WORKING GROUP ON NORTH ATLANTIC SALMON (WGNAS)

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i Executive summary

WGNAS met to consider the status of and threats to Atlantic salmon in the North Atlantic Salmon Conservation Organization (NASCO) commission areas: West Greenland (WGC), North American (NAC), and Northeast Atlantic (NEAC). Many updates are provided for 2021 and 2022 as WGNAS was not able to address all terms of reference (ToRs) in 2022. Information on the catch and exploitation, including salmon caught and released, and nominal harvest, as well as tagged and marked fish releases are provided by country and jurisdiction. Emerging threats are presented, including the first report of Infectious Salmon Anaemia (ISA) in Iceland, red skin disease in Europe, and Norway is evaluating new offshore farming sites. New scientific advancements reported on include non-lethal *Gyrodactylus* treatment, homewater return rate estimation methods, and genetic tools to understand the reproductive success of salmon that have been caught and released. ICES did not conduct a full assessment for salmon in NEAC because the Framework of Indicators (FWI) did not indicate that the forecast estimates of abundance for the four NEAC stock complexes had been underestimated.

WGNAS was asked to provide information on three key issues in 2023, namely:

1. the causes of variability in return rates between rivers within regions of the North Atlantic, concluding that factors at river-specific, regional and oceanic scales interact to affect marine survival rates and maturation schedules, and it is unlikely that a single factor alone accounts for temporal variations and the decline of wild salmon in the North Atlantic;
2. the current state of knowledge on freshwater and marine predation by cormorants, concluding that cormorants can have substantial impacts on salmon abundance in areas where cormorant populations have increased or declines in other cormorant prey abundance have occurred, an issue of special concern where salmon populations are already threatened or endangered; and,
3. an evaluation of the risk of salmon bycatch occurring in pelagic and coastal fisheries, and effectiveness and adequacy of current bycatch monitoring programmes, concluding that ICES ability to evaluate the risk of bycatch is limited because few pelagic fisheries are screened for bycatch and screening covers small proportions of catch. To advance our capacity to evaluate such risks, a series of data deficiencies, monitoring needs and research requirements are identified.

Looking forward, a Bayesian life cycle assessment model and data inputs were discussed in connection with the 2023 benchmark.

ii Expert group information

Expert group name	**Working Group on North Atlantic Salmon (WGNAS)**
Expert group cycle	Annual
Year cycle started	2023
Reporting year in cycle	1/1
Chairs	Alan Walker (UK: England and Wales)
	Martha Robertson (Canada)
Meeting venues and dates	14-15 February 2023, Online, 27
	27 March- 6 April 2023, Copenhagen, Denmark and online, 37

1 Introduction

1.1 Main tasks

On 10 March 2023, ICES resolved in C. Res. 2022/2/FRSG17 that the Working Group on North Atlantic Salmon (WGNAS) would meet in two parts:

4. from 14-15 February 2023 to address ToR 2.4 via online web conference, chaired by Cindy Breau (CA)
5. from 27 March–6 April 2023 at the Black Diamond and in ICES HQ in Copenhagen, Denmark, during hybrid meetings chaired by Alan Walker (UK) and Martha Robertson (CA).

The working group met according to this schedule, to address questions posed to ICES by the North Atlantic Salmon Conservation Organization (NASCO).

The terms of reference were met.

The sections of the report which provide the answers to the questions posed by NASCO are identified below:

Question posed by NASCO		Report section
No.		
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 2021 and 2022;[1]	2.1, 2.2 and Annex 4
1.2	report on significant new or emerging threats to, or opportunities for, salmon conservation and management;[2]	2.3
1.3	provide information on causes of variability in return rates between rivers within regions in the North Atlantic	2.4
1.4	provide a summary of the most recent findings of ongoing research projects investigating the marine phase of Atlantic salmon (e.g. SeaSalar, SeaMonitor, SAMARCH, satellite tagging at Greenland);	2.5
1.5	provide a summary of the current state of knowledge on freshwater and marine predation by cormorants and impact on stocks	2.6
1.6	provide a compilation of tag releases by country in 2021 and 2022;	2.10
1.7	identify relevant data deficiencies, monitoring needs and research requirements;	Annex 7
2	**With respect to Atlantic salmon in the Northeast Atlantic Commission area:**	Section 3

[1] With regard to ToR 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 ToR 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.

Question posed by NASCO		Report section
2.1	describe the key events of the 2021 and 2022 fisheries;[3]	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 CLs 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 CLs by jurisdiction.	3.3
2.4	advise on the risks of salmon bycatch occurring in pelagic and coastal fisheries, and report on effectiveness and adequacy of current bycatch monitoring programs	3.4
3	**With respect to Atlantic salmon in the North American Commission area:**	Section 4
3.1	describe the key events of the 2021 and 2022 fisheries (including the fishery at Saint Pierre and Miquelon);[3]	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 CLs by jurisdiction; and	4.2
3.3	describe the status of the stocks, including updating the time-series of trends in the number of river stocks meeting CLs 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 2021 and 2022 fisheries;[3] and	5.1
4.2	describe the status of the stocks.[4]	5.3
5	**Address relevant points in the Generic ToRs for Regional and Species Working Groups for each salmon stock complex.**	Section 6

1.2 Participants

Member	Country
Ida Ahlbeck Bergendahl	Sweden
Julien April	Canada
Jan Arge Jacobsen	Faroe Islands
Hlynur Bárðarson	Iceland

[3] In the responses to ToRs 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 ToR 4.1, if any new surveys are conducted and reported to ICES, ICES should review the results and advise on the appropriateness of incorporating resulting estimates into the assessment process.

[4] In response to ToR 4.2, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to ToRs 2.3 and 3.3.

Member	Country
Geir Bolstad	Norway
Cindy Breau	Canada
Colin Bull	UK
Mathieu Buoro	France
Gérald Chaput	Canada
Anne Cooper	Denmark (ICES)
Guillaume Dauphin	Canada
Sophie Elliott	Chair-invited Member
Dennis Ensing	UK (Northern Ireland)
Jaakko Erkinaro	Finland
Peder Fiske	Norway
Marko Freese	Germany
Jonathan Gillson	UK (England and Wales)
Stephen Gregory	UK (England and Wales)
Derek Hogan	Canada
Niels Jepsen	Denmark
Séan Kelly	Ireland
Richard Kennedy	Northern Ireland
MacKenzie Kermoade	Denmark (ICES)
Clément Lebot	France
Hugo Maxwell	Ireland
David Meerburg	Canada
Michael Millane	Ireland
Rasmus Nygaard	Greenland
James Ounsley	UK (Scotland)
Rémi Patin	France
Etienne Rivot	France
Martha Robertson (Chair)	Canada
Kjell Rong Utne	Norway

Member	Country
Timothy Sheehan	USA
Tom Staveley	Sweden
Andrew Taylor	Canada
Alan Walker (Chair)	UK (England and Wales)
Vidar Wennevik	Norway
Jonathan White	Ireland

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 Organization (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 organization as:

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

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks" and 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. 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 and recruitment relationship (Ricker, 1975; ICES, 1993). NASCO has adopted the region-specific CLs (NASCO, 1998). These CLs are limit reference points (S_{lim}); having populations fall below these limits should be avoided with high probability.

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

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

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

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

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

For catch advice on fish exploited at West Greenland (primarily 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/jurisdiction levels (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.

2 Atlantic salmon in the North Atlantic area

2.1 Catches of North Atlantic salmon

2.1.1 Nominal catches of salmon

This year we used R software to create the tables and figures instead of Microsoft Excel. Please be aware that there are some rounding differences between R and Excel which can cause slight variations in displayed numbers and sums. In particular, R is IEC 605599 compliant when rounding fractions, and Excel is not. For example, R will round 2.5 as "2" and Excel will display 2.5 with no decimal places as "3". We have tried to preserve precision as best we can.

The nominal catch of a fishery is defined as the round, fresh weight of fish that are caught and retained, and reported. Total nominal catches of salmon reported by country in all fisheries for 1960–2022 are given in Table 2.1.1.1. Catch statistics in the North Atlantic also include fish-farm escapees and, in some Northeast Atlantic countries, ranched fish (see Section 2.2.2). Catch and release has become increasingly commonplace in some countries, but these fish do not appear in the nominal catches (see Section 2.1.2).

Icelandic catches have traditionally been split into two 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 2021 and 2022 (Table 2.1.1.1). Catches in Sweden are 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 (Ireland, UK (Northern Ireland), 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, all Iceland, Sweden and Denmark); ‘Southern Europe’ (Ireland, UK (Scotland), UK (England and Wales), UK (Northern Ireland), France and Spain); ‘North America’ (Canada, USA and St Pierre and Miquelon (France)); and ‘Greenland and Faroes’.

The total nominal catches for 2021 and 2022 (provisional) were 630 and 700 t, respectively. The 2021 nominal catch was 276 t below the updated 2020 catch (906 t) and below the previous five- and ten-year means (inclusive) by 483 t and 632 t, respectively. Although, nominal catches increased in 2022, they were still below the 2020 catch by 206 t and below the previous five- and ten-year means by 223 t and 391 t, respectively. Catches in the majority of countries/jurisdictions in 2021/2022 were below the previous five- and ten-year means and several countries (Finland, Iceland, Ireland, Norway, UK (England and Wales), UK (Northern Ireland) and UK (Scotland)) recorded their lowest ever catch (period 1960-2022) in either 2021 or 2022 (Table 2.1.1.1).

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 2022 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 recognizes that mixed-stock fisheries present particular threats to stock status (ICES, 2019a). 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 whereas 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 have been no coastal fisheries in Iceland, Spain, or Denmark throughout the time-series. Coastal fisheries ceased in Ireland in 2007 and no fishing has occurred in coastal waters of UK (Northern Ireland) since 2012, in UK (Scotland) since 2016, or in the UK (England and Wales) since 2019 (England) and 2020 (Wales). In most countries in recent years, the majority of the catch has been taken in rivers and estuaries.

Coastal, estuarine and in-river catch data for the period 2009 to 2022 aggregated by region are presented in Figure 2.1.1.3 and the whole time-series are presented in Table 2.1.1.3.

In the Northern NEAC area, catches in coastal fisheries have declined from 306 t in 2009 to 115 t in 2021 and 153 t in 2022, and in-river catches have declined from 594 t in 2009 to 287 t in 2021 and 357 t in 2022. 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 around 30%–40% of the total.

In the Southern NEAC area, catches in coastal and estuarine fisheries have declined over the period. While coastal and estuarine fisheries have historically made up the largest component of the catch, coastal fisheries dropped sharply in 2007 (from 306 t in 2006 to 71 t in 2007) and remained at lower levels to 2018; there have been no coastal catches since 2019. Estuarine fisheries have also declined, from 72 t in 2007 to 20 t in 2021 and 14 t in 2022. The reduction in more recent years in coastal and estuarine fisheries reflects 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. In 2022, about one quarter of the catch was from estuarine fisheries and three quarters from in-river fisheries.

In North America, the total catch has been fluctuating between 80 and 182 t over the period 2009 to 2022. Around two thirds of the total catch in this area has been taken by in-river fisheries, although it was about half since 2018. The estuarine catch has fluctuated between about 23% and 44% of the total catch. The catch in coastal fisheries has been typically less than 10% of the catch each year with the biggest catch taken in 2013 and 2016 (13 t in both years).

In Greenland, the total coastal catch increased steadily from 25 t in 2007 to 56 t in 2015, and has since fluctuated between 26 and 42 t. A small number of salmon have been caught in the estuary near the Kapisillit River (in 2019, 19 salmon, total weight 81 kg; in 2020 no catch reported, in 2022 one salmon was reported caught). Genetic studies have shown this river stock is very isolated from other stocks in the North Atlantic but is an outgroup of the NEAC phylogenetic group, and salmon caught in the estuary were exclusively from the Kapisillit River (Krohn 2013 unpublished; Arnekleiv *et al.*, 2019).

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, the mandatory release of large (MSW) salmon has been in place since 1984. 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 2022 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 2021 and 2022 this ranged from 5% in France, to 96% in UK (England and Wales) and UK (Scotland), reflecting varying management practices and angler attitudes among these countries. There are no restrictions on the total numbers of fish that may be caught and released in most countries, although in Ireland some rivers are closed completely to recreational angling owing to low conservation status, whereas there are some daily limits for individual fishers in some Canadian fisheries. 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 greater proportions than smaller fish. Overall, about 183 000 salmon were reported to have been released from rod fisheries around the North Atlantic in 2021 and 2022, similar to the previous five-year mean (approximately 182 000).

Catch and release is also practised in some commercial salmonid net fisheries, for example in UK (England and Wales) and UK (Scotland), where gears that previously targeted and retained salmon and sea trout, and kept the fish alive until retrieval, are now only allowed to retain sea trout and must release any salmon alive.

Summary information on how catch and release levels, and estimates of post-release mortality rates, are incorporated into national assessments was provided to ICES in 2010 (ICES, 2010).

2.1.3 Unreported catches

Unreported catches by year (1987 to 2022) and Commission Area are presented in Table 2.1.3.1 and are presented relative to the total nominal catch in Figure 2.1.3.1. A description of the methods used to derive the unreported catches was provided in ICES (2000) and updated for the NEAC Region in ICES (2002). Detailed reports from different countries were also submitted to NASCO in 2007 in support of a special session on this issue. There have been no estimates of unreported catch for Russia since 2008, for Canada in 2007 and 2008, and for France since 2016. The unreported catches for Canada for 2009, 2010 and since 2019 are incomplete as estimates are not available for all regions. There are also no estimates of unreported catch for Spain, where total catches are typically small.

In general, despite the methods used by each country to derive estimates of unreported catch remaining relatively unchanged, incompleteness and inconsistencies in annual reporting mean that comparisons over time may not be appropriate (see Stock Annex). Over recent years, efforts have been made to reduce the level of unreported catch in a number of countries (e.g. through improved reporting procedures and the introduction of carcase tagging and logbook schemes).

The total unreported catch in NASCO areas in 2021 and 2022 were estimated to be 163 and 202 t, respectively. The unreported catch in the NEAC area in 2021 and 2022 were estimated at 134 and 174 t, respectively, and those for West Greenland were 10 t in both years and the NAC area were 19 and 18 t, respectively. The 2021 and 2022 unreported catches by country are provided in Table 2.1.3.2. It is not possible to fully partition the unreported catches into coastal, estuarine and in-river areas.

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

2.2 Farming and sea ranching of Atlantic salmon

2.2.1 Production of farmed Atlantic salmon

The estimate of farmed Atlantic salmon production in the North Atlantic area for 2021 was 1990 kt, and the provisional estimate for 2022 was 1938 kt. These are increases on the production for 2020 (1775 kt) and the previous five-year mean (1750 kt). The production of farmed Atlantic salmon in this area has been over one million tonnes since 2009 (Table 2.2.1.1 and Figure 2.2.1.1). Norway continues to produce the majority of the farmed salmon in the North Atlantic (77%), followed by UK (Scotland; 10%). Farmed salmon production in 2021 and 2022 were above the previous five-year mean in all countries with the exception of Ireland. Data for UK (Northern Ireland) since 2001 and data for east coast USA since 2012 are not reported to ICES, as the data are not publicly available. This is also the case for some regions within countries in some years.

Worldwide production of farmed Atlantic salmon has been over one million tonnes since 2001 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 as data for 2021 and 2022 are not available, the Working Group has used 2020 data for some countries and assumed the same levels of production for 2021 and 2022 (FAO Fisheries and Aquaculture Department database), to estimate worldwide production. The total worldwide production in 2021 was provisionally estimated at around 2965 kt, and 2912 kt in 2022 (Table 2.2.1.1 and Figure 2.2.1.1), which were higher than in 2020 (2757 kt) and the previous five-year mean (2641 kt). Production of farmed Atlantic salmon outside the North Atlantic is estimated to have accounted for one third of the worldwide total in 2021 and 2022 and is still dominated by Chile (80%). 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 2022 was over 4000 times the reported nominal catch of wild 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 hatchery-origin smolts are re-leased 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 a small number of salmon rivers.

The total harvest of ranched Atlantic salmon in countries bordering the North Atlantic in 2021 and 2022 were 20 and 23 t (Iceland and Sweden; Table 2.2.2.1; Figure 2.2.2.1) with the majority of catch taken in Iceland during both years. The total harvest was 23% below the previous five-year mean (30 t). No estimates of ranched salmon harvest are provided for Ireland or UK (Northern Ireland) where the proportion of ranched fish in the catches are more difficult to assess. However, in both instances ranched catches are considered to be an insignificant proportion of the overall harvest.

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

This section answers question 1.2 of the ToRs, providing updates with regard to understanding of effects of Covid-19, threats pertaining to infectious salmon anaemia (ISA), red skin disease (RSD), sea lice, *Gyrodactylus salaris* and offshore fish farming in Norway, and opportunities pertaining to the ongoing development of model-based estimates of homewater returns in France, and a genetic parentage study revealing that salmon caught and released had a demonstrable reproductive success.

2.3.1 Impacts of COVID-19

In Ireland, exploitation rates along with their error terms were revised for MSW salmon in 2020 and 2021 to account for reduced recreational angling due to COVID-related restricted movement orders in spring of each year which likely affected fishing effort on MSW stocks.

In Scotland, in order to use the 2020 and 2021 catch data to undertake stock estimation, the catches were first adjusted to account for the reduction in fishing effort due to Covid-19 restrictions. Statistical models were updated in 2022 to include water flow in the relationships, which improved model fits.

Travel to Greenland was restricted in 2021, and three of the participants in the International Sampling Programme were unable to secure travel arrangements. The samplers who were able to secure travel arrangements were successful in sampling the harvest in the communities they were stationed in. Additional samples were also collected by a local resident in Qaqortoq, Greenland, sampling in Nuuk by the Greenland Institute of Natural Resources (GINR) and the Citizen Science program initiated by the GINR. The Sampling program adequately sampled the Greenland harvest in 2021 given these additional efforts.

2.3.2 Threats

2.3.2.1 ISA noted in farmed salmon in sea-pens in Iceland for the first time

In November 2021 a farmed salmon in a sea-pen in Reyðarfjörður was detected with an Infectious Salmon Anaemia (ISA-HPR-del) viral infection. The virus was also detected in spring of 2022 in a sea-pen in Berufjörður which is about 40 km from Reyðarfjörður and most likely carried between the fjords with an equipment that was moved between these two areas prior to the first ISA identification. The decision was made to remove and slaughter all salmon in both areas and rest all operation for 90 days. Following the detection, a screening of ISA was carried out in 4660 samples from 14 different sea-pens in the East fjords along with 517 samples from three smolt facilities in 2022, all of which came out negative. ISA has caused problems in aquaculture in several countries since it was first discovered in Norway 1984, but this is the first time the virus has been detected in Iceland.

2.3.2.2 Update on Red Skin Disease

Various surveillance programmes and awareness-raising campaigns for reporting of RSD have been established or continued in 2021 and 2022. As in 2019 and 2020, several European countries reported Atlantic salmon returning to rivers with RSD in 2021 and 2022 during late spring into summer. While the majority of recorded cases in Ireland are observed in 1SW salmon, this is not the case elsewhere in Europe (notably UK (Scotland) and northern European countries) where RSD is principally observed in MSW stocks. This may be a consequence of the Irish stocks being predominantly 1SW. RSD was not reported in Greenland, Canada or the USA.

2.3.2.3 Update on sea lice investigations in Norway

The surveillance program for sea lice infections on wild salmon postsmolts and sea trout at specific localities along the Norwegian coast continued in 2021 and 2022 (Nilsen et al. 2021, 2022). Activities in the field included trawling for salmon postsmolts in fjords and coastal areas, near-shore traps and nets catching sea trout/arctic char, 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 postsmolts, and a period one week later focused on sea trout infection. As in previous years, the field activities in the surveillance program were partly based on predictions from the hydrodynamic model for spreading and geo-graphic distribution of salmon louse larvae. Field sampling was directed to areas where the model predicted high densities of infective salmon louse copepodites in the smolt migration period.

In 2021, in general, the surveillance program demonstrated varying infection pressure along the coast during the postsmolt migration period. In the southernmost counties (Production area 1), an area with little salmon farming, low levels of salmon louse infections were observed. In southwestern Norway, county Rogaland data indicated low to moderate infection pressure in the salmon postsmolt migration period. In parts of Vestland county (Hardangerfjord and Sognefjord) infection levels on outmigrating salmon postsmolts were relatively high with up to 86% (Hardangerfjord) and 83% (Sognefjord) of the fish having >0.1 sea louse per gramme fish in some weeks in these fjords. Further north, in Romsdalsfjord lice levels were somewhat lower. In two weeks of trawling the proportion of fish with lice levels >0.1 louse/g was 23% and 17%. In Trondheimsfjord, in the middle part of Norway, trawling for postsmolts was conducted in weeks 19-26. The proportion of fish with >0.1 lice/g varied from 2-31%. In the three northernmost counties lice levels were generally low in 2021, as in earlier years. The sea lice situation on the fish farms did not change significantly compared to 2020, though the level of motile lice was reduced compared to 2020. The average number of adult female sea lice was similar to the previous year. The number of chemical treatments (719) was on the same level as in the last years, as was other methods of treatment (Sommerset et al. 2022).

In 2022, in general, the surveillance program, as in earlier years, demonstrated varying infection pressure along the coast during the postsmolt migration period in 2022. In the southernmost counties (Production area 1), an area with little salmon farming, low levels of salmon louse infections were observed. In southwestern Norway, county Rogaland data indicated low to moderate infection pressure in the salmon postsmolt migration period. The prevalence of sea lice on postsmolts caught in trawls was 53% in the first week of trawling, and dropped to 40% in the last two weeks. The proportion of fish with >0.1 louse/g varied between 11% and 45% in the different weeks. In Hardangerfjord, Vestland county, the infection levels were higher and the prevalence of sea lice on trawl-caught postsmolts increased from 30% in the first week of trawling (week 19) to 100% in the last week (week 22). The proportion of fish with >0.1 lice/g increased from 8% in the first week to 94% in the last week. In the Sognefjord the prevalence of sea lice on migrating postsmolts varied between 72% and 100% in weeks 21 to 24. The proportion of fish with >0.1 lice/g varied between 35% and 92% in the different weeks. Further north, in the Romsdalsfjord, lice levels on postsmolts were lower, and lower than in 2021. In the area outside the

Trondheimsfjord prevalence was relatively low during the period of trawling, with prevalence increasing from 5% in the first week of trawling to 23% in the last week. The numbers are similar to what has been observed in previous years. In the three northernmost counties lice levels were generally low in 2022, as in earlier years. In fish farms, sea lice levels were comparable to 2021, and the five year period 2016-2020. The average number of adult female sea lice was 0.15, similar to previous years. The number of chemical treatments was on the same level, but the use of other methods (thermic, mechanical etc.) increased (Sommerset et al. 2023).

2.3.2.4 *Gyrodactylus* in Norway

In November 2022 one of the previously infected clusters of rivers ("the Skibotn region") was declared free of the parasite *Gyrodactylus salaris*. This declaration was made because no parasites had been found in salmon samples taken yearly in the rivers since they were treated with rotenone for the last time in 2016.

The Driva river has been treated with chloramine against *G. salaris* in 2022. Chloramine is a new treatment that will kill the parasite but not the fish if administered in the correct dosage, eliminating the problems created by rotenone killing all the fish in the river. The treatment will continue in 2023. The smaller rivers in this region was treated with rotenone in 2022, and a new treatment is planned in 2023.

At present, only the Drammen region has not been treated against the parasite, because of the complexity of the water basins, and the number of infected rivers in Norway is decreasing.

2.3.2.5 Offshore Fish Farming in Norway

In Norway, plans are under development for opening offshore areas for aquaculture. A number of suggested areas along the coast have been evaluated for suitability for farming of salmon, and also for potential conflict other natural resources such as deep-sea coral reefs and spawning areas for marine species, as well as other activities that may use these areas such as fishing. Through a formal consultation process with a number of institutions and agencies many of the initially proposed areas were excluded and three areas were selected for further evaluation: one off southwest Norway, one area in Mid-Norway and one in northern Norway (http://www.fiskeridirektoratet.no/Akvakultur/Dokumenter/Rapporter/anbefaling-av-tre-omrader-for-havbruk-til-havs). Depending on the technology being developed for the offshore fish farms, the level of production in the areas, and their proximity to migration routes of wild postsmolts, aquaculture in these areas may have an effect on outmigrating postsmolts from the rivers.

2.3.3 Opportunities

2.3.3.1 Estimating homewater catches and returns in France

In the context of the WGNAS benchmarking process, France has identified the need to review the models used to provide time-series (1971 onwards) of homewater catches and adult re-turns at the national level. A new integrated hierarchical Bayesian model is currently under development that makes the best use of the available data and expertise, while accounting for regional specificities of fisheries and population dynamics. The model integrates various sources of data such as catches of estuarine net fisheries and freshwater angling fisheries, but also estimates of abundances at regional and river scales as well as surface area of production. Regional expertise was used to make assumptions on time-trends of harvest rates, de-pending on the fishery and the sea age class considered. The results provide new insights on the abundance of adults returning to homewaters and on associated harvest rates, both on a regional basis and aggregated at the national level. The decrease of 1SW adults is estimated to be less severe than that which the run-reconstruction model has estimated so far whereas no major changes were observed between the estimates for MSW returns from the two models. The new approach still needs to be validated and the new estimates are expected to be used for the Working Group's assessment in 2024.

2.3.3.2 Effect of Catch-and-Release and temperature on reproductive success on a Quebec river

A new project investigating the effect of catch-and-release and temperature at release on reproductive success of Atlantic salmon has been conducted in Quebec, Canada (Bouchard et al. 2022). This project was motivated by the fact that while this conservation practice is increasingly common and usually cause low mortality rates (Van Leeuwen et al. 2020), its effects on the reproductive success of caught-and-released fish are poorly understood. In this project, the relative reproductive success of caught-and-released to non-caught salmon was compared and the effect of temperature at release was tested. Molecular parentage analysis to link parents with their young-of-the-year progeny shows that at least 83% of caught-and-released salmon successfully reproduced, including fish that have been released in water warmer than 20 °C. However, the reproductive success of caught-and-released female salmon was only 73% of the reproductive success of non-caught salmon. Moreover, the increasing temperature did not affect the reproductive success of released fish. These findings should be useful for evaluating the risks and benefits of catch-and-release, and for optimizing conservation practices used for the preservation of Atlantic salmon populations.

