	5	10	40	53	16	43
2007			5	10	5	10	42	57	16	43
2008			5	10	5	10	42	57	16	43
2009			5	10	5	10	42	57	16	43
2010			5	10	5	10	42	57	16	43

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	40,511	37,105	40	60	40	60	65	85	65	85
1984	34,248	38,614	40	60	40	60	65	85	65	85
1985	47,877	36,968	40	60	40	60	65	85	65	85
1986	51,839	41,890	40	60	40	60	65	85	65	85
1987	48,690	39,641	40	60	40	60	65	85	65	85
1988	53,775	37,145	40	60	40	60	65	85	65	85
1989	43,128	25,279	40	60	40	60	55	75	55	75
1990	44,259	25,907	40	60	40	60	55	75	55	75
1991	30,771	19,054	40	60	40	60	55	75	55	75
1992	32,488	24,124	40	60	40	60	55	75	55	75
1993	34,503	22,835	30	50	30	50	55	75	55	75
1994	42,551	20,903	30	50	30	50	55	75	55	75
1995	32,685	24,725	30	50	30	50	55	75	55	75
1996	27,739	26,029	30	50	30	50	55	75	55	75
1997	31,381	14,922	25	45	25	45	50	70	50	70
1998	38,299	16,966	25	45	25	45	50	70	50	70
1999	31,256	9,881	25	45	25	45	50	70	50	70
2000	54,671	22,208	25	45	25	45	50	70	50	70
2001	59,425	29,896	25	45	25	45	50	70	50	70
2002	39,068	21,513	25	45	25	45	50	70	50	70
2003	41,642	28,168	20	40	20	40	50	70	50	70
2004	35,616	22,226	20	40	20	40	50	70	50	70
2005	51,159	22,350	20	40	20	40	50	70	50	70
2006	36,331	31,235	20	40	20	40	50	70	50	70
2007			20	40	20	40	50	70	50	70
2008			20	40	20	40	50	70	50	70
2009			20	40	20	40	50	70	50	70
2010			20	40	20	40	50	70	50	70

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	121,221	74,648	40	60	40	60	65	85	65	85
1984	94,373	67,639	40	60	40	60	65	85	65	85
1985	114,613	56,641	40	60	40	60	65	85	65	85
1986	106,921	77,225	40	60	40	60	65	85	65	85
1987	83,669	62,216	40	60	40	60	65	85	65	85
1988	80,111	45,609	40	60	40	60	65	85	65	85
1989	94,897	30,862	40	60	40	60	55	75	55	75
1990	78,888	40,174	40	60	40	60	55	75	55	75
1991	67,370	30,087	40	60	40	60	55	75	55	75
1992	51,463	33,092	40	60	40	60	55	75	55	75
1993	58,326	28,184	30	50	30	50	55	75	55	75
1994	113,427	33,520	30	50	30	50	55	75	55	75
1995	57,813	42,696	30	50	30	50	55	75	55	75
1996	28,925	31,613	30	50	30	50	55	75	55	75
1997	43,127	20,565	25	45	25	45	50	70	50	70
1998	63,497	26,817	25	45	25	45	50	70	50	70
1999	60,689	28,792	25	45	25	45	50	70	50	70
2000	109,278	42,452	25	45	25	45	50	70	50	70
2001	88,096	52,031	25	45	25	45	50	70	50	70
2002	42,669	52,774	25	45	25	45	50	70	50	70
2003	91,118	46,963	20	40	20	40	50	70	50	70
2004	38,286	49,760	20	40	20	40	50	70	50	70
2005	63,749	37,941	20	40	20	40	50	70	50	70
2006	46,495	47,691	20	40	20	40	50	70	50	70
2007			20	40	20	40	50	70	50	70
2008			20	40	20	40	50	70	50	70
2009			20	40	20	40	50	70	50	70
2010			20	40	20	40	50	70	50	70

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	104,040	49,413	40	60	40	60	70	90	70	90
1984	150,372	58,858	40	60	40	60	70	90	70	90
1985	118,841	58,956	40	60	40	60	70	90	70	90
1986	84,150	63,418	40	60	40	60	70	90	70	90
1987	72,370	34,232	40	60	40	60	70	90	70	90
1988	53,880	32,140	40	60	40	60	70	90	70	90
1989	42,010	13,934	40	60	40	60	60	80	60	80
1990	38,216	17,321	40	60	40	60	60	80	60	80
1991	42,888	21,789	40	60	40	60	60	80	60	80
1992	34,593	19,265	40	60	40	60	60	80	60	80
1993	51,440	39,014	30	50	30	50	60	80	60	80
1994	37,489	33,411	30	50	30	50	60	80	60	80
1995	36,283	26,037	30	50	30	50	60	80	60	80
1996	40,792	36,636	30	50	30	50	60	80	60	80
1997	39,930	30,115	25	45	25	45	60	80	60	80
1998	46,645	34,806	25	45	25	45	60	80	60	80
1999	46,394	46,744	25	45	25	45	60	80	60	80
2000	61,854	51,569	25	45	25	45	60	80	60	80
2001	46,331	54,023	25	45	25	45	60	80	60	80
2002	38,101	43,100	25	45	25	45	60	80	60	80
2003	44,947	35,972	20	40	20	40	60	80	60	80
2004	34,640	28,077	20	40	20	40	60	80	60	80
2005	45,530	33,334	20	40	20	40	60	80	60	80
2006	48,688	39,508	20	40	20	40	60	80	60	80
2007			20	40	20	40	60	80	60	80
2008			20	40	20	40	60	80	60	80
2009			20	40	20	40	60	80	60	80
2010			20	40	20	40	60	80	60	80

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	134	16,592	5	15	5	15	40	80	40	80
1972	116	14,434	5	15	5	15	40	80	40	80
1973	169	20,924	5	15	5	15	40	80	40	80
1974	170	21,137	5	15	5	15	40	80	40	80
1975	140	17,398	5	15	5	15	40	80	40	80
1976	111	13,781	5	15	5	15	40	80	40	80
1977	78	9,722	5	15	5	15	40	80	40	80
1978	82	10,134	5	15	5	15	40	80	40	80
1979	112	13,903	5	15	5	15	40	80	40	80
1980	156	19,397	5	15	5	15	40	80	40	80
1981	68	8,394	5	15	5	15	40	80	40	80
1982	71	8,797	5	15	5	15	40	80	40	80
1983	48	11,938	5	15	5	15	40	80	40	80
1984	21	10,680	5	15	5	15	40	80	40	80
1985	454	11,183	5	15	5	15	40	80	40	80
1986	12	12,291	5	15	5	15	40	80	40	80
1987	647	8,734	5	15	5	15	40	80	40	80
1988	224	9,978	5	15	5	15	40	80	40	80
1989	989	10,245	5	15	5	15	40	80	40	80
1990	1,418	8,429	10	20	10	20	40	80	40	80
1991	421	8,725	15	25	15	25	40	80	40	80
1992	1,031	3,949	20	30	20	30	40	80	40	80
1993	196	4,251	25	35	25	35	40	80	40	80
1994	334	5,631	30	40	30	40	40	80	40	80
1995	386	5,214	40	50	40	50	40	80	40	80
1996	231	3,753	50	60	50	60	40	80	40	80
1997	721	3,351	50	60	50	60	40	80	40	80
1998	585	4,208	50	60	50	60	40	80	40	80
1999	299	3,101	50	60	50	60	40	80	40	80
2000	514	3,382	50	60	50	60	40	80	40	80
2001	363	2,348	50	60	50	60	40	80	40	80
2002	1,676	2,439	50	60	50	60	40	80	40	80
2003	893	2,041	50	60	50	60	40	80	40	80
2004	990	3,761	50	60	50	60	40	80	40	80
2005	1,252	3,809	50	60	50	60	40	80	40	80
2006	2,133	1,795	50	60	50	60	40	80	40	80
2007			50	60	50	60	40	80	40	80
2008			50	60	50	60	40	80	40	80
2009			50	60	50	60	40	80	40	80
2010			50	60	50	60	40	80	40	80

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	4892	5979	10	20	10	20	40	50	40	50
1972	7978	9750	10	20	10	20	40	50	40	50
1973	9376	11460	10	20	10	20	35	45	35	45
1974	12794	15638	10	20	10	20	35	45	35	45
1975	13872	13872	10	20	10	20	40	50	40	50
1976	11493	14048	10	20	10	20	50	60	50	60
1977	7257	8253	10	20	10	20	45	55	45	55
1978	7106	7113	10	20	10	20	50	60	50	60
1979	6707	3141	10	20	10	20	35	45	35	45
1980	6621	5216	10	20	10	20	35	45	35	45
1981	4547	5973	10	20	10	20	35	45	35	45
1982	5159	4798	10	20	10	20	30	40	30	40
1983	8,504	9,943	10	20	10	20	30	40	30	40
1984	9,453	12,601	10	20	10	20	30	40	30	40
1985	6,774	7,877	10	20	10	20	30	40	30	40
1986	10,147	5,352	10	20	10	20	35	45	35	45
1987	8,560	5,149	10	20	10	20	35	45	35	45
1988	6,644	3,655	10	20	10	20	30	40	30	40
1989	13,424	6,787	10	20	10	20	35	45	35	45
1990	16,038	8,234	10	20	10	20	35	45	35	45
1991	4,550	7,568	10	20	10	20	25	35	25	35
1992	11,394	7,109	10	20	10	20	25	35	25	35
1993	8,642	5,690	10	20	10	20	25	35	25	35
1994	6,101	4,632	10	20	10	20	25	35	25	35
1995	6,318	3,693	10	20	10	20	25	35	25	35
1996	6,815	1,701	15	25	15	25	20	30	20	30
1997	3,564	867	20	30	20	30	10	20	10	20
1998	1,854	280	30	40	30	40	10	15	10	15
1999	1,510	424	35	45	35	45	5	10	5	10
2000	805	323	45	55	45	55	4	8	4	8
2001	591	241	55	65	55	65	2	5	2	5
2002	1,436	2,478	40	60	40	60	5	15	15	25
2003	1,938	1,095	40	60	40	60	5	15	15	25
2004	1,095	850	40	60	40	60	5	15	15	25
2005	859	426	50	70	50	70	5	15	15	25
2006	1,372	844	50	70	50	70	5	15	15	25
2007			40	60	40	60	5	15	15	25
2008			40	60	40	60	5	15	15	25
2009			40	60	40	60	5	15	15	25
2010			40	60	40	60	5	15	15	25

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

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

Year	Catch (numbers) Current year returns		Unrep. as % of 1SW		Unrep. as % of MSW		Exp. rate 1SW (%)		Exp. Rate MSW (%)		Catch (numbers) Previous year returns	
	1SW	MSW	min	max	min	max	min	max	min	max	1SW	MSW
1971	67,845	29,077	1	5	1	5	40	60	50	70		
1972	45,837	19,644	1	5	1	5	40	60	50	70		
1973	68,684	29,436	1	5	1	5	40	60	50	70		
1974	63,892	27,382	1	5	1	5	40	60	50	70		
1975	109,038	46,730	1	5	1	5	40	60	50	70		
1976	76,281	41,075	1	5	1	5	40	60	50	70		
1977	47,943	32,392	1	5	1	5	40	60	50	70		
1978	49,291	17,307	1	5	1	5	40	60	50	70		
1979	69,511	21,369	1	5	1	5	40	60	50	70		
1980	46,037	23,241	1	5	1	5	40	60	50	70		
1981	40,172	12,747	1	5	1	5	40	60	50	70		
1982	32,619	14,840	1	5	1	5	40	60	50	70		
1983	54,217	20,840	1	5	1	5	40	60	50	70		
1984	56,786	16,893	1	5	1	5	40	60	50	70		
1985	87,274	16,876	1	5	1	5	40	60	50	70		
1986	72,102	17,681	1	5	1	5	40	60	50	70		
1987	79,639	12,501	1	5	1	5	40	60	40	60		
1988	44,813	18,777	1	5	1	5	40	50	40	50		
1989	53,293	11,448	5	10	5	10	40	50	40	50		
1990	44,409	11,152	10	15	10	15	40	50	40	50		
1991	31,978	6,263	15	20	15	20	30	40	30	40		
1992	23,827	3,680	20	25	20	25	20	30	20	30		
1993	20,987	5,552	20	30	20	30	20	30	20	30		
1994	25,178	3,680	25	35	25	35	20	30	10	20		
1995	19,381	2,847	30	40	30	40	20	30	10	20		
1996	27,097	2,710	30	40	30	40	20	30	10	20		
1997	27,695	2,085	30	40	30	40	20	30	10	20		
1998	32,693	1,963	30	40	30	40	20	30	10	20		
1999	22,330	2,841	30	40	30	40	20	30	10	20		
2000	26,376	4,396	30	40	30	40	20	30	10	20		
2001	20,483	3,959	30	40	30	40	10	20	10	20	1215	663
2002	19,174	3,937	30	40	30	40	10	20	10	20	2176	784
2003	15,687	3,734	30	40	30	40	10	20	10	20	3717	1182
2004	10,947	1,990	30	40	30	40	10	20	10	20	3989	1301
2005	13,172	2,388	30	40	30	40	10	20	10	20	1212	878
2006	15,004	2,071	30	40	30	40	10	20	10	20	3,852	399
2007			30	40	30	40	10	20	10	20		
2008			30	40	30	40	10	20	10	20		
2009			30	40	30	40	10	20	10	20		
2010			30	40	30	40	10	20	10	20		

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

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

Year	Catch (numbers)		Unrep. as % of total		Unrep. as % of total		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	605	17,728	10	30	10	30	50	80	50	80
1972	825	24,175	10	30	10	30	50	80	50	80
1973	1,705	49,962	10	30	10	30	50	80	50	80
1974	1,320	38,680	10	30	10	30	50	80	50	80
1975	1,298	38,046	10	30	10	30	50	80	50	80
1976	991	34,394	10	30	10	30	50	80	50	80
1977	589	20,464	10	30	10	30	50	80	50	80
1978	759	26,341	10	30	10	30	50	80	50	80
1979	421	14,614	10	30	10	30	50	80	50	80
1980	1,123	39,001	10	30	10	30	50	80	50	80
1981	126	20,874	10	30	10	30	50	80	50	80
1982	54	13,546	10	30	10	30	50	80	50	80
1983	598	16,002	10	30	10	30	50	80	50	80
1984	1,833	15,967	10	30	10	30	50	80	50	80
1985	2,763	29,738	10	30	10	30	50	80	50	80
1986	66	32,734	10	30	10	30	50	80	50	80
1987	21	21,179	10	30	10	30	50	80	50	80
1988	3,184	12,816	10	30	10	30	50	80	50	80
			Input data for analisis of total adult returns to Home Waters				**Input data for spawner abundance analysis**			
	Estimated numbers of adult returns to fresh water		**Marine Unrep. as % of adult returns to FW 1SW**		**Marine Unrep. as % of adult returns to FW MSW**		**Freshwater Unrep. as % of adult returns to FW 1SW**		**Freshwater Unrep. as % of adult returns to FW MSW**	
	1SW	**MSW**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
1989	24,596	27,404	5	15	5	15	50	80	50	80
1990	50	49,950	5	15	5	15	50	80	50	80
1991	7,975	47,025	5	15	5	15	50	80	50	80
1992	550	54,450	5	15	5	15	50	80	50	80
1993	68	67,932	5	15	5	15	50	80	50	80
1994	3,900	48,100	5	15	5	15	50	80	50	80
1995	9,280	70,720	5	15	5	15	50	80	50	80
1996	8,664	48,336	5	15	5	15	50	80	50	80
1997	1,440	38,560	5	15	5	15	50	80	50	80
1998	780	59,220	5	15	5	15	50	80	50	80
1999	2,120	37,880	5	15	5	15	50	80	50	80
2000	84	83,916	5	15	5	15	50	80	50	80
2001	2,244	41,756	5	15	5	15	50	80	50	80
2002	405	44,595	5	15	5	15	50	80	50	80
2003	1,650	31,350	5	15	5	15	50	80	50	80
2004	6,075	20,925	5	15	5	15	50	80	50	80
2005	2,852	28,148	5	15	5	15	50	80	50	80
2006	1,472	30,528	5	15	5	15	50	80	50	80
2007			5	15	5	15	50	80	50	80
2008			5	15	5	15	50	80	50	80
2009			5	15	5	15	50	80	50	80
2010			5	15	5	15	50	80	50	80

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

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

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

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	28,915	23,611	29	48	29	48	36	56	30	50
1972	24,613	34,364	29	49	29	49	35	55	29	49
1973	28,989	26,097	29	48	29	48	35	55	29	49
1974	35,431	18,776	29	49	29	49	34	54	29	49
1975	36,465	25,819	29	48	29	48	35	55	29	49
1976	25,422	14,113	28	46	28	46	35	55	30	50
1977	27,836	17,260	29	49	29	49	36	56	31	51
1978	31,397	14,228	29	48	29	48	36	56	30	50
1979	29,030	6,803	29	48	29	48	35	55	30	50
1980	26,997	22,019	29	49	29	49	36	56	30	50
1981	28,414	31,115	29	48	29	48	36	56	30	50
1982	24,139	12,003	29	48	29	48	36	56	30	50
1983	35,903	13,861	28	46	28	46	37	57	31	51
1984	31,923	11,355	27	46	27	46	37	57	31	51
1985	30,759	16,020	29	49	29	49	37	57	31	51
1986	35,695	21,822	28	47	28	47	37	57	31	51
1987	36,339	17,101	29	48	29	48	37	57	31	51
1988	47,989	21,560	30	50	30	50	37	57	31	51
1989	33,610	18,098	28	46	28	46	38	58	32	52
1990	24,152	22,294	28	46	28	46	38	58	32	52
1991	23,018	9,402	28	47	28	47	37	57	31	51
1992	22,787	6,806	30	50	30	50	37	57	31	51
1993	30,526	7,160	28	47	28	47	34	54	28	48
1994	41,662	12,444	18	30	18	30	35	55	29	49
1995	30,148	11,724	17	28	17	28	32	52	26	46
1996	21,848	11,764	15	26	15	26	31	51	25	45
1997	18,690	6,913	14	24	14	24	27	47	22	42
1998	19,466	3,987	14	24	14	24	25	45	20	40
1999	14,603	6,872	13	22	13	22	20	40	12	32
2000	23,116	6,145	11	19	11	19	20	40	8	28
2001	19,119	6,037	11	18	11	18	18	38	7	27
2002	17,676	5,582	11	19	11	19	19	39	7	27
2003	10,459	5,152	13	22	13	22	17	37	6	26
2004	19092	4478	13	22	13	22	19	39	7	27
2005	15200	5067	13	22	13	22	18	38	7	27
2006	13189	3939	13	22	13	22	15	35	5	25
2007			13	22	13	22	19	39	7	27
2008			13	22	13	22	19	39	7	27
2009			13	22	13	22	19	39	7	27
2010			13	22	13	22	19	39	7	27

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	78,037	5,874	10	33	10	33	75	85	45	55
1972	64,663	4,867	10	33	10	33	75	85	45	55
1973	57,469	4,326	10	33	10	33	75	85	45	55
1974	72,587	5,464	10	33	10	33	75	85	45	55
1975	51,061	3,843	10	33	10	33	75	85	45	55
1976	36,206	2,725	10	33	10	33	75	85	45	55
1977	36,510	2,748	10	33	10	33	75	85	45	55
1978	44,557	3,354	10	33	10	33	75	85	45	55
1979	34,413	2,590	10	33	10	33	75	85	45	55
1980	45,777	3,446	10	33	10	33	75	85	45	55
1981	32,346	2,435	10	33	10	33	75	85	45	55
1982	55,946	4,211	10	33	10	33	75	85	45	55
1983	77,424	5,828	10	33	10	33	75	85	45	55
1984	27,465	2,067	10	33	10	33	75	85	45	55
1985	37,685	2,836	10	33	10	33	75	85	45	55
1986	43,109	3,245	10	33	10	33	75	85	45	55
1987	17,189	1,294	10	33	10	33	62	76	41	51
1988	43,974	3,310	10	33	10	33	58	71	32	40
1989	60,288	4,538	10	37	10	37	80	98	54	66
1990	39,875	3,001	10	17	10	17	56	68	34	42
1991	21,709	1,634	10	17	10	17	58	71	39	47
1992	39,299	2,958	10	23	10	23	50	62	30	36
1993	35,366	2,662	10	17	10	17	37	45	11	13
1994	36,144	2,720	10	28	10	28	63	77	36	44
1995	33,398	2,514	10	17	10	17	60	74	38	46
1996	28,406	2,138	10	20	10	20	47	67	24	44
1997	40,886	3,077	5	15	5	15	50	70	24	44
1998	37,154	2,797	5	15	5	15	20	30	15	30
1999	21,660	1,630	5	15	5	15	58	68	25	40
2000	30,385	2,287	5	15	5	15	53	63	25	40
2001	21,368	1,608	0	10	0	10	45	55	25	35
2002	37,914	2,854	0	5	0	5	45	65	25	35
2003	30,441	2,291	0	1	0	1	40	55	20	30
2004	20,730	1,560	0	1	0	1	30	40	15	25
2005	23,746	1,787	0	1	0	1	25	35	45	55
2006	11,324	852	0	1	0	1	25	35	25	35
2007			0	1	0	1	30	40	15	25
2008			0	1	0	1	30	40	15	25
2009			0	1	0	1	30	40	15	25
2010			0	1	0	1	30	40	15	25

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	35506	2673	10	33	10	33	75	85	45	55
1972	34550	2601	10	33	10	33	75	85	45	55
1973	29229	2200	10	33	10	33	75	85	45	55
1974	22307	1679	10	33	10	33	75	85	45	55
1975	26701	2010	10	33	10	33	75	85	45	55
1976	17886	1346	10	33	10	33	75	85	45	55
1977	16778	1263	10	33	10	33	75	85	45	55
1978	24857	1871	10	33	10	33	75	85	45	55
1979	14323	1078	10	33	10	33	75	85	45	55
1980	15967	1202	10	33	10	33	75	85	45	55
1981	15994	1204	10	33	10	33	75	85	45	55
1982	14068	1059	10	33	10	33	75	85	45	55
1983	20,845	1,569	10	33	10	33	75	85	45	55
1984	11,109	836	10	33	10	33	75	85	45	55
1985	12,369	931	10	33	10	33	75	85	45	55
1986	13,160	991	10	33	10	33	75	85	45	55
1987	9,240	695	10	33	10	33	62	76	41	51
1988	14,320	1,078	10	33	10	33	58	71	32	40
1989	15,081	1,135	10	37	10	37	80	98	54	66
1990	9,499	715	10	17	10	17	56	68	34	42
1991	6,987	526	10	17	10	17	58	71	39	47
1992	9,346	703	10	23	10	23	50	62	30	36
1993	7,906	595	10	17	10	17	37	45	11	13
1994	11,206	843	10	28	10	28	63	77	36	44
1995	11,637	876	10	17	10	17	60	74	38	46
1996	10,383	781	10	20	10	20	47	67	24	44
1997	10,479	789	5	15	5	15	50	70	24	44
1998	9,375	706	5	15	5	15	20	30	15	30
1999	9,011	678	5	15	5	15	58	68	25	40
2000	10,598	798	5	15	5	15	53	63	25	40
2001	8,104	610	0	10	0	10	45	55	25	35
2002	3,315	249	0	5	0	5	45	65	25	35
2003	2,236	168	0	5	0	5	40	55	20	30
2004	2,411	181	0	1	0	1	30	40	15	25
2005	3,012	227	0	1	0	1	25	35	45	55
2006	2,288	172	0	1	0	1	25	35	25	35
2007			0	1	0	1	30	40	15	25
2008			0	1	0	1	30	40	15	25
2009			0	1	0	1	30	40	15	25
2010			0	1	0	1	30	40	15	25

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	216,873	135,527	15	35	15	35	62.8	87.9	39.9	59.9
1972	220,106	183,872	15	35	15	35	64.0	89.6	41.2	61.7
1973	259,773	204,825	15	35	15	35	62.4	87.4	39.9	59.8
1974	245,424	158,951	15	35	15	35	68.3	95.6	45.1	67.6
1975	181,940	180,828	15	35	15	35	67.1	93.9	44.0	66.1
1976	150,069	92,179	15	35	15	35	63.8	89.3	40.5	60.8
1977	154,306	118,645	15	35	15	35	67.9	95.0	44.6	66.9
1978	158,844	139,688	15	35	15	35	63.0	88.2	40.8	61.2
1979	160,791	116,514	15	35	15	35	65.3	91.4	43.1	64.6
1980	101,665	155,646	10	25	10	25	64.0	89.6	41.6	62.4
1981	129,690	156,683	10	25	10	25	63.3	88.6	41.0	61.4
1982	175,355	113,180	10	25	10	25	59.2	82.9	36.2	54.3
1983	170,843	126,104	10	25	10	25	64.2	89.8	39.5	59.3
1984	175,675	90,829	10	25	10	25	58.4	81.8	35.1	52.7
1985	133,073	95,012	10	25	10	25	51.5	72.2	31.1	46.7
1986	180,276	128,813	10	25	10	25	49.6	69.4	30.0	45.1
1987	139,252	88,519	10	25	10	25	53.8	75.3	32.4	48.6
1988	118,580	91,068	10	25	10	25	33.6	47.0	23.4	35.0
1989	142,992	85,348	5	15	5	15	31.3	43.8	22.4	33.5
1990	63,297	73,954	5	15	5	15	33.2	46.5	23.0	34.5
1991	53,835	53,676	5	15	5	15	30.7	42.9	22.0	32.9
1992	79,883	67,968	5	15	5	15	26.8	37.5	20.7	31.0
1993	73,396	60,496	5	15	5	15	29.4	41.2	21.5	32.3
1994	80,498	72,523	5	15	5	15	27.6	38.6	20.9	31.3
1995	72,961	69,047	5	15	5	15	25.8	36.1	20.3	30.5
1996	56,610	50,356	5	15	5	15	24.0	33.6	19.6	29.4
1997	37,468	34,845	5	15	5	15	25.5	35.7	20.1	30.2
1998	44,952	32,231	5	15	5	15	20.2	28.3	18.3	27.5
1999	20,907	27,014	5	15	5	15	20.7	28.9	18.7	28.0
2000	36,871	31,280	5	15	5	15	18.2	25.5	17.8	26.7
2001	36,646	30,470	5	15	5	15	17.0	23.8	17.1	26.1
2002	26,579	21,720	5	15	5	15	16.1	22.5	16.9	25.4
2003	25,817	24,214	5	15	5	15	14.5	20.0	15.0	23.5
2004	31,324	30,676	5	15	5	15	14.5	20.0	15.0	23.5
2005	31,106	23,524	5	15	5	15	14.5	20.0	15.0	23.5
2006	25,461	20,235	5	15	5	15	14.5	20.0	15.0	23.5
2007			5	15	5	15	14.5	20.0	15.0	23.5
2008			5	15	5	15	14.5	20.0	15.0	23.5
2009			5	15	5	15	14.5	20.0	15.0	23.5
2010			5	15	5	15	14.5	20.0	15.0	23.5

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)	
	1SW	MSW	min	max	min	max	min	max	min	max
1971	45287	26074	25	45	25	45	31.4	44.0	20.0	29.9
1972	31359	34151	25	45	25	45	32.0	44.8	20.6	30.9
1973	33317	33095	25	45	25	45	31.2	43.7	19.9	29.9
1974	43992	29406	25	45	25	45	34.2	47.8	22.5	33.8
1975	40424	27150	25	45	25	45	33.5	46.9	22.0	33.0
1976	38423	22403	25	45	25	45	31.9	44.7	20.3	30.4
1977	39958	20342	25	45	25	45	33.9	47.5	22.3	33.5
1978	45626	23266	25	45	25	45	31.5	44.1	20.4	30.6
1979	26445	15995	25	45	25	45	32.7	45.7	21.5	32.3
1980	19776	16942	20	35	20	35	32.0	44.8	20.8	31.2
1981	21048	18038	20	35	20	35	31.6	44.3	20.5	30.7
1982	32706	15062	20	35	20	35	29.6	41.5	18.1	27.2
1983	38,774	19,857	20	35	20	35	32.1	44.9	19.8	29.6
1984	37,404	16,384	20	35	20	35	29.2	40.9	17.6	26.3
1985	24,939	19,636	20	35	20	35	25.8	36.1	15.6	23.4
1986	22,579	19,584	20	35	20	35	24.8	34.7	15.0	22.5
1987	25,533	15,475	20	35	20	35	26.9	37.6	16.2	24.3
1988	30,518	21,094	20	35	20	35	16.8	23.5	11.7	17.5
1989	31,949	18,538	15	25	15	25	15.6	21.9	11.2	16.8
1990	17,797	13,970	15	25	15	25	16.6	23.2	11.5	17.2
1991	19,773	11,517	15	25	15	25	15.3	21.5	11.0	16.5
1992	21,793	14,873	15	25	15	25	13.4	18.7	10.3	15.5
1993	21,121	11,230	15	25	15	25	14.7	20.6	10.8	16.2
1994	18,277	12,295	15	25	15	25	13.8	19.3	10.4	15.6
1995	16,843	9,141	15	25	15	25	12.9	18.0	10.2	15.2
1996	9,559	7,472	15	25	15	25	12.0	16.8	9.8	14.7
1997	9,066	5,509	15	25	15	25	12.7	17.8	10.1	15.1
1998	8,369	6,150	15	25	15	25	10.1	14.1	9.2	13.8
1999	4,149	3,589	15	25	15	25	10.3	14.5	9.3	14.0
2000	6,974	5,301	15	25	15	25	9.1	12.7	8.9	13.4
2001	5,603	4,194	15	25	15	25	8.5	11.9	8.5	13.1
2002	4,691	4,548	15	25	15	25	8.0	11.2	8.5	12.7
2003	3,536	3,060	15	25	15	25	4.0	5.5	4.0	6.5
2004	5,836	6,010	15	25	15	25	6.0	8.0	6.0	9.0
2005	7,426	4,913	15	25	15	25	6.0	8.0	6.0	9.0
2006	4,300	3,524	15	25	15	25	6.0	8.0	6.0	9.0
2007			15	25	15	25	6.0	8.0	6.0	9.0
2008			15	25	15	25	6.0	8.0	6.0	9.0
2009			15	25	15	25	6.0	8.0	6.0	9.0
2010			15	25	15	25	6.0	8.0	6.0	9.0

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

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

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

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

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

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

Year	Catch (numbers)		Unrep. as % of total 1SW		Unrep. as % of total MSW		Exp. rate 1SW (%)		Exp. rate MSW (%)		Prop'n EU
	1SW	MSW	min	max	min	max	min	max	min	max	
1971	0	856,369	0	0	5	15	100	100	100	100	**0.50**
1972	0	614,244	0	0	5	15	100	100	100	100	**0.50**
1973	0	560,048	0	0	5	15	100	100	100	100	**0.50**
1974	0	535,475	0	0	5	15	100	100	100	100	**0.50**
1975	0	650,641	0	0	5	15	100	100	100	100	**0.50**
1976	0	386,513	0	0	5	15	100	100	100	100	**0.50**
1977	0	442,368	0	0	5	15	100	100	100	100	**0.50**
1978	0	293,731	0	0	5	15	100	100	100	100	0.48
1979	0	417,665	0	0	5	15	100	100	100	100	0.50
1980	0	370,807	0	0	5	15	100	100	100	100	0.52
1981	0	398,738	0	0	5	15	100	100	100	100	0.41
1982	0	346,302	0	0	5	15	100	100	100	100	0.38
1983	0	100,000	0	0	5	15	100	100	100	100	0.60
1984	0	95,498	0	0	5	15	100	100	100	100	0.50
1985	0	301,045	0	0	5	15	100	100	100	100	0.50
1986	0	316,832	0	0	5	15	100	100	100	100	0.43
1987	0	305,696	0	0	5	15	100	100	100	100	0.41
1988	0	280,818	0	0	5	15	100	100	100	100	0.57
1989	0	117,422	0	0	5	15	100	100	100	100	0.44
1990	0	101,859	0	0	5	15	100	100	100	100	0.26
1991	0	178,113	0	0	5	15	100	100	100	100	0.37
1992	0	84,342	0	0	5	15	100	100	100	100	0.55
1993	0	2,000	0	0	-25	25	100	100	100	100	**0.3**
1994	0	2,000	0	0	-25	25	100	100	100	100	**0.3**
1995	0	32,422	0	0	5	15	100	100	100	100	0.32
1996	0	31,944	0	0	10	20	100	100	100	100	0.27
1997	0	21,402	0	0	9	19	100	100	100	100	0.20
1998	0	3,957	0	0	3	13	100	100	100	100	0.21
1999	0	6,169	0	0	40	60	100	100	100	100	0.10
2000	0	8,171	0	0	30	50	100	100	100	100	0.30
2001	0	14,333	0	0	14	24	100	100	100	100	0.31
2002	0	3,369	0	0	43	63	100	100	100	100	0.32
2003	0	4,050	0	0	35	55	100	100	100	100	0.32
2004	0	5,412	0	0	30	50	100	100	100	100	0.27
2005	0	4,784	0	0	29	49	100	100	100	100	0.24
2006	0	6,401	0	0	23	43	100	100	100	100	0.28
2007	0	0	0	0	0	0	100	100	100	100	0.00
2008	0	0	0	0	0	0	100	100	100	100	0.00
2009	0	0	0	0	0	0	100	100	100	100	0.00
2010	0	0	0	0	0	0	100	100	100	100	0.00

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

Table 3.8.13.1. Estimated number of returning maturing 1SW salmon by NEAC country or region and year.

Year	Northern Europe								Southern Europe								
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%
1971	26,031	9,431		154,291	17,522				49,573	62,581	1,057,288	103,311	181,418	664,794	1,867,999	**2,128,900**	2,466,597
1972	40,709	8,601		117,360	13,852				99,215	50,597	1,120,809	90,541	158,795	573,329	1,839,521	**2,106,840**	2,469,537
1973	36,840	10,317		172,953	17,141				60,836	54,335	1,220,282	105,684	138,791	698,782	1,999,402	**2,299,580**	2,689,230
1974	73,409	10,300		172,822	24,690				28,302	38,558	1,401,418	133,428	151,625	668,497	2,100,427	**2,431,230**	2,864,648
1975	51,076	12,593		264,512	26,589				56,493	60,164	1,534,931	132,244	124,567	549,388	2,133,689	**2,477,824**	2,951,518
1976	34,848	12,572		184,122	14,974				52,127	47,378	1,050,722	90,414	86,559	448,872	1,538,249	**1,777,827**	2,111,451
1977	17,907	17,575		117,827	7,074				39,997	48,579	904,718	100,202	85,152	495,492	1,468,468	**1,683,170**	1,966,203
1978	24,357	17,801		118,623	8,022				41,200	63,448	791,273	111,732	111,285	566,896	1,493,024	**1,694,431**	1,947,807
1979	28,417	17,086		164,750	8,536				47,128	58,613	729,926	105,974	77,923	475,473	1,321,053	**1,503,453**	1,745,562
1980	12,794	2,584		117,139	10,842				98,456	26,665	553,846	97,113	98,713	299,145	1,039,155	**1,185,448**	1,366,248
1981	19,724	13,310		96,662	19,532				77,352	34,304	291,444	101,211	77,356	370,216	872,063	**962,245**	1,065,678
1982	5,764	6,144		84,968	17,172				48,168	35,376	603,642	86,012	111,783	513,480	1,263,404	**1,407,640**	1,579,646
1983	28,521	9,015	703,360	141,546	22,998	797,143	**906,131**	1,038,241	51,400	44,697	1,063,969	121,686	156,672	549,538	1,781,978	**1,999,293**	2,271,305
1984	31,912	3,286	730,694	153,011	32,397	832,772	**954,282**	1,096,652	84,749	27,493	559,737	107,959	61,679	559,305	1,269,922	**1,412,999**	1,577,298
1985	48,229	22,668	742,192	208,855	38,288	943,047	**1,064,534**	1,204,211	31,516	44,602	927,931	108,164	80,047	464,920	1,479,136	**1,664,733**	1,899,592
1986	43,702	28,241	643,904	179,407	40,587	834,362	**938,935**	1,061,949	48,539	73,178	1,040,031	122,610	89,692	568,258	1,735,838	**1,963,901**	2,237,734
1987	56,131	16,645	541,548	190,846	32,730	751,612	**842,852**	945,244	85,323	45,618	668,193	126,433	49,023	432,058	1,251,936	**1,430,056**	1,660,988
1988	26,801	24,031	499,071	131,919	27,375	636,147	**712,311**	800,918	29,894	81,752	909,025	171,376	115,695	649,025	1,754,169	**1,967,710**	2,241,465
1989	62,537	12,924	553,094	196,999	8,757	746,766	**836,796**	949,421	15,640	45,608	651,853	111,870	111,282	696,880	1,472,072	**1,642,807**	1,846,103
1990	59,284	9,685	496,138	163,429	19,514	668,901	**749,565**	847,082	27,043	41,993	407,990	80,358	92,084	347,896	906,961	**1,006,756**	1,131,169
1991	72,234	14,102	431,169	138,330	23,625	610,829	**683,101**	771,077	20,047	46,535	291,669	79,062	51,526	337,085	748,405	**833,083**	927,559
1992	95,606	26,562	363,825	171,454	25,990	619,773	**685,886**	762,633	35,952	53,063	421,736	81,741	104,409	479,495	1,069,763	**1,190,722**	1,333,415
1993	67,220	21,722	365,392	146,867	27,705	571,934	**632,709**	701,992	51,304	51,826	344,708	112,070	122,223	455,356	1,043,410	**1,153,430**	1,292,862
1994	26,734	6,956	494,767	173,094	21,099	641,677	**726,470**	825,596	40,048	42,944	439,175	121,821	83,857	481,891	1,099,363	**1,224,770**	1,372,069
1995	26,190	20,096	322,756	155,741	30,726	504,001	**559,657**	623,321	13,313	58,010	491,029	92,710	77,885	481,103	1,103,997	**1,221,713**	1,362,911
1996	60,711	10,699	245,768	212,112	18,930	498,533	**552,658**	614,094	16,556	50,077	456,219	66,997	80,347	327,667	898,931	**1,006,280**	1,136,656
1997	52,137	14,666	282,233	208,227	8,643	510,835	**569,727**	634,855	8,452	36,628	457,051	62,291	95,392	247,488	813,176	**912,865**	1,036,951
1998	59,983	24,937	368,555	227,372	7,634	621,525	**692,541**	773,672	16,487	50,065	478,259	68,742	208,010	331,114	1,046,212	**1,162,922**	1,301,946
1999	86,095	13,197	342,497	176,624	11,301	569,690	**632,817**	701,735	5,525	42,359	445,983	58,997	54,182	186,195	706,409	**800,856**	916,411
2000	90,501	14,209	563,456	193,460	22,361	795,875	**888,718**	994,424	14,122	37,583	620,318	90,848	78,625	355,764	1,071,316	**1,205,653**	1,374,334
2001	40,836	13,421	486,054	260,522	14,620	718,956	**823,584**	951,382	12,444	33,571	493,996	79,494	62,114	343,732	939,197	**1,032,528**	1,136,875
2002	28,633	23,648	296,853	235,201	14,905	528,014	**606,341**	713,707	17,392	42,724	430,173	71,925	76,974	277,157	843,037	**923,861**	1,018,312
2003	33,970	12,213	412,182	210,686	9,131	597,891	**686,230**	793,689	11,476	50,091	420,794	46,854	69,267	279,974	808,869	**886,317**	976,281
2004	13,115	33,850	249,387	147,756	7,869	406,973	**460,662**	528,558	13,870	49,483	311,041	79,625	66,633	329,687	784,778	**858,951**	941,620
2005	33,493	31,601	371,797	168,116	6,679	547,560	**618,599**	707,875	8,786	73,159	309,174	66,097	89,794	352,712	815,258	**890,237**	972,983
2006	63,399	22,328	301,127	203,243	8,165	532,182	**603,609**	696,203	9,795	54,480	236,764	64,557	45,641	258,084	600,898	**659,959**	727,087
10yr Av.	50,216	20,407	367,414	203,121	11,131	582,950	**658,283**	749,610	11,835	47,014	420,355	68,943	84,663	296,191	842,915	**933,415**	1,040,280

Table 3.8.13.2. Estimated number of returning non-maturing 1SW salmon by NEAC country or region and year.

Year	Northern Europe								Southern Europe								
	Finland	Iceland N&E	Norway	Russia	Sweden	Total			France	Iceland S&W	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
						2.5%	50.0%	97.5%							2.5%	50.0%	97.5%
1971	23,928	9,639		132,435	1,058				10,870	24,459	157,408	96,853	21,928	615,203	819,031	**934,833**	1,074,187
1972	37,436	15,070		134,731	745				21,624	37,500	168,324	146,122	19,155	785,719	1,038,176	**1,187,649**	1,365,196
1973	44,634	14,117		222,822	2,590				13,292	33,828	183,066	109,306	16,743	857,000	1,064,029	**1,222,906**	1,419,748
1974	66,822	13,397		210,037	1,665				6,173	29,211	206,509	79,308	18,277	603,715	827,230	**950,307**	1,097,443
1975	73,893	14,755		225,123	405				12,337	31,019	230,815	108,262	15,020	668,185	936,173	**1,076,017**	1,246,226
1976	60,860	12,178		194,987	1,210				8,994	26,786	160,317	56,775	10,443	401,658	580,487	**670,296**	776,372
1977	37,318	16,948		134,486	906				6,911	26,126	139,276	69,663	10,294	461,921	629,488	**722,200**	831,849
1978	23,682	21,877		115,863	692				7,078	33,758	121,176	58,245	13,397	562,589	693,501	**800,201**	929,907
1979	25,194	14,418		101,540	2,017				8,185	21,674	108,746	27,913	9,415	408,524	507,970	**590,466**	691,176
1980	26,388	20,035		169,066	3,540				17,072	30,439	120,181	91,111	11,918	516,650	698,570	**795,041**	908,982
1981	29,207	7,043		96,598	1,027				11,587	20,266	88,175	127,603	9,337	577,077	742,499	**840,739**	959,767
1982	38,221	8,082		85,384	3,695				7,175	14,312	51,423	49,418	13,489	446,175	514,166	**583,373**	674,423
1983	41,571	6,162	427,567	123,814	2,528	535,904	**604,652**	684,180	7,715	23,958	154,404	54,070	18,894	484,679	639,759	**758,425**	991,924
1984	39,503	7,935	436,813	123,511	3,561	544,715	**614,236**	693,412	12,752	20,337	76,556	44,028	7,449	399,969	500,793	**563,425**	643,164
1985	30,699	5,111	403,384	135,435	1,483	514,242	**577,900**	650,949	9,500	14,708	83,639	64,547	9,641	494,901	601,083	**678,176**	771,697
1986	26,691	13,946	483,307	133,910	1,431	585,918	**661,660**	749,476	9,667	12,289	94,818	86,028	10,865	632,745	745,955	**847,438**	977,174
1987	33,350	14,422	361,929	99,627	4,295	458,470	**515,958**	584,057	5,137	10,905	117,708	68,363	5,553	405,317	543,667	**615,776**	703,009
1988	21,384	9,306	305,988	99,794	4,155	394,327	**441,529**	498,572	14,319	12,394	84,607	88,344	15,618	624,765	742,510	**844,603**	968,710
1989	24,182	7,884	216,171	97,119	11,595	321,781	**358,636**	401,507	6,542	11,114	77,551	68,918	12,417	544,083	640,078	**723,684**	826,351
1990	30,633	8,317	257,370	124,710	7,366	386,218	**429,137**	481,211	6,586	10,994	37,246	85,046	11,316	472,195	555,467	**624,810**	709,223
1991	36,612	5,784	217,003	122,123	8,506	355,553	**392,338**	435,675	6,019	10,969	55,984	36,876	5,808	341,887	407,088	**459,641**	524,358
1992	39,269	8,602	235,510	116,399	11,041	371,091	**411,610**	457,374	7,731	12,368	43,001	27,988	13,325	450,685	488,425	**555,890**	640,517
1993	45,477	9,716	226,616	137,789	15,017	399,879	**436,669**	477,693	3,686	6,039	42,189	30,463	31,442	375,108	433,327	**494,661**	568,244
1994	37,818	8,239	222,364	121,806	11,002	366,243	**403,452**	446,072	7,654	9,798	67,625	42,065	11,040	454,117	526,952	**594,429**	680,136
1995	23,332	5,743	238,006	138,742	7,737	378,068	**415,308**	458,617	3,632	11,089	65,087	42,102	9,353	431,052	501,299	**563,259**	646,299
1996	20,593	7,536	238,448	104,289	9,807	345,802	**383,091**	425,076	6,468	7,127	43,678	42,550	10,213	322,445	383,318	**434,228**	497,910
1997	29,890	4,236	159,199	85,323	6,408	258,930	**286,496**	317,538	3,317	7,998	56,378	26,663	12,730	225,415	294,534	**338,014**	391,563
1998	25,039	6,167	191,246	105,550	4,727	303,806	**334,499**	368,880	2,822	4,974	32,828	16,395	17,499	234,213	274,528	**309,555**	353,963
1999	23,626	7,313	204,389	93,014	4,069	300,682	**333,709**	371,760	6,097	9,731	51,022	37,884	7,993	200,869	273,637	**320,213**	383,076
2000	52,422	4,367	282,871	162,102	8,878	467,014	**513,809**	566,273	4,246	2,686	64,103	39,833	10,614	256,751	340,517	**384,568**	443,536
2001	75,498	5,244	332,931	114,647	10,689	488,504	**542,436**	602,311	4,972	4,675	56,837	41,133	7,802	245,865	322,326	**371,167**	436,957
2002	60,510	5,112	288,754	125,034	7,842	477,771	**525,293**	581,045	3,660	5,266	65,561	38,959	10,612	202,506	291,945	**335,074**	393,453
2003	42,993	6,497	255,473	87,172	8,917	389,680	**428,480**	472,647	5,325	8,081	69,023	39,067	9,898	230,143	318,672	**370,585**	440,906
2004	20,611	6,027	231,060	67,163	6,481	315,499	**349,705**	389,882	9,953	6,622	38,073	31,739	8,774	287,731	336,762	**390,070**	456,869
2005	15,888	7,549	214,495	76,165	4,939	311,024	**342,561**	378,733	6,470	5,891	49,373	36,602	4,046	229,474	282,185	**327,704**	387,011
2006	28,070	12,192	271,859	73,173	4,937	377,240	**416,189**	460,674	7,536	5,359	35,763	31,753	3,436	185,698	225,491	**270,349**	334,428
10yr Av.	37,455	6,471	243,228	98,934	6,789	369,015	**407,318**	450,974	5,440	6,128	51,896	34,003	9,340	229,867	296,060	**341,730**	402,176

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

Year	Northern Europe								Southern Europe								
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%
1971	33,287	11,994		198,757	22,336				63,279	79,625	1,343,524	131,706	231,104	837,751	2,294,291	**2,699,706**	3,210,385
1972	51,860	10,955		150,905	17,701				126,329	64,315	1,426,845	115,583	202,278	720,900	2,262,398	**2,676,896**	3,200,355
1973	47,027	13,137		222,336	21,880				77,533	69,180	1,554,960	134,815	176,751	878,662	2,453,714	**2,916,634**	3,493,659
1974	93,606	13,122		220,955	31,497				36,180	49,130	1,780,560	169,885	193,136	840,889	2,591,474	**3,079,563**	3,723,845
1975	65,083	16,037		339,902	33,937				72,220	76,709	1,955,674	168,551	158,516	692,972	2,626,171	**3,145,556**	3,843,821
1976	44,437	15,995		236,652	19,122				66,267	60,303	1,335,526	115,353	110,256	565,402	1,892,244	**2,259,214**	2,733,659
1977	22,851	22,391		151,373	9,047				50,794	61,883	1,152,454	127,641	108,363	623,429	1,805,020	**2,134,271**	2,560,327
1978	31,086	22,694		152,737	10,279				52,357	80,913	1,005,013	142,229	141,602	713,378	1,836,302	**2,150,128**	2,540,403
1979	36,266	21,714		211,909	10,916				60,038	74,637	928,626	135,324	99,365	597,284	1,619,972	**1,906,472**	2,262,974
1980	16,505	3,289		150,517	13,980				125,542	33,974	705,390	124,086	125,929	377,087	1,278,817	**1,504,783**	1,785,395
1981	25,527	16,979		124,925	25,195				98,867	43,670	371,020	129,458	98,807	467,313	1,069,518	**1,221,949**	1,396,894
1982	7,687	7,817		109,461	22,173				61,603	45,123	767,895	110,416	142,670	646,710	1,551,613	**1,785,878**	2,062,612
1983	36,688	11,506	896,260	182,186	29,579	989,342	**1,156,108**	1,363,276	65,700	57,031	1,355,191	155,722	200,041	692,825	2,186,394	**2,536,303**	2,972,330
1984	40,873	4,190	929,333	195,929	41,307	1,033,768	**1,216,339**	1,432,524	108,209	34,986	710,933	137,838	78,685	704,497	1,559,517	**1,791,991**	2,063,095
1985	61,494	28,882	944,940	268,590	48,754	1,169,812	**1,355,730**	1,587,460	40,126	56,841	1,181,461	138,001	101,973	585,740	1,812,588	**2,111,389**	2,483,071
1986	55,809	35,926	819,400	230,362	51,762	1,032,291	**1,196,987**	1,389,633	61,851	93,235	1,321,684	156,357	114,463	714,089	2,130,269	**2,489,687**	2,918,615
1987	71,683	21,139	690,375	245,936	41,755	928,187	**1,076,162**	1,246,826	108,572	58,015	848,901	161,453	62,621	544,184	1,546,426	**1,814,163**	2,159,746
1988	34,214	30,556	636,307	169,120	34,871	786,583	**908,486**	1,054,042	38,089	104,030	1,156,763	218,321	147,486	817,509	2,155,788	**2,498,638**	2,917,047
1989	79,753	16,452	703,576	250,740	11,250	919,595	**1,066,030**	1,247,717	19,947	58,085	828,840	142,457	141,869	877,604	1,810,280	**2,081,566**	2,406,063
1990	75,658	12,335	631,017	208,358	24,929	823,938	**954,513**	1,117,012	34,519	53,387	517,413	102,466	117,312	438,539	1,110,889	**1,278,076**	1,479,351
1991	92,047	17,949	548,743	177,486	30,030	752,334	**870,719**	1,009,755	25,616	59,133	370,071	100,940	65,660	424,598	919,052	**1,054,765**	1,216,264
1992	121,550	33,837	462,979	219,219	33,133	760,301	**873,017**	1,001,593	45,676	67,638	536,277	104,216	132,890	604,002	1,312,069	**1,507,625**	1,739,003
1993	85,536	27,628	465,091	188,068	35,280	703,702	**804,579**	924,746	65,166	66,067	437,671	142,380	155,507	573,387	1,277,864	**1,461,366**	1,689,044
1994	34,035	8,848	630,002	222,432	26,894	793,006	**925,494**	1,084,338	50,936	54,676	558,722	155,716	106,664	606,843	1,350,548	**1,551,324**	1,790,840
1995	33,418	25,546	410,660	199,458	39,049	619,759	**712,657**	819,955	16,954	73,922	623,316	118,091	99,151	606,171	1,352,026	**1,547,079**	1,779,002
1996	77,303	13,613	312,390	271,369	24,097	613,584	**704,367**	810,749	21,107	63,761	579,407	85,452	102,494	412,180	1,103,975	**1,274,554**	1,481,972
1997	66,523	18,657	358,850	267,421	11,015	628,302	**726,162**	837,321	10,754	46,612	581,911	79,530	121,337	311,650	1,000,935	**1,157,705**	1,356,573
1998	76,107	31,780	468,730	292,358	9,697	767,523	**882,550**	1,021,299	20,941	63,839	607,218	87,423	264,512	416,323	1,284,047	**1,473,376**	1,704,020
1999	109,454	16,778	435,795	226,002	14,328	702,216	**805,442**	926,598	7,017	53,967	567,074	75,041	68,886	234,397	869,072	**1,014,093**	1,195,916
2000	115,218	18,095	717,865	248,148	28,478	980,414	**1,131,887**	1,308,555	18,040	47,846	789,150	115,587	100,021	447,451	1,313,108	**1,527,809**	1,796,330
2001	52,025	17,109	618,223	333,873	18,624	888,542	**1,049,526**	1,250,032	15,763	42,734	628,171	101,322	79,031	431,980	1,148,325	**1,305,604**	1,494,433
2002	36,435	30,173	377,753	301,928	18,965	651,784	**774,188**	935,917	22,134	54,473	549,209	91,567	98,159	348,902	1,027,216	**1,170,942**	1,339,433
2003	43,250	15,509	524,460	269,491	11,599	738,618	**873,361**	1,036,917	14,639	63,800	535,930	59,715	88,278	352,346	987,688	**1,124,611**	1,282,989
2004	16,697	43,064	317,022	189,303	9,993	501,651	**587,232**	693,756	17,648	63,025	396,310	101,410	84,779	414,686	957,960	**1,087,080**	1,235,465
2005	42,621	40,313	472,882	215,267	8,491	676,293	**788,633**	925,625	11,177	93,155	393,934	84,050	114,324	444,726	994,060	**1,126,870**	1,279,586
2006	80,705	28,494	383,133	259,818	10,411	657,759	**770,142**	913,465	12,464	69,396	301,429	82,236	58,164	324,876	734,350	**834,601**	953,308
10yr Av.	63,904	25,997	467,471	260,361	14,160	719,310	**838,912**	984,948	15,058	59,885	535,033	87,788	107,749	372,733	1,031,676	**1,182,269**	1,363,805

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

Year	Northern Europe								Southern Europe								
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%
1971	63,276	25,786		262,505	6,014				53,122	63,272	379,659	347,472	31,981	1,753,806	2,185,633	**2,641,842**	3,211,461
1972	74,966	24,233		421,389	8,923				34,301	57,069	379,698	258,329	27,958	1,760,739	2,073,521	**2,527,814**	3,117,047
1973	111,804	22,900		391,950	6,386				21,373	49,213	410,671	200,181	30,462	1,299,982	1,657,341	**2,022,459**	2,485,944
1974	123,905	25,213		424,537	4,751				31,195	52,383	450,842	247,259	25,089	1,403,563	1,816,320	**2,219,540**	2,729,355
1975	102,416	20,825		362,937	5,454				27,876	45,165	343,242	170,451	17,472	1,000,809	1,339,436	**1,605,975**	1,944,081
1976	62,460	28,650		251,045	3,764				19,217	44,011	278,679	163,213	17,193	973,982	1,238,238	**1,503,602**	1,843,971
1977	39,916	36,806		214,127	3,174				20,566	56,609	252,455	149,638	22,332	1,163,677	1,366,813	**1,671,531**	2,056,705
1978	42,454	24,425		196,050	5,734				19,245	36,500	216,715	80,475	15,712	836,332	985,903	**1,212,866**	1,505,708
1979	44,535	34,233		337,596	11,322				36,691	51,560	256,877	206,917	19,921	1,108,250	1,397,563	**1,685,037**	2,055,104
1980	49,117	12,871		232,116	10,168				27,047	34,983	207,858	269,962	15,593	1,222,684	1,480,876	**1,781,100**	2,176,378
1981	64,283	14,555		209,353	14,006				18,440	24,971	138,993	127,777	22,534	966,646	1,080,742	**1,301,268**	1,580,722
1982	69,763	11,123		265,385	10,423				18,061	40,741	299,628	127,472	31,527	989,836	1,221,791	**1,537,563**	2,039,309
1983	65,999	13,820	798,730	250,322	10,099	936,396	**1,139,588**	1,389,788	23,725	34,474	150,131	92,856	12,449	766,587	884,557	**1,079,884**	1,327,547
1984	51,151	9,107	743,840	271,405	6,643	888,063	**1,077,562**	1,314,373	17,748	25,128	159,737	125,673	16,110	912,945	1,025,025	**1,255,596**	1,553,023
1985	44,806	23,945	886,878	271,463	7,294	1,010,486	**1,229,206**	1,504,300	22,106	21,180	201,657	184,807	18,122	1,245,592	1,386,258	**1,690,405**	2,092,230
1986	56,189	24,735	682,142	209,756	11,889	810,370	**982,726**	1,200,400	13,957	18,872	235,896	151,298	9,279	847,687	1,053,822	**1,276,761**	1,560,479
1987	35,914	15,929	555,435	196,993	9,747	670,093	**810,974**	995,243	28,902	21,140	173,667	181,425	26,071	1,190,456	1,323,099	**1,624,959**	2,013,156
1988	40,797	13,695	418,739	197,342	22,960	574,958	**690,956**	835,293	17,215	19,042	171,232	156,518	20,742	1,092,902	1,218,671	**1,479,374**	1,815,989
1989	51,427	14,362	483,087	244,895	15,478	664,937	**804,829**	972,213	13,073	18,794	80,482	160,310	18,885	870,953	947,335	**1,163,080**	1,436,960
1990	61,547	9,851	384,882	226,392	15,571	573,834	**695,165**	851,512	11,101	18,472	102,033	70,264	9,704	613,174	669,227	**825,988**	1,030,647
1991	65,725	14,499	405,103	209,365	19,185	581,119	**708,622**	867,526	15,538	20,787	87,325	63,147	22,232	826,622	835,579	**1,034,916**	1,289,531
1992	75,784	16,310	389,176	246,980	25,800	617,507	**748,904**	911,227	8,034	10,216	82,022	63,141	52,389	681,991	728,110	**904,160**	1,128,285
1993	63,200	13,842	380,868	221,236	18,958	570,458	**695,050**	850,921	12,816	16,439	114,370	73,282	18,390	772,570	807,701	**1,010,191**	1,271,262
1994	39,077	9,660	408,434	251,357	13,540	587,289	**715,837**	875,106	6,086	18,612	110,380	73,342	15,599	735,504	767,265	**958,885**	1,213,863
1995	34,497	12,632	408,804	190,679	17,039	539,590	**660,526**	806,607	11,238	11,986	76,564	76,265	17,094	559,461	604,490	**752,665**	951,064
1996	50,063	7,073	267,044	152,195	10,779	393,445	**484,086**	594,861	5,902	13,377	96,462	48,120	21,313	389,860	462,832	**581,168**	735,024
1997	42,026	10,335	320,146	187,438	7,939	460,170	**563,184**	689,369	4,884	8,287	55,791	29,341	29,320	400,174	422,225	**527,389**	662,237
1998	39,429	12,218	341,506	165,951	6,805	458,640	**561,882**	694,844	10,218	16,262	85,969	65,768	13,359	340,483	421,081	**540,527**	697,589
1999	87,802	7,302	472,909	288,781	14,860	706,280	**864,377**	1,058,345	7,159	4,483	107,579	69,246	17,769	435,653	520,755	**649,497**	821,178
2000	126,255	8,780	556,445	204,052	17,905	739,655	**910,031**	1,123,490	8,450	7,807	96,072	71,794	13,029	419,850	498,630	**630,641**	806,886
2001	100,959	8,541	482,845	222,722	13,124	720,591	**884,165**	1,083,812	6,302	8,814	110,866	68,759	17,775	346,919	453,261	**572,127**	727,679
2002	71,903	10,887	427,240	155,812	14,976	588,587	**719,031**	882,794	8,935	13,503	115,925	68,136	16,585	389,773	491,392	**627,408**	809,979
2003	34,298	10,054	386,412	119,885	10,850	477,940	**588,463**	725,944	16,684	11,070	64,178	55,438	14,720	488,636	518,544	**658,315**	843,559
2004	26,529	12,629	358,036	136,096	8,282	471,732	**576,956**	707,834	10,890	9,847	82,837	63,522	6,748	388,268	433,820	**554,824**	712,117
2005	46,934	20,417	454,151	130,317	8,292	568,180	**697,992**	857,965	12,664	8,956	60,104	55,345	5,745	314,814	349,303	**458,751**	608,974
10yr Av.	62,620	10,824	406,673	176,325	11,381	558,522	**685,017**	841,926	9,209	10,240	87,578	59,547	15,636	391,443	457,184	**580,065**	742,522

Table 3.8.13.5. Estimated number of 1SW spawners by NEAC country or region and year.

