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

29 March–7 April 2017

Copenhagen, Denmark

ICES CIEM
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Conseil International pour l'Exploration de la Mer

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Executive Summary

Working Group on North Atlantic Salmon [WGNAS], ICES HQ, 29 March–7 April 2016.

Chair: Gérald Chaput (Canada).

Number of meeting participants: 26 in person participants representing twelve countries from North America (NAC) and the Northeast Atlantic (NEAC): Canada, USA, Iceland, Norway, Finland, Ireland, UK(England & Wales), UK (Scotland), UK(Northern Ireland), Russia, France, and the ICES Secretariat (Denmark). Information was also provided by correspondence or by WebEx link from Greenland, Faroes, Denmark, France, and Spain for use by the Working Group.

WGNAS met to consider questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO) and also generic questions for regional and species Working Groups posed by ICES.

The terms of reference were addressed by reviewing working documents prepared prior to the meeting as well as development of analyses, documents and text during the meeting.

The report is presented in five sections, structured to the terms of reference. Sections include:

1) Introduction;
2) Catches, farming and significant developments, threats and opportunities;
3) The status of stocks in the Northeast Atlantic Commission area;
4) The status of stocks in the North American commission area; and
5) The status of stocks in the Atlantic salmon in the Greenland commission area.

The need to develop catch advice in 2017 was dependent on the outcome of applying two indicator frameworks prior to the meeting.

- The Framework of Indicators (FWI) for West Greenland was updated during the Working Group in 2015, with the advice that there were no mixed-stock fishery options for 2015 to 2017 in either NAC or WGC that would be consistent with a 75% chance or greater of simultaneously meeting the seven (for West Greenland) and six (for NAC) management objectives for 2SW salmon. The West Greenland FWI was applied in January 2017. It did not indicate the need to update catch options, hence no new management advice for this fishery was requested by NASCO for 2017.
- The Faroes FWI for multi-annual catch options for NEAC stocks was also updated in 2016 along with management advice for 2016 and 2017. The conclusion in 2016 was that there were no fishery options that ensure a greater than 95% probability of each stock complex achieving its SER in both 2016 and 2017. The NEAC FWI was applied in January 2017. It did not indicate the need to update catch options, hence no new management advice for this fishery was requested by NASCO for 2017.

In summary of the findings of the Working group on North Atlantic Salmon:

- In the North Atlantic, exploitation rates on Atlantic salmon continue to be among the lowest in the time-series.
- Nominal catch in 2016 was 1209 t. This is down on the previous year (1282 t in 2015) and 10% and 19% on the previous five year and ten year mean values, respectively.
- The provisional estimate of farmed Atlantic salmon production in the North Atlantic area for 2016 is 1512 kt; production of farmed Atlantic salmon in this area has been over one million tonnes since 2009 and in 2016 provisional worldwide production of 2262 kt is 1800 times the catch of wild Atlantic salmon.
- The Working Group reported on a range of new findings regarding salmon assessment and management, including tracking programs of Atlantic salmon in the Northwest Atlantic, monitoring of bycatch in mackerel fisheries in Iceland providing additional information on salmon at-sea, recovery programmes in the River Rhine, and progress in life cycle modelling to further opportunities for understanding salmon dynamics.
- A number of threats were discussed including disease events in wild salmon in Sweden and Russia, introgression of farmed salmon in wild salmon populations that affect phenotype, and sea lice monitoring in Norway.
- In response to specific questions from NASCO, information is provided on prey and key prey species of Atlantic salmon during the marine phase, and on the status of key prey species of salmon. Atlantic salmon are opportunistic feeders and changes in diet reflect changes in distribution at sea and changes in prey size availability as salmon grow. Prey consumed by Atlantic salmon include fish species that are commercially exploited in the North Atlantic (herring, capelin, blue whiting, mackerel) as well as numerous fish and invertebrate forage species that are not fished.
- A workshop was convened by ICES to respond to the question from NASCO on the impacts of climate change on Atlantic salmon stock dynamics. The workshop report is presented separately.
- Specific for the NEAC area, exploitation rates on NEAC stocks continue to decline and catches in 2016 were 1043 t, among the lowest in the time-series. Northern NEAC stock complexes, prior to the commencement of distant-water fisheries in were considered to be at full reproductive capacity. The southern NEAC maturing 1SW stock complex however, was considered to be at risk of suffering reduced reproductive capacity and the non-maturing 1SW stock complex to be suffering reduced reproductive capacity.
- Information describing the blue whiting fishery characteristics in the Northeast Atlantic and information on observations of Atlantic salmon bycatch in these fisheries are presented. None of the information available to the Working Group suggested that salmon are taken frequently as bycatch in the blue whiting fishery as much of the blue whiting catch is taken at a time prior to salmon smolts emigrating into the marine environment. Further, blue whiting are mainly captured at some depth, while salmon are generally thought to be distributed in surface waters. It is nonetheless recognised that uncertainties remain as detection of small numbers of post-smolts in large catches of blue whiting would be very difficult.

- Specific for the NAC area, the 2016 provisional harvest in Canada was 134.8 t; overall, harvests remain very low relative to pre-1990 values (>1000 t). The majority of harvest fisheries on NAC stocks were directed toward small salmon. In recreational fisheries, large salmon could only be retained in 22 rivers in Quebec.
- In 2016, the midpoints of the estimates of returns to rivers for all regions of NAC except Labrador, are suffering reduced reproductive capacity. The 5th percentile of the estimated returns to Labrador was below CL and for this region the stock is at risk of suffering reduced reproductive capacity.
- The continued low abundance of salmon stocks across North America, despite significant fishery reductions, strengthens the conclusions that factors acting on survival in the first and second years at sea, at both local and broad ocean scales are constraining abundance of Atlantic salmon.
- In Greenland a total catch of 27.1 t was reported for 2016 compared to 56.8 t in 2015. North American origin salmon comprised 66% of the sampled catch.

1 Introduction

1.1 Main tasks

At its 2016 Statutory Meeting, ICES resolved (C. Res. **2016**/2/ACOM10) that the **Working Group on North Atlantic Salmon** [WGNAS] (chaired by Gerald Chaput, Canada) will meet at ICES HQ, 29 March–7 April 2017 to address: (a) relevant points in the Generic ToRs for Regional and Species Working Groups for each salmon stock complex; and (b) questions posed to ICES by the North Atlantic Salmon Conservation Organisation (NASCO).

The terms of reference were met. The questions posed in the Generic ToRs for Regional and Species Working Groups for each salmon stock complex overlap substantially with the questions posed by NASCO. As such, responses to the former were restricted to a limited subset of the questions; brief responses are provided at Annex 5. The sections of the report which provide the answers to the questions posed by NASCO are identified below:

Question		Section
1	With respect to Atlantic salmon in the North Atlantic area:	Section 2
1.1	provide an overview of salmon catches and landings by country, including unreported catches and catch and release, and production of farmed and ranched Atlantic salmon in 2016[1];	2.1 & 2.2
1.2	report on significant new or emerging threats to, or opportunities for, salmon conservation and management[2];	2.3
1.3	provide a review of examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations[3];	2.4
1.4	provide a summary of the available diet data for marine life stages of Atlantic salmon and identify key prey species at different life stages (e.g. herring at post-smolt stages, capelin in West Greenland waters and the Barents Sea)[4];	2.5
1.5	quantify possible future impacts of climate change on salmon stock dynamics	2.6
1.6	provide a compilation of tag releases by country in 2016; and	2.7
1.7	identify relevant data deficiencies, monitoring needs and research requirements.	2.9
2	With respect to Atlantic salmon in the North East Atlantic Commission area:	Section 3
2.1	describe the key events of the 2016 fisheries[5];	3.1
2.2	review and report on the development of age-specific stock conservation limits including updating the time-series of the number of river stocks with established CL's by jurisdiction;	3.2
2.3	describe the status of the stocks including updating the time-series of trends in the number of river stocks meeting CL's by jurisdiction;	3.3
2.4	provide information on the size, distribution and timing of the blue whiting fishery in the Northeast Atlantic area and any official observer information relating to bycatch which may indicate possible impact of this fishery on wild salmon.	3.4
3	With respect to Atlantic salmon in the North American Commission area:	Section 4

QUESTION		SECTION
3.1	describe the key events of the 2016 fisheries (including the fishery at St Pierre and Miquelon)[5];	4.1
3.2	update age-specific stock conservation limits based on new information as available including updating the time-series of the number of river stocks with established CL's by jurisdiction;	4.2
3.3	describe the status of the stocks including updating the time-series of trends in the number of river stocks meeting CL's by jurisdiction;	4.3
4	With respect to Atlantic salmon in the West Greenland Commission area:	Section 5
4.1	describe the key events of the 2016 fisheries[5];	5.1
4.2	describe the status of the stocks[6];	5.2

Notes:

[1.] With regard to question 1.1, for the estimates of unreported catch the information provided should, where possible, indicate the location of the unreported catch in the following categories: in-river; estuarine; and coastal. Numbers of salmon caught and released in recreational fisheries should be provided.

[2.] With regard to question 1.2, ICES is requested to include reports on any significant advances in understanding of the biology of Atlantic salmon that is pertinent to NASCO, including information on any new research into the migration and distribution of salmon at sea and the potential implications of climate change for salmon management.

[3.] With regards to question 1.3, NASCO is particularly interested in case studies highlighting successes and failures of various restoration efforts employed across the North Atlantic by all Parties/jurisdictions and the metrics used for evaluating success or failure.

[4.] In response to question 1.4, ICES is requested to comment on any significant changes in population dynamics (i.e. abundance, distribution, size structure, and energy density) of key prey species which may be associated with changes in salmon abundance, distribution, and marine ecology (e.g. the recently identified decreases in capelin energy density and the consequences on marine productivity of Atlantic salmon while also providing information related to fisheries which catch significant numbers of the identified key prey species (i.e. direct harvest or bycatch).

[5.] In the responses to questions 2.1, 3.1 and 4. 1, ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Information on any other sources of fishing mortality for salmon is also requested. For 4.1 ICES should review the results of the recent phone surveys and advise on the appropriateness for incorporating resulting estimates of unreported catch into the assessment process.

[6.] In response to question 4.2, ICES is requested to provide a brief summary of the status of North American and Northeast Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.3 and 3.3.the status of these stocks should be provided in response to questions 2.3 and 3.3.

In response to the Terms of Reference, the Working Group considered 41 Working Documents submitted by participants (Annex 1); other references cited in the Report are given in Annex 2. Information provided by correspondence by Working Group members unable to attend the meeting is included in the list of working documents. A full address list for the meeting participants is provided in Annex 3. A complete list of acronyms used within this document is provided in Annex 7.

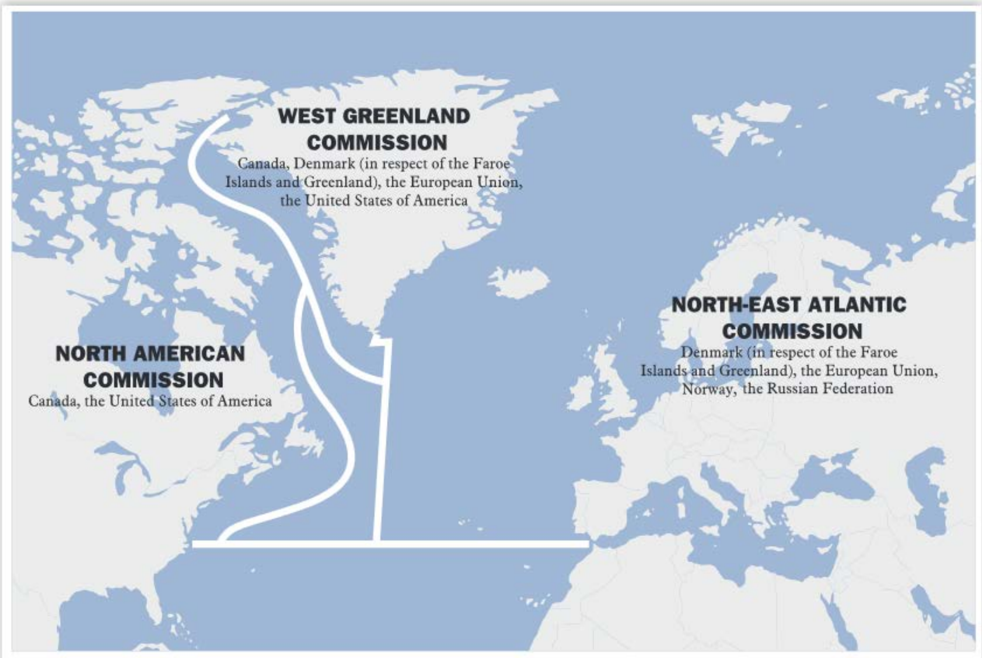
1.2 Participants

Member	Country
Bolstad, G.	Norway
Camara, K.	Germany
Chaput, G.	Canada
de la Hoz, J.	Spain (by correspondence)
Degerman, E.	Sweden
Ensing, D.	UK (Northern Ireland)
Erkinaro, J.	Finland
Fiske, P.	Norway
Gillson, J.,	UK (England & Wales)
Gudbergsson, G.	Iceland
Jacobsen, J.A.	Faroes (by correspondence)
LeBlanc, S.G.	Canada
Levy, A.	Canada
Maxwell, H.	Ireland
Meerburg, D.	Canada
Millane, M.	Ireland
Miller, D.	ICES Secretariat
Nygaard, R.	Greenland (Video link)
Ó Maoiléidigh, N.	Ireland
Olmos, M.	France
Penil, C.	France (by correspondence)
Prusov, S.	Russian Federation
Rasmussen, G.	Denmark (by correspondence)
Rivot, E.	France
Robertson, M.	Canada
Russell, I.	UK (England & Wales)
Sheehan, T.	United States
Smith, G.	UK (Scotland)
Ustiuzhinskii, G.	Russia
Utne, K.R.	Norway
Wennevik, V.	Norway

1.3 Management framework for salmon in the North Atlantic

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

NASCO discharges these responsibilities *via* three Commission areas shown below:



1.4 Management objectives

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

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

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks" and NASCO's 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 as the level of stock (number of spawners) that will achieve long-term average maximum sustainable yield (MSY). In many regions of North America, the CLs are calculated as the number of spawners required to fully seed the wetted area of the river. The definition of conservation in Canada varies by region and in some areas, historically, the values used were equivalent to maximizing / optimizing freshwater production. These are used in Canada as limit reference points and they do not correspond to MSY values. Reference points for Atlantic salmon are currently being reviewed for conformity with the Precautionary Approach policy in Canada. Revised reference points are expected to be developed. 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 MSY, as derived from the adult-to-adult stock–recruitment relationship (Ricker, 1975; ICES, 1993). NASCO has adopted the region specific CLs (NASCO, 1998). These CLs are limit reference points (S_{lim}); having populations fall below these limits should be avoided with high probability.

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

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

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

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

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

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

NASCO has not formally agreed a management plan for the fishery at Faroes. However, the Working Group has developed a risk-based framework for providing catch advice for fish exploited in this fishery (mainly MSW fish from NEAC countries). Catch advice is currently provided at both the stock complex and country level (for NEAC stocks only) and catch options tables provide both individual probabilities and the probability of simultaneous attainment of meeting proposed management objectives for both. ICES has recommended (ICES, 2013) that management decisions should be based principally on a 95% probability of attainment of CLs in each stock complex/ country individually. The simultaneous attainment probability may also be used as a guide, but managers should be aware that this will generally be quite low when large numbers of management units are used.

Full details of the assessment approaches used by the Working Group are provided in the Stock Annex, and this includes a general introduction in Section 1. Readers new to this report would be advised to read the Stock Annex in the first instance. (See Annex 6).

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 1960–2016 are provided in Table 2.1.1.1. Catch statistics in the North Atlantic also include fish-farm escapees and, in some Northeast Atlantic countries, ranched fish (see Section 2.2.2). Catch and release has become increasingly commonplace in some countries, but these fish do not appear in the nominal catches (see Section 2.1.2).

Icelandic catches have traditionally been split into two separate categories, wild and ranched, reflecting the fact that Iceland has been the main North Atlantic country where large-scale ranching has been undertaken with the specific intention of harvesting all returns at the release site and with no prospect of wild spawning success. The release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching for rod fisheries in two Icelandic rivers continued into 2016 (Table 2.1.1.1). Catches in Sweden have also now been split between wild and ranched categories over the entire time-series. The latter fish represent adult salmon which have originated from hatchery-reared smolts and which have been released under programmes to mitigate for hydropower development schemes. These fish are also exploited very heavily in homewaters and have no possibility of spawning naturally in the wild. While ranching does occur in some other countries, this is on a much smaller scale. Some of these operations are experimental and at others harvesting does not occur solely at the release site. The ranched component in these countries has therefore been included in the nominal catch.

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

The provisional total nominal catch for 2016 was 1209 t, 73 t below the updated catch for 2015 (1282 t) and 136 and 286 t below the averages for the last five and ten years, respectively. Catches were below the previous five and ten-year averages in the majority of countries. The most notable decline in nominal catch was reported for UK (Scotland) where catch in 2016 (27 t) dropped by four and fivefold compared with the previous five and ten years means (111 and 138 t), respectively. This reflected both the impact of the conservation regulations in 2016 and the increased take up of catch and release in recent years.

Nominal catches (weight only) in homewater fisheries were split, where available, by sea age or size category (Table 2.1.1.2). The data for 2016 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 in Annex 4. Countries use different methods to partition their catches by sea age class (outlined in the footnotes to Annex 4). The composition of catches in different areas is discussed in more detail in Sections 3, 4, and 5.

ICES recognises that mixed-stock fisheries present particular threats to stock status. These fisheries predominantly operate in coastal areas and NASCO specifically requests that the nominal catches in homewater fisheries be partitioned according to whether the catch is taken in coastal, estuarine or riverine areas. Figure 2.1.1.2 presents these data on a country-by-country basis. It should be noted, however, that the way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries. For example, in some countries these catches are split according to particular gear types and in other countries the split is based on whether fisheries operate inside or outside headlands. While it is generally easier to allocate the freshwater (riverine) component of the catch, it should also be noted that catch and release (C&R) is now in widespread use in many 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 of the distribution of the catch among individual countries. There are no coastal fisheries in Iceland, Spain, Denmark, or Finland. Coastal fisheries ceased in Ireland in 2007 and no fishing has occurred in coastal waters of UK(Northern Ireland) since 2012. In UK(Scotland), coastal catches in 2016 were restricted to a single research fishery. In most countries in recent years the majority of the catch has been taken in rivers and estuaries. However, in Norway and Russia roughly half of the total catch has been taken in coastal waters in recent years and in UK(England & Wales) around 80% of the total catch has been taken in coastal waters in the last two years.

Coastal, estuarine and riverine catch data for the period 2006 to 2016 aggregated by region are presented in Figure 2.1.1.3. In Northern NEAC, catches in coastal fisheries have been in decline over the period and have reduced from 565 t in 2006 to 293 t in 2016. Freshwater catches have been fluctuating between 763 t (2008) and 490 t (2014) over the same period. At the beginning of the time-series about half the catch was taken in coastal waters and half in rivers, whereas since 2008 the coastal catch represents only one third of the total. In Southern NEAC, catches in coastal and estuarine fisheries have declined dramatically over the period. While coastal and estuarine fisheries have historically made up the largest component of the catch, these fisheries have declined from 306 t and 109 t in 2006 to 71 t and 37 t in 2016, respectively, reflecting widespread measures to reduce exploitation in a number of countries. At the beginning of the time-series about half the catch was taken in coastal waters and one third in rivers. From 2007 to 2009 the coastal catch comprised about 20% of the total catch; this has increased to around one third of the catch from 2010 to 2016.

In North America (NAC), the total catch has been fluctuating between 112 and 178 t over the period 2006 to 2016. Two thirds of the total catch in this area has been taken in riverine fisheries; the catch in coastal fisheries has been relatively small in any year with the biggest catch taken in 2013 (13 t).

In Greenland the total catch increased steadily from 22 t in 2006 to 56 t in 2015, but decreased to 26 t in 2016.

2.1.2 Catch and release

The practice of catch and release in rod fisheries has become increasingly common. This has occurred in part as a consequence of salmon management measures aimed at conserving stocks while maintaining opportunities for recreational fisheries, but also reflects increasing voluntary release of fish by anglers. In some areas of Canada and USA, mandatory catch and release of large (MSW) salmon has been in place since

1984, and since the beginning of the 1990s it has also been widely used in many European countries.

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 2016 for countries that have records. Catch and release may also be practised in other countries while not being formally recorded or where figures are only recently available. There are large differences in the percentage of the total rod catch that is released: in 2016 this ranged from 18% in Sweden, to 90% in UK (Scotland) reflecting varying management practices and angler attitudes among these countries. There are no restrictions on the numbers of fish that may be caught on a catch-and-release basis in most countries. For all countries, the percentage of fish released has tended to increase over time. There is also evidence from some countries that larger MSW fish are released in larger proportions than smaller fish. Overall, over 195 000 salmon were reported to have been released around the North Atlantic in 2016, 12% above the average for the last five years (174 000).

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

2.1.3 Unreported catches

Unreported catches by year (1987 to 2016) and Commission Area are presented in Table 1.3.1 and are presented relative to the total nominal catch in Figure 2.1.3.1. A description of the methods used to derive the unreported catches was provided in ICES (2000) and updated for the NEAC Region in ICES (2002). Detailed reports from different countries were also submitted to NASCO in 2007 in support of a special session on this issue. There have been no estimates of unreported catch for Russia since 2008, for Canada in 2007 and 2008, and for France in 2016. There are also no estimates of unreported catch for Spain and St Pierre & Miquelon (France), where total catches are typically small.

In general, the methods used by each country to derive estimates of unreported catch have remained relatively unchanged and thus comparisons over time may be appropriate (see Stock Annex). However, the estimation procedures vary markedly between countries. For example, some countries include only illegally caught fish in the unreported catch, while other countries include estimates of unreported catch by legal gear as well as illegal catches in their estimates. Over recent years efforts have been made to reduce the level of unreported catch in a number of countries (e.g. through improved reporting procedures and the introduction of carcass tagging and logbook schemes).

The total unreported catch in NASCO areas in 2016 was estimated to be 335 t (Table 2.1.3.2). The unreported catch in the Northeast Atlantic Commission Area in 2016 was estimated at 298 t, and that for the West Greenland and North American Commission areas at 10 t and 27 t, respectively. The 2016 unreported catch by country is provided in Table 2.1.3.2. It was not possible to partition the unreported catches into coastal, estuarine and riverine areas.

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

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 2016 is 1512 kt, which is close to the updated production for 2015 (1543 kt) and the previous five-year mean (1510 kt). The production of farmed Atlantic salmon in this area has been over one million tonnes since 2009 (Table 2.1.1 and Figure 2.2.1.1). Norway and UK(Scotland) continue to produce the majority of the farmed salmon in the North Atlantic (78% and 12%, respectively). With the exception of Norway and Faroes, farmed salmon production in 2016 was above the previous five-year average in all countries. Data for UK (N. Ireland) since 2001 and data for east coast USA since 2011 are not reported to the Working Group.

Worldwide production of farmed Atlantic salmon has been over one million tonnes since 2002 and has been over two million tonnes since 2012. It is difficult to source reliable production figures for all countries outside the North Atlantic area and it has been necessary to use 2015 data from the FAO Fisheries and Aquaculture Department database for some countries in deriving a worldwide estimate for 2016. Data for west coast USA is not available to the Working group. The total worldwide production in 2016 is provisionally estimated at around 2262 kt (Table 2.2.1.1; Figure 2.2.1.1), which is at the same level as in 2015 (2292 kt) and slightly higher than the previous five-year mean (2118 kt). Production of farmed Atlantic salmon outside the North Atlantic is estimated to have accounted for one third of the worldwide total in 2016 and is still dominated by Chile (81%). Increasingly, Atlantic salmon are being produced in land-based and closed containment facilities around the world and the figures provided in Table 2.2.1.1 may not include all countries where such production is occurring.

The worldwide production of farmed Atlantic salmon in 2016 was over 1800 times the reported nominal catch of Atlantic salmon in the North Atlantic.

2.2.2 Harvest of ranched Atlantic salmon

Ranching has been defined as the production of salmon through smolt releases with the intent of harvesting the total population that returns to freshwater (harvesting can include fish collected for broodstock) (ICES, 1994). The release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching with the specific intention of harvesting by rod fisheries has been practised in two Icelandic rivers since 1990 and these data are now included in the ranched catch (Table 2.1.1.1). A similar approach has been adopted, over the available time-series, for one river in Sweden (River Lagan). These fish originate from hatchery-reared smolts released under programmes to mitigate for hydropower development schemes with no possibility of spawning naturally in the wild. These have therefore also been designated as ranched fish and are included in Figure 2.2.2.1. In Ireland ranching is currently only carried out in two salmon rivers under limited experimental conditions.

The total harvest of ranched Atlantic salmon in countries bordering the North Atlantic in 2016 was 37 t (Iceland, Ireland and Sweden; Table 2.2.2.1; Figure 2.2.2.1) with the majority of catch taken in Iceland (31 t). The total harvest was just 4% below the average of the last five years (39 t). No estimate of ranched salmon production was made in Norway in 2016 where such catches have been very low in recent years (<1 t) and UK(N. Ireland) where the proportion of ranched fish was not assessed between 2008 and 2016 due to a lack of microtag returns.

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 Tracking and acoustic tagging studies in Canada

There is continued interest in the development of techniques to help investigate salmon mortality at-sea and to better partition mortality between different periods of the marine phase of the life cycle. To this end, NASCO's International Atlantic Salmon Research Board (IASRB) adopted a resolution in 2014 to further support the development of telemetry programmes in the ocean.

The Working Group reviewed the results of ongoing projects led by the Atlantic Salmon Federation (ASF) in collaboration with the Ocean Tracking Network, Miramichi Salmon Association (MSA), Restigouche River Watershed Management Committee, Department of Fisheries and Oceans (DFO) and others, to assess estuarine and marine survival of tagged Atlantic salmon released in rivers of the Gulf of St Lawrence (GoSL), Canada. More than 3000 smolts from four rivers (Cascapedia, Restigouche, southwest and northwest branches of the Miramichi) were tagged with acoustic transmitters and released over a period of fourteen years, 2003 to 2016. In addition other research projects were releasing acoustically tagged smolts in 2016 from the Matatpedia River (a Restigouche River tributary), a river in Prince Edward Island (Canada), and Middle River in Cape Breton, Nova Scotia (Canada). Acoustic arrays to detect tagged fish were positioned at the head of tide of each river, at the exit from the bays to the Gulf of St Lawrence (GoSL) and at the Strait of Belle Isle (SoBI) leading to the Labrador Sea, more than 800 km from the point of release.

A Bayesian state–space model variant of the Cormac-Jolly-Seber model was used to distinguish the imperfect detection of tagged smolts on the sonic arrays from apparent survival during their out migration (ICES, 2015). The model reduced uncertainty in expected values of the annual and river-specific detection probabilities at the head of tide and bay exit arrays. In 2015 and 2016, an additional parallel receiver line at SoBI (about 4 km to the northeast of the original line) was put in place to estimate the detection probabilities at the original SoBI receiver line. These two years of information were used to update all years of estimates of survival at the SoBI receiver line.

The probability of smolt survival through freshwater (Figure 2.3.1.1) was high for Cascapedia and the NW Miramichi and lower and highly variable in SW Miramichi and Restigouche. The survival rate through freshwater was negatively associated with migration duration. The survival rates from release to the outer bays leading to the GoSL varied annually, with noticeably lower survivals in this area during the last four years in both the NW Miramichi and the SW Miramichi. The survival rates through the GoSL to the Labrador Sea were also highly variable, although in some years, there was very low mortality in this area.

The SoBI (between Labrador and Newfoundland) appears to be the primary route for smolts and kelts exiting the GoSL. (Figure 2.3.1.2) The only other possible exit is through the Cabot Strait, and this array has been in place since 2012. Only two smolt tags were detected on the Cabot array (originating in Miramichi in 2012 and Cascapedia in 2013) although adult salmon, tagged as kelt in the preceding year, have been detected at this array. In 2016, kelts from Miramichi and Restigouche rivers crossed the SoBI array during a three week period at end of June and early July, whereas smolts from many different stocks crossed this line together, between July 10–20.

Salmon kelts (400 in total) have been acoustically tagged since 2008 in Miramichi and 2013 in Restigouche rivers. Some of these acoustically tagged kelts (53) have also been fitted with satellite tags (PSATs) since 2012 in Miramichi River and starting in 2016 in Restigouche River. There has been a high mortality of kelts in the GoSL and pop-up tags have provided data on where and how some of the kelts are dying (Strom *et al.*, 2017).

Seven of the PSAT tagged kelts have migrated beyond the Gulf of St Lawrence and into the Labrador Sea via SoBI. Of these seven, four have followed the Labrador coast north towards Baffin Island, whereas three have moved off the continental shelf over deep-water zones and deep dives from 600–800 m have been detected.

In 2013, a collaborative four-year project was started between the ASF, the Miramichi Salmon Association and DFO to quantify the predator–prey interaction among diadromous species in the Miramichi River. The partners have documented the spatial and temporal overlap of the two principal species of interest, Atlantic salmon and striped bass (using acoustic tags), and the contribution of smolts to the diet of striped bass has been examined. Losses of acoustically tagged Miramichi smolts have been estimated in areas where striped bass were known to be spawning. Analysis to date indicated Atlantic salmon smolts to be present in about 2% of Striped Bass stomachs sampled and these smolts contributed about 3% of the prey biomass in the stomachs with stomach contents. Preliminary modelling of acoustic tag tracks from smolts suggest that from 10 to 19% of smolt tracks from Northwest Miramichi and 2 to 20% of smolt tracks from the Southwest Miramichi are consistent with tag tracks of striped bass leading to the conclusion that these tagged smolts had been predated by striped bass. However the results are highly variable over the four years (2013–2016).

The Working Group encourages the continuation and expansion of tracking programmes as information from it is expected to be useful in the assessment of marine mortality on North Atlantic salmon stocks. The Working Group also notes that these techniques have been proposed, and are being implemented in other areas, both in the Northwest and the Northeast Atlantic (e.g. SALSEA Track), in line with the NASCO IASRB resolution.

2.3.2 Review of major threats to Atlantic salmon in Norway

A recent paper has evaluated the major anthropogenic threats to Atlantic salmon in Norway using two dimensional analyses (Forseth *et al.*, 2017). One dimension considered the effect of the threat and the other dimension considered the most likely development of the threat in future (Figure 2.3.2.1). Escaped farmed salmon and salmon lice from fish farms were identified as expanding population threats since they scored high on both axes, with escaped farmed salmon being the largest current threat. The parasite *Gyrodactylus salaris*, acidification, and hydropower development also scored high along the effect axis, but lower on the development axis and were thus categorised as stabilised.

2.3.3 Gene flow from farmed escapes alters the life history of wild Atlantic salmon

Gene flow from domesticated organisms into wild conspecific populations is widespread. In Atlantic salmon, this phenomenon is documented for many wild populations with introgression levels up to 40% (domesticated ancestry) on average among the spawners (Karlsson *et al.*, 2016). Many experimental studies show that farmed salmon and hybrids have altered phenotypes compared to wild salmon (reviewed in

Glover *et al.*, 2017 and ICES, 2016b). This literature provides strong evidence that farmed introgression is likely to be detrimental to population demography. However, the experimental conditions and the limited number of whole-river experiments do not necessarily represent the extent or scale of the impact of domesticated introgression on natural populations.

In a recent study of 62 salmon populations along the entire Norwegian coastline, Bolstad *et al*. (2017) showed that groups of individuals with a high level of introgression had altered size and age at maturation. The study included individuals from populations of both the Eastern Atlantic phylogenetic group and the Barents/White Sea phylogenetic group. The effect of introgression on size and age at maturation differed between sexes and among different types of populations.

In the Eastern Atlantic populations with high mean sea age (number of winters spent at-sea), females with high levels of introgression had a higher probability of maturing after two winters at sea compared to individuals with a low level of introgression. In contrast, males with a higher level of introgression had a higher probability of maturing after one winter at-sea (Figure 2.3.3.1). Thus, there are fewer old and large salmon with increasing levels of introgression in these populations. These effects of introgression were not observed in populations with a lower mean sea age. There was also an effect on age-independent size, which increased with increasing introgression. This effect was largest in the populations with low mean sea age.

In the Barents/White Sea populations, the results were more uncertain due to lower sample size. However, the estimated effects of introgression were in several cases stronger in this phylogenetic group than in the Eastern Atlantic phylogenetic group. In particular, there was a dramatic increase in age-independent weight in the populations with low mean sea age, and the males in these populations with high levels of introgression matured after to sea winters instead of one.

The study of Bolstad *et al*. (2017) together with the extensive experimental literature on the subject provides solid evidence that gene flow from escaped farmed salmon has a strong effect on important biological characteristics of wild Atlantic salmon.

2.3.4 Diseases and parasites

2.3.4.1 Update on Red Vent Syndrome (*Anisakiasis*)

Over recent years, there have been reports from a number of countries in the NEAC and NAC areas of salmon returning to rivers with swollen and/or bleeding vents (ICES, 2016a). The condition, known as red vent syndrome (RVS or *Anisakiasis*), has been noted since 2004, and has been linked to the presence of a nematode worm, *Anisakis simplex* (Beck *et al.*, 2008) which occurs commonly in other marine fish and marine mammals. A number of regions within the NEAC area observed a notable increase in the incidence of salmon with RVS in 2007 (ICES, 2008). Levels in the NEAC area were typically lower from 2008 (ICES, 2009; ICES, 2010; ICES, 2011).

Trapping records for rivers in the UK(England & Wales) and France suggested that levels of RVS increased again in 2013, with the observed levels being the highest in the time-series for some of the monitored stocks (ICES, 2014). Monitoring for the presence of RVS has continued on three rivers in UK(England & Wales) (Tyne, Dee and Lune). In 2016, RVS levels on the Tyne and Dee, 4% and 22% respectively, were below or at the long-term average of the time-series. Similarly, the RVS level on the Lune (19%) was at the average of the observed values, although the sample size was small.

In Ireland in 2016, a lower level of incidence of RVS was reported in fish taken in the Galway weir salmon fishery compared to 2015.

There is no clear indication that RVS affects either the survival of the fish in freshwater or their spawning success. Recent results have also demonstrated that affected vents show signs of progressive healing in freshwater (ICES, 2014).

2.3.4.2 Update on sea lice investigations in Norway

The surveillance programme for salmon lice infections on wild salmon post-smolts and sea trout at specific localities along the Norwegian coast continued in 2016 (Nilsen *et al.*, 2017). In 2016, the field activities in the surveillance programme were based on predictions from the hydrodynamic model in relation to the spread and distribution of salmon louse larvae. In this model, data from weekly counts of sea lice at fish farms are coupled with detailed hydrodynamic modelling to predict the distribution of sea lice larvae, and the infection pressure on wild salmonids (Sandvik *et al.*, 2016). Field sampling was directed to areas where the model predicted high densities of infective salmon louse copepodites in the post-smolt migration period. Activities in the field included trawling for salmon post-smolts in fjords and coastal areas, near-shore traps and nets catching sea trout, and sentinel cages with smolts placed at various locations. The field examinations were conducted in two periods; an early period covering the migration period of salmon post-smolts, and a late period 2–3 weeks later focused on sea trout infection.

In general, the surveillance programme demonstrated varying infection pressure along the coast during the post-smolt migration period in 2016. They describe low levels of sea lice and low infection pressure in southeastern Norway, higher levels in some areas in western Norway with expected negative impacts on wild salmon post-smolts. In mid-Norway, higher levels of sea lice infection were found in coastal areas compared to fjords, and negative impacts were expected on salmon passing though these areas. In the three northernmost counties, the results indicated a limited negative effect of salmon lice on migrating salmon, though in some areas the effect was considered to be moderate.

The number of sea lice observed on salmon in fish farms was generally at the same level as in 2015, but with increased levels in some regions and lower in others (Hjeltnes *et al.*, 2017). There was a significant reduction in the use of chemicals to treat salmon louse infections on farmed salmon in 2016 compared to 2015 (41% reduction). This decrease resulted from fish farmers switching to alternative methods for removal of sea lice, such as various mechanical methods, as resistance to the commonly used chemicals continues to be a serious problem (Hjeltnes *et al.*, 2017).

In 2017, a new management regime for salmonid aquaculture will be implemented in Norway (Anon., 2017a). Under this management regime, the level of aquaculture production in 13 defined production areas along the coast will be regulated and adjusted according to the estimated added mortality inferred on wild salmon populations in each production area resulting from salmon louse infections. In production areas where estimates indicate that mortality from salmon lice is >30%, salmonid aquaculture production may be reduced. Where estimates indicate that added mortality from salmon lice infections is between 10% and 30%, aquaculture production may remain at the same level. If added mortality is estimated to be below 10%, production may be allowed to increase in that area (Anon, 2015a; Anon, 2015b).

2.3.4.3 Disease reports

Sweden

Disease and mortality issues in returning salmon and sea trout have been prevalent in a number of rivers in Sweden that drain to the Baltic Sea. After high levels of mortality in two consecutive years (2014 and 2015), the Swedish National Veterinary Institute (SVA) was asked to carry out a sampling programme in 2016 to investigate the source of the problem. The rivers affected were the Torneälven (northern Baltic), Umeälven (mid Baltic), and the Mörrumsån (southern Baltic) which is approximately 200 km from North Atlantic salmon rivers. The sampling in Torneälven was done in collaboration with Evira (the Finnish food safety authority).

In total, 112 diseased or wounded fish were sampled in 2016. The main symptoms observed in fish from the River Mörrumsån were erythemas and petechial bleeding, with concurrent fungal infections. Lesions similar to those associated with ulcerative dermal necrosis (UDN) were also quite common. Affected fish began appearing in mid-May and showed high mortality, but this increase levelled off subsequently. In the River Torneälven, some fish had mild erythemas and bleeding, but a high percentage of wounds was also seen. However, the salmon sampled in the Torneälven were generally healthy. Bleeding, erythemas and fungal infections, as well as UDN-like symptoms, were the most common symptoms in the River Umeälven, where affected fish were observed drifting downstream.

Of the 112 fish sampled, 42 (38%) had UDN-like wounds, but analyses showed that only 15 met criteria indicative of UDN. However, it has still not been concluded that UDN was the underlying cause of the symptoms observed, as other infections can result in similar wounds and damaged tissue. Routine analyses for viruses and bacteria gave no conclusive results, although bacteria associated with skin lesions were identified in a few individuals. Next generation sequencing indicated the presence of herpes- and irido-viruses, that are harder to cultivate, in the population. These vira can cause skin lesions, but the findings need to be investigated further to ascertain the presence of virus and clarify virulence and prevalence. In summary, no outbreak of UDN was confirmed and numbers of dead salmon seem to have decreased since 2015.

Russia

ICES (2016a) noted that in summer 2015 there was a mass mortality of adult salmon observed in Russia in the Kola River, Murmansk region, which was diagnosed as UDN. Salmon parr in the river did not show any sign of disease. In 2016, mortality of spawning fish caused by the same disease was observed in the Kola River again and in the Tuloma River, the outlet of which is located 10 km from the Kola River mouth. Both rivers drain into the inner part of the Kola Bay.

The source of the pathogen was unknown but the timing of the disease incidence in 2015 coincided with timing of mass mortalities of farmed salmon in late autumn 2014 and spring /summer 2015 and the disposal in summer 2015 of dead farmed fish on the bank of the Kola River, near the urban settlement of Molochny near the Kola River outlet.

In total 219 wild salmon died in the cage used for holding broodstock near the counting fence in the Kola River in 2016. While the total number of salmon that died in the river is unknown, reports from anglers indicated smaller numbers of sick salmon in this river compared to 2015.

The total count of adult salmon in the Lower Tuloma fish ladder in 2016 was 6678 salmon which was above the Conservation Limit (3380). Of these, 400 salmon showed symptoms of disease similar to the Kola fish. There were also some reports of dead salmon found by anglers in the Tuloma tributaries later in the season. However, the total mortality in this river is also unknown. In 2016, the Murmansk Regional Commissions on Regulation for Harvesting Anadromous Fish did not make any decision to close or restrict salmon recreational fisheries in the Kola River and in the tributaries of the Tuloma river system for the 2016 season.

In late July 2016 a few salmon with red bellies (symptoms of disease similar to Kola and Tuloma fish) were caught in the Motovsky Gulf with gillnets during surveys in the coastal areas of the Barents Sea. The Motovsky Gulf is a body of water between the northwest coast of the Kola Peninsula and the south coast of the Rybachy Peninsula, Murmansk region. The Bolshaya Zapadnaya Litsa River, Titovka River and Ura River drain in the Motovsky Gulf. It was noted that salmon farms in the Titovka Bay and in the Ura Bay also suffered from mass mortality of farmed salmon in sea cages in 2015. Some further more sporadic reports were also received for individual diseased salmon caught or found in other Barents Sea rivers of the Kola Peninsula in 2015–2016.

2.3.4.4 New disease and parasite investigations

The Atlantic Salmon Federation (ASF) has started a Wild Atlantic Salmon Health Monitoring Programme. The objective of this programme is to better understand what pathogens are potentially impacting wild salmon in both the freshwater and marine environments. There is also interest in determining the impact of fish culture (both hatcheries and cage rearing) in the prevalence and transmission of diseases to wild salmon. In 2016, working with the Listuguj First Nation, and the Restigouche Watershed Management Committee, samples of heart, gills, pyloric caeca, spleen and kidney were collected between June 23–July, 18 from 40 adult salmon (6 1SW and 34 MSW). In assessments performed to date, only one fish showed evidence of a bacterial infection. Also in 2016, a sampler from the international sampling programme at Greenland collected kidney samples from 48 salmon (57–88 cm) from Paamiut, Greenland; these samples are currently in storage for later analysis.

2.3.5 Reintroduction of Atlantic salmon in the Rhine

Following the extinction of Atlantic salmon in Germany in the 1950s, reintroducing the species was not considered for many years, mainly due to heavy water pollution, and lack of river continuity in many places. In the late 1970s the first salmon reintroduction initiatives started in tributaries of Ems and Elbe followed later by initiatives in all German river areas that flow into the North- and Baltic Seas (e.g. Weser, Rhine, and Oder). Some of these activities were discontinued, because prospects of success remained uncertain, and/or due to insurmountable obstacles. Others resulted in more comprehensive and long-term programs (i.e. “Salmon 2000”).

Despite the overwhelming problems of the international Rhine, once one of the most heavily polluted European rivers and still a heavily modified waterbody, salmon now return regularly and migrate upstream to spawn. From 1990 to 2016, around ten million young salmon were stocked in the Rhine system. Since then, 8816 adult returns were officially enumerated through various methods (control stations, fish counters, and random electro fishing campaigns or random observations and reports, Figure 2.3.5.1). It is possible based on anecdotal evidence that the actual number might be considerably higher. Fisheries on salmon are still prohibited in the entire Rhine catchment. Reintroduction and restoration activities are coordinated and accompanied by the International Commission for the Protection of the Rhine (ICPR) through the programme "Salmon 2020" as part of the programme "Rhine 2020", and carried out and/or supported by the countries Netherlands, Germany, Luxembourg, France, and Switzerland.

As part of the scientific exchange at ICPR expert groups, annual meetings of all partners are held where issues are discussed relating to data collection on stocking, returns, natural reproduction, progresses in habitat restoration and river continuity and future challenges such as climate change. While the stocks of mixed origin were used in the early years for restocking the Rhine, this is now carried out with mainly local stocks from regional hatcheries, mainly produced from Rhine returns, and partially supplemented by imported ova of internationally agreed origin (Upper Rhine: Allier/France; Middle/ Lower Rhine: Ätran/Sweden).

Details of a coordinated genetic monitoring programme, which allows the assignment of all stocked fish will be prepared in 2017, and carried out for the next two years. Due to high natural reproduction, stocking measures have been stopped in some tributaries, to investigate the development of "self-sustaining" salmon populations (e.g. River Agger). A lot of measures have been implemented since the publication of the "ICPR Master Plan for Migratory Fish" which provides guidelines on how to establish self-sustaining, stable populations of migratory fish in the Rhine watershed as far as the Basel area within reasonable cost and time frames. Ecological continuity in main channel and tributaries of the Rhine was further improved over the last years and partial opening of the Haringvliet sluices, an important access from the North Sea to the river system in the Netherlands, in 2018 is on schedule.

In Germany, a complimentary study on downstream migration of Atlantic salmon smolt at three hydropower stations using different technologies to reduce negative impact on migrating fish showed mortalities up to 25% for the whole study area. This area included the reservoir above the hydropower plant and a longer downstream section below the power station which was also monitored to include hydropower passage related delayed mortality. The mortality was assessed against losses in a free-flowing reference river stretch. The reservoir upstream of the power station was identified as an area of high mortality, especially in the River Sieg, with the main reason suggested as potential presence of fish predators in a slow-flowing reservoir compared to a free-flowing river stretch (Økland *et al.*, 2016).

2.3.6 Progress in development of alternative stock assessment models–Embedding Atlantic salmon stock assessment within a life cycle modelling approach

The Working Group previously reviewed developments in modelling and forecasting abundance of Atlantic salmon using life cycle models (ICES, 2015; 2016a). The life cycle model approach improves on the stock assessment approach currently used by ICES to estimate abundance of post-smolts at-sea before any fisheries (Pre-Fishery Abundance; PFA) and to forecast the influence of catch options at-sea on the returns in the different jurisdictions in Europe and North America (Rago *et al.*, 1993; Potter *et al.*, 2004; reviewed by Chaput, 2012). The life cycle model also provides a framework to improve on the understanding of the drivers and mechanisms of changes in Atlantic salmon population dynamics and productivity in the North Atlantic. The life cycle model addresses deficiencies in the models currently used by ICES WGNAS:

1) The PFA models used by ICES rely on a stock–recruitment principle that models future returns as function of egg deposition in which the outputs of run reconstruction procedures are used to define the independent (the egg deposition) and the dependent (the future returns) variables as if they were independent data when they are in fact correlated.

2) The implicit demographic hypotheses made in the PFA models, such as lagged eggs or lagged spawners to PFA, cannot be easily challenged or changed by using more data because of the lack of flexibility.

3) Three different models are run for the three stock complexes: Northern NEAC, Southern NEAC and NAC. Some core demographic hypotheses are not harmonized among the three stock complexes. The models for the NEAC stock complexes consider the dynamics of both 1SW and MSW fish, while the NAC model considers the dynamics of 2SW only, the dominant age group exploited at West Greenland (there are no 1SW maturing salmon exploited at West Greenland). This precludes the collective analysis of the population dynamics among all stock units and hampers the identification of the drivers and mechanisms of the response of Atlantic salmon populations to ecosystem changes. The three models are also run independently which prevents exploration and modelling of covariation in the dynamics of the different stock units which share part of the marine environment and are harvested by the same fisheries at sea (West Greenland fishery for NAC and Southern NEAC complexes, Faroes fishery for Southern NEAC and Northern NEAC complexes with a smaller component of NAC salmon).

Previous versions of the life cycle model were applied to the Southern NEAC stock complex (Massiot-Granier *et al.*, 2014; ICES, 2015). The version of the life cycle model presented at the Working Group, which forms the basis of a graduate thesis research (Maxime Olmos, Agrocampus Ouest, Rennes, France) considers the dynamics of the stock units in Southern NEAC and NAC complexes in a single hierarchical model where all populations follow the same life-history processes but with stock-specific parameters and data inputs (Figure 2.3.6.1). The modelling approach presented brings several improvements to the population dynamics framework:

1) The stock assessment is fully embedded in an age and stage-based life cycle model with life histories that are harmonized among all stock units in NAC (six units) and Southern NEAC (seven units) complexes. The life cycle considers the variability of life histories (river age distributions of outmigrating smolts, sea age of returns, eggs per sea age group). It makes explicit hypotheses about the demographics and the shared locations at-sea at specific times that are easier to discuss, challenge and incorporate than with the PFA modelling approach currently used by ICES WGNAS.

2) The life cycle model simultaneously considers the dynamics of both 1SW and 2SW fish and estimates the temporal variation of the proportion of fish maturing as 1SW for all stock units. This was previously considered by ICES for the Southern NEAC complex but represents an important change for the NAC complex which currently only considers the 1SW non-maturing / 2SW returns and spawners. The addition of the two sea age groups for NAC in the life cycle model allows for a fuller consideration of the variability of sea age composition of salmon in the NAC complex.

3) Setting the dynamics of all stock units in a single hierarchical model provides the rationale for implicitly modelling covariation in the dynamics of the different populations that share migration routes and feeding areas at sea and are harvested in mixed-stock fisheries, particularly at West Greenland for NAC and Southern NEAC salmon. The approach also allows for disentangling the effects of fisheries from those of environmental and ecosystem factors in a hierarchy of spatial scales from a global effect scale shared by all populations to local effect scales for each stock unit independently.
4) This forms the basis for forecasting home-water returns in all stock units based on catch options for high seas fisheries that may harvest several (if not all) stock units.
5) The life cycle model is developed in a Bayesian integrated modelling framework that can assimilate additional data and knowledge.

The life cycle model reviewed by the Working Group was a new version of the model applied to 13 stock units; seven in the Southern NEAC stock complex and six stock units in NAC. The model is applied to time-series data that extend from 1971 to 2014 (plus three forecasting years). Stock units of the Northern NEAC complex were not included yet because of differences in the available time-series which only covers the 1983 to 2014 period. The life cycle model is implemented in JAGS (http://mcmc-jags.sourceforge.net/) and was run under the R platform (*rjags* library).

The model provides estimates of trends in marine productivity (expressed as post-smolt survival rate to January 1 of the first winter at-sea) and the proportion maturing as one-sea-winter for all stock units of Southern NEAC and NAC. These parameter estimates form the basis for forecasting home-water returns based on catch options for the mixed-stock sea fisheries. The outputs from the model also allow for a collective analysis of trends in the population dynamics among the stock units, revealing common temporal trends in both the post-smolt survivals and proportions of fish that mature after one year at-sea.

The results provide a broad picture of Atlantic salmon population dynamics in the North Atlantic, and provide evidence of a decline in the marine survival and an increase in the proportions of fish that mature after one year at-sea, common to all stock units in NAC and Southern NEAC (Figure 2.3.6.2). Post-smolt survivals decreased over the time-series with a marked decline in the early 1990s, while the proportion of early maturing fish increased for almost all stocks from the 1970s to the 1990s and then decreased again for some stock units (Figure 2.3.6.2). For both the post-smolt survivals and the proportions of fish maturing as 1SW, common trends extracted from a Principal Component Analysis account for more than 50% of the variance of the time-series, with only slight differences between the trends extracted from NAC and Southern NEAC stock units separately, emphasizing the synchronous nature of the trends across all populations (Figure 2.3.6.2).

The collective patterns observed across the 13 stock units largely support the hypothesis of a synchronous response of populations to large-scale ecosystem changes in the North Atlantic in the last three decades that simultaneously impact distant populations during their marine migrations and/or at common marine feeding grounds (West Greenland, Labrador, Faroes). Results also suggest some yet unknown relationships between marine survival and age at maturation. Although the causes and mechanisms for those changes remain unknown, results support previous studies that suggest a mechanism involving a decline in salmon prey abundance and/or quality as a response to bottom–up environmentally driven changes (Beaugrand and Reid, 2012; Mills *et al.*, 2013; Friedland *et al.*, 2014; Renkawitz *et al.*, 2015).

The life cycle model provides estimates and forecasts of variables of interest that can be compared to the ICES PFA model outputs. Estimates of stock unit specific PFA are similar for the Southern NEAC stock units (Figure 2.3.6.3). For the NAC complex, there can be important differences in the posterior distribution estimates from the life cycle model compared to the ICES PFA models. This is the result of differences in the inclusion of factors in the life cycle model, including the egg contributions of 1SW maturing salmon, and the covariance structure in both the post-smolt survivals and the proportions maturing. The differences are more important for the Newfoundland stock unit, for example, in which there is an important contribution to total eggs by 1SW maturing fish, but estimates from the two modelling approaches are very close for stock units in NAC that have lower contributions to eggs by 1SW maturing salmon (e.g. Quebec or Scotia-Fundy; Figure 2.3.6.3).

2.3.6.1 Improvements to data inputs

The integrated life cycle modelling framework facilitates incorporation of improvements in data inputs. Given the reported changes in smolt characteristics including proportions at-age over time (Russell *et al.*, 2012), and the variations in the biological characteristics of returns of salmon to rivers (ICES, 2013), there would be benefit in improving a number of input data streams. Additionally, new stock origin data on catches in mixed-stock fisheries, based on genetic analyses, are becoming available and these inputs should be examined and compared to the current assumptions of stock composition of the mixed-stock fishery catches currently used by ICES. Revisions to the data inputs should be provided well ahead of the next ICES Working Group meeting so that the assessment and forecast model can be examined at the 2018 meeting of the Working Group for the next cycle of multiyear catch advice.

2.3.6.2 Incorporating density-dependent dynamics in freshwater

The life cycle model currently models the dynamics between eggs and smolts as a density-independent function, with an average survival rate of 0.7% from eggs to smolts. This value was selected based on average egg to smolt survival rates over a range of populations of varying status in UK(England and Wales) and UK(Scotland) as summarized in Hutchings and Jones (1998). There are consequences to the inferences on post-smolt survival rates if alternate freshwater dynamics are assumed, including compensatory density-dependent functions (Massiot-Granier *et al.*, 2014). Including more data and information on the freshwater phase of the life cycle constitutes one of the most important improvements in the modelling and for advancing the understanding of ecological inferences. Available data on monitored rivers could be used to provide better information on the egg-to-smolt survival rate dynamics, including parameterisation of density-dependent survival rates, and the variability among stock units.

2.3.6.3 Using the model to forecast returns and to assess catch options

The life cycle model built in a Bayesian framework provides a fully integrated method for assessing the consequences of mixed-stock fisheries (West Greenland, Faroes, Labrador, Newfoundland, Saint-Pierre and Miquelon) options on returns to rivers and to attainment of conservation limits by stock units, within a risk analysis framework. This differs from the current models used by ICES in which three independent models for Southern NEAC, Northern NEAC and NAC are used.

2.3.6.4 Extension of the life cycle model to include Northern NEAC stock units

The Northern NEAC stock units are not included in the current version of the model because of differences in the available time-series; the Northern NEAC complex input data begin in 1983 whereas the Southern NEAC and NAC time-series begin in 1971. Technical options could be explored to assess the feasibility of using time-series of data of different lengths between stock units as a means of integrating the Northern NEAC complex in the life cycle model without compromising the information from the longer time-series. For the objective of developing catch options, it may be sufficient to align the time-series in all the stock complexes to those of the Northern NEAC complex. This compromise would likely have minimal impact on forecasting results for the provision of advice but it would result in an important loss of information for ecological inferences.

The Working Group recommends that in order to fully consider a life cycle model as an improvement and alternative to the current assessment and forecast model used for providing catch advice, improvements to data inputs and the incorporation of a number of alternative life-history dynamics need to occur well ahead of the 2018 ICES WGNAS meeting. As such, a workshop of jurisdictional experts is proposed before the end of the 2017 calendar year. The purpose of the meeting would be to review current national input data given reductions in fisheries particularly in the NEAC area, to incorporate improved data inputs and alternate population dynamic functions, to enable the running of the inference and forecast components, and to develop documentation related to the model. The changes to the model inputs and the model would then be reviewed at the 2018 ICES WGNAS meeting for consideration as an alternate approach for the provision of the next cycle of multiyear catch advice.

2.3.7 Update on opportunities for investigating salmon at sea

2.3.7.1 The International Ecosystem Summer Survey of the Nordic Seas (IESSNS)

This is a collaborative programme involving research vessels from Iceland, the Faroes and Norway; surveys are carried out annually in July–August and present an opportunity for improving knowledge of many marine fish species including salmon at-sea. The area surveyed (3.0 million km^2 in 2016) overlaps in time and space with the known distribution of post-smolts in the North Atlantic, and as these cruises target pelagic species such as herring and mackerel with surface trawling at predetermined locations, bycatch of salmon post-smolts and adult salmon is not uncommon. In 2016 a total of 103 post-smolt and adult salmon were caught by the participating vessels in different regions of the North Atlantic (Figure 2.3.7.1). The breakdown by average length (Figure 2.3.7.2) differentiates between locations of post-smolts and adults. This post-smolt distribution is similar to previous marine surveys for salmon at-sea (Anon., 2012) and simulated distributions based on larger sample size from directed surveys (Mork *et al.*, 2012). The Working Group has been liaising with the coordinator of the IESSNS surveys to clarify sampling protocols and a number of samples have been collected and frozen for subsequent analysis. The Institute of Marine Research (Bergen, Norway) is developing a plan to collate all the information from the analysis of the samples of individual salmon caught in earlier years, as well as those from last year’s cruises.

The samples are expected to provide valuable information on the distribution of salmon at-sea, the size, sex and diet of individual fish and will also enable stock origin to be investigated using genetic techniques. The IESSNS survey data will also provide information on salmon distribution in relation to other pelagic species, hydrography and plankton abundance.

2.3.7.2 Bycatch of salmon in the Icelandic mackerel fishery

Since 2007, mackerel have been at high abundance within the Icelandic EEZ. A fishery opened in that year and the average catch of mackerel has been 163 thousand tonnes over the past five years. Mackerel are predominantly caught using midwater trawls during the summer months. Partial screening of the catch has been undertaken by the Icelandic Directorate of Fisheries to check for possible bycatch of salmon; this screening has involved both on-board inspections and screening at landing sites. In addition, salmon taken as bycatch have been voluntarily reported by the Icelandic mackerel fleet and have been recovered during surveys carried out by Marine and Freshwater Research Institute research vessels.

Between 2010 and 2014, 703 salmon have been recovered from the screening programmes and subject to investigation including: tag recovery, collection of scales, otoliths and DNA samples, and stomach contents analysis. DNA analysis to date has enabled 186 salmon to be assigned to their area of origin (Olafsson *et al*., 2015). Eight fish, from post-smolts caught close to land, were determined to be of Icelandic origin. Of the remaining 178 samples, 121 individuals (68%) were from mainland Europe, the UK, and Ireland, 53 individuals (30%) were from Scandinavia and Northern Russia, and four individuals were from Iceland (2%) (ICES, 2016a).

Between 2010 and 2013, 107 894 tonnes of mackerel catches have been screened for salmon, resulting in a total bycatch recovery of 170 salmon. On average, the bycatch of salmon has been estimated at 5.4 fish per 1000 tonnes of mackerel caught. Over the period, this has ranged from 4.7 fish per 1000 tonnes in 2013 to 6.2 fish per 1000 tonnes in 2011. In 2016, the Icelandic Directorate of Fisheries detected 53 salmon. Of these, 50 were recovered from a mackerel catch of 9186 tonnes, again representing an average of 5.4 salmon per 1000 tonnes of mackerel. The remaining three salmon were caught in other fisheries. The data collected to date thus suggest that the proportion of salmon in the mackerel catches has been relatively stable over the time, and similar to those reported by ICES (2014). The Icelandic Directorate of Fisheries plan to continue screening for salmon bycatch in the mackerel fishery. This ongoing analysis will provide further information on the distribution and origin of salmon off the east and west coasts of Iceland.

2.3.8 Poor juvenile recruitment in UK(England & Wales) in 2016

Densities of juvenile salmon, particularly 0+ fry, were very low in many rivers in UK(England & Wales) in 2016 and well below long-term averages. While there has been a modest decline in juvenile salmon densities since 2009, the scale of the downturn in 2016 was particularly notable and affected rivers throughout the country (Figure 2.3.8.1). The widespread nature of these observations suggested that factors operating at a broad scale were responsible for the declines in juvenile densities, albeit with some regional variation.

The UK Met Office described the winter of 2015/2016 as ‘remarkable’, with severe flooding in December from record rainfall totals, accompanied by exceptional warmth from a persistent flow of tropical maritime air. The winter was the second wettest in the UK (in a time-series back to 1910) and Storm Desmond on 5 December set a new 24-hour rainfall record for the UK, with 341.4 mm of rain falling in a 24-hour period. This resulted in severe and extensive flooding across many northern and western parts of the country and affected many rivers, with rivers like the River Tyne registering the highest winter flows on record. These extreme high flow events coincided with the salmon spawning period and may have caused mortality due to the washout of eggs and alevins from redds and/or sediment deposition in the redds.

The winter of 2015/2016 was also the warmest on record in UK(E&W) and temperatures in December were reported to be the warmest for both the UK and the Central England Temperature (CET) series, which dates back to 1659. It is speculated that these elevated temperatures may have influenced early fry survival or reproductive success. Impacts on adult reproduction and subsequent juvenile survival can occur at winter water temperatures above 11–12°C (Taranger and Hansen, 1993; Solomon and Lightfoot, 2008; Pankhurst and King, 2010; Fenkes *et al*., 2016) and temperatures at or above this level were recorded in some rivers. The unusually warm conditions in the winter of 2015/2016 may thus also have been an important factor in the observed declines in juvenile salmon recruitment.

In some rivers, the observed low fry numbers may also have been influenced by smaller numbers of returning adults, particularly in rivers where 1SW fish normally comprise the main component of the run, since 1SW salmon numbers have declined in UK(&W) in recent years (ICES, 2016a). However, this is not considered to be the main factor.

In summary, low densities of juvenile salmon in 2016 (Figure 2.3.8.1) probably resulted from a combination of factors including unusually high winter flows and unusually high winter temperatures, with relatively small numbers of spawners in some catchments. It is probable that the relative importance of different factors affected different catchments and subcatchments to varying degrees. The impact of this event will be monitored to assess the effects on subsequent smolt and adult recruitment.

Higher temperatures and increased climate variability are predicted to affect all components of the global freshwater system, with temperature increases over land expected to exceed those over the surface of the oceans (IPCC, 2007). Among the changes, rainfall levels are expected to increase with "wet" areas typically becoming even wetter, but with increased variability such that the risk of both floods and droughts will increase. Increasing trends in river water temperatures are also predicted (IPCC, 2007). The observed weather conditions in UK(E&W) in the winter of 2015–2016 are thus consistent with predicted climate-driven changes to the freshwater environment. At a time of continuing low levels of marine survival for salmon stocks, widespread climate-driven reductions in juvenile densities are likely to have further implications for the recovery potential of salmon stocks from UK(E&W) and elsewhere. Friedland *et al*. (2009) have speculated that the changing state of conditions in freshwater may be the more important factor controlling the future distribution and viability of Atlantic salmon, while change in the marine environment may be the main factor regulating stock productivity.

2.3.9 Progress with implementing the Quality Norm for Norwegian salmon populations

In August 2013, a management system - The Quality Norm for Wild Populations of Atlantic Salmon ("Kvalitetsnorm for ville bestander av Atlantisk laks") - was adopted by the Norwegian government (Anon., 2013). This system was based on an earlier proposal by the Norwegian Scientific Advisory Committee for Atlantic Salmon Management (Anon., 2011). A more detailed description of the Quality Norm is given in ICES (2014).

In 2016, the first classification of populations based on both dimensions (conservation limit and harvest potential, and genetic integrity) was conducted for 104 populations. In 2017, 148 salmon populations were classified. These populations included the 104 classified in 2016. Updated estimates of the degree of introgression from farmed Atlantic salmon in a large number of salmon populations were available, and a combined classification in both dimensions of the quality norm was made (Anon., 2017b). Of the 148 populations considered, 29 (20%) were classified as being in good or very good condition, 42 (28%) populations were classified as being in moderate condition, while 77 (52%) were in poor or very poor condition (Figure 2.3.9.1).

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

The Working Group on the Effectiveness of Recovery Actions for Atlantic salmon (WGERAAS) met for a third and final time from the 10–12 November 2015 at ICES HQ in Copenhagen and completed analysis of both the case studies and the Database on Effectiveness of Recovery Actions for Atlantic Salmon (DBERAAS). A total of 15 case studies were received, together with a total of 568 individual river stocks entered in DBERAAS (Table 2.4.1). Analysis of both case studies and DBERAAS has been completed, and the report is currently being finalised. Some preliminary results were presented to the Working Group.

Successful restoration and rehabilitation was characterised by:

- A limited number of stressors acting on population;
- Successfully addressing all stressors acting on the population;
- A river stock with moderate to high marine survival estimates.

Based on the analysis of DBERAAS 'Stressor' entries the following stressors were most often reported as having a high or very high impact:

1) Climate Change;
2) Barriers;
3) Freshwater habitat degradation.

Similarly, on the basis of the analysis of the DBERAAS 'Action' entries the following recovery and restoration were most often reported as having a high or very high benefit:

1) Improvements in connectivity;
2) Improvements in freshwater quality;
3) Freshwater habitat restoration.

For 2017 the WGERAAS final report will be submitted to ICES and reviewed by the Working Group in 2018.

2.5 NASCO has asked ICES to provide a summary of the available diet data for marine life stages of Atlantic salmon and identify key prey species at different life stages (e.g. herring at post-smolt stages, capelin in West Greenland waters and the Barents Sea)

2.5.1 Diet of salmon in the Northwest Atlantic during the marine phase

The marine phase of North American Atlantic salmon was partitioned into six discrete stages based on age, location, maturity, and the availability of information in the primary and secondary literature as well as unpublished data. This provided a geographic and ecological framework for grouping information (from sources covering over 85 years of intermittent data collection; 1935–2017) from which key prey items were identified. The resulting areas, stages and sources of information are shown in Figure 2.5.1.1 and the key prey species shown in Table 2.5.1.1. These stages and areas are defined as:

- the post-smolt-nearshore phase which includes information obtained from coastal embayments and nearshore continental shelf;
- the post-smolt-Labrador Sea phase which includes information from the shelf and oceanic waters from Newfoundland and Labrador;
- the 1SW maturing/non-maturing - Labrador Sea phase from the waters of Grand Bank and the Flemish Cap northward into the Labrador Sea Basin;
- the 1SW non-maturing - West Greenland phase from the Greenland Banks and coastal waters;
- the 1SW/2SW mature/maturing - nearshore phase in coastal North American waters; and
- the kelt phase in the coastal waters of North America.

The primary prey items were determined based on historic and contemporary abundance in Atlantic salmon diets. Generally, the item was classified as a key prey species if it comprised over 20% (by weight or number) of the stomach contents or if significant regional variation in dominant or emerging prey (i.e. increasing over time) was evident.

Feeding intensity and diet composition varies with life stage, gape size (Scharff *et al*., 2000), season and location, and tends to correlate with water depth. Capelin, Atlantic herring and sandlance (*Ammodytes* spp.) are consumed over shallow depths while deep-water fish (i.e. white barracudina), amphipods (*Themisto* sp.), euphausiids (i.e. *Meganyctiphanes norvegica* and *Thysanoessa intermis*) and cephalopods (i.e. boreo-atlantic armhook squid) are consumed over greater depths. Renkawitz and Sheehan (2011) showed differences between hatchery and wild diets with hatchery post-smolts consuming less food and lower quality food than naturally reared smolts.

Some of the key prey species identified are important during multiple life stages in multiple locations as follows:

- Post-smolt in the nearshore phase: Emigrating post-smolts forage on abundant fish such as Atlantic herring in US waters (fall spawned 1+, 30% by weight) and sandlance in Canadian waters (94% occurrence) over shallow nearshore waters, but switch to pelagic amphipods (39% by number) and euphausiids (49% by number) with offshore progression.;

- Post-smolt in the Labrador Sea phase: When over deep waters of the Labrador Sea post-smolts consume amphipods (59% by weight) and cephalopods (24% by weight), but consume capelin (78% by weight) when over shallow offshore banks;
- 1SW non-maturing in West Greenland: When non-maturing 1SW salmon enter the waters of the West Greenland feeding grounds, they forage primarily on capelin (53% by weight). However, some deep-water pelagic species such as *Themisto* sp. (20% by weight; amphipod) and *Gonatus* sp. (armhook squid, 15% by weight but increasing;) are also important, likely because the shelf waters and fjords are still very deep and deeper water animals are available and abundant.
- 1SW maturing/non-maturing in the Labrador Sea phase: Over offshore banks in the Labrador Sea, they forage on sandlance (67% by weight), however in deeper water they consume primarily deeper water fish (i.e. barracudina; 58% by weight).
- 1SW/2SW mature/maturing in the nearshore phase: As 1SW/2SW mature and maturing adults move into shallower coastal waters during the spring of the spawning migration to North American rivers, they consume a wide variety of prey but with intensive feeding on capelin (76% by weight) and Atlantic herring (15% by weight but important regionally in the Gulf of Maine and Bay of Fundy) and sometimes on sandlance in smaller amounts. Returning adults, thought to cease foraging before freshwater entry (Cairns, 2002), have also been shown to forage in coastal waters on diadromous species (i.e. rainbow smelt and alewife).
- Kelt phase: Currently, no studies detail the diet of kelts in the Northwest Atlantic however they probably feed on the same spatio-temporally abundant foods that other salmon consume. Kelts are known to feed actively in rivers and estuaries in spring while migrating back to the ocean. Previous spawners have been sampled with other life stages in other studies but details of diet have not been reported separately. At West Greenland there was no difference in the diets of 1SW non-maturing fish and previous spawners (NOAA, unpublished).

Geographic position and water depth appear to be useful indicators of Atlantic salmon diet at different stages during the marine phase. Identifying key prey items of salmon at different marine life stages furthers the understanding of feeding and ecology of salmon and the identification of potential bottom–up effects on salmon abundance and population dynamics.

2.5.2 Key prey species of Northwest Atlantic salmon during the marine phase from post-smolt to mature adult and their potential association with Atlantic salmon marine productivity

For each of the identified key prey species (Table 2.5.1.1), the Working Group reviewed summary information for the following six topics:

- Distribution: global and regional distributions if available;
- Abundance: Population trends and current abundance in the region if available;

- Size structure: sizes by sex, age-at-maturity, and trends in sizes over time if available;
- Energy density/proximate composition: energy density (kJ·g-1 wet weight), moisture, protein, lipids, and ash as presented if available;
- Fishery management: current fishery management plan for the species if available;
- Fishery descriptions: description of targeted fishery (commercial or personal use) including landings, or bycatch in other fisheries including estimates of frequency if available.

The key species fell into two general categories: harvested fish (capelin and Atlantic herring) and unharvested fish (barracudina and sandlance), crustaceans (amphipods and euphausiids), and cephalopods (armhook squid)). More information was available for Atlantic herring (in US waters) as it is an important commercial species supporting a significant commercial fishery. Information was also available for capelin in Canadian waters for a similar reason although very little information was available for capelin in Greenlandic waters. Conversely for all the other unharvested species, very little is known besides basic life history and distribution.

In terms of fisheries management, the harvested species (Atlantic herring in US waters and capelin in Canadian waters) appear to be responding positively to the fishery management actions taken over the past 25 years. Spawning–stock biomass (SSB) of Atlantic herring in US waters is estimated to be well above the SSB target (Deroba, 2015) although the mean weight of Atlantic herring in the Gulf of Maine has declined drastically over the past 30 years (Golet *et al*., 2015). The abundance indices for the Newfoundland/Labrador stock of capelin suggest that the stock is approximately 25% of the peak estimates from the 1980s, but increasing over the past few years (DFO, 2015). Very little is known about the unharvested species although they are considered to be fairly abundant given their prevalence in the diets of many other marine species.

There have been recent examples of how ecosystem changes have reduced prey quality of these harvested species (see Renkawitz *et al*., 2015 for capelin in the Labrador Sea, and Golet *et al*., 2007; Golet *et al.*, 2015 for Atlantic herring in the Gulf of Maine) over the past few decades. Altered forage conditions have been shown to have effects for some species in terms of size and body condition (Golet *et al*., 2007: Golet *et al*., 2015; Sherwood *et al*., 2007) and survival and population abundance via direct and indirect mechanisms (Walsh and Morgan, 1999; Dutil and Brander, 2003; Mills *et al*., 2013; Renkawitz *et al*., 2015). However, the extent to which these drivers affect unharvested species remains unknown due to insufficient baselines of key metrics or time-series of monitoring information/data. As a result, it is not known whether or not these species have undergone changes in distribution, abundance, size structure, proximate composition or energy density. Additional information is required to build more detailed time-series of baseline information for evaluation of both harvested and unharvested species to monitor the impacts species dynamics from environmental changes.

2.5.3 Diet and prey availability in the Northeast Atlantic

There are large temporal and spatial differences in the diet of salmon in the Northeast Atlantic (Rikardsen and Dempson, 2011). There are also differences in the diet with increasing size of the salmon. Post-smolt in the northern region in the early 2000s were mainly feeding on herring larvae, sandeel larvae and amphipods, while post-smolt located further south were feeding on blue whiting larvae, sandeel larvae and other fish larvae (Haugland *et al*., 2006). There was however large interannual variability. Other fish larvae and euphausiids can also be important for post-smolt (Hanson and Pethon, 1985). In general, post-smolts feed on fish larvae in coastal regions and on large zooplankton in oceanic regions (Rikardsen and Dempson, 2011). Smaller zooplankton such as *Calanus finmarchicus*, the most common zooplankton in the Northeast Atlantic, are not an important part of the salmon diet. Occurrences of important food items are summarized in Table 2.5.2.1 (after Rikardsen and Dempson, 2011).

From the SALSEA data (Anon., 2012), the diets of salmon, herring and mackerel differed although they were feeding in the same parts of the ocean. The main food of herring and mackerel was *Calanus finmarchicus*, and secondly euphausids and gastropods, respectively. The salmon's main food items were juvenile fish and amphipods of the genus *Themisto*. Salmon also showed clear differences in diet among years from 2002–2009. In 2009, when *Themisto* and fish were less dominant in their diet, salmon post-smolts seemed to have a broader diet and were feeding more on small prey.

The composition of the post-smolt diet varies among Norwegian fjords and among years (Rikardsen *et al*., 2004). Feeding in the fjords was more extensive with more food and fewer empty stomachs in the north than in the south probably because of better prey availability in these fjords. This suggests that salmon are opportunistic feeders when they migrate through the fjords, and that food availability might be higher in northern fjords. The diet in the fjords consists of a variety of organism groups (Table 2.5.2.2), but on a weight basis it was dominated by pelagic fish larvae (Rikardsen *et al*., 2004; Hvidsten *et al*., 2009), particularly sandeels, herring and gadoids (Rikardsen *et al*., 2004). The proportion of fish in the stomachs was higher in the outer reaches of the fjords than in the inner parts of the fjords (Rikardsen *et al*., 2004).

As with post-smolts, there are temporal and spatial differences in the diet of larger salmon which consists of small pelagic fish, large zooplankton and mesopelagic fish. Herring and capelin have previously been reported to be the main components of the diet along the middle and central Norwegian coast (Hansen and Pethon, 1985). Of the macrozooplankton, the euphausiids and amphipods are considered to be important. Mesopelagic fish (such as *Maurolicus muelleri* and *Benthosema glaciale*) and squid (*Gonatus fabricii*) are also preyed upon by larger salmon in the Northeast Atlantic, especially during winter (Jacobsen and Hansen, 2000). Further south, sandeel and herring were the dominant prey items in the diet of returning salmon in Scottish waters (Fraser, 1987), and blue whiting and mackerel have been important for salmon in Faroese waters in autumn (Jacobsen and Hansen, 2000). Spatial differences in diet are apparent considering that sprat was dominating the diets in coastal Irish waters (Twomey and Molly, 1974) and herring in the northern Baltic Sea (Salminen *et al*., 2001). The general picture is that larger salmon feed on larger prey and are opportunistic predators capable of switching diet according to availability (Rikardsen and Dempson, 2011).

The Northeast Atlantic is generally well monitored due to the intensity of fishing for commercially important small pelagic fish species. Annual landings of Norwegian-Spring-spawning herring, blue whiting and mackerel can each have annual landings exceeding 1 to 1.5 million tonnes. However, most of the large surveys are only carried out in summertime as there are few fish in this area outside this time period. Monitoring in summertime is concentrated in the Norwegian Sea and the surrounding area (Icelandic Sea, Greenland Sea, northern North Sea), as these are the main feeding grounds for the large pelagic stocks.

2.5.3.1 Zooplankton

In general, there are more zooplankton in the northwestern region, than in the south-eastern region of the Norwegian Sea. The water masses in the western region are cold Arctic waters which flow southward. As this water is too cold for most pelagic fish (<2ºC), larger zooplankton which would otherwise be vulnerable to fish predation are more prevalent in this region. The biomass of small zooplankton (<2 mm) in the Norwegian Sea and surrounding area is surveyed each May with WP-2 nets hauled vertically from 200 m to the surface. The samples consist mainly of smaller copepods with *Calanus finmarchicus* as a dominating species. The time-series (1996–2016) indicate that there has been a generally decreasing trend, but with some variation between years (Bakketeig *et al.*, 2016). The lowest biomass was recorded in 2009, but since then has the biomass increased slightly. Although the biomass is lower than in the 1990s, the levels are still high compared to other regions such as in the Barents Sea. Copepods such as *C. finmarchicus* are not an important prey for salmon, but are important prey for organisms that salmon prey upon. A reduction of smaller zooplankton can therefore lead to reduced prey for salmon, given that the ecosystem is bottom–up driven.

Large zooplankton are sampled with MOCNESS (Multiple Opening/Closing Net and Environmental Sensing System) multi-net or with macrozooplankton trawls. This group includes amphipods and euphausiids, which are important prey for both post-smolt and larger salmon. A time-series is only available from the MOCNESS as the zooplankton trawl has only been used in more recent years. MOCNESS nets are not fully efficient for capturing large zooplankton as it is possible for individuals to avoid the gear. As for the smaller zooplankton, there has been decreasing abundance of large zooplankton during the last 5–10 years compared to the period 1991–2010 (ICES, 2016c). However, these data are uncertain and need to be quality controlled before any final conclusions are made. The spatial variation and exact decrease of large zooplankton are not quantified to date.

2.5.3.2 Mesopelagic and pelagic fish

There are numerous stocks of herring in the Northeast Atlantic. The largest stocks are the Norwegian-spring-spawning (NSS) herring (SSB in 2016 ~5 million tonnes, ICES, 2016c) and North Sea herring (SSB in 2016 ~2 million tonnes). In addition there are some smaller Icelandic, Norwegian, Scottish and Irish stocks. Although all stocks can be locally important prey for salmon, NSS herring are probably the most important prey due to the large stock size and spatial overlap with both post-smolt and larger salmon. However, NSS herring have very variable recruitment success, with roughly ten years between each large year class (Toresen and Østvedt, 2000). There were several strong year classes in the late 1990s and early 2000s. The last strong year was in 2004. Although the following year classes have been weak, there would have been abundant herring larvae available for post-smolts, given that recruitment failure of herring is caused by high mortality after the larvae phase.

In recent years a large biomass of mackerel has migrated into the Norwegian Sea along the Norwegian coast in May. These mackerel are feeding to some extent on herring larvae (Skaret *et al.*, 2015) and can be an important competitor for salmon.

The mackerel stock is currently around 4.5 million tonnes and has had very good recruitment in the last 10–15 years (ICES, 2016d). The stock is expanding further north and west, and is now distributed over the entire Norwegian Sea, around Iceland and to the southeastern part of Greenland during summer (Nøttestad *et al*., 2016), and into the Barents Sea. Mackerel can be important for salmon both as prey and as a potential competitor. Although several strong year classes have been produced lately, the spatio-temporal overlap with post-smolt and larger salmon is probably limited. With the expansion of feeding, mackerel including the smaller mackerel (one and two year olds) have migrated further north, and are now found over large parts of the Norwegian Sea.

There are two stocks of capelin in the Northeast Atlantic, the Icelandic capelin and the Barents Sea capelin. The majority of capelin spawn at three to four years of age and are short-lived. The Icelandic stock is utilizing feeding grounds north and west of Iceland. After low stock levels around 1980 and 1990, the stock size has been fairly stable, and well above ICES B_{lim} (biomass limit) reference point since the early 1990s (ICES, 2016f). The Barents Sea stock has had large fluctuations since the 1970s (ICES, 2016f). The stock collapsed around 1985, 1993 and 2003, but recovered quickly again each time. The stock has currently collapsed again, but is assumed it will recover again as high abundance of juvenile capelin has been recorded.

Sandeel larvae can be an important part of the diet for post-smolt (Haugland *et al*., 2006) due to their large spatio-temporal overlap. In the northern North Sea sandeel populations are considered to have collapsed and in the area around Shetland there are no fisheries currently. The sandeel stock in the southern and central North Sea is in good condition, although much smaller than during the 1980s and 1990s (ICES, 2016g).

The biomass of blue whiting has increased in recent years due to good recruitment and is currently around 6.7 million tonnes (ICES, 2016c). Blue whiting larvae can be an important part of the diet for post-smolt in the southern region (Haugland *et al*., 2006), as the larvae are distributed north and west of the UK and Ireland in April and May. Juvenile blue whiting can also be an important part of the diet for larger salmon in winter, as the juveniles do not migrate to the spawning areas but remain widely distributed from Portugal to the Norwegian Sea during winter.

Mesopelagic fish are present worldwide. They inhabit depths of 200–1000 m with diurnal migrations. The most common species in the Northeast Atlantic are *Maurolicus muelleri*, *Benthosema glaciale* and *Arctozenus risso*. It is assumed that abundance decreases with latitude. The present and historic biomass of mesopelagic fish in the Northeast Atlantic is unknown but they are known to be a feature of the diet of Atlantic salmon.

2.5.3.3 Ecosystem considerations

There have been large changes in the preferred feeding areas for NSS herring, mackerel and capelin since the mid-1990s and up to the present time. NSS herring are now feeding east of Iceland and further northwest towards Greenland, instead of in the central Norwegian Sea. Mackerel are found throughout the Norwegian Sea, south of Iceland and into Greenland waters. Icelandic capelin are migrating further northwest than they used to do during the feeding periods. These changes may partly be related to climate change and warmer waters, but may also be due to changes in prey availability. Mackerel have shown reduced growth at-age in the last decade, and this change is correlated with the abundance of herring and mackerel feeding in the Northeast Atlantic (Olafsdottir *et al*., 2016).

In summary, although much of the available information for salmon prey abundance in the Northeast Atlantic is uncertain, the results indicate highly variable and generally less available prey for post-smolts in the last 10–15 years. Important fish larvae of herring and sandeel are less abundant than they used to be, and there is a low spatio-temporal overlap between post-smolt and mackerel/blue whiting larvae. Further, there are indications of a reduction in abundance of zooplankton in the Norwegian Sea.

For larger salmon there is however good availability of prey. All of the pelagic stocks feeding in the Norwegian Sea are abundant (NSS herring, blue whiting and mackerel). In addition, the Icelandic capelin stock is feeding in western Northeast Atlantic and the Greenland Sea areas. There are also more of the large zooplankton in the western Northeast Atlantic and Greenland Sea than further to the east. Abundant juvenile blue whiting and an unknown biomass of mesopelagic fish are potential prey during winter. Although the larval abundance of post-smolt prey species has declined it is uncertain whether this reduction has resulted in reduced growth and survival. Further, it is not known whether the changes in zooplankton abundance are driven by bottom–up or top–down processes.

2.6 NASCO has asked ICES to provide a description of the potential future impacts of climate change on salmon stock dynamics (not for WGNAS, to be dealt with by WKCCISAL)

NASCO asked ICES to quantify possible future impacts of climate change on salmon stock dynamics (ToR 1.5). Given that there is significant expertise both inside and outside the ICES scientific community relating to climate change, ICES considered that the examination of this topic in a workshop setting was the most appropriate venue to ensure that the full range of perspectives on the potential impacts of climate change on Atlantic salmon stock dynamics could be described. The workshop (WKCCISAL-Workshop on Potential Impacts of Climate Change on Atlantic Salmon Stock Dynamics) was held March 27 and 28, 2017 at ICES Headquarters in Copenhagen and was chaired by Dennis Ensing UK(NI) and Jim Irvine (Canada). ICES Workshops are open to all interested parties and participants from academia and research organisations participated.

The terms of reference, elaborated on following the NASCO meeting and the Workshop, were:

a) Identify the changes in climate that may potentially impact wild Atlantic salmon in its distributional range based on the predictions of climate change including those from the most recent International Panel on Climate Change (IPCC);

b) Review the conclusions of published literature and research on the biological and environmental drivers that impact on stock dynamics of Atlantic salmon;

c) Given the predicted changes in climate identified in (a) and the drivers that impact Atlantic salmon identified in (b), identify and describe the potential effects of climate change on Atlantic salmon stock dynamics including (but not limited to) the impacts on:

i) the biological characteristics (growth, condition, maturity, fecundity, time at-sea, survival, etc.) that may affect the productivity of the stocks;

ii) the riverine, estuarine and marine habitat and potential consequences for salmon;

iii) the interactions with other species (parasites, predators, preys and competing species including invasive species);

iv) the migration routes used by salmon and the timing of migration and implications of such changes;

v) the interpopulation genetic diversity.

WKCCISAL was asked to report by April 11, 2017 for the attention of the ICES Advisory Committee. The advice will be reviewed by ICES, independent of the other questions to WGNAS, and the outcomes from this workshop will lead to ICES Advice with a release on May 5, 2017.

2.7 Reports from ICES expert group relevant to North Atlantic salmon

2.7.1 WGRECORDS

The Working Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species (WGRECORDS) provides a topical forum for the coordination of ICES activities relating to species which use both freshwater and marine environments to complete their life cycles; like eel, Atlantic salmon, sea trout, lampreys, shads, smelts, etc. The Group considers progress and future requirements in the field of diadromous science and management and organizes Expert Groups, Theme Sessions and Symposia. There is also a significant role in coordinating with other science and advice Working Groups in ICES. Current chairs are Russell Poole (Ireland) and Johan Dannewitz (Sweden).

WGRECORDS noted that better coordination between diadromous fish scientists would be advantageous, particularly regarding data-poor species that have previously not received so much attention. To this end a proposal for a diadromous fish theme session in the 2017 ICES Annual Science Conference in Fort Lauderdale, Florida, USA, had been accepted by ICES.

This session will include papers on:

- Status, distribution, ecology or biology of poorly understood diadromous fish species;
- Approaches for systematic monitoring of poorly understood diadromous species, including:
    - Stock assessment methodologies for key species of interest for which assessments are currently not available or difficult;
    - Ecosystem approaches for poorly understood diadromous fish, with science and advisory requirements relating to environmental drivers;
    - The integration of data-poor diadromous fish into fisheries management; needs and implications;
- Using some species as index species for environmental change;
- Lessons learned that might help management and conservation of functionally similar species;

- Impending threats, particularly invasive species or interactions with other species undergoing range expansion;
- Physiological drivers controlling the movements of diadromous fish and addressing gaps in knowledge.

The proposal by WGRECORDS to establish a Working Group on Sea Trout in 2017–2019 was accepted by ICES in September 2016 and the Group will meet from the 24th to 26th of April, 2017. Cross cutting issues between this group and the ICES WGNAS would be of interest to both working groups, ICES and NASCO.

Other issues reported on included:

- Information from Portugal and the UK on fish passage and mitigation actions relevant to diadromous fish;
- The need for a host to support the DBERAAS database, a product of the ICES Working Group on Effective Recovery Actions for Atlantic Salmon (WGERAAS);
- That the ICES Cooperative Research Report on “Fifty Years of Marine Tag Recoveries from Atlantic Salmon” was in final editorial stages and would be published shortly (CRR 282).

2.7.2 ICES and the International Year of the Salmon

Further progress on developing an International Year of the Salmon event was made during 2016. Primary partners have been identified as North Pacific Anadromous Fish Commission (NPAFC) and North Atlantic Salmon Conservation Organization (NASCO), international inter-governmental organizations established to conserve anadromous salmon in the North Pacific and Atlantic oceans respectively http://www.npafc.org/new/science_IYS.html and //www.nasco.int/iys.html.

ICES has agreed to be one of the secondary partners along with the following organizations: Department of Fisheries and Oceans Canada (DFO), University of British Columbia (UBC), Simon Fraser University, PICES, Pacific Salmon Commission, World Meteorological Program, Pacific Salmon Foundation, Vancouver Aquarium, US National Marine Fisheries Service, Tula Foundation, First Nations Fisheries Council and Ocean Networks Canada, Ocean Tracking Network as well as NASCO’s accredited NGOs, EIFAAC, and the OSPAR Commission.

The IYS early activities were reported to SCICOM, WGNAS and WGRECORDS in 2015 and 2016. At the SCICOM meeting in September 2016, ICES formally accepted the invitation from the IYS Steering Committee to become a partner. ICES appointed the Head of Science Support and the SCICOM Representative for Ireland to engage with the process and be part of the North Atlantic Steering Committee and the Symposium Steering Committee. In November 2016, NASCO held a meeting of the North Atlantic Steering Committee which ICES attended. In March 2017 SCICOM approved a resolution to support the IYS symposium in the third quarter of 2018 with an issue of the ICES journal to be allocated pending discussions with Editor in Chief. ICES recognised this as high priority given that ICES are the primary advice providers for Atlantic salmon in the North Atlantic and have been advising the North Atlantic Salmon Conservation Organisation since 1983. Given the current persistent decline in salmon stocks in the North Atlantic, and a similar decline for some important Pacific salmon stocks, there is a need to share information to inform a wider research initiative to explain this decline and rational management.

It is anticipated that a wide range of participants will attend this symposium given the existing links between the Pacific, Atlantic (east and west) and Baltic and the degree of international interest in wild salmon biology and science between freshwater and marine environments. Specifically, it is anticipated that there will be involvement of scientists from ICES, NASCO, NPAFC, PICES, universities, government, state organisations and NGO's (e.g. Atlantic Salmon Trust, Atlantic Salmon Federation). The outputs of the symposium and the research activities associated with the IYS are expected to feed into the advice process of the ICES ACOM and WGNAS and enhance ICES advice to NASCO. There will also be links with the ICES Science Plan through SCICOM, Science Steering Group on Environmental Processes and Dynamics (SGEPD) and associate EGs e.g. WGRECORDS, WGTRUTTA.

2.8 NASCO has asked ICES to provide a compilation of tag releases by country in 2016

Data on releases of tagged, finclipped and otherwise marked salmon in 2016 were provided to the Working Group and are compiled as a separate report (ICES, 2017). In summary (Table 2.8.1), about 3.2 million salmon were marked in 2016, a decrease from the 3.8 million fish marked in 2015. The adipose clip was the most commonly used primary mark (2.55 million), with coded wire microtags (0.379 million) the most common tag applied and 254 880 fish were marked with external tags. Most marks were applied to hatchery-origin juveniles (3.1 million), while 81 188 wild juveniles and 8136 adults were also marked. In 2016, 6469 PIT tagged, Data Storage Tags (DSTs), radio and/or sonic transmitting tags (pingers) were also reported by some countries (Table 2.9.1).

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. USA have opted for a genetic "marking" procedure. The broodstock has been screened with molecular genetic techniques, which makes it feasible to trace an escaped farmed salmon back to its hatchery of origin through analysis of its DNA.

In 2015 the Working Group received information from the Institute of Marine Research (IMR; Bergen, Norway), related to a new tagging initiative and wide-scale tag screening programme in the Northeast Atlantic. The tagging programme is directed at pelagic species (herring and mackerel) using glass-encapsulated passive integrated transponder (PIT) tags / RFID tags (Radio Frequency Identity tags) (ICES, 2015). RFID detector systems have been installed at a number of fish processing plants in different countries, and catches landed at these plants are automatically screened for tagged fish. The use of RFID tags for salmon is increasing and in 2016 more than 32 000 salmon were released with such tags. Therefore there is a potential for RFID tagged salmon as bycatch in pelagic fisheries to be detected at fish plants with the appropriate detecting equipment. A list of unknown tags detected by these detectors was received from IMR in 2015 and updated in 2016 and distributed to agencies using RFID tags for salmon. One agency confirmed that one of the detected tags had been applied to a smolt in Norway. An updated list is expected to be released soon. It is recommended that the list is sent to the National Tagging co-ordinators (ICES, 2017) and to the members of the WGNAS.

2.8.1 NASCO has asked ICES to identify relevant data deficiencies, monitoring needs and research requirements

Issues pertinent to particular Commission areas are included in subsequent sections and, where appropriate, carried forward to the recommendations (Annex 8).

2.9 Tables

Table 2.1.1.1. Total reported nominal catch of salmon by country (in tonnes round fresh weight), 1960–2016. The values for 2016 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 (4)	Sweden Wild	Sweden Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E & W)	UK (N.Irl.) (6,7)	UK (Scotl.)	France (8)	Spain (9)	Faroes (10)	East Grld.	West Grld. (11)	Other (12)		NASCO Areas (13)	International waters (14)
1960	1 636	1	-	1 659	1 100	100	-	40	0	-	-	743	283	139	1 443	-	33	-	-	60	-	7 237	-	-
1961	1 583	1	-	1 533	790	127	-	27	0	-	-	707	232	132	1 185	-	20	-	-	127	-	6 464	-	-
1962	1 719	1	-	1 935	710	125	-	45	0	-	-	1 459	318	356	1 738	-	23	-	-	244	-	8 673	-	-
1963	1 861	1	-	1 786	480	145	-	23	0	-	-	1 458	325	306	1 725	-	28	-	-	466	-	8 604	-	-
1964	2 069	1	-	2 147	590	135	-	36	0	-	-	1 617	307	377	1 907	-	34	-	-	1 539	-	10 759	-	-
1965	2 116	1	-	2 000	590	133	-	40	0	-	-	1 457	320	281	1 593	-	42	-	-	861	-	9 434	-	-
1966	2 369	1	-	1 791	570	104	2	36	0	-	-	1 238	387	287	1 595	-	42	-	-	1 370	-	9 792	-	-
1967	2 863	1	-	1 980	883	144	2	25	0	-	-	1 463	420	449	2 117	-	43	-	-	1 601	-	11 991	-	-
1968	2 111	1	-	1 514	827	161	1	20	0	-	-	1 413	282	312	1 578	-	38	5	-	1 127	403	9 793	-	-
1969	2 202	1	-	1 383	360	131	2	22	0	-	-	1 730	377	267	1 955	-	54	7	-	2 210	893	11 594	-	-
1970	2 323	1	-	1 171	448	182	13	20	0	-	-	1 787	527	297	1 392	-	45	12	-	2 146	922	11 286	-	-
1971	1 992	1	-	1 207	417	196	8	17	1	-	-	1 639	426	234	1 421	-	16	-	-	2 689	471	10 735	-	-
1972	1 759	1	-	1 578	462	245	5	17	1	-	32	1 804	442	210	1 727	34	40	9	-	2 113	486	10 965	-	-
1973	2 434	3	-	1 726	772	148	8	22	1	-	50	1 930	450	182	2 006	12	24	28	-	2 341	533	12 670	-	-
1974	2 539	1	-	1 633	709	215	10	31	1	-	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	0	-	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	0	-	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	9	1	-	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	0	-	37	1 230	349	148	1 323	20	32	37	8	984	138	7 682	-	-
1979	1 287	3	-	1 831	455	219	6	11	1	-	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	16	1	-	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	25	1	-	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	24	1	-	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	27	1	-	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	39	1	-	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	44	1	-	49	1 595	361	98	913	22	13	566	7	864	-	8 108	-	-
1986	1 559	2	3	1 598	608	232	59	52	2	-	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	43	4	-	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	36	4	-	36	1 874	395	114	882	32	18	243	4	893	-	7 737	3 248	-
1989	1 139	2	2	905	364	141	136	25	4	-	52	1 079	296	142	895	14	7	364	-	337	-	5 904	2 277	-
1990	911	2	2	930	313	141	285	27	6	13	60	567	338	94	624	15	7	315	-	274	-	4 925	1 890	180-350

Table 2.1.1.1 (continued). Total reported nominal catch of salmon by country (in tonnes round fresh weight), 1960–2016. The values for 2016 include provisional data.

	NAC Area			NEAC (N. Area)								NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
						Iceland		Sweden					UK	UK	UK				East	West		Reported		
Year	Canada (1)	USA	St. P&M	Norway (2)	Russia (3)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	(E & W)	(N.Irl.) (6,7)	(Scotl.)	France (8)	Spain (9)	Faroes (10)	Grld.	Grld. (11)	Other (12)	Nominal Catch	NASCO Areas (13)	International waters (14)
1991	711	1	1	876	215	129	346	34	4	3	70	404	200	55	462	13	11	95	4	472	-	4 106	1 682	25-100
1992	522	1	2	867	167	174	462	46	3	10	77	630	171	91	600	20	11	23	5	237	-	4 119	1 962	25-100
1993	373	1	3	923	139	157	499	44	12	9	70	541	248	83	547	16	8	23	-	-	-	3 696	1 644	25-100
1994	355	0	3	996	141	136	313	37	7	6	49	804	324	91	649	18	10	6	-	-	-	3 945	1 276	25-100
1995	260	0	1	839	128	146	303	28	9	3	48	790	295	83	588	10	9	5	2	83	-	3 629	1 060	-
1996	292	0	2	787	131	118	243	26	7	2	44	685	183	77	427	13	7	-	0	92	-	3 136	1 123	-
1997	229	0	2	630	111	97	59	15	4	1	45	570	142	93	296	8	4	-	1	58	-	2 364	827	-
1998	157	0	2	740	131	119	46	10	5	1	48	624	123	78	283	8	4	6	0	11	-	2 395	1 210	-
1999	152	0	2	811	103	111	35	11	5	1	62	515	150	53	199	11	6	0	0	19	-	2 247	1 032	-
2000	153	0	2	1 176	124	73	11	24	9	5	95	621	219	78	274	11	7	8	0	21	-	2 912	1 269	-
2001	148	0	2	1 267	114	74	14	25	7	6	126	730	184	53	251	11	13	0	0	43	-	3 069	1 180	-
2002	148	0	2	1 019	118	90	7	20	8	5	93	682	161	81	191	11	9	0	0	9	-	2 654	1 039	-
2003	141	0	3	1 071	107	99	11	15	10	4	78	551	89	56	192	13	9	0	0	9	-	2 457	847	-
2004	161	0	3	784	82	111	18	13	7	4	39	489	111	48	245	19	7	0	0	15	-	2 157	686	-
2005	139	0	3	888	82	129	21	9	6	8	47	422	97	52	215	11	13	0	0	15	-	2 155	700	-
2006	137	0	3	932	91	93	17	8	6	2	67	326	80	29	192	13	11	0	0	22	-	2 028	670	-
2007	112	0	2	767	63	93	36	6	10	3	58	85	67	30	171	11	9	0	0	25	-	1 548	475	-
2008	158	0	4	807	73	132	69	8	10	9	71	89	64	21	161	12	9	0	0	26	-	1 721	443	-
2009	126	0	3	595	71	126	44	7	10	8	36	68	54	16	121	4	2	0	0,8	26	-	1 318	343	-
2010	153	0	3	642	88	147	42	9	13	13	49	99	109	12	180	10	2	0	1,7	38	-	1 610	393	-
2011	179	0	4	696	89	98	30	20	19	13	44	87	136	10	159	11	7	0	0,1	27	-	1 629	421	-
2012	126	0	3	696	82	50	20	21	9	12	64	88	58	9	124	10	7	0	0,5	33	-	1 412	403	-
2013	137	0	5	475	78	116	31	10	4	11	46	87	84	4	119	11	5	0	0,0	47	-	1 270	306	-
2014	118	0	4	490	81	51	18	24	6	9	58	57	54	5	84	12	6	0	0,1	58	-	1 134	287	-
2015	140	0	4	583	80	94	31	9	7	9	45	63	68	3	68	16	5	0	1,0	56	-	1 282	325	-
2016	135	0	5	612	56	87	31	6	3	9	51	58	86	5	27	6	5	0	1,5	26	-	1 209	335	-
Average																								
2011-2015	140	0	4	588	82	82	26	17	9	11	51	76	80	6	111	12	6	0	0,3	44	-	1 345	348	-
2006-2015	139	0	3	668	80	100	34	12	9	9	54	105	77	14	138	11	6	0	0,4	36	-	1 495	407	-

Table 2.1.1.1 (continued). Total reported nominal catch of salmon by country (in tonnes round fresh weight), 1960–2016. The values for 2016 include provisional data.

KEY:	
1. Includes estimates of some local sales, and, prior to 1984, bycatch	9. Weights estimated from mean weight of fish caught in Asturias (80–90% of Spanish catch).
2. Before 1966, sea trout and sea charr included (5% of total).	10. Between 1991 & 1999, there was only a research fishery at Faroes. In 1997 & 1999 no fishery took place; the commercial fishery resumed in 2000, but has not operated since 2001.
3. Figures from 1991 to 2000 do not include catches taken in the recreational (rod) fishery.	11. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965–1975.
4 From 1990, catch includes fish ranched for both commercial and angling purposes.	12. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and logbooks from 2002.	13. No unreported catch estimate available for Canada in 2007 and 2008. Data for Canada in 2009 and 2010 are incomplete. No unreported catch estimate available for Russia since 2008.
6. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.	14. Estimates refer to season ending in given year.
7. Angling catch (derived from carcase tagging and logbooks) first included in 2002.	15. Catches from hatchery-reared smolts released under programmes to mitigate for hydropower development
8. Data for France include some unreported catches.	

Table 2.1.1.2. Total reported nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2016. (2016 figures include provisional data). S = Salmon (2SW or MSW fish). G = Grilse (1SW fish). Sm = small. Lg = large; T = S + G or Lg + Sm.

	NAC Area				NEAC (N. Area)												NEAC (S. Area)										
								Russia	Iceland		Sweden						Ireland			UK	UK(N.I.)						
Year	Canada (1)			USA	Norway (2)			(3)	Wild	Ranch	Wild	Ranch	Denmark	Finland			(4,5)			(E&W)	(4,6)	UK(Scotland)			France	Spain	Total
	Lg	Sm	T	T	S	G	T	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	0	-	-	-	-	-	-	743	283	139	971	472	1,443	-	33	7,177
1961	-	-	1,583	1	-	-	1,533	790	127	-	27	0	-	-	-	-	-	-	707	232	132	811	374	1,185	-	20	6,337
1962	-	-	1,719	1	-	-	1,935	710	125	-	45	0	-	-	-	-	-	-	1,459	318	356	1,014	724	1,738	-	23	8,429
1963	-	-	1,861	1	-	-	1,786	480	145	-	23	0	-	-	-	-	-	-	1,458	325	306	1,308	417	1,725	-	28	8,138
1964	-	-	2,069	1	-	-	2,147	590	135	-	36	0	-	-	-	-	-	-	1,617	307	377	1,210	697	1,907	-	34	9,220
1965	-	-	2,116	1	-	-	2,000	590	133	-	40	0	-	-	-	-	-	-	1,457	320	281	1,043	550	1,593	-	42	8,573
1966	-	-	2,369	1	-	-	1,791	570	104	2	36	0	-	-	-	-	-	-	1,238	387	287	1,049	546	1,595	-	42	8,422
1967	-	-	2,863	1	-	-	1,980	883	144	2	25	0	-	-	-	-	-	-	1,463	420	449	1,233	884	2,117	-	43	10,390
1968	-	-	2,111	1	-	-	1,514	827	161	1	20	0	-	-	-	-	-	-	1,413	282	312	1,021	557	1,578	-	38	8,258
1969	-	-	2,202	1	801	582	1,383	360	131	2	22	0	-	-	-	-	-	-	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	0	-	-	-	-	-	-	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	17	1	-	-	-	-	-	-	1,639	426	234	719	702	1,421	-	16	7,574
1972	1,201	558	1,759	1	1,064	514	1,578	462	245	5	17	1	-	-	-	32	200	1,604	1,804	442	210	1,013	714	1,727	34	40	8,356
1973	1,651	783	2,434	3	1,220	506	1,726	772	148	8	22	1	-	-	-	50	244	1,686	1,930	450	182	1,158	848	2,006	12	24	9,767
1974	1,589	950	2,539	1	1,149	484	1,633	709	215	10	31	1	-	-	-	76	170	1,958	2,128	383	184	912	716	1,628	13	16	9,566
1975	1,573	912	2,485	2	1,038	499	1,537	811	145	21	26	0	-	-	-	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	0	-	-	-	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	9	1	-	-	-	59	145	1,227	1,372	345	110	639	521	1,160	19	19	7,755
1978	1,225	320	1,545	4	668	382	1,050	476	285	6	10	0	-	-	-	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	11	1	-	-	-	26	105	922	1,027	261	99	598	478	1,076	10	29	6,340
1980	1,763	917	2,680	6	1,352	478	1,830	664	241	8	16	1	-	-	-	34	202	745	947	360	122	851	283	1,134	30	47	8,119
1981	1,619	818	2,437	6	1,189	467	1,656	463	147	16	25	1	-	-	-	44	164	521	685	493	101	844	389	1,233	20	25	7,351
1982	1,082	716	1,798	6	985	363	1,348	364	130	17	24	1	-	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	27	1	-	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	39	1	-	37	9	46	101	728	829	345	78	504	509	1,013	25	18	5,882
1985	540	593	1,133	2	923	638	1,561	659	162	55	44	1	-	38	11	49	100	1,495	1,595	361	98	514	399	913	22	13	6,667
1986	779	780	1,559	2	1,042	556	1,598	608	232	59	52	2	-	25	12	37	136	1,594	1,730	430	109	745	526	1,271	28	27	7,742
1987	951	833	1,784	1	894	491	1,385	564	181	40	43	4	-	34	15	49	127	1,112	1,239	302	56	503	419	922	27	18	6,611
1988	633	677	1,310	1	656	420	1,076	420	217	180	36	4	-	27	9	36	141	1,733	1,874	395	114	501	381	882	32	18	6,591
1989	590	549	1,139	2	469	436	905	364	141	136	25	4	-	33	19	52	132	947	1,079	296	142	464	431	895	14	7	5,197
1990	486	425	911	2	545	385	930	313	146	280	27	6	13	41	19	60	-	-	567	338	94	423	201	624	15	7	4,327

Table 2.1.1.2 (continued). Total reported nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2016. (2016 figures include provisional data). S = Salmon (2SW or MSW fish). G = Grilse (1SW fish). Sm = small. Lg = large; T = S + G or Lg + Sm.