2.4 Provide information on causes of variability in return rates between rivers within regions in the North Atlantic

Annual estimates of marine return rates of Atlantic salmon in the North Atlantic have been compiled and updated annually by the ICES Working Group on North Atlantic salmon. There are 35 rivers in the Northwest and Northeast Atlantic with monitoring data that provides estimates of return rates of wild outmigrating salmon smolts to adult returns (Figure 2.4.1). This is supplemented by data from 28 rivers with hatchery smolt-to-adult return rates. The datasets cover the period from the 1969 to 2019 smolt migration years. Temporal coverage is sparse for a number of the rivers but 37 datasets including wild and hatchery origin smolts have a temporal coverage of 20 or more years (Figure 2.4.2).

Rivers with return rates reported as 1SW, 2SW (or MSW) returns are categorized as MSW rivers whereas rivers with return rates reported as 1SW only are categorized as 1SW rivers.

Return rates are expressed as the ratio of returning first time spawning salmon to outmigrating salmon smolts for the smolt migration year. Estimates of return rates are provided for one-sea-winter (1SW), two-sea-winter (2SW or MSW), and for some series for the sum of first time spawning salmon.

- $RR.1SW_y = {1SW_{y+1}}/{Smolts_y}$ representing returns rates to 1SW first time spawners
-
- $RR.2SW_y = {2SW_{y+2}}/{Smolts_y}$ representing returns rates to 2SW first time spawners, or
-
- $RR.All_y = {\sum_k kSW_{y+k}}/{Smolts_y}$ representing returns rates to first time spawners of all sea age groups (k) for the smolt migration year y.

The return rates are estimated from the point where smolt and returning adult abundances are assessed and therefore represent the outcome of marine and estuarine fishing and non-fishing related mortality.

It is not possible to speak about marine return rates for Atlantic salmon without considering the interaction of marine survival and sea age at maturity processes. Return rates are the product of sea survival rates (S1, S2,..) and the probability of maturing (〖p.mat〗 _1, …) at a given sea age:

- $RR.1SW_y \quad = \frac{Smolts_y * p.mat_1 * S_1}{Smolts_y}$
  $= p.mat_1 * S_1$

- $RR.2SW_y \quad = \frac{Smolts_y * S_1 * (1 - p.mat_1) * S_2}{Smolts_y}$
  $= S_1 * (1 - p.mat_1) * S_2$

A number of factors at local, regional, and continental scales, that potentially fluctuate over time, can result in variations in return rates from monitored rivers within and among regions assessed by ICES.

2.4.1 Data Considerations

Smolt and adult return monitoring programs most often occur at freshwater monitoring sites. There may be important losses of smolts in the freshwater portion of the river during the downstream migration of smolts and the mortality in the freshwater phase may be important in some rivers and regions, with factors dependent upon the geography of the river systems, predator communities, and anthropogenic stressors (Newton et al. 2019; Flávio et al., 2020; Thorstad et al., 2012; Belletti et al., 2020). An illustration of these high mortalities can be found in Stevens et al. (2019) where they modelled the survival to ocean entry of hatchery origin smolts stocked at various points above the multitude of dams in the Penobscot River (USA) and concluded that over a 43 year period of stocking, only 39% of the smolts stocked survived to ocean entry.

Losses of adult salmon returning to rivers may also occur in proximity to their natal rivers or in the river itself downstream of the assessment facility and this will have consequences on the calculation of return rates. Standardizing the return rate reporting as returns of adults to freshwater is much easier than attempting to correct for the freshwater location of the smolt monitoring site. Survival rates of smolts through freshwater below the monitoring sites cannot be easily corrected as the rates can be highly variable among rivers and years and estimates from acoustic tagged smolts may not be representative of survival rates of untagged and unmanipulated animals (Vollset et al., 2020).

In the calculation of return rates, the assumption is made that adult survivors return to the rivers from which they emigrated as smolts. The exchange of adults between populations via dispersal (also known as straying) in Atlantic salmon occurs to varying degrees due to a variety of factors including growing conditions, water temperature and flow, size of watersheds and salmon abundance, and metapopulation structure (Birnie-Gauvin et al. 2019; Lamarins et al 2022). Unbalanced emigration and immigration can skew estimates of return rates of local populations with some examples of populations with greater than expected return rates (sometimes exceeding 50%; e.g. Oir in France). A higher rate of emigration than immigration, on the other hand, would result in an underestimation of marine survival. Differences in population size (larger populations provide more immigrants to smaller adjacent populations for a given dispersal rate), river attractivity (e.g. due to chemical attraction to congeners, collective behaviour, and/or the influence of river discharge), and human activities can all influence unbalanced dispersal (see Keefer and Caudill 2014; Bett et al 2017 for review). Smolts from hatcheries, for example, stray more than wild fish (Quinn, 1993; Nilsen et al. 2022b). Thus, the expected return rate of a population can be affected not only by management practices (such as restocking), but also by those of its neighbours. Dispersal is also likely to be influenced by individual traits (e.g. sex-biased dispersal, age at river/sea, genetic) and can impact comparisons of return rates between sea age.

2.4.2 Genetics and equilibrium population considerations

Atlantic salmon in the North Atlantic are structured into more than 2000 genetically discrete populations distributed in watercourses flowing towards the North Atlantic Ocean (Verspoor et al., 2007). Several genes are associated with adaptation in Atlantic salmon, including genes that influence growth rates, age and size at maturity, run timing, and immune function among many (Barson et al. 2015; Aykanat et al. 2019; Cauwelier et al. 2018; Pritchard et al. 2018; Sinclair-Waters et al. 2020; Dionne et al. 2007; Gutierrez et al. 2015).

An attempt to assess the extent of the genetic determinants of marine return rates of Atlantic salmon was inconclusive. Bourret et al. (2014) examined differences in allelic and genotype frequencies between smolts and returning 1SW salmon from two populations for two cohorts going to sea and did not find significant patterns of selective mortality; they concluded that it was more likely that selection caused small changes in allele frequencies among many co-varying loci rather than a small number of changes at loci with large effects.

Atlantic salmon in the North Atlantic exhibit substantial variation in the age and size at maturation both within and among populations (Fleming, 1996). This is regarded as an evolutionary adaptation to varying environmental conditions that maximizes reproductive success (Good and Davidsen, 2016). The maturation process is influenced by the interactive effects of genetic and environmental factors (Thorpe et al., 1998; Czorlich et al., 2018; Mobley et al. 2021).

There are broad regional patterns in the proportions at sea age of first time spawners in the North Atlantic; for example, salmon returns to the Newfoundland and to Ireland have large proportions of first time spawners as 1SW salmon in contrast to the USA region and Norway that have proportionally more MSW first time spawners (Figure 2.4.3).

Return rates are expected to differ between rivers and regions based on the dominant sea age at maturity of the females. MSW salmon are larger bodied and the MSW females have substantially more eggs per fish (twice or more) than the smaller bodied 1SW salmon females (Fleming, 1996). The generational replacement of an individual female spawner depends on the combination of the fecundity of the female salmon, freshwater egg to smolt survival rate, and cumulative smolt to returning female marine survival rate. For similar egg to smolt survival rates, a population dominated by 1SW female sea age at maturity requires a higher marine survival rate for replacement than a population characterized by 2SW females, because the 2SW salmon female has individually more eggs. Both life-history types require a higher marine survival rate for replacement if freshwater survival rate declines.

2.4.3 Regional variations and differences in return rates

Return rates of wild salmon smolts in the Southern NEAC regions are generally higher than those of the Northern NEAC regions, and both are higher than return rates of regions in NAC (Figure 2.4.4). The differences between continental complexes are also noted in the hatchery origin smolt return rates. In both continent complexes and smolt origin type, the return rates to first time spawners are higher in populations dominated by 1SW salmon compared to the return rates of the MSW dominated rivers of those regions. The return rate over all years and regions of 1SW type rivers has a median value of 5.2% in NAC (0.6% to 15% range), and almost double that value at 9.4% in Southern NEAC (4.3% to 26.9% range). Return rates to 2SW (or MSW spawners) are lowest again in NAC, at a median value of 2.0% (0.4% to 15.7% range), higher in Northern NEAC at 4.5% (0.3% to 22.9%) and highest in Southern NEAC rivers at a median of 6.5% (0.3% to 46.7%) (Figure 2.4.4). River-specific return rates are highly variable among monitored rivers with general characteristics consistent with the sea age at maturity characteristics of the stocks and the continent of origin patterns (Figure 2.4.5).

The temporal trends in return rates in regions are variable. In NAC there is general declining trend over the 1980s to the 2000s in the return rates to the Quebec region contrasted to increased return rates to rivers for 1SW salmon in the Newfoundland region (Figure 2.4.6). In NEAC, there is an obvious decline in returns rates for Ireland and UK (Northern Ireland), and in UK (England and Wales), there is a recent decline trend in the 1SW and an increasing trend in the MSW return rates. The declining trend in return rates to 1SW salmon in Norway has occurred from the 1980s to 2000 and levelled off since (Figure 2.4.7).

The trends in regions are not representative of all rivers within those regions. Increased re-turn rates to freshwater in some monitored rivers in Newfoundland region after 1992 are attributed to the closure of the homewater marine commercial fisheries whereas in other rivers, return rates declined further after the commercial fishery closure (Figure 2.4.8). In the NEAC areas, river-specific return rates for wild salmon are equally variable among rivers and regions. With few exceptions, the general pattern is a decline in return rates to 1SW salmon and for the overall smolt cohort across all rivers from Iceland to Norway, with exception of the rivers in UK (England and Wales) and UK (Scotland). The strongest decline has occurred for the 1SW salmon return rate, and much less for the MSW return rate (Figure 2.4.9).

2.4.4 Factors contributing to variation in return rates

A number of studies and reviews over the past two decades have considered the potential factors and mechanisms that modify marine survival of Atlantic salmon (Cairns, 2001; Crozier et al., 2003; Russell et al., 2012; Forseth et al., 2017; Thorstad et al., 2021; Gillson et al., 2022). Overall, these studies point to the interactions and inter-dependence of the different ecosystems that anadromous salmon occupy and that shape their life histories. Marine survival in Atlantic salmon can be influenced by a range of factors associated with individual outmigrating smolt characteristics (size, condition, genetics), the rearing environment of the juveniles (natural vs. captive rearing), and local and broad-scale ecosystem conditions including physical attributes of the receiving environment, prey and predator communities. In addition to these are the diverse anthropogenic stressors to salmon that differ across the species distribution range.

A large component of the inter-river variation in return rates within the same year are most likely attributable to local and regional variations in factors that affect the early phase of the marine migration and survival whereas the long-term temporal patterns of return rates are most likely determined by the combination of local, regional and North Atlantic factors acting throughout the time of salmon at sea. It is probably a given that predation is the final cause of the death of an individual fish but the factors that lead to it being predated upon may be associated with stresses at an earlier time and location of its life history. These carryover effects can originate in freshwater, in the early phase of the marine migration, and up to the point of return to rivers as potential spawners.

2.4.4.1 Carryover effects from freshwater

Survival of smolts at sea is in part related to the freshwater life stages and therefore not independent of smolt characteristics (McCormick et al., 2009; Russell et al., 2012). Compromised survival from stressors in freshwater may manifest itself once the smolts migrate to the sea and although death may occur in the marine environment, the underlying factor that compromised the survival may have originated in the freshwater habitat. As these factors initially occur in freshwater, large differences in their effects on return rates among rivers within a region, and among regions and continental areas may be expected.

Smolts are particularly vulnerable to predation due to their relatively small body size and predation during the first months at sea is probably the most important source of mortality affecting the abundance of salmon populations (Hansen et al., 2003; Friedland et al., 2012; Thorstad et al., 2012). Larger smolts have a higher probability of returning to rivers than smaller smolts due to their better condition and faster growth which seems to favour survival by providing greater resilience to predation and inhospitable environmental conditions (Gregory et al., 2018, 2019). If traits, such as larger body size, have fitness benefits that are heritable, then this would contribute to high between stock variability in return rates.

The timing of smolt migration is crucial to the survival of Atlantic salmon at sea and it is regarded as an adaptation to the prevailing environmental conditions in an area (McCormick et al., 1998; Russell et al., 2012). Possible changes in the run-timing of smolts as a result of environmental variability are, therefore, a concern because of the possible temporal mismatch with optimal conditions for early post-smolt growth and survival. Given the potential for a high degree of congruence in smolt run-timing in particular areas such impacts might be expected to be manifest over rivers in a region.

The stresses of fish passage around and through obstructions (e.g. hydro dams) can also result in lower survival. Stich et al. (2015a, b) estimated that the smolt survival through estuaries was decreased by up to 40%, dependent on the number of dams passed during freshwater migration, highlighting the carryover effects of dams and stress of passage on survival of Atlantic salmon smolts during estuary migration. Stress from passage through turbines or over spillways can also lead to increased predation and disease (Odea, 1999). These stressors would be spatially local within rivers and add to the variability among rivers in a region.

Juvenile salmon in freshwater exposed to sublethal concentrations of contaminants, such as endocrine-disrupting chemicals, may have compromised survival at sea (McCormick et al., 1998, 2009; Fairchild et al., 2002, Moore et al., 2003, Waring and Moore, 2004). Sources of these compounds may include agriculture, sewage, pesticide spraying and industrial effluents. Industrial developments would be most important in the southern regions of NAC, potentially throughout S-NEAC, and the southern areas of N-NEAC.

Acidification of freshwater resulting from depositions of airborne pollutants may affect Atlantic salmon directly. The effects are related to reduced pH and high levels of aluminium, the latter being mobilized from soils and its increased solubility in water as pH is reduced. Even short-term episodic exposure in freshwater to aluminium at moderate acidification can reduce marine survival (Staurnes et al., 1996; McCormick et al., 2009; Liebich et al., 2011; Thorstad et al., 2013). Acidification stress on freshwater systems is most important in areas with poor buffering capacity of the underlying geology of the watersheds.

2.4.4.2 Carryover effects from estuarine and nearshore areas

Marine aquaculture of both finfish and shellfish can interact with and affect the environment occupied by Atlantic salmon. Pathogens and parasites are two aquaculture related stressors that can have delayed effects on survival of salmon. Enhanced sea lice burdens on salmon smolts that migrate through or proximate to aquaculture producing areas can result in a delayed mortality of the fish at a time and location distant from the initial infection area. Although Atlantic salmon marine aquaculture occurs in a large number of countries of the North Atlantic area (ICES 2021a), to date salmonid aquaculture is restricted to the coastal areas that provide the appropriate temperature (ice-free), salinity ranges, and flushing capabilities; the impacts would be particularly important on salmon populations that undertake migrations proximate to these production areas.

2.4.4.3 Geographic scale effects

Considering the diverse geological and glacial history of the more than 2000 rivers in the North Atlantic occupied by Atlantic salmon, it should not be surprising that the nearshore and coastal receiving environments of seaward migrating salmon would be physically and biologically diverse and heterogeneous. Some rivers empty directly into a saline environment (e.g. Saint-Jean River Canada, Lefèvre et al., 2012), in contrast to other rivers with long, wide and relatively shallow bays (Miramichi River, Chaput et al., 2018), to complex deep and saline fjords (Dempson et al., 2011; Thorstad et al., 2012; Bjerk et al., 2021).

Estuary and nearshore habitat are not generally occupied or otherwise used for rearing by salmon smolts and passage through these areas may be rapid, i.e. a matter of days to a few weeks (Lacroix et al., 2004; Hedger et al., 2008; Halfyard et al., 2012; Renkawitz et al., 2012; Chaput et al., 2018). In complex nearshore environments, the time to exit these areas is longer, 29 days or 36 days in a fjord-like system of approximately 30 km and 50 km axial length, respectively (Dempson et al., 2011; Bøe et al., 2019). The extent to which this residency time is related to feeding opportunities or environmental constraints (e.g. cold water) is not known. While in these nearshore areas, smolts can be exposed to enhanced sea lice densities in areas of aquaculture production. If the smolt migration window through these areas is extended, they may be at a greater predation risk. Avian and fish predator communities in the estuarine and nearshore areas (e.g. Striped bass in Canada, Gibson et al., 2015; Daniels et al., 2018; avian predators, Hawkes et al., 2013; Dieperink et al., 2002) can be very different across the range of salmon rivers in the North Atlantic, contributing in part to the variations in reported return rates.

2.4.5 Effects at North Atlantic scale

The consensus view is that marine survival and production of Atlantic salmon in the North Atlantic is not density-dependent.

2.4.5.1 Bottom up effects (prey)

Correlations between survival and growth during first summer and winter at sea suggest food resources in quantity and quality may be a limiting factor for some populations. However, variable environmental conditions in the ocean, rather than competition-induced shortages, have been hypothesized to influence marine growth more strongly (Peyronnet et al., 2007). Friedland et al. (2009) found that survival of post-smolts in the Northeast Atlantic was positively associated with plankton and possibly post-smolt food abundance and these prey abundances had declined since the 1970s. Several studies have reported on of ecosystem changes resulting in reduced prey quality including capelin in the Labrador Sea (Renkawitz et al., 2015) and Atlantic herring in the Gulf of Maine (Golet et al., 2015). Renkawitz et al. (2015) reported that over the period 1968 to 2008, the mean energy density of capelin, a key forage species in the North Atlantic, decreased approximately 34% resulting in substantially reduced energy consumption by Atlantic salmon over time. Altered forage conditions can manifest themselves as variations in size and body condition, as well as on survival and population abundance (Mills et al., 2013; Renkawitz et al., 2015).

Atlantic salmon at sea occupy the upper pelagic area and may compete with other pelagic species for food. In the Northeast Atlantic, salmon occupy similar habitat at times to Atlantic herring and Atlantic mackerel, two species whose abundances exceed that of salmon by several orders of magnitude and that are important predators on zooplankton, a prey item shared with salmon during early marine life. Utne et al. (2021) indicated that there was a low diet overlap between post-smolts and planktivorous pelagic species in the Northeast Atlantic and there was no correlation between the abundance or survival of salmon from key index rivers and the abundance of pelagic fish.

Olmos et al. (2020) examined the environmental drivers and the demographic mechanisms of the widespread decline of marine survival rate in Atlantic salmon in the North Atlantic Ocean for the 13 stocks units from the NAC and Southern NEAC complexes. A life cycle model was used to investigate whether the temporal variations in the post-smolt survival were best explained by environmental variations encountered by salmon during the early post-smolt phase when salmon use transitional habitats, or during the later phase of the first year at sea when salmon of different origins concentrate in common foraging areas. Results show a strong coherence in the temporal variation in post-smolt survival among the 13 stocks units of NAC and Southern NEAC. Synchrony in survival is stronger between stocks within each complex. Temporal variations of the post-smolt marine survival are best explained by the temporal variations of sea surface temperature (negative correlation) and primary production (positive correlation) encountered by salmon in space-time domains corresponding to late summer/early autumn feeding areas. Those findings support the hypothesis of a response of salmon populations to large-scale bottom–up environmentally driven changes in the North Atlantic that can simultaneously affect several populations originating in distant continental habitats. Also, ecological drivers and/or mechanisms could be different between NAC and Southern NEAC populations in relation to partially different migration routes at sea.

2.4.5.2 Top-down effects (predation)

The distribution of potential predators is not homogenous in the North Atlantic, with large numbers in discrete colonies of seabird predators and seasonal distributions of potential fish predators (e.g. Atlantic bluefin tuna) that are limited by sea temperatures. Interactions between marine mammals and salmon populations are not well understood because predation offshore is difficult to detect and salmon often comprise a small portion of the diet of marine mammals compared to other prey species.

2.4.6 Genetic perturbations associated with domestication

There are multiple examples that show that the return rates of hatchery stocked smolts are lower than the return rates of wild smolts (Figure 2.4.10). Environmental conditions and selective pressures differ between the hatchery and wild environments with the result that hatchery rearing causes plastic and genetic changes to phenotypes that often result in reduced fitness when these fish are released back into the wild (Fraser, 2008, 2016; Perrier et al., 2013). Unfortunately, rapid selection under domestic conditions can create challenges when attempting to supplement natural populations with hatchery-reared fish. Genetic data suggest that stocked fish have often had limited reproductive success (Fontaine et al., 1997; Saltveit, 2006; Milot et al., 2013).

The influx of genes from escaped farmed salmon into populations of wild salmon affects a number of important traits closely connected to fitness (e.g. growth, age at outmigration, sea age, parr maturation, and predator avoidance) (Bolstad et al., 2017; Glover et al., 2017; Solberg et al., 2020; Bolstad et al., 2021, Besnier et al., 2022). In addition, it strongly affects survival probability in the wild for individuals with farmed genetic ancestry (Fleming et al., 2000; McGinnity et al., 2003; Skaala et al., 2012, 2019; Wacker et al., 2021).

Interbreeding between domesticated and wild Atlantic salmon occurs in many parts of its natural range on both sides of the Atlantic (Clifford et al., 1998; Crozier, 2000; Skaala et al., 2006;

Bourret et al., 2011; Karlsson et al., 2016; Wringe et al., 2018). Hence, genetic introgression has the potential of widespread population effects in Atlantic salmon. However, rivers vary in their level of introgression, even on small geographic scale (Karlsson et al., 2016; Wringe et al., 2018; Diserud et al., 2022), and this may therefore have a large influence on local variation in return rates.

2.4.7 Conclusion

Variations in return rates of smolts to 1SW, MSW, and the smolt cohort observed among monitored rivers, among regions and continental groups suggest that factors at river-specific, regional and North Atlantic scales interact to affect marine survival rates and maturation schedules. With exception to very specific identifiable factors, such as exploitation of returning spawners in rivers or mortality of downstream migrating smolts through turbines, it is very unlikely there is a single factor that can account for the temporal variations, and in several areas, the declines of wild Atlantic salmon in the North Atlantic.

2.5 Provide a summary of the most recent findings of on-going research projects investigating the marine phase of Atlantic salmon (e.g. SeaSalar, SeaMonitor, SA-MARCH, satellite tagging at Greenland

The Working Group is aware of a number of large-scale collaborative projects investigating the marine phase of Atlantic salmon across the North Atlantic. These projects are ongoing and this section introduces these projects and provides updates on status and preliminary results. Information was provided directly by Working Group members involved in the pro-jects.

2.5.1 Atlantic Salmon Federation's Acoustic Tracking

Since 2003 the Atlantic Salmon Federation and its partners have tracked more than 4500 smolts (acoustic tags) and 600 kelts (acoustic and satellite tags) from several Gulf of St Lawrence (GoSL) rivers through estuaries, bays, the GoSL and into Labrador Sea. This tracking program is designed to monitor the migration of smolts and kelts through the freshwater, estuarine and nearshore environments of the GoSL en route to the North Atlantic (Figure 2.5.1.1). Long-term monitoring programs like this are valuable in that they allow researchers to address a number of topics across a long temporal scales encompasses varying environmental conditions.

Across the 20-year monitoring period, tagged smolt survival through the freshwater environments has generally been greater than 80% throughout the time-series (Figure 2.5.1.2). Survival for smolts from the Cascapédia and Restigouche rivers through Chaleur Bay (head of tide to the outer Bay) has generally been higher than that of Miramichi smolts migrating through Miramichi Bay. This is particularly noticeable for Northwest Miramichi smolts in recent years. Various studies utilizing these datasets have focused on the role of increased striped bass populations in the areas resulting in decreased survival of Miramichi River salmon smolts (Daniels et al. 2018, Daniels et al. 2019, Brunsdon et al. 2019). Out-migrating smolts and kelts exclusively use the Strait of Belle Isle (SoBI) to enter the North Atlantic, a journey upwards of 700 km. Survival through the GoSL to the SoBI has remained fairly consistent for all populations through the time-series and at approximately the same rate, although a slight decrease over the time-series is noted for the Northwest Miramichi smolts. Collectively these results demonstrate relatively high freshwater survival, moderate GoStL survival with variable rates of survival within estuarine and nearshore environments, which are driven by local conditions.

Tagging operations have been partially supported and enhanced since 2021 with support from the (Environmental Studies Research Fund; Section 2.5.2). Moving forward, tagging by Atlantic Salmon Federation and its partners is expected to continue in the near term to maintain this dataset.

2.5.2 Environmental Studies Research Fund

A five year research project focusing on the marine migration of Atlantic salmon in the North Atlantic was funded by the government of Canada's Environmental Studies Research Fund in 2020. The project was titled "*Atlantic salmon in the Eastern Canadian offshore regions (ESRF Regions 8 to 15): timing, duration and the effects of environmental variability and climate change*" and has over 20 project partners including Indigenous communities, Indigenous organizations, non-government organizations and several provincial and federal government departments. The objective of the project is to determine when, where and for how long Atlantic salmon from three different life stages (juvenile post-smolt, post-spawned kelt and multi-sea winter adults) are in the Eastern Canadian offshore oil and gas regions (ESRF Regions 8 to 15). The project is applying telemetry (acoustic and pop-off satellite tags) and ocean model-ling methods to better understand the migratory behaviour (location and habitat use) of salmon at sea. The results will support regulatory decision-making in Canada's areas of offshore oil and gas activity as well as advance our understanding of the marine phase of Atlantic salmon.

In 2021 and 2022, a total of 2314 smolts and 434 kelts were tagged with acoustic transmitters and an additional 122 kelts were released with PSATs (pop-off satellite tag) from 38 rivers across eastern Canada. PSAT tagged salmon were released at Greenland in 2021 (70 salmon) and 2022 (114 salmon) as well as an additional 95 salmon with acoustic transmitters in 2022 (see Section 2.5.5). ESRF funds have also supported the deployment of a new network of offshore acoustic receivers that added to the existing infrastructure maintained by project partners (Figure 2.5.2.1). Wave glider and drifter missions were also conducted to improve detection coverage within the area of focus.