Year	Northern Europe								Southern Europe								
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
		N&E				2.5%	50.0%	97.5%		S&W					2.5%	50.0%	97.5%
1971	13,036	4,728		77,722	8,236				47,833	31,309	395,187	55,557	36,429	262,602	212,720	**880,981**	286,035
1972	20,371	4,293		59,567	6,509				95,735	25,254	418,407	49,562	31,822	202,259	220,851	**863,201**	312,131
1973	18,357	5,155		88,687	8,099				58,706	27,182	454,629	58,024	27,764	256,627	246,950	**944,869**	332,478
1974	36,935	5,152		90,062	11,667				27,312	19,208	528,824	74,452	30,414	227,475	268,088	**959,507**	368,441
1975	25,575	6,316		133,813	12,507				54,513	30,121	573,434	72,248	24,952	204,026	275,938	**1,013,671**	396,717
1976	17,403	6,264		90,548	7,094				50,307	23,657	393,046	49,497	17,385	175,873	196,271	**727,268**	281,304
1977	8,942	8,817		58,995	3,333				38,597	24,318	338,709	53,806	17,070	186,452	170,625	**705,635**	242,020
1978	12,167	8,879		58,422	3,775				39,765	31,595	296,071	59,968	22,333	239,640	164,306	**742,469**	215,243
1979	14,157	8,551		84,599	4,047				45,483	29,211	274,005	58,116	15,614	175,767	151,221	**649,881**	203,056
1980	6,368	1,291		60,320	5,106				95,026	13,325	207,488	52,261	19,730	117,720	124,446	**547,801**	157,633
1981	9,843	6,644		49,634	9,206				74,632	17,066	70,739	54,299	15,554	144,177	78,698	**425,806**	89,697
1982	2,876	3,076		45,094	8,078				46,488	17,708	169,730	46,214	22,483	215,745	113,867	**567,188**	135,200
1983	14,257	4,485	164,759	74,752	10,843	66,722	**271,325**	80,363	49,600	22,325	361,146	64,030	31,348	224,061	166,675	**824,354**	217,819
1984	15,907	1,643	165,837	80,984	15,316	72,464	**282,095**	85,956	81,789	13,754	197,090	56,971	12,366	244,344	118,492	**669,551**	139,606
1985	24,102	11,322	173,157	106,867	18,022	77,184	**337,046**	91,364	30,416	22,346	237,661	57,178	16,044	226,119	142,424	**637,607**	181,774
1986	21,756	14,134	152,234	93,016	19,226	68,042	**303,676**	78,405	45,139	36,543	323,565	64,840	17,949	273,566	184,536	**830,632**	224,277
1987	28,062	8,335	127,811	97,918	15,397	61,395	**282,105**	69,595	79,323	22,849	199,595	66,656	15,224	200,053	142,811	**636,491**	202,744
1988	13,415	12,006	119,342	73,707	12,836	45,865	**234,047**	52,950	27,794	40,955	344,218	90,448	41,005	425,716	171,764	**1,023,515**	211,902
1989	25,019	6,455	189,416	104,040	4,112	60,604	**330,832**	75,733	14,540	22,759	222,822	57,690	12,286	470,058	139,954	**840,108**	163,191
1990	23,671	4,832	169,736	92,028	10,702	56,231	**302,820**	66,987	25,143	20,975	159,770	41,774	34,939	227,729	84,102	**548,839**	104,682
1991	28,898	7,063	145,390	87,682	12,951	50,438	**286,027**	60,840	18,647	23,365	117,762	41,957	18,292	234,707	72,915	**480,954**	80,548
1992	38,211	13,302	123,785	125,439	14,289	51,687	**317,991**	58,401	33,452	26,501	159,119	43,272	46,097	348,722	101,744	**686,179**	123,372
1993	26,785	10,813	123,163	108,203	15,231	49,102	**288,105**	54,951	47,704	25,807	142,275	62,510	72,186	315,206	98,921	**714,735**	130,901
1994	10,697	3,473	169,796	126,510	11,530	63,022	**325,613**	76,297	37,248	21,514	124,695	67,136	25,249	337,152	105,494	**661,171**	126,821
1995	10,468	10,050	109,781	110,729	19,147	44,288	**264,001**	51,079	11,644	28,973	178,427	53,690	25,778	345,259	99,689	**686,273**	117,650
1996	30,250	5,347	82,217	154,763	11,789	46,861	**287,944**	54,524	14,493	25,047	182,065	39,537	34,670	242,740	88,582	**558,206**	107,209
1997	26,154	7,335	105,177	158,096	5,389	50,641	**304,879**	58,650	7,392	18,324	227,214	39,196	38,193	181,241	80,508	**530,451**	105,331
1998	30,002	12,478	138,289	172,145	4,762	60,428	**361,727**	71,132	14,422	25,046	220,365	44,644	156,280	257,771	99,770	**742,749**	118,729
1999	34,386	7,105	128,348	137,461	7,078	53,174	**317,030**	60,539	4,835	22,424	232,065	41,334	20,080	142,421	76,135	**485,873**	97,138
2000	36,281	7,827	213,445	149,806	13,912	75,837	**426,079**	84,587	12,330	19,864	351,770	63,444	33,025	279,493	112,856	**795,534**	144,650
2001	16,246	7,740	185,187	224,973	9,122	90,712	**450,784**	119,382	10,900	18,040	257,258	57,008	31,074	274,878	91,498	**677,518**	103,287
2002	14,227	14,012	111,499	198,709	9,318	70,625	**353,577**	102,931	13,902	23,361	214,843	51,120	23,305	223,674	79,752	**587,457**	93,488
2003	17,061	7,093	157,136	175,683	5,693	78,205	**373,144**	97,819	9,168	26,935	246,646	34,160	29,892	241,723	76,059	**607,563**	89,135
2004	6,546	20,317	93,627	117,891	4,919	48,535	**255,348**	63,880	11,101	26,256	157,204	56,399	35,774	280,991	72,800	**590,465**	81,695
2005	16,782	19,802	140,787	139,402	4,165	63,790	**328,880**	81,190	7,001	38,854	171,476	47,617	54,029	303,722	73,730	**627,177**	82,335
2006	31,736	14,086	111,837	166,800	5,108	65,401	**338,748**	88,032	7,845	28,970	126,652	48,568	24,713	220,118	58,916	**458,827**	65,669
10yr Av.	22,942	11,779	138,533	164,097	6,947	65,735	**351,020**	82,814	9,890	24,807	220,549	48,349	44,636	240,603	82,202	**610,362**	98,146

Table 3.8.13.6. Estimated number of MSW spawners by NEAC country or region and year.

Year	Northern Europe								Southern Europe								
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total		
		N&E				2.5%	50.0%	97.5%		N&E					2.5%	50.0%	97.5%
1971	10,719	2,880		54,742	446				6,810	7,367	82,134	57,810	10,970	358,409	102,954	**566,925**	124,828
1972	16,862	4,524		56,642	316				13,504	11,240	87,885	88,922	9,586	447,478	129,374	**707,474**	159,150
1973	19,985	4,250		92,787	1,100				8,322	10,172	95,967	66,338	8,391	492,412	138,654	**729,672**	173,861
1974	30,070	4,031		91,208	704				3,863	8,783	108,012	48,005	9,141	321,485	109,078	**531,253**	132,121
1975	33,219	4,414		93,442	172				7,717	9,318	120,795	65,694	7,530	354,220	123,845	**605,907**	151,049
1976	27,420	3,657		77,621	511				5,614	8,033	83,917	33,990	5,235	236,241	80,591	**386,076**	95,538
1977	16,879	5,077		54,828	382				4,311	7,850	72,766	41,008	5,152	246,338	81,257	**410,089**	96,575
1978	10,637	6,569		45,440	292				4,413	10,108	63,568	34,742	6,703	318,605	93,618	**463,555**	114,661
1979	13,822	4,320		41,912	849				5,130	6,536	57,114	16,724	4,715	217,656	71,708	**323,772**	88,812
1980	14,518	5,961		68,655	1,493				10,702	9,165	62,844	54,498	5,964	279,273	88,077	**455,324**	105,397
1981	16,067	2,120		40,807	432				7,507	6,069	45,919	76,139	4,668	319,122	89,101	**509,056**	110,159
1982	21,130	2,432		37,733	1,562				4,655	4,287	32,475	29,639	6,744	268,314	63,666	**367,221**	84,655
1983	22,940	1,848	101,453	57,291	1,063	42,892	**187,331**	50,367	5,015	7,191	111,454	31,880	9,441	278,999	113,170	**483,652**	229,324
1984	21,727	2,380	103,054	59,275	1,497	43,526	**190,707**	49,018	8,312	6,132	43,224	25,990	3,733	249,397	56,464	**355,999**	74,951
1985	16,847	1,529	94,679	58,882	629	40,722	**174,356**	46,971	6,170	4,406	53,409	37,933	4,829	330,186	70,902	**460,024**	87,782
1986	14,616	4,177	114,113	54,623	605	46,633	**190,042**	55,300	6,267	3,688	51,098	50,661	5,430	421,883	94,742	**568,049**	119,959
1987	18,252	4,310	87,305	44,313	1,807	37,127	**158,072**	43,799	3,337	3,274	79,544	40,259	3,005	263,099	65,916	**408,686**	81,714
1988	11,722	2,795	73,401	48,944	1,754	29,677	**139,950**	34,751	9,319	3,694	52,643	51,934	10,004	468,193	96,154	**616,914**	118,090
1989	10,811	2,358	74,238	44,917	4,887	26,448	**139,081**	30,937	4,242	3,353	40,952	39,918	4,969	411,236	79,593	**521,975**	100,286
1990	13,868	2,496	88,497	55,065	3,649	31,063	**164,528**	38,019	4,286	3,297	14,941	49,269	7,020	346,989	66,580	**452,795**	82,009
1991	16,455	1,737	73,566	59,491	4,205	28,652	**157,622**	32,349	3,919	3,289	41,116	21,640	3,311	260,440	50,583	**343,361**	63,322
1992	17,603	2,575	80,534	57,236	5,527	30,092	**164,579**	34,221	5,031	3,717	20,923	16,537	8,927	351,879	65,886	**412,385**	82,527
1993	20,377	2,907	75,424	66,748	7,478	31,082	**175,182**	33,641	2,386	1,803	24,533	18,944	27,677	286,264	60,414	**375,014**	72,120
1994	17,113	2,463	74,741	66,555	5,491	31,326	**168,440**	34,957	5,354	2,925	40,249	25,627	6,622	348,496	65,032	**440,769**	83,419
1995	10,460	1,724	81,162	67,766	4,449	31,495	**166,615**	35,932	2,537	3,345	37,891	26,922	5,433	329,655	59,708	**419,556**	80,966
1996	11,265	2,266	80,178	53,685	5,623	29,522	**154,994**	32,389	4,526	2,141	19,641	27,688	6,779	251,638	49,351	**319,568**	61,972
1997	16,455	1,272	57,630	44,652	3,675	23,722	**125,034**	27,046	2,316	2,391	39,028	18,119	8,424	174,769	42,768	**255,659**	52,788
1998	13,699	1,842	69,532	48,385	2,713	26,620	**137,764**	29,387	1,976	1,501	12,523	11,455	13,607	188,091	34,343	**232,507**	43,785
1999	11,768	2,702	72,180	52,878	2,333	26,820	**142,901**	30,912	4,266	3,158	33,507	29,549	5,418	159,110	45,618	**248,896**	62,668
2000	26,125	1,713	102,886	85,031	5,098	41,565	**222,983**	44,818	2,969	949	44,196	32,644	7,179	208,217	43,509	**309,488**	58,350
2001	37,707	2,287	122,231	71,543	6,125	44,326	**243,134**	48,948	3,483	1,582	36,899	34,074	5,461	200,180	48,255	**297,974**	65,146
2002	30,135	2,407	107,011	75,302	4,487	40,743	**257,514**	45,171	2,279	2,013	47,460	32,388	6,573	166,913	42,861	**272,865**	58,373
2003	21,482	3,987	95,636	50,919	5,111	32,593	**205,738**	37,100	3,329	2,650	54,165	32,824	6,940	196,882	52,049	**308,908**	70,147
2004	10,287	3,468	87,210	37,042	3,721	28,174	**161,278**	33,140	6,234	2,295	24,791	26,282	6,450	244,413	52,664	**319,849**	66,268
2005	7,914	4,429	79,865	41,026	2,846	26,246	**160,428**	29,796	4,028	2,182	37,779	30,454	1,354	195,482	45,094	**269,398**	58,986
2006	14,088	8,420	101,605	40,664	2,834	31,531	**193,614**	36,636	4,702	1,948	25,269	26,953	1,894	157,499	44,634	**220,816**	63,804
10yr Av.	18,966	3,253	89,579	54,744	3,894	32,234	**185,039**	36,295	3,558	2,067	35,562	27,474	6,330	189,156	45,180	**273,636**	60,031

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

Smolt	Iceland[1]					Ireland		Norway[2]				UK (Scotland)[2]		France	UK (NI)[7]
migration	Ellidaar	Vesturdalsa[4]		R.Midfjardara[4]		R. Corrib		R. Halselva		R. Imsa		North Esk		Nivelle[5]	R. Bush
year	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	MSW	All ages	1SW[3]
1975	20.8														
1980						17.9	1.1								
1981						7.6	3.8			17.3	4.0	14.2	6.8		
1982						20.9	3.3			5.3	1.2	16.3	7.6		
1983		2.0				10.0	1.8			13.5	1.3				
1984						26.2	2.0			12.1	1.8	10.5	6.8		
1985	9.4					18.9	1.8			10.2	2.1	19.6	8.6		
1986						-	-			3.8	4.2			15.1	31.3
1987				2.4	1.4	16.6	0.7	2.0	0.3	17.3	5.6	16.2	5.9	2.6	35.1
1988	12.7			0.6	0.9	14.6	0.7	5.8	0.7	13.3	1.1			2.4	36.2
1989	8.1	1.1	2.0	0.2	0.7	6.7	0.7	2.1	1.0	8.7	2.2	10.0	6.9	3.5	25.0
1990	5.4	1.0	1.0	1.2	1.3	5.0	0.6	3.9	1.6	3.0	1.3	10.5	5.5	1.8	34.7
1991	8.8	4.2	0.6	1.1	0.5	7.3	1.3	2.1	0.3	8.7	1.2	13.2	5.7	9.2	27.8
1992	9.6	2.4	0.8	1.4	0.5	7.3	-	2.1	0.4	6.7	0.9			8.9	29.0
1993	9.8			1.0	1.1	10.8	0.1	2.1	0.0	15.6				7.2 [6]	
1994	9.0			1.4	0.6	9.8	1.4	0.6	0.4			14.1	5.1	2.3 [6]	27.1
1995	9.4	1.6	1.2	0.3	0.9	8.4	0.1	0.9	0.0	1.8	1.5	14.0	7.2	4.4	
1996	4.6	1.4	0.3	1.2	0.7	6.3	1.2	2.8	0.0	3.5	0.9	13.1	6.5	3.4	31.0
1997	5.3	0.7	0.5	2.4	0.5	12.7	0.8	0.8	0.0	1.7	0.3	14.0	8.6	2.7	19.8
1998	5.3	1.0	1.0	1.3		5.5	1.1	1.5	0.6	7.2	1.0			1.9	13.4
1999	7.7	1.3	0.9			6.4	0.9	1.3	0.0	4.2	2.2			2.8	16.5
2000	6.3	0.8	0.5			9.4	0.0	0.4	1.1	12.5	1.7	9.0	4.6	3.3	10.1
2001	5.1	2.8	1.1			7.2	1.1	1.3	1.3	2.5	2.2	8.5	4.9	0.4	12.4
2002	4.4	0.8	0.8			6.0	0.5	0.8	0.5	5.5	1.1	6.4	6.0	0.8	11.3
2003	9.1	1.2	0.2			8.3	2.1	4.3	0.9	3.5	0.7			0.5	6.8
2004	7.7	1.7				6.3	0.8	3.1	1.2	6.1	1.4	18.0	11.7		6.8
2005	6.4							2.5		3.4		12.8			5.9
Mean															
(5-year)	6.5	1.5	0.7			7.4	0.9	2.0	1.0	6.0	1.4	10.5	6.8	1.3	9.5
(10-year)	6.5	1.3	0.7	1.3	0.7	7.7	0.8	1.7	0.6	4.9	1.3	11.9	7.1	2.2	14.2

[1] Microtags.
[2] Carlin tags, not corrected for tagging mortality.
[3] Microtags, corrected for tagging mortality.
[4] Assumes 50% exploitation in rod fishery.
[5] From 0+ stage in autumn.
[6] Incomplete returns.
[7] Assumes 30% exploitation in trap fishery.

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

Smolt year	Iceland[1]		Norway[2]						Sweden[2]	
	R. Ranga		R. Halselva		R. Imsa		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1981					10.1	1.3				
1982					4.2	0.6				
1983					1.6	0.1				
1984					3.8	0.4	3.5	3.0	11.8	1.1
1985					5.8	1.3	3.4	1.9	11.8	0.9
1986					4.7	0.8	6.1	2.2	7.9	2.5
1987			1.5		9.8	1.0	1.7	0.7	8.4	2.4
1988			1.2	0.1	9.5	0.7	0.5	0.3	4.3	0.6
1989	1.6	0.1	1.9	0.5	3.0	0.9	1.9	1.3	5.0	1.3
1990	0.9	0.2	2.1	0.3	2.8	1.5	0.3	0.4	5.2	3.1
1991	0.1	0.0	0.6	0.0	3.2	0.7	0.1	0.1	3.6	1.1
1992	0.4	0.1	0.5	0.0	3.8	0.7	0.4	0.6	1.5	0.4
1993	0.9	0.1	-	-	6.5	0.5	3.0	1.0	2.6	0.9
1994	1.2	0.2	-	-	6.2	0.6	1.2	0.9	4.0	1.2
1995	0.9	0.1	-	-	0.4	0.0	0.7	0.3	3.9	0.6
1996	0.1	0.0	1.2	0.2	2.1	0.2	0.3	0.2	3.5	0.5
1997	0.2	0.1	0.6	0.0	1.0	0.0	0.5	0.2	0.6	0.5
1998	0.5	0.0	0.5	0.5	2.4	0.1	1.9	0.7	1.6	0.9
1999	0.6	0.0	2.3	0.2	12.0	1.1	1.9	1.6	2.1	
2000	1.0	0.1	1.0	0.7	8.4	0.1	1.1	0.6		
2001	0.2	0.1	1.9	0.6	3.4	0.1	2.2	1.2		
2002	0.4		1.4	0.0	4.5	0.8	1.1	0.9		
2003			0.5	0.3	2.6	0.7	0.3	0.7		
2004			0.2	0.1	3.6	0.7	0.3	0.4		
2005			0.2		2.6		0.3			
Mean										
(5-year)	0.6	0.1	1.0	0.3	4.5	0.5	1.0	0.8		
(10-year)	0.5	0.1	1.1	0.3	4.0	0.4	1.0	0.7	2.3	0.6

[1] Microtagged.

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

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

	Ireland									UK (N. Ireland)[3]	
Smolt year	R. Shannon	R. Screebe	R. Burrishoole[1]	R. Delphi	R. Bunowen	R. Lee	R. Corrib Cong.[2]	R. Corrib Galway[2]	R. Erne	R. Bush smolts 1+	R. Bush smolts 2+
1980	8.6		3.3			8.3	0.9				
1981	2.8		6.9			2.0	1.5				
1982	4.0		8.2			16.3	2.7	16.1			
1983	3.9		2.3			2.0	2.8	4.1		1.9	8.1
1984	5.0	10.4	23.5			2.3	5.2	13.2	9.2	13.3	
1985	17.8	12.3	26.3			14.7	1.4	14.4	7.9	15.4	17.5
1986	2.1	0.4	7.6			16.4		7.6	10.1	2.0	9.7
1987	4.7	8.3	11.2			8.8		2.2	7.0	6.5	19.4
1988	4.9	9.2	13.8			5.5	4.2		2.6	4.9	6.0
1989	5.0	1.6	7.9			1.7	6.0	4.9	1.2	8.1	23.2
1990	1.3	0.0	7.1			2.5	0.2	2.3	2.5	5.6	5.6
1991	4.2	0.2	12.5	11.3		0.8	4.9	4.0	1.3	5.4	8.8
1992	4.4	1.3	6.3	10.7	4.2		0.9	0.6		6.0	7.8
1993	2.9	2.2	12.0	14.0	5.4		1.0			1.1	5.8
1994	5.2	1.9	14.3	3.9	10.8			5.3		1.6	
1995	3.6	4.1	6.6	3.4	3.5		2.4			3.1	2.4
1996	2.9	1.8	5.3	10.1	3.4					2.0	2.3
1997	6.0	0.4	13.3	16.2	5.3	7.0			7.6	-	4.1
1998	3.1	1.3	4.9	7.0	2.9	4.6	3.3	2.9	2.5	2.3	4.5
1999	1.0	2.8	8.1	15.4	2.0			3.6	3.5	2.7	5.8
2000	1.2	3.8	11.8	15.9	5.4	3.5	6.7		4.0	2.8	4.4
2001	2.0	2.5	9.7	17.2	3.2	2.0	3.4		5.9	1.1	2.2
2002	1.0	4.1	9.2	11.5	2.0	1.9		2.0	1.9	0.7	3.1
2003	1.2		6.0	3.7	1.6	4.3		1.2	1.0	2.5	1.9
2004	0.4	1.8	9.4	7.6	1.8	2.2		4.5	3.2	0.7	1.9
2005	0.7	3.4	4.8	11.0	0.9	1.0		4.8	0.9	1.8	1.7
Mean											
(5-year)	1.2	3.1	9.2	11.2	2.8	2.8	5.1	2.6	3.2	1.5	2.7
(10-year)	2.2	2.5	8.4	10.8	3.1	3.6	4.0	2.8	3.7	2.0	3.3

1 Return rates to rod fishery with constant effort.

2 Different release sites

3 Microtagged.

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

Country	Objective	Measure	Assessment	Outcome/extent achieved	Further consideration
Russia	Reduce commercial fishing effort and enhance recreational catch and release fisheries	Various management measures including prohibition of some important commercial in-river fisheries and allocation quotas for fisheries	Examination of catch statistics	Mean total commercial catch reduced by 38% and mean in-river commercial catch reduced by 67% (2002-2006 compared to 1997-2001). Catch and release increased twice in past 5 years	Further reductions likely to be introduced
Ireland	Reduce exploitation rates and increase freshwater returns leading to simultaneous attainment of CLs in all rivers	TAC imposed in 2002 which has been reduced by 17%, 11%, 14% and 35% annually or 58% in total. Restrictions in angling catch including bag limits and mandatory catch and release operated from the 1st of September in 8 fishery districts which were assessed as being below their Conservation Limits	Examination of coded wire tagging returns to Irish and UK rivers pre and post imposition of TACs	Exploitation rate reduced from 61% (pre-2002) to 46% (post 2002) for wild salmon, 82% to 69% for hatchery salmon Exploitation rate on UK stocks reduced by up to 50% following management measures in 1997 and imposition of TACs	Mixed stock marine fisheries will not operate in 2007 and hereafter.
	Maintain salmon stocks in SAC rivers at favourable conservation status	As above	Examination of counter (14 rivers) or rod catch (16 rivers)data to assess CL compliance for 30 SAC rivers	Following re-apraisal in 2007 and with the closure of the irish mixed stock fishery at sea, 19 of 30 SAC rivers will probably meet CLs	Under the EU Water Framework Directive water quality and fish passage are expected to improve
UK (England & Wales)	Safeguard MSW stock component	National spring salmon measures introduced in 1999 (restricted net fishing before June and required compulsory catch & release by anglers up to June 16)	Estimated 1,000 salmon saved from net fisheries and 1,600 saved from rod fisheries in 2006 due to these measures	Spawning escapement of spring salmon may have increased by up to one third on some rivers due to measures	Measures will remain in place until at least 2008.
	Stocks to meet or exceed CLs in at least 4 years of 5	Mixed stock fishery measures imposed including phase outs, closures, buy outs and reductions in fisheries	Examination of catch statistics and annual compliance	Coastal fishery catch reduced from average of 41,000 (88-92) to under 32,000 (98-02) and to about 9,500 (03-06) Declared rod catch in 5 north east rivers 61% higher on average in the 4 years since net buy out in 2003, relative to average of 5 years before buy out.	Continuing to phase out remaining mixed stock fisheries and focus on other limiting factors. Annual application of decision structure to assess need for effort controls.
			Examination of counters	Recorded runs (salmon + sea trout) into the Tyne 97% higher since 2003 compared with mean of previous 5 years.	Continue monitoring
		Promote catch and release, including 100% catch and release in some catchments.	Examination of catch statistics, release rates and annual compliance	Catch and release increased to over 50% of rod caught fish in recent years & 100% C&R on some catchments. Estimated to have contributed an extra 34 million eggs in 2006.	Continuing promotion of C&R at national and local levels.

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

Country	Objective	Measure	Assessment	Outcome/extent achieved	Further consideration
UK (England & Wales)	To meet a management target on the River Lune of 14.4 million eggs or about 5,000 adults	Regulations on River Lune introduced in 2000 to reduce exploitation in net and rod fisheries by 50% and 25% respectively.	Assessment of counter data, catch statistics and juvenile monitoring data	Increase in salmon spawning and management target exceeded in all years since the regulation. Increases in juvenile production and net catch.	Contine to meet management objectives
	Maintain salmon stocks in SAC rivers at favourable conservation status	Fishing controls, catch and release and addressing issues identified in Salmon Action Plans as appropriate.	Examination of counter/rod data to assess CL compliance for 18 rivers designated as SACs	2 are currently considered to be complying with the management objective of passing the CL 4 years out of 5.	Continue with management plan to meet management objectives. Targeted actions as identified in Salmon Action Plans.
UK (Northern Ireland)	To conserve, enhance, restore and manage salmon stocks in catchments throughout Northern Ireland through two Salmon Management Plans (FCB and Loughs Agency areas).	Voluntary net buyout scheme initiated in FCB area in 2001/2.	Examination of fish counter & rod catch data to assess spawning escapement on index rivers with defined CLs	Homewater exploitation in FCB area reduced from around 10,542 fish per year (1992-2001) to about 2,852 salmon per year (2002-06).	Continue monitoring and management protocols under the salmon management plans.
		Introduction of conservation policies in angling byelaws including mandatory catch & release before 1st June and bag limit of 2 salmon per day thereafter in the FCB area.	Examination of juvenile electric fishing assessments in-river habitat surveys		Continue to develop salmon management plans on other major catchments to define CLs and compliance monitoring mechanisms.
		Rational management of fishery in Loughs Agency area based on compliance against temporal management targets with statutory instruments to increase/decrease in-season effort accordingly.	Assessment of commercial and recreational exploitation through a carcass tagging scheme in both FCB and Loughs Agency areas.		Monitor effect of habitat enhancement schemes.
		Introduction of salmon management plan in FCB area to facilitate monitoring against CL's.	Examination of CWT data to assess exploitation/survival rates.		

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

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

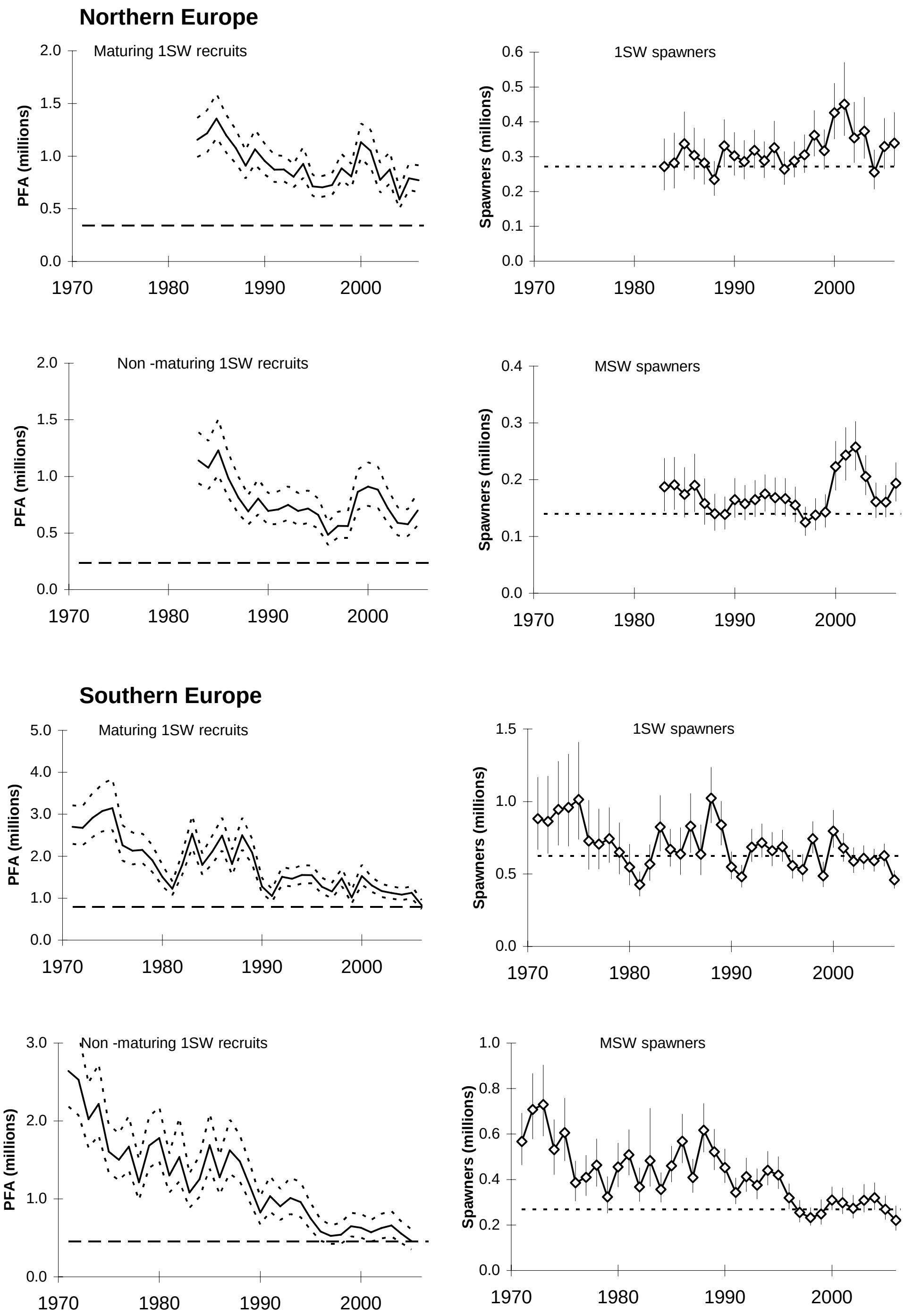


Figure 3.1.1. **Estimated PFA (recruits), with 95% confidence limits, and Spawning Escapement Reserve for maturing and non-maturing salmon in Northern & Southern Europe**

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

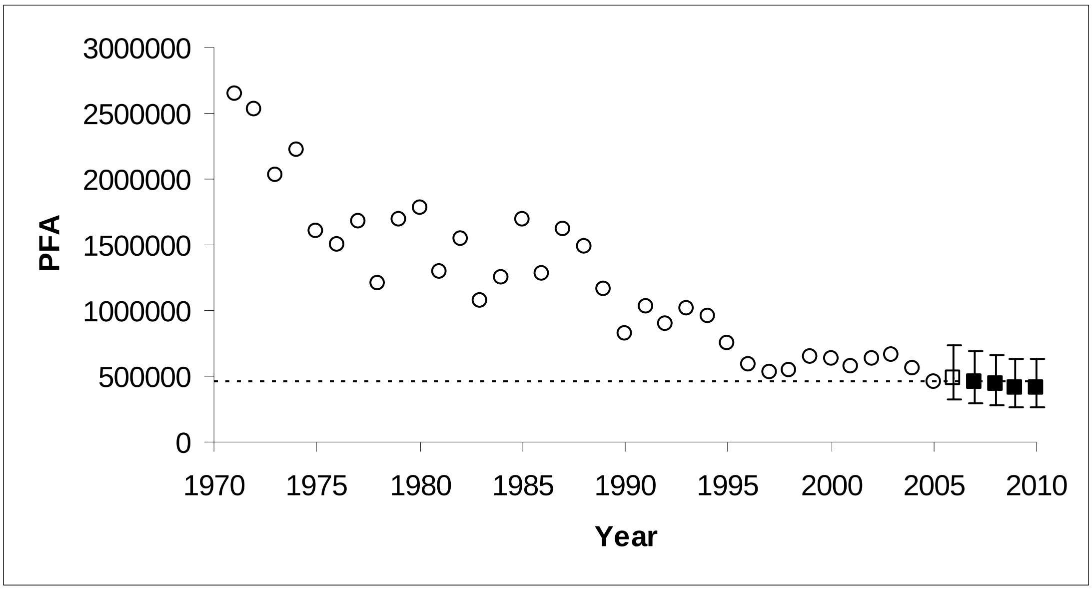


Figure 3.6.1.1. PFA trends and predictions (95% confidence limits) for non-maturing 1SW European stock. Note: open square is 2006 update and blocked squares are 2007 to 2010 forecasts.

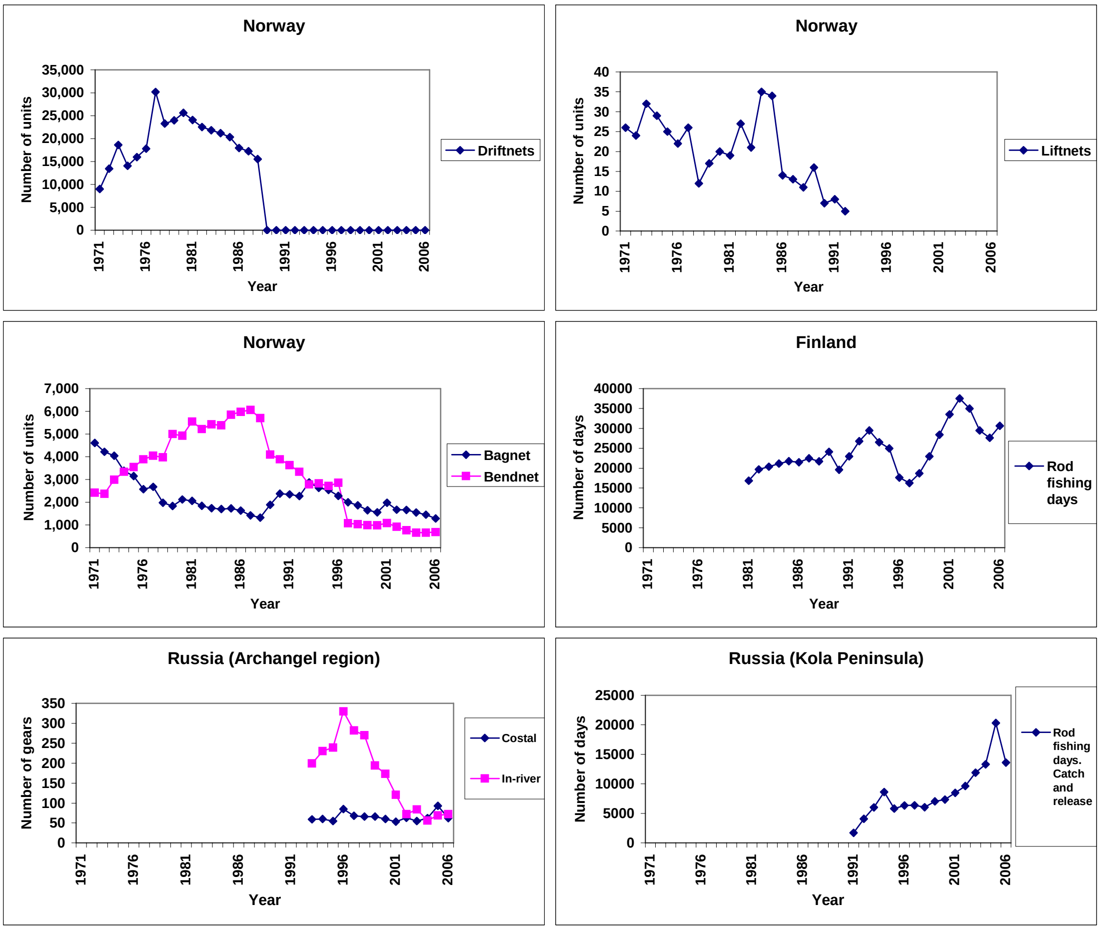


Figure 3.8.3.1. Overview of effort as reported for various fisheries and countries 1971- 2006 in the Northern NEAC area.

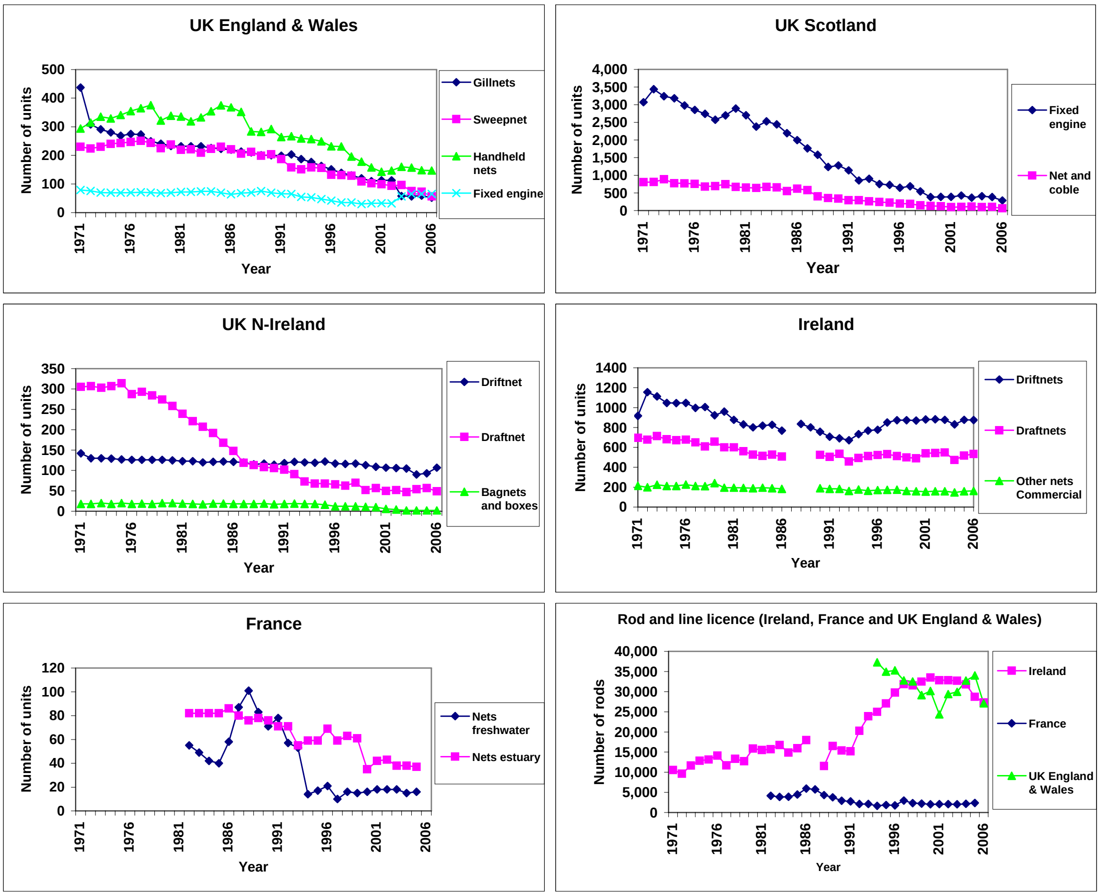


Figure 3.8.3.2. Overview of effort as reported for various fisheries and countries 1971- 2006 in the Southern NEAC area.

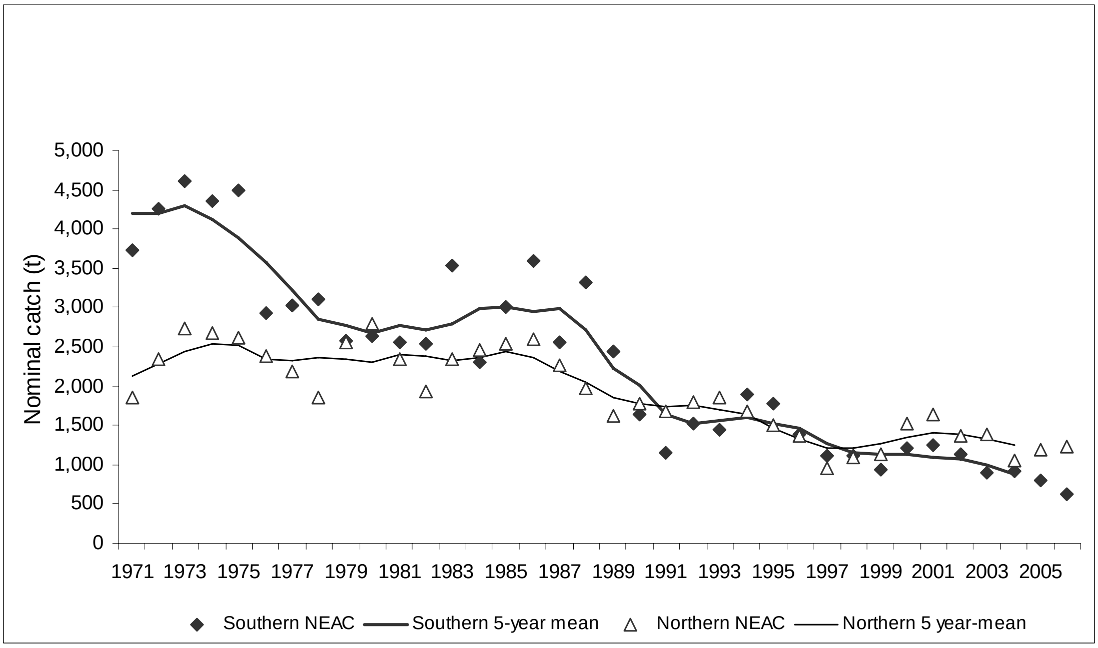


Figure 3.8.4.1. Nominal catch of salmon and 5-year running means in the Southern and Northern NEAC Areas, 1971–2006.

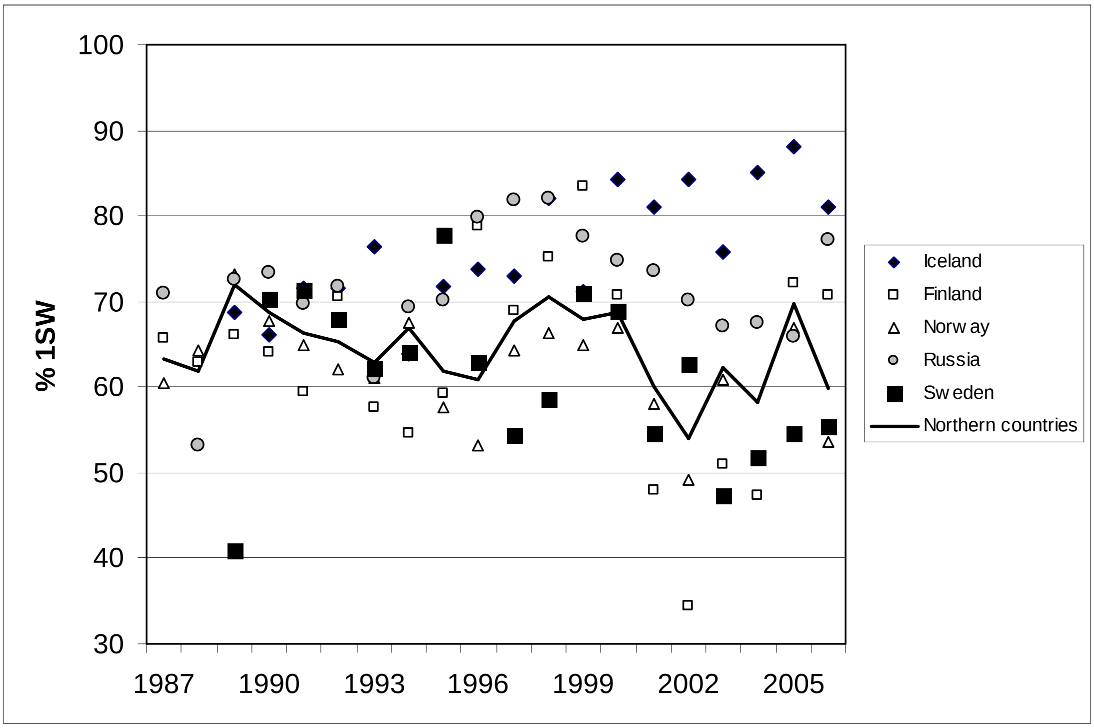


Figure 3.8.6.1. Percentage of 1SW salmon in the reported catch for Northern NEAC countries, 1987–2006. Solid line denotes mean value from catches in all NEAC Northern countries.

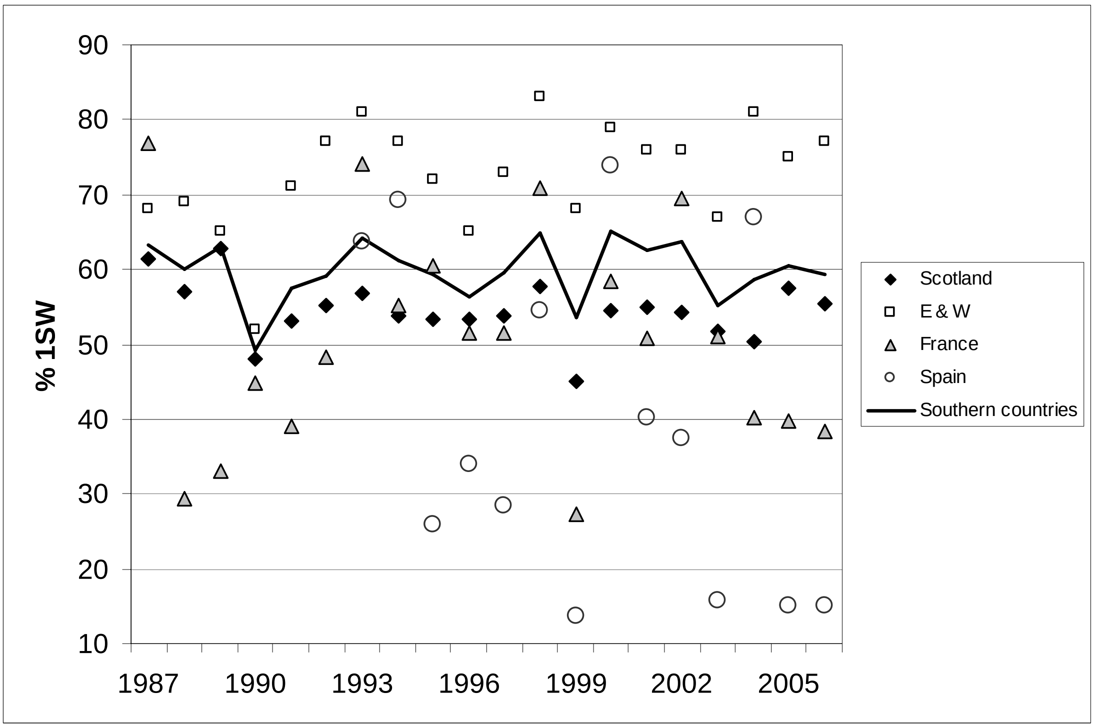
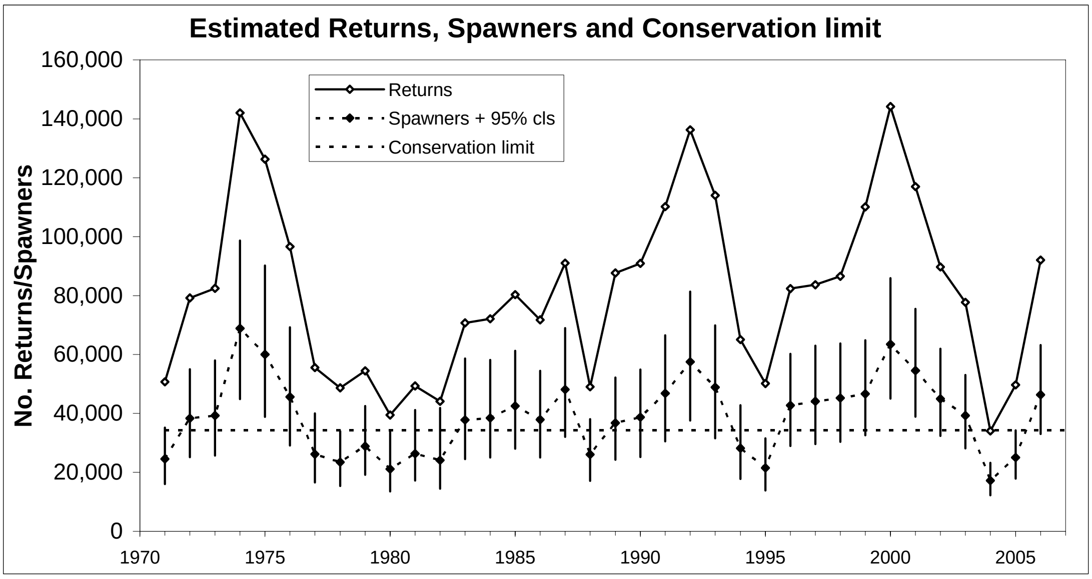
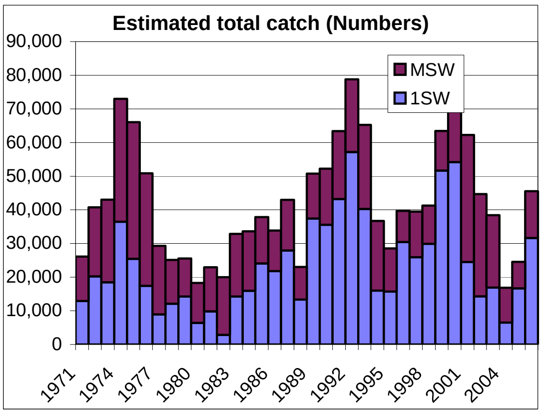
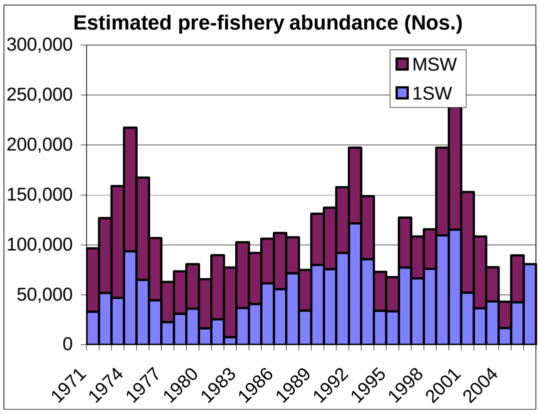
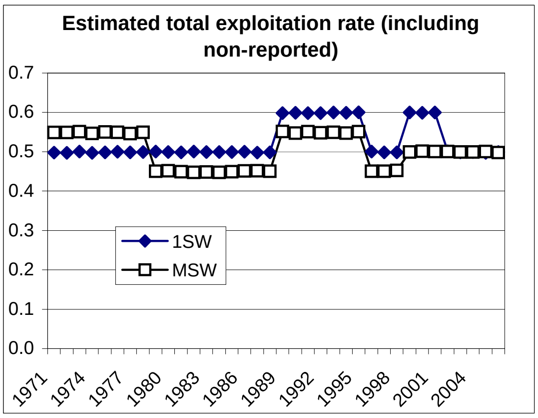


Figure 3.8.6.2. Percentage of 1SW salmon in the reported catch for Southern NEAC countries, 1987–2006. Solid line denotes mean value from catches in all NEAC Southern countries.









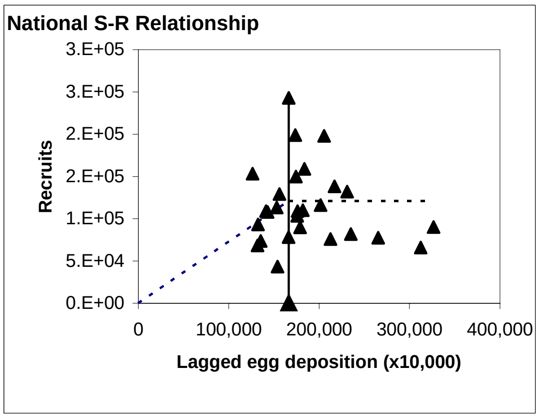


Figure 3.8.12.1a. Summary of fisheries and stock description. R. Tana/Teno (Finland & Norway combined).

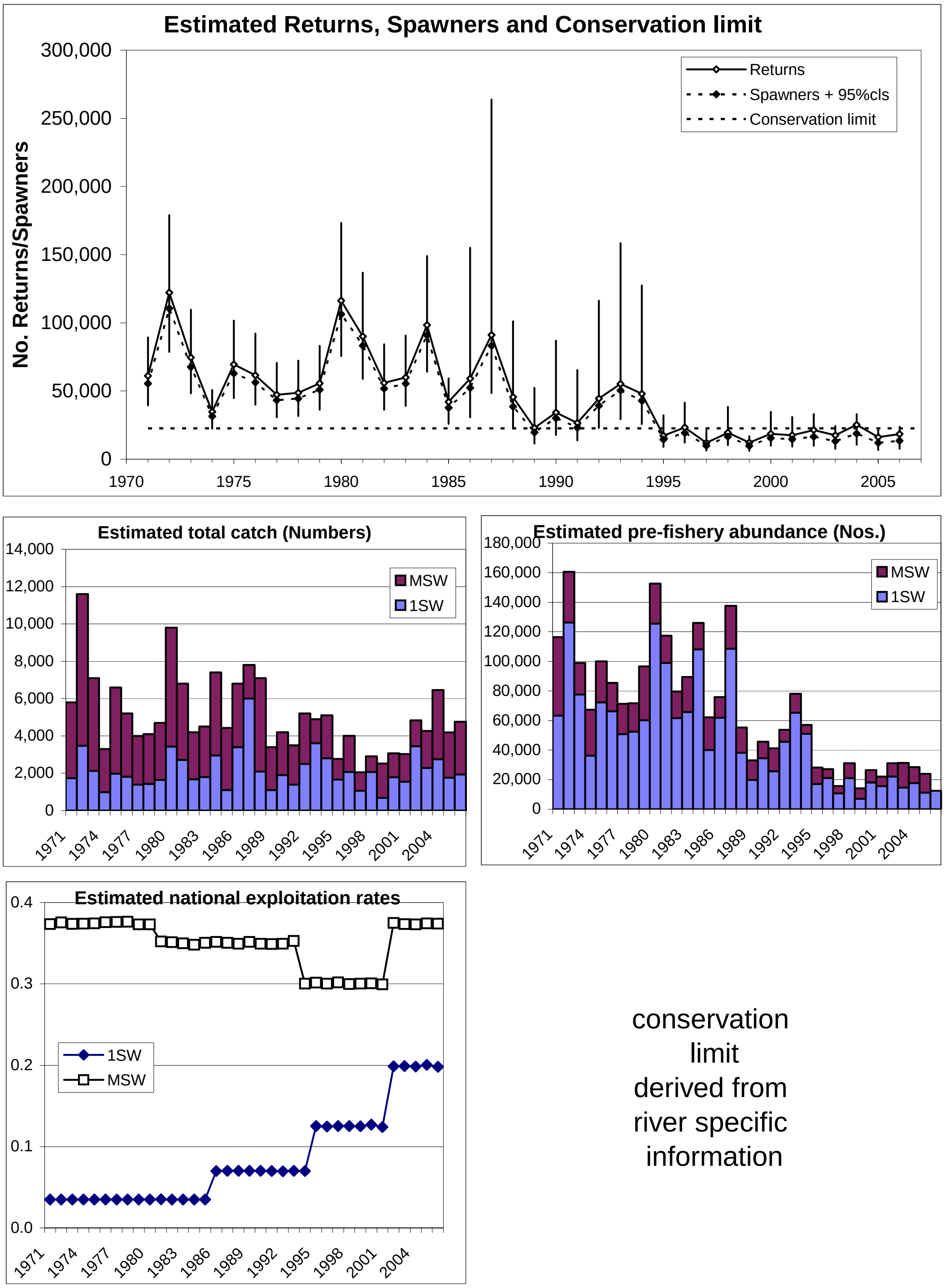


Figure 3.8.12.1b. Summary of fisheries and stock description. France.

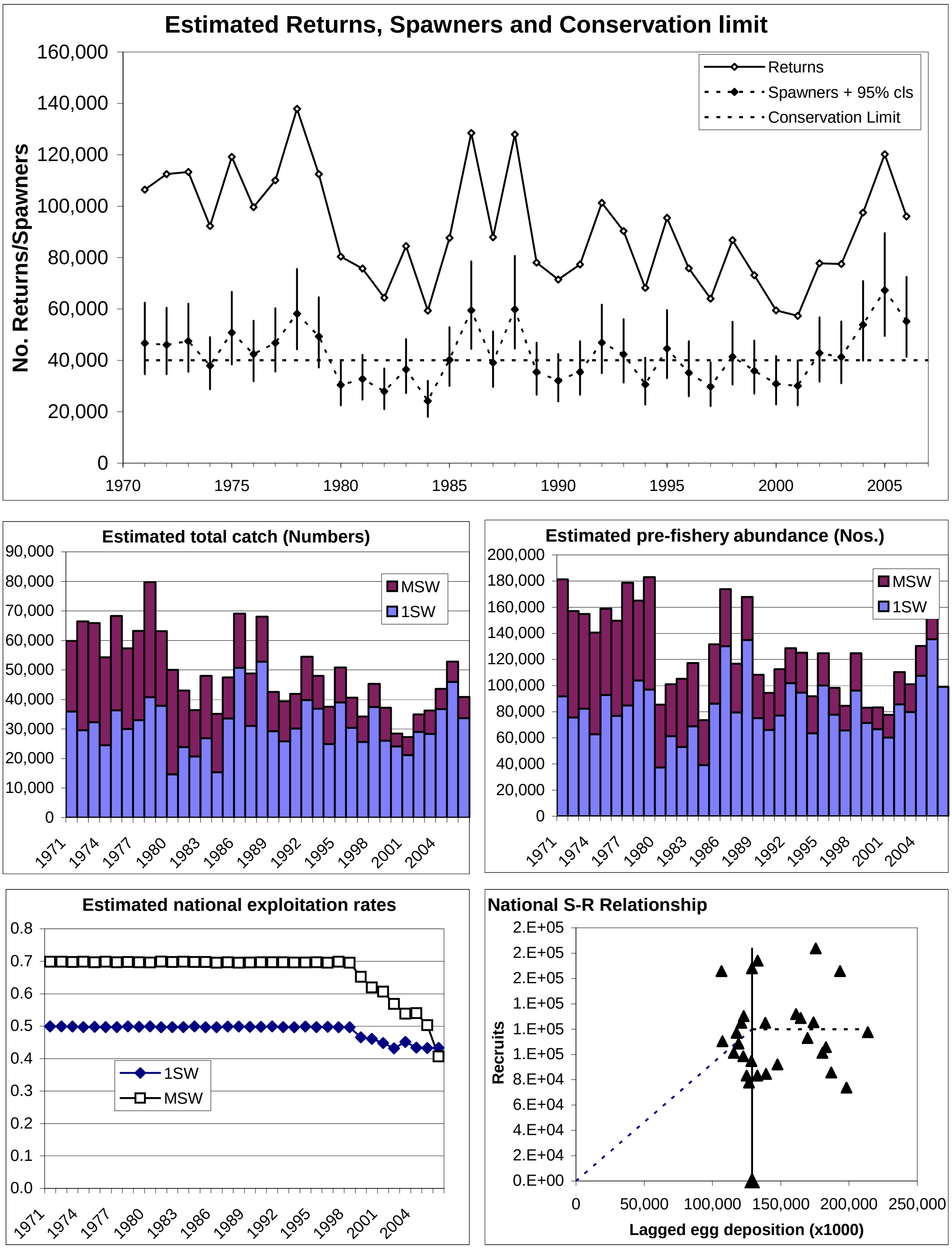


Figure 3.8.12.1c. Summary of fisheries and stock description. Iceland.