	NAC Area				NEAC (N. Area)												NEAC (S. Area)										
Year	Canada (1)			USA	Norway (2)			Russia (3)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	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	T	S	G	T	S	G	T	T	T	S	G	T	T	T	T
1991	370	341	711	1	535	342	876	215	129	346	34	4	3	53	17	70	-	-	404	200	55	285	177	462	13	11	3 530
1992	323	199	522	1	566	301	867	167	174	462	46	3	10	49	28	77	-	-	630	171	91	361	238	599	20	11	3 847
1993	214	159	373	1	611	312	923	139	157	499	44	12	9	53	17	70	-	-	541	248	83	320	227	547	16	8	3 659
1994	216	139	355	0	581	415	996	141	136	313	37	7	6	38	11	49	-	-	804	324	91	400	248	648	18	10	3 927
1995	153	107	260	0	590	249	839	128	146	303	28	9	3	37	11	48	-	-	790	295	83	364	224	588	10	9	3 530
1996	154	138	292	0	571	215	787	131	118	243	26	7	2	24	20	44	-	-	685	183	77	267	160	427	13	7	3 035
1997	126	103	229	0	389	241	630	111	97	59	15	4	1	30	15	45	-	-	570	142	93	182	114	296	8	3	2 300
1998	70	87	157	0	445	296	740	131	119	46	10	5	1	29	19	48	-	-	624	123	78	162	121	283	8	4	2 371
1999	64	88	152	0	493	318	811	103	111	35	11	5	1	29	33	63	-	-	515	150	53	142	57	199	11	6	2 220
2000	58	95	153	0	673	504	1 176	124	73	11	24	9	5	56	39	96	-	-	621	219	78	161	114	275	11	7	2 873
2001	61	86	148	0	850	417	1 267	114	74	14	25	7	6	105	21	126	-	-	730	184	53	150	101	251	11	13	3 016
2002	49	99	148	0	770	249	1 019	118	90	7	20	8	5	81	12	94	-	-	682	161	81	118	73	191	11	9	2 636
2003	60	81	141	0	708	363	1 071	107	99	11	15	10	4	63	15	75	-	-	551	89	56	122	71	193	13	7	2 432
2004	68	94	161	0	577	207	784	82	111	18	13	7	4	32	7	39	-	-	489	111	48	159	88	247	19	7	2 133
2005	56	83	139	0	581	307	888	82	129	21	9	6	8	31	16	47	-	-	422	97	52	126	91	217	11	13	2 133
2006	55	82	137	0	671	261	932	91	93	17	8	6	2	38	29	67	-	-	326	80	28	118	75	193	13	11	1 999
2007	49	63	112	0	627	140	767	63	93	36	6	10	3	52	6	59	-	-	85	67	30	100	71	171	11	9	1 511
2008	57	100	157	0	637	170	807	73	132	69	8	10	9	65	6	71	-	-	89	64	21	110	51	161	12	9	1 680
2009	52	74	126	0	460	135	595	71	122	44	7	10	8	25	13	38	-	-	68	54	16	83	37	121	5	2	1 278
2010	53	100	153	0	458	184	642	88	124	36	9	13	13	37	13	49	-	-	99	109	12	111	69	180	10	2	1 525
2011	69	110	179	0	556	140	696	89	98	30	20	19	13	29	15	44	-	-	87	136	10	126	33	159	11	7	1 579
2012	52	74	126	0	534	162	696	82	50	20	21	9	12	31	33	64	-	-	88	58	9	84	40	124	10	8	1 368
2013	66	72	138	0	358	117	475	78	116	31	10	4	11	32	14	46	-	-	87	84	4	74	45	119	11	4	1 217
2014	41	77	118	0	319	171	490	81	51	18	24	6	9	31	26	58	-	-	56	54	5	58	26	84	12	6	1 071
2015	54	86	140	0	430	153	583	80	94	31	9	7	9	32	13	45	-	-	63	68	3	39	29	68	16	5	1 222
2016	56	79	135	0	495	117	612	56	87	31	6	3	9	37	14	51	-	-	58	86	5	18	8	27	6	5	1 177
Average																											
2011-2015	56	84	140	0	439	149	588	82	82	26	17	9	11	31	20	52	-	-	76	80	6	76	34	111	12	6	1291
2006-2015	55	84	139	0	505	163	668	80	97	33	12	9	9	37	17	54	-	-	105	77	14	90	48	138	11	6	1445

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

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, 1991–2016. Figures for 2016 are provisional.

Year	Canada [4]		USA		Iceland		Russia [1]		UK (E&W)		UK (Scotland)		Ireland		UK (N Ireland) [2]		Denmark		Sweden		Norway [3]	
	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch	Total	% of total rod catch
1991	22 167	28	239	50			3 211	51														
1992	37 803	29	407	67			10 120	73														
1993	44 803	36	507	77			11 246	82	1 448	10												
1994	52 887	43	249	95			12 056	83	3 227	13	6 595	8										
1995	46 029	46	370	100			11 904	84	3 189	20	12 151	14										
1996	52 166	41	542	100	669	2	10 745	73	3 428	20	10 413	15										
1997	50 009	50	333	100	1 558	5	14 823	87	3 132	24	10 965	18										
1998	56 289	53	273	100	2 826	7	12 776	81	4 378	30	13 464	18										
1999	48 720	50	211	100	3 055	10	11 450	77	4 382	42	14 846	28										
2000	64 482	56	0	-	2 918	11	12 914	74	7 470	42	21 072	32										
2001	59 387	55	0	-	3 611	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	29 170	55										
2004	62 316	57	0	-	7 362	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	46 165	55	2 553	12			606	27				
2006	60 486	62	1	100	8 735	19	33 380	82	10 959	56	47 669	55	5 409	22	302	18	794	65				
2007	41 192	58	3	100	9 691	18	44 341	90	10 917	55	55 660	61	15 113	44	470	16	959	57				
2008	54 887	53	61	100	17 178	20	41 881	86	13 035	55	53 347	62	13 563	38	648	20	2 033	71			5 512	5
2009	52 151	59	0	-	17 514	24			9 096	58	48 418	67	11 422	39	847	21	1 709	53			6 696	6
2010	55 895	53	0	-	21 476	29	14 585	56	15 012	60	78 357	70	15 142	40	823	25	2 512	60			15 041	12
2011	71 358	57	0	-	18 593	32			14 406	62	64 813	73	12 688	38	1 197	36	2 153	55			14 303	12
2012	43 287	57	0	-	9 752	28	4 743	43	11 952	65	63 370	74	11 891	35	5 014	59	2 153	55			18 611	14
2013	50 630	59	0	-	23 133	34	3 732	39	10 458	70	54 003	80	10 682	37	1 507	64	1 932	57			15 953	15
2014	41 613	54	0	-	13 616	41	8 479	52	7 992	78	37 270	82	6 537	37	1 065	50	1 918	61	445	15	20 281	19
2015	65 440	64	0	-	21 914	31	7 028	50	8 113	79	46 827	84	9 383	37	61	100	2 989	70	725	19	25 433	19
2016	69 590	65	0	-	16 643	29	10 793	76	9 192	80	49 469	90	10 280	41	230	100	3 801	72	345	18	25 198	21
5-yr mean 2011-2015	54 466	58			17 402	33	5 996	46	10 584	71	53 257	78	10 236	37	1 769	62	2 229	60			18 916	16
% change on 5-year mean	28	12			-4	-11	80	65	-13	13	-7	15	0	11			71	21			33	32

Key:

[1] Since 2009 data are either unavailable or incomplete, however catch-and-release is understood to have remained at similar high levels as before.

[2] Data for 2006-2009, 2014 is for the DCAL area only; the figures from 2010 are a total for UK (N.Ireland). Data for 2015 and 2016 is for R. Bush only.

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

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

Table 2.1.3.1. Estimates of unreported catches (tonnes round fresh weight) by various methods within national EEZs in the Northeast Atlantic, North American and West Greenland Commissions of NASCO, 1987–2016.

Year	North-East Atlantic	North-America	West Greenland	Total
1987	2 554	234	-	2 788
1988	3 087	161	-	3 248
1989	2 103	174	-	2 277
1990	1 779	111	-	1 890
1991	1 555	127	-	1 682
1992	1 825	137	-	1 962
1993	1 471	161	< 12	1 644
1994	1 157	107	< 12	1 276
1995	942	98	20	1 060
1996	947	156	20	1 123
1997	732	90	5	827
1998	1 108	91	11	1 210
1999	887	133	12,5	1 032
2000	1 135	124	10	1 269
2001	1 089	81	10	1 180
2002	946	83	10	1 039
2003	719	118	10	847
2004	575	101	10	686
2005	605	85	10	700
2006	604	56	10	670
2007	465	-	10	475
2008	433	-	10	443
2009	317	16	10	343
2010	357	26	10	393
2011	382	29	10	421
2012	363	31	10	403
2013	272	24	10	306
2014	256	21	10	287
2015	298	17	10	325
2016	298	27	10	335
Mean 2011-2015	314	24	10	349

Notes:
There were no estimates available for Canada in 2007-08 and estimates for 2009-10 are incomplete.
No estimates have been available for Russia since 2008.
Unreported catch estimates are not provided, Spain and St. Pierre et Miquelon.
No estimates were available for France for 2016.

Table 2.1.3.2. Estimates of unreported catches by various methods in tonnes by country within national EEZs in the Northeast Atlantic, North American and West Greenland Commissions of NASCO, 2016.

Commission Area	Country	Unreported Catch t	Unreported as % of Total North Atlantic Catch (Unreported + Reported)	Unreported as % of Total National Catch (Unreported + Reported)
NEAC	Denmark	6	0,4	40
NEAC	Finland	6	0,4	10
NEAC	Iceland	3	0,2	2
NEAC	Ireland	6	0,4	9
NEAC	Norway	263	18,8	30
NEAC	Sweden	1	0,1	10
NEAC	UK (E & W)	10	0,7	11
NEAC	UK (N.Ireland)	0	0,0	6
NEAC	UK (Scotland)	3	0,2	10
NAC	USA	0	0,0	0
NAC	Canada	27	2,0	17
WGC	Greenland	10	0,7	27
	Total Unreported Catch *	335	21,7	
	Total Reported Catch of North Atlantic salmon	1 209		

* No unreported catch estimate available for France and Russia in 2016.
Unreported catch estimates not provided for Spain & St. Pierre et Miquelon

Table 2.2.1.1. Production of farmed salmon in the North Atlantic area and in areas other than the North Atlantic (in tonnes round fresh weight), 1980–2016.

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	Total	Total
1980	4 153	598	0	11	21	0	0	0	0	4 783	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	9 611
1982	10 266	2 152	70	38	100	0	0	0	0	12 626	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	19 972
1984	22 300	3 912	120	227	385	0	0	0	0	26 944	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	37 196
1986	45 675	10 337	1 370	672	1 215	0	123	0	0	59 392	0	11	0	10	0	0	59 392
1987	47 417	12 721	3 530	1 334	2 232	365	490	0	0	68 089	41	196	0	62	0	299	68 388
1988	80 371	17 951	3 300	3 542	4 700	455	1 053	0	0	111 372	165	925	0	240	0	1 330	112 702
1989	124 000	28 553	8 000	5 865	5 063	905	1 480	0	0	173 866	1 860	1 122	1 000	1 750	0	5 732	179 598
1990	165 000	32 351	13 000	7 810	5 983	2 086	2 800	<100	5	229 035	9 478	696	1 700	1 750	300	13 924	242 959
1991	155 000	40 593	15 000	9 395	9 483	4 560	2 680	100	0	236 811	14 957	1 879	3 500	2 653	1 500	24 489	261 300
1992	140 000	36 101	17 000	10 380	9 231	5 850	2 100	200	0	220 862	23 715	4 238	6 600	3 300	680	38 533	259 395
1993	170 000	48 691	16 000	11 115	12 366	6 755	2 348	<100	0	267 275	29 180	4 254	12 000	3 500	791	49 725	317 000
1994	204 686	64 066	14 789	12 441	11 616	6 130	2 588	<100	0	316 316	34 175	4 834	16 100	4 000	434	59 543	375 859
1995	261 522	70 060	9 000	12 550	11 811	10 020	2 880	259	0	378 102	54 250	4 868	16 000	6 192	654	81 964	460 066
1996	297 557	83 121	18 600	17 715	14 025	10 010	2 772	338	0	444 138	77 327	5 488	17 000	7 647	193	107 655	551 793
1997	332 581	99 197	22 205	19 354	14 025	13 222	2 554	225	0	503 363	96 675	5 784	28 751	7 648	50	138 908	642 271
1998	361 879	110 784	20 362	16 418	14 860	13 222	2 686	114	0	540 325	107 066	2 595	33 100	7 069	40	149 870	690 195
1999	425 154	126 686	37 000	23 370	18 000	12 246	2 900	234	0	645 590	103 242	5 512	38 800	9 195	0	156 749	802 339
2000	440 861	128 959	32 000	33 195	17 648	16 461	2 600	250	0	671 974	166 897	6 049	49 000	10 907	0	232 853	904 827
2001	436 103	138 519	46 014	36 514	23 312	13 202	2 645	-	0	696 309	253 850	7 574	68 000	12 724	0	342 148	1 038 457
2002	462 495	145 609	45 150	40 851	22 294	6 798	1 471	-	0	724 668	265 726	5 935	84 200	14 356	0	370 217	1 094 885
2003	509 544	176 596	52 526	38 680	16 347	6 007	3 710	-	300	803 710	280 301	10 307	65 411	15 208	0	371 227	1 174 937
2004	563 914	158 099	40 492	37 280	14 067	8 515	6 620	-	203	829 190	348 983	6 645	55 646	16 476	0	427 750	1 256 940
2005	586 512	129 588	18 962	45 891	13 764	5 263	6 300	-	204	806 484	385 779	6 110	63 369	16 780	0	472 038	1 278 522
2006	629 888	131 847	11 905	47 880	11 174	4 674	5 745	-	229	843 342	376 476	5 811	70 181	20 710	0	473 178	1 316 520
2007	744 222	129 930	22 305	36 368	9 923	2 715	1 158	-	111	946 732	331 042	7 117	70 998	25 336	0	434 493	1 381 225
2008	737 694	128 606	36 000	39 687	9 217	9 014	330	-	51	960 599	388 847	7 699	73 265	25 737	0	495 548	1 456 147
2009	862 908	144 247	51 500	43 101	12 210	6 028	742	-	2 126	1 122 862	233 308	7 923	68 662	29 893	0	339 786	1 462 648
2010	939 575	154 164	45 391	43 612	15 691	11 127	1 068	-	4 500	1 215 128	123 233	8 408	70 831	31 807	0	234 279	1 449 407
2011	1 065 974	158 018	60 473	41 448	12 196	6 031	1 083	-	8 500	1 353 723	264 349	7 467	83 144	36 662	0	391 622	1 745 345
2012	1 232 095	162 223	76 564	52 951	12 440	-	2 923	-	8 754	1 547 950	399 678	8 696	79 981	43 982	0	532 337	2 080 287
2013	1 168 324	163 234	75 821	47 649	9 125	-	3 018	-	16 097	1 483 268	492 329	6 834	74 673	42 776	0	616 612	2 099 880
2014	1 295 105	179 022	86 454	29 988	9 368	-	3 965	-	18 675	1 622 577	644 459	6 368	54 971	41 591	0	747 389	2 369 966
2015	1 236 577	171 722	66 090	48 684	13 116	-	3 260	-	3 232	1 542 681	608 546	-	92 926	48 330	0	749 802	2 292 483
2016	1 179 834	177 857	68 271	48 684	16 300	-	8 420	-	12 857	1 512 223	608 546	-	92 926	48 330	0	749 802	2 262 025
5-yr mean 2011-2015	1 199 615	166 844	73 080	44 144	11 249		2 850		11 052	1 510 040	481 872	7 341	77 139	42 668	0	607 552	2 117 592
% change on 5-year mean	-2	+7	-7	+10	+45		+195		+16	+0	+26		+20	+13		+23	+7

Notes: Data for 2016 are provisional for many countries.
Where production figures were not available for 2016, values as in 2015 were assumed.
West Coast USA = Washington State.
West Coast Canada = British Columbia.
Australia = Tasmania.
Source of production figures for non-Atlantic areas: http://www.fao.org/fishery/statistics/global-aquaculture-production/en
Data for UK (N. Ireland) since 2001 and data for East coast USA since 2012 are not publicly available.

Table 2.2.2.1. Production of ranched salmon in the North Atlantic (tonnes round fresh weight), 1980–2016.

Year	Iceland (1)	Ireland (2)	UK(N.Ireland) River Bush (2,3)	Sweden (2)	Norway various facilities (2)	Total production
1980	8,0			0,8		9
1981	16,0			0,9		17
1982	17,0			0,6		18
1983	32,0			0,7		33
1984	20,0			1,0		21
1985	55,0	16,0	17,0	0,9		89
1986	59,0	14,3	22,0	2,4		98
1987	40,0	4,6	7,0	4,4		56
1988	180,0	7,1	12,0	3,5	4,0	207
1989	136,0	12,4	17,0	4,1	3,0	172
1990	285,1	7,8	5,0	6,4	6,2	310
1991	346,1	2,3	4,0	4,2	5,5	362
1992	462,1	13,1	11,0	3,2	10,3	500
1993	499,3	9,9	8,0	11,5	7,0	536
1994	312,8	13,2	0,4	7,4	10,0	344
1995	302,7	19,0	1,2	8,9	2,0	334
1996	243,0	9,2	3,0	7,4	8,0	271
1997	59,4	6,1	2,8	3,6	2,0	74
1998	45,5	11,0	1,0	5,0	1,0	64
1999	35,3	4,3	1,4	5,4	1,0	47
2000	11,3	9,3	3,5	9,0	1,0	34
2001	13,9	10,7	2,8	7,3	1,0	36
2002	6,7	6,9	2,4	7,8	1,0	25
2003	11,1	5,4	0,6	9,6	1,0	28
2004	18,1	10,4	0,4	7,3	1,0	37
2005	20,5	5,3	1,7	6,0	1,0	35
2006	17,2	5,8	1,3	5,7	1,0	31
2007	35,5	3,1	0,3	9,7	0,5	49
2008	68,6	4,4	-	10,4	0,5	84
2009	44,3	1,1	-	9,9	-	55
2010	42,3	2,5	-	13,0	-	58
2011	30,2	2,5	-	19,1	-	52
2012	20,0	5,3	-	8,9	-	34
2013	30,7	2,8	-	4,2	-	38
2014	17,9	2,8	-	6,2	-	27
2015	31,4	4,6	-	6,6	-	43
2016	31,1	3,0	-	3,1	-	37
5-yr mean 2011-2015	26,0	3,6		9,0		39
% change on 5-year mean	19	-17		-66		-4

1 From 1990 to 2000, catch includes fish ranched for both commercial and angling purposes. No commercial ranching since 2000.
2 Total yield in homewater fisheries and rivers.
3 The proportion of ranched fish was not assessed between 2008 and 2016 due to a lack of microtag returns.

Table 2.4.1. Overview of number of case studies and Database on Effectiveness of Recovery Actions for Atlantic Salmon (DBERAAS) river stock entries per nation.

Country	Region	Number rivers DBERAAS	Number Case Studies
Iceland	N/S NEAC	84	0
Faroe Islands	N NEAC	0	0
Norway	N NEAC	0	1
Sweden	N NEAC/HELCOM	77	1
Russian Federation	N NEAC/HELCOM	0	1
Finland	N NEAC/HELCOM	69	1
Poland	HELCOM	0	0
Lithuania	HELCOM	0	0
Estonia	HELCOM	12	0
Denmark	N NEAC/HELCOM	9	0
Germany	S NEAC/HELCOM	4	1
France	S NEAC	0	2
Spain	S NEAC	10	0
Ireland	S NEAC	148	4
UK (England & Wales)	S NEAC	93	2
UK (Scotland)	S NEAC	0	0
UK (Northern Ireland)	S NEAC	19	0
Canada	NAC	0	1
USA	NAC	43	1
Greenland	WGC	0	0
Total		568	15

Table 2.5.1.1. Summary of key prey items in diets of salmon in the Northwest Atlantic.

Marine Phase	Key Prey	
	Shallow	Deep
Post-smolt – nearshore	Atlantic herring Capelin	Amphipods Euphausiids
Post-smolt – Labrador Sea	Capelin	Amphipods Armhook squid
1SW maturing/non-maturing – Labrador Sea	Sandlance	Barricudina
1SW non-maturing – Greenland	Capelin	Amphipods Armhook squid
1SW/2SW mature/maturing – nearshore	Atlantic herring Capelin	-
Kelt	-	-

Table 2.5.2.1. Atlantic salmon prey item list compiled from Rikardsen *et al.*, 2004. • • • • =very important prey (>50%W if taken), • • • =prey often found in stomachs and important if less energy rich prey is assumed not available, •• =occasionally found, but in low abundance, •=rare (<1%W) and-= not reported.

Prey organism	Post-smolts estuaries	Post-smolts Fjord and coast	Post-smolt oceanic	Pre-adults / adults oceanic
Pisces				
Ammodytidae (Sandeel)	***	****	****	****
Herring *(Clupea harengus)*	***	****	****	****
Other Clupeoids	-	-	-	**
Capelin *(Malotus villosus)*	-	***	***	****
Gadidae (Cod fish)	***	***	***	***
Atlantic cod *(Gadus morhua)*	**	***	**	**
Saithe *(Pollachius virens)*	**	***	**	*
Blue whiting *(Micromesistius poutassou)*	-	-	***	**
Other Gadidae	-	-	**	**
Myctophidae (Lanternfish)	-	-	**	****
Paralepididae/Barracudinas (2)	-	-	-	***
Perlside	-	-	*	***
Scorpaenidae (Red-fish)	-	-	*	*
Gasterosteidae (Stickleback)	*	-	-	*
Scombridae (Mackerel, *Scomber scomber)*	-	-	-	*
Anarhichadidae (Wolf-fish fry)	-	-	-	*
Belonidae (Garpike)	-	-	-	*
Pleuronedidae (Flattish)	-	-	-	*
Osmeridae	-	-	-	*
Cyclopteridae (Lumpfish)	-	-	-	*
Stichaeidae	-	-	-	*
Cottidae (Sculpins fry)	-	-	-	*
Cottunculidae	-	-	-	*
Agonidae	-	-	-	*
Crustacea				
Copepodaisopoda	**	**	**	*
Amphipoda - planktonic (Hyperiidae)	**	***	***	****
Amphipoda - Bentic (Gammaridae)	***	**	-	-
lsopoda	*	*	*	*
Mysidacea (Mysids)	-	*		
Euphausiacea (Euphausids)	*	**	**	***
Decapoda - Plantonic larvae	*	*	*	*
Decapoda - Shrimps	-	-	*	***
Other crustacean	-	*	*	*
Mollusca - Cephalopoda (Squids)	-	-	*	**

Prey organism	Post-smolts estuaries	Post-smolts Fjord and coast	Post-smolt oceanic	Pre-adults / adults oceanic
Mollusca - Gastropods (sea slugs)	-	*	*	*
Mollusca - Bivalvia (pelagic)	-	-	-	*
Insecta	****	****	*	*
Polychaetea	*	*	*	*
Chaetognatha (Arrow worm)	-	*	-	*

Table 2.5.2.2. Atlantic salmon prey item list compiled from two publications (Rikardsen *et al.*, 2004; Hvidsten *et al.*, 2009). Each 'x' represents a report of the given prey in stomachs of post-smolts captured during their fjord migration.

Number of publications	2		
Number of fjords	8		
Number of salmon sampled	1802		
Prey item			
Insects			x
Spiders (Aracnida)			x
Arrow worms (Chaetognatha)			x
Polychaeta			x
Mollusca (sea slugs)			x
Crustaceans			
	Euphasiidae (krill)		x
		Meganyctiphanes norvegica (Northern krill)	x
	Copepodaisopoda		x
	Isopoda		x
	Ampipoda		x
		Hyperiidae	x
		Gammaridae	x
	Dekapoda		x
Fish			
		Sandeels (*Ammodytes* spp.)	x
		Herring (*Clupea harengus*)	x
	Gadidae		x
		Cod (*Gadus morhua*)	x
		Pollachius spp.	x

Table 2.9.1. Summary of Atlantic salmon tagged and marked in 2016 - 'Hatchery' and 'Wild' juvenile refer to smolts and parr.

		Primary Tag or Mark				
Country	Origin	Microtag	External mark[2]	Adipose clip	Other Internal[1]	Total
Canada	Hatchery Adult	0	2,557	0	1,521	**4,078**
	Hatchery Juvenile	0	305	202,027	45	**202,377**
	Wild Adult	0	3,197	35	79	**3,311**
	Wild Juvenile	0	20,093	20,737	590	**41,420**
	Total	**0**	**26,152**	**222,799**	**2,235**	**251,186**
Denmark	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	92,450	20,000	305,100	1,903	419,453
	Wild Adult	0	0	0	788	788
	Wild Juvenile	0	0	0	0	0
	Total	**92,450**	**20,000**	**305,100**	**2,691**	**420,241**
France [4]	Hatchery Adult					
	Hatchery Juvenile[3]					
	Wild Adult[3]					
	Wild Juvenile					
	Total					
Iceland	Hatchery Adult	0		0	0	0
	Hatchery Juvenile	47,345	0	0	0	47,345
	Wild Adult	0	79	0	0	79
	Wild Juvenile	6,052	9	0	0	6,061
	Total	**53,397**	**88**	**0**	**0**	**53,485**
Ireland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	185,891	0	0	0	185,891
	Wild Adult	0	0	0	0	0
	Wild Juvenile	6,639	0	0	0	6,639
	Total	**192,530**	**0**	**0**	**0**	**192,530**
Norway	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	22,445	6,958	0	40,797	70,200
	Wild Adult	0	1,003	0	0	1,003
	Wild Juvenile	0		0	2,638	2,638
	Total	**22,445**	**7,961**	**0**	**43,435**	**73,841**
Russia	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	1,461,482	0	1,461,482
	Wild Adult	0	1,524	0	0	1,524
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**1,524**	**1,461,482**	**0**	**1,463,006**
Spain	Hatchery Adult	0	0	0	0	**0**
	Hatchery Juvenile	0	92,393	0	0	**92,393**
	Wild Adult	0	0	0	0	**0**
	Wild Juvenile	0	0	0	0	**0**
	Total	**0**	**92,393**	**0**	**0**	**92,393**
Sweden	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	3100	164,931	0	168,031
	Wild Adult	0	381	0	0	381
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**3,481**	**164,931**	**0**	**168,412**
UK (England & Wales)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	11,647	0	11,647
	Wild Adult	0	514	0	2	516
	Wild Juvenile	5,722	0	6,121		11,843
	Total	**5,722**	**514**	**17,768**	**2**	**24,006**
UK (N. Ireland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	10,230	0	57,645	0	67,875
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**10,230**	**0**	**57,645**	**0**	**67,875**
UK (Scotland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	103,141	0	103,141
	Wild Adult	0	520	14	0	534
	Wild Juvenile	2,300	0	30	10,257	12,587
	Total	**2,300**	**520**	**103,185**	**10,257**	**116,262**
USA	Hatchery Adult	0	7	22	3,293	3,322
	Hatchery Juvenile	0	102,240	215,074	2,756	320,070
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**102,247**	**215,096**	**6,049**	**323,392**
All Countries	Hatchery Adult	0	2,564	22	4,814	7,400
	Hatchery Juvenile	358,361	224,996	2,521,047	45,501	3,149,905
	Wild Adult	0	7,218	49	869	8,136
	Wild Juvenile	20,713	20,102	26,888	13,485	81,188
	Total	**379,074**	**254,880**	**2,548,006**	**64,669**	**3,246,629**

[1] Includes other internal tags (PIT, ultrasonic, radio, DST, etc.); [2]Includes Carlin, spaghetti, streamers, VIE etc.; [3] includes external dye mark. [4] Tag information for France not available for 2016.

2.10 Figures

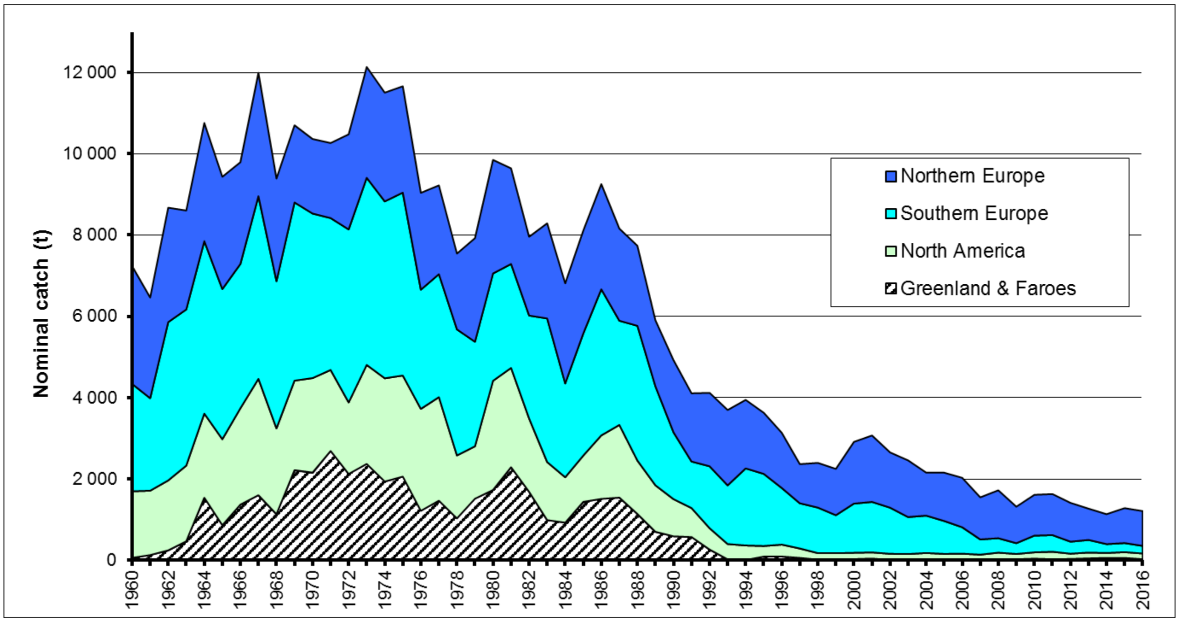


Figure 2.1.1.1.a. Total reported nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2016.

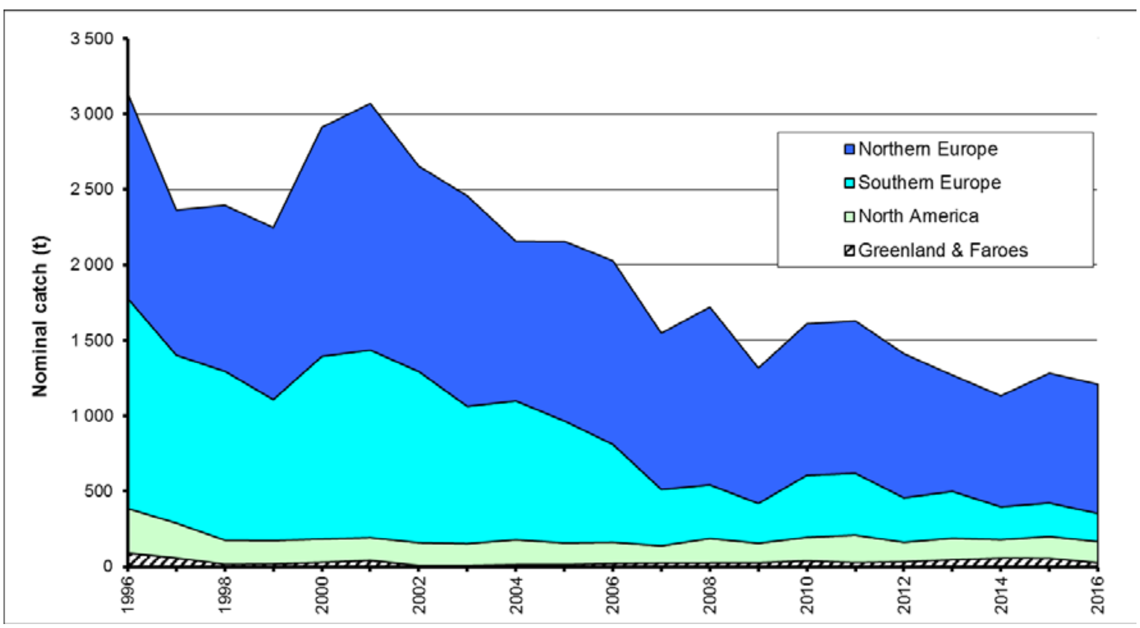


Figure 2.1.1.1.b. Total reported nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, 1995–2016.

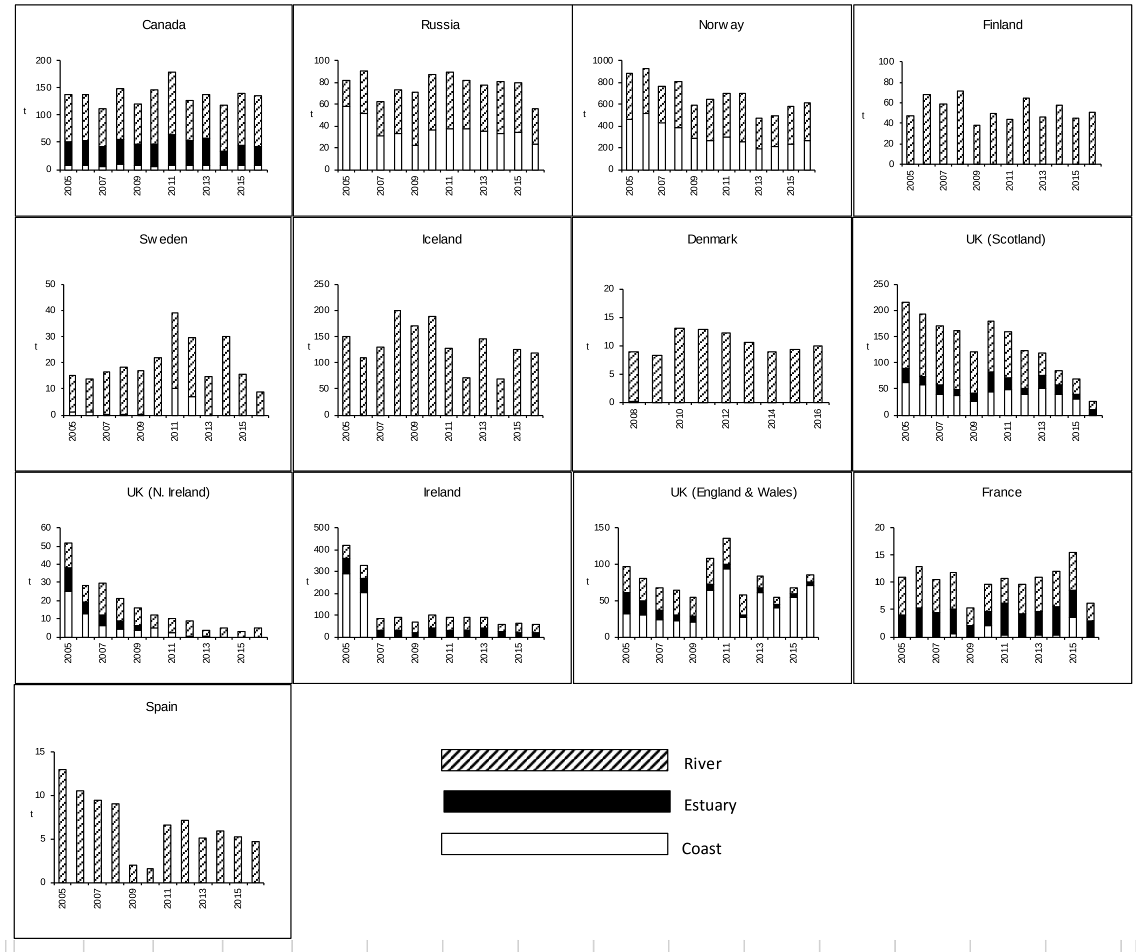


Figure 2.1.1.2. Nominal catch (tonnes) taken in coastal, estuarine and riverine fisheries by country (2005–2016). The way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries; see text for details. Note also that the y-axes scales vary.

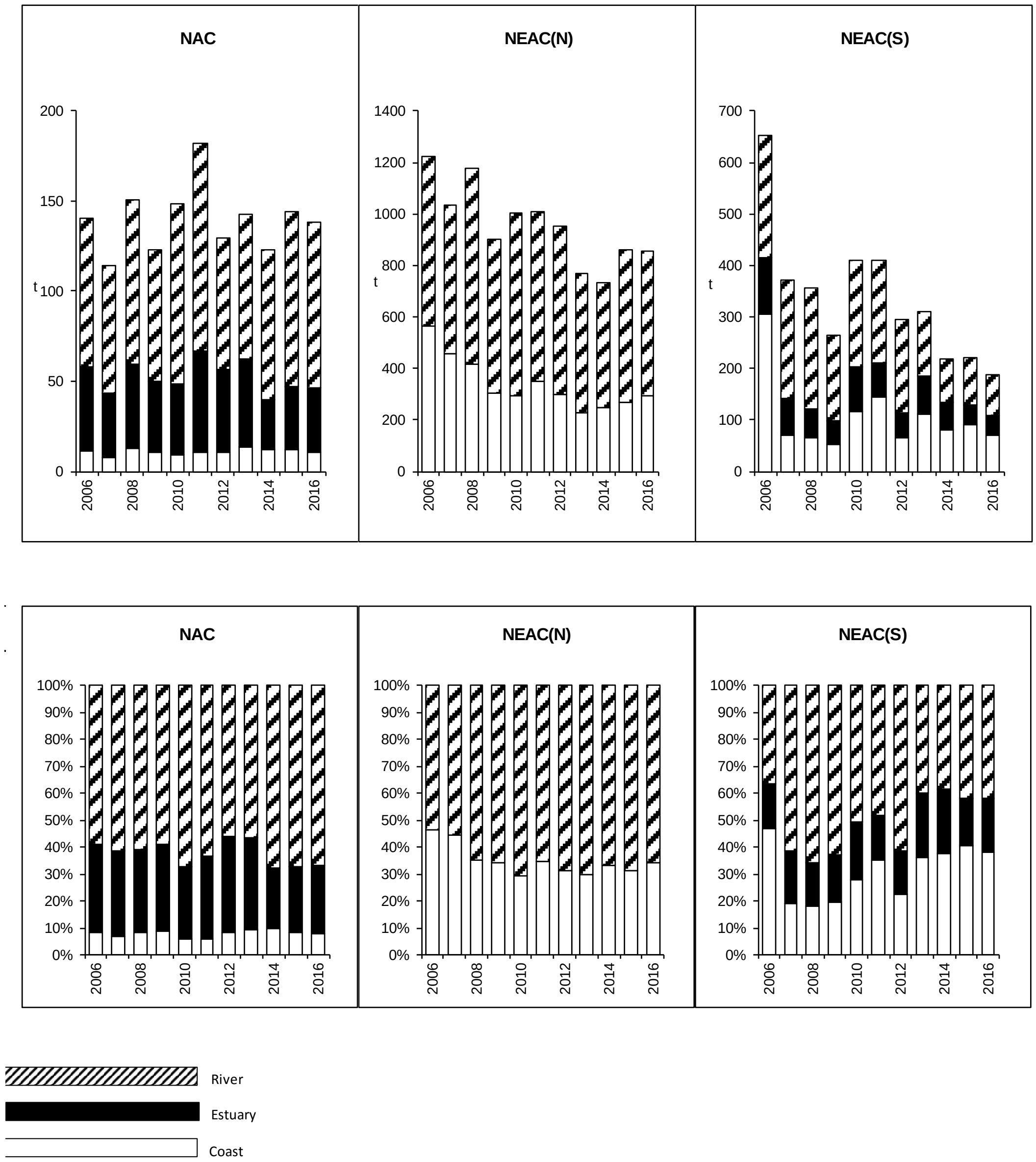


Figure 2.1.1.3. Nominal catches (tonnes) (upper panel) and percentages (lower panel) of nominal catch taken in coastal, estuarine and riverine fisheries for the NAC area (2006–2016) and for NEAC northern and southern areas (2006–2016). Note y-axes vary.

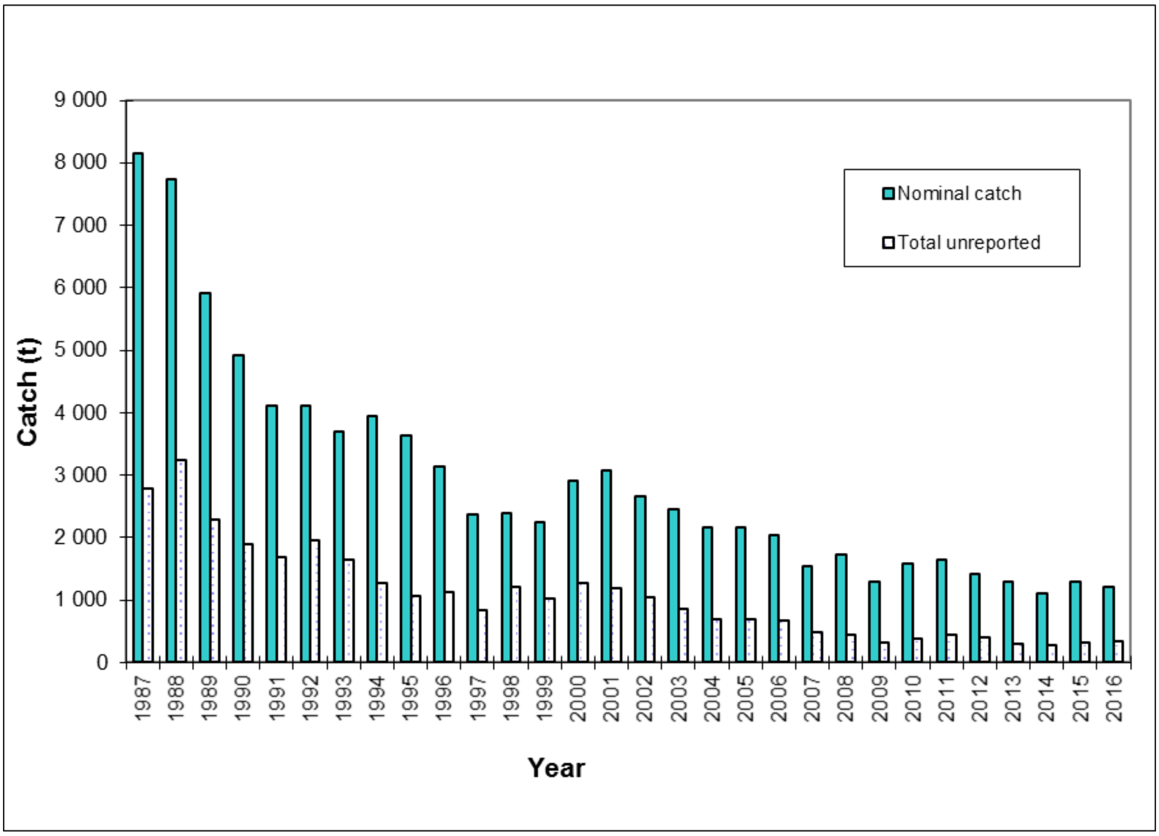


Figure 2.1.3.1. Nominal North Atlantic salmon catch and unreported catch in NASCO Areas, 1987–2016.

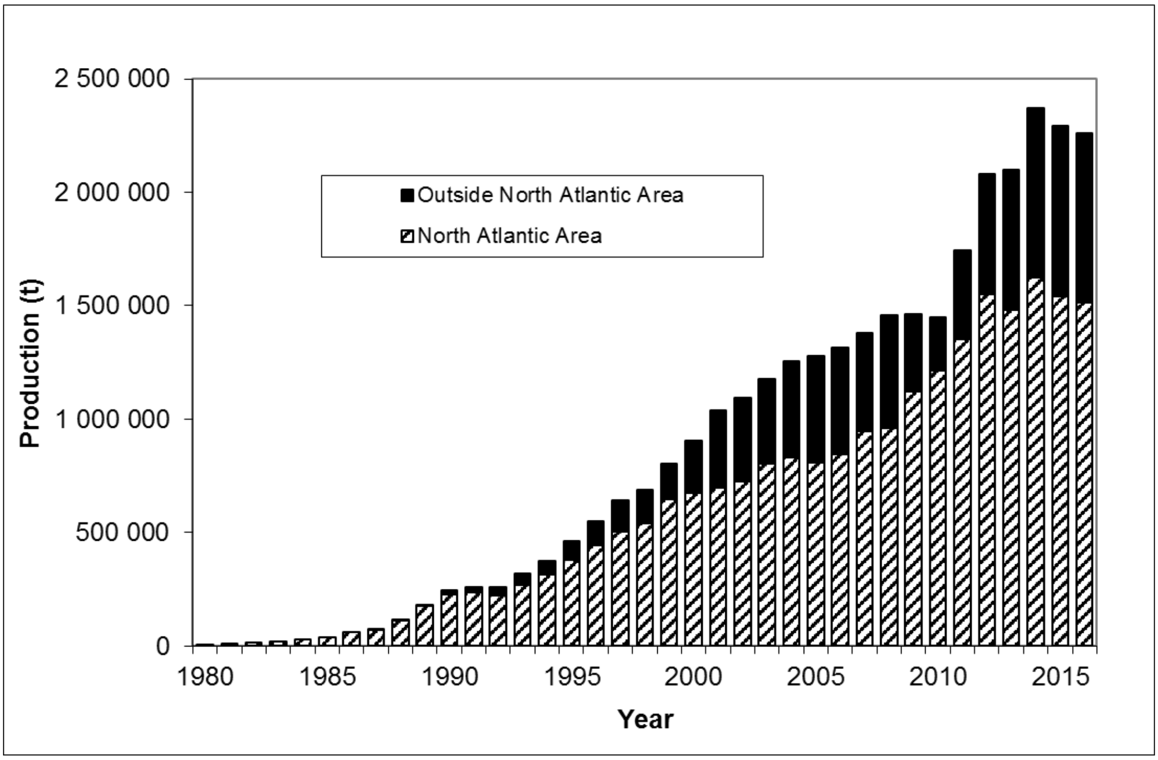


Figure 2.2.1.1. Worldwide farmed Atlantic salmon production, 1980–2016.

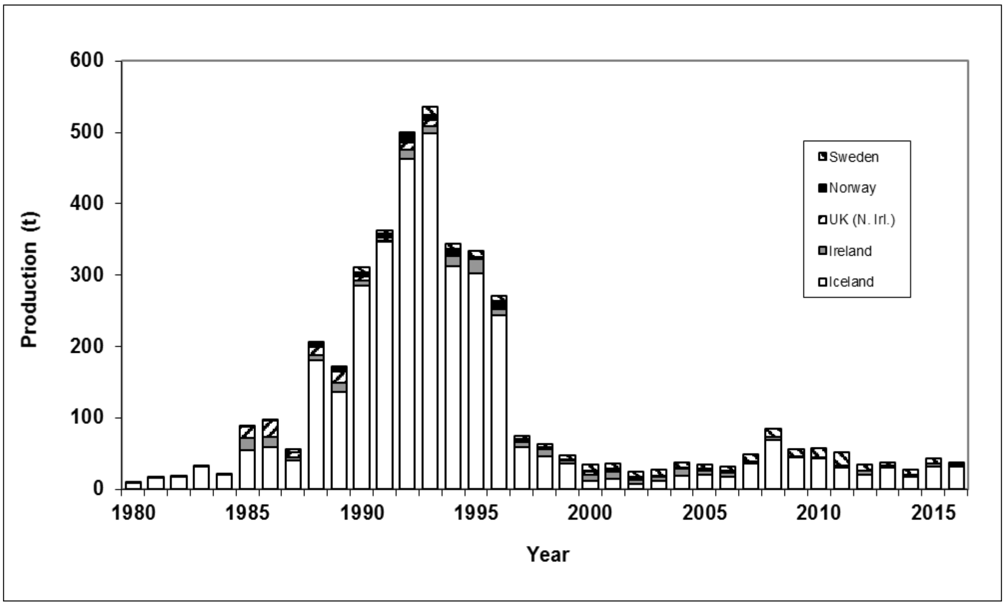


Figure 2.2.2.1. Production of ranched salmon (tonnes round fresh weight) in the North Atlantic, 1980–2016.

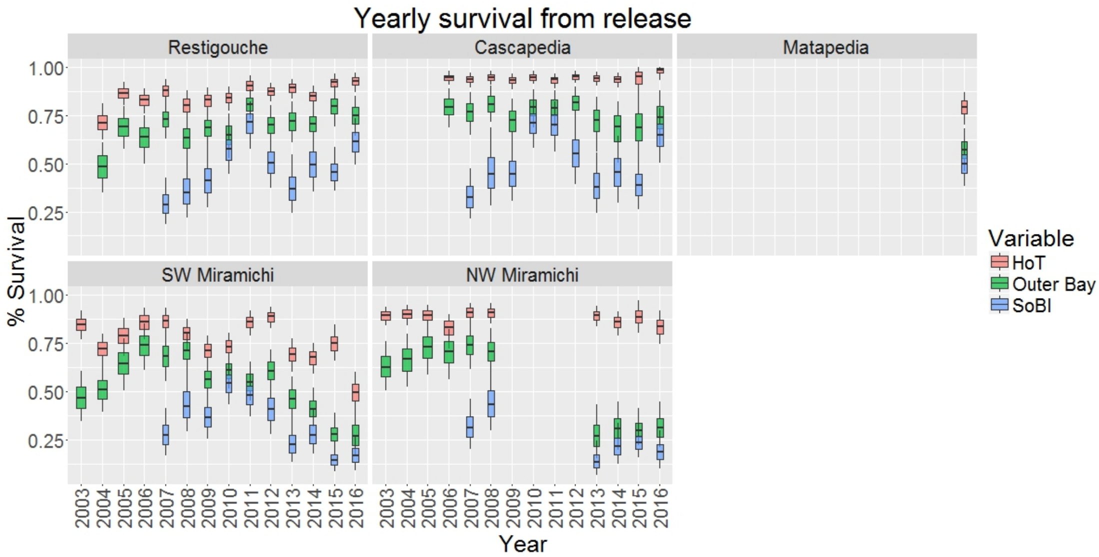


Figure 2.3.1.1. Survivals of acoustically tagged Atlantic salmon smolt to the Head of Tide (HoT), the Outer Bay and the Strait of Belle Isle (SoBI) from the Restigouche, Cascapedia, SW Miramichi, NW Miramichi rivers and to 2016, the Matapedia River (a Restigouche tributary).

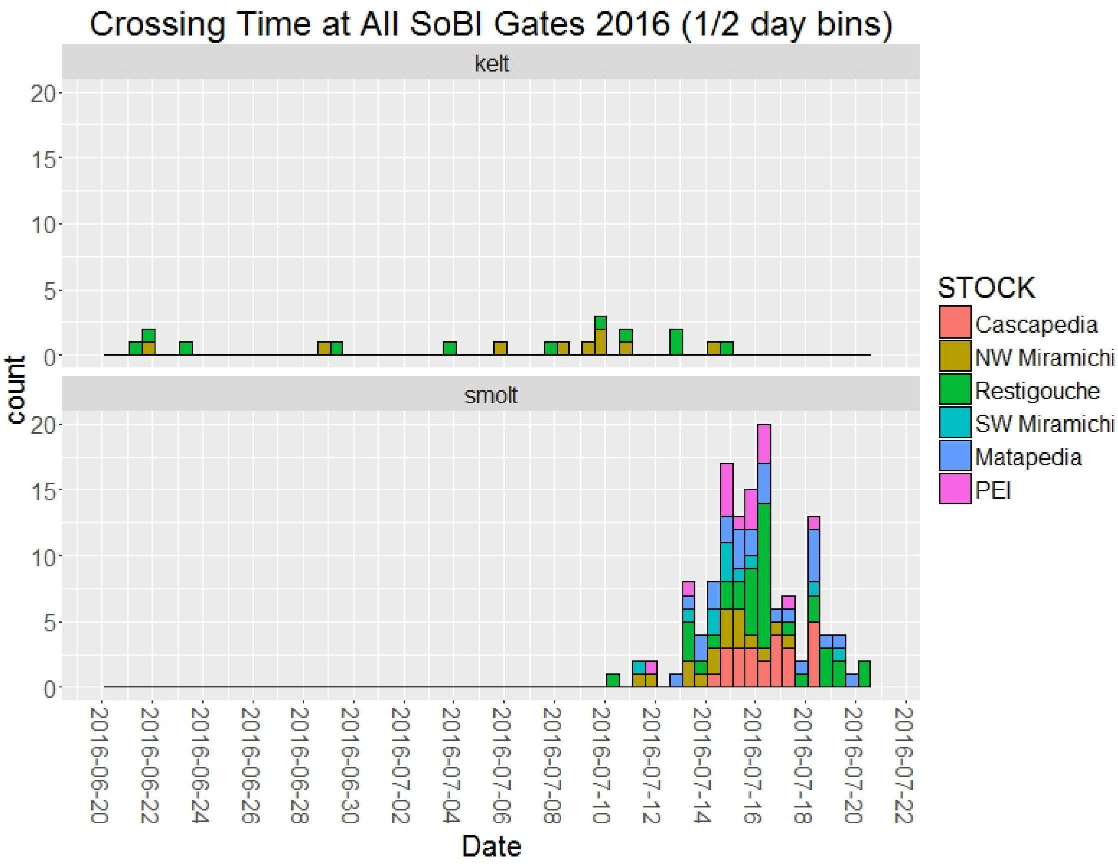


Figure 2.3.1.2 Counts and dates of acoustically tagged Atlantic salmon smolts and kelt from various Gulf of St Lawrence rivers crossing the Strait of Belle Isle receiver array in 2016.

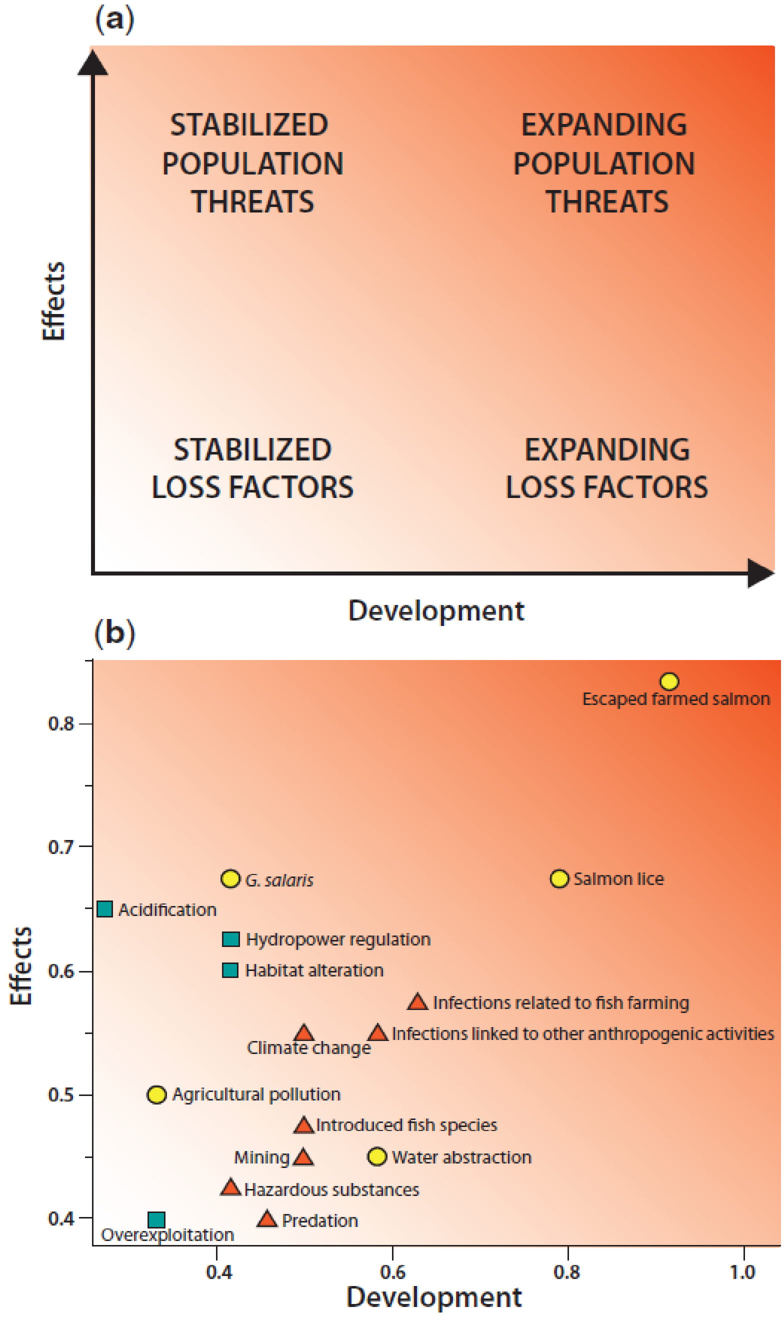


Figure 2.3.2.1 (a.) The classification system developed to rank different anthropogenic impacts on Norwegian Atlantic salmon populations along Effect and Development axes. The four major impact categories are indicated, but the system is continuous. Background colouring indicates severity of impacts, with dark as the most severe. (b) Location within the classification system of the 16 impact factors considered in 2015. For illustration, the information on each impact factor and the uncertainty of future development is indicated by the colour of the markers. Green squares = Extensive knowledge and small uncertainty, yellow circles = moderate knowledge and moderate uncertainty, and red triangles = poor knowledge and high uncertainty. Figure extracted from Forseth *et al.* (2017).

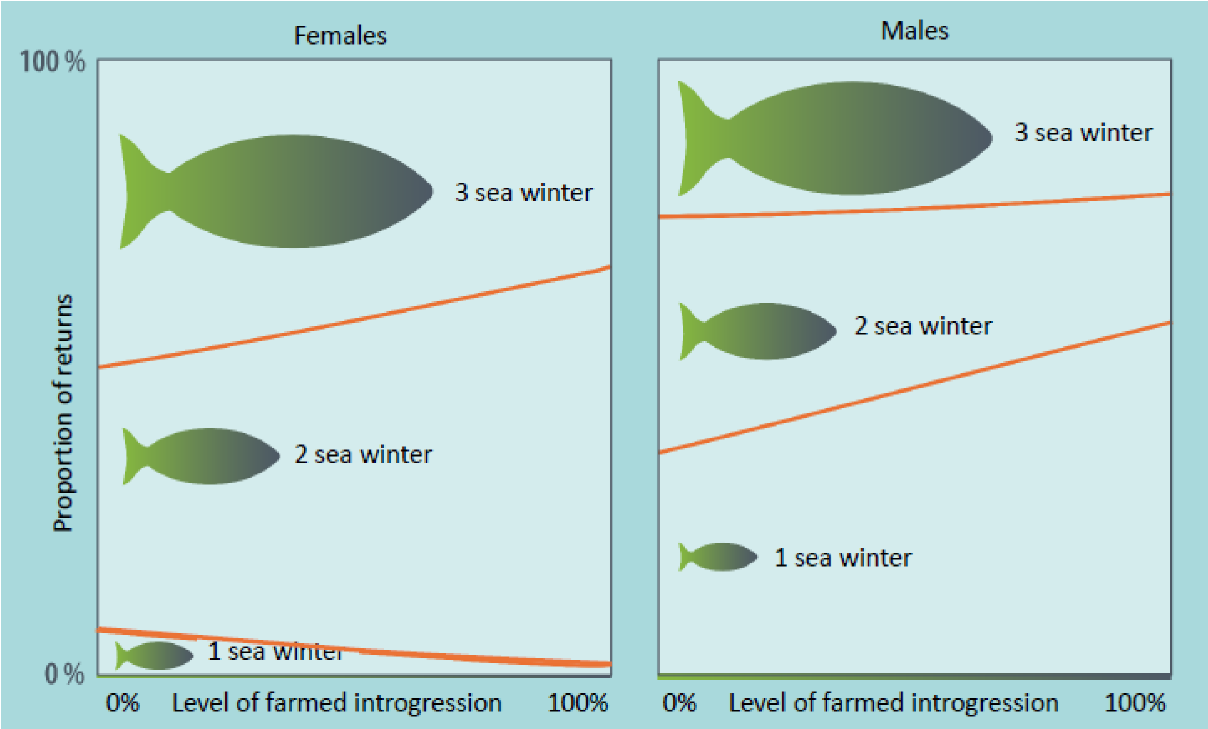


Figure 2.3.3.1. Changes in sea age distribution of returns with level of farmed introgression (farmed ancestry) in 22 rivers of the Eastern Atlantic phylogenetic, with large proportion of late maturing fish, distributed along the Norwegian coast.

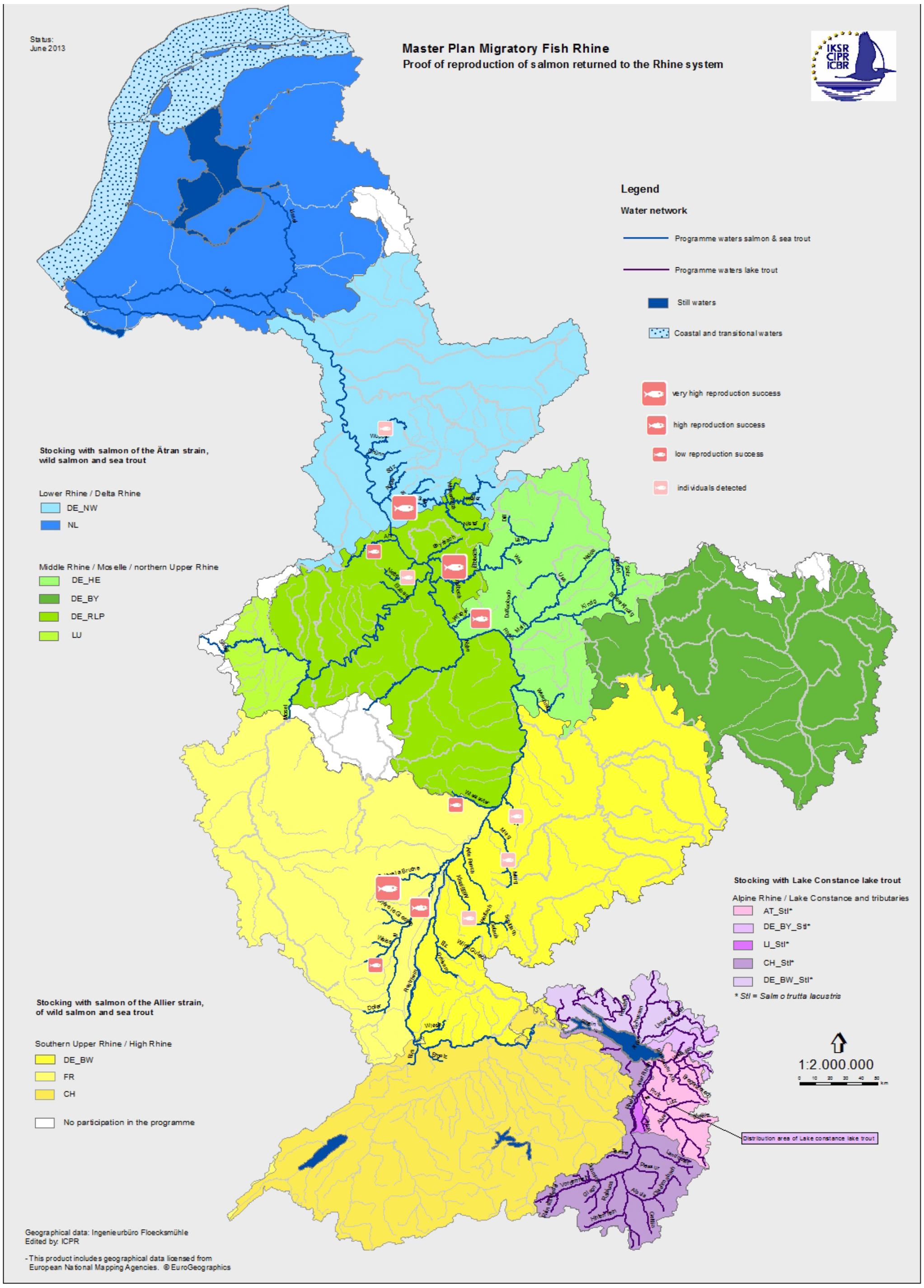


Figure 2.3.5.1. Reintroduction of salmon in the Rhine system: stocking origins and evidence of reproductive success of returning salmon (figure from ICPR, 2013).

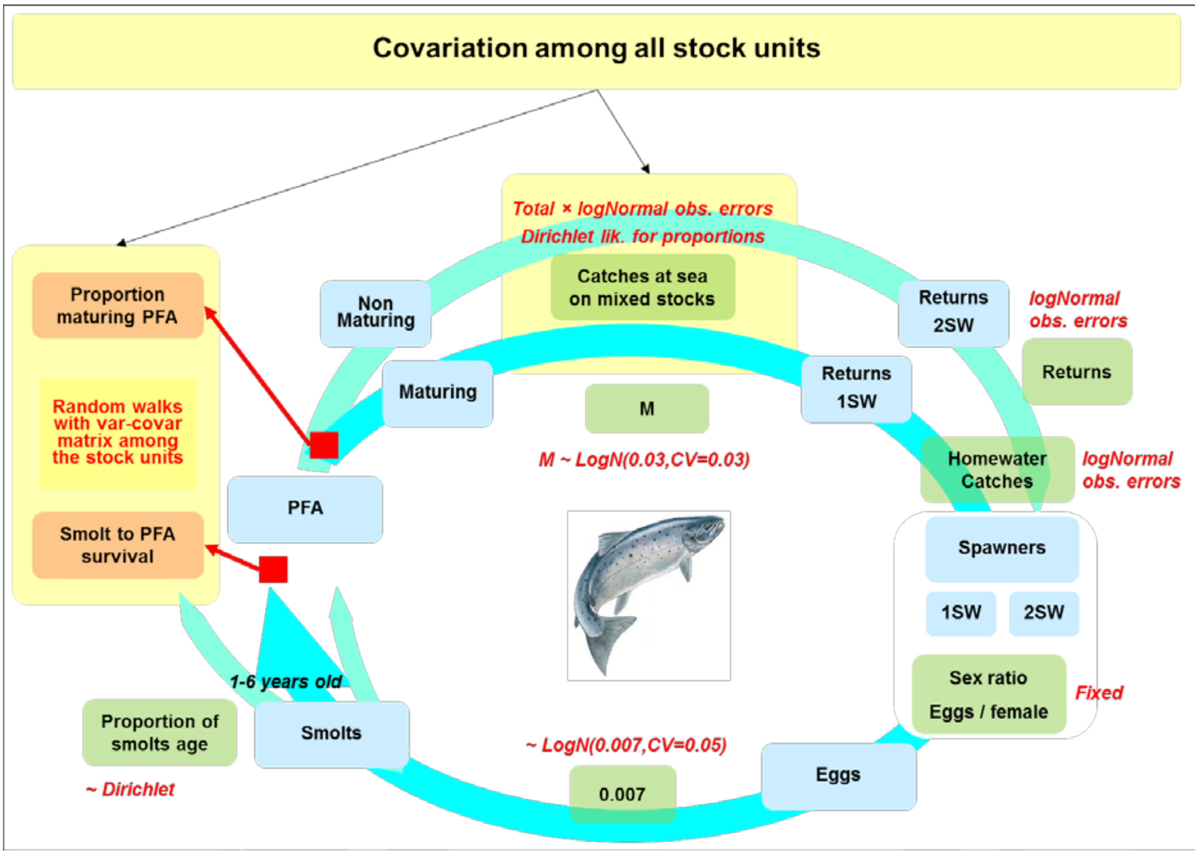


Figure 2.3.6.1. Scheme of the full life cycle model applied to the 13 stock units of North America and Southern NEAC. Variables in light grey are the main stages considered in the stage-structured model. Light green boxes are the main sources of data assimilated in the model. Observation errors are introduced in returns and catches at-sea as lognormal errors (variance of observation errors directly derived from the run-reconstruction). The smolt-to-PFA survival and the proportion of maturing PFA are estimated for the time-series (1971–2014) and modelled as a random walk with covariation among stock units. Yellow boxes indicate the location of the covariation among stock units.

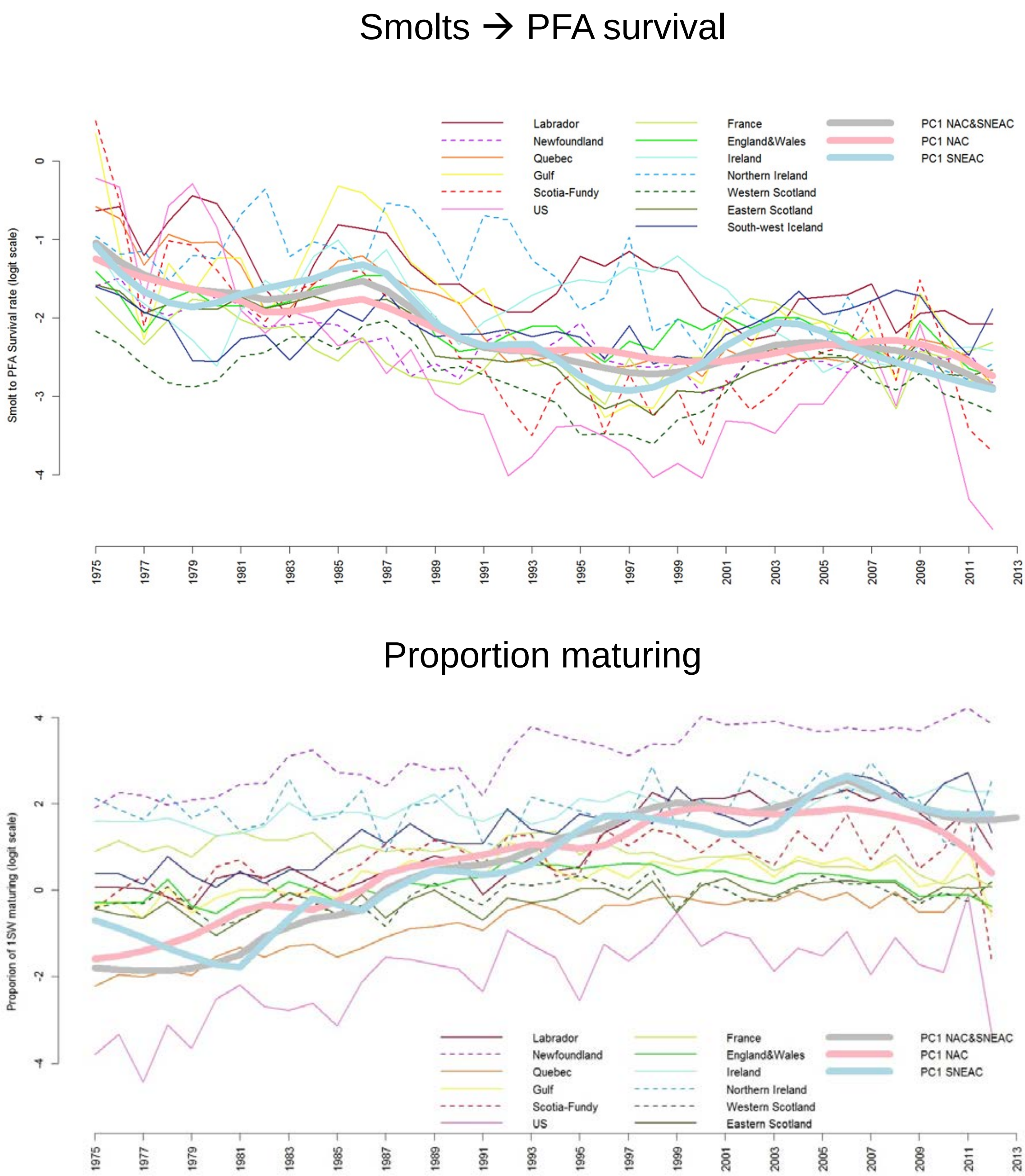


Figure 2.3.6.2. Time-series of estimates of smolt-to-PFA survival and proportion of maturing PFA, on the logit scale, for 13 stock units in North America and Southern NEAC. Thin lines: medians of marginal posterior distributions for the 13 stock units. Thick lines are the first principal components indicating global trends among the 13 stock units, and separately for stock units in NAC and Southern NEAC, on the range corresponding to logit range.

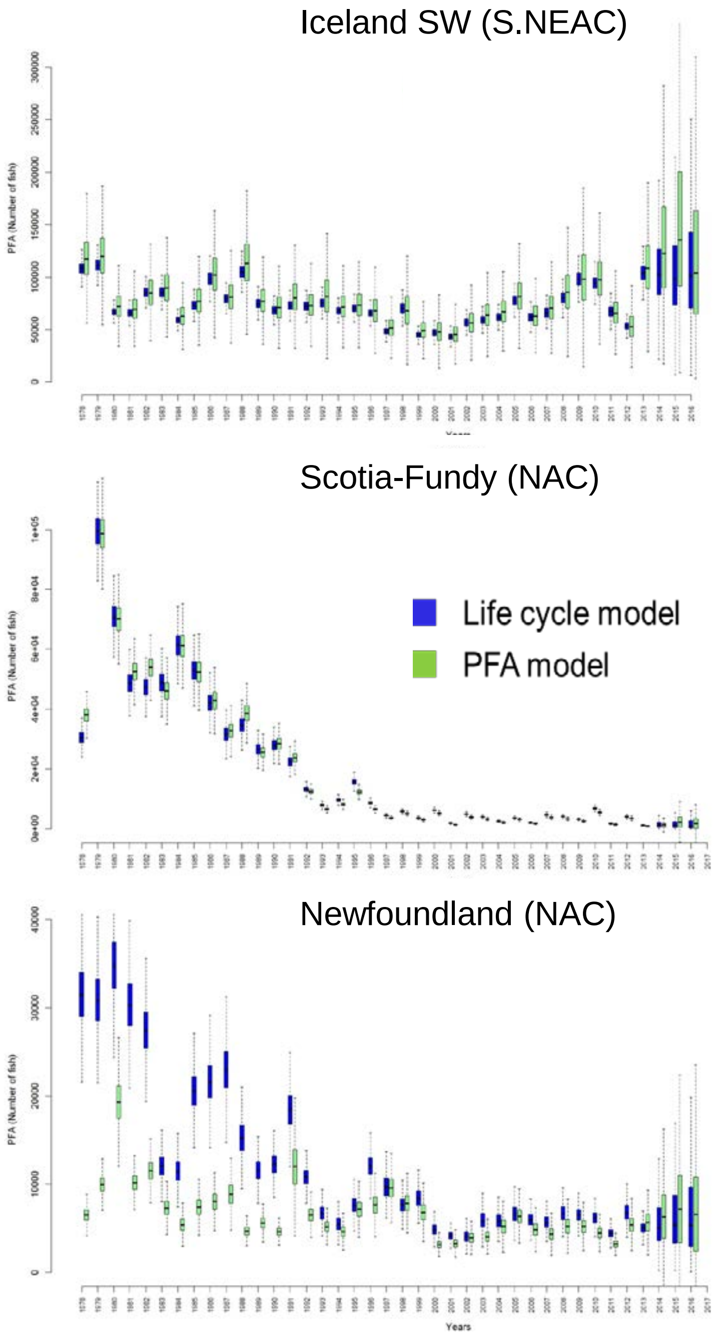


Figure 2.3.6.3. Comparison between the PFA estimates (non-maturing component of the PFA only) from the PFA and from the Bayesian life cycle model. Box plots are summary of marginal posterior distributions. Forecasting is presented for the last three years. Both methods provide very similar estimates of PFA for stock units in S.NEAC (here exemplified by Iceland), and for stock units in NAC with small proportion of 1SW fish in returns (here exemplified by Scotia-Fundy). Differences are higher for stock units with large proportion of 1SW in returns (here Newfoundland), with an average 90% of 1SW in returns.

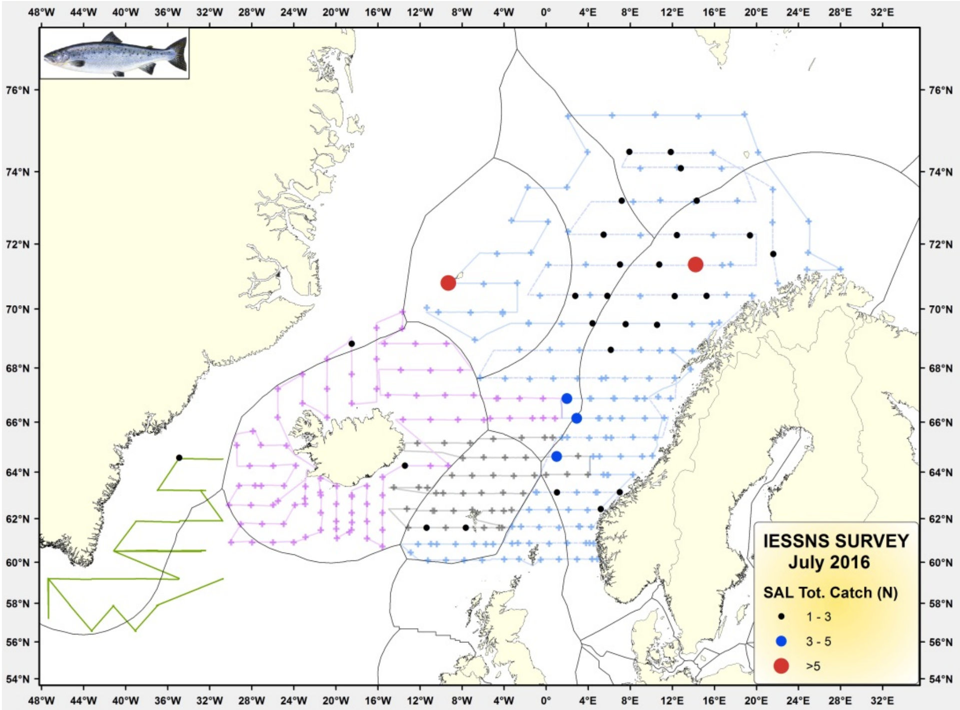


Figure 2.3.7.1. Number of Atlantic salmon taken during IESSNS surveys in the Northeast Atlantic in July 2016. This is the main survey where salmon would be expected to be taken in the survey nets.

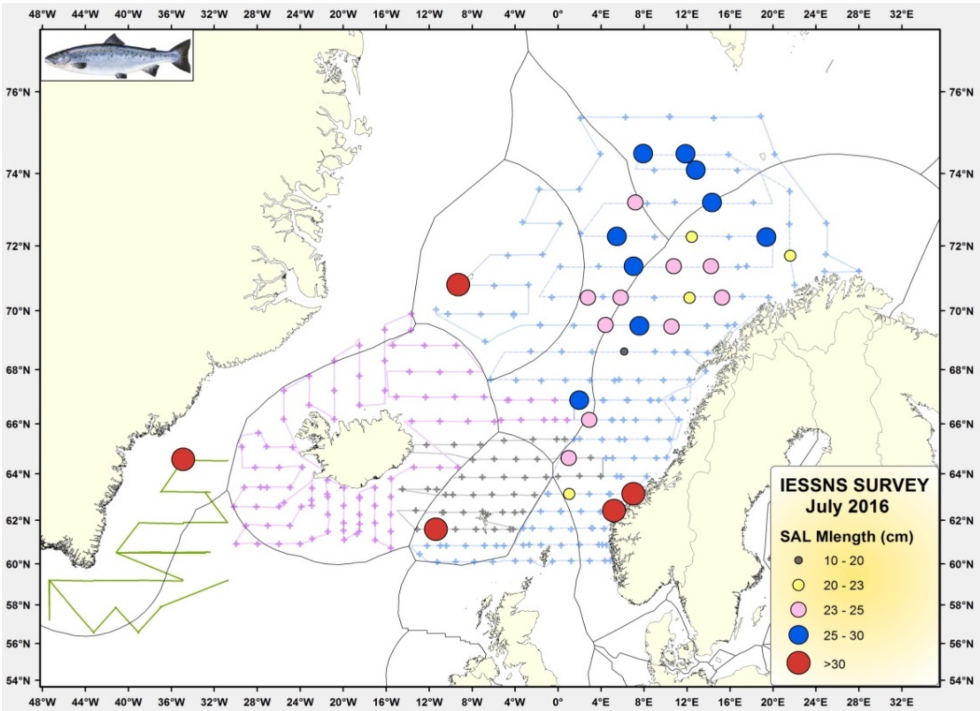


Figure 2.3.7.2. Mean length of Atlantic salmon taken during IESSNS surveys in the Northeast Atlantic in July 2016 indicating locations of adult and post-smolts. This is the main survey where salmon would be expected to be taken in the survey nets.

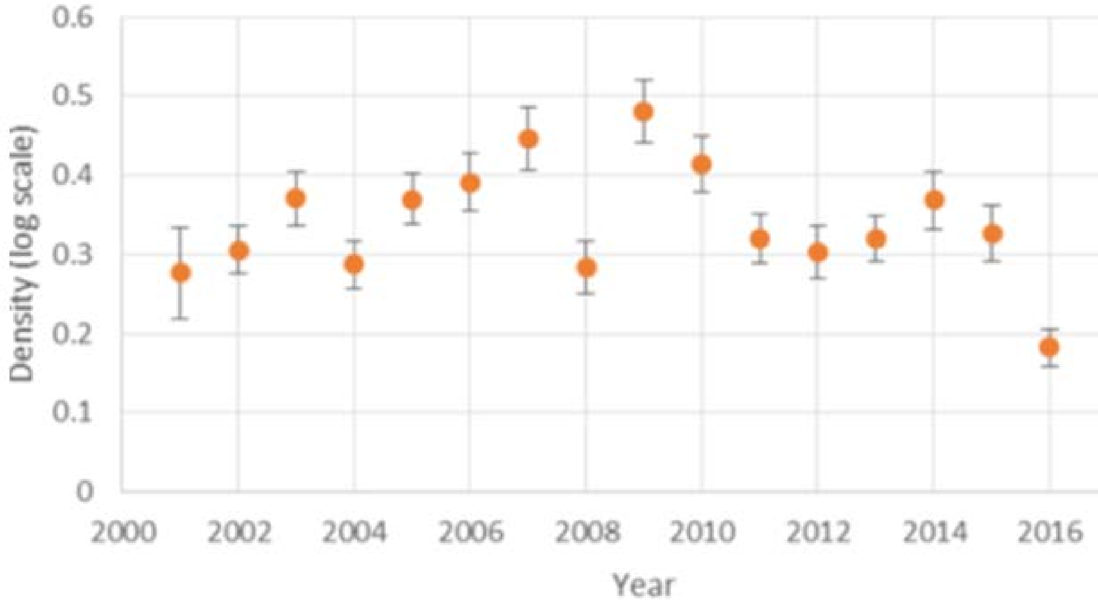


Figure 2.3.8.1. The density of 0+ salmon fry averaged for all catchments in England where juvenile screening data were consistently available, 2001–2016. (Note y-axis on log scale).

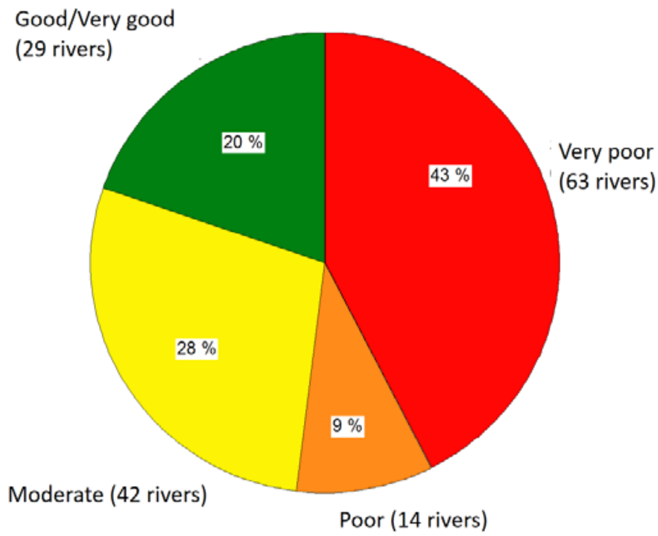


Figure 2.3.9.1. Final classification in the Quality Norm system for 148 Norwegian rivers. Figure translated from Anon., 2017 b.

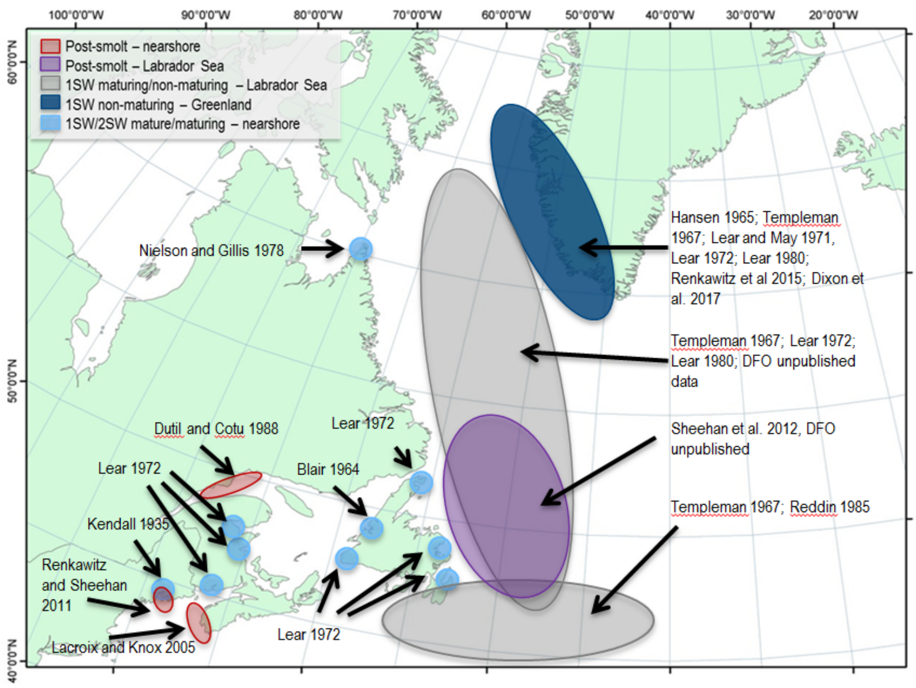


Figure 2.5.1.1. Approximate geographical areas, associated distinct marine phases, and literature sources of Atlantic salmon dietary information.

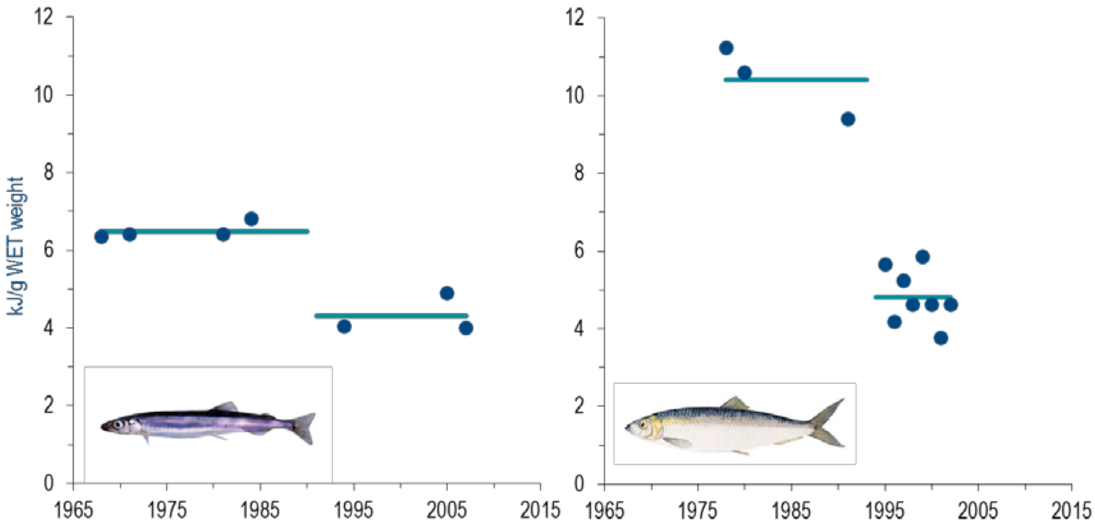


Figure 2.5.1.2. Energy density estimates (kJg-1) of capelin in the Labrador Sea (left) and Atlantic herring in the Gulf of Maine (right) with and mean (bars) energy densities before and after the year 1990. Energy density estimates were selected to incorporating potentially large seasonal and ontogenic energy density variations. Data are reproduced from Renkawitz *et al.*, 2015 (for capelin) and McGurk *et al.*, 1980; Steimel *et al.*, 1985; Lawson *et al.*, 1998; and Diamond and Devlin, 2003 (for Atlantic salmon).

3 Northeast Atlantic Commission area

3.1 NASCO has requested ICES to describe the key events of the 2016 fisheries

- There were no significant changes in fishing methods used in 2016.
- There has been a marked decline in fishing effort by nets and traps in all NEAC countries over the available time-series. This reflects the closure of many fisheries and increasingly restrictive measures to reduce levels of exploitation.
- The practice of catch-and-release in rod fisheries continues to increase.
- The provisional nominal catch in 2016 (1043 t) decreased slightly from 2015, and is among the lowest in the time-series.
- Exploitation rates on NEAC stocks are among the lowest recorded.

3.1.1 Fishing at Faroes

No fishery for salmon has been prosecuted since 2000.

3.1.2 Key events in NEAC homewater fisheries

3.1.2.1 Norway & Finland

A new fishing agreement between Norway and Finland on the salmon fishing in the Teno/Tana River was concluded in late 2016, confirmed in parliaments of both countries in March 2017, and comes into force for the 2017 fishing season. The new agreement is based on a population-specific, target-based and flexible management framework. It aims at substantial reduction in exploitation of the Teno salmon in all fisheries, and for all gear types and user groups. The regulation especially focuses on the vulnerable populations in the large headwater tributaries with a marked proportion of MSW salmon that migrate early in the season and are subject to mixed-stock fishery in the main stem. The measures include reductions in weekly and seasonal fishing times, restrictions to simultaneous number of nets in use, and temporal and regional quotas for recreational angling licences issued.

3.1.2.2 UK (Scotland)

Following consultation in 2014, spring conservation regulations came into effect in January 2015 which sought to underpin a range of existing voluntary and statutory measures. Under these regulations, the start of the net fishing season is delayed in most areas until 1 April while fishing by rod and line in any given district is restricted to catch and release from the season start date until 31 March. The measures continued in 2016 and are to be reviewed annually, more information is available at

http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/spring

A package of conservation measures took effect from 1 April 2016, designed to run on from the existing spring conservation regulations. Key aspects of the regulations are:

- The killing of salmon beyond estuary limits is prohibited for three years.
- The killing of Atlantic salmon in inland waters will be managed on an annual basis by categorising stocks by their conservation status.

- Local salmon management bodies will be required to develop a Conservation Plan irrespective of the conservation status of stocks in their area.
- Carcass tagging for net-caught fish in inland areas.

Stocks will be managed according to their conservation status. Conservation status is assessed by estimating the probability that the stock attained its conservation limit (CL) based on the stock abundance data (rod catch and fish counts where available) for the previous five years. Conservation status for a given year will determine the conservation measures for that area in the following year.

Category	Probability of achieving CL in previous five years	Management measures
1	At least 80%	No additional management action is currently required.
2	60–80%	Management action is necessary to reduce exploitation. Mandatory catch and release will not be required in the first instance, but this will be reviewed annually.
3	Less than 60%	Management action is required immediately to reduce exploitation. Mandatory catch and release (all methods) for the coming year.

More detailed information may be found at:

http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/status

In 2016, the killing of Atlantic salmon in inland waters was managed at a district scale which uses the already defined 109 fishery districts (Marine Scotland Science, 2014) together with Special Areas of Conservation (SACs), designated under the Habitats Directive due to their importance for Atlantic salmon. Assessment in 2016, for the 2017 season onwards, was based on river stocks, or groups of smaller neighbouring rivers in cases where rod fishery data for a five year period is not yet available by river.

3.1.3 Gear and effort

No significant changes in gear type used were reported in 2016, however, changes in effort were recorded. The number of gear units licensed or authorised in several of the NEAC area countries provides a partial measure of effort (Table 3.1.3.1), but does not take into account other restrictions, for example, closed seasons. In addition, there is no indication from these data of the actual number of licences actively utilized or the time each licensee fished.

The numbers of gear units used to take salmon with nets and traps have declined markedly over the available time-series in all NEAC countries. This reflects the closure of many fisheries and increasingly restrictive measures to reduce levels of exploitation in many countries. There are fewer measures of effort in respect of in-river rod fisheries, and these indicate differing patterns over available time-series. However, anglers in all countries are making increasing use of catch-and-release (see below).

Trends in effort are shown in Figures 3.1.3.1 and 3.1.3.2 for the Northern and Southern NEAC countries, respectively. In the Northern NEAC area (Figure 3.1.3.1), driftnet effort in Norway accounted for the majority of the effort expended in the early part of the time-series. However, this fishery closed in 1989, reducing the overall effort substantially. The number of bag nets and bendnets in Norway has decreased for the past 15–20 years and in 2016, was the third the lowest in the time-series for bendnets. There was slight increase in the number of bag nets from the previous year. The number of gear units in the coastal fishery in the Archangelsk region, Russia, has been relatively stable but decreased in 2016 to the lowest level in the time-series. The number of units in the in-river fishery decreased markedly from 1996 to 2002, and then remained relatively stable thereafter.

The number of gear units licensed in UK(E&W) and Ireland (Table 3.1.3.1; Figure 3.1.3.2) was among the lowest reported in the time-series. In UK(Scotland) fixed engine and net and coble effort was the lowest in the time-series. For UK(NI), driftnet, draftnet, bag nets and boxes decreased throughout the time-series and there was no fishing for the past four years. Licence numbers then remained stable for over a decade, before decreasing from 2002 due to fishery closures. In France, the number of nets in estuaries has reduced while the in-river netting effort has remained relatively stable over time with a slight increase in 2016.

Rod effort trends, where available, have varied for different areas across the time-series (Table 3.1.3.1). In the Northern NEAC area, the number of anglers and fishing days in Finland has shown an increase throughout the time period with a slight decrease in the River Teno in 2016. In the Southern NEAC area, rod licence numbers increased from 2001 to 2011 in UK(E&W), but have decreased for the past five years. In Ireland, there was an apparent increase in the early 1990s owing to the introduction of one day licences. The subsequent decline observed post-2006 is attributed to lower angling incentive because of the movement to single-stock management which resulted in the closure of many fisheries or their designation as catch and release only, as well as an increase in the licence fee to support conservation measures. In France, the effort has been fairly stable throughout the time period (Table 3.1.3.1).

3.1.4 Catches

NEAC area catches for the period 1960 to 2016 are presented in Table 3.1.4.1. The provisional nominal catch in the NEAC area in 2016 (1043 t) was 39 t below the updated catch for 2015 (1081 t) and 10% and 21% below the previous 5-year and 10-year averages, respectively. It should be noted that changes in nominal catch may reflect changes in exploitation rates and the extent of catch and release in rivers, in addition to stock size, and thus cannot be regarded as a direct indicator of abundance.

The provisional nominal catch in Northern NEAC in 2016 (856 t) was at the same level as the updated catch for 2015 (859 t) and the previous 5-year average (866 t), but 11% below the previous ten-year average (Table 3.1.4.1; Figure 3.1.4.1). Catches in 2016 were close to or below long-term averages in most Northern NEAC countries although the catch in Norway has steadily increased from 475 t in 2013 to 612 t in 2016 (Table 2.1.1.1).

In the Southern NEAC area the provisional nominal catch for 2016 (187 t) was the lowest in the time-series, 36 t below the updated catch for 2015 (223 t) and was 36% and 47% below the previous 5-year and 10-year averages, respectively (Table 3.1.4.1; Figure 3.1.4.1). Catches in 2016 were below long-term averages in most Southern NEAC countries except UK(E&W) where the catch in 2016 was slightly above both the 5- and 10-year averages. The greatest reduction in catches in Southern NEAC was observed in UK(Scotland) where the catch in 2016 (27 t) was below the catch in 2015

(68 t) and below the previous five and ten years means (111 and 138 t, respectively) (Table 2.1.1.1).

Figure 3.1.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 until 2016. The catch in the Southern area has declined over the period from about 4500 t in 1972 to 1975 to below 1000 t since 2003. The catch fell sharply in 1976, and between 1989 and 1991, and continues to show a steady decline over the last 15 years from over 1000 t to below 200 t. The catch in the Northern area declined over the time-series, although this decrease was less distinct than the reductions noted in the Southern area (Figure 3.1.4.1). The catch in the Northern area varied between 2000 t and 2800 t from 1971 to 1988, fell to a low of 962 t in 1997, and then increased to over 1600 t in 2001. Catch in the Northern area has exhibited a downward trend since and has been consistently below 1000 t since 2012. Thus, the catch in the Southern area, which comprised around two thirds of the total NEAC catch in the early 1970s, has been lower than that in the Northern area since 1999, and has been around 20% of the total catch in the NEAC area in recent years.

3.1.5 Catch per unit of effort (cpue)

Cpue is a measure that can be influenced by various factors, such as fishing conditions, perceived likelihood of success, and experience. Both cpue of net fisheries and rod cpue may be affected by measures taken to reduce fishing effort, for example, changes in regulations affecting gear. If changes in one or more factors occur, a pattern in cpue may not be immediately evident, particularly over larger areas. It is, however, expected that for a relatively stable effort, cpue can reflect changes in the status of stocks and stock size. Cpue may be affected by increasing rates of catch and release in rod fisheries.

The cpue data are presented in Tables 3.1.5.1 to 3.1.5.6. The cpue for rod fisheries have been derived by relating the catch to rod days or angler season. Cpue for net fisheries were calculated as catch per licence-day, trap-month or crew-month.

In the Southern NEAC area (Figure 3.1.5.1), cpue has decreased in the net fisheries in the southwest and northwest part of UK(E&W) and an increase was noticed in the northeast part (Table 3.1.5.3). The cpue for the net and coble fishery in UK(Scotland) shows a general decline over the time-series with a slight increase in the most recent years (Table 3.1.5.5). The cpue for the fixed engine fishery showed a slight increase for the last three years available in the time-series; there was no information on effort in 2016 due to changes in fishery regulations (Table 3.1.5.5). The cpue values for rod fisheries in UK(E&W) showed a general increasing trend to 2011 (Table 3.1.5.4). There was a decrease until 2015 followed by an increase again in 2016. In UK(NI), the River Bush rod fishery cpue showed an increase in 2016 from 2015 which was lowest in the time-series (Table 3.1.5.1). The rod fishery cpue in France has remained stable for the past five years available in the time-series and close to the long-term average (Table 3.1.5.1).

In the Northern NEAC area, the cpue for the commercial coastal net fisheries in the Archangelsk area, Russia, showed a general decreasing trend, although the cpue in 2016 was among the highest in the time-series Table 3.1.5.2). The cpue for the in-river fishery has shown a general increase with a slight decrease in 2016 (Figure 3.1.5.1 and Table 3.1.5.2). In Finland the cpue per angler season in the River Teno has been relatively stable over time while cpue per angler day has decreased (Figure 3.1.5.1; Table 3.1.5.2). For the River Naatamo, catch per angler season and catch per angler day for 2016 were close to the long-term averages. An increasing trend was observed for the cpue in the Norwegian net fisheries (Figure 3.1.5.1; Table 3.1.5.6). The cpue values for salmon 3–7 kg were the highest in the time-series for bendnet and among the highest for bag nets (Figure 3.1.5.1; Table 3.1.5.6).

3.1.6 Age composition of catches

The percentage of 1SW salmon in NEAC catches is presented by country in Table 3.1.6.1 and shown separately for Northern and Southern NEAC countries in Figure 3.1.6.1. Except for Iceland the proportion of 1SW has declined for all countries over the period 1987–2016. The decline in the proportion of 1SW salmon was evident in both stock complexes.

The overall percentage of 1SW fish in the Northern NEAC area catch remained reasonably consistent at 66% in the period 1987 to 2000 (range 61% to 72%), but has fallen in more recent years to 58% (range 50% to 69%), when greater variability among countries and years has also been evident. Comparing the two periods the decreased proportion of 1SW was significant in four northern countries (Finland, Norway, Russia, Sweden), while a significant increase was noted for Iceland. On average, 1SW fish comprise a higher percentage of the catch in Iceland and to some extent Russia than in the other northern NEAC countries (Table 3.1.6.1).

In the Southern NEAC area, the percentage of 1SW fish in the catch in 1987–2000 averaged 60% (range 49% to 65%), and the mean was 55% in 2001–2016 (range 44% to 64%). The percentage of 1SW salmon in the Southern NEAC has decreased, although with some differences between countries. For Spain (data from the Asturias region) there was a significant decline in 1SW comparing the two periods (Table 3.1.6.1).

3.1.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2016 was again generally low in most countries, with the exception of Norway, Iceland and Sweden, and is similar to the values that have been reported in previous years. Such fish are usually included in assessments of the status of national stocks (Section 3.3).

The estimated proportion of farmed salmon in Norwegian angling catches in 2016 was at the lower end of the range (4%) in the time-series, whereas the proportion in samples taken from Norwegian rivers in autumn was the lowest in the time-series (7%). No current data are available for the proportion of farmed salmon in coastal fisheries.

The number of farmed salmon that escaped from Norwegian farms in 2016 is reported to be 126 000 fish (provisional figure), down from the previous year (170 000). An assessment of the likely effect of these fish on the estimates of PFA has been reported previously (ICES, 2001).

The release of smolts for commercial ranching purposes ceased in Iceland in 1998, but ranching for rod fisheries in two Icelandic rivers continued in 2016. Icelandic catches have traditionally been split into two separate categories, wild and ranched (Table 2.1.1.1). In 2016, 31.1 t were reported as ranched salmon in contrast to 87.4 t harvested as wild. Similarly, Swedish catches have been split into two separate categories, wild and ranched (Table 2.1.1.1). In 2016, 3.1 t were reported as ranched salmon in contrast to 5.9 t harvested as wild. Ranching occurs on a much smaller scale in Ireland and Norway. Some of these operations are experimental while for others harvesting does not occur solely at the release site.

3.1.8 National origin of catches

3.1.8.1 Catches of Russian salmon in northern Norway

Previously the Working Group has reported on investigations of the coastal fisheries in northern Norway where genetic methods have been applied to analyse the stock composition of this mixed-stock fishery (ICES, 2015) based on results from the Kolarctic Salmon project (Kolarctic ENPI CBC programme 2007–2013) (Svenning *et al.*, 2014). Overall, the incidence of Russian salmon in the catches varied strongly within season and among fishing regions, averaging 17% for 2011–2012 in the coastal catches in Finnmark County, while nearly 50% of all salmon captured in Varangerfjord, close to the border, were of Russian origin.

In autumn 2015 the Russian Federation and Norway signed the Memorandum of understanding between the Ministry of Climate and Environment (Norway) and the Federal Agency for Fishery (the Russian Federation) on cooperation in management of and monitoring and research on wild Atlantic salmon in Finnmark County (Norway) and the Murmansk region (the Russian Federation). The Joint Working group was established under the Memorandum consisting of managers and scientists from each country as appointed by Parties. It shall meet and report annually to the Ministry of Climate and Environment (Norway) and to the Federal Agency for Fishery (the Russian Federation). An organisational meeting was held in November, 2015 in Oslo and the first meeting of the joint Working group was held in April, 2016 in Trondheim, Norway.

At its 2016 meeting the Joint Working Group discussed different issues such as the scientific foundation for conservation limits and catch advice in Norway, status of relevant salmon populations in Finnmark, trends in fisheries, the management system, policies and processes in Norway with emphasis on Finnmark County, the salmon fisheries management in Russia, development of fisheries and conservation limits for salmon populations in the Murmansk region. The group agreed that the first report should focus on the main topic i.e. the mandate for the group, the salmon stocks and the fisheries. Then in later reports other topics like fish farming, etc. will be covered. No report of the Joint Working Group has been produced so far and the next meeting was scheduled for the second half of 2017.

3.1.8.2 UK (England and Wales) and UK (Scotland)

New genetic information taken from samples sourced in 2011 (Gilbey *et al.*, 2016a; Gilbey *et al.*, 2016b) was used to update estimates of the country of origin of catches taken in the coastal net fisheries in the northeast of England. The analysis resulted in an increase in the proportion of the catch identified as coming from English river stocks and these data have been used to update the input data for the NEAC run-reconstruction model for 2011 season onwards (Section 3.3.2).

3.1.9 Exploitation indices for NEAC stocks

Exploitation rates for 1SW and MSW salmon from the Northern NEAC (1983–2016) and Southern NEAC (1971–2016) areas are shown in Figure 3.1.9.1. National exploitation rates are an output of the NEAC PFA Run Reconstruction Model. These were combined as appropriate by weighting each individual country's exploitation rate to the reconstructed returns. Data gathered prior to the 1980s represent estimates of national exploitation rates whereas post-1980s exploitation rates have often been subject to more robust analysis.

The exploitation of 1SW salmon in both Northern NEAC and Southern NEAC areas has shown a general decline over the time-series (Figure 3.1.9.1), with a notable sharp decline in 2007 as a result of the closure of the Irish driftnet fisheries in the Southern NEAC area. The weighted exploitation rate on 1SW salmon in the Northern NEAC area was 39% in 2016 being roughly at the same level as the previous five year (40%) and ten year (41%) averages. Exploitation on 1SW fish in the Southern NEAC complex was 8% in 2016 indicating a decrease from the previous five year (11%) and the ten year (14%) averages.

The exploitation rate of MSW fish also exhibited an overall decline over the time-series in both Northern NEAC and Southern NEAC areas (Figure 3.1.9.1). Exploitation on MSW salmon in the Northern NEAC area was 44% in 2016, being roughly at the same level as the previous five year average (43%) but showing a decline from the ten year average (48%). Exploitation on MSW fish in Southern NEAC was 9% in 2016, being lower than both the previous five year (11%) and ten year (12%) averages.

The rate of change of exploitation of 1SW and MSW salmon in Northern NEAC and Southern NEAC countries over the available time periods is shown in Figure 3.1.9.2. This was derived from the slope of the linear regression between time and natural logarithm transformed exploitation rate. The relative rate of change of exploitation over the entire time-series indicates an overall reduction of exploitation in most Northern NEAC countries for 1SW and MSW salmon (Figure 3.1.9.2). Exploitation rates in Finland has been relatively stable over the time period while the largest rate of reduction has been for 1SW salmon in Russia. The Southern NEAC countries have also shown a general decrease in exploitation rate (Figure 3.1.9.2) on both 1SW and MSW components. The greatest rate of decrease for 1SW fish was in UK(Scotland), and for MSW fish in UK(E&W), while France (MSW) and Iceland (both 1SW and MSW) showed relative stability in exploitation rates during the time-series. Exploitation rates for 1SW salmon in France have increased.

3.2 Management objectives and reference points

3.2.1 NEAC conservation limits

River-specific Conservation Limits (CLs) have been derived for salmon stocks in most countries in the NEAC area (France, Ireland, UK(E&W), UK(NI), Finland, Norway and Sweden) and these are used in national assessments. In these cases, CL estimates for individual rivers are summed to provide estimates at a country level for these countries.

River-specific CLs have also been derived for salmon stocks in UK(Scotland) and for a small number of rivers in Russia, but these are not yet used in national assessments. An interim approach has been developed for countries that do not use river-specific CLs in the national assessment. This approach is based on the establishment of pseudo stock–recruitment relationships for national salmon stocks; further details are provided in the Stock Annex (Annex 6).

CL estimates for all individual countries are summed to provide estimates for the northern and southern NEAC stock complexes (Table 3.2.1.1). These data are also used to estimate the Spawner Escapement Reserves (SERs, the CL increased to take account of natural mortality between the recruitment date, 1st January in the first sea winter, and return to homewaters). SERs are estimated for maturing and non-maturing 1SW salmon from the individual countries as well as Northern NEAC and Southern NEAC stock complexes (Table 3.2.1.1). The Working Group considers that the current national CL and SER levels may be less appropriate to evaluating the historical status of stocks (e.g. pre-1985), that in many cases have been estimated with less precision.