Preliminary results from PSAT tags and 2021 and 2022 acoustic tag detections are being compiled. A third year of tagging is schedule for 2023 within eastern Canada and Greenland. Additional glider missions will also be conducted. Oceanographic modelling is underway and data analyses will continue through 2025. Expected project outcomes are:

- Document the occurrence of Atlantic salmon from different rivers entering areas of interest to oil and gas production/exploration activities with an assessment of the timing, duration and areas where this may occur;
- Determine the physical and biological oceanographic processes driving observed salmon migration patterns;
- Develop an Atlantic salmon migration model using oceanographic models and the migration patterns observed by electronically tagged salmon to predicted migration patterns given expected changes in environmental conditions;
- Provision of this new knowledge in a usable form to Indigenous groups, stakeholders, salmon scientists, managers, industry and regulators.

2.5.3 Atlantic salmon at sea - factors affecting their growth and survival (SeaSalar)

A research project focusing on salmon at sea and funded by the Research Council of Norway was initiated in Norway in 2018 (https://www.seasalar.no). The four-year project has been extended and will end in August 2023. An important part of the project was to utilize existing datasets and activities, including salmon collected at sea, genetic material, archival scale samples, survival data, population size data and datasets on other marine species and oceanic ecosystems. This aim has been fulfilled, as a number of existing samples and datasets have been worked up and analysed, and the resulting scientific papers have expanded our knowledge and understanding of the marine phase of the salmon's life cycle. To date, 24 scientific papers related to this project have been published (https://www.seasalar.no/Publications12). These papers have contributed to a better under-standing of oceanic migration routes and feeding areas, both for postsmolts and kelts, diet and feeding of postsmolts in fjords and in the ocean, ocean growth over time for a large number of rivers and variation in life history among rivers and regions. Some of the main findings so far are described below.

Gilbey et al. (2021) analysed a dataset consisting of more than 9000 postsmolts caught in the ocean over many years and coupled catch and effort data to provide a description of the monthly distribution of postsmolts in the Norwegian Sea. Genetic data were available for around 3500 postsmolts, and these were assigned to different regions of Europe, providing data to describe how postsmolts from different regions are distributed in the ocean. The diet and feeding studies by Utne et al. (2020, 2021a, b, 2022) showed some diet overlap between postsmolts and other pelagic species such as herring and mackerel, a change in prey composition over time and a reduction in growth for postsmolts around the year 2005, and how this was correlated to reduced influx of Arctic water in the Norwegian Sea. This was also observed in a study by Vollset et al. (2022) who analysed a large dataset of growth data from scale samples of returning spawners to Norwegian rivers. As in the postsmolt studies, 1st year growth dropped for salmon from all regions of Norway, except north, around the year 2005. Rikardsen et al. (2021) compiled a large dataset of satellite tagging of kelts from several countries in Europe, and Greenland, and generated a new map demonstrating both overlap and regional differences in oceanic feeding areas for kelts. During SeaSalar, new data from kelt tagging in rivers in Norway have also been collected and are currently under analysis. In the study by Persson et al. (2022) data from over 500000 scale samples from rod fisheries in Norwegian rivers was analysed to investigate patterns in life-history variation among rivers and region. They identified 141 unique life-history types, and repeat spawners contributed 75% of that variation.

Collectively, the scientific papers generated from SeaSalar and other projects related to marine survival of Atlantic salmon have significantly increased our understanding of the under-lying mechanisms that influence and regulate the oceanic phase of the salmon's life cycle. By analysing time-trends in parameters such as first year growth at sea, coupled with increased knowledge of how salmon are distributed and relevant data on oceanic conditions, new understanding of large- and small-scale processes have been achieved.

2.5.4 SAlmonid MAnagement Round the CHannel (SAMARCH)

The SAlmonid MAnagement Round the CHannel (SAMARCH) project (https://www.samarch.org) was a multiyear project (2017-2023) partly funded by the EU Interreg VA France (Channel) England programme and involving five UK and five French partners. SAMARCH collected scientific evidence to inform the management of salmon and sea trout (salmonids) in the estuaries and coastal waters on both the French and English sides of the Channel. It had four work packages that had the following themes: (1) tracking, (2) genetics, (3) modelling, and (4) communications. SAMARCH did work in four Index Rivers: rivers Frome and Tamar (UK) and Scorff and Selune (France), although some of the work involved stocks from rivers elsewhere around Europe and the Atlantic Basin.

Data generated by SAMARCH include biometric measurements, migration timings, movement observations and growth patterns from scale-reading. These data were collected from 900 juvenile salmonids acoustic tracked in four rivers and estuaries, 314 adult sea trout fitted with Data

Storage Tags in three rivers, 100 000 PIT-tagged juvenile salmonids and 24 000 observations of their returns in two rivers, genetic sexing of 9500 juvenile salmonids, and reading of over 10 000 salmon scales collected since 1971.

To date, SAMARCH staff published 17 scientific papers (https://samarch.org/publication-reports/), supervised two PhD projects and 12 MSc projects to completion, and gave greater than 200 students valuable work experience.

Among the highlights from those outputs concerning Atlantic salmon are:

- New data on salmon growth at sea showing a pan-populations decline in growth during the first summer at sea in the last four decades for smolts of all index rivers;
- Results highlighting that smolts with the highest body size at smolt migration on average have a higher return rate;
- New insights on growth-mediated maturation schedule, with post-smolts that have the higher growth during the first summer at sea have the greater probability to mature as 1SW, and clear differences between sexes with males having a greater probability to mature as 1SW than females;
- New model to estimate adult returns from rod exploitation for all UK (England and Wales) rivers; and
- Improvements to the Bayesian Life Cycle Model proposed for ICES WGNAS annual assessment.

SAMARCH held a closing conference in March 2023. Much of the discussion centred on how the new information generated by SAMARCH could contribute to better management of salmonids around the Channel. Among the issues considered were whether salmonids are sufficiently well-protected by marine legislation, and if not, whether salmonids might be better protected if they were treated as marine species.

2.5.5 Pop-off satellite tagging at Greenland

A primary gap in our understanding of the North Atlantic decline in wild Atlantic salmon is in the ocean phase of their migration and telemetry is a tool that can be used to address this gap. With a better understanding of the spatial and temporal distribution of Atlantic salmon in the marine environment, researchers can begin linking the physical and biological mechanisms that are contributing to mortality. A 5-year pop-off satellite tagging (PSAT) study on Atlantic salmon captured at West Greenland was initiated in 2018 with the goal of mapping the marine distribution and migration patterns for maiden Atlantic salmon and post spawned adults released at West Greenland so that oceanographic features (physical and biological) may be evaluated to assess how they may influence survival.

This is a collaborative research program involving the ASF, Fisheries and Oceans Canada and NOAA Fisheries Service. Additional funding has been provided by Equinor (an international private company invested in oil and gas exploration), the government of Canada's Atlantic Salmon Research Joint Venture (ASRJV) and Environmental Studies Research Fund (ESRF). Kalaallit Nunaanni Aalisartut Piniartullu Kattuffiat (KNAPK), the Organization of Fisher-men and Hunters in Greenland, has also provided logistical support.

Tagging occurred in the southwest of Greenland in 2018, 2019, 2021 and 2022 during the months of September and October. To date, 341 Atlantic salmon have been captured (99% by trolling) and 317 have been tagged and released.

Tagging Overview					
Tag type	2018	2019	2020	2022	Total
Acoustic	2	4	-	95	**101**
PSAT	12	20	70	96	**198**
Double tagged (PSAT and acoustic)	-	-	-	18	**18**
Total	**14**	**24**	**70**	**209**	**317**

Overall, the fork length of tagged salmon ranged from 555-890 mm with an average of 665 mm and whole weight ranged from 1.4-11.0 kg with an average of 3.7 kg. Approximately 96% of the tagged salmon were 1SW non-maturing salmon and 74% were of North American origin, 24% European origin and 2% unknown. Preliminary analysis of region of origin suggests that 14 regional reporting groups from North America and four from Europe are represented. Further work on the continent and region of origin analyses is continuing.

Data collection is ongoing as a large number of PSAT tags released in 2022 may still be active and data from acoustic tags detections have yet to be downloaded from all potential receiver units. Pre-programmed pop-off dates were set for the spring following release, but a number of tags pop-off early for a variety of reasons. After pop-off, the PSAT surfaces and transmits it data to the researchers via satellite connections. PSAT pop-offs have occurred across the North Atlantic (Figure 2.5.5.1.) and to date, marine migration data have been collected for over 12 000 migration days. Data collected by the PSATs are temperature, depth profiles and light intensity data, all of which can be used to reconstruct the individual migration tracks. Tagging activities are planned for 2023 and data processing and analysis are planned for 2023-2025.

2.5.6 SeaMonitor

SeaMonitor was a regional marine research project studying the seas around Ireland, Western Scotland and Northern Ireland. The project was led by the Loughs Agency and supported by eight other research institutions using innovative marine species tracking technology to better understand and protect vulnerable marine life in the region’s ocean (including salmon, basking sharks and seals). Funding for the SeaMonitor project has been provided in part by the EU’s INTERREG VA Programme (Environment Theme), which is managed by the Special EU Programmes Body (SEUPB). This investment facilitated the deployment of the longest ‘fish counter’ in Europe with a line of >100 acoustic receivers running between Ireland (Malin Head) and Scotland (Islay island; SeaMonitor Main Array) and the use of innovative technologies (e.g. wave-glider, autonomous vehicles, programmed tags) to track fish emigrating from local rivers.

Salmon research principally relied on acoustic tagging of smolts by the four main (salmon) partners (Loughs Agency, Agri-Food and Biosciences Institute Northern Ireland, Marine Institute, Glasgow University) across the region (Northern Ireland, Ireland and Scotland). The science objectives included; the development of salmon management plans for the rivers Foyle and Clyde, assessment of early marine migration, directionality and mortality, and the development of marine pathway models for post-smolts exiting the region. Some initial findings have indicated common migratory trajectories for regional smolt groupings detected on the Main Array, a dominant North-Northwest outward migration route for smolts and variable migration speeds/mortality rates between rivers. Integration of the SeaMonitor data with other tracking projects on rivers in the Irish Sea/West Scottish area has added further value to salmon tracking research in the region (https://www.loughs-agency.org/managing-our-loughs/funded-programmes/current-programmes/sea-monitor/seamonitor-publications/).

2.5.7 SMOLTRACK

SMOLTRACK is a NASCO coordinated, EU-funded project aimed at establishing a strategic salmon telemetry advisory group. Through conducting simultaneous salmon telemetry research projects in multiple partner countries, SMOLTRACK facilitates exchange of knowledge and best practices related to tracking salmon smolts during the early (freshwater, estuarine and coastal) phase of their marine migration. Given the critical importance of this migratory phase for complete life cycle survival rates, the data and knowledge acquired through the SMOLTRACK project from different European salmon populations in distinct habitats, will aid with understanding causes of mortality as well as environmental drivers of migration timing and movement behaviour. Ultimately, the aim of the SMOLTRACK project is to provide an evidence-base for supporting management actions implemented to improve salmon conservation practices, such as highlighting potential mitigation measures that may improve survival rates of seaward migrating smolts.

There are numerous partners with established river monitoring site from across Europe. These include the Technical University of Denmark (Rivers Skjern and Storå, Denmark); Centre for Environment, Fisheries and Aquaculture Science (River Tamar and Taff, UK (England and Wales)); Inland Fisheries Ireland (River Erriff, Ireland); Agri-Food and Biosciences Institute (River Bush, UK (Northern Ireland)); General Directorate of Natural Heritage, Environmental Ministry, Galician Government (River Minho, Spain), University of Gothenburg (Rivers Göta älv and Högvadsån, Sweden), Natural Resources Institute Finland (Teno, Finland) and the Marine and Environmental Sciences Centre and University of Évora (Minho, Portugal).

The third iteration of the project, SMOLTRACK III concluded at the end of 2022. A fourth iteration, SMOLTRACK IV, is currently underway.

2.6 Provide a summary of the current state of knowledge on freshwater and marine predation by cormorants and impact on stocks

In the North Atlantic region, the great cormorant (*Phalacrocorax carbo*) and the double-crested cormorant (*Nannopterum auritum*) can be found, where the latter is only present in North America. The great cormorant consists of two subspecies; *Phalacrocorax carbo carbo* and *P. c. sinensis*. They exhibit predominantly a piscivorous diet and *P. c. sinensis* is likely to pose the greater threat in regards to the predation of salmon.

In Europe, cormorants (principally *P. c. sinensis*) have increased extensively since the 1980s mainly in the North Sea and Baltic Sea regions. Numbers of this subspecies have increased substantially in Europe (excluding Russia, Belarus, Moldova and Ukraine) from approximately 10 000 breeding pairs in 1970 to approximately 233 000 in 2006, though estimates vary depending on subspecies, geographical region and year (FAQ - Nature - Cormorants - Environment - European Commission (europa.eu)). The greatly increased population has led to widespread conflicts throughout Europe, where even mitigation measures and cormorant regulation (Article 9 of the EU Birds Directive, The Birds Directive - Environment - European Commission (europa.eu)) have not been effective in resolving these (EIFAAC, 2022).

In Denmark, there was a rapid increase of breeding pairs of cormorants in the 1990s, from very few to 40 000 pairs. The main food was coastal fish and main conflicts were on the coast with poundnet fishers. Common prey species of cormorants such as cod, flounder, dab and eelpout populations (Dab = *Limanda limanda*, cod = *Gadus morhua*, flounder = *Platichthys flesus*, eelpout = *Zoarces viviparus*), have ostensibly decreased substantially. It is hypothesized that as a result of this, the abundance of breeding cormorant pairs has decreased to around 30 000 breeding pairs (Jepsen et al. 2019).

Many studies have been conducted focusing on the impacts of cormorants on fish populations in Denmark. For example, Jepsen et al. (2019) found, from results of 23 individual studies, that a mean of 47% of smolts (both salmon and trout) are consumed by cormorants over multiple rivers and years. In Denmark, cormorant/smolt studies have been carried out for 20 years and it is noteworthy that when the cormorant breeding population was at its highest with more than 40 000 breeding pairs, the rapid rebuilding of the Danish salmon populations took place simultaneously (personal communication, Jepsen). However, after a steep decrease in available prey on the coasts, the cormorants started to forage in Danish rivers, consuming a large proportion of salmon parr. It is hypothesized this reduction in traditional marine prey for cormorants resulted in decreased cormorant abundance but increased predation on salmon in freshwater, and is likely the reason for the stagnation of the recovery of Danish salmon stocks, despite increased and improved spawning and rearing habitats.

A series of predator exclusion experiments were conducted in several Danish rivers and the results showed that winter survival of 0+ and 1+ salmon parr increased from 17% to 50% when cormorants were excluded (other predators had access) by installing covernets over river stretches (Jepsen, unpublished data, Skarver i vandløb - hvad betyder det for laks og ørred? - Fiskepleje.dk). Results from these studies suggest that cormorant predation will lower smolt production and could result in as much as a 75% decrease in adult salmon runs, a substantial impact on EU-listed salmon in Danish rivers (Habitats Directive, Annex V; The Habitats Directive - Environment - European Commission (europa.eu)). In Europe, the cormorant diet can vary sizeably over time and space, and in particular in relation to the prey availability in freshwater or marine environments, which has led to the conclusion that the effects of cormorant predation on salmon in some areas may be more limited (Lyach and Čech, 2017).

In Sweden and Finland, a similar increase in breeding cormorants has been observed during the last decades. Similarly to Denmark, coastal fish populations have decreased, and therefore shifts in cormorant diet may be expected. In Sweden, results from PIT-tagging in the river Dalälven show (like in Denmark) that trout is more commonly preyed upon by cormorants compared to salmon, particularly in the Baltic Sea (Fågelpredation i Dalälven mynningsområde - en tredjedel av all öring som sätts ut blir uppäten av fåglar | Externwebben (slu.se)). On the Swedish west coast, only a few studies have been conducted focusing on cormorant-prey dynamics. However, it has been suggested that the predation pressure on cod is more of a concern than that on salmon in the marine environment. Some accounts also propose that in west coast rivers, cormorants may be feeding upon salmon (pers. com. K. Lundström, SLU). Reports from Ireland conclude that predation from cormorants (note: carbo subspecies) can also be a problem for salmon stocks in some areas (Kennedy et al., 1988; Flavio et al. 2020). Cormorant predation has also been identified as an issue for grayling populations in some areas of Europe, even leading to local extinctions (Carss and Russell, 2022, Jepsen et al. 2018).

Very few salmonid studies met the criteria for inclusion in a global meta-analysis of the effect of predation from cormorants (multiple *Phalacrocorax* species) on fish in general (Ovegård et al. 2021). No Atlantic salmon studies were included in this analysis because they did not meet the criteria, and therefore, the range-wide effect of cormorant predation on Atlantic salmon populations remains unclear. More studies are required, and these must be statistically robust, with clear treatment-control setups so that confident conclusions can be made.

In North America, Cairns (1998) reported that Double-crested cormorants (*Phalacrocorax auritus*) breed along coasts and estuaries in the Atlantic New England states, the Maritimes Provinces, and Eastern Quebec. A few inland colonies are also found in the Gulf region. They forage primarily along the coast but may intrude freshwater habitat during spring runs of anadromous fish. At that time, diets may include a substantial fraction of Atlantic salmon during smolt outmigration in rivers whose runs are supplemented by stocking. At other times, this species feed on a variety of marine and estuarine species. Double crested cormorants leave the region in autumn to winter in the southeastern United States.

Great cormorants (*P. carbo carbo*) mainly breed in Nova Scotia with a few colonies found in Quebec and Newfoundland. They forage almost exclusively in salt water. Information on their diet is only available for populations on the coasts of Nova Scotia and the Magdalen Islands (Quebec). No salmonids were found in the stomach, vomit or pellets samples from this species.

In 2004 and 2005, Hawkes et al. (2013) conducted experiments to evaluate the effectiveness of non-lethal harassment of Double-crested cormorants to improve smolt survival in the Narraguagus River (USA). Their study highlighted the lack of overlap between the peak migration of smolts (mainly at night) and cormorant presence in the estuary (mainly in the morning). Most mortalities observed (30/127 smolt marked) during the study occurred in the estuary in the morning hours with reduced mortality rate when harassment occurred. A study (Carrier et al., 2016) on a colony of about a thousand breeding pairs of Double-crested cormorants located at the mouth of the Restigouche river (New Brunswick, Canada) found two salmon otoliths out of 441 regurgitated pellets during the 2014 smolt run, suggesting that Atlantic salmon smolts did not make a large part of the diet of these cormorants.

In conclusion, in areas where cormorants have increased, and/or declines in other cormorant prey species abundances have occurred, there is a higher likelihood that salmon will be predated upon. Cormorant predation can have substantial impacts on salmon populations, particularly in areas where salmon populations are already threatened or endangered, but further and more robust studies are required to determine local and widespread effects on salmon populations.

2.7 Data Call for NASCO requested information used by the Working Group

The terms of reference from NASCO defines the work of WGNAS. Other than for the catch data, the terms of reference are not specific as to what type of information would be used by ICES to develop the status of stocks.

2.7.1 Process for collating catch data

The request for catch data is specific as to the type of information to be compiled:

- 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 2021 and 2022.

In each Commission Area, the request includes:

- describe the key events of the 2021 and 2022 fisheries (ToR 2.1, 3.1, 4.1)

2.7.2 Review of the 2023 Data Call

On 30 January 2023, ICES communicated the Data Call for Atlantic salmon from the North Atlantic to ICES Member Countries. The salmon call was contained within the wider "Joint ICES Fisheries Data call 2023 for landings, discards, biological sample, catch and effort data" (see Data calls (ices.dk)). Subsequently on 16 February 2023, the chair of WGNAS copied the ICES Data Call to members of the Working Group. The Data Call included instructions in a covering letter and a template spreadsheet in Excel as attachments (Annex 7.12.1 WGNAS template.xlsx). The request was for members to return the catch data for 2021 and 2022 to ICES by 10 March 2023.

The Data Call was specific to the compilation of catches as defined in the terms of reference from NASCO. Note also that NASCO requests from parties, as part of the annual reporting, similar information as requested by ICES in the Data Call.

The Data Call should provide data that can be used by WGNAS to address the NASCO request, i.e. for the primary catch tables in WGNAS report (Tables 2.1.1.1, 2.1.1.2, 2.1.1.3, 2.1.2.1, 2.1.3.1, 2.1.3.2, 2.2.1.1, 2.2.2.1, Annex 4; Figures 2.1.1.1a,b, 2.1.1.2, 2.1.1.3, 2.1.3.1, 2.2.1.1, 2.2.2.1). When collated across jurisdictions, the Data Call submissions should be appropriate for NASCO themselves to generate summaries. The future Data Call request would also provide catch data that are used in the North Atlantic wide Life-Cycle Model (LCM, see below).

In previous years, the data requested in the Data Call would have been compiled by members of the Working Group from national working papers and summarized in the report. The ICES Data Call has resulted in more prompt and comprehensive reporting for some countries where in the past the collation of catch data had been difficult and incomplete.

The following country/jurisdiction reports were received:

- NAC: Canada, USA, France (reporting for Saint Pierre and Miquelon);
- NEAC: Iceland, Spain, France, UK (England and Wales), UK (Scotland), UK (Northern Ireland), Denmark, Sweden, Norway, Finland;
- WGC: Greenland.

Some reports were received after the deadline because of issues with the communication of the official request. These have been noted by ICES and the countries, and solutions will be found to make the process more successful in future years.

Data call submissions were not received for the following NEAC jurisdictions with known/historic salmon fisheries or farmed salmon production: Ireland, Russia, Faroe Islands, Portugal, Germany. Equivalent data from Ireland and Faroe Islands were received via national reports to the Working Group. Major salmon stocks in German North Sea-draining rivers are extirpated and now rely on stocking and reintroduction programmes. The Working Group understands there was no commercial catch in Germany in 2022. There may have been a small amount of recreational catch but the amount has not been reported.

The data submitted in March 2023 were reviewed by the Working Group and some issues were identified. Details of the review and proposed changes are outlined in Annex 8.

2.8 Progress on developing the Atlantic salmon Benchmark

Following previous discussions at WGNAS 2020 and WGNAS 2021 (ICES, 2020, 2021a), and following the resolutions of the Workshop for Salmon Life-Cycle Modelling (WKSalModel; 5-8 January 2021, remote) (ICES, 2021c: WKSALMODEL), and in preparation of the adoption of the Life Cycle Model (LCM) by WGNAS for stock assessment and provision of multiyear catch advice, an ICES WGNAS benchmark process was decided. It started in 2022 and will be achieved by end 2023.

WGNAS benchmark scoping meeting held 15-17 November 2022 (hybrid). Objectives were to discuss and agree on the ToR's of the Benchmark, and set the dates for the Data meeting and the Assessment meeting.

The benchmark process should be achieved before the end of 2023, so as the new model can be officially used for assessment, multiple years forecast and catch advice in 2024 (full assessment year). In order to reserve sufficient time between the data meeting and the assessment meeting, and at least two months between the assessment meeting and the end of 2023, the following schedule was decided:

- allocate 1/2 day during WGNAS 2023 to advance preparatory work for the Data meeting
- Data meeting – 3 days (fully remote) during the week June 19^{th}-22^{th} 2023
- Benchmark assessment meeting – 5 days (hybrid), during the week October 23^{th}-27^{th} 2023

In order to advance the preparation of the Benchmark ToR's, resolutions were made during the scoping meeting and further discussed during WGNAS 2023 meeting (ICES, 2022a). Chaired by the benchmark ICES chair Jonathan White, the group agreed on modelling hypotheses and data issues to be reviewed and tested during the benchmark. Based on these discussions, a data call specific for the benchmarking process will be sent in early April 2023 to prepare the data meeting. Tasks have also been assigned to different WGNAS members to advance benchmark work from now to the data meeting.

2.9 Reports from ICES expert group and other investigations relevant to North Atlantic salmon

2.9.1 WGDIAD

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

The annual meeting of WGDIAD was held in a hybrid format, both remotely (by WebEx) and in-person, from 20–21 September 2022, and chaired by Hugo Maxwell (Ireland) and Dennis Ensing (UK). There were 17 participants in total from 13 countries who participated in the meeting for at least one of the days. The following topics relevant to Atlantic salmon were discussed:

- International Year of the Salmon (IYS) Synthesis Symposium in Vancouver, Canada, 4-5 October 2022;
- Northern Hemisphere Pink Salmon Experts Group meeting, Vancouver, Canada, 2-3 October 2022;
- A progress report of the work of the Intersessional Sub Group Diadromous fish (ISSG Diad) of the Regional Coordination Groups (RCGs). The subgroup has a coordinating function and identifies data collection needs for diadromous species in relation to the EU data collection regulation;

- A discussion on a formal ICES/WGDIAD link with diadromous fish scientists in the Pacific within organizations such as the North Pacific Marine Science Organization (PICES) and North Pacific Anadromous Fish Commission (NPAFC);
- A report from ICES Assessment Working Group on Baltic Salmon and Trout (WGBAST)

The next meeting of WGDIAD will be held during the 2023 ICES ASC in Bilbao, Spain, 11–14 September – WGDIAD meeting dates to be confirmed.

2.10 NASCO has asked ICES to provide a compilation of tag releases by country in 2021 and 2022

Data on releases of tagged, finclipped and other marked salmon in 2021 and 2022 were provided to the Working Group and are compiled as a separate report (ICES WGNAS Addendum, 2023c). In summary (Table 2.10.1a and Table 2.10.1b), approximately 1.50 million salmon were marked in 2021 and 1.12 million in 2022. These were a decrease from the 1.96 million fish marked in 2020. In 2021, the adipose clip was the most commonly used primary mark (1.11 million) with around half (0.465 million) of these marked and released in the Russian Federation. The adipose clip was also the most commonly used (0.777 million) primary mark in 2022 with the decrease between years related to no data being provided from Russia. Coded wire microtags (CWT) were the next most common primary mark with similar numbers as reported for the 2020 tagging season (0.196 million). In both years, most marks were applied to hatchery-origin juveniles or 1.42 million (1.03 million in 2022), while 67 169 (70 603 in 2022) wild juveniles, 13 212 (14 656 in 2022) wild adults and 4 213 (5 198 in 2022) hatchery adults were also marked.