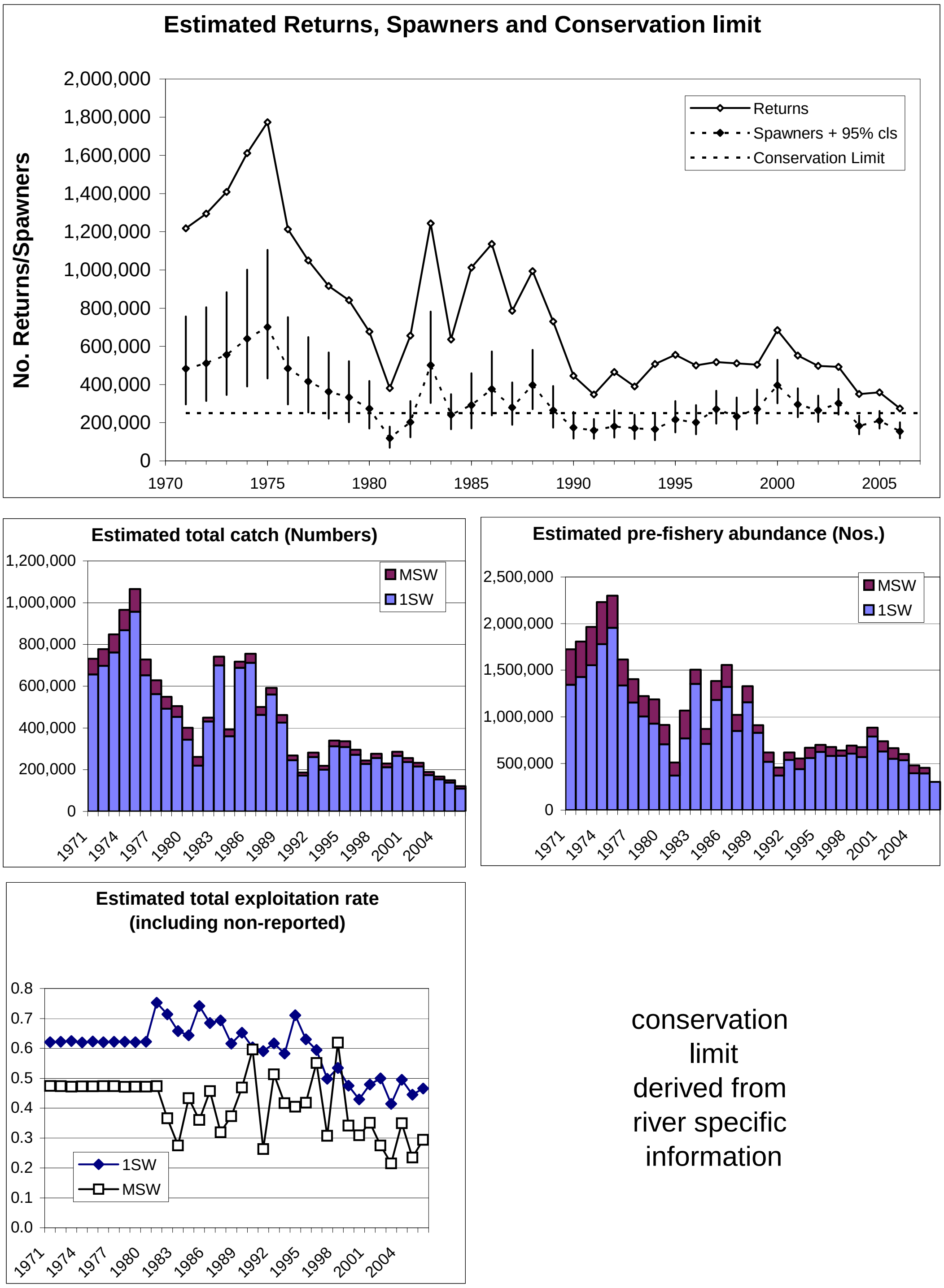


Figure 3.8.12.1d. Summary of fisheries and stock description. Ireland.

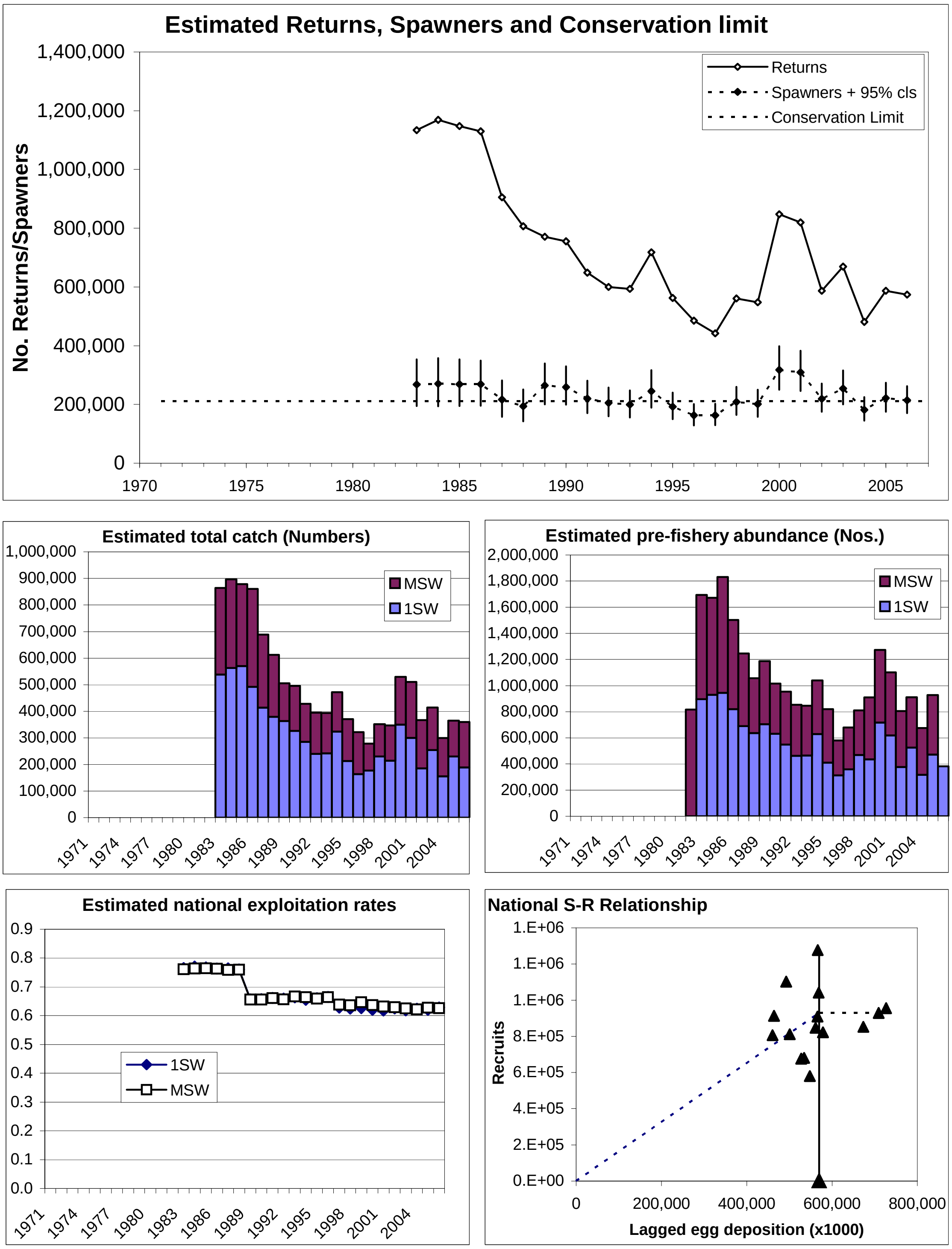


Figure 3.8.12.1e. Summary of fisheries and stock description. Norway (minus Norwegian rod catches from the R. Teno).

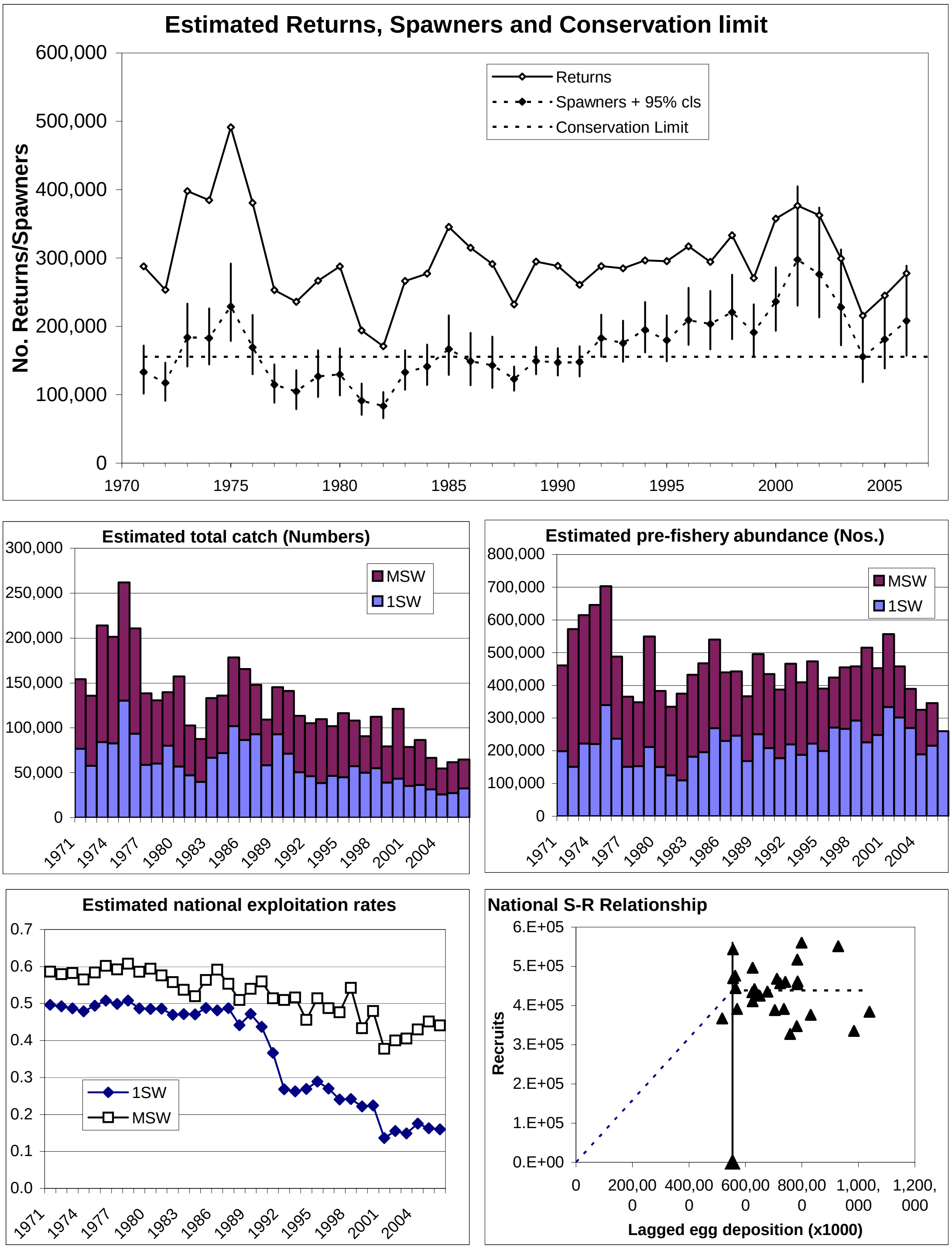


Figure 3.8.12.1f. Summary of fisheries and stock description. Russia.

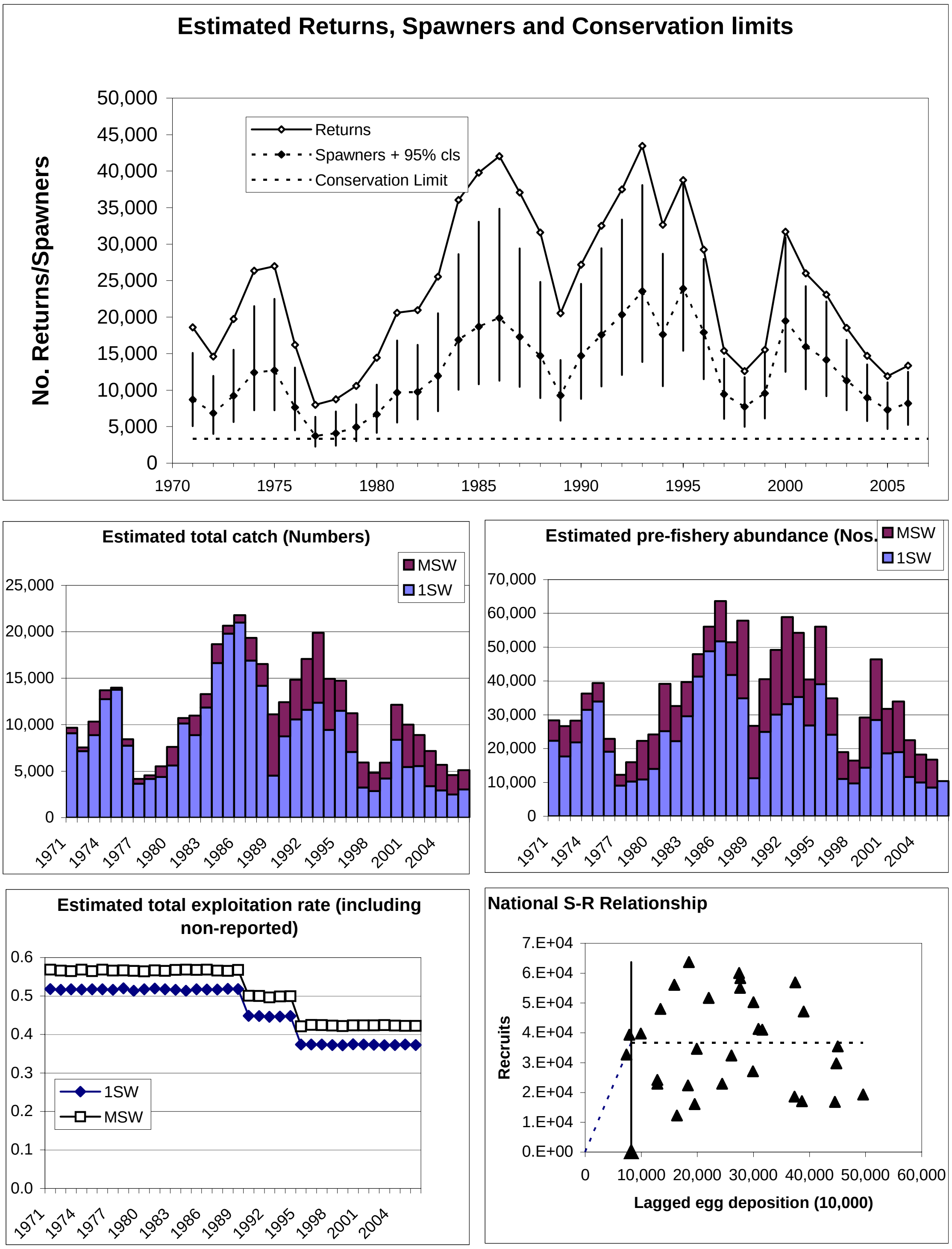


Figure 3.8.12.1g. Summary of fisheries and stock description. Sweden.

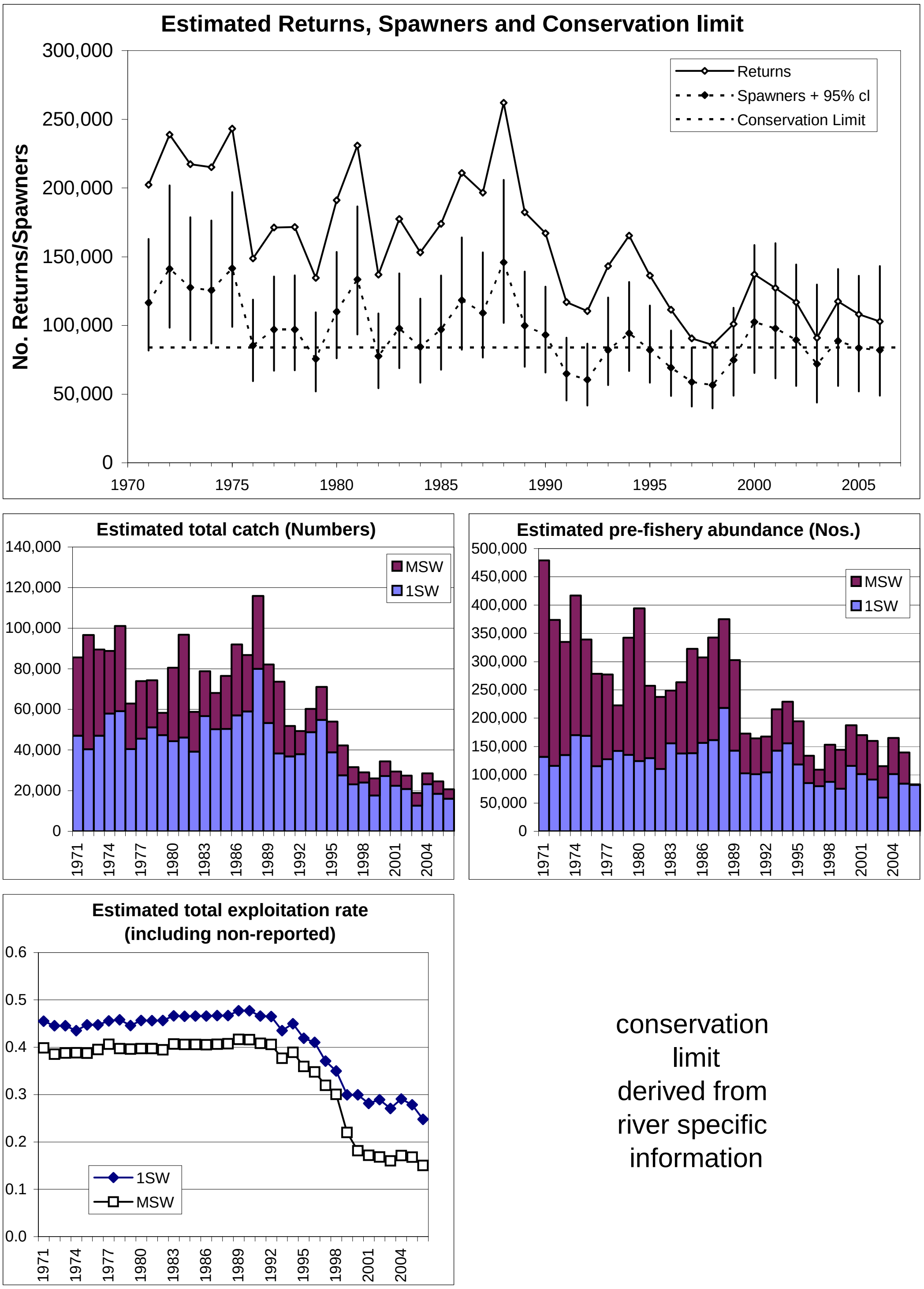


Figure 3.8.12.1h. Summary of fisheries and stock description. UK (England & Wales).

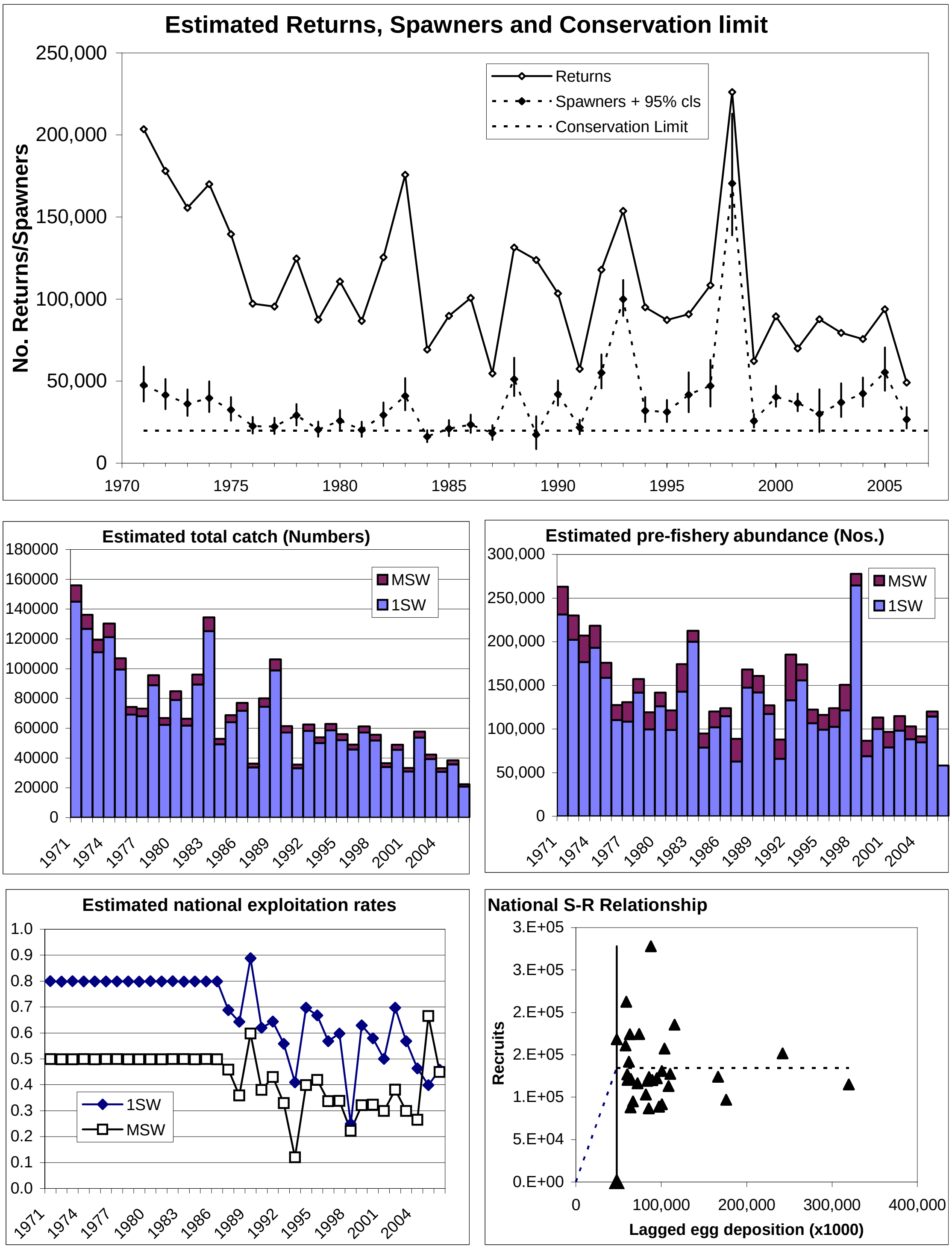


Figure 3.8.12.1i. Summary of fisheries and stock description. UK (Northern Ireland).

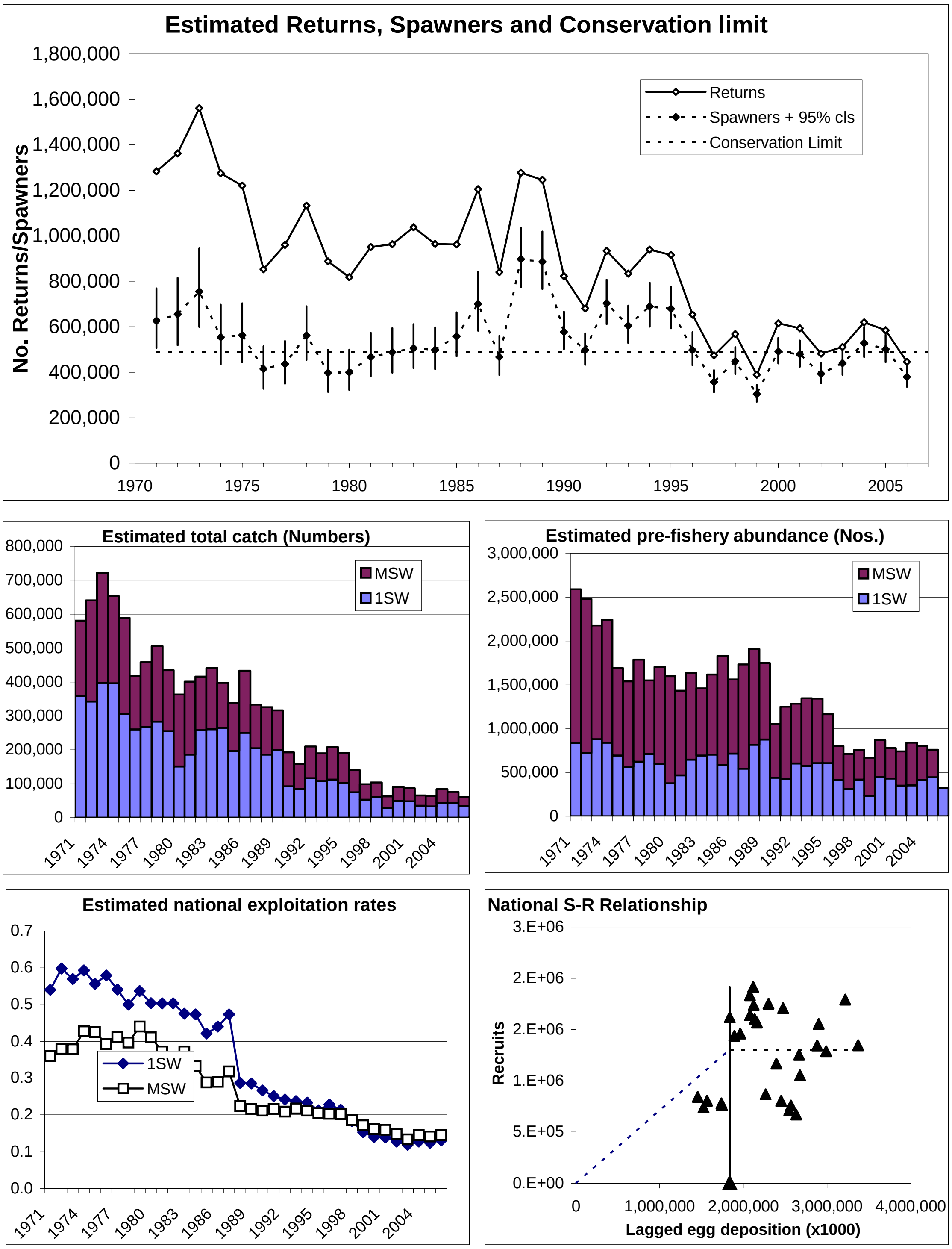


Figure 3.8.12.1j. Summary of fisheries and stock description. UK (Scotland).

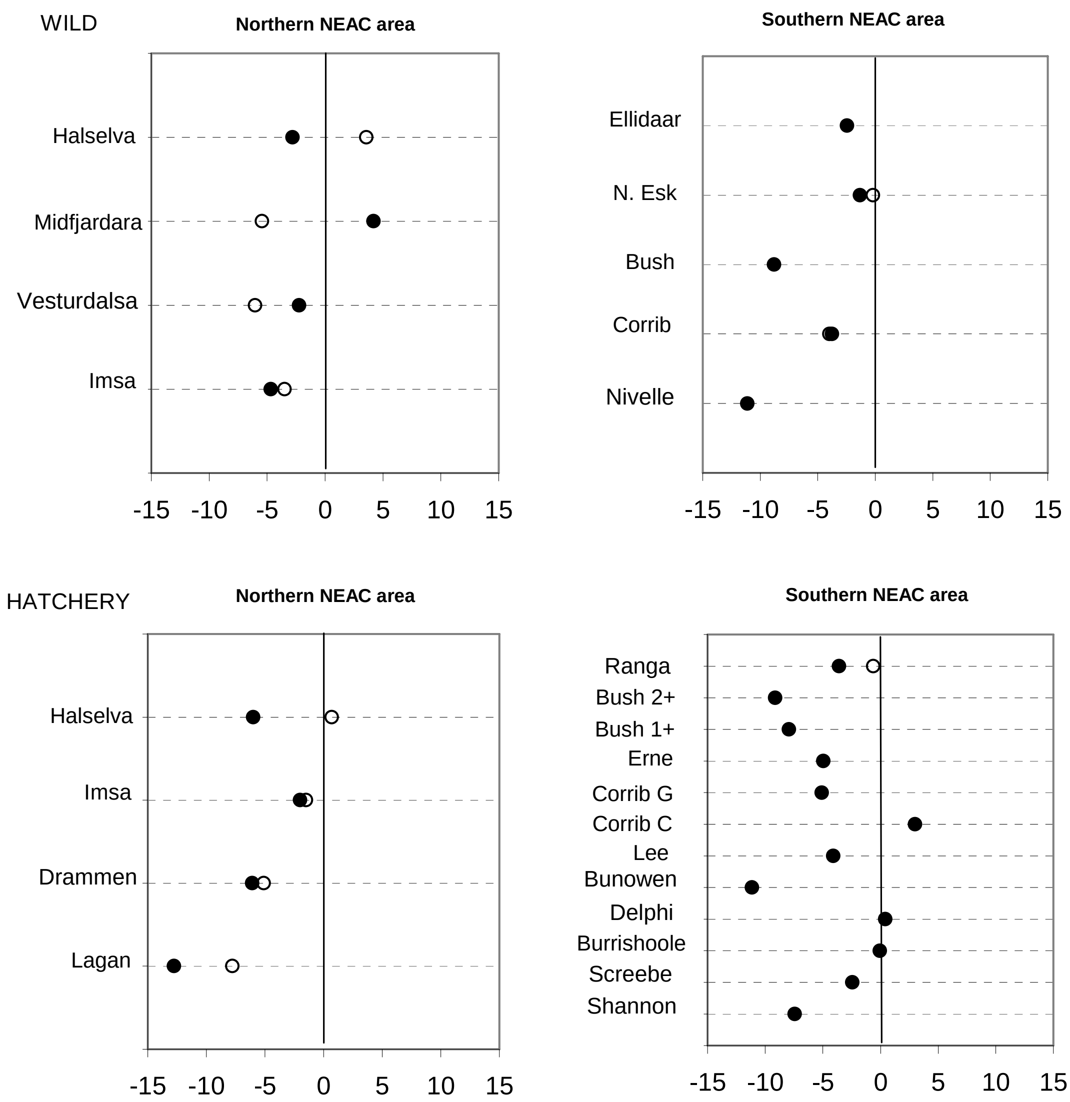


Figure 3.8.14.1. Annual rates of change (%) in marine survival indices of wild and hatchery smolts to adult returns to homewaters (prior to coastal fisheries) in different rivers in northern and Southern NEAC areas. Filled circle = 1SW salmon; open circle = 2SW salmon. NB. The annual rates of change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

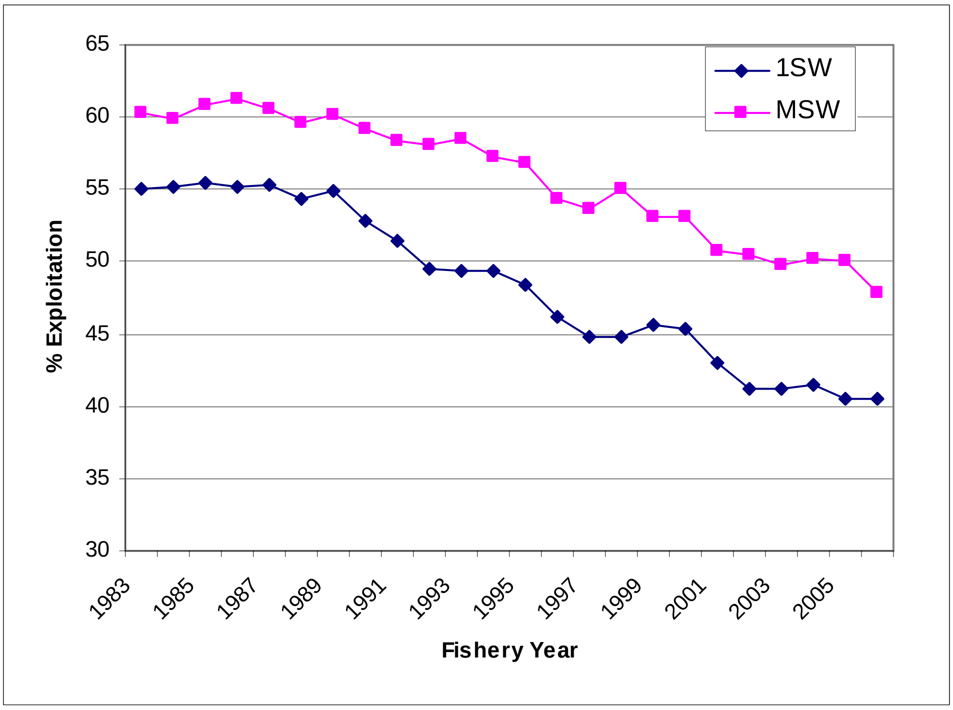


Figure 3.8.15.1. Exploitation rates of wild 1SW and MSW salmon by commercial and recreational fisheries in the Northern NEAC area from 1971–2006.

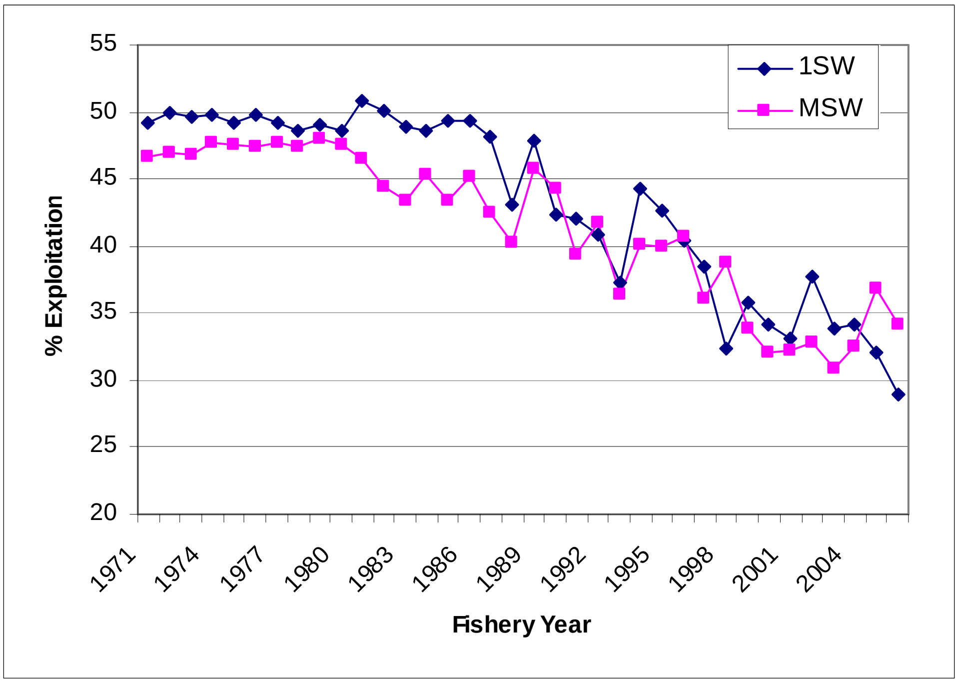


Figure 3.8.15.2. Exploitation rates of wild 1SW and MSW salmon by commercial and recreational fisheries in the Southern NEAC area from 1971–2006.

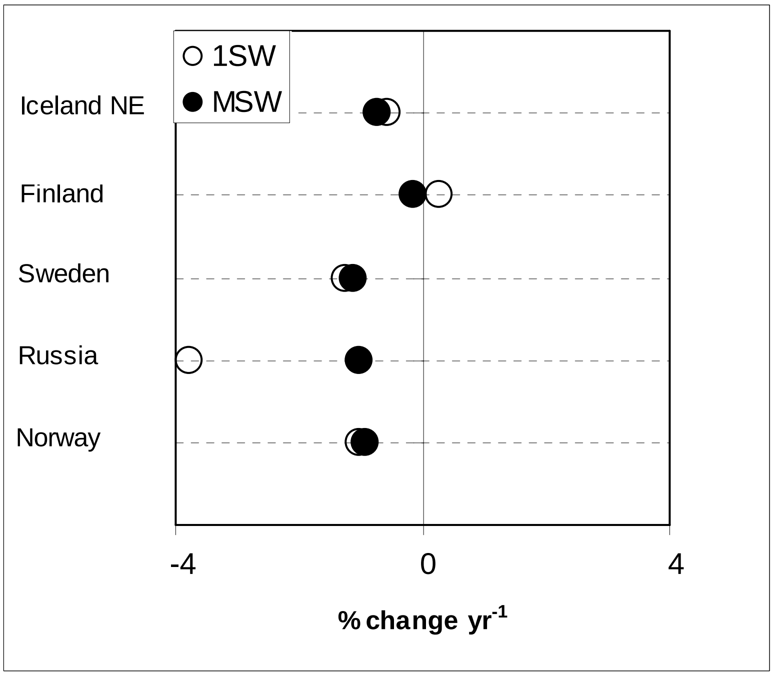


Figure 3.8.15.3. The rate of change of exploitation of 1SW and MSW salmon in northern NEAC countries.

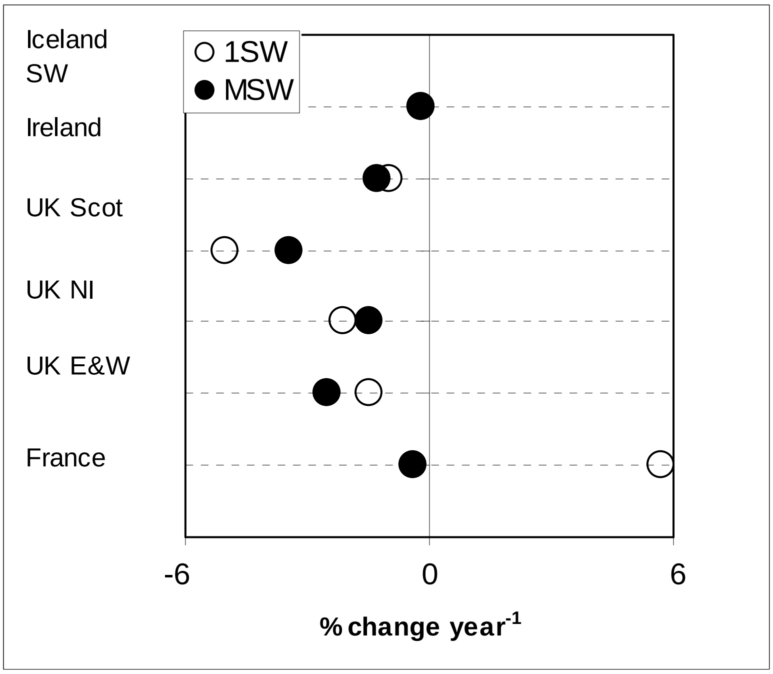


Figure 3.8.15.4. The rate of change of exploitation of 1SW and MSW salmon in southern NEAC countries.

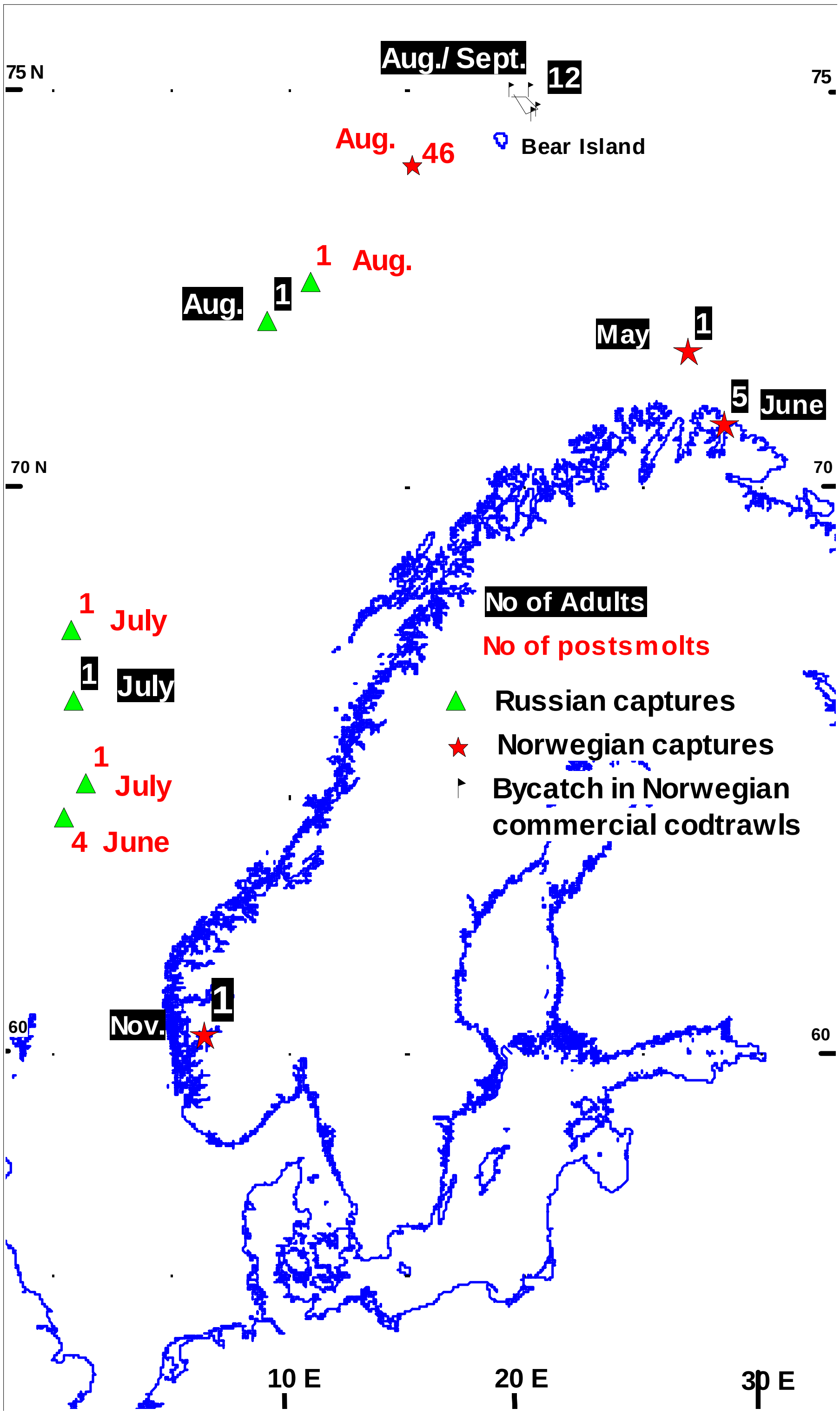


Figure 3.10.2. Number and month of capture of post-smolts and adult salmon in non- target fisheries by Russian commercial trawlers (triangles) and Norwegian research ships (stars) in 2006.

4 North American Commission

4.1 Status of stocks/exploitation

In 2006, the midpoint of the 2SW spawner estimates for six geographic areas indicated that all areas except Newfoundland were below their conservation limit (Figure 4.9.7.3) and are suffering reduced reproductive capacity. Newfoundland was at risk of suffering reduced reproductive capacity.

The estimated exploitation rate of North American origin salmon in NAC fisheries has declined (Figure 4.9.6.1) from approximately 80% to 17% for 2SW salmon and from approximately 60% to 17% for 1SW salmon.

The stock status is elaborated in Section 4.9.

4.2 Management objectives

Management objectives are included in Section 1.4.

4.3 Reference points

There are no changes recommended in the 2SW salmon conservation limits (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	4 022
	Gulf of St. Lawrence	30 430
	Québec	29 446
	Scotia-Fundy	24 705
Canada Total		123 349
USA		29 199
North American Total		152 548

4.3.1 Conservation Requirements for Labrador

The current conservation requirement for Labrador was developed from maximum total harvests and an assumed recruit per spawner factor of three. The current standard conservation requirement of 240 eggs per 100 m^2 of parr-rearing habitat that is used for some Eastern Canadian rivers has not been applied to Labrador because of the lack of river specific production areas and because this rate may be unsuitable. Labrador rivers are more northerly and are exposed to a much colder climate than rivers than where the rate was derived. As a result of the colder climate, Labrador salmon generally have older smolt ages and therefore longer freshwater residency which could affect the conservation requirement. Also, many Labrador rivers have abundant anadromous charr (*Salvelinus alpinus* L.) and trout (*Salvelinus fontinalis* Mitchill) which are more abundant than in rivers to the south and may compete with salmon in freshwater for space and food. The preferred approach to defining biological reference points is through the analysis of stock and recruit relationships (SR). Development of reference points, such as conservation requirements, from SR time series requires a number of years of measured spawners and adult returns which have not been collected for any Labrador river.

The Working Group was informed of a publication (Reddin *et al*., 2006) that utilized local and regional data to develop three conservation reference point values for Labrador rivers. The first approach was based on a quasi-stock and recruit method and used fishery generated SR data previously developed for ICES to assess the returns and spawners in the Labrador. The second considered measured smolt production from Sand Hill River adjusted to variable freshwater survival rates developed in Newfoundland to derive comparable rates for Sand Hill River. The third was based on re-constructed SR data derived from angling catch rates from years when a counting fence was operated. The re-constructed SR data was used to estimate a conservation requirement at 50% of the equilibrium population. Results from the three methods indicated 161 (95% CL 110 to 309) eggs per 100 m^2 for the quasi-SR approach, 152 (95% CL 80 to 370) eggs per 100 m^2 based on the Sand Hill smolt production data and 187 (95% CL 153 to 201) from the SR analysis of Sand Hill River fence and angling data. Based on the data and analysis and until more information can be collected at higher escapements, it was decided that a CL of 190 eggs per 100 m^2 be adopted.

The Working Group noted that these new rates will only be used for river specific salmon management and not for international fisheries management at this time. The Working Group encouraged the development of conservation requirements based on local information but noted that application of these rates was dependent on quantification of local juvenile salmon production areas that are currently unavailable for Labrador. The Working Group also encouraged the comparison of any new conservation requirements to that currently used which was developed from past high yields and assumed escapements that led to those yields.

4.4 Management advice

As the predicted number of 2SW salmon returning to North America in 2007 is substantially lower than the 2SW CL there are no catch options for the composite North American fisheries. Where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

Wild salmon populations are now critically low in an extensive portions of North America and remnant populations require alternative conservation actions to fisheries regulation to maintain their genetic integrity and their 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

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

4.6 Updated forecast of 2SW maturing fish for 2006

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

It is possible to provide catch options for the North American Commission area for four years. The updated forecast for 2007 for 2SW maturing fish is based on an updated forecast of the 2006 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2006 as 1SW non-maturing fish. The estimates for the 2008–2010 fisheries on maturing 2SW salmon are based on the pre-fishery abundance forecast for 2007–2009 from Section 4.9.10.

4.6.1 Catch options for 2007 fisheries on 2SW maturing salmon

The updated forecast of the pre-fishery abundance for 2006 provides a PFA mid-point of 117 431, about 1% lower than the forecast last year. The 2006 pre-fishery abundance of maturing 2SW salmon will be available in homewaters in 2007.

To compare the PFA to CLs, the pre-fishery abundance of 117 431 fish can be expressed as 2SW equivalents by considering natural mortality of 3% per month for 11 months resulting in 84 424 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2006 for both the Labrador (744 midpoint of estimates) and Greenland (4 286) fisheries (Table 4.9.10.3). Adjusted for natural mortality these catches equate to 3 616 2SW salmon equivalents which potentially leaves 80 808 2SW salmon to return to rivers in North America in 2007.

As the predicted number of 2SW salmon returning to North America in 2007 is substantially lower than the 2SW CL of 152 548, there are no catch options at probability levels of 75%. Catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

4.7 Catch options for 2008–2010 for non-maturing 1SW

Catch options derived from the pre-fishery abundance forecast for 2007–2009 apply to North American fisheries in 2008–2010. Accounting for potential catches in 2007–2009 at West Greenland, and natural mortality to home waters, the management objective to achieve conservation escapements, (assuming a sharing arrangement of 40% of the surplus West Greenland and 60% to North America) the only risk averse catch option for 2SW salmon in 2008–2010 is zero catch on the composite North American stock.

4.8 Comparison with previous assessment and advice

The updated forecast of the pre-fishery abundance for 2006 provides a PFA mid-point of 117 000 fish. This is unchanged (-1%) from the value forecast last year at this time of 119 000 fish. This is mainly due to slight changes in the input values to the model used to forecast PFA for these stocks as well as changes in the parameter values resulting from the additional year of PFA and lagged spawner values used in the model.

4.9 NASCO has requested ICES to describe key events of the 2006 fisheries and the status of the stocks

4.9.1 Key events of the 2006 fisheries

- The majority of harvest fisheries were directed to small salmon.
- 95% of the harvest was taken in rivers or estuaries and 5% was taken in coastal waters.
- Harvest was 35 171 salmon in 2006, down 22% from the five year mean.
- Catches remain low relative to pre 1990 values.

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

Harvest histories (1972–2006) of salmon, expressed as 2SW salmon equivalents are provided in Tables 4.9.1.1. The Newfoundland–Labrador commercial fishery historically was a mixed stock fishery and harvested both maturing and non-maturing 1SW salmon as well as 2SW maturing salmon. The harvest in these fisheries of repeat spawners and older sea-ages was not considered in the run reconstructions.

Harvests of 1SW non-maturing salmon in Newfoundland-Labrador commercial fisheries have been adjusted by natural mortalities of 3% per month for 13 months, and 2SW harvests in these same fisheries have been adjusted by one month to express all harvests as 2SW equivalents in the year and time they would reach rivers of origin. Starting in 1998, the Labrador commercial fishery was closed. Aboriginal Peoples' fisheries in Labrador (1998–2006) have been included. As well, a residents' food fishery in Labrador which started in 2000 is included. Mortalities (principally in fisheries) in mixed stock and terminal fisheries areas in Canada are summed with those of USA to estimate total 2SW equivalent mortalities in North America. The terminal fisheries included coastal, estuarine and river catches of all areas, except Newfoundland and Labrador where only river catches were included. Harvest equivalents within North America peaked at about 365 000 in 1976 and are now about 11 300 2SW salmon equivalents.

In the most recent year, the harvest of cohorts destined to be 2SW salmon in terminal fisheries of North America was 73% of the total catch. The values ranged from 20 to 31% in 1972-1982 to 73–91% in 1996–2006 (Table 4.9.1.1). Percentages increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries. The number of 2SW salmon equivalents taken in the food fisheries in Labrador was 3073 fish in 2006.

4.9.3 Gear and effort

Canada

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

Three groups exploited salmon in Canada in 2006: Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in Canada in 2006.

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

The following management measures were in effect in 2006.

Aboriginal peoples' food fisheries

In Québec, Aboriginal peoples' food fisheries took place subject to agreements or through permits issued to the bands. There are 10 bands with subsistence fisheries in addition to the fishing activities of the Inuit in Ungava (Q11), who fished in estuaries or within rivers. The permits generally stipulate gear, season, and catch limits. Catches in food fisheries have to be reported collectively by each Aboriginal user group. However, if reports are not available, the catches are estimated. In the Maritimes (SFAs 15 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2006. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries. Harvests that occurred both within and outside agreements were obtained directly from the Aboriginal peoples. In Labrador (SFAs 1 and 2), food fishery arrangements with the Nunatsiavut Government, the Innu First Nation, and the Labrador Metis Nation, resulted in fisheries in estuaries and coastal areas. There are further details on the Labrador Aboriginal fisheries in Section 4.9.5. By agreement with First Nations there were no food fisheries for salmon in Newfoundland in 2006. Harvest by Aboriginal peoples with recreational licenses is reported under the recreational harvest categories.

Residents food fisheries in Labrador

In 2006, a licensed food fishery for local residents took place, using gillnets, in Lake Melville (SFA 1) and in estuary and coastal areas of southern Labrador (SFA 2). Residents who requested a license were permitted to retain a maximum of four salmon of any size while fishing for trout and charr; four salmon tags accompanied each license. All licensees were requested to complete logbooks.

Recreational fisheries

Licenses are required for all persons fishing recreationally for Atlantic salmon. Gear is generally restricted to fly fishing and there are restrictive daily/seasonal bag limits. Recreational fisheries management in 2006 varied by area (Figure 4.9.3.2). Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries.

USA

In the USA there was a one month fall catch and release recreational fishery for sea-run Atlantic salmon on a 2 km reach on one river in 2006. This is the first recreational fishery on sea-run Atlantic salmon in the USA since closures in 1999. A total of 241 licenses were sold and there were 247 angler trips reported.

France (Islands of Saint-Pierre and Miquelon)

Licenses remained consistent with previous years at 14 professional and 48 recreational gill net fishers . The time series of available data is below:

Year	Number of Professional Licenses	Number of Recreational Licenses
1995	12	42
1996	12	42
1997	6	36
1998	9	42
1999	7	40
2000	8	35
2001	10	42
2002	12	42
2003	12	42
2004	13	42
2005	14	52
2006	14	48

4.9.4 Catches in 2006

Canada

The provisional harvest of salmon in 2006 by all users was 132 t, about 5% lower than the 2005 harvest (Table 2.1.1.1; Figure 4.9.4.1). The 2006 harvest was 44 233 small salmon and 11 131 large salmon, 7% less small salmon and 2% more large salmon, compared to 2005 (Annex 4). The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998, and the closure of the Québec commercial fishery in 2000. These reductions were introduced as a result of declining abundance of salmon.

Aboriginal peoples' food fisheries

Harvests in 2006 (by weight) were up 11 % from 2005 and 6 % lower than the previous 5-year average harvest.

ABORIGINAL PEOPLES' FOOD FISHERIES			
Year	Harvest (t)	% large	
		by weight	by number
1990	31.9	78	
1991	29.1	87	
1992	34.2	83	
1993	42.6	83	
1994	41.7	83	58
1995	32.8	82	56
1996	47.9	87	65
1997	39.4	91	74
1998	47.9	83	63
1999	45.9	73	49
2000	45.7	68	41
2001	42.1	72	47
2002	46.3	68	43
2003	44.3	72	49
2004	60.8	66	44
2005	56.7	57	34
2006	58.9	63	42

Residents fishing for food in Labrador

The estimated total catch for the fishery in 2006 was 2.6 t, about 1052 fish (73% small salmon by number).

Recreational fisheries

Harvest in recreational fisheries in 2006 totalled 35 171 small and large salmon, 22% below the previous 5-year average, 8% below the 2005 harvest level, and the lowest total harvest reported (Figure 4.9.4.2). The small salmon harvest of 32 171 fish was 5% below 2005 and 22% below the previous 5-year mean. The large salmon harvest of 3000 fish was 31% below the previous five-year mean and 27% below 2005. The small salmon size group has contributed 88% on average of the total harvests since the imposition of catch-and-release recreational fisheries in the Maritimes and insular Newfoundland (SFA 3 to 14B, 15 to 23) in 1984.

In 2006, about 49 279 salmon (about 21 186 large and 28 093 small) were caught and released (Table 4.9.4.1), representing about 58% of the total number caught, including retained fish. This was a 22% decrease from the number released in 2005. There is some mortality on these released fish, which is accounted for in rivers assessed for their attainment of CLs.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2006 and the catch therefore was zero. Catches have decreased from a peak in 1980 of almost 2500 t to zero as a result of effort reductions, low abundance of stocks, and closures of fisheries.

Unreported catches

Canada's unreported catch value for 2006 was 56 t. Estimates were incomplete at the time of the Working Group and therefore the value for 2006 is incomplete.

The unreported catch estimates for 2006 in tonnes were:

Stock Area	Unreported Catch (t)
Labrador	<1
Newfoundland	<1
New Brunswick	39
Nova Scotia	1
Québec	16
Total	56

USA

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

France (Islands of Saint-Pierre and Miquelon) harvests

The harvest totalled 3.6 t of salmon in 2006 the highest in the time series. The time series of available data is below:

Year	Professional Licenses (t)	Recreational Licenses (t)	Total (t)
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	0.392	0.445	0.837
1996	0.951	0.617	1.568
1997	0.762	0.729	1.491
1998	1.039	1.268	2.307
1999	1.182	1.140	2.322
2000	1.134	1.133	2.267
2001	1.544	0.611	2.155
2002	1.223	0.729	1.952
2003	1.620	1.272	2.892
2004	1.499	1.285	2.784
2005	2.243	1.044	3.287
2006	1.730	1.825	3.555

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

4.9.5 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. These fisheries have been closed. The Aboriginal Peoples' and resident food fisheries that exist in Labrador may intercept some salmon from other areas of North America although there are no reports of tagged fish being captured there in 2006. No information on the 2006 Saint-Pierre and Miquelon fishery, which harvests salmon of both USA and Canadian origin, was provided.

4.9.5.1 NASCO has asked ICES to provide a comprehensive description of coastal fisheries including timing and location of harvest, biological characteristics (size, age, origin) of the catch, and potential impacts on non-local salmon stocks.

In Canada all Aboriginal Peoples have a constitutional right to harvest for food social and ceremonial purposes. In 2006, there were four subsistence fisheries harvesting salmonids in Labrador: **1)** Nunatsiavut Government (NG) members fishing in the northern Labrador communities of Rigolet, Makkovik, Hopedale, Postville, and Nain and in Lake Melville; **2)** Innu Nation members fishing in Natuashish and in Lake Melville from the community of Sheshatshiu; **3)** Labrador residents fishing in Lake Melville and coastal communities in southern Labrador from Cartwright to Cape St. Charles and, **4)** LMN (Labrador Métis Nation) members fishing in southern Labrador from Fish Cove Point to Cape St. Charles.

The NG, Innu, and LMN fisheries were jointly regulated by Aboriginal Fishery Guardians administered under the Aboriginal Fisheries Strategy Program with the Department of Fisheries and Oceans (DFO) as well as by DFO Fishery Officers and Guardian staff. The new Nunatsiavut Government is directly responsible through the Torngat Fisheries Board for regulating its fishery through its Conservation Officers. DFO staff are also responsible for regulating the Resident Fishery.

Description of the fisheries

The fishing gear is multifilament gillnets of 15 fathoms in length of a stretched mesh size ranging from 3 to 4 inches. Although nets are mainly set in estuarine waters some nets are also set in coastal areas usually within bays.

FSC fisheries catch statistics are based on log book reports and fisheries guardians. The overall reporting rate for subsistence fisheries, was 79% in 2005 and 2006.

Timing and location

Timing and location of the four FSC fisheries are described in 2006 Management Plans for these fisheries as follows:

> **NUNATSIAVUT GOVERNMENT (formerly LABRADOR INUIT ASSOCIATION)**

The conditions for the NG communal fishery were as follows:

> Harvest Limits: each designated fisher has an allowance of 7 salmon for the fishing season for that portion of Labrador extending from Fish Cove Point, north to Cape Chidley, including Lake Melville (Zone 1). Once the 7 salmon are caught nets must be removed from the water or moved to an area where only charr have been historically caught.

Seasons: May 14 to July 9 and July 19 to August 14 in Goose Bay, North West River and Mud Lake, May 14 to August 31 in Rigolet, June 1 to August 31 in Makkovik and Postville, June 1 to September 30 in Hopedale and Nain.

INNU NATION

The Community Guidelines for the Innu Nation fishery were as follows:

Harvest limits: There is an allowance of 3.0 t for the community of Sheshatsiu in Lake Melville and 0.5 t in the coastal community of Natuashish.

Season: mid-May to end of September.