3.2.2 Progress with setting river-specific conservation limits

3.2.2.1 UK(Scotland)

A method for assessing Scottish salmon stocks with respect to CLs has been described previously (ICES, 2016a). In 2015, stocks were assessed at the salmon fishery district scale (Marine Scotland Science, 2014). In addition, Special Areas of Conservation (SACs) designated under the Habitats Directive where salmon are a qualifying species were assessed separately. In total 126 assessable areas were identified and formed the basis of the management measures implemented in 2016.

Considerable progress has been made associating reported fishery data with individual river systems. In 2016, assessable areas comprised SACs and individual rivers where reported fishery data supported identification of catch to the river level. Where rod fishery data for a five year period is not yet available by river, groups of neighbouring rivers were assessed together. Currently, 216 rivers have been identified as supporting salmon fisheries. In 2016, 168 assessable areas were identified and their stocks assessed. This assessment will form the basis of the management measures undertaken for 2017. Work is continuing to improve the reporting system with the aim that the assessment can be undertaken by river stock.

3.2.2.2 Sweden

There is one index river, the Högvadsån, for Atlantic salmon on the Swedish west coast. After adjusting for catch efficiencies of the spawner trap in the river (stock) and smolt trap (recruits) a Ricker stock–recruitment curve was fitted to data. The conservation limit was set to MSY which was estimated as 4.5 eggs per m^2. Wetted area of salmon habitat was used to estimate the CL in preference to the whole wetted river area. Using the bootstrapped values, a probability density function was established showing the risk of the stock in the Högvadsån River falling short of CL.

The transport of the biological reference points (BRPs) from the index river to other rivers was done using available salmon habitat in the rivers. Applying the egg requirement established in the index river to all rivers, the total amount of mature salmon (females) or eggs needed to reach CL in each individual river on the west coast of Sweden (total 13 995 million eggs) was estimated. However, as data on ascending spawners in most other rivers are lacking, it is not possible to estimate the probability that individual river stocks will meet CL. Instead, the use of proxy BRPs from electrofishing data to evaluate CL attainment is being explored and was used for the year 2016. As 87% of smolts are two years old, the abundance of > 0+ parr in electrofishing surveys was used as a proxy. In undisturbed rivers and in good salmon habitat (class >5 in a scale from 0–8) the CL was found to be ten parr per 100 m^2. Good reproductive status is when the mean parr abundance and the lower limit of the 90% confidence interval are above CL. If the lower c.i. falls below CL the river is at risk of having reduced productive capacity (see Section 1.5).

3.3 NASCO has requested ICES to describe the status of stocks including updating the time-series of trends in the number of river stocks meeting CLs by jurisdiction

3.3.1 The NEAC PFA run-reconstruction model

The Working Group uses a run-reconstruction model to estimate the PFA of salmon from countries in the NEAC area (Potter *et al.,* 2004). PFA in the NEAC area is defined as the number of 1SW recruits on January 1st in the first sea winter. The model is generally based on the annual retained catch in numbers of 1SW and MSW salmon in each country which are raised to take account of minimum and maximum estimates of non-reported catches and exploitation rates of these two sea-age groups. These values are then raised to take account of the natural mortality between January 1st in the first sea winter and the mid-date of return of the stocks to freshwater.

Where the standard input data are themselves derived from other data sources, the raw data may be included in the model to permit the uncertainty in these analyses to be incorporated into the modelling approach. Some countries have developed alternative approaches to estimate the total returning stock, and the Working Group reports these changes and the associated data inputs in the year in which they are first implemented.

For some countries, the data are provided in two or more regional blocks. In these instances, model output is provided for the regions and is also combined to provide stock estimates for the country as a whole. The input data for Finland comprise the total Finnish and Norwegian catches (net and rod) for the River Teno, and the Norwegian catches from this river are not included in the input data for Norway.

A Monte Carlo simulation (10 000 trials) is used to estimate confidence intervals on the stock estimates. Further details of the model are provided in the Stock Annex (Annex 6), including a step-by-step walkthrough of the modelling process.

3.3.2 Changes to national input data for the NEAC PFA Run-Reconstruction Model

Model inputs are described in detail in Section 2.2 of the Stock Annex, and input data for the current year are provided in Appendix 3 of the Stock Annex. In addition to adding new data for 2016, the following changes were made to the national/regional input data for the model.

UK(England and Wales) and UK(Scotland): New information was made available on the stock composition of fish caught in the coastal fishery that operates on the northeast coast of England (Gilbey *et al.*, 2016b). The proportions of fish caught in the fishery that originate in UK(Scotland) and UK(E&W) were assessed through a genetic stock identification programme. The genetic baseline used consisted of genetic samples from 3787 fish from 147 sites covering 27 rivers in Scotland and Northeast England, screened at a panel of 349 Single Nucleotide Polymorphic (SNP) markers. A total of 1000 fishery samples, collected in 2011, were screened at the SNP markers and proportions of fish in the different fisheries estimated using genetic Mixed-stock Analysis (MSA) analytical techniques. The results were in close agreement with previous estimates used by the Working Group based on tagging studies and estimates of stock status.

The relative proportions of Scottish and English fish taken in the various parts of the coastal fishery were used to split the catches by country of origin for the period from

2011 to 2016. The fishery has not been subject to annual genetic assessment, so this assumes that there has been no change in the relative proportions over time. The changes resulted in a small increase in the proportion of the catch of English origin fish over this period and a corresponding small decrease in the proportion derived from Scotland.

Minor corrections were made to river-specific CL estimates for three rivers in UK(E&W). This resulted in a small decrease in the national CLs (based on aggregated river-specific values).

Locally derived return data, as discussed previously by the group (ICES, 2016a), was not available for UK(Scotland) and time-series of input data as previously supplied were updated.

UK(Northern Ireland): Conservation limits had been determined previously for a number of salmon rivers in UK(NI), through the transport of optimal productivity metrics determined from the River Bush stock–recruitment study to measured habitat parameters for each recipient river. Habitat surveys have been completed on the Agivey River and a CL is now available for this catchment. CL estimates for UK(NI) have been updated accordingly.

Sweden: New CL estimates were available for Sweden based on 4.5 eggs m^{-2}, replacing the preliminary CL estimates from 2016 based on six eggs m^{-2}. This resulted in a substantial decrease in the national CL, though still much higher than the value derived from the pseudo S–R relationship used before 2016.

The working group agreed that a review of data inputs was required particularly as retained catch, used to estimate stock abundance in most NEAC countries, is declining across most of these countries both as absolute numbers and as a proportion to the total catch (Section 2.3.6).

3.3.3 Changes to the NEAC PFA run-reconstruction model

No changes were made in the NEAC-PFA run-reconstruction model in 2016.

3.3.4 Description of national stocks and NEAC stock complexes as derived from the NEAC PFA run-reconstruction model

The NEAC PFA run-reconstruction model provides an overview of the status of national salmon stocks in the Northeast Atlantic. It does not capture variations in the status of stocks in individual rivers or small groups of rivers, although this has been addressed, in part, by the regional splits within some countries and the analysis set out in Section 3.3.5.

The model output for each country has been displayed as a summary sheet (Figures 3.3.4.1(a–j)) comprising the following:

- PFA and SER of maturing 1SW and non-maturing 1SW salmon.
- Homewater returns and spawners (90% confidence intervals) and CLs for 1SW and MSW salmon.
- Exploitation rates of 1SW and MSW salmon in homewaters estimated from the returns and catches.
- Total catch (including unreported) of 1SW and MSW salmon.
- National pseudo stock–recruitment relationship (PFA against lagged egg deposition) used to estimate CLs in countries that cannot provide one

based upon river-specific estimates (Section 3.2). This panel also includes the river-specific CL where this is used in the assessment.

Tables 3.3.4.1–3.3.4.6 summarise salmon abundance estimates for individual countries and stock complexes in the NEAC area. The PFA of maturing and non-maturing 1SW salmon and the numbers of 1SW and MSW spawners for the Northern NEAC and Southern NEAC stock complexes are shown in Figure 3.3.4.2.

The model provides an index of the current and historical status of stocks based upon fisheries data. The 5th and 95th percentiles shown by the whiskers in each of the plots (Figures 3.3.4.1 and 3.3.4.2) reflect the uncertainty in the input data. It should also be noted that the results for the full time-series can change when the assessment is re-run from year to year and as the input data are refined.

Status of stocks is assessed relative to the probability of exceeding CLs, or for PFA SERs. Based on the NEAC run-reconstruction model, the status of the two age groups of the Northern NEAC stock complex, prior to the commencement of distant-water fisheries in the latest available PFA year, were considered to be at full reproductive capacity (Section 1.5; Figure 3.3.4.2). The two age groups of the Southern NEAC complex were both considered to be at risk of suffering reduced reproductive capacity prior to the commencement of distant water fisheries in the latest available PFA year (Figure 3.3.4.2).

The abundances of both maturing 1SW and non-maturing 1SW recruits (PFA) for northern NEAC (Figure 3.3.4.2) show a general decline over the time period, the decline being more marked in the maturing 1SW stock. Both Northern NEAC stock complexes have, however, been at full reproductive capacity prior to the commencement of distant water fisheries throughout the time-series.

1SW spawners in the Northern NEAC stock complex have been at full reproductive capacity throughout the time-series. MSW spawners, on the other hand, while generally being at full reproductive capacity, have periodically been at risk of suffering reduced reproductive capacity (Figure 3.3.4.2).

The abundances of both maturing 1SW and of non-maturing 1SW recruits (PFA) for Southern NEAC (Figure 3.3.4.2) demonstrate broadly similar declining trends over the time period. Both age-group stock complexes were at full reproductive capacity prior to the commencement of distant water fisheries throughout the early part of the time-series. Since the mid-1990s, however, the non-maturing 1SW stock has been at risk of suffering reduced reproductive capacity in approximately 50% of the assessment years (Figure 3.3.4.2). The maturing 1SW stock, on the other hand, was first assessed as being at risk of suffering reduced reproductive capacity in 2009. For most years thereafter, the stock has either been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity (Figure 3.3.4.2).

The 1SW spawning stock in the Southern NEAC stock complex has been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity for most of the time-series Figure 3.3.4.2). In contrast, the MSW stock was at full reproductive capacity for most of the time-series until 1996. After this point, however, the stock has generally been either at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity (Figure 3.3.4.2).

3.3.4.1 Individual country stocks

The assessment of PFA against SER (Figure 3.3.4.3) and returns and spawners against CL are shown for individual countries (Figures 3.3.4.4 and 3.3.4.5) and by regions (Figures 3.3.4.6 and 3.3.4.7) for the most recent PFA and return years. These assessments show the same broad contrasts between northern (including Iceland) and Southern NEAC stocks as was apparent in the stock complex data.

Thus, for all countries in Northern NEAC, except for maturing 1SW stocks in Sweden, the PFAs of both maturing and non-maturing 1SW stocks were at full reproductive capacity prior to the commencement of distant-water fisheries in the latest PFA year (Figure 3.3.4.3). Spawning stocks in some northern NEAC countries were, however, at risk of suffering, or suffering, reduced reproductive capacity (Figures 3.3.4.4 and 3.3.4.5).

In Southern NEAC, all maturing 1SW stocks with the exception of UK(NI) were at risk of suffering or were suffering reduced reproductive capacity both prior to the commencement of distant water fisheries and at spawning (Figures 3.3.4.3 and 3.3.4.4). In UK(NI), the PFA and spawners of maturing 1SW stocks were at full reproductive capacity (Figures 3.3.4.3 and 3.3.4.4). For Southern NEAC non-maturing 1SW stocks, UK(NI) and UK(E&W) were at full reproductive capacity both before the commencement of distant-water fisheries and as spawners (Figures 3.3.4.3 and 3.3.4.5). All other Southern NEAC country stocks were either at risk of suffering, or suffering reduced reproductive capacity.

Figures 3.3.4.6 and 3.3.4.7 provide more detailed descriptions of the status of returning and spawning stocks by country and region (where assessed) for both Northern and Southern NEAC stocks, again for the most recent return year.

3.3.5 Compliance with river-specific conservation limits

In the NEAC area, nine jurisdictions currently assess salmon stocks using river-specific CLs (Tables 3.3.5.1 and 3.3.5.2 and Figure 3.3.5.1). The attainment of CLs is assessed based on spawners, after fisheries.

- For the River Teno (Finland/Norway), the number of major tributary stocks with established CLs rose from nine between 2007 and 2012 (with five annually assessed against CL), to 24 since 2013 (with seven to eleven assessed against CL). None met CL prior to 2013 with 40%, 20% and 36% meeting CLs in 2014, 2015 and 2016, respectively.
- CLs were established for 439 Norwegian salmon rivers in 2009, but CL attainment was retrospectively assessed for 165–170 river stocks back to 2005. An average of 179 stocks are assessed since 2009. An overall increasing trend in CL attainment was evident from 39% in 2009 to 74% in 2015 (data are pending for 2016).
- Since 1999, CLs have been established for 85 river stocks in Russia (Murmansk region) with eight of these annually assessed for CL attainment, 88% of which have consistently met their CL during the time-series.
- Sweden established CLs in 2016 for 23 stocks with eight of the 20 assessed stocks meeting CL.
- In France, CLs were established for 28 river stocks in 2011, rising to 35 by 2016. The percentage of stocks meeting CL peaked in 2013 at 74% declining to 60% in 2016.

- Ireland established CLs for all 141 stocks in 2007, rising to 143 since 2013 to include catchments above hydrodams. The mean percentage of stocks meeting CLs is 34% over the time-series, with the highest attainment of 43% achieved in 2014. This has been followed by a progressive decline to 38% in 2015 and 34% in 2016.
- UK(E&W) established CLs in 1993 for 61 rivers, increasing to 64 from 1995 with a mean of 46% meeting CL. In recent years, a downward trend was observed from 66% attainment in 2011 to a minimum of 20% in 2014, followed by an increase to 38% in 2015. In 2016, 33% of rivers attained CL.
- Data on UK(NI) river-specific CLs are presented from 2002, when CLs were assigned to ten river stocks. Currently, 16 stocks have established CLs and five to eleven rivers were assessed annually for CL attainment over the time-series. A mean of 43% have met their CLs over the presented time-series and an upward trend is evident from 2011, with 64% of assessed stocks attaining CL in 2016.
- UK(Scotland) established CLs for 168 individual rivers and groups of smaller neighbouring rivers in 2016. Retrospective assessment conducted to 2011 indicated 57% mean attainment over the time-series. A progressive decline in meeting CL was observed from 2011 (69%) to 2014 (46%) with a subsequent upturn to 54% evident in 2015 (data are pending for 2016).

Iceland have set provisional CLs for all salmon producing rivers and continue to work towards finalising an assessment process for determining CL attainment. No river-specific CLs have been established for Denmark, Germany and Spain.

3.3.6 Marine survival (return rates) for NEAC stocks

An overview of the trends of marine survival for wild and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) is presented in Figures 3.3.6.1 and 3.3.6.2. The figures provide the percent change in return rates between five year averages for the smolt years 2006 to 2010 and 2011 to 2015 for 1SW salmon, and 2005 to 2009 and 2010 to 2014 for 2SW salmon. The annual return rates for different rivers and experimental facilities are presented in Tables 3.3.6.1 and 3.3.6.2. Return rates of hatchery-released fish, however, may not always be a reliable indicator of return rates of wild fish.

The overall trend for hatchery smolts in Southern NEAC areas is generally indicative of a decline in marine survival. The overall trend for Northern NEAC hatchery smolts shows a more varied picture with one of the two dataseries showing an increase in return rates. Note, however, that Northern NEAC is now only represented by one river: River Imsa (1SW and 2SW) in Norway. For the wild smolts a decline is also apparent for the Northern NEAC areas where five out of six dataseries show a decline. For the Southern NEAC areas, data show a general increase in return rates to 2SW in the most recent five year period compared to the five years before (Figure 3.3.6.1), and a decrease in return rates to 1SW. The percentage change between the averages of the five-year periods varied from a 100% decline (River Halselva 1SW) to a 147% increase (River Tamar MSW) (Figure 3.3.6.1). However, the scale of change in some rivers is influenced by low total return numbers, where a few fish more or less returning may have a large consequence on the percent change.

The return rates for wild and reared smolts for migration year 2015 (1SW) and 2014 (MSW) displayed a mixed picture with some rivers above and some below the previous five and ten year averages (Tables 3.3.6.1 and 3.3.6.2). For Northern NEAC, return rates decreased for 2015 compared to 2014 for wild 1SW smolts in both dataseries from Norway. For the Southern NEAC area, wild 1SW return rates showed a general increase for the 2015 smolt cohort compared to 2014, with the exception of subcatchment stocks of the River Dee in the UK (Scotland). Decreased survival for wild 2SW returns from the 2014 smolt year compared to 2013 was noted in the River Imsa (Norway). For Southern NEAC, the River Bush in UK(NI) indicated a decrease in marine survival for wild 2SW fish in 2014 relative to the previous year. The River Frome in UK(E&W) showed increased values for both 2013 and 2014. The rivers Bresle and Scorff (France) show decreased survivals for both 2015 and 2014 compared to 2014 and 2013, respectively. Note that there is no distinction between 1SW and MSW in French rivers.

The two remaining return rate dataseries for 1SW hatchery smolts in the Northern NEAC area for the 2015 smolt year showed a decrease relative to 2014 for the River Imsa (Table 3.3.6.2). In the Southern NEAC area, return rates for hatchery smolts show a more varied picture with increases in five of the nine rivers in the same period. Three rivers showed decreased return rates and one river had similar values to the previous year (River Lee, Ireland). The MSW survival index for the River Imsa in Norway was not updated for the 2014 smolt cohort.

Least squared (or marginal mean) average annual return rates were calculated to provide indices of survival for Northern and Southern NEAC 1SW and 2SW returning adult wild and hatchery salmon (Figure 3.3.6.3). Values were calculated to balance for variation in the annual number of contributing experimental groups through application of a GLM (generalised linear model) with survival related to smolt year and river, each as factors, with a quasi-Poisson distribution (log-link function). Each of the hatchery and wild, 1SW and 2SW, northern and southern area river survival indices were run independently, as presented in Tables 3.3.6.1 and 3.3.6.2. Only return rates given in separate 1SW and 2SW age classes were used. In summary:

- 1SW return rates of wild smolts to the Northern NEAC area (three river indices) although varying annually, have generally decreased since 1980 ($p < 0.05$). The time-series can be seen as three period groups, 1981 to 1993, 1994 to 2005 and 2006 to 2015. In the first period, survival varies greatly but was generally high (averaging 6.1%), before declining sharply in 1994 to a period of low, but gradually improving survival (average of 2.8%), followed by a further decline from 2004 to 2006. Survival in the third period (2006 to 2015) has been at the lowest level (average of 1.4%). The return rate for the last point in the time-series (the 2015 smolt cohort) of 0.6% is down on the 2014 return rate of 1.8%, and is the lowest in the time-series. Additionally, there is a declining trend evident for the 2SW wild component (comprising three river indices), with the most recent return rate (for 2014 smolts) of 0.5%, representing a decrease from the previous year.
- Return rates of 1SW wild smolts to the Southern NEAC area (eight river indices) have generally decreased since 1980 ($p < 0.05$). A steep decrease between 1988 and 1989 was followed by a decline from around 10% to around 6% over the period 2000–2008. An increase in 2009 was followed by two years of declining survival. This subsequently improved slightly for the 2012 smolt cohort to 6.0%, declined for the 2013 cohort to 2.9% (the lowest in the time-series), and increased to 5.6% for the 2015 cohort. There is no evident declining trend for the 2SW wild component (five river indi-

ces), though pre-1999 rates were generally higher than post-2000 rates. Following a slight increase in the return rate of the 2009 smolt cohort, the return rate of the most recent cohort (2014) was 0.9%, the lowest return rate for the 2006–2015 period.

- 1SW return rates of hatchery smolts to the Northern NEAC area (four river indices) although varying annually, have decreased since 1980 (p <0.05). A slight improvement was noted in the years preceding 2014, but the 2015 value (0.8%) was close to the mean of the last ten years and among the lowest in the time-series. The declining trend is not evident for the 2SW hatchery component (four river indices). A notable increase for the 2007 to the 2009 smolt cohorts has not been maintained. The most recent return rate (the 2014 smolt cohort) is down from the preceding year, and well below the average of the last ten years.
- 1SW return rates of hatchery smolts to the Southern NEAC area (13 river indices) although varying annually, have decreased since 1980 (p <0.05). The returns of the 2014 cohort are the second lowest in the time-series (1.2%) with the same return rate for 2015 return (1.2%). The six most recent years include the five lowest return rates in the time-series and again indicate a persistent period of poor marine survival. There is no 2SW hatchery component for the southern NEAC area.

The low return rates in recent years highlighted in these analyses are broadly consistent with the trends in estimated returns and spawners as derived from the PFA model (Section 3.3.4), and with the view that abundance is strongly influenced by factors in the marine environment.

3.4 NASCO has asked ICES to provide information on the size, distribution and timing of the blue whiting fishery in the Northeast Atlantic area and any official observer information relating to bycatch which may indicate possible impact of this fishery on wild salmon

3.4.1 Background information–the blue whiting fishery

Blue whiting (*Micromesistius poutassou*) is a small pelagic fish which spawns to the west of the British Isles in February–March. After spawning the fish disperse to the feeding area which covers a large part of the Northeast Atlantic, but with most fish concentrated in the Norwegian Sea and the surrounding areas (Figure 3.4.1.1). The main fishery targeting this species occurs at the spawning grounds when the fish are aggregated. The fishery starts in January southeast of the Faroes Islands targeting fish migrating southwards towards the spawning areas. In February and March, the fishery moves to the west of Ireland and in April is located to the north and west of UK(Scotland). There is, however, some interannual variation in the areas fished depending on the geographic distribution of spawning fish. Nonetheless, the fishery on spawning blue whiting occurs before smolts migrate from rivers and enter Northeast Atlantic feeding areas.

The vessels used in the blue whiting fishery are ocean-going trawlers capable of operating large pelagic trawls. The fleet concentrates fishing effort on large aggregations of fish, which are often found close to the continental slope and typically at depths of 250–600 m. The trawl is set around 3 nautical miles from the aggregations of fish to allow time for the trawl to be positioned at the correct depth before the gear reaches the fish. A single catch can be around 800 tonnes and each vessel can store around 2000 tonnes or more before returning to port to deliver the catch. Most of the blue whiting are used for fishmeal production, but occasionally some fish go for human consumption. It is fishery directly targeting blue whiting only, and the level of by-catch is very low. Annual landings have fluctuated in recent decades. This mainly reflects natural fluctuations in stock biomass due to variable levels of recruitment success between years. However, there have been years where participating coastal states have failed to agree on a management plan, resulting in annual catch limits exceeding ICES recommendations.

The highest landings have been recorded in 2003 and 2004 with annual catches of more than 2 million tonnes (Figure 3.4.1.2). In 2015, total landings were approaching 1.4 million tonnes. In years when coastal states have not agreed on a management plan, access to the spawning grounds has been restricted for vessels not belonging to the EU. In these years, for example in 2015, a spring and summer fishery has operated targeting feeding blue whiting in the Norwegian Sea (Figure 3.4.1.3). When it takes place, the fishery on feeding fish is similar to the one on the spawning grounds using vessels with large pelagic trawls. However, during the feeding period the fish are more widely distributed and do not occur in the dense aggregations seen at the spawning grounds. This results in lower cpue and longer trawling times. The blue whiting are also higher in the water column during feeding, but nets are still typically fished at depths of 50–400 m.

3.4.2 Information about the potential bycatch of salmon in the blue whiting fishery

Relevant experts from Norway, Netherlands, Germany and the Faroe Islands participating in ICES working groups were contacted by the ICES Secretariat regarding potential bycatch of salmon; these countries are the main parties participating in the blue whiting fishery. None of the country representatives had heard any reports of bycatch of salmon in the fishery or had any data that might indicate that such bycatch had taken place.

The Working Group was informed about screening programmes for blue whiting in the Icelandic EEZ. As of September 15, 2016, a total of 5905 metric tonnes of blue whiting had been caught (for calendar year 2016). Observers do not go out on the vessels, but samplers do examine the blue whiting catch as it is landed at the wharf to check for bycatch. For each catch above 100 tonnes, five random samples are taken, with each sample weighing approximately 100 kg. In 2016, no Atlantic salmon were detected from these blue whiting samples. In 2015, 5 kg of Atlantic salmon were recorded as bycatch.

A number of additional investigations were conducted in Norway to gather information about the potential bycatch of salmon in the blue whiting fishery:

- Fishermen who collaborate with the Institute of Marine Research in Norway were contacted for their views. These fishers responded that they had experienced some bycatch of salmon in the commercial fishery for mackerel and herring, but not in the fishery for blue whiting.
- Secondly, the Norwegian Directorate for Fisheries were consulted. There had been no formal reporting of any bycatch of salmon in the blue whiting fishery by Norwegian vessels. One vessel had reported 500 kg of "salmon fish" in 2007, but this was assumed to have been an error since no salmon were ever landed. Further, screening of blue whiting landings in 2012–

2014, and partly in 2015, had not revealed any bycatch of salmon. The controls are defined as "full-controls", where several samples are taken from selected landing and checked for bycatch. The number of controls are based on previous experience of bycatch in the fishery. As the blue whiting fishery is considered to have very little bycatch in general, there are fewer controls of this fishery compared to several other fisheries, for instance the trawl fishery in the North Sea targeting fish used for fishmeal.

- Finally, information was sought from the Norwegian reference fleet. This is a subset of the Norwegian fishing fleet who get paid to report detailed information about their commercial catches, fishing effort, and to provide full details of any bycatch taken in the commercial fishery. Data from the reference fleet for the years 2008–2016 were retrieved and comprised more than 200 commercial blue whiting catches, each exceeding 1000 kg. These catches were taken in different areas, both from the spawning grounds and the feeding areas. There were no records of any salmon taken as bycatch in these blue whiting catches. In the same period (2008–2016), there were about 20 instances of salmon being taken as bycatch reported by the Norwegian reference fleet targeting other species. These salmon were caught when targeting saithe, haddock, cod, ling, herring, capelin and redfish. The individual salmon taken had been in the range 0.4–7.1 kg.

None of the information available to the Working Group suggest that salmon are taken frequently as bycatch in the blue whiting fishery. In addition, much of the blue whiting catch is taken at a time prior to salmon smolts emigrating into the marine environment. Further, blue whiting are mainly captured at some depth, while salmon are generally thought to be distributed in surface waters. The Working Group therefore believes that there is likely to be very little impact by the blue whiting fishery on salmon stocks.

It is nonetheless recognised that uncertainties remain. Aside from the Icelandic screening, there have been no independent observers on board vessels during the blue whiting fishery. This would, in any event, pose substantial practical and logistic difficulties. Detecting small numbers of salmon in large blue whiting catches that can exceed 2000 tonnes would be very challenging, not least since post-smolts and blue whiting are about the same size and fairly similar in appearance. However, the main portion of fishery occurs in February and March, a time period in which there are no post-smolts at sea, and any bycatch of salmon would be of adult size that would be more detectable by the fishing fleets. Detection of bycatch in the May–June fishery in the Norwegian Sea would be more challenging and post-smolts may be vulnerable in that time and location.

3.5 Tables

Table 3.1.3.1. Number of gear units licensed or authorised by country and gear type, 1971 to 2016.

Year	England & Wales					UK (Scotland)		UK (N. Ireland)			Ireland				France		
	Gillnet licences	Sweepnet	Hand-held net	Fixed engine	Rod & Line	Fixed engine[1]	Net and coble[2]	Driftnet	Draftnet	Bagnets and boxes	Driftnets No.	Draftnets	Other nets Commercial	Rod	Rod and line licences in freshwater	Com. nets in freshwater[5]	Drift net Licences in estuary[6,7]
1971	437	230	294	79	-	3080	800	142	305	18	916	697	213	10566	-	-	-
1972	308	224	315	76	-	3455	813	130	307	18	1156	678	197	9612	-	-	-
1973	291	230	335	70	-	3256	891	130	303	20	1112	713	224	11660	-	-	-
1974	280	240	329	69	-	3188	782	129	307	18	1048	681	211	12845	-	-	-
1975	269	243	341	69	-	2985	773	127	314	20	1046	672	212	13142	-	-	-
1976	275	247	355	70	-	2862	760	126	287	18	1047	677	225	14139	-	-	-
1977	273	251	365	71	-	2754	684	126	293	19	997	650	211	11721	-	-	-
1978	249	244	376	70	-	2587	692	126	284	18	1007	608	209	13327	-	-	-
1979	241	225	322	68	-	2708	754	126	274	20	924	657	240	12726	-	-	-
1980	233	238	339	69	-	2901	675	125	258	20	959	601	195	15864	-	-	-
1981	232	219	336	72	-	2803	655	123	239	19	878	601	195	15519	-	-	-
1982	232	221	319	72	-	2396	647	123	221	18	830	560	192	15697	4145	55	82
1983	232	209	333	74	-	2523	668	120	207	17	801	526	190	16737	3856	49	82
1984	226	223	354	74	-	2460	638	121	192	19	819	515	194	14878	3911	42	82
1985	223	230	375	69	-	2010	529	122	168	19	827	526	190	15929	4443	40	82
1986	220	221	368	64	-	1955	591	121	148	18	768	507	183	17977	5919	58 [8]	86
1987	213	206	352	68	-	1679	564	120	119	18	768	507	183	17977	5724 [9]	87 [9]	80
1988	210	212	284	70	-	1534	385	115	113	18	836	507	183	11539	4346	101	76
1989	201	199	282	75	-	1233	353	117	108	19	801	507	183	16484	3789	83	78
1990	200	204	292	69	-	1282	340	114	106	17	756	525	189	15395	2944	71	76
1991	199	187	264	66	-	1137	295	118	102	18	707	504	182	15178	2737	78	71
1992	203	158	267	65	-	851	292	121	91	19	691	535	183	20263	2136	57	71
1993	187	151	259	55	-	903	264	120	73	18	673	457	161	23875	2104	53	55
1994	177	158	257	53	37278	749	246	119	68	18	732	494	176	24988	1672	14	59
1995	163	156	249	47	34941	729	222	122	68	16	768	512	164	27056	1878	17	59
1996	151	132	232	42	35281	643	201	117	66	12	778	523	170	29759	1798	21	69
1997	139	131	231	35	32781	680	194	116	63	12	852	531	172	31873	2953	10	59
1998	130	129	196	35	32525	542	151	117	70	12	874	513	174	31565	2352	16	63
1999	120	109	178	30	29132	406	132	113	52	11	874	499	162	32493	2225	15	61
2000	110	103	158	32	30139	381	123	109	57	10	871	490	158	33527	2037	16	51
2001	113	99	143	33	24350	387	95	107	50	6	881	540	155	32814	2080	18	63
2002	113	94	147	32	29407	426	102	106	47	4	833	544	159	35024	2082	18	65
2003	58	96	160	57	29936	363	109	105	52	2	877	549	159	31809	2048	18	60
2004	57	75	157	65	32766	450	118	90	54	2	831	473	136	30807	2158	15	62
2005	59	73	148	65	34040	381	101	93	57	2	877	518	158	28738	2356	16	59
2006	52	57	147	65	31606	364	86	107	49	2	875	533	162	27341	2269	12	57
2007	53	45	157	66	32181	238	69	20	12	2	0	335	100	19986	2431	13	59
2008	55	42	130	66	33900	181	77	20	12	2	0	160	0	20061	2401	12	56
2009	50	42	118	66	36461	162	64	20	12	2	0	146	38	18314	2421	12	37
2010	51	40	118	66	36159	189	66	2	1	2	0	166	40	17983	2200	12	33
2011	53	41	117	66	36991	201	74	2	1	2	0	154	91	19899	2540	12	29
2012	51	34	115	73	35135	237	79	1	1	2	0	149	86	19588	2799	12	25
2013	49	29	111	62	33301	238	59	0	0	0	0	181	94	19109	3010	12	25
2014	48	34	109	65	31605	204	56	0	0	0	0	122	37	18085	2878	12	20
2015	52	33	102	63	30847	127	65	0	0	0	0	100	6	18460	2850	12	20
2016	49	32	105	60	30015	13	41	0	0	0	0	98	4	18303	3015	19	20
Mean 2011-2015	51	34	111	66	33576	201	67	1	0	1	0	141	63	19028	2 815	12	24
% change [3]	-3,2	-6,4	-5,2	-8,8	-10,6	-93,5	-38,4	-100,0	-100,0	-100,0	0,0	-30,6	-93,6	-3,8	7,1	58,3	-16,0
Mean 2006-2015	51	40	122	66	33819	214	69	17	9	1	88	205	65	19883	2 580	12	36
% change [3]	-4,7	-19,4	-14,2	-8,8	-11,2	-93,9	-40,8	-100,0	-100,0	-100,0	-100,0	-52,1	-93,9	-7,9	16,9	57,0	-44,6

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

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

[3] (2016/mean - 1) * 100

[4] Dash means "no data"

[5] Lower Adour only since 1994 (Southwestern France), due to fishery closure in the Loire Basin.

[6] Adour estuary only (Southwestern France).

[7] Number of fishermen or boats using drift nets: overestimates the actual number of fishermen targeting salmon by a factor 2 or 3.

[8] Common licence for salmon and sea trout introduced in 1986, leading to a short-term increase in the number of licences issued.

[9] Compulsory declaration of salmon catches in freshwater from 1987 onwards.

Table 3.1.3.1 (continued). Number of gear units licensed or authorised by country and gear type, 1971 to 2016.

	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational fishery		Local rod and	Recreational	Catch-and-release	Commercial,	
Year	Bagnet	Bendnet	Liftnet	Driftnet	Tourist anglers		net fishery	fishery	Fishing days	number of gears	
				(No. nets)	Fishing days	Fishermen	Fishermen	Fishermen		Coastal	In-river
1971	4608	2421	26	8976	-	-	-	-	-	-	-
1972	4215	2367	24	13448	-	-	-	-	-	-	-
1973	4047	2996	32	18616	-	-	-	-	-	-	-
1974	3382	3342	29	14078	-	-	-	-	-	-	-
1975	3150	3549	25	15968	-	-	-	-	-	-	-
1976	2569	3890	22	17794	-	-	-	-	-	-	-
1977	2680	4047	26	30201	-	-	-	-	-	-	-
1978	1980	3976	12	23301	-	-	-	-	-	-	-
1979	1835	5001	17	23989	-	-	-	-	-	-	-
1980	2118	4922	20	25652	-	-	-	-	-	-	-
1981	2060	5546	19	24081	16859	5742	677	467	-	-	-
1982	1843	5217	27	22520	19690	7002	693	484	-	-	-
1983	1735	5428	21	21813	20363	7053	740	587	-	-	-
1984	1697	5386	35	21210	21149	7665	737	677	-	-	-
1985	1726	5848	34	20329	21742	7575	740	866	-	-	-
1986	1630	5979	14	17945	21482	7404	702	691	-	-	-
1987	1422	6060	13	17234	22487	7759	754	689	-	-	-
1988	1322	5702	11	15532	21708	7755	741	538	-	-	-
1989	1888	4100	16	0	24118	8681	742	696	-	-	-
1990	2375	3890	7	0	19596	7677	728	614	-	-	-
1991	2343	3628	8	0	22922	8286	734	718	1711	-	-
1992	2268	3342	5	0	26748	9058	749	875	4088	-	-
1993	2869	2783	-	0	29461	10198	755	705	6026	59	199
1994	2630	2825	-	0	26517	8985	751	671	8619	60	230
1995	2542	2715	-	0	24951	8141	687	716	5822	55	239
1996	2280	2860	-	0	17625	5743	672	814	6326	85	330
1997	2002	1075	-	0	16255	5036	616	588	6355	68	282
1998	1865	1027	-	0	18700	5759	621	673	6034	66	270
1999	1649	989	-	0	22935	6857	616	850	7023	66	194
2000	1557	982	-	0	28385	8275	633	624	7336	60	173
2001	1976	1081	-	0	33501	9367	863	590	8468	53	121
2002	1666	917	-	0	37491	10560	853	660	9624	63	72
2003	1664	766	-	0	34979	10032	832	644	11994	55	84
2004	1546	659	-	0	29494	8771	801	657	13300	62	56
2005	1453	661	-	0	27627	7776	785	705	20309	93	69
2006	1283	685	-	0	29516	7749	836	552	13604	62	72
2007	1302	669	-	0	33664	8763	780	716		82	53
2008	957	653	-	0	31143	8111	756	694		66	62
2009	978	631	-	0	29641	7676	761	656		79	72
2010	760	493	-	0	30646	7814	756	615		55	66
2011	767	506	-	0	31269	7915	776	727		78	52
2012	749	448	-	0	32614	7930	785	681		72	53
2013	786	459	-	0	33148	8074	785	558		110	71
2014	700	436	-	0	32852	7791	746	396		57	74
2015	724	406	-	0	33435	7809	765	232		81	62
2016	798	438	-	0	31923	7273	712	512		42	59
Mean 2011-2015	745	451		0	32664	7904	771	519		80	62
% change [3]	7,1	-2,9		0,0	-2,3	-8,0	-7,7	-1,3		-47,2	-5,4
Mean 2006-2015	901	539		0	31793	7963	775	583		74	64
% change [3]	-11,4	-18,7		0,0	0,4	-8,7	-8,1	-12,1		-43,4	-7,4

3 (2016/mean - 1) * 100

[4] Dash means "no data"

Table 3.1.4.1. Nominal catch of salmon in the NEAC Area (in tonnes round fresh weight), 1960–2016. The 2016 figures are provisional.

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total Reported Catch	Unreported catches NEAC Area (3)	Unreported catches International waters (4)
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	1,684	6	-	3,586	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	-	2,496	946	-
2003	908	1,394	0	-	2,303	719	-
2004	919	1,059	0	-	1,978	575	-
2005	809	1,189	0	-	1,998	605	-
2006	650	1,217	0	-	1,867	604	-
2007	373	1,036	0	-	1,408	465	-
2008	355	1,178	0	-	1,533	433	-
2009	266	898	0	-	1,164	317	-
2010	411	1,003	0	-	1,414	357	-
2011	410	1,009	0	-	1,419	382	-
2012	295	955	0	-	1,250	363	-
2013	310	770	0	-	1,080	272	-
2014	218	736	0	-	954	256	-
2015	223	859	0	-	1,081	298	-
2016	187	856	0	-	1,043	298	-
Average							
2011-2015	291	866	0	-	1157	314	-
2006-2015	351	966	0	-	1317	375	-

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

Table 3.1.5.1. Cpue for salmon rod fisheries in Finland (Teno, Naatamo), France, and UK(NI)(Bush), 1974 to 2016.

	Finland (R. Teno)		Finland (R. Naatamo)		France		UK(N.Ire.)(R.Bus
	Catch per angler season	Catch per angler day	Catch per angler season	Catch per angler day	Catch per angler season		Catch per rod day
Year	kg	kg	kg	kg	Number		Number
1974		2,8					
1975		2,7					
1976		-					
1977		1,4					
1978		1,1					
1979		0,9					
1980		1,1					
1981	3,2	1,2					
1982	3,4	1,1					
1983	3,4	1,2					0,248
1984	2,2	0,8	0,5	0,2			0,083
1985	2,7	0,9	n/a	n/a			0,283
1986	2,1	0,7	n/a	n/a			0,274
1987	2,3	0,8	n/a	n/a	0,39		0,194
1988	1,9	0,7	0,5	0,2	0,73		0,165
1989	2,2	0,8	1,0	0,4	0,55		0,135
1990	2,8	1,1	0,7	0,3	0,71		0,247
1991	3,4	1,2	1,3	0,5	0,60		0,396
1992	4,5	1,5	1,4	0,3	0,94		0,258
1993	3,9	1,3	0,4	0,2	0,88		0,341
1994	2,4	0,8	0,6	0,2	2,32		0,205
1995	2,7	0,9	0,5	0,1	1,15		0,206
1996	3,0	1,0	0,7	0,2	1,57		0,267
1997	3,4	1,0	1,1	0,2	0,44	[1]	0,338
1998	3,0	0,9	1,3	0,3	0,67		0,569
1999	3,7	1,1	0,8	0,2	0,76		0,273
2000	5,0	1,5	0,9	0,2	1,06		0,259
2001	5,9	1,7	1,2	0,3	0,97		0,444
2002	3,1	0,9	0,7	0,2	0,84		0,184
2003	2,6	0,7	0,8	0,2	0,76		0,238
2004	1,4	0,4	0,9	0,2	1,25		0,252
2005	2,7	0,8	1,3	0,2	0,74		0,323
2006	3,4	1,0	1,9	0,4	0,89		0,457
2007	2,9	0,8	1,0	0,2	0,74		0,601
2008	4,2	1,1	0,9	0,2	0,77		0,457
2009	2,3	0,6	0,7	0,1	0,50		0,136
2010	3,0	0,8	1,3	0,2	0,87		0,226
2011	2,4	0,6	1,0	0,2	0,65		0,122
2012	3,6	0,9	1,7	0,4	0,61		0,149
2013	2,5	0,6	0,7	0,2	0,57		0,270
2014	3,3	0,8	1,4	0,3	0,73		0,15
2015	2,6	0,6	1,7	0,3	0,77		0,07
2016	2,9	0,7	1,1	0,2	na		0,3
Mean	3,1	1,0	1,0	0,2	0,8	#	0,3
2011-15	2,9	0,7	1,3	0,3	0,7	#	0,2

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

Table 3.1.5.2. Cpue for salmon in coastal and in-river fisheries the Archangelsk region, Russia, 1993 to 2016.

	Archangelsk region	
	Commercial fishery (tonnes/gear)	
Year	Coastal	In-river
1993	0,34	0,04
1994	0,35	0,05
1995	0,22	0,08
1996	0,19	0,02
1997	0,23	0,02
1998	0,24	0,03
1999	0,22	0,04
2000	0,28	0,03
2001	0,21	0,04
2002	0,21	0,11
2003	0,16	0,05
2004	0,25	0,08
2005	0,17	0,08
2006	0,19	0,05
2007	0,14	0,09
2008	0,12	0,08
2009	0,09	0,05
2010	0,21	0,08
2011	0,15	0,07
2012	0,17	0,09
2013	0,12	0,09
2014	0,22	0,10
2015	0,16	0,09
2016	0,31	0,08
Mean	0,21	0,06
2011-15	0,16	0,09

Table 3.1.5.3. Cpue data for net and fixed engine salmon fisheries by Region in UK(E&W). Data expressed as catch per licence-tide, except the Northeast, for which the data are recorded as catch per licence day.

		Region (aggregated data, various methods)				
Year	North East drift nets	North East	South West	Midlands	Wales	North West
1988		5,49				-
1989		4,39				0,82
1990		5,53				0,63
1991		3,20				0,51
1992		3,83				0,40
1993	8,23	6,43				0,63
1994	9,02	7,53				0,71
1995	11,18	7,84				0,79
1996	4,93	3,74				0,59
1997	6,48	4,40	0,70	0,48	0,07	0,63
1998	5,92	3,81	1,25	0,42	0,08	0,46
1999	8,06	4,88	0,79	0,72	0,02	0,52
2000	13,06	8,11	1,01	0,66	0,18	1,05
2001	10,34	6,83	0,71	0,79	0,16	0,71
2002	8,55	5,59	1,03	1,39	0,23	0,90
2003	7,13	4,82	1,24	1,13	0,11	0,62
2004	8,17	5,88	1,17	0,46	0,11	0,69
2005	7,23	4,13	0,60	0,97	0,09	1,28
2006	5,60	3,20	0,66	0,97	0,09	0,82
2007	7,24	4,17	0,33	1,26	0,05	0,75
2008	5,41	3,59	0,63	1,33	0,06	0,34
2009	4,76	3,08	0,53	1,67	0,04	0,51
2010	17,03	8,56	0,99	0,26	0,09	0,47
2011	19,25	9,93	0,63	0,14	0,10	0,34
2012	6,80	5,35	0,69		0,21	0,31
2013	11,06	8,22	0,54		0,08	0,39
2014	10,30	6,12	0,43		0,07	0,31
2015	12,93	7,22	0,64		0,08	0,39
2016	10,95	9,98	0,78		0,10	0,38
Mean	9,15	5,72	0,77	0,84	0,10	0,61
2011-15	12,07	7,37	0,59	0,14	0,11	0,35

Table 3.1.5.4. Catch per unit of effort (cpue) for salmon rod fisheries in each Region in UK(E&W), 1997–2016. Cpue is expressed as number of salmon (including released fish) caught per 100 days fished.

Year	Region						NRW	England &
	NE	Thames	Southern	SW	Midlands	Wales	Wales	Wales
1997	5,0	0,6	3,1	5,2	1,7	2,6	2,6	4,0
1998	6,5	0,0	5,9	7,5	1,3	3,9	3,9	6,0
1999	7,4	0,3	3,1	6,3	2,1	3,5	3,5	5,5
2000	9,2	0,0	5,2	8,8	4,9	4,4	4,4	7,9
2001	11,3	0,0	11,0	6,6	5,4	5,5	5,5	8,7
2002	9,4	0,0	18,3	6,0	3,5	3,6	3,6	6,8
2003	9,7	0,0	8,8	4,7	5,2	2,9	2,9	5,7
2004	14,7	0,0	18,8	9,6	5,5	6,6	6,6	11,4
2005	12,4	0,0	12,7	6,2	6,6	4,5	4,5	9,0
2006	14,2	0,0	15,6	8,7	6,6	5,9	5,9	10,1
2007	11,7	0,0	18,0	8,7	5,7	6,0	6,0	9,6
2008	12,7	0,0	21,8	10,9	5,8	7,3	7,3	10,5
2009	9,5	0,0	13,7	5,7	3,6	3,6	3,6	6,6
2010	16,7	2,8	17,1	9,9	4,3	6,5	6,5	10,2
2011	17,5	0,0	14,5	9,4	6,5	6,0	6,0	10,9
2012	15,4	0,0	17,3	9,2	6,3	6,5	6,5	10,6
2013	16,7	0,0	10,0	5,9	7,9	5,7	5,7	8,9
2014	12,1	0,0	11,9	4,8	5,0	6,9	4,4	7,1
2015	8,7	0,0	16,6	8,8	9,0	7,0	4,8	7,1
2016	13,7	0,0	18,1	7,8	10,0	8,4	6,6	9,2
Mean	11,7	0,2	13,1	7,5	5,3	5,4	5,0	8,3
Mean (2011-2015)	14,1	0,0	14,1	7,6	6,9	6,4	5,5	8,9

Table 3.1.5.5. Cpue data for Scottish net fisheries. Catch in numbers of fish per unit of effort, 1952 to 2016.

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	54,4	105,5
2001	61,0	77,4
2002	35,9	67,0
2003	68,3	66,8
2004	42,9	54,5
2005	45,8	80,9
2006	45,8	73,3
2007	47,6	91,5
2008	56,1	52,5
2009	42,2	73,3
2010	77,0	179,3
2011	62,6	80,7
2012	50,2	46,7
2013	64,6	129,4
2014	60,6	80,6
2015	74,8	56,7
2016*		68,6
Mean	50,8	153,6
2011-2015	62,6	78,8

[1] Excludes catch and effort for Solway Region
* No information on effort for fixed presented due to fishery regulation

Table 3.1.5.6. Catch per unit of effort for the marine fishery in Norway, 1998 to 2016. The cpue is expressed as numbers of salmon caught per net day in bag nets and bendnets divided by salmon weight.

	Bagnet				Bendnet		
Year	**< 3kg**	**3-7 kg**	**>7 kg**		**< 3kg**	**3-7 kg**	**>7 kg**
1998	0,88	0,66	0,12		0,80	0,56	0,13
1999	1,16	0,72	0,16		0,75	0,67	0,17
2000	2,01	0,90	0,17		1,24	0,87	0,17
2001	1,52	1,03	0,22		1,03	1,39	0,36
2002	0,91	1,03	0,26		0,74	0,87	0,32
2003	1,57	0,90	0,26		0,84	0,69	0,28
2004	0,89	0,97	0,25		0,59	0,60	0,17
2005	1,17	0,81	0,27		0,72	0,73	0,33
2006	1,02	1,33	0,27		0,72	0,86	0,29
2007	0,43	0,90	0,32		0,57	0,95	0,33
2008	1,07	1,13	0,43		0,57	0,97	0,57
2009	0,73	0,92	0,31		0,44	0,78	0,32
2010	1,46	1,13	0,39		0,82	1,00	0,38
2011	1,30	1,98	0,35		0,71	1,02	0,36
2012	1,12	1,26	0,43		0,89	1,03	0,41
2013	0,69	1,09	0,25		0,38	1,30	0,29
2014	1,83	1,08	0,24		1,27	1,08	0,29
2015	1,32	1,61	0,30		0,41	1,16	0,22
2016	0,84	1,40	0,35		0,55	1,83	0,42
Mean	1,15	1,10	0,28		0,74	0,97	0,31
2011-15	1,25	1,40	0,31		0,73	1,12	0,31

Table 3.1.6.1. Percentage of 1SW salmon in catches from countries in the Northeast Atlantic, 1987–2016. The total for the combined countries is averages weighted by catch.

Year	Iceland	Finland	Norway	Russia	Sweden	**Northern countries**	UK (Scot)	UK (E&W)	France	Spain (Asturia)	**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	75	**69**	48	52	45		**49**
1991	71	59	65	70	74	**66**	53	71	39		**58**
1992	72	70	62	72	69	**65**	55	77	48		**59**
1993	76	58	61	61	67	**63**	57	81	74	64	**64**
1994	63	55	68	69	67	**67**	54	77	55	69	**61**
1995	71	59	58	70	85	**62**	53	72	60	26	**59**
1996	73	79	53	80	68	**61**	53	65	51	34	**56**
1997	73	69	64	82	57	**68**	54	73	51	28	**60**
1998	82	75	66	82	66	**70**	58	82	71	54	**65**
1999	70	83	65	78	81	**68**	45	68	27	14	**54**
2000	82	71	67	75	69	**69**	54	79	58	74	**65**
2001	78	48	58	74	54	**60**	55	75	51	40	**62**
2002	83	34	49	70	62	**54**	54	76	69	38	**64**
2003	75	51	61	67	79	**62**	52	66	51	16	**55**
2004	86	47	52	68	50	**58**	51	81	40	67	**59**
2005	87	72	67	66	59	**69**	58	76	41	15	**61**
2006	84	73	54	77	61	**60**	57	78	50	15	**61**
2007	91	30	42	69	34	**50**	57	78	45	26	**61**
2008	90	34	46	58	36	**54**	48	76	42	11	**55**
2009	91	62	49	63	40	**59**	49	72	42	30	**54**
2010	82	50	56	58	49	**61**	55	78	67	32	**63**
2011	85	61	41	58	32	**50**	36	57	35	2	**44**
2012	86	76	47	70	30	**55**	49	50	38	18	**48**
2013	93	59	52	65	38	**64**	55	58	47	13	**55**
2014	80	65	59	63	46	**61**	49	58	40	4	**48**
2015	91	44	51	65	29	**58**	60	47	34	4	**51**
2016	84	53	43	66	35	**52**	51	41	51	30	**44**
Means											
1987-2000	72	67	64	72	68	66	55	71	51	45	60
2001-2016	85	54	52	66	46	58	52	67	46	23	55

Table 3.2.1.1. Conservation limit options for NEAC stock groups estimated from river-specific values, where available, or the national PFA run-reconstruction model. SERs based on the CLs used are also shown.

	National Model CLs		River Specific CLs		Conservation limit used		SER	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
Northern Europe								
Finland			14,271	9,562	14,271	9,562	17,336	16,386
Iceland (north & east)	5,854	1,678			5,854	1,678	7,218	2,876
Norway			60,614	72,747	60,614	72,747	77,009	120,991
Russia	62,752	34,506			62,752	34,506	79,785	61,997
Sweden			2,099	2,583	2,099	2,583	2,707	4,492
			Stock Complex		**145,590**	**121,075**	**184,055**	**206,742**

	National Model CLs		River Specific CLs		Conservation limit used		SER	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
Southern Europe								
France			17,400	5,100	17,400	5,100	22,440	9,419
Iceland (south & west)	17,790	1,171			17,790	1,171	21,935	2,006
Ireland			211,471	46,943	211,471	46,943	268,672	78,075
UK (E & W)			53,988	29,918	53,988	29,918	68,591	51,271
UK (NI)			19,911	3,280	19,911	3,280	24,365	5,504
UK (Sco)	256,548	182,741			256,548	182,741	325,942	310,205
			Stock Complex		**577,107**	**269,153**	**731,946**	**456,480**

Table 3.3.4.1. Estimated number of returning 1SW salmon by NEAC country or region and year, 1971 to 2016.

	Northern Europe								Southern Europe									NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		S&W					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	25,974	9,408		154,722	17,129				49,963	62,730	1,052,323	82,167	181,833	619,973	1,838,183	**2,060,067**	2,351,941			
1972	101,177	8,613		117,495	13,632				99,147	50,657	1,124,838	79,417	158,734	542,245	1,832,189	**2,072,027**	2,383,347			
1973	47,035	10,294		172,561	16,850				61,071	54,294	1,223,091	93,954	138,971	650,538	1,977,251	**2,236,909**	2,565,773			
1974	64,878	10,294		172,243	24,599				28,402	38,702	1,391,819	117,813	151,814	618,181	2,067,343	**2,359,638**	2,732,130			
1975	77,762	12,586		264,377	26,547				56,040	59,950	1,537,148	119,855	124,282	503,730	2,101,514	**2,413,124**	2,813,074			
1976	70,828	12,616		183,593	14,996				52,569	47,112	1,047,552	80,328	86,505	433,029	1,541,830	**1,756,161**	2,035,902			
1977	40,076	17,550		117,484	6,797				40,243	48,514	904,913	91,756	85,109	452,126	1,440,280	**1,631,940**	1,875,801			
1978	38,101	17,897		118,742	7,992				41,008	63,783	790,208	104,763	111,066	518,259	1,463,831	**1,640,256**	1,860,024			
1979	34,222	17,063		164,531	8,214				47,104	58,745	728,261	99,438	77,745	427,583	1,289,929	**1,449,522**	1,650,358			
1980	27,052	2,592		117,054	10,609				98,587	26,660	553,584	93,264	98,708	266,438	1,021,114	**1,149,167**	1,305,308			
1981	24,137	13,355		96,623	19,363				77,504	34,364	291,824	98,014	77,385	327,822	838,887	**917,140**	1,003,503			
1982	14,377	6,136		85,013	17,080				48,242	35,418	603,545	83,437	111,916	470,801	1,240,716	**1,361,559**	1,503,229			
1983	35,225	9,059	697,832	142,181	22,812	818,176	**909,455**	1,019,835	51,161	44,872	1,064,212	122,027	157,048	480,901	1,739,947	**1,928,877**	2,163,851	2,626,172	**2,842,029**	3,098,356
1984	38,440	3,287	729,378	153,105	32,112	857,853	**959,025**	1,079,680	84,150	27,454	560,855	106,446	61,670	508,587	1,236,748	**1,360,898**	1,501,256	2,161,058	**2,323,821**	2,504,818
1985	50,769	22,645	743,076	208,666	38,263	966,284	**1,067,418**	1,183,745	31,376	44,553	927,635	107,024	80,055	420,802	1,456,164	**1,618,309**	1,818,562	2,493,918	**2,689,435**	2,917,166
1986	40,036	28,193	646,163	178,292	39,856	850,810	**935,975**	1,035,707	48,244	73,382	1,034,075	123,680	89,795	523,802	1,720,565	**1,914,642**	2,144,495	2,636,434	**2,854,052**	3,101,954
1987	48,630	16,592	543,171	191,211	31,708	760,586	**834,624**	919,645	85,230	45,455	668,399	128,590	49,123	403,585	1,247,757	**1,404,776**	1,600,310	2,067,991	**2,243,865**	2,451,791
1988	28,622	24,058	498,811	131,852	26,611	649,980	**711,576**	783,394	29,805	81,527	909,787	177,039	115,786	608,934	1,750,497	**1,936,300**	2,158,299	2,454,292	**2,647,823**	2,881,030
1989	62,297	12,931	549,015	197,012	7,748	754,489	**830,296**	922,925	16,155	45,522	651,380	118,805	111,301	670,412	1,477,019	**1,624,315**	1,796,416	2,288,764	**2,457,360**	2,649,124
1990	62,280	9,670	491,364	163,327	17,916	681,046	**746,753**	826,175	26,802	41,952	407,524	85,107	92,261	320,851	894,150	**984,359**	1,090,335	1,617,281	**1,734,413**	1,862,206
1991	61,208	14,100	430,595	138,631	22,518	609,236	**669,753**	741,091	19,328	46,244	290,455	84,089	51,634	318,965	747,980	**818,590**	899,961	1,395,300	**1,490,115**	1,596,539
1992	86,167	26,570	361,416	171,413	25,056	619,248	**674,701**	737,255	35,847	53,149	422,688	88,052	104,522	465,136	1,077,932	**1,182,227**	1,303,650	1,737,937	**1,859,321**	1,995,293
1993	58,388	21,829	363,447	146,596	24,935	568,458	**618,626**	674,631	51,592	51,875	344,594	122,188	122,132	417,071	1,029,651	**1,125,044**	1,244,378	1,636,501	**1,745,241**	1,875,909
1994	32,445	6,973	491,518	173,837	19,260	658,205	**728,317**	810,512	40,194	42,745	439,680	135,261	83,997	445,366	1,097,850	**1,202,071**	1,327,508	1,803,321	**1,933,669**	2,081,098
1995	32,294	18,226	320,646	156,327	28,236	512,611	**559,075**	610,671	13,436	52,983	491,895	103,841	77,853	437,459	1,080,126	**1,184,365**	1,306,438	1,628,091	**1,744,206**	1,876,693
1996	54,687	9,758	244,852	212,146	16,678	495,985	**541,448**	592,055	16,491	45,538	456,800	77,214	80,510	313,476	905,173	**997,598**	1,109,843	1,435,168	**1,541,035**	1,660,883
1997	49,757	13,292	282,787	208,243	7,581	516,555	**564,604**	618,632	8,427	33,261	457,477	69,045	95,551	225,788	807,024	**895,605**	1,001,669	1,357,430	**1,462,007**	1,578,690
1998	62,242	22,682	368,205	227,200	6,123	630,524	**690,834**	756,915	16,640	45,600	478,132	76,113	207,824	307,668	1,038,907	**1,141,409**	1,262,782	1,714,450	**1,833,714**	1,971,899
1999	83,332	11,595	342,238	176,822	9,663	575,345	**626,742**	684,907	5,535	36,963	445,603	59,724	54,182	152,247	677,991	**758,972**	859,739	1,289,852	**1,388,124**	1,502,876
2000	90,596	12,189	563,093	192,822	17,784	805,178	**881,401**	968,460	14,340	33,015	619,346	91,810	78,669	297,406	1,022,188	**1,142,917**	1,284,609	1,879,914	**2,026,306**	2,188,643
2001	65,738	11,049	486,218	259,801	11,017	752,390	**840,706**	950,452	12,247	29,424	492,026	79,177	63,262	291,369	897,511	**976,588**	1,069,183	1,698,590	**1,822,136**	1,958,807
2002	44,599	19,136	298,030	236,392	10,672	544,284	**613,329**	706,956	27,961	36,710	430,828	74,888	114,294	235,437	858,558	**932,146**	1,015,838	1,441,297	**1,549,382**	1,671,011
2003	44,011	10,114	412,304	210,870	5,779	614,310	**688,387**	775,892	18,216	44,053	421,000	58,292	70,250	266,392	817,385	**890,713**	973,537	1,473,264	**1,582,106**	1,700,249
2004	18,685	27,362	249,957	147,594	4,818	406,555	**451,990**	509,390	22,185	43,993	310,640	105,246	67,486	316,448	805,485	**879,629**	969,163	1,245,247	**1,333,738**	1,436,852
2005	41,030	24,412	370,625	168,772	4,723	553,600	**613,897**	686,187	14,457	64,765	309,121	85,641	84,761	343,565	843,814	**914,247**	997,106	1,434,762	**1,531,333**	1,638,019
2006	71,661	25,694	299,980	204,021	5,289	548,605	**610,606**	687,758	19,909	45,966	237,253	84,161	57,412	332,836	722,566	**790,479**	873,351	1,306,756	**1,404,998**	1,514,249
2007	21,055	19,031	168,018	110,115	1,632	289,052	**322,010**	362,638	15,902	52,639	156,219	80,688	85,040	326,522	652,963	**739,717**	861,954	968,267	**1,064,230**	1,191,218
2008	22,632	17,488	210,165	114,190	2,553	332,424	**370,164**	415,417	15,870	63,586	252,102	79,104	53,238	281,414	654,399	**769,295**	980,953	1,017,723	**1,142,323**	1,354,662
2009	40,109	28,089	168,811	109,105	2,723	316,925	**351,122**	390,496	4,453	72,278	203,352	49,213	33,175	240,453	530,755	**622,891**	782,142	874,687	**976,044**	1,137,429
2010	32,273	22,509	249,970	123,941	4,660	393,200	**436,455**	484,554	15,035	74,155	273,541	97,713	32,988	439,800	816,997	**968,312**	1,190,688	1,247,368	**1,406,893**	1,630,338
2011	36,664	18,567	175,467	131,573	3,963	332,208	**368,426**	411,899	10,451	51,990	236,276	65,478	23,819	232,824	539,907	**639,868**	822,940	900,772	**1,010,924**	1,197,489
2012	63,559	9,651	195,762	152,456	5,556	388,090	**430,451**	485,218	11,147	29,459	242,174	38,082	54,634	311,601	592,509	**727,526**	935,965	1,016,689	**1,161,608**	1,372,704
2013	36,718	23,021	184,352	118,317	3,265	330,817	**369,875**	415,796	15,778	87,597	204,742	53,460	61,145	362,640	684,461	**833,259**	1,032,440	1,047,875	**1,206,138**	1,409,058
2014	51,917	10,832	251,806	111,141	8,997	391,992	**439,917**	496,834	14,058	21,705	125,704	31,264	27,221	276,714	427,073	**524,170**	656,363	854,805	**967,112**	1,108,971
2015	32,356	30,488	221,757	116,061	3,906	366,199	**409,568**	459,453	12,860	60,373	180,072	38,371	29,477	293,636	530,491	**650,235**	812,731	932,623	**1,061,389**	1,229,382
2016	25,270	18,638	171,919	82,696	2,474	274,224	**304,045**	338,759	11,673	38,078	176,201	39,964	57,899	284,715	537,134	**638,016**	786,844	837,313	**943,818**	1,094,796
10yr Av.	36,255	19,831	199,803	116,960	3,973	341,513	**380,203**	426,107	12,723	55,186	205,038	57,334	45,864	305,032	596,669	**711,329**	886,302	969,812	**1,094,048**	1,272,605

Table 3.3.4.2. Estimated number of returning MSW salmon by NEAC country or region and year, 1971 to 2016.

	Northern Europe								Southern Europe									NEAC Area		
Year	**Finland**	**Iceland**	**Norway**	**Russia**	**Sweden**	**Total**			**France**	**Iceland**	**Ireland**	**UK(EW)**	**UK(NI)**	**UK(Scot)**	**Total**			**Total**		
		N&E				5.0%	**50.0%**	95.0%		**S&W**					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	23,911	9,665		132,840	642				10,845	24,447	157,701	90,952	21,902	568,933	782,043	**880,870**	997,368			
1972	25,049	15,053		134,550	508				21,694	37,564	169,163	149,724	19,216	730,258	1,009,032	**1,138,201**	1,291,547			
1973	40,009	14,132		221,954	2,253				13,209	33,742	182,519	115,036	16,745	803,348	1,034,248	**1,174,671**	1,338,876			
1974	68,848	13,386		209,675	1,417				6,170	29,199	207,518	84,438	18,324	568,131	814,955	**921,543**	1,047,648			
1975	88,200	14,772		225,202	403				12,332	30,979	231,563	115,690	15,009	626,429	919,508	**1,040,965**	1,188,855			
1976	68,717	12,164		194,757	1,211				9,004	26,798	159,539	60,096	10,453	391,372	587,084	**663,248**	755,700			
1977	47,862	17,007		134,358	520				6,905	26,127	140,196	76,231	10,276	427,594	612,613	**693,536**	786,342			
1978	24,289	21,885		115,935	641				7,121	33,744	120,949	64,478	13,382	532,158	688,703	**777,860**	887,662			
1979	24,092	14,432		101,631	1,672				8,173	21,597	108,664	31,849	9,405	394,923	508,317	**578,439**	665,350			
1980	23,762	20,072		168,945	3,237				17,009	30,411	119,979	103,252	11,915	482,188	686,825	**772,868**	873,874			
1981	28,111	7,027		96,597	714				11,690	20,293	88,402	145,252	9,316	517,570	711,654	**802,233**	907,714			
1982	37,291	8,082		85,483	3,476				7,158	14,327	51,445	56,192	13,521	420,084	502,294	**566,770**	646,019			
1983	41,670	6,145	428,330	123,941	2,272	547,256	**604,867**	670,747	7,744	23,983	106,208	64,359	18,947	450,526	606,580	**675,753**	760,937	1,190,692	**1,283,140**	1,388,583
1984	34,757	7,966	438,385	123,835	3,192	554,608	**610,047**	674,809	12,644	20,215	76,448	51,470	7,434	376,843	491,709	**548,405**	616,766	1,077,482	**1,161,302**	1,252,734
1985	33,406	5,132	404,975	135,385	1,186	528,603	**582,364**	642,163	9,484	14,736	83,854	75,725	9,649	464,413	591,091	**661,284**	742,822	1,155,187	**1,245,475**	1,345,168
1986	27,663	13,956	486,710	134,073	602	601,015	**665,226**	736,181	9,747	12,299	94,700	103,124	10,836	593,206	738,059	**830,883**	942,058	1,380,370	**1,498,734**	1,630,083
1987	36,208	14,473	367,186	99,458	2,727	474,451	**521,916**	577,274	5,154	10,899	117,328	82,787	5,551	387,150	546,827	**613,484**	688,984	1,053,194	**1,137,464**	1,230,399
1988	25,519	9,297	306,902	99,781	2,928	407,597	**445,902**	489,262	14,239	12,419	84,943	107,645	15,623	601,034	748,819	**842,002**	950,514	1,187,641	**1,288,472**	1,404,500
1989	24,989	7,886	219,652	97,141	10,200	332,034	**361,425**	394,459	6,555	11,094	77,375	86,921	12,446	523,850	647,223	**723,433**	813,357	1,003,479	**1,085,763**	1,180,797
1990	27,699	8,347	260,117	124,741	5,330	392,504	**427,434**	469,275	6,672	10,995	37,255	106,625	11,330	437,934	549,338	**616,432**	695,011	968,147	**1,045,251**	1,134,260
1991	37,090	5,783	220,082	122,269	7,157	363,357	**393,679**	428,629	6,055	10,965	56,029	47,011	5,821	332,608	412,691	**461,441**	518,171	797,090	**856,531**	922,412
1992	35,860	8,614	239,257	116,344	9,959	379,681	**411,379**	448,470	7,610	12,368	42,991	36,030	13,330	443,999	498,093	**558,387**	633,322	900,748	**971,801**	1,052,673
1993	37,768	9,735	229,720	137,781	11,232	398,306	**427,960**	460,334	3,557	6,063	42,295	39,403	31,383	364,088	437,673	**492,202**	558,353	857,852	**921,509**	994,755
1994	35,560	8,239	224,340	121,752	8,582	370,555	**400,526**	434,806	7,633	9,841	67,588	55,780	11,054	441,478	534,853	**596,954**	675,122	927,730	**998,613**	1,082,973
1995	23,462	5,221	240,306	138,533	4,267	382,877	**413,199**	448,195	3,638	10,062	65,264	55,754	9,343	409,500	497,692	**557,652**	631,046	901,694	**972,564**	1,053,381
1996	24,018	6,832	241,614	104,805	6,965	356,002	**386,246**	420,208	6,476	6,503	43,632	57,290	10,235	312,614	392,116	**441,648**	500,095	769,178	**828,412**	895,793
1997	28,922	3,867	159,089	85,188	5,012	261,867	**284,081**	308,972	3,321	7,303	56,104	35,568	12,761	214,700	295,672	**336,609**	384,436	573,769	**621,980**	675,105
1998	27,544	5,629	191,410	105,432	2,781	309,113	**334,417**	362,153	2,832	4,528	32,836	23,408	17,507	227,929	278,186	**311,642**	352,159	603,910	**646,884**	695,918
1999	29,484	6,457	204,290	93,212	1,982	308,936	**336,750**	368,668	6,069	8,831	51,395	46,440	7,964	175,241	261,673	**305,745**	363,593	590,315	**643,855**	707,875
2000	56,465	3,781	283,070	162,273	7,087	476,275	**515,380**	558,710	4,238	2,391	63,953	48,161	10,603	224,552	318,560	**360,085**	409,202	818,307	**875,957**	941,076
2001	74,966	4,346	333,675	114,866	8,427	494,052	**538,496**	588,198	4,959	4,214	57,055	52,081	6,619	213,913	302,590	**345,743**	398,105	822,047	**885,403**	954,558
2002	65,899	4,100	289,248	125,081	5,789	452,143	**491,950**	538,623	4,584	4,561	65,691	46,951	8,471	175,237	274,477	**311,731**	356,267	749,726	**805,524**	867,688
2003	47,404	4,317	255,237	87,095	1,382	365,251	**397,496**	433,222	6,653	7,272	69,395	60,203	5,085	217,713	326,296	**374,203**	432,819	713,623	**772,161**	840,231
2004	21,543	4,242	231,493	67,257	4,259	300,629	**329,652**	363,425	12,453	5,878	37,814	51,410	5,352	282,643	351,633	**401,886**	461,510	673,549	**732,252**	799,583
2005	17,862	5,269	213,185	80,666	2,869	294,590	**320,619**	350,826	7,610	5,185	49,233	56,216	6,735	222,105	309,995	**353,275**	406,846	623,689	**675,008**	736,193
2006	28,151	5,027	270,499	77,210	2,983	353,274	**384,878**	420,788	7,651	4,305	35,835	51,042	5,299	230,540	297,343	**343,471**	398,822	672,790	**729,425**	793,742
2007	40,822	4,821	230,051	80,537	2,790	332,644	**359,890**	390,863	7,246	2,654	13,728	48,885	5,502	221,713	263,428	**306,103**	357,076	615,765	**667,138**	724,587
2008	41,100	6,231	265,532	125,947	3,916	407,416	**445,167**	488,953	7,993	3,032	18,696	53,242	4,293	248,429	294,108	**343,148**	405,463	725,392	**789,848**	863,639
2009	17,572	4,994	207,818	107,187	3,459	312,581	**342,437**	377,823	3,727	4,699	23,510	40,626	4,336	210,786	250,808	**293,897**	347,118	583,580	**637,968**	699,778
2010	28,266	7,127	229,322	132,522	4,006	367,834	**403,286**	443,251	3,069	9,696	21,836	60,533	6,352	278,050	330,380	**388,952**	464,214	721,943	**793,162**	878,282
2011	21,739	7,961	318,568	131,742	7,547	444,579	**489,979**	544,597	8,595	4,949	23,733	101,880	8,087	313,298	396,534	**473,965**	576,460	873,317	**966,166**	1,078,501
2012	26,280	4,488	279,514	64,936	10,698	349,660	**387,060**	430,116	6,857	2,807	21,054	79,660	19,119	247,240	324,710	**390,589**	475,045	701,018	**779,475**	872,826
2013	25,360	5,130	197,610	74,399	4,530	280,263	**308,123**	339,242	7,100	7,759	23,893	78,481	6,113	218,839	291,588	**354,028**	434,443	594,240	**663,280**	747,414
2014	27,498	6,134	202,580	73,587	9,123	289,180	**320,345**	357,665	8,740	4,757	20,011	52,733	3,279	186,900	234,563	**284,688**	348,853	545,125	**606,519**	678,323
2015	26,549	5,845	256,549	69,141	9,797	332,266	**369,293**	412,739	9,873	4,312	20,721	85,720	4,238	134,682	220,760	**268,950**	341,257	577,330	**640,380**	721,093
2016	28,262	7,980	280,838	59,009	4,021	343,802	**381,109**	424,010	4,193	6,616	19,916	114,017	8,597	137,741	245,460	**299,214**	393,623	613,308	**683,135**	783,615
10yr Av.	28,345	6,071	246,838	91,901	5,989	346,023	**380,669**	420,926	6,739	5,128	20,710	71,578	6,992	219,768	285,234	**340,353**	414,355	655,102	**722,707**	804,806

Table 3.3.4.3. Estimated pre-fishery abundance of maturing 1SW salmon (potential 1SW returns) by NEAC country or region and year, 1971 to 2016.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		S&W					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	31,752	11,695	NA	NA	22,118				64,699	77,520	1,344,856	105,451	222,653	792,565	2,282,575	**2,623,050**	3,047,770			
1972	123,298	10,741	NA	151,133	17,595				127,885	62,634	1,438,472	101,961	195,012	694,066	2,274,571	**2,639,518**	3,090,751			
1973	57,364	12,802	NA	222,182	21,803				79,215	67,300	1,564,691	120,667	170,909	832,476	2,462,684	**2,852,254**	3,329,503			
1974	79,155	12,775	NA	220,853	31,638				36,852	47,896	1,775,134	150,242	186,015	790,459	2,572,742	**3,000,942**	3,553,023			
1975	94,711	15,611	NA	339,453	34,239				72,647	74,246	1,961,214	153,426	152,549	644,701	2,621,884	**3,072,790**	3,647,527			
1976	86,291	15,647	NA	236,293	19,335				67,921	58,379	1,335,988	102,611	106,082	553,490	1,916,870	**2,237,167**	2,640,271			
1977	48,856	21,708	NA	150,933	8,754				52,114	59,939	1,154,094	116,875	104,403	576,226	1,792,952	**2,077,333**	2,430,469			
1978	46,451	22,122	NA	152,818	10,295				53,132	78,884	1,007,033	133,797	136,042	661,322	1,813,550	**2,084,296**	2,413,853			
1979	41,682	21,139	NA	211,582	10,636				60,974	72,650	930,363	127,437	95,647	545,932	1,603,769	**1,846,278**	2,146,191			
1980	33,105	3,317	NA	150,723	13,735				127,888	33,280	709,479	120,173	121,556	345,036	1,280,023	**1,475,236**	1,707,270			
1981	29,563	16,590	NA	125,048	25,038				100,929	42,753	377,467	126,214	95,933	424,025	1,050,275	**1,179,463**	1,326,505			
1982	17,679	7,736	NA	109,722	22,089				62,936	44,075	775,415	107,882	138,061	606,835	1,546,656	**1,747,100**	1,980,108			
1983	43,175	11,388	889,199	183,159	29,503	1,018,056	**1,159,536**	1,332,457	67,033	55,809	1,361,196	157,681	193,608	621,797	2,174,041	**2,467,540**	2,831,492	3,256,351	**3,633,407**	4,074,478
1984	46,942	4,168	929,730	196,508	41,458	1,065,170	**1,221,507**	1,408,797	109,083	34,202	718,441	136,808	76,466	652,909	1,542,317	**1,742,467**	1,967,417	2,667,330	**2,969,012**	3,296,667
1985	61,958	28,069	944,639	268,797	49,369	1,197,534	**1,357,967**	1,549,179	40,834	55,269	1,184,318	137,077	98,575	539,368	1,806,216	**2,063,057**	2,367,372	3,078,089	**3,425,809**	3,823,343
1986	48,926	34,951	820,750	229,780	51,461	1,055,062	**1,190,685**	1,353,577	62,929	90,921	1,321,647	159,063	110,948	673,142	2,141,839	**2,444,906**	2,806,561	3,263,613	**3,640,819**	4,078,466
1987	59,219	20,551	690,481	246,187	40,879	940,466	**1,061,621**	1,202,680	109,671	56,243	851,608	164,073	60,603	516,206	1,551,606	**1,793,730**	2,084,475	2,548,871	**2,861,221**	3,212,749
1988	34,955	29,774	634,225	169,104	34,298	804,020	**904,233**	1,023,317	38,553	101,007	1,158,946	225,425	141,952	778,485	2,166,525	**2,465,096**	2,805,237	3,022,420	**3,371,566**	3,764,412
1989	75,924	16,023	699,139	251,797	9,992	931,557	**1,055,740**	1,203,919	21,129	56,527	829,872	152,335	136,420	857,111	1,832,922	**2,069,134**	2,345,571	2,818,135	**3,126,983**	3,479,894
1990	75,906	12,019	626,444	208,665	23,223	839,837	**949,446**	1,075,021	34,846	52,051	520,803	109,042	113,047	411,436	1,110,529	**1,254,832**	1,426,240	1,992,025	**2,210,477**	2,443,784
1991	74,460	17,420	547,289	178,057	29,140	751,025	**849,511**	965,386	25,000	57,203	369,783	107,313	63,234	406,409	925,364	**1,039,932**	1,173,052	1,712,505	**1,893,230**	2,090,607
1992	104,991	32,827	460,296	218,982	32,401	761,492	**853,946**	960,348	46,272	65,537	537,447	112,074	127,563	591,753	1,330,871	**1,497,822**	1,696,915	2,131,838	**2,354,345**	2,608,973
1993	71,109	26,994	461,966	187,835	32,236	700,874	**784,651**	878,629	66,782	64,147	438,747	155,697	149,134	530,891	1,267,589	**1,425,949**	1,616,130	2,002,172	**2,212,899**	2,452,087
1994	39,544	8,598	626,612	223,814	24,935	814,918	**926,096**	1,055,179	51,819	52,841	558,913	172,533	102,652	566,798	1,355,537	**1,526,663**	1,731,592	2,213,686	**2,457,439**	2,728,228
1995	39,307	22,537	408,001	200,231	36,418	633,330	**710,258**	799,645	17,414	65,449	626,043	132,286	95,223	556,465	1,332,945	**1,500,060**	1,699,257	1,999,941	**2,213,011**	2,454,235
1996	66,596	12,072	311,555	271,772	21,575	610,850	**687,911**	774,186	21,286	56,345	581,451	98,445	98,428	400,059	1,116,950	**1,264,595**	1,439,947	1,764,243	**1,952,382**	2,177,325
1997	60,567	16,463	359,309	267,034	9,792	636,580	**716,729**	808,522	10,916	41,089	581,064	87,700	116,548	286,998	994,572	**1,131,874**	1,298,839	1,665,839	**1,851,188**	2,065,562
1998	75,856	28,045	468,314	292,448	7,920	777,778	**876,809**	990,825	21,468	56,284	607,380	96,685	253,377	391,395	1,278,640	**1,439,279**	1,630,227	2,097,677	**2,319,738**	2,567,334
1999	101,435	14,326	435,544	226,366	12,482	707,612	**793,300**	891,717	7,146	45,656	566,635	75,991	66,220	193,862	838,787	**962,032**	1,109,925	1,583,520	**1,758,723**	1,958,262
2000	110,278	15,036	716,184	247,615	22,984	990,002	**1,117,605**	1,262,123	18,491	40,787	786,125	116,628	95,960	379,112	1,265,011	**1,449,370**	1,666,766	2,307,531	**2,568,490**	2,860,454
2001	80,015	13,625	616,678	333,052	14,215	932,603	**1,068,237**	1,234,978	15,798	36,325	626,814	100,799	77,298	371,423	1,103,194	**1,237,800**	1,394,964	2,084,578	**2,309,938**	2,565,992
2002	54,240	23,598	378,494	303,092	13,821	673,453	**779,411**	915,755	36,296	45,284	547,662	95,390	139,759	299,233	1,052,549	**1,176,531**	1,323,390	1,769,431	**1,960,641**	2,185,734
2003	53,619	12,511	524,796	269,929	7,476	761,576	**873,447**	1,008,246	23,538	54,461	536,962	74,241	85,895	339,061	1,005,726	**1,126,090**	1,269,969	1,808,257	**2,005,674**	2,225,532
2004	22,781	33,696	317,699	189,393	6,226	503,280	**574,007**	661,224	28,703	54,324	394,784	133,770	82,517	402,488	991,440	**1,113,410**	1,261,237	1,525,213	**1,691,147**	1,881,203
2005	49,882	30,108	471,118	216,017	6,095	685,536	**779,498**	892,680	18,644	79,872	393,750	108,729	103,521	436,264	1,035,742	**1,155,176**	1,296,663	1,758,035	**1,938,437**	2,142,720
2006	87,174	31,739	381,532	260,936	6,822	675,929	**773,799**	890,422	25,678	56,809	301,440	106,845	70,089	423,773	890,795	**1,000,662**	1,133,328	1,603,122	**1,778,433**	1,979,057
2007	25,650	23,528	213,669	140,790	2,108	356,302	**408,578**	470,329	20,586	64,991	199,143	102,726	103,733	415,747	806,943	**935,949**	1,108,755	1,192,007	**1,348,988**	1,540,041
2008	27,573	21,578	267,686	146,122	3,299	410,362	**469,986**	539,869	20,529	78,678	322,584	100,674	65,188	359,036	811,267	**978,140**	1,252,090	1,254,994	**1,453,272**	1,744,812
2009	48,826	34,639	214,447	137,877	3,510	388,570	**442,049**	503,167	5,744	89,042	258,603	62,663	40,543	306,110	658,535	**789,330**	1,002,065	1,078,940	**1,236,789**	1,462,604
2010	39,301	27,806	318,071	156,962	6,026	486,020	**552,170**	628,488	19,423	91,533	347,990	123,989	40,419	560,572	1,016,524	**1,228,486**	1,533,499	1,539,910	**1,784,635**	2,106,088
2011	44,630	22,942	222,796	166,968	5,123	409,541	**464,840**	532,634	13,460	64,215	300,286	83,375	29,181	296,476	671,893	**812,910**	1,056,522	1,115,368	**1,284,323**	1,541,047
2012	77,299	11,919	248,771	194,872	7,178	478,509	**544,323**	628,103	14,399	36,336	309,147	48,409	66,569	396,437	737,742	**922,662**	1,196,858	1,256,954	**1,470,938**	1,765,047
2013	44,705	28,512	234,514	151,979	4,230	408,696	**469,004**	540,305	20,324	108,277	260,875	68,236	74,686	460,389	849,692	**1,055,114**	1,323,179	1,299,634	**1,526,738**	1,810,507
2014	63,355	13,381	320,546	142,648	11,613	484,046	**557,864**	644,225	18,180	26,730	160,408	39,788	33,296	352,736	533,443	**665,470**	842,305	1,057,167	**1,226,909**	1,432,874
2015	39,405	37,645	282,024	149,237	5,057	454,422	**519,466**	597,059	16,627	74,553	229,739	48,908	36,092	374,221	661,089	**824,582**	1,042,896	1,155,902	**1,346,686**	1,588,182
2016	30,801	22,976	218,924	105,978	3,201	338,860	**385,460**	439,600	15,125	47,034	224,130	50,918	71,183	362,822	668,654	**808,489**	1,007,431	1,035,564	**1,196,897**	1,408,489
10yr Av.	44,155	24,493	254,145	149,343	5,135	421,533	**481,374**	552,378	16,440	68,139	261,291	72,969	56,089	388,455	741,578	**902,113**	1,136,560	1,198,644	**1,387,618**	1,639,969

Table 3.3.4.4. Estimated pre-fishery abundance of non-maturing 1SW salmon (potential MSW returns) by NEAC country or region and year, 1971 to 2016.

	Northern Europe								Southern Europe									NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		S&W					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	51,961	27,155	NA	267,056	4,655				62,424	65,811	400,350	381,797	32,883	1,765,615	2,311,338	**2,721,607**	3,221,236			
1972	78,518	25,509	NA	429,842	7,054				39,274	59,186	382,899	280,499	28,908	1,710,925	2,103,958	**2,513,256**	3,028,318			
1973	125,266	23,877	NA	397,417	4,780				22,693	50,899	405,478	208,698	31,336	1,232,150	1,641,484	**1,964,395**	2,348,411			
1974	160,038	26,467	NA	430,507	3,387				35,111	54,216	449,692	268,060	25,982	1,350,017	1,838,891	**2,198,658**	2,640,628			
1975	124,275	21,675	NA	367,301	4,366				29,133	46,747	333,052	173,131	18,001	960,936	1,326,423	**1,566,286**	1,860,281			
1976	86,473	29,782	NA	253,787	2,481				21,480	45,476	279,933	179,328	17,596	931,476	1,242,080	**1,484,488**	1,770,350			
1977	45,085	38,143	NA	218,207	2,388				20,495	58,464	240,574	151,364	22,729	1,077,830	1,311,592	**1,580,562**	1,901,373			
1978	46,876	25,466	NA	199,472	4,379				20,938	37,714	211,820	87,776	16,248	807,097	985,908	**1,188,079**	1,440,578			
1979	54,239	35,981	NA	346,099	8,793				40,434	53,601	245,475	229,046	21,271	1,029,920	1,361,657	**1,629,670**	1,951,951			
1980	69,989	14,398	NA	239,663	5,802				31,345	37,024	195,269	307,347	17,757	1,109,476	1,432,414	**1,709,799**	2,050,620			
1981	84,170	16,027	NA	213,910	10,193				21,326	26,591	125,099	145,696	24,586	907,683	1,052,721	**1,256,468**	1,502,306			
1982	87,308	12,234	833,745	269,292	7,194	1,013,581	**1,213,228**	1,454,124	20,761	42,727	207,835	149,039	33,230	920,227	1,157,000	**1,377,039**	1,654,967	2,203,442	**2,593,071**	3,065,774
1983	69,748	14,737	808,223	252,139	7,549	964,286	**1,155,402**	1,382,675	26,843	35,799	142,864	108,860	13,422	720,812	875,719	**1,053,779**	1,274,335	1,865,975	**2,211,108**	2,617,369
1984	68,090	9,916	755,632	276,602	4,135	930,807	**1,117,446**	1,341,522	20,533	26,261	152,944	149,036	17,175	859,588	1,016,785	**1,231,103**	1,491,160	1,975,906	**2,351,564**	2,793,327
1985	60,411	25,384	910,059	280,676	3,872	1,072,174	**1,285,050**	1,539,374	24,947	22,428	192,123	217,958	19,363	1,168,821	1,375,232	**1,655,744**	2,000,635	2,489,794	**2,940,304**	3,488,104
1986	74,402	26,240	706,073	215,859	7,397	864,030	**1,031,607**	1,233,698	16,206	19,937	228,592	181,272	10,468	815,964	1,071,009	**1,277,472**	1,530,425	1,959,962	**2,312,067**	2,728,643
1987	49,838	16,672	560,012	197,406	6,670	696,230	**834,440**	996,258	32,137	21,985	170,061	217,484	26,737	1,156,371	1,352,738	**1,634,244**	1,979,741	2,079,377	**2,468,997**	2,939,269
1988	50,674	14,406	425,330	197,065	19,614	597,005	**709,272**	846,521	18,666	19,811	162,214	186,708	21,539	1,045,771	1,220,169	**1,460,642**	1,759,607	1,836,975	**2,172,419**	2,578,799
1989	53,648	14,974	478,371	242,104	10,499	669,558	**800,501**	958,553	14,945	19,508	74,514	198,678	19,512	806,852	937,880	**1,142,724**	1,385,863	1,632,183	**1,942,456**	2,311,994
1990	67,527	10,341	394,776	231,861	13,332	598,535	**721,830**	856,470	12,687	19,240	100,161	89,087	10,115	600,026	687,274	**836,250**	1,015,544	1,305,002	**1,559,583**	1,847,370
1991	63,716	15,031	412,331	213,974	17,954	606,586	**725,244**	868,844	16,363	21,444	83,036	74,484	22,384	807,705	847,274	**1,028,256**	1,251,091	1,475,708	**1,755,537**	2,088,122
1992	67,091	16,976	395,739	253,389	20,154	632,056	**754,942**	902,085	8,083	10,620	78,087	76,502	52,621	654,883	731,163	**888,537**	1,087,237	1,384,382	**1,646,528**	1,963,019
1993	62,839	14,378	386,122	226,158	15,316	591,253	**707,215**	847,940	14,471	17,097	113,638	98,436	18,673	757,891	838,364	**1,023,996**	1,254,084	1,451,545	**1,733,997**	2,071,668
1994	42,538	9,197	416,531	257,726	7,830	613,985	**735,926**	880,575	7,080	17,496	110,299	98,431	15,843	701,548	782,098	**956,880**	1,173,693	1,418,316	**1,693,120**	2,025,081
1995	42,854	11,943	414,155	194,624	12,527	565,823	**678,484**	815,005	12,688	11,309	75,767	102,648	17,372	545,965	630,106	**772,252**	943,272	1,215,014	**1,451,616**	1,735,375
1996	49,932	6,664	266,174	154,377	8,843	405,537	**489,157**	587,976	6,542	12,565	96,073	63,280	21,466	373,889	473,838	**583,497**	717,018	894,169	**1,073,622**	1,286,032
1997	47,863	9,701	319,652	191,825	4,917	480,149	**576,319**	691,388	5,454	7,797	55,732	41,432	29,486	392,009	438,120	**535,590**	657,764	932,721	**1,113,253**	1,326,669
1998	50,847	11,128	340,270	169,186	3,477	478,298	**575,183**	695,666	11,416	15,205	86,461	80,228	13,387	298,742	412,892	**521,163**	660,676	911,489	**1,100,380**	1,326,971
1999	97,208	6,514	472,579	295,632	12,457	738,488	**886,105**	1,065,121	7,949	4,132	107,066	83,300	17,851	382,908	498,115	**611,436**	753,672	1,261,191	**1,498,848**	1,793,486
2000	129,615	7,479	555,049	207,311	14,786	762,986	**915,901**	1,106,959	9,679	7,261	97,778	91,881	13,139	372,942	487,466	**603,565**	745,608	1,275,524	**1,521,413**	1,819,272
2001	113,137	7,072	481,358	225,592	10,140	699,200	**838,955**	1,012,255	8,751	7,860	111,159	82,107	14,187	302,940	435,473	**535,420**	660,116	1,154,815	**1,376,929**	1,644,096
2002	81,532	7,412	425,505	158,523	2,449	562,727	**676,896**	815,099	12,638	12,495	116,980	105,131	8,507	376,615	519,715	**643,683**	805,755	1,103,111	**1,321,084**	1,589,949
2003	37,214	7,350	386,120	121,905	7,452	464,878	**561,024**	678,303	23,191	10,142	63,881	89,102	9,005	484,273	556,892	**688,918**	858,407	1,043,193	**1,251,871**	1,509,883
2004	30,730	9,081	355,720	146,263	5,023	454,707	**548,328**	658,054	14,286	8,926	82,554	97,206	11,306	380,907	488,137	**604,469**	752,431	960,723	**1,155,079**	1,384,151
2005	48,427	8,676	450,938	139,656	5,239	542,963	**654,057**	784,990	14,315	7,395	60,180	88,458	8,902	393,622	471,597	**584,449**	732,998	1,037,752	**1,239,750**	1,489,255
2006	70,168	8,307	382,691	145,465	4,898	512,366	**613,109**	739,010	13,653	4,564	23,583	84,407	9,246	380,394	419,072	**524,443**	657,631	951,102	**1,138,087**	1,370,519
2007	70,754	10,769	442,240	228,989	6,854	631,227	**759,854**	921,739	15,006	5,226	31,813	92,517	7,193	426,680	466,114	**588,286**	743,124	1,123,587	**1,351,468**	1,631,635
2008	30,247	8,627	346,232	194,322	6,082	485,281	**587,590**	713,331	7,019	8,096	39,812	70,508	7,297	363,069	399,333	**503,905**	637,742	905,134	**1,094,275**	1,323,312
2009	48,878	12,326	382,253	240,291	7,034	573,691	**692,983**	835,822	5,744	16,706	36,885	104,586	10,698	475,053	521,812	**662,062**	844,586	1,123,061	**1,358,096**	1,640,457
2010	37,562	13,768	531,181	239,722	13,214	689,554	**838,692**	1,018,736	16,134	8,519	40,387	176,207	13,702	536,357	632,512	**809,250**	1,049,084	1,357,980	**1,650,930**	2,016,810
2011	45,255	7,736	465,680	117,609	18,766	542,013	**656,516**	796,798	12,756	4,846	35,339	137,589	32,014	422,839	517,741	**668,071**	860,150	1,089,206	**1,328,651**	1,618,980
2012	43,578	8,859	328,480	134,361	7,929	434,616	**525,153**	633,392	13,270	13,397	40,342	135,213	10,236	374,274	469,607	**604,207**	785,890	927,530	**1,131,840**	1,387,413
2013	47,401	10,636	338,166	133,363	16,018	449,391	**548,263**	666,663	16,403	8,213	34,142	91,883	5,539	319,841	378,145	**487,079**	631,701	853,466	**1,037,776**	1,263,260
2014	45,794	10,099	427,674	125,649	17,212	517,159	**628,895**	765,421	18,649	7,448	36,110	149,043	7,209	236,543	359,219	**468,800**	623,472	904,011	**1,103,856**	1,342,691
2015	48,829	13,802	468,411	107,210	7,075	533,194	**647,474**	785,228	7,955	11,407	34,221	197,970	14,590	238,250	394,533	**520,680**	717,300	957,284	**1,175,112**	1,449,914
10yr Av.	48,847	10,493	411,301	166,698	10,508	536,849	**649,853**	787,614	12,659	8,842	35,263	123,992	11,772	377,330	455,809	**583,678**	755,068	1,019,236	**1,237,009**	1,504,499

Table 3.3.4.5. Estimated number of 1SW spawners by NEAC country or region and year, 1971 to 2016.

	Northern Europe								Southern Europe									NEAC Area		
Year	Finland	Iceland N&E	Norway	Russia	Sweden	Total 5.0%	Total 50.0%	Total 95.0%	France	Iceland S&W	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total 5.0%	Total 50.0%	Total 95.0%	Total 5.0%	Total 50.0%	Total 95.0%
1971	13,006	4,703	NA	NA	8,024				48,223	31,508	392,584	34,895	36,502	212,505	583,236	**765,952**	1,018,528			
1972	50,666	4,305	NA	72,105	6,439				95,667	25,293	420,670	38,526	31,744	168,189	596,536	**797,154**	1,068,229			
1973	23,489	5,129	NA	78,178	7,938				58,941	27,123	455,761	46,229	27,848	203,827	614,200	**833,580**	1,122,303			
1974	32,385	5,144	NA	93,335	11,669				27,412	19,355	517,926	58,598	30,434	173,643	601,933	**836,870**	1,165,660			
1975	38,931	6,309	NA	111,593	12,562				54,060	29,895	577,467	59,669	24,978	153,527	655,062	**909,021**	1,260,363			
1976	35,426	6,307	NA	109,405	7,097				50,749	23,414	391,551	39,674	17,327	159,658	514,532	**689,752**	932,045			
1977	20,081	8,776	NA	74,227	3,222				38,843	24,243	338,874	45,438	17,094	139,318	454,271	**611,475**	825,781			
1978	19,075	8,967	NA	58,909	3,747				39,573	31,925	294,380	52,888	22,220	187,237	492,427	**636,933**	829,580			
1979	17,175	8,536	NA	75,038	3,864				45,459	29,387	272,705	51,611	15,575	123,620	415,032	**548,604**	724,670			
1980	13,591	1,298	NA	73,342	5,034				95,157	13,314	205,847	48,492	19,799	82,041	367,205	**478,380**	614,497			
1981	12,002	6,698	NA	53,720	9,150				74,784	17,127	70,478	51,409	15,540	97,691	270,145	**338,059**	413,870			
1982	7,185	3,066	NA	49,731	8,058				46,562	17,721	169,615	43,842	22,458	169,702	379,077	**478,571**	595,776			
1983	17,646	4,528	160,252	64,821	10,766	205,187	**259,635**	324,309	49,361	22,490	359,615	64,300	31,425	148,125	536,828	**684,717**	875,487	785,894	**947,092**	1,148,440
1984	19,245	1,645	164,462	80,824	15,131	224,009	**283,095**	351,199	81,190	13,714	199,174	55,796	12,367	187,876	456,822	**562,896**	681,865	723,820	**847,960**	982,052
1985	25,344	11,304	171,918	92,557	17,971	262,337	**321,851**	390,968	30,276	22,257	234,727	55,893	15,987	177,471	417,022	**545,915**	704,258	724,297	**870,372**	1,040,933
1986	20,055	14,085	152,333	101,882	18,894	256,127	**309,590**	370,504	44,844	36,739	322,082	65,504	17,902	223,969	573,768	**733,596**	920,034	875,236	**1,045,419**	1,240,264
1987	24,373	8,285	127,681	95,771	15,076	227,311	**272,607**	324,153	79,217	22,711	199,923	69,108	15,275	168,679	452,767	**582,230**	753,346	717,150	**856,396**	1,033,937
1988	14,327	12,044	117,134	86,672	12,517	205,942	**245,645**	289,299	27,742	40,673	344,081	96,201	41,227	381,830	797,782	**947,135**	1,128,044	1,039,815	**1,195,156**	1,379,595
1989	24,890	6,448	184,032	96,336	3,655	267,424	**316,363**	379,651	15,031	22,710	222,312	64,766	12,281	440,915	669,233	**790,354**	930,101	974,118	**1,110,364**	1,261,216
1990	24,923	4,822	164,825	97,226	9,799	259,353	**303,249**	358,243	24,916	20,970	159,441	46,690	35,083	197,683	420,393	**496,168**	583,967	710,187	**802,660**	903,433
1991	24,417	7,060	144,324	83,331	12,311	232,595	**273,687**	321,843	17,966	23,066	117,108	46,971	18,438	214,854	386,635	**447,099**	516,511	647,309	**721,750**	805,698
1992	34,310	13,310	121,716	116,212	13,783	263,808	**302,244**	345,248	33,357	26,602	159,385	49,576	46,079	332,950	573,066	**661,831**	766,828	866,731	**966,045**	1,078,611
1993	23,367	10,933	121,100	113,853	13,683	247,759	**285,288**	326,359	48,011	25,875	142,047	72,315	72,034	274,393	565,535	**652,221**	761,511	843,886	**938,088**	1,054,453
1994	12,998	3,488	166,724	116,184	10,534	263,046	**312,002**	371,618	37,384	21,333	125,223	80,252	25,183	298,236	512,732	**603,777**	713,878	810,191	**919,129**	1,039,391
1995	12,881	9,088	107,549	121,740	17,653	236,190	**270,933**	310,127	11,767	26,558	179,935	65,088	25,746	299,303	527,223	**615,728**	718,854	792,434	**888,256**	996,236
1996	27,304	4,884	81,024	138,547	10,353	232,349	**263,839**	298,589	14,428	22,716	182,917	49,657	34,758	228,054	462,876	**541,001**	633,235	720,780	**806,475**	902,892
1997	24,955	6,624	105,350	158,229	4,712	265,634	**301,894**	341,591	7,367	16,582	227,153	45,987	38,489	158,588	428,182	**501,289**	590,634	721,578	**804,876**	900,969
1998	31,083	11,323	137,955	162,793	3,826	305,104	**349,574**	397,850	14,575	22,794	219,464	52,293	156,125	233,518	621,747	**710,219**	813,871	961,312	**1,061,078**	1,174,394
1999	33,217	6,044	128,080	162,305	6,021	296,124	**338,270**	385,491	4,845	18,817	232,111	41,939	20,090	107,636	364,033	**430,895**	515,695	689,729	**770,886**	867,459
2000	36,094	6,351	212,695	141,427	11,061	353,518	**410,848**	478,709	12,548	16,873	350,634	64,631	33,078	218,895	602,773	**706,197**	826,921	999,256	**1,120,154**	1,254,977
2001	26,391	5,865	185,470	198,157	6,850	364,112	**426,595**	498,413	10,703	15,280	255,510	57,011	32,197	221,100	522,610	**600,948**	692,611	926,204	**1,031,489**	1,143,243
2002	22,275	10,345	112,198	210,364	6,661	306,744	**364,091**	431,129	24,467	19,049	216,237	54,036	61,418	180,181	493,678	**566,918**	649,480	837,193	**933,178**	1,038,157
2003	21,981	5,450	156,651	198,983	3,606	327,256	**389,630**	460,661	15,888	22,923	246,724	45,857	31,035	227,933	529,726	**602,562**	684,113	895,696	**994,051**	1,102,158
2004	9,302	15,054	93,791	145,722	2,987	228,193	**268,697**	317,204	19,382	22,847	156,931	81,787	36,679	267,029	525,555	**598,366**	687,802	782,334	**869,052**	968,352
2005	20,467	13,698	140,430	133,095	2,938	266,560	**312,713**	364,918	12,629	33,535	171,770	66,936	49,085	293,810	569,523	**639,059**	721,301	868,214	**953,892**	1,048,737
2006	35,788	14,143	111,385	162,530	3,288	280,040	**329,453**	386,037	17,379	23,911	127,024	67,792	37,596	286,858	506,536	**573,410**	656,407	817,927	**905,271**	1,002,421
2007	10,551	10,652	62,136	123,035	1,012	176,410	**209,073**	249,940	13,930	27,938	149,074	66,300	65,440	285,300	544,286	**630,816**	752,695	746,311	**842,266**	967,323
2008	11,334	10,175	87,800	93,022	1,843	175,904	**205,832**	239,817	13,857	33,620	229,643	65,144	40,290	251,084	543,391	**657,673**	869,490	745,299	**865,554**	1,078,338
2009	20,014	16,874	71,835	100,920	1,969	182,504	**214,048**	249,811	3,889	37,703	187,090	40,619	24,924	217,305	439,046	**531,173**	690,573	647,513	**747,415**	907,606
2010	16,166	13,525	116,361	92,798	3,386	209,466	**244,188**	283,844	13,133	39,426	251,409	80,606	26,429	391,069	685,692	**836,669**	1,059,974	926,658	**1,082,681**	1,305,705
2011	18,284	11,513	79,848	102,657	2,188	186,893	**216,506**	249,273	9,148	27,592	216,890	51,793	19,524	206,984	450,945	**550,881**	734,062	663,095	**768,891**	954,404
2012	31,692	5,799	90,051	109,731	4,023	210,487	**243,661**	280,667	9,749	15,612	220,110	31,719	49,517	287,717	520,177	**654,998**	863,155	759,693	**899,626**	1,109,293
2013	18,341	14,301	90,854	100,299	2,287	194,714	**228,371**	265,811	13,789	46,320	187,664	44,245	56,017	334,320	581,501	**730,146**	929,082	805,036	**960,840**	1,162,073
2014	25,886	6,718	138,075	90,598	6,290	229,158	**270,561**	319,264	12,306	11,755	115,925	26,283	25,021	259,061	380,847	**477,858**	610,214	641,280	**750,761**	889,941
2015	16,158	19,846	109,197	89,520	2,730	204,691	**240,167**	279,455	11,271	33,186	165,357	32,509	27,430	273,953	459,432	**579,307**	741,226	695,143	**820,676**	986,571
2016	12,638	10,451	82,915	76,392	1,859	158,434	**186,037**	216,520	10,214	20,903	162,295	34,058	54,273	275,605	486,051	**586,707**	735,702	669,085	**774,077**	924,719
10yr Av.	18,106	11,985	92,907	97,897	2,759	192,866	225,844	263,440	11,128	29,405	188,546	47,328	38,886	278,240	509,137	623,623	798,617	729,911	851,279	1,028,597

Table 3.3.4.6. Estimated number of MSW spawners by NEAC country or region and year, 1971 to 2016.