A recommendation has been developed by the Working Group for more efficient identification of the origin of PIT tagged salmon. The creation of a database listing individual PIT tag numbers or codes identifying the origin, source or programme of the tags should be implemented on a North Atlantic basin-wide scale. This is needed to facilitate identification of individual tagged fish, taken in marine fisheries or surveys, back to the source. Such a database has been designed by Missing Salmon Alliance UK (MSA) and IMR in Norway, and hosted and maintained by Missing Salmon Alliance (https://shiny.missingsalmonalliance.org/tag-database/). The database provides a central, searchable tag data repository against which unknown PIT detections can be searched. It also holds information on tag detections from pelagic marine fish species in the eastern Atlantic region with a network of over 20 PIT detector stations operated at fish processing plants in several countries.

Since 2003, the Working Group has reported information on marks being applied to farmed salmon to facilitate tracing the origin of farmed salmon captured in the wild in the case of escape events. In the USA, genetic "marking" procedures have been adopted where broodstock are genetically screened, and the resulting database is used to match genotyped escaped farmed salmon to a specific parental mating pair and subsequent hatchery of origin, stocking group, and marine site the individual escaped from. This has also been applied in Iceland, where in recent years, 20 out of 24 farmed escapees could be traced to the pens they escaped from by matching their genotypes to known parental genotypes, and a further three could be traced to foreign broodstocks.

Issues pertinent to particular Commission areas are included in subsequent sections and, where appropriate, carried forward to the recommendations (Annex 7).

Table 2.1.1.1. Total reported nominal catch of salmon by country (in tonnes round fresh weight), 1960–2022 (2022 figures include provisional data).

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)
1960	1636	1		1659	1100	100		40	0			743	283	139	1443		33			60		7237		
1961	1583	1		1533	790	127		27	0			707	232	132	1185		20			127		6464		
1962	1719	1		1935	710	125		45	0			1459	318	356	1738		23			244		8673		
1963	1861	1		1786	480	145		23	0			1458	325	306	1725		28			466		8604		
1964	2069	1		2147	590	135		36	0			1617	307	377	1907		34			1539		10759		
1965	2116	1		2000	590	133		40	0			1457	320	281	1593		42			861		9434		
1966	2369	1		1791	570	104	2	36	0			1238	387	287	1595		42			1370		9792		
1967	2863	1		1980	883	144	2	25	0			1463	420	449	2117		43			1601		11991		
1968	2111	1		1514	827	161	1	20	0			1413	282	312	1578		38	5		1127	403	9793		
1969	2202	1		1383	360	131	2	22	0			1730	377	267	1955		54	7		2210	893	11594		
1970	2323	1		1171	448	182	13	20	0			1787	527	297	1392		45	12		2146	922	11286		
1971	1992	1		1207	417	196	8	17	1			1639	426	234	1421		16			2689	471	10735		
1972	1759	1		1578	462	245	5	17	1		32	1804	442	210	1727	34	40	9		2113	486	10965		

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)
1973	2434	3		1726	772	148	8	22	1		50	1930	450	182	2006	12	24	28		2341	533	12670		
1974	2539	1		1633	709	215	10	31	1		76	2128	383	184	1628	13	16	20		1917	373	11877		
1975	2485	2		1537	811	145	21	26	0		76	2216	447	164	1621	25	27	28		2030	475	12136		
1976	2506	1	2	1530	542	216	9	20	0		66	1561	208	113	1019	9	21	40	<1	1175	289	9328		
1977	2545	2		1488	497	123	7	9	1		59	1372	345	110	1160	19	19	40	6	1420	192	9414		
1978	1545	4		1050	476	285	6	10	0		37	1229	349	148	1323	20	32	37	8	984	138	7681		
1979	1287	2		1831	455	219	6	11	1		26	1097	261	99	1076	10	29	119	<0.5	1395	193	8118		
1980	2680	6		1830	664	241	8	16	1		34	947	360	122	1134	30	47	536	<0.5	1194	277	10127		
1981	2437	6		1656	463	147	16	25	1		44	685	493	101	1233	20	25	1025	<0.5	1264	313	9954		
1982	1798	6		1348	364	130	17	24	1		54	993	286	132	1092	20	10	606	<0.5	1077	437	8396		
1983	1424	1	3	1550	507	166	32	27	1		58	1656	429	187	1221	16	23	678	<0.5	310	466	8756		
1984	1112	2	3	1623	593	139	20	39	1		46	829	345	78	1013	25	18	628	<0.5	297	101	6913		
1985	1133	2	3	1561	659	162	55	44	1		49	1595	361	98	913	22	13	566	7	864		8108		
1986	1559	2	2	1598	608	232	59	52	2		37	1730	430	109	1271	28	27	530	19	960		9255	315	
1987	1784	1	2	1385	564	181	40	43	4		49	1239	302	56	922	27	18	576	<0.5	966		8160	2788	

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)
1988	1310	1	2	1076	420	217	180	36	4		36	1874	395	114	882	32	18	243	4	893		7737	3248	
1989	1139	2	2	905	364	141	136	25	4		52	1079	296	142	895	14	7	364		337		5904	2277	
1990	911	2	2	930	313	146	280	27	6	13	60	567	338	94	624	15	7	315		274		4924	1890	180-350
1991	711	1	1	876	215	129	346	34	4	3	70	404	200	55	462	13	11	95	4	472		4106	1682	25-100
1992	522	1	2	867	167	174	462	46	3	10	77	630	171	91	599	20	11	23	5	237		4118	1962	25-100
1993	373	1	3	923	139	157	499	44	12	9	70	541	248	83	547	16	8	23				3696	1644	25-100
1994	355	0	3	996	141	136	313	37	7	6	49	804	324	91	648	18	10	6				3944	1276	25-100
1995	260	0	1	839	128	146	303	28	9	3	48	790	295	83	588	10	9	5	2	83		3629	1060	
1996	292	0	2	787	131	118	243	26	7	2	44	685	183	77	427	13	7		<0.5	92		3136	1123	
1997	229	0	2	630	111	96	59	15	4	1	45	570	142	93	296	8	3		1	58		2364	827	
1998	157	0	2	740	131	118	46	10	5	1	48	624	123	78	283	8	4	6	0	11		2396	1210	
1999	152	0	2	811	103	111	35	11	5	0	63	515	150	53	199	11	6	0	<0.5	19		2247	1032	
2000	153	0	2	1176	124	73	11	24	9	5	96	621	219	78	275	11	7	8	0	21		2914	1270	
2001	148	0	2	1267	114	74	14	25	7	6	126	730	184	53	251	11	13	0	0	43		3068	1180	
2002	148	0	2	1019	118	90	7	20	8	5	94	682	161	81	191	11	9	0	0	9		2655	1039	

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)
2003	141	0	3	1071	107	99	11	15	10	4	75	551	89	56	193	13	7	0	0	9		2453	847	
2004	161	0	3	784	82	112	18	13	7	4	39	489	111	48	247	19	7	0	0	15		2158	686	
2005	139	0	3	888	82	129	20	9	6	8	47	422	96	52	217	11	13	0	0	15		2157	700	
2006	137	0	3	932	91	93	17	8	6	2	67	326	80	28	193	13	11	0	0	22		2030	670	
2007	112	0	2	767	62	93	36	6	10	3	59	85	67	30	171	11	9	0	0	25		1548	475	
2008	157	0	4	807	73	132	69	8	10	9	71	89	64	21	161	12	9	0	0	26		1720	443	
2009	126	0	3	595	71	126	44	7	10	8	38	68	54	16	121	5	2	0	1	26		1322	343	
2010	153	0	3	642	88	147	42	9	13	13	49	99	109	12	180	10	2	0	2	38		1610	382	
2011	179	0	4	696	89	98	30	20	19	13	44	87	136	10	159	11	7	0	<0.5	27		1630	441	
2012	126	0	3	696	82	50	20	21	9	12	64	88	58	9	124	10	8	0	0	33		1412	403	
2013	138	0	5	475	78	116	31	10	4	11	46	87	84	4	119	11	4	0	0	47		1269	306	
2014	118	0	4	490	81	50	18	24	6	9	58	56	54	5	84	12	6	0	<0.5	58		1133	287	
2015	140	0	4	583	80	94	31	11	7	9	45	63	68	3	68	16	5	0	1	56		1284	326	
2016	135	0	5	612	56	71	34	6	3	9	51	58	86	5	27	6	5	0	2	26		1196	335	
2017	110	0	3	667	47	66	24	9	10	12	32	59	49	5	27	10	2	0	<0.5	28		1159	353	

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)
2018	79	0	1	594	80	60	22	12	4	11	24	46	42	4	19	10	3	0	1	39		1052	312	
2019	100	0	1	513	57	37	14	13	8	13	21	45	5	2	13	15	5	0	1	28		889	259	
2020	103	0	2	527	49	42	28	7	7	9	16	46	3	2	14	8	5	0	1	31		898	275	
2021	98	0	2	295	49	41	16	6	5	2	1	51	1	2	7	7	4	0	1	42		630	164	
2022	100	0	1	389	55	35	21	7	2		1	40	1	1	6	7	3	0	1	30		700	202	
Mean																								
2017 - 2021	98	0	2	519	56	49	21	7	7	11	19	49	20	4	16	10	4	0	1	34		923	272	
2012 - 2021	115	0	3	545	66	63	24	11	6	11	36	60	45	5	50	10	5	0	1	39		1091	302	
1. Includes estimates of some local sales, and, prior to 1984, bycatch.																								
2. Before 1966, sea trout and sea char included (5% of total).																								
3. Figures from 1991 to 2000 do not include catches taken in the recreational (rod) fishery.																								
4. From 1990, catch includes fish ranched for both commercial and angling purposes.																								
5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and logbooks from 2002.																								

Year	NAC			NEAC (N. Area)				NEAC (S. Area)										Faroes and Greenland					Unreported catches	
						Iceland		Sweden																
	Canada (1)	USA	St P&M	Norway (2)	Russia (3,16)	Wild	Ranch (4)	Wild	Ranch (15)	Denmark	Finland	Ireland (5,6)	UK (E&W)	UK (NI) (6,7)	UK (Scot)	France (8)	Spain (9)	Faroes (10)	East Gnld.	West Gnld. (11)	Other (12)	Total	NASCO (13)	International (14)

6. Catch on River Foyle allocated 50% Ireland and 50% UK (NI).

7. Angling catch (derived from carcase tagging and logbooks) first included in 2002.

8. Data for France include some unreported catches.

9. Spanish data until 2018 (inclusive), weights estimated from mean weight of fish caught in Asturias (80% - 90% of Spanish catch). Weight for 2019 for all Spain, supplied via data call.

10. Between 1991 and 1999, there was only a research fishery at Faroes. In 1997 and 1999, no fishery took place; the commercial fishery resumed in 2000, but has not operated since 2001.

11. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.

12. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.

13. No unreported catch estimate available for Canada in 2007 and 2008. Data for Canada in 2009, 2010 and 2019 are incomplete. No unreported catch estimate available for Russia since 2008.

14. Estimates refer to season ending in given year.

15. Catches from hatchery-reared smolts released under programmes to mitigate for hydropower development schemes; returning fish unable to spawn in the wild and exploited heavily.

16. Data extracted from NASCO website at https://nasco.int/conservation/third-reporting-cycle-2/.

Table 2.1.1.2. Total reported nominal catch of salmon in homewaters by country (in tonnes round fresh weight), 1960–2022 (2022 figures include provisional data). S = Salmon (2SW or MSW fish); G = Grilse (1SW fish); Sm = small; Lg = large; T = total = S + G or Lg + Sm.

Year	NAC Area				NEAC (N. Area)													NEAC (S. Area)										
	Canada (1)			USA	Norway (2)			Russia (3,7)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK (NI) (4,6)	UK (Scot)			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			1636	1			1659	1100	100		40	0							743	283	139	971	472	1443		33	7177
1961			1583	1			1533	790	127		27	0							707	232	132	811	374	1185		20	6337
1962			1719	1			1935	710	125		45	0							1459	318	356	1014	724	1738		23	8429
1963			1861	1			1786	480	145		23	0							1458	325	306	1308	417	1725		28	8138
1964			2069	1			2147	590	135		36	0							1617	307	377	1210	697	1907		34	9220
1965			2116	1			2000	590	133		40	0							1457	320	281	1043	550	1593		42	8573
1966			2369	1			1791	570	104	2	36	0							1238	387	287	1049	546	1595		42	8422
1967			2863	1			1980	883	144	2	25	0							1463	420	449	1233	884	2117		43	10390
1968			2111	1			1514	827	161	1	20	0							1413	282	312	1021	557	1578		38	8258
1969			2202	1	801	582	1383	360	131	2	22	0							1730	377	267	997	958	1955		54	8484
1970	1562	761	2323	1	815	356	1171	448	182	13	20	0							1787	527	297	775	617	1392		45	8206
1971	1482	510	1992	1	771	436	1207	417	196	8	17	1							1639	426	234	719	702	1421		16	7574
1972	1201	558	1759	1	1064	514	1578	462	245	5	17	1				32	200	1604	1804	442	210	1013	714	1727	34	40	8356
1973	1651	783	2434	3	1220	506	1726	772	148	8	22	1				50	244	1686	1930	450	182	1158	848	2006	12	24	9767

Year	NAC Area				NEAC (N. Area)												NEAC (S. Area)										
	Canada (1)			USA	Norway (2)			Russia (3,7)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK (NI) (4,6)	UK (Scot)			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
1974	1589	950	2539	1	1149	484	1633	709	215	10	31	1				76	170	1958	2128	383	184	912	716	1628	13	16	9566
1975	1573	912	2485	2	1038	499	1537	811	145	21	26	0				76	274	1942	2216	447	164	1007	614	1621	25	27	9603
1976	1721	785	2506	1	1063	467	1530	542	216	9	20	0				66	109	1452	1561	208	113	522	497	1019	9	21	7821
1977	1883	662	2545	2	1018	470	1488	497	123	7	9	1				59	145	1227	1372	345	110	639	521	1160	19	19	7755
1978	1225	320	1545	4	668	382	1050	476	285	6	10	0				37	147	1082	1229	349	148	781	542	1323	20	32	6514
1979	705	582	1287	2	1150	681	1831	455	219	6	11	1				26	105	922	1097	261	99	598	478	1076	10	29	6410
1980	1763	917	2680	6	1352	478	1830	664	241	8	16	1				34	202	745	947	360	122	851	283	1134	30	47	8119
1981	1619	818	2437	6	1189	467	1656	463	147	16	25	1				44	164	521	685	493	101	844	389	1233	20	25	7351
1982	1082	716	1798	6	985	363	1348	364	130	17	24	1		49	5	54	63	930	993	286	132	596	496	1092	20	10	6275
1983	911	513	1424	1	957	593	1550	507	166	32	27	1		51	7	58	150	1506	1656	429	187	672	549	1221	16	23	7298
1984	645	467	1112	2	995	628	1623	593	139	20	39	1		37	9	46	101	728	829	345	78	504	509	1013	25	18	5882
1985	540	593	1133	2	923	638	1561	659	162	55	44	1		38	11	49	100	1495	1595	361	98	514	399	913	22	13	6667
1986	779	780	1559	2	1042	556	1598	608	232	59	52	2		25	12	37	136	1594	1730	430	109	745	526	1271	28	27	7742
1987	951	833	1784	1	894	491	1385	564	181	40	43	4		34	15	49	127	1112	1239	302	56	503	419	922	27	18	6611
1988	633	677	1310	1	656	420	1076	420	217	180	36	4		27	9	36	141	1733	1874	395	114	501	381	882	32	18	6591

Year	NAC Area				NEAC (N. Area)												NEAC (S. Area)										
	Canada (1)			USA	Norway (2)			Russia (3,7)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK (NI) (4,6)	UK (Scot)			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
1989	590	549	1139	2	469	436	905	364	141	136	25	4		33	19	52	132	947	1079	296	142	464	431	895	14	7	5197
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	4327
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	3530
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	3847
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	3659
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	3927
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	3530
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	3035
1997	126	103	229	0	389	241	630	111	96	59	15	4	1	30	15	45			570	142	93	182	114	296	8	3	2300
1998	70	87	157	0	445	296	740	131	118	46	10	5	1	29	19	48			624	123	78	162	121	283	8	4	2371
1999	64	88	152	0	493	318	811	103	111	35	11	5	0	29	33	63			515	150	53	142	57	199	11	6	2220
2000	58	95	153	0	673	504	1176	124	73	11	24	9	5	56	39	96			621	219	78	161	114	275	11	7	2873
2001	61	86	148	0	850	417	1267	114	74	14	25	7	6	105	21	126			730	184	53	150	101	251	11	13	3016
2002	49	99	148	0	770	249	1019	118	90	7	20	8	5	81	12	94			682	161	81	118	73	191	11	9	2636
2003	60	81	141	0	708	363	1071	107	99	11	15	10	4	63	15	75			551	89	56	122	71	193	13	7	2432

Year	NAC Area				NEAC (N. Area)												NEAC (S. Area)										
	Canada (1)			USA	Norway (2)			Russia (3,7)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK (NI) (4,6)	UK (Scot)			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
2004	68	94	161	0	577	207	784	82	112	18	13	7	4	32	7	39			489	111	48	159	88	247	19	7	2133
2005	56	83	139	0	581	307	888	82	129	20	9	6	8	31	16	47			422	96	52	126	91	217	11	13	2133
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	1999
2007	49	63	112	0	627	140	767	62	93	36	6	10	3	52	6	59			85	67	30	100	71	171	11	9	1511
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	1680
2009	52	74	126	0	460	135	595	71	126	44	7	10	8	25	13	38			68	54	16	83	37	121	5	2	1282
2010	53	100	153	0	458	184	642	88	147	42	9	13	13	37	13	49			99	109	12	111	69	180	10	2	1554
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	1579
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	1368
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	1217
2014	41	77	118	0	319	171	490	81	50	18	24	6	9	31	26	58			56	54	5	58	26	84	12	6	1071
2015	54	86	140	0	430	153	583	80	94	31	11	7	9	32	13	45			63	68	3	39	29	68	16	5	1224
2016	56	79	135	0	495	117	612	56	71	34	6	3	9	37	14	51			58	86	5	18	8	27	6	5	1164
2017	55	55	110	0	503	164	667	47	66	24	9	10	12	27	5	32			59	49	5	19	7	27	10	2	1128
2018	39	39	79	0	427	167	594	80	60	22	12	4	11	13	11	24			46	42	4	12	8	19	10	3	1012

Year	NAC Area				NEAC (N. Area)												NEAC (S. Area)											
	Canada (1)			USA	Norway (2)			Russia (3,7)	Iceland Wild	Iceland Ranch	Sweden Wild	Sweden Ranch	Denmark	Finland			Ireland (4,5)			UK (E&W)	UK (NI) (4,6)	UK (Scot)			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
2019	47	53	100	0	391	122	513	57	37	14	13	8	13	17	4	21			45	5	2	8	5	13	15	5	858
2020	51	52	103	0	384	143	527	49	42	28	7	7	9	13	3	16	3	43	46	3	2	9	5	14	8	5	866
2021	40	58	98	0	214	81	295	49	41	16	6	5	2	1	0	1	5	46	51	1	2	4	3	7	7	4	585
2022	43	57	100	0	272	118	389	55	35	21	7	2		1	0	1	5	35	40	1	1	4	2	6	7	3	668
Mean																											
2017 - 2021	46	51	98	0	384	135	519	56	49	21	9	7	11	14	5	19	4	44	49	20	4	10	6	16	10	4	890
2012 - 2021	50	64	115	0	406	140	545	66	63	24	12	6	11	23	12	36	4	44	60	45	5	32	18	50	10	5	1048

1. Includes estimates of some local sales, and, prior to 1984, bycatch.

2. Before 1966, sea trout and sea char included (5% of total).

3. Figures from 1991 to 2000 do not include catches taken in the recreational (rod) fishery.

4. Catch on River Foyle allocated 50% Ireland and 50% UK (NI).

5. Improved reporting of rod catches in 1994 and data derived from carcase tagging and logbooks from 2002.

6. Angling catch (derived from carcase tagging and logbooks) first included in 2002.

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

7. Data extracted from NASCO website at https://nasco.int/conservation/third-reporting-cycle-2/.

Table 2.1.1.3. Available time-series of nominal catch (tonnes round fresh weight) and percentages of total catches taken in coastal, estuarine and in-river fisheries by country, 1996 to 2022. The way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries, see text for details.

		Coastal		**Estuarine**		**In-river**		**Total**
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
Canada								
	2000	2	2	29	19	117	79	148
	2001	3	2	28	20	112	78	143
	2002	4	2	30	20	114	77	148
	2003	5	3	36	27	96	70	137
	2004	7	4	46	29	109	67	161
	2005	7	5	44	32	88	63	139
	2006	8	6	46	34	83	60	137
	2007	6	5	36	32	70	63	112
	2008	9	6	47	32	92	62	147
	2009	7	6	40	33	73	61	119
	2010	6	4	40	27	100	69	146
	2011	7	4	56	31	115	65	178
	2012	8	6	46	36	73	57	127
	2013	8	6	49	36	80	58	137
	2014	7	6	28	24	83	71	118
	2015	8	6	35	25	97	69	140
	2016	8	6	34	25	93	69	135
	2017	7	6	35	32	68	62	110
	2018	7	9	35	45	36	46	79
	2019	6	6	40	40	54	54	100
	2020	8	7	45	44	50	49	103
	2021	7	8	40	41	50	51	98
	2022	7	7	42	42	51	51	100
Denmark								
	2008	0	1	0	0	9	99	9

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2009	0	0	0	0	8	100	8
	2010	0	1	0	0	13	99	13
	2011	0	0	0	0	13	100	13
	2012	0	0	0	0	12	100	12
	2013	0	0	0	0	11	100	11
	2014	0	0	0	0	9	100	9
	2015	0	0	0	0	9	100	9
	2016	0	0	0	0	10	100	10
	2017	0	1	0	0	12	99	12
	2018	0	1	0	0	11	99	11
	2019	0	1	0	0	13	99	13
	2020	0	0	0	0	9	100	9
	2021					2	100	2
Finland								
	1996	0	0	0	0	44	100	44
	1997	0	0	0	0	45	100	45
	1998	0	0	0	0	48	100	48
	1999	0	0	0	0	63	100	63
	2000	0	0	0	0	96	100	96
	2001	0	0	0	0	126	100	126
	2002	0	0	0	0	94	100	94
	2003	0	0	0	0	75	100	75
	2004	0	0	0	0	39	100	39
	2005	0	0	0	0	47	100	47
	2006	0	0	0	0	67	100	67
	2007	0	0	0	0	59	100	59
	2008	0	0	0	0	71	100	71
	2009	0	0	0	0	38	100	38

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2010	0	0	0	0	49	100	49
	2011	0	0	0	0	44	100	44
	2012	0	0	0	0	64	100	64
	2013	0	0	0	0	46	100	46
	2014	0	0	0	0	58	100	58
	2015	0	0	0	0	45	100	45
	2016	0	0	0	0	51	100	51
	2017	0	0	0	0	32	100	32
	2018	0	0	0	0	24	100	24
	2019	0	0	0	0	21	100	21
	2020	0	0	0	0	16	100	16
	2021					1	100	1
	2022					1	100	1
France (1,4)								
	1996			4	31	9	69	13
	1997			3	38	5	62	8
	1998	1	12	2	25	5	62	8
	1999	0	0	4	35	7	65	11
	2000	0	4	4	35	7	61	11
	2001	0	4	5	44	6	53	11
	2002	2	14	4	30	6	56	12
	2003	0	0	6	44	7	56	13
	2004	0	0	10	51	9	49	19
	2005	0	0	4	38	7	62	11
	2006	0	0	5	41	8	59	13
	2007	0	0	4	42	6	58	11
	2008	1	5	5	39	7	57	12
	2009	0	4	2	34	3	62	5

Country	Year	Coastal		Estuarine		In-river		Total
		Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2010	2	22	2	26	5	52	10
	2011	0	3	6	54	5	43	11
	2012	0	1	4	44	5	55	10
	2013	0	3	4	40	6	57	11
	2014	0	2	5	43	7	55	12
	2015	4	23	5	32	7	45	16
	2016	0	2	3	45	3	52	6
	2017	0	5	3	36	6	59	10
	2018	0	0	5	47	6	53	11
	2019	0	2	8	54	6	44	15
	2020	0	2	4	48	4	50	8
	2021	0	1	3	38	4	61	7
	2022	0	0	3	50	3	50	7
Greenland								
	2020	32	100					32
	2021	43	100					43
	2022	30	97	1	3			31
Iceland (6)								
	1996	10	9	0	0	111	91	122
	1997	0	0	0	0	156	100	156
	1998	0	0	0	0	164	100	164
	1999	0	0	0	0	146	100	146
	2000	0	0	0	0	85	100	85
	2001	0	0	0	0	88	100	88
	2002	0	0	0	0	97	100	97
	2003	0	0	0	0	110	100	110
	2004	0	0	0	0	130	100	130
	2005	0	0	0	0	149	100	149

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2006	0	0	0	0	111	100	111
	2007	0	0	0	0	129	100	129
	2008	0	0	0	0	200	100	200
	2009	0	0	0	0	171	100	171
	2010	0	0	0	0	190	100	190
	2011	0	0	0	0	128	100	128
	2012	0	0	0	0	70	100	70
	2013	0	0	0	0	146	100	146
	2014	0	0	0	0	68	100	68
	2015	0	0	0	0	125	100	125
	2016	0	0	0	0	105	100	105
	2017	0	0	0	0	90	100	90
	2018	0	0	0	0	82	100	82
	2019	0	0	0	0	51	100	51
	2020	0	0	0	0	70	100	70
	2021					44	100	44
	2022					56	100	56
Ireland								
	1996	440	64	134	20	110	16	684
	1997	380	67	100	18	91	16	571
	1998	433	69	92	15	99	16	624
	1999	335	65	83	16	97	19	515
	2000	440	71	79	13	102	16	621
	2001	551	75	109	15	70	10	730
	2002	514	75	89	13	79	12	682
	2003	403	73	92	17	56	10	551
	2004	342	70	76	16	71	15	489
	2005	291	69	70	17	60	14	421