LABRADOR MÉTIS NATION

The conditions for the LMN Communal fishery were as follows:

Harvest limits: each designated fishery has an allowance of 6 salmon to be harvested for the season in the area from Fish Cove Point to Cape St. Charles. Once the 6 salmon are caught nets must be removed from the water.

Seasons: July 7 - August 15

RESIDENT SUBSISTENCE

The Management Plan for the Labrador Resident subsistence fishery was as follows:

Catch limits: four salmon per licence with a season limit of 50 trout. Once four salmon have been caught a fishers net must be removed from the water.

Seasons: July 11 to July 30 (Fish Cove Point to Bolsters Rock) and July 11 to July 23 (Bolsters Rock to Cape Charles) in southern Labrador, June 15 to July 2 and July 22 to August 6 (Kenamu closes July 30th) (Cape Rouge to Fish Cove Point (including Lake Melville)) and June 17 to July 3 (Cape Rouge to Davis Inlet) and July 1 to July 17 (Davis Inlet to Cape Chidley) in northern Labrador.

Coastal versus estuary landings

The division of catch between coastal and estuary origins in Labrador FSCs was revised in 2006. Originally, when NASCO requested ICES to provide estimates of coastal versus estuary catches there was little information on fishing locations. In 2000–2005, coastal harvests were determined as all catches in FSCs in Labrador the exception of Lake Melville which was estuarine. In 2006, location was added to the FSC fishing logs, however, the number of logs that provided exact locations was limited. Consequently, Fishery Officers employed by Fisheries & Oceans in Labrador as well as aboriginal enforcement staff were asked to provide proportions of catch in estuary and coastal areas based on their local knowledge of locations were salmon were caught. The definition used for an estuary was that of Pritchard (1967) which states that an estuary is a partly enclosed coastal body of water in which river water is mixed with seawater. These proportions are shown in Figure 4.9.5.2. The text table below compares the new breakdown of catches into estuary and coastal areas to the old proportions.

Year	Weight (kg) Estuarine	Coastal	Total	Percentages (kg) Estuarine	Coastal	Previous methods Percentages (kg) Estuarine	Coastal
2000	13,278	2,335	15,613	85	15	38	62
2001	13,497	2,792	16,288	83	17	26	74
2002	13,987	3,585	17,572	80	20	23	77
2003	17,485	4,622	22,108	79	21	20	80
2004	24,862	6,787	31,649	79	21	23	77
2005	25,303	6,611	31,914	79	21	35	65
2006	23,169	7,073	30,242	77	23	30	70

The Working Group concluded that revised approach improved the assignment of fishing locations to estuarine and costal and encouraged the continued efforts to include more precise locations on the logbooks returned by fishers.

Results of sampling program for Labrador FSCs

A sampling program was in place for the FSC fisheries in Labrador in 2006. Landed fish were sampled opportunistically. Fish were measured (fork length to the nearest cm), weighed (gutted weight or whole weight if available to the nearest 1/10th of a kg) and if possible the sex was determined. Scales were taken for subsequent age analysis. In addition, fish were examined for the presence of external tags, brands or elastomer marks, and adipose fin clips. In southern Labrador, there were three persons hired by the Labrador Metis Nation to conduct the sampling. In northern Labrador, Conservation Officers of the Nunatsiavut Government conducted the sampling.

In total, 336 samples were collected that based on scale reading indicated 86% 1SW, 8% 2SW and 6% previously spawned salmon. Small and large salmon based on a 2.7 kg, similar to that used in the fishery, indicated small salmon were 95% 1SW, 2% 2SW and 3% previously spawned salmon and large salmon were 24% 1SW, 52% 2SW and 24% previously spawned salmon.

The river ages (Figure 4.9.5.1) of the FSC samples were compared to ages from scales obtained from adults at assessment four facilities in Labrador. Freshwater samples numbered 1946 from north Labrador and 975 in south Labrador.

There were no differences in river age distributions of adults from fisheries compared to returns to rivers in North (Chi-square=4.64, P=0.46) or South Labrador (Chi-square=4.25, P=0.51). Further, the freshwater age distribution did not differ (Chi-square=2.32, P=0.80) between the two regions of Labrador.

The relative absence of age 1 and 2 smolts in the FSC catches in 2006 suggests that these fisheries did not exploit southern North America stocks to any extent. The presence of river age 5 to 7 years in the FSC samples provides evidence that the FSC fisheries are exploiting northern area (predominantly Labrador) stocks.

The Working Group noted that the sampling program conducted in 2006 provided significant improvement in the biological characteristics of the harvest as well as provide material for a an analysis about the origin of salmon in this fishery. Working Group recommended that sampling be repeated in future fisheries and if possible expand sampling to include other areas and increase the sample size.

4.9.6 Exploitation rates

Canada

There is no directed exploitation by commercial fisheries. In the Newfoundland angling fishery, exploitation rates from retained small salmon ranged from a high of 12% on Torrent River to a low of 4% on Terra Nova River. Overall, exploitation of small salmon in these rivers declined from 30% in 1986 to 10% in 2006 and was the lowest in the 23 years. In Labrador, exploitation on small salmon was 3% at Sand Hill River. Exploitation on large salmon was less than 1%.

USA

There was no exploitation of USA salmon in home waters, and no tagged salmon of USA origin were reported in Canadian fisheries in 2006.

Exploitation trends for North American salmon fisheries

Annual exploitation rates of 1SW and 2SW salmon in North America for the 1970 to 2006 time period were calculated by dividing annual harvests in all North American fisheries by annual estimates of the returns to all 6 regions of North America. The fisheries included coastal, estuarine and river fisheries in all areas, as well as the commercial fisheries of Newfoundland and Labrador which harvests salmon from all regions in North America.

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

4.9.7 Elaboration on status of stocks

To date, approximately 550 Atlantic salmon rivers have been identified in eastern Canada and 21 rivers in eastern USA, each of which could contain at least one population of salmon. Assessments were prepared for 77 of these rivers in 2006.

4.9.7.1 Smolt and juvenile abundance

Canada

Wild smolt production was estimated in 15 rivers in 2006. Of these, eight rivers have at least ten years of information (Figure 4.9.7.1).

In 2006, smolt production increased (>10% change) from 2005 in seven rivers, decreased in four rivers and remained unchanged in two rivers (Figure 4.9.7.1). The relative smolt production, scaled to the size of the river using the conservation egg requirements, was highest in the rivers of Québec and low in the southern rivers of the Scotia Fundy and USA areas. In the nine rivers monitored over at least the past ten years, there has generally been no significant linear change ($P>0.05$) in smolt production with the exception of a significant increase in Western Arm Brook (Newfoundland) and a significant decrease in River de la Trinite (Quebec) (Figure 4.9.7.1).

Juvenile salmon abundance has been monitored annually since 1971 in the Miramichi (SFA 16) and Restigouche (SFA 15) rivers and for shorter and variable time periods in a large number of other rivers in the Maritime Provinces. In the rivers of the southern Gulf of St. Lawrence, densities of young-of-the-year (age 0+) and parr (age-1+ and 2+) have increased since 1985 in response to increased spawning escapements and densities of fry and parr in 2006 remained at high values. Rivers in SFAs 20 and 21 along the Atlantic coast of Nova Scotia are high in dissolved organics, have low productivity, and influenced by acid deposition. In the partially acidified St. Mary's River, fry and older parr densities remained among the lowest of record (1985–2006). Trends in densities of age-1+ and older parr in the outer Bay of Fundy (SFA 23) have varied since 1980, with densities in the Nashwaak River and Saint John River above Mactaquac Dam declining in response to reduced spawning escapements. For the salmon stock in 33 rivers of the inner Bay of Fundy (SFA 22 and a portion of SFA 23), juvenile densities remained critically low.

USA

Wild salmon smolt production has been estimated on the Narraguagus River for nine years (Figure 4.9.7.1). Smolt production in 2006 was higher than 2005 and 22% higher than the previous five-year mean production. The mean juvenile densities in this river have been low over the period of sampling dating to 1997.

4.9.7.2 Estimates of total adult abundance by geographic area

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

Returns are the number of salmon that returned to the geographic region, including fish caught by homewater commercial fisheries, except in the case of the Newfoundland and Labrador regions where returns do not include landings in commercial and food fisheries. This avoided double counting fish because commercial catches in Newfoundland and Labrador and food fisheries in Labrador were added to returns to create the PFA of North American salmon. The basis for estimates of 2SW and 1SW salmon returns and spawners for Labrador (SFAs 1, 2 & 14B) prior to 1998 are catch data from angling and commercial fisheries. In 1998, the commercial fishery in Labrador was closed and the model for returns and spawners from commercial catch data could not be used. From 2002–2006, there were counting projects on four salmon rivers in Labrador. Because the same four out of about 100 rivers (one in SFA 1A, Northern Labrador and three in SFA 2) were monitored, the Working Group extrapolated from return rates per accessible drainage areas to the unsurveyed rivers in Labrador (ICES 2005).

Estimates of 1SW and 2SW returns and spawners for Newfoundland (SFAs 3–12 & 14A) were previously documented based on the classification scheme of the Salmon Management Plan. Returns and spawners were updated for 2005 and new estimates were provided for 2006 based on catches, calculated exploitation rates and large to small salmon ratios from the Licence Stub Return System in 2006. It has been noticed in the last couple of years that angling catches when completed in the year following the current estimate year increase and exploitation rates decrease leading to a reduction in return and spawner estimates compared to those reported the previous year. Consequently, the current year estimate may be overestimated.

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

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

Returns do not include aquaculture escapes in rivers where removal is possible. In the Magaguadavic River (SFA 23) 6 fish farm escapees were removed in 2006. Aquaculture escapes were also intercepted on the St. Croix (7), Dennys (4), and Penobscot (1) rivers.

Canada

Labrador

The mid-point of the estimated returns (214 051) of 1SW salmon to Labrador rivers in 2006 is 3% lower than in 2005 and is the 2sd highest recorded (Figure 4.9.7.2, Annex 5). The mid-point (14 000) of the estimated 2SW returns to Labrador rivers in 2006 was 2% higher than in 2005 and 1% lower than the recent 5–year average of 13 820 (Figure 4.9.7.3).

Newfoundland

The mid-point of the estimated returns (225 154) of 1SW salmon to Newfoundland rivers in 2006 is 19% higher than the average 1SW returns (189 150) for the past five years (Figure 4.9.7.2). The mid-point (4542) of the estimated 2SW returns to Newfoundland rivers in 2006 was 26% higher than in 2005 and 13% higher than the recent 5-year average of 4029 (Figure 4.9.7.3).

Québec

The mid-point of the estimated returns to Québec in 2006 of 1SW salmon (29 844) is 19% above that observed in 2005 but unchanged from the previous five-year mean (Figure 4.9.7.2). The mid-point of the estimated returns of 2SW (28 808) salmon is similar (-9%) to that observed for 2005 and the previous 5-year average (-12%) (Figure 4.9.7.3).

Gulf of St. Lawrence, SFAs 15–18

The mid-point (53 238) of the estimated returns in 2006 of 1SW salmon to the Gulf of St. Lawrence was 23% higher than 2005 and unchanged from the previous five year mean return. The values noted in 1997 through 2006 are low relative to the values observed during 1985–1993 (Figure 4.9.7.2). The mid-point (25 275) of the estimate of 2SW returns in 2006 is unchanged from the estimate for 2005 but 11% above the previous 5-year average return (Figure 4.9.7.3).

Scotia-Fundy, SFAs 19–23

The mid-point (9331) of the estimate of the 1SW returns in 2006 to the Scotia-Fundy Region was a 34% increase from the 2005 estimate, and the sixth lowest value in the time-series, 1971–2006. Returns have generally been low since 1990 (Figure 4.9.7.2). Six of the seven lowest values have occurred since 2000. The mid-point (2682) of the 2SW returns in 2005 is 58% higher than the returns in 2005 but is still low in relation to the 1971–2006 time series (Figure 4.9.7.3). A declining trend in returns has been observed from 1985 to 2006, despite this recent single year increase.

USA

Total returns of salmon to USA rivers was 1480, a 13% increase from returns in 2005 (1313). Total salmon returns to the rivers of New England remain below the long term average of 2122 (1967–2002). The 2006 level is above the 10-year average and below the 5-year average (Figure 4.9.7.2). Returns of 1SW salmon were 450, greater than the 5-year (306) and 10-year

(342) averages. The 2SW returns in 2006 to USA rivers were 1030 fish, an increase over the 5–year average (856) but not the 10–year (1148) average (Figure 4.9.7.3).

4.9.7.3 Estimates of spawning escapements

Updated estimates for 1SW spawners were derived for the six geographic regions (Table 4.9.7.3). Estimates of 2SW spawners, 1971–2006 are provided in Table 4.9.7.4. These estimates were calculated by subtracting the in-river removals from the estimates of returns to rivers and/or adding stocked spawners. A comparison between the numbers of spawners, returns, and CLs for 2SW salmon (Figure 4.9.7.3).

Canada

Labrador

Spawner estimates for Labrador in 1998–2006 were developed, using the monitoring facilities for 2002–2006 and the proportional method for 1998–2001 (Section 4.9.5). The mid-point of the estimated numbers of 2SW spawners (13 791) was 2% below the previous year and was 40% of the total 2SW CL for Labrador (Figure 4.9.7.3). The 2SW spawner limit has only been exceeded once (1998) since 1971. The mid-point of the estimated numbers of 1SW spawners (211 972) was 3% lower that estimated for 2005 (Figure 4.9.7.2).

Newfoundland

The mid-point of the estimated numbers of 2SW spawners (4491) in 2006 was 27% above that estimated in 2005 (3540) and was 112% of the total 2SW CL for all rivers. The 2SW spawner limit has been met or exceeded at the mid-point of spawner estimates in eight years out of the last ten (Figure 4.9.7.3). The 1SW spawner abundance (205 489) in 2006 was 24% higher than in 2005 (199 153). The abundance of 1SW spawners in 1992 was higher than in 1989–1991 and similar to levels in the late 1970s and 1980s (Figure 4.9.7.2), although in 1995–1996 it was unusually high. There was a general increase in both 2SW and 1SW spawners during the period 1992–96 and 1998–2000, which is consistent with the closure of the commercial fisheries in Newfoundland.

Québec

The mid-point of the estimated numbers of 2SW spawners (19 070) in 2006 was unchanged (<10%) relative to 2005, to the previous five year mean, and was about 65% of the sum of the 2SW CL for all rivers (Figure 4.9.7.3). The mid-point of the estimated 1SW spawner abundance in 2006 (21 660) was about 18% higher than in 2005 (Figure 4.9.7.2) and approximates the 10 year average.

Gulf of St. Lawrence

The mid-point of the estimated numbers of 2SW spawners (24 639) in 2006 was unchanged (<10%) relative to 2005, up by 11% relative to the previous five year mean, and was about 81% of the total 2SW CL for the region (Figure 4.9.7.3). This area has not met the combined 2SW CL since 1996. The mid-point of the estimated spawning escapement of 1SW salmon (34 900) increased by 22% from 2005 and was 13% above the average for the last ten year (Figure 4.9.7.2).

Scotia-Fundy

The mid-point of the estimated numbers of 2SW spawners (2546) in 2006 is a 58% increase from 2005 and is about 10% of the total 2SW CLs for rivers in this region (Figure 4.9.7.3). Neither the spawner estimates nor the CLs include rivers of the inner Bay of Fundy (SFA 22 and part of SFA 23) as these rivers are minor contributors to distant water fisheries and spawning escapements are extremely low. The 2SW spawning escapement in the rest of the area has been generally declining since 1985. The mid-point of the estimated 1SW spawners (9114) in 2006 is a 34% increase from 2005 (Figure 4.9.7.2).

USA

Pre-spawning adults were stocked into USA rivers, however, even with these, all age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2006 (1876 salmon) represented 6.4% of the 2SW spawner requirements for all USA rivers combined.

4.9.7.4 Reconstructed spawning escapements

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

Spawning escapement of 2SW salmon to several stock complexes has been below CLs (Labrador, Québec, Scotia-Fundy, USA) since the 1980s (Table 4.9.7.3). Lagged 2SW spawner abundance has decreased in Labrador and Newfoundland over the past five years, has remained steady in Québec, declining and very low in Scotia Fundy and decreased for 2007 in the Gulf from the previous year (Figure 4.9.7.4).

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

4.9.8 Egg depositions in 2006

Egg depositions by all sea-ages combined in 2006 exceeded or equalled the river specific CLs in 35 of the 77 assessed rivers (45%) and were less than 50% of CLs in 27 other rivers (35%) (Figure 4.9.8.1).

- In Newfoundland, 63% of the rivers assessed met or exceeded the CLs and 4% had egg depositions that were less than 50% of limits.
- Due to high water conditions 6 of 7 rivers in St. George Bay in southwest Newfoundland (SFA 13) where 2SW salmon are more prominent in the populations could not be assessed in 2006.
- None of the four assessed rivers in Gulf and 6 of the 35 assessed rivers in Québec had egg depositions less than 50% of CLs.
- For 3 of 4 of the Gulf rivers and 54% of the Québec rivers, egg depositions equalled or exceeded CLs.
- Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia (SFA 19-23) where 11 of the 13 rivers assessed (85%) had egg depositions that were less than 50% of CLs.

- Large deficiencies in egg depositions were noted in the USA, where only one of the rivers assessed had egg depositions that were greater than 10% of CLs. On an individual river basis, the Penobscot River met 10% of its spawner requirement while all the other USA rivers were between 0.0–1.0% of their 2SW requirements

4.9.9 Marine survival rates

In 2006, return rate data were available from 10 wild and five hatchery populations from rivers distributed among Newfoundland, Québec, Scotia-Fundy and USA (Figure 4.9.9.1). Return rates to 1SW fish in 2006 increased by >10% relative to 2005 for three hatchery stocks (+25% to +44%) and in seven of the wild stocks (+25% to +600%) but decreased in three wild stocks (-20% to –46%).

Return rates to 2SW salmon from the 2004 smolt class increased relative to the 2003 smolt class for only one wild stock (+270%) and four hatchery stocks (+22% to 671%) while rates declined in three wild stocks (-1% to –21%) and in one hatchery stock (-4%).

These time series of return rates of smolts to 1SW and 2SW adults (Figure 4.9.9.1) and analysis of exponential rates of change (Figures 4.9.9.2) provide insights into temporal changes in marine survival of wild and hatchery stocks:

- Return rates of fish to many rivers are low compared to historical levels, especially in the south.
- Return rates of fish to home waters did not increase as expected after closure of the commercial fisheries in 1984 and subsequently in 1992,
- 1SW return rates in MSW salmon stocks (USA, Scotia-Fundy, Gulf, Quebec) are lower than those in predominantly 1SW salmon stocks of Newfoundland,
- 1SW return rates in MSW salmon stocks of the Scotia-Fundy and Gulf exceed those of 2SW salmon but 2SW returns rates are greater than 1SW return rates in Québec and Maine populations, and
- Return rates of wild stocks exceed those of hatchery stocks.

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

Origin	Age Group	Region	Return rate Mean (%)	Return rate Range (%)	Number Of stocks
Wild	1SW	Maine (USA)	0.14	0.08 to 0.24	1
		Scotia-Fundy	4.47	1.13 to 12.73	2
		Gulf	4.20	1.90 to 6.40	2
		Québec	0.73	0.36 to 1.49	2
		Newfoundland	6.08	2.20 to 15.10	5
Wild	2SW	Maine (USA)	0.68	0.15 to 0.94	1
		Scotia-Fundy	0.77	0.23 to 1.58	2
		Gulf	1.08	0.30 to 2.20	2
		Québec	0.71	0.12 to 1.39	2
Hatchery	1SW	USA	0.04	0.015 to 0.067	3
		Scotia-Fundy	0.54	0.32 to 0.87	2
Hatchery	2SW	USA	0.10	0.004 to 0.261	3
		Scotia-Fundy	0.10	0.05 to 0.17	2

4.9.10 Pre-fisheries abundance

4.9.10.1 North American run-reconstruction model

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

4.9.10.2 Non-maturing 1SW salmon

The non-maturing component of 1SW fish, destined to be 2SW returns (excludes 3SW and previous spawners) is represented by the pre-fishery abundance estimator for year i designated as [NN1(i)]. This annual pre-fishery abundance is the estimated number of salmon in West Greenland prior to the start of the fishery on August 1st. Definitions of the variables are given in Table 4.9.10.2. It is constructed by summing 2SW returns in year i+1 [NR2(i+1)], 2SW salmon catches in commercial and Aboriginal peoples’ food fisheries in Canada [NC2(i+1)], and catches in year i from fisheries on non-maturing 1SW salmon in Canada [NC1(i)] and Greenland [NG1(i)] (Table 4.9.10.3). In Labrador, Aboriginal peoples’ food harvests of small (AH_s) and large salmon (AH_l) were included in the reported catches for 1999–2006 (Table 4.9.10.1). Because harvests occurred in both Lake Melville and coastal areas of northern Labrador, the fraction of these catches that are immature was labelled as af_imm. This was necessary because non-maturing salmon do not occur in Lake Melville where much of the catch originated. However, non-maturing salmon may occur in marine areas in the remainder of northern Labrador. Consequently, af_imm for the fraction of Aboriginal peoples’ harvests that was non-maturing was set at 0.05 to 0.1 which is half of f_imm from commercial fishery samples. The full details and equations for calculating prefishery abundance are in ICES (2004). The model does not take into account non-catch fishing mortality in any of the fisheries. The West Greenland (1993 and 1994), Newfoundland (1992–2006), and Labrador commercial fishery (1998–2006), were closed in these years.

As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate of PFA is available is 2005. This is because pre-fishery abundance estimates for 2006 require 2SW returns to rivers in North America in 2007. The minimum and maximum values of the catches and returns for the 2SW cohort are summarized in Table 4.9.10.3. The 2005 abundance estimates ranged between 75 095 and 145 408 salmon. The mid-point of this range (110 251) is similar to the 2004 value (109 813) and is the 5th lowest in the 34-year time-series (Figure 4.9.10.1). Even though the 2005 value has increased somewhat from 2001, which was the lowest in the time series, the general trend towards lower values in recent years is still evident and current year values are still much lower than the 917 282 in 1975.

4.9.10.3 Maturing 1SW salmon

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

For the commercial catches in Newfoundland and Labrador, all small salmon are assumed to be 1SW fish based on catch samples which show the percentage of 1SW salmon to be in excess of 95%. Large salmon are primarily MSW salmon, but some maturing and non-maturing 1SW are also present in commercial catches in SFAs 1–7, and 14B. Estimates of fractions of non-maturing salmon present in the Newfoundland and Labrador catch were presented in ICES (1991). The large category in SFAs 1–7 and 14B consists of 0.1–0.3 1SW salmon (Rago *et al*., 1993a; ICES, 1993). Salmon catches in SFAs 8–14A are mainly maturing salmon (Idler *et al*., 1981). These values were assumed to apply to the Aboriginal food fishery catches in marine coastal areas of northern Labrador. Catches used in the run-reconstruction model for the Newfoundland commercial fishery were set to zero for 1992–2006 and for Labrador for 1998–2006 to remain consistent with catches used in other years in these areas. Full details on the method used to calculate the numbers of maturing 1SW salmon are in ICES (2004).

The minimum and maximum values of the catches and returns for the 1SW cohort are summarized in Table 4.9.10.4. The mid-point values of the reconstructed abundance of the 1SW maturing cohort are shown in Figure 4.9.10.1. The mid-point of the range of pre-fishery abundance estimates for 2006 (557 364) is 2% higher than in 2005 (546 364), had increased considerably from the value of 309 015 in 1994, which was the lowest estimated in the time-series 1971–2006.

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

The pre-fishery abundance of 1SW maturing salmon for the 1971–2006 and 1SW non-maturing salmon from North America for 1971–2005 were combined to give total recruits (Figure 4.9.10.2). While maturing 1SW salmon in 1998–2006 have increased over the lowest value in 1994, the non-maturing portion of these cohorts remains basically unchanged since 1997. The prefishery abundance of the non-maturing portion (potential 2SW salmon) has been consistently well below the Spawning Escapement Reserve (derived from the CL) since 1993. The maturing component has declined by 47% the non maturing has declined by 92%.

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

A two-phase regression between pre-fishery abundance (PFANA) and lagged spawners (LSNA) as described by Chaput *et al*. (2005) was updated with the addition of the previous years PFA_{NA} estimate. The relative recruits (PFA_{NA}) per spawner index (LS_{NA}) has declined from an average of 5.7 during 1978–1989 to an average of 1.9 during the period 1990 to 2005 (Figure 4.9.10.3). As in 2006, a number of models were examined including two models without phase shifts, plus five models with phase shifts and with eight possible break year points (1986–1993) for each model (Table 4.9.10.5). In each simulation the most parsimonious model was selected using Akaike’s Information Criterion and this selected model was used to generate a value for the probability density for the 2007 PFA_{NA}. Simulation methods, in the software package SAS (SAS Institute, 1996), were used to generate the probability density function of PFA_{NA} (Annex 6).

For phase shift models, the probability of being in either phase was based on changes in PFA_{NA} from year t relative to year t-2 (Figure 4.9.10.4). The two-year lag is used because current year PFA (i.e 2006) is not available due to its dependence upon 2SW returns in the next year. The approach taken in 2007 was identical to the method used in previous years and as described by Chaput *et al.* (2005).

Although 42 combinations of models and break years (8 years * 5 regressions + 2 regressions without break years) were possible that could be represented in estimating the distribution of PFA_{NA}, those selected most often were model numbers 2 and 6 and break years 1988 through 1992 (Table 4.9.10.6). The lagged spawner variable was informative for PFA_{NA} in 70% of the simulated data sets. In such cases, the break years describing the phase shift were mostly 1991 or 1989 and to lesser extents 1988 and 1992. The proportional model with the intercept through the origin was selected most often (62% of all models). For the 2007 forecast of PFA_{NA}, the probability (runs/10 000) of being in the high phase was low (2.5%) and the probability of being in the lower productivity phase was over 97% (Table 4.9.10.6).

The PFA_{NA} abundance during 2007 to 2009 is expected to be about 115 000 non-maturing 1SW salmon (Table 4.9.10.7), a value similar to the estimated abundance for the period 1988 to 2005. The PFA_{NA} values over the most recent 15 year period (1991–2005) have declined by 64% (Figure 4.9.10.2). Between 1971 and 2005, the PFA_{NA} abundance has declined by 92%.

4.9.11 Summary on status of stocks

In 2006, the midpoint of the spawner abundance estimates for six geographic areas indicated that five areas were below their CL for 2SW salmon and are suffering reduced reproductive capacity. Newfoundland was at or slightly above CL.

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. During 1993 to 2005, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. The maturing component has declined by 47% the non maturing has declined by 92%.

The returns of 2SW fish in 2006 were similar to 2005 in Labrador, in the Gulf of St. Lawrence, Scotia Fundy and in the USA, increased slightly in Newfoundland, but declined slightly in Québec. However, in all areas returns remain close to the lower end of the 35-year time-series (1971–2005). While 2SW salmon are a minor component of Newfoundland stocks even here decreases of about 30% have occurred from peak levels of the 1990's. Returns in 2006 of 1SW salmon increased from 2005 in Newfoundland and Labrador but declined or were similar in all other areas.

The rank of the estimated returns in the 1971–2006 time-series and the proportions of the 2SW CL achieved in 2006 for six regions in North America are shown below:

Region	Rank of 2006 returns in 1971-2006, (36=lowest)		Rank of 2006 returns in 1997-2006 (10=lowest)		Mid-point estimate of 2SW spawners as percentage of conservation limit (S_{LIM})
	1SW	2SW	1SW	2SW	(%)
Labrador	2	20	2	6	40
Newfoundland	4	19	1	6	112
Québec	16	35	4	3	65
Gulf	24	27	3	9	81
Scotia-Fundy	30	32	4	6	10
USA	12	31	1	7	5

Egg depositions by all sea-ages combined in 2006 exceeded or equalled the river specific CLs in 35 of the 77 assessed rivers (45%) and were less than 50% of CLs in 27 other rivers (35%, Figure 4.9.8.1).

Return rates to 1SW and 2SW salmon remain variable and unpredictable with higher return rates in the northern areas (Newfoundland) and lower rates in the southern areas, including southern Newfoundland, Maritimes and USA.

Based on the genera1 increase in 1SW returns in 2006 in all areas except Labrador an increase could be expected for 2SW salmon in 2007. However, return rates of 2SW salmon in monitored stocks remain low. An additional concern is the number of salmon stocks suffering reduced reproductive capacity in eastern NAC, particularly in the Bay of Fundy, Atlantic coast and USA Despite major changes in fisheries management, returns have continued to decline in these southern areas and many populations are currently threatened with extirpation.

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

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

Table 4.9.1.1. Catches expressed as 2SW salmon equivalents in North American salmon fisheries, 1972–2006, based on the mid-points of the estimated values.

	CANADA															
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i						USA					
Year i	NF-LAB Comm 1SW (Year i-1) (a)	Year i % 1SW of total 2SW equivalents	Year i NF-LAB Comm 2SW (a)	Year i NF-Lab comm total	Labrador rivers	Nfld rivers	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total		North American Total	Terminal Fisheries as a % of NA Total	Greenland Total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic
1972	20,857	9	153,775	174,632	314	633	27,417	22,389	6,801	232,186	346	232,532	25	206,814	439,346	53
1973	17,971	6	219,175	237,146	719	895	32,751	17,914	6,680	296,105	327	296,433	20	144,348	440,781	67
1974	24,564	7	235,910	260,475	593	542	47,631	21,430	12,734	343,405	247	343,652	24	173,615	517,267	66
1975	24,181	7	237,598	261,779	241	528	41,097	15,677	12,375	331,696	389	332,085	21	158,583	490,668	68
1976	35,801	10	256,586	292,388	618	412	42,139	18,090	11,111	364,758	191	364,949	20	200,464	565,413	65
1977	27,519	8	241,217	268,736	954	946	42,301	33,433	15,562	361,932	1,355	363,287	26	112,077	475,364	76
1978	27,836	11	157,299	185,135	580	559	37,421	23,806	10,781	258,281	894	259,175	29	136,386	395,561	66
1979	14,086	10	92,058	106,144	469	144	25,234	6,300	4,506	142,798	433	143,231	26	85,446	228,677	63
1980	20,894	6	217,209	238,103	646	699	53,567	29,832	18,411	341,257	1,533	342,789	31	143,829	486,618	70
1981	34,486	11	201,336	235,822	384	485	44,375	16,329	13,988	311,383	1,267	312,650	25	135,157	447,807	70
1982	34,341	14	134,417	168,757	473	433	35,204	25,709	12,353	242,929	1,413	244,342	31	163,718	408,060	60
1983	25,701	12	111,562	137,263	313	445	34,472	27,097	13,515	213,105	386	213,491	36	139,985	353,476	60
1984	19,432	14	82,807	102,238	379	215	24,408	5,997	3,971	137,210	675	137,884	26	23,897	161,781	85
1985	14,650	11	78,760	93,410	219	15	27,483	2,708	4,930	128,765	645	129,410	28	27,978	157,388	82
1986	19,832	12	104,890	124,723	340	39	33,846	4,542	2,824	166,313	606	166,919	25	100,098	267,017	63
1987	25,163	13	132,208	157,371	457	20	33,807	3,757	1,370	196,781	300	197,082	20	123,472	320,553	61
1988	32,081	21	81,130	113,211	514	29	34,262	3,832	1,373	153,220	248	153,468	26	124,868	278,336	55
1989	22,197	16	81,355	103,551	337	9	28,901	3,426	265	136,488	397	136,886	24	83,947	220,832	62
1990	19,577	18	57,359	76,937	261	24	27,986	2,700	593	108,501	696	109,197	30	43,634	152,831	71
1991	12,048	14	40,433	52,481	66	16	29,277	1,777	1,331	84,949	231	85,180	38	52,560	137,740	62
1992	9,979	14	25,108	35,087	581	67	30,016	2,673	1,114	69,539	167	69,706	50	79,571	149,277	47
1993	3,229	8	13,273	16,502	378	0	23,153	1,211	1,110	42,353	166	42,519	61	30,091	72,610	59
1994	2,139	5	11,938	14,077	455	0	24,052	2,206	756	41,547	1	41,548	66	0	41,548	100
1995	1,242	3	8,677	9,918	408	0	23,331	2,007	330	35,994	0	35,994	72	0	35,994	100
1996	1,075	3	5,646	6,721	334	0	22,413	2,389	766	32,623	0	32,623	79	15,343	47,966	68
1997	969	4	5,390	6,360	158	0	18,574	1,849	581	27,521	0	27,521	77	15,776	43,297	64
1998	1,155	7	1,872	3,027	231	0	11,256	2,238	322	17,074	0	17,074	82	12,088	29,162	59
1999	179	1	894	1,073	320	0	9,032	1,127	450	12,002	0	12,002	91	2,175	14,177	85
2000	152	1	1,115	1,267	262	0	9,425	1,714	193	12,861	0	12,861	90	3,863	16,725	77
2001	286	2	1,380	1,666	338	0	10,104	616	255	12,979	0	12,979	87	4,005	16,984	76
2002	263	3	1,185	1,448	207	0	7,297	306	179	9,437	0	9,437	85	6,982	16,419	57
2003	312	3	1,794	2,106	222	0	8,870	590	189	11,977	0	11,977	82	1,617	13,594	88
2004	355	3	3,049	3,403	259	0	8,756	662	105	13,186	0	13,186	74	1,914	15,100	87
2005	470	4	2,324	2,793	291	0	7,803	596	91	11,575	0	11,575	76	2,755	14,330	81
2006	563	5	2,509	3,073	213	0	7,147	637	137	11,206	0	11,206	73	2,416	13,621	82

NF-Lab comm as 1SW = NC1(mid-pt) * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries)

NF-Lab comm as 2SW = NC2 (mid-pt) * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal fisheries)

Terminal fisheries = 2SW returns (mid-pt) - 2SW spawners (mid-pt)

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

Table 4.9.4.1. The numbers of hooked and released salmon in the angling fisheries of Eastern Canada.

Year	Newfoundland			Nova Scotia			New Brunswick					Prince Edward Island			Quebec			CANADA*		
	Small	Large	Total	Small	Large	Total	Small Kelt	Small Bright	Large Kelt	Large Bright	Total	Small	Large	Total	Small	Large	Total	**SMALL**	**LARGE**	**TOTAL**
1984				939	1,655	2,594	661	851	1,020	14,479	17,011							**2,451**	**17,154**	**19,605**
1985		315	315	1,323	6,346	7,669	1,098	3,963	3,809	17,815	26,685			67				**6,384**	**28,285**	**34,669**
1986		798	798	1,463	10,750	12,213	5,217	9,333	6,941	25,316	46,807							**16,013**	**43,805**	**59,818**
1987		410	410	1,311	6,339	7,650	7,269	10,597	5,723	20,295	43,884							**19,177**	**32,767**	**51,944**
1988		600	600	1,146	6,795	7,941	6,703	10,503	7,182	19,442	43,830	767	256	1,023				**19,119**	**34,275**	**53,394**
1989		183	183	1,562	6,960	8,522	9,566	8,518	7,756	22,127	47,967							**19,646**	**37,026**	**56,672**
1990		503	503	1,782	5,504	7,286	4,435	7,346	6,067	16,231	34,079			1,066				**13,563**	**28,305**	**41,868**
1991		336	336	908	5,482	6,390	3,161	3,501	3,169	10,650	20,481	1,103	187	1,290				**8,673**	**19,824**	**28,497**
1992	5,893	1,423	7,316	737	5,093	5,830	2,966	8,349	5,681	16,308	33,304			1,250				**17,945**	**28,505**	**46,450**
1993	18,196	1,731	19,927	1,076	3,998	5,074	4,422	7,276	4,624	12,526	28,848							**30,970**	**22,879**	**53,849**
1994	24,442	5,032	29,474	796	2,894	3,690	4,153	7,443	4,790	11,556	27,942	577	147	724				**37,411**	**24,419**	**61,830**
1995	26,273	5,166	31,439	979	2,861	3,840	770	4,260	880	5,220	11,130	209	139	348		922	922	**32,491**	**15,188**	**47,679**
1996	34,342	6,209	40,551	3,526	5,661	9,187						472	238	710		1,718	1,718	**38,340**	**13,826**	**52,166**
1997	25,316	4,720	30,036	713	3,363	4,076	3,457	4,870	3,786	8,874	20,987	210	118	328	182	1,643	1,825	**34,748**	**22,504**	**57,252**
1998	31,368	4,375	35,743	688	2,476	3,164	3,154	5,760	3,452	8,298	20,664	233	114	347	297	2,680	2,977	**41,500**	**21,395**	**62,895**
1999	24,567	4,153	28,720	562	2,186	2,748	3,155	5,631	3,456	8,281	20,523	192	157	349	298	2,693	2,991	**34,405**	**20,926**	**55,331**
2000	29,705	6,479	36,184	407	1,303	1,710	3,154	6,689	3,455	8,690	21,988	101	46	147	445	4,008	4,453	**40,501**	**23,981**	**64,482**
2001	22,348	5,184	27,532	527	1,199	1,726	3,094	6,166	3,829	11,252	24,341	202	103	305	809	4,674	5,483	**33,146**	**26,241**	**59,387**
2002	23,071	3,992	27,063	829	1,100	1,929	1,034	7,351	2,190	5,349	15,924	207	31	238	852	4,918	5,770	**33,344**	**17,580**	**50,924**
2003	21,379	4,965	26,344	626	2,106	2,732	1,555	5,375	1,042	7,981	15,953	240	123	363	1,238	7,015	8,253	**30,413**	**23,232**	**53,645**
2004	23,430	5,168	28,598	828	2,339	3,167	1,050	7,517	4,935	8,100	21,602	135	68	203	1,291	7,455	8,746	**34,251**	**28,065**	**62,316**
2005	33,129	6,598	39,727	933	2,617	3,550	1,520	2,695	2,202	5,584	12,001	83	83	166	1,116	6,445	7,561	**39,476**	**23,529**	**63,005**
2006	20,626	4,323	24,949	991	2,460	3,451	1,071	4,186	2,638	5,538	13,433	128	42	170	1,091	6,185	7,276	**28,093**	**21,186**	**49,279**

Table 4.9.7.1. Estimated numbers of 1SW returns in North America by geographic regions, 1971–2006.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	32,966	115,382	112,644	226,129	14,969	22,453	33,115	57,968	11,515	19,525	32	205,241	441,490	323,365
1972	24,675	86,362	109,282	219,412	12,470	18,704	42,195	73,700	9,522	16,915	18	198,161	415,112	306,637
1973	5,399	18,897	144,267	289,447	16,585	24,877	43,653	77,061	14,766	24,823	23	224,693	435,128	329,910
1974	27,034	94,619	85,216	170,748	16,791	25,186	65,663	114,068	26,723	44,336	55	221,481	449,011	335,246
1975	53,660	187,809	112,272	225,165	18,071	27,106	58,607	101,878	25,940	36,316	84	268,633	578,358	423,496
1976	37,540	131,391	115,034	230,595	19,959	29,938	90,292	155,669	36,931	55,937	186	299,942	603,716	451,829
1977	33,409	116,931	110,114	220,501	18,190	27,285	31,311	56,070	30,860	48,387	75	223,959	469,250	346,605
1978	16,155	56,542	97,375	195,048	16,971	25,456	26,003	45,407	12,457	16,587	155	169,117	339,195	254,156
1979	21,943	76,800	107,402	215,160	21,683	32,524	50,771	93,190	30,875	49,052	250	232,923	466,976	349,950
1980	49,670	173,845	121,038	242,499	29,791	44,686	45,688	81,695	49,925	73,560	818	296,929	617,103	457,016
1981	55,046	192,662	157,425	315,347	41,667	62,501	70,085	128,432	37,371	62,083	1,130	362,724	762,155	562,440
1982	38,136	133,474	141,247	283,002	23,699	35,549	79,756	143,370	23,839	38,208	334	307,011	633,938	470,474
1983	23,732	83,061	109,934	220,216	17,987	26,981	25,325	43,905	15,553	23,775	295	192,826	398,233	295,530
1984	12,283	42,991	130,836	262,061	21,566	30,894	37,670	63,906	27,954	47,493	598	230,907	447,943	339,425
1985	22,732	79,563	121,731	243,727	22,771	33,262	61,215	110,517	29,410	51,983	392	258,250	519,444	388,847
1986	34,270	119,945	125,329	251,033	33,758	46,937	114,665	204,378	30,935	54,678	758	339,715	677,730	508,722
1987	42,938	150,283	128,578	257,473	37,816	54,034	86,492	155,985	31,746	55,564	1,128	328,698	674,466	501,582
1988	39,892	139,623	133,237	266,895	43,943	62,193	123,472	223,211	32,992	56,935	992	374,529	749,850	562,189
1989	27,113	94,896	60,260	120,661	34,568	48,407	72,906	129,462	34,957	59,662	1,258	231,063	454,347	342,705
1990	15,853	55,485	99,543	199,416	39,962	54,792	84,934	161,505	33,939	60,828	687	274,918	532,713	403,816
1991	12,849	44,970	64,552	129,308	31,488	42,755	56,479	108,066	19,759	31,555	310	185,437	356,964	271,200
1992	17,993	62,094	118,778	237,811	35,257	48,742	150,290	234,582	22,832	37,340	1,194	346,344	621,764	484,054
1993	25,186	80,938	134,150	268,550	30,645	42,156	75,124	195,457	16,714	27,539	466	282,284	615,107	448,696
1994	18,159	56,888	91,495	189,808	29,667	40,170	50,402	83,027	8,216	11,583	436	198,375	381,912	290,144
1995	25,022	76,453	167,485	301,743	23,851	32,368	46,511	72,939	14,239	21,822	213	277,321	505,537	391,429
1996	51,867	153,553	200,277	422,635	32,008	42,558	40,140	70,561	22,795	36,047	651	347,737	726,005	536,871
1997	66,972	169,030	118,973	192,852	24,300	33,018	22,183	43,688	7,173	10,467	365	239,966	449,420	344,693
1998	9,233	192,621	150,644	202,611	24,495	34,301	28,890	55,130	14,948	22,625	403	228,613	507,690	368,152
1999	6,761	188,043	163,417	215,042	25,880	36,679	27,725	46,616	8,045	11,588	419	232,247	498,387	365,317
2000	4,022	216,034	148,710	254,736	24,129	35,070	37,847	57,237	8,801	13,697	270	223,779	577,043	400,411
2001	3,419	169,125	136,949	194,299	16,939	24,452	31,332	52,440	4,021	5,966	266	192,926	446,548	319,737
2002	60,917	148,152	134,679	187,273	28,609	39,275	52,940	89,502	6,876	10,937	450	284,471	475,590	380,030
2003	47,127	127,368	174,862	256,264	23,142	31,892	30,452	53,537	4,135	6,509	237	279,955	475,807	377,881
2004	68,331	125,093	160,252	243,479	30,423	43,266	52,684	91,504	5,951	9,437	319	317,961	513,098	415,530
2005	154,976	287,868	185,846	261,393	20,685	29,531	31,664	55,072	5,456	8,466	319	398,945	642,649	520,797
2006	128,560	299,541	203,627	246,681	24,971	34,717	37,584	68,891	7,055	11,607	450	402,247	661,888	532,067

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

Table 4.9.7.2. Estimated numbers of 2SW returns in North America by geographic regions, 1971–2006.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	4,312	29,279	2,388	8,923	34,568	51,852	29,450	46,846	11,187	16,410	653	81,905	153,310	117,607
1972	3,706	25,168	2,511	9,003	45,094	67,642	35,604	59,953	14,028	19,731	1,383	102,328	182,881	142,604
1973	5,183	35,196	2,995	11,527	49,765	74,647	34,871	59,568	10,359	14,793	1,427	104,600	197,158	150,879
1974	5,003	34,148	1,940	6,596	66,762	100,143	49,044	83,418	21,902	29,071	1,394	146,045	254,771	200,408
1975	4,772	32,392	2,305	7,725	56,695	85,042	31,153	51,874	23,944	31,496	2,331	121,200	210,860	166,030
1976	5,519	37,401	2,334	7,698	56,365	84,547	29,238	51,439	21,768	29,837	1,317	116,541	212,240	164,390
1977	4,867	33,051	1,845	6,247	66,442	99,663	58,774	100,788	28,606	39,215	1,998	162,533	280,963	221,748
1978	3,864	26,147	1,991	6,396	59,826	89,739	30,411	51,505	16,946	22,561	4,208	117,247	200,555	158,901
1979	2,231	15,058	1,088	3,644	32,994	49,491	8,643	14,337	8,962	12,968	1,942	55,860	97,440	76,650
1980	5,190	35,259	2,432	7,778	78,447	117,670	43,359	73,863	31,897	44,823	5,796	167,121	285,189	226,155
1981	4,734	32,051	3,451	12,035	61,633	92,449	17,695	29,615	19,030	28,169	5,601	112,144	199,921	156,033
1982	3,491	23,662	2,914	9,012	54,655	81,982	31,591	51,156	17,516	24,182	6,056	116,222	196,049	156,136
1983	2,538	17,181	2,586	8,225	44,886	67,329	28,987	46,897	14,310	20,753	2,155	95,462	162,540	129,001
1984	1,806	12,252	2,233	7,060	44,661	59,160	20,437	34,150	17,938	27,899	3,222	90,298	143,743	117,020
1985	1,448	9,779	958	3,059	45,916	61,460	22,965	43,606	22,841	38,784	5,529	99,657	162,218	130,937
1986	2,470	16,720	1,606	5,245	55,159	72,560	35,866	71,110	18,102	33,101	6,176	119,379	204,912	162,145
1987	3,289	22,341	1,336	4,433	52,699	68,365	22,289	48,137	11,529	20,679	3,081	94,223	167,036	130,629
1988	2,068	14,037	1,563	5,068	56,870	75,387	25,976	50,039	10,370	19,830	3,286	100,134	167,646	133,890
1989	2,018	13,653	697	2,299	51,656	67,066	17,094	35,461	11,939	21,818	3,197	86,602	143,493	115,047
1990	1,148	7,790	1,347	4,401	50,261	66,352	23,152	51,735	10,248	18,871	5,051	91,207	154,201	122,704
1991	548	3,740	1,054	3,429	46,841	60,724	19,711	42,977	10,613	17,884	2,647	81,415	131,401	106,408
1992	2,515	15,548	3,111	10,554	46,917	61,285	30,396	59,868	9,777	16,456	2,459	95,174	166,171	130,673
1993	3,858	18,234	1,499	5,094	37,023	46,484	18,731	74,077	6,791	10,536	2,231	70,133	156,656	113,395
1994	5,653	24,396	1,495	5,226	37,703	47,180	20,372	43,698	4,464	6,674	1,346	71,032	128,519	99,776
1995	12,368	44,205	2,243	7,535	43,755	54,186	29,885	50,879	5,382	8,484	1,748	95,382	167,038	131,210
1996	9,113	32,759	2,964	8,832	39,413	49,846	17,775	37,200	7,458	11,786	2,407	79,130	142,829	110,979
1997	8,919	26,674	3,469	8,538	32,443	41,017	14,774	37,114	3,847	5,888	1,611	65,063	120,841	92,952
1998	21,886	50,512	4,280	8,813	24,358	31,832	8,447	26,746	2,261	3,466	1,526	62,759	122,896	92,827
1999	5,245	30,259	2,599	9,661	25,415	33,710	9,475	20,747	3,814	5,594	1,168	47,715	101,139	74,427
2000	7,108	32,391	2,022	12,023	24,317	33,992	10,451	20,965	1,859	2,992	533	46,290	102,896	74,593
2001	7,869	36,361	1,614	7,832	25,562	35,398	17,510	32,424	3,444	5,370	788	56,788	118,172	87,480
2002	5,446	17,586	1,268	5,796	18,714	26,135	7,249	19,082	734	1,063	511	33,922	70,173	52,047
2003	4,006	15,399	1,419	6,894	28,787	38,262	15,303	34,747	2,579	4,323	1,192	53,287	100,818	77,052
2004	6,578	16,395	1,309	6,934	25,401	33,207	15,454	37,661	1,920	2,807	1,283	51,945	98,286	75,116
2005	6,695	21,865	1,324	5,900	24,622	31,996	13,886	35,077	1,328	2,077	984	48,840	97,900	73,370
2006	7,351	20,648	1,986	7,098	22,599	29,835	14,168	36,383	1,994	3,371	1,023	49,120	98,358	73,739

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

Table 4.9.7.3. Estimated numbers of 1SW spawners in North America by geographic regions, 1971–2006.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	29,032	111,448	85,978	199,463	9,338	14,007	18,714	35,529	4,800	12,810	29	147,891	373,287	260,589
1972	21,728	83,415	84,880	195,010	8,213	12,320	22,883	43,310	2,992	10,385	17	140,713	344,457	242,585
1973	0	11,405	108,785	253,965	10,987	16,480	26,468	51,224	8,658	18,715	13	154,911	351,802	253,356
1974	24,533	92,118	58,731	144,263	10,067	15,100	45,426	84,673	16,209	33,822	40	155,005	370,016	262,511
1975	49,688	183,837	78,882	191,775	11,606	17,409	40,108	74,913	18,232	28,608	67	198,582	496,608	347,595
1976	31,814	125,665	80,571	196,132	12,979	19,469	52,720	99,791	24,589	43,595	151	202,825	484,803	343,814
1977	28,815	112,337	75,762	186,149	12,004	18,006	13,339	27,572	16,704	34,231	54	146,679	378,350	262,514
1978	13,464	53,851	68,756	166,429	11,447	17,170	13,008	25,469	5,678	9,808	127	112,480	272,854	192,667
1979	17,825	72,682	76,233	183,991	15,863	23,795	28,073	57,265	18,577	36,754	247	156,817	374,732	265,774
1980	45,870	170,045	85,189	206,650	20,817	31,226	25,014	50,265	28,878	52,513	722	206,490	511,420	358,955
1981	49,855	187,471	110,755	268,677	30,952	46,428	37,218	77,324	18,236	42,948	1,009	248,026	623,858	435,942
1982	34,032	129,370	99,376	241,131	16,877	25,316	48,992	96,935	12,179	26,548	290	211,746	519,591	365,668
1983	19,360	78,689	77,514	187,796	12,030	18,045	12,821	24,669	7,747	15,969	255	129,726	325,423	227,574
1984	9,348	40,056	91,505	222,730	16,316	24,957	16,981	33,633	17,964	37,503	540	152,655	359,420	256,037
1985	19,631	76,462	85,179	207,175	15,608	25,140	37,301	73,871	18,158	40,731	363	176,240	423,742	299,991
1986	30,806	116,481	87,833	213,537	22,230	33,855	77,403	149,553	21,204	44,947	660	240,135	559,033	399,584
1987	37,572	144,917	104,096	232,991	25,789	40,481	56,009	110,287	21,589	45,407	1,087	246,141	575,169	410,655
1988	34,369	134,100	93,396	227,054	28,582	44,815	80,832	159,806	23,288	47,231	923	261,391	613,930	437,660
1989	22,429	90,212	41,798	102,199	24,710	37,319	42,161	81,697	23,873	48,578	1,080	156,051	361,086	258,568
1990	12,544	52,176	69,576	169,449	26,594	39,826	49,760	124,531	22,753	49,642	617	181,844	436,243	309,043
1991	10,526	42,647	44,023	108,779	20,582	30,433	36,475	87,038	13,814	25,610	235	125,655	294,741	210,198
1992	15,229	59,331	95,096	214,129	21,754	33,583	106,918	192,842	15,125	29,633	1,124	255,247	530,642	392,945
1993	22,499	78,251	107,816	242,217	17,493	27,444	50,042	169,880	11,539	22,252	444	209,834	540,487	375,160
1994	15,242	53,971	60,194	158,507	16,758	25,642	27,038	56,937	6,918	10,218	427	126,577	305,703	216,140
1995	22,199	73,630	134,676	268,934	14,409	21,548	21,202	46,851	12,114	19,697	213	204,813	430,872	317,843
1996	48,924	150,610	161,780	384,138	18,923	27,805	13,691	41,225	19,253	32,472	651	263,223	636,901	450,062
1997	64,389	166,446	93,841	167,720	14,724	22,210	7,109	25,768	6,143	9,428	365	186,571	391,937	289,254
1998	6,726	190,114	125,215	177,182	16,743	25,730	16,670	36,724	14,520	22,172	403	180,277	452,325	316,301
1999	4,244	185,526	138,692	190,317	18,969	28,808	16,569	31,282	7,666	11,203	419	186,559	447,555	317,057
2000	752	212,764	124,643	230,669	16,444	25,865	23,140	38,650	8,460	13,331	270	173,709	521,547	347,628
2001	906	166,612	111,756	169,106	10,836	16,989	18,906	36,376	3,718	5,634	266	146,388	394,983	270,686
2002	58,341	145,576	111,970	164,564	17,070	25,625	31,809	62,935	6,607	10,635	450	226,247	409,786	318,016
2003	44,522	124,763	151,998	233,401	15,445	23,187	18,467	36,691	3,912	6,262	237	234,582	424,541	329,561
2004	65,927	122,689	138,564	221,790	20,513	32,081	30,885	61,941	5,726	9,179	319	261,935	448,000	354,967
2005	152,257	285,149	161,379	236,926	14,295	22,278	19,931	37,131	5,292	8,277	319	353,474	590,081	471,777
2006	126,481	297,462	183,984	226,993	17,351	25,970	23,117	46,666	6,863	11,365	450	358,245	608,907	483,576

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

Table 4.9.7.4. Estimated numbers of 2SW spawners in North America by geographic regions, 1971–2006.

	Labrador		Newfoundland		Quebec		Gulf of St. Lawrence		Scotia-Fundy		USA	North America		
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Mid-points
1971	4,012	28,882	1,817	8,055	11,822	17,733	4,270	8,251	4,496	9,032	490	26,907	72,444	49,675
1972	3,435	24,812	2,008	8,240	23,160	34,741	17,768	33,012	7,459	12,699	1,038	54,868	114,541	84,705
1973	4,565	34,376	2,283	10,449	23,564	35,346	20,469	38,143	3,949	7,844	1,100	55,929	127,256	91,593
1974	4,490	33,475	1,510	5,942	28,657	42,985	31,661	57,942	9,526	15,979	1,147	76,991	157,470	117,231
1975	4,564	32,119	1,888	7,086	23,818	35,726	18,450	33,223	11,861	18,830	1,942	62,522	128,926	95,724
1976	4,984	36,701	2,011	7,198	22,653	33,980	14,787	29,709	11,045	18,337	1,126	56,608	127,051	91,829
1977	4,042	31,969	1,114	5,088	32,602	48,902	32,485	60,210	13,578	23,119	643	84,462	169,932	127,197
1978	3,361	25,490	1,557	5,712	29,889	44,834	11,446	22,859	6,517	11,428	3,314	56,085	113,637	84,861
1979	1,823	14,528	980	3,463	12,807	19,210	3,541	6,839	4,683	8,234	1,509	25,343	53,783	39,563
1980	4,633	34,525	1,888	6,925	35,594	53,390	19,884	37,673	14,270	25,628	4,263	80,533	162,404	121,468
1981	4,403	31,615	3,074	11,442	26,132	39,199	4,599	10,054	5,870	13,353	4,334	48,412	109,997	79,205
1982	3,081	23,127	2,579	8,481	26,492	39,738	10,965	20,363	5,656	11,335	4,643	53,416	107,687	80,551
1983	2,267	16,824	2,244	7,677	17,308	25,963	7,375	14,316	1,505	6,529	1,769	32,468	73,078	52,773
1984	1,478	11,822	2,063	6,800	22,345	32,659	15,308	27,285	14,245	23,650	2,547	57,986	104,763	81,374
1985	1,258	9,530	946	3,042	20,668	31,742	21,057	40,100	18,185	33,580	4,884	66,997	122,877	94,937
1986	2,177	16,334	1,575	5,198	24,088	35,939	32,682	65,210	15,435	30,120	5,570	81,526	158,371	119,949
1987	2,895	21,821	1,320	4,409	21,723	31,727	19,532	43,380	10,235	19,233	2,781	58,487	123,351	90,919
1988	1,625	13,452	1,540	5,033	25,390	38,343	23,296	45,055	9,074	18,381	3,038	63,963	123,303	93,633
1989	1,727	13,270	690	2,289	25,016	35,905	14,604	31,099	11,689	21,539	2,800	56,526	106,901	81,713
1990	923	7,493	1,327	4,372	24,422	36,219	21,030	48,457	9,688	18,245	4,356	61,745	119,142	90,443
1991	491	3,665	1,041	3,410	19,959	29,052	18,294	40,840	9,356	16,479	2,416	51,558	95,862	73,710
1992	2,012	14,889	3,057	10,474	19,337	28,833	28,297	56,620	8,725	15,280	2,292	63,720	128,388	96,054
1993	3,624	17,922	1,449	5,017	15,774	21,428	17,721	72,665	5,737	9,370	2,065	46,371	128,466	87,418
1994	5,347	23,992	1,368	5,024	15,631	21,147	18,718	40,940	3,767	5,859	1,344	46,175	98,305	72,240
1995	12,083	43,828	2,125	7,343	22,575	28,703	28,275	48,475	5,069	8,138	1,748	71,875	138,236	105,055
1996	8,878	32,448	2,824	8,605	19,010	25,421	15,946	34,250	6,738	10,974	2,407	55,804	114,105	84,954
1997	8,785	26,497	3,348	8,346	15,531	20,780	13,317	34,873	3,297	5,277	1,611	45,890	97,384	71,637
1998	21,574	50,200	4,195	8,674	14,240	19,439	6,777	23,940	1,957	3,126	1,526	50,268	106,906	78,587
1999	4,832	29,846	2,551	9,565	17,250	23,811	8,663	19,303	3,373	5,135	1,168	37,837	88,829	63,333
2000	6,701	31,984	1,829	11,781	16,128	23,331	8,947	19,040	1,676	2,790	1,587	36,869	90,513	63,691
2001	7,384	35,876	1,534	7,709	16,696	24,056	16,997	31,705	3,205	5,099	1,491	47,308	105,936	76,622
2002	5,263	17,370	1,175	5,586	12,467	17,787	7,040	18,679	568	871	511	27,024	60,803	43,914
2003	3,793	15,147	1,375	6,803	20,738	28,570	14,858	34,013	2,401	4,123	1,192	44,357	89,849	67,103
2004	6,332	16,104	1,259	6,834	17,462	23,633	14,993	36,798	1,823	2,694	1,283	43,152	87,345	65,249
2005	6,443	21,567	1,276	5,804	17,529	23,482	13,473	34,298	1,245	1,978	1,088	41,055	88,218	64,636
2006	7,160	20,422	1,938	7,043	16,211	21,930	13,746	35,531	1,868	3,223	1,419	42,343	89,569	65,956

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

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

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

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

	North America		Prefishery	Recruits/	Labrador (L)		Newfoundland (N)		Quebec (Q)		Gulf of St. Lawrence (G)		Scotia-Fundy (S)		USA (US)	
Year	Total 2SW spawners	Lagged 2SW spawners	abundance recruits	2SW lagged spawner	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged	Total	Lagged
1971	49675		730732		16447		4936		14777		6261		6764		490	
1972	84705		742060		14124		5124		28951		25390		10079		1038	
1973	91593		884679		19470		6366		29455		29306		5896		1100	
1974	117231		817732		18982		3726		35821		44802		12752		1147	
1975	95724		917282		18341		4487		29772		25836		15345		1942	
1976	91829		840510		20842		4605		28316		22248		14691		1126	
1977	127197		670646		18006		3101		40752		46347		18348		643	
1978	84861	95524	374325	3.92	14425	14759	3635	5802	37362	28128	17152	35360	8973	10034	3314	1442
1979	39563	107013	847626	7.92	8175	17486	2221	4664	16008	32232	5190	36809	6459	14270	1509	1553
1980	121468	96086	736023	7.66	19579	18903	4406	4316	44492	31940	28779	24963	19949	14937	4263	1029
1981	79205	104065	682597	6.56	18009	18795	7258	4472	32666	30266	7327	31944	9612	16888	4334	1699
1982	80551	107269	567290	5.29	13104	19695	5530	3661	33115	34821	15664	34034	8496	12699	4643	2358
1983	52773	82167	339893	4.14	9546	18710	4961	3440	21636	36526	10845	13244	4017	7514	1769	2733
1984	81374	79786	352236	4.41	6650	15422	4432	2801	27502	28065	21296	14925	18947	14569	2547	4006
1985	94937	85392	539963	6.32	5394	11576	1994	3786	26205	32359	30578	19559	25882	13668	4884	4443
1986	119949	80959	574509	7.10	9255	15361	3386	6075	30013	35728	48946	11269	22777	8998	5570	3528
1987	90919	78592	520156	6.62	12358	17772	2865	6023	26725	33119	31456	13506	14734	5813	2781	2359
1988	93633	79004	422740	5.35	7538	14762	3287	5209	31866	27538	34176	15145	13728	13002	3038	3347
1989	81713	93796	340070	3.63	7498	10875	1490	4544	30461	25762	22851	24688	16614	23026	2800	4901
1990	90443	102732	295155	2.87	4208	7799	2850	2951	30320	26580	34744	37620	13966	23978	4356	3805
1991	73710	99735	342105	3.43	2078	6285	2225	2953	24506	28072	29567	41457	12917	17965	2416	3003
1992	96054	89423	222815	2.49	8451	8072	6765	3018	24085	28227	42459	33050	12002	14173	2292	2883
1993	87418	92185	158550	1.72	10773	10649	3233	3080	18601	29616	45193	29594	7554	15464	2065	3781
1994	72240	88099	196412	2.23	14669	9247	3196	2178	18389	30646	29829	27915	4813	15007	1344	3105
1995	105055	88063	185151	2.10	27955	7453	4734	2400	25639	30138	38375	32341	6604	13350	1748	2381
1996	84954	84548	160167	1.89	20663	5299	5714	2585	22216	27289	25098	34850	8856	12373	2407	2152
1997	71637	87195	150243	1.72	17641	3511	5847	5004	18155	24550	24095	43176	4287	9336	1611	1618
1998	78587	78484	108059	1.38	35887	6285	6435	4337	16839	21312	15358	39005	2542	5932	1526	1613
1999	63333	74528	110907	1.49	17339	9930	6058	3404	20531	19459	13983	33680	4254	5902	1168	2152
2000	63691	83070	129596	1.56	19343	14110	6805	4219	19730	22055	13994	32847	2233	7945	1587	1893
2001	76622	83141	84145	1.01	21630	22173	4621	5307	20376	22898	24351	25088	4152	6100	1491	1575
2002	43914	73964	112382	1.52	11316	22675	3380	5786	15127	20286	12860	20650	720	3264	511	1303
2003	67103	64892	111911	1.72	9470	20485	4089	6202	24654	18121	24435	15067	3262	3579	1192	1439
2004	65249	71300	109813	1.54	11218	27626	4046	6202	20547	18894	25896	14029	2258	3031	1283	1518
2005	64636	72473	110251	1.52	14005	23828	3540	6460	20506	19796	23886	18116	1612	3396	1088	878
2006	65956	67154			13791	19497	4491	5331	19070	19806	24639	19480	2546	2081	1419	960
2007		63252				19884		3939		18129		17801		2265		1234
2008		67756				15012		3877		20380		24682		2645		1159
2009		64579				10721		4014		21613		25056		1876		1300

Spawners lagged by:

Labrador = 0.0768 x i-5 spawners + 0.542 x i-6 + 0.341 x i-7 + 0.0401 x i-8

Newfoundland = 0.0408 x i-4 spawners + 0.5979 x i-5 + 0.3237 x i-6 + 0.0375 x i-7

Quebec = 0.0577 x i-4 spawners + 0.4644 x i-5 + 0.3783 x i-6 + 0.0892 x i-7 + 0.0104 x i-8

Gulf = 0.3979 x i-4 spawners + 0.5731 x i-5 + 0.0291 x i-6

Scotia-Fundy = 0.6002 x i-4 spawners + 0.3942 x i-5 + 0.0055 x i-6

USA = 0.3767 x i-3 spawners + 0.520 x i-4 + 0.1033 x i-5, 1971-1989

& 0.6274 x i-3 spawners + 0.3508 x i-4 + 0.0218 x i-5, 1990-2003.