Year	Northern Europe								Southern Europe									NEAC Area		
	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		N&E					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	10,735	2,906	NA	NA	271				6,785	7,357	82,386	52,368	10,950	307,687	387,708	**475,563**	578,026			
1972	11,251	4,502	NA	58,975	213				13,574	11,316	88,538	93,014	9,615	389,229	500,967	**615,720**	752,064			
1973	17,782	4,264	NA	65,798	951				8,239	10,084	95,508	71,943	8,391	434,791	515,096	**640,243**	787,352			
1974	31,029	4,015	NA	98,116	598				3,860	8,754	109,319	52,987	9,182	283,950	380,702	**477,815**	588,616			
1975	39,624	4,433	NA	86,486	170				7,712	9,275	121,146	72,980	7,512	309,708	430,625	**540,950**	672,807			
1976	30,756	3,639	NA	86,437	511				5,624	8,039	83,081	37,681	5,242	225,344	302,366	**371,735**	456,547			
1977	21,542	5,130	NA	71,579	220				4,305	7,847	73,614	47,513	5,146	209,508	283,675	**354,797**	438,043			
1978	10,893	6,569	NA	50,426	270				4,456	10,092	63,389	40,936	6,703	286,626	339,552	**418,918**	516,935			
1979	13,177	4,331	NA	44,376	707				5,118	6,455	56,921	20,704	4,713	201,698	238,880	**300,443**	378,040			
1980	13,027	6,005	NA	47,974	1,367				10,639	9,143	63,071	66,525	5,957	241,988	325,981	**405,887**	501,319			
1981	15,446	2,099	NA	66,062	302				7,610	6,088	46,162	94,287	4,661	254,430	340,019	**423,977**	522,422			
1982	20,446	2,428	NA	40,745	1,479				4,638	4,304	32,448	36,533	6,766	239,962	269,003	**328,398**	403,160			
1983	22,911	1,833	101,190	49,363	956	142,580	**178,394**	218,884	5,044	7,215	63,592	42,095	9,479	241,751	309,744	**373,783**	453,637	478,069	**553,326**	641,618
1984	19,074	2,412	103,622	61,989	1,344	154,934	**190,133**	229,983	8,204	6,006	43,163	33,405	3,721	223,775	269,203	**322,356**	386,331	448,119	**514,570**	589,436
1985	18,351	1,551	95,138	51,196	502	136,471	**168,904**	203,946	6,154	4,427	53,503	49,057	4,823	296,394	353,160	**418,820**	496,191	514,714	**588,599**	673,976
1986	15,269	4,188	115,135	52,372	255	149,861	**189,151**	232,347	6,347	3,705	51,020	67,527	5,418	379,723	434,311	**520,641**	626,237	613,249	**711,458**	824,064
1987	19,930	4,367	89,435	53,567	1,141	138,068	**170,571**	207,708	3,348	3,271	79,629	54,647	3,003	243,606	331,274	**393,113**	463,336	493,758	**565,416**	644,201
1988	13,959	2,788	73,173	44,862	1,238	112,720	**137,679**	165,646	9,275	3,721	53,176	71,471	10,000	442,450	507,438	**596,299**	699,612	642,930	**734,704**	841,432
1989	11,170	2,360	77,776	50,892	4,321	126,529	**147,945**	172,011	4,273	3,328	40,765	57,828	4,982	389,190	432,123	**505,807**	594,441	576,457	**654,448**	744,479
1990	12,422	2,526	91,411	48,169	2,664	133,990	**158,587**	187,828	4,340	3,293	14,926	71,020	7,039	310,265	351,282	**416,404**	493,060	505,262	**575,741**	657,798
1991	16,647	1,739	76,479	60,553	3,560	136,968	**160,471**	186,811	3,930	3,289	41,152	31,798	3,320	250,579	289,587	**336,970**	392,669	444,165	**498,430**	558,995
1992	16,061	2,589	84,223	58,493	4,976	144,145	**167,769**	195,458	4,939	3,722	20,885	24,511	8,923	344,695	351,244	**410,138**	483,658	514,215	**578,981**	656,293
1993	17,027	2,922	78,455	55,688	5,600	138,132	**161,381**	186,692	2,303	1,821	24,478	27,670	27,621	274,698	310,976	**364,188**	429,378	467,022	**526,332**	595,500
1994	16,005	2,466	76,841	65,380	4,310	142,910	**166,143**	192,121	5,343	2,966	40,204	39,367	6,633	334,667	371,860	**432,735**	509,630	533,680	**599,750**	680,352
1995	10,628	1,559	83,456	64,319	2,452	139,276	**163,778**	191,055	2,543	3,002	37,983	40,684	5,421	307,324	341,971	**400,882**	473,080	499,512	**565,372**	641,783
1996	13,209	2,033	83,167	63,386	3,990	142,319	**167,183**	193,752	4,533	1,958	19,590	42,449	6,792	241,501	273,160	**321,636**	379,128	433,815	**489,291**	552,602
1997	15,931	1,164	57,557	53,019	2,866	112,396	**132,189**	154,055	2,320	2,190	38,672	27,055	8,440	163,774	209,138	**249,477**	296,745	336,837	**382,171**	433,947
1998	15,084	1,692	69,572	41,906	1,597	110,590	**131,459**	154,260	1,986	1,366	12,519	18,180	13,594	181,382	198,653	**231,637**	271,756	323,882	**363,759**	409,386
1999	14,660	2,261	72,073	54,635	1,143	122,923	**145,533**	170,275	4,238	2,831	33,904	38,140	5,391	133,120	183,673	**227,374**	285,375	323,775	**373,705**	435,590
2000	28,346	1,360	103,117	59,024	4,072	167,373	**197,265**	229,788	2,961	809	44,085	40,924	7,172	175,424	236,623	**277,606**	326,303	424,509	**475,205**	533,018
2001	37,429	1,650	122,932	89,357	4,841	221,236	**258,059**	298,986	3,470	1,396	37,108	44,658	4,274	167,188	222,463	**265,075**	317,324	466,426	**524,513**	588,433
2002	32,962	1,633	107,102	74,531	3,322	189,235	**221,130**	257,353	3,207	1,597	47,696	40,328	4,491	138,958	205,597	**242,712**	286,902	414,848	**465,360**	521,170
2003	23,678	2,030	95,532	63,167	795	159,635	**186,924**	217,802	4,653	2,325	54,471	53,818	2,135	184,146	261,886	**309,412**	368,065	441,320	**497,265**	561,766
2004	10,778	1,911	87,341	48,128	2,438	127,526	**151,783**	180,521	8,707	1,935	24,529	45,929	3,034	239,240	279,799	**329,809**	389,016	426,150	**482,279**	546,733
2005	8,934	2,429	79,262	36,424	1,651	109,138	**129,447**	152,569	5,319	1,809	37,597	50,297	4,050	187,927	250,378	**293,286**	346,660	375,246	**423,222**	481,554
2006	14,068	2,755	101,207	46,688	1,719	141,153	**167,416**	197,106	5,343	1,505	25,290	46,419	3,808	198,163	243,649	**289,363**	344,806	405,278	**457,212**	518,735
2007	20,457	3,078	83,930	39,782	1,602	126,843	**149,971**	175,050	5,060	906	11,614	44,824	4,251	193,163	224,065	**266,368**	316,868	368,026	**416,546**	471,790
2008	20,592	3,425	126,081	47,376	2,643	170,871	**201,282**	237,518	5,574	1,304	15,938	48,862	3,422	218,116	251,887	**300,741**	362,885	443,417	**502,868**	573,474
2009	8,760	3,188	100,032	70,036	2,334	158,249	**186,142**	219,736	2,598	1,742	20,058	37,274	3,418	187,850	216,404	**259,213**	312,235	394,172	**446,706**	507,684
2010	14,098	4,413	123,175	60,911	2,697	176,487	**206,767**	241,352	2,150	3,382	18,788	55,678	5,624	244,455	281,360	**339,477**	414,524	479,546	**547,314**	628,626
2011	10,842	5,258	178,399	72,465	3,775	230,887	**272,567**	321,801	6,020	1,896	20,111	91,488	6,654	275,197	337,263	**414,803**	516,890	598,604	**689,373**	801,224
2012	13,116	3,007	156,571	63,942	7,203	209,545	**245,818**	286,516	4,803	1,318	17,981	73,311	17,414	223,170	285,681	**351,660**	435,994	521,614	**599,614**	690,893
2013	12,672	3,537	111,733	33,535	2,938	140,913	**165,453**	193,592	4,974	3,488	20,526	71,842	5,603	195,671	251,494	**313,996**	394,181	412,609	**480,633**	563,996
2014	13,695	4,284	124,211	36,727	5,914	157,059	**186,364**	221,967	6,097	2,383	17,052	48,500	3,010	168,859	204,257	**254,208**	318,265	381,816	**441,967**	513,126
2015	13,300	3,969	148,112	33,704	6,840	173,641	**207,454**	247,975	6,895	2,025	17,661	79,141	3,979	119,542	190,505	**238,627**	310,832	386,904	**448,013**	527,545
2016	14,128	4,480	159,469	31,632	3,002	179,691	**213,978**	253,717	2,933	3,515	17,210	105,515	7,874	126,917	218,340	**271,986**	366,484	420,225	**489,333**	587,802
10yr Av.	14,166	3,864	131,171	49,011	3,895	172,419	203,580	239,922	4,711	2,196	17,694	65,643	6,125	195,294	246,126	301,108	374,916	440,693	506,236	586,616

Table 3.3.5.1. Time-series of jurisdictions in Northern NEAC area with established CLs and trends in the number of stocks meeting CLs, 1999 to 2016.

Year	Teno River (Finland/Norway)				Norway				Russia				Sweden			
	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met
1999									85	8	7	88				
2000									85	8	7	88				
2001									85	8	7	88				
2002									85	8	7	88				
2003									85	8	7	88				
2004									85	8	7	88				
2005					0	167*	70	42	85	8	7	88				
2006					0	165*	73	44	85	8	7	88				
2007	9	5	0	0	80	167*	76	46	85	8	7	88				
2008	9	5	0	0	80	170*	87	51	85	8	7	88				
2009	9	5	0	0	439	176	68	39	85	8	7	88				
2010	9	5	0	0	439	179	114	64	85	8	7	88				
2011	9	5	0	0	439	177	128	72	85	8	7	88				
2012	9	5	0	0	439	187	139	74	85	8	7	88				
2013	24	7	2	29	439	185	111	60	85	8	7	88				
2014	24	10	4	40	439	167	116	69	85	8	7	88				
2015	24	10	2	20	439	179	132	74	85	8	7	88				
2016	24	11	4	36	439	NA	NA	NA	85	8	7	88	23	20	8	40

*** CL attainment retrospectively assessed, NA = data pending.**

Table 3.3.5.2. Time-series of jurisdictions in Southern NEAC area with established CLs and trends in the number of stocks meeting CLs, 1993 to 2016.

Year	France				Ireland				UK (England & Wales)				UK (Northern Ireland)				UK (Scotland)			
	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met
1993									61	61	33	54								
1994									63	63	41	65								
1995									63	63	26	41								
1996									63	63	31	49								
1997									64	64	21	33								
1998									64	64	30	47								
1999									64	64	19	30								
2000									64	64	26	41								
2001									64	58	21	36								
2002									64	64	27	42	10	10	4	40				
2003									64	64	19	30	10	10	4	40				
2004									64	64	41	64	10	10	3	30				
2005									64	64	32	50	10	10	4	40				
2006									64	64	38	59	10	10	3	30				
2007					141	141	45	32	64	64	33	52	10	6	2	33				
2008					141	141	54	38	64	64	43	67	10	5	3	60				
2009					141	141	56	40	64	64	22	34	10	6	2	33				
2010					141	141	56	40	64	64	39	61	10	7	2	29				
2011	28	28	15	54	141	141	58	41	64	64	42	66	11	9	3	33	168	168	116	69
2012	28	28	16	57	141	141	58	41	64	64	34	53	11	8	4	50	168	168	105	63
2013	30	27	20	74	143	143	57	40	64	64	20	31	13	8	5	63	168	168	90	54
2014	33	30	22	73	143	143	62	43	64	64	13	20	15	9	4	44	168	168	78	46
2015	33	27	16	59	143	143	55	38	64	64	24	38	16	10	5	50	168	168	91	54
2016	35	35	21	60	143	143	48	34	64	64	21	33	16	11	7	64	168	NA	NA	NA

NA = data pending.

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

Smolt	Iceland[1]			Norway[2]				Ireland			UK (Scotland)[11]		UK (NI)[7]		UK (E & W)						France[8]			
migration	Ellidaar	R.Vesturdalsa[4]		R. Halselva		R. Imsa		R. Corrib		B'shoole	North Esk		R. Bush		R. Dee		R. Tamar		R. Frome		Nivelle[5]	Scorff	Oir	Bresle
year	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	1SW	MSW	1SW[3]	2SW[10]	1SW	MSW	1SW	MSW	1SW	MSW	All ages	All ages	All ages	All ages
1975.00	20.80																							
1980.00								17.90	1.06	5.3				0.59										
1981.00						17.30	4.00	9.20	3.76	12.3	8.24	3.79		0.92										
1982.00						5.30	1.20	20.90	3.33	12.2	11.22	4.95												
1983.00						13.50	1.30	10.00	1.84	8.6				1.69										3.00
1984.00						12.10	1.80	26.20	1.98	19.8	6.00	4.00		1.45										4.6
1985.00	9.40					10.20	2.10	18.90	1.75	19.3	13.63	5.35		1.92							15.2			5.9
1986.00						3.80	4.20			20.0			31.30	1.94							2.3			8.5
1987.00				2.00	0.30	17.30	5.60	16.60	0.71	26.9	10.43	3.89	35.10	0.44							2.5			7.7
1988.00	12.70			5.80	0.70	13.30	1.10	14.60	0.69	22.9			36.20	0.85							3.5			
1989.00	8.10			2.10	1.00	8.70	2.20	6.70	0.71	7.1	6.62	4.15	25.00	1.44							1.4			
1990.00	5.40			3.90	1.60	3.00	1.30	5.00	0.63	16.0	5.98	3.13	34.70	1.76							4.7			
1991.00	8.80			2.10	0.30	8.70	1.20	7.30	1.26	21.7	7.61	3.11	27.80	2.22							7.3			
1992.00	9.60			2.10	0.40	6.70	0.90	7.30		15.9	10.87	6.46	29.00	1.99							7.00		5.30	3.2
1993.00	9.80			2.10	0.00	15.60		10.80	0.07	23.9	14.45	6.09		1.99	6.30	2.50					4.1		17.00	3.00
1994.00	9.00			0.60	0.40			9.80	1.35	26.9	10.93	3.58	27.10	0.75	1.30	1.20					1.3		3.54	5.6
1995.00	9.40		1.45	0.90	0.00	1.80	1.50	8.40	0.07	14.6	8.44	3.82		2.50	2.70	0.40					2.5	10.3	4.99	2.3
1996.00	4.60	2.51	0.37	2.80	0.60	3.50	0.90	6.30	1.17	18.3	5.86	2.70	31.00	2.14	4.80	2.10					2.6	22.4	4.83	2.6
1997.00	5.30	1.00	1.51	0.80	0.00	1.70	0.30	12.70	0.75	15.6	7.19	4.19	19.80	0.72	6.20	3.40					2.2	5.7	14.01	4.3
1998.00	5.30	1.53	1.04	1.50	0.60	7.20	1.00	5.50	1.06	12.4	2.55	1.35	13.40	0.52	2.30	3.70					2.9	4.8	6.58	2.5
1999.00	7.70	1.30	1.22	1.30	0.00	4.20	2.20	6.40	0.91	14.9	6.78	3.78	16.50	0.75	5.00	12.40					2.9	10.4		11.4
2000.00	6.30	1.14	0.68	0.40	1.10	12.50	1.70	9.40		22.5	6.04	2.80	10.10	0.15	2.00	0.90					3.1	10.00	2.38	6.7
2001.00	5.10	3.40	1.32	2.50	2.50	3.60	2.23	7.20	1.08	16.6	4.70	2.86	12.40	0.27	4.30	0.00					0.5	4.9	3.68	
2002.00	4.40	1.11	2.31	0.80	0.60	5.50	0.90	6.00	0.53	12.3	2.22	1.95	11.30	0.23	2.90	0.70	3.60	1.40	5.60	1.74	0.9	22.9	3.12	2.4
2003.00	9.10	5.47	0.59	4.90	1.60	3.50	0.70	8.30	2.10	19.4			6.80	0.35	2.60	0.40	6.10	1.80	4.83	0.94	1.2	11.1	5.70	4.4
2004.00	7.70	5.68	0.60	3.50	1.20	5.90	1.40	6.30	0.80	12.8			6.80	0.44	4.50	1.00	6.00	1.50	5.29	2.90	1.5	6.2	4.00	5.00
2005.00	6.40	2.47	0.91	3.00	1.00	3.70	1.80			8.1	6.66	2.78	5.90	0.61	5.10	0.50	6.40	1.20			1.00	8.3	6.60	2.5
2006.00	7.10	1.75	0.95	0.80	0.80	0.80	5.80	1.20	0.87	12.9	3.28	3.40	14.00	0.82	4.30	1.50	3.50	2.40	5.11	2.22	3.1	7.1	5.30	3.1
2007.00	19.25	0.89	0.30	0.30	0.00	0.80	0.60	0.90		8.4	4.99	3.98	8.30	0.80	1.30	0.70	3.50	3.40	5.69	1.30	3.4	5.00	4.00	3.4
2008.00	14.90	2.59	1.07	0.20	0.20	1.10	2.30	1.70	1.03	8.2	6.40		3.97	0.69	2.50	1.30	1.70	0.90	3.13	1.63	3.00	3.00		2.00
2009.00	14.20	1.33	1.57	1.10	0.60	2.40	3.10	6.00	0.99	8.9	9.00	8.65	5.92	0.95	4.80	1.10	8.20	1.90	7.68	2.58	3.2	6.5		14.9
2010.00	8.60	1.97	1.11	0.40	0.40	1.70	1.10	2.90	1.25	7.5			3.96	1.34	1.90	1.00	3.40	5.00	8.64	2.40	1.5	4.4		6.1
2011.00	6.10	1.31	0.57	0.00		3.90	2.90	2.36	0.00	10.8			2.67	0.53	0.00	0.30	1.10	1.9[9]	1.50	1.8[9]	2.4	4.9		3.2
2012.00	10.90	2.06				3.50	1.70	1.49	0.00	9.4			11.70	1.79	4.8[9]		2.5[9]		3.2[9]	2.10	0.6	8.5		3.00
2013.00	4.30		0.33			2.20	2.40	2.23	0.30	4.5			4.60	0.91	1.90	1.40		4.70	1.50	2.10		9.00		9.8
2014.00	7.20	1.62				2.90	0.80	2.85	0.50	8.00			2.90	0.50		0.00			2.00	2.60		5.8		5.7
2015.00	10.90					1.00		5.47		7.79			6.70		0.50		4.20		5.90		3.00	4.00		5.00
Mean																								
(5-year)	7.88	1.66	0.45			2.70	1.95	2.88	0.20	8.10			5.71	0.93	0.80	0.57	2.65	4.70	2.73	2.27	3.00	6.50		4.00
(10-year)	10.35	1.69	0.84	0.47	0.40	2.03	2.30	2.71	0.62	8.65	5.92	5.34	6.47	0.93	2.15	0.91	3.66	3.05	4.57	2.12	3.00	5.25	4.65	3.33

[1] Microtags.
[2] Carlin tags, not corrected for tagging mortality.
[3] Microtags, corrected for tagging mortality.
[4] Assumes 50% exploitation in rod fishery.
[5] From 0+ stage in autumn.
[6] Incomplete returns.
[7] Assumes 30% exploitation in trap fishery.
[8] France data based on retruns to freshwater
[9] Minimum count. High flows hindered sampling effort
[10] Bush 2SW data based on retruns to freshwater
[11] Estimates of emigrating smolt numbers not available since 2009

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

Smolt year	Iceland[1]		Norway[2]						Sweden[2]	
	R. Ranga		R. Halselva		R. Imsa[3]		R. Drammen		R. Lagan	
	2SW	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1981					10.10	1.30				
1982					4.20	0.60				
1983					1.60	0.10				
1984					3.80	0.40	3.50	3.00	11.80	1.10
1985					5.80	1.30	3.40	1.90	11.80	0.90
1986					4.70	0.80	6.10	2.20	7.90	2.50
1987			1.50	0.40	9.80	1.00	1.70	0.70	8.40	2.40
1988			1.20	0.10	9.50	0.70	0.50	0.30	4.30	0.60
1989	3.0	0.08	1.90	0.50	3.00	0.90	1.90	1.30	5.00	1.30
1990	2.0	0.19	2.10	0.30	2.80	1.50	0.30	0.40	5.20	3.10
1991	0.4	0.04	0.60	0.00	3.20	0.70	0.10	0.10	3.60	1.10
1992	0.6	0.05	0.50	0.00	3.80	0.70	0.40	0.60	1.50	0.40
1993	1.9	0.05			6.50	0.50	3.00	1.00	2.60	0.90
1994	2.2	0.16			6.20	0.60	1.20	0.90	4.00	1.20
1995	1.1	0.10			0.40	0.00	0.70	0.30	3.90	0.60
1996	0.7	0.03	1.20	0.20	2.10	0.20	0.30	0.20	3.50	0.50
1997	0.6	0.06	0.60	0.00	1.00	0.00	0.50	0.20	0.60	0.50
1998	0.4	0.02	0.50	0.50	2.40	0.10	1.90	0.70	1.60	0.90
1999	0.6	0.04	2.30	0.20	12.00	1.10	1.90	1.60	2.10	
2000	1.2	0.06	1.00	0.70	8.40	0.10	1.10	0.60		
2001	0.4	0.10	1.90	0.60	3.30	0.30	2.50	1.10		
2002	1.1		1.40	0.00	4.50	0.80	1.20	0.80		
2003	1.3		0.50	0.30	2.60	0.70	0.30	0.60		
2004	0.9		0.20	0.10	3.60	0.70	0.40	0.40		
2005	1.0		1.20	0.20	2.80	1.20	0.30	0.70		
2006	1.3		0.20	0.10	1.00	1.80	0.10	0.60		
2007	3.2		0.30	0.00	0.60	0.70	0.20	0.10		
2008	3.1		0.10	0.00	1.80	2.20	0.10	0.30		
2009	1.6				1.30	3.30				
2010	0.9		1.00	0.20	2.60	1.90				
2011	0.9				1.70	0.80				
2012	1.1				1.90	0.20				
2013	0.7				2.90	0.70				
2014	2.2				1.50	0.20				
2015	2.3				1.40					
Mean										
(5-year)	1.43				1.88	0.48				
(10-year)	1.77		0.40	0.08	1.67	1.31	0.13	0.33		

[1] Microtagged.
[2] Carlin-tagged, not corrected for tagging mortality.
[3] since 1999 only 1 year old smolts included

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

	Ireland										UK (N. Ireland)[3]	
Smolt year	R. Shannon	R. Screebe	R. Burrishoole[1]	R. Delphi/ R. Burrishoole[4]	R. Delphi	R. Bunowen	R. Lee	R. Corrib Cong.[2]	R. Corrib Galway[2]	R. Erne	R. Bush 1+ smolts	R. Bush 2+ smolts
1980	8.63		5.58				8.32	0.94				
1981	2.80		8.14				2.00	1.50				
1982	4.05		10.96				16.32	2.70	16.15			
1983	3.88		4.55					2.82	4.09		1.90	8.10
1984	4.97	10.37	27.08				2.27	5.15	13.17	9.44	13.30	
1985	17.81	12.33	31.05				15.75	1.41	14.45	8.23	15.40	17.50
1986	2.09	0.43	9.40				16.42		7.69	10.81	2.00	9.70
1987	4.74	8.40	14.13				8.76		2.16	6.97	6.50	19.40
1988	4.92	9.25	17.21				5.51	4.47		2.94	4.90	6.00
1989	5.03	1.77	10.50				1.71	5.98	4.83	1.19	8.10	23.20
1990	1.33		11.41		0.20		2.52	0.25	2.27	2.62	5.60	5.60
1991	4.25	0.31	13.65	10.78	6.19		0.76	4.87	4.03	1.28	5.40	8.80
1992	4.35	1.35	7.39	10.01	1.67	4.18		0.94	0.57		6.00	7.80
1993	2.91	3.36	11.99	14.34	6.48	5.45		0.98			1.10	5.80
1994	5.21	1.86	14.29	3.94	2.71	10.82			5.30		1.60	
1995	3.63	4.12	6.57	3.42	1.73	3.47		2.38			3.10	2.40
1996	2.93	1.81	5.35	10.63	6.74	3.45					2.00	2.30
1997	5.97	0.37	13.32	17.30	5.64	5.25	7.00			7.74	-	4.10
1998	3.12	1.30	4.93	7.16	3.13	2.88	4.92	3.35	2.89	2.61	2.30	4.50
1999	0.96	2.83	8.15	19.92	8.25	1.97			3.56	3.30	2.70	5.80
2000	1.17	3.82	11.81	19.53	13.24	5.43	3.55	6.69		4.00	2.80	4.40
2001	1.98	2.46	9.73	17.25	7.40	3.16	1.95	3.40		6.00	1.10	2.20
2002	1.01	4.12	9.17	12.57	4.90	2.00	1.93		2.03	1.89	0.68	3.07
2003	1.17		5.95	3.71	1.48	1.65	4.31		1.17	0.96	2.45	1.87
2004	0.41	1.78	9.36	7.64	2.31	1.77	2.23		4.40	3.13	0.71	1.89
2005	0.64	3.37	4.40	10.97		0.97	0.96		4.76	0.87	1.80	1.70
2006	0.27	1.35	5.17	3.68	1.48	0.02	0.19	0.30	0.16	0.86	2.00	3.75
2007	0.50	0.77	7.11		3.64				3.49	0.66		
2008		0.19	1.35		1.38		0.05		1.62			
2009	0.34	0.19	2.33		1.48		0.07		1.34	1.14		
2010	0.20	0.10	3.00		1.90		0.09	1.40	1.43	0.90		
2011	0.40		5.20		1.30		0.09	2.00	0.36	0.50	0.80	1.86
2012	0.50		3.20		1.80		0.22	6.60		1.90	2.19	3.46
2013	0.20	0.10	3.20		1.70		0.05	1.40	0.92	0.70	1.34	1.21
2014	0.10	0.70	4.40		2.30		0.10	1.60	1.20	1.00	0.75	0.67
2015	0.40		3.50		0.30		0.10	2.00	0.90	1.30	2.89	1.44
Mean												
(5-year)	0.32	0.40	3.90		1.48		0.11	2.72	0.85	1.08	1.59	1.73
(10-year)	0.32	0.49	3.84	3.68	1.73	0.02	0.11	2.19	1.27	1.00	1.66	2.07

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

[2] Different release sites

[3] Microtagged.

[4] Delphi fish released at Burrishoole

3.6 Figures

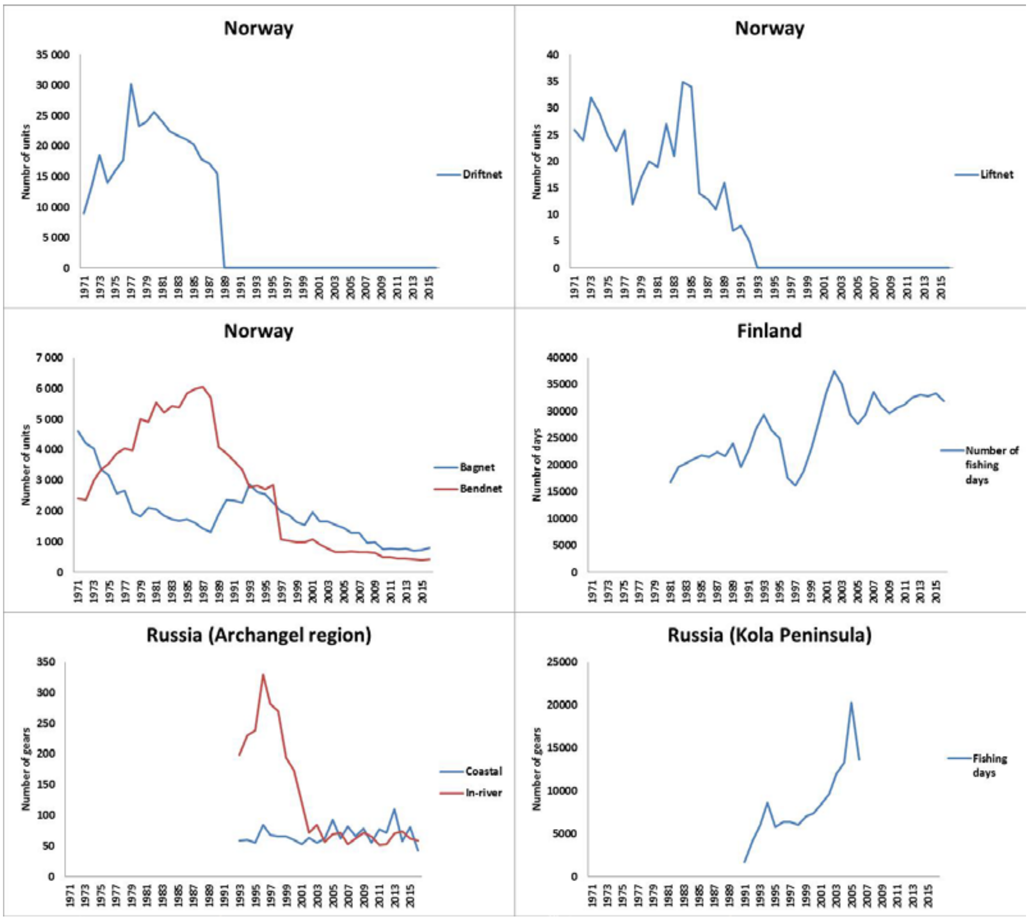


Figure 3.1.3.1. Overview of effort as reported for various fisheries and countries in the Northern NEAC area, 1971–2016.

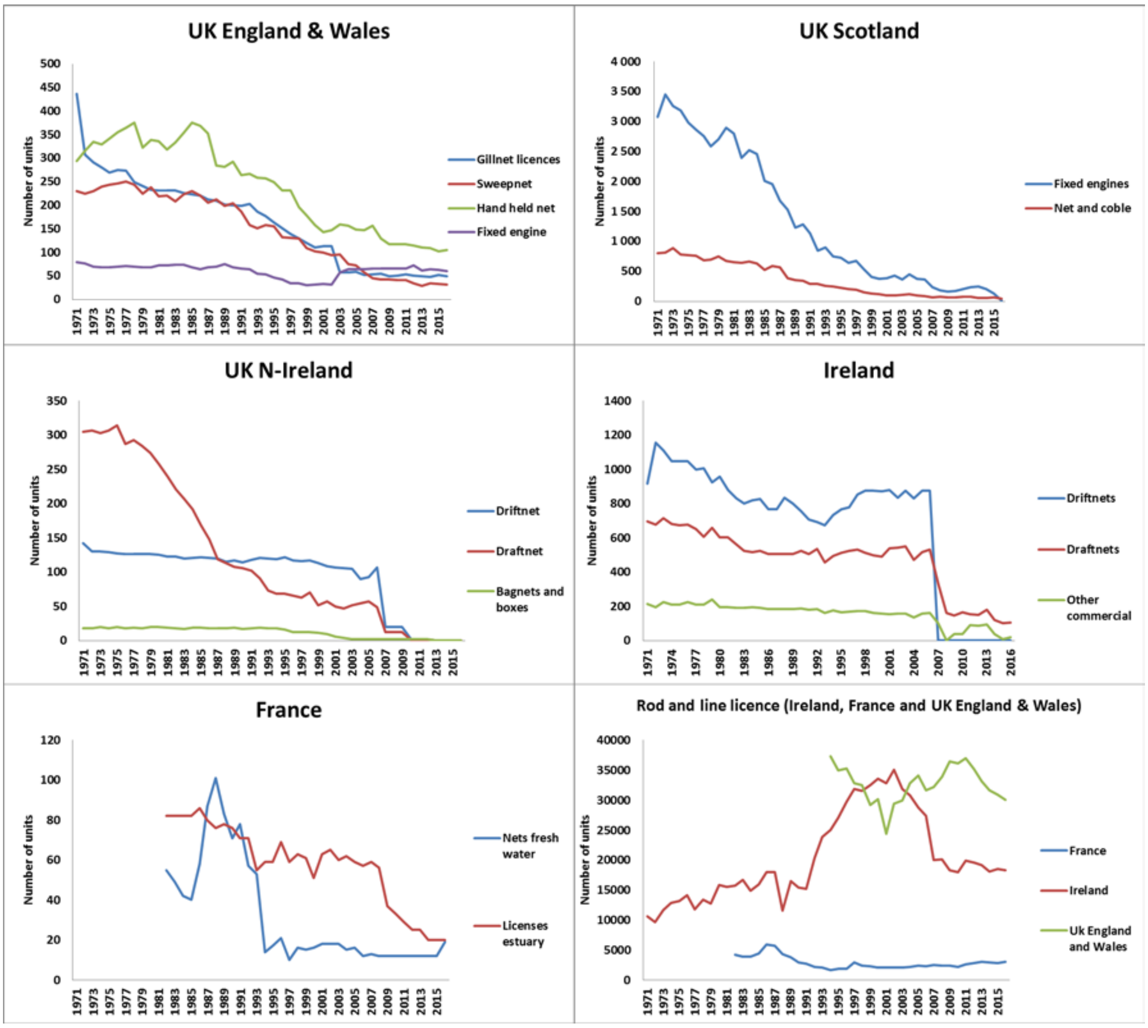


Figure 3.1.3.2. Overview of effort as reported for various fisheries and countries in the Southern NEAC area, 1971–2016.

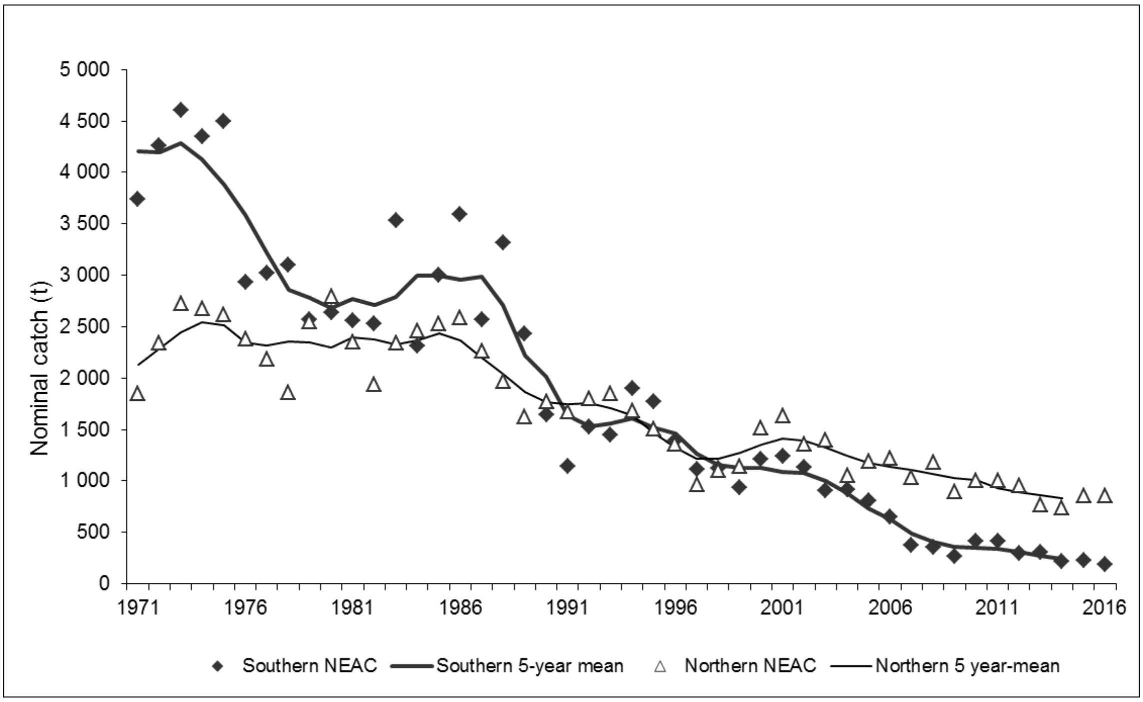


Figure 3.1.4.1. Nominal catches of salmon and 5-year running means in the Southern and Northern NEAC areas, 1971–2016.

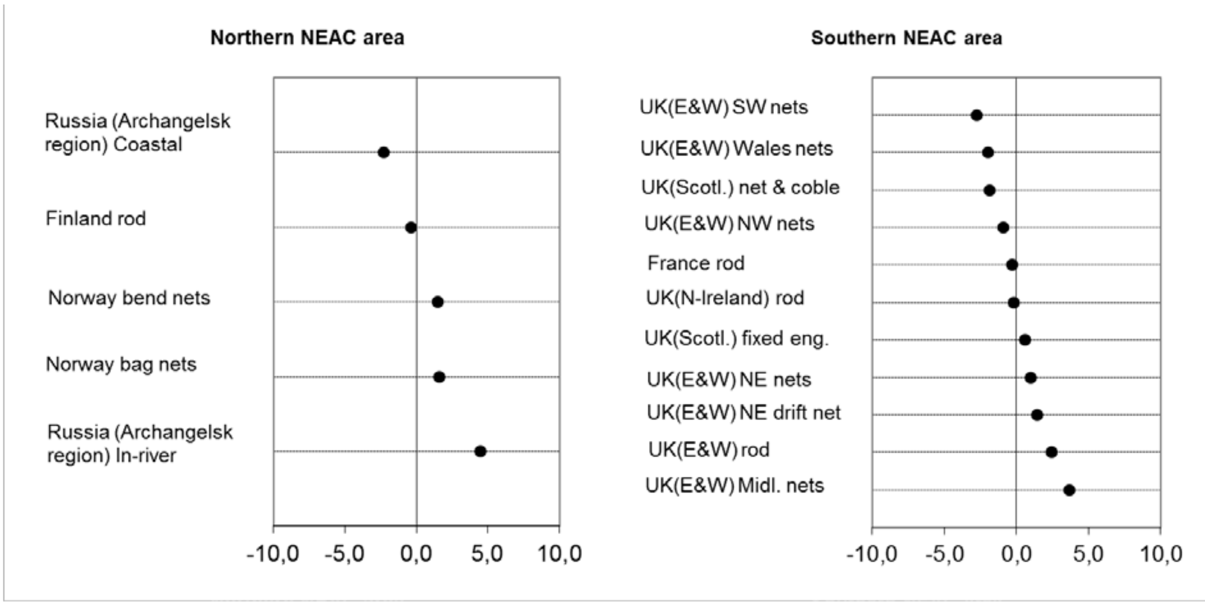


Figure 3.1.5.1. Proportional change (%) over years with available data in cpue estimates for various rod and net fisheries in the Northern and Southern NEAC areas.

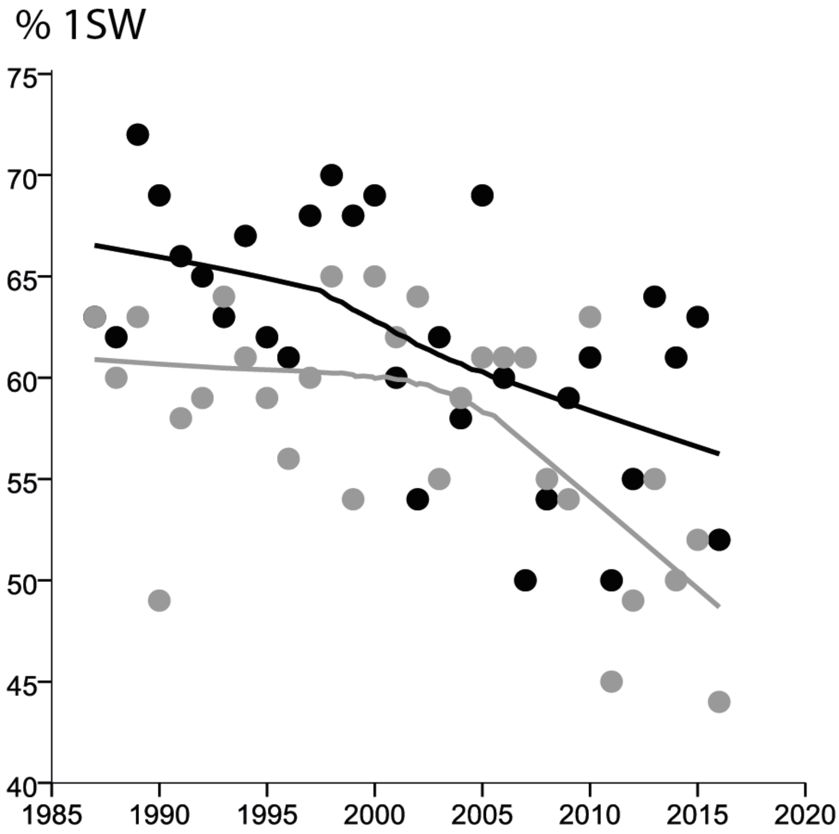


Figure 3.1.6.1. Percentage of 1SW salmon in the reported catch for Northern (black symbols) and Southern (grey symbols) NEAC areas, 1987–2016. The lines indicate loess regressions over the time-series.

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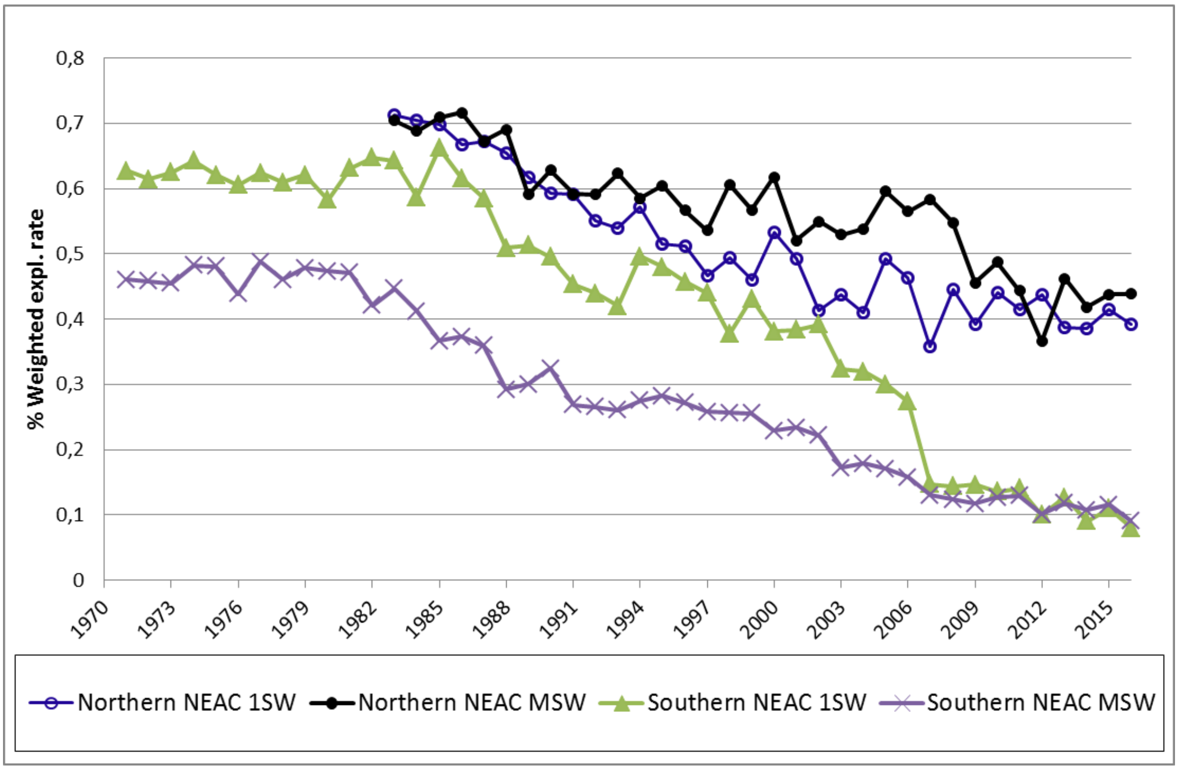


Figure 3.1.9.1. Mean annual exploitation rate of 1SW and MSW salmon by commercial and recreational fisheries in Northern and Southern NEAC areas from 1971 to 2016.

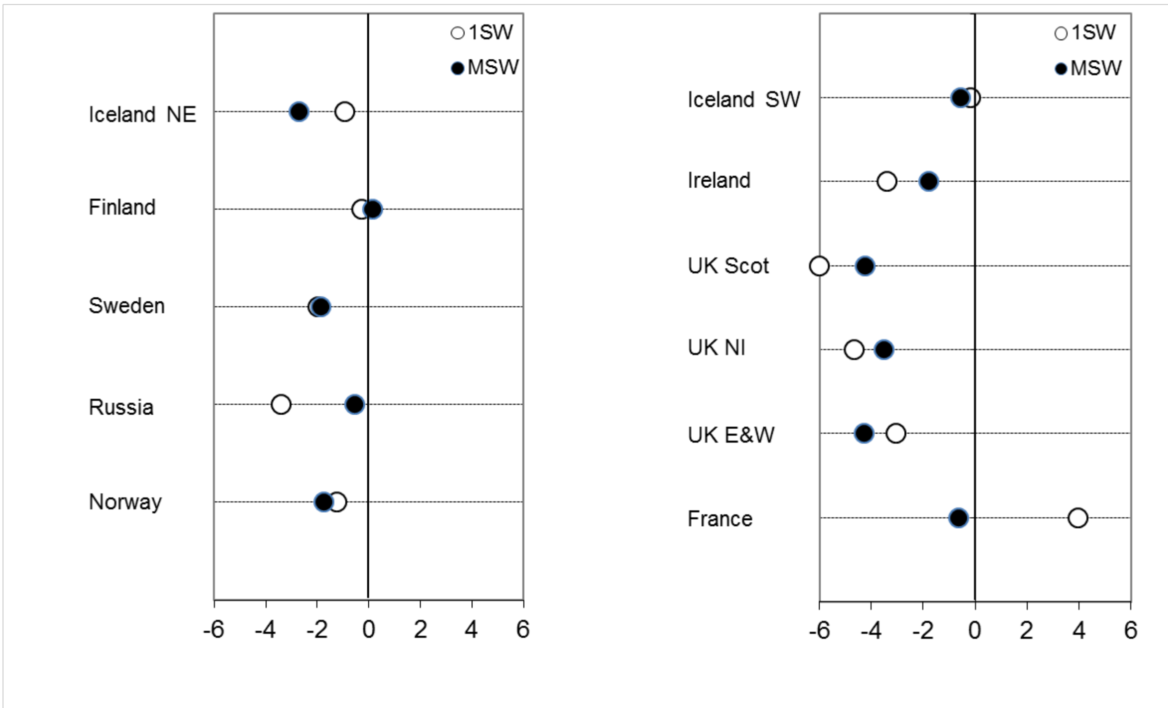


Figure 3.1.9.2. The annual rate of change (%) of exploitation of 1SW and MSW salmon in northern NEAC (left) and southern NEAC (right) countries over the period 1971–2015, except for Norway (1983–2015).

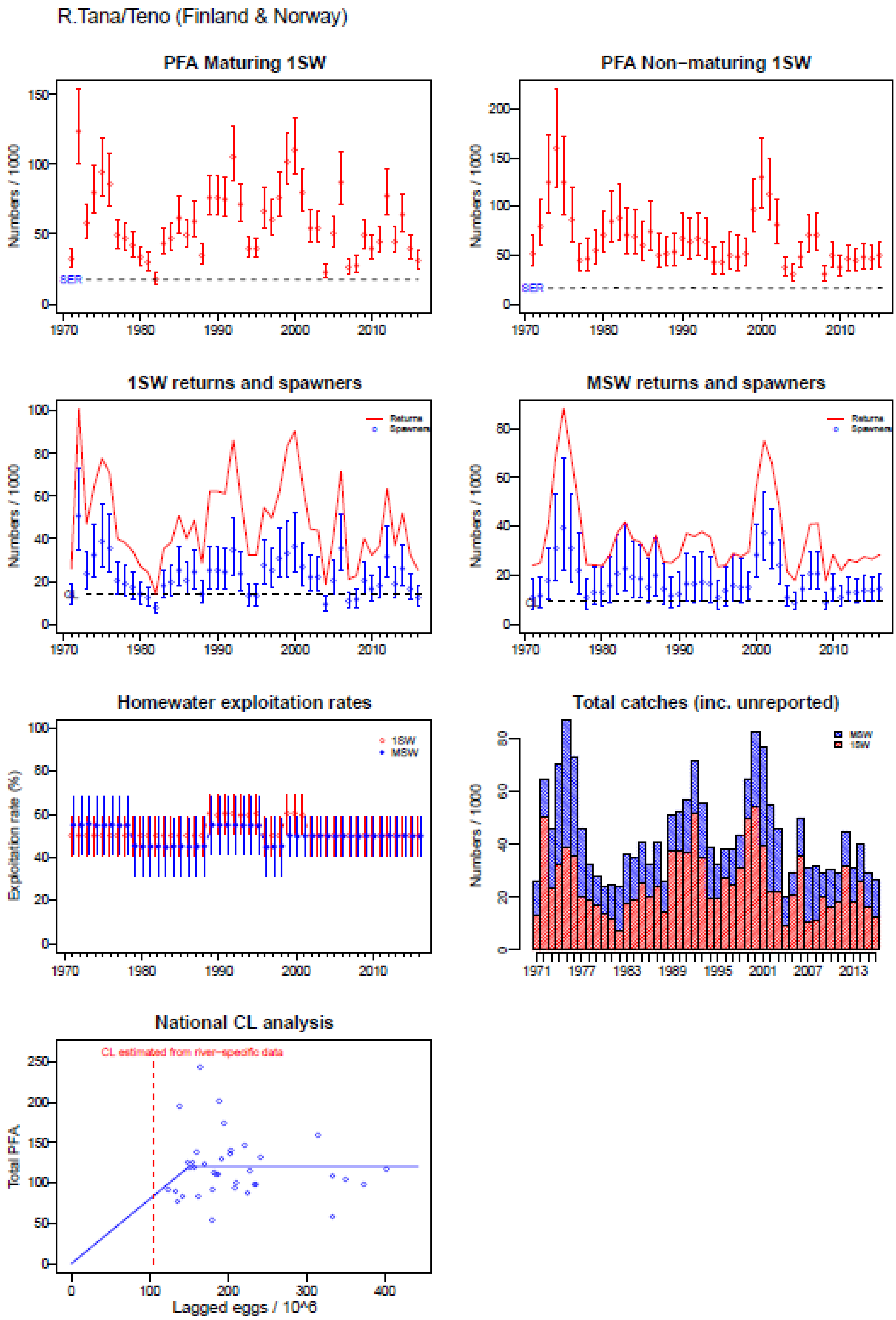


Figure 3.3.4.1a. Summary of fisheries and stock description, River Teno / Tana (Finland and Norway combined). The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

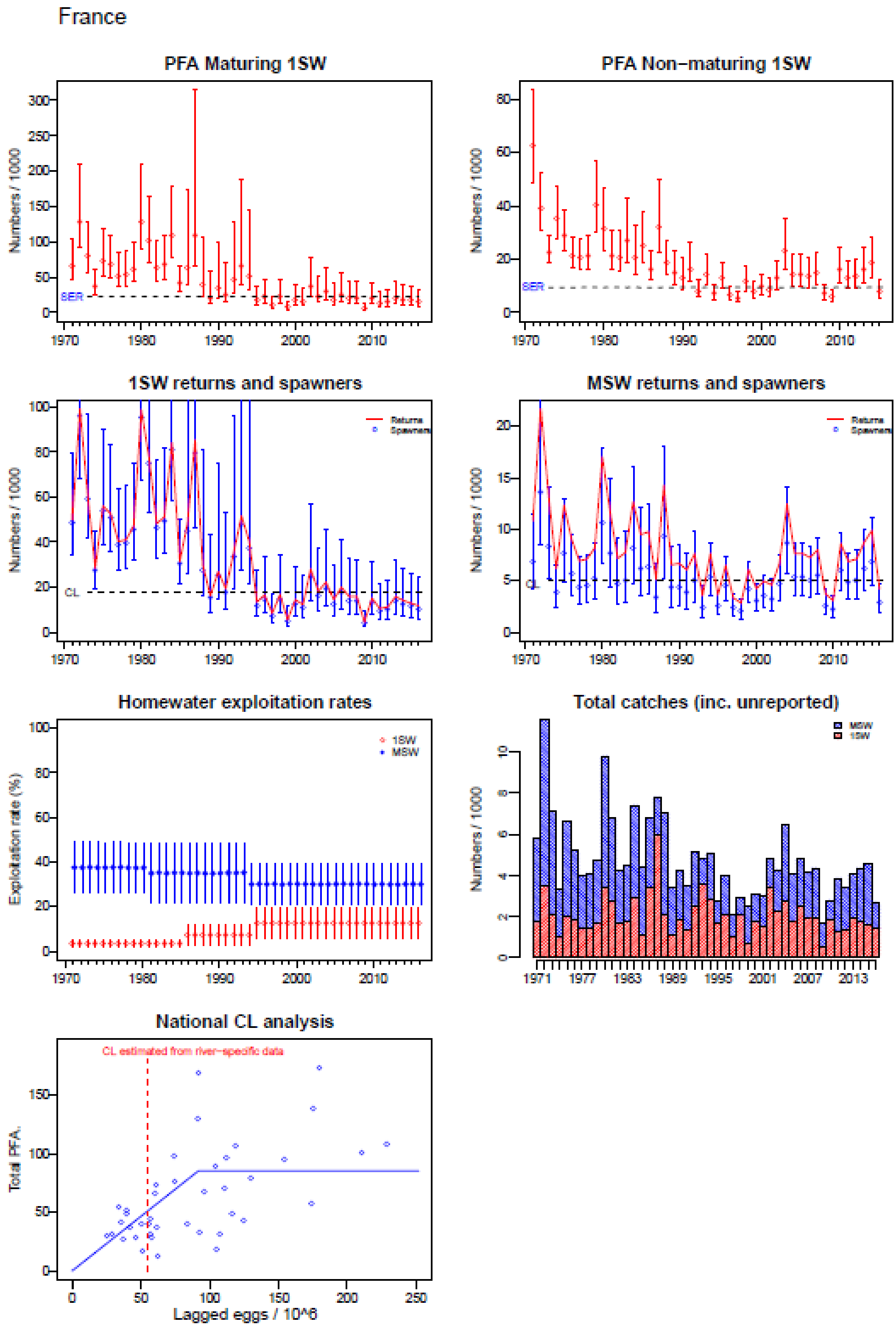


Figure 3.3.4.1b. Summary of fisheries and stock description, France. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

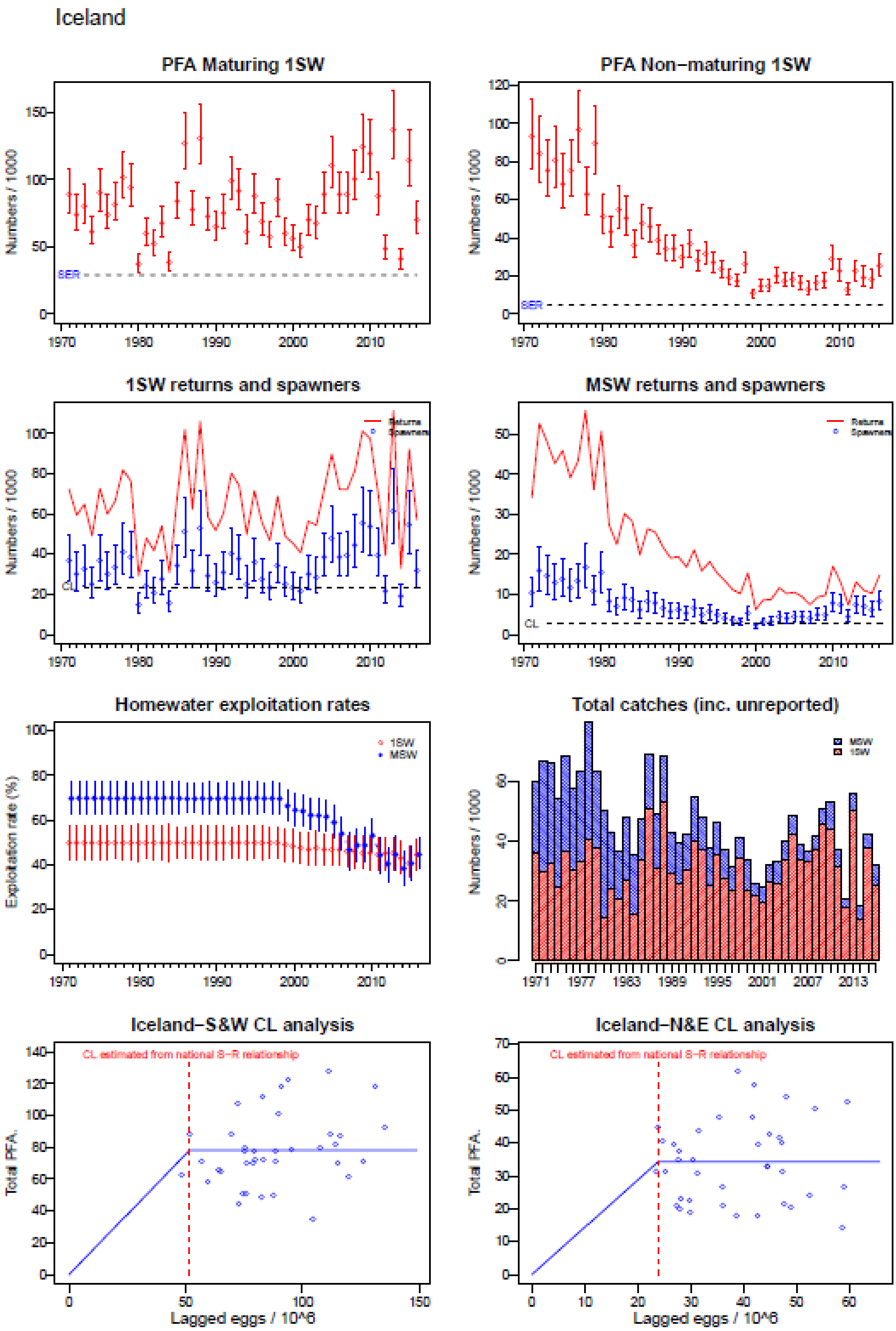


Figure 3.3.4.1c. Summary of fisheries and stock description, Iceland.

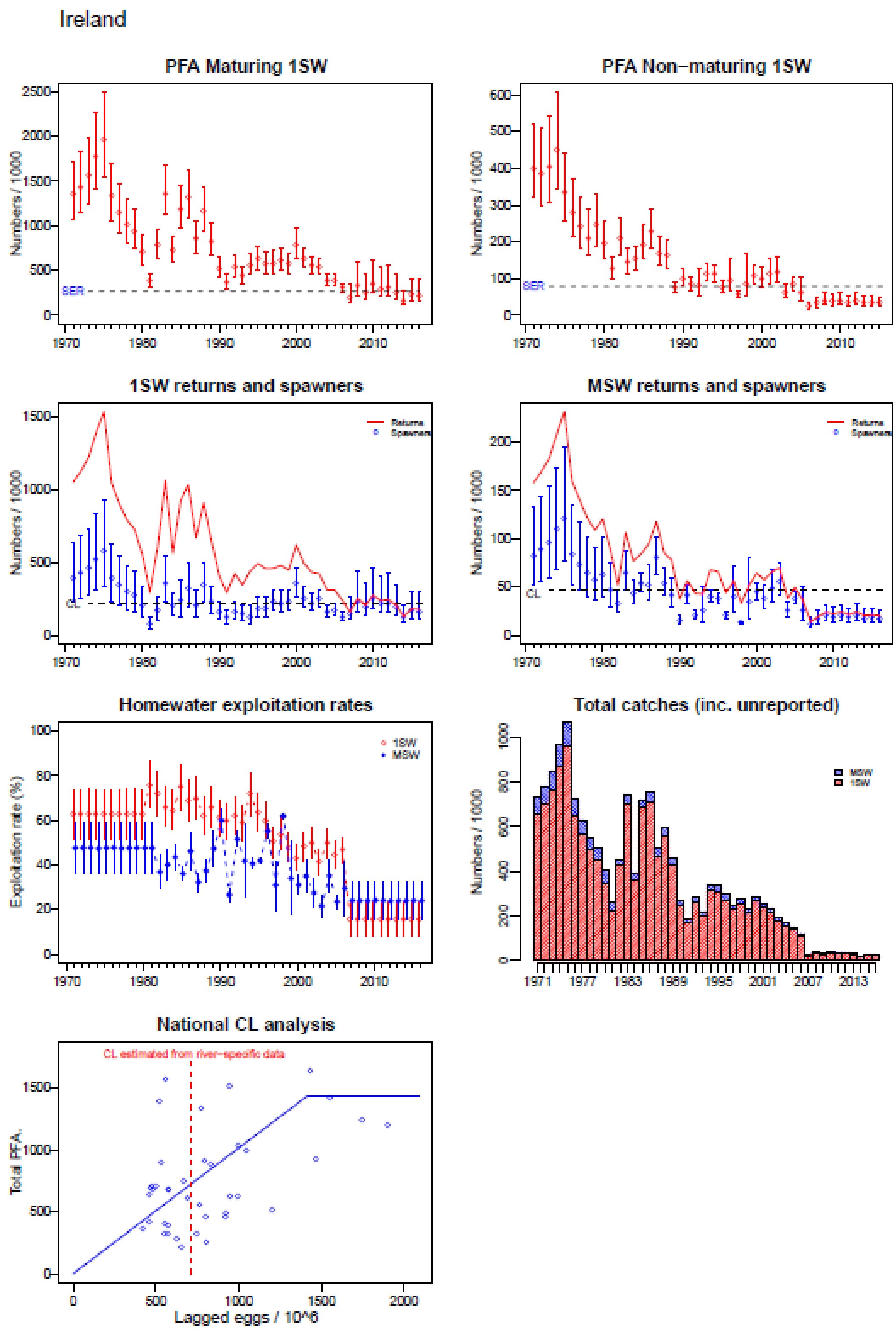


Figure 3.3.4.1d. Summary of fisheries and stock description, Ireland. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

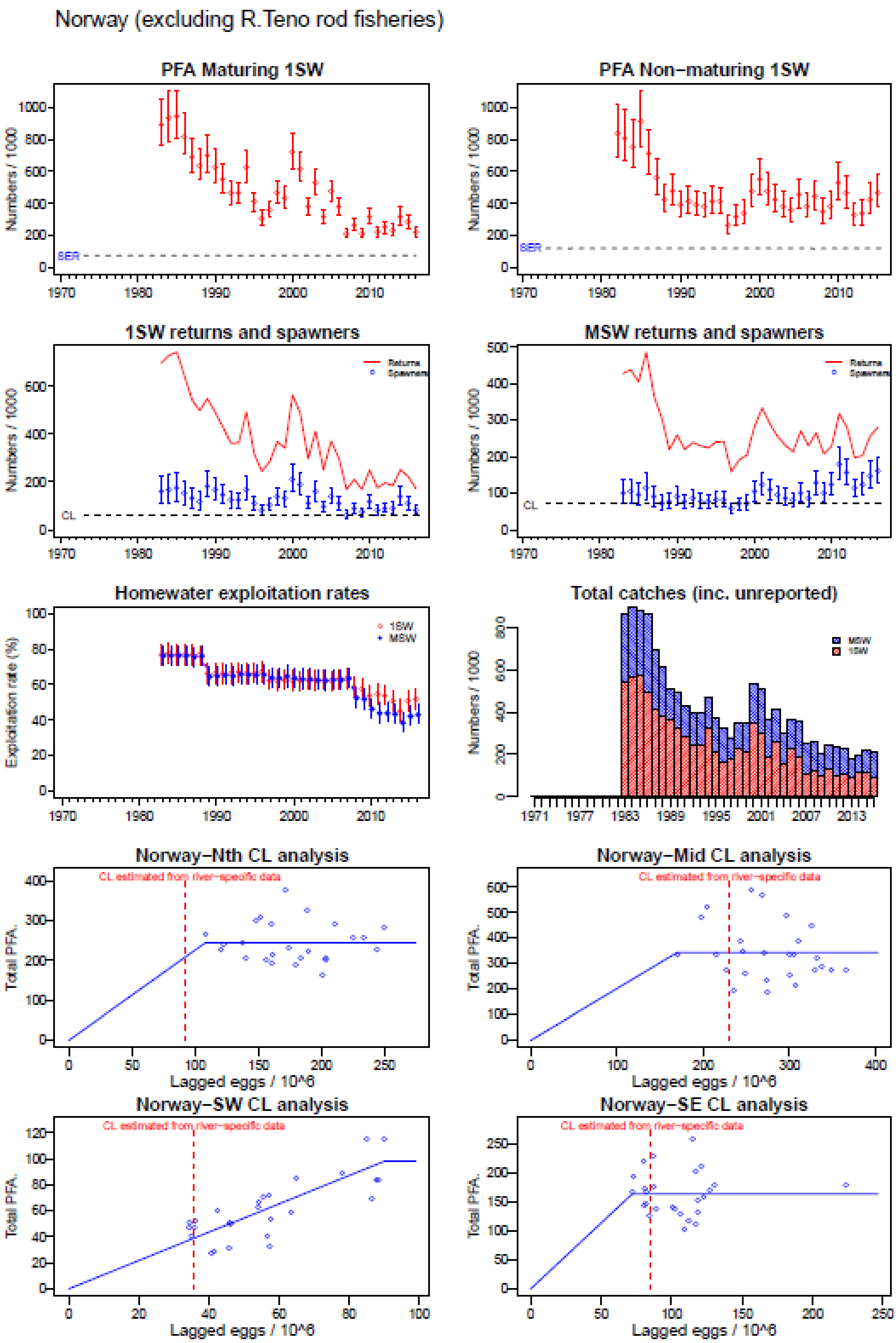


Figure 3.3.4.1e. Summary of fisheries and stock description, Norway (minus Norwegian catches from the Rivers Teno / Tana). The river-specific CLs, which are used for assessment purposes, are included on the regional CL analysis plots (for comparison, the CLs estimated from the regional S–R relationships are at the inflection points).

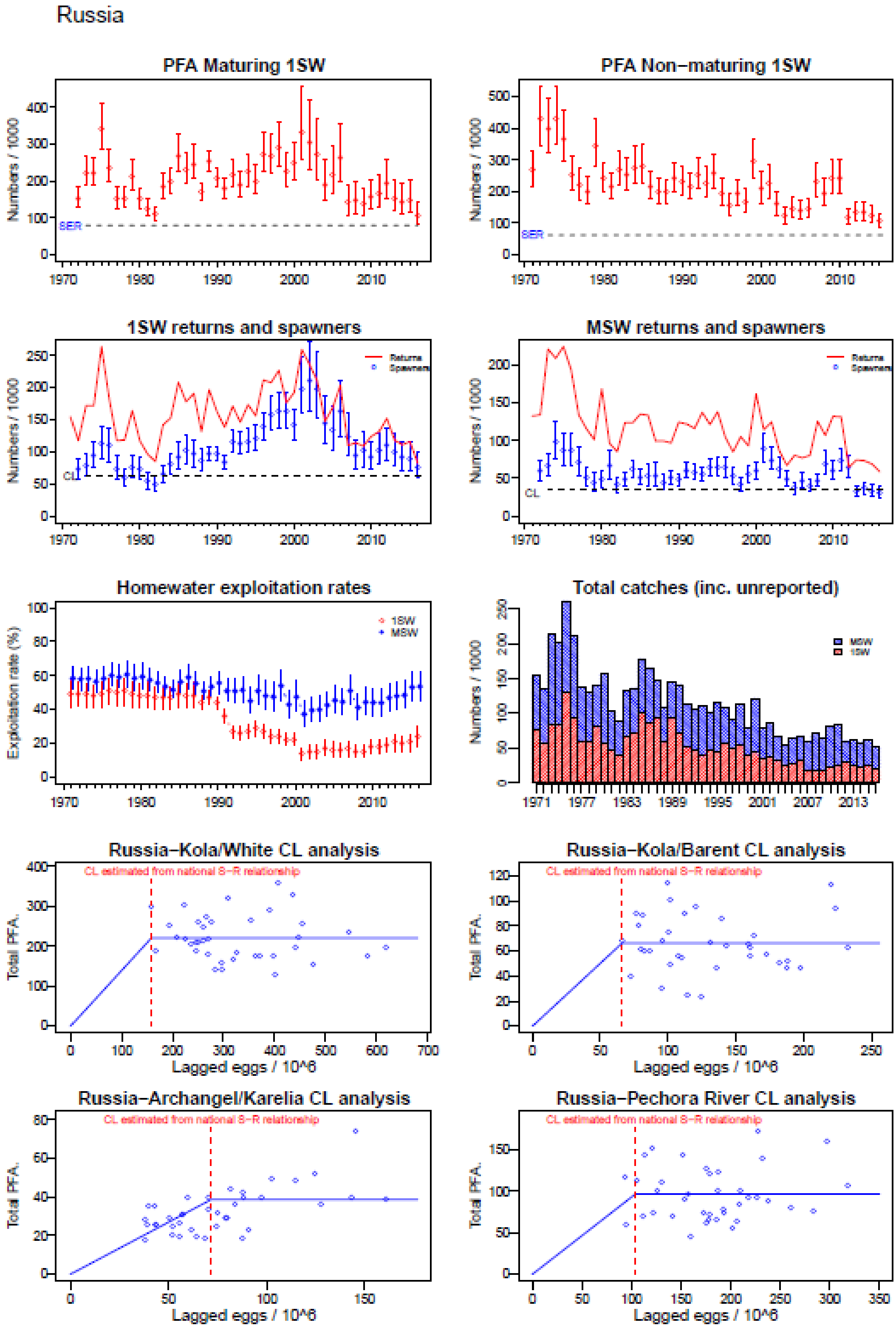


Figure 3.3.4.1f. Summary of fisheries and stock description, Russia.

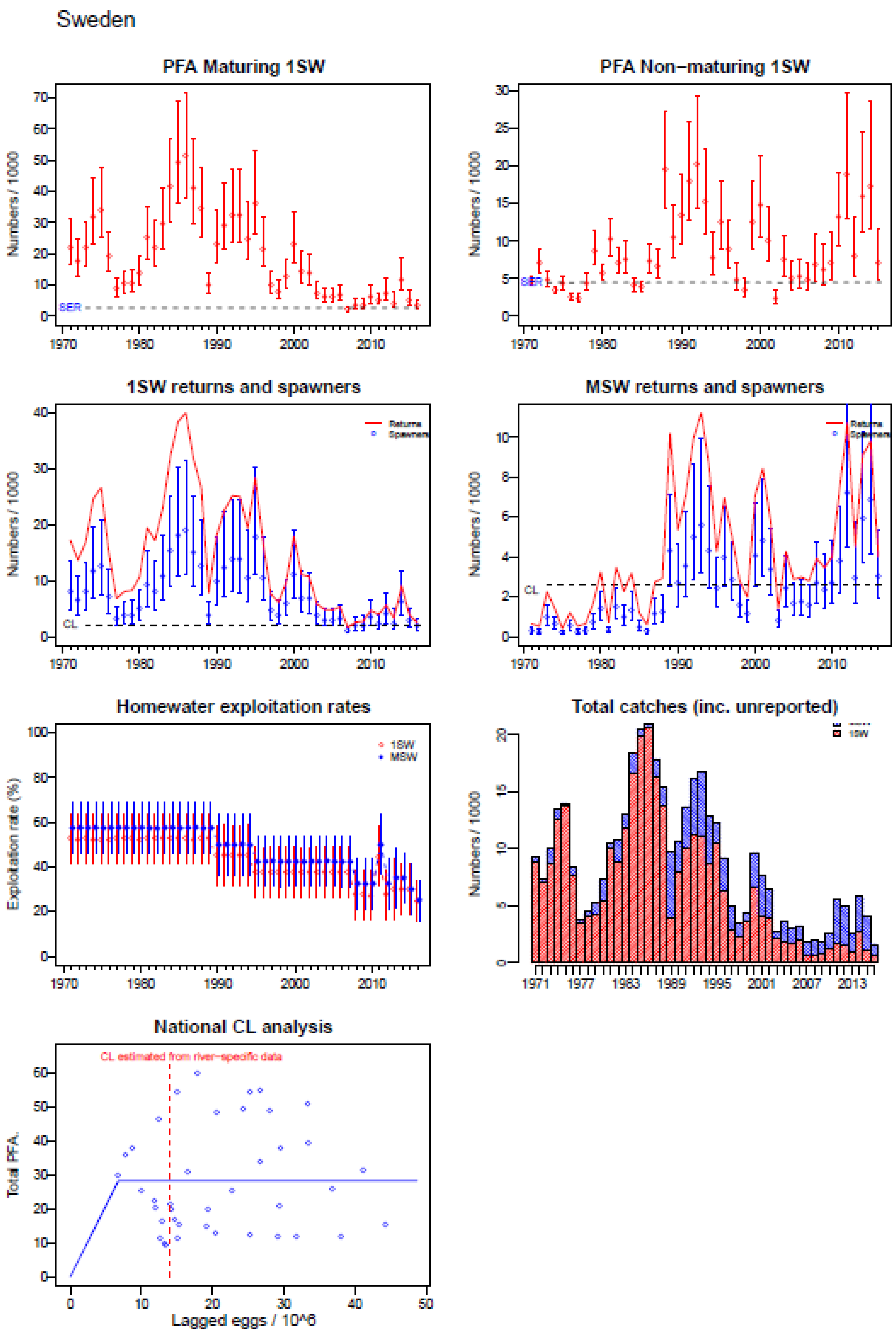


Figure 3.3.4.1g. Summary of fisheries and stock description, Sweden. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

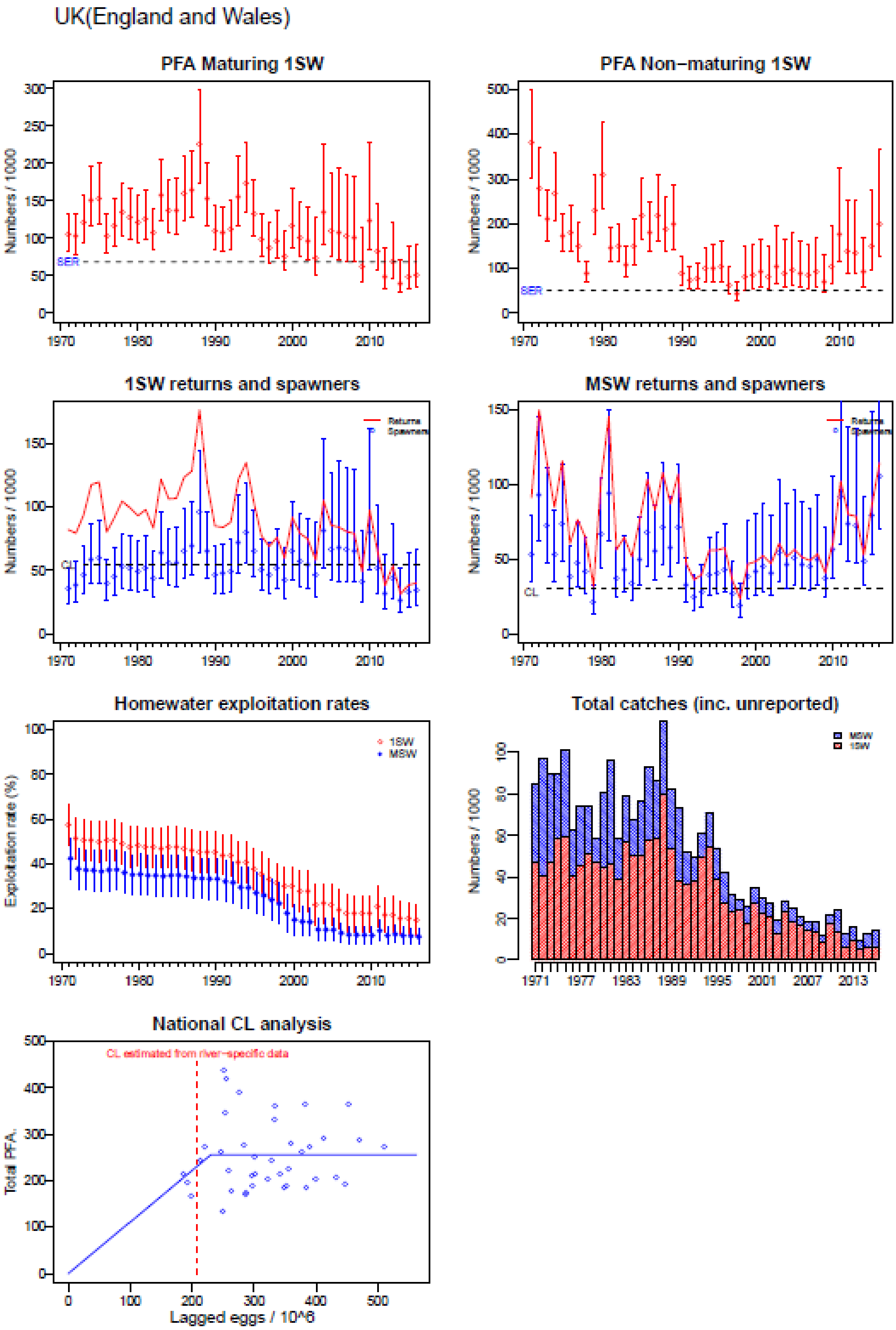


Figure 3.3.4.1h. Summary of fisheries and stock description, UK(E&W). The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

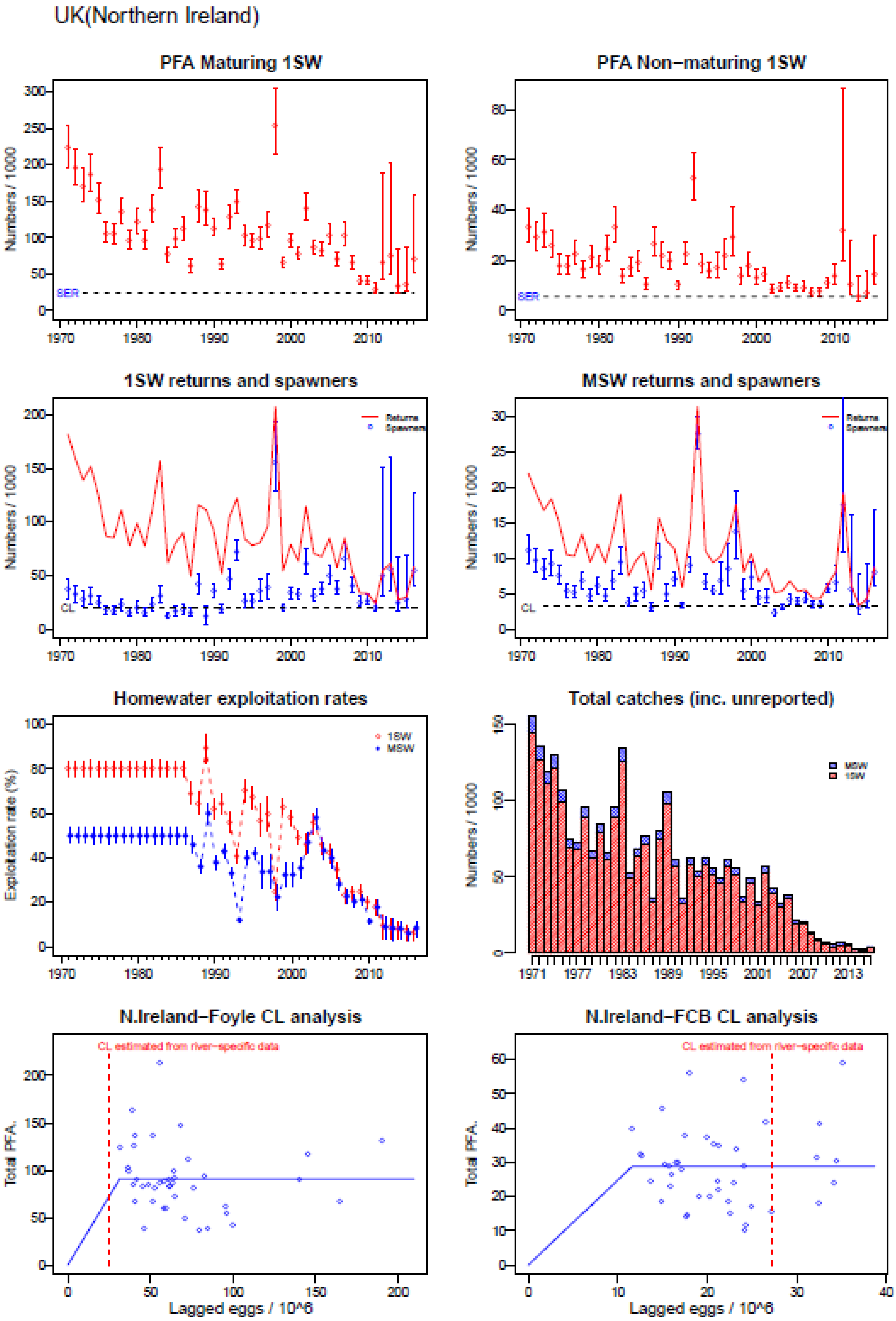


Figure 3.3.4.1i. Summary of fisheries and stock description, UK(NI). The river-specific CLs, which are used for assessment purposes, are included on the regional CL analysis plots (for comparison, the CLs estimated from the regional S–R relationships are at the inflection points).

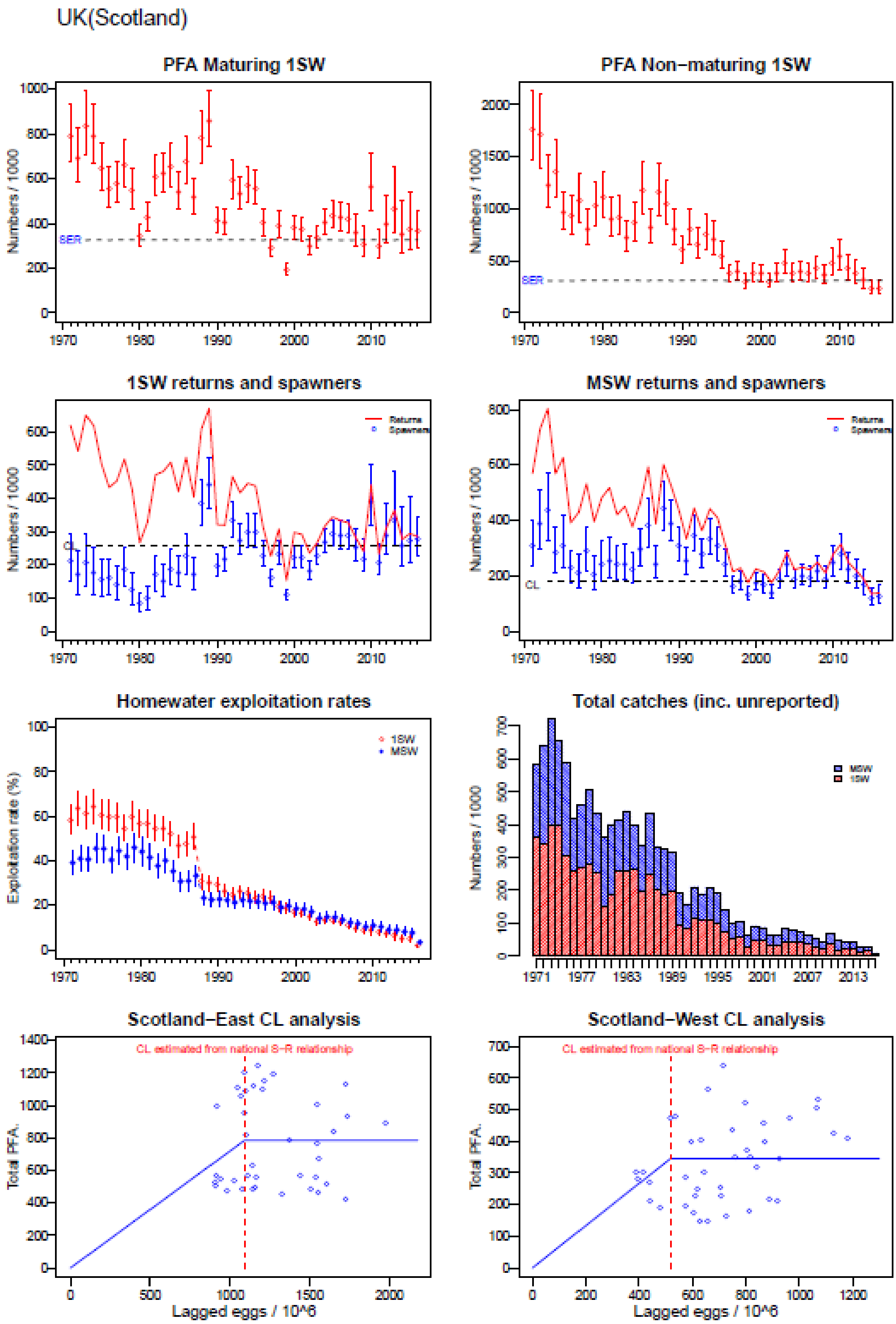


Figure 3.3.4.1j. Summary of fisheries and stock description, UK(Scotland).

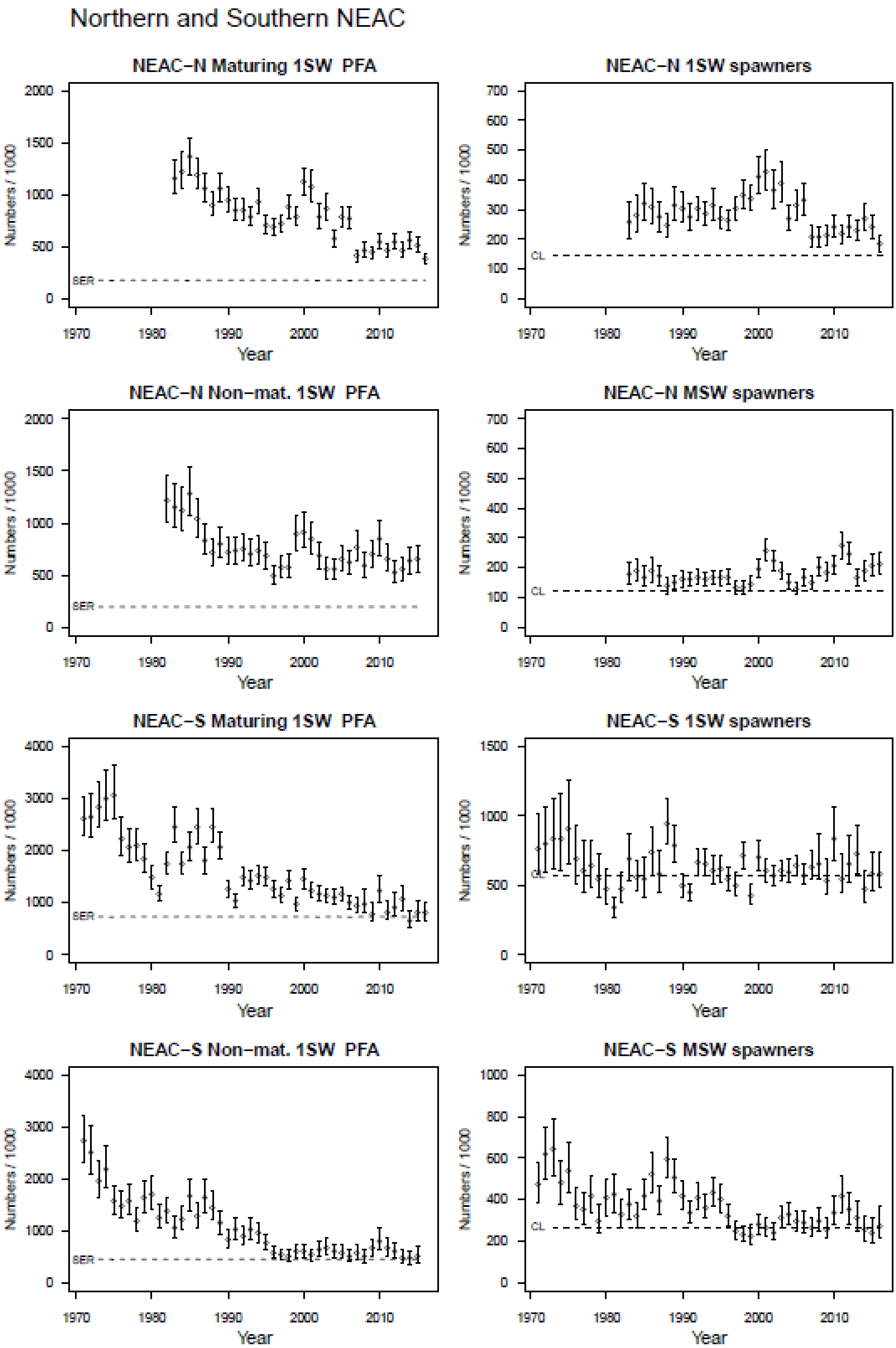


Figure 3.3.4.2. Estimated PFA (left panels) and spawning escapement (right panels) with 90% confidence limits, for maturing 1SW (1SW spawners) and non-maturing 1SW (MSW spawners) salmon in northern (NEAC – N) and southern (NEAC – S) NEAC stock complexes.

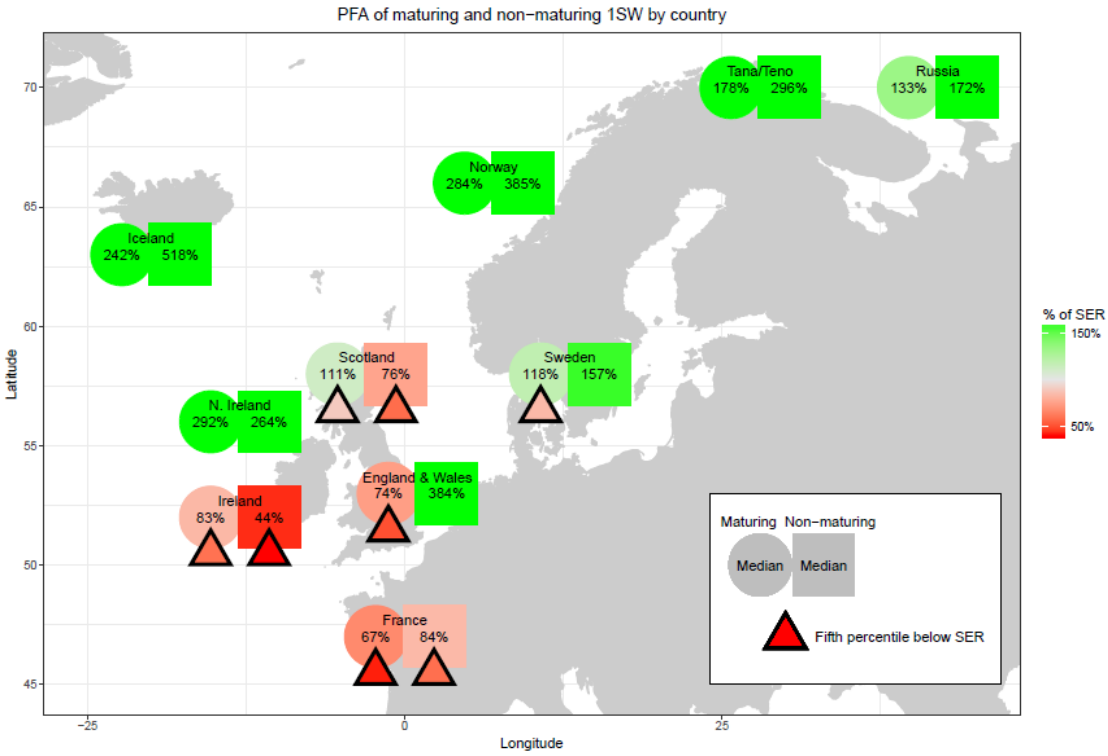


Figure 3.3.4.3. PFA of maturing (for 2016) and non-maturing (for 2015) 1SW as percent of spawner escapement reserve (% of SER). Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding SER value. The colour shading represents the percentages of SER attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of SER attained with red intensity inversely proportional to percentage of SER attained.

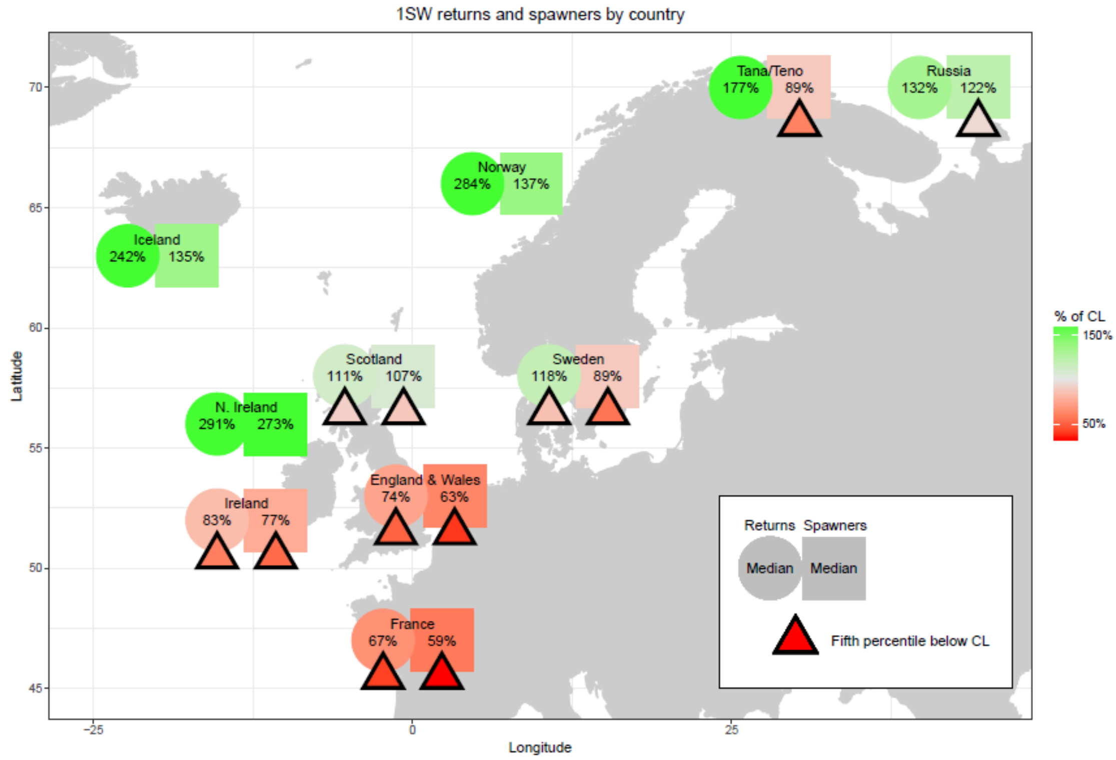


Figure 3.3.4.4. Estimated 1SW returns and spawners as percentages of conservation limits (% of CL) by country in the NEAC areas for 2016. Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding CL. The colour shading represents the percentages of CL attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of CL attained with red intensity inversely proportional to percentage of CL attained.

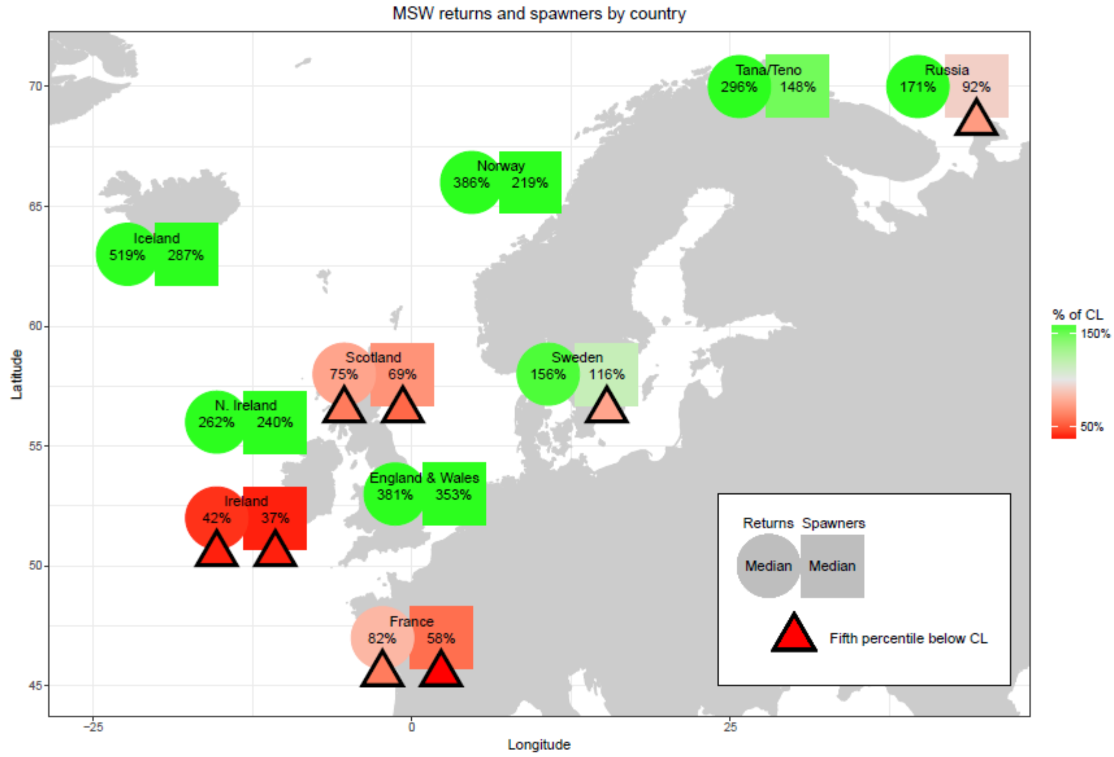


Figure 3.3.4.5. Estimated MSW returns and spawners as percent of conservation limit (% of CL) by country in the NEAC areas for 2016. Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding CL. The colour shading represents the percentages of CL attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of CL attained with red intensity inversely proportional to percentage of CL attained.

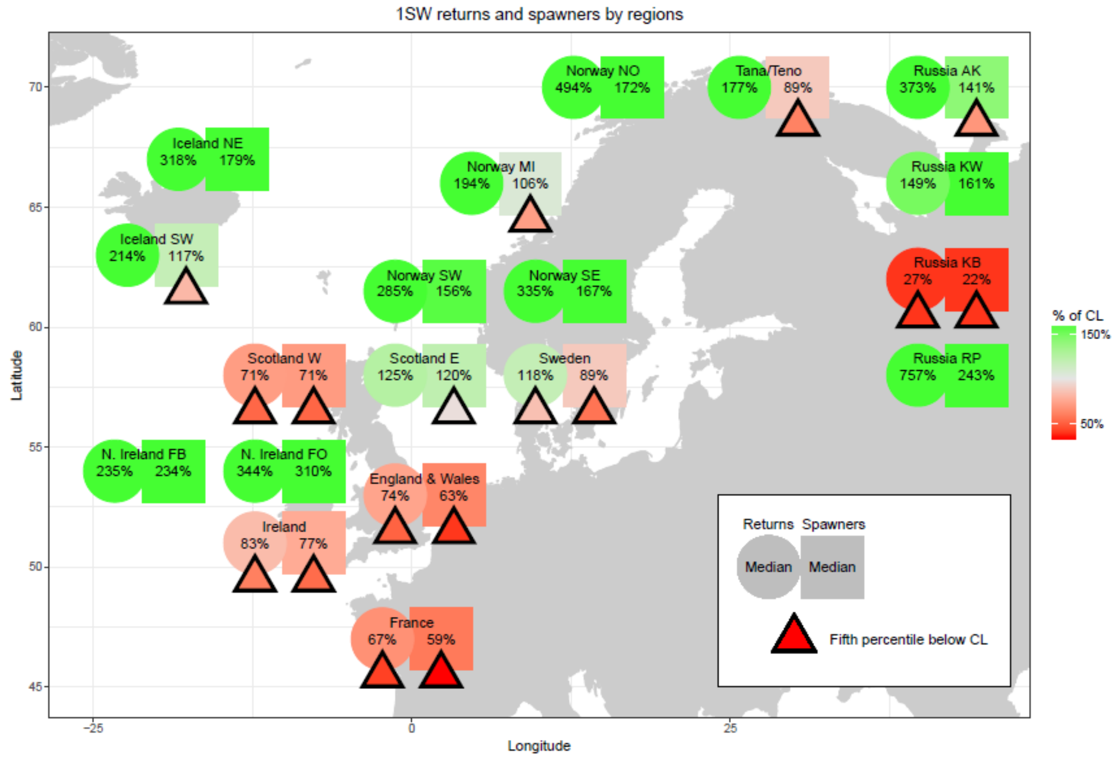


Figure 3.3.4.6. Estimated 1SW returns and spawners as percent of region-specific conservation limit (% of CL) for regions within NEAC countries in 2016. Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding CL. The colour shading represents the percentages of CL attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of CL attained with red intensity inversely proportional to percentage of CL attained.

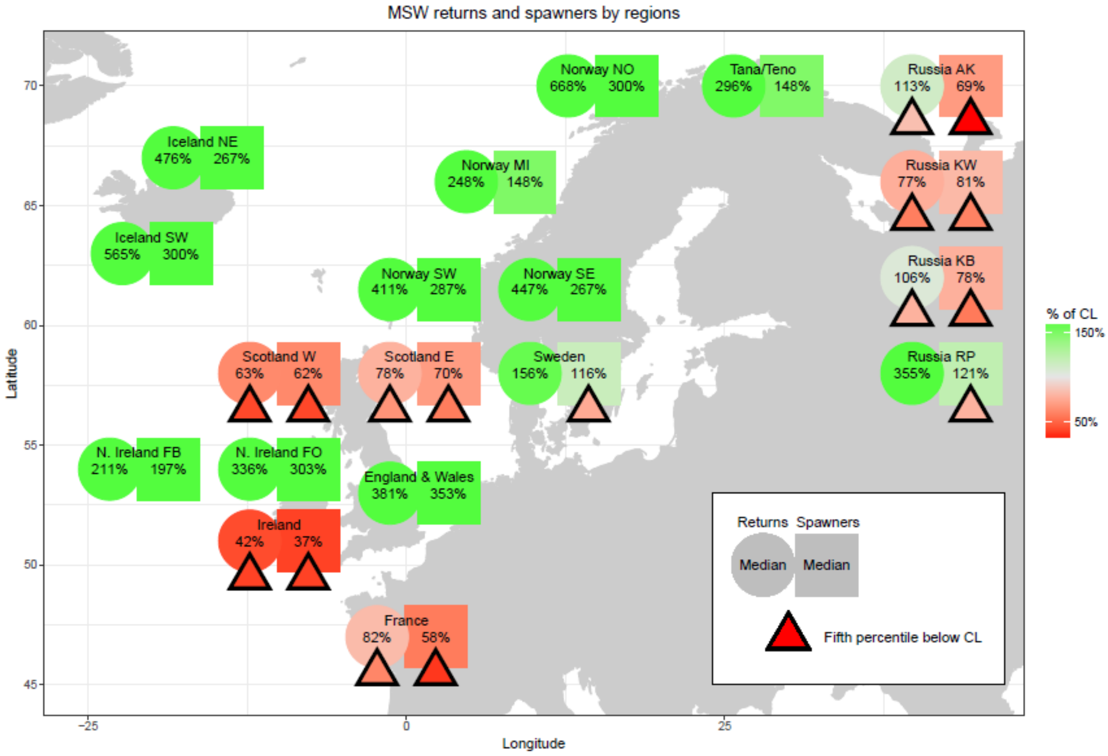


Figure 3.3.4.7. Estimated MSW returns and spawners as percent of region-specific conservation limit (% of CL) for regions within NEAC countries in 2016. Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding CL. The colour shading represents the percentages of CL attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of CL attained with red intensity inversely proportional to percentage of CL attained.

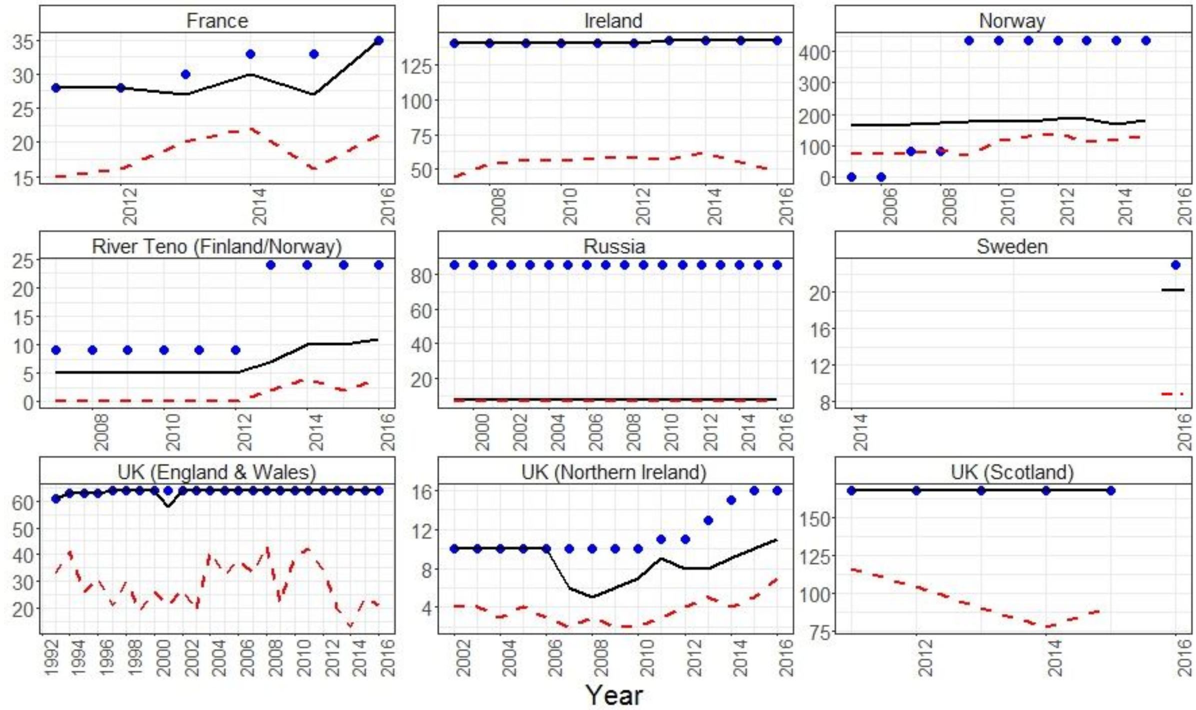


Figure 3.3.5.1. Time-series showing the number of rivers with established CLs (•), the number of river assessed annually (—), and the number of rivers meeting CLs annually (— —) for jurisdictions in the NEAC area.

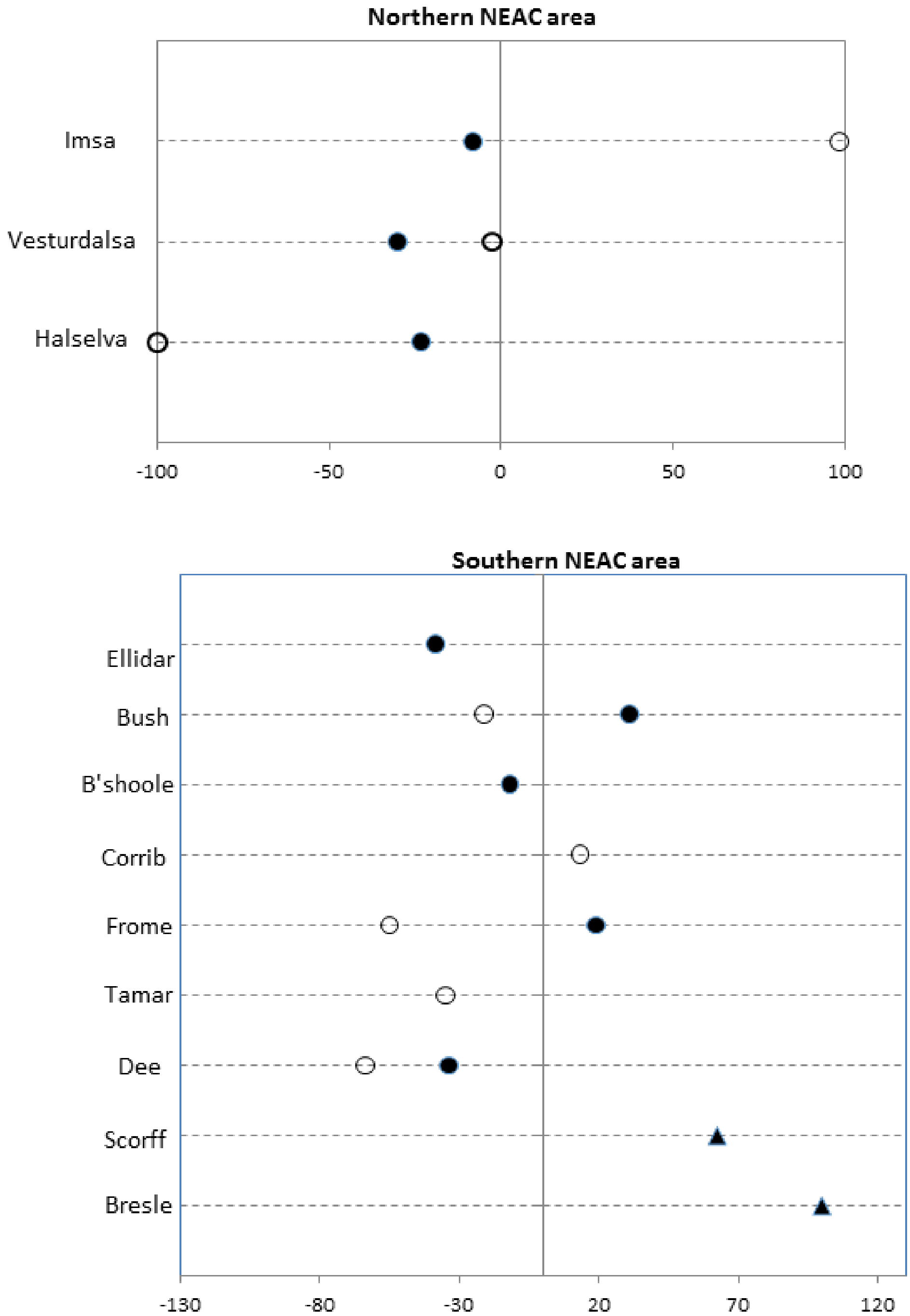


Figure 3.3.6.1. Comparison of the percent change in the five-year mean return rates for 1SW and 2SW wild salmon smolts to rivers of Northern (upper panel) and Southern NEAC (lower panel) areas for the 2006 to 2010 and 2011 to 2015 smolt years (2005 to 2009 and 2010 to 2014 for 2SW salmon). Open circles are for 1SW and filled circles are for 2SW dataseries. Triangles indicate all ages without separation into 1SW and 2SW returns. Populations with at least three datapoints in each of the two time periods are included in the analysis. The scale of change in some rivers is influenced by low return numbers, where a few fish more or less returning may have a large consequence on the percentage change.