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2006	206	63	60	18	61	19	327
	2007	0	0	31	37	52	63	83
	2008	0	0	29	33	60	67	89
	2009	0	0	21	31	47	69	68
	2010	0	0	38	39	60	61	98
	2011	0	0	32	37	55	63	87
	2012	0	0	28	32	60	68	88
	2013	0	0	38	44	49	56	87
	2014	0	0	26	46	31	54	57
	2015	0	0	21	33	42	67	63
	2016	0	0	19	33	39	67	58
	2017	0	0	18	31	41	69	59
	2018	0	0	15	33	31	67	46
	2019	0	0	15	35	29	65	45
	2020	0	0	17	36	29	64	46
	2021			17	35	33	65	51
	2022			11	27	29	73	40
Norway								
	1996	520	66	0	0	267	34	787
	1997	394	63	0	0	235	37	629
	1998	410	55	0	0	331	45	741
	1999	483	60	0	0	327	40	810
	2000	619	53	0	0	557	47	1176
	2001	696	55	0	0	570	45	1266
	2002	596	58	0	0	423	42	1019
	2003	597	56	0	0	474	44	1071
	2004	469	60	0	0	316	40	785
	2005	463	52	0	0	424	48	888

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2006	512	55	0	0	420	45	932
	2007	427	56	0	0	340	44	767
	2008	382	47	0	0	425	53	807
	2009	284	48	0	0	312	52	595
	2010	260	41	0	0	382	59	642
	2011	302	43	0	0	394	57	696
	2012	255	37	0	0	440	63	696
	2013	192	40	0	0	283	60	475
	2014	213	43	0	0	277	57	490
	2015	233	40	0	0	350	60	583
	2016	269	44	0	0	343	56	612
	2017	290	44	0	0	376	56	666
	2018	323	54	0	0	271	46	594
	2019	219	43	0	0	293	57	513
	2020	215	41	0	0	312	59	527
	2021	98	33			197	67	295
	2022	134	34			256	66	389
Russia (7)								
	1996	64	49	21	16	46	35	130
	1997	63	57	17	15	32	28	111
	1998	55	42	2	2	74	56	131
	1999	48	47	2	2	52	51	102
	2000	64	52	15	12	45	36	124
	2001	70	61	0	0	44	39	114
	2002	60	51	0	0	58	49	118
	2003	57	53	0	0	50	47	107
	2004	46	56	0	0	36	44	82
	2005	58	70	0	0	24	30	82

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2006	52	57	0	0	39	43	91
	2007	31	50	0	0	31	50	62
	2008	33	45	0	0	40	55	73
	2009	22	31	0	0	49	69	71
	2010	36	41	0	0	52	59	88
	2011	37	42	0	0	52	58	89
	2012	38	46	0	0	44	54	82
	2013	36	46	0	0	42	54	78
	2014	33	41	0	0	48	59	81
	2015	34	42	0	0	46	58	80
	2016	24	42	0	0	32	58	56
	2017	13	28	0	0	34	72	47
	2018	36	45	0	0	44	55	80
	2019	22	38	0	0	35	62	57
	2020	16	34	0	0	32	66	49
	2021	17	35			32	65	49
	2022	19	35			36	65	55
SPM								
	2019	1	100					1
	2020	2	100					2
	2021	2	100					2
	2022	1	100					1
Spain (5)								
	1996	0	0	0	0	7	100	7
	1997	0	0	0	0	4	100	4
	1998	0	0	0	0	4	100	4
	1999	0	0	0	0	6	100	6
	2000	0	0	0	0	7	100	7

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2001	0	0	0	0	13	100	13
	2002	0	0	0	0	9	100	9
	2003	0	0	0	0	7	100	7
	2004	0	0	0	0	7	100	7
	2005	0	0	0	0	13	100	13
	2006	0	0	0	0	10	100	10
	2007	0	0	0	0	9	100	9
	2008	0	0	0	0	9	100	9
	2009	0	0	0	0	2	100	2
	2010	0	0	0	0	2	100	2
	2011	0	0	0	0	7	100	7
	2012	0	0	0	0	7	100	7
	2013	0	0	0	0	5	100	5
	2014	0	0	0	0	6	100	6
	2015	0	0	0	0	5	100	5
	2016	0	0	0	0	5	100	5
	2017	0	0	0	0	2	100	2
	2018	0	0	0	0	3	100	3
	2019	0	0	0	0	5	100	5
	2020	0	0	0	3	5	97	5
	2021			0	1	4	99	4
	2022					3	100	3
Sweden (3)								
	1996	19	58	0	0	14	42	33
	1997	10	56	0	0	8	44	18
	1998	5	33	0	0	10	67	15
	1999	5	31	0	0	11	69	16
	2000	10	30	0	0	23	70	33

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2001	9	27	0	0	24	73	33
	2002	7	25	0	0	21	75	28
	2003	7	28	0	0	18	72	25
	2004	3	16	0	0	16	84	19
	2005	1	7	0	0	14	93	15
	2006	1	7	0	0	13	93	14
	2007	0	1	0	0	16	99	16
	2008	0	1	0	0	18	99	18
	2009	0	3	0	0	17	97	17
	2010	0	0	0	0	22	100	22
	2011	10	26	0	0	29	74	39
	2012	7	24	0	0	23	76	30
	2013	0	0	0	0	15	100	15
	2014	0	0	0	0	30	100	30
	2015	0	0	0	0	17	100	17
	2016	0	0	0	0	9	100	9
	2017	0	0	0	0	18	100	18
	2018	0	0	0	0	17	100	17
	2019	0	0	0	0	20	100	20
	2020	0	0	0	0	14	100	14
	2021	0	0	0	0	11	100	11
	2022	0	0	0	0	8	100	8
UK (E&W)								
	1996	83	45	42	23	58	31	183
	1997	81	57	27	19	35	24	142
	1998	65	53	19	16	38	31	123
	1999	101	67	23	15	26	17	150
	2000	157	72	25	12	37	17	219

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2001	129	70	24	13	31	17	184
	2002	108	67	24	15	29	18	161
	2003	42	47	27	30	20	23	89
	2004	39	35	19	17	53	47	111
	2005	32	33	28	29	36	37	97
	2006	30	37	21	26	30	37	80
	2007	24	36	13	20	30	44	67
	2008	22	34	8	13	34	53	64
	2009	20	37	9	16	25	47	54
	2010	64	59	9	8	36	33	109
	2011	93	69	6	5	36	27	136
	2012	26	45	5	8	27	47	58
	2013	61	73	6	7	17	20	84
	2014	41	75	4	8	9	17	54
	2015	55	82	4	6	8	12	68
	2016	71	82	6	6	10	11	86
	2017	36	73	3	7	10	19	49
	2018	36	84	3	8	4	8	42
	2019	0	0	1	12	4	88	5
	2020	0	0	0	0	3	100	3
	2021			0	0	1	100	1
	2022			0	0	1	100	1
UK (NI)								
	1999	44	83	9	17			53
	2000	63	82	14	18			77
	2001	41	77	12	23			53
	2002 (2)	40	49	24	29	18	22	81
	2003	25	45	20	35	11	20	56

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2004	23	48	11	22	14	29	48
	2005	25	49	13	25	14	26	52
	2006	13	45	6	22	9	32	28
	2007	6	21	6	20	17	59	30
	2008	4	19	4	22	12	59	21
	2009	4	24	2	15	10	62	16
	2010	5	39	0	0	7	61	12
	2011	2	24	0	0	8	76	10
	2012	0	0	0	0	9	100	9
	2013	0	1	0	0	4	99	4
	2014	0	0	0	0	5	100	5
	2015	0	0	0	0	3	100	3
	2016	0	0	0	0	4	100	4
	2017	0	0	0	0	5	100	5
	2018	0	0	0	0	4	100	4
	2019	0	0	0	0	2	100	2
	2020	0	0	0	0	2	100	2
	2021	0	0			2	100	2
	2022					1	100	1
UK (Scot)								
	1996	129	30	80	19	218	51	427
	1997	79	27	33	11	184	62	296
	1998	60	21	28	10	195	69	283
	1999	35	18	23	11	141	71	199
	2000	76	28	41	15	157	57	274
	2001	77	30	22	9	153	61	251
	2002	55	29	20	10	116	61	191
	2003	86	45	23	12	83	43	193

		Coastal		Estuarine		In-river		Total
Country	Year	Weight (t)	% of total	Weight (t)	% of total	Weight (t)	% of total	Weight (t)
	2004	67	27	20	8	160	65	247
	2005	62	29	27	12	128	59	217
	2006	57	30	17	9	119	62	193
	2007	40	24	17	10	113	66	171
	2008	38	24	11	7	112	70	161
	2009	27	22	14	12	79	66	121
	2010	44	25	38	21	98	54	180
	2011	48	30	23	15	87	55	159
	2012	40	32	11	9	73	59	124
	2013	50	42	26	22	43	36	119
	2014	41	49	17	20	26	31	84
	2015	31	45	9	14	28	41	68
	2016	0	0	10	37	17	63	27
	2017	0	0	7	27	19	73	26
	2018	0	0	12	63	7	37	19
	2019	0	0	2	13	11	87	13
	2020	0	0	3	19	11	81	14
	2021	0	0	2	30	5	70	7
	2022	0	0	2	31	4	69	6

1. An illegal net fishery operated from 1995 to 1998, catch unknown in the first 3 years but thought to be increasing. Fishery ceased in 1999. 2001/2 catches from the illegal coastal net fishery in Lower Normandy are unknown.

2. Rod catch data for river (rod) fisheries in UK (NI) from 2002.

3. Estuarine catch included in coastal catch.

4. Coastal catch included in estuarine catch.

5. Spain catch to 2018 was Asturias catch raised, 2019 data for All Spain.

6. Iceland total catch includes ranched fish.

7. Data extracted from NASCO website at https://nasco.int/conservation/third-reporting-cycle-2/.

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, 1991–2022. Figures for 2022 are provisional.

	Canada (4)		USA		Iceland		Russia (1,5)		UK (E&W)		UK (Scot)		Ireland		UK (NI) (2)		France		Denmark		Sweden		Norway (3)	
Year	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	To-tal	%	Total
1991	28	22167	50	239			51	3211																
1992	29	37803	67	407			73	10120																
1993	36	44803	77	507			82	11246	10	1448														
1994	43	52887	95	249			83	12056	13	3227	8	6595												
1995	46	46029	100	370			84	11904	20	3189	14	12151												
1996	41	52166	100	542	2	669	73	10745	20	3428	15	10413												
1997	50	50009	100	333	5	1558	87	14823	24	3132	18	10944												
1998	53	56289	100	273	7	2826	81	12776	30	4378	18	13464												
1999	50	48720	100	211	10	3055	77	11450	42	4382	28	14849												
2000	56	64482		0	11	2918	74	12914	42	7470	32	21072												
2001	55	59387		0	12	3611	76	16945	43	6143	38	27724												
2002	52	50924		0	18	5985	80	25248	50	7658	41	24058												
2003	55	53645		0	16	5361	81	33862	56	6425	55	29170												
2004	57	62316		0	16	7362	76	24679	48	13211	50	46279							19	255				
2005	62	63005		0	17	9224	87	23592	56	11983	55	46165	12	2553					27	606				
2006	62	60486	100	1	19	8735	82	33380	56	10959	55	47669	22	5409	18	302			65	794				

2007	58	41192	100	3	18	9691	90	44341	55	10917	61	55670	44	15113	16	470			57	959				
2008	53	54887	100	61	20	17178	86	41881	55	13035	62	53366	38	13563	20	648			71	2033			5	5512
2009	59	52151		0	24	17514			58	9096	67	48436	39	11422	21	847			53	1709			6	6696
2010	53	55895		0	29	21476	56	14585	60	15012	70	78459	40	15142	25	823			60	2512			12	15041
2011	57	71358		0	32	18593			62	14406	73	65330	38	12688	36	1197			55	2153	5	424	12	14303
2012	57	43287		0	28	9752	43	4743	65	11952	74	63628	35	11891	59	5014			55	2153	6	404	14	18611
2013	59	50630		0	34	23133	39	3732	70	10458	80	54003	37	10682	64	1507			57	1932	9	274	15	15953
2014	54	41613		0	40	13616	52	8479	78	7992	82	37355	37	6537	50	1065			61	1918	15	982	19	20281
2015	64	65440		0	31	21914	50	7028	79	8113	84	46837	37	9383	100	111			70	2989	14	690	19	25433
2016	65	68925		0	43	22751	76	10793	80	9700	90	50186	43	10934	100	280			72	3801	17	362	21	25198
2017	66	57357		0	42	19667	77	10110	83	11255	90	45652	45	12562	100	126			69	4435	14	680	20	25924
2018	82	56011		0	43	19409	73	10799	88	6857	93	35066	43	9249	49	3247			79	4613	16	806	22	22024
2019	72	60636			52	15185			89	8171	91	43825	48	9790	85	5000			70	3913	14	747	20	21178
2020	72	56618		0	51	21277	65	9508	93	11893	92	42854	51	12177	89	7333	8	72	69	4375	16	587	23	28753
2021	75	67056			54	19108	71	10727	95	6087	95	34853	51	14272	89	5132	4	43	66	4016	19	680	27	21357
2022	70	53001			53	23609	64	10324	96	6635	96	40753	53	13642	86	3570	5	38	73	4344	28	730	28	27189
5- year mean																								
2017 - 2021	74	59536		0	48	18929	72	10286	90	8853	92	40450	48	11610	82	4168	6	58	71	4270	16	700	23	23847

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 are for the Department of Culture, Arts and Leisure area only; the figures from 2010 are a total for UK (NI). Data for 2015, 2016 and 2017 are 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.
5. Data extracted from NASCO website at https://nasco.int/conservation/third-reporting-cycle-2/.

Table 2.1.3.1. Estimates of unreported catches by various methods in tonnes within national EEZs in the Northeast Atlantic, North American and West Greenland Commissions of NASCO, 1987–2022.

Year	Northeast Atlantic	North America	West Greenland	Total
1987	2554	234		2788
1988	3087	161		3248
1989	2103	174		2277
1990	1779	111		1890
1991	1555	127		1682
1992	1825	137		1962
1993	1471	161	<12	1644
1994	1157	107	<12	1276
1995	942	98	20	1060
1996	947	156	20	1123
1997	732	90	5	827
1998	1108	91	11	1210
1999	887	133	12	1032
2000	1136	124	10	1270
2001	1089	81	10	1180
2002	946	83	10	1039
2003	719	118	10	847
2004	575	101	10	686
2005	605	85	10	700
2006	604	56	10	670
2007	465	0	10	475
2008	433	0	10	443
2009	317	16	10	343
2010	357	15	10	382
2011	382	49	10	441
2012	363	30	10	403
2013	272	24	10	306
2014	256	21	10	287

Year	Northeast Atlantic	North America	West Greenland	Total
2015	299	17	10	326
2016	297	27	10	335
2017	318	25	10	353
2018	278	24	10	312
2019	238	12	10	259
2020	238	27	10	275
2021	134	19	10	163
2022	174	18	10	202
Mean				
2017 - 2021	241	22	10	273
1. No estimates available for Canada in 2007 - 2008 and estimates for 2009, 2010 and 2019 are incomplete.				
2. No estimates have been available for Russia since 2008.				
3. Unreported catch estimates are not provided for Spain or St Pierre and Miquelon.				
4. No estimates were available for France for 2018.				

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 for 2022.

Commission Area	Country	Unreported Catch (t)	Unreported as % of Total North Atlantic Catch (Unreported + Reported)	Unreported as % of National Catch (Un-reported + Reported)
NAC	Canada	18	2.0	15
NEAC	Denmark	0	0.0	
NEAC	Finland	0	0.0	
NEAC	Iceland	1	0.1	2
NEAC	Ireland	4	0.4	9
NEAC	Norway	167	18.5	30
NEAC	Sweden	1	0.1	10
NEAC	UK (E&W)	0	0.0	
NEAC	UK (NI)	0	0.0	
NEAC	UK (Scot)	1	0.1	14
WGC	West GRL	10	1.1	25
Total unreported catch		202	22	
Total Reported Catch of North Atlantic Salmon		700		

1. No estimates available for Canada in 2007 - 2008 and estimates for 2009, 2010 and 2019 are incomplete.

2. No estimates have been available for Russia since 2008.

3. Unreported catch estimates are not provided for Spain or St Pierre and Miquelon.

4. No estimates were available for France for 2018.

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), 1980–2022.

Year	North Atlantic Area											Outside the North Atlantic Area (6)						
	Norway	UK (Scot)	Faroes	Canada	Ireland	USA	Iceland	UK (NI) (7)	Russia	Spain (8)	Total	Chile	West Coast USA (3)	West Coast Canada (4)	Australia (5)	Turkey	Total	Worldwide Total
1980	4153	598	0	11	21	0	0	0	0	0	4783	0	0	0	0	0	0	4783
1981	8422	1133	0	21	35	0	0	0	0	0	9611	0	0	0	0	0	0	9611
1982	10266	2152	70	38	100	0	0	0	0	0	12626	0	0	0	0	0	0	12626
1983	17000	2536	110	69	257	0	0	0	0	0	19972	0	0	0	0	0	0	19972
1984	22300	3912	120	227	385	0	0	0	0	0	26944	0	0	0	0	0	0	26944
1985	28655	6921	470	359	700	0	91	0	0	0	37196	0	0	0	0	0	0	37196
1986	45675	10337	1370	672	1215	0	123	0	0	0	59392	0	11	0	10	0	21	59413
1987	47417	12721	3530	1334	2232	365	490	0	0	0	68089	41	196	0	62	0	299	68388
1988	80371	17951	3300	3542	4700	455	1053	0	0	0	111372	165	925	0	240	0	1330	112702
1989	124000	28553	8000	5865	5063	905	1480	0	0	0	173866	1860	1122	1000	1750	0	5732	179598
1990	165000	32351	13000	7810	5983	2086	2800	<100	5	0	229135	9478	696	1700	1750	300	13924	243059
1991	155000	40593	15000	9395	9483	4560	2680	100	0	0	236811	14957	1879	3500	2653	1500	24489	261300
1992	140000	36101	17000	10380	9231	5850	2100	200	0	0	220862	23715	4238	6600	3300	680	38533	259395
1993	170000	48691	16000	11115	12366	6755	2348	<100	0	0	267375	29180	4254	12000	3500	791	49725	317100
1994	204686	64066	14789	12441	11616	6130	2588	<100	0	0	316416	34175	4834	16100	4000	434	59543	375959

Year	North Atlantic Area											Outside the North Atlantic Area (6)						
1995	261522	70060	9000	12550	11811	10020	2880	259	0	0	378102	54250	4868	16000	6192	654	81964	460066
1996	297557	83121	18600	17715	14025	10010	2772	338	0	0	444138	77327	5488	17000	7647	193	107655	551793
1997	332581	99197	22205	19354	14025	13222	2554	225	0	0	503363	96675	5784	28751	7648	50	138908	642271
1998	361879	110784	20362	16418	14860	13222	2686	114	0	0	540325	107066	2595	33100	7069	40	149870	690195
1999	425154	126686	37000	23370	18000	12246	2900	234	0	0	645590	103242	5512	38800	9195	0	156749	802339
2000	440861	128959	32000	33195	17648	16461	2600	250	0	0	671974	166897	6049	49000	10907	0	232853	904827
2001	436103	138519	46014	36514	23312	13202	2645		0	0	696309	253850	7574	68000	12724	0	342148	1038457
2002	462495	145609	45150	40851	22294	6798	1471		0	0	724668	265726	5935	84200	14356	0	370217	1094885
2003	509544	176596	52526	38680	16347	6007	3710		300	0	803710	280301	10307	65411	15208	0	371227	1174937
2004	563914	158099	40492	37280	14067	8515	6620		203	0	829190	348983	6645	55646	16476	0	427750	1256940
2005	586512	129588	18962	45891	13764	5263	6300		204	0	806484	385779	6110	63369	16780	0	472038	1278522
2006	629888	131847	11905	47880	11174	4674	5745		229	0	843342	376476	5811	70181	20710	0	473178	1316520
2007	744222	129930	22305	36368	9923	2715	1158		111	0	946732	331042	7117	70998	25336	0	434493	1381225
2008	737694	128606	36000	39687	9217	9014	330		51	0	960599	388847	7699	73265	25737	0	495548	1456147
2009	862908	144247	51500	43101	12210	6028	742		2126	0	1122862	233308	7923	68662	29893	0	339786	1462648
2010	939575	154164	45391	43612	15691	11127	1068		4500	0	1215128	123233	8408	70831	31807	0	234279	1449407
2011	1065974	158018	60967	41448	12196	6031	1083		8500		1354217	264349	7467	83144	36662	0	391622	1745839
2012	1232095	162223	76596	52951	12440		2923		8754		1547982	399678	8696	79981	43982	0	532337	2080319

Year	**North Atlantic Area**											**Outside the North Atlantic Area (6)**						
2013	1168324	163234	77184	47649	9125		3018		16097		1484631	492329	6834	74673	42776	0	616612	2101243
2014	1258356	179022	86490	29988	9368		3965		18675		1585864	644459	6368	54971	41591	0	747389	2333253
2015	1303346	171722	80629	48684	13116		3260		3232	8	1623997	608546	10431	92926	48331	0	760234	2384231
2016	1233619	162817	83291	33011	16300		8420		12857	5	1550320	532225	8017	90511	56115	0	686868	2237188
2017	1237762	189707	86830	34945	19305		11265		13016	25	1592855	613611	6520	85608	52580	0	758319	2351174
2018	1278596	156025	78973	36174	12200		13448		20566		1595982	661138	16107	123184	61227	0	861656	2457638
2019	1361747	203881	94993	43925	19300		26957		32343	12	1783158	701984	16491	118630	56989	0	894094	2677252
2020	1388434	192129	88961	36421	14500		34341		10855		1765641	787131	16491	120427	66919	0	990968	2756609
2021	1562415	205393	115683	51919			44503		10855		1990768	787131		120427	66919		974477	2965245
2022	1539627	189693	108679	44088			44934		10855		1937876	787131		120427	66919		974477	2912353
Mean																		
2017 - 2021	1365791	189427	93088	40677	16326		26103		17527	18	1745681	710199	13902	113655	60927	0	895903	2641584
% change; recent year relative to mean	13	0	17	8			72		-38		11	11		6	10		9	10

1. Data for 2022 are provisional for many countries.

2. Where production figures were not available for 2022, values for the most recent year were used.

3. West Coast USA = Washington State.

Year	North Atlantic Area	Outside the North Atlantic Area (6)
4. West Coast Canada = British Columbia.		
5. Australia = Tasmania.		
6. Source of production figures for non-Atlantic areas: *Copyright FAO 2023. Global Production. Fisheries and Aquaculture Division [online]. Rome. [Cited Saturday, April 1st 2023].* *https://www.fao.org/fishery/en/collection/global_production, 2022 most recent data.*		
7. Data for UK (NI) since 2001 and data for East coast USA since 2012 are not publicly available.		
8. Data for Spain first provided in 2019, no data reported for 2020-2022.		

Table 2.2.2.1. Harvest of ranched salmon in the North Atlantic (tonnes round fresh weight), 1980–2022.

Year	Iceland (1)	Ireland (2,4)	UK (NI) River Bush (2,3,4)	Sweden (2)	Norway various facilities (2)	Total harvest
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	34
2006	17.2	5.8	1.3	5.7	1.0	31

Year	Iceland (1)	Ireland (2,4)	UK (NI) River Bush (2,3,4)	Sweden (2)	Norway various facilities (2)	Total harvest
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	4.7		6.6		43
2016	33.6	3.0		3.1		40
2017	24.4	2.8		9.6		37
2018	21.7	3.0		4.1		29
2019	13.7	3.6		7.7		25
2020	28.2	3.3		7.0		38
2021	15.9			4.6		20
2022	21.3			1.7		23
5-yr mean						
2017 - 2021	21	3		7		30
% change; recent year relative to mean						
	2			-74		-23
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 2018 due to a lack of microtag returns.						
4. No estimates of ranched catch available for 2021 or 2022, but catches are considered to have been very few.						