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

	{1}			{1-7, 14b}		{8-14a}		{1-7, 14b}
1SW Year (i)	AH_Small (i)	AH_Large (i+1)	AH_Large (i)	H_Small (i)	H_Large (i)	H_Small (i)	H_Large (i+1)	H_Large (i+1)
1971	0	0	0	158896	199176	70936	42861	144496
1972	0	0	0	143232	144496	111141	43627	227779
1973	0	0	0	188725	227779	176907	85714	196726
1974	0	0	0	192195	196726	153278	72814	215025
1975	0	0	0	302348	215025	91935	95714	210858
1976	0	0	0	221766	210858	118779	63449	231393
1977	0	0	0	220093	231393	57472	37653	155546
1978	0	0	0	102403	155546	38180	29122	82174
1979	0	0	0	186558	82174	62622	54307	211896
1980	0	0	0	290127	211896	94291	38663	211006
1981	0	0	0	288902	211006	60668	35055	129319
1982	0	0	0	222894	129319	77017	28215	108430
1983	0	0	0	166033	108430	55683	15135	87742
1984	0	0	0	123774	87742	52813	24383	70970
1985	0	0	0	178719	70970	79275	22036	107561
1986	0	0	0	222671	107561	91912	19241	146242
1987	0	0	0	281762	146242	82401	14763	86047
1988	0	0	0	198484	86047	74620	15577	85319
1989	0	0	0	172861	85319	60884	11639	59334
1990	0	0	0	104788	59334	46053	10259	39257
1991	0	0	0	89099	39257	42721	0	32341
1992	0	0	0	24249	32341	0	0	17096
1993	0	0	0	17074	17096	0	0	15377
1994	0	0	0	8640	15377	0	0	11176
1995	0	0	0	7980	11176	0	0	7272
1996	0	0	0	7849	7272	0	0	6943
1997	0	2269	0	9753	6943	0	0	0
1998	2988	1084	2269	0	0	0	0	0
1999	2739	1352	1084	0	0	0	0	0
2000	5323	1673	1352	0	0	0	0	0
2001	4789	1437	1673	0	0	0	0	0
2002	5806	2175	1437	0	0	0	0	0
2003	6477	3696	2175	0	0	0	0	0
2004	8385	2817	3696	0	0	0	0	0
2005	10436	3042	2817	0	0	0	0	0
2006	9214		3042	0	0	0	0	0

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

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

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

1SW Year (i)	NG1(i)	NC1(i) min	max	NC2(i+1) min	max	NR2(i+1) min	max	NN1(i) min	max	mid-point
1971	287672	17881	43730	144008	172907	102328	182881	642279	819184	730732
1972	200784	15768	37316	203072	248628	104600	197158	636167	847954	742060
1973	241493	21150	51412	223422	262767	146045	254771	767376	1001982	884679
1974	220584	21187	50243	223332	266337	121200	210860	711821	923643	817732
1975	278839	32385	73371	243315	285486	116541	212240	801769	1032796	917282
1976	155896	24285	57005	225424	271703	162533	280963	710550	970471	840510
1977	189709	24323	57902	146535	177644	117247	200555	574920	766372	670646
1978	118853	11796	29813	86644	103079	55860	97440	325305	423344	374325
1979	200061	19478	42242	202634	245013	167121	285189	725526	969725	847626
1980	187999	31132	70739	186367	228568	112144	199921	626689	845357	736023
1981	227727	31000	70441	125578	151442	116222	196049	589902	775292	682597
1982	194715	23583	52338	104116	125802	95462	162540	491624	642955	567290
1983	33240	17688	39712	76554	94103	90298	143743	279866	399920	339893
1984	38916	13255	30019	74062	88256	99657	162218	290764	413708	352236
1985	139233	18582	40002	97329	118841	119379	204912	455247	624679	539963
1986	171745	23343	50988	121610	150859	94223	167036	490306	658712	574509
1987	173687	29639	65127	74996	92205	100134	167646	443842	596469	520156
1988	116767	20709	44860	75300	92364	86602	143493	359581	485900	422740
1989	60693	18139	39691	53173	65040	91207	154201	277474	402667	340070
1990	73109	11072	24518	37739	45590	81415	131401	248369	341942	295155
1991	110680	9302	20175	22639	29107	95174	166171	282926	401284	342105
1992	41855	2748	6790	11967	15386	70133	156656	158311	287319	222815
1993	0	1878	4441	10764	13839	71032	128519	115212	201888	158550
1994	0	1018	2651	7823	10058	95382	167038	144251	248572	196412
1995	21341	910	2267	5090	6545	79130	142829	139189	231113	185151
1996	21944	858	2006	4860	6249	65063	120841	119863	200471	160167
1997	16814	1045	2367	1588	2269	62759	122896	107299	193188	150243
1998	3026	161	367	759	1084	47715	101139	70582	145537	108059
1999	5374	142	306	946	1352	46290	102896	71182	150631	110907
2000	5571	273	573	1171	1673	56788	118172	86415	172776	129596
2001	9712	248	529	1006	1437	33922	70173	58501	109789	84145
2002	2249	297	624	1523	2175	53287	100818	78722	146043	112382
2003	2663	335	713	2587	3696	51945	98286	78744	145078	111911
2004	3832	438	949	1972	2817	48840	97900	74866	144760	109813
2005	3360	536	1128	2129	3042	49120	98358	75095	145408	110251
2006	4286	476	1013					4762	5299	5030

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

	{1}			{1-7, 14b}		{8-14a}		{1-7, 14b}
1SW Year (i)	AH_Small (i)	AH_Large (i+1)	AH_Large (i)	H_Small (i)	H_Large (i)	H_Small (i)	H_Large (i+1)	H_Large (i+1)
1971	0	0	0	158896	199176	70936	42861	144496
1972	0	0	0	143232	144496	111141	43627	227779
1973	0	0	0	188725	227779	176907	85714	196726
1974	0	0	0	192195	196726	153278	72814	215025
1975	0	0	0	302348	215025	91935	95714	210858
1976	0	0	0	221766	210858	118779	63449	231393
1977	0	0	0	220093	231393	57472	37653	155546
1978	0	0	0	102403	155546	38180	29122	82174
1979	0	0	0	186558	82174	62622	54307	211896
1980	0	0	0	290127	211896	94291	38663	211006
1981	0	0	0	288902	211006	60668	35055	129319
1982	0	0	0	222894	129319	77017	28215	108430
1983	0	0	0	166033	108430	55683	15135	87742
1984	0	0	0	123774	87742	52813	24383	70970
1985	0	0	0	178719	70970	79275	22036	107561
1986	0	0	0	222671	107561	91912	19241	146242
1987	0	0	0	281762	146242	82401	14763	86047
1988	0	0	0	198484	86047	74620	15577	85319
1989	0	0	0	172861	85319	60884	11639	59334
1990	0	0	0	104788	59334	46053	10259	39257
1991	0	0	0	89099	39257	42721	0	32341
1992	0	0	0	24249	32341	0	0	17096
1993	0	0	0	17074	17096	0	0	15377
1994	0	0	0	8640	15377	0	0	11176
1995	0	0	0	7980	11176	0	0	7272
1996	0	0	0	7849	7272	0	0	6943
1997	0	2269	0	9753	6943	0	0	0
1998	2988	1084	2269	0	0	0	0	0
1999	2739	1352	1084	0	0	0	0	0
2000	5323	1673	1352	0	0	0	0	0
2001	4789	1437	1673	0	0	0	0	0
2002	5806	2175	1437	0	0	0	0	0
2003	6477	3696	2175	0	0	0	0	0
2004	8385	2817	3696	0	0	0	0	0
2005	10436	3042	2817	0	0	0	0	0
2006	9214		3042	0	0	0	0	0

Table 4.9.10.5. Reference number formula and brief description of the nested models included in the approach to modelling lagged spawner index and PFA_{NA} encompassing a possible phase shift in relative recruitment per spawner.

NUMBER	FUNCTION $Ln(PFA_{NA})$ =	MODEL DESCRIPTION
0	$\mu + \xi$	A single mean PFA_{NA}; No phases or lagged spawner index variable
1	$\alpha + \gamma * Ln(LS_{NA}) + \xi$	A single regression of PFA_{NA} on lagged spawner index
2	$\beta * Ph + \xi$	Two means of PFA_{NA} for the two phases; no lagged spawner index variable
3 4 5	$\alpha + \beta * Ph + (\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with possible variations in slopes and intercepts
6	$(\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with intercept trough the origin
PFA_{NA} = PFA for North America (1978 to 2005) *LS_{NA} = Lagged spawners (1978 to 2005)* *Ph = Phase (indicator variable representing two time periods)* *α β γ δ = coefficients of the slope and intercept variables* *ξ = residual error normal* *phase shift periods: ranging from 1978-1985 and 1986-2005 to 1978-1993 and 1994-2005*		

Table 4.9.10.6. Summary of model and break year selections for forecasting PFA for 2007–2009 based on 10 000 simulations. Break year refers to last year in high phase.

		BREAK YEAR							
MODEL	PHASE	1987	1988	1989	1990	1991	1992	1993	MODELS
2	High								2 956
	Low					1969	987		
3	High		30	18	1				388
	Low		161	132	2	42	2		
4	High		3	2					62
	Low		14	12		25	6		
5	High		6	11	1				377
	Low		157	145	4	50	3		
6	High		11	36	11	83	37		6217
	Low		466	1759	220	2621	972	1	
Phase	High		50	67	13	83	37		250
	Low		798	2048	226	4707	1970	1	9750

Table 4.9.10.7. PFA_{NA} forecast distributions for year of PFA, 2007 to 2009.

	PFA_{NA} forecast probability distribtuions for year of PFA		
Percentile	2007	2008	2009
5	60 320	63 880	60 058
10	69 328	73 845	70 227
15	76 091	80 967	77 127
20	81 770	86 977	83 229
25	86 909	92 013	88 558
30	92 083	97 620	93 679
35	97 297	102 316	99 042
40	102 019	107 307	103 781
45	107 245	112 786	109 100
50	113 078	118 002	114 187
55	118 719	124 142	119 678
60	124 812	129 980	125 631
65	131 068	136 437	131 965
70	138 807	143 285	138 845
75	147 123	151 400	146 909
80	157 056	161 346	156 228
85	169 538	174 980	169 874
90	185 455	193 541	188 556
95	217 714	227 515	224 222

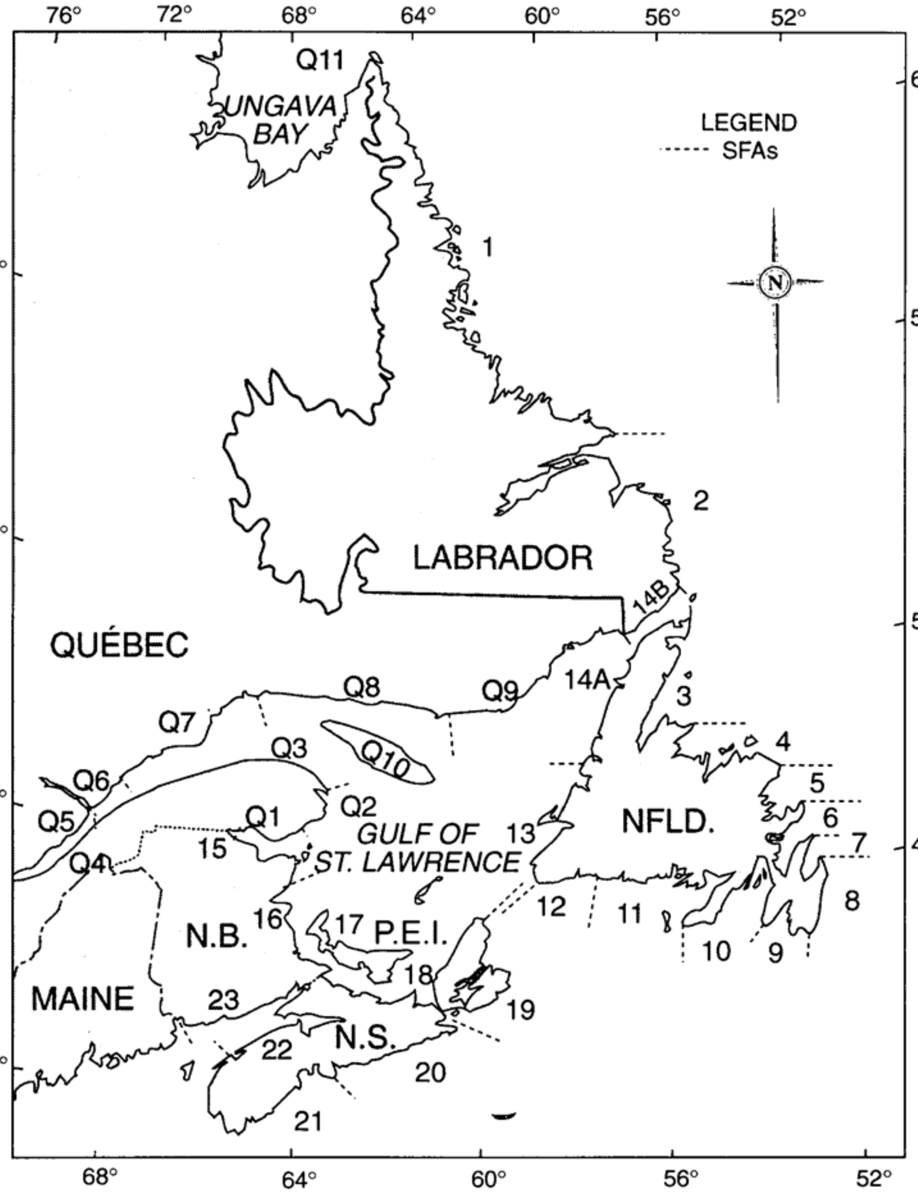


Figure 4.9.3.1. Map of Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada.

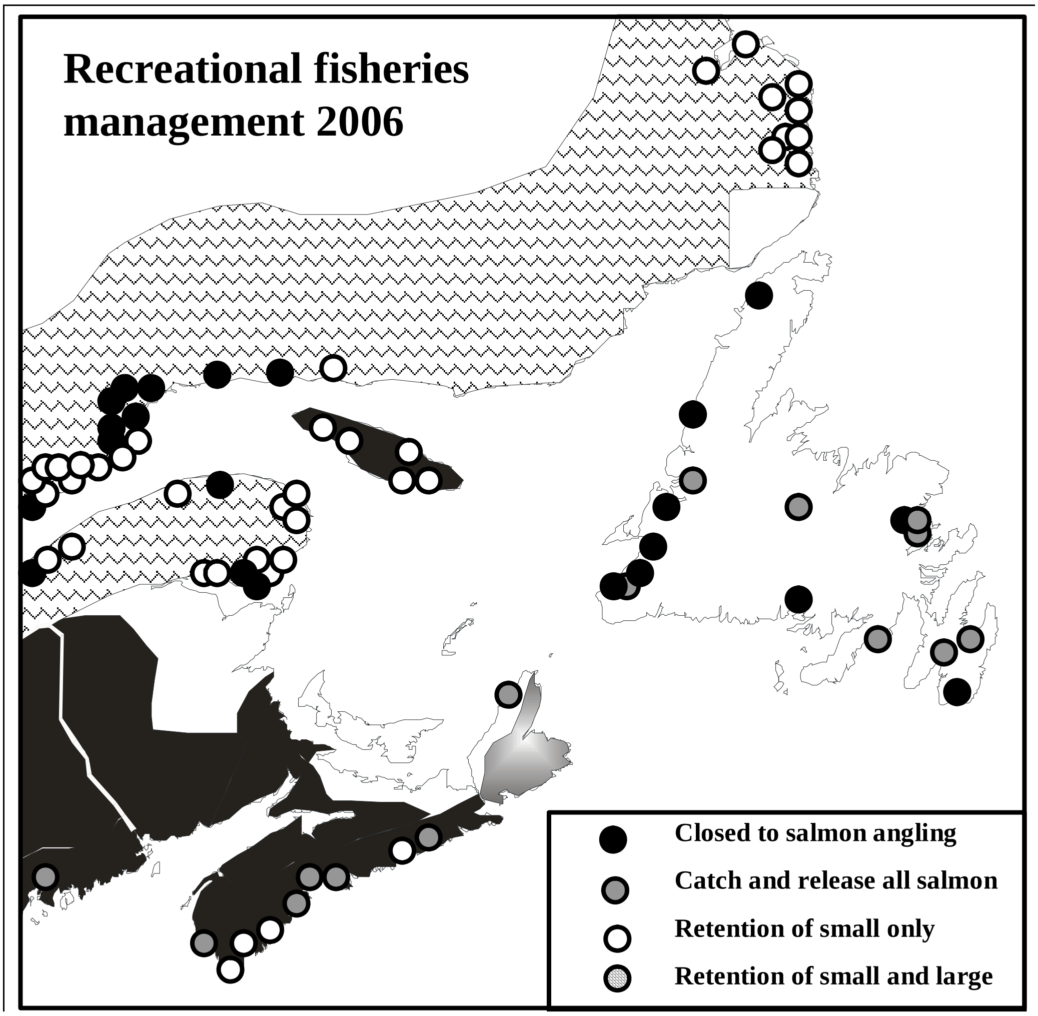


Figure 4.9.3.2. Summary of recreational fisheries management in eastern Canada and Maine (USA) during 2006.

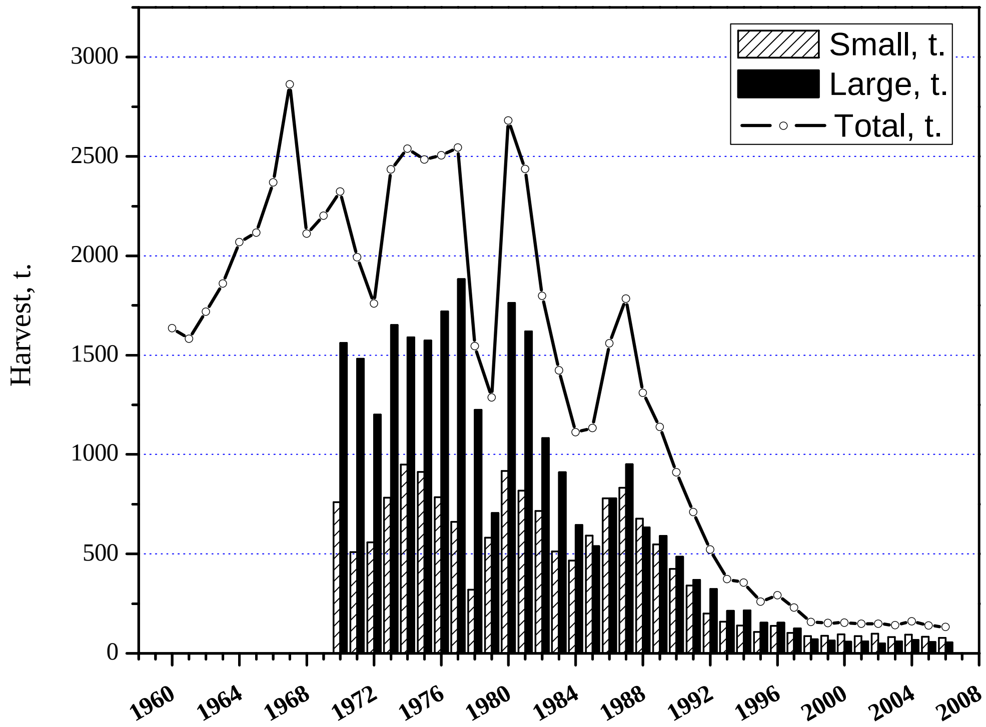


Figure 4.9.4.1. Harvest (t) of small salmon, large salmon and combined for Canada, 1960–2006 by all users.

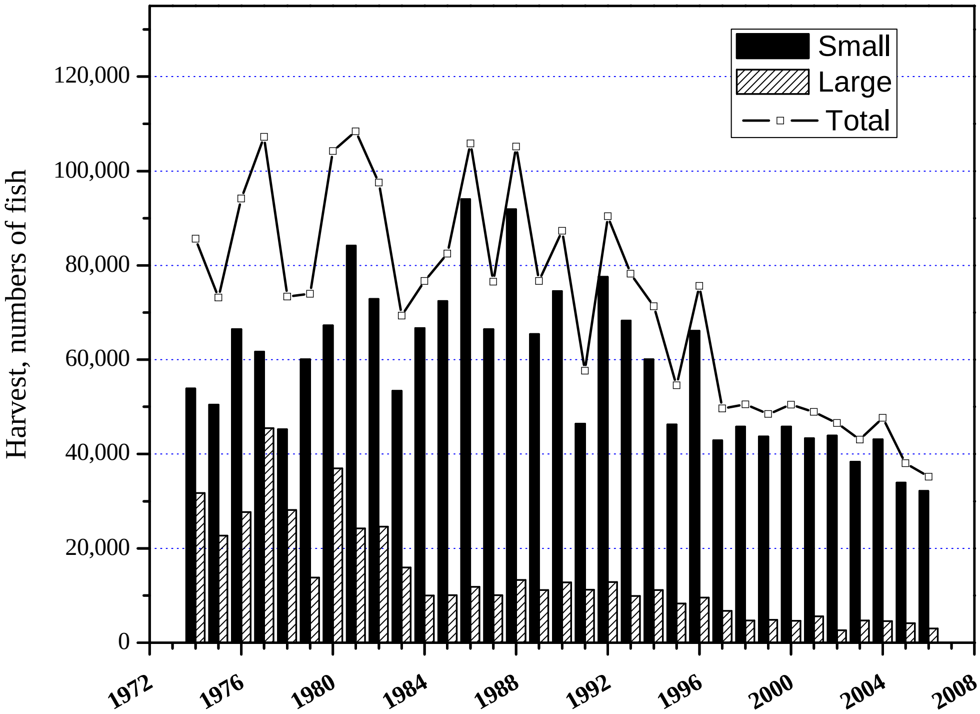


Figure 4.9.4.2. Harvest (number) of small salmon, large salmon and both sizes combined in the recreational fisheries of Canada, 1974– 2006

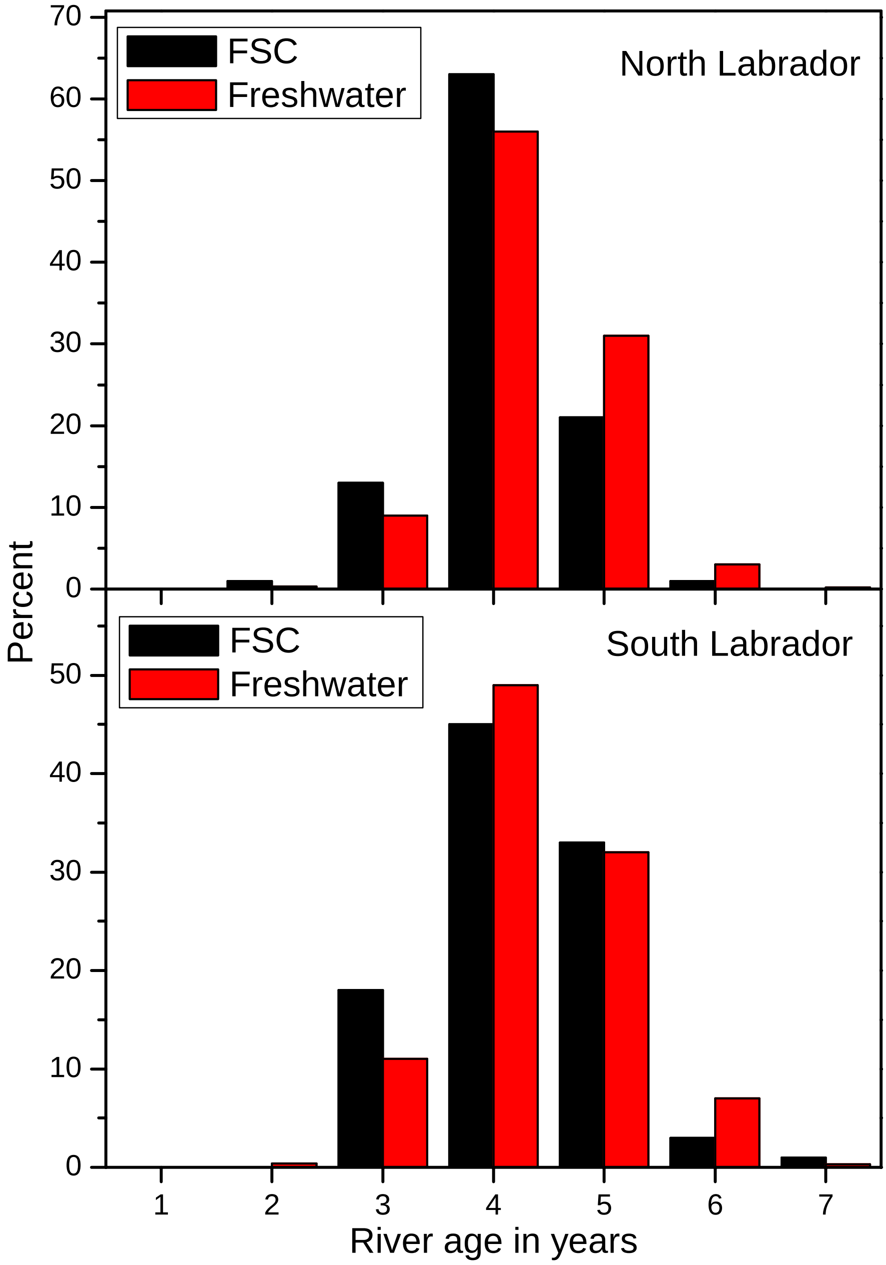


Figure 4.9.5.1. A comparison of the river age distribution of river ages of salmon from FSC fisheries in North and South Labrador in 2006 to those at assessment facilities in 2000–2005.

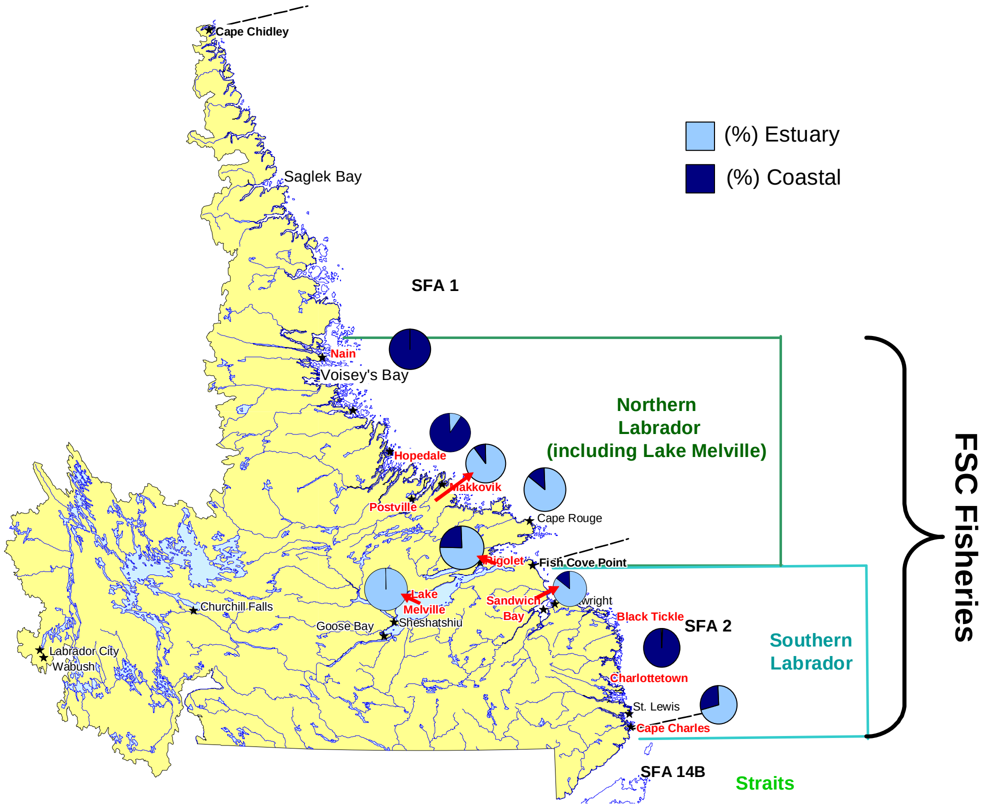


Figure 4.9.5.2. Map showing community locations mentioned in the text, SFAs, and proportions of estuary versus coastal in Labrador.

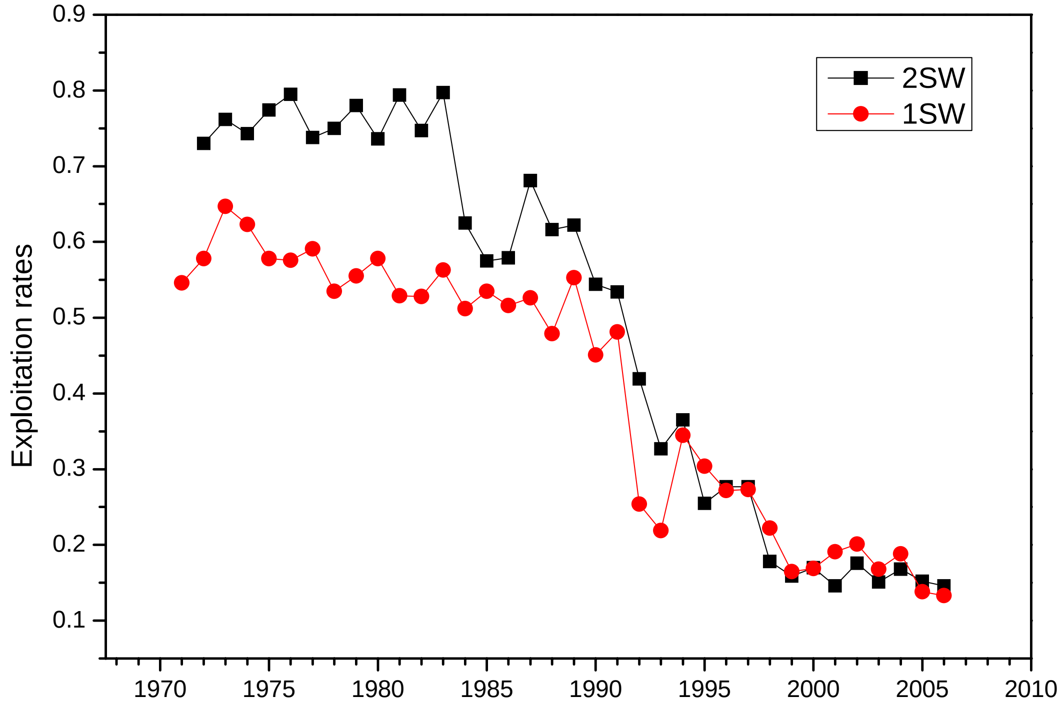


Figure. 4.9.6.1. Exploitation rates in North America on the North American stock complex of 1SW and 2SW salmon.

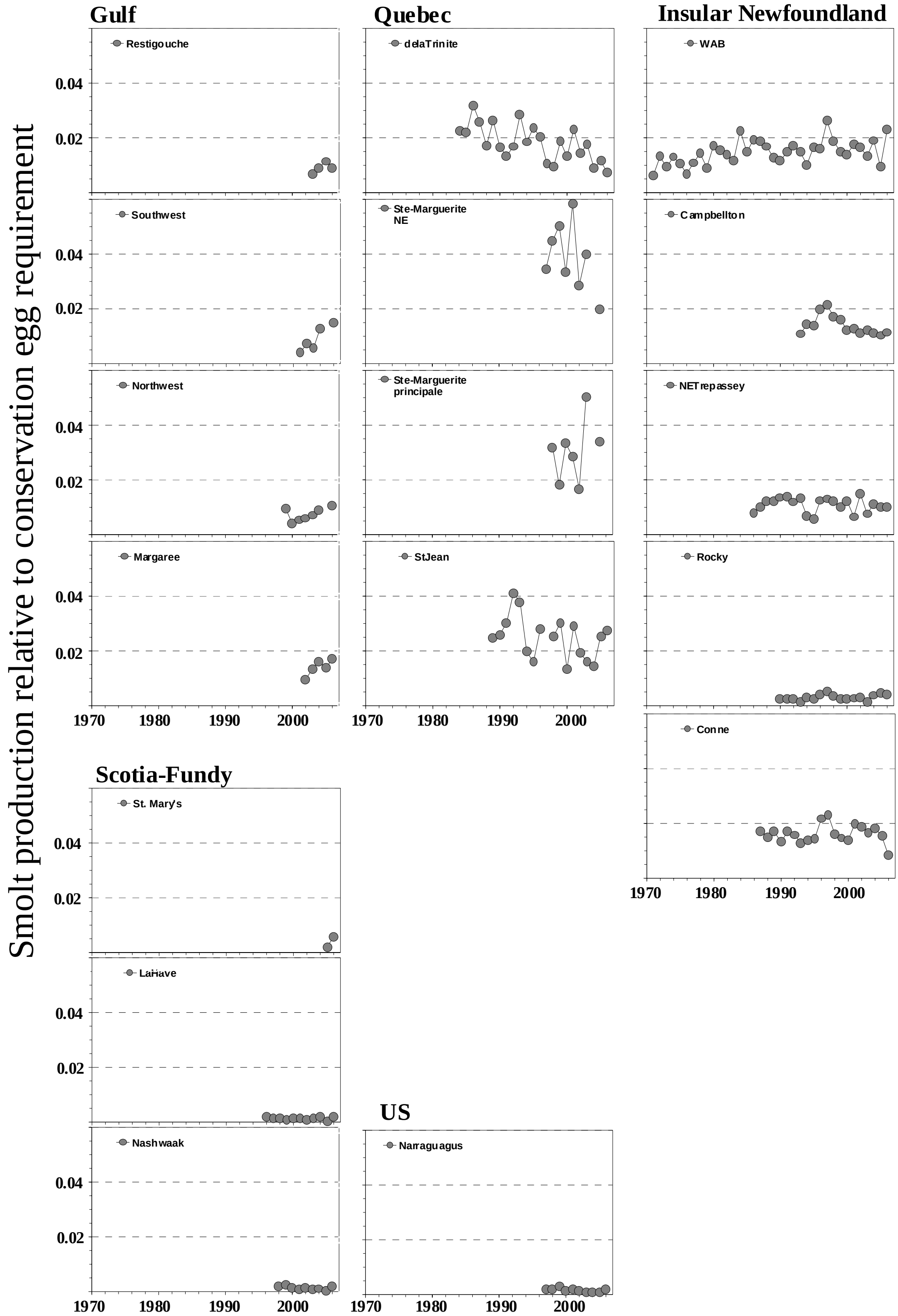


Figure 4.9.7.1. Time series of wild smolt production from sixteen monitored rivers in eastern Canada and one river of eastern USA, 1971–2006. Smolt production is expressed relative to the conservation egg requirements of the rivers.

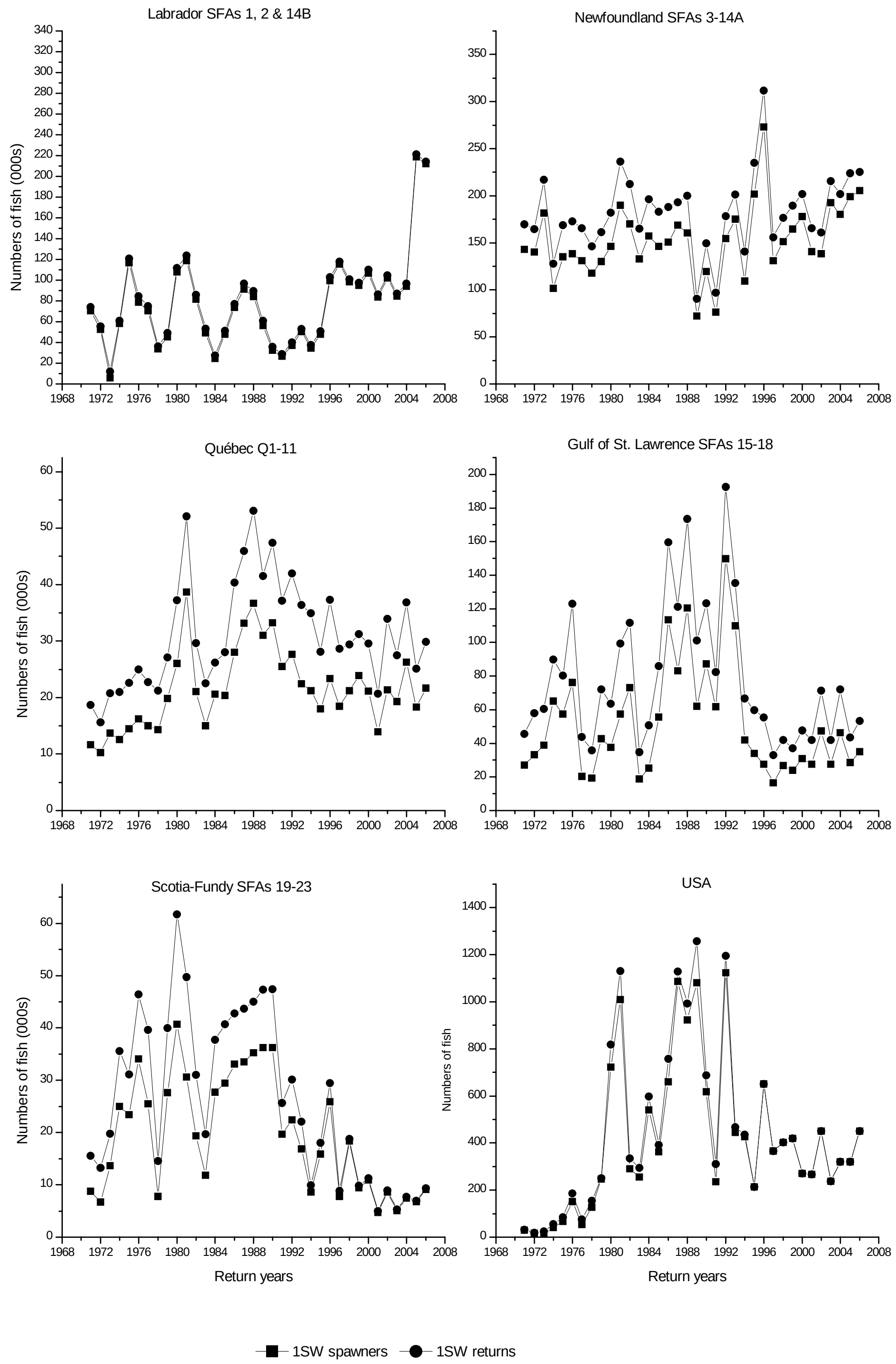


Figure 4.9.7.2. Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. Note scale differences for USA.

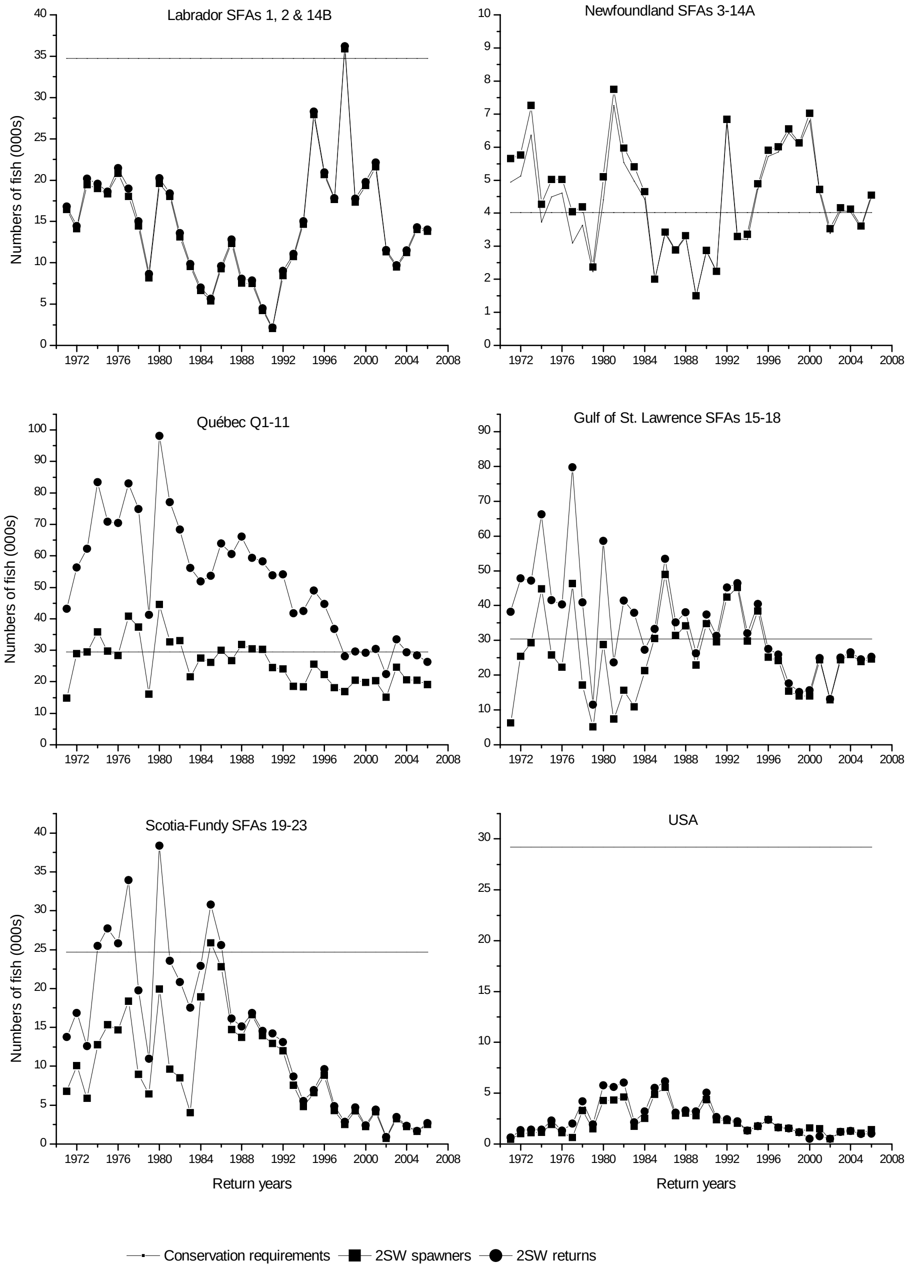


Figure 4.9.7.3. Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation requirements for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

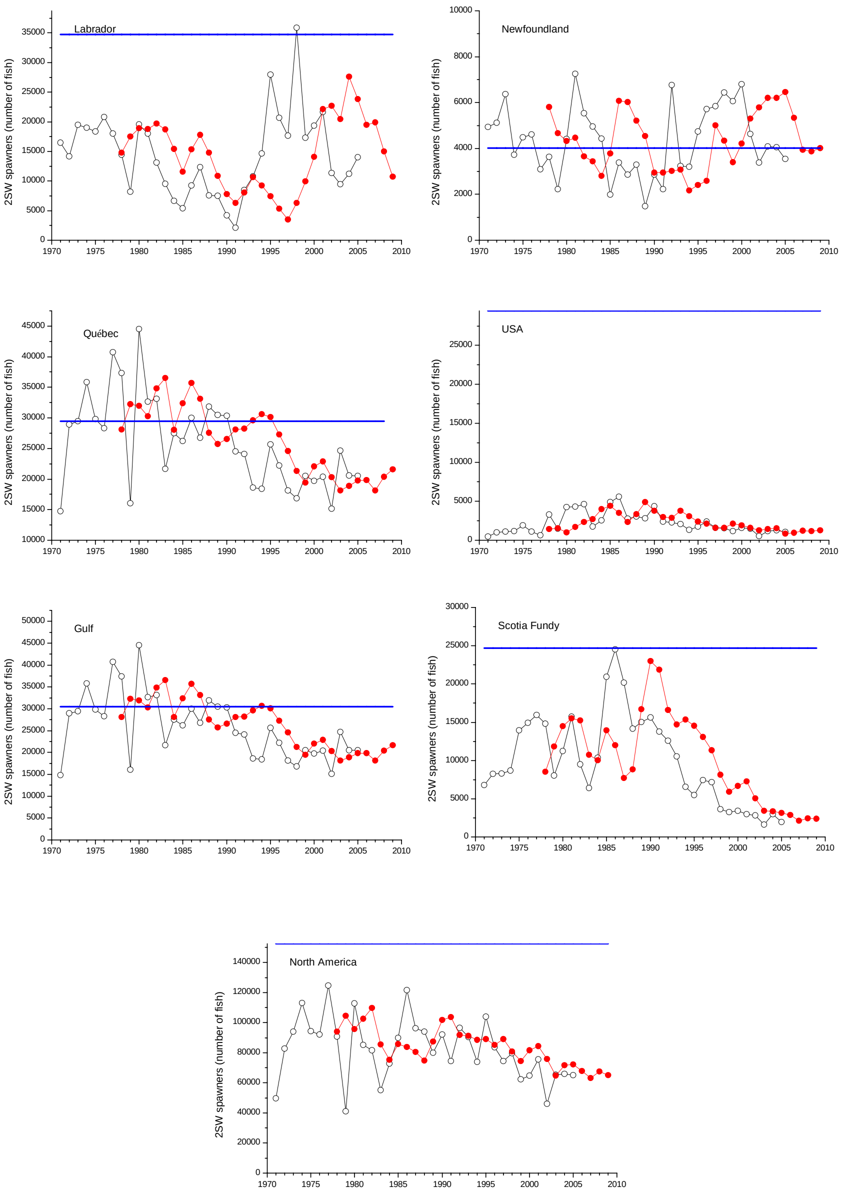


Figure 4.9.7.4. Midpoints of lagged spawners (solid circles) and estimated annual spawners (open circles) as contribution to potential recruitment in the year of prefishery abundance (PFA) for six geographic areas of North America. The horizontal line represents the spawning requirement (in terms of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

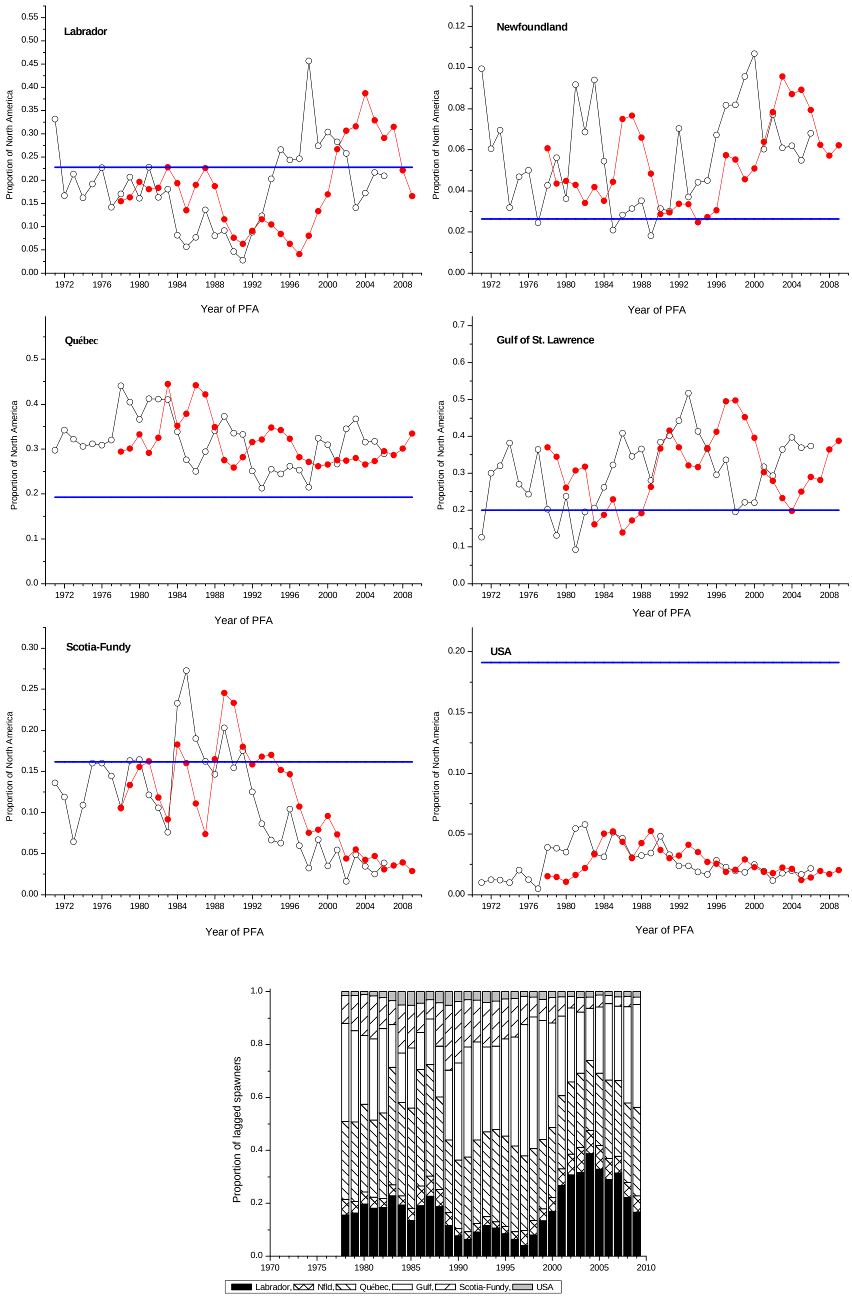


Figure 4.9.7.5. Proportion of spawners (mid-points) lagged to year of PFA (solid circles) and as returns to rivers (open circles) in six geographic areas of North America relative to the total lagged spawner or annual spawning escapement to North America. The horizontal line represents the theoretical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

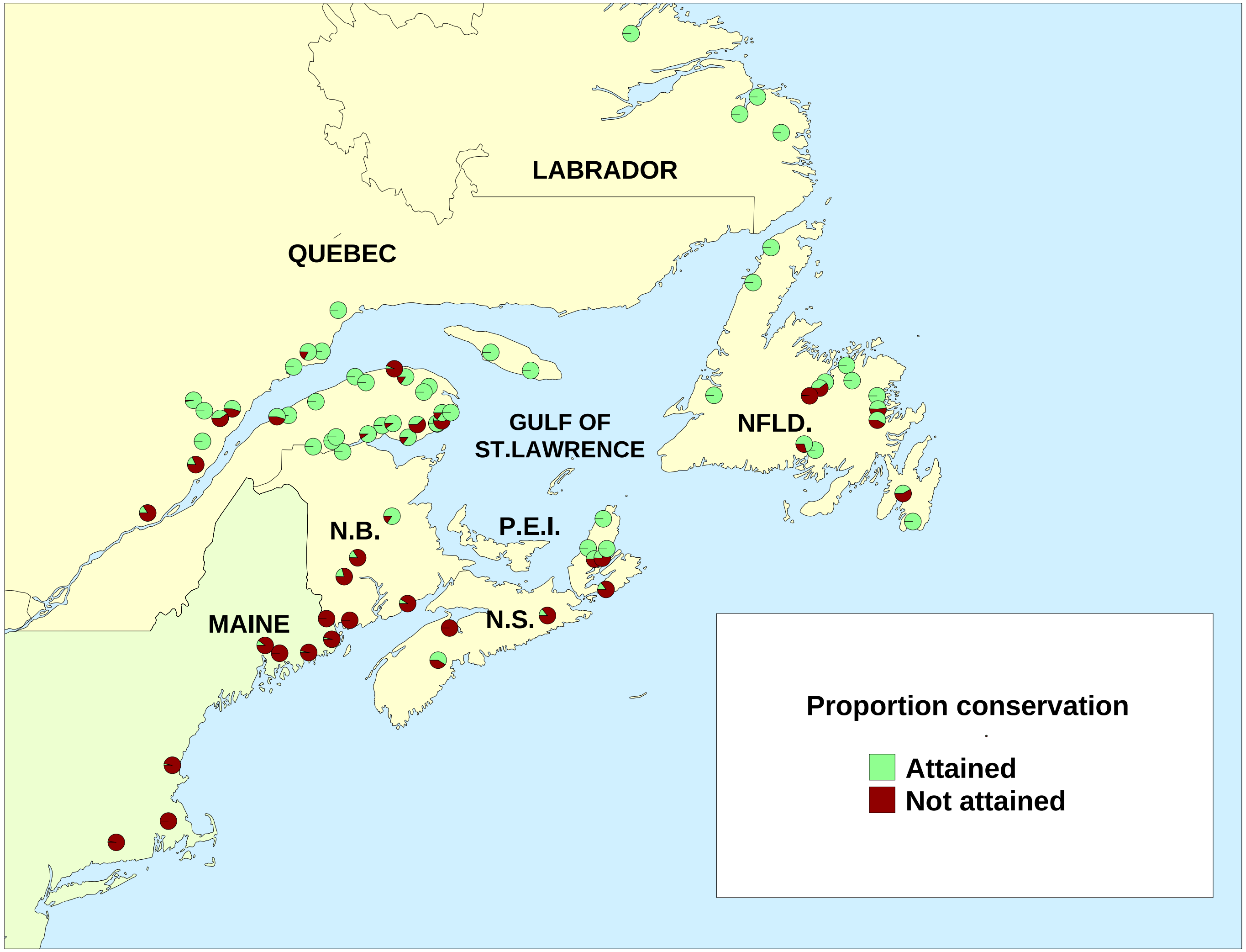


Figure 4.9.8.1. Proportion of the conservation requirement attained in assessed rivers of the North American Commission in 2006.