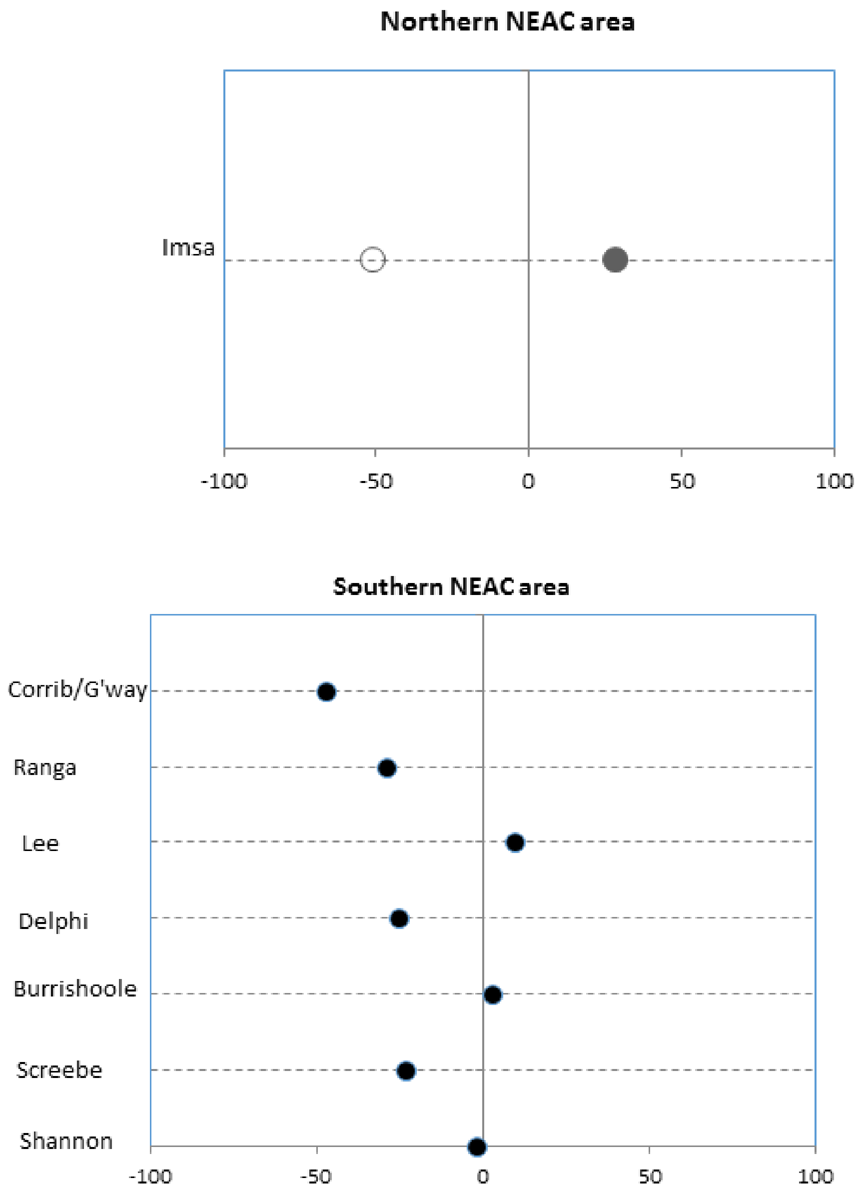


Figure 3.3.6.2. Comparison of the percent change in the five-year mean return rates for 1SW and 2SW hatchery salmon smolts to rivers of Northern (upper panel) and Southern NEAC (lower panel) areas for the 2005 to 2009 and 2010 to 2014 smolt years (2004 to 2008 and 2009 to 2013 for 2SW salmon). Open circles are for 1SW and filled circles are for 2SW dataseries. Populations with at least three datapoints in each of the two time periods are included in the analysis. The scale of change in some rivers is influenced by low return numbers, where a few fish more or less returning may have a large consequence on the percentage change.

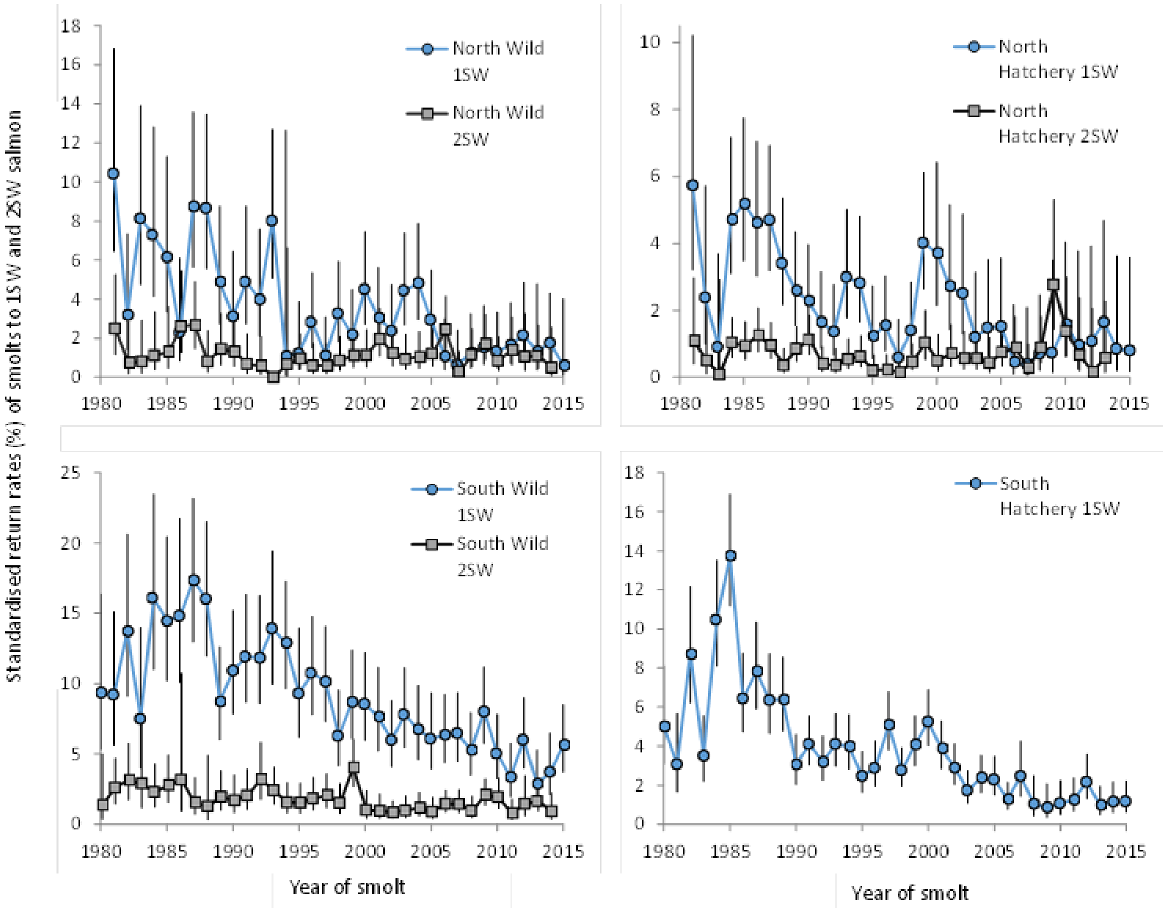


Figure 3.3.6.3. Least squared (marginal mean) average annual survival indices (%) of wild (left hand panels) and hatchery origin smolts (right hand panels) to 1SW and 2SW salmon to Northern (top panels) and Southern NEAC areas (bottom panels). For most rivers in Southern NEAC, the values are returns to the coast prior to the homewater coastal fisheries. Annual means derived from a general linear model analysis of rivers in a region with a quasi-Poisson distribution (log-link function). Error bars are 95% CIs. Note y-scale differences among panels. Following details in Tables 3.3.6.1 and 3.3.6.2 the analyses included estimated survival (%) to 1SW and 2SW returns by smolt year. Wild returns to Northern NEAC rivers (Vesturdalsa, Halselva and Imsa) and Southern NEAC rivers (Ellidaar, Corrib, Burrishoole, North Esk, Bush, Dee, Tamar and Frome). Hatchery returns to Northern NEAC rivers (Halselva, Imsa, Drammen and Lagan) and Southern NEAC rivers (Ranga, Shannon, Screebe, Burrishoole, Delphi-Burrishoole, Delphi, Bunowen, Lee, Corrib-Cong, Corrib-Galway, Erne, Bush 1+ smolts and Bush 2+ smolts).

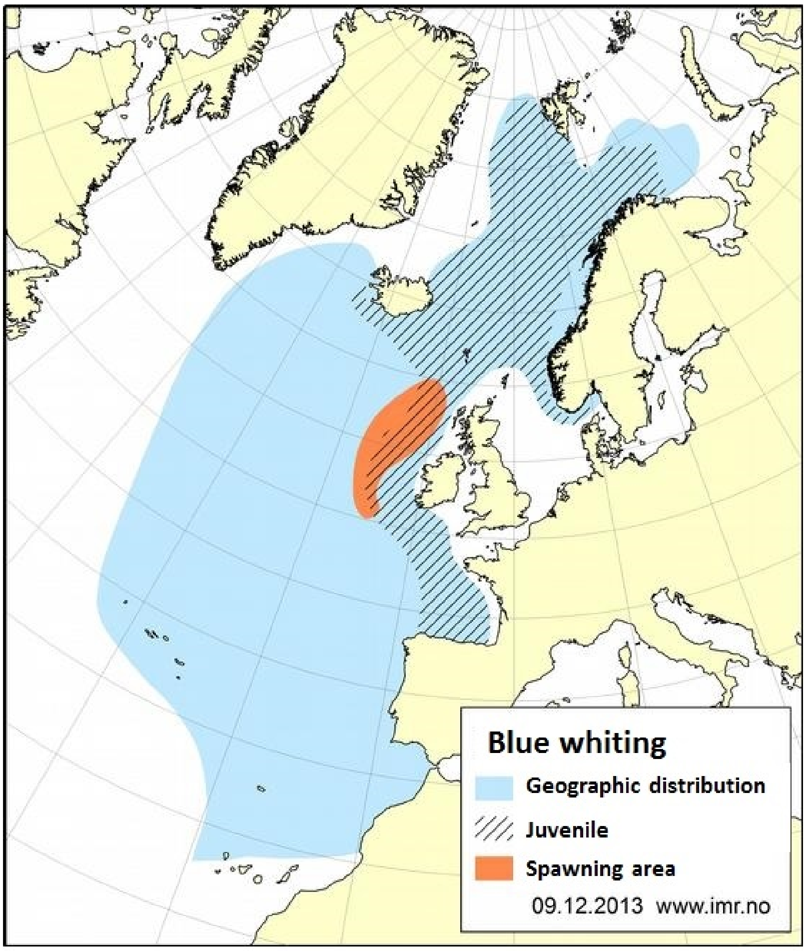


Figure 3.4.1.1. The geographic distribution of blue whiting in the North Atlantic. The orange shaded region is the spawning area where most of the blue whiting fishery takes place. During summer, most of the fish are located in the Norwegian Sea and surrounding areas. Figure from IMR in Norway (www.imr.no).

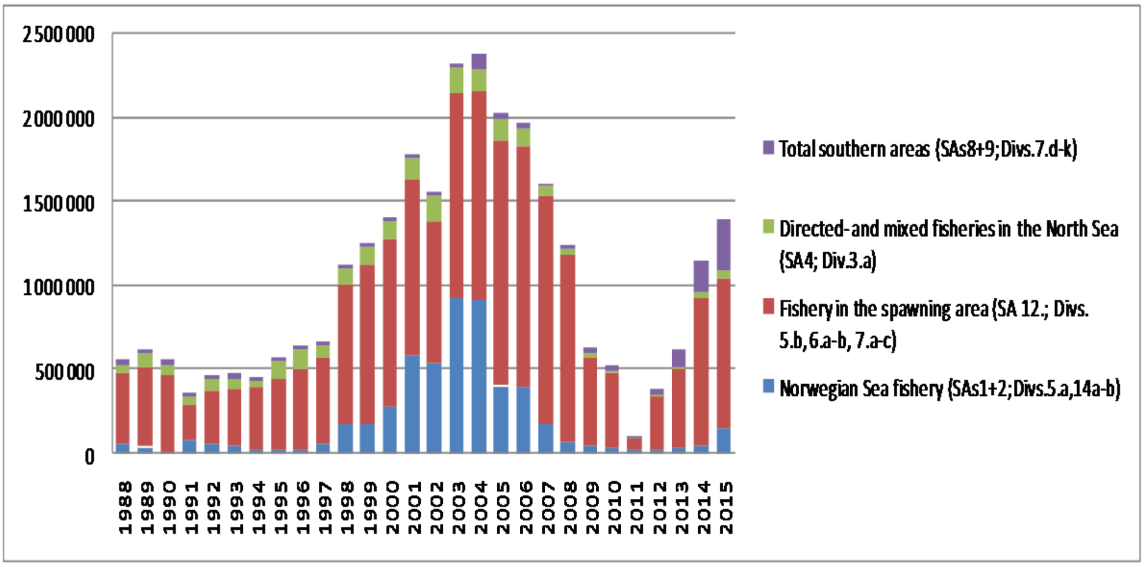


Figure 3.4.1.2. Official catches (tonnes) of blue whiting by fishery subareas from 1988–2015. Figure from the ICES WGWIDE report (ICES, 2016d).

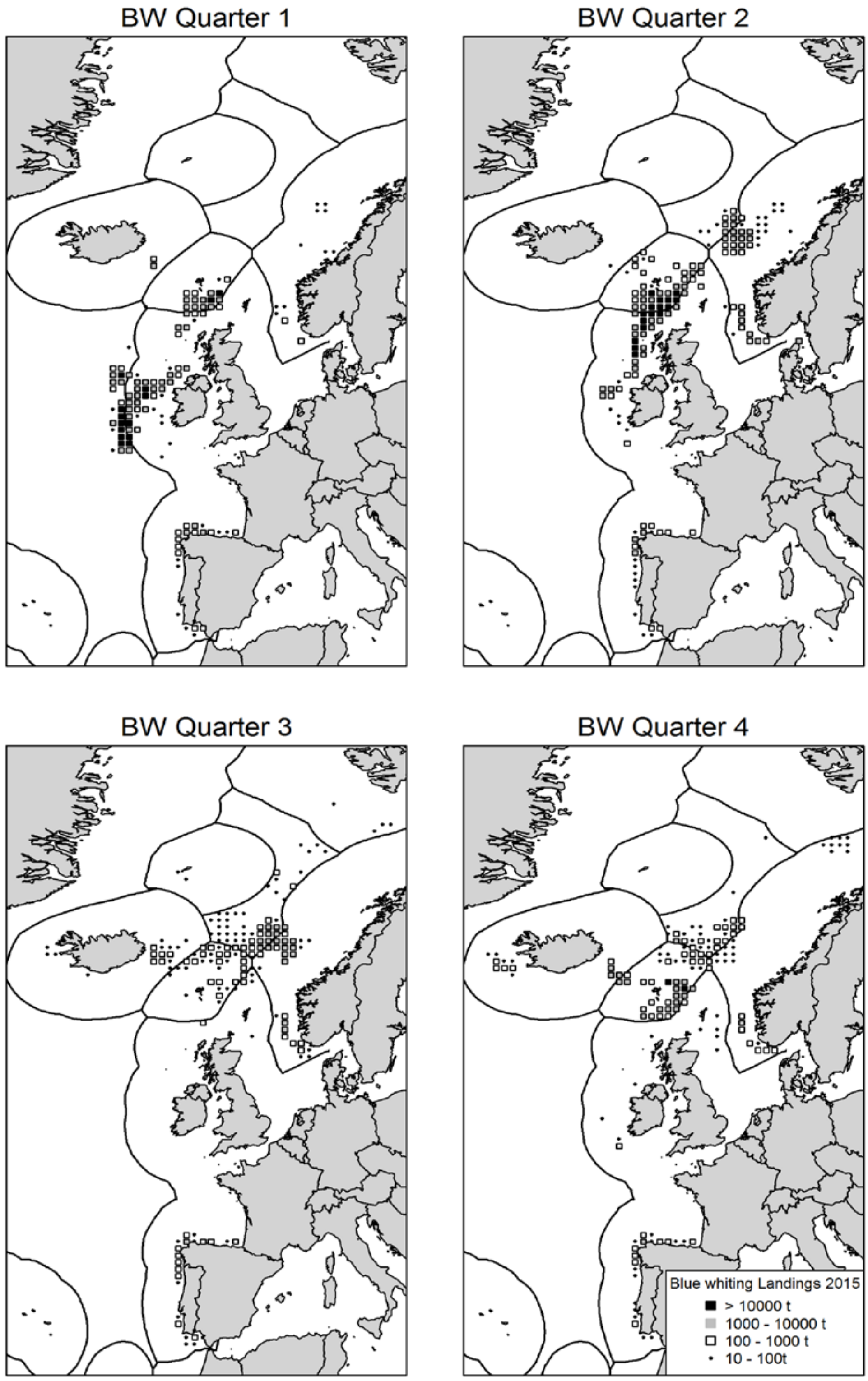


Figure 3.4.1.3. Blue whiting total catches (ICES estimates) in 2015 by quarter and ICES rectangle. Landings between 10 and 100 tonnes (black dots), between 100 and 1000 tonnes (open squares), 1000 and 10 000 tonnes (grey squares) and exceeding 10 000 tonnes black squares. The catches on the maps constitute 99.5 % of the total catches. Figure from ICES, 2016d.

4 North American commission

4.1 NASCO has requested ICES to describe the key events of the 2016 fisheries

The previous advice provided by ICES (2015) indicated that there were no mixed-stock fishery catch options on the 1SW non-maturing salmon component for the 2015 to 2017 PFA years. The NASCO Framework of Indicators of North American stocks for 2016 did not indicate the need for a revised analysis of catch options and no new management advice for 2017 is provided. The assessment was updated to 2016 and the stock status is consistent with the previous years' assessments and catch advice.

4.1.1 Key events of the 2016 fisheries

- Mandatory catch and release of small salmon was implemented in 2015, and continued in 2016 for the recreational fishery throughout the Gulf Region, and mandatory release of large salmon continued throughout Eastern Canada with the exception of a number of rivers in Quebec.
- The Province of Quebec published its 2016–2026 Salmon Management Plan for the recreational fisheries in March 2016. The following modifications of general fishing conditions are contained in that plan:
    - An annual quota (bag limit) for anglers of four salmon (including only one large salmon, except in Northern Quebec where the limit is four salmon, small or large), down from seven salmon (small or large) in previous years.
    - The daily licence is replaced with a licence that is valid for three consecutive days, including one tag permitting the harvest of a small salmon.
    - In the rivers where Atlantic salmon harvest is allowed, the maximum daily retention limit was reduced from three to two.
    - Until 2015, there was no limit to the number of salmon that could be caught and released. Starting in 2016, the maximum daily release limit is three salmon per day per fisher, with the exception of the regions of Northern Quebec and the Lower North Shore where there is no regulatory limit.
    - Harvests of large salmon made outside "scheduled" salmon rivers or parts of those same rivers identified in Annex 6 of the Québec Fishery Regulations was prohibited.
- The majority of recreational harvest fisheries were directed toward small salmon whereas the aboriginal and Labrador resident food fisheries harvested both size groups.
- The 2016 provisional harvest in Canada was 134.8 t, comprising 46 307 small salmon and 11 709 large salmon, 5% fewer small salmon and 2% more large salmon compared to 2015.
- Overall, harvests remain very low relative to pre-1990 values (> 1000 t).

4.1.2 Gear and effort

Canada

The 23 areas for which the Department of Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Quebec, the management is delegated to the province of Quebec (Ministère des Forêts, de la Faune, et des Parcs) and the fishing areas are designated by Q1 through Q11 (Figure 4.1.2.1). Harvests (fish which were retained) and catches (including harvests and fish caught and released in recreational fisheries) are categorized in two size groups: small and large. Small salmon, generally 1SW, in the recreational and aboriginal 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 and aboriginal 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 2016: Aboriginal peoples; residents fishing for food in Labrador; and recreational fishers. There were no commercial fisheries in Canada in 2016. There is no legal bycatch of salmon in commercial fisheries directing for other species and there are no estimates of the extent of the bycatch and the associated mortality of salmon from these fisheries, although previous analyses by ICES indicated the extent of the mortality was low (ICES, 2004). The selling of Atlantic salmon caught in fisheries in Canada is prohibited.

In 2016, four subsistence fisheries harvested salmon in Labrador: 1) Nunatsiavut Government (NG) members fishing in northern Labrador communities (Rigolet, Makkovik, Hopedale, Postville, and Nain) and Lake Melville; 2) Innu Nation members fishing in the northern Labrador community of Natuashish and Lake Melville community of Sheshatshiu; 3) NunatuKavut Community Council (NCC) members fishing in southern Labrador and Lake Melville and, 4) Labrador residents fishing in Lake Melville and various coastal communities. The NG, Innu, and NCC fisheries were monitored by Aboriginal Fishery Guardians jointly administered by the Aboriginal groups and DFO. The fishing gear is multifilament gillnets of 15 fathoms (27.4 m) in length of a stretched mesh size ranging from 3 to 4 inches (7.6 to 10.2 cm). Although nets are mainly set in estuarine waters some nets are also set in coastal areas usually within bays. Catch statistics are based on logbook reports.

Most catches (95% in 2016, Figure 2.1.1.2) in Canada now take place in rivers or in estuaries. Fisheries are principally managed on a river-by-river basis and in areas where retention of large salmon in recreational fisheries are allowed, the fisheries are closely controlled. In other areas, fisheries are managed on larger management units that encompass a collection of geographically neighbouring stocks. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located in bays generally inside the headlands. Sampling of the Labrador subsistence fishery occurred again in 2016 for biological characteristics and tissue samples to identify the origin of harvested salmon.

The following management measures were in effect in 2016.

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

In Quebec, Aboriginal peoples’ fisheries took place subject to agreements, conventions or through permits issued to the communities. There are approximately ten communities 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 with permits have to be reported collectively by each Aboriginal user group. However, catches under a convention, such as for Inuit in Ungava, do not have to be reported. When reports are not available, the catches are estimated based on the most reliable information available. In the Maritimes (SFAs 15 to 23), FSC agreements were signed with several Aboriginal peoples' groups (mostly First Nations) in 2016. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries. Harvests that occurred both within and outside agreements were obtained directly from the Aboriginal peoples. In Labrador (SFAs 1 and 2), fishery arrangements with the NG, Innu, and NCC resulted in fisheries in estuaries and coastal areas. By agreement with First Nations, there were no FSC fisheries for salmon on the island of Newfoundland in 2016. Harvest by Aboriginal peoples with recreational licences is reported under the recreational harvest categories.

Resident food fisheries in Labrador

The DFO is responsible for regulating the Resident Fishery. In 2016, a licensed subsistence trout and charr fishery for local residents took place, using gillnets, in Lake Melville (SFA 1) and in estuary and coastal areas of Labrador (SFA 1 and 2). Licence conditions restrict the seasonal bycatch to a maximum of three salmon of any size while fishing for trout and charr; three salmon tags accompanied each licence. When the bycatch of three salmon was caught, the resident fishers were required to remove their net from the water. If bycatch during a single gillnet set exceeded three salmon, resident fishers were required to discard the excess fish. All licence holders were requested to complete logbooks.

Recreational fisheries

Licences are required for all persons fishing recreationally for Atlantic salmon. Gear is restricted to fly fishing and there are daily and seasonal bag limits. Recreational fisheries management in 2016 varied by area and large portions of the southern areas remained closed to all directed salmon fisheries (Figure 4.1.2.2). Within the province of Quebec, there are 114 salmon rivers, and fishing for salmon was not allowed on 32 of them. Large salmon were allowed to be retained throughout the season on eight rivers (seven in the north and lower North shore as in the Causapscal, a tributary of the Matapedia River) and for only part of the season on 12 other rivers. Small salmon could be retained for the whole season on 75 rivers, and catch and release only for all sizes was permitted on seven rivers. Following the very low returns to many Gulf rivers in 2014, mandatory catch and release measures for small salmon were implemented in Gulf region in 2015 and continued in 2016.

Until 2011, recreational salmon anglers in Prince Edward Island (PEI; Gulf Region) had to first obtain a general angling licence, and then purchase a salmon licence. Beginning in 2012, separate salmon licences were no longer issued, and the provincial angling licence confers recreational fishing access to Atlantic salmon for catch and release fishing only and no retention is allowed.

In all areas of eastern Canada, there is no estimate of salmon released as bycatch in non-salmon directed recreational fisheries.

USA

There were no recreational or commercial fisheries for anadromous Atlantic salmon in the USA in 2016.

France (Islands of Saint Pierre & Miquelon)

Eight professional and 70 recreational gillnet licences were issued in 2016 (Table 4.1.2.1). Professional licences have a maximum authorization of three nets of 360 metres maximum length each whereas the recreational licence is restricted to one net of 180 metres. The selling of Atlantic salmon is only allowed by professional licence holders and is restricted to within the islands of Saint Pierre & Miquelon.

4.1.3 Catches in 2016

Canada

The provisional harvest of salmon in 2016 by all users was 134.8 t, about 4% lower than the 2015 harvest of 140.3 t (Tables 2.1.1.1, 2.1.1.2; Figure 4.1.3.1). This is the fifth lowest catch in the time-series since 1960. The 2016 harvest was 46 307 small salmon (79.2 t) and 11 709 large salmon (55.6 t), 5% fewer small salmon and 2% more large salmon by number compared to 2015. There has been a dramatic decline in harvested tonnage since 1988, in large part as a result of the reductions in commercial fisheries effort (closure of the insular Newfoundland commercial fishery in 1992, closure of the Labrador commercial fishery in 1998, and the closure of the last areas of the Quebec commercial fishery in 2000).

Aboriginal peoples' FSC fisheries

The provisional harvest by Aboriginal peoples in 2016 was 63.9 t, slightly above the 62.9 t reported in 2015 (Table 4.1.3.1). The percentage large by number (50%) was up on the 2015 value (46%) and was the second highest value since 1998.

In Labrador, catch statistics for the aboriginal and resident food fisheries were derived from logbooks issued to each fisher. Total catches were derived by adjusting the logbook catches proportionately to the number of fishers reporting out of the total licensed/designated fishers. For Quebec, catches from the aboriginal fisheries have to be reported collectively by each aboriginal community. However, most reports are not available and the catches are estimated on the basis of the most reliable information available. The reliability of the catch estimates varies among the user groups. As in Quebec, aboriginal groups with fishing agreements in the DFO Gulf and Maritimes regions are expected to report their catches. Reports in most years are incomplete. The 2016 values will be updated when the reports are finalized.

Complete and timely reporting of Aboriginal peoples' catch statistics is required in all areas of eastern Canada.

Residents fishing for food in Labrador

The estimated catch for the fishery in 2016 was 1.6 t, a decrease of 0.4 t from 2015. This represents approximately 592 fish, 39% large by number (Table 4.1.3.2).

Recreational fisheries

Harvest in recreational fisheries in 2016 totalled 38 178 small and large salmon (69.3 t). This harvest, in number of fish, decreased 3.6% from the 2015 harvest level and 2.8% from the previous five-year average, and remains at low levels and similar to the previous decade (Table 4.1.3.3; Figure 4.1.3.2). The small salmon harvest of 36 355 fish was 3.4% below the 2015 harvest. The large salmon harvest of 1823 fish was 7.5% lower than the 2015 harvest and these were taken exclusively in Quebec in both years. The small salmon size group has contributed 89% on average of the total recreational harvests since the imposition of catch and release measures for large salmon in recreational fisheries in the Maritimes (SFA 15 to 23) and Newfoundland (SFA 3 to 14B) in 1984.

In 2016, 69 590 salmon (38 322 small and 31 268 large) were caught and released (Table 4.1.3.4; Figure 4.1.3.3), representing about 65% of the total number caught (including retained fish), the highest value of the time-series that has consistently been above 50% since 1997. For the large salmon group, 95% of those caught were released, the highest value in the time-series since 1984.

Recreational catch statistics for Atlantic salmon are not collected regularly in all areas of Canada and there is no enforceable mechanism in place that requires anglers to report their catch statistics, except in Quebec where reporting of harvested salmon is an enforced legal requirement. The last recreational angler survey for New Brunswick was conducted in 1997 and the catch rates for the Miramichi River from that survey have been used to estimate catches (both harvest and catch and release) for all subsequent years.

Complete and timely reporting of recreational catch statistics is required in all areas of eastern Canada.

Commercial fisheries

All commercial fisheries for Atlantic salmon remained closed in Canada in 2016 and the catch therefore was zero.

Unreported catches

The unreported catch for Canada totalled 27.4 t in 2016. The majority of this unreported catch is illegal fisheries directed at salmon (Tables 2.1.3.1, 2.1.3.2). Of the unreported catch which could be attributed to a geographic location (12.7 t), 8.7 t was considered to have occurred in inland waters, 1.2 t in estuaries and 2.8 t in marine waters.

USA

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

France (Islands of Saint Pierre & Miquelon)

A total harvest of 4.7 t was reported in the professional and recreational fisheries in 2016, an increase of 34% from the 2015 reported harvest of 3.5 t (Tables 2.1.1.1, 4.1.2.1).

There are no unreported catch estimates for the time-series.

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

Harvest histories (1972 to 2016) of salmon, expressed as 2SW salmon equivalents, are provided in Table 4.1.4.1. The Newfoundland and Labrador commercial fishery was historically a mixed-stock fishery and harvested both maturing and non-maturing 1SW salmon as well as 2SW maturing salmon. The harvest of repeat spawners and older sea ages was not considered in the run-reconstructions.

Harvests of 1SW non-maturing salmon in Newfoundland and Labrador commercial fisheries have been adjusted by natural mortalities of 3% per month for 13 months, and 2SW harvests in these same fisheries have been adjusted by one month to express all harvests as 2SW equivalents in the year and time they would reach rivers of origin. The Labrador commercial fishery has been closed since 1998. Harvests from the Aboriginal Peoples' fisheries in Labrador (since 1998) and the residents' food fishery in Labrador (since 2000) are both included. Mortalities in mixed-stock fisheries and losses in terminal locations (including harvests, losses from catch and release mortality and other removals including broodstock) in Canada were summed with those of the USA to estimate total 2SW equivalent losses in North America. The terminal fisheries included coastal, estuarine and river catches of all areas, except Newfoundland and Labrador where only river catches were included, and excluding Saint Pierre & Miquelon. Data inputs were updated to 2016.

Total 2SW harvest equivalents of North American origin salmon in all fisheries peaked at 526 000 fish in 1974 and was above 200 00 fish in most years until 1990 (Table 4.1.4.1; Figure 4.1.4.1). Harvest equivalents within North America peaked at about 363 000 in 1976 and have remained below 12 000 2SW salmon equivalents for most years between 1999 and 2016 (Table 4.1.4.1; Figure 4.1.4.1). The proportion of the 2SW harvest equivalents taken at Greenland has varied from 0.36 to 0.55 of the total removals in all fisheries during 2007 to 2016 (Figure 4.1.4.1).

In the most recent year (2016), the losses of the cohort destined to be 2SW salmon in terminal areas of North America was estimated at 5133 fish (median), 50% of the total North American catch of 2SW salmon. The percentages of harvests occurring in terminal fisheries ranged from 17 to 33% during 1972 to 1991 and 44 to 87% during 1992 to 2016 (Table 4.1.4.1). Percentages increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed-stock fisheries. The percentage of 2SW salmon harvested in North American fisheries in 2016 is 47%, the fourth lowest of the time-series (Table 4.1.4.1). The percentages of the 2SW harvests by fishery and fishing area are summarized in Figure 4.1.4.1. The percentage of the 2SW harvest equivalents taken at Greenland was as high as 56% in 1992 and as low as 5% in 1994 when the internal use fishery at Greenland was suspended (Figure 4.1.4.1). In the last three years, the Greenland share of the 2SW harvest equivalents has been 52% to 55%. For similar years, the harvests in the Labrador subsistence fisheries have been 18% to 22% of the total harvests and 19% to 20% in terminal fisheries of Quebec (Figure 4.1.4.1).

4.1.5 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. Sampling programs of current marine fisheries (Labrador and Saint Pierre & Miquelon) are used to monitor salmon interceptions from other areas of North America.

Labrador Aboriginal peoples' FSC fisheries sampling program

The NCC and NG sampling program of Labrador FSC fisheries continued in 2016. Landed fish were sampled opportunistically for length, weight, sex, scales (for age analysis) and tissue (genetic analysis). Fish were also examined for the presence of external tags or marks.

In 2016, a total of 810 samples (6% of harvest by number) were collected from the Labrador FSC fisheries: 278 from northern Labrador (SFA 1A), 155 from Lake Melville (SFA 1B), and 377 samples from southern Labrador (SFA 2) (Figure 4.1.2.1). Based on the interpretation of the scale samples (n=756), 69% were 1SW salmon, 26% were 2SW, and 5% were previously spawned salmon. The majority of salmon sampled were river ages 3 to 5 years (99%) (modal age 4). There were no river age 1 and few river age 2 (0.3%) salmon sampled, suggesting, as in previous years (2006 to 2015), that very few salmon from the most southern stocks of North America (USA, Scotia-Fundy) were exploited in these fisheries.

Percentage of samples by river age within the three sampled areas in 2016								
Area	Number of Samples	River Age						
		1	2	3	4	5	6	7
Northern Labrador (SFA 1A)	234	0.0	0.0	20.0	60.0	20.0	0.0	0.0
Lake Melville (SFA 1B)	153	0.0	0.7	21.6	70.6	7.2	0.0	0.0
Southern Labrador (SFA 2)	369	0.0	0.5	24.9	57.5	15.7	1.4	0.0
All areas	756	0.0	0.5	22.1	62.0	14.7	0.7	0.0

Tissue samples from the 2015 and 2016 Labrador FSC fisheries were genetically typed to twelve regional groups (Figure 4.1.5.1) (Bradbury *et al.*, 2014; Moore *et al.*, 2014). The estimated percent contributions of the twelve groups (and associated standard errors) are shown in Table 4.1.5.1 and Figures 4.1.5.2 and 4.1.5.3. As with previous analyses (Bradbury *et al.*, 2014; ICES, 2015), the Labrador Central (LAB) regional group represents the majority (98% in 2015; 99% in 2016) of the salmon in the Labrador FSC fishery (Table 4.1.5.1).

Saint Pierre & Miquelon fisheries sampling programme

In 2016, 147 scale samples (146 corresponding tissue samples, 9% of harvest by number) were obtained from the fishery covering the period 16 June to 12 July, 2016. Salmon sampled in 2016 were predominantly river age 2 (28%), 3 (43%), and 4 (25%) with the majority of fish sampled being one-sea-winter maiden salmon (84%).

Sea age	River age					
	2	3	4	5	6	Total
1SW	27	56	32	2	2	119
2SW	10	5	3	2	0	20
Previous spawners	2	0	0	0	0	2
Total	39	61	35	4	2	141

Genetic mixed-stock analysis was used to analyse samples collected from the Saint Pierre & Miquelon fishery in 2016. Samples from 2015 are currently being analysed and results are currently unavailable. The estimated percent contributions of the twelve groups (and associated standard errors) for 2016 are shown in Table 4.1.5.2 and Figure 4.1.5.4. As with previous analyses (Bradbury *et al.*, 2016a; ICES, 2015), the estimated harvest composition was dominated (87%) by three regions: 23% Gulf of St Lawrence (GUL), 21% Gaspe Peninsula (GAS), and 43% Newfoundland (NFL).

Recommendations for future activities

The Working Group noted that the sampling intensity was low for the Labrador FSC (samples represented approximately 6% of the provisional harvest in 2016) and for the Saint Pierre & Miquelon (samples represented approximately 9% of reported harvest in 2016) fisheries. The Working Group recommends that sampling and supporting descriptions of the Labrador and Saint Pierre & Miquelon mixed-stock fisheries be continued and expanded (i.e. sample size, geographic coverage, tissue samples, seasonal distribution of the samples) in future years to improve the information on biological characteristics and stock origin of salmon harvested in these mixed-stock fisheries.

4.1.6 Exploitation rates

Canada

Provisional mean exploitation rates in the 2016 recreational fishery for retained small salmon was 16% for Newfoundland (nine rivers; range of 5% Terra Nova River to 30% Garnish River) and 3% for Labrador (Sand Hill River only), which were greater than the previous five year means of 10% and 2%, respectively. In Quebec, total fishing exploitation rate was estimated at 15%, with rates of 6% for the Aboriginal fishery and 9% for the recreational fishery. The total exploitation rate in 2016 for Quebec was the lowest value observed since 1984; it is mostly influenced by the closure of the commercial fishery between 1998 and 2000 and by the increase in the number of released fish in recent years due to regulatory changes. Retention of small and large salmon in the recreational fisheries of Nova Scotia, New Brunswick and Prince Edward Island was not permitted in 2016.

USA

There was no exploitation of anadromous salmon in homewaters.

Exploitation trends for North American salmon fisheries

Annual exploitation rates of small salmon (mostly 1SW) and large salmon (mostly MSW) in North America for the 1971 to 2016 time period were calculated by dividing annual estimated losses (harvests, estimated mortality from catch and release (ICES, 2010), broodstock) in all North American fisheries by annual estimates of the returns to North America prior to any homewater fisheries. The fisheries included coastal, estuarine and river fisheries in all areas, as well as the commercial fisheries of Newfoundland and Labrador which harvested salmon from all regions in North America.

Exploitation rates of both small and large salmon fluctuated annually but remained relatively steady until 1984 when exploitation of large salmon declined sharply with the introduction of the non-retention of large salmon in angling fisheries and reductions in commercial fisheries (Figure 4.1.6.1). Exploitation of small salmon declined steeply in North America with the closure of the Newfoundland commercial fishery in 1992. Declines continued in the 1990s with continuing management controls in all fisheries to reduce exploitation. In the last few years, exploitation rates on small salmon and large salmon have remained at the lowest in the time-series, averaging 10% for large salmon and 14% for small salmon over the past ten years. However, exploitation rates across regions within North America are highly variable.

4.2 Management objectives and reference points

Management objectives are described in Section 1.4 and reference points and the application of precaution are described in Section1.5.

In Quebec, reference points were reviewed and revisions were implementation in the Atlantic salmon management plan for 2016–2026 (Ministère des Forêts, de la Faune et des Parcs, 2016). Upper and lower reference points for each river were established using a Bayesian hierarchical analysis of stock–recruitment data (Dionne *et al.*, in press). The lower reference point corresponds to the spawner abundance that results at a risk of ≤25% of recruitment being less than 50% of maximum recruitment, a stock level below which productivity is considered to be sufficiently impaired as to cause serious harm. The lower reference point corresponds to the conservation limit. An additional lower reference point, defined on the basis of population genetic considerations that permits the preservation of 90% of the genetic diversity over 100 years, was set at an abundance of 200 adults. The upper reference point was set at level equal to the 95th percentile of the posterior distribution of the spawner estimate that results in maximum sustainable yield. Conservation limits by sea age have yet to be defined.

There were no changes to the 2SW salmon Conservation Limits (CLs) and Management Objectives from those identified previously (ICES, 2015). CLs for 2SW salmon for Canada total 123 349 and 29 199 for the USA, for a combined total of 152 548 2SW salmon.

Country and Comission Area	Stock Area	2SW spawner requirement	2SW Management Objective
	Labrador	34 746	
	Newfoundland	4022	
	Gulf of St Lawrence	30 430	
	Québec	29 446	
	Scotia-Fundy	24 705	10 976
Canada Total		123 349	
USA		29 199	4549
North American Total		152 548	

4.3 Status of stocks

To date, 1082 Atlantic salmon rivers have been identified in eastern Canada and 21 rivers in eastern USA, where salmon are or were present within the last half century. Conservation requirements have been defined for 503 (46%) of these rivers in eastern Canada and all rivers in USA. Assessments of adult spawners and egg depositions relative to conservation requirements were reported for 70 rivers in eastern North America in 2016.

4.3.1 Smolt abundance

Canada

Wild smolt production was estimated in nine rivers in 2016 (Table 4.3.1.1). The relative smolt production, scaled to the size of the river using the conservation egg requirements, was highest in Western Arm Brook (Newfoundland), and lowest in Rocky River (Newfoundland) and the Nashwaak River (Scotia-Fundy) (Figure 4.3.1.1). Trends in smolt production over the time-series declined ($p < 0.05$) in Conne River (Newfoundland, 1987–2015), Nashwaak River (Scotia-Fundy, 1998–2016) and the two monitored rivers of Quebec (St Jean, 1989–2016; de la Trinite, 1984–2016), whereas production significantly increased ($p < 0.05$) in Western Arm Brook (Newfoundland, 1971–2016). No other rivers showed statistically significant long-term trends (Figure 4.3.1.1).

USA

Wild salmon smolt production has been estimated on the Narraguagus River from 1997 to 2015 (Table 4.3.1.1; Figure 4.3.1.1). A smolt production value for 2016 was unavailable. There is a statistically significant ($p < 0.05$) declining trend in wild smolt production over the time-series.

4.3.2 Estimates of total adult abundance

Returns of small (1SW), large (MSW), and 2SW salmon (a subset of large) to each region were originally estimated by the methods and variables developed by Rago *et al*. (1993) and reported by ICES (1993). Further details are provided in the Stock Annex (Annex 6). The returns for individual river systems and management areas for both sea age groups were derived from a variety of methods. These methods included counts of salmon at monitoring facilities, population estimates from mark–recapture studies, and applying angling and commercial catch statistics, angling exploitation rates, and measurements of freshwater habitat. The 2SW component of the large returns was determined using the sea age composition of one or more indicator stocks.

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

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

Data from previous years were updated and corrections were made to data inputs when required (e.g. 2015 data were finalised and 2016 data are considered to be preliminary).

Since 2002, Labrador regional estimates are generated from data collected at four counting facilities, one in SFA 1 and three in SFA 2 (Figures 4.1.2.1 and 4.3.2.1). The current method to estimate Labrador returns assumes that the total returns to the northern area are represented by returns at the single monitoring facility in SFA 1 and returns in the southerly areas (SFA 2 and 14b) are represented by returns at the three monitoring facilities in SFA 2. The production area (km^2) in SFA 1 is approximately equal to the production area in SFA 2. The uncertainty in the estimates of returns and spawners has been relatively high compared with other regions in recent years (coefficient of variation approximately 20–30% in recent years).

The Working Group recommends that additional monitoring be considered in Labrador to estimate stock status for that region. Additionally, efforts should be undertaken to evaluate the utility of other available data sources (e.g. Aboriginal and recreational catches and effort) to describe stock status in Labrador.

Estimates of small, large and 2SW salmon returns to the six geographic areas and overall for NAC are reported in Tables 4.3.2.1 to 4.3.2.3 and are shown in Figures 4.3.2.2 to 4.3.2.4.

Small salmon returns

- The total estimate of small salmon returns to North America in 2016 (430 900) was 31% lower than the estimated returns in 2015 (624 700), and the 2016 estimate ranks 21st (descending) out of the 47 year time-series.
- Small salmon returns decreased in 2016 from the previous year in five (Labrador, Newfoundland, Quebec, Gulf, and Scotia-Fundy) of the six geographical regions, and increased in the USA.
- Small salmon returns in 2016 were the fourth lowest on record for Scotia-Fundy (2451), and the fifth lowest on record for Gulf (25 750), whereas small salmon returns to Labrador (206 300) were the sixth highest on record.
- Small salmon returns to Labrador (206 300) and Newfoundland (164 200) combined represent 86% of the 2016 total small salmon returns to North America (430 900) in 2016.

Large salmon returns

- The total estimate of large salmon returns to North America in 2016 (174 100) was 12% lower than the estimate for 2015 (196 800), and the 2016 estimate ranks 18th (descending) out of the 47 year time-series.
- Large salmon returns increased from the previous year in three (Quebec, Gulf, and Scotia-Fundy) of the six geographical regions in 2016, and decreased in the other three (Labrador, Newfoundland, and USA).
- Large salmon returns in 2016 were the second lowest on record for USA (392), and the fourth lowest on record for Scotia-Fundy (1545), whereas large salmon returns to Labrador (71 740) in 2016 were the second highest on record.
- Large salmon returns to Labrador (71 740), Québec (39 880), and Gulf (35 600) combined represent 85% of the total large salmon returns to North America (174 100) in 2016.

2SW salmon returns

- The total estimate of 2SW salmon returns to North America in 2016 (107 400) was 6% lower than the estimate for 2015 (114 600), and the 2016 estimate ranks 25th (descending) out of the 47 year time-series;
- 2SW salmon returns increased from the previous year in three (Quebec, Gulf, and Scotia-Fundy) of the six geographical regions in 2016, and decreased in the other three (Labrador, Newfoundland, and USA).
- 2SW salmon returns in 2016 were the second lowest on record for USA (389), and the sixth lowest on record for Scotia-Fundy (1494), whereas 2SW salmon returns to Labrador (46 550) in 2016 were the second highest on record.

- 2SW salmon returns from Labrador (46 550), Québec (29 120), and Gulf (26 180) regions combined represent 95% of 2SW salmon returns to North America in 2016. There are few 2SW salmon returns to Newfoundland (3540), as the majority of the large salmon returns to that region comprised previous spawning 1SW salmon.

4.3.3 Estimates of spawning escapements

Updated estimates for small, large and 2SW salmon spawners (1971 to 2016) were derived for the six geographic regions (Tables 4.3.3.1 to 4.3.3.3). A comparison between the numbers of returns and spawners for small and large salmon is presented in Figures 4.3.2.2 and 4.3.2.3. A comparison between the numbers of 2SW returns, spawners, CLs, and management objectives (Scotia-Fundy and USA) is presented in Figure 4.3.2.4.

Small salmon spawners

- The total estimate of small salmon spawners in 2016 for North America (389 350) was 33% lower than 2015, and the 2016 estimate ranks 17th (descending) out of the 47 year time-series;
- Estimates of small salmon spawners decreased in five (Labrador, Newfoundland, Quebec, Gulf, Scotia-Fundy) of the six geographical regions in 2016, and increased in the USA;
- Small salmon spawners in 2016 were the fourth lowest on record for Scotia-Fundy (2417), and the 10th lowest on record for Gulf (24 670), whereas the small salmon spawner estimate for Labrador (204 200) in 2016 was the sixth highest on record;
- Small salmon spawners for Labrador (204 200) and Newfoundland (132 300) regions combined represented 86% of the total small salmon spawners estimated for North America in 2016.

Large salmon spawners

- The total estimate of large salmon spawners in North America for 2016 (166 600) decreased by 13% from 2015 (190 400), and the 2016 estimate ranks fourth (descending) out of the 47 year time-series.
- Estimates of large salmon spawners decreased in three (Labrador, Newfoundland, and USA) of the six geographical regions in 2016, and increased in Quebec, Gulf, and Scotia-Fundy.
- Large salmon spawners in 2016 were fifth lowest on record for USA (881), and the sixth lowest on record for Scotia-Fundy (1526), whereas the large salmon spawner estimate for Labrador (71 450) was the second highest on record.
- Large salmon spawners for Labrador (71 450), Quebec (33 980), and Gulf (34 810) regions combined represent 84% of the total large salmon spawners in North America in 2016.

2SW salmon spawners

- The total estimate of 2SW salmon spawners in North America for 2016 (102 600) decreased by 7% from 2015 (110 600), and was lower than the combined 2SW CL for NAC (152 548). The 2016 estimate of 2SW salmon spawners ranks eighth (descending) out of the 47 year time-series;

- Estimates of 2SW salmon spawners in 2016 decreased in three (Labrador, Newfoundland, and USA) of the six geographical regions, and increased in Quebec, Gulf and Scotia-Fundy;
- Estimates of 2SW salmon spawners in 2016 were the fifth lowest on record for USA (878), and the sixth lowest on record for Scotia-Fundy (1478), whereas the 2SW salmon spawner estimate for Labrador (46 375) was the second highest on record;
- Estimates (median) of 2SW salmon spawners exceeded region specific 2SW CLs for one (Labrador) of the six geographical regions in 2016. 2SW CLs were not met for Newfoundland, Quebec, Gulf, Scotia-Fundy, or the USA with spawners relative to CLs ranging from 3% for USA to 84% for each of Newfoundland, Quebec, and Gulf regions in 2016;
- Labrador has met or exceeded the regional 2SW CL five times during the 47 year time-series and these all occurred in the last six years. The 2SW CL for Newfoundland has been met or exceeded in five of the last ten years, the 2SW CL for Gulf has been met or exceeded in one of the last ten years, and 2SW CLs have not been met for Quebec, Scotia-Fundy or USA in any of the last ten years;
- The 2SW management objectives for Scotia-Fundy (10 976) and USA (4549) were not met in 2016 and have not been met since 1991 (Scotia-Fundy), and 1990 (USA). For USA, 2SW returns are assessed relative to the management objective as adult stocking programs for restoration efforts contribute to the number of spawners.

4.3.4 Egg depositions in 2016

Egg depositions by all sea ages combined in 2016 exceeded or equalled the river-specific CLs in 41 of the 70 assessed rivers (59%) and were less than 50% of CLs in 21 rivers (30%) (Figure 4.3.4.1). The number of rivers assessed annually varies due to operational considerations and environmental conditions.

- CLs were exceeded in one of four (25%) assessed rivers in Labrador, seven of 12 rivers (58%) in Newfoundland, 30 of 33 rivers (91%) in Québec, and three of six rivers (50%) in Gulf;
- None of the seven assessed rivers in Scotia-Fundy met CLs and, with the exception for North River, all were below 50% of CLs. Large deficiencies in egg depositions were noted in the Southern Upland (SFA 21) and Outer Bay of Fundy (SFA 23) regions of Scotia-Fundy where assessed rivers were less than 8% of CLs. With the exception of three rivers in SFA 19 where catch and release fishing only was permitted, salmon fisheries were closed on all other rivers within Scotia-Fundy;
- Large deficiencies in egg depositions were noted in the USA. All eight assessed rivers were below 7% of their CLs. All anadromous Atlantic salmon fisheries in the USA region are closed.

The time-series of attained CLs for assessed rivers is presented in Table 4.3.4.1 and Figure 4.3.4.2. The time-series includes all assessed small rivers on Prince Edward Island (SFA 17) individually (DFO, 2017) and an additional eight partially assessed rivers in the USA.

- In Canada, CLs were first established in 1991 for 74 rivers. Since then the number of rivers with defined CLs increased to 266 in 1997 to 476 since

2014. The number of rivers assessed annually has ranged from 61 to 91 and the annual percentages of these rivers achieving CL has ranged from 26% to 67% (66% in 2016) with no temporal trend;

- Conservation limits have been established for 33 river stocks in the USA since 1995. Sixteen of these are assessed against CL attainment annually with none meeting CLs to date.

4.3.5 Marine survival (return rates)

In 2016, return rate estimates were available from seven wild and two hatchery populations from rivers distributed among Newfoundland, Québec, Scotia-Fundy, and USA (Tables 4.3.5.1 to 4.3.5.4). Return rates for wild small salmon declined for monitored rivers in Quebec ($p < 0.05$) over the time period, whereas there was no statistically significant trend for populations in Newfoundland and Scotia-Fundy (Figure 4.3.5.1). Although significant declines were not evident in the analysis for Scotia-Fundy, small salmon return rates have been below long-term averages in recent years. Overall regional return rates have improved since the low value from 2012. Although the analysis does not show a statistically significant decline for Scotia-Fundy, the wild 2SW return rates have been lower since 2010 compared to previous years (Figure 4.3.5.1). Quebec also did not show a statistically significant decline for 2SW and was around the long-term average and up from the low 2012 value (Figure 4.3.5.1).

In 2016, the return rate of small salmon of hatchery origin to the Penobscot River (USA) increased compared to 2015 and was above the average of 1991 to present. The return rate to the Saint John River (Scotia-Fundy, SFA 23)) decreased from 2015 and was the second lowest value of the time-series (Table 4.3.5.3; Figure 4.3.5.2). Hatchery origin 2SW return rates in 2016 increased from 2015 for the Saint John (Scotia-Fundy) but were still below the long-term average (Table 4.3.5.4; Figure 4.3.5.2). On the Penobscot, the hatchery origin 2SW return rate was the second lowest value in the time-series (USA) (Table 4.3.5.4; Figure 4.3.5.2).

Regional least squared (or marginal mean) average annual return rates were calculated to balance for variation in the annual number of contributing experimental groups through application of a GLM (generalised linear model) with survival related to smolt year and river with a quasi-Poisson distribution (log-link function) (Figures 4.3.5.1 and 4.3.5.2).

Analyses of time-series of regional return rates of wild smolts to small salmon and 2SW adults by area for the period of 1970–2016 (Tables 4.3.5.1 to 4.3.5.4; Figures 4.3.5.1 and 4.3.5.2) indicate the following:

- Return rates of wild populations exceed those of hatchery populations;
- Small salmon return rates to rivers in Newfoundland vary annually and without trend over the period 1970 to 2015;
- Small salmon return rates for Newfoundland populations in 2016 were greater than those for other populations in eastern North America;
- Small salmon and 2SW return rates of wild smolts to Quebec vary annually and have declined over the period 1983/1984 to 2015/2016;
- Small salmon and 2SW return rates of wild smolts to the Scotia-Fundy vary annually and without a statistically significant trend over the period mid-1990s to 2016;

- In Scotia-Fundy and USA, hatchery smolt return rates to 2SW salmon have decreased over the period 1970 to 2016. 1SW return rates for Scotia-Fundy hatchery stocks have also declined for the period, while they have been stable for USA.

4.3.6 Pre-fisheries abundance

4.3.6.1 North American run-reconstruction model

The run-reconstruction model developed by Rago *et al*. (1993) and described in previous Working Group reports (ICES, 2008; 2009) and in the primary literature (Chaput *et al*., 2005) was used to estimate returns and spawners by size (small salmon, large salmon) and sea age group (2SW salmon) to the six geographic regions of NAC. The input data were similar in structure to the data used previously by the Working Group (ICES, 2012; Stock Annex). Estimates of returns and spawners to regions were provided for the time-series to 2016. The full set of data inputs is included in the Stock Annex (Annex 6) and the summary output tables of returns and spawners by sea age or size group are provided in Tables 4.3.2.1–4.3.2.3 and 4.3.3.1–4.3.3.2.

4.3.6.2 Non-maturing 1SW salmon

The non-maturing component of 1SW salmon, destined to be 2SW returns (excluding 3SW and previous spawners) is represented by the pre-fishery abundance estimator for year i designated as PFANAC1SW. This annual pre-fishery abundance is the estimated number of salmon in the North Atlantic on August 1st of the second summer at-sea. As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate of PFA is available is 2015. This is because pre-fishery abundance estimates for 2016 require 2SW returns to rivers in North America in 2017.

The PFA estimates accounting for returns to rivers, fisheries at sea in North America, fisheries at West Greenland, and corrected for natural mortality are shown in Figure 4.3.6.1 and Table 4.3.6.1. The median of the estimates of non-maturing 1SW salmon in 2015 was 172 600 salmon (90% C.I. range 139 700 to 209 305). This value is 6% lower than the previous year (183 300) and 8% higher than the previous five year average (159 280). The estimated non-maturing 1SW salmon in 2015 ranks 27th (descending) out of the 45 year time-series.

4.3.6.3 Maturing 1SW salmon

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

The reconstructed distribution of the PFA of the 1SW maturing cohort of North American origin is shown in Figure 4.3.6.1 and Table 4.3.6.1. The estimated PFA of the maturing component in 2016 was 454 100 fish, 31% lower than the previous year and 17% lower than the previous five year mean (545 040). Maximum abundance of the maturing cohort was estimated at over 911 000 fish in 1981 and the recent estimate ranks 33rd (descending) out of the 46 year time-series.

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

The pre-fishery abundance of 1SW maturing salmon and 1SW non-maturing salmon from North America from 1971–2015 (2016 PFA requires 2SW returns in 2017) were summed to give total recruits of 1SW salmon (Figure 4.3.6.1; Table 4.3.6.1). The PFA of the 1SW cohort, estimated for 2015, was 827 700 fish, 20% higher than the 2014 PFA estimate (688 000), and 22% higher than the previous five year mean (680 470). The 2015 PFA estimate ranks 20th (descending) out of the 45 year time-series. The abundance of the 1SW cohort has declined by 51% over the time-series from a peak of 1 705 000 fish in 1975.

4.3.7 Summary on status of stocks

In 2016, the midpoints of the estimates of returns to rivers and of spawners were below the CLs for 2SW salmon for all regions of NAC except Labrador, and are therefore suffering reduced reproductive capacity. The medians of the 2SW returns and spawners for Labrador exceeded the CL, but the 5th percentiles were below the CL and for this region the stock is at risk of suffering reduced reproductive capacity (Figure 4.3.2.4 and 4.3.7.1).

The proportion of the 2SW CL attained from 2SW spawners was 84% for each of Newfoundland, Quebec, and Gulf. For 2SW salmon returns to rivers, prior to in-river exploitation, the percentages of CL attained were 88% for Newfoundland, 99% for Quebec, and 86% for Gulf. For the two southern areas of NAC, Scotia-Fundy and USA, the 2SW returns in 2016 were 6% and 1%, respectively of the 2SW CLs. Salmon abundance to these southern areas represents 13% and 9% of the management objectives for the Scotia-Fundy (10 976) and USA (4549), respectively. For USA, 2SW returns are assessed relative to the management objective as adult stocking programmes for restoration efforts contribute to the number of spawners.

The rank of the estimated returns in the 1971 to 2016 time-series and the proportions of the 2SW CLs achieved in 2016 for six regions in North America are shown below:

Region	Rank of 2016 returns in 1971 to 2016, (46=LOWEST)		Rank of 2016 returns in 2007 to 2016 (10=LOWEST)		Median estimate of 2016 2SW spawners as percentage of Conservation Limit (% of management objective)
	1SW	2SW	1SW	2SW	(%)
Labrador	6	2	4	2	133
Newfoundland	29	30	10	8	84
Québec	17	30	4	2	84
Gulf	42	29	6	2	84
Scotia-Fundy	43	41	7	6	6 (13)
USA	33	45	6	9	1 (9)

Estimates of PFA indicate continued low abundance of North American adult salmon, although the total 1SW recruit estimate (maturing and non-maturing) for 2015 was the highest value since 1992. The total population of 1SW and 2SW Atlantic salmon in the Northwest Atlantic has oscillated around a generally declining trend since the 1970s with a period of persistent low abundance since the early 1990s. During 1993 to 2015, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1971 to 1992. The maturing 1SW salmon in 2016 decreased by 31% relative to 2015 and was the 14th lowest estimate on record. Overall, 86% of 1SW salmon returns to NAC in 2016 (Figure 4.3.6.1) were from two (Labrador and Newfoundland) regions. The non-maturing 1SW PFA for 2015 decreased by 6% from 2014, and ranked 20th (descending) out of the 46 year time-series. Overall, 95% of 2SW salmon returns to NAC were from three regions in 2016 (Labrador, Quebec and Gulf).

The estimates of 1SW salmon returns in 2016 decreased from 2015 in all regions (range 12% to 42%) with the exception of USA, which increased by 55%. 1SW salmon returns in 2016 were among the lowest returns on record for Scotia-Fundy (fourth lowest on record), and Gulf (fifth lowest on record), whereas, the 1SW salmon returns to Labrador in 2016 were lower than in 2015 but among the highest on record (sixth highest on record). Returns of 1SW salmon have generally increased over the time-series for the NAC, mainly as a result of the commercial fishery closures in Canada and increased returns over time to Labrador and Newfoundland. Important variations in annual abundances continue to be observed, such as the low returns of 2009, 2013 and 2016, and the high returns of 2011 and 2015 (Figure 4.3.2.2).

The abundances of large salmon (multi-sea winter salmon including maiden and repeat spawners) returns in 2016 increased from 2015 in three regions (Quebec, Gulf, and Scotia-Fundy; range 6% to 109%); whereas, the returns of large salmon decreased in the other three regions (Labrador, Newfoundland, and USA; range 19% to 49%). The returns of 2SW salmon in 2016 also increased in the same three regions as large salmon (range 8% to 119%), and decreased in the same three regions as large salmon returns (range 19% to 49%). Although the returns of 2SW to Labrador declined from 2015, they were the second highest returns in the time-series for that region, whereas the returns of 2SW salmon to Scotia-Fundy and USA were among the lowest in the time-series for those regions (second lowest on record for USA, and sixth lowest on record for Scotia-Fundy).

Egg depositions by all sea ages combined in 2016 exceeded or equalled the river-specific CLs in 41 of the 70 assessed rivers (59%) and were less than 50% of CLs in 21 rivers (30%) (Figure 4.3.4.1). Large deficiencies in egg depositions (<8% CLs) were noted in the Scotia-Fundy and USA areas.

Despite major changes in fisheries, returns to the southern regions of NAC (Scotia-Fundy and USA) remain near historical lows and many populations are currently at risk of extirpation. All salmon stocks within the USA and the Scotia-Fundy regions have been or are being considered for listing under country specific species at risk legislation. Recovery Potential Assessments for the three Designatable Units of salmon in Scotia-Fundy as well as for one Designatable Unit in Quebec and one in Newfoundland occurred in 2012 and 2013 to inform the requirements under the Species at Risk Act listing process in Canada (ICES, 2014).

Regional return estimates in 2016 are reflected in the overall 2016 return estimates for NAC, as Labrador and Newfoundland collectively comprise 86% of the small salmon returns, and Labrador, Québec, and Gulf collectively comprise 85% of the large salmon returns and 95% of the 2SW salmon returns to NAC.

Over all populations in eastern North America, the estimated PFA of 1SW non-maturing salmon ranked 27th (descending) of the 45-year time-series and the estimated PFA of 1SW maturing salmon ranked 33rd (descending) of the 46-year time-series. The continued low abundance of salmon stocks across North America, despite significant fishery reductions, strengthens the conclusions that factors acting on survival in the first and second years at-sea, at both local and broad ocean scales are constraining abundance of Atlantic salmon.

4.4 Tables

Table 4.1.2.1. The number of professional and recreational gillnet licences issued at Saint Pierre & Miquelon and reported landings for the period 1990 to 2016. The data for 2016 are provisional.

Year	Number of licences		Reported Landings (t)		
	Professional	Recreational	Professional	Recreational	Total
1990			1.146	0.734	1.880
1991			0.632	0.530	1.162
1992			1.295	1.024	2.319
1993			1.902	1.041	2.943
1994			2.633	0.790	3.423
1995	12	42	0.392	0.445	0.837
1996	12	42	0.951	0.617	1.568
1997	6	36	0.762	0.729	1.491
1998	9	42	1.039	1.268	2.307
1999	7	40	1.182	1.140	2.322
2000	8	35	1.134	1.133	2.267
2001	10	42	1.544	0.611	2.155
2002	12	42	1.223	0.729	1.952
2003	12	42	1.620	1.272	2.892
2004	13	42	1.499	1.285	2.784
2005	14	52	2.243	1.044	3.287
2006	13	52	1.730	1.825	3.555
2007	13	53	0.970	1.062	2.032
2008	9	55	1.60	1.85	3.45
2009	8	50	1.87	1.60	3.46
2010	9	57	1.00	1.78	2.78
2011	9	58	1.76	1.99	3.76
2012	9	60	0.28	1.17	1.45
2013	9	64	2.29	3.01	5.30
2014	12	70	2.25	1.56	3.81
2015	8	70	1.21	2.30	3.51
2016	8	70	0.98	3.75	4.73

Table 4.1.3.1. Harvests (by weight), and the percent large by weight and by number in the Aboriginal Peoples' Food, Social, and Ceremonial (FSC) fisheries in Canada, 1990 to 2016. The data for 2016 are provisional.

Aboriginal Peoples' FSC fisheries			
Year	Harvest (t)	% large	
		by weight	by number
1990	31.9	78	
1991	29.1	87	
1992	34.2	83	
1993	42.6	83	
1994	41.7	83	58
1995	32.8	82	56
1996	47.9	87	65
1997	39.4	91	74
1998	47.9	83	63
1999	45.9	73	49
2000	45.7	68	41
2001	42.1	72	47
2002	46.3	68	43
2003	44.3	72	49
2004	60.8	66	44
2005	56.7	57	34
2006	61.4	61	39
2007	48.0	62	40
2008	62.5	66	43
2009	51.2	65	45
2010	59.1	59	38
2011	70.4	63	41
2012	59.6	62	40
2013	64.0	71	51
2014	52.9	61	41
2015	62.9	67	46
2016	63.9	72	50

Table 4.1.3.2. Harvests (by weight), and the percent large by weight and number in the Resident Food Fishery in Labrador, Canada, for the period 2000 to 2016. The data for 2016 are provisional.

Labrador resident food fishery			
Year	Harvest (t)	% Large	
		by weight	by number
2000	3.5	30	18
2001	4.6	33	23
2002	6.2	27	15
2003	6.7	32	21
2004	2.2	40	26
2005	2.7	32	20
2006	2.6	39	27
2007	1.7	23	13
2008	2.3	46	25
2009	2.9	42	28
2010	2.3	37	25
2011	2.1	51	37
2012	1.7	49	32
2013	2.1	65	51
2014	1.6	46	31
2015	2.0	54	38
2016	1.6	57	39

Table 4.1.3.3. Harvests of small and large salmon by number, and the percent large by number, in the recreational fisheries of Canada for the period 1974 to 2016. The data for 2016 are provisional.

Year	Small	Large	Both Size Groups	% Large
1974	53 887	31 720	85 607	37
1975	50 463	22 714	73 177	31
1976	66 478	27 686	94 164	29
1977	61 727	45 495	107 222	42
1978	45 240	28 138	73 378	38
1979	60 105	13 826	73 931	19
1980	67 314	36 943	104 257	35
1981	84 177	24 204	108 381	22
1982	72 893	24 640	97 533	25
1983	53 385	15 950	69 335	23
1984	66 676	9 982	76 658	13
1985	72 389	10 084	82 473	12
1986	94 046	11 797	105 843	11
1987	66 475	10 069	76 544	13
1988	91 897	13 295	105 192	13
1989	65 466	11 196	76 662	15
1990	74 541	12 788	87 329	15
1991	46 410	11 219	57 629	19
1992	77 577	12 826	90 403	14
1993	68 282	9 919	78 201	13
1994	60 118	11 198	71 316	16
1995	46 273	8 295	54 568	15
1996	66 104	9 513	75 617	13
1997	42 891	6 756	49 647	14
1998	45 810	4 717	50 527	9
1999	43 667	4 811	48 478	10
2000	45 811	4 627	50 438	9
2001	43 353	5 571	48 924	11
2002	43 904	2 627	46 531	6
2003	38 367	4 694	43 061	11
2004	43 124	4 578	47 702	10
2005	33 922	4 132	38 054	11
2006	33 668	3 014	36 682	8
2007	26 279	3 499	29 778	12
2008	46 458	2 839	49 297	6
2009	32 944	3 373	36 317	9
2010	45 407	3 209	48 616	7
2011	49 931	4 141	54 072	8
2012	30 453	2 680	33 133	8
2013	31 404	3 472	34 876	10
2014	33 339	1 343	34 682	4
2015	37 642	1 971	39 613	5
2016	36 355	1 823	38 178	5

Table 4.1.3.4. Numbers of salmon caught and released in Eastern Canadian salmon angling fisheries, for the period 1984 to 2016. Blank cells indicate no data. Released fish in the kelt fishery of New Brunswick are not included in the totals for New Brunswick nor Canada. Totals for all years prior to 1997 are incomplete and are considered minimal estimates. Estimates for 2016 are preliminary; both preliminary and final figures are shown for 2015.

	Newfoundland & Labrador			Nova Scotia			New Brunswick			Prince Edward Island			Quebec			CANADA		
YEAR	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL
1984				939	1,655	2,594	851	14,479	15,330							1,790	16,134	17,924
1985		315	315	1,323	6,346	7,669	3,963	17,815	21,778			67				5,286	24,476	29,762
1986		798	798	1,463	10,750	12,213	9,333	25,316	34,649							10,796	36,864	47,660
1987		410	410	1,311	6,339	7,650	10,597	20,295	30,892							11,908	27,044	38,952
1988		600	600	1,146	6,795	7,941	10,503	19,442	29,945	767	256	1,023				12,416	27,093	39,509
1989		183	183	1,562	6,960	8,522	8,518	22,127	30,645							10,080	29,270	39,350
1990		503	503	1,782	5,504	7,286	7,346	16,231	23,577			1,066				9,128	22,238	31,366
1991		336	336	908	5,482	6,390	3,501	10,650	14,151	1,103	187	1,290				5,512	16,655	22,167
1992	5,893	1,423	7,316	737	5,093	5,830	8,349	16,308	24,657			1,250				14,979	22,824	37,803
1993	18,196	1,731	19,927	1,076	3,998	5,074	7,276	12,526	19,802							26,548	18,255	44,803
1994	24,442	5,032	29,474	796	2,894	3,690	7,443	11,556	18,999	577	147	724				33,258	19,629	52,887
1995	26,273	5,166	31,439	979	2,861	3,840	4,260	5,220	9,480	209	139	348		922	922	31,721	14,308	46,029
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	4,870	8,874	13,744	210	118	328	182	1,643	1,825	31,291	18,718	50,009
1998	31,368	4,375	35,743	688	2,476	3,164	5,760	8,298	14,058	233	114	347	297	2,680	2,977	38,346	17,943	56,289
1999	24,567	4,153	28,720	562	2,186	2,748	5,631	8,281	13,912	192	157	349	298	2,693	2,991	31,250	17,470	48,720
2000	29,705	6,479	36,184	407	1,303	1,710	6,689	8,690	15,379	101	46	147	445	4,008	4,453	37,347	20,526	64,482
2001	22,348	5,184	27,532	527	1,199	1,726	6,166	11,252	17,418	202	103	305	809	4,674	5,483	30,052	22,412	59,387
2002	23,071	3,992	27,063	829	1,100	1,929	7,351	5,349	12,700	207	31	238	852	4,918	5,770	32,310	15,390	50,924
2003	21,379	4,965	26,344	626	2,106	2,732	5,375	7,981	13,356	240	123	363	1,238	7,015	8,253	28,858	22,190	53,645
2004	23,430	5,168	28,598	828	2,339	3,167	7,517	8,100	15,617	135	68	203	1,291	7,455	8,746	33,201	23,130	62,316
2005	33,129	6,598	39,727	933	2,617	3,550	2,695	5,584	8,279	83	83	166	1,116	6,445	7,561	37,956	21,327	63,005
2006	30,491	5,694	36,185	1,014	2,408	3,422	4,186	5,538	9,724	128	42	170	1,091	6,185	7,276	36,910	19,867	60,486
2007	17,719	4,607	22,326	896	1,520	2,416	2,963	7,040	10,003	63	41	104	951	5,392	6,343	22,592	18,600	41,192
2008	25,226	5,007	30,233	1,016	2,061	3,077	6,361	6,130	12,491	3	9	12	1,361	7,713	9,074	33,967	20,920	54,887

	Newfoundland & Labrador			Nova Scotia			New Brunswick			Prince Edward Island			Quebec			CANADA		
YEAR	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL
2009	26,681	4,272	30,953	670	2,665	3,335	2,387	8,174	10,561	6	25	31	1,091	6,180	7,271	30,835	21,316	52,151
2010	27,256	5,458	32,714	717	1,966	2,683	5,730	5,660	11,390	42	27	69	1,356	7,683	9,039	35,101	20,794	55,895
2011	26,240	8,119	34,359	1,157	4,320	5,477	6,537	12,466	19,003	46	46	92	3,100	9,327	12,427	37,080	34,278	71,358
2012	20,940	4,089	25,029	339	1,693	2,032	2,504	5,330	7,834	46	46	92	2,126	6,174	8,300	25,955	17,332	43,287
2013	19,962	6,770	26,732	480	2,657	3,137	2,646	8,049	10,695	12	23	35	2,238	7,793	10,031	25,338	25,292	50,630
2014	20,553	4,410	24,963	185	1,127	1,312	2,806	5,884	8,690	68	68	136	1,580	4,932	6,512	25,192	16,421	41,613
2015 (prelim)	24,637	5,580	30,217	653	1,656	2,309	11,478	7,443	18,921	68	68	136	3,066	9,510	12,576	39,902	24,257	64,159
2015(final)	24,861	6,943	31,804	548	1,260	1,808	11,552	7,489	19,041	68	68	136	3,078	9,573	12,651	40,107	25,333	65,440
2016(prelim)	26,954	10,348	37,302	318	1,655	1,973	7,130	7,958	15,088	68	68	136	3,852	11,239	15,091	38,322	31,268	69,590

Table 4.1.4.1. Reported harvests and losses expressed as 2SW salmon equivalents in North American salmon fisheries for the period 1972 to 2016. Only midpoints of the Monte Carlo simulated values are shown.

Year (i)	Mixed-stocks					Canada – losses from all sources (terminal fisheries, catch and release mortality, bycatch mortality) in year i						USA	North American Total	Terminal losses as % of NA Total	Greenland Total	NW Atlantic Total	Harvest in home-waters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rates in North America
	NF-LAB Comm / Food 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-LAB Comm / Food 2SW (Year i) (a)	NF-Lab Comm / Food total (Year i)	Saint-Pierre and Miquelon (Year i)	Labrador	Newfoundland	Quebec	Gulf	Scotia - Fundy	Total								
1972	20136	0.12	153622	173757	0	420	606	27390	20300	5620	54336	345	228438	24	197201	425638	54	302600	0.75
1973	17441	0.07	218933	236373	0	1005	756	32930	15520	6213	56424	327	293124	19	148098	441222	66	377150	0.78
1974	23738	0.09	235721	259459	0	800	502	47580	18440	13030	80352	247	340058	24	185842	525900	65	449600	0.76
1975	23467	0.09	237371	260838	0	330	491	41065	14310	12550	68746	389	329973	21	154712	484685	68	416200	0.79
1976	35031	0.12	256392	291423	323	830	391	42340	16180	11130	70871	191	362808	20	194253	557061	65	431400	0.84
1977	26757	0.10	240962	267719	0	1285	773	41795	29430	13430	86713	1355	355787	25	112799	468586	76	472900	0.75
1978	26998	0.15	157115	184113	0	760	536	37410	20260	9377	68343	894	253350	27	143066	396416	64	317300	0.80
1979	13514	0.13	91979	105493	0	609	128	25260	6275	3814	36086	433	142011	26	103884	245896	58	172100	0.83
1980	20596	0.09	216992	237588	0	890	659	53665	25370	17360	97944	1534	337065	30	141844	478909	70	451900	0.75
1981	33724	0.14	201173	234898	0	520	454	44190	14623	12900	72687	1267	308851	24	120995	429846	72	365300	0.85
1982	33582	0.20	134310	167892	0	620	387	35130	20530	8953	65620	1413	234925	29	161255	396179	59	291100	0.81
1983	25234	0.18	111504	136738	323	428	428	34420	17390	12296	64962	386	202409	32	145870	348279	58	237100	0.85
1984	19046	0.19	82721	101766	323	510	180	19400	3385	3940	27415	675	130180	22	26845	157024	83	199200	0.65
1985	14337	0.15	78693	93030	323	294	27	22230	1240	5010	28801	645	122799	24	32445	155244	79	212200	0.58
1986	19570	0.16	104808	124378	269	467	42	27240	1635	3020	32404	606	157657	21	99211	256869	61	266300	0.59
1987	24784	0.16	132078	156861	215	635	19	27290	2005	1400	31349	300	188726	17	123511	312237	60	260300	0.73
1988	31564	0.28	81052	112616	215	710	21	27560	1140	1470	30901	248	143980	22	123942	267923	54	215100	0.67
1989	21886	0.21	81275	103161	215	461	15	23810	1200	330	25816	396	129588	20	84761	214349	60	195800	0.66
1990	19279	0.25	57305	76584	205	357	11	22990	925	650	24933	695	102417	25	43660	146077	70	176000	0.58
1991	11835	0.23	40400	52235	129	93	11	23530	535	1360	25529	231	78124	33	52215	130339	60	148300	0.53
1992	9838	0.28	25076	34914	247	782	80	24320	1120	1160	27462	167	62790	44	79657	142447	44	146100	0.43
1993	3112	0.19	13256	16369	312	387	47	18610	850	1182	21076	166	37923	56	29843	67766	56	121800	0.31
1994	2077	0.15	11927	14003	366	490	145	19330	550	787	21302	2	35673	60	1880	37553	95	107000	0.33
1995	1183	0.12	8666	9850	86	460	146	17950	520	355	19431	0	29367	66	1881	31248	94	134000	0.22
1996	1035	0.16	5639	6673	172	385	178	17190	860	805	19418	0	26263	74	19167	45429	58	114600	0.23
1997	943	0.15	5384	6327	161	210	167	14130	905	612	16024	0	22512	71	19346	41858	54	93920	0.24
1998	1130	0.39	1759	2889	247	208	128	7940	500	330	9105	0	12242	74	13041	25283	48	64550	0.19
1999	174	0.17	841	1015	250	270	77	6600	750	456	8153	0	9418	87	4326	13744	69	68520	0.14
2000	150	0.12	1048	1198	244	265	157	6340	570	197	7529	0	8970	84	6439	15409	58	70060	0.13
2001	283	0.18	1334	1618	232	310	62	7070	990	272	8704	0	10554	82	5930	16483	64	81210	0.13
2002	260	0.19	1077	1337	211	200	47	4250	530	183	5210	0	6758	77	8606	15363	44	51530	0.13

Year (i)	Mixed-stocks					Canada – losses from all sources (terminal fisheries, catch and release mortality, bycatch mortality) in year i						USA	North American Total	Terminal losses as % of NA Total	Greenland Total	NW Atlantic Total	Harvest in home-waters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rates in North America
	NF-Lab Comm / Food 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-Lab Comm / Food 2SW (Year i) (a)	NF-Lab Comm / Food total (Year i)	Saint-Pierre and Miquelon (Year i)	Labrador	Newfoundland	Quebec	Gulf	Scotia - Fundy	Total								
2003	308	0.15	1687	1995	312	232	76	6060	780	209	7356	0	9662	76	3224	12886	75	78560	0.12
2004	350	0.11	2866	3215	300	270	112	5940	800	122	7244	0	10759	67	3475	14234	76	76150	0.14
2005	462	0.17	2184	2646	354	270	139	5350	1010	108	6877	0	9877	70	4338	14215	69	77995	0.13
2006	557	0.19	2396	2953	382	220	85	4880	820	153	6158	0	9493	65	4181	13675	69	74330	0.13
2007	557	0.21	2056	2613	210	230	47	4730	860	109	5976	0	8798	68	4935	13733	64	69860	0.13
2008	493	0.14	3031	3524	381	235	119	4550	880	98	5882	0	9787	60	6616	16403	60	76700	0.13
2009	537	0.17	2593	3130	373	220	34	4660	850	119	5883	0	9386	63	7549	16935	55	90385	0.10
2010	438	0.13	2888	3326	299	190	111	4230	810	134	5475	0	9100	60	6670	15770	58	73440	0.12
2011	537	0.13	3451	3988	405	145	4	5750	1565	86	7550	0	11943	63	8764	20706	58	145600	0.08
2012	609	0.16	3278	3887	156	70	9	4450	740	52	5321	0	9364	57	6871	16235	58	76480	0.12
2013	548	0.10	5024	5572	571	160	57	4890	1085	29	6221	0	12363	50	7080	19443	64	113100	0.11
2014	429	0.12	3097	3525	361	110	39	3480	380	14	4023	0	7910	51	9598	17507	45	83930	0.09
2015	494	0.09	4766	5260	485	90	99	4100	495	12	4796	0	10541	45	11417	21957	48	123500	0.09
2016	514	0.11	4341	4855	346	175	142	4320	480	16	5133	0	10334	50	11718	22052	47	115500	0.09

Variations in numbers from previous assessments are due to updates to data inputs and to stochastic variation from Monte Carlo simulation.

NF-Lab Comm / Food 1SW (Year i-1) = Catch of 1SW non-maturing * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries).

NF-Lab Comm / Food 2SW (Year i) = catch of 2SW salmon * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal fisheries).

Canada - Losses from all sources = 2SW returns - 2SW spawners (includes losses from harvests, from catch and release mortality, and other in-river losses such as bycatch mortality but excludes the fisheries at St-Pierre and Miquelon and NF-Lab Comm / Food fisheries).

a - starting in 1998, there was no commercial fishery in Labrador; numbers reflect harvests of the aboriginal and residential subsistence fisheries.

Greenland total catch = estimated catch of 1SW non-maturing salmon of North American origin at Greenland discounted for 11 months of mortality at sea as returning 2SW salmon to eastern North America (* 0.719; M of 0.03 per month for 11 months).

Table 4.1.5.1. Estimated percent contributions (mean and standard error) by regional group of North American origin salmon in the Labrador FSC fisheries, 2015 and 2016. Regional groups are shown in Figure 4.1.5.1. Note: values in shaded cells are not significantly different from 0.

Regional Groups	Salmon All size groups Mean (S.E.)		Small Salmon < 63 cm Mean (S.E.)		Large Salmon ≥ 63 cm Mean (S.E.)		Northern Labrador SFA 1A Mean (S.E.)		Lake Melville SFA 1B Mean (S.E.)		Southern Labrador SFA 2 Mean (S.E.)	
Year	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
ANT	0.03 (0.06)	0.03 (0.06)	0.07 (0.15)	0.05 (0.11)	0.06 (0.16)	0.08 (0.23)	0.07 (0.19)	0.08 (0.20)	0.05 (0.12)	0.06 (0.15)	0.05 (0.12)	0.07 (0.18)
AVA	0.03 (0.07)	0.03 (0.06)	0.06 (0.15)	0.04 (0.07)	0.05 (0.14)	0.10 (0.27)	0.08 (0.23)	0.07 (0.16)	0.05 (0.13)	0.06 (0.18)	0.06 (0.18)	0.07 (0.19)
FUN	0.03 (0.07)	0.03 (0.07)	0.05 (0.11)	0.04 (0.10)	0.06 (0.18)	0.07 (0.20)	0.08 (0.20)	0.08 (0.21)	0.05 (0.14)	0.05 (0.14)	0.07 (0.17)	0.06 (0.17)
GAS	0.05 (0.13)	0.03 (0.08)	0.27 (0.58)	0.04 (0.11)	0.08 (0.23)	0.10 (0.28)	0.17 (0.43)	0.10 (0.30)	0.06 (0.15)	0.06 (0.15)	0.17 (0.44)	0.09 (0.25)
GUL	0.04 (0.10)	0.04 (0.07)	0.34 (0.59)	0.04 (0.10)	0.10 (0.26)	0.11 (0.31)	0.15 (0.38)	0.10 (0.27)	0.06 (0.16)	0.05 (0.14)	0.11 (0.29)	0.07 (0.19)
LAB	98.54 (0.68)	99.26 (0.55)	91.05 (2.92)	99.02 (0.66)	96.09 (2.38)	92.24 (2.74)	94.20 (2.67)	97.19 (1.64)	98.84 (1.10)	99.28 (0.63)	95.98 (2.35)	97.84 (1.29)
NFL	0.03 (0.07)	0.05 (0.12)	0.46 (0.82)	0.12 (0.30)	0.07 (0.19)	0.25 (0.65)	0.14 (0.39)	0.31 (0.69)	0.07 (0.17)	0.07 (0.17)	0.09 (0.27)	0.16 (0.43)
NOS	0.03 (0.07)	0.03 (0.06)	0.06 (0.15)	0.05 (0.12)	0.07 (0.19)	0.09 (0.29)	0.07 (0.19)	0.07 (0.19)	0.05 (0.13)	0.07 (0.19)	0.08 (0.24)	0.08 (0.21)
QLS	0.13 (0.22)	0.05 (0.11)	4.00 (2.32)	0.07 (0.18)	2.29 (2.11)	1.96 (1.88)	0.42 (0.81)	0.09 (0.26)	0.09 (0.25)	0.08 (0.26)	2.11 (2.16)	0.27 (0.68)
QUE	0.05 (0.12)	0.03 (0.07)	1.13 (1.35)	0.04 (0.10)	0.06 (0.16)	0.19 (0.54)	0.15 (0.40)	0.08 (0.26)	0.08 (0.22)	0.07 (0.21)	0.08 (0.23)	0.06 (0.18)
UNG	0.99 (0.60)	0.37 (0.47)	2.46 (1.26)	0.45 (0.47)	0.96 (1.23)	4.74 (1.87)	4.40 (2.49)	1.77 (1.30)	0.55 (0.97)	0.10 (0.25)	1.02 (0.96)	1.14 (0.81)
USA	0.03 (0.06)	0.03 (0.07)	0.07 (0.21)	0.04 (0.08)	0.1 (0.26)	0.06 (0.18)	0.07 (0.21)	0.07 (0.20)	0.06 (0.16)	0.06 (0.18)	0.17 (0.37)	0.07 (0.22)

Table 4.1.5.2. Estimated percent contributions (mean and standard error) by regional group of North American origin salmon in the 2016 Saint Pierre & Miquelon fisheries. Regional groups are shown in Figure 4.1.5.1. Note: values in shaded cells are not significantly different from 0.

Regional Groups	Salmon All size groups Mean (S.E.)	Small Salmon < 63 cm Mean (S.E.)	Large Salmon ≥ 63 cm Mean (S.E.)
ANT	0.01 (0.32)	0.11 (0.32)	0.50 (1.54)
AVA	4.99 (2.11)	3.33 (1.90)	0.56 (2.04)
FUN	0.20 (0.57)	0.38 (0.94)	0.89 (2.55)
GAS	20.92 (4.41)	20.83 (5.50)	34.10 (15.28)
GUL	22.97 (4.49)	22.75 (5.19)	23.17 (12.31)
LAB	3.03 (1.81)	0.26 (0.77)	7.43 (7.32)
NFL	42.71 (5.28)	49.20 (6.26)	23.83 (13.72)
NOS	0.19 (0.53)	0.15 (0.47)	1.43 (3.71)
QLS	0.19 (0.47)	0.16 (0.46)	0.69 (2.26)
QUE	4.54 (2.75)	2.61 (2.50)	6.15 (8.63)
UNG	0.09 (0.24)	0.14 (0.38)	0.59 (1.81)
USA	0.08 (0.22)	0.10 (0.26)	0.67 (2.23)

Table 4.3.1.1. Estimated smolt production by smolt migration year in monitored rivers of eastern North America, 1991 to 2016.

Smolt Migration Year	USA	Scotia–Fundy				Gulf				
	Narraguagus	Nashwaak	LaHave	St. Mary's (West Br.)	Middle	Margaree	Northwest Miramichi	Southwest Miramichi	Restigouche	Kedgwick
1991										
1992										
1993										
1994										
1995										
1996			20 511							
1997	2749		16 550							
1998	2845	22 750	15 600							
1999	4247	28 500	10 420				390 500			
2000	1843	15 800	16 300				162 000			
2001	2562	11 000	15 700				220 000	306 300		
2002	1774	15 000	11 860			63 200	241 000	711 400		
2003	1201	9000	17 845			83 100	286 000	48 500	379 000	91 800
2004	1284	13 600	20 613			105 800	368 000	1 167 000	449 000	131 500
2005	1287	5 200	5270	7350		94 200	151 200		630 000	67 000
2006	2339	25 400	22 971	25 100		113 700	435 000	1 330 000	500 000	129 000
2007	1177	21 550	24 430	16 110		112 400		1 344 000	1 087 000	116 600
2008	962	7 300	14 450	15 217		128 800		901 500	486 800	110 100
2009	1176	15 900	8644	14 820		96 800		1 035 000	491 000	126 800
2010	2149	12 500	16 215					2 165 000	636 600	108 600
2011	1404	8750					768 000		792 000	275 178
2012	969	11 060							842 000	155 012
2013	1237	10 120	7159		11 103				842 000	104 081
2014	1615	11 100	29 175		11 907				230 743	59 792
2015	1201	7900	6664		24 110				490 000	218 589
2016		7150	25 849		14 848					64 762

Table 4.3.1.1 (continued). Estimated smolt production by smolt migration year in monitored rivers of eastern North America, 1991 to 2016.

Smolt Migration Year	Québec		Newfoundland				
	St. Jean	De la Trinite	Conne	Rocky	NE Trepassey	Campbellton	Western Arm Brook
1991	113 927	40 863	74 645	7732	1911		13 453
1992	154 980	50 869	68 208	7813	1674		15 405
1993	142 972	86 226	55 765	5115	1849	31 577	13 435
1994	74 285	55 913	60 762	9781	944	41 663	9283
1995	60 227	71 899	62 749	7577	792	39 715	15 144
1996	104 973	61 092	94 088	14 261	1749	58 369	14 502
1997		31 892	100 983	16 900	1829	62 050	23 845
1998	95 843	28 962	69 841	12 163	1727	50 441	17 139
1999	114 255	56 557	63 658	8 625	1419	47 256	13 500
2000	50 993	39 744	60 777	7616	1740	35 596	12 706
2001	109 845	70 318	86 899	9392	916	37 170	16 013
2002	71 839	44 264	81 806	10 144	2074	32 573	14 999
2003	60 259	53 030	71 479	4440	1064	35 089	12 086
2004	54 821	27 051	79 667	13 047	1571	32 780	17 323
2005	96 002	34 867	66 196	15 847	1384	30 123	8607
2006	102 939		35 487	13 200	1385	33 302	20 826
2007	135 360	42 923	63 738	12 355	1777	35 742	16 621
2008	45 978	35 036	68 242	18 338	1868	40 390	17 444
2009	37 297	32 680	71 085	14 041	1600	36 722	18 492
2010	47 187	37 500	54 392	15 098	1012	41 069	19 044
2011	45 050	44 400	50 701	9311	800	37 033	20 544
2012	40 787	45 108	51 220	5673	1557	44 193	13 573
2013	36 849	42 378	66 261	6989	520	40 355	19 710
2014	56 456	30 741	56 224	9901		45 630	19 771
2015		47 566	32 557	6454		32 759	14 278
2016	58 307	42 269		4542		44 747	14 255

Table 4.3.2.1. Estimated small salmon returns (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC, 1970 to 2016. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of returns of small salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	49150	135600	23590	63040	26580	NA	299200
1971	64175	118700	18650	49790	18835	32	271300
1972	48390	110500	15600	62920	16940	18	255150
1973	14040	159800	20740	63080	24420	23	282200
1974	54020	120600	20960	98105	43550	55	338500
1975	103100	151400	22670	88310	33890	84	400700
1976	73465	158700	25030	128500	52860	186	440300
1977	65190	159400	22720	46320	46120	75	341200
1978	32770	139700	21160	40960	15800	155	251600
1979	42090	151800	27060	72190	48820	250	343600
1980	95950	172400	37270	63220	70630	818	441700
1981	105800	225200	52045	106300	59460	1130	552200
1982	73410	200700	29640	121400	36030	334	463500
1983	45765	157000	22450	37265	22640	295	286600
1984	24110	206400	25250	54360	42790	598	354400
1985	43490	195700	26720	86455	47470	392	401500
1986	65215	200000	38260	161700	49310	758	517100
1987	82085	135600	43860	123800	51350	1128	439200
1988	75360	217700	50450	173300	51840	992	572300
1989	52105	107600	39780	103500	54550	1258	360300
1990	30310	152400	45200	117800	55270	687	402900
1991	24240	105600	35240	86180	28205	310	280700
1992	34195	229200	39810	193600	33930	1194	533300
1993	45595	265300	34370	137000	25740	466	510500
1994	33860	160700	32850	67970	10450	436	307600
1995	47780	203900	26360	61190	20020	213	360600
1996	90055	313000	35200	57860	31750	651	531250
1997	95410	177000	26620	31290	9374	365	341500
1998	151800	183700	28280	40180	20380	403	424900
1999	147600	201200	29890	36330	10600	419	426200
2000	181000	228700	27660	51840	12370	270	502100
2001	145300	156300	18930	43220	5417	266	369500
2002	102600	155500	30230	69830	9845	450	368550
2003	85570	242500	25180	41610	5840	237	400700
2004	94680	210000	34100	77020	8396	319	424600
2005	221650	221200	22990	46830	7475	319	520000
2006	212900	213000	28120	58100	10270	450	523100
2007	195700	183700	21370	41890	7721	297	450400
2008	204300	247800	35560	62350	15360	814	566300
2009	102600	222800	20860	25590	4240	241	376300
2010	121200	267600	26520	74540	14870	525	505350
2011	247850	243400	36400	75300	9447	1080	613900
2012	172550	270400	23660	18570	608	26	486350
2013	154900	187700	19190	24480	2103	78	388100
2014	267600	169900	23840	16250	1414	110	479400
2015	256700	283500	36800	43600	4210	150	624700
2016	206300	164200	32320	25750	2451	232	430900

	5th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	34170	120500	19370	53920	22780	NA	273000
1971	44590	105300	15360	42750	16050	32	244400
1972	33860	97510	12780	53660	14070	18	231200
1973	9436	141800	17000	54130	20740	23	260900
1974	37540	106900	17180	83720	37190	55	309600
1975	71240	133300	18540	75520	30400	83	358900
1976	51220	138900	20440	110800	46580	184	401900
1977	45550	140100	18650	39890	40330	74	309800
1978	22870	122100	17380	36180	14480	154	229595
1979	29280	133095	22230	62550	42220	248	315800
1980	66320	152400	30530	54470	62740	811	400200
1981	72840	198000	42730	85260	50950	1120	498200
1982	50380	177195	24320	96389	31350	331	417695
1983	31659	137600	18440	29620	19860	292	258900
1984	16790	180000	22960	44740	36590	593	323600
1985	29810	168600	24290	68290	40140	388	362900
1986	45180	175000	35310	127200	41640	751	465400
1987	56410	118400	40120	98760	43300	1118	394900
1988	51740	190200	46380	137700	44020	983	516500
1989	35610	94880	36640	81780	46490	1247	325700
1990	20990	138300	41890	93680	46530	681	370300
1991	16630	96290	32670	68160	24540	307	257200
1992	24270	200100	36740	165400	29320	1183	488995
1993	33400	235100	31850	90200	21950	462	450395
1994	25160	138300	30480	57890	9345	432	280400
1995	35790	173100	24510	52430	17490	211	325000
1996	67790	269400	32800	48510	27440	645	478000
1997	73678	159100	24550	25370	8254	362	310300
1998	102700	171400	25800	34370	18740	399	373700
1999	100300	185300	27390	31670	9816	415	375800
2000	123700	216700	24540	45390	11340	268	442600
2001	98840	148200	17200	37830	5013	264	322100
2002	66250	143000	28020	60620	8994	446	328895
2003	51840	232800	23160	36130	5344	235	365195
2004	72430	192000	30600	66000	7637	316	393300
2005	165995	176100	20860	39450	6783	316	445600
2006	140000	194400	25960	48050	9288	446	446795
2007	138800	158700	19400	33620	6984	294	387000
2008	148500	222200	32630	50110	13860	807	502500
2009	59810	194200	18980	20450	3838	239	322495
2010	82760	256100	24180	64930	13390	520	463400
2011	148800	216400	33570	62009	8537	1070	510095
2012	112100	250500	21490	14750	550	26	421700
2013	91449	172500	17430	19290	1906	77	323100
2014	184900	154900	21690	13090	1271	109	395700
2015	182500	253495	33670	37680	3819	149	543500
2016	119600	146200	29200	20590	2195	230	342900

	95th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	72850	150900	27880	72100	30300	NA	328300
1971	95132	132000	22100	56990	21650	32	304800
1972	71480	123400	18390	72080	19850	18	282900
1973	19880	177800	24480	72100	28080	23	304200
1974	79740	134200	24790	113000	49990	56	371500
1975	153100	169000	26610	101200	37250	85	454800
1976	109000	178400	29470	146500	59250	188	485200
1977	96810	179400	26850	52720	52020	76	379200
1978	47661	157400	25050	45980	17130	156	274805
1979	62730	170800	31980	82070	55440	252	374000
1980	142100	192500	43900	72000	78600	825	493405
1981	158105	253500	61420	127500	67690	1140	615500
1982	108700	223900	34910	146300	40790	337	512700
1983	67770	175800	26540	44740	25400	298	315900
1984	35720	233100	27570	63850	48820	603	385700
1985	64530	223100	29190	104200	54730	396	441005
1986	97051	225300	41270	195700	56810	765	571100
1987	121700	152200	47650	149200	59280	1138	489500
1988	113300	244100	54540	209700	59530	1001	630600
1989	77020	120200	42960	125900	62690	1269	396800
1990	44900	166605	48520	142600	64080	693	435700
1991	36560	114700	37840	104000	31980	313	304600
1992	51101	258100	42840	222500	38600	1205	578010
1993	67010	295500	36830	184500	29520	470	571300
1994	48460	183500	35200	78270	11570	440	336200
1995	66890	234400	28280	70050	22520	215	396900
1996	127700	356900	37640	67290	36030	657	586600
1997	130900	194900	28720	37190	10510	368	380005
1998	199905	196400	30790	46110	22040	407	474605
1999	194500	217000	32390	40970	11370	423	476300
2000	239800	240800	30670	58200	13390	272	562400
2001	192000	164500	20610	48710	5828	268	417100
2002	138900	168100	32420	79090	10700	454	408200
2003	118700	252100	27230	47200	6350	239	436400
2004	117700	227900	37660	88060	9148	322	456600
2005	275100	267100	25150	54180	8178	322	592900
2006	286500	231200	30300	67970	11250	454	599400
2007	251300	208805	23380	50040	8494	300	513300
2008	258605	273300	38500	74800	16850	821	628400
2009	144805	250800	22750	30760	4643	243	427900
2010	160900	279300	28910	84101	16350	530	548300
2011	346100	269900	39240	89090	10390	1090	715600
2012	234400	290500	25810	22370	666	26	551000
2013	220300	203400	20980	29730	2307	79	455905
2014	350100	184800	26070	19410	1556	111	562500
2015	331400	313300	39900	49540	4607	151	707500
2016	289900	182100	35480	30870	2713	234	517100

Table 4.3.2.2. Estimated large salmon returns (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of returns of large salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	10060	14880	103400	69580	20310	NA	218600
1971	14550	12540	59260	40020	15890	653	143200
1972	12400	12670	77320	57050	18980	1383	180100
1973	17425	17275	85410	53470	14760	1427	190300
1974	17120	14270	114200	77520	28550	1394	253700
1975	15875	18410	97025	50460	30620	2331	215200
1976	18090	16660	96740	48720	28780	1317	211100
1977	16365	14590	113100	87880	38090	1998	272700
1978	12680	11340	102500	43740	22250	4207	197000
1979	7260	7189	56530	17840	12790	1942	103700
1980	17520	12060	134400	62460	43730	5797	276500
1981	15710	28830	105100	39310	28190	5602	223500
1982	11490	11600	93560	54395	23670	6056	200900
1983	8325	12450	76800	40650	20570	2155	161500
1984	5980	12370	63690	32720	24570	3222	142700
1985	4725	10900	65890	44610	34230	5529	166100
1986	8136	12310	78020	68570	28250	6175	201700
1987	10960	8457	73450	46910	17680	3081	160900
1988	6912	12990	80920	53880	16400	3286	174800
1989	6608	6914	73710	42805	18500	3196	151900
1990	3858	10270	72530	56510	16000	5051	164300
1991	1876	7566	65300	57875	15670	2647	150800
1992	7530	31620	65650	60190	14300	2459	182000
1993	9426	17090	50460	63765	10060	2231	153500
1994	12920	17350	50960	41485	6314	1346	130900
1995	25460	19060	59220	48375	7507	1748	162000
1996	18685	28970	53600	41570	10890	2407	156700
1997	16270	27940	44170	36220	5579	1611	132300
1998	13430	35280	33920	30360	3846	1526	118400
1999	16080	32070	36980	27990	4940	1168	119200
2000	21870	27005	35390	30470	2872	533	118200
2001	23240	17840	37170	40420	4659	797	124100
2002	16920	16855	26520	23810	1584	526	86200
2003	14100	24450	42080	40255	3518	1199	125600
2004	16980	22230	36320	40000	3092	1316	120000
2005	21120	28290	35410	37890	2024	994	125800
2006	21205	35620	32750	37400	2987	1030	131000
2007	21930	29680	30050	35440	1593	958	119600
2008	26000	28840	36040	28910	3274	1799	124700
2009	39285	34480	35080	36635	3138	2095	150600
2010	18760	35330	37810	33200	2511	1098	128900
2011	57665	43460	48150	66640	4783	3087	223950
2012	33810	28860	34550	27290	1307	913	126700
2013	63960	37760	39070	35940	3176	533	180200
2014	62255	20210	22230	24010	758	340	129800
2015	88710	36980	36260	33595	738	771	196800
2016	71740	24730	39880	35600	1545	392	174100

	5th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	4962	11810	84680	67120	18000	NA	198000
1971	7079	10050	48500	37620	14150	647	128200
1972	6095	10080	63340	49060	17120	1370	161600
1973	8468	13760	69940	45650	13410	1414	169100
1974	8360	12680	93639	65930	26280	1381	226800
1975	7877	16080	79630	43030	27980	2310	192800
1976	8971	14650	79200	41280	25980	1305	187895
1977	8031	12940	93250	75090	34640	1980	245300
1978	6287	10340	83940	38820	20570	4170	176000
1979	3565	6301	46280	15660	11590	1924	92170
1980	8601	11120	110300	54740	39590	5744	247900
1981	7661	25290	86360	32910	25460	5551	200300
1982	5693	10100	76780	42800	21530	6001	178200
1983	4117	11270	63040	33760	18400	2136	144100
1984	2934	9110	60660	23340	21190	3193	131000
1985	2314	7683	62070	31760	29310	5479	150800
1986	3986	9466	74030	49278	23780	6120	180600
1987	5356	6460	69980	34240	14980	3053	145400
1988	3382	9847	76350	39869	13700	3257	158900
1989	3307	5382	69980	31610	15600	3168	138900
1990	1889	8345	68140	39990	13480	5005	146700
1991	918	6147	61700	39860	13450	2623	132300
1992	3962	22210	61720	51539	12330	2437	167600
1993	5915	13830	48600	34890	8905	2211	123900
1994	8471	13730	49200	33390	5659	1334	120100
1995	18180	14580	57290	41320	6594	1732	149900
1996	13440	23810	51410	33160	9567	2385	144500
1997	11650	22880	42400	28700	5001	1596	121300
1998	7959	27430	32100	24950	3533	1512	107000
1999	9542	24810	34840	23700	4590	1157	107900
2000	12990	22950	32530	25880	2615	528	106600
2001	13760	15160	34250	35230	4270	790	112500
2002	9873	13770	24190	20010	1445	521	77050
2003	7426	19450	38810	34010	3185	1188	114500
2004	11570	16970	33800	32940	2824	1304	109100
2005	12290	20390	33110	31120	1839	985	111600
2006	13270	29890	30590	30940	2677	1021	118700
2007	12880	23530	27950	29840	1454	949	106900
2008	15890	22520	32840	23100	2920	1783	110900
2009	20640	23840	32640	30870	2845	2076	127800
2010	11540	28750	35260	27820	2277	1088	117200
2011	33060	31340	45090	52820	4320	3059	192495
2012	20530	23230	32180	22270	1170	905	110900
2013	39550	25840	36570	28340	2802	528	150800
2014	38850	16480	20880	18810	677	337	105395
2015	53380	29110	33780	27090	666	764	160200
2016	39600	18860	37100	27480	1387	388	139500

	95th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	16920	17880	122000	71950	22650	NA	239105
1971	24150	15120	69720	42490	17630	659	158500
1972	20850	15200	91150	65080	20830	1395	199100
1973	29271	20840	100500	61340	16080	1440	211400
1974	28860	15830	134600	89140	30840	1407	280400
1975	26790	20740	114500	57700	33210	2352	237800
1976	30750	18660	114000	56150	31640	1329	233700
1977	27380	16260	134200	100300	41510	2016	300000
1978	21450	12350	120700	48820	23970	4246	218100
1979	12180	8087	66660	20020	14030	1959	115300
1980	29090	12990	158400	70320	47920	5848	304605
1981	26260	32450	124500	45760	30980	5651	246900
1982	19470	13100	110300	65380	25820	6111	224200
1983	14070	13630	90600	47590	22830	2174	178400
1984	10090	15660	66640	42000	27870	3251	154500
1985	7955	14210	69780	57120	39080	5579	180700
1986	13670	15150	82080	88120	32690	6231	223200
1987	18530	10440	76920	59130	20360	3109	176100
1988	11670	16160	85520	67890	19180	3316	191000
1989	11120	8470	77390	53690	21400	3226	165000
1990	6465	12170	76880	73810	18540	5096	182705
1991	3164	8968	68990	75580	17870	2671	169400
1992	12810	40860	69490	68920	16260	2481	196400
1993	15150	20440	52270	93221	11230	2251	183500
1994	20300	20850	52740	49680	6982	1358	142300
1995	37200	23470	61190	55490	8428	1764	176000
1996	27480	34130	55810	49800	12160	2429	169100
1997	23730	32990	45980	43690	6173	1626	143800
1998	18830	43070	35670	35830	4160	1540	129800
1999	22570	39260	39150	32110	5285	1178	130200
2000	30840	31020	38270	35180	3134	538	129500
2001	32630	20540	40160	45480	5059	804	135800
2002	24000	19920	28770	27610	1722	531	95360
2003	20870	29560	45370	46660	3859	1210	137000
2004	22480	27430	38800	47210	3363	1328	130800
2005	29820	36350	37700	44740	2213	1003	139900
2006	28810	41440	34900	43990	3290	1039	143200
2007	30910	35900	32180	40820	1737	967	132200
2008	36480	35120	39140	34690	3621	1815	139200
2009	57970	45060	37440	42400	3435	2114	173705
2010	26020	42020	40370	38760	2747	1108	140700
2011	82220	55651	51200	80170	5274	3115	255500
2012	47140	34460	36970	32070	1446	921	142400
2013	88630	49620	41510	43410	3551	538	210000
2014	85320	23990	23540	29110	836	343	153900
2015	124200	44670	38700	40170	812	778	233805
2016	104500	30580	42720	43580	1709	396	208500