Table 2.10.1a Summary of Atlantic salmon tagged and marked in 2021 - '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	1813	23	453	2289
	Hatchery Juvenile	0	24	24 741	50	24 815
	Wild Adult	0	2474	13	1243	3730
	Wild Juvenile	0	13 511	13 545	1762	28 818
	Total	**0**	**17 822**	**38 322**	**3508**	**59 652**
Denmark	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	90 000	0	90 000
	Wild Adult	0	0	0	241	241
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**90 000**	**241**	**90 241**
France	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	87 957	0	87 957
	Wild Adult	0	0	0	524	524
	Wild Juvenile	0	0	0	5030	5030
	Total	**0**	**0**	**87 957**	**5554**	**93 511**
Iceland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	29 585	0	0	0	29 585
	Wild Adult	0	415	0	0	415
	Wild Juvenile	4947	0	0	1095	6042
	Total	**34 532**	**415**	**0**	**1095**	**36 042**
Ireland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	152 486	0	0	0	152 486
	Wild Adult	0	0	0	0	0
	Wild Juvenile	114	0	0	3387	3501
	Total	**152 600**	**0**	**0**	**3387**	**155 987**
Norway	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	2986	0	7925	10 911

		Primary Tag or Mark				
Country	Origin	Microtag	External mark[2]	Adipose clip	Other Inter-nal[1]	Total
	Wild Adult	0	0	0	6467	6467
	Wild Juvenile	0	415	0	0	415
	Total	**0**	**3401**	**0**	**14 392**	**17 793**
Russia	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	464 740	0	464 740
	Wild Adult	0	784	0	0	784
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**784**	**464 740**	**0**	**465 524**
Spain	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	121 902	0	121 902
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**121 902**	**0**	**121 902**
Sweden	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	183 285	0	183 285
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	123	123
	Total	**0**	**0**	**183 285**	**123**	**183 408**
UK (England &	Hatchery Adult	0	0	0	0	0
Wales)	Hatchery Juvenile	0	0	19	26	45
	Wild Adult	0	465	0	40	505
	Wild Juvenile	2824	0	0	10 393	13 217
	Total	**2824**	**465**	**19**	**10 459**	**13 767**
UK (N. Ireland)	Hatchery Adult	0	0	0	22	22
	Hatchery Juvenile	7018	0	100 487	30	107 535
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	418	418
	Total	**7018**	**0**	**100 487**	**470**	**107 975**

Country	Origin	Primary Tag or Mark Microtag	External mark[2]	Adipose clip	Other Internal[1]	Total
UK (Scotland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	33 251	0	33 251
	Wild Adult	0	472	0	4	476
	Wild Juvenile	0	0	806	8799	9605
	Total	**0**	**472**	**34 057**	**8803**	**43 332**
Germany	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**
Greenland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	70	0	0	70
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**70**	**0**	**0**	**70**
USA	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	4	0	1898	1902
	Wild Adult	0	0	112 835	72	112 907
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**4**	**112 835**	**1970**	**114 809**
All Countries	Hatchery Adult	0	1817	23	2373	4213
	Hatchery Juvenile	189 089	124 912	1 097 315	8103	1 419 419
	Wild Adult	0	4680	13	8519	13 212
	Wild Juvenile	7885	13 926	14 351	31 007	67 169
	Total	**196 974**	**145 335**	**1 111 702**	**50 002**	**1 504 013**

[1] **Includes other internal tags (PIT, ultrasonic, radio, DST, etc.)**

[2] **Includes Carlin, spaghetti, streamers, VIE etc.**

Table 2.10.1b Summary of Atlantic salmon tagged and marked in 2022 - 'Hatchery' and 'Wild' juvenile refer to smolts and parr.

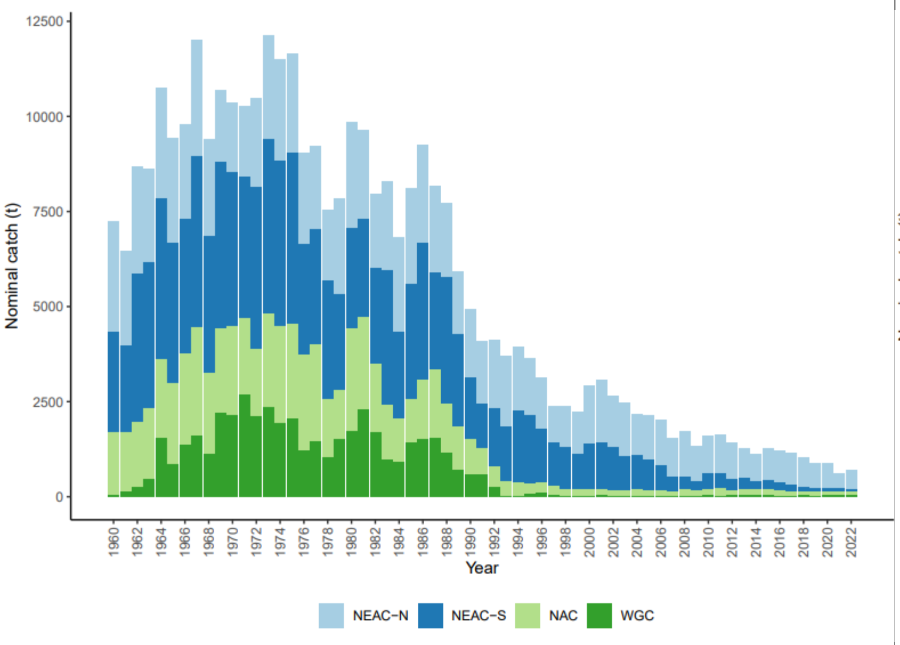
		Primary Tag or Mark				
Country	Origin	Microtag	External mark[2]	Adipose clip	Other Internal[1]	Total
Canada	Hatchery Adult	0	1195	128	581	1904
	Hatchery Juvenile	0	0	202	0	202
	Wild Adult	0	1731	0	378	2109
	Wild Juvenile	0	13 171	10 369	1551	25 091
	Total	**0**	**16 097**	**10 699**	**2510**	**29 306**
Denmark	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	230 000	0	230 000
	Wild Adult	0	0	0	668	668
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**230 000**	**668**	**230 668**
France	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	0	0	277	277
	Wild Juvenile	0	0	0	5326	5326
	Total	**0**	**0**	**0**	**5603**	**5603**
Iceland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	38 150	0	0	0	38 150
	Wild Adult	0	355	0	0	355
	Wild Juvenile	1975	0	0	1891	3866
	Total	**40 125**	**355**	**0**	**1891**	**42 371**
Ireland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	133 075	0	0	0	133 075
	Wild Adult	0	0	0	0	0
	Wild Juvenile	5190	0	0	3442	8632
	Total	**138 265**	**0**	**0**	**3442**	**141 707**
Norway	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	2995	2995

		Primary Tag or Mark				
Country	Origin	Microtag	External mark[2]	Adipose clip	Other Internal[1]	Total
	Wild Adult	0	0	0	8776	8776
	Wild Juvenile	0	376	0	0	376
	Total	**0**	**376**	**0**	**11 771**	**12 147**
Russia	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**
Spain	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	179 895	0	179 895
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**179 895**	**0**	**179 895**
Sweden	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	202 733	0	202 733
	Wild Adult	0	0	0	482	482
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**202 733**	**482**	**203 215**
UK (England &	Hatchery Adult	0	0	0	0	0
Wales)	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	638	0	25	663
	Wild Juvenile	6216	0	0	9054	15 270
	Total	**6216**	**638**	**0**	**9079**	**15 933**
UK (N. Ireland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	11 202	0	0	76 499	87 701
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	491	491
	Total	**11 202**	**0**	**0**	**76 990**	**88 192**

		Primary Tag or Mark				
Country	Origin	Microtag	External mark[2]	Adipose clip	Other Internal[1]	Total
UK (Scotland)	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	27 320	0	27 320
	Wild Adult	0	215	0	7	222
	Wild Juvenile	0	0	0	11 551	11 551
	Total	**0**	**215**	**27 320**	**11 558**	**39 093**
Germany	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	0	0	0	0
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**
Greenland	Hatchery Adult	0	0	0	0	0
	Hatchery Juvenile	0	0	0	0	0
	Wild Adult	0	100	0	109	209
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**100**	**0**	**109**	**209**
USA	Hatchery Adult	0	0	0	3294	3294
	Hatchery Juvenile	0	0	126 252	148	126 400
	Wild Adult	0	13	327	555	895
	Wild Juvenile	0	0	0	0	0
	Total	**0**	**13**	**126 579**	**3997**	**130 589**
All Countries	Hatchery Adult	0	1195	128	3875	5198
	Hatchery Juvenile	182 427	0	766 402	79 642	1 028 471
	Wild Adult	0	3052	327	11 277	14 656
	Wild Juvenile	13 381	13 547	10 369	33 306	70 603
	Total	**195 808**	**17 794**	**777 226**	**128 100**	**1 118 928**

[1] Includes other internal tags (PIT, ultrasonic, radio, DST, etc.)

[2] Includes Carlin, spaghetti, streamers, VIE etc.



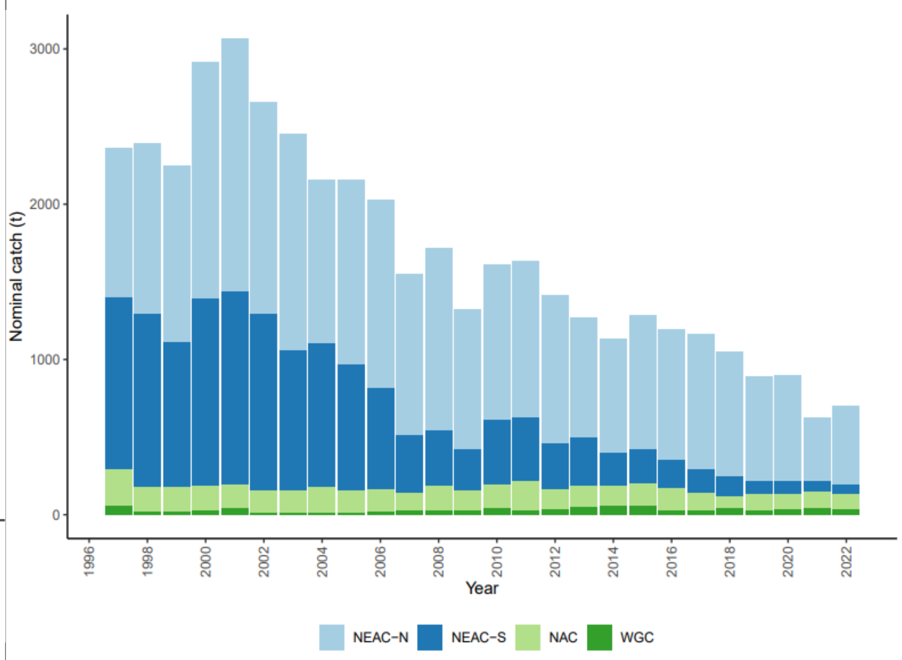


Figure 2.1.1.1. (a) Total reported nominal catches of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2022.

Figure 2.1.1.1. (b) Total reported nominal catches of salmon (tonnes round fresh weight) in four North Atlantic regions, 1997–2022.

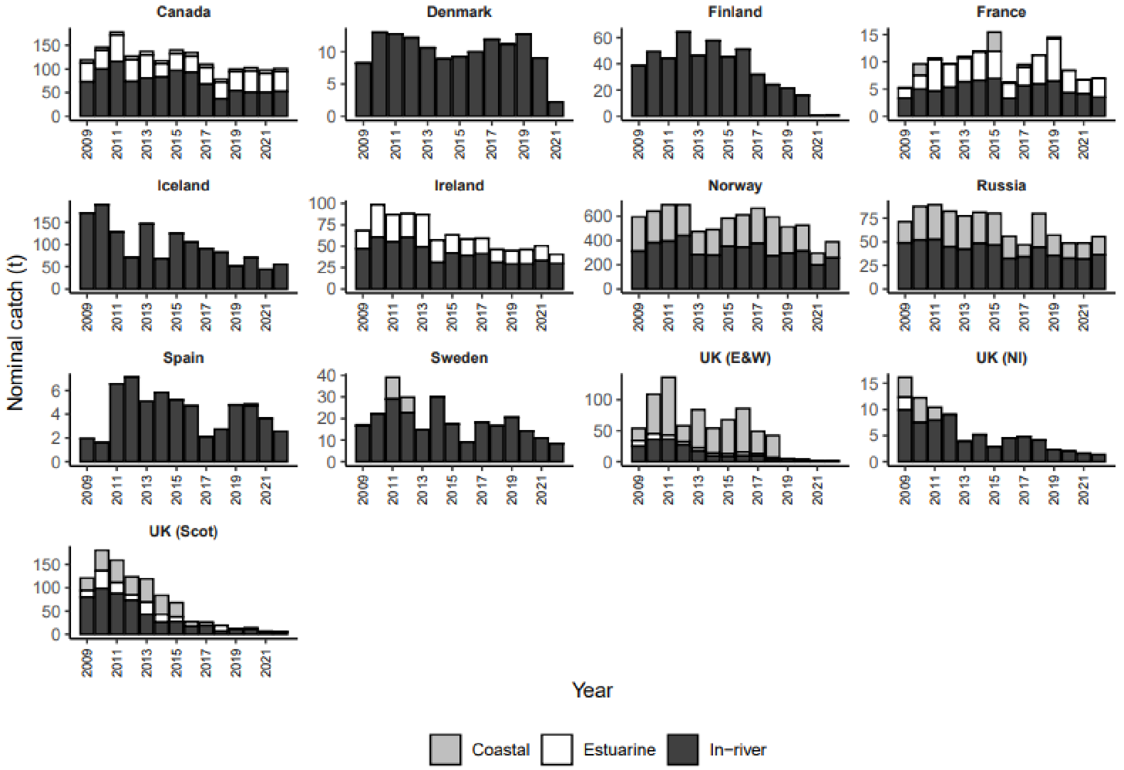


Figure 2.1.1.2. Nominal catch (tonnes round fresh weight) taken in coastal, estuarine and in-river fisheries by country, 2009–2022. The way in which the nominal catch is partitioned among categories varies between countries, particularly for estuarine and coastal fisheries, see text for details. Note also that the y-axes scales vary.

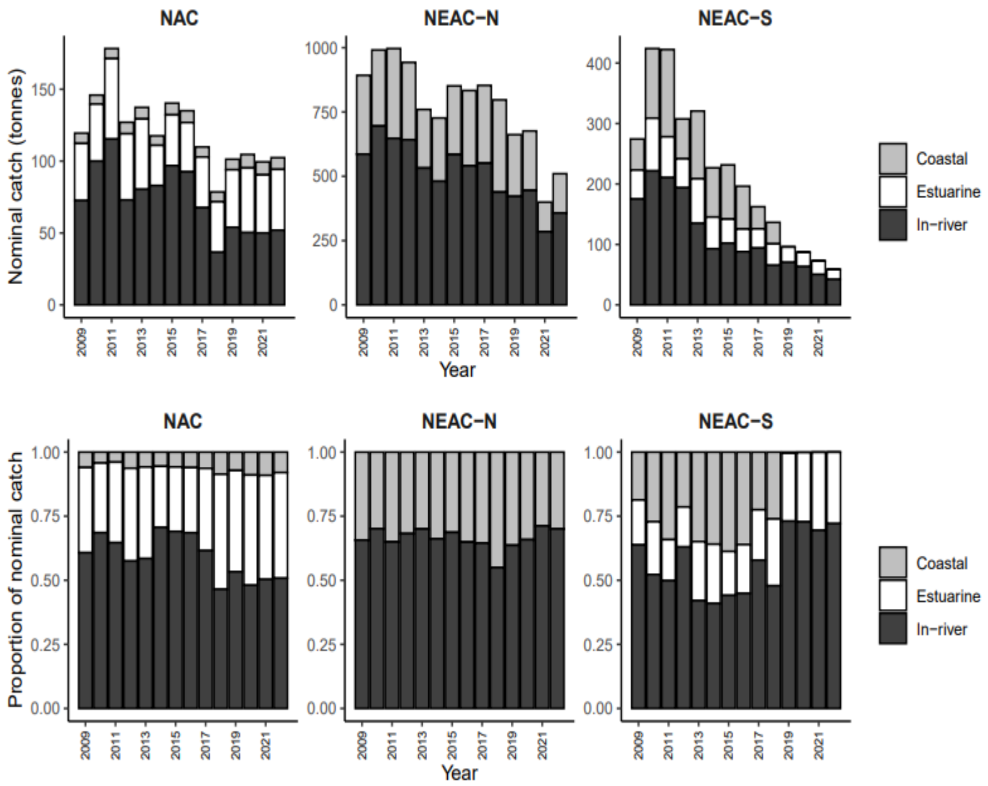


Figure 2.1.1.3. Top panel - Nominal catches (tonnes round fresh weight) taken in coastal, estuarine and in-river fisheries for the NAC area (2009–2022) and for NEAC Northern (NEAC_N) and Southern (NEAC_S) areas (2009–2022). Bottom panel - percentages of nominal catch taken in coastal, estuarine and in-river fisheries in each commission area, 2009–2022. Note that y-axes in the top panel vary.

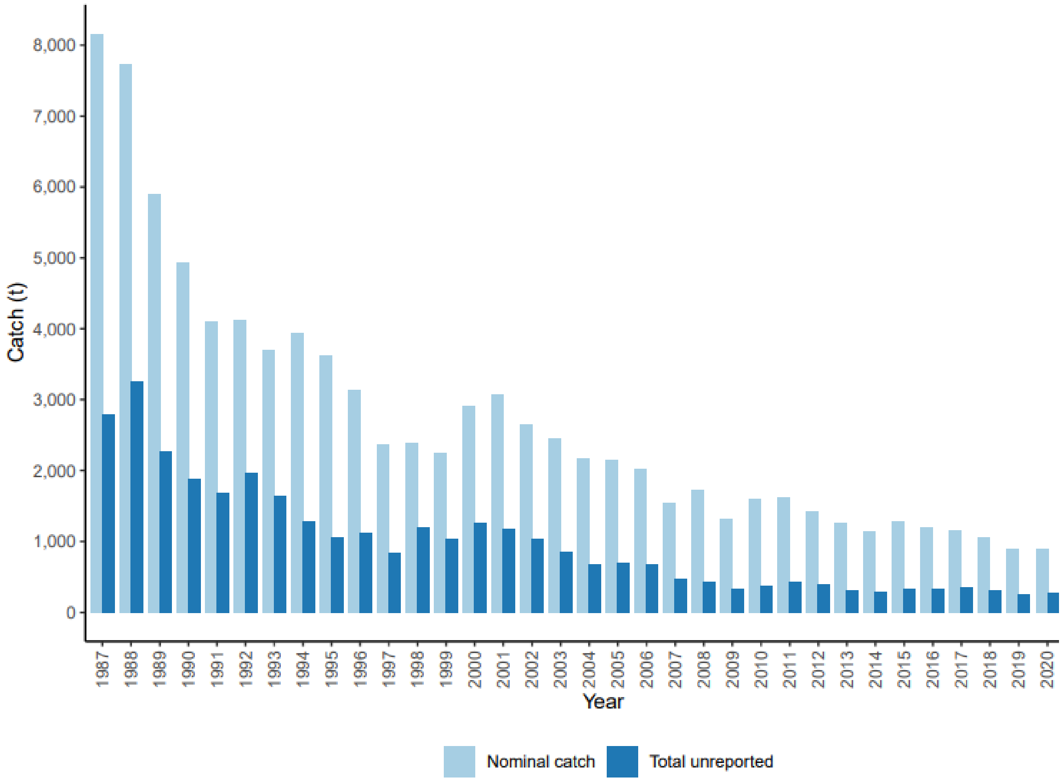


Figure 2.1.3.1. Nominal North Atlantic salmon catch (tonnes round fresh weight) and unreported catch (tonnes round fresh weight) in NASCO Areas, 1987–2022.

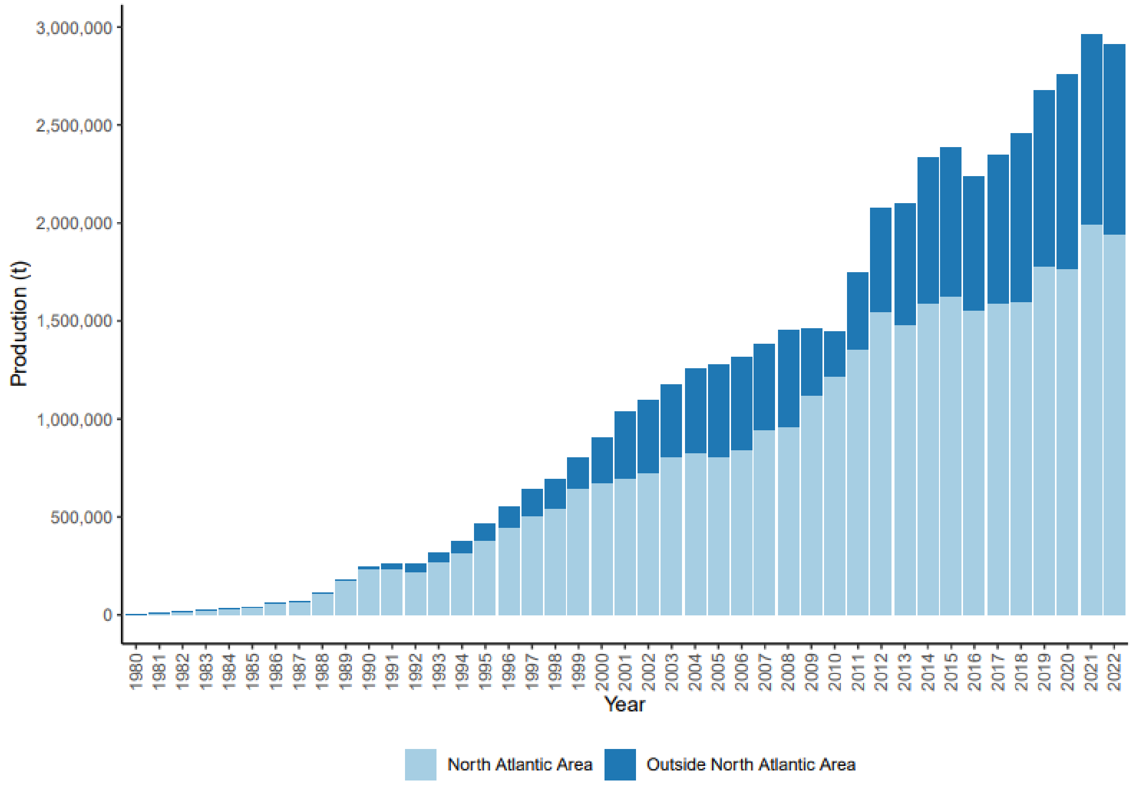


Figure 2.2.1.1. Worldwide farmed Atlantic salmon production (tonnes round fresh weight) 1980–2022. Note no data available for USA West coast production at time of writing.

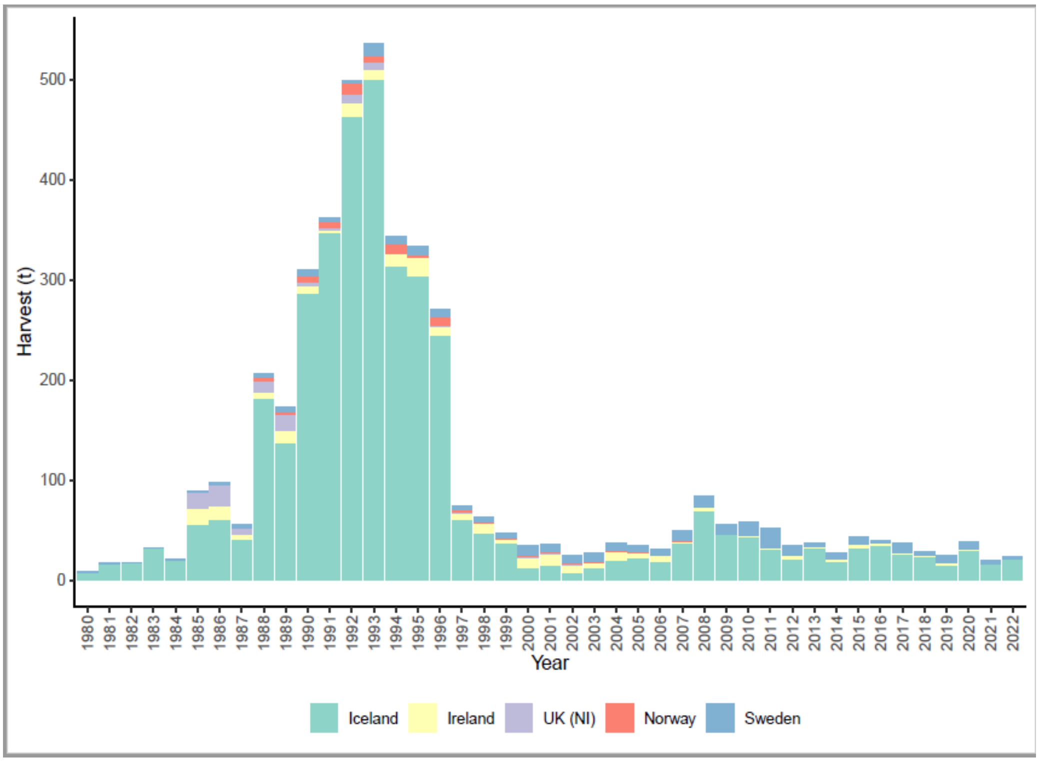
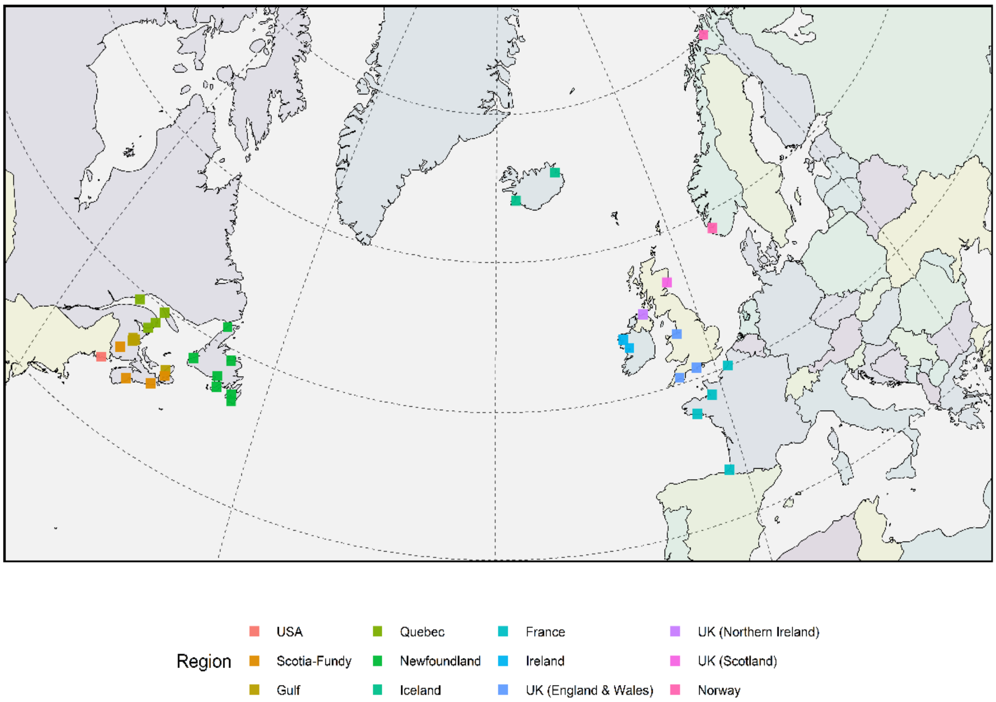


Figure 2.2.2.1. Harvest of ranched salmon (tonnes round fresh weight) in the North Atlantic, 1980–2022.