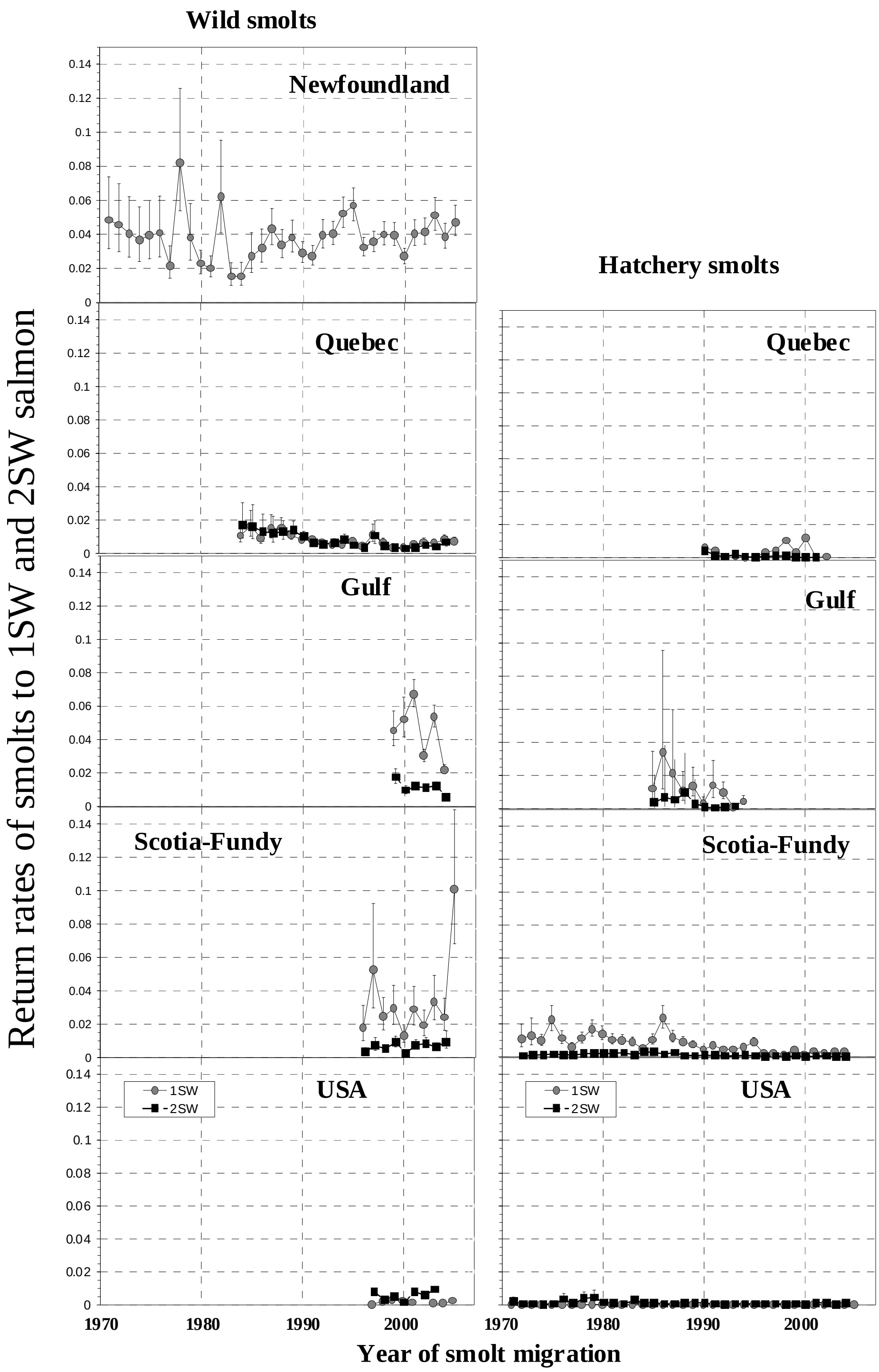


Figure 4.9.9.1. Standardized mean (one standard error bars) annual return rates of wild and hatchery origin smolts to 1SW and 2SW salmon to the geographic areas of North America The standardized values are annual means derived from a general linear model analysis of rivers in a region. Survival rates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

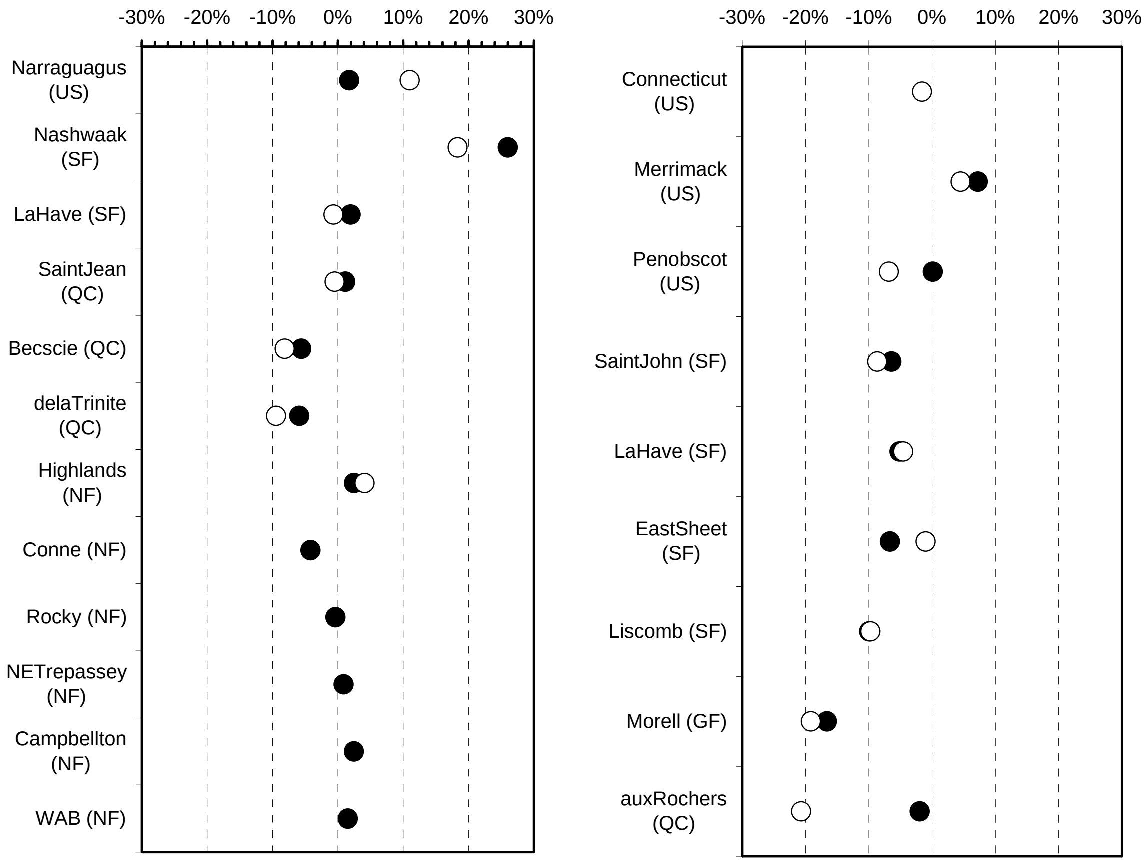


Figure 4.9.9.2. Annual rate of change (%) of return rates to 1SW and 2SW salmon by wild (left) and hatchery (right) salmon smolts to rivers of eastern North America. Black circles are for 1SW and open circles are for 2SW data series.

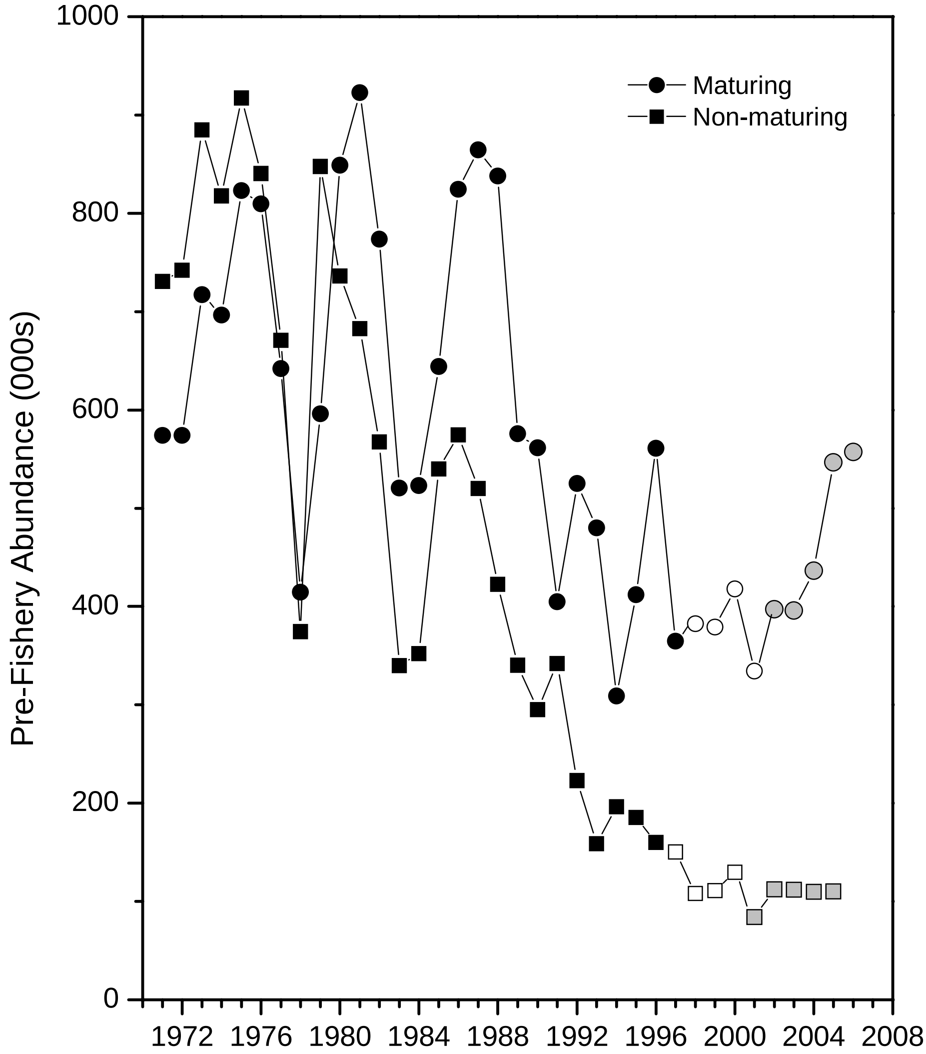


Figure 4.9.10.1. Prefishery abundance estimate of maturing and non-maturing salmon in North America. Open symbols are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America and the grey symbols for deriving returns to Labrador using returns per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

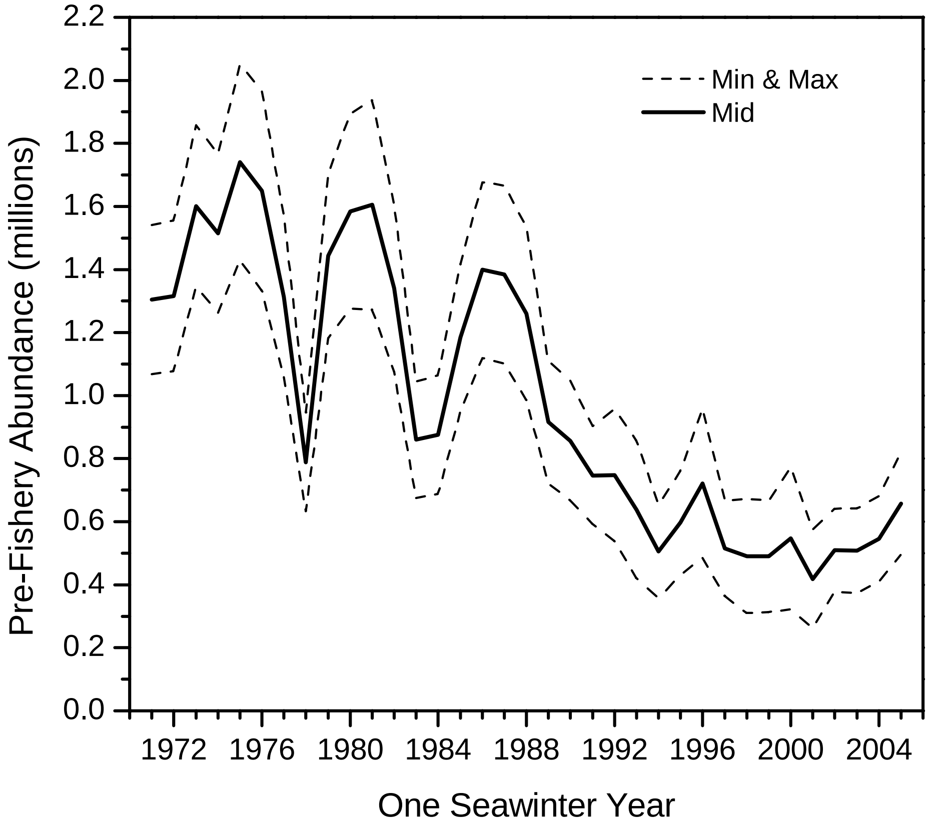


Figure 4.9.10.2. Total 1SW recruits (non-maturing and maturing) originating in North America.

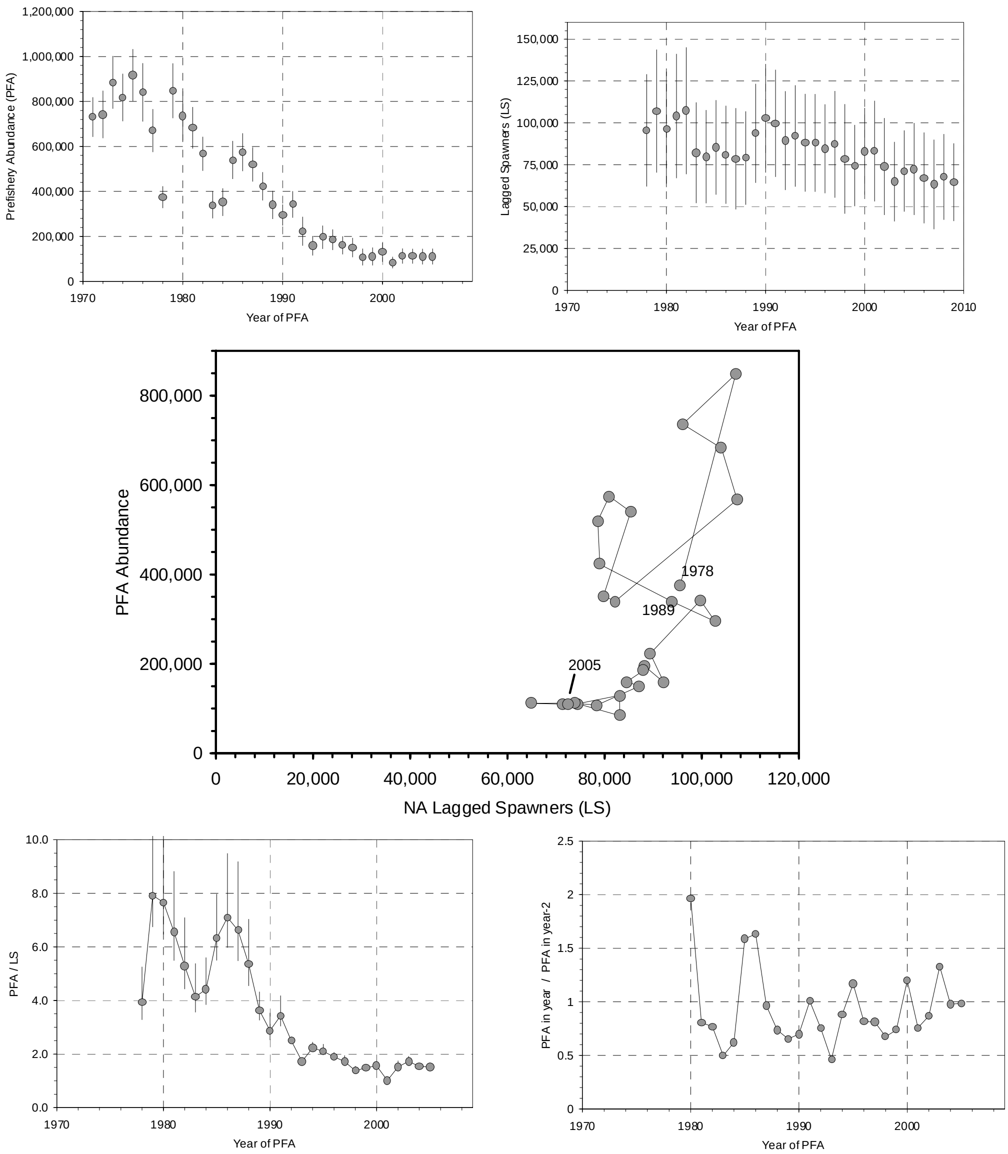


Figure 4.9.10.3. PFA estimates (mid-point, minimum and maximum range; top left), lagged spawners for North America (mid-point, minimum and maximum range; top right), PFA to lagged spawner association for the NAC area showing the sequence from 1978 to 2005 (middle panel), recruitment rate (mid-point, minimum, maximum ratios of PFA to LS; bottom left) and the change of the PFA in year relative to year-2 (bottom right panel).

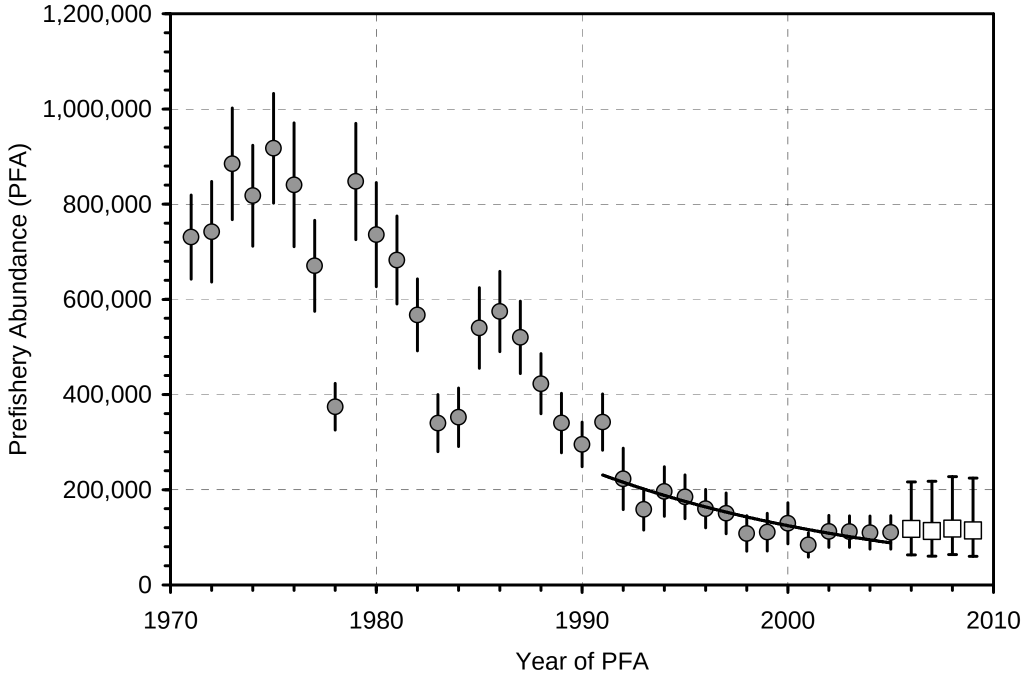


Figure 4.9.10.4. Run reconstruction estimates (grey bullets) of PFA_{NA} and forecast estimate distributions (white squares) for the years 2006 to 2009 non-maturing 1SW salmon. Error bars are minimum and maximum range for reconstructed values, 5^{th} to 95^{th} percentile ranges for the forecast values. Trend line is the exponential change in PFA for the most recent 15 years.

5 Atlantic salmon in the West Greenland Commission

5.1 Status of stocks/exploitation

The Working Group considers the stock complex at West Greenland to be below conservation limits and thus suffering reduced reproductive capacity.

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

The Working Group noted that an exploitation rate for North American non-maturing 1SW fish at West Greenland can be calculated by dividing the recorded harvest of 1SW salmon at West Greenland by the PFA estimate for the corresponding year for North American salmon. These exploitation rates in the last four years have averaged around 3% (Figure 5.1.1).

5.2 Management objectives

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

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

Although not a formal management objective, ICES also provides the probability of returns to North America being equal or less than the previous five-year average. USA returns relative to returns during 1992–1996 to carry forward in catch options.

5.3 Reference points

The reference points for West Greenland catch options are the conservation limits (CLs) for North American and Southern European stock complex. 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.

CLs for the West Greenland fishery for North America are limited to 2SW salmon and southern European stocks are limited to MSW fish because fish at West Greenland are primarily (> 90%) 1SW non-maturing salmon destined to mature as either 2SW or 3SW salmon. The 2SW spawner limits of salmon stocks from North America total 152 548 fish, with 123 349 required in Canadian rivers and 29 199 in USA rivers (see Section 4.3). The current CL estimate for Southern European MSW stocks is approximately 269 000 fish (Section 3.3.2). There is still considerable uncertainty in the CLs for European stocks and estimates may change from year to year as the input of new data affects the pseudo-stock-recruitment relationship.

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

5.4 Management advice

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

5.4.1 Catch options for West Greenland

None of the stated management objectives would allow a fishery at West Greenland to take place in 2007, 2008, or 2009.

In the absence of any marine fishing mortality, there is a very low probability (<3 %) that the returns of 2SW salmon to North America in 2008, 2009, and 2010 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 5.4.1). There is essentially no chance (<1%) that the returns in the southern regions (Scotia-Fundy and USA) will be greater than the returns observed in the 1992–1996 base period in any of the three years. Lastly, in the absence of a fishery, the probability that returns in all regions of North America will be decline further from the average of the period 2002 to 2006 is 36% for 2008, 30% for 2009, and 34% for 2010 (Table 5.4.2).

In the absence of any fisheries, there is only a 64% chance that the MSW CL for southern Europe will be met in 2008 (Table 5.4.1). For 2009 and 2010, the probability that the MSW returns for southern Europe will meet or exceed the CL in the absence of fisheries declines to 56% and 47%, respectively (Tables 5.4.1).

5.5 Relevant factors to be considered in management

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

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

5.6 Prefishery abundance forecasts 2007, 2008, 2009

The PFA forecasts for the West Greenland stock complex are among the lowest in time series (Figure 5.6.1).

5.6.1 North American stock complex

The Working Group has described two temporal phases (ICES 2003) of salmon production in the Northwest Atlantic. Lower recruitment rates are evident throughout eastern Canada and USA. The PFA_{NA} forecast for 2007 has a median value of 113 100 (Table 4.9.10.7). For 2008 and 2009, the PFA_{NA} forecasts remain among the lowest in the time series. For 2008, the median value is 118 000 fish and is highly unlikely to meet the 2SW spawner reserve of 212 189 salmon to North America. For 2009, the median forecast value is 114 200, also highly unlikely to meet the 2SW spawner reserve to North America (Table 4.9.10.7).

5.6.2 Southern European MSW stock complex

The southern European PFA forecast for 2007 has a median value of 455 415 (Table 3.6.1.2). The spawning escapement to southern Europe MSW stocks has not exceeded CLs throughout most of the time period (Figure 3.1.1). The PFA for NEAC MSW southern stock complex is expected to decline in 2008 and 2009 (Figure 3.6.1.). For 2008, the median value is 434 060 fish and for 2009, the median forecast value is 413 701 fish. It is unlikely that spawner reserves will be met in either year.

5.7 Comparison with previous assessment and advice

The management advice for the West Greenland fishery has been the same since 2003. The current modelling approach has provided stable comparisons of the previous year predictions and updated PFA_{NA} in the last two years. For 2006, the median value of the updated analysis for NAC has decreased to 117 431 fish from the 119 000 predicted in the previous year's analysis. The variability of the two predictions was similar. The revised forecast of the southern NEAC MSW PFA for 2006 provides a PFA mid-point of 483 700. This is close to the value forecast last year at this time of 489 000.

5.8 NASCO has requested ICES to describe the events of the 2006 fishery and status of the stocks

5.8.1 Catch and effort in 2006

By the end of the season a total of 20.7 t of landed salmon were reported (Table 5.8.1.1). In total, 236 reports were received, a 61% increase from the 145 last year. Catches were distributed among the six NAFO divisions on the western coast of Greenland (Figure 5.8.1.1), with catches in 1A, 1D, and 1F higher than the other three divisions (Table 5.8.1.2). In 2006, catch was reported from week 32 to week 44, with 44% of the catch by weight reported in week 44 and no more than 10% in any of the remaining weeks. Since 2003, the proportion of the catch reported in week 44 or later has ranged from 2% to 20%. In late October 2006, the Greenland Home Rule License Office broadcast TV requests that catch reports be submitted for the season. Thus, it is possible that the temporal distribution of reported catch in 2006 reflects changes in reporting practice.

In 2006 a total of 136 people landed salmon, with five reporting landings in more than one NAFO Division. The number of fishermen reporting catches has steadily increased from approximately 40 to 136 over the last 5 years, but is below the 400 to 600 people reporting landings in the commercial fishery 1987 to 1991. There is presently no quantitative approach for estimating the unreported catch. However, in 2006 it is likely to have been at the same level proposed in recent years (10 t).

5.8.2 Biological characteristics of the catches

The international sampling program for landings at West Greenland initiated by NASCO in 2001 was continued in 2006. The sampling teams from Greenland, Ireland, UK (Scotland), UK (England & Wales), Canada, and United States were in place at the start of the fishery and continued through October. Tissue and biological samples were collected from five landing sites: Qaqortoq (NAFO Div. 1F), Paamiut (NAFO Div.1E), Nuuk (NAFO Div. 1D), Maniitsoq (NAFO Div. 1C), and Ilulissat (NAFO Div. 1A) (Figure 5.8.1.1). In total 1253 salmon were inspected for the presence of tags, representing 25 % by weight of the reported landings. Of these, 1104 were measured for fork length and weight, and scales were collected from 1118 (Table 5.8.2.1). Tissue was removed for DNA analysis from 1193 salmon. The broad geographic distribution of the subsistence fishery caused practical problems for the sampling teams. However, temporal coverage was adequate to assess the fishery. Unlike in previous years, the Working Group did not need to adjust the total landings by replacing the reported catch with the weight of fish sampled to use in assessment calculations (Table 5.8.2.2).

The average weight of a fish from the 2006 catch was 3.24 kg across all ages, with North American 1SW fish averaging 65.3 cm and 3.10 kg whole weight and European 1SW salmon averaging 65.3 cm and 3.25 kg (Table 5.8.2.3). The mean lengths and mean weights for the 2006 samples were among the highest in the last decade. It should be noted that the average weight is not adjusted for standard week and may not represent a true increase in mean weight over years.

North American salmon up to river age 6 were caught at West Greenland in 2006 (Table 5.8.2.4), with approximately 44% being river age 3 and 27% being river age 4. The river ages of European salmon ranged from 1 to 5 (Table 5.8.2.4). Over half (54%) of the European fish in the catch were river-age 2 and 23.6% were river age 3. The proportion of the European origin river age 1 salmon in the catch has ranged been between 9% and 19% since 2001 (Table 5.8.2.4).

In 2006, 98.8 % of the European samples were 1SW salmon, with previous spawners 1.2% of the samples (Table 5.8.2.5). 1SW salmon dominated (93%) the North American component, with previous spawners decreasing to 5.6% from 6.4% of the samples last year (Table 5.8.2.5).

Tissue for disease testing was obtained from 119 whole fish in Nuuk. These samples were tested for the presence of ISAv by RT-PCR assay only and all test results were negative. The sex was determined by examining gonads for 121 salmon (119 whole and 3 viscera); of these 23 (18%) were males and 98 (82%) females.

5.8.3 Continent of origin of catches at West Greenland

Of the 1193 samples collected for genetic characterization, most (1042) were genotyped at four microsatellites (Ssa202, Ssa289, SSOSL438, and SSOSL311). Two samples were removed from the analysis and the remainder were genotyped at 2 (n=3) or 3 (n=146) loci. A database of approximately 5000 Atlantic salmon genotypes of known origin was used as a baseline to assign these salmon to continent of origin. In total, 72% of the salmon sampled from the 2006 fishery were of North American origin and 28% fish were of European origin.

The continent of origin of the samples varied among the divisions in 2006 (see table below) (Chi Square p =0.019). The Working Group recommends a broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery.

NAFO division	North America		Europe	
	Number	%	Number	%
1A	33	56%	26	44%
1C	81	64%	45	36%
1D	620	74%	218	26%
1E	25	61%	16	39%
1F	98	77%	29	23%
Total	857	72%	334	28%

Applying the continental percentages for the NAFO division catches resulted in estimates of 14.3 t of North American origin and 6.4 t of European origin fish (4000 and 1800 rounded to the nearest 100 fish, respectively) landed in West Greenland in 2006 (Table 5.8.3.1 and Figure 5.8.3.1).

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

MSW stocks from North America and southern Europe contribute to the fishery at West Greenland. The percentage of North American salmon in the West Greenland catch has averaged approximately 70% from 2000–2005 (Table 5.8.3.1).

5.8.4.1 North American Stock

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has declined since the 1970s (Figure 4.9.10.1). During 1994–2006, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972–1990. The decline from earlier higher levels of abundance has been more severe for the 2SW salmon component than for the small salmon (maturing 1SW salmon) age group.

In most regions, the returns of 2SW fish in 2006 increased slightly from 2005, however, they are still close to the lowest of the 35-year time-series (1972–2006). In 2006, the estimated overall spawning escapement was below the CL for the stock complex. Specifically 2SW spawners in the regions are:

- **Newfoundland:** at risk of suffering reduced reproductive capacity (112% of 2SW CL)
- **Labrador:** suffering reduced reproductive capacity (40% of 2SW CL)
- **Québec:** suffering reduced reproductive capacity (65% of 2SW CL)
- **Gulf of St. Lawrence**: suffering reduced reproductive capacity (86% of 2SW CL)
- **Scotia-Fundy:** suffering reduced reproductive capacity (10% of 2SW CL)
- **United States:** suffering reduced reproductive capacity (6% of 2SW CL)

5.8.4.2 Southern European Stock

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

- **Southern European stock complex:** suffering reduced reproductive capacity (82% of 2SW CL)

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

5.9.1 Run-reconstruction models

The run-reconstruction models to estimate pre-fishery abundance of 1SW non-maturing and maturing 2SW fish adjusted by natural mortality to the time prior to the West Greenland fishery are the same as those used since 2003 (ICES, 2003, 2004, 2005, 2006). See Sections 4.9.10 and 3.8.9 for additional details.

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

The forecast models used to estimate pre-fishery abundance of non-maturing 1SW salmon (potential MSW) from the Southern European stock group were the same as those used since 2002 (ICES, 2002, 2003, 2004, 2005, 2006). The overall approach is to select the best model by adding variables (eg. spawners, habitat, PFA of maturing 1SW salmon and year) until addition of any other parameter was not significant. See Section 3.6 for details.

The forecast models used to estimate pre-fishery abundance of non-maturing 1SW salmon (potential MSW) for North America were the same as those used since 2004 (ICES, 2004, 2005, 2006). The overall approach of modelling the natural log transformed PFA_{NA} and LS_{NA} using linear regression and the Monte Carlo method used to derive the probability density for the PFA_{NA} forecast was also retained from previous years. See Section 4.9.10 for details.

5.9.3 Development and risk assessment of catch options

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

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

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

The uncertainty in the PFA_{NA} and PFA_{NEAC} is accounted for in the approaches described below. The number of fish of North American and European origin in a given catch (t) is conditioned by the continent of origin of the fish ($prop_{NA}$, $prop_E$), by the average weight of the fish in the fishery ($Wt1SW_{NA}$, $Wt1SW_E$) and a correction factor by weight for the other age groups in the fishery (ACF). For the 2007 to 2009 fisheries, it was assumed that the parameters for $Wt1SW_{NA}$ (2.84–3.19 kg), $Wt1SW_E$ (2.92–3.33 kg), $prop_{NA}$ (0.68–0.76), and the ACF (1.0245–1.0985) could vary uniformly within the values observed in the past five years.

For a level of fishery under consideration, the weight of the catch is converted to fish of each continent's origin and subtracted from one of the simulated forecast values of PFA_{NA} and

PFA_{NEAC}. The fish that escape the Greenland fishery are immediately discounted by the fixed sharing fraction (Fna) historically used in the negotiations of the West Greenland fishery. The sharing fraction chosen is the 40:60 West Greenland:North America split. The same sharing arrangement was assumed for NEAC stocks. Any sharing fraction can be considered and incorporated at this stage of the risk assessment. After the fishery, fish returning to home waters are discounted for natural mortality from the time they leave West Greenland to the time they return to rivers. For North America this is a total of 11 months at a rate of M = 0.03 (equates to 28.1% mortality). For Southern European stocks this is a total of 8 months at a rate of M = 0.03 (equates to 21% mortality). The fish that survive to North American homewaters are then distributed among the regions and the total fish escaping to each region is compared to the region's 2SW spawning requirements.

The final step in the risk analysis of the catch options involves combining the conservation requirement with the probability distribution of the returns to North America for different catch options. The returns to North America are partitioned into regional returns based on the regional proportions of 2SW returns of the last five years, 2002 to 2006. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and USA are compared to the objective of achieving an increase of 10% and 25% relative to average returns of the base period, 1992–1996.

5.9.4 Critical Evaluation

Any changes to the run-reconstruction and pre-fishery abundance forecast models would have been critically examined in Sections 3.8 and 4.9. There were no changes to the risk assessment of catch options model.

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

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

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

Table 5.3.1. A – Lagged spawners achieved, 2SW conservation limits and the PFA number of fish required to meet region specific conservation limits if the returns to the regions are in proportion to the average lagged spawner distributions of 2002 to 2006. B – 2SW returns to the regions of North America for two time periods, 1992–1996, 2002–2006. C – Management objectives for the NAC area used to develop the risk analysis of catch options for the 2007 to 2009 fisheries.

Achieved lagged spawners by PFA year

PFA Year	Region: Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
2002	22675	5786	20286	20650	3264	1303	73964
2003	20485	6202	18121	15067	3579	1439	64892
2004	27626	6202	18894	14029	3031	1518	71300
2005	23828	6460	19796	18116	3396	878	72473
2006	19497	5331	19806	19480	2081	960	67154
Average	22822	5996	19380	17468	3070	1219	69957
Prop. of total	0.326	0.086	0.277	0.250	0.044	0.017	
2SW Conservation Limit							
Number of fish	34,746	4,022	29,446	30,430	24,705	29,199	152,548
Prop. of NA	0.228	0.026	0.193	0.199	0.162	0.191	
Spawner Reserve corrected for 11 months of M at 0.03 per month							212,189
PFA required to meet regional 2SW requirements based on average spawner distribution from 2002 to 2006	148,147	63,343	143,476	164,501	759,867	2,261,043	

2SW Returns to regions

B	Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
1992-1996	16,865	4,855	46,379	38,288	8,781	2,038	117,206
2002-2006	12,199	3,994	27,972	22,909	2,218	999	70,289

Management objectives for NAC area

C

Region: Labrador	Newfoundland	Quebec	Gulf	Region: Scotia-Fundy	US	
2SW Conservation Limit (number of fish)				**Average returns** Base years 1992-1996		
34,746	4,022	29,446	30,430	8,781	2,038	
2SW Conservation Limit				**Increase relative to base years**		
				9,659	**2,242**	**+10%**
98,644				**10,976**	**2,548**	**+25%**

Table 5.4.1. Catch options (t) for West Greenland harvest in 2007, 2008, and 2009 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2007

West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.016	0.002	0.001	0.635
5	0.015	0.002	0.001	0.629
10	0.015	0.002	0.001	0.624
15	0.014	0.002	0.001	0.618
20	0.013	0.002	0.001	0.612
25	0.012	0.002	0.001	0.606
30	0.012	0.002	0.001	0.603
35	0.011	0.002	0.001	0.597
40	0.011	0.002	0.001	0.592
45	0.011	0.002	0.001	0.587
50	0.010	0.002	0.001	0.582
100	0.007	0.001	0.001	0.525

2008

West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.025	0.007	0.005	0.559
5	0.024	0.007	0.005	0.552
10	0.023	0.007	0.004	0.546
15	0.022	0.007	0.004	0.540
20	0.021	0.007	0.004	0.535
25	0.021	0.006	0.004	0.529
30	0.020	0.006	0.004	0.523
35	0.020	0.006	0.004	0.516
40	0.019	0.006	0.004	0.509
45	0.018	0.006	0.004	0.503
50	0.018	0.006	0.004	0.497
100	0.015	0.005	0.003	0.441

Table 5.4.1. Continued. Catch options (t) for West Greenland harvest in 2007, 2008, and 2009 with the probability of meeting management objectives: meeting the 2SW conservation limits simultaneously in the four northern areas of North America; achieving increases in returns from base year average (1992–1996) in the two southern areas; and meeting the MSW conservation limit of the southern European stock complex relative to quota options.

2009				
WEST GREENLAND HARVEST (T)	SIMULTANEOUS CONSERVATION (LAB, NF, QUEB, GULF)	IMPROVEMENT (SF, USA) OF RETURNS		CONSERVATION MSW SALMON SOUTHERN NEAC
		> 10%	> 25%	
0	0.024	0.006	0.003	0.470
5	0.023	0.005	0.003	0.464
10	0.022	0.005	0.003	0.457
15	0.021	0.005	0.003	0.452
20	0.021	0.005	0.003	0.445
25	0.020	0.005	0.003	0.440
30	0.019	0.005	0.003	0.434
35	0.018	0.004	0.003	0.430
40	0.018	0.004	0.002	0.424
45	0.017	0.004	0.002	0.418
50	0.017	0.004	0.002	0.413
100	0.012	0.003	0.002	0.358

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

(SF, USA) = Scotia-Fundy and USA

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

Table 5.4.2. Probability of 2SW returns in 2008, 2009, and 2010 being less than the previous five-year average (2002–2006) returns to regions of North America, relative to catch options at West Greenland.

WEST GREENLAND HARVEST	2008	2009	2010
TONS	PROBABILITY	PROBABILITY	PROBABILITY
0	0.359	0.304	0.340
5	0.385	0.331	0.367
10	0.411	0.360	0.394
15	0.436	0.390	0.421
20	0.463	0.416	0.448
25	0.486	0.442	0.473
30	0.510	0.467	0.500
35	0.537	0.491	0.527
40	0.559	0.517	0.554
45	0.582	0.541	0.578
50	0.605	0.563	0.598
100	0.784	0.760	0.784

Table 5.8.1.1. Nominal catches of salmon, West Greenland 1977–2006 (metric tons round fresh weight).

Year	Total	Quota
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 [2]
1982	1077	1253 [2]
1983	310	1191
1984	297	870
1985	864	852
1986	960	909
1987	966	935
1988	893	[3]
1989	337	[3]
1990	274	[3]
1991	472	840
1992	237	258 [4]
1993	[1]	895
1994	[1]	137 [5]
1995	83	77
1996	92	174 [4]
1997	58	57
1998	11	206
1999	19	206
2000	21	206
2001	43	114 [7]
2002	9 [10]	55 [5 8 9]
2003	9 [10]	[6 8]
2004	15 [10]	[6 8]
2005	14 [10]	[6 8]
2006	21	[6 8]

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

Table 5.8.1.2. Distribution of nominal catches (metric tons) by Greenland vessels (1977-2006).

Year	NAFO Division							Total		
	1A	1B	1C	1D	1E	1F	NK	West Greenland	East Greenland	Greenland
1977	201	393	336	207	237	46	-	1 420	6	1 426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1 395	+	1 395
1980	52	275	404	231	158	74	-	1 194	+	1 194
1981	105	403	348	203	153	32	20	1 264	+	1 264
1982	111	330	239	136	167	76	18	1 077	+	1 077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993 [1]	-	-	-	-	-	-	-	-	-	-
1994 [1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	4	-	14	-	14
2006	5	2	3	4	2	4	-	21	-	21

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

Table 5.8.2.1. Size of biological samples and percentage (by number) of North American and European salmon in research vessel catches at West Greenland (1969–82) from commercial samples (1978–92 1995–97 and 2001) and from local consumption samples (1998–2000 and 2002–2006).

		Sample Size			Continent of origin (%)			
Source		Length	Scales	Genetics	NA	(95%CI)[1]	E	(95%CI)
Research	1969	212	212		51	(57,44)	49	(56,43)
	1970	127	127		35	(43,26)	65	(75,57)
	1971	247	247		34	(40,28)	66	(72,50)
	1972	3488	3488		36	(37,34)	64	(66,63)
	1973	102	102		49	(59,39)	51	(61,41)
	1974	834	834		43	(46,39)	57	(61,54)
	1975	528	528		44	(48,40)	56	(60,52)
	1976	420	420		43	(48,38)	57	(62,52)
	1978[2]	606	606		38	(41,34)	62	(66,59)
	1978[3]	49	49		55	(69,41)	45	(59,31)
	1979	328	328		47	(52,41)	53	(59,48)
	1980	617	617		58	(62,54)	42	(46,38)
	1982	443	443		47	(52,43)	53	(58,48)
Commercial	1978	392	392		52	(57,47)	48	(53,43)
	1979	1653	1653		50	(52,48)	50	(52,48)
	1980	978	978		48	(51,45)	52	(55,49)
	1981	4570	1930		59	(61,58)	41	(42,39)
	1982	1949	414		62	(64,60)	38	(40,36)
	1983	4896	1815		40	(41,38)	60	(62,59)
	1984	7282	2720		50	(53,47)	50	(53,47)
	1985	13272	2917		50	(53,46)	50	(54,47)
	1986	20394	3509		57	(66,48)	43	(52,34)
	1987	13425	2960		59	(63,54)	41	(46,37)
	1988	11047	2562		43	(49,38)	57	(62,51)
	1989	9366	2227		56	(60,52)	44	(48,40)
	1990	4897	1208		75	(79,70)	25	(30,21)
	1991	5005	1347		65	(69,61)	35	(39,31)
	1992	6348	1648		54	(57,50)	46	(50,43)
	1995	2045	2045		68	(72,65)	32	(35,28)
	1996	3341	1297		73	(76,71)	27	(29,24)
	1997	794	282		80	(84,75)	20	(25,16)
Local consumption	1998	540	406		79	(84,73)	21	(27,16)
	1999	532	532		90	(97,84)	10	(16,3)
	2000	491	491		70		30	
Commercial	2001	4721	2655		69	(71,67)	31	(33,29)
Local consumption	2002	1374	1374	1329	68		32	
	2003	1824	1824	1779	68		32	
	2004	1639	1639	1688	73		27	
	2005	767	767	767	76		24	
	2006	1104	1118	1193	72		28	

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

2 During 1978 Fishery

3 Research samples after 1978 fishery closed

Table 5.8.2.2. Reported landings provided by the Home Rule Government at West Greenland Atlantic salmon fisheries (kg) by NAFO Division for the 2002–2006 and adjusted landings for divisions where the sampling teams observed more fish landed than were reported.

		NAFO Division						
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	1166	2811	2018	681	2646	4465	13 786
	Adjusted				2730			15 835
2006	Reported	4889	2352	3085	4262	2375	3777	20 740
	Adjusted							20 740

Table 5.8.2.3. Annual mean whole weights (kg) and fork lengths (cm) of Atlantic salmon caught at West Greenland 1969–1992 and 1995–2006. NA = North America; E = Europe.

	Whole weight (kg) Sea age & origin									Fork length (cm) Sea age & origin					
	1SW		2SW		PS		All sea ages		TOTAL	1SW		2SW		PS	
	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.90	2.63	2.84	2.71	62.3	63.6	85.7	84.0	79.4	87.0
1998	2.72	2.83	6.44	-	3.28	4.77	2.76	2.84	2.78	62.0	62.7	84.0	-	66.3	76.0
1999	3.02	3.03	7.59	-	4.20	-	3.09	3.03	3.08	63.8	63.5	86.6	-	70.9	-
2000	2.47	2.81	-	-	2.58	-	2.47	2.81	2.57	60.7	63.2	-	-	64.7	-
2001	2.89	3.03	6.76	5.96	4.41	4.06	2.95	3.09	3.00	63.1	63.7	81.7	79.1	75.3	72.1
2002	2.84	2.92	7.12	-	5.00	-	2.89	2.92	2.90	62.6	62.1	83.0	-	75.8	-
2003	2.94	3.08	8.82	5.58	4.04	-	3.02	3.10	3.04	63.0	64.4	86.1	78.3	71.4	-
2004	3.11	2.95	7.33	5.22	4.71	6.48	3.17	3.22	3.18	64.7	65.0	86.2	76.4	77.6	88.0
2005	3.19	3.33	7.05	4.19	4.31	2.89	3.31	3.33	3.31	65.9	66.4	83.3	75.5	73.7	62.3
2006	3.10	3.25	9.72		5.05	3.67	3.25	3.26	3.24	65.3	65.3	90.0		76.8	69.5

Table 5.8.2.4. River age distribution (%) and mean river age for all North American and European origin salmon caught at West Greenland 1968–1992 and 1995–2006.

YEAR	1	2	3	4	5	6	7	8
				North American				
1968	0.3	19.6	40.4	21.3	16.2	2.2	0	0
1969	0	27.1	45.8	19.6	6.5	0.9	0	0
1970	0	58.1	25.6	11.6	2.3	2.3	0	0
1971	1.2	32.9	36.5	16.5	9.4	3.5	0	0
1972	0.8	31.9	51.4	10.6	3.9	1.2	0.4	0
1973	2.0	40.8	34.7	18.4	2.0	2.0	0	0
1974	0.9	36.0	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
1978	2.7	31.9	43	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
1995	2.4	19.0	45.4	22.6	8.8	1.8	0.1	0
1996	1.7	18.7	46	23.8	8.8	0.8	0.1	0
1997	1.3	16.4	48.4	17.6	15.1	1.3	0	0
1998	4.0	35.1	37	16.5	6.1	1.1	0.1	0
1999	2.7	23.5	50.6	20.3	2.9	0	0	0
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
Mean	2.9	32.1	38.8	18.0	6.9	1.2	0.1	0.0

Table 5.8.2.4. cont. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland 1968–1992 and 1995–2006.

YEAR	1	2	3	4	5	6	7	8
					European			
1968	21.6	60.3	15.2	2.7	0.3	0	0	0
1969	0	83.8	16.2	0	0	0	0	0
1970	0	90.4	9.6	0	0	0	0	0
1971	9.3	66.5	19.9	3.1	1.2	0	0	0
1972	11.0	71.2	16.7	1.0	0.1	0	0	0
1973	26.0	58.0	14.0	2.0	0	0	0	0
1974	22.9	68.2	8.5	0.4	0	0	0	0
1975	26.0	53.4	18.2	2.5	0	0	0	0
1976	23.5	67.2	8.4	0.6	0.3	0	0	0
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	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
1995	14.8	67.3	17.2	0.6	0	0	0	0
1996	15.8	71.1	12.2	0.9	0	0	0	0
1997	4.1	58.1	37.8	0	0	0	0	0
1998	28.6	60.0	7.6	2.9	0	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	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
Mean	18.7	61.1	17.3	2.6	0.3	0.0	0.0	0.0

Table 5.8.2.5. Sea-age composition (%) of samples from fishery landings at West Greenland, 1985–2006 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 [1]	96.8	0.5	2.7	99.4	0.0	0.6
1999 [1]	96.8	1.2	2.0	100.0	0.0	0.0
2000 [1]	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	2.6	0.5	97.8	2.0	0.3
2002 [1]	97.3	0.9	1.8	100.0	0.0	0.0
2003 [1]	96.7	1.0	2.3	98.9	1.1	0.0
2004 [1]	97.0	0.5	2.5	97.0	2.8	0.2
2005 [1]	92.4	1.2	6.4	96.7	1.1	2.2
2006 [1]	93.0	0.8	5.6	98.8	0.0	1.2

[1] Catches for local consumption only

Table 5.8.3.1. The catch weighted numbers of North American (NA) and European (E) Atlantic salmon caught at West Greenland 1982-1992 and 1995-2006, the proportion of the catch by weight, and the PFA for non-maturing 1SW fish for North American and Southern European stock complexes. Numbers are rounded to the nearest hundred fish.

Year	Numbers of Salmon caught		Proportion weighted by catch in number	
	NA	E	NA	E
1971	291 166	565 204	34	66
1972	221 128	393 116	36	64
1973	274 423	285 624	49	51
1974	230 254	305 221	43	57
1975	286 282	364 359	44	56
1976	166 201	220 313	43	57
1977	199 065	243 302	45	55
1978	126 304	167 427	43	57
1979	208 832	208 832	50	50
1980	192 820	177 988	52	48
1981	235 256	163 483	59	41
1982	130 900	204 700	57	43
1983	314 900	302 500	40	60
1984	229 000	425 300	54	46
1985	291 200	56 5300	47	53
1986	221 200	393 200	59	41
1987	274 500	285 700	59	41
1988	230 300	305 300	43	57
1989	286 300	364 400	55	45
1990	166 300	220 400	74	26
1991	199 100	243 400	63	37
1992	126 400	167 500	45	55
1995	22 100	10 400	67	33
1996	23 400	8700	70	30
1997	17 200	4300	85	15
1998	3200	900	79	21
1999	5600	700	91	9
2000	5800	2500	65	35
2001	9900	4500	67	33
2002	2300	1100	72	28
2003	2800	1300	65	35
2004	4000	1500	72	28
2005	3700	1200	76	24
2006	4000	1800	69	31

Table 5.10.1. Assessing the objectives of NASCO management of the West Greenland fishery.

Objective	Assessment	Outcome/extent achieved	Further consideration
Reduce exploitation.	Assessment, reported and unreported landings compared to negotiated catch quotas for the fishery.	There in no Commercial Fishery (quota set at nil). The internal consumption fishery has no quota.	Reporting rate for the internal consumption fishery and reported catch increased in 2006. Estimates of unreported catch are unchanged.
75% chance of meeting the conservation limits simultaneously in the four northern regions of North America	Assessment of returns to North America. Run reconstruction to estimate overall returns (Sec. 4.9) related to estimated spawning escapement reserve at West Greenland.	This objective has not yet been achieved.	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc.
75% chance of achieving increases in returns relative to previous years with the hope that this leads to the rebuilding Scotia-Fundy and USA stocks.	Assessment of returns to North America. Run reconstruction to estimate overall returns (Sec. 4.9). Improvements of greater than 10% and greater than 25% relative to returns are evaluated (Sec 4.9)	This objective has not been achieved.	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other limiting factors such as causes of increased marine mortality, habitat quality, predators etc. Recovery plans developed for the stocks listed as endangered/ at risk.
75% chance of meeting spawner escapement requirement for the Southern NEAC MSW complex.	Assessment of returns to Southern NEAC. Run reconsruction to estimate overall returns (Sec. 3.3) related to estimated spawning escapement reserve at West Greenland.	This objective has not been achieved.	Restrict fisheries on mixed stocks and stocks below Conservation Limits. Examine other biologically limiting factors such as causes of increased or high marine mortality, habitat quality, by-catch, predators etc.

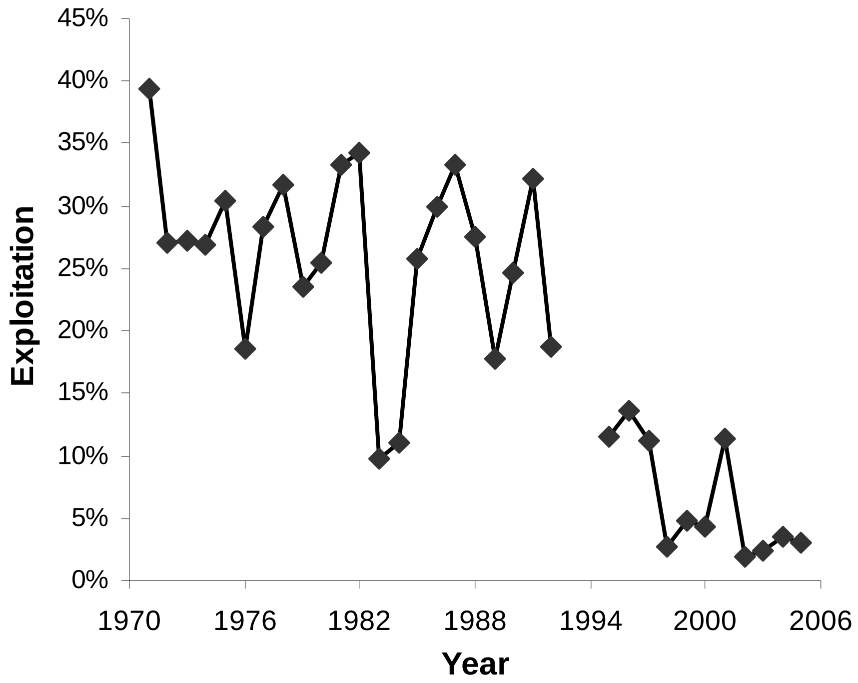


Figure 5.1.1. Exploitation rate for non-maturing 1SW Atlantic salmon at West Greenland, estimated from harvest and PFA of North American non-maturing 1SW salmon.

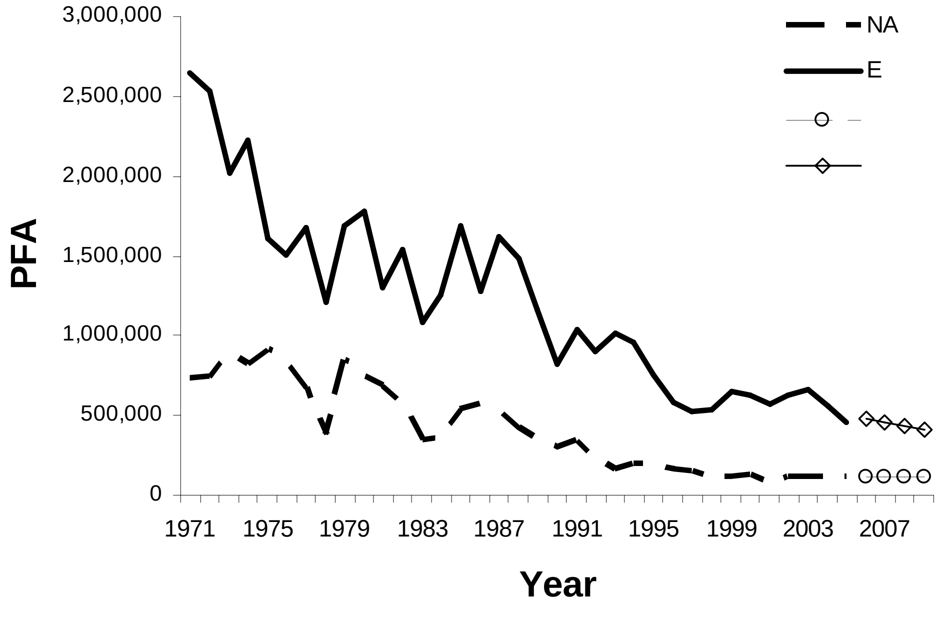


Figure 5.6.3.1. PFA estimated for North American (NA) and European (E) non-maturing 1SW salmon contributing to the stock complex at West Greenland. Open symbols are forecast estimates.

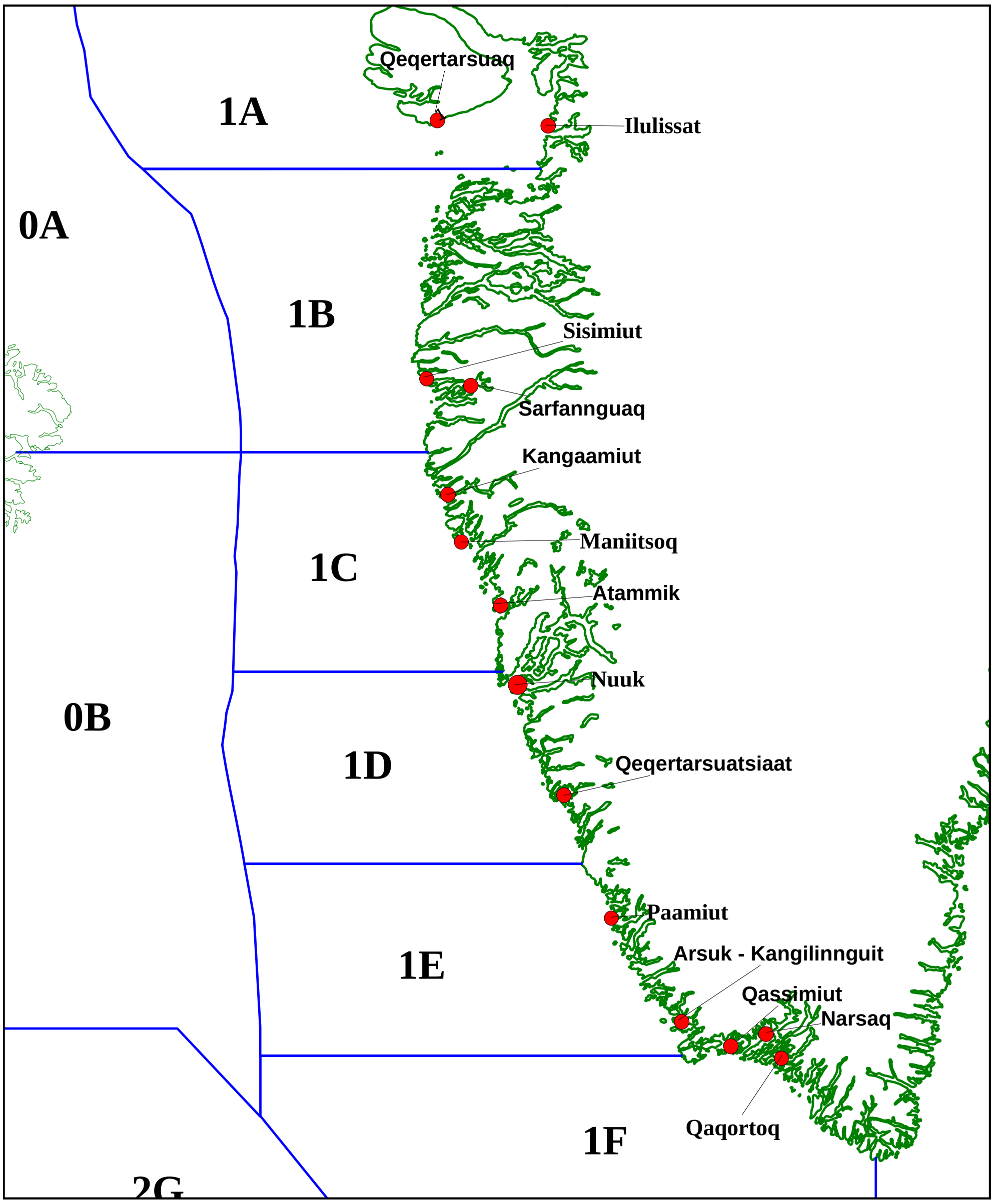


Figure 5.8.1.1. Location of NAFO divisions along the coast of West Greenland.

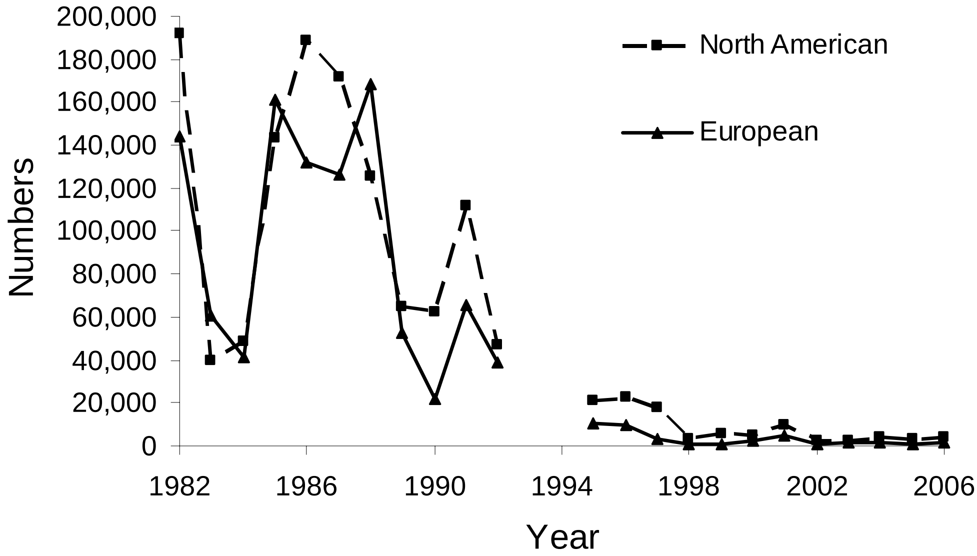


Figure 5.8.3.1. Number of North American and European salmon caught at West Greenland, 1982–1992 and 1995–2006.