Table 4.3.2.3. Estimated 2SW salmon returns (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC, 1970 to 2016. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of returns of 2SW salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	10060	4132	75480	59600	17120	NA	166700
1971	14550	3591	43260	34840	13490	653	110600
1972	12400	3741	56440	49550	15980	1383	139700
1973	17425	4617	62350	47700	12900	1427	146900
1974	17120	3644	83390	67300	27110	1394	200300
1975	15875	5203	70825	43080	28900	2331	166600
1976	18090	4368	70620	40250	26650	1317	162000
1977	16365	3541	82565	80750	32280	1998	217950
1978	12680	3591	74820	36260	18780	4207	150700
1979	7260	1743	41260	12030	10500	1942	74910
1980	17520	3908	98125	56900	38680	5797	221300
1981	15710	7030	76750	24370	23250	5602	153200
1982	11490	3159	68300	41870	16760	6056	148000
1983	8325	3706	56065	31260	16480	2155	118200
1984	5980	3359	46490	29475	21470	3222	110200
1985	4725	2749	48100	36080	29710	5529	127000
1986	8136	3268	56950	57185	21450	6175	153300
1987	10960	2346	53620	35985	13620	3081	120000
1988	6912	3433	59070	42670	11790	3286	127300
1989	6608	1690	53810	28300	14620	3196	108500
1990	3858	2683	52950	36985	11650	5051	113200
1991	1876	2056	47670	35975	13020	2647	103400
1992	7530	8163	47920	38020	11990	2459	116400
1993	9426	4354	36840	43370	8106	2231	104700
1994	12920	4035	37200	30360	5173	1346	91525
1995	25460	3858	43230	39760	6835	1748	121300
1996	18685	5656	39130	29880	9195	2407	105300
1997	16270	6040	32240	24445	4582	1611	85610
1998	8758	6462	24760	16470	2601	1526	60650
1999	10520	6297	26990	16200	4190	1168	65410
2000	14300	6362	25840	17290	2378	533	66700
2001	15190	2492	27130	27390	4274	788	77260
2002	11060	2430	19360	14370	969	504	48730
2003	9224	3378	30720	26340	3335	1192	74220
2004	11120	3330	26510	25910	2695	1283	70760
2005	13820	4444	25850	26450	1696	984	73170
2006	13850	5366	23910	22670	2544	1023	69340
2007	14290	4157	21940	22770	1388	954	65530
2008	16980	3888	26310	18980	3055	1764	71040
2009	25455	4597	25610	24320	2667	2069	84740
2010	12170	4668	27600	20540	2017	1078	68080
2011	37515	3635	35150	53565	4645	3045	137500
2012	21960	2282	25220	19380	1082	879	70755
2013	41530	4814	28520	25905	2949	525	104200
2014	40400	3094	16230	17230	687	334	77965
2015	57560	4928	26470	24285	683	761	114600
2016	46550	3540	29120	26180	1494	389	107400

	5th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	4962	3086	61820	57570	15020	NA	150800
1971	7079	2607	35410	32630	11890	647	98150
1972	6095	2719	46240	42380	14250	1370	124600
1973	8468	3475	51060	40640	11690	1414	129300
1974	8360	2871	68360	56990	24880	1381	178300
1975	7877	3877	58130	36620	26280	2310	148500
1976	8971	3320	57820	34260	23870	1305	143000
1977	8031	2877	68070	68960	28950	1980	195800
1978	6287	2924	61280	32140	17160	4170	134300
1979	3565	1349	33780	10590	9424	1924	65920
1980	8601	3179	80520	49660	34690	5744	198600
1981	7661	5495	63050	20340	20810	5551	135400
1982	5693	2522	56050	32730	14840	6001	130200
1983	4117	3028	46020	25730	14500	2136	105000
1984	2934	2437	44280	20840	18360	3193	99620
1985	2314	1909	45310	25260	25410	5479	114500
1986	3986	2381	54040	40700	18140	6120	135500
1987	5356	1670	51080	25980	11570	3053	107100
1988	3382	2463	55740	31129	9936	3257	114600
1989	3307	1250	51080	20630	12380	3168	98949
1990	1889	2007	49740	26240	9922	5005	101500
1991	918	1568	45040	24780	11120	2623	91510
1992	3962	5411	45050	32140	10270	2437	107800
1993	5915	3227	35480	23220	7196	2211	83650
1994	8471	2892	35920	24240	4649	1334	82960
1995	18180	2594	41820	33840	6009	1732	110800
1996	13440	4058	37530	23300	8130	2385	96030
1997	11650	4272	30950	18589	4113	1596	76970
1998	5187	4533	23430	12890	2391	1512	54720
1999	6231	4346	25430	13350	3917	1157	59400
2000	8475	4516	23740	14290	2162	528	59430
2001	9001	1700	25000	23640	3919	781	69370
2002	6426	1609	17660	11790	895	500	42890
2003	4862	2230	28330	21690	3008	1181	67000
2004	7530	2075	24670	20600	2464	1271	63790
2005	7985	2554	24170	21330	1541	975	64800
2006	8667	3550	22330	18250	2293	1014	61800
2007	8404	2637	20400	19050	1270	945	58060
2008	10380	2466	23970	14640	2729	1748	62320
2009	13410	2799	23830	20170	2424	2050	71610
2010	7502	3144	25740	16460	1840	1068	61240
2011	21600	2396	32910	41890	4190	3018	117200
2012	13360	1613	23490	15850	969	871	61200
2013	25660	3057	26700	20370	2593	520	87129
2014	25200	2101	15240	13380	615	331	61990
2015	34690	3293	24660	19290	614	754	91160
2016	25750	2303	27080	20150	1340	386	85470

	95th percentile of estimates of returns						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	16920	5187	89070	61590	19230	NA	182500
1971	24150	4570	50900	37040	15120	659	123600
1972	20850	4761	66540	56480	17700	1395	155200
1973	29271	5760	73390	54670	14110	1440	165100
1974	28860	4421	98271	77440	29380	1407	222200
1975	26790	6518	83570	49290	31450	2352	185200
1976	30750	5392	83250	46350	29430	1329	181200
1977	27380	4223	97970	92050	35680	2016	240800
1978	21450	4250	88100	40460	20380	4246	167500
1979	12180	2136	48660	13460	11640	1959	84060
1980	29090	4618	115600	63970	42590	5848	243900
1981	26260	8590	90900	28370	25590	5651	171800
1982	19470	3809	80510	50950	18620	6111	165800
1983	14070	4393	66140	36770	18480	2174	131700
1984	10090	4273	48650	38330	24620	3251	120800
1985	7955	3571	50940	46750	34050	5579	139500
1986	13670	4148	59920	73680	24680	6231	171500
1987	18530	3030	56150	45940	15720	3109	133000
1988	11670	4404	62430	53960	13660	3316	140400
1989	11120	2125	56500	35800	16870	3226	117800
1990	6465	3359	56120	47580	13430	5096	124900
1991	3164	2541	50360	47140	14950	2671	115100
1992	12810	10930	50730	44040	13700	2481	125400
1993	15150	5474	38160	63321	8993	2251	125500
1994	20300	5192	38500	36670	5678	1358	101100
1995	37200	5138	44670	45650	7660	1764	134400
1996	27480	7286	40740	36280	10270	2429	116100
1997	23730	7803	33560	30200	5035	1626	94890
1998	12490	8372	26040	20110	2815	1540	66430
1999	14930	8213	28580	19140	4471	1178	71340
2000	20430	8240	27940	20340	2594	538	74070
2001	21590	3318	29320	31140	4631	795	85270
2002	15960	3245	21000	16900	1041	509	54520
2003	13810	4536	33120	30970	3647	1203	81370
2004	14910	4550	28320	31070	2916	1295	77780
2005	19740	6299	27520	31570	1848	993	81620
2006	19160	7174	25470	27030	2798	1032	76720
2007	20390	5699	23490	26620	1507	963	73210
2008	24120	5336	28570	23260	3383	1780	79780
2009	37950	6435	27330	28400	2915	2088	98302
2010	17030	6212	29470	24570	2194	1088	75010
2011	53980	4920	37370	64790	5092	3072	157900
2012	30840	2979	26990	22870	1195	887	80630
2013	58100	6536	30300	31490	3301	530	122000
2014	56070	4059	17190	21040	760	337	94021
2015	81710	6559	28250	29170	749	768	139500
2016	68210	4797	31190	32310	1651	392	130200

Table 4.3.3.1. Estimated small salmon spawners (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC, 1970 to 2016. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of spawners of small salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	45130	104900	13850	39380	18410	NA	NA
1971	60240	92100	11700	32620	12190	29	209800
1972	45440	86115	10240	40285	10835	17	194200
1973	6547	124400	13730	45700	18300	13	209000
1974	51520	94140	12560	75975	33140	40	268400
1975	99150	117400	14490	67270	26160	67	325800
1976	67740	124000	16210	89815	40730	151	340800
1977	60595	125000	14980	24730	32300	54	259200
1978	30080	111000	14290	22750	9031	127	188000
1979	37970	120900	19855	49750	36530	247	266400
1980	92150	136100	26090	43455	49630	722	349650
1981	100600	178700	38730	70145	40300	1009	431600
1982	69310	158600	21100	89125	24370	290	365000
1983	41395	124500	15040	23660	14830	255	220500
1984	21180	166900	20350	21690	32730	540	264300
1985	40390	159100	20140	60050	36190	363	317300
1986	61750	162600	27700	123000	39460	660	417000
1987	76715	111100	32770	90885	41100	1087	355500
1988	69840	177700	36380	127900	42250	923	457100
1989	47425	89305	30720	69630	43610	1080	283400
1990	27005	122600	32810	84740	44025	617	312800
1991	21915	85070	25250	67090	22290	235	222900
1992	31430	205500	27350	160000	26280	1124	453400
1993	42910	239500	21980	113500	20485	444	440800
1994	30940	130000	20745	45340	9142	427	237700
1995	44960	171400	17710	48380	17880	213	301600
1996	87110	275000	23170	35760	28220	651	452600
1997	92830	151900	17950	19480	8333	365	292000
1998	149300	158300	21200	25700	19900	403	374900
1999	145100	176500	23700	21970	10210	419	378100
2000	177800	204700	21050	31940	11990	270	447800
2001	142800	133500	13670	26770	5091	266	321800
2002	100000	133000	21350	44830	9532	450	308900
2003	82960	219700	19330	25730	5599	237	353500
2004	92270	188600	26270	49670	8135	319	365600
2005	218900	196800	18320	29255	7293	319	470500
2006	210700	190900	21560	37710	10030	450	471300
2007	193450	167800	16710	27040	7524	297	412450
2008	201750	217800	26730	40230	15130	814	502450
2009	100900	197300	16240	15695	4078	241	334600
2010	119300	235500	20450	47770	14770	525	438400
2011	245700	214300	27800	49290	9359	1080	546450
2012	170850	246800	18270	11340	592	26	448300
2013	153100	163000	14985	14980	2080	78	348000
2014	265600	146000	18780	10490	1404	110	442250
2015	254950	252100	28030	41360	4185	150	581200
2016	204200	132300	25520	24670	2417	232	389350

	5th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	30160	90170	11320	30270	14660	NA	NA
1971	40660	78940	9571	25570	9365	29	182900
1972	30910	73320	8417	31060	7938	17	170100
1973	1944	106600	11270	36660	14650	13	187700
1974	35040	80539	10310	61630	26650	40	239500
1975	67270	99789	11890	54520	22740	66	284395
1976	45490	104400	13320	72150	34390	150	301895
1977	40960	105400	12310	18680	26200	54	227100
1978	20180	93318	11730	17960	7697	126	166100
1979	25170	101800	16250	40080	29980	245	239000
1980	62520	116200	21360	35030	41750	716	308400
1981	67650	150200	31670	49230	31900	1000	377795
1982	46270	135300	17310	64159	19680	287	318700
1983	27289	105300	12340	16220	12020	253	193800
1984	13850	139600	18080	12460	26600	535	233000
1985	26710	131700	17670	42390	28900	360	278895
1986	41720	137795	24780	88000	32060	654	365000
1987	51040	94000	29050	66040	33220	1077	311195
1988	46220	150000	32280	92620	34560	915	401100
1989	30930	76640	27540	48410	35410	1070	249095
1990	17680	108500	29470	61110	35170	611	280500
1991	14310	75900	22650	49470	18540	233	199600
1992	21510	176800	24350	131900	21660	1114	408500
1993	30710	209595	19510	65970	16680	440	380100
1994	22240	107695	18360	35630	8046	423	210600
1995	32970	141300	15850	39700	15330	211	266800
1996	64850	230900	20710	29080	23950	645	398900
1997	71098	134000	15890	14990	7214	362	260700
1998	100200	145900	18670	21260	18270	399	323200
1999	97808	160900	21270	18380	9433	415	327200
2000	120500	192800	18020	26950	10970	268	389000
2001	96330	125200	12130	22650	4688	264	274600
2002	63670	120500	19110	37460	8697	446	269900
2003	49230	210000	17250	21610	5101	235	318200
2004	70030	170800	22760	41260	7396	316	334000
2005	163200	152000	16120	23970	6597	316	397200
2006	137800	172600	19420	30300	9063	446	396300
2007	136600	142400	14750	21170	6784	294	350000
2008	146000	192000	23720	30730	13640	807	438895
2009	58120	168895	14380	11760	3686	239	280800
2010	80820	223600	18120	40790	13300	520	397295
2011	146600	186900	24940	39000	8427	1070	444600
2012	110400	226600	16140	8337	534	26	384100
2013	89640	147700	13190	11030	1882	77	282800
2014	182900	130800	16580	7961	1261	109	359100
2015	180700	222900	24910	35480	3789	149	500700
2016	117500	114500	22380	19550	2162	230	301500

	95th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	68840	120000	16320	48350	22160	NA	NA
1971	91192	105600	13770	39650	14980	29	243905
1972	68540	98810	12110	49430	13700	17	221200
1973	12390	141900	16210	54570	21960	13	230005
1974	77240	107600	14850	90650	39540	40	301700
1975	149200	135300	17110	80060	29550	68	380300
1976	103205	143400	19150	107900	47030	152	383700
1977	92220	144900	17720	31010	38060	54	296000
1978	44970	128500	16870	27620	10350	128	211300
1979	58610	139405	23420	59160	43180	249	296300
1980	138300	156500	30700	51800	57460	728	400705
1981	152905	207000	45650	90380	48610	1018	494005
1982	104600	182200	24910	114200	29190	293	414600
1983	63400	143100	17720	31250	17590	257	249700
1984	32780	193705	22650	31340	38940	545	295405
1985	61430	186400	22540	77841	43450	366	357300
1986	93591	188600	30650	156300	47100	666	471105
1987	116400	127900	36500	116000	48980	1097	405400
1988	107800	204600	40440	163000	50070	931	516600
1989	72340	102100	33870	91570	51610	1090	319400
1990	41590	136600	36100	109100	52860	622	346400
1991	34240	94330	27810	84600	25980	237	246400
1992	48340	234300	30350	188500	30910	1134	497605
1993	64320	269200	24450	160600	24260	448	501000
1994	45540	152500	23070	55050	10230	431	265400
1995	64070	201705	19600	57120	20400	215	337700
1996	124700	318705	25610	42570	32540	657	507800
1997	128300	169500	20040	23980	9453	368	330700
1998	197400	170600	23640	30160	21560	407	424900
1999	192000	192000	26240	25530	10970	423	428100
2000	236600	216700	24130	36900	13020	272	507300
2001	189500	141600	15170	30900	5492	268	369600
2002	136300	145400	23580	52010	10390	454	348900
2003	116100	229200	21330	29820	6096	239	388800
2004	115200	207000	29780	58130	8888	322	396200
2005	272400	242105	20460	34520	7980	322	543105
2006	284205	209500	23760	45290	10990	454	547500
2007	249100	192600	18720	33010	8282	300	474700
2008	256100	243400	29660	49780	16610	821	564500
2009	143105	225800	18080	19640	4465	243	387400
2010	159000	246800	22880	55010	16220	530	480500
2011	343900	241600	30610	59360	10270	1090	650005
2012	232700	266600	20420	14320	650	26	512700
2013	218500	178400	16780	18970	2278	79	415700
2014	348100	160900	20930	13020	1545	111	525905
2015	329700	282300	31190	47220	4584	151	662810
2016	287800	150000	28660	29730	2676	234	475400

Table 4.3.3.2. Estimated large salmon spawners (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC, 1970 to 2016. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of spawners of large salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	9498	12740	39170	11885	7900	NA	NA
1971	14070	10960	20230	11830	8217	490	65870
1972	11980	11300	39800	33300	12010	1038	109800
1973	16420	15380	40300	35350	7606	1100	116400
1974	16320	13070	49060	55860	15170	1147	150900
1975	15545	17160	40760	33630	17770	1942	127300
1976	17260	15620	38740	29125	16970	1126	119500
1977	15080	11850	55850	55620	21560	643	161000
1978	11920	9785	51250	19415	10890	3313	106800
1979	6650	6646	21910	8798	7926	1509	53650
1980	16630	10120	60900	34320	24030	4263	150400
1981	15190	27500	44600	16140	12770	4335	121000
1982	10870	10340	45430	27270	10390	4643	109300
1983	7897	11060	29650	18090	5712	1769	74390
1984	5470	11890	37110	28490	20000	2547	105700
1985	4431	10950	35440	43040	28560	4884	127600
1986	7668	12180	40690	66560	24905	5569	157800
1987	10325	8394	36070	44020	16100	2781	118100
1988	6202	12970	43160	51960	14710	3038	132300
1989	6146	6892	41090	40680	18150	2800	116000
1990	3502	10220	41040	54930	15260	4356	129500
1991	1782	7544	33070	56430	14120	2416	115300
1992	6748	31270	32330	58320	12930	2292	144200
1993	9040	16960	24970	63545	8780	2065	125650
1994	12430	16900	24480	40470	5446	1344	101600
1995	25000	18540	34630	47530	7104	1748	135200
1996	18300	28390	30050	40270	9937	2407	129900
1997	16060	27595	24810	34910	4909	1611	110300
1998	13120	34850	23040	29500	3473	1526	105500
1999	15670	31720	27930	26410	4440	1168	107300
2000	21460	26470	26710	29480	2649	1587	108300
2001	22750	17450	27490	39050	4357	1491	112600
2002	16610	16500	20700	23010	1373	511	78700
2003	13740	24210	33790	38900	3289	1192	115200
2004	16570	21850	28180	38720	2960	1283	109500
2005	20700	28020	28090	36530	1899	1088	116200
2006	20865	35260	26070	36170	2809	1419	122600
2007	21570	29290	23580	34000	1469	1189	111100
2008	25650	28340	29800	27480	3163	2231	116700
2009	38945	34150	28700	35080	3003	2318	142200
2010	18460	34880	32020	31750	2368	1502	121000
2011	57440	42905	40280	64580	4696	3914	214000
2012	33700	28600	28450	26195	1247	2054	120300
2013	63710	37480	32370	34380	3133	5250	176300
2014	62095	19920	17460	23370	741	572	124300
2015	88570	36230	30640	32760	726	1519	190400
2016	71450	24010	33980	34810	1526	881	166600

	5th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	4400	9704	32080	9671	5583	NA	NA
1971	6593	8363	16600	9446	6458	486	56210
1972	5671	8726	32530	25470	10120	1029	95910
1973	7459	11750	33030	27800	6281	1090	101200
1974	7557	11480	40260	44380	12910	1137	132500
1975	7550	14860	33450	26390	15230	1924	112100
1976	8141	13550	31760	22160	14150	1116	104400
1977	6745	10220	45760	43320	18090	637	141100
1978	5520	8796	42020	14650	9172	3284	93520
1979	2956	5753	18000	6655	6705	1495	47090
1980	7712	9204	49920	26800	19790	4224	132800
1981	7141	23880	36700	9868	9963	4295	105900
1982	5072	8842	37210	15770	8250	4601	92470
1983	3689	9874	24340	11190	3490	1753	63640
1984	2424	8684	34150	19230	16680	2524	94080
1985	2020	7688	31590	30570	23700	4840	112695
1986	3519	9330	36540	46990	20420	5520	136000
1987	4723	6422	32550	31670	13370	2756	103000
1988	2672	9845	38530	37980	12080	3011	116000
1989	2846	5381	37460	29610	15240	2775	103100
1990	1532	8329	36590	38180	12740	4316	111100
1991	825	6126	29380	38790	11900	2394	96860
1992	3180	21880	28490	49750	10990	2271	130100
1993	5528	13590	23150	33900	7600	2046	95460
1994	7981	13380	22690	32270	4785	1332	90760
1995	17720	14260	32700	40690	6168	1732	123100
1996	13060	23170	27820	32140	8676	2385	118000
1997	11440	22510	23010	27370	4325	1596	99510
1998	7646	26900	21240	24110	3158	1512	94270
1999	9129	24650	25750	22200	4098	1157	96330
2000	12580	22360	23870	24860	2391	1573	96940
2001	13270	14780	24830	33970	3965	1478	100995
2002	9569	13420	18400	19170	1236	506	69740
2003	7072	19030	30570	32809	2959	1181	103800
2004	11160	16650	25620	31510	2692	1271	98600
2005	11870	19830	25810	29810	1717	1078	101895
2006	12930	29640	23910	29770	2511	1406	110500
2007	12520	23090	21410	28420	1325	1178	98130
2008	15540	22020	26630	21810	2811	2211	102900
2009	20300	23530	26300	29560	2712	2297	119395
2010	11230	28210	29460	26400	2137	1489	109400
2011	32840	30810	37250	51300	4220	3879	182600
2012	20430	23080	26060	21310	1113	2035	104500
2013	39310	25629	29930	26780	2765	5204	147200
2014	38690	16250	16120	18210	663	567	99730
2015	53240	28490	28220	26520	653	1505	153600
2016	39310	18080	31220	26810	1364	873	132900

	95th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	16350	15740	46220	14160	10210	NA	NA
1971	23660	13460	23870	14230	9973	494	77010
1972	20430	13880	46800	41180	13840	1047	124000
1973	28261	18900	47600	42890	8960	1110	133100
1974	28050	14640	57820	67290	17450	1157	170000
1975	26460	19480	48130	40910	20480	1960	143100
1976	29920	17590	45830	36380	19830	1136	136200
1977	26100	13510	65920	67991	25000	649	180800
1978	20680	10800	60340	24140	12570	3344	120900
1979	11580	7538	25890	10880	9166	1523	60590
1980	28200	11060	71940	41920	28070	4302	168900
1981	25740	31000	52810	22330	15510	4373	136700
1982	18850	11850	53510	38380	12540	4685	126000
1983	13641	12220	34980	24940	7911	1785	85520
1984	9581	15130	40100	37800	23390	2570	117600
1985	7661	14170	39260	55770	33450	4928	142405
1986	13210	15040	44720	85600	29360	5620	179000
1987	17900	10320	39500	56670	18720	2806	133300
1988	10960	16020	47740	65990	17530	3065	148600
1989	10660	8387	44720	51790	21000	2825	129000
1990	6108	12180	45290	71660	17770	4395	147400
1991	3071	8951	36750	74160	16350	2438	134000
1992	12020	40830	36270	66870	14940	2312	158700
1993	14760	20290	26760	92200	9936	2084	155100
1994	19810	20440	26240	48620	6074	1356	112900
1995	36740	22760	36580	54610	8004	1764	149405
1996	27100	33640	32320	48560	11240	2429	142700
1997	23520	32650	26620	42370	5492	1626	121700
1998	18520	42810	24800	34790	3787	1540	116800
1999	22150	38890	30050	30680	4786	1178	118300
2000	30440	30600	29610	34020	2907	1601	119800
2001	32140	20180	30080	44000	4752	1504	124100
2002	23690	19630	23020	26760	1511	516	87720
2003	20510	29210	37110	45410	3627	1203	126700
2004	22070	27130	30640	45810	3229	1295	120500
2005	29400	35960	30330	43150	2084	1098	130500
2006	28470	40930	28230	42680	3113	1432	134400
2007	30560	35400	25700	39350	1605	1200	123500
2008	36130	34540	33000	33150	3516	2251	130900
2009	57630	44750	31140	40640	3301	2339	164900
2010	25710	41530	34580	37160	2596	1516	132900
2011	82000	54870	43310	78340	5182	3949	246000
2012	47030	34000	30810	30960	1386	2072	135900
2013	88380	49130	34830	41820	3508	5298	205205
2014	85160	23690	18790	28600	821	577	148000
2015	124000	43890	33100	39240	800	1533	227100
2016	104200	29770	36760	42730	1684	889	200900

Table 4.3.3.3. Estimated 2SW salmon spawners (medians, 5th percentile, 95th percentile) to the six geographic areas and overall for NAC, 1970 to 2016. Returns for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

	Median estimates of spawners of 2SW salmon						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	9498	3238	28595	9968	6492	NA	NA
1971	14070	2975	14770	10440	7026	490	49810
1972	11980	3136	29050	29250	10360	1038	85040
1973	16420	3862	29420	32180	6687	1100	90010
1974	16320	3142	35810	48860	14080	1147	119800
1975	15545	4712	29760	28770	16350	1942	97460
1976	17260	3977	28280	24070	15520	1126	90675
1977	15080	2768	40770	51320	18850	643	129700
1978	11920	3055	37410	16000	9403	3313	81380
1979	6650	1615	16000	5756	6686	1509	38280
1980	16630	3250	44460	31530	21320	4263	121600
1981	15190	6576	32560	9747	10350	4335	79000
1982	10870	2772	33170	21340	7807	4643	80910
1983	7897	3278	21645	13870	4184	1769	53025
1984	5470	3179	27090	26090	17530	2547	82025
1985	4431	2722	25870	34840	24700	4884	97630
1986	7668	3226	29710	55550	18430	5569	120300
1987	10325	2327	26330	33980	12220	2781	88220
1988	6202	3412	31510	41530	10320	3038	96310
1989	6146	1675	30000	27100	14290	2800	82150
1990	3502	2672	29960	36060	11000	4356	87580
1991	1782	2045	24140	35440	11660	2416	77530
1992	6748	8083	23600	36900	10830	2292	88640
1993	9040	4308	18230	42520	6924	2065	83510
1994	12430	3890	17870	29810	4386	1344	70080
1995	25000	3712	25280	39240	6480	1748	101800
1996	18300	5478	21940	29020	8390	2407	85940
1997	16060	5874	18110	23540	3970	1611	69500
1998	8551	6334	16820	15970	2271	1526	51460
1999	10250	6220	20390	15450	3734	1168	57140
2000	14035	6204	19500	16720	2181	1587	60200
2001	14880	2430	20060	26400	4002	1491	69230
2002	10860	2383	15110	13840	785	511	43530
2003	8993	3302	24660	25560	3126	1192	66900
2004	10850	3219	20570	25110	2573	1283	63630
2005	13550	4305	20500	25440	1588	1088	66500
2006	13630	5280	19030	21850	2391	1419	63620
2007	14060	4110	17210	21910	1279	1189	59710
2008	16745	3769	21760	18100	2957	2809	66220
2009	25235	4563	20950	23470	2548	2292	79090
2010	11980	4557	23370	19730	1883	1482	63010
2011	37370	3631	29400	52000	4559	3872	130900
2012	21890	2273	20770	18640	1030	2020	66615
2013	41370	4758	23630	24820	2920	5242	102700
2014	40290	3055	12750	16850	673	566	74195
2015	57470	4828	22370	23790	671	1509	110600
2016	46375	3398	24800	25700	1478	878	102600

	5th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	4400	2294	23420	8165	4705	NA	NA
1971	6593	2073	12120	8294	5599	486	41180
1972	5671	2207	23740	22290	8737	1029	73350
1973	7459	2789	24110	25430	5551	1090	76440
1974	7557	2429	29390	38820	11950	1137	103395
1975	7550	3444	24420	22560	13890	1924	84430
1976	8141	2999	23190	18330	12940	1116	77390
1977	6745	2170	33400	39880	15720	637	112100
1978	5520	2469	30670	12060	7930	3284	70190
1979	2956	1239	13140	4365	5655	1495	32900
1980	7712	2642	36440	24630	17670	4224	106300
1981	7141	5098	26790	5843	8251	4295	67180
1982	5072	2168	27160	12130	6201	4601	67150
1983	3689	2654	17770	8458	2658	1753	43959
1984	2424	2278	24930	17350	14550	2524	71450
1985	2020	1898	23060	24330	20470	4840	85270
1986	3519	2349	26680	38810	15250	5520	102200
1987	4723	1643	23760	23890	10200	2756	75550
1988	2672	2437	28120	30100	8519	3011	83070
1989	2846	1242	27350	19470	12100	2775	72950
1990	1532	1992	26710	25240	9275	4316	75660
1991	825	1561	21450	24229	9850	2394	65720
1992	3180	5374	20790	31040	9153	2271	80270
1993	5528	3193	16900	22540	6048	2046	62580
1994	7981	2779	16560	23510	3895	1332	61600
1995	17720	2423	23870	33330	5645	1732	91470
1996	13060	3912	20310	22660	7320	2385	76790
1997	11440	4096	16800	17770	3536	1596	61370
1998	4988	4416	15510	12490	2071	1512	45860
1999	5962	4309	18800	12550	3452	1157	51370
2000	8218	4386	17420	13720	1966	1573	52970
2001	8693	1652	18130	22660	3655	1478	61440
2002	6229	1554	13430	11250	718	506	37740
2003	4633	2183	22320	20920	2805	1181	59630
2004	7264	2019	18700	19930	2352	1271	56780
2005	7717	2462	18840	20510	1439	1078	58170
2006	8446	3492	17450	17540	2144	1406	56320
2007	8165	2589	15630	18190	1164	1178	52130
2008	10150	2354	19440	13890	2638	2784	57659
2009	13200	2738	19200	19430	2310	2271	65940
2010	7302	3060	21510	15730	1705	1469	56140
2011	21450	2358	27190	40580	4102	3837	110500
2012	13290	1591	19030	15170	918	2002	56800
2013	25500	3001	21850	19310	2559	5196	85420
2014	25100	2100	11760	13050	600	561	58220
2015	34590	3183	20600	18850	604	1495	87140
2016	25550	2174	22790	19680	1322	870	80740

	95th percentile of estimates of spawners						
Year	1-LAB	2-NFLD	3-QC	4-GF	5-SF	6-USA	7-NAC
1970	16350	4181	33740	11790	8305	NA	NA
1971	23660	3885	17430	12540	8528	494	60410
1972	20430	4057	34170	36120	12030	1047	97210
1973	28261	4886	34750	39080	7836	1110	105000
1974	28050	3849	42210	58990	16210	1157	137000
1975	26460	5974	35140	35120	18890	1960	111900
1976	29920	4958	33450	29940	18120	1136	105900
1977	26100	3366	48130	62750	21970	649	147700
1978	20680	3634	44050	19900	10860	3344	93240
1979	11580	1995	18900	7153	7723	1523	44350
1980	28200	3892	52520	38360	24890	4302	138300
1981	25740	8050	38550	13590	12510	4373	92231
1982	18850	3363	39060	30310	9429	4685	94940
1983	13641	3915	25540	19410	5732	1785	62240
1984	9581	4066	29270	34800	20470	2570	92571
1985	7661	3564	28660	45610	28710	4928	110200
1986	13210	4104	32640	71800	21590	5620	138500
1987	17900	3034	28830	44020	14180	2806	101205
1988	10960	4394	34850	52680	12120	3065	109100
1989	10660	2117	32650	34450	16470	2825	91460
1990	6108	3349	33060	46540	12700	4395	99140
1991	3071	2530	26830	46330	13490	2438	88970
1992	12020	10830	26480	42710	12500	2312	97550
1993	14760	5442	19530	62610	7812	2084	104400
1994	19810	5005	19160	36050	4883	1356	79790
1995	36740	4975	26700	45180	7287	1764	115100
1996	27100	7117	23600	35400	9444	2429	96680
1997	23520	7626	19430	29320	4417	1626	78750
1998	12280	8254	18100	19460	2472	1540	57260
1999	14660	8101	21940	18370	4004	1178	63120
2000	20160	8044	21610	19690	2390	1601	67630
2001	21270	3217	21960	30200	4358	1504	77040
2002	15750	3184	16810	16420	853	516	49451
2003	13570	4443	27090	30150	3432	1203	73990
2004	14630	4469	22370	30140	2794	1295	70250
2005	19460	6177	22140	30530	1736	1098	74990
2006	18920	7101	20610	26150	2638	1432	71030
2007	20150	5596	18760	25650	1393	1200	67350
2008	23890	5197	24090	22400	3282	2834	75240
2009	37730	6347	22740	27450	2782	2313	92490
2010	16830	6048	25240	23620	2057	1495	69970
2011	53830	4887	31620	63410	5012	3907	151400
2012	30760	2962	22490	22130	1143	2038	76570
2013	57940	6482	25430	30340	3266	5290	120500
2014	55970	4017	13710	20630	746	571	90350
2015	81620	6448	24170	28650	738	1522	135500
2016	68010	4613	26840	31740	1636	886	125700

Table 4.3.4.1. Time-series of stocks in Canada and the USA with established CLs, the number of rivers assessed, and the number and percent of assessed rivers meeting CLs, 1991 to 2016.

Year	Canada				USA			
	No. CLs	No. assessed	No. met	% met	No. CLs	No. assessed	No. met	% met
1991	74	64	34	53				
1992	74	64	38	59				
1993	74	69	30	43				
1994	74	72	28	39				
1995	74	74	36	49	33	16	0	0
1996	74	76	44	58	33	16	0	0
1997	266	91	38	42	33	16	0	0
1998	266	83	38	46	33	16	0	0
1999	269	82	40	49	33	16	0	0
2000	269	81	31	38	33	16	0	0
2001	269	78	29	37	33	16	0	0
2002	269	80	21	26	33	16	0	0
2003	269	79	33	42	33	16	0	0
2004	269	75	39	52	33	16	0	0
2005	269	70	31	44	33	16	0	0
2006	269	65	29	45	33	16	0	0
2007	269	61	23	38	33	16	0	0
2008	269	68	29	43	33	16	0	0
2009	375	70	32	46	33	16	0	0
2010	375	68	31	46	33	16	0	0
2011	458	75	50	67	33	16	0	0
2012	472	74	32	43	33	16	0	0
2013	473	75	46	61	33	16	0	0
2014	476	69	20	29	33	16	0	0
2015	476	74	43	58	33	16	0	0
2016	476	62	41	66	33	16	0	0

Table 4.3.5.1. Return rates (%), by year of smolt migration, of wild Atlantic salmon to 1SW (or small) salmon to North American rivers, 1991 to 2015 smolt migration years. The year 1991 was selected for illustration as it is the first year of the commercial fishery moratorium for the island of Newfoundland.

	USA	Scotia-Fundy				Gulf				Québec				Newfoundland					
SMOLT YEAR	Narraguagus	Nashwaak	LaHave	St.Mary's	Middle	Margaree	NWMiramichi	SWMiramcihi	Miramichi	à la barbe	Saint Jean	Bec scie	de la Trinite	Highlands	Conne	Rocky	NE Trepassey	Campbellton	WAB
1991										0.6	0.5	1.2	1.6		3.4	3.1	2.6		3.6
1992										0.5	0.4	1.3	0.8		4.0	3.7	4.7		6.1
1993										0.4	0.3	0.9	0.7	1.5	2.7	3.1	5.4	9.0	7.1
1994											0.3	1.2	0.6	1.6	5.8	3.9	8.5	7.3	8.9
1995											0.6	1.4	0.9	1.6	7.2	4.7	9.2	8.1	8.1
1996			1.5								0.3		0.6	3.2	3.4	3.1	2.9	3.4	3.5
1997	0.04		4.3										1.7	1.4	2.9	2.5	5.0	5.3	7.2
1998	0.21	2.9	2.0								0.3		1.4	2.5	3.4	2.7	4.9	6.1	6.1
1999	0.31	1.8	4.8				3.0				0.3		0.4	0.6	8.1	3.2	5.9	3.8	11.1
2000	0.28	1.5	1.2				4.9				0.5		0.3	0.6	2.5	3.1	3.2	6.0	4.4
2001	0.16	3.1	2.7				6.6	8.6	7.9		0.5		0.6		3.0	2.9	7.1	5.3	9.2
2002	0.00	1.9	2.0			1.5	2.4	3.0	3.0		0.6		0.9		2.4	4.0	5.5	6.8	9.4
2003	0.08	6.4	1.8			1.6	4.1	6.8	5.9		0.6		0.6		5.3	3.8	6.6	7.8	9.5
2004	0.08	5.1	1.1			0.9	2.6	1.8	2.0		0.7		1.0		2.5	3.3	4.4	11.4	5.9
2005	0.24	12.7	8.0	3.0		1.1	3.6				0.4		1.5		4.0	2.2	5.5	9.2	15.1
2006	0.09	1.8	1.5	0.7		0.7	1.4	1.5	1.5		0.3				3.3	1.3	2.7	5.6	3.8
2007	0.35	5.6	2.3	2.2		1.3		1.6			0.4		1.5		4.4	5.6	5.5	11.2	11.6
2008	0.22	3.9	1.2	0.6		0.3		1.0			0.6		0.7		2.4	2.7	2.6	8.8	6.1
2009	0.26	12.4	3.5			1.0		3.3			0.8		1.9		2.5	6.8	4.9	9.5	9.6
2010	0.95	7.9	1.8					1.5			0.7		2.5		2.7	5.1	5.6	11.0	7.1
2011	0.32	0.3									0.4		0.6		3.9	4.6	3.0	9.7	5.7
2012	0.00	1.6									0.4		0.4		5.3	3.7	4.0	9.3	5.2
2013	0.26	1.6	0.6		0.20						0.9		0.6		1.9	5.3		10.0	7.2
2014	0.32	2.9	0.6		0.37						0.9		1.9		4.1			8.8	8.2
2015		5.0	0.4		0.15								1.2		3.6			8.4	9.4

Table 4.3.5.2. Return rates (%), by year of smolt migration, of wild Atlantic salmon to 2SW salmon to North American rivers, 1991 to 2014 smolt migration years. The year 1991 was selected for illustration as it is the first year of the commercial fishery moratorium for the island of Newfoundland.

	USA	Scotia-Fundy				Gulf				Québec				Nfld
SMOLT YEAR	Narraguagus	Nashwaak	LaHave	St.Mary's	Middle	Margaree	NWMiramichi	SW Miramcihi	Miramichi	à la barbe	Saint Jean	Bec scie	de la Trinite	Highlands
1991										0.6	0.9	0.4	0.6	
1992										0.5	0.7	0.4	0.5	
1993										0.4	0.8	0.9	0.7	1.2
1994											0.9	1.5	0.7	1.4
1995											0.9	0.4	0.5	1.3
1996			0.2								0.4		0.5	0.9
1997	0.87		0.4										1.1	1.2
1998	0.28	0.7	0.3								0.4		0.7	1.1
1999	0.53	0.8	0.9				1.2				0.7		0.2	0.7
2000	0.17	0.3	0.1				0.5				1.2		0.1	0.7
2001	0.85	0.9	0.6				0.6	3.3	2.3		0.9		0.3	
2002	0.58	1.3	0.5			6.2	0.7	1.4	1.3		0.9		0.5	
2003	1.01	1.6	0.2			3.9	0.9	2.0	1.6		1.4		0.2	
2004	0.98	1.3	0.3			3.0	0.5	0.8	0.7		1.1		0.7	
2005	0.73	1.5	0.5	0.3		2.3	1.1				0.6		0.5	
2006	0.74	0.6	0.4	0.1		3.0	0.2	0.5	0.4		0.5			
2007	2.07	1.3	0.2	0.1		2.1		0.8			0.5		0.3	
2008	0.65	2.1	0.3			2.4		0.7			1.8		0.5	
2009	1.80	3.3	0.9			5.7		2.2			1.9		0.8	
2010	0.24	0.4	0.2								1.0		0.6	
2011	0.56	1.0									1.7		0.3	
2012	1.02	0.3									0.6		0.1	
2013	1.91	0.5	0.2		1.7						1.9		0.3	
2014		0.6	0.2		1.5						1.2		0.6	

Table 4.3.5.3. Return rates (%), by year of smolt migration, of hatchery Atlantic salmon to 1SW salmon to North American rivers, 1991 to 2015 smolt migration years. The year 1991 was selected for illustration as it is the first year of the commercial fishery moratorium for Newfoundland.

SMOLT YEAR	USA			Scotia Fundy				Gulf				Québec
	Connecticut	Penobscot	Merrimack	Saint John	LaHave	East Sheet	Liscomb	Morell	Mill	West	Valley-field	auxRochers
1991	0.00	0.14	0.01	0.69	4.51	0.15	0.50	3.16			0.48	0.43
1992	0.00	0.04	0.00	0.41	1.26	0.21	0.42	1.43	0.44	2.16	0.70	0.07
1993	0.00	0.05	0.00	0.39	0.62	0.32	0.56	0.14	0.37		0.02	0.10
1994	0.00	0.03	0.00	0.66	1.44	0.36	0.35	5.20	0.11		0.08	0.02
1995		0.08	0.02	1.14	2.26	0.37	0.64					0.07
1996		0.04	0.02	0.56	0.47	0.07	0.17					0.31
1997		0.04	0.02	0.75	0.87	0.03	0.15					0.46
1998		0.04	0.09	0.47	0.34	0.05	0.10					1.04
1999		0.03	0.05	0.46	0.79	0.23						0.32
2000	0.00	0.04	0.01	0.27	0.43	0.03						1.15
2001		0.07	0.06	0.45	0.87							0.02
2002		0.04	0.02	0.34	0.63							0.07
2003	0.00	0.05	0.03	0.32	0.72							
2004	0.00	0.05	0.02	0.39	0.53							
2005	0.02	0.06	0.02	0.56								
2006	0.00	0.04	0.02	0.24								
2007	0.01	0.13	0.01	0.83								
2008	0.00	0.03	0.00	0.13								
2009	0.00	0.07	0.03	1.44								
2010	0.01	0.12	0.18	0.12								
2011	0.00	0.00	0.00	0.02								
2012		0.01	0.00	0.67								
2013		0.02	0.01	0.11								
2014		0.02		0.24								
2015		0.06		0.11								

Table 4.3.5.4. Return rates (%), by year of smolt migration, of hatchery Atlantic salmon to 2SW salmon to North American rivers, 1991 to 2014 smolt migration years. The year 1991 was selected for illustration as it is the first year of the commercial fishery moratorium for Newfoundland.

SMOLT YEAR	USA			Scotia Fundy				Gulf			Québec	
	Connecticut	Penobscot	Merrimack	Saint John	LaHave	East Sheet	Liscomb	Morell	Mill	West	Valley-field	auxRochers
1991	0.04	0.19	0.02	0.15	0.48	0.00	0.05	0.04			0.00	0.13
1992	0.08	0.08	0.00	0.22	0.24	0.01	0.03	0.07	0.00	0.05	0.06	0.06
1993	0.04	0.19	0.03	0.19	0.21	0.02	0.03	0.31	0.91		0.01	0.19
1994	0.04	0.22	0.05	0.27	0.23	0.06	0.02					0.05
1995		0.16	0.06	0.19	0.23	0.00	0.03					0.04
1996		0.14	0.09	0.08	0.13	0.01						0.07
1997		0.10	0.11	0.20	0.17	0.01						0.08
1998		0.05	0.06	0.06	0.11	0.00						0.09
1999		0.08	0.13	0.16	0.21	0.00						0.02
2000	0.01	0.06	0.03	0.05	0.07							0.01
2001		0.16	0.26	0.15	0.13							0.02
2002		0.17	0.18	0.11	0.17							
2003	0.00	0.12	0.05	0.06	0.09							
2004	0.03	0.12	0.13	0.09	0.11							
2005	0.02	0.10	0.10	0.12								
2006	0.02	0.23	0.15	0.06								
2007	0.02	0.30	0.08	0.17								
2008	0.01	0.15	0.05	0.16								
2009	0.04	0.39	0.17	0.13								
2010	0.00	0.09	0.11	0.07								
2011	0.01	0.05	0.02	0.02								
2012		0.03	0.08	0.10								
2013		0.10	0.02	0.02								
2014		0.04		0.09								

Table 4.3.6.1. Estimates (medians, 5th percentiles, 95th percentiles) of Prefishery Abundance (PFA) for 1SW maturing salmon, 1SW non-maturing salmon, and the total cohort of 1SW salmon by year (August 1 of the second summer at sea) for NAC for the years of Prefishery Abundance, 1971 to 2015.

	Median		
Year of PFA	1SW cohort	1SW non-maturing	1SW maturing
1971	1234500	713600	519800
1972	1262000	741000	520600
1973	1568000	900700	666700
1974	1512000	811800	699200
1975	1705000	904300	799100
1976	1634000	835400	798100
1977	1304000	667000	635800
1978	807600	396800	410700
1979	1428000	837000	589400
1980	1546000	711400	832550
1981	1579000	666700	911200
1982	1327000	559900	766000
1983	845900	334300	511500
1984	892000	352800	539100
1985	1185000	526100	657800
1986	1393000	559800	833050
1987	1311000	509000	800500
1988	1263000	414800	848100
1989	921200	326700	594100
1990	851100	290100	560800
1991	737400	322600	414600
1992	787250	210000	576600
1993	695200	150000	544600
1994	513800	185400	328000
1995	563950	182900	380600
1996	711600	155000	555750
1997	468950	106900	361900
1998	540200	98670	441750
1999	546500	103700	442700
2000	641900	118200	523300
2001	468700	81820	386400
2002	496900	110900	386200
2003	528500	108200	420100
2004	559200	112000	446800
2005	654000	106900	547200
2006	652600	101900	550400
2007	587800	113400	473900
2008	727500	133200	594400
2009	505900	109100	396800
2010	742300	209300	531500
2011	759000	113700	645400
2012	675800	163100	511700
2013	537250	127000	409800
2014	688000	183300	504100
2015	827700	172600	654200
2016	NA	NA	454100

	5th percentile		
Year of PFA	1SW cohort	1SW non-maturing	1SW maturing
1971	1164000	649495	484700
1972	1203000	684200	491500
1973	1487000	821000	636600
1974	1446000	751500	662500
1975	1627000	840100	747100
1976	1554950	766095	752100
1977	1235950	606595	594900
1978	771200	368200	383100
1979	1356000	771195	557700
1980	1475000	655195	781600
1981	1507000	620300	849200
1982	1268000	523500	715500
1983	805100	304600	479895
1984	847595	321300	505095
1985	1126000	483200	615700
1986	1322000	512400	776800
1987	1252000	472500	748700
1988	1197000	382400	788400
1989	874700	298700	556100
1990	809295	265600	525900
1991	703200	300195	389495
1992	728400	178900	530600
1993	628295	133400	482300
1994	477095	164195	299895
1995	521395	164500	343795
1996	653095	139300	500700
1997	434200	95890	329695
1998	485500	87400	388795
1999	491900	90990	390700
2000	577800	104000	461800
2001	417600	72000	337200
2002	453500	97600	345100
2003	488195	95590	383500
2004	521800	97389	414000
2005	575900	93620	470100
2006	571995	88920	471900
2007	519595	98760	408495
2008	657800	112200	528900
2009	449100	96420	341400
2010	684200	177000	487900
2011	649800	97730	538300
2012	600900	136500	444800
2013	463300	103300	342300
2014	591095	148200	417900
2015	735095	139700	570600
2016	NA	NA	363100

	95th percentile		
Year of PFA	1SW cohort	1SW non-maturing	1SW maturing
1971	1305000	778310	560300
1972	1324000	801100	553305
1973	1655000	987605	698200
1974	1583000	878500	739100
1975	1790000	974500	860105
1976	1720000	909900	849600
1977	1376000	730800	682000
1978	845900	426800	439105
1979	1503000	908005	623200
1980	1620000	770900	892100
1981	1658000	715905	982500
1982	1391000	600105	820400
1983	890400	366400	545905
1984	939300	387100	572900
1985	1246000	573500	700605
1986	1467000	608500	891800
1987	1373000	548800	857300
1988	1333000	448500	910505
1989	970100	356800	634500
1990	895305	317100	596300
1991	772800	346500	440400
1992	847005	245000	623705
1993	762100	169105	607700
1994	553200	210605	357805
1995	607100	204400	418100
1996	772900	172700	613800
1997	511600	118800	402100
1998	594700	111100	493600
1999	601500	117800	494500
2000	707305	134100	586000
2001	519600	92890	435700
2002	541300	125300	427105
2003	569305	122100	457200
2004	597100	127900	480200
2005	731705	121400	622205
2006	733000	116300	629100
2007	654900	129700	538705
2008	798100	156300	658305
2009	562405	122800	450600
2010	799700	244800	576005
2011	865600	131100	749905
2012	750800	193300	578905
2013	613600	152900	479500
2014	784100	222400	590000
2015	923905	209305	739700
2016	NA	NA	542905

4.5 Figures

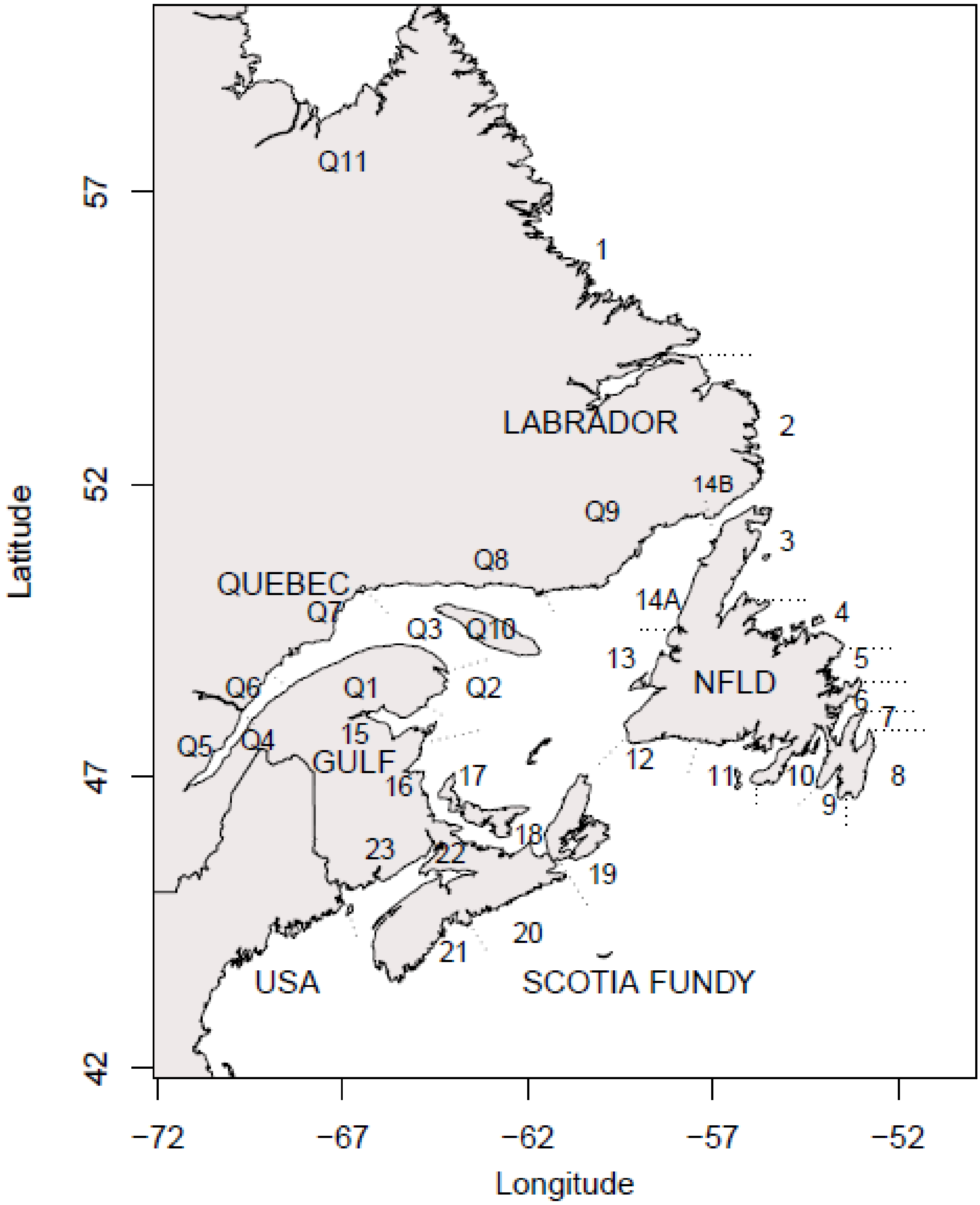


Figure 4.1.2.1. Map of Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada.

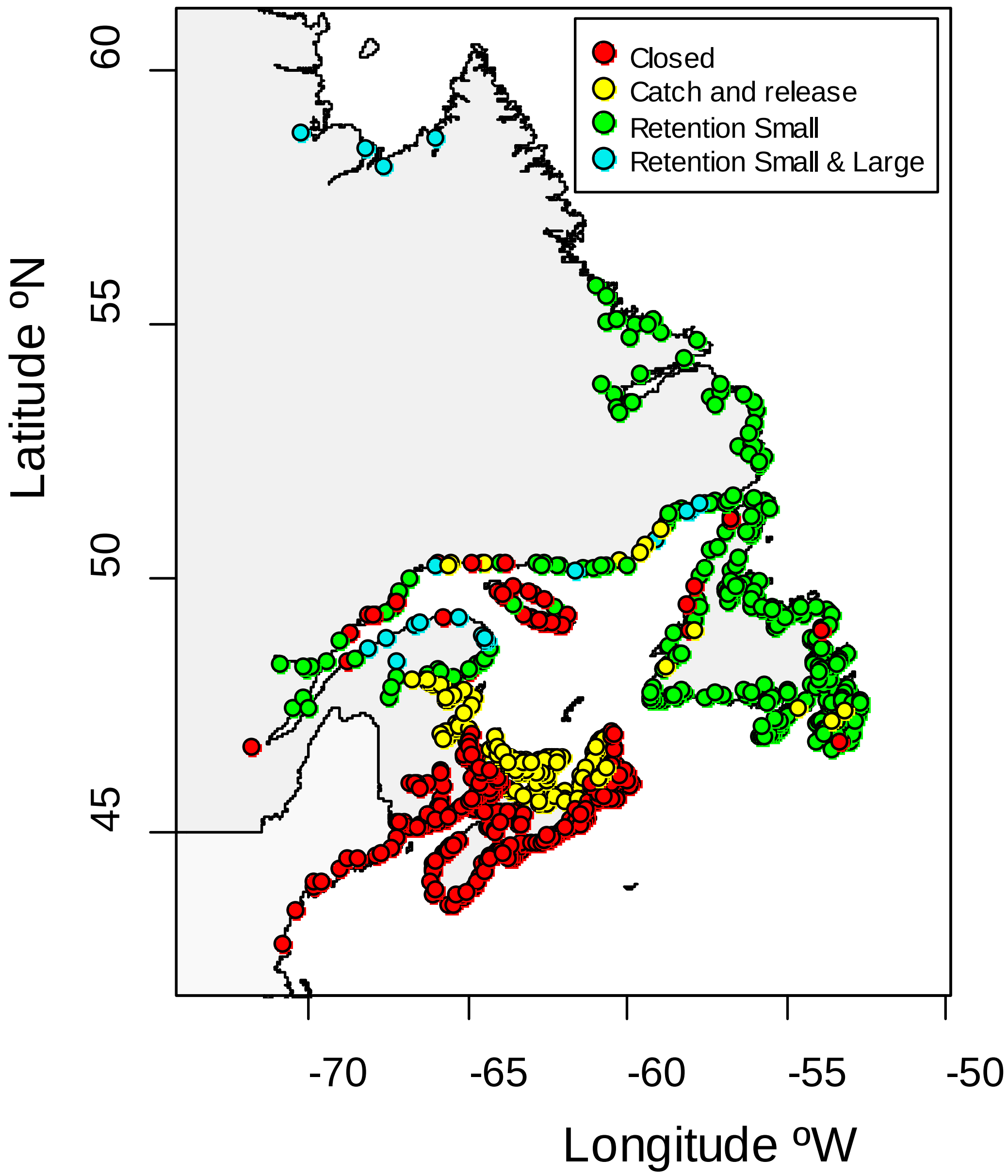


Figure 4.1.2.2. Summary of recreational fisheries management measures in Canada in 2016.

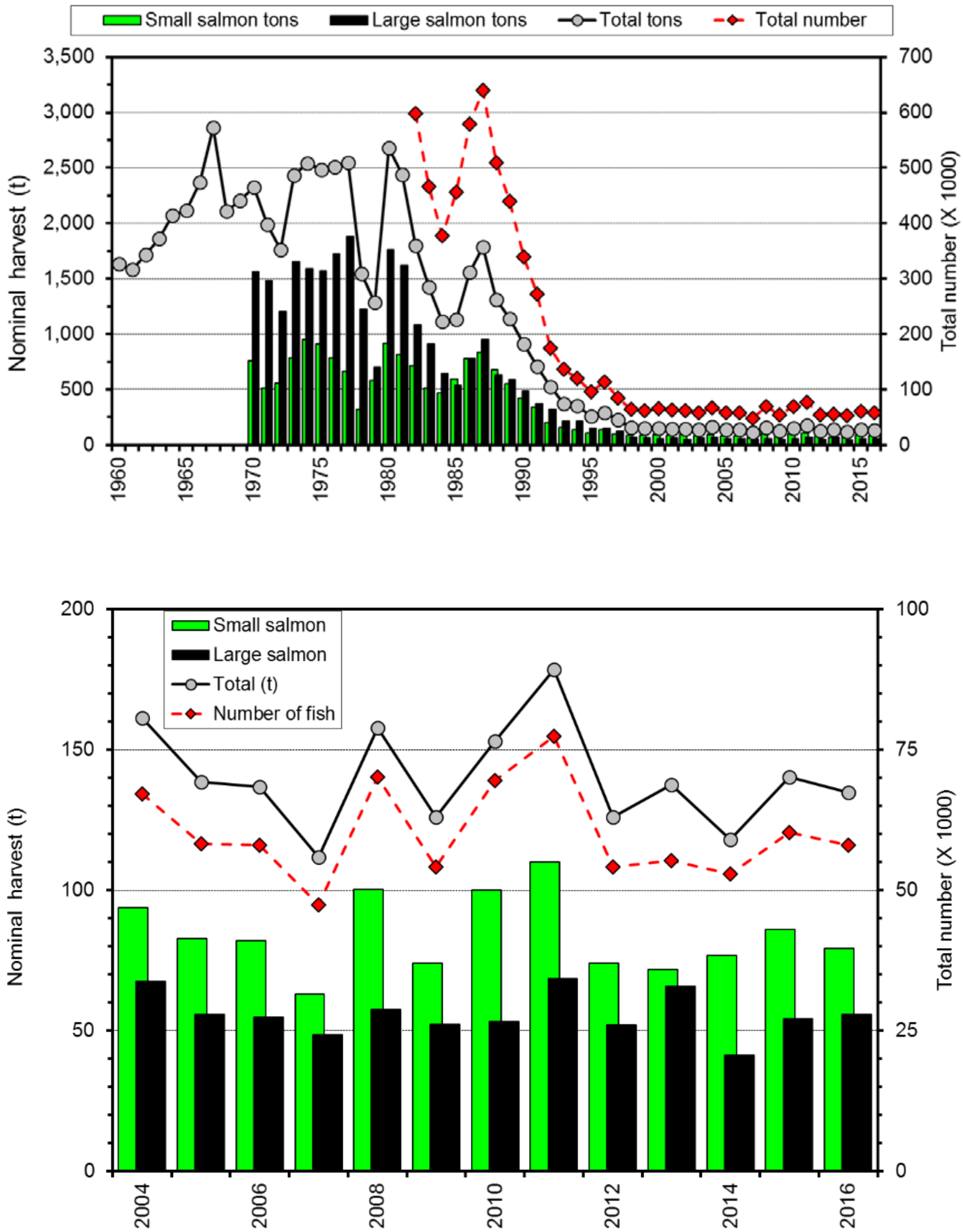


Figure 4.1.3.1. Harvest (t) of small salmon, large salmon and both sizes combined (weight and number) for Canada, 1960 to 2016 (top panel) and 2004 to 2016 (bottom panel) by all users.

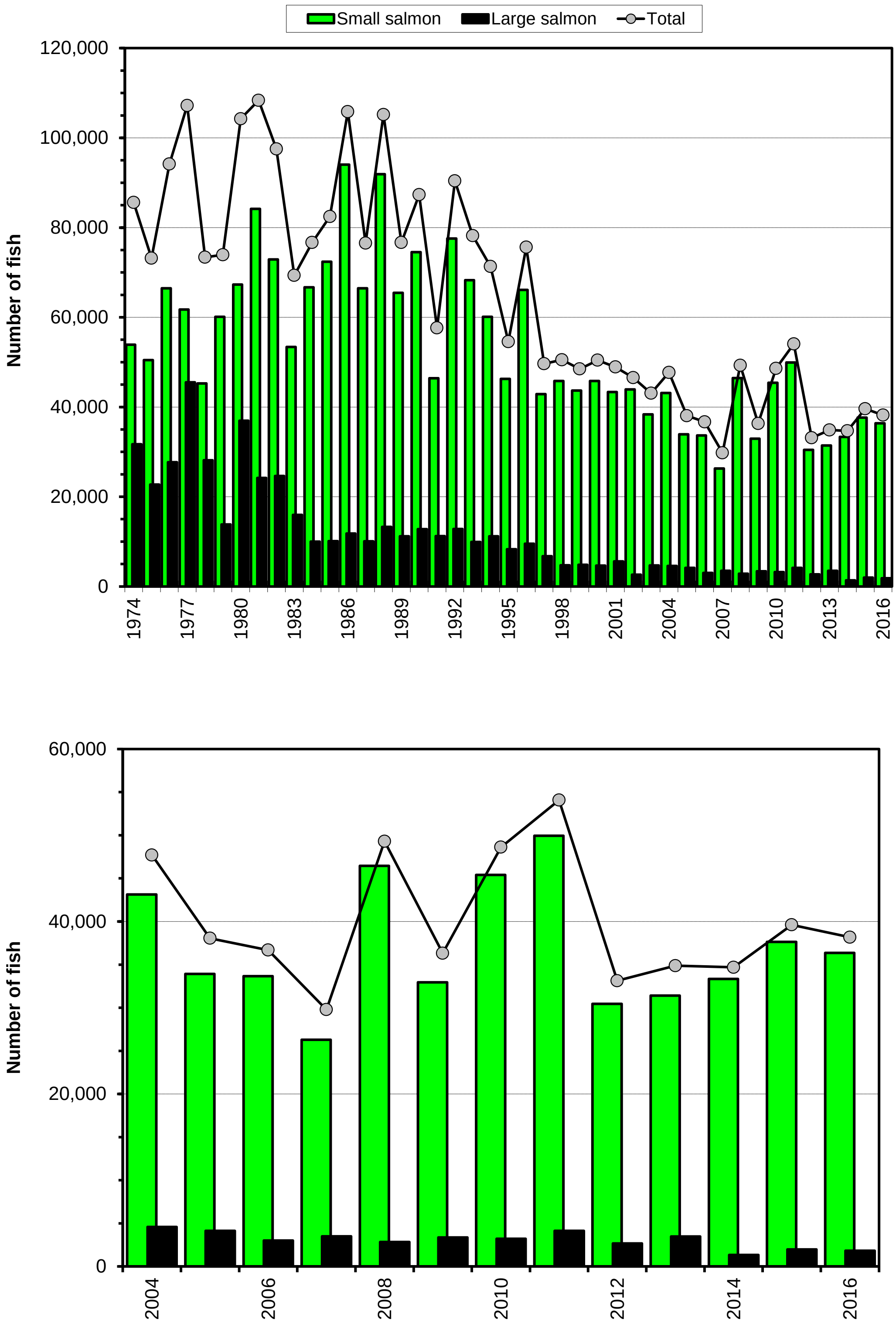


Figure 4.1.3.2. Harvest (number) of small salmon, large salmon and both sizes combined in the recreational fisheries of Canada, 1974 to 2016 (top panel) and 2004 to 2016 (bottom panel).

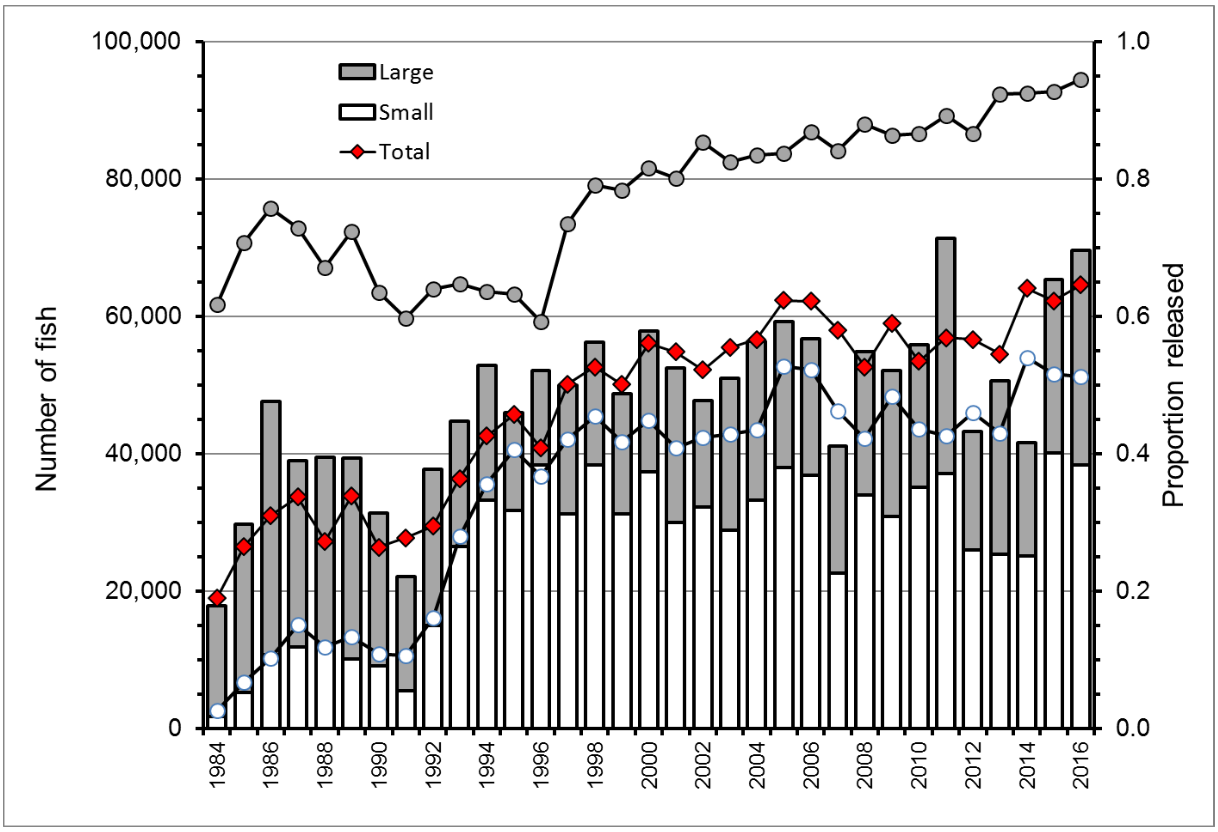


Figure 4.1.3.3. The number (bars) of caught and released small salmon and large salmon in the recreational fisheries of Canada, 1984 to 2016. Black lines represent the proportion released of the total catch (released and retained); small salmon (open circle), large salmon (grey circle), and both sizes combined (red diamond).

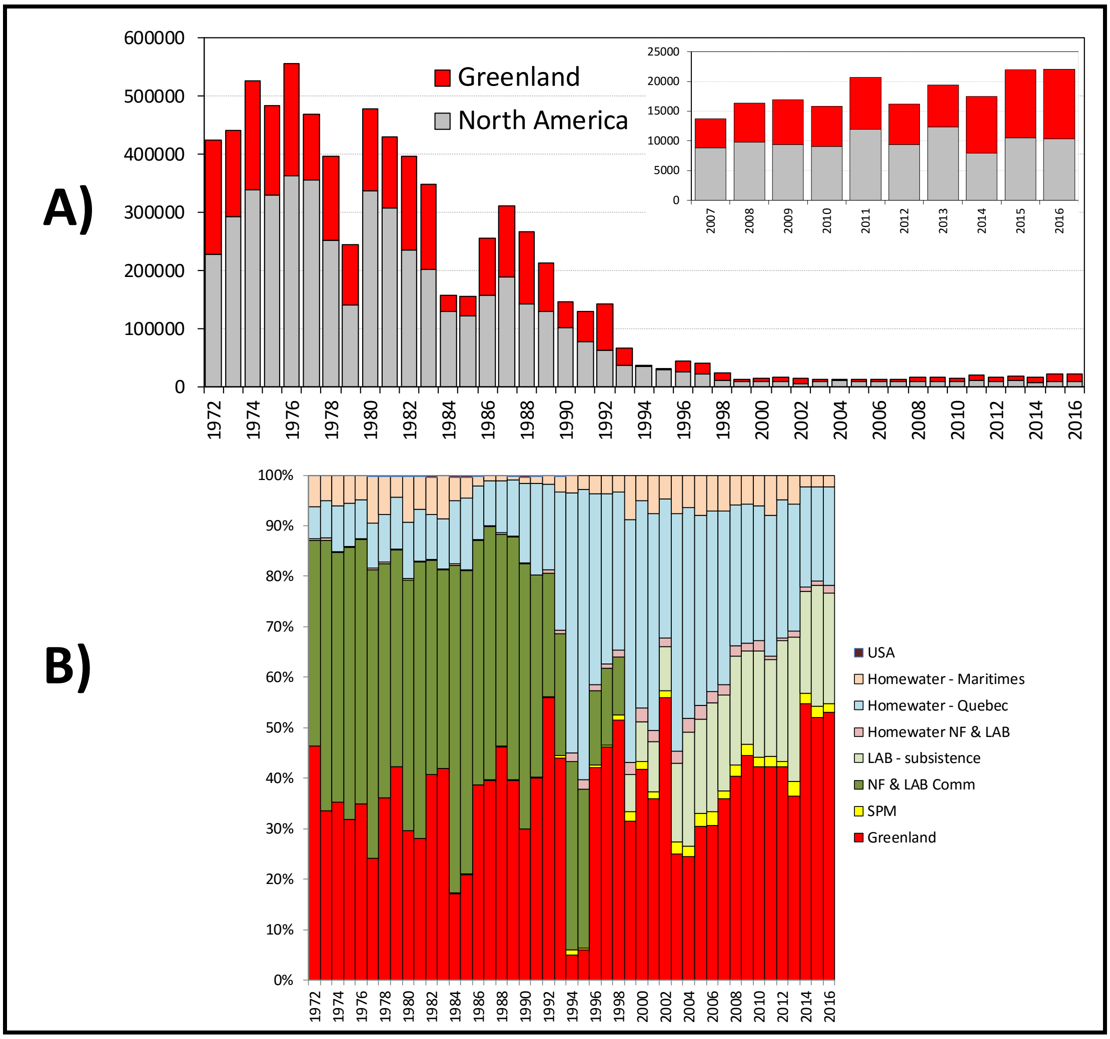


Figure 4.1.4.1. Estimates of 2SW salmon harvest equivalents (number of fish) taken at Greenland and in North America (upper panel A) and the percentages of the North American origin 2SW salmon harvest equivalents taken in various fishing areas of the North Atlantic (lower panel B), 1972 to 2016.

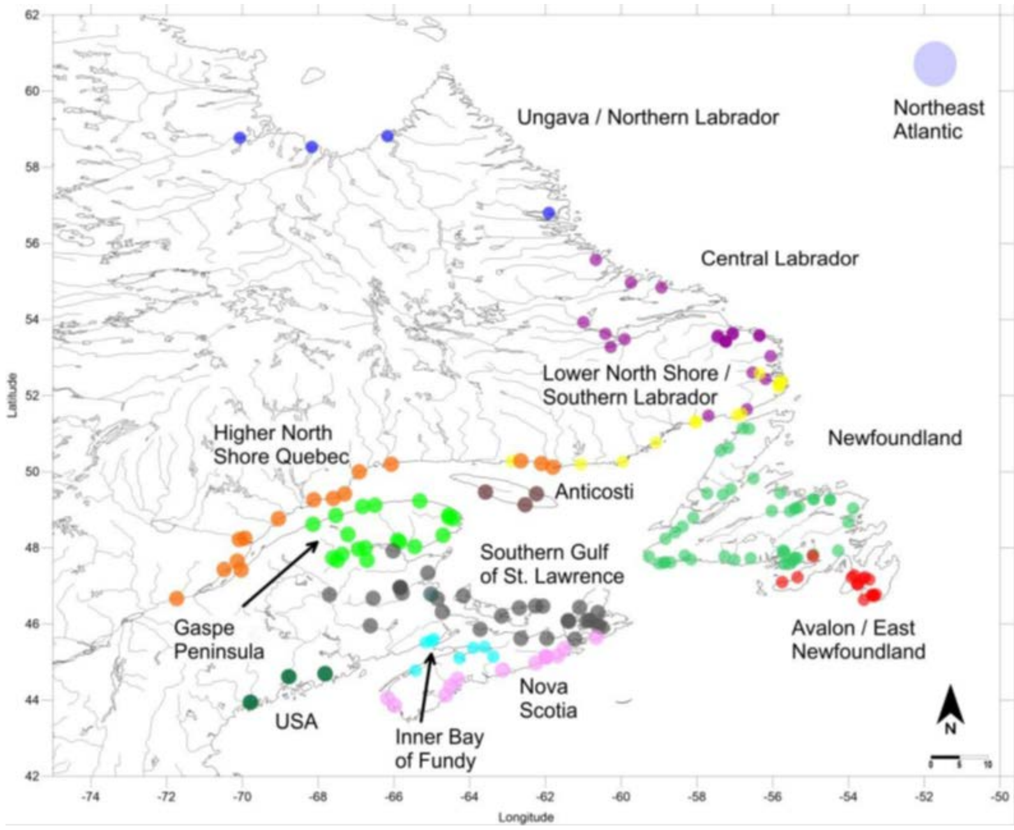


Figure 4.1.5.1. Map of sample locations used in microsatellite baseline for Atlantic salmon in North America and the twelve defined regional groups (labelled and identified by colour).

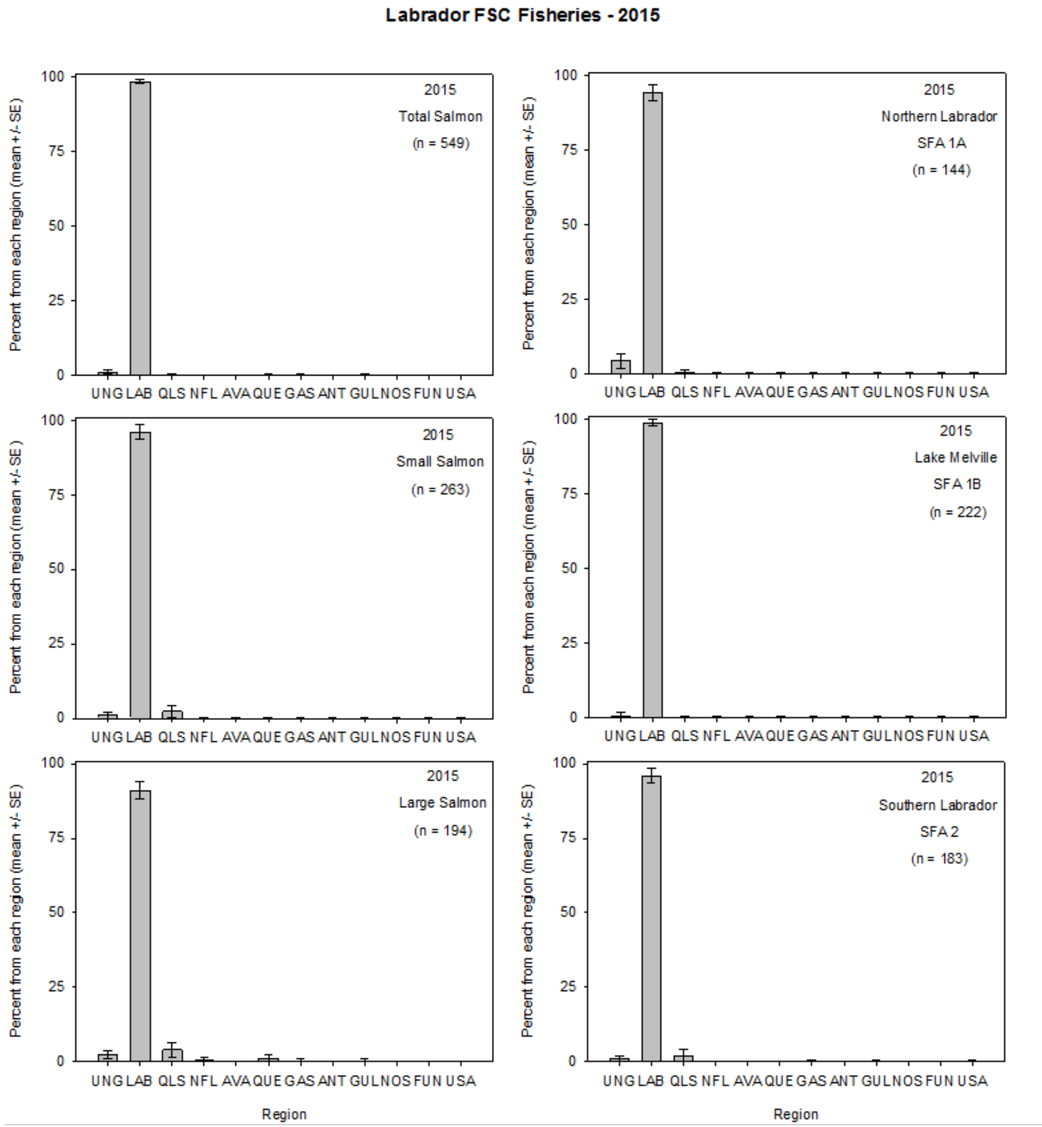


Figure 4.1.5.2. Estimated percent contributions (mean and standard error) by regional group of North American origin salmon in the 2015 Labrador FSC fisheries. Percent contributions are shown for all samples (Total), small salmon (<63 cm), large salmon (≥ 63 cm), and the three Salmon Fishing Areas in Labrador (SFA 1A – Northern, SFA 1B – Lake Melville, and SFA 2 – Southern). Regional groups are shown in Figure 4.1.5.1. Note: 92 samples did not have fish size.

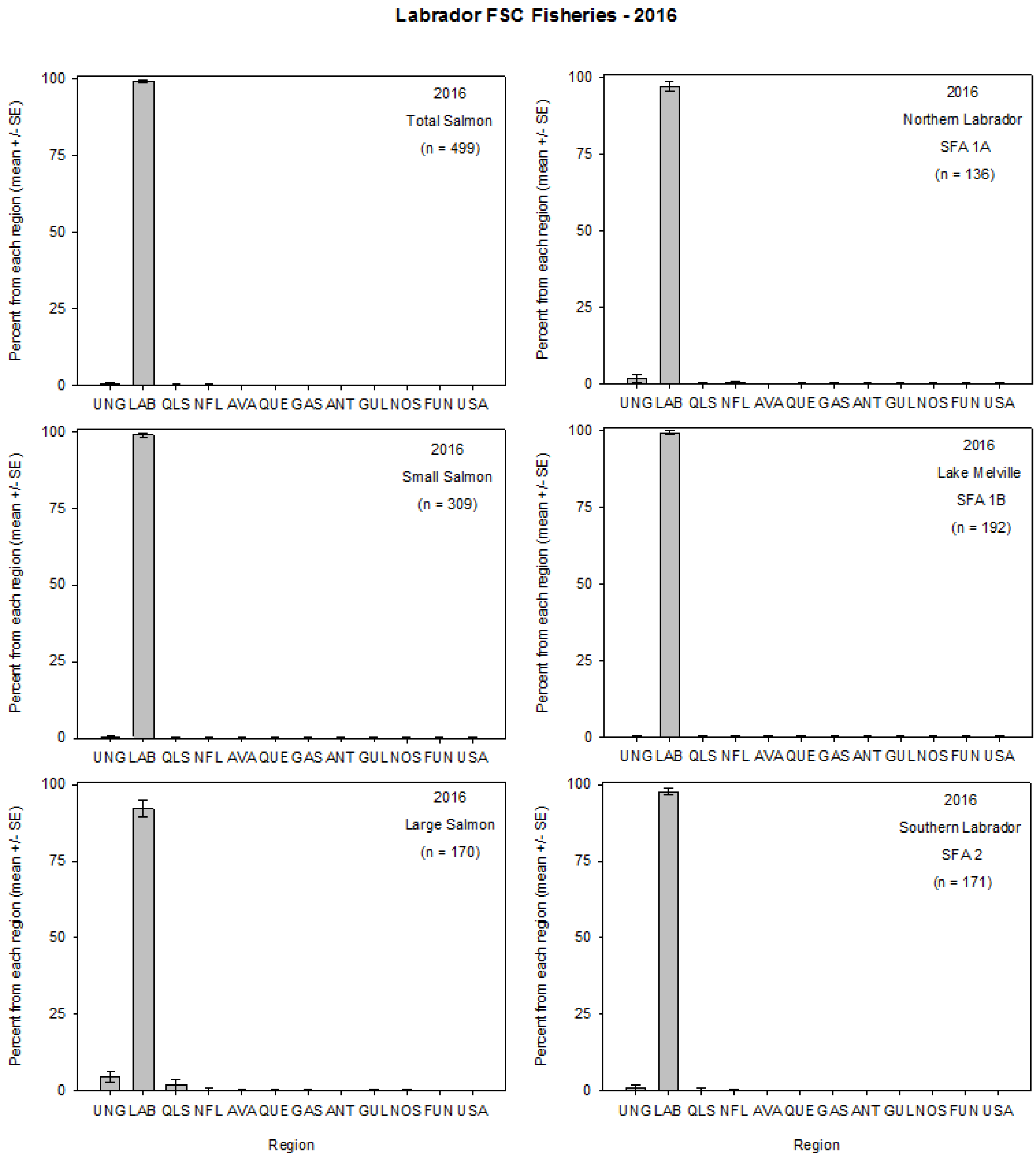


Figure 4.1.5.3. Estimated percent contributions (mean and standard error) by regional group of North American origin salmon in the 2016 Labrador FSC fisheries. Percent contributions are shown for all samples (Total), small salmon (<63 cm), large salmon (≥63 cm), and the three Salmon Fishing Areas in Labrador (SFA 1A – Northern, SFA 1B – Lake Melville, and SFA 2 – Southern). Regional groups are shown in Figure 4.1.5.1. Note: 20 samples did not have fish size.

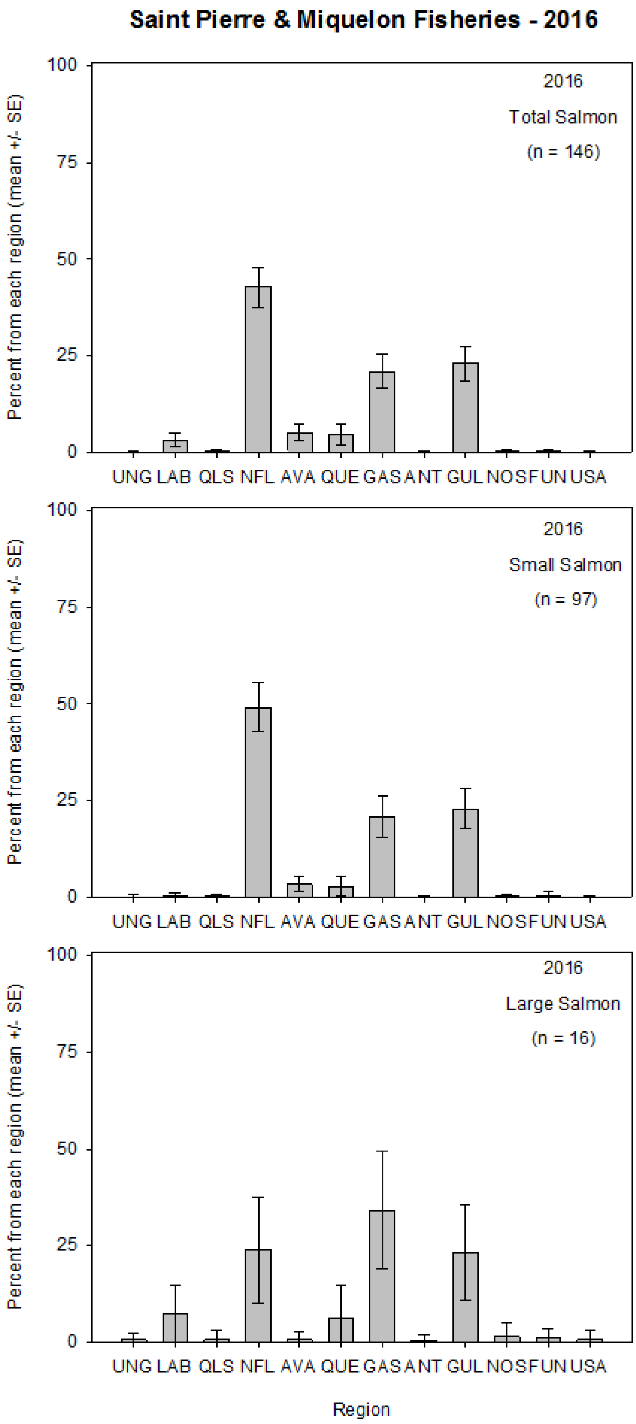


Figure 4.1.5.4. Estimated percent contributions (mean and standard error) by regional group of North American origin salmon in the 2016 Saint Pierre & Miquelon fisheries. Percent contributions are shown for all samples (Total), small salmon (<63 cm) and large salmon (≥63 cm). Regional groups are shown in Figure 4.1.5.1. Note: 33 samples did not have fish size.

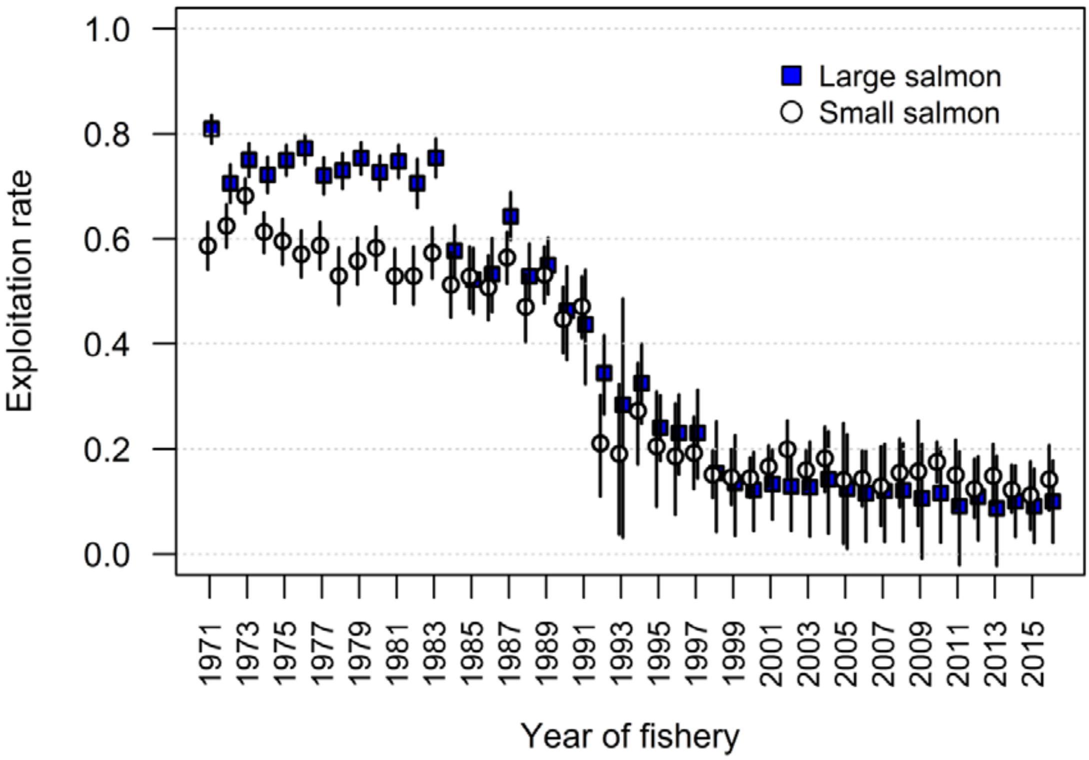


Figure 4.1.6.1. Exploitation rates in North America on the North American stock complex of small and large salmon, 1971 to 2016. The symbols are the median and the error bars are the 5th to 95th percentiles of the distributions from Monte Carlo simulation.

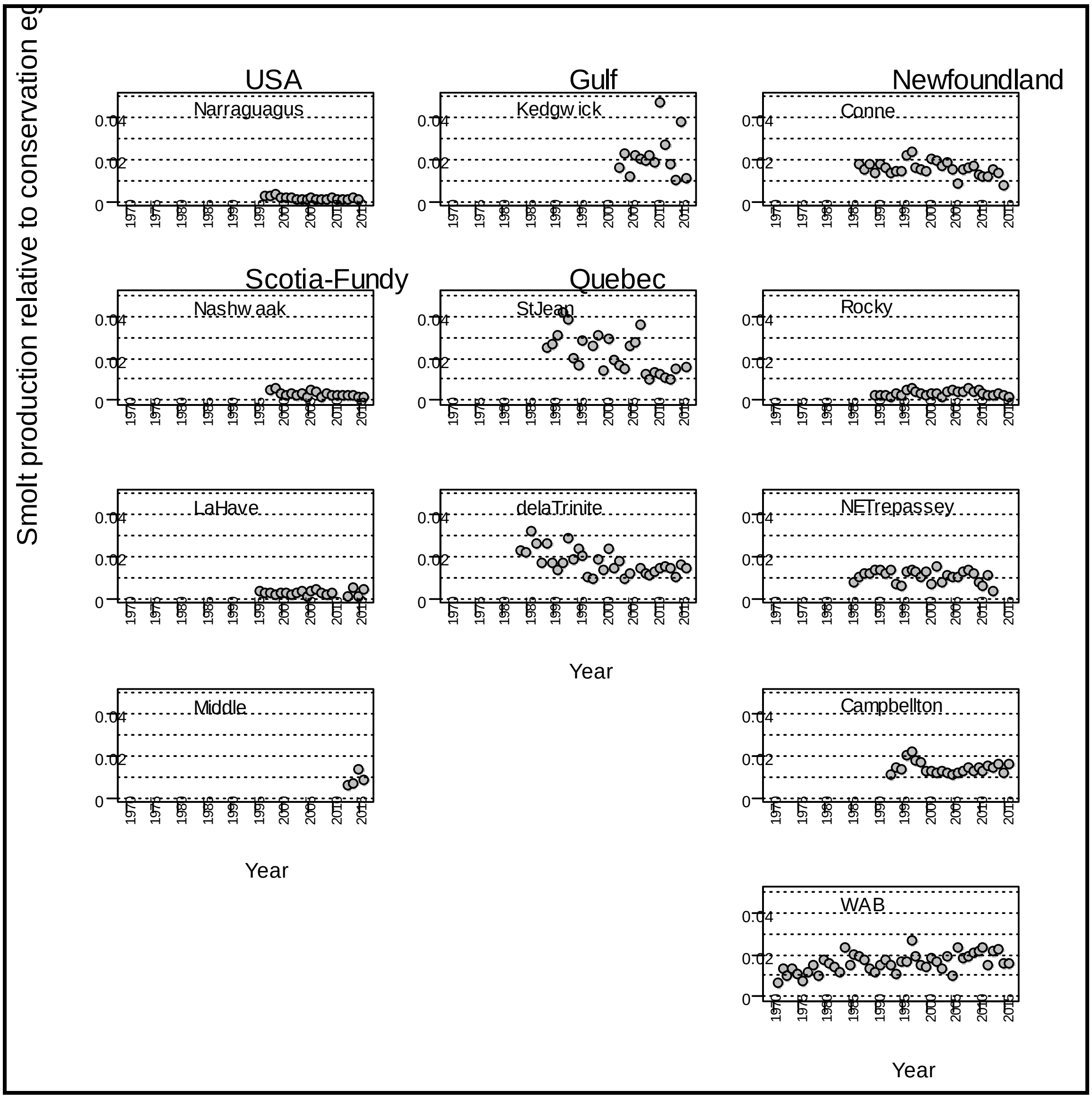


Figure 4.3.1.1 Time-series of wild smolt production from eleven monitored rivers in eastern Canada and one river in eastern USA, 1970 to 2016. Smolt production is expressed as a proportion of the conservation egg requirements for the river. The Unama'ki Institute of Natural Resources began monitoring smolts on Middle River (Scotia-Fundy) in 2011, and smolt population estimates are available for 2013–2016.

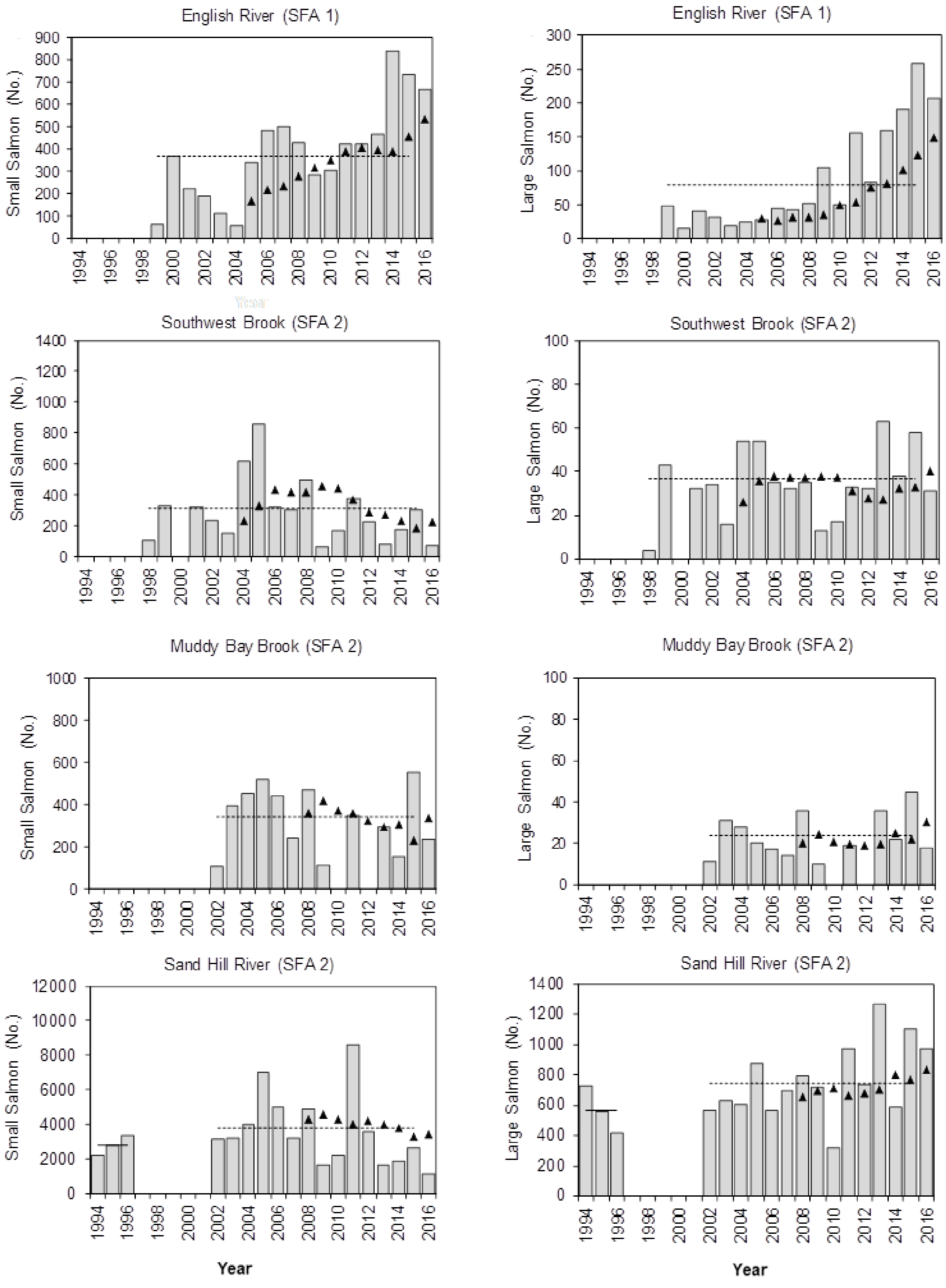


Figure 4.3.2.1. Total returns of small salmon (left column) and large salmon (right column) to English River (SFA 1), Southwest Brook (Paradise River) (SFA 2), Muddy Bay Brook (SFA 2) and Sand Hill River (SFA 2), Labrador, 1994–2016. The solid horizontal line represents the pre-moratorium (commercial salmon fishery in Newfoundland and Labrador) mean, the dashed line the moratorium mean, and the triangles the previous six-year mean.

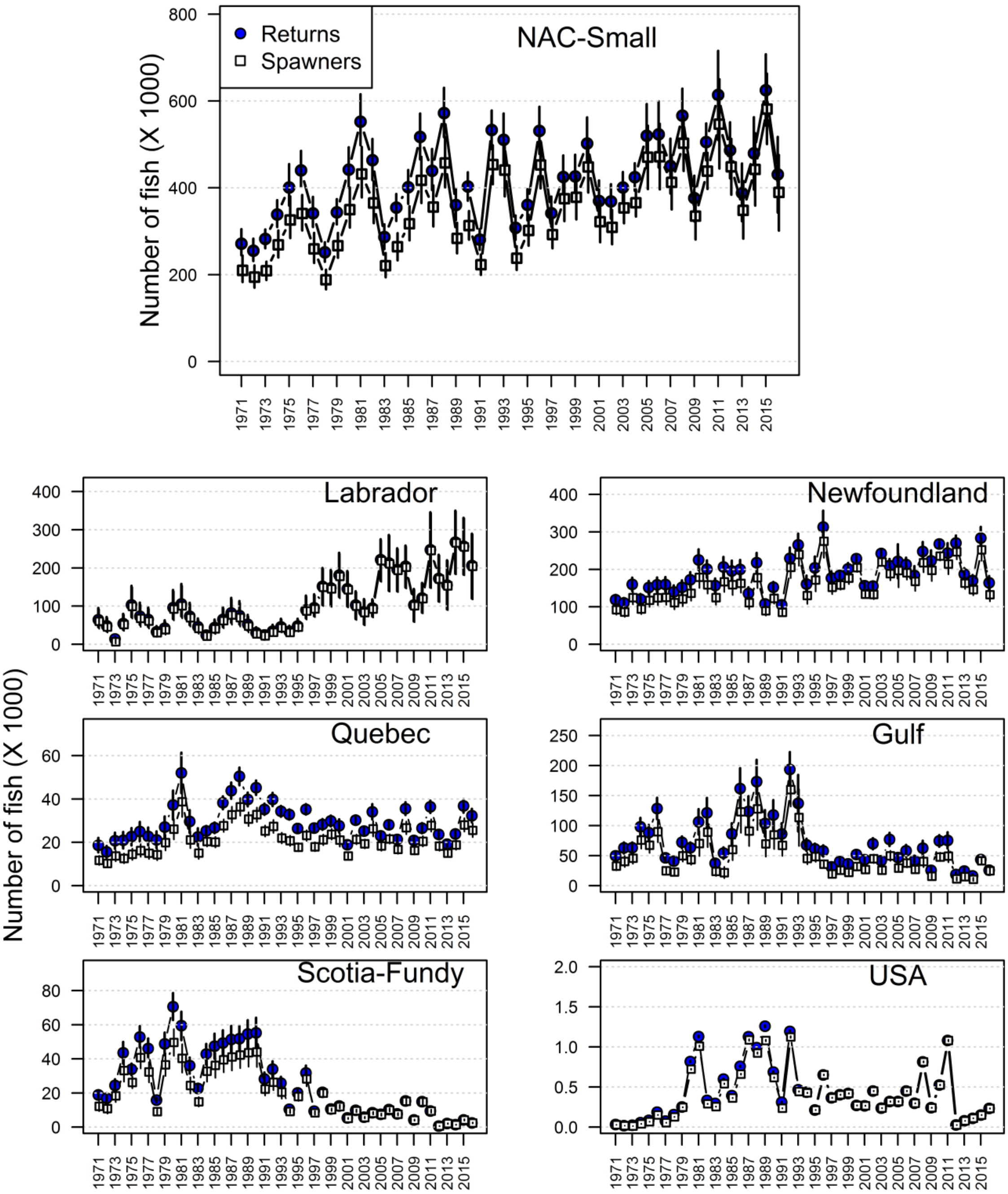


Figure 4.3.2.2. Estimated (median, 5th to 95th percentile range) returns (shaded circles) and spawners (open square) of small salmon for NAC and to each of the six regions 1971 to 2016. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

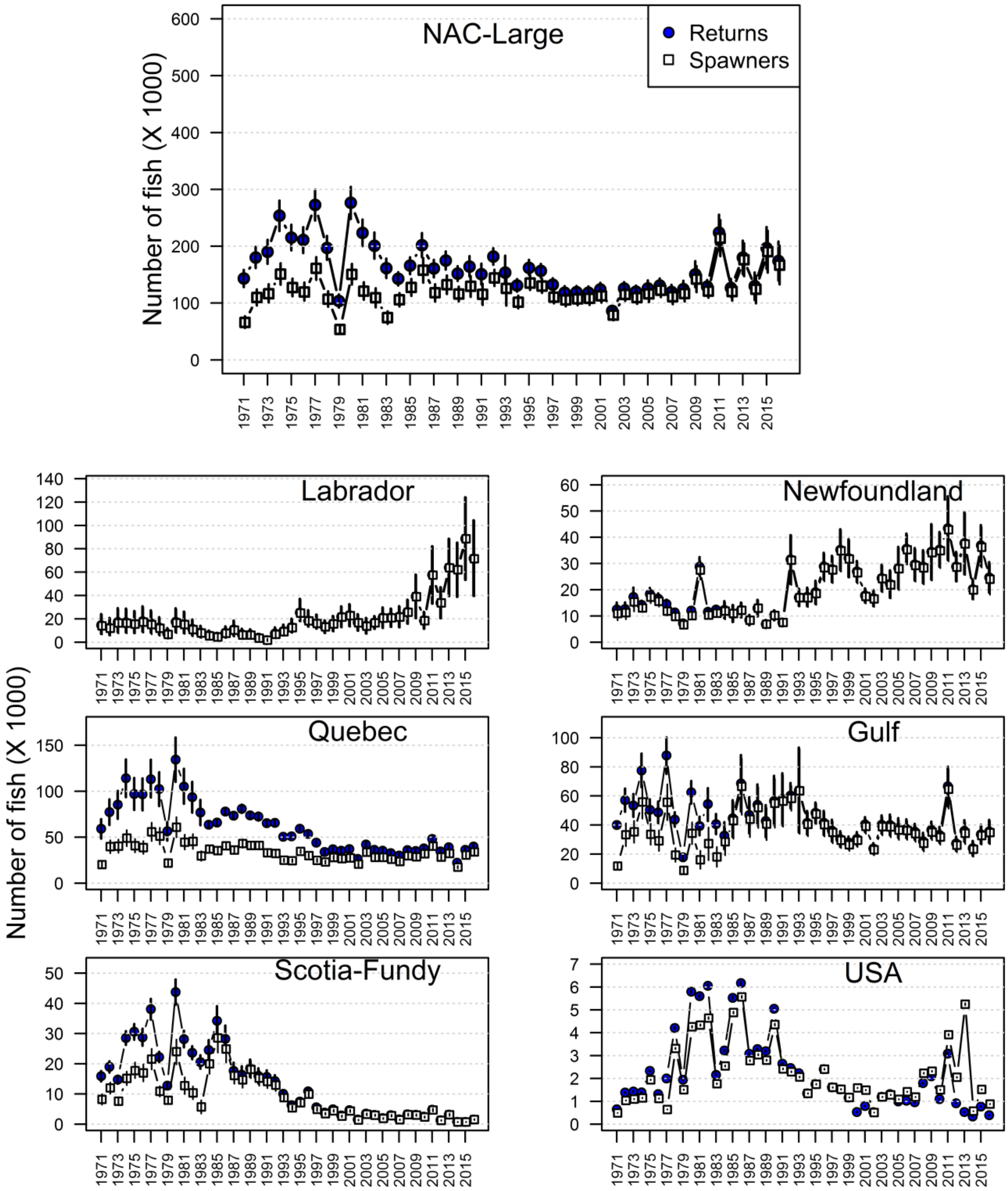


Figure 4.3.2.3. Estimated (median, 5th to 95th percentile range) returns (shaded circles) and spawners (open square) of large salmon for NAC and to each of the six regions 1971 to 2016. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. For USA estimated spawners exceed the estimated returns due to adult stocking restoration efforts.

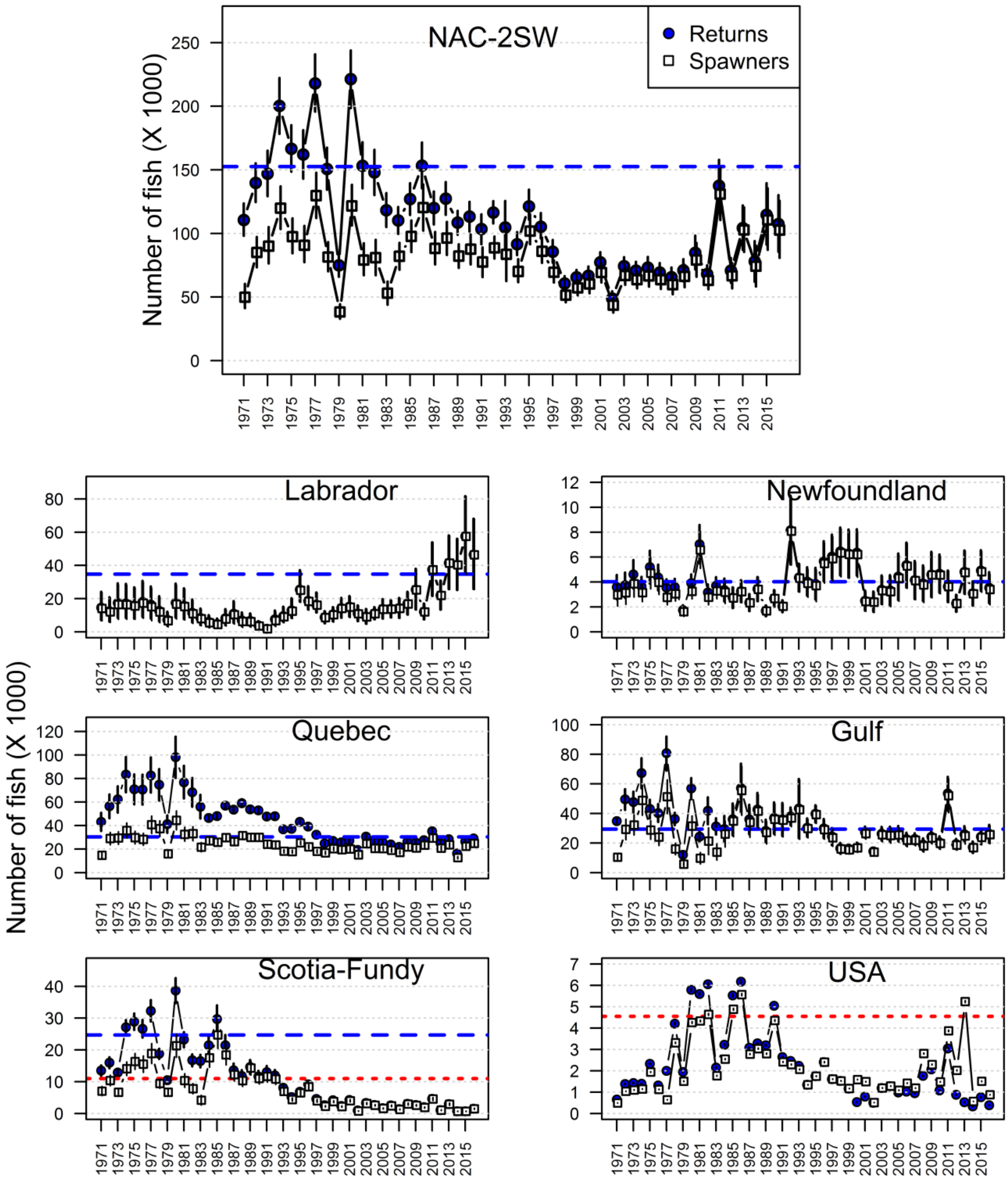


Figure 4.3.2.4. Estimated (median, 5th to 95th percentile range) returns (shaded circles) and spawners (open square) of 2SW salmon for NAC and to each of the six regions 1971 to 2016. The dashed line is the corresponding 2SW Conservation Limit for NAC overall and for each region; the 2SW CL for USA (29 990 fish) is off the scale in the plot for USA. The dotted line in the Scotia-Fundy and USA panels are the region specific management objectives. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. For USA estimated spawners exceed the estimated returns due to adult stocking restoration efforts; therefore, 2SW returns are assessed relative to the management objective for USA.