A



B

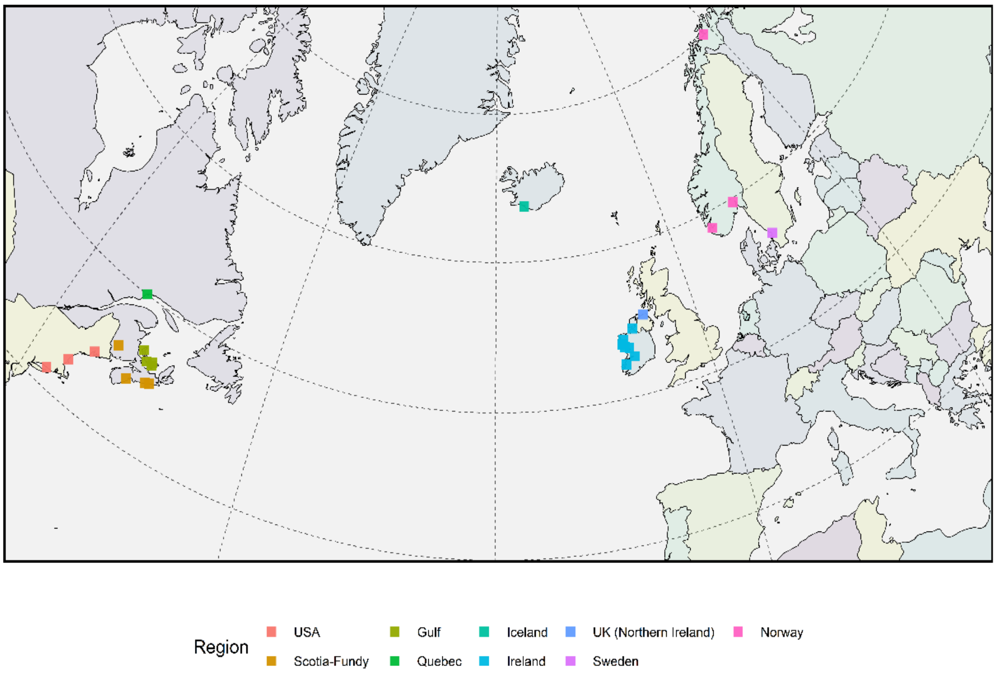


Figure 2.4.1. Location of rivers (coloured by region) with marine return rate data for wild (panel A) and hatchery origin (panel B) Atlantic salmon from the North Atlantic. Data are compiled from ICES (2021a).

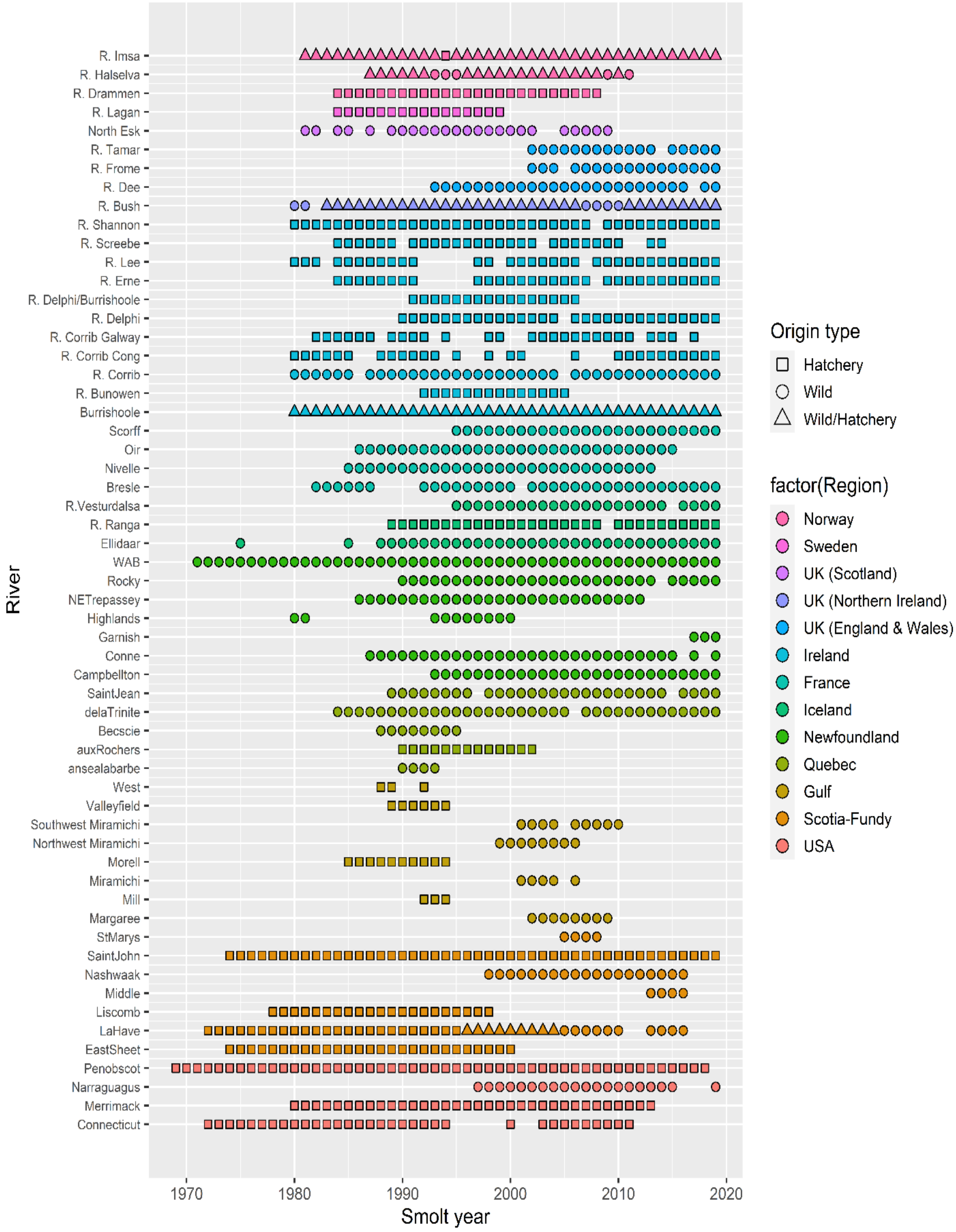


Figure 2.4.2. Time series of return rates by river (coloured by region) for origin (wild, hatchery, both wild and hatchery) of smolt-to-adult returns of Atlantic salmon from the North Atlantic. Data are compiled from ICES (2021a).

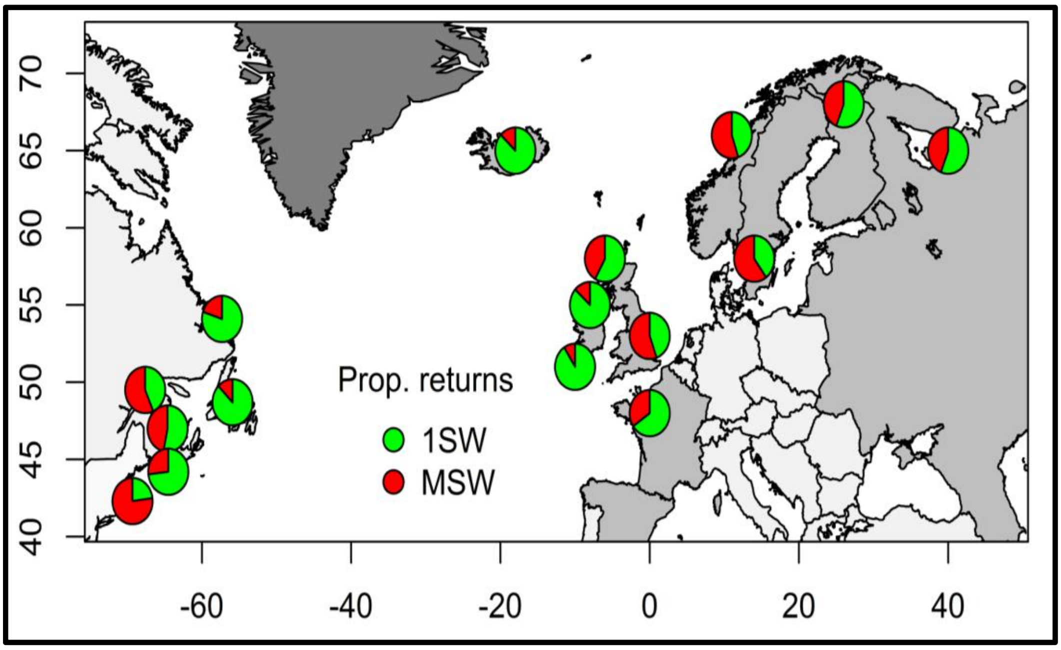


Figure 2.4.3. Figure drawn from data in ICES (2019a) of returns by age group by region.

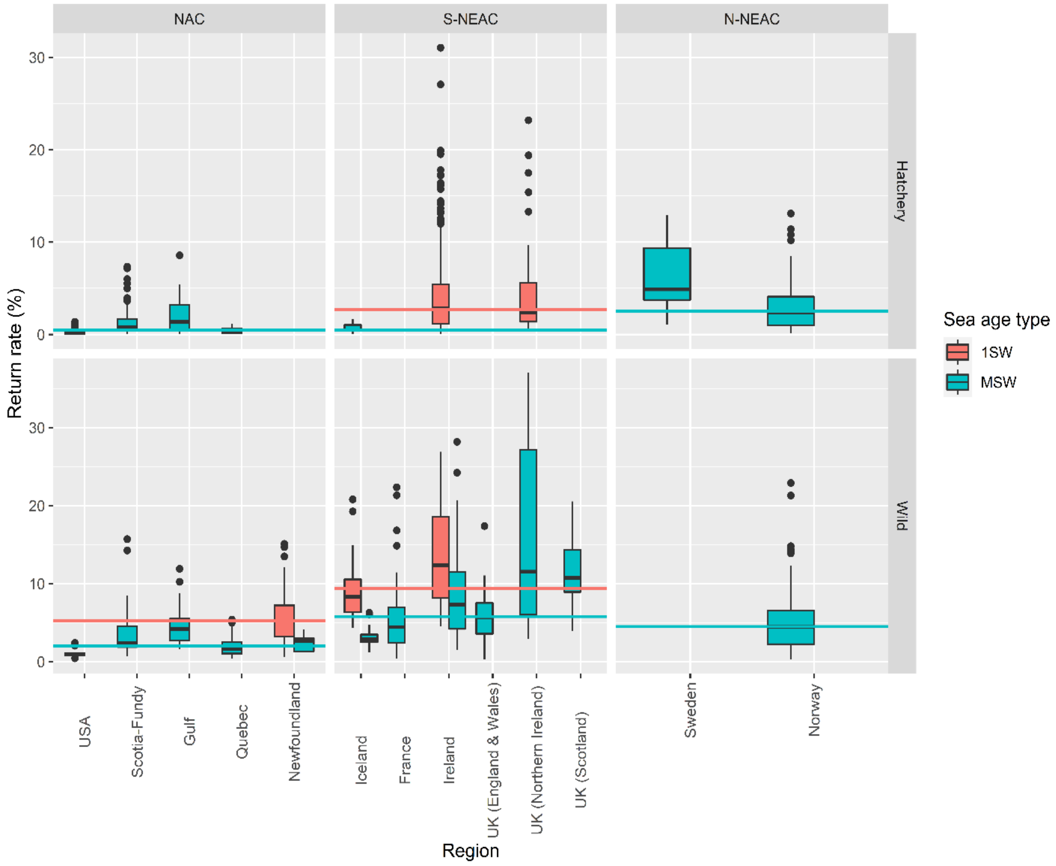


Figure 2.4.4. Contrast in return rates (%) of all first time spawning ages groups of wild and hatchery-origin Atlantic salmon for 1SW and MSW sea age types in regions of North America (NAC), Southern NEAC (S-NEAC) and Northern NEAC (N-NEAC), all years combined. The horizontal lines in each panel represent the median value over all regions for 1SW and MSW populations, respectively. Data are updated from ICES (2021a) to the 2020 smolt migration year and exclude River Oir (France).

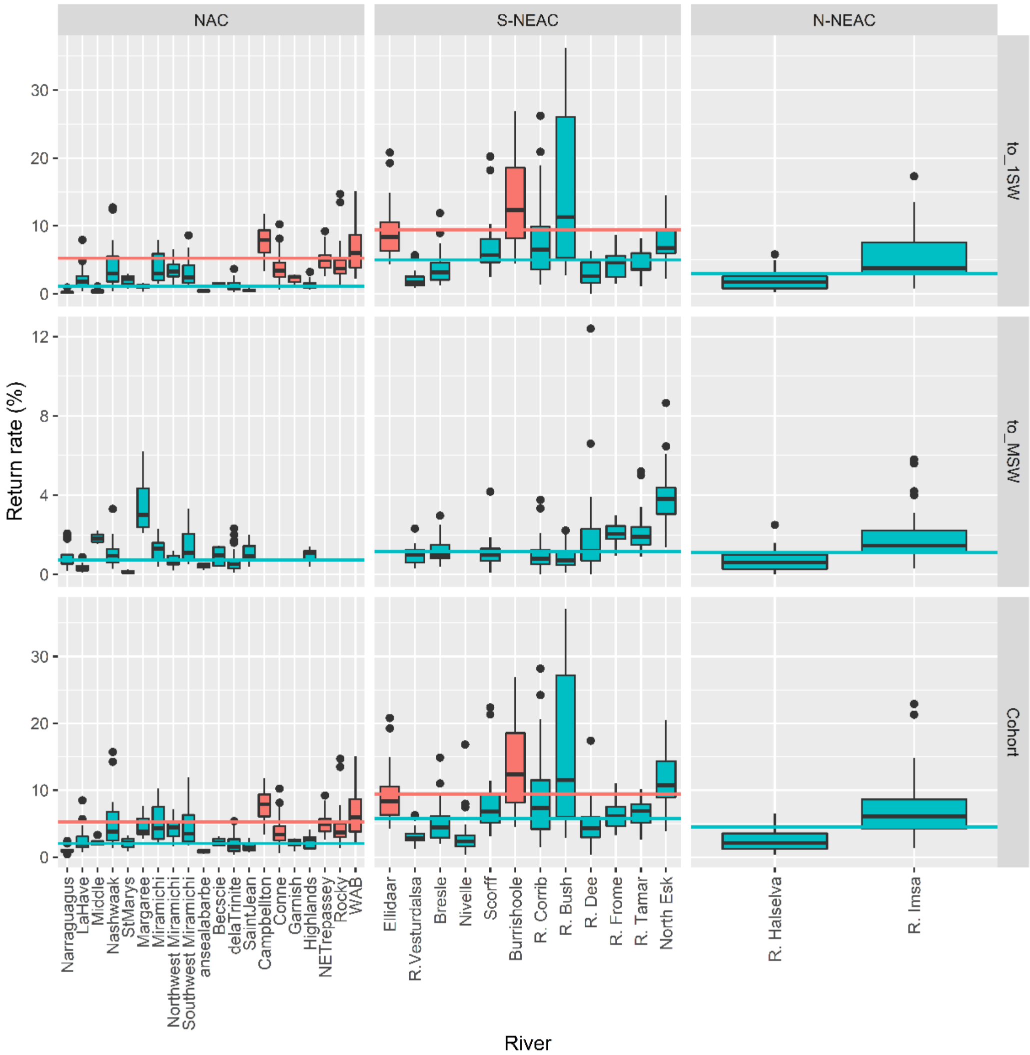


Figure 2.4.5. Contrast in return rates (%) by first time spawning ages (to_1SW, to_MSW, Cohort) of wild Atlantic salmon by river-specific sea age type (1SW, MSW) for rivers in North America (NAC), Southern NEAC (S-NEAC) and Northern NEAC (N-NEAC) rivers, all years combined. The horizontal lines in each panel represent the median value over all rivers for 1SW and MSW populations, respectively. Data are updated from ICES (2021a) to the 2020 smolt migration year and exclude River Oir (France).

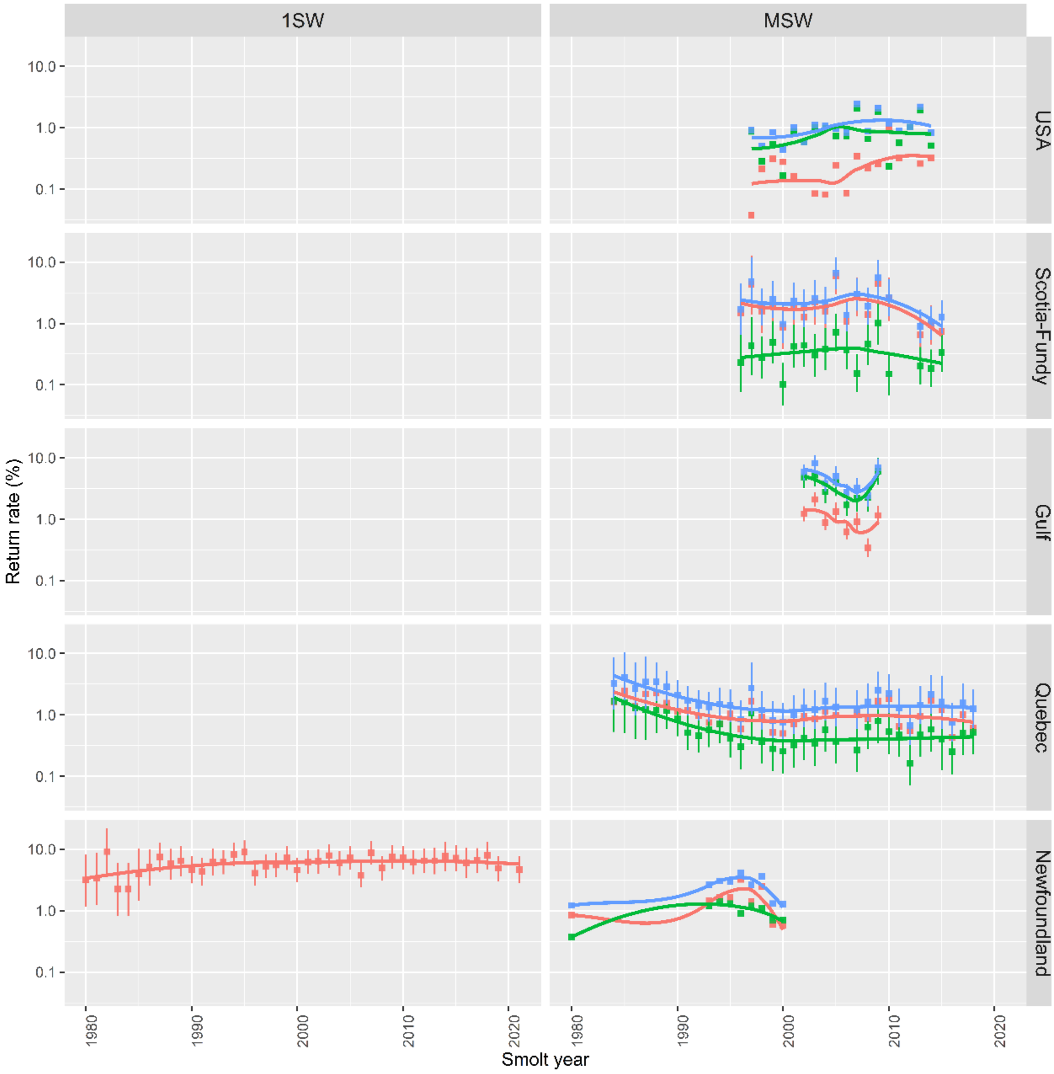


Figure 2.4.6. Annual mean return rates of wild Atlantic salmon by river sea age type (columns) and to 1SW, MSW and for the cohort in six regions of NAC. The annual means (95% confidence interval error bars) are derived from a general linear model (logit transformation) with year and river within region as factors. In the case of the USA and Newfoundland MSW type river, there is only one river in the region and the values shown are the annual point estimates. A Loess smoother (span = 0.9) is shown in each panel for illustration.

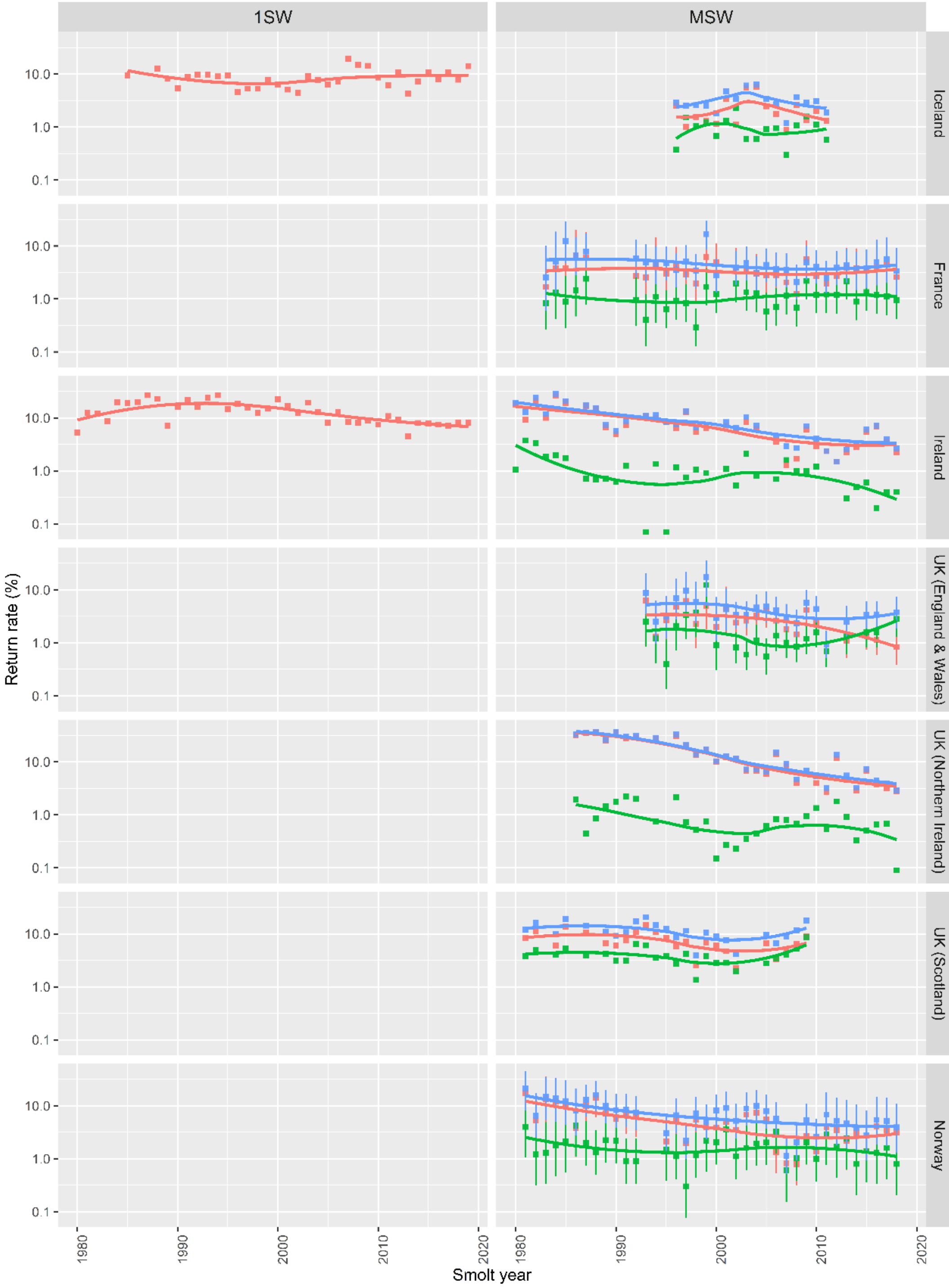


Figure 2.4.7. Annual mean return rates of wild Atlantic salmon by river sea age type (columns) and to 1SW, MSW and for the cohort in seven regions of NEAC. The annual means (95% confidence interval error bars) are derived from a general linear model (logit transformation) with year and river within region as factors. In the case of Iceland, Ireland, UK (Northern Ireland) and UK (Scotland), there is only one river in the region and the values shown are the annual point estimates. A Loess smoother (span = 0.9) is shown in each panel for illustration.