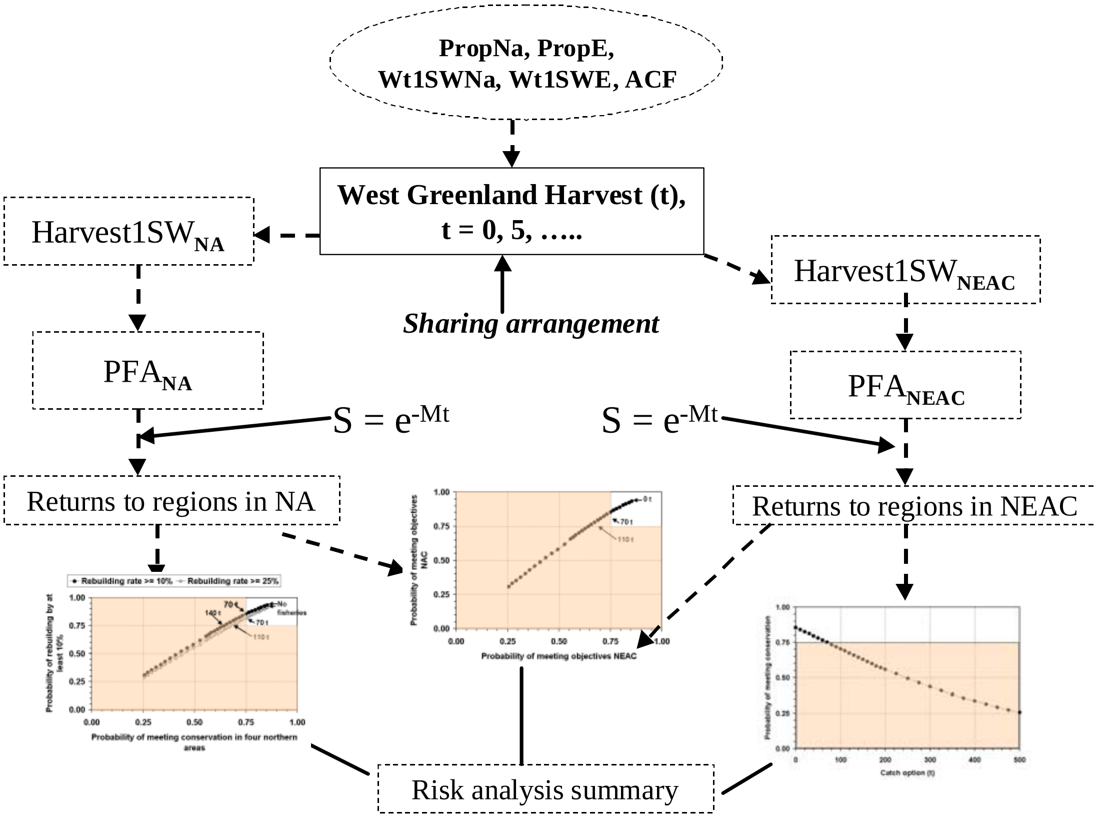


Figure 5.9.3.1. Flowchart, risk analysis for catch options at West Greenland using the PFA$_{NA}$ and the PFA$_{NEAC}$ predictions for the year of the fishery. Inputs with solid borders are considered known without error. Estimated inputs with observation error that is incorporated in the analysis have dashed borders. Solid arrows are functions that introduce or transfer without error whereas dashed arrows transfer errors through the components.

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

The Working Group recommends that it should meet in 2008 to address questions posed by ACFM, including those posed by NASCO. The Working Group intends to convene in the headquarters of the Marine Institute in Galway, Ireland from 1st to 10th April 2008. It is strongly recommended by the Working Group that this period is adhered to in order to provide sufficient time to adequately review and complete the report.

6.1 Data deficiencies and research needs.

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

3) The Working Group recommends that a second workshop be held to complete the collation of historical tag data initiated by the Workshop on the Development and Use of Historical Salmon Tagging Information from Oceanic Areas (WKDUHSTI) and further examine the available datasets in relation to pertinent environmental and oceanographic information. The standardized, collated dataset from this workshop will provide opportunities to conduct more detailed analysis of historical marine growth, mortality and oceanic distribution and migration patterns.

4) The Working Group recommends the facilitation of research using new and evolving technologies (e.g. acoustic tags, DST and popup tags) and techniques (e.g. use of kelts) and recommends further presentations from countries on the approaches taken to address questions on the marine ecology of Atlantic salmon. The co-ordination of efforts between countries would improve studies into the migration routes and early marine ecology of Atlantic salmon to further the presently limited understanding of the factors influencing marine survival.

5) The Working Group recommends the review and standardization of circuli spacing techniques with particular consideration of recently available analytical technologies such as computer assisted image analysis. These techniques provide opportunities to sharing and co-ordinate the examination of scale material available from different research agencies (or from different stocks and stock components) to identify spatial and temporal anomalies in the time series of scale growth during the marine phase, which may indicate common causes or factors influencing mortality.

6) The Working Group recognises the movement to river specific management which requires more extensive monitoring on individual river basins and recommends continued and extended monitoring programmes.

7) The Working Group recommends that coordinated efforts are made to collate information on biological characteristics (e.g. juvenile size at age (freshwater growth), smolt age composition, smolt run timing (and autumn parr movements), post-smolt growth, sea-age composition, size at return (marine growth), adult run timing and sex ratios) throughout the geographic range.

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

4) The Working Group recognizes the current limitations associated with forecasting pre-fishery abundances in the NEAC area pose difficulties in providing management advice for the Faroese fishery. The Working Group recommends that a study group be held to further develop and refine pre-fishery abundance forecast models.

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

No recommendations from section 4.

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

1) The Working Group recommends that the Home Rule Government of Greenland continue to provide information on the extent of fishing activity by all license holders. These inputs are essential to provide management advice on mixed stock fisheries at Greenland.

2) The Working Group recommends a broad geographic sampling program (multiple NAFO divisions) to more accurately estimate continent of origin in the mixed stock fishery. These inputs are essential to provide management advice on mixed stock fisheries at Greenland.

Annex 1: Working Documents submitted to the Working Group on North Atlantic Salmon, 2007

1. de la Hoz, J. Salmon Fisheries and Status of Stocks in Spain (Asturias). Report for 2007.
2. Siegstad, H. and J. Carl. The Salmon Fishery in Greenland 2006.
3. Sheehan, T.F., D. G., Reddin, T.L., King and H., Siegstad. The International Sampling Program, Continent of Origin and Biological Characteristics of Atlantic Salmon Collected at West Greenland in 2006.
4. Trial, J., Sweka, J., Gephart, S., and Sheehan, T. National Report for the United States, 2006.
5. Amiro, P., J. Gibson, R. Jones and H. Bowlby. Status of Atlantic salmon in Salmon Fishing Areas 19, 20, 21 and 23 of the Maritimes region of Canada.
6. Bradford Hubley, P., P. G. Amiro, A. J. F. Gibson, G. L. Lacroix and A. Redden. Acoustic tracking of migrating Atlantic salmon (Salmo salar L.) kelts from the LaHave River, Nova Scotia, Canada.
7. Gibson A.J.F, P.G. Amiro and R.A. Jones. Recovery Potential of Bay of Fundy and Southern Upland Salmon Populations
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Annex 4: Reported catch of salmon in numbers and weight (tonnes round fresh weight) be sea-age class. Catches reported for 2006 may be provisional. Methods used for estimating age composition given in footnote.

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
West Greenland	1982	315,532	-	17,810	-	-	-	-	-	-	-	-	-	2,688	-	336,030	1,077
	1983	90,500	-	8,100	-	-	-	-	-	-	-	-	-	1,400	-	100,000	310
	1984	78,942	-	10,442	-	-	-	-	-	-	-	-	-	630	-	90,014	297
	1985	292,181	-	18,378	-	-	-	-	-	-	-	-	-	934	-	311,493	864
	1986	307,800	-	9,700	-	-	-	-	-	-	-	-	-	2,600	-	320,100	960
	1987	297,128	-	6,287	-	-	-	-	-	-	-	-	-	2,898	-	306,313	966
	1988	281,356	-	4,602	-	-	-	-	-	-	-	-	-	2,296	-	288,254	893
	1989	110,359	-	5,379	-	-	-	-	-	-	-	-	-	1,875	-	117,613	337
	1990	97,271	-	3,346	-	-	-	-	-	-	-	-	-	860	-	101,477	274
	1991	167,551	415	8,809	53	-	-	-	-	-	-	-	-	743	4	177,103	472
	1992	82,354	217	2,822	18	-	-	-	-	-	-	-	-	364	2	85,540	237
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	31,241	-	558	-	-	-	-	-	-	-	-	-	478	-	32,277	83
	1996	30,613	-	884	-	-	-	-	-	-	-	-	-	568	-	32,065	92
	1997	20,980	-	134	-	-	-	-	-	-	-	-	-	124	-	21,238	58
	1998	3,901	-	17	-	-	-	-	-	-	-	-	-	88	-	4,006	11
	1999	6,124	18	50	0	-	-	-	-	-	-	-	-	84	1	6,258	19
	2000	7,715	21	0	0	-	-	-	-	-	-	-	-	140	0	7,855	21
	2001	14,795	40	324	2	-	-	-	-	-	-	-	-	293	1	15,412	43
	2002	3,344	10	34	0	-	-	-	-	-	-	-	-	27	0	3,405	10
	2003	3,933	12	38	0	-	-	-	-	-	-	-	-	73	0	4,044	12
	2004	4,488	14	51	0	-	-	-	-	-	-	-	-	88	0	4,627	15
	2005	3,120	13	40	0	-	-	-	-	-	-	-	-	180	1	3,340	14
	2006	5,746	18	183	2	-	-	-	-	-	-	-	-	224	1	6,153	21
Canada	1982	358,000	716	-	-	-	-	-	-	-	-	240,000	1,082	-	-	598,000	1,798
	1983	265,000	513	-	-	-	-	-	-	-	-	201,000	911	-	-	466,000	1,424
	1984	234,000	467	-	-	-	-	-	-	-	-	143,000	645	-	-	377,000	1,112
	1985	333,084	593	-	-	-	-	-	-	-	-	122,621	540	-	-	455,705	1,133
	1986	417,269	780	-	-	-	-	-	-	-	-	162,305	779	-	-	579,574	1,559
	1987	435,799	833	-	-	-	-	-	-	-	-	203,731	951	-	-	639,530	1,784
	1988	372,178	677	-	-	-	-	-	-	-	-	137,637	633	-	-	509,815	1,310
	1989	304,620	549	-	-	-	-	-	-	-	-	135,484	590	-	-	440,104	1,139
	1990	233,690	425	-	-	-	-	-	-	-	-	106,379	486	-	-	340,069	911
	1991	189,324	341	-	-	-	-	-	-	-	-	82,532	370	-	-	271,856	711
	1992	108,901	199	-	-	-	-	-	-	-	-	66,357	323	-	-	175,258	522
	1993	91,239	159	-	-	-	-	-	-	-	-	45,416	214	-	-	136,655	373
	1994	76,973	139	-	-	-	-	-	-	-	-	42,946	216	-	-	119,919	355
	1995	61,940	107	-	-	-	-	-	-	-	-	34,263	153	-	-	96,203	260
	1996	82,490	138	-	-	-	-	-	-	-	-	31,590	154	-	-	114,080	292
	1997	58,988	103	-	-	-	-	-	-	-	-	26,270	126	-	-	85,258	229
	1998	51,251	87	-	-	-	-	-	-	-	-	13,274	70	-	-	64,525	157
	1999	50,901	88	-	-	-	-	-	-	-	-	11,368	64	-	-	62,269	152
	2000	55,263	95	-	-	-	-	-	-	-	-	10,571	58	-	-	65,834	153
	2001	51,225	86	-	-	-	-	-	-	-	-	11,575	61	-	-	62,800	147
	2002	53,464	99	-	-	-	-	-	-	-	-	8,439	49	-	-	61,903	148
	2003	46,768	81	-	-	-	-	-	-	-	-	11,218	60	-	-	57,986	141
	2004	54,253	94	-	-	-	-	-	-	-	-	12,933	68	-	-	67,186	162
	2005	47,368	83	-	-	-	-	-	-	-	-	10,937	56	-	-	58,305	139
	2006	44,087	77	-	-	-	-	-	-	-	-	11,186	54	-	-	55,273	132

Annex 4 continued

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
USA	1982	33	-	1,206	-	5	-	-	-	-	-	-	-	21	-	1,265	6
	1983	26	-	314	1	2	-	-	-	-	-	-	-	6	-	348	1
	1984	50	-	545	2	2	-	-	-	-	-	-	-	12	-	609	2
	1985	23	-	528	2	2	-	-	-	-	-	-	-	13	-	566	2
	1986	76	-	482	2	2	-	-	-	-	-	-	-	3	-	563	2
	1987	33	-	229	1	10	-	-	-	-	-	-	-	10	-	282	1
	1988	49	-	203	1	3	-	-	-	-	-	-	-	4	-	259	1
	1989	157	0	325	1	2	-	-	-	-	-	-	-	3	-	487	2
	1990	52	0	562	2	12	-	-	-	-	-	-	-	16	-	642	2
	1991	48	0	185	1	1	-	-	-	-	-	-	-	4	-	238	1
	1992	54	0	138	1	1	-	-	-	-	-	-	-	-	-	193	1
	1993	17	-	133	1	0	0	-	-	-	-	-	-	2	-	152	1
	1994	12	-	0	0	0	0	-	-	-	-	-	-	-	-	12	0
	1995	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1996	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1997	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1998	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1999	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2000	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2001	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2002	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2003	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2004	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2005	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2006	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
Faroe Islands	1982/83	9,086	-	101,227	-	21,663	-	448	-	29	-	-	-	-	-	132,453	625
	1983/84	4,791	-	107,199	-	12,469	-	49	-	-	-	-	-	-	-	124,508	651
	1984/85	324	-	123,510	-	9,690	-	-	-	-	-	-	-	1,653	-	135,177	598
	1985/86	1,672	-	141,740	-	4,779	-	76	-	-	-	-	-	6,287	-	154,554	545
	1986/87	76	-	133,078	-	7,070	-	80	-	-	-	-	-	-	-	140,304	539
	1987/88	5,833	-	55,728	-	3,450	-	0	-	-	-	-	-	-	-	65,011	208
	1988/89	1,351	-	86,417	-	5,728	-	0	-	-	-	-	-	-	-	93,496	309
	1989/90	1,560	-	103,407	-	6,463	-	6	-	-	-	-	-	-	-	111,436	364
	1990/91	631	-	52,420	-	4,390	-	8	-	-	-	-	-	-	-	57,449	202
	1991/92	16	-	7,611	-	837	-	-	-	-	-	-	-	-	-	8,464	31
	1992/93	-	-	4,212	-	1,203	-	-	-	-	-	-	-	-	-	5,415	22
	1993/94	-	-	1,866	-	206	-	-	-	-	-	-	-	-	-	2,072	7
	1994/95	-	-	1,807	-	156	-	-	-	-	-	-	-	-	-	1,963	6
	1995/96	-	-	268	-	14	-	-	-	-	-	-	-	-	-	282	1
	1996/97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1997/98	339	-	1,315	-	109	-	-	-	-	-	-	-	-	-	1,763	6
	1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1999/00	225	-	1,560	-	205	-	-	-	-	-	-	-	-	-	1,990	8
	2000/01	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2001/02	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2002/03	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2003/04	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2004/05	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2005/06	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2006/07	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0

Annex 4 continued

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Finland	1982	2,598	5	-	-	-	-	-	-	-	-	5,408	49	-	-	8,006	54
	1983	3,916	7	-	-	-	-	-	-	-	-	6,050	51	-	-	9,966	58
	1984	4,899	9	-	-	-	-	-	-	-	-	4,726	37	-	-	9,625	46
	1985	6,201	11	-	-	-	-	-	-	-	-	4,912	38	-	-	11,113	49
	1986	6,131	12	-	-	-	-	-	-	-	-	3,244	25	-	-	9,375	37
	1987	8,696	15	-	-	-	-	-	-	-	-	4,520	34	-	-	13,216	49
	1988	5,926	9	-	-	-	-	-	-	-	-	3,495	27	-	-	9,421	36
	1989	10,395	19	-	-	-	-	-	-	-	-	5,332	33	-	-	15,727	52
	1990	10,084	19	-	-	-	-	-	-	-	-	5,600	41	-	-	15,684	60
	1991	9,213	17	-	-	-	-	-	-	-	-	6,298	53	-	-	15,511	70
	1992	15,017	28	-	-	-	-	-	-	-	-	6,284	49	-	-	21,301	77
	1993	11,157	17	-	-	-	-	-	-	-	-	8,180	53	-	-	19,337	70
	1994	7,493	11	-	-	-	-	-	-	-	-	6,230	38	-	-	13,723	49
	1995	7,786	11	-	-	-	-	-	-	-	-	5,344	38	-	-	13,130	49
	1996	12,230	20	1,275	5	1,424	12	234	4	19	1	-	-	354	3	15,536	44
	1997	10,341	15	2,419	10	1,674	15	141	2	22	1	-	-	418	3	15,015	45
	1998	11,792	19	1,608	7	1,660	16	147	3	0	0	-	-	460	3	15,667	48
	1999	18,830	33	1,528	8	1,579	16	129	2	6	0	-	-	490	3	22,562	62
	2000	20,817	39	5,152	24	2,379	25	110	2	0	0	-	-	991	6	29,449	95
	2001	13,062	21	6,308	32	5,415	58	104	2	0	0	-	-	2,360	13	27,249	126
	2002	6,531	12	5,361	20	4,276	43	148	2	11	0	-	-	2,619	16	18,946	93
	2003	8,130	15	1,828	7	3,599	38	161	3	6	0	-	-	2,204	15	15,928	78
	2004	3,815	7	1,424	6	1,153	11	251	4	6	1	-	-	1,400	11	8,049	39
	2005	9,216	16	1,027	5	1,575	16	66	1	48	1	-	-	837	8	12,769	47
	2006	16,886	29	4,165	18	1,347	14	64	1	0	0	-	-	1,379	5	23,841	67
Iceland	1991	30,011	-	11,935	-	-	-	-	-	-	-	-	-	-	-	41,946	130
	1992	38,955	-	15,416	-	-	-	-	-	-	-	-	-	-	-	54,371	175
	1993	37,611	-	11,611	-	-	-	-	-	-	-	-	-	-	-	49,222	160
	1994	25,480	62	14,408	78	-	-	-	-	-	-	-	-	-	-	39,888	140
	1995	34,046	93	13,380	57	-	-	-	-	-	-	-	-	-	-	47,426	150
	1996	28,039	69	9,971	53	-	-	-	-	-	-	-	-	-	-	38,010	122
	1997	23,945	62	8,872	44	-	-	-	-	-	-	-	-	-	-	32,817	106
	1998	35,537	90	7,791	40	-	-	-	-	-	-	-	-	-	-	43,328	130
	1999	20,031	64	8,093	57	-	-	-	-	-	-	-	-	-	-	28,124	120
	2000	23,850	58	4,456	24	-	-	-	-	-	-	-	-	-	-	28,306	82
	2001	23,717	58	5,564	29	-	-	-	-	-	-	-	-	-	-	29,281	87
	2002	26,679	68	5,683	29	-	-	-	-	-	-	-	-	-	-	32,362	97
	2003	27,519	68	8,813	41	-	-	-	-	-	-	-	-	-	-	36,332	110
	2004	38,445	99	6,739	31	-	-	-	-	-	-	-	-	-	-	45,184	130
	2005	47,108	119	6,396	30	-	-	-	-	-	-	-	-	-	-	53,504	149
	2006	34,680	82	8,062	39	-	-	-	-	-	-	-	-	-	-	42,742	121
Sweden	1989	3,181	7	-	-	-	-	-	-	-	-	4,610	22	-	-	7,791	29
	1990	7,428	18	-	-	-	-	-	-	-	-	3,133	15	-	-	10,561	33
	1991	8,987	20	-	-	-	-	-	-	-	-	3,620	18	-	-	12,607	38
	1992	9,850	23	-	-	-	-	-	-	-	-	4,656	26	-	-	14,506	49
	1993	10,540	23	-	-	-	-	-	-	-	-	6,369	33	-	-	16,909	56
	1994	8,304	18	-	-	-	-	-	-	-	-	4,661	26	-	-	12,965	44
	1995	9,761	22	-	-	-	-	-	-	-	-	2,770	14	-	-	12,531	36
	1996	6,008	14	-	-	-	-	-	-	-	-	3,542	19	-	-	9,550	33
	1997	2,747	7	-	-	-	-	-	-	-	-	2,307	12	-	-	5,054	19
	1998	2,421	6	-	-	-	-	-	-	-	-	1,702	9	-	-	4,123	15
	1999	3,573	8	-	-	-	-	-	-	-	-	1,460	8	-	-	5,033	16
	2000	7,103	18	-	-	-	-	-	-	-	-	3,196	15	-	-	10,299	33
	2001	4,634	12	-	-	-	-	-	-	-	-	3,853	21	-	-	8,487	33
	2002	4,733	12	-	-	-	-	-	-	-	-	2,826	16	-	-	7,559	28
	2003	2,891	7	-	-	-	-	-	-	-	-	3,214	18	-	-	6,105	25
	2004	2,494	6	-	-	-	-	-	-	-	-	2,330	13	-	-	4,824	19
	2005	2,122	5	-	-	-	-	-	-	-	-	1,770	10	-	-	3,892	15
	2006	2,211	4	-	-	-	-	-	-	-	-	1,772	10	-	-	3,983	14

Annex 4 continued

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Norway	1981	221,566	467	-	-	-	-	-	-	-	-	213,943	1,189	-	-	435,509	1,656
	1982	163,120	363	-	-	-	-	-	-	-	-	174,229	985	-	-	337,349	1,348
	1983	278,061	593	-	-	-	-	-	-	-	-	171,361	957	-	-	449,422	1,550
	1984	294,365	628	-	-	-	-	-	-	-	-	176,716	995	-	-	471,081	1,623
	1985	299,037	638	-	-	-	-	-	-	-	-	162,403	923	-	-	461,440	1,561
	1986	264,849	556	-	-	-	-	-	-	-	-	191,524	1,042	-	-	456,373	1,598
	1987	235,703	491	-	-	-	-	-	-	-	-	153,554	894	-	-	389,257	1,385
	1988	217,617	420	-	-	-	-	-	-	-	-	120,367	656	-	-	337,984	1,076
	1989	220,170	436	-	-	-	-	-	-	-	-	80,880	469	-	-	301,050	905
	1990	192,500	385	-	-	-	-	-	-	-	-	91,437	545	-	-	283,937	930
	1991	171,041	342	-	-	-	-	-	-	-	-	92,214	535	-	-	263,255	877
	1992	151,291	301	-	-	-	-	-	-	-	-	92,717	566	-	-	244,008	867
	1993	153,407	312	62,403	284	35,147	327	-	-	-	-	-	-	-	-	250,957	923
	1994	-	415	-	319	-	262	-	-	-	-	-	-	-	-	-	996
	1995	134,341	249	71,552	341	27,104	249	-	-	-	-	-	-	-	-	232,997	839
	1996	110,085	215	69,389	322	27,627	249	-	-	-	-	-	-	-	-	207,101	786
	1997	124,387	241	52,842	238	16,448	151	-	-	-	-	-	-	-	-	193,677	630
	1998	162,185	296	66,767	306	15,568	139	-	-	-	-	-	-	-	-	244,520	741
	1999	164,905	318	70,825	326	18,669	167	-	-	-	-	-	-	-	-	254,399	811
	2000	250,468	504	99,934	454	24,319	219	-	-	-	-	-	-	-	-	374,721	1,177
	2001	207,934	417	117,759	554	33,047	295	-	-	-	-	-	-	-	-	358,740	1,266
	2002	127,039	249	98,055	471	33,013	299	-	-	-	-	-	-	-	-	258,107	1,019
	2003	185,574	363	87,993	410	31,099	298	-	-	-	-	-	-	-	-	304,666	1,071
	2004	108,645	207	77,343	371	23,173	206	-	-	-	-	-	-	-	-	209,161	784
	2005	165,900	307	69,488	320	27,507	261	-	-	-	-	-	-	-	-	262,895	888
	2006	142,218	261	99,401	453	23,529	218	-	-	-	-	-	-	-	-	265,148	932
Russia	1987	97,242	-	27,135	-	9,539	-	556	-	18	-	-	-	2,521	-	137,011	564
	1988	53,158	-	33,395	-	10,256	-	294	-	25	-	-	-	2,937	-	100,065	420
	1989	78,023	-	23,123	-	4,118	-	26	-	0	-	-	-	2,187	-	107,477	364
	1990	70,595	-	20,633	-	2,919	-	101	-	0	-	-	-	2,010	-	96,258	313
	1991	40,603	-	12,458	-	3,060	-	650	-	0	-	-	-	1,375	-	58,146	215
	1992	34,021	-	8,880	-	3,547	-	180	-	0	-	-	-	824	-	47,452	167
	1993	28,100	-	11,780	-	4,280	-	377	-	0	-	-	-	1,470	-	46,007	139
	1994	30,877	-	10,879	-	2,183	-	51	-	0	-	-	-	555	-	44,545	141
	1995	27,775	62	9,642	50	1,803	15	6	0	0	0	-	-	385	2	39,611	129
	1996	33,878	79	7,395	42	1,084	9	40	0.5	0	0	-	-	41	1	42,438	131
	1997	31,857	72	5,837	28	672	6	38	0.5	0	0	-	-	559	3	38,963	110
	1998	34,870	92	6,815	33	181	2	28	0.3	0	0	-	-	638	3	42,532	130
	1999	24,016	66	5,317	25	499	5	0	0	0	0	-	-	1,131	6	30,963	102
	2000	27,702	75	7,027	34	500	5	3	0.1	0	0	-	-	1,853	9	37,085	123
	2001	26,472	61	7,505	39	1,036	10	30	0.4	0	0	-	-	922	5	35,965	115
	2002	24,588	60	8,720	43	1,284	12	3	0	0	0	-	-	480	3	35,075	118
	2003	22,014	50	8,905	42	1,206	12	20	0.3	0	0	-	-	634	4	32,779	107
	2004	17,105	39	6,786	33	880	7	0	0.0	0	0	-	-	529	3	25,300	82
	2005	16,591	39	7,179	33	989	8	1	0.0	0	0	-	-	439	3	25,199	82
	2006	22,412	54	5,392	28	759	6	0	0.0	0	0	-	-	449	3	29,012	91

Annex 4 continued

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Ireland	1980	248,333	745	-	-	-	-	-	-	-	-	39,608	202	-	-	287,941	947
	1981	173,667	521	-	-	-	-	-	-	-	-	32,159	164	-	-	205,826	685
	1982	310,000	930	-	-	-	-	-	-	-	-	12,353	63	-	-	322,353	993
	1983	502,000	1,506	-	-	-	-	-	-	-	-	29,411	150	-	-	531,411	1,656
	1984	242,666	728	-	-	-	-	-	-	-	-	19,804	101	-	-	262,470	829
	1985	498,333	1,495	-	-	-	-	-	-	-	-	19,608	100	-	-	517,941	1,595
	1986	498,125	1,594	-	-	-	-	-	-	-	-	28,335	136	-	-	526,460	1,730
	1987	358,842	1,112	-	-	-	-	-	-	-	-	27,609	127	-	-	386,451	1,239
	1988	559,297	1,733	-	-	-	-	-	-	-	-	30,599	141	-	-	589,896	1,874
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	330,558	1,079
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188,890	567
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	135,474	404
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235,435	631
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200,120	541
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286,266	804
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288,225	790
	1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	249,623	685
	1997	-	-	-	-	-	-	-	-	-	-	-	-	-	-	209,214	570
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	237,663	624
	1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180,477	515
	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228,220	621
	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270,963	730
	2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	256,808	682
	2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	204,145	551
	2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175,656	488
	2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156,308	422
	2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120,829	326
UK (England & Wales)	1985	62,815	-	-	-	-	-	-	-	-	-	32,716	-	-	-	95,531	361
	1986	68,759	-	-	-	-	-	-	-	-	-	42,035	-	-	-	110,794	430
	1987	56,739	-	-	-	-	-	-	-	-	-	26,700	-	-	-	83,439	302
	1988	76,012	-	-	-	-	-	-	-	-	-	34,151	-	-	-	110,163	395
	1989	54,384	-	-	-	-	-	-	-	-	-	29,284	-	-	-	83,668	296
	1990	45,072	-	-	-	-	-	-	-	-	-	41,604	-	-	-	86,676	338
	1991	36,671	-	-	-	-	-	-	-	-	-	14,978	-	-	-	51,649	200
	1992	34,331	-	-	-	-	-	-	-	-	-	10,255	-	-	-	44,586	171
	1993	56,033	-	-	-	-	-	-	-	-	-	13,144	-	-	-	69,177	248
	1994	67,853	-	-	-	-	-	-	-	-	-	20,268	-	-	-	88,121	324
	1995	57,944	-	-	-	-	-	-	-	-	-	22,534	-	-	-	80,478	295
	1996	30,352	-	-	-	-	-	-	-	-	-	16,344	-	-	-	46,696	183
	1997	30,203	-	-	-	-	-	-	-	-	-	11,171	-	-	-	41,374	142
	1998	30,641	-	-	-	-	-	-	-	-	-	6,276	-	-	-	36,917	123
	1999	27944	-	-	-	-	-	-	-	-	-	13,150	-	-	-	41,094	150
	2000	48,153	-	-	-	-	-	-	-	-	-	12,800	-	-	-	60,953	219
	2001	38993	-	-	-	-	-	-	-	-	-	12,314	-	-	-	51,307	184
	2002	34708	-	-	-	-	-	-	-	-	-	10,961	-	-	-	45,669	161
	2003	14,878	-	-	-	-	-	-	-	-	-	7,328	-	-	-	22,206	89
	2004	24,753	-	-	-	-	-	-	-	-	-	5,806	-	-	-	30,559	111
	2005	19,622	-	-	-	-	-	-	-	-	-	6,541	-	-	-	26,162	97
	2006	16,879	-	-	-	-	-	-	-	-	-	5,042	-	-	-	21,921	79

Annex 4 continued

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
UK (Scotland)	1982	208,061	496	-	-	-	-	-	-	-	-	128,242	596	-	-	336,303	1,092
	1983	209,617	549	-	-	-	-	-	-	-	-	145,961	672	-	-	355,578	1,221
	1984	213,079	509	-	-	-	-	-	-	-	-	107,213	504	-	-	320,292	1,013
	1985	158,012	399	-	-	-	-	-	-	-	-	114,648	514	-	-	272,660	913
	1986	202,855	526	-	-	-	-	-	-	-	-	148,397	745	-	-	351,252	1,271
	1987	164,785	419	-	-	-	-	-	-	-	-	103,994	503	-	-	268,779	922
	1988	149,098	381	-	-	-	-	-	-	-	-	112,162	501	-	-	261,260	882
	1989	174,941	431	-	-	-	-	-	-	-	-	103,886	464	-	-	278,827	895
	1990	81,094	201	-	-	-	-	-	-	-	-	87,924	423	-	-	169,018	624
	1991	73,608	177	-	-	-	-	-	-	-	-	65,193	285	-	-	138,801	462
	1992	101,676	238	-	-	-	-	-	-	-	-	82,841	361	-	-	184,517	599
	1993	94,517	227	-	-	-	-	-	-	-	-	71,726	320	-	-	166,243	547
	1994	99,459	248	-	-	-	-	-	-	-	-	85,404	400	-	-	184,863	648
	1995	89,921	224	-	-	-	-	-	-	-	-	78,452	364	-	-	168,373	588
	1996	66,413	160	-	-	-	-	-	-	-	-	57,920	267	-	-	124,333	427
	1997	46,872	114	-	-	-	-	-	-	-	-	40,427	182	-	-	87,299	296
	1998	53,447	121	-	-	-	-	-	-	-	-	39,248	162	-	-	92,695	283
	1999	25,183	57	-	-	-	-	-	-	-	-	30,651	142	-	-	55,834	199
	2000	43,879	114	-	-	-	-	-	-	-	-	36,657	160	-	-	80,536	274
	2001	42,565	101	-	-	-	-	-	-	-	-	34,908	150	-	-	77,473	251
	2002	31,347	73	-	-	-	-	-	-	-	-	26,383	118	-	-	57,730	191
	2003	29,547	71	-	-	-	-	-	-	-	-	27,544	122	-	-	57,091	192
	2004	37,288	87	-	-	-	-	-	-	-	-	36,745	158	-	-	74,033	245
	2005	38,602	90	-	-	-	-	-	-	-	-	28,515	125	-	-	67,117	215
	2006	29,927	62	-	-	-	-	-	-	-	-	24,089	101	-	-	54,016	164
France	1987	6,013	18	-	-	-	-	-	-	-	-	1,806	9	-	-	7,819	27
	1988	2,063	7	-	-	-	-	-	-	-	-	4,964	25	-	-	7,027	32
	1989	1,124	3	1,971	9	311	2	-	-	-	-	-	-	-	-	3,406	14
	1990	1,886	5	2,186	9	146	1	-	-	-	-	-	-	-	-	4,218	15
	1991	1,362	3	1,935	9	190	1	-	-	-	-	-	-	-	-	3,487	13
	1992	2,490	7	2,450	12	221	2	-	-	-	-	-	-	-	-	5,161	21
	1993	3,581	10	987	4	267	2	-	-	-	-	-	-	-	-	4,835	16
	1994	2,810	7	2,250	10	40	1	-	-	-	-	-	-	-	-	5,100	18
	1995	1,669	4	1,073	5	22	0	-	-	-	-	-	-	-	-	2,764	10
	1996	2,063	5	1,891	9	52	0	-	-	-	-	-	-	-	-	4,006	13
	1997	1,060	3	964	5	37	0	-	-	-	-	-	-	-	-	2,061	8
	1998	2,065	5	824	4	22	0	-	-	-	-	-	-	-	-	2,911	8
	1999	690	2	1,799	9	32	0	-	-	-	-	-	-	-	-	2,521	11
	2000	1,792	4	1,253	6	24	0	-	-	-	-	-	-	-	-	3,069	11
	2001	1,544	4	1,489	7	25	0	-	-	-	-	-	-	-	-	3,058	11
	2002	2,423	6	1,065	5	41	0	-	-	-	-	-	-	-	-	3,529	11
	2003	1,598	5	-	-	-	-	-	-	-	-	1,540	8	-	-	3,138	13
	2004	1,927	5	-	-	-	-	-	-	-	-	2,880	14	-	-	4,807	19
	2005	1,236	3	-	-	-	-	-	-	-	-	1,878	8	-	-	3,114	11
	2006	1,359	3	-	-	-	-	-	-	-	-	2,187	9	-	-	3,546	13

Annex 4 continued

Spain (2)	1993	1,589	-	827	-	75	-	-	-	-	-	-	-	-	-	2,491	8
	1994	1,658	5	-	-	-	-	-	-	-	-	735	4	-	-	2,393	9
	1995	389	1	-	-	-	-	-	-	-	-	1,118	6	-	-	1,507	7
	1996	349	1	-	-	-	-	-	-	-	-	676	3	-	-	1,025	4
	1997	169	0	-	-	-	-	-	-	-	-	425	2	-	-	594	3
	1998	481	1	-	-	-	-	-	-	-	-	403	2	-	-	884	3
	1999	157	0	-	-	-	-	-	-	-	-	986	5	-	-	1,143	6
	2000	1,227	3	-	-	-	-	-	-	-	-	433	3	-	-	1,660	6
	2001	1,129	3	-	-	-	-	-	-	-	-	1,677	9	-	-	2,806	12
	2002	651	2	-	-	-	-	-	-	-	-	1,085	6	-	-	1,736	8
	2003	210	1	-	-	-	-	-	-	-	-	1,116	6	-	-	1,326	6
	2004	1,195	3	-	-	-	-	-	-	-	-	589	3	-	-	1,784	6
	2005	412	1	-	-	-	-	-	-	-	-	2,336	11	-	-	2,748	12
	2006	335	1	-	-	-	-	-	-	-	-	1,879	9	-	-	2,214	10

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).

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

Year	Commercial Small Catch	Grilse Recruits SFA 1, 2 & 14B +Nfld Min	Grilse Recruits SFA 1, 2 & 14B +Nfld Max	Grilse to rivers SFA 1,2&14B Min	Grilse to rivers SFA 1,2&14B Max	Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B Min	Labrador grilse spawners Angling catch subtracted SFA 1, 2 & 14B Max
*1969	38722	48912	122280	18587	65053	15476	61942
*1970	29441	66584	166459	25302	88556	21289	84543
*1971	38359	86754	216884	32966	115382	29032	111448
*1972	28711	64934	162335	24675	86362	21728	83415
*1973	6282	14208	35520	5399	18897	0	11405
1974	37145	71142	177856	27034	94619	24533	92118
1975	57560	141210	353024	53660	187809	49688	183837
1976	47468	98790	246976	37540	131391	31814	125665
1977	40539	87918	219796	33409	116931	28815	112337
1978	12535	42513	106282	16155	56542	13464	53851
1979	28808	57744	144360	21943	76800	17825	72682
1980	72485	130710	326776	49670	173845	45870	170045
1981	86426	144859	362147	55046	192662	49855	187471
1982	53592	100357	250892	38136	133474	34032	129370
1983	30185	62452	156129	23732	83061	19360	78689
1984	11695	32324	80811	12283	42991	9348	40056
1985	24499	59822	149555	22732	79563	19631	76462
1986	45321	90184	225461	34270	119945	30806	116481
1987	64351	112995	282486	42938	150283	37572	144917
1988	56381	104980	262449	39892	139623	34369	134100
1989	34200	71351	178377	27113	94896	22429	90212
1990	20699	41718	104296	15853	55485	12544	52176
1991	20055	33812	84531	12849	44970	10526	42647
1992	13336	29632	79554	17993	62094	15229	59331
1993	12037	33382	93231	25186	80938	22499	78251
1994	4535	22306	63109	18159	56888	15242	53971
1995	4561	28852	82199	25022	76453	22199	73630
1996	5308	55634	159204	51867	153553	48924	150610
1997	8025	72467	176071	66972	169030	64389	166446
1998	0	9233	192621	9233	192621	6726	190114
1999	0	9500	190782	6761	188043	4244	185526
2000	0	9345	221357	4022	216034	752	212764
2001	0	8209	173915	3419	169125	906	166612
2002	0	66663	154260	60917	148152	58341	145576
2003	0	53606	134301	47127	127368	44522	124763
2004	0	76825	134255	68331	125093	65927	122689
2005	0	165333	298897	154976	287868	152257	285149
2006	0	137770	309394	128560	299541	126481	297462

Estimates are based on:

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

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

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

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

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

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

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

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

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

Furthermore small catches in 1973 were adjusted by ratio of large:small in 1972&74 (SFA 1-1.4591, SFA 2-2.2225, SFA 14B-1.55

Returns in 1998-2001 were estimated from regression

Returns in 2002 to present are from counting fence returns and drainage areas

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

Year	Commercial Large Catch	Labrador 2SW Recruits, SFAs 1,2 &14B		NF & Greenland Labrador a Greenland	Labrador salmon Totals		Labrador 2SW to rivers in SFAs 1,2 &14B		Labrador 2SW spawners in SFAs 1,2 &14B Angling catch subtracted	
		Min	Max		Min	Max	Min	Max	Min	Max
*1969	78052	32483	69198	34280	80636	133032	3248	20760	2890	20287
*1970	45479	30258	68490	56379	99561	154121	3026	20547	2676	20085
*1971	64806	43117	97596	24299	85831	163577	4312	29279	4012	28882
*1972	55708	37064	83895	59203	112096	178927	3706	25168	3435	24812
*1973	77902	51830	117319	22348	96314	189771	5183	35196	4565	34376
1974	93036	50030	113827	38035	109433	200476	5003	34148	4490	33475
1975	71168	47715	107974	40919	109012	195006	4772	32392	4564	32119
1976	77796	55186	124671	67730	146485	245646	5519	37401	4984	36701
1977	70158	48669	110171	28482	97937	185706	4867	33051	4042	31969
1978	48934	38644	87155	32668	87816	157045	3864	26147	3361	25490
1979	27073	22315	50194	18636	50481	90267	2231	15058	1823	14528
1980	87067	51899	117530	21426	95490	189152	5190	35259	4633	34525
1981	68581	47343	106836	32768	100331	185233	4734	32051	4403	31615
1982	53085	34910	78873	43678	93497	156236	3491	23662	3081	23127
1983	33320	25378	57268	30804	67021	112531	2538	17181	2267	16824
1984	25258	18063	40839	4026	29802	62306	1806	12252	1478	11822
1985	16789	14481	32596	3977	24644	50494	1448	9779	1258	9530
1986	34071	24703	55734	17738	52991	97275	2470	16720	2177	16334
1987	49799	32885	74471	29695	76625	135970	3289	22341	2895	21821
1988	32386	20681	46789	27842	57355	94614	2068	14037	1625	13452
1989	26836	20181	45509	26728	55528	91673	2018	13653	1727	13270
1990	17316	11482	25967	9771	26158	46828	1148	7790	923	7493
1991	7679	5477	12467	7779	15596	25571	548	3740	491	3665
1992	19608	14756	37045	13713	28469	50758	2515	15548	2012	14889
1993	9651	10242	29482	6592	16834	36074	3858	18234	3624	17922
1994	11056	11396	34514	0	11396	34514	5653	24396	5347	23992
1995	8714	16520	51530	0	16520	51530	12368	44205	12083	43828
1996	5479	11814	37523	4960	16773	42483	9113	32759	8878	32448
1997	5550	12605	31973	5161	17766	37134	8919	26674	8785	26497
1998	0	21886	50512	3990	25876	54502	21886	50512	21574	50200
1999	0	6329	31343	506	6835	31849	5245	30259	4832	29846
2000	0	8460	33743	873	9333	34616	7108	32391	6701	31984
2001	0	9542	38034	1232	10774	39266	7869	36361	7384	35876
2002	0	6308	18606	2958	9265	21564	5446	17586	5263	17370
2003	0	5311	16943	387	5698	17331	4006	15399	3793	15147
2004	0	8796	19019	554	9350	19573	6578	16395	6332	16104
2005	0	8386	23865	727	9112	24592	6695	21865	6443	21567
2006	0	9176	22808	931	10107	23739	7351	20648	7160	20422

Estimates are based on:

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

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

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

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

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

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

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

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

Returns in 1998-2001 were estimated from regression

Returns in 2002 to present are from counting fence returns and drainage areas

Annex 5(iii). Atlantic salmon returns to freshwater, total recruits prior to the commercial fishery and spawners summed for Salmon Fishing Area 3-14A, insular Newfoundland, 1969-2006.

Annex 5(iii). Atlantic salmon returns to freshwater, total recruits prior to the commercial fishery and spawners summed for Salmon Fishing Area 3-14A, insular Newfoundland, 1969-2006.
Ret. = retained fish; Rel. = released fish.

	Small catch	Small returns to river		Small recruits		Small spawners		Large returns to river		Large recruits		Large catch	Large spawners		2SW returns to river		2SW spawners	
Year	Retained	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Retained	Min	Max	Min	Max	Min	Max
1969	34944	109580	219669	219160	732230	74636	184725	10634	25631	35446	256307	2310	8324	23321	2193	8995	1383	7760
1970	30437	140194	281466	280388	938221	109757	251030	12731	29313	42435	293127	2138	10593	27175	3135	11517	2359	10340
1971	26666	112644	226129	225288	753763	85978	199463	9999	23221	33330	232208	1602	8397	21619	2388	8923	1817	8055
1972	24402	109282	219412	218564	731374	84880	195010	10368	23434	34560	234343	1380	8988	22054	2511	9003	2008	8240
1973	35482	144267	289447	288534	964822	108785	253965	13489	31645	44964	316451	1923	11566	29722	2995	11527	2283	10449
1974	26485	85216	170748	170431	569159	58731	144263	10541	21113	35137	211133	1213	9328	19900	1940	6596	1510	5942
1975	33390	112272	225165	224544	750550	78882	191775	11605	23260	38682	232596	1241	10364	22019	2305	7725	1888	7086
1976	34463	115034	230595	230068	768650	80571	196132	10863	21768	36211	217677	1051	9812	20717	2334	7698	2011	7198
1977	34352	110114	220501	220229	735004	75762	186149	9795	19624	32650	196237	2755	7040	16869	1845	6247	1114	5088
1978	28619	97375	195048	194751	650159	68756	166429	7892	15841	26307	158411	1563	6329	14278	1991	6396	1557	5712
1979	31169	107402	215160	214803	717199	76233	183991	5469	10962	18230	109619	561	4908	10401	1088	3644	980	3463
1980	35849	121038	242499	242076	808330	85189	206650	9400	18866	31335	188656	1922	7478	16944	2432	7778	1888	6925
1981	46670	157425	315347	314850	1051158	110755	268677	21022	42096	70074	420961	1369	19653	40727	3451	12035	3074	11442
1982	41871	141247	283002	282494	943342	99376	241131	9060	18174	30198	181736	1248	7812	16926	2914	9012	2579	8481
1983	32420	109934	220216	219868	734053	77514	187796	9717	19490	32391	194903	1382	8335	18108	2586	8225	2244	7677
1984	39331	130836	262061	261673	873537	91505	222730	8115	16268	27052	162684	511	7604	15757	2233	7060	2063	6800
1985	36552	121731	243727	243461	812424	85179	207175	3672	7370	12240	73702	0	3641	7339	958	3059	946	3042
1986	37496	125329	251033	250657	836778	87833	213537	7052	14140	23505	141400	0	6972	14060	1606	5245	1575	5198
1987	24482	128578	257473	257157	858244	104096	232991	6394	12817	21313	128170	0	6353	12776	1336	4433	1320	4409
1988	39841	133237	266895	266474	889652	93396	227054	6572	13183	21908	131832	0	6512	13123	1563	5068	1540	5033
1989	18462	60260	120661	120520	402203	41798	102199	3234	6482	10780	64815	0	3216	6463	697	2299	690	2289
1990	29967	99543	199416	199086	664721	69576	169449	5939	11909	19798	119093	0	5889	11859	1347	4401	1327	4372
1991	20529	64552	129308	129105	431027	44023	108779	4534	9090	15112	90896	0	4500	9056	1054	3429	1041	3410
1992	23118	118778	237811	118778	237811	95096	214129	16705	33463	16705	33463	0	16564	33322	3111	10554	3057	10474
1993	24693	134150	268550	134150	268550	107816	242217	8121	16267	8121	16267	0	7957	16103	1499	5094	1449	5017
1994	29225	91495	189808	91495	189808	60194	158507	7776	16029	7776	16029	0	7308	15561	1495	5226	1368	5024
1995	30512	167485	301743	167485	301743	134676	268934	13391	24268	13391	24268	0	12926	23802	2243	7535	2125	7343
1996	35440	200277	422635	200277	422635	161780	384138	17291	35518	17291	35518	0	16719	34946	2964	8832	2824	8605
1997	22819	118973	192852	118973	192852	93841	167720	18213	29000	18213	29000	0	17798	28584	3469	8538	3348	8346
1998	22668	150644	202611	150644	202611	125215	177182	23727	30545	23727	30545	0	23371	30189	4280	8813	4195	8674
1999	22870	163417	215042	163417	215042	138692	190317	22018	37509	22018	37509	0	21697	37189	2599	9661	2551	9565
2000	21808	148710	254736	148710	254736	124643	230669	16432	54789	16432	54789	0	15929	54286	2022	12023	1829	11781
2001	20977	136949	194299	136949	194299	111756	169106	14601	37188	14601	37188	0	14201	36788	1614	7832	1534	7709
2002	20913	134679	187273	134679	187273	111970	164564	10855	26315	10855	26315	0	9555	25015	1268	5796	1175	5586
2003	21226	174862	256264	174862	256264	151998	233401	12456	32090	12456	32090	0	12094	31727	1419	6894	1375	6803
2004	19946	160252	243479	160252	243479	138564	221790	11497	30067	11497	30067	0	11133	29702	1309	6934	1259	6834
2005	21869	185846	261393	185846	261393	161379	236926	16573	34961	16573	34961	0	16042	34430	1324	5900	1276	5804
2006	18006	203627	246681	203627	246681	183984	226993	27163	45744	27163	45744	0	26818	45380	1986	7098	1938	7043

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

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

Year	Small salmon				2SW salmon				Large salmon				Proportion 2SW in large salmon
	Returns		Spawners		Returns		Spawners		Returns		Spawners		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
1970	3513	7505	1497	4418	16221	23694	1246	3606	24955	36452	1917	5548	0.65
1971	2629	5566	1116	3246	7863	11318	550	1518	12096	17412	846	2335	0.65
1972	2603	5537	1092	3235	6266	12958	2550	7130	10621	21963	4323	12085	0.59
1973	5146	9852	1589	4720	7835	16023	3096	8648	10588	21653	4184	11686	0.74
1974	2869	6007	1159	3422	9564	19968	3902	11112	13102	27353	5345	15221	0.73
1975	3150	6567	1262	3717	5711	10976	1906	5261	7229	13894	2413	6660	0.79
1976	11884	20582	2619	7647	9362	19301	3804	10878	12318	25396	5005	14313	0.76
1977	7438	14652	2606	7527	11629	23571	4754	13270	14011	28399	5728	15988	0.83
1978	5215	9595	1477	4244	7287	14418	2826	7437	9716	19224	3768	9917	0.75
1979	5451	11163	2223	6260	1864	3196	568	1327	3655	6267	1114	2602	0.51
1980	9692	18781	3164	9285	9294	18255	3708	9717	11473	22537	4577	11997	0.81
1981	11367	21188	3362	9669	5677	9995	1487	3903	12078	21265	3163	8305	0.47
1982	8889	16834	2736	7978	5565	8856	1068	2713	9431	15011	1810	4599	0.59
1983	3621	6207	799	2268	5476	8770	976	2648	9281	14864	1654	4489	0.59
1984	11861	18589	1646	4732	5470	9667	2847	5848	6924	12237	3603	7403	0.79
1985	8525	18272	3639	10801	6175	12741	4788	10140	9802	20224	7600	16096	0.63
1986	12895	27635	5490	16311	10126	20617	7853	16317	13324	27128	10333	21470	0.76
1987	11708	24768	4930	14408	6161	12197	4437	9217	9627	19058	6932	14401	0.64
1988	16037	34159	6796	20027	9213	18880	7151	14979	12796	26222	9932	20804	0.72
1989	7673	16088	3185	9249	5646	11284	4172	8655	9905	19797	7319	15185	0.57
1990	9527	19902	3975	11418	5525	11070	4125	8592	8125	16280	6066	12636	0.68
1991	5276	10962	2219	6270	3092	6104	2311	4694	6185	12207	4621	9388	0.50
1992	10529	22220	4462	12930	5146	10399	3848	8052	9530	19257	7125	14911	0.54
1993	6578	13541	2739	7643	1763	3497	1262	2659	4407	8742	3156	6647	0.40
1994	10446	21861	4390	12580	5096	10286	3828	7990	8493	17143	6379	13317	0.60
1995	3310	6832	1344	3830	3636	7077	2587	5290	5590	10880	3977	8132	0.65
1996	7468	15529	3259	9043	5067	10234	3836	7979	7796	15745	5902	12275	0.65
1997	7666	16238	3572	9898	3446	6891	2605	5392	5302	10602	4008	8295	0.65
1998	7657	18381	3710	12036	1866	4916	390	2584	2871	7562	600	3976	0.65
1999	5712	12785	3096	8614	2225	4778	1632	3709	3423	7350	2511	5706	0.65
2000	7659	12983	4581	9160	3108	4676	1823	3145	4782	7193	2805	4838	0.65
2001	4640	10143	2563	8066	3604	7878	3507	7781	5545	12120	5396	11972	0.65
2002	11838	25877	6539	20578	2246	4910	2186	4850	3456	7555	3363	7462	0.65
2003	3226	7052	1782	5608	4032	8815	3924	8706	6204	13561	6037	13394	0.65
2004	12497	27317	6248	19122	3019	6599	2928	6480	4644	10152	4505	9970	0.65
2005	4535	9913	2268	6939	3540	7739	3434	7599	5446	11906	5283	11691	0.65
2006	8918	19494	4459	13646	2514	5494	2438	5396	3867	8453	3751	8301	0.65

Annex 5(v): Small, large, and 2SW return and spawner estimates for SFA 16.

Year	Small salmon				2SW salmon				Large salmon				Proportion 2SW in large salmon
	Returns		Spawners		Returns		Spawners		Returns		Spawners		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
1970													
1971	30420	52137	17557	32075	19697	32746	3508	5832	21457	35672	3822	6353	0.92
1972	39461	67633	21708	39659	24645	40972	14992	24924	25538	42456	15535	25827	0.97
1973	37986	65104	24550	44852	22896	38065	17134	28486	23905	39742	17889	29741	0.96
1974	62607	107303	44149	80656	33999	56523	27495	45711	37444	62250	30281	50343	0.91
1975	55345	94857	38775	70839	21990	36558	16366	27209	25334	42117	18855	31347	0.87
1976	78095	133848	49904	91171	17118	28459	10760	17889	20045	33325	12600	20947	0.85
1977	23658	40547	10598	19361	43160	71753	27404	45560	45575	75769	28938	48109	0.95
1978	20711	35496	11482	20977	18539	30822	8197	13627	21532	35797	9520	15827	0.86
1979	43460	74487	24678	45086	5484	9117	2751	4573	7960	13233	3992	6637	0.69
1980	35464	60782	21515	39307	30332	50426	15762	26204	31928	53080	16592	27584	0.95
1981	55661	95399	31943	58358	9489	15775	2702	4492	14226	23651	4051	6735	0.67
1982	68543	117477	44800	81846	21875	36368	9429	15676	27040	44954	11655	19377	0.81
1983	21476	36807	11879	21702	19762	32854	5986	9951	24549	40812	7436	12362	0.81
1984	25333	43418	15143	27665	12562	20884	12189	20264	13307	22123	12912	21466	0.94
1985	51847	88862	33452	61114	15861	26369	15390	25586	18231	30309	17690	29409	0.87
1986	100240	171802	71518	130659	23460	39003	22659	37670	27503	45724	26564	44162	0.85
1987	72327	123962	50222	91751	13590	22594	12635	21006	17073	28385	15873	26390	0.80
1988	103966	178189	72222	131945	15599	25933	15050	25021	19116	31781	18444	30663	0.82
1989	64153	109953	38708	70717	9880	16426	8921	14831	15131	25155	13662	22712	0.65
1990	72484	124286	44376	98325	14452	24087	13785	23420	23462	39102	22378	38019	0.62
1991	48713	83516	33289	69878	14892	24820	14321	24249	24615	41025	23670	40080	0.61
1992	136440	202198	100557	172041	21106	30340	20377	29610	34127	49058	32948	47879	0.62
1993	65555	169011	45516	151446	14946	58092	14483	57629	21684	84280	21012	83609	0.69
1994	39087	57794	22232	41929	13155	24008	12826	23679	17440	31827	17003	31390	0.75
1995	41524	61253	18895	39208	24711	35937	24192	35419	29278	42579	28664	41965	0.84
1996	30041	44423	8618	22923	10711	18429	10185	17903	15708	27026	14936	26255	0.68
1997	13470	23300	3051	12766	8254	13759	7727	13231	14210	23686	13302	22778	0.58
1998	19962	31885	12360	21044	4565	11229	4428	10892	11032	27138	10701	26323	0.41
1999	21073	29884	13048	19723	6059	9627	5877	9339	12449	19782	12076	19189	0.49
2000	29411	40958	18211	27032	6280	10757	6092	10435	13250	22696	12853	22015	0.47
2001	25606	37705	15854	24886	12615	17780	12236	17247	19538	27539	18952	26713	0.65
2002	40139	59277	24853	39123	4074	9322	3952	9043	8112	18563	7869	18006	0.50
2003	26045	41966	16126	27698	9549	16916	9262	16408	16317	28907	15828	28040	0.59
2004	39089	58513	24203	38619	10368	20028	10057	19427	18189	35137	17643	34083	0.57
2005	26158	40418	17264	26676	8375	16830	8123	16325	12593	25308	12216	24548	0.67
2006	27629	44253	18235	29207	9748	20732	9456	20110	14659	31176	14220	30241	0.67

Annex 5(vi): Small, large, and 2SW return and spawner estimates for SFA 17.

Year	Small salmon				2SW salmon				Large salmon			
	Returns		Spawners		Returns		Spawners		Returns		Spawners	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0
1973	5	9	3	7	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	14	28	8	22	2	5	1	4	2	5	1	4
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	2	5	1	4	5	9	3	7	5	9	3	7
1980	12	23	7	18	2	5	1	4	2	5	1	4
1981	259	498	151	390	40	77	36	73	40	77	36	73
1982	175	336	102	263	16	31	8	23	16	31	8	23
1983	17	32	10	25	17	32	15	30	17	32	15	30
1984	17	32	10	25	13	26	13	26	13	26	13	26
1985	113	217	66	170	8	15	8	15	8	15	8	15
1986	566	1,088	330	852	5	11	5	11	5	11	5	11
1987	1,141	2,194	665	1718	66	128	66	128	66	128	66	128
1988	1,542	2,963	899	2320	96	185	96	185	96	185	96	185
1989	400	770	233	603	149	287	149	287	149	287	149	287
1990	1,842	3,539	1074	2771	284	545	284	545	284	545	284	545
1991	1,576	3,028	919	2371	188	361	188	361	188	361	188	361
1992	1,873	3,599	1092	2818	95	183	95	183	95	183	95	183
1993	1,277	2,454	745	1922	22	43	22	43	22	43	22	43
1994	210	385	118	292	169	310	166	307	169	310	166	307
1995	1,058	1,914	585	1441	85	154	81	151	85	154	81	151
1996	1,161	2,576	738	2154	158	351	154	347	158	351	154	347
1997	485	932	283	730	31	59	30	58	31	59	30	58
1998	635	1,221	370	956	79	151	76	149	79	151	76	149
1999	379	728	221	570	23	45	20	41	23	45	20	41
2000	304	584	177	457	56	108	55	107	56	108	55	107
2001	429	824	250	645	57	110	55	107	57	110	55	107
2002	307	591	179	463	46	88	45	87	46	88	45	87
2003	591	1,135	344	889	77	148	74	145	77	148	74	145
2004	163	313	95	245	32	61	31	61	32	61	31	61
2005	216	415	126	325	35	67	35	67	35	67	35	67
2006	210	404	122	316	34	65	34	65	34	65	34	65

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

Year	Small salmon				2SW salmon				Large salmon			
	Returns		Spawners		Returns		Spawners		Returns		Spawners	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1970	264	1,073	167	842	4744	6836	546	2314	6161	7858	709	2660
1971	65	265	41	208	1891	2782	213	901	2456	3198	276	1036
1972	131	530	82	416	4693	6024	226	958	6095	6924	293	1101
1973	516	2,095	325	1645	4140	5481	238	1009	5376	6299	309	1160
1974	187	757	118	595	5481	6928	264	1119	7119	7963	343	1286
1975	112	454	71	357	3452	4340	178	752	4483	4989	231	864
1976	299	1,212	188	951	2755	3674	222	939	3578	4223	288	1080
1977	215	871	135	684	3985	5463	326	1381	5175	6280	424	1587
1978	78	316	49	248	4585	6265	424	1794	5954	7201	550	2062
1979	1,857	7,536	1170	5915	1290	2014	220	932	1676	2315	286	1071
1980	520	2,108	327	1655	3732	5177	413	1748	4846	5951	536	2009
1981	2,797	11,348	1762	8908	2490	3769	375	1586	3234	4332	487	1823
1982	2,150	8,722	1354	6847	4135	5901	461	1951	5370	6783	598	2242
1983	212	858	133	674	3733	5241	398	1686	4848	6024	517	1938
1984	460	1,867	182	1210	2391	3573	259	1148	3105	4107	336	1319
1985	730	3,167	144	1786	921	4481	870	4358	1196	5150	1130	5009
1986	965	3,854	64	1731	2274	11479	2164	11213	2953	13195	2811	12888
1987	1,316	5,061	191	2410	2471	13218	2394	13030	3209	15193	3109	14977
1988	1,927	7,900	915	5514	1068	5040	998	4870	1387	5794	1296	5598
1989	680	2,651	35	1129	1418	7464	1362	7326	1842	8579	1768	8420
1990	1,082	13,778	335	12017	2891	16033	2836	15900	3754	18429	3683	18276
1991	914	10,559	48	8519	1539	11692	1475	11536	1998	13439	1915	13260
1992	1,448	6,565	807	5053	4048	18947	3978	18776	5257	21778	5166	21581
1993	1,714	10,451	1043	8869	2000	12445	1954	12334	2597	14305	2538	14177
1994	660	2,988	298	2136	1951	9095	1898	8964	2534	10454	2465	10304
1995	619	2,939	379	2372	1453	7710	1415	7617	1887	8862	1837	8755
1996	1,470	8,033	1076	7105	1839	8185	1771	8021	2388	9408	2300	9220
1997	562	3,219	204	2375	3043	16404	2955	16192	3951	18856	3838	18611
1998	636	3,643	231	2688	1938	10450	1883	10315	2517	12012	2445	11856
1999	562	3,219	204	2375	1168	6297	1134	6215	1517	7238	1473	7144
2000	473	2,712	172	2001	1006	5424	977	5354	1306	6234	1269	6154
2001	657	3,767	238	2780	1234	6655	1199	6569	1603	7650	1557	7551
2002	656	3,757	238	2772	883	4762	858	4700	1147	5473	1114	5402
2003	591	3,384	214	2497	1645	8868	1598	8753	2136	10194	2075	10061
2004	935	5,361	339	3956	2035	10973	1977	10830	2643	12612	2567	12449
2005	755	4,326	274	3192	1937	10443	1881	10307	2515	12003	2443	11847
2006	827	4,740	300	3497	1872	10092	1818	9961	2431	11600	2361	11450

Annex 5(viii): Total 1SW returns and spawners, SFAs 19, 20, 21 and 23, 1970-2005.