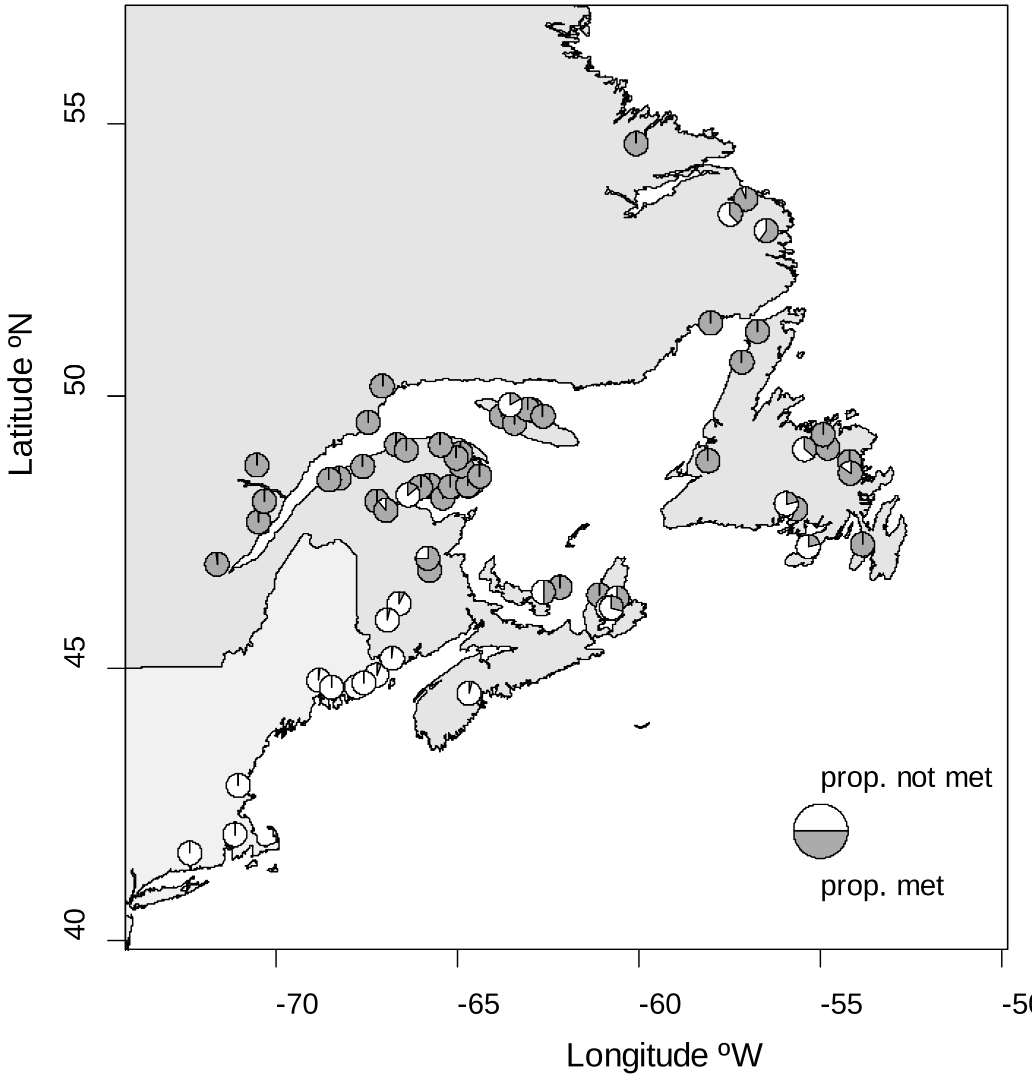


Figure 4.3.4.1. Proportion of the conservation requirement attained in the 70 assessed rivers of the North American Commission area in 2016.

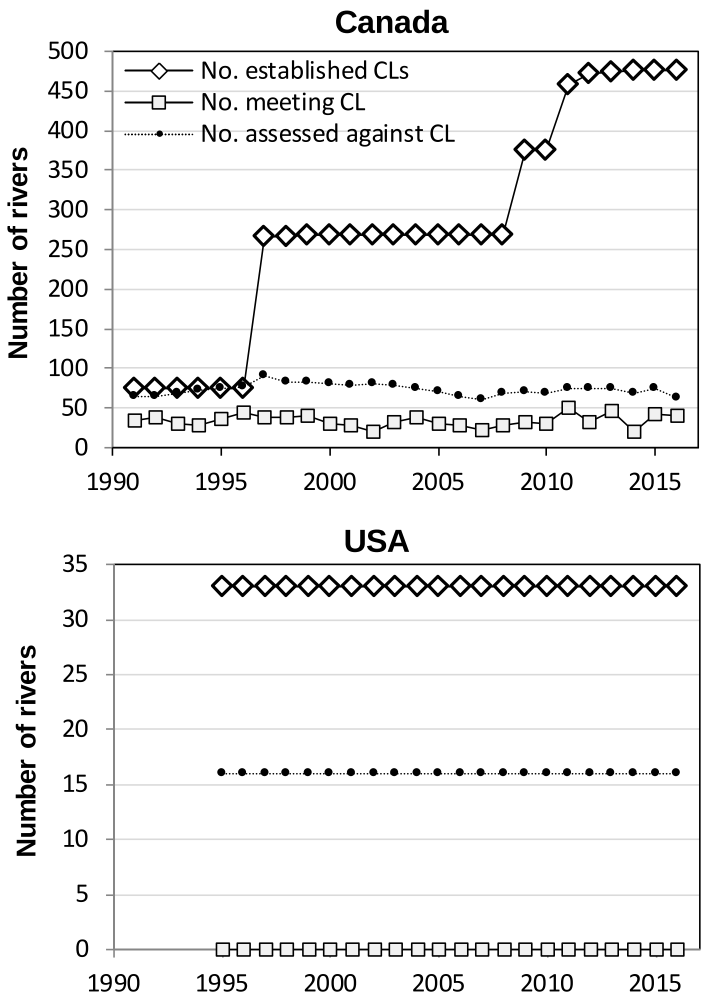


Figure 4.3.4.2. Time-series for Canada and the USA showing the number of rivers with established CLs, the number rivers assessed, and the number and percent of assessed rivers meeting CLs, for the period 1991 to 2016.

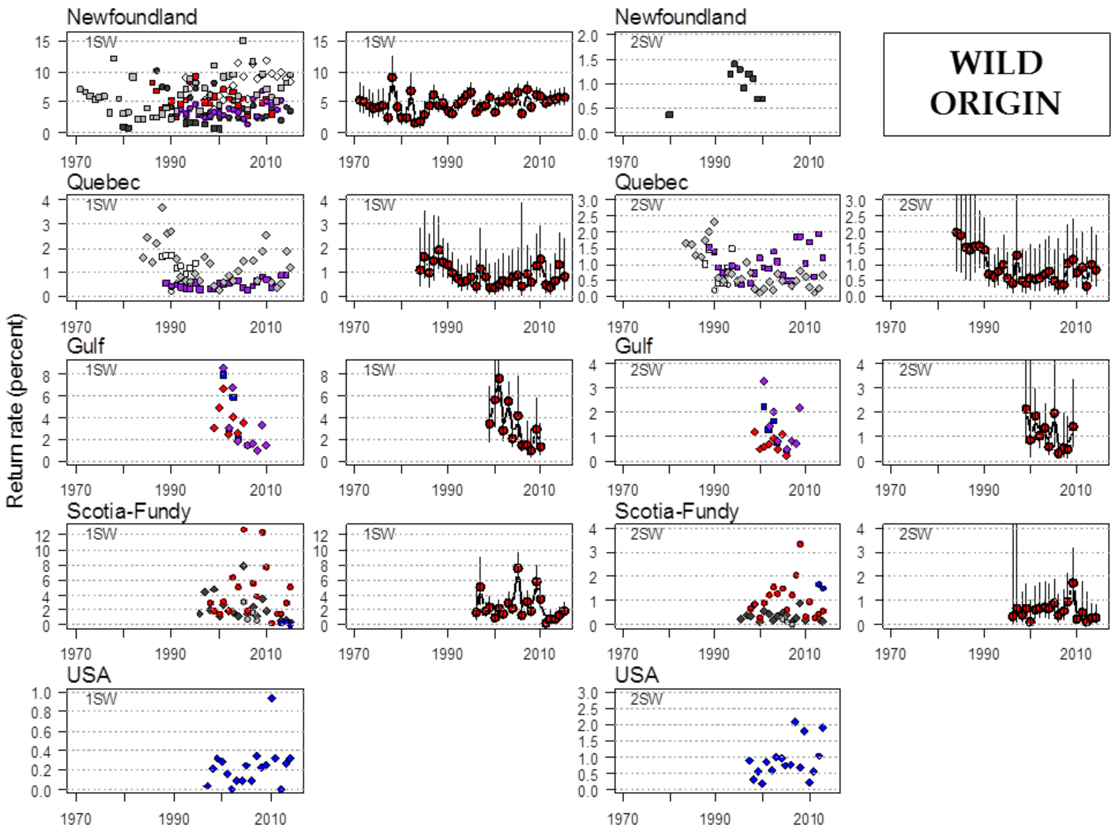


Figure 4.3.5.1. Estimated annual return rates (left and third column of panels; individual rivers are shown with different symbols and colours) and least squared (or marginal mean) average annual return rates, (with one standard error bars) (second and right column of panels) of wild origin smolts to 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. Note y-scale differences among panels. Standardized rates are not shown for regions with a single population.

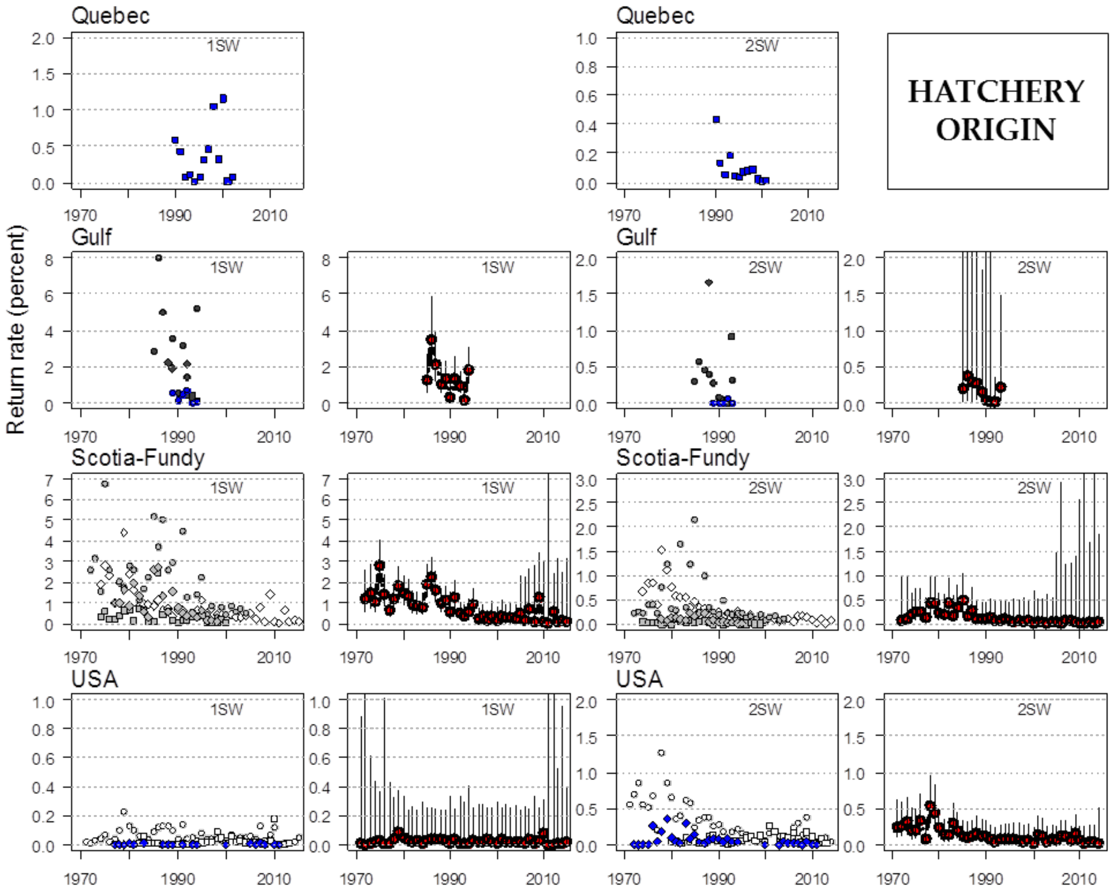


Figure 4.3.5.2. Estimated annual return rates (left and third column of panels; individual rivers are shown with different symbols and colours) and least squared (or marginal mean) average annual return rates (with one standard error bars) of hatchery origin smolts to 1SW and 2SW salmon to the geographic areas of North America. The standardized values are annual means derived from a general linear model analysis of rivers in a region. Note y-scale differences among panels. Standardized rates are not shown for regions with a single population.

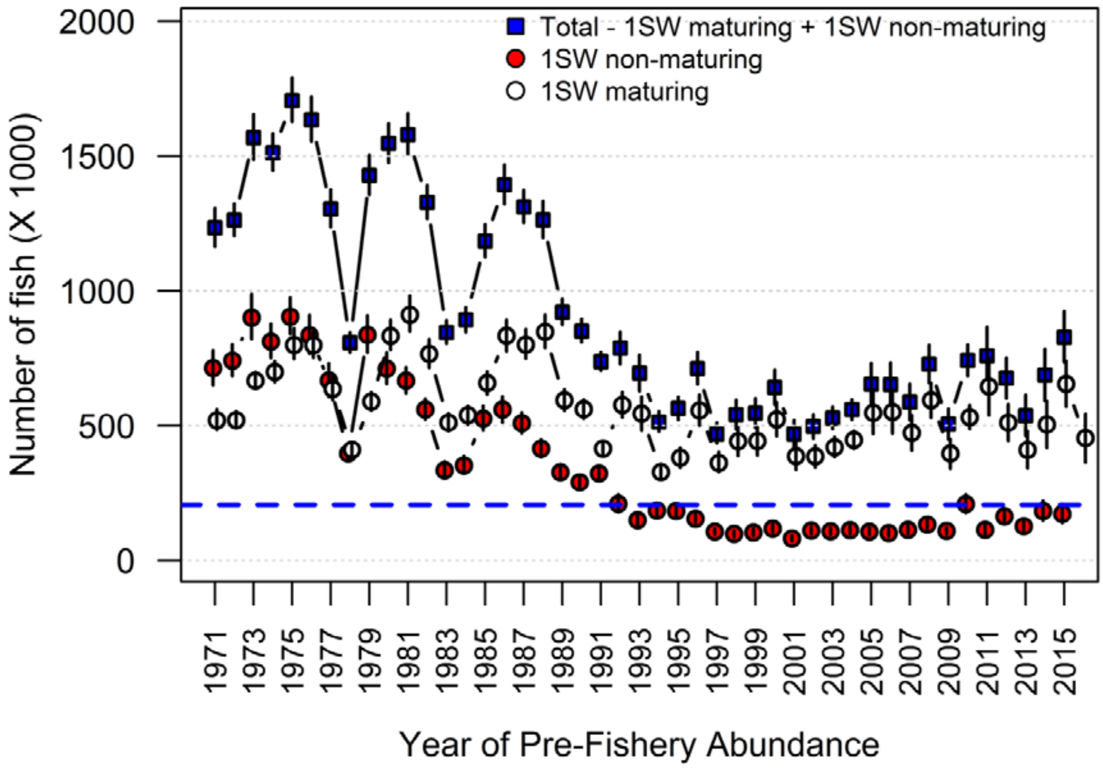


Figure 4.3.6.1. Estimated (median, 5th to 95th percentile range) Prefishery Abundance (PFA) for 1SW maturing, 1SW non-maturing, and total cohort of 1SW salmon for NAC, PFA years 1971 to 2015. The dashed blue horizontal line is the corresponding sum of the 2SW conservation limits for NAC (152 548), corrected for 11 months of natural mortality (205 918) against which 1SW non-maturing are assessed.

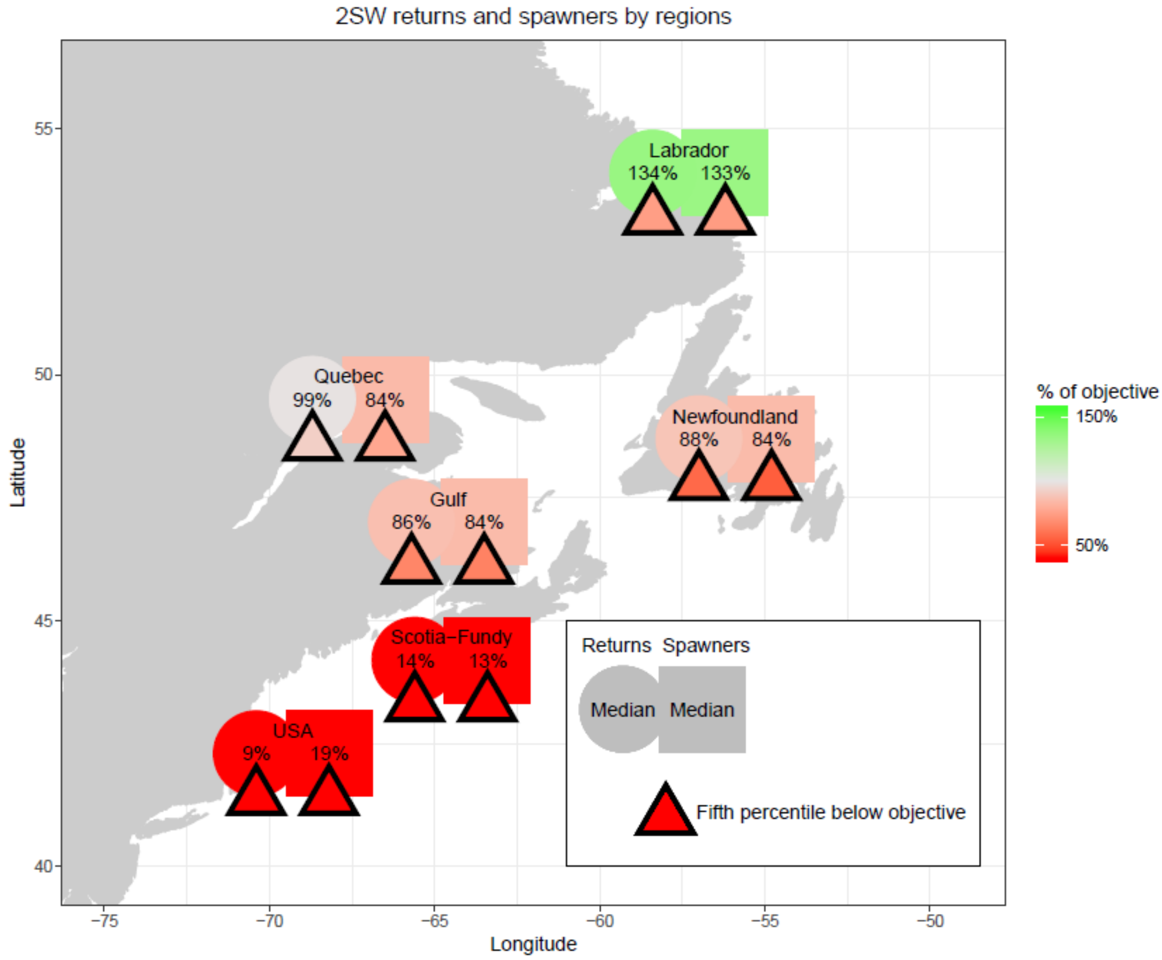


Figure 4.3.7.1. Medians of the estimated returns (square symbol) and spawners (circle symbol) of 2SW salmon in 2016 to six regions of North America expressed as a percentage of the 2SW CLs for the four northern regions and to the rebuilding management objectives for the two southern areas. The colour shading of the symbols represents the percentage of the CL or rebuilding objective attained, with red less than 100% and green >100%. The triangular symbols accompanying the respective returns and spawners symbols are indicated when the 5th percentiles of the estimates are below the CLs or management objective, i.e. the stocks are at risk of or suffering reduced reproductive capacity. The intensity of the red colour shading is inversely associated with the percentage of the objective attained.

5 Atlantic salmon in the West Greenland Commission

5.1 NASCO has requested ICES to describe the events of the 2016 fishery and status of the stock

The previous advice provided by ICES (2015) indicated that none of the stated management objectives would allow a mixed-stock fishery at West Greenland to take place in 2015, 2016, or 2017. The NASCO Framework of Indicators for the West Greenland Commission, run in 2016, did not indicate the need for a revised analysis of catch options and therefore no new management advice for the 2016 fishery was provided (ICES, 2016a). This year's Framework of Indicators assessment of the contributing stock complexes confirms the 2015 assessment and therefore no new advice is provided for the 2017 fishery.

The Atlantic salmon fishery is regulated according to the Government of Greenland Executive Order No 12 of August 1, 2012. Since 1998, with the exception of 2001, the export of Atlantic salmon has been banned. From 2002–2011 there have been two landing categories reported for the fishery: commercial landings where licensed fishers can sell salmon to hotels, institutions and local markets and private landings where both licensed and unlicensed fishers fish for private consumption. During 2012 to 2014 (for the first time since 2001), licensed fishers were additionally allowed to land to factories and a 35 t factory quota was set by the Greenland authorities. This quota was reduced to 30 t in 2014. The quota did not apply to the commercial or private landings and the export ban persisted as the landed salmon could only be sold within Greenland. In 2015, the Government of Greenland unilaterally set a quota for all components of the fishery (private, commercial, and factory landings) to 45 t as a quota could not be agreed by all parties of the West Greenland Commission of NASCO (NASCO, 2015; see WGC(15)21). The Government of Greenland did agree that any overharvest in a particular year would result in an equal reduction in the catch limit in the following year and as a result of an overharvest in 2015, the 2016 quota was unilaterally set by Greenland to 32 t. The export ban persists as the landed salmon could only be sold within Greenland.

Only hook, fixed gillnets and driftnets are allowed to target salmon directly and the minimum mesh size has been 140 mm (stretched mesh) since 1985. Fishing seasons have varied from year to year, but in general the season has started in August and continued until the quota has been met or until a specified date later in the season, typically the end of October. From 2005-2014, the fishing season has been from 1 August to 31 October. Starting in 2015, the Government of Greenland delayed the opening of the fishery until 15 August with a closing date of 31 October. In 2015, factory landings were only allowed from 9 October to the end of the season on 31 October. Factory landings were not allowed in 2016.

5.1.1 Catch and effort in 2016

Catch data were collated from fisher reports. The reports were screened for errors and missing values. Catches were assigned to NAFO/ICES area based on the reporting community. Reports which contained only the total number of salmon caught or the total catch weight without the number of salmon, were corrected using an average of 3.25 kg gutted weight per salmon. Since 2005 it has been mandatory to report gutted weights, and these have been converted to whole weight using a conversion multiplier of 1.11.

In 2016, catches were distributed among the six NAFO Divisions on the west coast of Greenland and in ICES Division XIV (East Greenland) (Tables 5.1.1.1 and 5.1.1.2; Figure 5.1.1.1). A total catch of 27.1 t of salmon was reported for the 2016 fishery compared to 56.8 t of salmon in the 2015 fishery (Tables 5.1.1.1 and 5.1.1.2). For West Greenland only, 25.7 t were reported in 2016 and 55.9 t in 2015. A harvest of 1.5 t was reported from East Greenland in 2016, accounting for 5.4% of the total reported catch. Harvest reported for East Greenland is not included in assessments of the contributing stock complexes, owing to a lack of information on the stock composition of that fishery. Catches of Atlantic salmon decreased until the closure of the export commercial fishery in 1998, but the internal use only fishery has been increasing in recent years, although the 2016 reported landing is the lowest since 2009 (Figure 5.1.1.2).

Of the total catch (27.1 t), 8.7 t was reported as being commercial and 18.4 t for private consumption (Table 5.1.1.3; Figure 5.1.1.2). Private landings (from licensed and unlicensed fishers combined) were approximately equal to the 2015 total (19.2 t) whereas the commercial landings were lower than the 2015 value (33.8 t).

A total of 72% (19.4 t) of the reported landings came from licensed fishers and 28% (7.7 t) came from unlicensed fishers (Table 5.1.1.3). For private landings, 41% (7.6 t) came from unlicensed fishers and 59% (10.8 t) were reported by licensed fishers. Although not allowed to sell their catch, 0.4% (0.1 t, approximately 30 fish) of the commercial landings was reported as coming from unlicensed fishers.

There is currently no quantitative approach for estimating the unreported catch for the private fishery, but the 2016 value is likely to have been at the same level proposed in recent years (10 t), as reported by the Greenlandic authorities. The 10 t estimate was historically meant to account for private non-licensed fishers in smaller communities fishing for personal consumption, but not reporting landings. This estimate was not meant to represent underreporting by commercial fishers as the Working Group previously did not have a method for estimating that amount until recently with the implementation of the phone survey. An adjustment for some unreported catch, primarily for commercial landings, has been done since 2002 by comparing the weight of salmon seen by the sampling teams and the corresponding community-specific reported landings for the entire fishing season (commercial and private landings combined, see Section 5.1.2). However, sampling only occurs during a portion of the fishing season and therefore these adjustments are considered to be minimum adjustments for unreported catch.

The seasonal distribution of catches has previously been reported to the Working Group (ICES, 2002). However since 2002, this has not been possible. Although fishers are required to record daily catches, previous comparisons of returned catch reports suggest that many fishers do not provide daily statistics. The seasonal distribution for factory landings, when allowed, is assumed to be accurate given the reporting structure in place between the factories and the Greenland Fisheries Licence Control Authority (GFLK).

The Working Group is aware of the updated reporting requirements for the 2015 fishery, but they did not receive the detailed returns from the 2016 fishery and therefore no further evaluation of the seasonal distribution of the fishery was conducted. Information on the seasonal distribution of the 2016 reported landings was made available to the Working Group (Figure 5.1.1.3). A small amount (78 kg) of harvest was reported in week 32 in 2016, which was before the August 15 opening of the fishing season. The data do seem to reflect general spatial/temporal patterns of the fishery (early reported landings in the southern regions (1D–1F), later reported landings in the northern regions (1A–1C), low landings in the northernmost regions (1A–1B)). However, given the recent changes in the reporting requirements and the uncertainty of the accuracy of the data, the Working Group did not formally compare reported landings by standard week and community to the sampling data to evaluate if non-reporting was evident.

Greenland Authorities issued 263 licences (Table 5.1.1.4) and received 503 reports from 143 fishers (three additional fishers were identified as reporting, but their NAFO division was unknown and they are not included in Table 5.1.1.4) in 2016 compared to 938 reports from 189 fishers out of 310 licences in 2015 and 669 reports from 114 fishers out of 321 licences in 2014. The number of licences issued, the number of fishers who reported, and the number of reports received decreased from 2015. These levels remain well below the 400 to 600 people reporting landings in the commercial export fishery from 1987 to 1991. The total number of fishers reporting catches from all areas has increased from a low of 41 in 2002 to its current level. The number of licences issued has risen slightly since 2003 as has the number of fishers reporting catches (Figure 5.1.1.4). Over this same time period the number of reports received has increased greatly, but a large decrease was noted in 2016. This trend appears to be driven by the licensed fishers as the number of unlicensed fishers reporting catches is lower than the licensed fishers.

The Working Group previously reported on the procedures for reporting salmon harvested in Greenland (ICES, 2014) and modifications to these procedures were made by the Government of Greenland in 2015. In summary, private, and commercial landings are required to be reported to GFLK by e-mail, phone, fax, or return logbook on a daily basis. Factory landings are submitted to GFLK either on a daily or weekly basis, depending on the likelihood of exceeding a quota. However, both the 2014 factory only quota and the 2015 total quota were exceeded (Figure 5.1.1.2) due to reporting issues (ICES, 2015; ICES, 2016a). No modifications to reporting procedures were noted for 2016.

Similar information is requested for factory, commercial and private fisher landings. Requested data includes fishing date, location, and information on catch and effort required for the calculation of catch per unit of effort statistics. These types of data allow for a more accurate characterization and assessment of the nature and extent of the fishery than is currently available. The Working Group did not receive any detailed statistics beyond reported landings and licence related information by community and NAFO Divisions and therefore could not further characterize and assess the fishery beyond what is currently presented. The Working Group has previously been informed that this level of detail is often lacking from commercial and private landing reports. The variations in the numbers of people reporting catches, variation in reported landings in each of the NAFO Divisions and documentation of underreporting of landings (ICES, 2016a) suggest that there are inconsistencies in the catch data and highlights the need for better data. The Working Group recommends that efforts to improve the reporting system of catch in the Greenland fishery continue and that detailed statistics related to spatially and temporally explicit catch and effort data should be made available to the Working Group for analysis.

5.1.2 Results of phone surveys and appropriateness for incorporating estimates of unreported catch into the assessment

The Working Group reviewed results from a phone survey conducted by GFLK to gain further information on the 2016 fishery. As of February 2017, only 75 of the 263

(29%) licensed fishers had reported catches. The phone survey occurred in March 2017 when a random sample of 49 licensed fishers (30 of which had not reported catches and 19 had reported catches) were interviewed via a phone survey.

The first question of the survey was intended gather information to develop an estimate of landings for fishers who did not report catches. A NAFO division-specific mean estimate of catch per fisher who did not report catches was generated based on the survey results and this mean estimate was multiplied by the number of fishers in each NAFO division who did not report (Table 5.1.1.5). This resulted in an estimate of 4249 kg of unreported catch across all NAFO divisions for the licensed fishery.

Phone surveys were also conducted in 2015 and 2016 to assess the 2014 and 2015 fisheries, respectively. The number of fishers contacted, the questions asked, and the method to estimate unreported catch differed from year to year. In 2015, attempts were made to contact all licensed fishers, both those who reported and those who did not report catches in 2014 (ICES, 2015). In 2016, a subset of licensed fishers who did not report catches was contacted (ICES, 2016a). Analysis of the 2015 results suggested that there was no systematic bias indicating a tendency of over- or underreporting of reported catches. A total of 12.2 t of non-reported harvest was recorded during the 2015 survey, but a division-specific weighting was not applied and therefore a total estimated of non-reported harvest was not available. The 12.2 t identified in 2015 is considered a minimum estimate. In 2016 and 2017, a division-specific weighting was developed and applied. An overview of the results from these surveys is presented in Table 5.1.1.6.

The Working Group acknowledges the analyses of the information from the post-season telephone surveys. The 'adjusted landings (survey)' of 12.2 t in 2014, 5.0 t in 2015, and 4.2 t in 2016 have been added to the 'adjusted landings (sampling)' as described in Section 5.1.2, and 'reported landings' for use in 'landings for assessment'. A summary of the reported landings, adjusted landings (survey), and the adjusted landings (sampling) is presented in Table 5.1.1.7. Adjusted landings for assessment do not replace the official reported statistics. For the assessment the unreported catch of 10 t provided by the Government of Greenland is also included.

The Working Group recommends continuation of the phone survey programme according to a standardized and consistent annual approach with consideration given to surveying a larger proportion of licensed fishers and the inclusion of the non-licensed fishers. Information gained on the level of total catches for this fishery will provide for a more accurate assessment of the status of stocks and assessment of risk with varying levels of harvest.

5.1.3 Exploitation

An extant exploitation rate for NAC and southern NEAC non-maturing 1SW fish at West Greenland can be calculated by dividing the estimated continent of origin reported harvest of 1SW salmon at West Greenland by the PFA estimate for the corresponding year for each stock complex. Exploitation rates are available for the 1971 to 2015 PFA years (Figure 5.1.1.5). The most recent estimate of exploitation available is for the 2015 fishery as the 2016 exploitation rate estimates are dependent on the 2016 PFA estimates, which depends on 2017 2SW returns. NAC PFA estimates (Table 4.3.6.1) are provided for August of the PFA year and Southern NEAC PFA estimates (Table 3.3.4.4) are provided for January of the PFA year, the latter adjusted by eight months (January to August) of natural mortality at 0.03 per month. The 2015 NAC exploitation rate was 9.7%, which is slightly higher than the 2014 estimate (9.5%), and the previous five-year mean (8.4%, 2010–2014), but remains among the lowest in the time-series. NAC exploitation rate peaked in 1971 at approximately 40%. The 2015 southern NEAC exploitation rate of 1.0% is a decrease from the previous year's estimate (1.9%) and slightly above the previous five-year mean (0.8%, 2010–2014), but remains among the lowest in the time-series. Southern NEAC exploitation rate at Greenland peaked in 1975 at 28.5%. It should be noted that annual estimates of exploitation vary slightly from year to year as they are dependent on the output from the run-reconstruction models which vary slightly from assessment to assessment (see Sections 4.3 and 3.3)

5.1.4 International sampling programme

The international sampling programme for the fishery at West Greenland agreed by the parties at NASCO continued in 2016 (NASCO, 2016; see WGC(16)9). The sampling was undertaken by participants from Canada, Ireland, UK(Scotland), UK(E&W), and USA. Additionally, staff from the Greenland Institute of Natural Resources assisted with coordination of the programme. Sampling began in August and continued through September.

Samplers were stationed in four communities (Figure 5.1.1.1) representing four NAFO Divisions: Sisimiut (NAFO division 1B), Maniitsoq (1C), Paamiut (1E) and Qaqortoq (1F). As in previous years no sampling occurred in the fishery in East Greenland. No sampling occurred at any factories as factory landings were not allowed in 2016. Tissue and biological samples were collected from all sampled fish.

A total of 1624 salmon were observed by the sampling teams, approximately 19% by weight of the reported landings. Of this total, 1314 were sampled for biological characteristics, 277 fish were only checked for an adipose clip, and 33 were documented as being landed, but were not sampled or examined further. Approximately 1300 fork lengths and weights (Table 5.1.2.1), 1240 scale samples for age determination, and 1302 useable tissue samples for DNA analysis to determine the continent and region-specific origin of the fish were collected.

A total of 19 adipose finclipped fish were recorded, two of which contained coded wire tags (one each from the River Corrib, Ireland and the River Dee, UK(E&W)). A total of 12 additional tags were returned by a fisher or consumer directly to a sampler or the Nature Institute. These tags were returned over the past year and efforts continue to identify the origin of all recovered tags.

Starting in 2002, non-reporting of harvest was evident based on a comparison of reported landings to the sample data. In at least one of the NAFO Divisions where international samplers were present, the sampling team observed more fish than were reported as being landed for the whole season. When there is this type of discrepancy, the reported landings are adjusted according to the total weight of the fish identified as being landed (Adjusted landings (sampling)) during the sampling effort and these adjusted landings are carried forward for assessments. Adjusted landings do not replace the official reported statistics (Tables 5.1.1.1 and 5.1.1.2).

The time-series of reported landings and subsequent adjusted landings (sampling) for 2002–2016 are presented in Table 5.1.2.2. In all years, with the exception of 2006, 2011, and 2015, discrepancies were identified. In 2016, the discrepancy was minor (265 kg) and restricted to Sisimuit. It should be noted that samplers were only stationed within selected communities for 2–5 weeks per year whereas the fishing season runs for 10–12 weeks. It is not possible to correct for misreporting for an entire fishing season or area given the discrepancy in sampling coverage vs. fishing season without more accurate daily/weekly catch statistics. Landings for assessment are presented in Table 5.1.1.7.

Landings in Nuuk averaged 15% of the total reported landings over the past ten years (2007–2016) and were 17% in 2016. As reported previously (ICES, 2012), access to fish in support of the sampling programme in Nuuk had in previous years been compromised. In 2015, the conditions attached to a salmon fishing licence were modified and a requirement of allowing samplers access to landed catch was included. It was unclear if a solution to this issue had been reached prior to the 2016 sampling season. Given the difficulty and cost associated with samplers participating in the sampling programme and potentially being denied access to fish, the programme coordinator was not able to commit to assigning a sampler to Nuuk and consequently no sampling was occurred in Nuuk. Unless assurances can be provided that access to fish will be allowed, there may continue to be no sampling in Nuuk for the foreseeable future. Although the potential for bias exists when describing the biological characteristics of the harvest, stock assessment results, and catch advice, this potential bias is expected to be small given that sampling occurred both to the north (NAFO Division 1C) and to the south (NAFO Division 1E) of Nuuk. Regardless, the need to obtain samples from fish landed in Nuuk is reiterated.

5.1.4.1 Biological characteristics of the catches

The mean length and whole weight of North American 1SW salmon was 65.2 cm and 3.18 kg and the means for European 1SW salmon were 62.6 cm and 2.79 kg (Table 5.1.2.3). The North American 1SW fork length estimate was approximately equal to the 2015 value (65.6 cm) and the previous ten year means (65.4 cm, 2006–2015). The European 1SW mean fork length was below the 2015 value (64.4 cm) and the previous ten year mean (64.5 cm).

North American salmon sampled from the fishery at West Greenland were predominantly river age two (21.3%), three (43.3%) and four (26.8%) year old fish (Table 5.1.2.4). European salmon were predominantly river age two (63.3%) and three (29.6%) year old fish (Table 5.1.2.5). As expected, the 1SW age group dominated the 2016 sample collection for both the North American (93.5%) and European (95.5%) origin fish (Table 5.1.2.6).

5.1.4.2 Continent of origin of catches at West Greenland

In 2016, a total of 1302 samples were analysed from salmon from four communities representing four NAFO Divisions: Sisimiut in 1B (n=318), Maniitsoq in 1C (n=542), Paamiut in 1E (n=125) and Qaqortoq in 1F (n=317). DNA isolation and the subsequent microsatellite analysis, as described by King *et al.* (2001), were performed. As in previous years, a database of approximately 5000 Atlantic salmon genotypes of known origin was used as a baseline to assign these individuals to continent of origin. Overall, 66.4% of the salmon sampled were determined to be of North American origin and 33.6% were determined to be of European origin (Table 5.1.2.7). A large proportion of North American origin salmon were identified from the fishery samples in recent years, however the 2016 value is the lowest percentage of North American origin fish since 2003 (Figure 5.1.2.1; Table 5.1.2.8).

The NAFO division-specific continent of origin assignments for 2016 are presented in Table 5.1.2.7 and Figure 5.1.2.2. The annual variability of the continental representation among divisions within the recent time-series (Figure 5.1.2.3) underscores the need to sample multiple NAFO Divisions to achieve the most accurate estimate of the contribution of fish from each continent to the mixed-stock fishery.

The estimated weighted proportions of North American and European salmon since 1982 and the weighted numbers of North American and European Atlantic salmon caught at West Greenland (excluding unreported catch and reported harvest from ICES Area 14) are provided in Table 5.1.2.8 and Figure 5.1.2.4. Approximately 5100 (~17.2 t) North American origin fish and approximately 3300 (~8.7 t) European origin fish were harvested in 2016. The 2016 total number of fish harvested (8400) is well below the 2015 estimate (17 400). It is the lowest estimate since 2011 (8100) and only 2.5% of the maximum estimate of 336 000 fish harvested in 1982. The Working Group recommends a continuation and potential expansion of the broad geographic sampling programme including in Nuuk (multiple NAFO divisions including factory landings when permitted) to more accurately estimate continent and region of origin and biological characteristics of the mixed-stock fishery.

5.1.4.3 Region of origin of catches at West Greenland

The Working Group has previously reported on the region of origin of catches at West Greenland, both for North American and European origin salmon (ICES, 2015). Estimates of contribution from 12 regions in North America (Figure 4.1.5.1) were reported for the 2011–2014 fisheries (Bradbury *et al.*, 2016b; ICES, 2015) and from 14 regions in Europe for the 2002 and 2004–2012 fisheries. Three regional groups in NAC contribute the majority (over 90%) of the North American origin salmon in the West Greenland fishery: Québec (UNG, QUE, GAS, ANT) at 39%, Gulf of St Lawrence (GUL) at 29% and Labrador (LAB, QLS) at 26%. Smaller contributions were identified from Newfoundland (NFL, AVA) at 5%, Scotia-Fundy (NOS, FUN) at 1% and USA at 1%. Three regional groups in NEAC also contribute the majority (over 90%) of the European origin salmon in the West Greenland fishery: N Scotland and N&W Ireland at 25.2%, Irish Sea (principally fish originating in English (west coast), Welsh and Scottish (Solway) rivers and the large rivers of Ireland's east and south coast.) at 26.6%, and S&E Scotland (which includes some of the east coast of England) at 40%. Overall, UK (Scotland) appears to be the major European contributor to the fishery with almost 70% of the sampled fish being assigned to this unit.

New assignment results were available for the North American contributions to the 2015 Greenland fishery. A total of 750 North American origin samples were used for mixture analysis using the Bayesian mixture model from Pella and Masuda (2001) as implemented in cBAYES (Neaves *et al.*, 2005). The accuracy of assignment in the mixture analyses was very high and the power of the baseline to resolve rare contributions was previously examined using simulations (ICES, 2015; Bradbury *et al.*, 2015). Accurate estimation of the rare stock contributions is possible when they represented from 0.5–1.0% and above. Region of origin assignments for the European origin salmon harvested at West Greenland in 2015–2016 have not been conducted. The Working Group recommends that progress be made in assigning the European origin salmon from the West Greenland fishery to sub-complex region of origin.

Preliminary results from the 2015 fishery (Figure 5.1.2.3) confirm those previously reported by the Working Group (ICES, 2015) and by Bradbury *et al.* (2016b). The 2015 North American contribution was dominated by the same three regions (Québec (UNG, QUE, GAS, ANT), Gulf of St Lawrence (GUL), and Labrador (LAB, QLS)) with each contributing >20% each year. Smaller contributions were made by other regions (Newfoundland, Scotia-Fundy, and USA). The Working Group was informed that funding has been secured to analyse samples the North American samples from the

2016 through 2018 fisheries and the 2015 preliminary results will be updated, reported, and finalized when those data are available.

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

The stocks contributing to the Greenland fishery are the NAC 2SW and Southern NEAC MSW complexes. The midpoints of the spawner abundance estimates for five out of the seven stock complexes exploited at West Greenland are below CLs (Figure 5.2.1). A more detailed overview of status of stocks in the NEAC and NAC areas is presented in the relevant commission sections (Sections 3 and 4).

5.2.1 North American stock complex

The total estimate of 2SW salmon spawners in North America for 2016 decreased by 7% from 2015 and ranks eighth (descending) out of the 47 year time-series. The midpoints of the spawner abundance estimates were below the CLs for all regions of NAC except Labrador, and are therefore suffering reduced reproductive capacity. For Labrador, the median estimate was above the CL but the 5th percentile of the estimate is below the CL and the stock is at risk of suffering reduced reproductive capacity (Figure 5.2.14). The proportion of the 2SW CL attained from 2SW spawners was 133% for Labrador, 84% for each of the Newfoundland, Québec, and Gulf regions, and 6% and 1% (13% and 9% of the management objectives) for Scotia-Fundy and USA, respectively. Within each of the geographic areas there are individual river stocks which are failing to meet CLs. In the southern areas of NAC (Scotia-Fundy and USA) there are numerous populations at high risk of extinction and these are under consideration or receiving special protections under federal legislation. The estimated exploitation rate of North American origin salmon in North American fisheries has declined (Figure 4.1.6.1) from peaks of 81% in 1971 for 2SW salmon to averaging 10% over the past ten years. Increasingly restrictive fishing regulations are directed at populations and in regions that are failing to meet their CLs (see Section 4.1.2 and Figure 4.1.2.2).

5.2.2 MSW Southern European stock complex

The midpoint of the spawner abundance estimate for the southern NEAC MSW stock complex was above the CL, but the stock complex is considered at risk of suffering reduced reproductive capacity (Figure 3.3.4.2). For individual countries within the southern NEAC MSW stock complex, estimated spawners for two countries were considered at full reproductive capacity whereas three countries were either at risk of suffering or suffering reduced reproductive capacity (Figure 3.3.4.5). In addition, rivers in the south and west of Iceland are included in the assessment of the southern NEAC stock complex and spawners for MSW stock were assessed to be at full reproductive capacity (Figure 3.3.4.7). Within individual jurisdictions there are large numbers of rivers not meeting CLs after homewater fisheries (Table 3.3.5.1). The status of MSW spawners against conservation limits is summarized in Figure 5.2.1. Homewater exploitation rates on the MSW southern NEAC stock complex are shown in Figure 3.1.9.1. Exploitation on MSW fish in Southern NEAC was 9% in 2016, which was lower than both the previous 5-year (11%) and ten year (12%) averages.

5.2.3 Salmon in Kapisillit River, Greenland

The only documented spawning population of Atlantic salmon in Greenland is located in the Kapisillit River in the inner part of the Nuuk (NAFO division 1D) fjord (Nielsen, 1961). The potential for other salmon producing rivers was investigated in the early 1970s, but only a few potential rivers were identified as most rivers in Greenland are relatively short, steep, and cold and assessed to not be suitable to sustain Atlantic salmon populations (Jonas, 1974).

The Working Group was informed about a recently completed MSc project that was conducted through cooperation with Aarhus University (Denmark) and the Greenland Institute of Natural Resources. The project focused on electrofishing the Kapisillit River in 2016. Juvenile salmon one through six years old were captured in the lower river and age-specific juvenile population estimates were generated. It is not clear when this population became established, but its existence was noted by Fabricius (1780) and the results from this study show recent and annual recruitment. Although persistent, the contribution of the small Kapisillit population to the salmon fishery around Greenland is considered to be very small. It is noted that there is currently no direct legal protection of the Kapisillit River stock.

5.3 Tables

Table 5.1.1.1. Distribution of nominal catches (t) by Greenland vessels since 1960. NAFO Division is represented by 1A–1F. Since 2005, gutted weights have been reported and converted to total weight by a factor of 1.11.

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
1960							60	60		60
1961							127	127		127
1962							244	244		244
1963	1	172	180	68	45			466		466
1964	21	326	564	182	339	107		1539		1539
1965	19	234	274	86	202	10	36	861		861
1966	17	223	321	207	353	130	87	1338		1338
1967	2	205	382	228	336	125	236	1514		1514
1968	1	90	241	125	70	34	272	833		833
1969	41	396	245	234	370		867	2153		2153
1970	58	239	122	123	496	207	862	2107		2107
1971	144	355	724	302	410	159	560	2654		2654
1972	117	136	190	374	385	118	703	2023		2023
1973	220	271	262	440	619	329	200	2341		2341
1974	44	175	272	298	395	88	645	1917		1917
1975	147	468	212	224	352	185	442	2030		2030
1976	166	302	262	225	182	38		1175		1175
1977	201	393	336	207	237	46	-	1 420	6	1426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1 395	+	1395
1980	52	275	404	231	158	74	-	1 194	+	1194
1981	105	403	348	203	153	32	20	1 264	+	1264
1982	111	330	239	136	167	76	18	1 077	+	1077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993 [1]	-	-	-	-	-	-	-	-	-	-
1994 [1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	5	-	15	-	15
2006	6	2	3	4	2	4	-	22	-	22
2007	2	5	6	4	5	2	-	25	-	25
2008	4.9	2.2	10.0	1.6	2.5	5.0	0	26.2	0	26.2
2009	0.2	6.2	7.1	3.0	4.3	4.8	0	25.6	0.8	26.3
2010	17.3	4.6	2.4	2.7	6.8	4.3	0	38.1	1.7	39.6
2011	1.8	3.7	5.3	8.0	4.0	4.6	0	27.4	0.1	27.5
2012	5.4	0.8	15.0	4.6	4.0	3.0	0	32.6	0.5	33.1
2013	3.1	2.4	17.9	13.4	6.4	3.8	0	47.0	0.0	47.0
2014	3.6	2.8	13.8	19.1	15.0	3.4	0	57.8	0.1	57.9
2015	0.8	8.8	10.0	18.0	4.2	14.1	0	55.9	1.0	56.8
2016	0.8	1.2	7.3	4.6	4.5	7.3	0	25.7	1.5	27.1

[1] The fishery was suspended.

+ Small catches <5 t.

- No catch.

Table 5.1.1.2. Nominal catches of salmon at West Greenland since 1960 (t round fresh weight) by participating nations. For Greenlandic vessels specifically, all catches up to 1968 were taken with set gillnets only and catches after 1968 were taken with set gillnets and driftnets. All non-Greenlandic vessel catches from 1969–1975 were taken with driftnets. The quota figures applied to Greenlandic vessels only and parenthetical entries identify when quotas did not apply to all sectors of the fishery.

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
1960	-	-	-	-	60	60		
1961	-	-	-	-	127	127		
1962	-	-	-	-	244	244		
1963	-	-	-	-	466	466		
1964	-	-	-	-	1539	1539		
1965	-	36	-	-	825	858		Norwegian harvest figures not avaialble, but known to be less than Faroese catch
1966	32	87	-	-	1251	1370		
1967	78	155	-	85	1283	1601		
1968	138	134	4	272	579	1127		
1969	250	215	30	355	1360	2210		
1970	270	259	8	358	1244	2139		Greenlandic total includes 7 t caught by longlines in the Labrador Sea
1971	340	255	-	645	1449	2689	-	
1972	158	144	-	401	1410	2113	1100	
1973	200	171	-	385	1585	2341	1100	
1974	140	110	-	505	1162	1917	1191	
1975	217	260	-	382	1171	2030	1191	
1976	-	-	-	-	1175	1175	1191	
1977	-	-	-	-	1420	1420	1191	
1978	-	-	-	-	984	984	1191	
1979	-	-	-	-	1395	1395	1191	
1980	-	-	-	-	1194	1194	1191	
1981	-	-	-	-	1264	1264	1265	Quota set to a specific opening date for the fishery
1982	-	-	-	-	1077	1077	1253	Quota set to a specific opening date for the fishery

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
1983	-	-	-	-	310	310	1191	
1984	-	-	-	-	297	297	870	
1985	-	-	-	-	864	864	852	
1986	-	-	-	-	960	960	909	
1987	-	-	-	-	966	966	935	
1988	-	-	-	-	893	893	840	Quota for 1988–1990 was 2520 t with an opening date of August 1. Annual catches were not to exceed an annual average (840 t) by more than 10%. Quota adjusted to 900 t in 1989 and 924 t in 1990 for later opening dates.
1989	-	-	-	-	337	337	900	
1990	-	-	-	-	274	274	924	
1991	-	-	-	-	472	472	840	
1992	-	-	-	-	237	237	258	Quota set by Greenland authorities
1993	-	-	-	-			89	The fishery was suspended. NASCO adopt a new quota allocation model.
1994	-	-	-	-			137	The fishery was suspended and the quotas were bought out.
1995	-	-	-	-	83	83	77	Quota advised by NASCO
1996	-	-	-	-	92	92	174	Quota set by Greenland authorities
1997	-	-	-	-	58	58	57	Private (non-commercial) catches to be reported after 1997
1998	-	-	-	-	11	11	20	Fishery restricted to catches used for internal consumption in Greenland
1999	-	-	-	-	19	19	20	
2000	-	-	-	-	21	21	20	
2001	-	-	-	-	43	43	114	Final quota calculated according to the ad hoc management system
2002	-	-	-	-	9	9	55	Quota bought out, quota represented the maximum allowable catch (no factory landing allowed), and higher catch figures based on sampling programme information are used for the assessments
2003	-	-	-	-	9	9		Quota set to nil (no factory landing allowed), fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information are used for the assessments
2004	-	-	-	-	15	15		same as previous year
2005	-	-	-	-	15	15		same as previous year

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
2006	-	-	-	-	22	22		Quota set to nil (no factory landing allowed) and fishery restricted to catches used for internal consumption in Greenland
2007	-	-	-	-	25	25		Quota set to nil (no factory landing allowed), fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information are used for the assessments
2008	-	-	-	-	26	26		same as previous year
2009	-	-	-	-	26	26		same as previous year
2010	-	-	-	-	40	40		No factory landing allowed and fishery restricted to catches used for internal consumption in Greenland
2011	-	-	-	-	28	28		same as previous
2012	-	-	-	-	33	33	(35)	Unilateral decision made by Greenland to allow factory landing with a 35 t quota for factory landings only, fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information are used for the assessments
2013	-	-	-	-	47	47	(35)	same as previous year
2014	-	-	-	-	58	58	(30)	Unilateral decision made by Greenland to allow factory landing with a 30 t quota for factory landings only, fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information and phone surveys are used for the assessments
2015	-	-	-	-	57	57	45	Unilateral decision made by Greenland to set a 45 t quota for all sectors of the fishery, fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information and phone surveys are used for the assessments
2016	-	-	-	-	27	27	32	Unilateral decision made by Greenland to reduce the previously set 45 t quota for all sectors of the fishery to 32 t based on overharvest of 2015 fishery, fishery restricted to catches used for internal consumption in Greenland, and higher catch figures based on sampling programme information and phone surveys are used for the assessments

Table 5.1.1.3. Reported landings (t) by landing category, the number of fishers reporting and the total number of landing reports received for licensed and unlicensed fishers in 2013–2016. Empty cells identify categories with no reported landings and 0.0 entries represents reported values of <0.5.

NAFO/ICES	Licensed	No. of Fishers	No. of Reports	Comm.	Private	Factory	Total	Licensed	No. of Fishers	No. of Reports	Comm.	Private	Factory	Total
2016								**2015**						
1A	NO							NO	5	6		0.1		0.1
1A	YES	9	19		0.7		0.7	YES	13	29	0.1	0.6		0.7
1A	TOTAL	9	19	0.0	0.7		0.7	TOTAL	18	35	0.1	0.7		0.8
1B	NO	4	9		0.2		0.2	NO	3	5		0.1		0.1
1B	YES	7	22	0.1	1.0		1.0	YES	15	96	7.3	1.5		8.7
1B	TOTAL	11	31	0.1	1.1		1.2	TOTAL	18	101	7.3	1.5		8.8
1C	NO	8	30		1.0		1.0	NO	16	58	0.1	1.7		1.8
1C	YES	23	113	4.1	2.1		6.2	YES	42	181	2.9	3.9	1.5	8.2
1C	TOTAL	31	143	4.1	3.1		7.3	TOTAL	58	239	3.0	5.6	1.5	10.1
1D	NO	8	13		0.9		0.9	NO	20	35		0.8		0.8
1D	YES	8	42	1.2	2.5		3.8	YES	11	161	14.3	0.5	2.4	17.1
1D	TOTAL	16	55	1.2	3.4		4.6	TOTAL	31	196	14.3	1.3	2.4	18
1E	NO	13	22		1.4		1.4	NO	3	5	0.1	0.2		0.2
1E	YES	10	74	0.6	2.5		3.1	YES	11	71	2.0	1.9		3.9
1E	TOTAL	23	96	0.6	3.9		4.5	TOTAL	14	76	2.1	2.1		4.2
1F	NO	27	66	0.1	2.9		3.0	NO	20	69		2.4		2.4
1F	YES	13	46	2.6	1.7		4.3	YES	21	173	7.1	4.6		11.7
1F	TOTAL	40	112	2.7	4.6		7.3	TOTAL	41	242	7.1	7.0		14.1
XIV	NO	9	46		1.3		1.3	NO	8	32		0.6		0.6
XIV	YES	1	1		0.2		0.2	YES	1	17	0	0.4		0.4
XIV	TOTAL	10	47	0.0	1.5		1.5	TOTAL	9	49	0	0.9		1
ALL	NO	69	186	0.1	7.6		7.7	NO	75	210	0.1	5.9		6
ALL	YES	71	317	8.6	10.8		19.4	YES	114	728	33.7	13.3	3.8	50.8
ALL	TOTAL	140	503	8.7	18.4		27.1	TOTAL	189	938	33.8	19.2	3.8	56.8

NAFO/ICES	Licensed	No. of Fishers	No. of Reports	Comm.	Private	Factory	Total	Licensed	No. of Fishers	No. of Reports	Comm.	Private	Factory	Total
2014								**2013**						
1A	NO	1	1		0.1		0.1	NO	10	32	0.3	0		0.3
1A	YES	20	87	3.0	0.5		3.5	YES	18	94	1.2	1.6		2.8
1A	TOTAL	21	88	3.0	0.6		3.6	TOTAL	28	126	1.5	1.6		3.1
1B	NO							NO	2	5	0.2			0.2
1B	YES	8	28	2.1	0.7		2.8	YES	6	14	1.3	0.9		2.2
1B	TOTAL	8	28	2.1	0.7		2.8	TOTAL	8	19	1.4	0.9		2.4
1C	NO	5	18	0.6			0.6	NO						
1C	YES	35	212	1.5	2.1	9.7	13.2	YES	21	205	2.2	3.5	12.3	18
1C	TOTAL	40	230	2.1	2.1	9.7	13.8	TOTAL	21	205	2.2	3.5	12.3	18
1D	NO	6	10	0.2	0.3		0.5	NO	10	23	0.4	0.0		0.5
1D	YES	14	115	0.4	5.5	12.8	18.6	YES	9	112	0.1	4.8	8	12.9
1D	TOTAL	20	135	0.6	5.7	12.8	19.1	TOTAL	19	135	0.5	4.9	8	13.4
1E	NO	1	1	0.2			0.2	NO	1	1	0.1			0.1
1E	YES	9	102	1.4	0.8	12.6	14.8	YES	6	41	0.8	0.2	5.3	6.4
1E	TOTAL	10	103	1.6	0.8	12.6	15.0	TOTAL	7	42	0.9	0.2	5.3	6.4
1F	NO	3	3	0.1	0.1		0.2	NO	5	10	0.3			0.3
1F	YES	11	80	2.0	1.2		3.2	YES	6	15	1.0	2.4		3.4
1F	TOTAL	14	83	2.1	1.3		3.4	TOTAL	11	25	1.4	2.4		3.8
XIV	NO							NO	1	1	0.0			0.0
XIV	YES	1	12	0.1	0.0		0.1	YES						
XIV	TOTAL	1	12	0.1	0.0		0.1	TOTAL	1	1	0.0			0.0
ALL	NO	16	33	1.2	0.4		1.6	NO	29	72	1.3	0.1		1.4
ALL	YES	98	636	10.5	10.7	35	56.2	YES	66	481	6.6	13.4	25.6	45.6
ALL	TOTAL	114	669	11.6	11.2	35	57.8	TOTAL	95	553	7.9	13.4	25.6	47

Table 5.1.1.4. Total number of licences issued by NAFO (1A-1F)/ICES Divisions and the number of people (licensed and unlicensed) reporting catches of Atlantic salmon in the Greenland fishery. Reports received by fish plants prior to 1997 and to the Licence Office from 1998 to present. Blanks cells indicate that the data were not reported or available. Three additional fishers were identified as reporting in 2016 (n=143), but are not included here as their NAFO division was not known.

Year	Licences	1A	1B	1C	1D	1E	1F	ICES	Unk.	Number of fishers reporting	Number of reports received
1987		78	67	74		99	233		0	579	
1988		63	46	43	53	78	227		0	516	
1989		30	41	98	46	46	131		0	393	
1990		32	15	46	52	54	155		0	362	
1991		53	39	100	41	54	123		0	410	
1992		3	9	73	9	36	82		0	212	
1993											
1994											
1995		0	17	52	21	24	31		0	145	
1996		1	8	74	15	23	42		0	163	
1997		0	16	50	7	2	6		0	80	
1998		16	5	8	7	3	30		0	69	
1999		3	8	24	18	21	29		0	102	
2000		1	1	5	12	2	25		0	43	
2001	452	2	7	13	15	6	37		0	76	
2002	479	1	1	9	13	9	8		0	41	
2003	150	11	1	4	4	12	10		0	42	
2004	155	20	2	8	4	20	12		0	66	
2005	185	11	7	17	5	17	18		0	75	
2006	159	43	14	17	20	17	30		0	141	
2007	260	29	12	26	10	33	22		0	132	
2008	260	44	8	41	10	16	24		0	143	
2009	294	19	11	35	15	25	31	9	0	145	
2010	309	86	17	19	16	30	27	13	0	208	389
2011	234	25	9	20	15	20	23	5	0	117	394
2012	279	35	9	32	8	16	16	6	0	122	553
2013	228	28	8	21	19	7	11	1	0	95	553
2014	321	21	8	40	20	10	14	1	0	114	669
2015	310	18	18	58	31	14	41	9	0	189	938
2016	263	9	11	31	16	23	40	10	0	140	503

Table 5.1.1.5. Summary of the phone survey for licensed fishers who did not report catches in 2016.

NAFO Division	Licensed fishermen	Licensed Reporting	Licensed Not Reporting	Not reporting Interviewed	% of non-reporting	Sum (Kg)	Avgerage (Kg)	Total (Kg)
1A	61	9	52	11	21	53	6	265
1B	35	9	26	4	15	15	4	98
1C	71	25	46	3	7	75	25	1150
1D	26	8	18	8	44	360	45	810
1E	20	10	10	2	20	130	65	650
1F	41	13	28	2	7	45	23	630
XIV	9	1	8	-	-	-	-	-
Total	263	75	188	30	16	678	23	4249

Table 5.1.1.6. Summary of the 2014-2016 phone surveys conducted by the GFLK (Greenland Fisheries Control Authority), APNN (the fisheries department), and GINR (Greenland Institute of Natural Resources.

	2014	2015	2016
Licensed fishers	321	310	263
Number who reported by February the following year	98	114	75
Number who reported catches	114	189	143
Number who did not report catches	207	196	188
Number interviewed who reported catches	88*	0	19
Number interviewed who did not report catches	119*	105	30
Weighting	None	NAFO Division-specific	NAFO Division-specific
Estimated unreported catch (t)	12.2	5.0	4.2

*** Includes approximately 11 nonprofessional fishers.**

Table 5.1.1.7. Adjusted landings estimated from comparing the weight of salmon seen by the sampling teams and the corresponding community-specific reported landings (Adjusted landings (sampling)) and from phone surveys (Adjusted landings (survey)). Dashes '-' indicate that no adjustment was necessary or no phone surveys were conducted from 2002–2013. Adjusted landings (sampling and surveys) are added to the reported landings and estimated unreported catch for assessment purposes.

Year	Reported Landings (West Greenland only)	Adjusted Landings (Sampling)	Adjusted Landings (Survey)	Landings for Assessment
2002	9.0	0.7	-	9.8
2003	8.7	3.6	-	12.3
2004	14.7	2.5	-	17.2
2005	15.3	2.0	-	17.3
2006	23.0	-	-	23.0
2007	24.6	0.2	-	24.8
2008	26.1	2.5	-	28.6
2009	25.5	2.5	-	28.0
2010	37.9	5.1	-	43.1
2011	27.4	-	-	27.4
2012	32.6	2.0	-	34.6
2013	46.9	0.7	-	47.7
2014	57.7	0.6	12.2	70.5
2015	55.9	-	5.0	60.9
2016	25.7	0.3	4.2	30.2

Table 5.1.2.1. Size of biological samples and percentage (by number) of North American and European salmon in research vessel catches at West Greenland (1969 to 1982), from commercial samples (1978 to 1992, 1995 to 1997, and 2001) and from local consumption samples (1998 to 2000, and 2002 to present).

Source	Year	Sample Size			Continent of Origin (%)			
		Length	Scales	Genetics	N. American	(95% CI)[1]	European	(95% CI)[1]
Research	1969	212	212		51	(57, 44)	49	(56, 43)
	1970	127	127		35	(43, 26)	65	(75, 57)
	1971	247	247		34	(40, 28)	66	(72, 50)
	1972	3488	3488		36	(37, 34)	64	(66, 63)
	1973	102	102		49	(59, 39)	51	(61, 41)
	1974	834	834		43	(46, 39)	57	(61, 54)
	1975	528	528		44	(48, 40)	56	(60, 52)
	1976	420	420		43	(48, 38)	57	(62, 52)
	1978[2]	606	606		38	(41, 38)	62	(66, 59)
	1978[3]	49	49		55	(69, 41)	45	(59, 31)
	1979	328	328		47	(52, 41)	53	(59, 48)
	1980	617	617		58	(62, 54)	42	(46, 38)
	1982	443	443		47	(52, 43)	53	(58, 48)
Commercial	1978	392	392		52	(57, 47)	48	(53, 43)
	1979	1653	1653		50	(52, 48)	50	(52, 48)
	1980	978	978		48	(51, 45)	52	(55, 49)
	1981	4570	1930		59	(61, 58)	41	(42, 39)
	1982	1949	414		62	(64, 60)	38	(40, 36)
	1983	4896	1815		40	(41, 38)	60	(62, 59)
	1984	7282	2720		50	(53, 47)	50	(53, 47)
	1985	13 272	2917		50	(53, 46)	50	(52, 34)
	1986	20 394	3509		57	(66, 48)	43	(52, 34)
	1987	13 425	2960		59	(63, 54)	41	(46, 37)
	1988	11 047	2562		43	(49, 38)	57	(62, 51)
	1989	9366	2227		56	(60, 52)	44	(48, 40)
	1990	4897	1208		75	(79, 70)	25	(30, 21)
	1991	5005	1347		65	(69, 61)	35	(39, 31)
	1992	6348	1648		54	(57, 50)	46	(50, 43)
	1995	2045	2045		68	(75, 65)	32	(35, 28)
	1996	3341	1397		73	(76, 71)	27	(29, 24)
	1997	794	282		80	(84, 75)	20	(25, 16)
	2001	4721	2655		69	(71, 67)	31	(33, 29)
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	
	2002	501	501	501	68		32	
	2003	1743	1743	1779	68		32	
	2004	1639	1639	1688	73		27	

Source	Year	Sample Size			Continent of Origin (%)			
		LENGTH	SCALES	GENETICS	N. AMERICAN	(95% CI)[1]	EUROPEAN	(95% CI)[1]
	2005	767	767	767	76		24	
Local Consumption	2006	1209	1209	1193	72		28	
	2007	1116	1110	1123	82		18	
	2008	1854	1866	1853	86		14	
	2009	1662	1683	1671	91		9	
	2010	1261	1265	1240	80		20	
	2011	967	965	964	92		8	
	2012	1372	1371	1373	82		18	
	2013	1155	1156	1149	82		18	
	2014	892	775	920	72		28	
	2015	1708	1704	1674	80		20	
	2016	1300	1240	1302	66		34	

[1] CI - confidence interval calculated by method of Pella and Robertson (1979) for 1984–1986 and binomial distribution for the others.

[2] During 1978 Fishery

[3] Research samples after 1978 fishery closed.

Table 5.1.2.2. Reported landings (kg) for the West Greenland Atlantic salmon fishery from 2002 by NAFO division and the division-specific adjusted landings (sampling) where the sampling teams observed more fish landed than were reported. Adjusted landings (sampling) were not calculated for 2006, 2011, and 2015 as the sampling teams did not observe more fish than were reported. Shaded cells indicate that sampling took place in that year and division.

Year	Type	1A	1B	1C	1D	1E	1F	Total
2002	Reported	14	78	2100	3752	1417	1661	9022
	Adjusted						2408	9769
2003	Reported	619	17	1621	648	1274	4516	8694
	Adjusted			1782	2709		5912	12 312
2004	Reported	3476	611	3516	2433	2609	2068	14 712
	Adjusted				4929			17 209
2005	Reported	1294	3120	2240	756	2937	4956	15 303
	Adjusted				2730			17 276
2006	Reported	5427	2611	3424	4731	2636	4192	23 021
	Adjusted							
2007	Reported	2019	5089	6148	4470	4828	2093	24 647
	Adjusted						2252	24 806
2008	Reported	4882	2210	10024	1595	2457	4979	26 147
	Adjusted				3577		5478	28 627
2009	Reported	195	6151	7090	2988	4296	4777	25 496
	Adjusted				5466			27 975
2010	Reported	17 263	4558	2363	2747	6766	4252	37 949
	Adjusted		4824		6566		5274	43 056
2011	Reported	1858	3662	5274	7977	4021	4613	27 407
	Adjusted							
2012	Reported	5353	784	14 991	4564	3993	2951	32 636
	Adjusted		2001				3694	34 596
2013	Reported	3052	2358	17 950	13 356	6442	3774	46 933
	Adjusted		2461				4408	47 669
2014	Reported	3625	2756	13 762	19 123	14 979	3416	57 662
	Adjusted						4036	58 282
2015	Reported	751	8801	10 055	17 966	4170	14 134	55 877
	Adjusted							
2016	Reported	763	1234	7271	4630	4492	7265	25 655
	Adjusted		1498					25 919

Table 5.1.2.3. Annual mean whole weights (kg) and fork lengths (cm) by sea age and continent of origin of Atlantic salmon caught at West Greenland 1969 to 1992 and 1995 to present (NA = North America and E = Europe).

Year	Whole weight (kg)									Fork Length (cm)					
	1SW		2SW		PS		All sea ages		Total	1SW		2SW		PS	
	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.9	2.63	2.84	2.71	62.3	63.6	85.7	84.0	79.4	87.0
1998	2.72	2.83	6.44	-	3.28	4.77	2.76	2.84	2.78	62.0	62.7	84.0	-	66.3	76.0
1999	3.02	3.03	7.59	-	4.20	-	3.09	3.03	3.08	63.8	63.5	86.6	-	70.9	-
2000	2.47	2.81	-	-	2.58	-	2.47	2.81	2.57	60.7	63.2	-	-	64.7	-
2001	2.89	3.03	6.76	5.96	4.41	4.06	2.95	3.09	3.00	63.1	63.7	81.7	79.1	75.3	72.1
2002	2.84	2.92	7.12	-	5.00	-	2.89	2.92	2.90	62.6	62.1	83.0	-	75.8	-
2003	2.94	3.08	8.82	5.58	4.04	-	3.02	3.10	3.04	63	64.4	86.1	78.3	71.4	-
2004	3.11	2.95	7.33	5.22	4.71	6.48	3.17	3.22	3.18	64.7	65.0	86.2	76.4	77.6	88.0
2005	3.19	3.33	7.05	4.19	4.31	2.89	3.31	3.33	3.31	65.9	66.4	83.3	75.5	73.7	62.3
2006	3.10	3.25	9.72		5.05	3.67	3.25	3.26	3.24	65.3	65.3	90.0		76.8	69.5
2007	2.89	2.87	6.19	6.47	4.94	3.57	2.98	2.99	2.98	63.5	63.3	80.9	80.6	76.7	71.3
2008	3.04	3.03	6.35	7.47	3.82	3.39	3.08	3.07	3.08	64.6	63.9	80.1	85.5	71.1	73.0
2009	3.28	3.40	7.59	6.54	5.25	4.28	3.48	3.67	3.50	64.9	65.5	84.6	81.7	75.9	73.5
2010	3.44	3.24	6.40	5.45	4.17	3.92	3.47	3.28	3.42	66.7	65.2	80.0	75.0	72.4	70.0

Year	Whole weight (kg)									Fork Length (cm)					
	1SW		**2SW**		**PS**		**All sea ages**		**Total**	**1SW**		**2SW**		**PS**	
	NA	**E**	**NA**	**E**	**NA**	**E**	**NA**	**E**		**NA**	**E**	**NA**	**E**	**NA**	**E**
2011	3.30	3.18	5.69	4.94	4.46	5.11	3.39	3.49	3.40	65.8	64.7	78.6	75.0	73.7	76.3
2012	3.34	3.38	6.00	4.51	4.65	3.65	3.44	3.40	3.44	65.4	64.9	75.9	70.4	72.8	68.9
2013	3.33	3.16	6.43	4.51	3.64	5.38	3.39	3.20	3.35	66.2	64.6	81.0	72.8	69.9	73.6
2014	3.25	3.02	7.60	6.00	4.47	5.42	3.39	3.13	3.32	65.6	64.7	86.0	78.7	73.6	83.5
2015	3.36	3.13	7.52	7.1	4.53	3.81	3.42	3.18	3.37	65.6	64.4	84.1	82.5	74.2	67.2
2016	3.18	2.79	7.77	5.18	4.03	4.12	3.32	2.89	3.18	65.2	62.6	85.1	76.0	72.2	70.9
Prev. 10-yr mean	3.23	3.17	6.95	5.89	4.50	4.22	3.33	3.27	3.31	65.4	64.5	82.1	78.0	73.7	72.7
Overall mean	2.89	3.15	6.67	6.19	4.11	4.70	3.04	3.24	3.14	63.5	65.2	82.1	80.8	71.9	75.7

Table 5.1.2.4. River age distribution (%) and mean river age for all North American origin salmon caught at West Greenland, 1968 to 1992 and 1995 to present.

YEAR	1	2	3	4	5	6	7	8
1968	0.3	19.6	40.4	21.3	16.2	2.2	0	0
1969	0	27.1	45.8	19.6	6.5	0.9	0	0
1970	0	58.1	25.6	11.6	2.3	2.3	0	0
1971	1.2	32.9	36.5	16.5	9.4	3.5	0	0
1972	0.8	31.9	51.4	10.6	3.9	1.2	0.4	0
1973	2.0	40.8	34.7	18.4	2.0	2.0	0	0
1974	0.9	36	36.6	12.0	11.7	2.6	0.3	0
1975	0.4	17.3	47.6	24.4	6.2	4.0	0	0
1976	0.7	42.6	30.6	14.6	10.9	0.4	0.4	0
1977	-	-	-	-	-	-	-	-
1978	2.7	31.9	43.0	13.6	6.0	2.0	0.9	0
1979	4.2	39.9	40.6	11.3	2.8	1.1	0.1	0
1980	5.9	36.3	32.9	16.3	7.9	0.7	0.1	0
1981	3.5	31.6	37.5	19.0	6.6	1.6	0.2	0
1982	1.4	37.7	38.3	15.9	5.8	0.7	0	0.2
1983	3.1	47.0	32.6	12.7	3.7	0.8	0.1	0
1984	4.8	51.7	28.9	9.0	4.6	0.9	0.2	0
1985	5.1	41.0	35.7	12.1	4.9	1.1	0.1	0
1986	2.0	39.9	33.4	20.0	4.0	0.7	0	0
1987	3.9	41.4	31.8	16.7	5.8	0.4	0	0
1988	5.2	31.3	30.8	20.9	10.7	1.0	0.1	0
1989	7.9	39.0	30.1	15.9	5.9	1.3	0	0
1990	8.8	45.3	30.7	12.1	2.4	0.5	0.1	0
1991	5.2	33.6	43.5	12.8	3.9	0.8	0.3	0
1992	6.7	36.7	34.1	19.1	3.2	0.3	0	0
1993	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-
1995	2.4	19.0	45.4	22.6	8.8	1.8	0.1	0
1996	1.7	18.7	46.0	23.8	8.8	0.8	0.1	0
1997	1.3	16.4	48.4	17.6	15.1	1.3	0	0
1998	4.0	35.1	37.0	16.5	6.1	1.1	0.1	0
1999	2.7	23.5	50.6	20.3	2.9	0.0	0	0
2000	3.2	26.6	38.6	23.4	7.6	0.6	0	0
2001	1.9	15.2	39.4	32.0	10.8	0.7	0	0
2002	1.5	27.4	46.5	14.2	9.5	0.9	0	0
2003	2.6	28.8	38.9	21.0	7.6	1.1	0	0
2004	1.9	19.1	51.9	22.9	3.7	0.5	0	0
2005	2.7	21.4	36.3	30.5	8.5	0.5	0	0
2006	0.6	13.9	44.6	27.6	12.3	1.0	0	0
2007	1.6	27.7	34.5	26.2	9.2	0.9	0	0
2008	0.9	25.1	51.9	16.8	4.7	0.6	0	0
2009	2.6	30.7	47.3	15.4	3.7	0.4	0	0

YEAR	1	2	3	4	5	6	7	8
2010	1.6	21.7	47.9	21.7	6.3	0.8	0	0
2011	1.0	35.9	45.9	14.4	2.8	0	0	0
2012	0.3	29.8	39.4	23.3	6.5	0.7	0	0
2013	0.1	32.6	37.3	20.8	8.6	0.6	0	0
2014	0.4	26.0	44.5	21.9	6.9	0.4	0	0
2015	0.1	31.6	40.6	21.6	6.0	0.2	0	0
2016	0.1	21.3	43.3	26.8	7.3	1.1	0	0
Prev. 10-yr mean	0.9	27.5	43.4	21.0	6.7	0.6	0	0
Overall Mean	2.4	31.3	39.8	18.6	6.8	1.1	0.1	0

Table 5.1.2.5. River age distribution (%) and mean river age for all European origin salmon caught in West Greenland, 1968 to 1992 and 1995 to present.

YEAR	1	2	3	4	5	6	7	8
1968	21.6	60.3	15.2	2.7	0.3	0	0	0
1969	0	83.8	16.2	0	0	0	0	0
1970	0	90.4	9.6	0	0	0	0	0
1971	9.3	66.5	19.9	3.1	1.2	0	0	0
1972	11.0	71.2	16.7	1.0	0.1	0	0	0
1973	26.0	58.0	14.0	2.0	0	0	0	0
1974	22.9	68.2	8.5	0.4	0	0	0	0
1975	26.0	53.4	18.2	2.5	0	0	0	0
1976	23.5	67.2	8.4	0.6	0.3	0	0	0
1977	-	-	-	-	-	-	-	-
1978	26.2	65.4	8.2	0.2	0	0	0	0
1979	23.6	64.8	11.0	0.6	0	0	0	0
1980	25.8	56.9	14.7	2.5	0.2	0	0	0
1981	15.4	67.3	15.7	1.6	0	0	0	0
1982	15.6	56.1	23.5	4.2	0.7	0	0	0
1983	34.7	50.2	12.3	2.4	0.3	0.1	0.1	0
1984	22.7	56.9	15.2	4.2	0.9	0.2	0	0
1985	20.2	61.6	14.9	2.7	0.6	0	0	0
1986	19.5	62.5	15.1	2.7	0.2	0	0	0
1987	19.2	62.5	14.8	3.3	0.3	0	0	0
1988	18.4	61.6	17.3	2.3	0.5	0	0	0
1989	18.0	61.7	17.4	2.7	0.3	0	0	0
1990	15.9	56.3	23.0	4.4	0.2	0.2	0	0
1991	20.9	47.4	26.3	4.2	1.2	0	0	0
1992	11.8	38.2	42.8	6.5	0.6	0	0	0
1993	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-
1995	14.8	67.3	17.2	0.6	0	0	0	0
1996	15.8	71.1	12.2	0.9	0	0	0	0
1997	4.1	58.1	37.8	0.0	0	0	0	0
1998	28.6	60.0	7.6	2.9	0.0	1.0	0	0
1999	27.7	65.1	7.2	0	0	0	0	0
2000	36.5	46.7	13.1	2.9	0.7	0	0	0
2001	16.0	51.2	27.3	4.9	0.7	0	0	0
2002	9.4	62.9	20.1	7.6	0	0	0	0
2003	16.2	58.0	22.1	3.0	0.8	0	0	0
2004	18.3	57.7	20.5	3.2	0.2	0	0	0
2005	19.2	60.5	15.0	5.4	0	0	0	0
2006	17.7	54.0	23.6	3.7	0.9	0	0	0
2007	7.0	48.5	33.0	10.5	1.0	0	0	0
2008	7.0	72.8	19.3	0.8	0.0	0	0	0
2009	14.3	59.5	23.8	2.4	0.0	0	0	0

YEAR	1	2	3	4	5	6	7	8
2010	11.3	57.1	27.3	3.4	0.8	0	0	0
2011	19.0	51.7	27.6	1.7	0	0	0	0
2012	9.3	63.0	24.0	3.7	0	0	0	0
2013	4.5	68.2	24.4	2.5	0	0	0	0
2014	4.5	60.7	30.8	4.0	0	0	0	0
2015	9.2	54.9	28.8	5.8	1.2	0	0	0
2016	2.5	63.3	29.6	4.3	0.3	0	0	0
Prev. 10-yr mean	10.4	59.0	26.3	3.8	0.4	0	0	0
Overall Mean	16.5	60.9	19.4	2.8	0.3	0	0	0

Table 5.1.2.6. Sea age composition (%) of samples from fishery landings in West Greenland from by continent of origin, 1985 to 2016.

Year	North American			European		
	1SW	2SW	Previous Spawners	1SW	2SW	Previous Spawners
1985	92.5	7.2	0.3	95.0	4.7	0.4
1986	95.1	3.9	1.0	97.5	1.9	0.6
1987	96.3	2.3	1.4	98.0	1.7	0.3
1988	96.7	2.0	1.2	98.1	1.3	0.5
1989	92.3	5.2	2.4	95.5	3.8	0.6
1990	95.7	3.4	0.9	96.3	3.0	0.7
1991	95.6	4.1	0.4	93.4	6.5	0.2
1992	91.9	8.0	0.1	97.5	2.1	0.4
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	96.8	1.5	1.7	97.3	2.2	0.5
1996	94.1	3.8	2.1	96.1	2.7	1.2
1997	98.2	0.6	1.2	99.3	0.4	0.4
1998	96.8	0.5	2.7	99.4	0.0	0.6
1999	96.8	1.2	2.0	100.0	0.0	0.0
2000	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	2.6	0.5	97.8	2.0	0.3
2002	97.3	0.9	1.8	100.0	0.0	0.0
2003	96.7	1.0	2.3	98.9	1.1	0.0
2004	97.0	0.5	2.5	97.0	2.8	0.2
2005	92.4	1.2	6.4	96.7	1.1	2.2
2006	93.0	0.8	5.6	98.8	0.0	1.2
2007	96.5	1.0	2.5	95.6	2.5	1.5
2008	97.4	0.5	2.2	98.8	0.8	0.4
2009	93.4	2.8	3.8	89.4	7.6	3.0
2010	98.2	0.4	1.4	97.5	1.7	0.8
2011	93.8	1.5	4.7	82.8	12.1	5.2
2012	93.2	0.7	6.0	98.0	1.6	0.4
2013	94.9	1.4	3.7	96.6	2.4	1.0
2014	91.3	1.1	7.6	96.1	2.4	1.5
2015	97.0	0.7	2.3	98.2	1.2	0.6
2016	93.5	2.5	4.0	95.5	3.5	1.0

Table 5.1.2.7. The estimated numbers of North American (NA) and European (E) Atlantic salmon caught in West Greenland and the percentage by continent of origin, based on NAFO Division continent of origin weighted by catch (weight) in each division, 1971 to 1992 and 1995 to present. Numbers are rounded to the nearest hundred fish. Unreported catch is not included in this assessment.

Year	Percentageby continent weighted by catch in number		Numbers of salmon by continent	
	NA	E	NA	E
1982	57	43	192 200	143 800
1983	40	60	39 500	60 500
1984	54	46	48 800	41 200
1985	47	53	143 500	161 500
1986	59	41	188 300	131 900
1987	59	41	171 900	126 400
1988	43	57	125 500	168 800
1989	55	45	65 000	52 700
1990	74	26	62 400	21 700
1991	63	37	111 700	65 400
1992	45	55	46 900	38 500
1995	67	33	21 400	10 700
1996	70	30	22 400	9700
1997	85	15	18 000	3300
1998	79	21	3100	900
1999	91	9	5700	600
2000	65	35	5100	2700
2001	67	33	9400	4700
2002	69	31	2300	1000
2003	64	36	2600	1400
2004	72	28	3900	1500
2005	74	26	3500	1200
2006	69	31	4000	1800
2007	76	24	6100	1900
2008	86	14	8000	1300
2009	89	11	7000	800
2010	80	20	10 000	2600
2011	93	7	6800	600
2012	79	21	7800	2100
2013	82	18	11 500	2700
2014	72	28	12 800	5400
2015	79	21	13 500	3900
2016	64	36	5100	3300

Table 5.1.2.8. The number of samples and continent of origin of Atlantic salmon by NAFO Division sampled in West Greenland in 2016. NA = North America, E = Europe.

NAFO Division	Sample dates	Numbers			Percentages	
		NA	E	Total	NA	E
1B	Sept 06–Oct 19	249	69	318	78.3	21.7
1C	Sept 08–28	384	158	542	70.8	29.2
1E	Sept 12–Sept 23	49	76	125	39.2	60.8
1F	Aug 17–Sept 20	182	135	317	57.4	42.6
TOTAL		864	438	1302	66.4	33.6

5.4 Figures

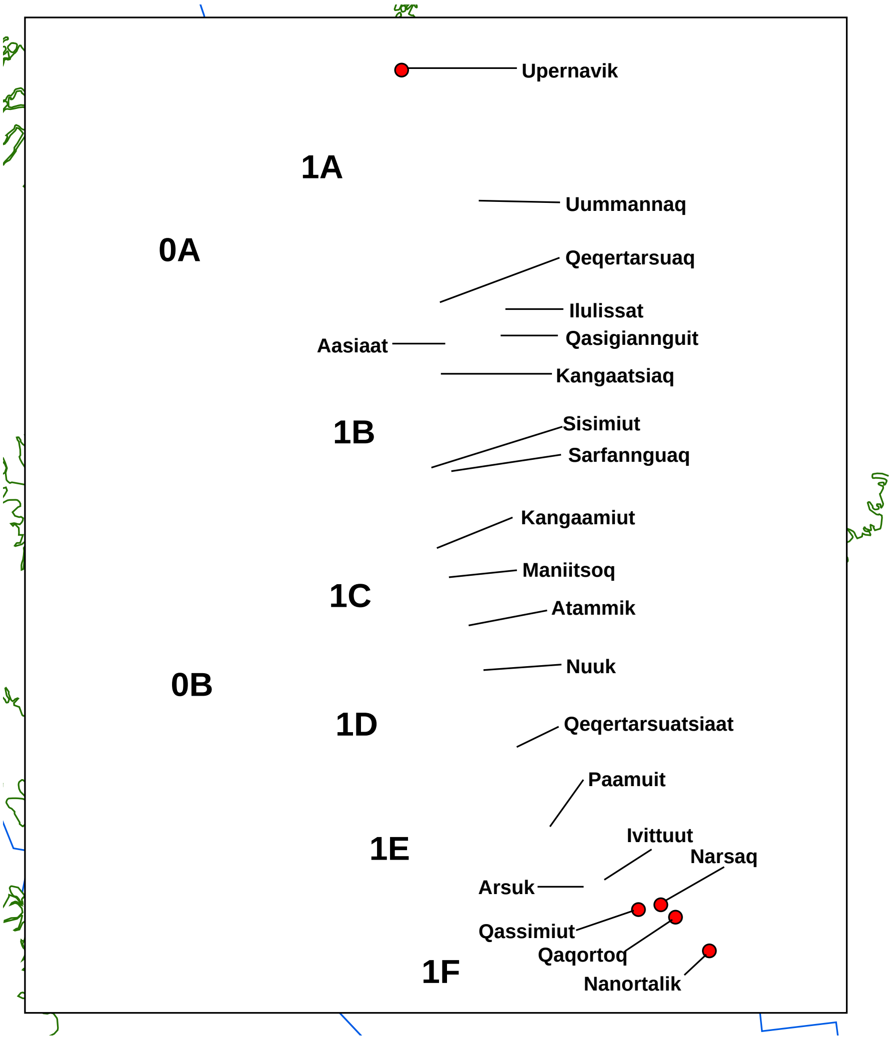


Figure 5.1.1.1. Map of southwest Greenland showing communities to which Atlantic salmon have historically been landed and corresponding NAFO divisions. In 2016 samples were obtained from Sisimuit (NAFO division 1B), Maniitsoq (1C), Paamuit (1E) and Qaqortoq (1F).

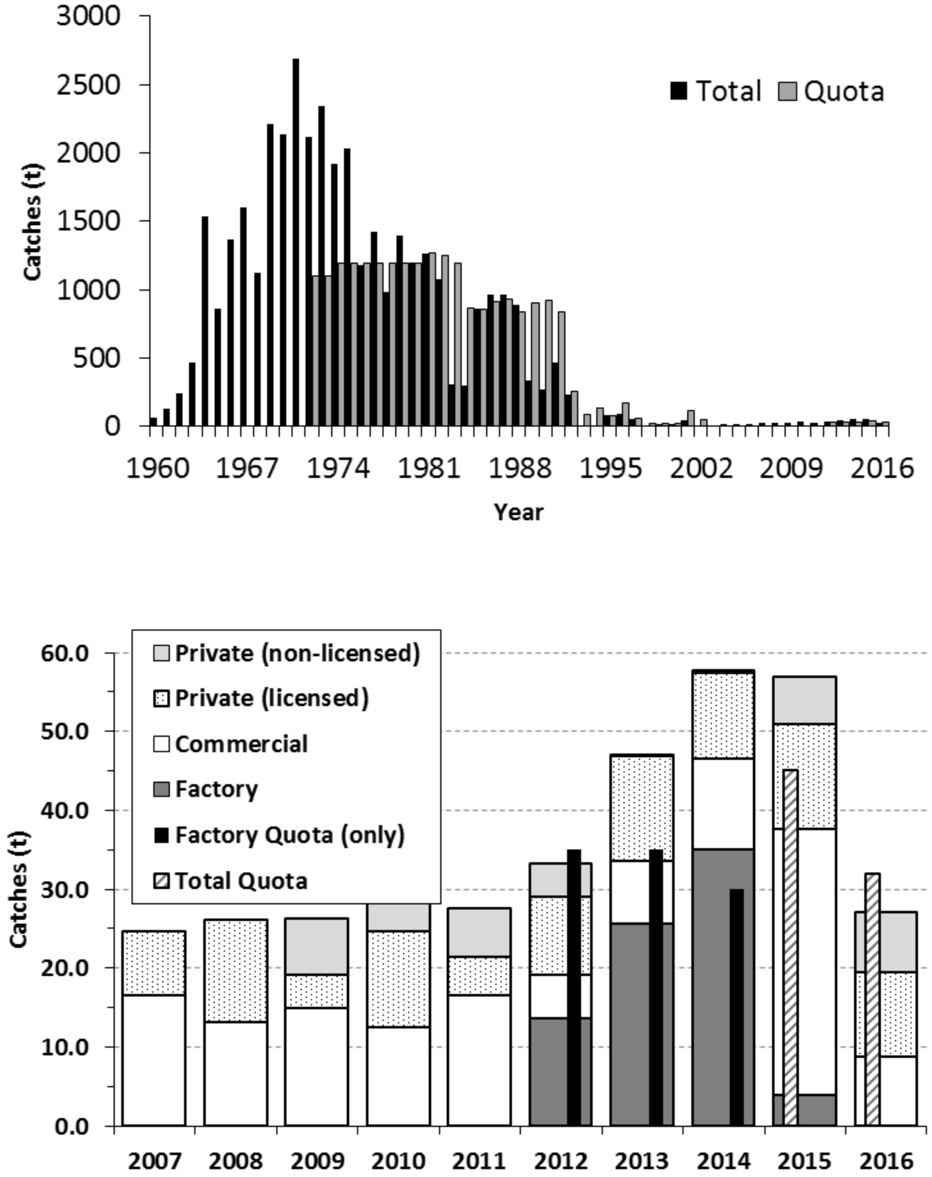


Figure 5.1.1.2. Nominal catches and commercial quotas (t, round fresh weight) of salmon at West Greenland for 1960–2016 (top panel) and 2007–2016 (bottom panel). Total reported landings from 2007–2016 are displayed by landings type. No quotas were set from 2002–2011, a factory only quota was set from 2012–2014, and a single quota of 45 t for all components of the fishery was applied in 2015. The 2016 quota was reduced to 32 t due to overharvest of the 2015 TAC.

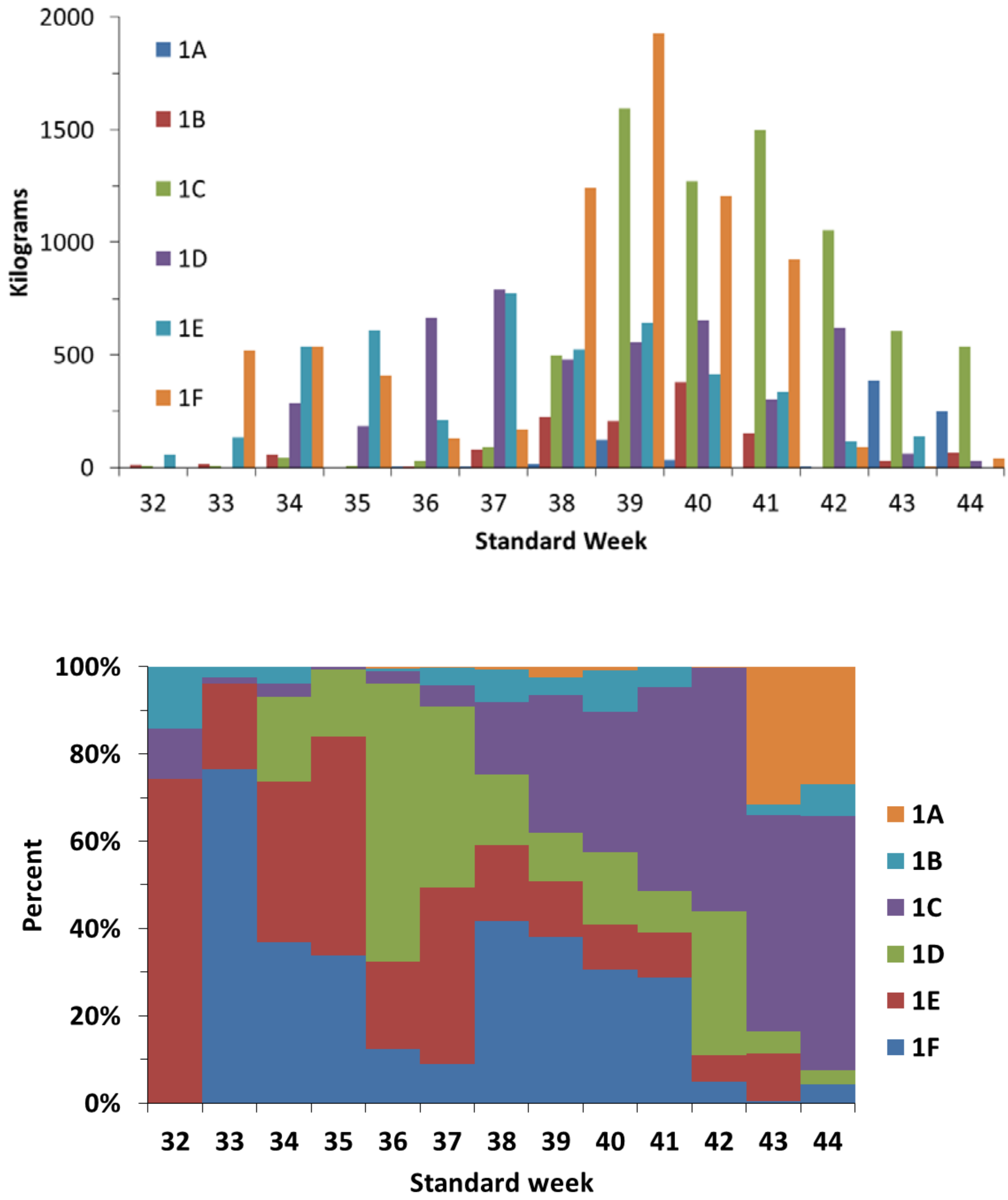


Figure 5.1.1.3. 2016 reported landings for the 2016 Atlantic salmon fishery by NAFO Division (landings from ICES Division XIV are excluded, but amounted to 1.5 t). Reported landings are presented by NAFO Division and standard week by kilograms (top) and proportion within each standard week (bottom). Standard week 32 represents August 6–12, week 37 represents September 10–16, and week 44 represents October 29–November 4.

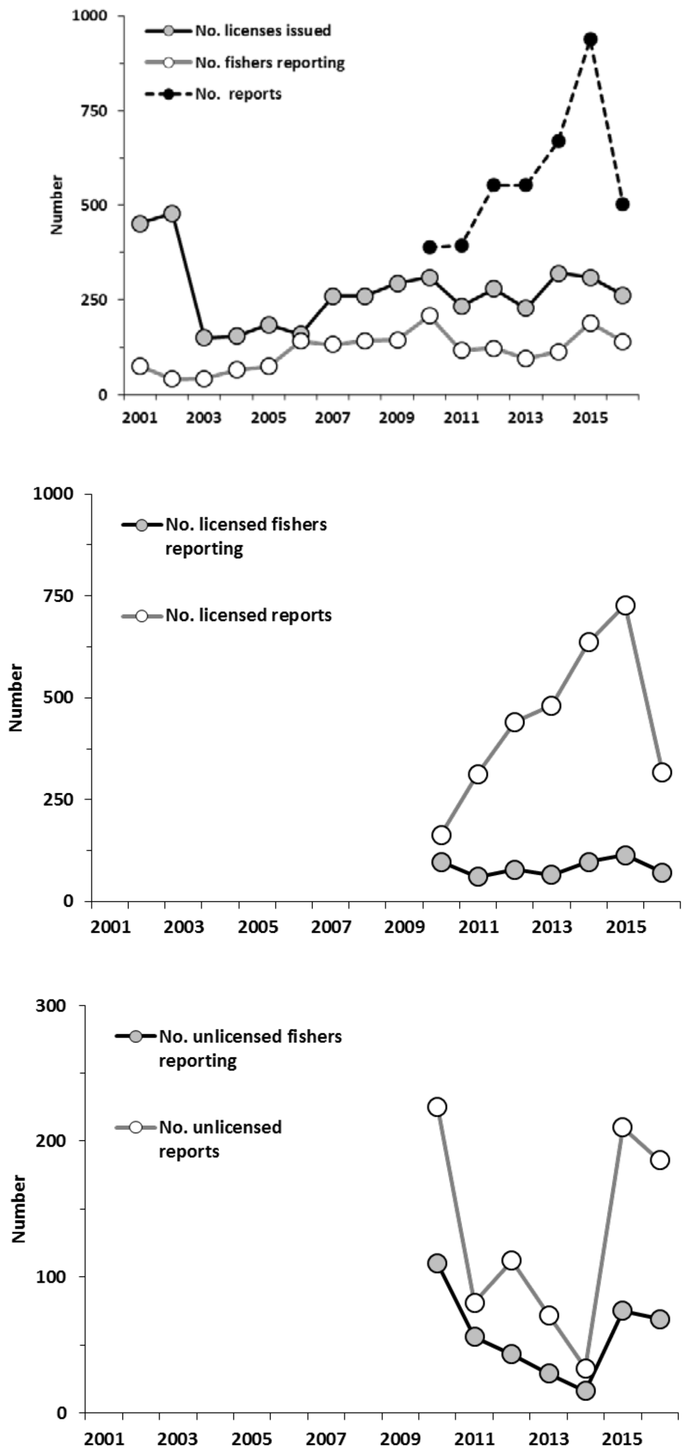


Figure 5.1.1.4. Number of licences issued (2001–2016), total number of fishers reporting landings (2001–2016), and the total number of reports received (2010–2016; top). The number of fishers reporting and the number of reports received for licensed (middle) and unlicensed (bottom) fishers are also provided. These data are only available since 2010.

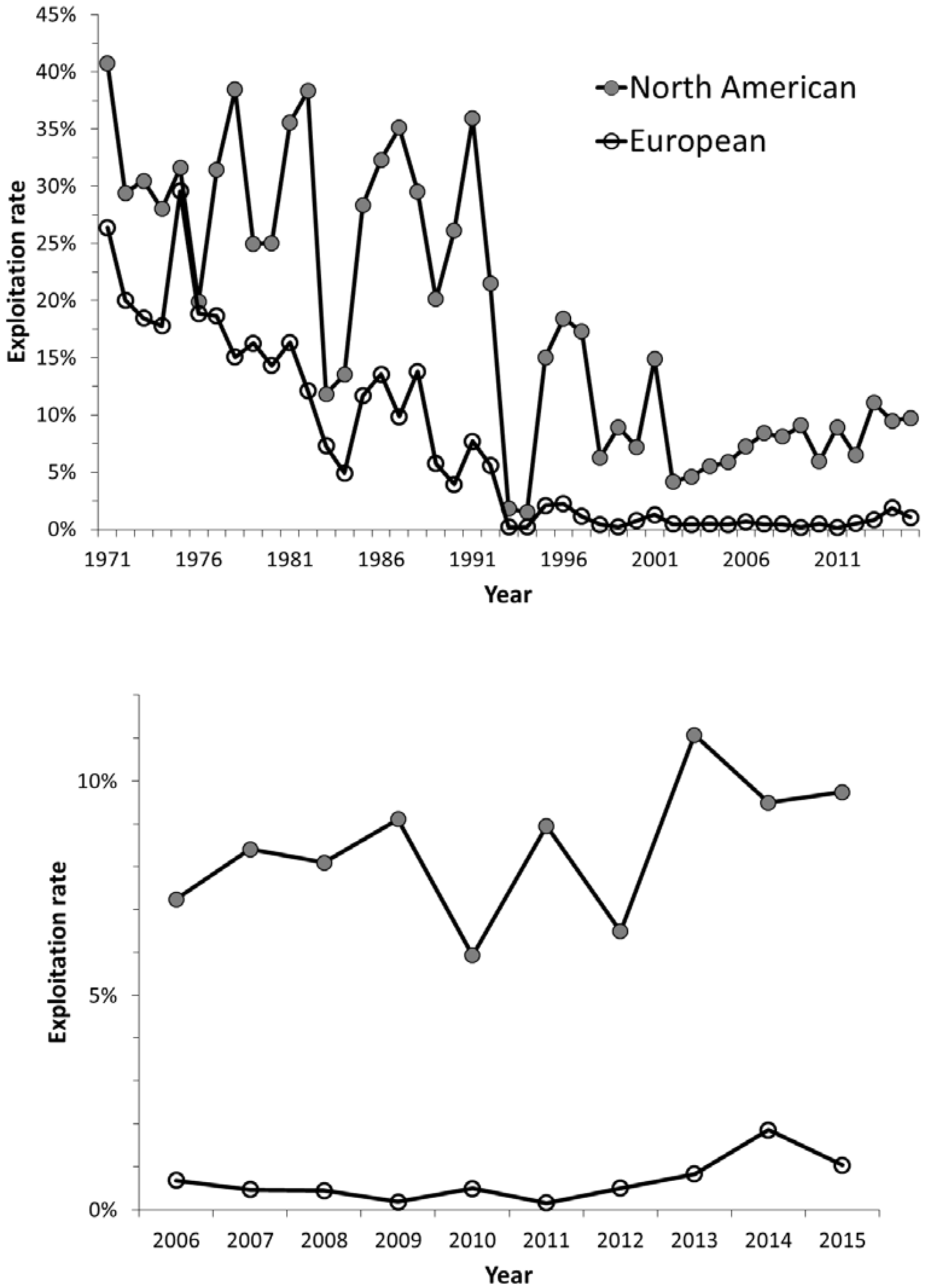


Figure 5.1.1.5. Exploitation rate (%) for NAC 1SW non-maturing and Southern NEAC non-maturing Atlantic salmon at West Greenland, 1971–2015 (top) and 2006–2015 (bottom). Exploitation rate estimates are only available to 2015, as 2016 exploitation rates are dependent on 2017 returns.

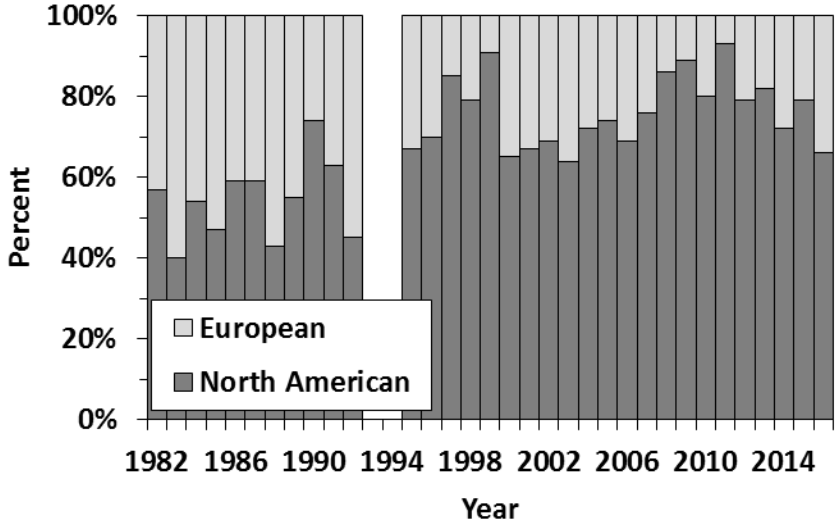


Figure 5.1.2.1. Percent of the sampled catch by continent of origin for 1982 to the present.

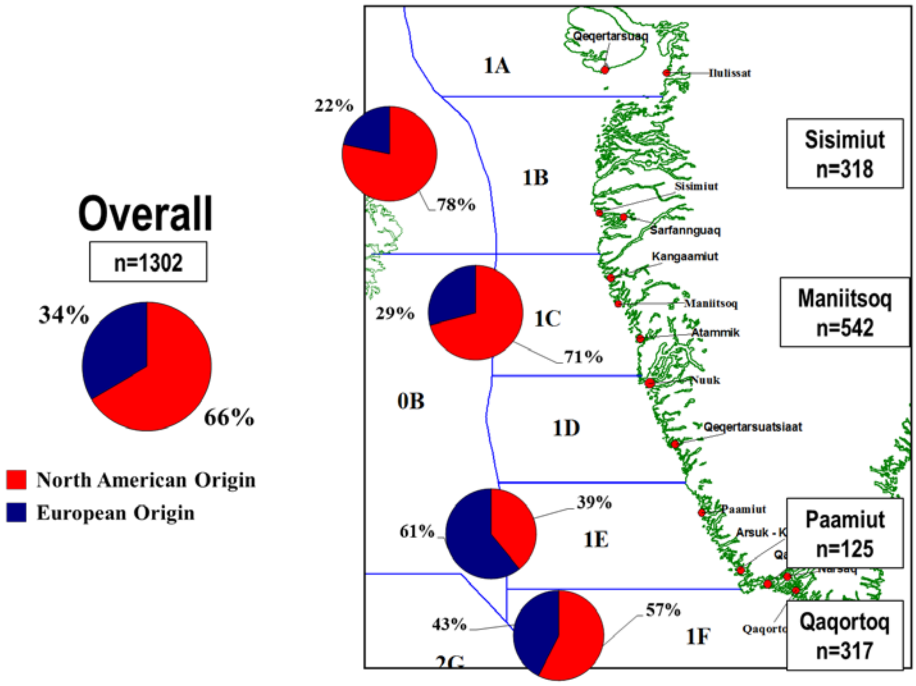


Figure 5.1.2.2. Percentage of North American and European origin Atlantic salmon sampled from the 2016 Greenland fishery according to NAFO division and community sampled. Samples were collected from four NAFO divisions (1B (Sisimiut), 1C (Maniitsoq), 1E (Paamiut), and 1F (Qaqortoq)).

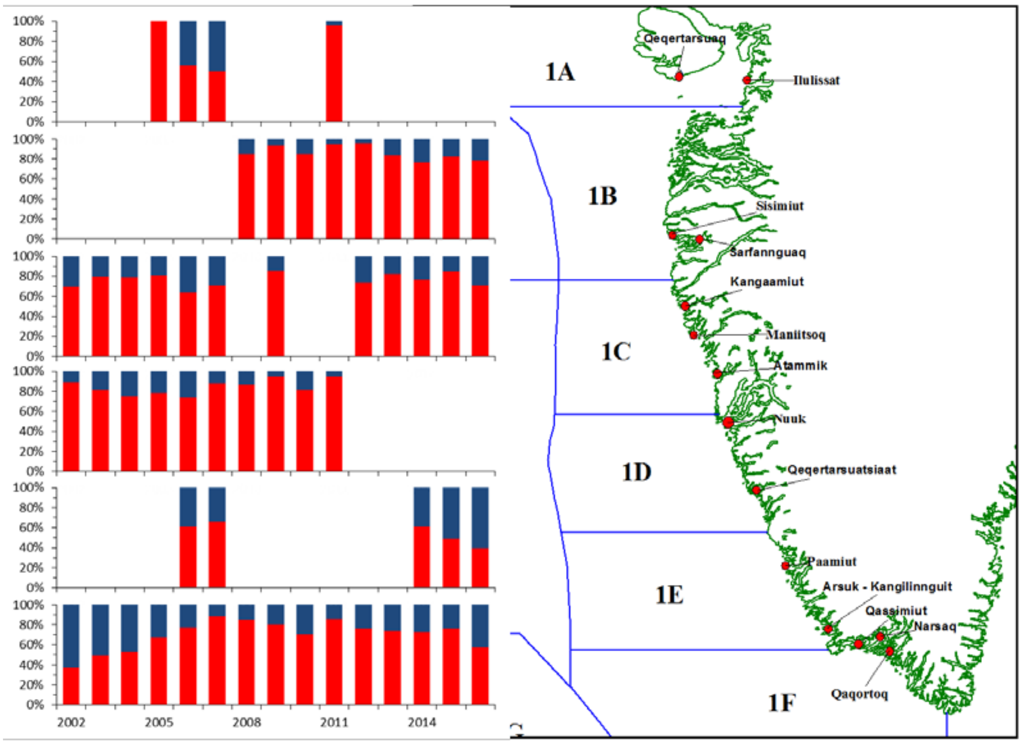
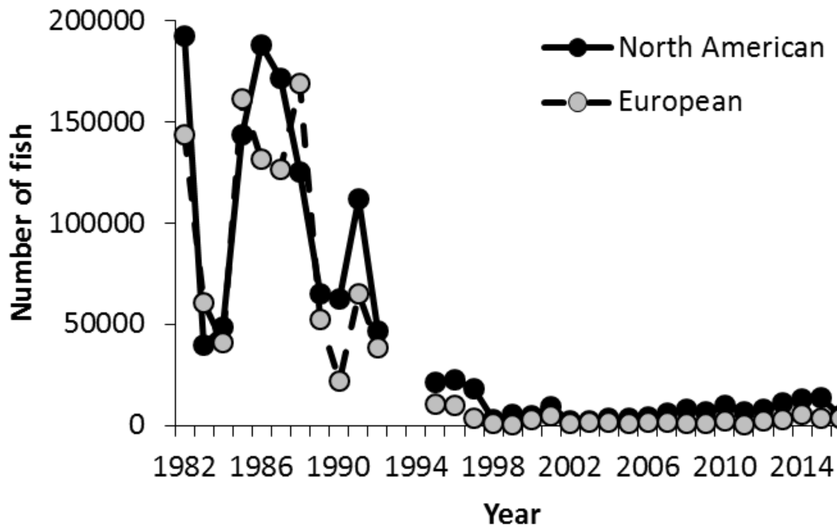


Figure 5.1.2.3. Percentage of North American (red) and European (blue) origin Atlantic salmon sampled from Greenland fisheries by year (2002-2016) and NAFO Division. Where data are presented, samples were collected during that year and within that division. The Division 1A 2005 value is from a single sample.



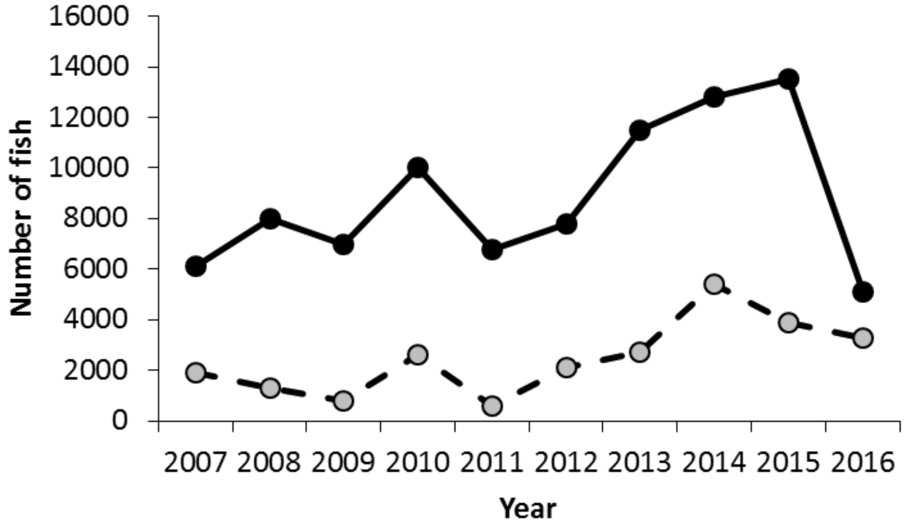


Figure 5.1.2.4. Number of North American and European Atlantic salmon caught at West Greenland from 1982 to the present (upper panel) and 2007 to the present (lower panel). Estimates are based on continent of origin by NAFO division, weighted by catch (weight) in each division. Numbers are rounded to the nearest hundred fish. Unreported catch is not included in this assessment.

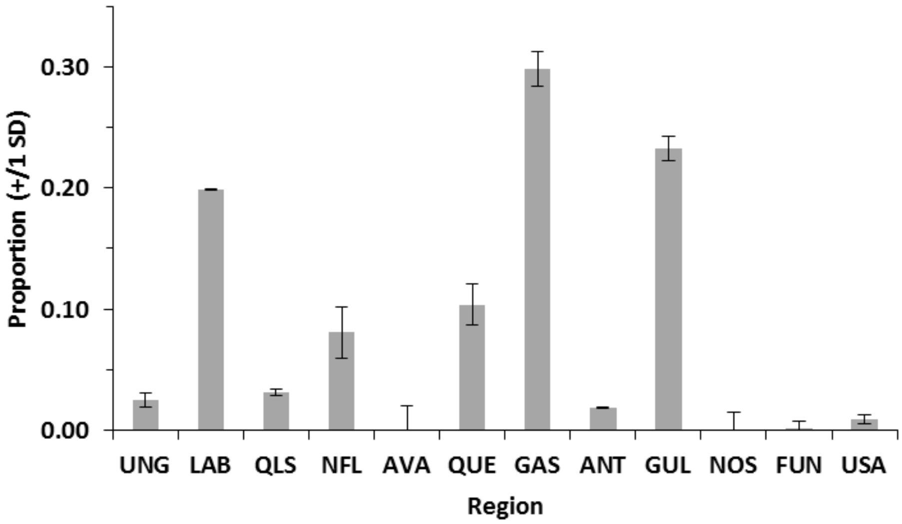


Figure 5.1.2.3. Genetic mixture estimates (proportion) of North American composition of samples from the 2015 West Greenland fishery. Error bars represent one standard error of the estimates. Baseline locations refer to regional reporting groups shown in Figure 4.1.5.1.

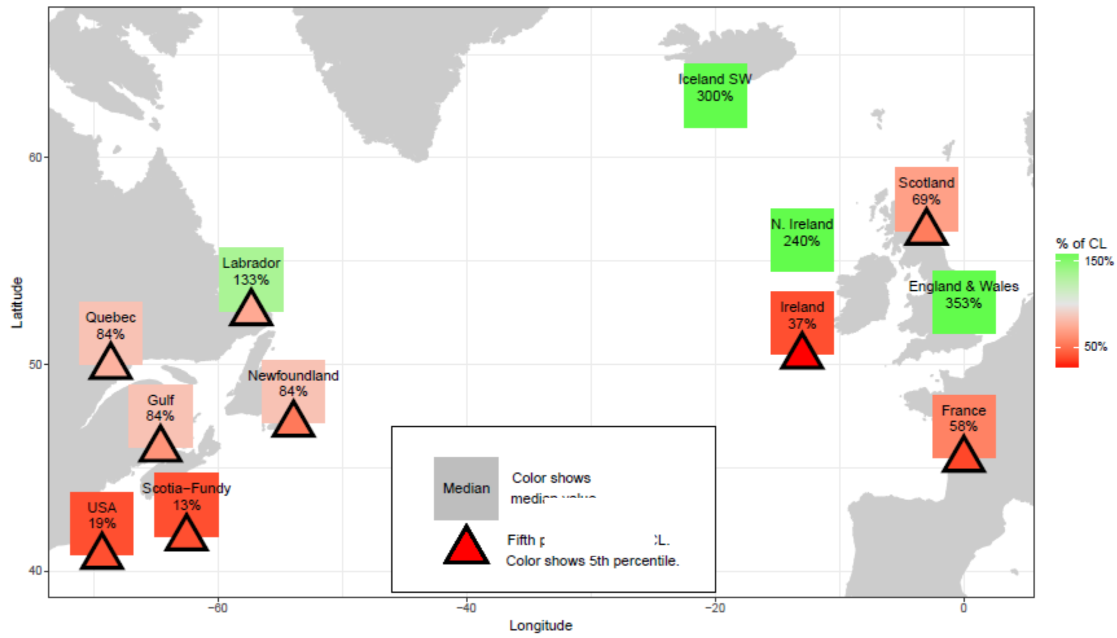


Figure 5.2.1. Summary 2SW (NAC regions) and MSW (NEAC regions) 2016 median spawner estimates in relation to CLs. Median and 5th percentiles refer to the Monte Carlo posterior distributions of each estimate. The triangle symbol is shown only for cases where the 5th percentile of the estimate is below the corresponding CL. The colour shading represents the percentages of CL attained with red being less than 100% and green being greater than 100%. The intensity of the shading is proportional to the percentage of CL attained with red intensity inversely proportional to percentage of CL attained.

Annex 1: List of Working Papers submitted to WGNAS 2017

WP No.	Authors	Title
1	de la Hoz, J.	Salmon Fisheries and Status of Stocks in Spain (Asturias-2016). Report for 2017 Meeting WGNAS
2	April, J., and Cauchon, V.	Status of Atlantic salmon Stocks in Québec in 2016
3	April, J., and Cauchon, V.	Smolt production, freshwater and sea survival on two index rivers in Québec, the Saint-Jean and the Trinité
4	Matanowski, J.	Rapport annuel relatif à la pêche du saumon Atlantique à Saint Pierre et Miquelon Saison 2016
5	Chaput, G., Ehlers, E., Maoiléidigh, N. Ó., and Saunders, R.	NASCO - West Greenland Commission Report of the Framework of Indicators Working Group 2017
6	Nygaard, R.	The Salmon Fishery in Greenland 2016
7	Atkinson, E., Sweka, J., Kocik, J., Bailey, M., and Sheehan, T.	National Report for the United States, 2016
8	Sheehan, T.F., Deschamps, D., Downie, H., Hawkes, J., McAuliffe, M., Millane, M., Sims, K., Nygaard, R., Lubinski, B., Robertson, M.J., and Ó Maoiléidigh, N.	The International Sampling Program: Continent of Origin and Biological Characteristics of Atlantic Salmon Collected at West Greenland in 2016
9	Renkawitz, M.D., and Sheehan, T.F.	Diet of Northwest Atlantic salmon during the marine phase
10	Renkawitz, M.D., and Sheehan, T.F.	Key prey species of Northwest Atlantic salmon during the marine phase from post-smolt to mature adult and their potential association with Atlantic salmon marine productivity
11	Fiske, P., Wennevik, V., Jensen, A.J., Utne, K.R., and Bolstad, G.	Atlantic salmon; National Report for Norway 2016
12	Utne, K.R.	The feeding situation in the Norwegian Sea and surrounding areas
13	Degerman, E., Tamario, C., Persson, J., and Sers, B.	Fisheries, Status and Management of Atlantic Salmon stocks in Sweden: National Report for 2016
14	Tamario, C., and Degerman, E.	Setting biological reference points for Atlantic salmon in Sweden
15	Erkinaro, J., Orell, P., Länsman, M., Falkegård, M., Kuusela, J., Kylmäaho, M., Johansen, N., Haantie, J. and Niemelä, E.	Status of Atlantic salmon stocks in the rivers Teno/Tana and Näätämöjoki/Neidenelva
16	Gudbergsson, G., Jonsson, I.R., Bardarson, H., and Sturlaugsson, J.	National Report for Iceland - the 2016 Salmon Season.
17	Prusov, S., and Ustyuzhinsky, G.	Atlantic Salmon Fisheries and Status of Stocks in Russia. National Report for 2016
18	Bolstad, G. *et al*.	Gene flow from domesticated escapes alters the life history of wild Atlantic salmon

WP No.	Authors	Title
19	Fisheries and Oceans Canada	Update of Indicators of Atlantic Salmon (*Salmo Salar*) in DFO Gulf Region Salmon Fishing Areas 15–18 for 2016
20	Levy, A.L., R.A. Jones, L.G. De Mestral and A.J.F. Gibson	Status of Atlantic Salmon in Canada's Maritimes Region (Salmon Fishing Areas 19 to 21, and 23)
21	Cefas, Environment Agency and Natural Resources Wales	Salmon stocks and fisheries in UK (England and Wales), 2016 - Preliminary assessment prepared for ICES, March 2017.
22	Russell, I., Fiske, P., Samokhvalov, I., and Hansen, J.	NASCO - North East Atlantic Commission Framework of Indicators Working Group report for 2017
23	Jacobsen, J.A..	Status of the fisheries for Atlantic salmon and production of farmed salmon in 2016 for the Faroe Islands
24	Rasmussen, G.	National report for Denmark
25	Smith, G.W., Anderson, J., Armstrong, J., Downie, H., Glover, R., Henry, J., Malcolm, I., Middlemas, S., Morgan, T., Simpson, I.	National Report for UK (Scotland): 2016 season
26	Roberson, M.J. *et al*.	Newfoundland and Labrador Atlantic Salmon 2016
27	Bradbury, I.	Genetic analyses of mixed-stock fisheries in the Northwest Atlantic
28	Meerburg, D.	Update on ASF tracking activities (presentation)
29	Rivot, E., and Olmos, M.	Embedding Atlantic salmon population dynamics and stock assessment within a life cycle modelling framework
30	Pénil, C.	Data for France to 2016
31	Millane, M., Ó Maoiléidigh, N., Gargan, P., White, J., O'Higgins, K., Dillane, M., McGrory, T., Bond, N., McLaughlin, D., Rogan, G., Cotter, D., Maxwell, H., and Poole, R.	National Report for Ireland - The 2016 Salmon Season
32	Camara, K.	Salmon reintroduction, river Rhine, Germany Short update 2016 - Numbers and challenges
33	Ensing, D., Kennedy, R., and Boylan, P.	Summary of Salmon Fisheries and Status of Stocks in Northern Ireland for 2016
34	Ensing, D.	WKICCAS
35	Ensing, D.	WGERAAS report final - update
36	Chaput, G., April, J., Cairns, D., Biron, M., Douglas, S., Jones, R., Levy, A., Poole, R., Robertson, M., and Veinott, G.	Catch Statistics and Aquaculture Production Values for Canada: preliminary 2016, final 2015
37	Ó Maoiléidigh, N.	WGRECORDS highlights for WGNAS 2016
38	Ó Maoiléidigh, N	International Year of the Salmon Update
39	Nygaard, R., Uldall-Jessen, L., Hansen, P.N., and Villadsen, J.	Results of the phone interview survey of licensed Greenlandic salmon fishermen for the 2016 season
40	Utne, S.R.	Bycatch of salmon in blue whiting fisheries
41	Miller, D.C.M.	Notes on potential salmon bycatch in the blue whiting fishery

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Annex 4. Reported catch of salmon in numbers and weight (tonnes round fresh weight) by sea age class. Catches reported for 2016 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
Greenland	1982	315532	-	17810	-	-	-	-	-	-	-	-	-	2688	-	336030	1077
	1983	90500	-	8100	-	-	-	-	-	-	-	-	-	1400	-	100000	310
	1984	78942	-	10442	-	-	-	-	-	-	-	-	-	630	-	90014	297
	1985	292181	-	18378	-	-	-	-	-	-	-	-	-	934	-	311493	864
	1986	307800	-	9700	-	-	-	-	-	-	-	-	-	2600	-	320100	960
	1987	297128	-	6287	-	-	-	-	-	-	-	-	-	2898	-	306313	966
	1988	281356	-	4602	-	-	-	-	-	-	-	-	-	2296	-	288254	893
	1989	110359	-	5379	-	-	-	-	-	-	-	-	-	1875	-	117613	337
	1990	97271	-	3346	-	-	-	-	-	-	-	-	-	860	-	101477	274
	1991	167551	415	8809	53	-	-	-	-	-	-	-	-	743	4	177103	472
	1992	82354	217	2822	18	-	-	-	-	-	-	-	-	364	2	85540	237
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1995	31241	-	558	-	-	-	-	-	-	-	-	-	478	-	32277	83
	1996	30613	-	884	-	-	-	-	-	-	-	-	-	568	-	32065	92
	1997	20980	-	134	-	-	-	-	-	-	-	-	-	124	-	21238	58
	1998	3901	-	17	-	-	-	-	-	-	-	-	-	88	-	4006	11
	1999	6124	18	50	0	-	-	-	-	-	-	-	-	84	1	6258	19
	2000	7715	21	0	0	-	-	-	-	-	-	-	-	140	0	7855	21
	2001	14795	40	324	2	-	-	-	-	-	-	-	-	293	1	15412	43
	2002	3344	10	34	0	-	-	-	-	-	-	-	-	27	0	3405	10
	2003	3933	12	38	0	-	-	-	-	-	-	-	-	73	0	4044	12
	2004	4488	14	51	0	-	-	-	-	-	-	-	-	88	0	4627	15
	2005	3120	13	40	0	-	-	-	-	-	-	-	-	180	1	3340	14
	2006	5746	20	183	1	-	-	-	-	-	-	-	-	224	1	6153	22
	2007	6037	24	82	0	6	0	-	-	-	-	-	-	144	1	6263	25
	2008	9311	26	47	0	0	0	-	-	-	-	-	-	177	1	9535	26
	2009	7442	27	268	1	0	0	-	-	-	-	-	-	328	1	8038	29
	2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11747	40
	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8396	28
	2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9689	33
	2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12920	47
	2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18200	58
	2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17845	57
	2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8966	27
Canada	1982	358000	716	-	-	-	-	-	-	-	-	240000	1082	-	-	598000	1798
	1983	265000	513	-	-	-	-	-	-	-	-	201000	911	-	-	466000	1424
	1984	234000	467	-	-	-	-	-	-	-	-	143000	645	-	-	377000	1112
	1985	333084	593	-	-	-	-	-	-	-	-	122621	540	-	-	455705	1133
	1986	417269	780	-	-	-	-	-	-	-	-	162305	779	-	-	579574	1559
	1987	435799	833	-	-	-	-	-	-	-	-	203731	951	-	-	639530	1784
	1988	372178	677	-	-	-	-	-	-	-	-	137637	633	-	-	509815	1310
	1989	304620	549	-	-	-	-	-	-	-	-	135484	590	-	-	440104	1139
	1990	233690	425	-	-	-	-	-	-	-	-	106379	486	-	-	340069	911
	1991	189324	341	-	-	-	-	-	-	-	-	82532	370	-	-	271856	711
	1992	108901	199	-	-	-	-	-	-	-	-	66357	323	-	-	175258	522
	1993	91239	159	-	-	-	-	-	-	-	-	45416	214	-	-	136655	373
	1994	76973	139	-	-	-	-	-	-	-	-	42946	216	-	-	119919	355
	1995	61940	107	-	-	-	-	-	-	-	-	34263	153	-	-	96203	260
	1996	82490	138	-	-	-	-	-	-	-	-	31590	154	-	-	114080	292
	1997	58988	103	-	-	-	-	-	-	-	-	26270	126	-	-	85258	229
	1998	51251	87	-	-	-	-	-	-	-	-	13274	70	-	-	64525	157
	1999	50901	88	-	-	-	-	-	-	-	-	11368	64	-	-	62269	152
	2000	55263	95	-	-	-	-	-	-	-	-	10571	58	-	-	65834	153
	2001	51225	86	-	-	-	-	-	-	-	-	11575	61	-	-	62800	147
	2002	53464	99	-	-	-	-	-	-	-	-	8439	49	-	-	61903	148
	2003	46768	81	-	-	-	-	-	-	-	-	11218	60	-	-	57986	141
	2004	54253	94	-	-	-	-	-	-	-	-	12933	68	-	-	67186	162
	2005	47368	83	-	-	-	-	-	-	-	-	10937	56	-	-	58305	139
	2006	46747	82	-	-	-	-	-	-	-	-	11248	55	-	-	57995	137
	2007	37075	63	-	-	-	-	-	-	-	-	10311	49	-	-	47386	112
	2008	58386	100	-	-	-	-	-	-	-	-	11736	57	-	-	70122	158
	2009	42943	74	-	-	-	-	-	-	-	-	11226	52	-	-	54169	126
	2010	58531	100	-	-	-	-	-	-	-	-	10972	53	-	-	69503	153
	2011	63756	110	-	-	-	-	-	-	-	-	13668	69	-	-	77424	179
	2012	43192	74	-	-	-	-	-	-	-	-	10980	52	-	-	54172	126
	2013	41311	72	-	-	-	-	-	-	-	-	13887	66	-	-	55198	138
	2014	44171	77	-	-	-	-	-	-	-	-	8756	41	-	-	45328	106
	2015	48838	86	-	-	-	-	-	-	-	-	11473	54	-	-	60311	140
	2016	46307	79	-	-	-	-	-	-	-	-	11709	56	-	-	58016	135

Annex 4. (Continued).

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
USA	1982	33	-	1206	-	5	-	-	-	-	-	-	-	21	-	1265	6
	1983	26	-	314	1	2	-	-	-	-	-	-	-	6	-	348	1
	1984	50	-	545	2	2	-	-	-	-	-	-	-	12	-	609	2
	1985	23	-	528	2	2	-	-	-	-	-	-	-	13	-	566	2
	1986	76	-	482	2	2	-	-	-	-	-	-	-	3	-	563	2
	1987	33	-	229	1	10	-	-	-	-	-	-	-	10	-	282	1
	1988	49	-	203	1	3	-	-	-	-	-	-	-	4	-	259	1
	1989	157	0	325	1	2	-	-	-	-	-	-	-	3	-	487	2
	1990	52	0	562	2	12	-	-	-	-	-	-	-	16	-	642	2
	1991	48	0	185	1	1	-	-	-	-	-	-	-	4	-	238	1
	1992	54	0	138	1	1	-	-	-	-	-	-	-	-	-	193	1
	1993	17	-	133	1	0	0	-	-	-	-	-	-	2	-	152	1
	1994	12	-	0	0	0	0	-	-	-	-	-	-	-	-	12	0
	1995	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1996	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1997	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1998	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	1999	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2000	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2001	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2002	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2003	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2004	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2005	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2006	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2007	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2008	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2009	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2010	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2011	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2012	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2013	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2014	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2015	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
	2016	0	0	0	0	0	0	-	-	-	-	-	-	-	-	0	0
Faroe Islands	1982/83	9086	-	101227	-	21663	-	448	-	29	-	-	-	-	-	132453	625
	1983/84	4791	-	107199	-	12469	-	49	-	-	-	-	-	-	-	124508	651
	1984/85	324	-	123510	-	9690	-	-	-	-	-	-	-	1653	-	135177	598
	1985/86	1672	-	141740	-	4779	-	76	-	-	-	-	-	6287	-	154554	545
	1986/87	76	-	133078	-	7070	-	80	-	-	-	-	-	-	-	140304	539
	1987/88	5833	-	55728	-	3450	-	0	-	-	-	-	-	-	-	65011	208
	1988/89	1351	-	86417	-	5728	-	0	-	-	-	-	-	-	-	93496	309
	1989/90	1560	-	103407	-	6463	-	6	-	-	-	-	-	-	-	111436	364
	1990/91	631	-	52420	-	4390	-	8	-	-	-	-	-	-	-	57449	202
	1991/92	16	-	7611	-	837	-	-	-	-	-	-	-	-	-	8464	31
	1992/93	-	-	4212	-	1203	-	-	-	-	-	-	-	-	-	5415	22
	1993/94	-	-	1866	-	206	-	-	-	-	-	-	-	-	-	2072	7
	1994/95	-	-	1807	-	156	-	-	-	-	-	-	-	-	-	1963	6
	1995/96	-	-	268	-	14	-	-	-	-	-	-	-	-	-	282	1
	1996/97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1997/98	339	-	1315	-	109	-	-	-	-	-	-	-	-	-	1763	6
	1998/99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
	1999/00	225	-	1560	-	205	-	-	-	-	-	-	-	-	-	1990	8
	2000/01	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2001/02	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2002/03	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2003/04	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2004/05	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2005/06	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2006/07	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2007/08	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2008/09	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2009/10	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2010/11	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2011/12	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2012/13	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2013/14	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2014/15	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2015/16	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0
	2016/17	0	-	0	-	0	-	-	-	-	-	-	-	-	-	0	0

Annex 4. (Continued).

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Finland	1982	2598	5	-	-	-	-	-	-	-	-	5408	49	-	-	8006	54
	1983	3916	7	-	-	-	-	-	-	-	-	6050	51	-	-	9966	58
	1984	4899	9	-	-	-	-	-	-	-	-	4726	37	-	-	9625	46
	1985	6201	11	-	-	-	-	-	-	-	-	4912	38	-	-	11113	49
	1986	6131	12	-	-	-	-	-	-	-	-	3244	25	-	-	9375	37
	1987	8696	15	-	-	-	-	-	-	-	-	4520	34	-	-	13216	49
	1988	5926	9	-	-	-	-	-	-	-	-	3495	27	-	-	9421	36
	1989	10395	19	-	-	-	-	-	-	-	-	5332	33	-	-	15727	52
	1990	10084	19	-	-	-	-	-	-	-	-	5600	41	-	-	15684	60
	1991	9213	17	-	-	-	-	-	-	-	-	6298	53		-	15511	70
	1992	15017	28	-	-	-	-	-	-	-	-	6284	49	-	-	21301	77
	1993	11157	17	-	-	-	-	-	-	-	-	8180	53	-	-	19337	70
	1994	7493	11	-	-	-	-	-	-	-	-	6230	38	-	-	13723	49
	1995	7786	11	-	-	-	-	-	-	-	-	5344	38	-	-	13130	49
	1996	12230	20	1275	5	1424	12	234	4	19	1	-	-	354	3	15536	44
	1997	10341	15	2419	10	1674	15	141	2	22	1	-	-	418	3	15015	45
	1998	11792	19	1608	7	1660	16	147	3	-	-	-	-	460	3	15667	48
	1999	17929	31	2055	8	1643	17	120	2	6	0	-	-	592	3	22345	63
	2000	20199	37	5247	25	2502	25	101	2	0	0	-	-	1090	7	29139	96
	2001	14979	25	6091	28	5451	59	101	2	0	0	-	-	2137	12	28759	126
	2002	8095	15	5550	20	3845	41	135	2	10	0	-	-	2466	15	20101	94
	2003	8375	15	2332	8	3551	33	145	2	5	0	-	-	2424	15	16832	75
	2004	4177	7	1480	6	1077	10	246	4	6	0	-	-	1430	11	8416	39
	2005	10412	19	1287	5	1420	14	56	1	40	1	-	-	804	7	14019	47
	2006	17359	30	4217	18	1350	13	62	1	0	0	-	-	764	5	23752	67
	2007	4861	7	5368	20	2287	22	17	0	6	0	-	-	1195	8	13734	59
	2008	5194	8	2518	8	4161	40	227	4	0	0	-	-	1928	11	14028	71
	2009	9960	13	1585	5	1252	11	223	3	0	0	-	-	899	5	13919	38
	2010	7260	13	3270	13	1244	11	282	4	5	0	-	-	996	8	13057	49
	2011	9043	15	1859	8	1434	13	173	3	10	0	-	-	789	5	13308	44
	2012	15904	30	2997	13	1234	11	197	3	5	0	-	-	967	7	21304	64
	2013	9408	14	3044	15	1186	11	63	1	7	0	-	-	806	5	14514	46
	2014	13031	26	3323	13	928	9	96	2	0	0	-	-	1284	7	18662	58
	2015	8255	13	3562	16	1069	9	79	1	0	0	-	-	903	6	13868	45
	2016	6763	14	3028	10	1997	20	91	1	0	0	-	-	959	5	12838	51
Iceland	1991	29601	-	11892	-	-	-	-	-	-	-	-	-	-	-	41493	130
	1992	38538	-	15312	-	-	-	-	-	-	-	-	-	-	-	53850	175
	1993	36640	-	11541	-	-	-	-	-	-	-	-	-	-	-	48181	160
	1994	24224	59	14088	76	-	-	-	-	-	-	-	-	-	-	38312	135
	1995	32767	90	13136	56	-	-	-	-	-	-	-	-	-	-	45903	145
	1996	26927	66	9785	52	-	-	-	-	-	-	-	-	-	-	36712	118
	1997	21684	56	8178	41	-	-	-	-	-	-	-	-	-	-	29862	97
	1998	32224	81	7272	37	-	-	-	-	-	-	-	-	-	-	39496	119
	1999	22620	59	9883	52	-	-	-	-	-	-	-	-	-	-	32503	111
	2000	20270	49	4319	24	-	-	-	-	-	-	-	-	-	-	24589	73
	2001	18538	46	5289	28	-	-	-	-	-	-	-	-	-	-	23827	74
	2002	25277	64	5194	26	-	-	-	-	-	-	-	-	-	-	30471	90
	2003	24738	61	8119	37	-	-	-	-	-	-	-	-	-	-	32857	99
	2004	32600	84	6128	28	-	-	-	-	-	-	-	-	-	-	38728	111
	2005	39980	101	5941	28	-	-	-	-	-	-	-	-	-	-	45921	129
	2006	29857	71	5635	23	-	-	-	-	-	-	-	-	-	-	35492	93
	2007	31899	74	3262	15	-	-	-	-	-	-	-	-	-	-	35161	89
	2008	44391	106	5129	26	-	-	-	-	-	-	-	-	-	-	49520	132
	2009	43981	103	4561	24	-	-	-	-	-	-	-	-	-	-	48542	126
	2010	43457	105	9251	43	-	-	-	-	-	-	-	-	-	-	52708	147
	2011	28550	74	4854	24	-	-	-	-	-	-	-	-	-	-	33404	98
	2012	17011	15	2848	14	-	-	-	-	-	-	-	-	-	-	19859	29
	2013	40412	97	4274	19	-	-	-	-	-	-	-	-	-	-	44686	116
	2014	13593	29	3317	17	-	-	-	-	-	-	-	-	-	-	16910	47
	2015	33713	78	3201	16	-	-	-	-	-	-	-	-	-	-	36914	94
	2016	41911	56	6337	32	-	-	-	-	-	-	-	-	-	-	48248	87
Sweden	1990	7430	18	-	-	-	-	-	-	-	-	3135	15	-	-	10565	33
	1991	8990	20	-	-	-	-	-	-	-	-	3620	18	-	-	12610	38
	1992	9850	23	-	-	-	-	-	-	-	-	4655	26	-	-	14505	49
	1993	10540	23	-	-	-	-	-	-	-	-	6370	33	-	-	16910	56
	1994	8035	18	-	-	-	-	-	-	-	-	4660	26	-	-	12695	44
	1995	9761	22	-	-	-	-	-	-	-	-	2770	14	-	-	12531	36
	1996	6008	14	-	-	-	-	-	-	-	-	3542	19	-	-	9550	33
	1997	2747	7	-	-	-	-	-	-	-	-	2307	12	-	-	5054	19
	1998	2421	6	-	-	`	-	-	-	-	-	1702	9	-	-	4123	15
	1999	3573	8	-	-	-	-	-	-	-	-	1460	8	-	-	5033	16
	2000	7103	18	-	-	-	-	-	-	-	-	3196	15	-	-	10299	33
	2001	4634	12	-	-	-	-	-	-	-	-	3853	21	-	-	8487	33
	2002	4733	12	-	-	-	-	-	-	-	-	2826	16	-	-	7559	28
	2003	2891	7	-	-	-	-	-	-	-	-	3214	18	-	-	6105	25
	2004	2494	6	-	-	-	-	-	-	-	-	2330	13	-	-	4824	19
	2005	2122	5	-	-	-	-	-	-	-	-	1770	10	-	-	3892	15
	2006	2585	4	-	-	-	-	-	-	-	-	1772	10	-	-	4357	14
	2007	1228	3	-	-	-	-	-	-	-	-	2442	13	-	-	3670	16
	2008	1197	3	-	-	-	-	-	-	-	-	2752	16	-	-	3949	18
	2009	1269	3	-	-	-	-	-	-	-	-	2495	14	-	-	3764	17
	2010	2109	5	-	-	-	-	-	-	-	-	3066	17	-	-	5175	22
	2011	2726	7	-	-	-	-	-	-	-	-	5759	32	-	-	8485	39
	2012	1900	5	-	-	-	-	-	-	-	-	4826	25	-	-	6726	30
	2013	1052	3	-	-	-	-	-	-	-	-	1996	12	-	-	3048	15
	2014	2887	8	-	-	-	-	-	-	-	-	3657	22	-	-	6544	30
	2015	1028	2	-	-	-	-	-	-	-	-	2569	15	-	-	3597	18
	2016	742	2	-	-	-	-	-	-	-	-	1389	7	-	-	2131	9

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	221566	467	-	-	-	-	-	-	-	-	213943	1189	-	-	435509	1656
	1982	163120	363	-	-	-	-	-	-	-	-	174229	985	-	-	337349	1348
	1983	278061	593	-	-	-	-	-	-	-	-	171361	957	-	-	449422	1550
	1984	294365	628	-	-	-	-	-	-	-	-	176716	995	-	-	471081	1623
	1985	299037	638	-	-	-	-	-	-	-	-	162403	923	-	-	461440	1561
	1986	264849	556	-	-	-	-	-	-	-	-	191524	1042	-	-	456373	1598
	1987	235703	491	-	-	-	-	-	-	-	-	153554	894	-	-	389257	1385
	1988	217617	420	-	-	-	-	-	-	-	-	120367	656	-	-	337984	1076
	1989	220170	436	-	-	-	-	-	-	-	-	80880	469	-	-	301050	905
	1990	192500	385	-	-	-	-	-	-	-	-	91437	545	-	-	283937	930
	1991	171041	342	-	-	-	-	-	-	-	-	92214	535	-	-	263255	877
	1992	151291	301	-	-	-	-	-	-	-	-	92717	566	-	-	244008	867
	1993	153407	312	62403	284	35147	327	-	-	-	-	-	-	-	-	250957	923
	1994	-	415	-	319	-	262	-	-	-	-	-	-	-	-	-	996
	1995	134341	249	71552	341	27104	249	-	-	-	-	-	-	-	-	232997	839
	1996	110085	215	69389	322	27627	249	-	-	-	-	-	-	-	-	207101	786
	1997	124387	241	52842	238	16448	151	-	-	-	-	-	-	-	-	193677	630
	1998	162185	296	66767	306	15568	139	-	-	-	-	-	-	-	-	244520	741
	1999	164905	318	70825	326	18669	167	-	-	-	-	-	-	-	-	254399	811
	2000	250468	504	99934	454	24319	219	-	-	-	-	-	-	-	-	374721	1177
	2001	207934	417	117759	554	33047	295	-	-	-	-	-	-	-	-	358740	1266
	2002	127039	249	98055	471	33013	299	-	-	-	-	-	-	-	-	258107	1019
	2003	185574	363	87993	410	31099	298	-	-	-	-	-	-	-	-	304666	1071
	2004	108645	207	77343	371	23173	206	-	-	-	-	-	-	-	-	209161	784
	2005	165900	307	69488	320	27507	261	-	-	-	-	-	-	-	-	262895	888
	2006	142218	261	99401	453	23529	218	-	-	-	-	-	-	-	-	265148	932
	2007	78165	140	79146	363	28896	264	-	-	-	-	-	-	-	-	186207	767
	2008	89228	170	69027	314	34124	322	-	-	-	-	-	-	-	-	192379	807
	2009	73045	135	53725	241	23663	219	-	-	-	-	-	-	-	-	150433	595
	2010	98490	184	56260	250	22310	208	-	-	-	-	-	-	-	-	177060	642
	2011	71597	140	81351	374	20270	183	-	-	-	-	-	-	-	-	173218	696
	2012	81638	162	63985	289	26689	245	-	-	-	-	-	-	-	-	172312	696
	2013	70059	117	49264	227	14367	131	-	-	-	-	-	-	-	-	133690	475
	2014	85419	171	47347	203	12415	116	-	-	-	-	-	-	-	-	145181	490
	2015	83196	153	64069	296	15407	134	-	-	-	-	-	-	-	-	162672	583
	2016	65470	117	69167	321	19406	174	-	-	-	-	-	-	-	-	154043	612
Russia	1987	97242	-	27135	-	9539	-	556	-	18	-	-	-	2521	-	137011	564
	1988	53158	-	33395	-	10256	-	294	-	25	-	-	-	2937	-	100065	420
	1989	78023	-	23123	-	4118	-	26	-	0	-	-	-	2187	-	107477	364
	1990	70595	-	20633	-	2919	-	101	-	0	-	-	-	2010	-	96258	313
	1991	40603	-	12458	-	3060	-	650	-	0	-	-	-	1375	-	58146	215
	1992	34021	-	8880	-	3547	-	180	-	0	-	-	-	824	-	47452	167
	1993	28100	-	11780	-	4280	-	377	-	0	-	-	-	1470	-	46007	139
	1994	30877	-	10879	-	2183	-	51	-	0	-	-	-	555	-	44545	141
	1995	27775	62	9642	50	1803	15	6	0	0	0	-	-	385	2	39611	129
	1996	33878	79	7395	42	1084	9	40	1	0	0	-	-	41	1	42438	131
	1997	31857	72	5837	28	672	6	38	1	0	0	-	-	559	3	38963	110
	1998	34870	92	6815	33	181	2	28	0	0	0	-	-	638	3	42532	130
	1999	24016	66	5317	25	499	5	0	0	0	0	-	-	1131	6	30963	102
	2000	27702	75	7027	34	500	5	3	0	0	0	-	-	1853	9	37085	123
	2001	26472	61	7505	39	1036	10	30	0	0	0	-	-	922	5	35965	115
	2002	24588	60	8720	43	1284	12	3	0	0	0	-	-	480	3	35075	118
	2003	22014	50	8905	42	1206	12	20	0	0	0	-	-	634	4	32779	107
	2004	17105	39	6786	33	880	7	0	0	0	0	-	-	529	3	25300	82
	2005	16591	39	7179	33	989	8	1	0	0	0	-	-	439	3	25199	82
	2006	22412	54	5392	28	759	6	0	0	0	0	-	-	449	3	29012	91
	2007	12474	30	4377	23	929	7	0	0	0	0	-	-	277	2	18057	62
	2008	13404	28	8674	39	669	4	8	0	0	0	-	-	312	2	23067	73
	2009	13580	30	7215	35	720	5	36	0	0	0	-	-	173	1	21724	71
	2010	14834	33	9821	48	844	6	49	0	0	0	-	-	186	1	25734	88
	2011	13779	31	9030	44	747	5	51	0	0	0	-	-	171	1	23778	82
	2012	17484	42	6560	34	738	5	53	0	0	0	-	-	173	1	25008	83
	2013	14576	35	6938	36	857	6	27	0	0	0	-	-	93	1	22491	78
	2014	15129	35	7936	38	1015	7	34	0	0	0	-	-	106	1	24220	81
	2015	15011	38	7082	36	723	5	19	0	0	0	-	-	277	1	23112	80
	2016	11064	28	4716	22	621	4	23	0	0	0	-	-	289	2	16713	56

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	248333	745	-	-	-	-	-	-	-	-	39608	202	-	-	287941	947
	1981	173667	521	-	-	-	-	-	-	-	-	32159	164	-	-	205826	685
	1982	310000	930	-	-	-	-	-	-	-	-	12353	63	-	-	322353	993
	1983	502000	1506	-	-	-	-	-	-	-	-	29411	150	-	-	531411	1656
	1984	242666	728	-	-	-	-	-	-	-	-	19804	101	-	-	262470	829
	1985	498333	1495	-	-	-	-	-	-	-	-	19608	100	-	-	517941	1595
	1986	498125	1594	-	-	-	-	-	-	-	-	28335	136	-	-	526460	1730
	1987	358842	1112	-	-	-	-	-	-	-	-	27609	127	-	-	386451	1239
	1988	559297	1733	-	-	-	-	-	-	-	-	30599	141	-	-	589896	1874
	1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	330558	1079
	1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188890	567
	1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	135474	404
	1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235435	631
	1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200120	541
	1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	286266	804
	1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288225	790
	1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	249623	685
	1997	-	-	-	-	-	-	-	-	-	-	-	-	-	-	209214	570
	1998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	237663	624
	1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180477	515
	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228220	621
	2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270963	730
	2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	256808	682
	2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	204145	551
	2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180953	489
	2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156308	422
	2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120834	326
	2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30946	84
	2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33200	89
	2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25170	68
	2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36508	99
	2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32308	87
	2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32599	88
	2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32303	87
	2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20883	56
	2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23416	63
	2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21504	58
UK	1985	62815	-	-	-	-	-	-	-	-	-	32716	-	-	-	95531	361
(England & Wales)	1986	68759	-	-	-	-	-	-	-	-	-	42035	-	-	-	110794	430
	1987	56739	-	-	-	-	-	-	-	-	-	26700	-	-	-	83439	302
	1988	76012	-	-	-	-	-	-	-	-	-	34151	-	-	-	110163	395
	1989	54384	-	-	-	-	-	-	-	-	-	29284	-	-	-	83668	296
	1990	45072	-	-	-	-	-	-	-	-	-	41604	-	-	-	86676	338
	1991	36671	-	-	-	-	-	-	-	-	-	14978	-	-	-	51649	200
	1992	34331	-	-	-	-	-	-	-	-	-	10255	-	-	-	44586	171
	1993	56033	-	-	-	-	-	-	-	-	-	13144	-	-	-	69177	248
	1994	67853	-	-	-	-	-	-	-	-	-	20268	-	-	-	88121	324
	1995	57944	-	-	-	-	-	-	-	-	-	22534	-	-	-	80478	295
	1996	30352	-	-	-	-	-	-	-	-	-	16344	-	-	-	46696	183
	1997	30203	-	-	-	-	-	-	-	-	-	11171	-	-	-	41374	142
	1998	30272	-	-	-	-	-	-	-	-	-	6645	-	-	-	36917	123
	1999	27953	-	-	-	-	-	-	-	-	-	13154	-	-	-	41107	150
	2000	48153	-	-	-	-	-	-	-	-	-	12800	-	-	-	60953	219
	2001	38480	-	-	-	-	-	-	-	-	-	12827	-	-	-	51307	184
	2002	34708	-	-	-	-	-	-	-	-	-	10961	-	-	-	45669	161
	2003	14656	-	-	-	-	-	-	-	-	-	7550	-	-	-	22206	89
	2004	24753	-	-	-	-	-	-	-	-	-	5806	-	-	-	30559	111
	2005	19883	-	-	-	-	-	-	-	-	-	6279	-	-	-	26162	97
	2006	17204	-	-	-	-	-	-	-	-	-	4852	-	-	-	22056	80
	2007	15540	-	-	-	-	-	-	-	-	-	4383	-	-	-	19923	67
	2008	14467	-	-	-	-	-	-	-	-	-	4569	-	-	-	19036	64
	2009	10015	-	-	-	-	-	-	-	-	-	3895	-	-	-	13910	54
	2010	25502	-	-	-	-	-	-	-	-	-	7193	-	-	-	32695	109
	2011	19708	-	-	-	-	-	-	-	-	-	14867	-	-	-	34575	136
	2012	7493	-	-	-	-	-	-	-	-	-	7433	-	-	-	14926	58
	2013	13113	-	-	-	-	-	-	-	-	-	9495	-	-	-	22608	84
	2014	7678	-	-	-	-	-	-	-	-	-	6541	-	-	-	14219	54
	2015	9053	-	-	-	-	-	-	-	-	-	10209	-	-	-	19262	68
	2016	9213	-	-	-	-	-	-	-	-	-	13258	-	-	-	22471	86

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	208061	496	-	-	-	-	-	-	-	-	128242	596	-	-	336303	1092
	1983	209617	549	-	-	-	-	-	-	-	-	145961	672	-	-	355578	1221
	1984	213079	509	-	-	-	-	-	-	-	-	107213	504	-	-	320292	1013
	1985	158012	399	-	-	-	-	-	-	-	-	114648	514	-	-	272660	913
	1986	202838	525	-	-	-	-	-	-	-	-	148197	744	-	-	351035	1269
	1987	164785	419	-	-	-	-	-	-	-	-	103994	503	-	-	268779	922
	1988	149098	381	-	-	-	-	-	-	-	-	112162	501	-	-	261260	882
	1989	174941	431	-	-	-	-	-	-	-	-	103886	464	-	-	278827	895
	1990	81094	201	-	-	-	-	-	-	-	-	87924	423	-	-	169018	624
	1991	73608	177	-	-	-	-	-	-	-	-	65193	285	-	-	138801	462
	1992	101676	238	-	-	-	-	-	-	-	-	82841	361	-	-	184517	600
	1993	94517	227	-	-	-	-	-	-	-	-	71726	320	-	-	166243	547
	1994	99479	248	-	-	-	-	-	-	-	-	85404	400	-	-	184883	648
	1995	89971	224	-	-	-	-	-	-	-	-	78511	364	-	-	168482	588
	1996	66465	160	-	-	-	-	-	-	-	-	57998	267	-	-	124463	427
	1997	46866	114	-	-	-	-	-	-	-	-	40459	182	-	-	87325	296
	1998	53503	121	-	-	-	-	-	-	-	-	39264	162	-	-	92767	283
	1999	25255	57	-	-	-	-	-	-	-	-	30694	143	-	-	55949	199
	2000	44033	114	-	-	-	-	-	-	-	-	36767	161	-	-	80800	275
	2001	42586	101	-	-	-	-	-	-	-	-	34926	150	-	-	77512	251
	2002	31385	73	-	-	-	-	-	-	-	-	26403	118	-	-	57788	191
	2003	29598	71	-	-	-	-	-	-	-	-	27588	122	-	-	57091	192
	2004	37631	88	-	-	-	-	-	-	-	-	36856	159	-	-	74033	245
	2005	39093	91	-	-	-	-	-	-	-	-	28666	126	-	-	67117	215
	2006	36668	75	-	-	-	-	-	-	-	-	27620	118	-	-	63848	192
	2007	32335	71	-	-	-	-	-	-	-	-	24098	100	-	-	56433	171
	2008	23431	51	-	-	-	-	-	-	-	-	25745	110	-	-	49176	161
	2009	18189	37	-	-	-	-	-	-	-	-	19185	83	-	-	37374	121
	2010	33426	69	-	-	-	-	-	-	-	-	26988	111	-	-	60414	180
	2011	15706	33	-	-	-	-	-	-	-	-	28496	126	-	-	44202	159
	2012	19371	40	-	-	-	-	-	-	-	-	19785	84	-	-	39156	124
	2013	20747	45	-	-	-	-	-	-	-	-	17223	74	-	-	37970	119
	2014	12581	26	-	-	-	-	-	-	-	-	13329	58	-	-	25910	84
	2015	13659	29	-	-	-	-	-	-	-	-	9162	39	-	-	22821	68
	2016	4298	8	-	-	-	-	-	-	-	-	4161	18	-	-	8459	27
France	1987	6013	18	-	-	-	-	-	-	-	-	1806	9	-	-	7819	27
	1988	2063	7	-	-	-	-	-	-	-	-	4964	25	-	-	7027	32
	1989	1124	3	1971	9	311	2	-	-	-	-	-	-	-	-	3406	14
	1990	1886	5	2186	9	146	1	-	-	-	-	-	-	-	-	4218	15
	1991	1362	3	1935	9	190	1	-	-	-	-	-	-	-	-	3487	13
	1992	2490	7	2450	12	221	2	-	-	-	-	-	-	-	-	5161	21
	1993	3581	10	987	4	267	2	-	-	-	-	-	-	-	-	4835	16
	1994	2810	7	2250	10	40	1	-	-	-	-	-	-	-	-	5100	18
	1995	1669	4	1073	5	22	0	-	-	-	-	-	-	-	-	2764	10
	1996	2063	5	1891	9	52	0	-	-	-	-	-	-	-	-	4006	13
	1997	1060	3	964	5	37	0	-	-	-	-	-	-	-	-	2061	8
	1998	2065	5	824	4	22	0	-	-	-	-	-	-	-	-	2911	8
	1999	690	2	1799	9	32	0	-	-	-	-	-	-	-	-	2521	11
	2000	1792	4	1253	6	24	0	-	-	-	-	-	-	-	-	3069	11
	2001	1544	4	1489	7	25	0	-	-	-	-	-	-	-	-	3058	11
	2002	2423	6	1065	5	41	0	-	-	-	-	-	-	-	-	3529	11
	2003	1598	5	-	-	-	-	-	-	-	-	1540	8	-	-	3138	13
	2004	1927	5	-	-	-	-	-	-	-	-	2880	14	-	-	4807	19
	2005	1236	3	-	-	-	-	-	-	-	-	1771	8	-	-	3007	11
	2006	1763	3	-	-	-	-	-	-	-	-	1785	9	-	-	3548	13
	2007	1378	3	-	-	-	-	-	-	-	-	1685	9	-	-	3063	12
	2008	1471	3	-	-	-	-	-	-	-	-	1931	9	-	-	3402	12
	2009	487	1	-	-	-	-	-	-	-	-	975	4	-	-	1462	5
	2010	1658	4	-	-	-	-	-	-	-	-	821	4	-	-	2479	7
	2011	1145	3	-	-	-	-	-	-	-	-	2126	9	-	-	3271	11
	2012	1010	2	-	-	-	-	-	-	-	-	1669	7	-	-	2679	10
	2013	1457	3	-	-	-	-	-	-	-	-	1679	7	-	-	3136	11
	2014	1469	3	-	-	-	-	-	-	-	-	2159	9	-	-	3628	12
	2015	1239	3	-	-	-	-	-	-	-	-	2435	9	-	-	3674	12
	2016	817	2	-	-	-	-	-	-	-	-	985	4	-	-	1802	6

Annex 4. (Continued).

Country	Year	1SW		2SW		3SW		4SW		5SW		MSW (1)		PS		Total	
		No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Spain (2)	1993	1589	-	827	-	75	-	-	-	-	-	-	-	-	-	2491	8
	1994	1658	5	-	-	-	-	-	-	-	-	735	4	-	-	2393	9
	1995	389	1	-	-	-	-	-	-	-	-	1118	6	-	-	1507	7
	1996	349	1	-	-	-	-	-	-	-	-	676	3	-	-	1025	4
	1997	169	0	-	-	-	-	-	-	-	-	425	2	-	-	594	3
	1998	481	1	-	-	-	-	-	-	-	-	403	2	-	-	884	3
	1999	157	0	-	-	-	-	-	-	-	-	986	5	-	-	1143	6
	2000	1227	3	-	-	-	-	-	-	-	-	433	3	-	-	1660	6
	2001	1129	3	-	-	-	-	-	-	-	-	1677	9	-	-	2806	12
	2002	651	2	-	-	-	-	-	-	-	-	1085	6	-	-	1736	8
	2003	210	1	-	-	-	-	-	-	-	-	1116	6	-	-	1326	6
	2004	1053	3	-	-	-	-	-	-	-	-	731	4	-	-	1784	6
	2005	412	1	-	-	-	-	-	-	-	-	2336	11	-	-	2748	12
	2006	350	1	-	-	-	-	-	-	-	-	1864	9	-	-	2214	10
	2007	481	1	-	-	-	-	-	-	-	-	1468	7	-	-	1949	8
	2008	162	0	-	-	-	-	-	-	-	-	1371	7	-	-	1533	7
	2009	106	0	-	-	-	-	-	-	-	-	250	1	-	-	356	1
	2010	81	0	-	-	-	-	-	-	-	-	166	1	-	-	247	1
	2011	18	0	-	-	-	-	-	-	-	-	1027	5	-	-	1045	5
	2012	237	1	-	-	-	-	-	-	-	-	1064	6	-	-	1301	6
	2013	111	0	-	-	-	-	-	-	-	-	725	4	-	-	836	4
	2014	48	0	-	-	-	-	-	-	-	-	1160	6	-	-	1208	6
	2015	43	0	-	-	-	-	-	-	-	-	1051	5	-	-	1094	5
	2016	345	1	-	-	-	-	-	-	-	-	793	4	-	-	1138	5

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: WGNAS responses to the generic ToRs for Regional and Species Working Groups

The Working Group was asked, where relevant, to consider the questions posed by ICES under their generic ToRs for regional and species Working Groups. Only brief responses are provided since the majority of questions are already addressed in response to the ToRs from NASCO (see main report) or in the WGNAS Stock Annex (see below).

GENERIC TOR QUESTIONS	WGNAS RESPONSE
Consider and comment on ecosystem overviews where available.	A brief ecosystem overview is provided in the WGNAS stock annex (see Annex 6 below) and environmental influences on the stock are incorporated in the annual advice to NASCO. The advice to NASCO is provided for three Commission areas – Northeast Atlantic, North America and West Greenland and may address a wide range of factors affecting salmon at different stages in their life cycle. Detailed consideration has been given to possible ecosystem drivers in both freshwater and the marine environment, but at present it is not possible to incorporate such drivers in the assessment process.
For the fisheries considered by the Working Group consider and comment on: descriptions of ecosystem impacts of fisheries where available; descriptions of developments and recent changes to the fisheries; mixed fisheries overview; and emerging issues of relevance for the management of the fisheries.	i) Salmon fisheries have no, or only minor, influence on the marine ecosystem. The exploitation of salmon in freshwater may affect the riverine ecosystem through changes in species composition. There is limited knowledge of the magnitude of these effects. ii) Any recent changes in fisheries are documented in response to the ToR from NASCO (see main report). iii) Salmon are not caught in mixed fisheries to any great extent. Most salmon are caught in targeted fisheries in homewaters, principally net and trap fisheries in estuaries and coastal waters, and rod-and-line fisheries in freshwater. There is very little bycatch of other species in these fisheries or in the inshore drift and gillnet fishery at West Greenland. There was some limited bycatch of other fish species (e.g. lumpsucker) in the Faroese longline fishery when this fishery operated. There is also some bycatch of salmon post-smolts and adults in pelagic fisheries operated in the Norwegian Sea and North Atlantic; further details were provided in Section 3.4 of the 2014 WGNAS report (ICES, 2014). Some fisheries targeted at other fish species in freshwater and coastal areas (e.g. aboriginal trout and charr fisheries in Canada) are licensed to land salmon caught as a bycatch. Numbers are typically small. Species interaction effects and ecosystem drivers are summarised in the stock annex (see below). iv) NASCO also routinely requests ICES to document emerging issues of relevance to the management of salmon fisheries. Details are provided in Section 2 of the report (above).

GENERIC TOR QUESTIONS	WGNAS RESPONSE
Conduct an assessment to update advice on the stock(s) using the method (analytical, forecast or trends indicators) as described in the stock annex and produce a brief report of the work carried out regarding the stock, summarising where the item is relevant: Input data (including information from the fishing industry and NGO that is pertinent to the assessments and projections); Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information; For relevant stocks estimate the percentage of the total catch that has been taken in the NEAFC regulatory area by year in the recent three years; The developments in spawning–stock biomass, total-stock biomass, fishing mortality, catches (wanted and unwanted landings and discards) using the method described in the stock annex; The state of the stocks against relevant reference points; Catch options for next year; Historical performance of the assessment and catch options and brief description of quality issues with these.	The questions posed in this section of the generic ToR are addressed routinely in the WGNAS report when responding to the questions posed by NASCO. Details of all inputs used in the latest assessments for Atlantic salmon are provided in response to the ToRs from NASCO (see main report). Estimates of unreported catch levels as used in the latest assessments for Atlantic salmon are provided in response to the ToRs from NASCO (see main report). The different components of the catch of Atlantic salmon are reported as fully as possible in the Working Group report in response to the specific questions posed by NASCO. Details of the data collection procedures for each country / region are also provided in the stock annex. Nominal catches are reported annually by country for all fisheries and estimates of unreported catch are also provided for most countries. These values are carried forward to the advice. Discards do not typically apply for salmon fisheries, although when the Faroese longline fishery was being prosecuted (the fishery has not operated since 2000) there was a legal requirement for salmon <63 cm in total length to be discarded. The catch options risk framework developed by WGNAS for the Faroes fishery makes allowance for these discards. Not applicable to Atlantic salmon. Not applicable to Atlantic salmon. The latest assessments of stock status for Atlantic salmon are provided in response to the ToRs from NASCO (see main report). The latest catch options for Atlantic salmon are provided in response to the ToRs from NASCO (see main report). Quality issues relating to the input data and models are described in the main report and stock annex.
Produce a first draft of the advice on the fish stocks and fisheries under considerations according to ACOM guidelines.	This task will be completed by the WG and WGNAS Chair in advance of the RG/ADG meeting in April.
With reference to the Frequency of Assessment criteria agreed by ACOM (see section 5.1 of WGCHAIRS document 03): (1) Complete the calculation of the first set of criteria, by calculating Mohn's rho index for the final assessment year F; (2) Comment on the list of stocks initially identified as candidates for less frequent assessment from the first set of criteria (adding stocks to the list or removing them would require a sufficient rationale to be provided).	Following agreement with NASCO, WGNAS provides multiyear advice, with forecasts for three years into the future, accompanied by a Framework of Indicators (FWI) for the Greenland fishery and a FWI for Faroese fishery. The FWIs are designed to trigger re-assessment and recalculation of forecasts in the event of a certain proportion of stock status indicators showing a higher than expected performance against the forecast stock status. At the beginning of 2016 the FWI for the Faroese fishery triggered a re-assessment, while the Greenland FWI did not. In light of this WGNAS 2016 provided the appropriate re-assessment for the stocks contributing to the Faroese fishery (North European), and reset the FWI for a further two years. The Greenland FWI and the Faroes FWI were run in January 2017 and both indicated that there was no change in stock status from the previous advice and the previously provided advice was still relevant. The FWIs will be updated for the next multiyear advice cycle planned for Marhc 2018. At which point (and in light of neither FWIs indicating re-assessment in intervening years) the WGNAS have recommended that both NAC and NEAC stocks are re-assessed, to realign the time frames of the respective FWIs.

GENERIC TOR QUESTIONS	WGNAS RESPONSE
Consider and propose stocks to be benchmarked;	In 2015 and 2016 the status of NAC and NEAC stocks were assessed using comparable tools to those applied in previous years. Work on developing life cycle forecast models is ongoing and their application is seen to be one year away. Upon the completion of these forecast models, a benchmarking exercise may be requested prior to their implementation, although this remains to be determined.
Review progress on benchmark processes of relevance to the expert group;	Not applicable.
Propose specific actions to be taken to improve the quality and transmission of the data (including improvements in data collection)	There are significant uncertainties in some of the input data for the assessment models, particularly relating to unreported catches (used in the NEAC assessments). However, efforts are made to take account of these in the stock status and stock forecast models. Data deficiencies are recorded in the 'Quality Considerations' section of the annual advice document and specific concerns/ recommendations for improvement are included in WGNAS reports. Recommendations in relation to data collection needs for assessment of Atlantic salmon were recently provided in the report of the ICES Workshop on Eel and Salmon Data Collection Framework WKESDCF (ICES, 2012c); discussions have continued with the EU on the implementation of these recommendations.
Prepare the data calls for the next year update assessment and for the planned data compilation workshops.	Not applicable to WGNAS.
Update, quality check and report relevant data for the stock: Load fisheries data on effort and catches into the InterCatch database by fisheries/fleet Abundance survey results; Environmental drivers.	Not applicable to WGNAS. The InterCatch database is not used for Atlantic salmon. All data inputs used in assessments are updated and reported in the WGNAS report. All data are subject to routine checking and QA by WGNAS members. Not applicable to WGNAS. Not applicable to WGNAS.
Produce an overview of the sampling activities on a national basis based on the InterCatch database or, where relevant, the regional database.	Not applicable to WGNAS. The InterCatch database is not used for Atlantic salmon.
Identify research needs of relevance for the Working Group.	This is addressed by WGNAS in response to the ToRs from NASCO (see main report).

Annex 6: WGNAS Stock Annex for Atlantic salmon

The table below provides an overview of the WGNAS Stock Annex. Stock Annexes for other stocks are available on the ICES website Library under the Publication Type "Stock Annexes". Use the search facility to find a particular Stock Annex, refining your search in the left-hand column to include the *year*, *ecoregion*, *species*, and *acronym* of the relevant ICES expert group.

STOCK ID	STOCK NAME	LAST UPDATED	LINK
sal-nea	Atlantic Salmon	April 2017	Salmo salar

Annex 7: Glossary of acronyms used in this report

1SW (*One-Sea-Winter*). Maiden adult salmon that has spent one winter at-sea.

2SW (*Two-Sea-Winter*). Maiden adult salmon that has spent two winters at-sea.

ACOM (*Advisory Committee*) of ICES. The Committee works on the basis of scientific assessment prepared in the ICES expert groups. The advisory process includes peer review of the assessment before it can be used as the basis for advice. The Advisory Committee has one member from each member country under the direction of an independent chair appointed by the Council.

ASF (*Atlantic Salmon Federation*). A non-governmental organisation dedicated to the conservation, protection and restoration of wild Atlantic salmon and the ecosystems on which their well-being and survival depend.

BHSRA (*Bayesian Hierarchical Stock and Recruitment Approach*). Models for the analysis of a group of related stock–recruit datasets. Hierarchical modelling is a statistical technique that allows the modelling of the dependence among parameters that are related or connected through the use of a hierarchical model structure. Hierarchical models can be used to combine data from several independent sources.

B_{lim} (*Biomass limit reference point*). The minimum spawning–stock biomass.

BRP (*Biological Reference Point*). The spawning stock level that produces maximum sustainable yield (Conservation Limit).

CET (Central England Temperature). Daily and monthly temperatures time-series representative of a roughly triangular area of the United Kingdom enclosed by Lancashire, London and Bristol.

CL, i.e. Slim (*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 of Effort*). A derived quantity obtained from the independent values of catch and effort.

C&R (*Catch and Release*). Catch and release is a practice within recreational fishing intended as a technique of conservation. After capture, the fish are unhooked and returned to the water before experiencing serious exhaustion or injury. Using barbless hooks, it is often possible to release the fish without removing it from the water (a slack line is frequently sufficient).

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.

DBERAAS (*Database on Effectiveness of Recovery Actions for Atlantic Salmon*). Database output from WGERAAS.

DFO (*Department of Fisheries and Oceans*). DFO and its Special Operating Agency, the Canadian Coast Guard, deliver programs and services that support sustainable use and development of Canada's waterways and aquatic resources.

DNA (*Deoxyribonucleic Acid*). DNA is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms (with the exception of RNA- Ribonucleic Acid viruses). The main role of DNA molecules is the long-term storage of information. DNA is often compared to a set of blueprints, like a recipe or a code, since it contains the instructions needed to construct other components of cells, such as proteins and RNA molecules.

DST *(Data Storage Tag).* A miniature data logger with sensors including salinity, temperature, and depth that is attached to fish and other marine animals.

EEZ *(Exclusive Economic Zone).* EEZ is a concept adopted at the Third United Nations Conference on the Law of the Sea, whereby a coastal State assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf, taken to be a band extending 200 miles from the shore.

ENPI CBC *(European Neighbourhood and Partnership Instrument Cross-Border Cooperation).* ENPI CBC is one of the financing instruments of the European Union. The ENPI programmes are being implemented on the external borders of the EU. It is designed to target sustainable development and approximation to EU policies and standards; supporting the agreed priorities in the European Neighbourhood Policy Action Plans, as well as the Strategic Partnership with Russia.

FSC (*Food, Social and Ceremonial fishery*). Aboriginal fishery in Canada for food, social or ceremonial purposes.

FWI (*Framework of Indicators*)*.* The FWI is a tool used to indicate if any significant change in the status of stocks used to inform the previously provided multiannual management advice has occurred.

GFLK (*Greenland Fisheries Licence Control Authority*).

GLM (*Generalised Linear Model*). A conventional linear regression model for a continuous response variable given continuous and/or categorical predictors.

GoSL (*Gulf of St Lawrence*).

GUL (*Gulf of St Lawrence*)*.*

HoT (Head of Tide). Limit of tidal influence in a river.

IASRB (*International Atlantic Salmon Research Board*). Platform established by NASCO in 2001 to encourage and facilitate cooperation and collaboration on research related to marine mortality in Atlantic salmon.

ICES (*International Council for the Exploration of the Sea*). A global organisation that develops science and advice to support the sustainable use of the oceans through the coordination of oceanic and coastal monitoring and research, and advising international commissions and governments on marine policy and management issues.

ICPR (*International Commission for the Protection of the Rhine*).

IESSNS (*International Ecosystem Survey of the Nordic Seas*). A collaborative programme involving research vessels from Iceland, the Faroe Islands and Norway.

IMR (*Institute of Marine Research*). Norwegian institute who provide advice to Norwegian authorities on aquaculture and the ecosystems of the Barents Sea, the Norwegian Sea, the North Sea and the Norwegian coastal zone.

IPCC (*Intergovernmental Panel on Climate Change*). The international body for assessing the science related to climate change.

IYS (*International Year of the Salmon*). An international framework for collaborative outreach and research launched by NPAFC, NASCO and other partners. The IYS focal year will be 2019, with projects and activities starting in 2018 and continuing into 2020.

JAGS (*Just Another Gibbs Sampler*). A program for analysis of Bayesian hierarchical models using Markov Chain Monte Carlo (MCMC) simulation.

LAB (*Labrador Central*).

LE (*Lagged Eggs*). The summation of lagged eggs from 1 and 2 sea-winter fish is used for the first calculation of PFA.

MCMC (*Markov Chain Monte Carlo*). Re-sampling algorithm used in (Bayesian) statistics.

MOCNESS (*Multiple Opening/Closing Net and Environmental Sensing System*).

MSA (*Mixed-stock Analysis*). Genetic analytical technique to estimate the proportions origin of fish in a mixed-stock fishery.

or

MSA (*Miramichi Salmon Association*).

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*). A MSW salmon is an adult salmon which has spent two or more winters at sea and may be a repeat spawner.

NAC (*North American Commission*). The North American Atlantic Commission of NASCO or the North American Commission area of NASCO.

NAFO (*Northwest Atlantic Fisheries Organisation*). NAFO is an intergovernmental fisheries science and management organization that ensures the long-term conservation and sustainable use of the fishery resources in the Northwest Atlantic.

NASCO (*North Atlantic Salmon Conservation Organisation*). An international organisation, established by an inter-governmental convention in 1984. The objective of NASCO is to conserve, restore, enhance and rationally manage Atlantic salmon through international cooperation taking account of the best available scientific information.

NCC (*NunatuKavut Community Council*). NCC is one of four subsistence fisheries harvesting salmonids in Labrador.

NEAC (*North Eastern Atlantic Commission*). North East Atlantic Commission of NASCO or the North East Atlantic Commission area of NASCO.

NEAC – N (*North Eastern Atlantic Commission- northern area*). The northern portion of the North East Atlantic Commission area of NASCO.

NEAC – S (*North Eastern Atlantic Commission – southern area*). The southern portion of the North East Atlantic Commission area of NASCO.

NFL (*Newfoundland*).

NG (*Nunatsiavut Government*). NG is one of four subsistence fisheries harvesting salmonids in Labrador. NG members are fishing in the northern Labrador communities.

NOAA (*National Oceanic and Atmospheric Administration*). A scientific agency within the United States Department of Commerce.

NPAFC (*North Pacific Anadromous Fish Commission*). An international inter-governmental organization established by the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean. The Convention was signed on February 11, 1992, and took effect on February 16, 1993. The member countries are Canada, Japan, Republic of Korea, Russian Federation, and United States of America. As defined in the Convention, the primary objective of the NPAFC is to promote the conservation of anadromous stocks in the Convention Area. The Convention Area is the international waters of the North Pacific Ocean and its adjacent seas north of 33°North beyond the 200-mile zones (exclusive economic zones) of the coastal States.

NSS (*Norwegian-spring-spawning*).

OSPAR (*Convention for the Protection of the Marine Environment of the North-East Atlantic*). OSPAR is the mechanism by which fifteen Governments of the west coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the Northeast Atlantic. It started in 1972 with the Oslo Convention against dumping. It was broadened to cover land-based sources and the offshore industry by the Paris Convention of 1974. These two conventions were unified, updated and extended by the 1992 OSPAR Convention. The new annex on biodiversity and ecosystems was adopted in 1998 to cover non-polluting human activities that can adversely affect the sea.

PFA (*Pre-Fishery Abundance*). The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time. In the previous version of the stock complex Bayesian PFA forecast model two productivity parameters are calculated, for the *maturing* (PFAm) and *non-maturing* (PFAnm) components of the PFA. In the updated version only one productivity parameter is calculated, and used to calculate total PFA, which is then split into PFAm and PFAnm based upon the *proportion of PFAm* (p.PFAm).

PICES (*North Pacific Marine Science Organization*). PICES, the North Pacific Marine Science Organization, is an intergovernmental scientific organization that was established and held its first meetings in 1992. Its present members are Canada, People's Republic of China, Japan, Republic of Korea, Russian Federation, and the United States of America. The purposes of the Organization are as follows: (1) Promote and coordinate marine research in the northern North Pacific and adjacent seas especially northward of 30 degrees North, (2) advance scientific knowledge of the ocean environment, global weather and climate change, living resources and their ecosystems, and the impacts of human activities, and (3) promote the collection and rapid exchange of scientific information on these issues.

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.

PSAT (*ParkinsonSat satellite tags*)

Q Areas. (*Québec Areas*). Areas for which the Ministère des Ressources naturelles et de la Faune manages the salmon fisheries.

RFID (*Radio Frequency Identity tag*).

RR model (*Run-Reconstruction model*). RR model is used to estimate PFA and national CLs.

RVS (*Red Vent Syndrome*). This condition has been noted since 2005, and has been linked to the presence of a nematode worm, *Anisakis simplex*. This is a common parasite of marine fish and is also found in migratory species. The larval nematode stages in fish are usually found spirally coiled on the mesenteries, internal organs and less frequently in the somatic muscle of host fish.

SAC (*Special Area of Conservation*). Strictly protected site designated under the European Committee Habitats Directive.

SALSEA (*Salmon at Sea*). An international programme of co-operative research, adopted in 2005, designed to improve understanding of the migration and distribution of salmon at sea in relation to feeding opportunities and predation.

SALSEA-Merge (*Salmon at Sea Merge*). SALSEA-Merge is an international programme of cooperative research designed to improve understanding of the migration and distribution of salmon at sea in relation to feeding opportunities and predation. It differentiates between tasks which can be achieved through enhanced coordination of existing ongoing research, and those involving new research for which funding is required.

SALSEA-Track (*Salmon at Sea Track*). SALSEA-Track is the second phase of the SALSEA Programme. It employs advances in telemetry technology to precisely track Atlantic salmon along their migration routes through cooperative international research initiatives.

SE (*standard error*).

SER (*Spawning Escapement Reserve*). The CL increased to take account of natural mortality between the recruitment date (assumed to be 1st January) and the date of return to homewaters.

SFA *(Salmon Fishing Areas).* Areas for which the Department of Fisheries and Oceans (DFO) Canada manages the salmon fisheries.

Slim, 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.

S$_{MSY}$ (*Spawners for maximum sustainable yield*). The spawner abundance that generates recruitment at a level that provides a maximum exploitable yield (recruitment minus spawners).

SNP (*Single Nucleotide Polymorphism*). Type of genetic marker used in stock identification and population genetic studies.

S–R (*Stock recruitment*).

SoBI (*Strait of Belle Isle*).

SSB (Spawning-stock biomass).

SVA (*Swedish National Veterinary Institute*)

TAC (*Total Allowable Catch*). TAC is the quantity of fish that can be taken from each stock each year.

ToR (*Terms of reference*).

UDN (*Ulcerative Dermal Necrosis*). Disease mainly affecting wild Atlantic salmon, sea trout and sometimes other salmonids. It usually occurs in adult fish returning from the sea in the colder months of the year and starts as small lesions on the scale-less regions of the fish, mainly the snout, above the eye and near the gill cover. On entry to freshwater lesions ulcerate and may become infected with secondary pathogens like the fungus *Saprolegnia* spp. Major outbreaks of UDN occurred in the 1880s (UK) and 1960s–1970s (UK and Ireland), but the disease has also been reported from France, and in 2015 from the Baltic and Russia.

UK (*United Kingdom and Northern Ireland*). Country in Europe.

VIE (*Visual implant elastomer tag*).

WGC (*West Greenland Commission*). The West Greenland Commission of NASCO or the West Greenland Commission area of NASCO.

WGERAAS (*Working Group on Effectiveness of Recovery Actions for Atlantic Salmon*). The task of the working group is to provide a review of examples of successes and failures in wild salmon restoration and rehabilitation and develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations. The Working Group held its final meeting in Copenhagen in November 2015.

WGF (*West Greenland Fishery*). Regulatory measures for the WGF have been agreed by the West Greenland Commission of NASCO for most years since NASCO's establishment. These have resulted in greatly reduced allowable catches in the WGF, reflecting declining abundance of the salmon stocks in the area.

WGNAS (*Working Group on North Atlantic Salmon*). ICES working group responsible for the annual assessment of the status of salmon stocks across the North Atlantic and formulating catch advice for NASCO.

WGRECORDS (*Working Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species)*. WGRECORDS was reconstituted as a Working Group from the Transition Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species (TGRECORDS).

WGWIDE (*ICES Working Group on Widely Distributed Stocks*).

WKCCISAL (*The Workshop on Potential Impacts of Climate Change on Atlantic Salmon Stock Dynamics*).

WKTRUTTA2 (*Workshop on sea trout*). A workshop was held in February 2016 to focus on the development of models to help address key management questions and to develop Biological Reference Points for use in the management of sea trout stocks and fisheries.

Annex 8: NASCO has requested ICES to identify relevant data deficiencies, monitoring needs and research requirements

The Working Group recommends that it should meet in 2018 (incoming Chair, Martha Robertson, Canada) to address questions posed by ICES, including those posed by NASCO. In the absence of a formal invitation elsewhere, the Working Group intends to convene in the headquarters of ICES in Copenhagen, Denmark. The meeting will be held from 4—13 April 2018.

List of recommendations

1) The Working Group encourages the continuation and expansion of tracking programmes as information from it is expected to be useful in the assessment of marine mortality on North Atlantic salmon stocks. The Working Group also notes that these techniques have been proposed, and are being implemented in other areas, both in the Northwest and the Northeast Atlantic (e.g. SALSEA Track), in line with the NASCO IASRB resolution.
2) The Working Group recommends that in order to fully consider a life cycle model as an improvement and alternative to the current assessment and forecast model used for providing catch advice, improvements to data inputs and the incorporation of a number of alternative life-history dynamics need to occur well ahead of the 2018 ICES WGNAS meeting. As such, a workshop of jurisdictional experts is proposed before the end of the 2017 calendar year. The purpose of the meeting would be to review current national input data given reductions in fisheries particularly in the NEAC area, to incorporate improved data inputs and alternate population dynamic functions, to enable the running of the inference and forecast components, and to develop documentation related to the model. The changes to the model inputs and the model would then be reviewed at the 2018 ICES WGNAS meeting for consideration as an alternate approach for the provision of the next cycle of multiyear catch advice.
3) In 2015 the Working Group received information from the Institute of Marine Research (IMR), Bergen, Norway, related to a new tagging initiative and wide-scale tag screening programme in the Northeast Atlantic. The tagging programme is directed at pelagic species (herring and mackerel) using glass-encapsulated passive integrated transponder (PIT) tags / RFID tags (Radio Frequency Identity tags) (ICES 2015). RFID detector systems have been installed at a number of fish processing plants in different countries, and catches landed at these plants are automatically screened for tagged fish. It is recommended that the list of tag detections be sent to the National Tagging co-ordinators (ICES 2017) and to the members of the WGNAS.
4) The Working Group recommends that sampling and supporting descriptions of the Labrador and Saint Pierre & Miquelon mixed-stock fisheries be continued and expanded (i.e. sample size, geographic coverage, tissue samples, seasonal distribution of the samples) in future

years to improve the information on biological characteristics and stock origin of salmon harvested in these mixed-stock fisheries.

5) The Working Group recommends that additional monitoring be considered in Labrador to estimate stock status for that region. Additionally, efforts should be undertaken to evaluate the utility of other available data sources (e.g. Aboriginal and recreational catches and effort) to describe stock status in Labrador.
6) The Working Group recommends that efforts to improve the reporting system of catch in the Greenland fishery continue and that detailed statistics related to spatially and temporally explicit catch and effort data should be made available to the Working Group for analysis.
7) The Working Group recommends the continuation of the phone survey programme in Greenland according to a standardized and consistent annual approach with consideration given to surveying a larger proportion of licensed fishers and the inclusion of the non-licensed fishers. Information gained on the level of total catches for this fishery will provide for a more accurate assessment of the status of stocks and assessment of risk with varying levels of harvest. This information is a critical input for the assessment of stocks.
8) The Working Group recommends a continuation and potential expansion of the broad geographic sampling programme including in Nuuk (multiple NAFO divisions including factory landings when permitted) to more accurately estimate continent and region of origin and biological characteristics of the mixed-stock fishery.
9) The Working Group recommends that progress be made in assigning the European origin salmon from the West Greenland fishery to sub-complex region of origin.

Annex 9: Response of WGNAS 2017 to Technical Minutes of the Review Group (ICES, 2017)

As per the request of the ICES Review Group (RG), this section provides responses from the Working Group on North Atlantic Salmon (WGNAS) to the Technical Minutes of the RG provided in Annex 10 of ICES (2017) and elaborates on initial comments provided at the 2016 Review Group meeting. The points are addressed in the same order as they were listed in the Technical Minutes.

General comments on the report

A written review of the WGNAS 2016 report was provided and is included as Annex 10 of the 2016 WGNAS report (ICES, 2017). The review was discussed during the RG meeting, which provided a good opportunity for feedback and exchange of ideas in both directions. Many of the minor and editorial comments were addressed and incorporated in the 2016 WGNAS report. Responses to the more specific comments are detailed below having been considered more widely by WGNAS participants at their 2017 meeting.

The RG indicated that WGNAS had produced a well written report substantiated with appropriate analyses. The models used to evaluate different management options appeared reasonable and the Bayesian framework used in run reconstruction appeared to be robust.

Specific comments

RG COMMENT	WGNAS RESPONSE
Atlantic salmon in the North Atlantic Area	
1. p. 34. The variation in energy density observed in capelin among periods is interesting. Has a similar analysis been performed for other prey? The information presented in that section suggest that constant values were used for all the prey but capelin. Research performed in Alaska has showed that the energy density can vary among years within planktonic taxa (lower in warm compared to cool years). Hence, cautious must be exercised when the energy density of the food consumed by salmon is compared among periods until prey-specific and year-specific values are used.	The working group agrees that there is information from a broad range of studies indicating that energy content is not constant within a prey species across space and or time. The analysis presented on capelin used the available data for this prey species and showed that capelin energy content standardized for season and location had seemingly declined over time, however, similar data were lacking for other prey species considered. Information presented in this report of WGNAS in 2017, figure 2.5.1.2, shows changes in relative energy content of herring over time, providing further support to the reviewer's comment that variations in energy density over time should be assumed and incorporated in analyses when these are available.

Specific comments

RG COMMENT	WGNAS RESPONSE
2. p. 35. The potential for sea lice transmission form farmed to wild salmon is an ongoing issue wherever salmon farming occurs. In the second paragraph of Section 2.3.3.2, the WGNAS concluded that “the migrating salmon smolts were probably negatively affected by salmon lice infection in 2015” in some areas in Norway. While this may be the case, it is unclear from the information presentation in that section that this was the case or not. Hence, this statement need to be substantiated by appropriate documentation, otherwise the report will only fuel to the rhetoric of a polarized issue. It should be noted that Norway is one of the few countries to have reached their SER in recent years, yet it is also the country with the highest production of farmed salmon in the world. So either the treatments that they are using in their farms are effective, or the impacts of salmon farms on wild smolts may not be that important in some regions.	This issue was reviewed at some length by WKCULEF and advice was provided by ICES in 2016. In the paragraph in section 2.3.3.2 referred to by the reviewer, WGNAS does not make conclusions regarding the impact of salmon louse on wild salmonids, but refers rather to the evaluation made by the expert group that produced the report from the national salmon louse surveillance program (referenced in the text). This expert group evaluates available data from different field investigations conducted along the coast, and makes an estimate of the impact from salmon louse infections on out-migrating salmon postsmolts in investigated areas. That Norway reached its SER in recent years is not relevant in this context, and this cannot be taken as proof that salmon lice does not influence wild salmon populations negatively. The attainment of SER for Norway is a combined measure from all stocks in the country, and variation in attainment among different individual populations and regions will be hidden within this measurement.
3. p. 40–42. The WGNAS considered the potential use of the smolt-to-adult supplementation (SAS) activity as a measure to circumvent the low smolt-to-adult return rates of Atlantic salmon. There is certainly concern that this approach may affect the genetic make-up of the populations where this strategy is employed, as well as their fitness. It should be noted that at this point, this is an untested assumption that deserve further testing. But it is clear that if nothing is done to reverse the trend of poor marine survival, that these populations may become extinct. For instance, the sockeye salmon population of the Snake River would likely have become extirpated if a conservation hatchery programme hadn’t been started in the 1990s, when there were often less than ten adults returning to spawn (one year with a single male) compared to the 5000–6000 adults that returned in the 1950s and 1960s.	The Working Group was informed of a recent science peer review meeting and the development of advice related to a request to undertake a smolt-to-adult supplementation activity in the Northwest Miramichi River, Canada. The concern of the peer review included not only issues about the genetic make-up of the populations but also the consequences to fitness particularly in sea survival of introgressing wild populations with captive reared adults whose numerous phenological characteristics would differ from those of wild returning salmon. These conservation activities are being conducted in both USA and Canada to conserve genetic diversity in salmon populations that are at high risk of extinction due to severe mortality on seaward migrating smolts. The conservation programs for the endangered Atlantic salmon populations in Canada are intended to preserve genetic variability by maintaining demographically important numbers of fish, even if the preserved individuals are not exposed to selection pressures in the marine environment. The thresholds of abundance which would be used to determine when such interventions are undertaken have not been defined. The proposed adult-captive reared program was proposed for a salmon population whose abundance had declined as in salmon populations throughout the North Atlantic in general but for which returning anadromous adults numbered from 2500 fish in the lowest year to more than 10 000 fish in the higher returns of recent years and the salmon population is not considered at risk of extinction in the absence of stocking.

Specific comments	
RG COMMENT	**WGNAS RESPONSE**
4. p. 45. Given that poor marine survival has been identified throughout this report as the leading cause for the low return of Atlantic salmon in various regions of the NEAC and NAC, I find it odd that the analysis of DBERAAS 'Stressors" revealed that barriers to migration and freshwater habitat degradation as two of the three leading stressors having a high or very high impacts, and that all the 'Action' entries that were most often reported as having a high or very high benefit were actions conducted in freshwater. Certainly, having more healthy smolts would be beneficial for these populations, but more effort need to be directed to understand the cause of these poor marine survivals to determine what can be done, if anything, to improve their marine survival and subsequent returns.	The Working Group agrees that further research is required in the marine environment to better understand the factors that have contributed to the low marine survival rates experienced by Atlantic salmon in the North Atlantic. The compilation of the DBERAAS database including the identification of the stressors that were constraining salmon population rehabilitation and recovery was completed by regional experts and based on available evidence, which is much more complete for freshwater systems. Indeed habitat fragmentation and water quality degradation are two important stressors that have been demonstrated to have contributed to the reductions and in some cases the loss of salmon populations in rivers. As Atlantic salmon is an obligate freshwater spawner, conditions in freshwater particularly those associated with connectivity and barriers are important stressors for which clear remedial actions can be undertaken to improve the probabilities of population persistence.
5. p. 50, second paragraph. Peter Hutchinson from NASCO attended the second scoping meeting of the IYS.	Noted
NEAC	
6. p. 74. Genetic stock identification analyses performed on Atlantic salmon caught in northern Norway indicate that between 20% and 70% of these fish originate in Russia. Is this information taken into consideration by the WGNAS in the PFA and SER assessment? Currently, the 1SW stocks in Norway have a high likelihood of achieving their SER, but not Russia (Table 3.6.1.3). Would that change if a fraction of the catch in Norway was allocated to Russia?	Currently all the coastal catches in Norway are attributed to the Norwegian stocks. ICES (2015, WGNAS) reported that in Finnmark County the number of registered fishing localities declined over the last twenty years from 2733 to 1119, however, there were still significant salmon fisheries operating in Finnmark and neighbouring counties exploiting Atlantic salmon of Russian origin. The estimated catches of salmon in the northern area of Norway have been in the range of 60 thousand salmon, age groups combined, of which around 46% is harvested in marine (including coasts and fjords) mixed-stock fisheries. Attributing the portion of the catch based on genetics data from Norway to Russia would result in a relatively small decrease to the Norwegian catches and a small increase in the Russian estimates of recruitment. The Working Group will consider in future how to make the best use of information on stock origin of catches in mixed-stock fisheries.

Specific comments

RG COMMENT	WGNAS RESPONSE
7. p. 84–90. The WGNAS did an excellent job at trying various scenarios to assess the potential effects of different biases introduced by using historical data on the catch advice for the Faroes. However, all these sensitivity analyses were performed by changing the value of one parameter at a time, which is the best they probably could achieve given the data they have. It is conceivable for instance, that changing the timing of the catch might not only affect the number of fish caught, but also the stocks that are being caught (this concept was investigated to some extant for the WGC). For this particular example, a detailed examination of the temporal changes in stock composition from archived scales collected when the fishery occurred may help to resolve this question.	Analysis of archived scales and other samples would be informative of past fisheries timing and distributions on the origin of salmon in these catches and to assess the potential changes in distributions of contributiong stocks. Information from tag recoveries as described in Jacobsen et al. (2012: ICES J. Mar. Sci. 69: 1598-1608) indicates that "The distribution of salmon in the Faroes zone partly depends on their geographic origin; salmon from countries in the northern European stock complex were distributed significantly farther northeast than those from countries in the southern European stock complex. Furthermore, the proportion of tag recoveries from southern European countries was higher in autumn, and the proportion recovered from northern European countries higher in winter". The challenge remains that any advice provided in future on opportunities for fishing salmon at the Faroes will use historical information on stock composition and other biological characteristics from historical data, without knowing until fishing begins again and contemporary sampling is conducted whether the historical characteristics of the fishery catches are still relevant today.
8. p. 93, last paragraph of Section 3.6.1. I'm not sure I understand what the WGNAS is trying to say here.	The last paragraph referred to by the reviewer is the summary of catch advice: "The Working Group therefore notes that there are no catch options for the Faroes fishery that would allow all national or stock complex management units to achieve their CLs with a greater than 95% probability in any of the seasons 2016/2017 to 2018/2019. While the abundance of stocks remains low, even in the absence of a fishery at Faroes, particular care should be taken to ensure that fisheries in homewaters are managed to protect stocks that are below their CLs." Without being more precise about the question, the Working Group interpreted the question as referring to the last sentence that advises that homewater fisheries should be managed in such a way as to reduce exploitation on stocks that are considered to be below their CLs prior to fishing at Faroes.

Specific comments

RG COMMENT	WGNAS RESPONSE
NAC	
9. I understand that the Bay of Ungava is in Quebec (region Q11), but for the purpose of examining trends in abundance, it probably make more sense to either pool this region with Labrador (because they are closer geographically) or leave it as a separate entity, since it is under a different jurisdiction.	The working group agrees that wherever possible, data from mutliple rivers should be grouped according to the most credible biological considerations. However the data for salmon populations from the Ungava region are provided by the province of Quebec and overall, the returns to Quebec are compiled. The input assessment data for the Ungava Bay rivers are categorized as C5 and C6 approaches which are the most uncertain. During 1984 to 2016, the estimates of abundance for the Ungava Bay rivers have been about 9% of total small salmon returns and 5% of total large salmon return estimates to the Quebec region. Over comparable years, 1998 to 2016, the average returns of small salmon to Ungava Bay rivers have been equivalent to 1.4% for small salmon and 5% for large salmon of the total returns to Labrador. So moving fish from one group (i.e. Quebec) to another group (i.e. Labrador) would represent a minor change relative to the underlying uncertainties in the Ungava Bay estimates and the Labrador estimates
10. p. 181. Some populations did not exhibit any significant trends in smolt survival. In some cases, this may be due to the short duration of the time-series. Perhaps one analysis that could be done in future years is to determine the minimum smolt survival (or adult return rates) that is needed to sustain the populations in the absence of any fisheries or interventions. This might help to assess the recovery potential for some populations.	This is an interesting question from the review group. Indeed, Atlantic salmon is a species that can accommodate fairly high marine mortality and still replace its spawning stock due to the relatively high freshwater survival rates in freshwater from eggs to smolts. Egg to smolt survival rates are routinely reported from only a few monitored index rivers in either the NAC or NEAC areas. For example, for the de la Trinite River in Quebec, freshwater survival rates estimated from monitoring programs and marine return rates of 1SW salmon and 2SW salmon to this river combined with the biological characteristics of the returning salmon (sex ratio, fecundity per female) indicates that for average egg to smolt survival rates of 2.26% over the time-series, average return rates of smolts of 1.35% for 1SW salmon and 0.84% for 2SW salmon, and average fecundities of 8.7% female X 3000 eggs per female and 91.5% female in 2SW salmon and 6500 eggs per female, the intrinsic rate of increase of the population is 1.20, a fairly low average value but sufficient to replace and likely periodically produce important surpluses of returns to parental spawners.. Of course, annual variations in survival rates and return rates will result in some conditions under which realized returns are less than parental spawners, and this is particularly the case for salmon populations in the southern range of the distribution that have both lower freshwater and marine survival rates.

Specific comments

RG COMMENT	WGNAS RESPONSE
11. p. 183. Return of 1SW salmon have generally increased over the time-series in Labrador and Newfoundland. The WGNAS concludes that this was primarily due to the fishery closure in Canada (commercial fishery). If that is the case, we should see an increase in smolt output from these systems during the same period. Was that the case?	The link between spawners and smolt production is not necessarily proportional. Some rivers such as Western Arm Brook in Newfoundalnd have shown an increasing trend in smolt production since the closure of the marine fisheries and the increased realized spawning escapments to rivers (see Section 4.3.1 of WGNAS report). However, there are relatively few rivers with completely monitoring data on spawning escapement and smolt production with which to assess the benefits of management interventions such as fishery closures on subsequent freshwater production.
12. p. 214. I presume that the Scotia-Fundy correspond to Areas 19–23, and Gulf Region to Areas 15–18? It might be beneficial to the reader that is not familiar with the geography of Canada to make that statement clear in the figure caption.	Comment noted.
WGC	
13. p. 228, bottom of the page. Would hydroacoustics be able to detect these fish? That is are they sufficiently abundant to be detected? Any thoughts on what would be done with the carcasses collected as part of a test fishery (aside diet, DNA, and basic morphometrics, there is probably not much need to keep the whole carcass)?	Invariably, the need to obtain fishery-independent data on salmon abundance at Greenland will necessitate the consideration of alternative monitoring approaches to cpue data from fisheries, including acoustics and open ended trawls with video cameras or other detectors to sample the large areas occupied by salmon in the North Altantic. We don’t know if single beam acoustics would work however this field of technology is rapidly expanding and the possbility of using new generation mutli-beam sonar technologies to obtain indices of generally sparsely distributed salmon at sea should not be discounted. As for test fisheries, the most satisfying approach to a test fishery would be to collaborate with established fish harvsters in the area, who would provide access to captured fish for sampling and who would utilize the post-mortem samples as part of the internal use fisheries. Other sharing arrangements between local harvesters and scientific sampling could also be envisioned.

Annex 10: Technical Minutes from the Salmon Review Group

- RGSalmon
- By correspondence, April 2017
- Reviewer: Marc Trudel, Canada
- Working Group: WGNAS

General comments

The ICES Working Group on North Atlantic Salmon (WGNAS) produced a comprehensive report on the status and trends of Atlantic salmon abundance and productivity in the Northern Europe, Southern Europe, and North America, that included additional information requested by NASCO on Atlantic salmon in the North Atlantic Ocean. The authors of the report should be commended for their effort in pulling a comprehensive document in a very short time.

Specific comments

Atlantic salmon in the North Atlantic area

1) Section 2.1.1 and 3.1.4. The authors compared the 2016 nominal catches in NEAC with the previous five and ten year averages. This is helpful to examine recent changes in catches. However, one may lose a longer term perspective and suffer from a shifting baseline issue. For instance, a nominal catch of 1400 tonnes would be higher than the 10-year average for NEAC. However, that would still be approximately 4–5 times below catches observed in the 1960s. Perhaps indicating the rank of the catch relative to the entire time-series would help to provide this perspective. Or alternatively, compare the recent catches to a standard period, such as the 1960–1980 average.

2) Section 2.2.1. In the last sentence of the second paragraph, the authors indicated that the production of Atlantic salmon in land-based facilities has increased around the world. However, no data are provided to support this statement. It may be desirable to document this in future report, as land-based aquaculture is often perceived as a solution to address wild farm interactions, but it may not be economically sustainable without subsidies.

3) Section 2.3.1 and Figure 2.3.1.1. The report present some new results on the survival of salmon tagged with acoustic tags in a number of rivers that drain in the Gulf of Saint Lawrence in North America. These results are important, as they can help to determine when and where significant mortality occurs, but also to obtain estimate of survival beyond the first few months at-sea. For instance, in the Southwest Miramichi River, return rates are provided for 2007–2010, and averaged 1.9% (Table 4.3.5.1). Survival during the first two months averaged around 36%. These results imply that survival beyond the first two months would be around 5.3% (0.019/0.36). Hence, significant mortality can occur beyond a period that is often considered “critical” for salmon post-smolts. It may also indicate that the survival bottleneck may be further offshore than previously thought, though some of this mortality could be due to the fishery off West Greenland and

St Pierre and Miquelon. I encourage the authors to explore this type of analyses further in future and their consequences.

4) Section 2.3.3. In general, the report is well balanced by providing nuances and highlighting uncertainties when they exist and future areas of research to reduce these uncertainties. At the end of this section, the authors conclude that, based on the experimental results provided by Bolstad *et al*. (2017) on age-at-maturity, that "gene flow from escaped farmed salmon as a strong effect on important biological characteristics of wild Atlantic salmon". While the results of Bolstad *et al*. are compelling, ultimately the question is whether or not the demographic parameters of the populations affected by introgression (such as overall recruitment). For instance, Ian Bradbury's team has showed that in one of the river in Newfoundland, F1–F3 hybrids from wild-farm crosses were present, indicating some reproductive and fitness success of the escaped farmed salmon. Hence further work is warranted to explore the consequences of introgression on long-term success of wild populations.

5) Section 2.3.4.1, 3rd paragraph. The authors indicated that the incidence of RVS in the Galleway weir was lower in 2016 relative to 2015. However, no actual values were reported. For the benefit of the reader, it would be useful to see what those values were.

6) Section 2.3.4.2. A hydrodynamic model has been used to predict the dispersal of lice larvae from aquaculture in Norwegian fjords and predict the infection pressures on Atlantic salmon post-smolts during their residence in these fjords. The report indicates that field sampling was directed in areas where the model predicted high densities of infective stages of the salmon louse and discusses some of the results of this surveillance programme in the following paragraphs. What I couldn't get from the summary of that work was whether or not the model predictions were actually tested. That is, was concentration of lice copepodites higher in areas predicted to have higher lice copepodites (and vice versa). This is important to at least ground-truth the model.

7) Section 2.3.8. The authors report on usual weather conditions observed in the UK in the winter of 2015/2016, and the potential effects that these conditions had on the abundance of salmon fry. Were these conditions unique to the UK, or was this something that was broader? Further exploration of these anomalous conditions is certainly warranted. Also, given the low abundance of fry observed in 2016, it might be beneficial to the reader to indicate when this is expected to have an impact on the return of adult salmon somewhere in the report. Basically, this would provide a heads up on what to look for in future. Also one of the main point here is that the authors were able to document the effects of these unusual conditions on salmon fry because there is a monitoring program that is in place to assess the abundance of fry. Perhaps one of the recommendation that can be made is to encourage other regions/countries to undertake such a monitoring program, as this is the only way to separate freshwater vs. marine effects on salmon populations. And there are too few returns rates available for wild smolts (Tables 3.3.6.1, 4.3.5.1 and 4.3.5.2), with many time-series being compromised and truncated.

8) Section 2.5.1. A synthesis of diet data of salmon in the Northwest Atlantic during the marine phase collated from 1935 to 2017 has been provided.

Comparisons were made between different phases of their marine life. Perhaps one of the next steps that should have been highlighted in the report would be to identify how diet has changed over time, and whether or not there were any linkages between changes in diet and the productivity of salmon in the Northwest Atlantic. Similarly, comparison with diet in the Northeast Atlantic would be interesting to perform.

9) Section 2.5.3 (Zooplankton). Zooplankton abundance (or biomass?) appears to be higher in northern vs. southern regions of the Norwegian Sea. Was that for the summer? Is that consistent among seasons?

10) Section 2.8, 2nd paragraph. The report indicates that the USA opted for a genetic "marking" procedure to trace the origin of farmed salmon captured in the wild following escape events. Perhaps some additional information of the genetic marking would be useful, as some readers may think that the fish were genetically modified, when in all likelihood they are using microsatellites or SNPs from the parental broodstock to identify their offspring (sometimes referred to as Parental Based Tagging).

NEAC

11) Section 3.2.2.2. The conservation limits for Sweden are based on egg deposition that produces MSY for a reference system. Unfortunately, egg deposition is not available for most system, and they had to use parr densities from "undisturbed rivers and in good salmon habitat" as a proxy for the conservation limits. Perhaps a comparison of both approaches for estimating the conservation limits to see if they provide a similar picture of the current situation in Sweden, and whether or not this can be exported to other countries.

12) Section 3.3.6, first paragraph: The report indicated that return rates of hatchery-released fish may not always be a reliable indicator of return rates of wild fish. While this may be the case, they may follow similar trends, although the return rates of hatchery fish may be lower. A comparison of survival trends between wild and hatchery fish should be performed to determine to what extent the return rates of hatchery salmon can be used as an indicator of the return rates of wild salmon.

13) Figure 3.3.6.3 and Table 3.3.6.1: Based on the information that is presented in this report, it would appear that return rates are overall higher in Southern NEAC vs. Northern NEAC. This was to me surprising, as the WGNAS has often concluded that the declines of Atlantic salmon appear to be due to a persistent period of poor marine survival. If this was the case, one might expect to see a much more pronounced decline of salmon return in Northern NEAC compared to Southern NEAC, yet it is the opposite that we see, implying that the poor performance of salmon in Southern NEAC is due to poor freshwater conditions in Southern NEAC. This needs to be discussed in the report, in particular if there are caveats in making this comparison.

NAC

14) Section 4.1.2. The report indicates that there are 23 regions for which DFO manages the salmon fisheries. However, for this report (and all previous ones), fish from area 22 and a portion of area 23 in the Bay of Fundy are not included in any of the calculations. For readers not familiar with Atlan-

tic salmon in the area, it might be beneficial if an explanation was provided within the context of NASCO as to why this was done.

15) Section 4.1.4. Attempts were made to express the harvest histories in North America as 2SW equivalents. It was unclear to me why this was actually done, considering that 1SW appears to dominate the returns to Newfoundland. A justification for doing this work might be warranted.

16) Section 4.1.6. A reference might be required to help the reader find information on how catch and release mortality is accounted for in the exploitation rates.

17) Section 4.3.7, p. 18. The report concludes that the return of 1SW has generally increased over the time-series for the NAC, mainly as a result of the commercial fishery closures in Canada. While the increased returns of salmon in Labrador and Newfoundland appear to coincide with the closure of the commercial fishery in these waters in 1992, elsewhere, returns have not increased despite the closure of the commercial fishery (for instance, no increase in Québec since the commercial fishery was closed in 2000) or complete fishery closures (not even catch and release) in some cases (Bay of Fundy for instance). So the statement that the closure of the fishery closure is the main reason why returns increased might be over simplistic and misleading.

West Greenland

18) Section 5.1.2. To estimate the total harvest in the West Greenland fishery, the Working Group accounted for unreported catches, by adding the values report by the Government of Greenland for unreported catches, values determined from phone surveys, and the discrepancies in the landing noted by the observers (that is they weighed more fish than was actually reported in the area). The Working Group recognized that this was likely a minimal estimate, as the observers were only present for two weeks during the six week salmon fishery period. It should be noted that it is possible that the discrepancies reported by the observers may have already been caught as part of the phone survey, though this is unknown. Hence, the unreported catch documented by the observers may have been counted twice in the assessment of the unreported catch (that is, once by the observers, and once by the phone survey), which would overestimate the unreported catch. The values reported by the observers are small though relative to those derived from the phone surveys, and is unlikely to have a large influence on the results presented by the Working Group. Nevertheless, this source of uncertainty need to be recognized in the report.

19) Section 5.1.3. The report concludes that the exploitation rate of salmon in the West Greenland fishery was 9.7%, which was among the lowest value observed in the time-series. Here, exploitation rate is estimated by dividing the nominal catch in West Greenland (adjusted for unreported catch) by the estimated pre-fishery abundance (PFA) in this area. It should be noted though that the PFA is sensitive to the mortality rates assumed to occur in the ocean during the last 13 months of their marine life, which is currently set at 3% per month, for all years. While this value appears to be reasonable, there is currently no direct empirical estimate of mortality of salmon during that phase of the life cycle (though it was probably justified in a previous assessment), and some effort should be directed to obtain this es-

timate. For instance, in comment #3, it was inferred that the survival beyond the first two months could be around 5.3% for the Southwest Miramichi River. If we assumed that the fish remained in the ocean for 24 months before maturing (and that there was no fishing mortality in West Greenland), monthly mortality would be around 12%. As a first approximation, this implies that the pre-fishery abundance of the non-maturing 1SW in the NAC complex would be about three times larger if monthly mortality was 12% compared to 3% (this would be roughly equal to $e^{(-0.03+0.12)*12}$, where 12 is the number of months at-sea following harvest). And the estimated exploitation rate of NAC in West Greenland would have been overestimated by a factor of 3.

Lorenzen (1996. J. Fish Biol 49: 627–647) derived an allometric model of annual mortality rates of fish using published estimates of annual mortality rate and body weight. Using the model he derived for mortality rate in the ocean and an average body weight of 3200 g for salmon caught in West Greenland would provide an annual mortality rate of 0.315 per year or 2.6% per month. This would be in line with the value used by the WGNAS. However, the unexplained variance around fish weighing 3.2 kg is about plus or minus half an order of magnitude. That means that the most likely annual mortality rate is somewhere between 0.1 and 1 per year for fish of that size, or a monthly mortality rate of 0.8% to 8%. Hence there is considerable uncertainty in the natural mortality rate for the non-maturing 1SW off West Greenland. And depending on the value that is used, it will affect the estimated exploitation rate in the West Greenland fishery, and the perceived impact of this fishery on the abundance of NAC and Southern NEAC stocks. Hence the choice of the mean monthly mortality rate used by the WGNAS to estimate the PFA needs to be well documented, as well as to how uncertainty around that estimate was derived, and then referred to in the report.

20) Section 5.2.3. Sampling for juvenile salmon has been conducted in a West Greenland river in 2016. These samples would provide useful material for genetic stock identification, if salmon from West Greenland have not been included in the baseline that is used to determine the origin of the catch in the West Greenland fishery. Future genetic stock identification of the catch should include not only the Northwest and Northeast Atlantic stocks, but also the West Greenland stocks.

Inconsistencies

The unreported catch for 2015 is reported as 298 in Table 2.1.1.1 and as 256 in Table 3.1.4.1.

The total catch in Southern NEAC and Northern NEAC for 2009 adds up to 265 and 897, respectively, in Table 2.1.1.1, for a combined catch of 1162. In Table 3.1.4.1, the total catch in Southern NEAC and Northern NEAC for 2009 is listed as 266 and 898, respectively, for a total of 1164.

In Table 3.1.4.1, the Southern NEAC and Northern NEAC catches are listed as 373 and 1036, respectively. This adds up to 1409 (which match the total from Table 2.1.1.1), but the total is presented as 1408 in Table 3.1.4.1.

Typos

Section 1.5, p. 9: "as part of an management plan". Change "an" to "a". DONE

Section 2.2.1, p. 4, next to last paragraph: "facilities round the world". Change "round" to "around". DONE

Figure 2.5.1.2, end of the paragraph: should that be Atlantic herring rather than Atlantic salmon?

Section 3.2.1, p. 7, last paragraph, 5th line: "as well as Nrthern NEAC". Change "Nrthern NEAC" to "Northern NEAC". DONE

Section 3.3.6, p. 12, 2nd paragraph: "for the Ssouthern NEAC areas". Change "Ssouthern" to "Southern". DONE

Tables 3.1.5.1 to 3.1.5.6: The comma is used for decimals, whereas elsewhere it is the period.

Figure 3.3.5.1: The scale for about half of the figure goes down to zero, and the other half do not. Was there a reason for doing this?

Final thoughts

NASCO requested a review of examples of successes and failures in wild salmon restoration and rehabilitation, and to develop a classification of activities which could be recommended under various conditions or threats to the persistence of populations. A brief summary of this review was provided in Section 2.4. It was noted that successful restoration and rehabilitation was characterised by river stocks with moderate to high marine survival estimates. Given that marine survival has decreased since the 1990s and has remained low for two decades, it is perhaps not surprising that salmon abundance has declined in many areas of the North Atlantic, despite numerous measures that have been implemented to recover these populations such as the closure or reduction of commercial fisheries, and various habitat restorations and rehabilitations. As Einstein once said, "Insanity is doing the same thing over and over again and expecting different results". Clearly, if these low marine survival periods persist, alternative management measures will be needed to reverse the trends. Otherwise, efforts to restore salmon populations to their previous abundance will likely fail.