Appendix 5(viii). Total 1SW returns and spawners, SFAs 19, 20, 21 and 23, 1970-2005.

	RETURNS						***TOTAL RETURNS***		***SPAWNERS***						***TOTAL SPAWNERS***	
	River returns SFA 19-21		Comm-ercial	SFA 23			SFAs 19,20,21,23		angled	Spawners 19-21		SFA 23 H+W rtns		Harvest	19,20,21,23	
Year	MIN	MAX	19-21	Wild MIN	Wild MAX	Hatch	MIN	MAX	19-21	MIN	MAX	MIN	MAX		MIN	MAX
1970	8,236	16,868	3,189	5,206	7,421	100	16,731	27,578	3,609	4,627	13,259	5,306	7,521	1,420	8,513	19,360
1971	6,345	13,062	1,922	2,883	4,176	365	11,515	19,525	2,761	3,584	10,301	3,248	4,541	2,032	4,800	12,810
1972	6,636	13,354	1,055	1,546	2,221	285	9,522	16,915	2,917	3,719	10,437	1,831	2,506	2,558	2,992	10,385
1973	8,225	16,744	1,067	3,509	5,047	1,965	14,766	24,823	3,604	4,621	13,140	5,474	7,012	1,437	8,658	18,715
1974	14,478	29,385	2,050	6,204	8,910	3,991	26,723	44,336	6,340	8,138	23,045	10,195	12,901	2,124	16,209	33,822
1975	5,096	10,393	2,822	11,648	16,727	6,374	25,940	36,316	2,227	2,869	8,166	18,022	23,101	2,659	18,232	28,608
1976	12,421	25,398	1,675	13,761	19,790	9,074	36,931	55,937	5,404	7,017	19,994	22,835	28,864	5,263	24,589	43,595
1977	13,349	27,943	3,773	6,746	9,679	6,992	30,860	48,387	5,841	7,508	22,102	13,738	16,671	4,542	16,704	34,231
1978	2,535	5,241	3,651	3,227	4,651	3,044	12,457	16,587	1,113	1,422	4,128	6,271	7,695	2,015	5,678	9,808
1979	12,365	25,381	3,154	11,529	16,690	3,827	30,875	49,052	5,428	6,937	19,953	15,356	20,517	3,716	18,577	36,754
1980	16,534	33,825	8,252	14,346	20,690	10,793	49,925	73,560	7,253	9,281	26,572	25,139	31,483	5,542	28,878	52,513
1981	18,594	38,329	1,951	11,199	16,176	5,627	37,371	62,083	8,163	10,431	30,166	16,826	21,803	9,021	18,236	42,948
1982	10,008	20,552	2,020	8,773	12,598	3,038	23,839	38,208	4,361	5,647	16,191	11,811	15,636	5,279	12,179	26,548
1983	4,662	9,562	1,621	7,706	11,028	1,564	15,553	23,775	2,047	2,615	7,515	9,270	12,592	4,138	7,747	15,969
1984	12,398	25,815	0	14,105	20,227	1,451	27,954	47,493	4,724	7,674	21,091	15,556	21,678	5,266	17,964	37,503
1985	16,354	34,055	0	11,038	15,910	2,018	29,410	51,983	6,360	9,994	27,695	13,056	17,928	4,892	18,158	40,731
1986	16,661	34,495	0	13,412	19,321	862	30,935	54,678	6,182	10,479	28,313	14,274	20,183	3,549	21,204	44,947
1987	18,388	37,902	0	10,030	14,334	3,328	31,746	55,564	7,056	11,332	30,846	13,358	17,662	3,101	21,589	45,407
1988	16,611	33,851	0	15,131	21,834	1,250	32,992	56,935	6,384	10,227	27,467	16,381	23,084	3,320	23,288	47,231
1989	17,378	35,141	0	16,240	23,182	1,339	34,957	59,662	6,629	10,749	28,512	17,579	24,521	4,455	23,873	48,578
1990	20,119	41,652	0	12,287	17,643	1,533	33,939	60,828	7,391	12,728	34,261	13,820	19,176	3,795	22,753	49,642
1991	6,718	13,870	0	10,602	15,246	2,439	19,759	31,555	2,399	4,319	11,471	13,041	17,685	3,546	13,814	25,610
1992	9,269	18,936	0	11,340	16,181	2,223	22,832	37,340	3,629	5,640	15,307	13,563	18,404	4,078	15,125	29,633
1993	9,104	18,711	0	7,610	8,828		16,714	27,539	3,327	5,777	15,384	5,762	6,868		11,539	22,252
1994	2,446	4,973	0	5,770	6,610		8,216	11,583	493	1,953	4,480	4,965	5,738		6,918	10,218
1995	5,974	12,364	0	8,265	9,458		14,239	21,822	1,885	4,089	10,479	8,025	9,218		12,114	19,697
1996	9,888	20,791	0	12,907	15,256		22,795	36,047	2,211	7,677	18,580	11,576	13,892		19,253	32,472
1997	2,665	5,488	0	4,508	4,979		7,173	10,467	493	2,172	4,995	3,971	4,433		6,143	9,428
1998	5,745	11,824	0	9,203	10,801		14,948	22,625	0	5,745	11,824	8,775	10,348		14,520	22,172
1999	2,537	5,222	0	5,508	6,366		8,045	11,588	67	2,470	5,155	5,196	6,048		7,666	11,203
2000	4,005	8,244	0	4,796	5,453		8,801	13,697	0	4,005	8,244	4,455	5,087		8,460	13,331
2001	1,508	3,104	0	2,513	2,862		4,021	5,966	0	1,508	3,104	2,210	2,530		3,718	5,634
2002	3,375	6,946	0	3,501	3,991		6,876	10,937	0	3,375	6,946	3,232	3,689		6,607	10,635
2003	1,843	3,793	0	2,292	2,716		4,135	6,509	0	1,843	3,793	2,069	2,469		3,912	6,262
2004	2,497	5,140	0	3,454	4,297		5,951	9,437	0	2,497	5,140	3,229	4,039		5,726	9,179
2005	1,859	3,826	0	3,597	4,640		5,456	8,466	0	1,859	3,826	3,433	4,450		5,292	8,277
2006	3,335	6,864	0	3,720	4,743		7,055	11,607	0	3,335	6,864	3,528	4,501		6,863	11,365

SFAs 19, 20, 21: Returns, 1970-1997, estimated as run size (1SW recreational catch / expl. rate [0.2 to 0.45]; where MIN and MAX selected as 5th and 95th percentile values from 1,000 monte carlo estimates) + estimated 1SW fish in commercial landings 1970-1983 (Cutting MS 1984). For 1998-2004, see "a" below.

SFA 22: Inner Fundy stocks and inner-Fundy SFA 23 (primarily 1SW fish) do not go to the North Atlantic.

SFA 23: For 1970-'97, similar to SFAs 19-21 except that estimated wild 1SW returns destined for Mactaquac Dam, Saint John River, replaced values for recreational catch and estimated proportions that production above Mactaquac is of the total (0.4-0.6) river replaced exploitation rates (commercial harvest, bi-catch etc., incl. in estimated returns); hatchery returns attributed to above Mactaquac only; 1SW production in rest of SFA (outer Fundy) omitted.

"a"- Revision of method, SFA 23, 1993-2004, estimated returns to Nashwaak fence raised by proportion of area below Mactaquac (0.21-0.30) and added to total estimated returns originating upriver of Mactaquac (Marshall et al. 1998); MIN and MAX removals below Mactaquac based on Nashwaak losses, Mactaquac losses are a single value and together summed and removed from returns to establish estimate of spawners. SFAs 19-21, estimate of returns 1998-2004 based on regression (revised in March 2005 with intercept set to zero) of LaHave wild counts on MIN and MAX estimates of total SFA 19-21 returns, 1984-1997, because there was no (1998,2000-04) & little (1999) angling in SFAs 20-21.

Annex 5(ixa): Total 2SW returns to SFAs 19, 20, 21 and 23, 1970 to 2006

Appendix 5(ixa). Total 2SW returns to SFAs 19, 20, 21 and 23, 1970-2006.

								SFA 23					
	SFA 19		**SFA 20**		**SFA 21**		Total	Wild	Wild	Htch	Htch	**TOTAL RETURNS**	
	MIN	MAX	MIN	MAX	MIN	MAX	Comm-	MIN	MAX	MIN	MAX	**SFAs 19,20,21,23**	
	2SW=0.7-0.9		2SW=0.6-0.9		2SW=0.5-0.9		ercial	2SW= 0.85-0.95		2SW= 0.85-0.95			
Year	Exp. rate=0.2-0.45		Exp. rate=0.2-0.45		Exp. rate=0.2-0.45		19-21	p. abv= 0.4-0.6				MIN	MAX
1970	1,170	2,537	658	1,535	597	1,525	2,644	8,540	12,674	0	0	13,609	20,915
1971	600	1,266	344	802	481	1,199	2,607	7,089	10,463	66	73	11,187	16,410
1972	735	1,614	421	1,002	454	1,198	4,549	7,362	10,809	507	559	14,028	19,731
1973	726	1,571	665	1,532	546	1,437	4,217	3,773	5,559	432	477	10,359	14,793
1974	1,035	2,225	691	1,588	548	1,397	8,873	8,766	12,790	1,989	2,198	21,902	29,071
1975	376	824	149	343	882	2,321	9,430	11,217	16,490	1,890	2,088	23,944	31,496
1976	791	1,672	346	822	441	1,146	5,916	12,304	18,106	1,970	2,175	21,768	29,837
1977	999	2,152	660	1,509	873	2,354	9,205	14,539	21,420	2,330	2,575	28,606	39,215
1978	810	1,739	429	995	655	1,706	6,827	6,059	8,903	2,166	2,391	16,946	22,561
1979	532	1,169	431	978	508	1,288	2,326	4,149	6,084	1,016	1,123	8,962	12,968
1980	1,408	3,051	746	1,714	1,483	3,989	9,204	16,500	24,041	2,556	2,824	31,897	44,823
1981	886	1,856	926	2,133	1,754	4,475	4,438	8,696	12,690	2,330	2,577	19,030	28,169
1982	917	1,990	316	746	682	1,756	5,819	8,266	12,198	1,516	1,673	17,516	24,182
1983	477	1,030	641	1,475	552	1,434	2,978	8,718	12,793	944	1,043	14,310	20,753
1984	828	1,768	638	1,500	766	2,004	0	14,753	21,573	953	1,054	17,938	27,899
1985	1,495	3,132	2,703	6,355	2,102	5,469	0	15,793	23,002	748	826	22,841	38,784
1986	3,500	7,541	2,561	5,987	2,150	5,312	0	9,210	13,507	681	754	18,102	33,101
1987	2,427	5,237	1,066	2,527	1,114	2,872	0	6,512	9,590	410	453	11,529	20,679
1988	2,635	5,724	1,914	4,464	1,105	2,945	0	3,936	5,836	780	861	10,370	19,830
1989	2,236	4,810	1,512	3,485	1,631	4,086	0	6,159	8,994	401	443	11,939	21,818
1990	2,406	5,178	1,085	2,515	1,271	3,260	0	4,994	7,375	492	543	10,248	18,871
1991	1,890	4,050	965	2,200	421	1,071	0	6,739	9,902	598	661	10,613	17,884
1992	1,788	3,923	631	1,488	480	1,236	0	6,213	9,074	665	735	9,777	16,456
1993	876	1,897	1,006	2,321	564	1,498	0	4,345	4,820			6,791	10,536
1994	833	1,845	242	561	305	773	0	3,084	3,495			4,464	6,674
1995	759	1,582	666	1,565	518	1,339	0	3,439	3,998			5,382	8,484
1996	1,231	2,692	604	1,404	894	2,293	0	4,729	5,397			7,458	11,786
1997	607	1,299	170	387	301	1,026	0	2,769	3,176			3,847	5,888
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				889	1,824	0	1,372	1,642			2,261	3,466
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,439	2,954	0	2,375	2,640			3,814	5,594
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				870	1,786	0	988	1,206			1,859	2,992
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,506	3,091	0	1,938	2,279			3,444	5,370
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				251	515	0	483	548			734	1,063
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,523	3,126	0	1,056	1,198			2,579	4,323
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				585	1,202	0	1,335	1,605			1,920	2,807
2005	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				519	1,065	0	809	1,012			1,328	2,077
2006	>>>>>>>>>>>>>>>>>>>>>>>>>>>>				1,072	2,200	0	922	1,171			1,994	3,371

SFAs 19, 20, 21: Returns, 1970-'97 estimated as run size (MSW recreational catch * prop. 2SW [range of values]/ expl. rate [range of values]; where MIN and MAX selected as 5th and 95th percentile values from 1,000 monte carlo estimates) + estimated 2SW fish in commercial landings 1970-1983 (Cutting MS 1984). For 1998-2004 see "a" below.

SFA 22: Inner Fundy stocks do not go to north Atlantic.

SFA 23: For 1970-1997 Similar approach as for SFAs 19-21 except that estimated wild MSW returns destined for Mactaquac Dam, Saint John River, replaced values for recreational catch; and estimated proportions that production above Mactaquac is of the total river replaced exploitation rates (commercial harvest,bi-catch etc., incl. in estimated returns) + est. 0.85-0.95* MSW hatchery returns to Mactaquac; 2SW production in rest of SFA omitted. Note revisions to returns from 1993 to 2005 made in 2005.

"a": Revision of method, SFA 23, 1993-2005, estimated MSW returns to Nashwaak fence raised by prop. of area below Mactaquac (0.21-0.30) * prop. 2SW (0.7 & 0.9) and added to estimated MSW hatchery and wild returns * (Marshall et al. MS 1998) (0.85-0.95; 2SW) originating upriver of Mactaquac. MIN & MAX removals below Mactaquac based on Nashwaak losses: Mactaquac losses were a single value and together summed and removed from MSW returns (prevously) to estimate spawners.
SFAs 19-21, estimate of 2SW returns for 1998-'04, based on regression (revised in March 2005 with intercept set to zero) of LaHave wild counts on MIN and MAX estimates of total SFA 19-21 MSW returns and proportion 2SW fish in total MSW returns to LaHave.

Annex 5(ixb): Total 2SW spawners in SFAs 19, 20, 21 and 23, 1970-2006

Appendix 5(ixb). Total 2SW spawners in SFAs 19, 20, 21 and 23, 1970-2006.

	RETURNS						REMOVALS		SPAWNERS		SFA 23					
	SFA 19		SFA 20		SFA 21		angled (19-21)		SFAs (19-21)		RETURNS		REMOVALS		TOTAL SPAWNERS	
Year	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1970	1,170	2,537	658	1,535	597	1,525	941	1,375	1,485	4,222	8,540	12,674	7,004	7,828	3,021	9,068
1971	600	1,266	344	802	481	1,199	541	812	884	2,455	7,155	10,536	3,543	3,960	4,496	9,032
1972	735	1,614	421	1,002	454	1,198	623	922	987	2,892	7,869	11,368	1,397	1,562	7,459	12,699
1973	726	1,571	665	1,532	546	1,437	740	1,108	1,197	3,432	4,205	6,036	1,454	1,625	3,949	7,844
1974	1,035	2,225	691	1,588	548	1,397	871	1,277	1,404	3,933	10,755	14,988	2,632	2,942	9,526	15,979
1975	376	824	149	343	882	2,321	534	867	874	2,621	13,107	18,578	2,120	2,369	11,861	18,830
1976	791	1,672	346	822	441	1,146	603	887	975	2,754	14,274	20,281	4,203	4,698	11,045	18,337
1977	999	2,152	660	1,509	873	2,354	967	1,463	1,565	4,552	16,869	23,995	4,856	5,427	13,578	23,119
1978	810	1,739	429	995	655	1,706	723	1,088	1,171	3,352	8,225	11,294	2,879	3,218	6,517	11,428
1979	532	1,169	431	978	508	1,288	560	851	911	2,585	5,165	7,207	1,393	1,557	4,683	8,234
1980	1,408	3,051	746	1,714	1,483	3,989	1,390	2,131	2,247	6,623	19,056	26,865	7,033	7,860	14,270	25,628
1981	886	1,856	926	2,133	1,754	4,475	1,338	2,125	2,228	6,339	11,026	15,267	7,384	8,253	5,870	13,353
1982	917	1,990	316	746	682	1,756	734	1,096	1,181	3,396	9,782	13,871	5,307	5,932	5,656	11,335
1983	477	1,030	641	1,475	552	1,434	633	971	1,037	2,968	9,662	13,836	9,194	10,275	1,505	6,529
1984	828	1,768	638	1,500	766	2,004	267	419	1,965	4,853	15,706	22,627	3,426	3,829	14,245	23,650
1985	1,495	3,132	2,703	6,355	2,102	5,469			6,300	14,956	16,541	23,828	4,656	5,204	18,185	33,580
1986	3,500	7,541	2,561	5,987	2,150	5,312			8,211	18,840	9,891	14,261	2,667	2,981	15,435	30,120
1987	2,427	5,237	1,066	2,527	1,114	2,872			4,607	10,636	6,922	10,043	1,294	1,446	10,235	19,233
1988	2,635	5,724	1,914	4,464	1,105	2,945			5,654	13,133	4,716	6,697	1,296	1,449	9,074	18,381
1989	2,236	4,810	1,512	3,485	1,631	4,086			5,379	12,381	6,560	9,437	250	279	11,689	21,539
1990	2,406	5,178	1,085	2,515	1,271	3,260			4,762	10,953	5,486	7,918	560	626	9,688	18,245
1991	1,890	4,050	965	2,200	421	1,071			3,276	7,321	7,337	10,563	1,257	1,405	9,356	16,479
1992	1,788	3,923	631	1,488	480	1,236			2,899	6,647	6,878	9,809	1,052	1,176	8,725	15,280
1993	876	1,897	1,006	2,321	564	1,498			2,446	5,716	4,345	4,820	1,054	1,166	5,737	9,370
1994	833	1,845	242	561	305	773			1,380	3,179	3,084	3,495	697	815	3,767	5,859
1995	759	1,582	666	1,565	518	1,339			1,943	4,486	3,439	3,998	313	346	5,069	8,138
1996	1,231	2,692	604	1,404	894	2,293			2,729	6,389	4,729	5,397	720	812	6,738	10,974
1997	607	1,299	170	387	301	1,026			1,078	2,712	2,769	3,176	550	611	3,297	5,277
1998	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								889	1,824	1,372	1,642	304	340	1,957	3,126
1999	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								1,439	2,954	2,375	2,640	441	459	3,373	5,135
2000	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								870	1,786	988	1,206	183	202	1,676	2,790
2001	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								1,506	3,091	1,938	2,279	239	271	3,205	5,099
2002	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								251	515	483	548	166	192	568	871
2003	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								1,523	3,126	1,056	1,198	178	200	2,401	4,123
2004	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								585	1,202	1,335	1,605	97	113	1,823	2,694
2005	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								519	1,065	809	1,012	83	99	1,245	1,978
2006	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								1,072	2,200	922	1,171	126	148	1,868	3,223

Spawners = returns minus removals where: "returns" are from previous Appendix as are outlines of revisions to methods for SFAs 19-21, 1998-2000, and SFA 23, 1993-2000. "Removals" of 2SW fish in SFAs 19-21 have been few, largely illegal and unascribed since the catch-and-release angling regulations in 1985; removals in SFA 23, 1985-1997, had been in total, the assessed losses to stocks originating above Mactaquac. The revised method, 1993-2000, incorporates 5th and 95th percentile values for losses noted on the Nashwaak raised to the total production area downstream of Mactaquac as well as the previously assessed and used values for stocks upstream of Mactaquac.

Annex 5(x): Estimated numbers of salmon returns and spawners for Québec 1969-2006

	Recruit of small salmon		Recruit of large salmon		Spawner of small salmon		Spawner of large salmon		Recruit of 2SW salmon		Spawner of 2SW salmon	
Year	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1969	25,355	38,032	74,653	111,979	16,313	24,470	25,532	38,299	54,496	81,745	18,639	27,958
1970	18,904	28,356	82,680	124,020	11,045	16,568	31,292	46,937	60,356	90,534	22,843	34,264
1971	14,969	22,453	47,354	71,031	9,338	14,007	16,194	24,292	34,568	51,852	11,822	17,733
1972	12,470	18,704	61,773	92,660	8,213	12,320	31,727	47,590	45,094	67,642	23,160	34,741
1973	16,585	24,877	68,171	102,256	10,987	16,480	32,279	48,419	49,765	74,647	23,564	35,346
1974	16,791	25,186	91,455	137,182	10,067	15,100	39,256	58,884	66,762	100,143	28,657	42,985
1975	18,071	27,106	77,664	116,497	11,606	17,409	32,627	48,940	56,695	85,042	23,818	35,726
1976	19,959	29,938	77,212	115,818	12,979	19,469	31,032	46,548	56,365	84,547	22,653	33,980
1977	18,190	27,285	91,017	136,525	12,004	18,006	44,660	66,990	66,442	99,663	32,602	48,902
1978	16,971	25,456	81,953	122,930	11,447	17,170	40,944	61,416	59,826	89,739	29,889	44,834
1979	21,683	32,524	45,197	67,796	15,863	23,795	17,543	26,315	32,994	49,491	12,807	19,210
1980	29,791	44,686	107,461	161,192	20,817	31,226	48,758	73,137	78,447	117,670	35,594	53,390
1981	41,667	62,501	84,428	126,642	30,952	46,428	35,798	53,697	61,633	92,449	26,132	39,199
1982	23,699	35,549	74,870	112,305	16,877	25,316	36,290	54,435	54,655	81,982	26,492	39,738
1983	17,987	26,981	61,488	92,232	12,030	18,045	23,710	35,565	44,886	67,329	17,308	25,963
1984	21,566	30,894	61,180	81,041	16,316	24,957	30,610	44,739	44,661	59,160	22,345	32,659
1985	22,771	33,262	62,899	84,192	15,608	25,140	28,312	43,482	45,916	61,460	20,668	31,742
1986	33,758	46,937	75,561	99,397	22,230	33,855	32,997	49,232	55,159	72,560	24,088	35,939
1987	37,816	54,034	72,190	93,650	25,789	40,481	29,758	43,462	52,699	68,365	21,723	31,727
1988	43,943	62,193	77,904	103,269	28,582	44,815	34,781	52,524	56,870	75,387	25,390	38,343
1989	34,568	48,407	70,762	91,871	24,710	37,319	34,268	49,185	51,656	67,066	25,016	35,905
1990	39,962	54,792	68,851	90,893	26,594	39,826	33,454	49,615	50,261	66,352	24,422	36,219
1991	31,488	42,755	64,166	83,184	20,582	30,433	27,341	39,797	46,841	60,724	19,959	29,052
1992	35,257	48,742	64,271	83,953	21,754	33,583	26,489	39,497	46,917	61,285	19,337	28,833
1993	30,645	42,156	50,717	63,677	17,493	27,444	21,609	29,353	37,023	46,484	15,774	21,428
1994	29,667	40,170	51,649	64,630	16,758	25,642	21,413	28,968	37,703	47,180	15,631	21,147
1995	23,851	32,368	59,939	74,227	14,409	21,548	30,925	39,320	43,755	54,186	22,575	28,703
1996	32,008	42,558	53,990	68,282	18,923	27,805	26,042	34,824	39,413	49,846	19,010	25,421
1997	24,300	33,018	44,442	56,187	14,724	22,210	21,275	28,466	32,443	41,017	15,531	20,780
1998	24,495	34,301	33,368	43,605	16,743	25,730	19,506	26,629	24,358	31,832	14,240	19,439
1999	25,880	36,679	34,815	46,178	18,969	28,808	23,631	32,618	25,415	33,710	17,250	23,811
2000	24,129	35,070	33,312	46,565	16,444	25,865	22,094	31,960	24,317	33,992	16,128	23,331
2001	16,939	24,452	35,016	48,490	10,836	16,989	22,871	32,954	25,562	35,398	16,696	24,056
2002	28,609	39,275	25,635	35,801	17,070	25,625	17,079	24,366	18,714	26,135	12,467	17,787
2003	23,142	31,892	39,435	52,413	15,445	23,187	28,409	39,137	28,787	38,262	20,738	28,570
2004	30,423	43,266	34,796	45,488	20,513	32,081	23,920	32,374	25,401	33,207	17,462	23,633
2005	20,685	29,531	33,728	43,831	14,295	22,278	24,012	32,168	24,622	31,996	17,529	23,482
2006	24,971	34,717	30,957	40,870	17,351	25,970	22,206	30,042	22,599	29,835	16,211	21,930
Mean 84-06	**28,734**	**40,064**	**51,286**	**67,030**	**18,789**	**28,765**	**26,217**	**37,161**				

Annex 6: SAS program code for the provision of catch options for the West Greenland fishery for 2006 to 2008

A – code for forecasting PFA for North America using lagged spawners and phase shift

SAS Code written by Gerald Chaput, DFO Canada, revised April 2007;

```
OPTIONS NOCENTRE;
/* ASCII file containing regional lagged spawner estimates, by minimum and maximum generated from
Excel table of regional lagged spawners, for 1978 to most recent year, edited and updated by Dave
Reddin, DFO NL Region, Canada */

Filename in1
"w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/regional-lagged-spawners.prn";

data spawners;
infile in1 missover;
input year LBLS_L LBLS_H NFLS_L NFLS_H QCLS_L QCLS_H GFLS_L GFLS_H SFLS_L
SFLS_H USALS;
RUN;
proc print data = spawners; run;

/* ASCII file containing input data to calculate PFA
as well as estimates of 2SW returns by region lagged to year of PFA, as minimum and maximum
generated from Excel table of regional returns edited and updated by Dave Reddin, DFO NL Region,
Canada
delete the last PFA entry line (2006 in the case of the 2007-2009 WG forecast) because the returns are
incomplete for all regions
year is the PFA year for all the catch data but for the return data, year is the year of 2SW return so they
must be lagged back to PFA year before deleting last year line ****/

Filename in2
"w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/catch-returns-2007vers.prn";
data catchreturns;
  infile in2 missover;
  INPUT YEAR NG1 NC1_L NC1_H NC2_L NC2_H NR2_L NR2_H LBR2_L LBR2_H NFR2_L
NFR2_H QCR2_L QCR2_H GFR2_L GFR2_H SFR2_L SFR2_H USAR2;
  RUN;
  PROC PRINT DATA = CATCHRETURNS; RUN;

PROC SORT DATA = catchreturns; BY YEAR; RUN;
PROC SORT DATA = spawners; BY YEAR; RUN;
DATA INPUTS; MERGE spawners catchreturns;
  BY YEAR;
  RUN;
proc print data = inputs; run;

/* this section creates various sub-files used in generating PFA estimates, model fits, PFA predictions
and for subsequent risk analysis   */
data fishdata (keep = sim break year phase pfa lnspawn lnpfa dumb)
    /** this is the base file for modelling  */
     pfa (keep = sim year lnpfa)
 /* this is the base file for estimating change in pfa relative to year-2 */
    lnpfa4GL (keep = sim lnpfa4GL)
    lnpfa4NA (keep = sim lnpfa4NA)
  /* these files are later combined with "pfa" file to generate predictions of PFA for the years of interest,
the earlier year lnpfa4NA is for an update, later year, lnpfa4GL is for prediction in year of interest  */
    returnsall (keep = sim year USAR2 R2SF R2GF R2QC R2NF R2LB R2NA)
    RETURNSSOUTH (keep = sim year R2SF USAR2)
  /* these files are used to accumulate returns by region for apportioning PFA to regions and for
developing indices of returns for risk analysis */
    yearofinterest (keep = sim break year phase lnspawn dumb);
  /* this file accumulates years for which forecasts will be generated, it is required to automatically
generate forecasts under two phase states */
  set inputs;
```

```
  maxsim = 3000;   *** maximum number of simulations;

do sim = 1 to maxsim;
/*  incorporating uncertainty in PFA estimated  */
  RAN_C1  = NC1_L + (NC1_H - NC1_L)* RANUNI(0);
  RAN_C2  = NC2_L + (NC2_H - NC2_L)* RANUNI(0);
  RAN_R2  = NR2_L + (NR2_H - NR2_L)* RANUNI(0);
  nareturns = (((RAN_R2*exp(0.03*1) + RAN_C2)*exp(0.03*10))+ RAN_C1);
  pfa = nareturns + NG1;
     * PFA based on equation 4.2.3.3 in WG report;
  lnpfa = log(pfa);

 /* calculates uncertainty of lagged spawner index and the lagged spawner proportions by region   */
  LSLB = LBLS_L + (LBLS_H - LBLS_L)* RANUNI(0);
  LSNF = NFLS_L + (NFLS_H - NFLS_L)* RANUNI(0);
  LSQC = QCLS_L + (QCLS_H - QCLS_L)* RANUNI(0);
  LSGF = GFLS_L + (GFLS_H - GFLS_L)* RANUNI(0);
  LSSF = SFLS_L + (SFLS_H - SFLS_L)* RANUNI(0);

  LSNA = LSLB+LSNF+LSQC+LSGF+LSSF+USALS;
 ** all lagged spawners including Labrador;
  lnspawn = log(LSNA);
 * variable used in forecasting, change to LSNA when Labrador is included;
  if year = 2004 then do;
 /* for updated forecasts, adjust year as needed to update NA forecast, use second to last year when PFA
has been estimated */
  lnpfa4NA = lnpfa;
              output lnpfa4NA;
              end;
  if year = 2005 then do;
 /** for forecast of year of interest, Geenland fishery, adjust year to last year when PFA has been
estimated **/
     lnpfa4GL = lnpfa;
              output lnpfa4GL;
              end;
* file to prepare data for selecting phase;
  if lnpfa ne . then do;
     output pfa;
              end;

     R2SF = SFR2_L + (SFR2_H - SFR2_L)* RANUNI(0);
     R2LB = LBR2_L + (LBR2_H - LBR2_L)* RANUNI(0);
     R2NF = NFR2_L + (NFR2_H - NFR2_L)* RANUNI(0);
     R2QC = QCR2_L + (QCR2_H - QCR2_L)* RANUNI(0);
     R2GF = GFR2_L + (GFR2_H - GFR2_L)* RANUNI(0);
     R2NA = sum(R2LB, R2NF, R2QC, R2GF, R2SF, USAR2);

if 1991 le year le 1995 then OUTPUT RETURNSSOUTH;
 *** 5 year base period for return years 1992 to 1996 for Scotia-Fundy and USA returns improvement
year = PFA year --**;

if 2001 le year le 2005 then do;
*** 5 year moving period for proportioning PFA to regions slide 5-year period as more recent PFA value
is obtained, year = PFA year;
  OUTPUT RETURNSALL;
  end;

  dumb = 1;  * need this to calculate likelihood of null model;

do break = 1985 to 1993;
 * stepping through possible break years;
  if year le break then phase = 1;
  if break lt year le 2005 then phase = 2;
 ** change end year to last year PFA is known;
  if lnspawn ne . and lnpfa ne . then output fishdata;
  if 2006 le year le 2009 then do;
  /** change years of NA update and GL forecast **/
```

```
    do i = 1 to 2;
     phase = i;
     output yearofinterest;
     end;
    end;
  end;
end;   * finish generating the data sets;
run;

proc means data = returnssouth noprint nway mean;
 class sim;
 var R2SF USAR2;
 output out = meanretsouth  mean = R2SF USAR2;
 run;
data _nul_; set meanretsouth;
  file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/meanretsouth.dat";
/* file of average returns by simulation to southern areas, 1991 to 1995 */
  put sim 8. R2SF 10.  USAR2 10.;
run;

proc means data = returnsall noprint nway mean;
 class sim;
 var USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
 output out = meanretall  mean = USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
 run;
data _nul_; set meanretall;
  file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/meanretall.dat";
  /* file of average returns by simulation to all areas, most recent five years */
  put sim 8. USAR2 10. R2SF 10. R2GF 10. R2QC 10. R2NF 10. R2LB 10. R2NA 10.;
run;

/* prepares the predictions files for year of interest based on history of ratio of pfa in year to pfa in year-2
*/
data pfa2 (keep = sim year lnpfa2); set pfa;
  year = year+2;
  lnpfa2 = lnpfa;
  run;

proc sort data = pfa; by sim year; run;
proc sort data = pfa2; by sim year; run;
data pfaratio; merge pfa2 pfa;
  by sim year;
  pfaratio = lnpfa/lnpfa2;
  if pfaratio ne . then output pfaratio;
  run;
 proc sort data = lnpfa4NA; by sim; run;
 proc sort data = lnpfa4GL; by sim; run;
data expectations (keep = sim year expectedNA expectedGL);
/** variable names correspond to years of interest during this analysis, i.e. update North America and
forecast Greenland */
  merge pfaratio lnpfa4NA lnpfa4GL;
  by sim;
  expectedNA = pfaratio*lnpfa4NA;
  expectedGL = pfaratio*lnpfa4GL;
run;

/*   Model fitting, seven nested models considered    */
/** file to analyze the models for different break years ***/
data analyze; set fishdata yearofinterest;
  run;
proc sort data = analyze; by sim break;  run;

/*model 0, just intercept  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class dumb;
  model lnpfa = dumb /  intercept solution;
```

```
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
run;
data model0 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 2;
          model = 0;
          output;
  end;
run;
data pred0 (keep = sim break model year phase predpfa prederror meanerror); set pred;
  model = 0;
  if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/*model 1, fixed intercept, just slope  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  model lnpfa = lnspawn /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model1 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 3;
      model = 1;
      output;
  end;
  run;
data pred1 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 1;
  if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/*  model 2 - no slope, just intercept, two phases  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model2 (keep = sim break model  parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 3;
      model = 2;
      output;
  end;
  run;
data pred2 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 2;
  if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/* model 3  different intercept, common slope  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase lnspawn /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model3 (keep = sim break model  parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 4;
      model = 3;
```

```
      output;
  end;
  run;
data pred3 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 3;
if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/*   model 4 - common intercept, different slope  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase*lnspawn /  intercept solution;
  output out = pred  p = predpfa  stdi = prederror  stdp = meanerror;
  run;
data model4 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 4;
      model = 4;
      output;
  end;
  run;
data pred4 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 4;
if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/*  model 5 - different slope, different intercept, full model  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase lnspawn phase*lnspawn / intercept solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model5 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 5;
      model = 5;
      output;
  end;
  run;
data pred5 (keep = sim break model year phase predpfa prederror meanerror);
  set pred;
  model = 5;
if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/*  model 6 - different slope, intercept through the origin  */
proc glm data = analyze noprint outstat = results;
  by sim break;
  class phase;
  model lnpfa = phase*lnspawn / noint solution;
  output out = pred  p = predpfa  stdi = prederror stdp = meanerror;
  run;
data model6 (keep = sim break model parameters SS DF); set results;
  if _SOURCE_ = "ERROR" then do;
      parameters = 3;
      model = 6;
      output;
  end;
  run;
data pred6 (keep = sim break model year phase predpfa prederror meanerror);
```

```
  set pred;
  model = 6;
if 2006 le year le 2009;
* adjust to years for which PFA is still unknown, do for each model;
  run;

/* calculates negative log likelihood and Akaike information criterion
   for each simulation and model and break year */

data models; set model0 model1 model2 model3 model4 model5 model6;
   N = 28;
* number of observations in the model fitting, N = 28 once PFA 2005 is known and Labrador is included
in LS, adjust for each new year;
   MSE = SS / DF;
   LH = (N/2 *log(2*(3.141593)) + (N/2 * log(MSE)) + (1/(2*MSE))*SS);
   AICc = 2*LH + 2*parameters *(N / (N-parameters-1));
  run;

/* summarizes parsimonious model based on break year,
 and uncertainty in data */
proc sort data = models; by sim;
  run;

proc means data = models noprint min;
/* finds the minimum Akaike value among break year and models for each sim */
  by sim;
  var AICc;
  output out = minac min = minaicc;
  run;

data modelkeep (keep = sim break model aicdiff);
   merge models minac;
 * calculates AIC differences as per Burnham and Anderson 1998 for each sim;
  by sim;
  aicdiff = aicc - minaicc;
  run;

/* output predicted PFA for years of interest in phase 1 and phase 2 for each model and break year */
/* year of interest for forecast for 2007 WGNAS meeting, interested in updated 2006 forecast for NA
and 2007 to 2009 PFA forecasts for West Greenland*/
data predyear;
  set pred0 pred1 pred2 pred3 pred4 pred5 pred6;
  run;
proc sort data = modelkeep; by sim break model;
proc sort data = predyear; by sim break model;
data predictNA predictGL predictNAhigh predictNAlow predictGLhigh predictGLlow predictGLmulti;
  merge modelkeep predyear;
  by sim break model;
  if aicdiff = 0;
  if year = 2006 and phase = 1 then output predictNAhigh;
  if year = 2006 and phase = 2 then output predictNAlow;
  if year = 2007 and phase = 1 then output predictGLhigh;
  if year = 2007 and phase = 2 then output predictGLlow;
  if year = 2006 then output predictNA;
  if year = 2007 then output predictGL;
  if 2008 le year le 2009 then output predictGLmulti;
/* must update the years in bold */
  run;

/* calculates the relative probability of the year of interest
   being in either phase 1 or phase 2. Calculate the density based
   on the normal distribution of observing for example, in 2003
   the value of PFA in 2001 times pfaratio within the 2003 predicted
   value distribution. Then sums the exact densities for 2003 in phase 1,
   2003 in phase 2 and calculates relative probabilities of phase 1
   and phase 2. */
```

```
proc sort data = predictNAhigh; by sim; run;
proc sort data = predictNAlow; by sim; run;

proc sort data = predictGLhigh; by sim; run;
proc sort data = predictGLlow; by sim; run;
proc sort data = expectations; by sim; run;


/**** REVISED PREDICTIONS FOR UPCOMING 2SW YEAR IN NORTH AMERICA ****/
data densityNAlow;  merge predictNAlow expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedNA-predpfa)/meanerror)**2));
** from Neter, Kutner Nachtsheim and Wasserman 1996, Applied Linear Regression Models, p. 34-35;
  run;
data densityNAhigh;  merge predictNAhigh expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedNA-predpfa)/meanerror)**2));
** from Neter, Kutner Nachtsheim and Wasserman 1996, Applied Linear Regression Models, p. 34-35;
  run;

proc means data = densityNAlow noprint nway sum;
  class sim;  * sum of densities by sim in low phase;
  var density;
  output out = sumNAlow sum = densNAlow;
  run;
proc means data = densityNAhigh noprint nway sum;
  class sim;  * sum of densities by sim in high phase;
  var density;
  output out = sumNAhigh sum = densNAhigh;
  run;
data phaseweightNA; merge sumNAlow sumNAhigh;
  by sim;
  densityNA = densNAlow + densNAhigh;
  weightlow = densNAlow/densityNA;
  if ranuni(0) le weightlow then phasekeep = 2; *** low phase;
  else phasekeep = 1; *** high phase;
  run;

data predictionsNA (keep = sim model break phase predpfa prederror pfa);
  merge phaseweightNA predictNA;
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
proc tabulate data = predictionsNA noseps formchar(1)=" " format = 6.;
    class model break phase;
    table break all, model*phase / rts = 15;
    table break all, model phase / rts = 15;
    run;

/****** PREDICTIONS FOR West Greenland PFA  ************/
data densityGLlow;  merge predictGLlow expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedGL-predpfa)/meanerror)**2));
  run;
data densityGLhigh;  merge predictGLhigh expectations;
  by sim;
  density = (1 / (sqrt(2*3.14159)*prederror))* exp(-0.5 * (((expectedGL-predpfa)/meanerror)**2));
  run;

proc means data = densityGLlow noprint nway sum;
  class sim;  * sum of densities by sim in low phase;
  var density;
  output out = sumGLlow sum = densGLlow;
  run;
proc means data = densityGLhigh noprint nway sum;
  class sim;  * sum of densities by sim in high phase;
```

```
  var density;
  output out = sumGLhigh sum = densGLhigh;
  run;
data phaseweightGL ; merge sumGLlow sumGLhigh;
  by sim;
  densityGL = densGLlow + densGLhigh;
  weightlow = densGLlow/densityGL;
  if ranuni(0) le weightlow then phasekeep = 2; *** low phase;
  else phasekeep = 1; *** high phase;
  run;


data predictionsGL (keep = sim model break phase predpfa prederror pfa);
  merge phaseweightGL predictGL;
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
proc tabulate data = predictionsGL noseps formchar(1)=" " format = 6.;
    class model break phase;
    table break all, model*phase / rts = 15;
    table break all, model phase / rts = 15;
    run;

data predictionsGLmulti (keep = sim year model break phase predpfa prederror pfa);
  merge phaseweightGL predictGLmulti;
  by sim;
  if phase = phasekeep;
  pfa = exp(predpfa + prederror*(rannor(0)));
  run;
proc tabulate data = predictionsGLmulti noseps formchar(1)=" " format = 6.;
    class model break phase year;
    table year, break all, model*phase / rts = 15;
    table year, break all, model phase / rts = 15;
    run;

data _nul_; set predictionsNA;
  file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/predictedNA-1.dat";
/* ASCII file containing the predicted values, models kept for each simulation for the updated NA year
of interest ***/
  put sim 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
data _nul_; set predictionsGL;
  file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/predictedGL-1.dat";
/* ASCII file containing the predicted values, models kept for each simulation for the Greenland year of
interest */
  put sim 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
data _nul_; set predictionsGLmulti;
  file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/predictedGLmulti-1.dat";
/* ASCII file containing the predicted values, models kept for each simulation for the Greenland years of
interest */
  put sim 8. year 8. break 8. model 6. phase 6. pfa 12. predpfa 12.6 prederror 12.6;
  run;
```

B – code for the risk analysis of catch options at West Greenland relative to NAC and southern NEAC PFA and CLs

```
OPTIONS NOCENTRE;

/* RISK-ANALYSIS-NAC-NEAC-2007.SAS
   this is the risk analysis portion of the Greenland advice PFA forecast, returns variability, etc. are
generated using previous program  called PFA-model-prediciton-2004.sas
   written by Gerald Chaput, DFO Gulf Region    */

data harvestperton (keep = sim NA1SW NEAC1SW NA1SWRet NEAC1SWRet Total1SW);
/*** this generates number of fish of NA and NEAC origin per ton of catch at West Greenland */
```

```
  maxsim = 10000;
/*** maximum number of simulations, should match number of simulations from PFA estimation run
**/

do sim = 1 to maxsim;
   seed = 0;
/* calculating harvest of NA and European fish per ton of fishery input parameters for biological
characteristics variations for 2007 using recent five year range of values
        PropNA:  0.68 to 0.76
        PropE:  1 - propNA
        Wt1SWNA:  2.84 to 3.19 kg
        Wt1SWE:  2.92 to 3.33 kg
        ACF:    1.0245 to 1.0985
        HarvestNA: harvest of NA 1SW salmon based on bio characteristics.
        Harvest per ton = (1000 / ACF / (propNA*Wt1SWNA + propE*Wt1SWE))*propNA
        HarvestNEAC: harvest of NEAC 1SW salmon based on bio characteristics.
        Harvest (per ton) = (1000 / ACF / (propNA*Wt1SWNA + propE*Wt1SWE))*propE  */
   propNA = 0.68 + ((0.76 - 0.68)*ranuni(seed));   /* change min and max as required-*/
   propE =  1 - propNA;
   Wt1SWNA = 2.84 + ((3.19 - 2.84)*ranuni(seed));  * -change min and max as required ;
   Wt1SWE = 2.92 + ((3.33 - 2.92)*ranuni(seed));  *** <<-change min and max as required;
   ACF = 1.0245 + ((1.0985 - 1.0245)*ranuni(seed));  *** <<-change min and max as required;
   NA1SW = (1000 / ACF / (propNA * Wt1SWNA + propE * Wt1SWE))* propNA;
   NEAC1SW =  (1000 / ACF / (propNA * Wt1SWNA + propE * Wt1SWE))* propE;
   NA1SWRet = NA1SW*exp(-0.03*11);
   NEAC1SWRet = NEAC1SW*exp(-0.03*11);
   Total1SW = NA1SW+NEAC1SW;
  output harvestperton;  /*** number of fish by continent per ton of catch----*/
  end;
run;
proc univariate data = harvestperton;
  var NA1SWRet NEAC1SWRet Total1SW;
  run;

filename a1 "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/meanretsouth.prn";
/*generated previously, mean returns to southern areas for period 1992 to 1996*/
data southobj (keep = sim R2SFthen USAR2then); infile a1 missover;
  input sim R2SF USAR2;
  R2SFthen = R2SF;
  USAR2then = USAR2;
  * mean returns to southern areas for 1992 to 1996;
  run;

filename a2 "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/meanretall.prn";
/*** mean returns to each region for most recent five years, 2002 to 2006  ****/
data returnna;
  infile a2 missover;
  input sim USAR2 R2SF R2GF R2QC R2NF R2LB R2NA;
  propUSA = USAR2/R2NA;
  propSF = R2SF/R2NA;
  propGF = R2GF/R2NA;
  propQC = R2QC/R2NA;
  propNF = R2NF/R2NA;
  propLB = R2LB/R2NA;
  run;

filename a4 "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/predicted-2007.prn";
data pfayearnac (keep = sim pfanac); infile a4 missover;
  input sim break model phase pfanac predpfa prederror;
  /* predicted PFA over all models and break years*/
run;
filename a5 "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/NEAC-
southernMSWPFA-2007to2009.prn";
data pfayearneac (keep = sim pfaneac2007); infile a5 missover;
  input sim pfaneac2007 pfaneac2008 pfaneac2009;
/* 10000 values of PFA NEAC were derived using CrystallBall and lognormal distibution parametrized
   by 95% CI of: for 2007 -  300621 to 689913
```

```
                2008 -  285640 to 659602
                2009 -  271389 to 630733   */
  run;

/**** doing the Greenland risk analysis ********/
data risk; merge southobj harvestperton returnna pfayearnac pfayearneac;
   by sim;
    ShFr = 0.4;
            /*sharing fraction 40:60 Greenland:NA, used to bump up Greenland quota to
            pre-agreed or historical sharing arrangement for NA
            the same sharing arrangement was assumed for NEAC fish at West Greenland   **/
    do t = 0 to 100 by 5;
      na1swt = na1sw * t;
              neac1swt = neac1sw*t;
              returnna = (pfanac - (na1swt/ShFr))*exp(-0.03*11);
              returnneac = (pfaneac2007*exp(-0.03*7) - (neac1swt/ShFr))*exp(-0.03*8);
              /** NEAC PFA is for Jan. 1 of first year at sea therfore fish are discounted for 7 months (Jan
1 to Aug 1) to get to the Greenland fishery and after harvests are taken, fish are discounted for 8 months
on their return to homewaters  (Aug. 1 to April 1 of next year)  */
      consLB = ((returnna*propLB)>=34746);
              consNF = ((returnna*propNF)>=4022);
              consQC = ((returnna*propQC)>=29446);
              consGF = ((returnna*propGF)>=30430);
              consNorth = consLB*consNF*consQC*consGF;
              consneac = (returnneac>=269327);  /* NEAC CL for MSW southern Europe - 2005 report**/
       /*  SER = 455413   */
      objLBless0 = ((returnna*propLB) lt R2LB);
              objNFless0 = ((returnna*propNF) lt R2NF);
      objQCless0 = ((returnna*propQC) lt R2QC);
      objGFless0 = ((returnna*propGF) lt R2GF);
      objSFless0 = ((returnna*propSF) lt R2SF);
              objUSless0 = ((returnna*propUSA) lt USAR2);
      objNAless0 = objLBless0*objNFless0*objQCless0*objGFless0*objSFless0*objUSless0;

              objSouthless0 = objSFless0*objUSless0;

     objSF10then = ((returnna*propSF) ge (R2SFthen*1.1));
             objUS10then = ((returnna*propUSA) ge (USAR2then*1.1));
              objSF25then = ((returnna*propSF) ge (R2SFthen*1.25));
              objUS25then = ((returnna*propUSA) ge (USAR2then*1.25));
             objSouth10then = objSF10then*objUS10then;
              objSouth25then = objSF25then*objUS25then;

              output risk;
              end;
              run;

proc means data = risk noprint sum nway;
                class t;
                        var consLB consNF consQC consGF consNorth
          objSF10then  objUS10then objSouth10then
          objSF25then objUS25then objSouth25then
          objSFless0 objUSless0 objsouthless0 consneac objNAless0 ;
                        output out = byton
            sum = consLB consNF consQC consGF consNorth
          objSF10then  objUS10then objSouth10then
          objSF25then objUS25then objSouth25then
          objSFless0 objUSless0 objsouthless0 consneac objNAless0;
                        run;

data probtable; set byton;
 file "w:/acfm/wgnas/2007/Personal/Gerald Chaput/catch advice for WG/risk-analysis-results-2007.dat";
         put t 6. consLB 10. consNF 10. consQC  10. consGF  10. consNorth 10.
          objSF10then  10.  objUS10then  10. objSouth10then 10.
          objSF25then  10. objUS25then  10. objSouth25then 10.
          objSFless0 10.  objUSless0 10.  objsouthless0 10. consneac 10.
          objNAless0 10.;
```

```
                    run;
proc print data = probtable;
var t consLB consNF consQC consGF consNorth
    objSF10then  objUS10then objSouth10then
    objSF25then objUS25then objSouth25then
    objSFless0 objUSless0 objsouthless0 consneac
    objNAless0;
          run;
```

Annex 7: Glossary of acronyms used by the Working Group on North Atlantic Salmon, 2007

1SW *(One-Sea-Winter)* Maiden adult salmon that has spent one winter at sea.

2SW *(Two-Sea-Winter)* Maiden adult salmon that has spent two winters at sea.

ASAP *(The Atlantic Salmon Arc Project)* The initial aim of ASAP is to collect samples from the majority of salmon rivers on the Western Atlantic coast of Europe and use methods of Genetic Stock Identification (GSI).

BHSRA *(Bayesian Hierarchical Stock and Recruitment Approach)* Models for the analysis of a group of related stock–recruit data sets. Hierarchical modeling is a statistical technique that allows the modeling of the dependence among parameters that are related or connected through the use of a hierarchical model structure. Hierarchical models can be used to combine data from several independent sources.

CL, i.e. S_{lim} *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that undesirable levels are avoided.

CPUE *(Catch Per Unit Effort)* A derived quantity obtained from the independent values of catch and effort.

CWT *(Coded Wire Tag)* The CWT is a length of magnetized stainless steel wire 0.25 mm in diameter. The tag is marked with rows of numbers denoting specific batch or individual codes. Tags are cut from rolls of wire by an injector that hypodermically implants them into suitable tissue. The standard length of a tag is 1.1 mm.

DST *(Data Storage Tag)* A miniature data logger with sensors including salinity, temperature, and depth that is attached to fish and other marine animals.

FV *(Fishing Vessel)* A vessel that undertakes cruise for commercial fishing purposes.

GIS *(Geographic Information Systems)* A computer technology that uses a geographic information system as an analytic framework for managing and integrating data.

GSI *(Genetic Stock Identification)* Methods used to 'genetically type' salmon from particular regions and rivers across Atlantic.

ISAV *(Infectious Salmon Anemia Virus)* ISA is a highly infectious disease of Atlantic salmon caused by an enveloped virus.

MSY *(Maximum Sustainable Yield)* The largest average annual catch that may be taken from a stock continuously without affecting the catch of future years; a constant long-term MSY is not a reality in most fisheries, where stock sizes vary with the strength of year classes moving through the fishery.

MSW *(Multi-Sea-Winter)* An adult salmon which has spent two or more winters at sea or a repeat spawner.

PFA *(Pre-Fishery Abundance)* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time.

PGA *(The Probabilistic-based Genetic Assignment model)* An approach to partition the harvest of mixed stock fisheries into their finer origin parts. PGA uses Monte Carlo sampling to partition the reported and unreported catch estimates to continent, country and within country levels.

PIT *(Passive Integrated Transponder)* PIT tags use radio frequency identification technology. PIT tags lack an internal power source. They are energized on encountering an electromagnetic field emitted from a transceiver. The tag's unique identity code is programmed into the microchip's nonvolatile memory.

Q Areas for which the Ministère des Ressources naturelles et de la Faune manages the salmon fisheries in Québec.

RT-PCR *(Reverse Transcription-Polymerase Chain Reaction)* is the most sensitive technique for mRNA detection and quantitation currently available. Compared to the two other commonly used techniques for quantifying mRNA levels, Northern blot analysis and RNase protection assay, RT-PCR can be used to quantify mRNA levels from much smaller samples.

RV *(Research Vessel)* A vessel that undertakes cruises to conduct scientific research.

SAC *(Special Areas of Conservation)* To comply with the EU Habitats Directive (92/43/EEC) on Conservation of Natural Habitat and of Wild Fauna and Flora, which stipulates that member states maintain or restore habitats and species to favourable conservation status, a number of rivers in the NEAC area that support important populations of vulnerable qualifying species have been designated SACs. Where salmon is a "qualifying species", additional protection measures specifically for salmon are required.

SER *(Spawning Escapement Reserve)* The CL increased to take account of natural mortality between the recruitment date (1st January) and return to home waters.

SFA *(Salmon Fishing Areas)* Areas for which the Department of Fisheries and Oceans (DFO) Canada manages the salmon fisheries.

SGBYSAL *(Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries).* The ICES Study Group that was established in 2005 to study Atlantic salmon distribution at sea and fisheries for other species with a potential to intercept salmon.

SGEFISSA *(Study Group on Establishing a Framework of Indicators of Salmon Stock Abundance)* A Study Group established by ICES and met in November 2006.

S_{lim}, i.e. CL *(Conservation Limit)* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that the undesirable levels are avoided.

TAC *(Total Allowable Catch)* The quantity of fish that can be taken from each stock each year.

VHSV *(Viral Haemorrhagic Septicaemia Virus)* VHS is a highly infectious virus disease caused by the virus family *Rhabdoviridae*, genus *Novirhabdovirus*.

VIE *(Visual Implant Elastomer)* The VIE tags consist of fluorescent elastomer material which is subcutaneously injected as a liquid into transparent or translucent tissue via a hand-held injector.

WFD *(Water Framework Directive)* Directive 2000/60/EC (WFD) aims to protect and enhance the water environment, updates all existing relevant European legislation, and promotes a new approach to water management through river-based planning. The Directive requires the development of River Basin Management Plans (RBMP) and Programmes of Measures (PoM) with the aim of achieving Good Ecological Status or, for artificial or more modified waters, Good Ecological Potential.

WKDUHSTI *(Workshop on the Development and Use of Historical Salmon Tagging Information from Oceanic Areas)* The Workshop established by ICES was held in February 2007.

This glossary has been extracted from various sources, but chiefly the EU SALMODEL report (Crozier et al.., 2003).

Annex 8: Technical minutes from the ACFM Review Group on Salmon

ICES 30 April – 3 May 2007.

Participants:

Tim Sheehan, Martin Pastoors, Denis Rivard, Atso Romakkaniemi, Vidar Vennevik, Paivi Haapasaari, Henrik Sparholt, Catherine Michielsen.

General

Section 3.7.1 "…Changes were also made to non-reporting rates to better reflect current knowledge…" There should be more details explaining this. Iceland should have presented a working paper documenting these changes so that the WG could evaluate these changes and could explain them to ACFM.

In the Table 3.9.1 the year that the specific measures are introduced and the years that they will be evaluated should also be included as separate columns.

It would be beneficial to try and develop a Bayesian based approach to model pre-fishery abundance to utilize all the available information similar to the Baltic approach. As an example the smolt abundance and marine survival estimates are not used in the present models. This is regarded as a weakness in the modelling. If these efforts are undertaken, it would be informative to run the current model and the Bayesian based model concurrently for a number of years.

Close communication with the Baltic Salmon WG might be useful. Maybe the wgs could meet back to back.

Fisheries data

In the NAC area, the un-reported catch was estimated at 56 t with 136 t of reported catch. The unreported catch is a significant amount and is underestimated and expected to be updated in 2008. ICES expressed concerned over such a high rate of unreported catch relative to the reported catch. In addition, the 2006 NAC unreported catch was reported as 101 t in the 2006 report, but has been changed to 85 t in the 2007 report. ICES noted this difference and the lack of explanation for the change in reported catch. It would be nice to have a better description of the nature of the misreporting and how they have been estimated. A full description of estimating unreported catches for all stock complexes could be detailed in the Quality handbook.

Management

In 2006 for the first time NASCO agreed 3 yr regulatory measures with 2nd and 3rd year dependent on the acceptance of a finalised FWI.

ICES notes that there no explicit management objectives for managing the NEAC stock complexes (i.e. Faroese fishery).

The FWI could be incorporated into a HCR (Harvest Control Rule) and evaluated as an integrated analysis. In this way the approach for salmon would be more in line with what is done for other fish species stocks.

There were some questions raised about whether the PA was served when aggregating information for indicators and indicator-rivers. However, it was noted that the FWI aggregates indicators within the West Greenland FWI according to the explicit management objectives for that fishery.

The wg has developed a spread sheet with the indicators that can be used by NASCO if they continue on the route of the multi-annual management agreement, with an indicator framework.

Sea survival is the main issue with both the Atlantic and the Baltic salmon stocks.

There will be a need for resolving precisely how the FWI will be arranged between NASCO and ICES.

NEAC

Same models used as in past many years.

The model was considered to some extent. It was found that the relationship between lagged spawners and PFA in fact is a kind of S-R model as lagged spawner is a kind of index of S and PFA is a kind of an index of recruitment. It might thus seem strange that the model fit is giving a concave curvilinear relationship as opposed for instance to a B&H one which is convex.

The conservation limit definitions were discussed. The hockey stick model is used on a national basis and when river specific data are available this is the basis for the conservation limit. The WG seems to make good progress on developing river specific conservation levels.

Forecast models do not exist for three of the four NEAC stock complexes. This hinders the WG ability to provide quantitative management advice for the Faroese fishery.

In order to give forecast for Faroe for 3 years ahead it is needed to give advice to and including 2010. To do this the 5 year mean of the contribution of 1 year smolts to the lagged egg variable was assumed. The contribution of 1 year smolts to the total lagged eggs is a very small proportion. The reason for the forecast needing to extend to 2010 is that the 2007 fishing (from October 2006 to march 2007) has already been decided upon.

The smolt age distribution is evaluated every 5 year in NA area and on a more national and ad hoc basis on the European side.

SGBYSAL was dissolved until data are more readily available.

NAC stock complex

Current marine survival estimates should be compared to a standard measure (i.e. five year mean) rather than the previous year's estimate.

Same models used as in past many years.

Greenland

Same models used as in past many years.

Research needs

NASCO seems to be evolving from negotiating quotas to more conservation/restoration mode and thus more towards facilitating science and communication among stakeholders, researcher and managers.

Further consideration should be given to the issue of marine survival. The SALSEA project and the numerous tagging and tracking efforts reported on are attempting to do this.

It was suggested that the European samples collected from West Greenland be further analysed to inform about which rivers in Europe is contributing to the West Greenland harvest and in what proportions. These further analyses are possible due to recent efforts which have bolstered the southern European Atlantic salmon genetic baseline.

The assessments were accepted as basis for the advice.