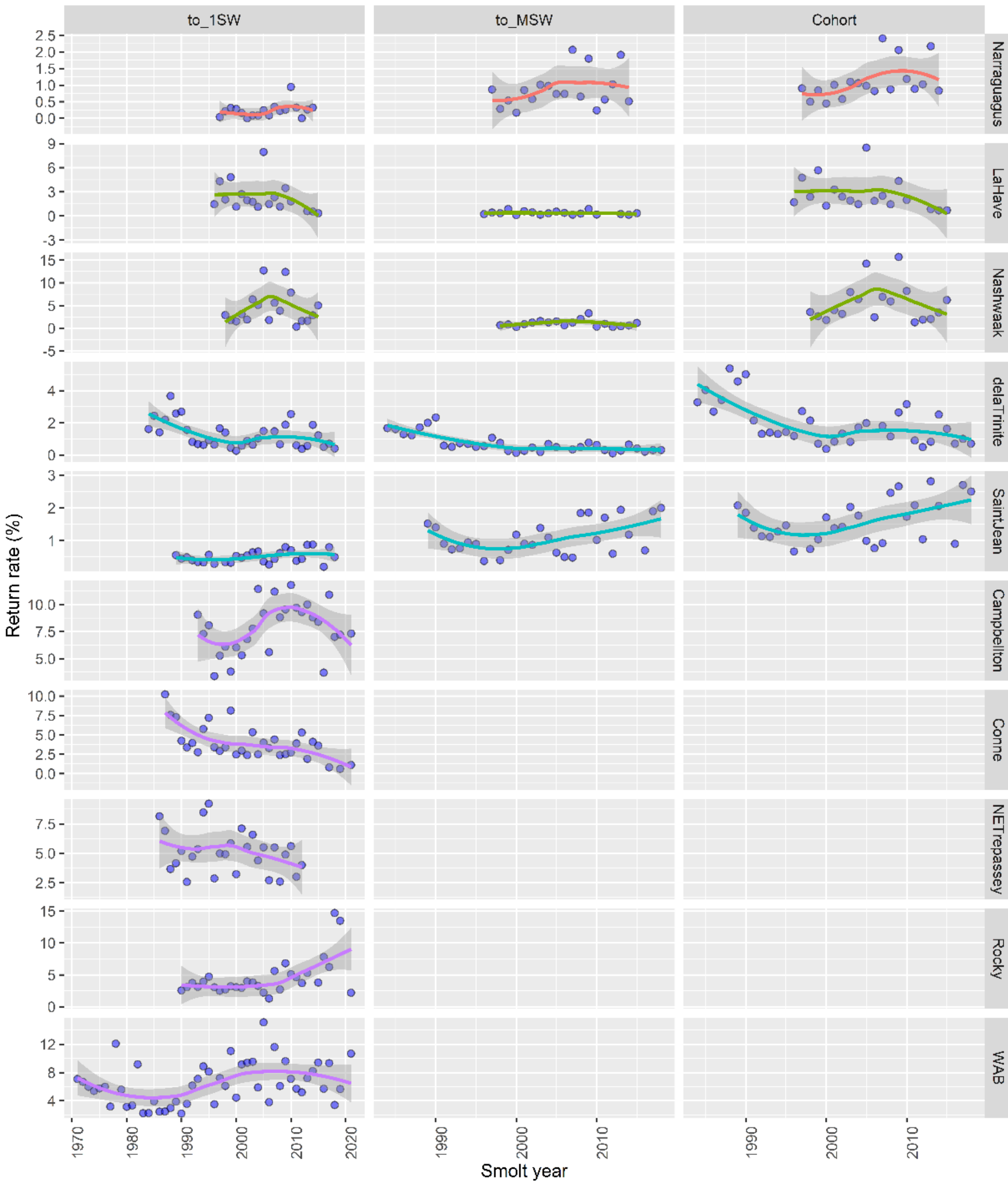


Figure 2.4.8. River-specific trends in return rates of wild Atlantic salmon to monitored rivers of NAC. The rivers are aligned generally south to north by row. A Loess smoother (span = 0.9) is shown in each panel for illustration.

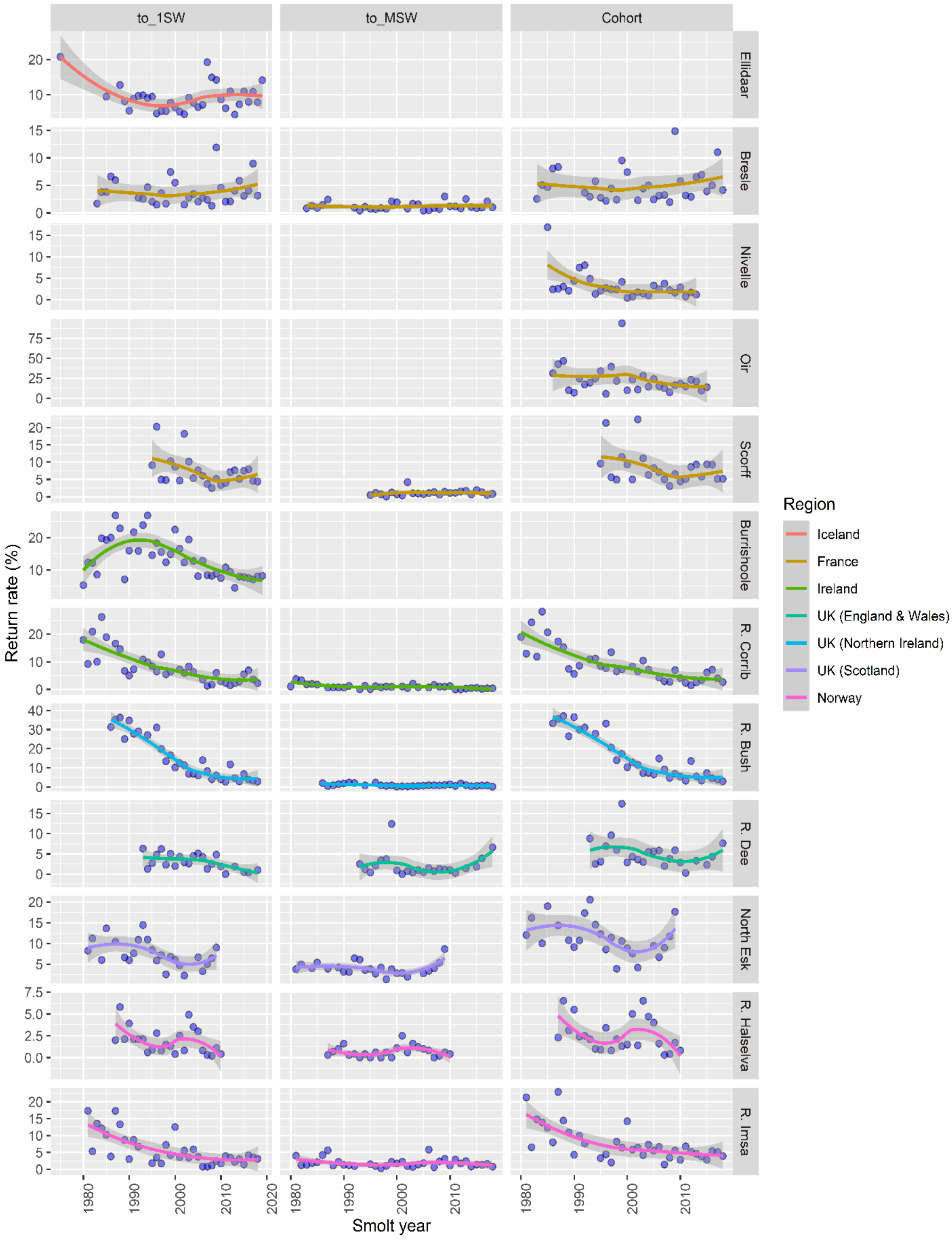


Figure 2.4.9. River-specific trends in return rates of wild Atlantic salmon to monitored rivers of NEAC. The rivers are aligned top to bottom from Iceland, France and north to Norway. A Loess smoother (span = 0.9) is shown in each panel for illustration.

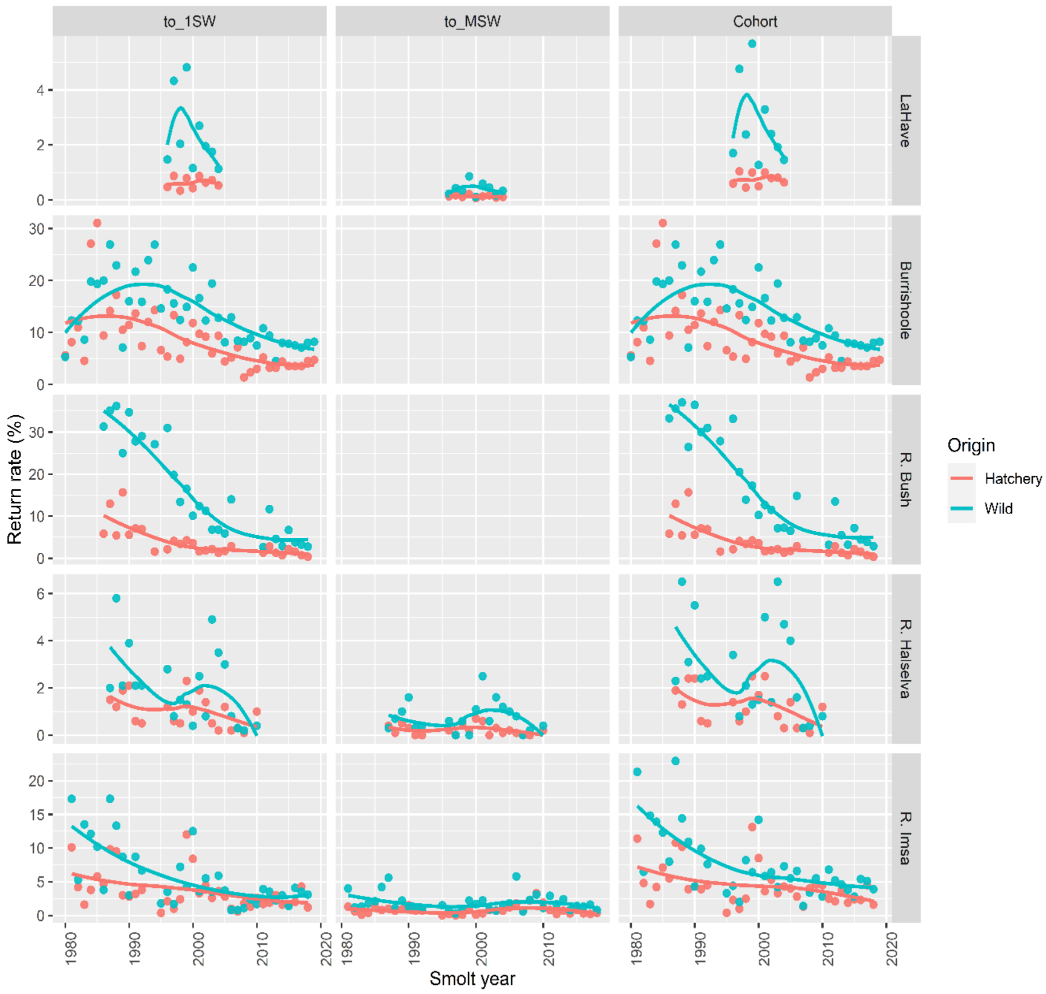


Figure 2.4.10. Examples of trends in returns rates of wild Atlantic salmon smolts and hatchery origin smolts to monitored rivers in the North Atlantic as reported in ICES (2021a).

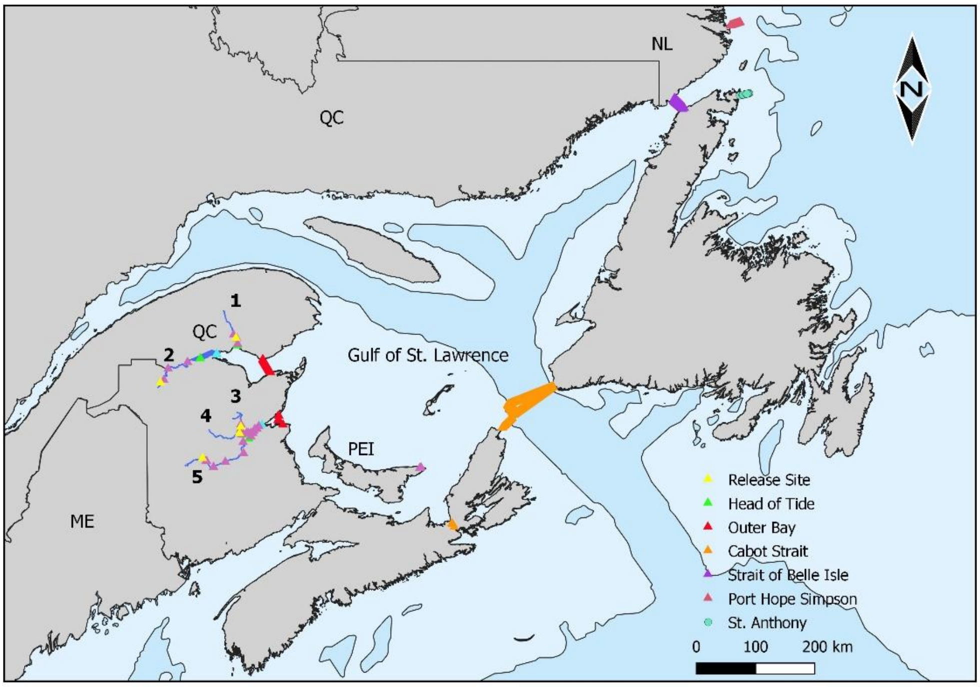


Figure 2.5.1.1. Map of telemetry study area showing study rivers, tag release sites and major receiver arrays. Cascapédia River = 1, Restigouche River = 2, Northwest Miramichi = 3, Little Southwest Miramichi = 4, and Southwest Miramichi = 5.

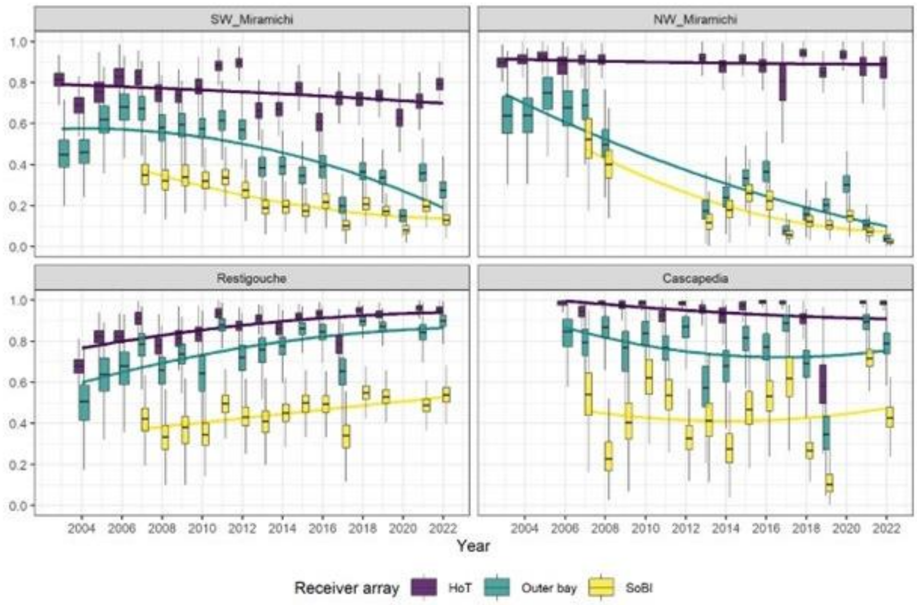


Figure 2.5.1.2. Probability of cumulative smolt survival from four index rivers for the head of tide (HoT), Outer bay and the Gulf of St Lawrence to the exit at the Strait of Belle Isle (SoBI), 2003-2022. Estimates have been standardized for a smolt mean fork length of 14.5 cm.

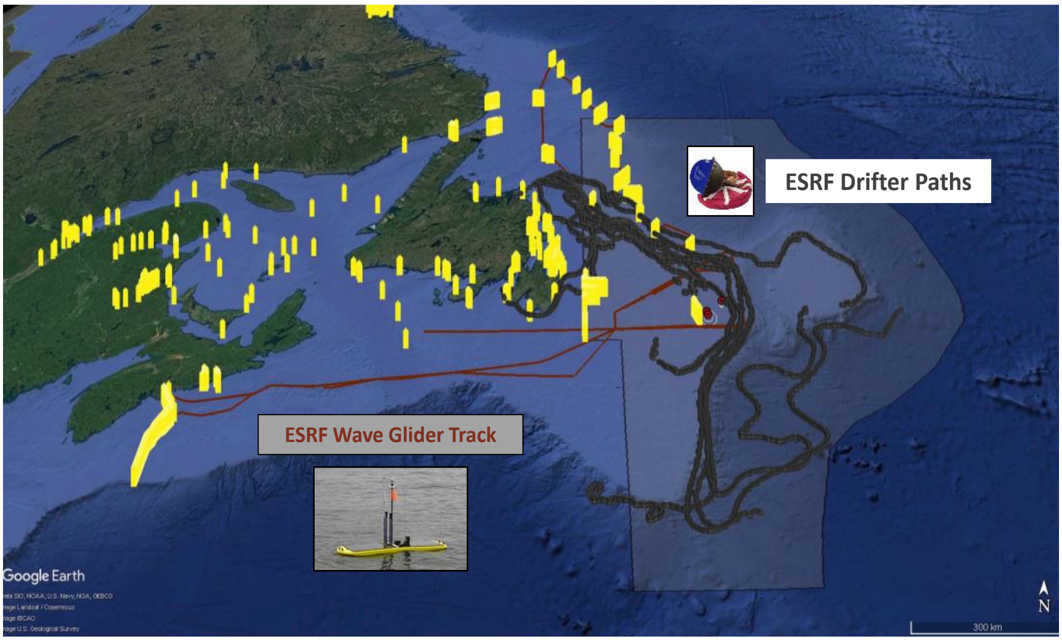


Figure 2.5.2.1. Map of the "Atlantic salmon in the Eastern Canadian offshore regions (ESRF Regions 8 to 15): timing, duration and the effects of environmental variability and climate change" study area. Yellow mark indicate the location of acoustic receivers deployed by project partners, the tracks of the wave glider missions and drifters. The ESRF Regions 8 to 15, the focus area of the study, are highlighted by the shaded polygon.

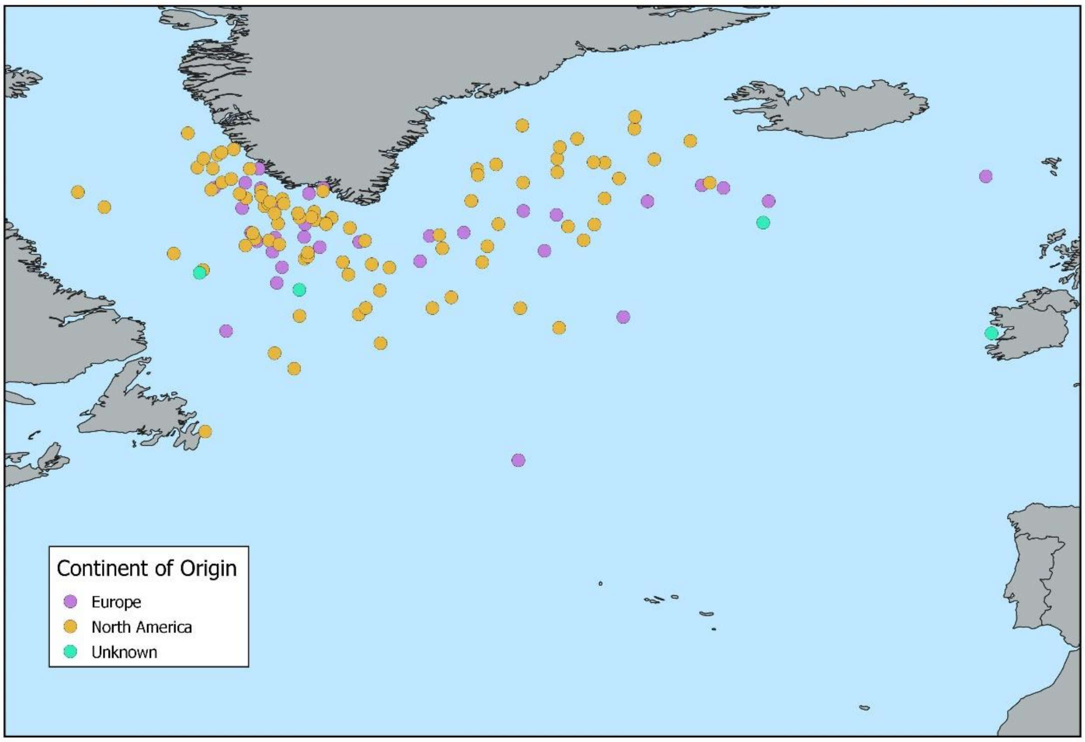


Figure 2.5.5.1. Pop-off location of all PSAT tags released at West Greenland from 2018-2022 by continent of origin. A number of tags released in 2022 may still be active and additional tagging is planned for 2023. Two pop-off locations occur east of the map scale, but projection issues prevented them from being displayed on this map.

3 Northeast Atlantic Commission area

3.1 NASCO has requested ICES to describe the key events of the 2021 and 2022 fisheries

3.1.1 Fishing at Faroe Islands

No fishery for salmon has been prosecuted since 2000.

3.1.2 Key events in NEAC homewater fisheries

In 2021, ICES advised that there were no mixed-stock fisheries options on the NEAC stock complexes at the Faroes for the fishing seasons 2021/2022 to 2023/2024 (ICES, 2021). NASCO subsequently agreed a multiannual (three-year) decision for the Faroes fishery stipulating not to set a quota for these seasons. The measure for 2022/2023 and 2023/2024 was predicated on the application of a Framework of Indicators (FWI) to provide an annual check that there had been no substantive change in the forecasts of abundance. The FWI was not applied in January 2022 as originally planned. However, when the FWI was applied in January 2023, there was no indication that the forecast estimates of abundance for the four NEAC stock complexes in the FWI had been underestimated. There was, therefore, no need for a full reassessment by ICES in 2023.

Norway: The total number of marine fishers actively fishing was 431 in 2021 and 351 in 2022, a notable marked reduction from 2020 (956 marine fishers). The reason for this reduction are changes of the rules for marine fishing for Atlantic salmon from 2021. In 2021, bagnet fishing was banned in coastal areas south of Finnmark. This led to bagnet fishing only being permitted in selected fjords from Troms to Rogaland (the part of Norway facing westwards), and no bagnet fishing at all in the southeastern part of Norway (Agder to the border with Sweden). In Finnmark (the northernmost part of Norway), bagnet and bend-net fishing were banned in the Tana-fjord and adjacent coastal areas, because of the state of the Tana salmon stock. In 2022, bend-net fishing was banned also in Finnmark, leading to this gear no longer being legal to use in Norway. For bagnets the regulations from 2021 was continued in 2022, with minor exceptions.

River Teno/Tana (Finland/Norway): Because of the poor status of salmon populations in the River Teno/Tana (Finland/Norway) in recent years, a total salmon fishing moratorium was implemented for both 2021 and 2022. The salmon fishing ban was also extended to the Tanafjord and nearby Barents Sea coast in Norway.

In addition, any significant impacts of the COVID-19 pandemic on salmon fisheries in NEAC countries in 2021 are summarized in Section 2.3.1. However, such reported impacts were much less extensive than 2020.

3.1.3 Gear and effort

No notable changes in gear type used were reported in 2021 and 2022 (except for the cessation of bend-net fisheries in Finnmark, Norway in 2022), however, changes in effort were recorded. The number of gear units licensed or authorized in several of the NEAC area countries provides a partial measure of effort (Table 3.1.3.1), but does not take into account other restrictions, for example, closed seasons. In addition, there is no indication from these data of the actual number of licences actively utilized or the time each licensee fished.

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 increasingly practicing 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, the number of bagnets and bend-nets in Norway has decreased for the past 15–20 years and in 2021 and 2022, the numbers were substantially reduced from 2020, and the use of bend-nets was phased out in 2022. No effort information is available from Russia since 2020.

The numbers of gear units licensed in UK (England and Wales) and Ireland (Table 3.1.3.1) in 2021-2022 were among the lowest reported in the time-series. In UK (England and Wales), licences were only issued for sea trout fishing and therefore no net fishing for salmon has taken place following the introduction of the National Salmon and Sea Trout Protection byelaws in 2019 in UK (England) with additional restrictions introduced in UK (Wales) in 2020. In UK (Scotland) the numbers of fixed engines, and net and cobles have been among the lowest in the time-series in 2021-2022. For UK (Northern Ireland) driftnet, draft-net, bagnets and boxes decreased throughout the time-series and no commercial fishing activity has occurred in coastal Northern Irish waters since 2012. In France, the number of nets in estuaries and in freshwater have slightly decreased during the latest years. No data for 2021-2022 from freshwater nets were available for France at the time of the Working Group meeting.

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 the River Teno/Tana showed a dramatic decrease in 2017 following a new fishery agreement between Finland and Norway, and all salmon fishing has been closed in 2021-2022. The number of anglers has stayed relatively stable at the River Näätämöjoki in Finland. In the Southern NEAC area, rod licence numbers have decreased in UK (England and Wales), and 2022 showed the lowest figure in the time series. In Ireland, there has been an increase in the numbers of licences issued since 2020. In France, the rod-and-line effort in freshwater has been relatively stable over the latest years, although the figure in 2022 was below long-term averages.

3.1.4 Catches

NEAC area catches are presented in Table 3.1.4.1. The nominal catch in the NEAC area in 2021 (491 t) was lower than the updated catch for 2020 (768 t) and 38% and 47% below the previous five-year (inclusive) and ten-year (inclusive) means, respectively. Provisional nominal catch estimates for 2022 (568 t) indicate that this figure has increased compared to 2021 but is still 28% and 39% below the previous five-year and ten-year means 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.

Both the total nominal catch in Northern NEAC in 2021 (419 t) and provisional total nominal catch in 2022 (510 t) were lower than the updated catch for 2020 (689 t) and the previous five-year and ten-year means (689 t, 760 t, respectively). In the Southern NEAC area, the total nominal catch for 2021 (72 t) and the provisional total nominal catch in 2022 (58 t) were lower than the updated catch for 2020 (79 t) and below the previous five-year (100 t) and ten-year (172 t) means respectively (both means inclusive of 2021). The greatest reductions in catches in Southern NEAC since 2018 were observed in UK (England and Wales) where the catch in 2019 (5 t) was only 12%

of the catch in 2018 (42 t), and the 2020 catch was even lower (3 t). The reduction is largely a result of closure of all net fisheries targeting salmon in this area.

Figure 3.1.4.1 shows the trends in nominal catches of salmon in the Southern and Northern NEAC areas from 1971 to 2022. The catch in the Southern NEAC 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 has steadily decreased by an order of magnitude over the last 20 years, from over 1000 t in 2002 to currently below 100 t. The catch in the Northern NEAC area declined over the time-series, although this decrease was less distinct than the reductions noted in the Southern NEAC area. The catch in the Northern NEAC 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 NEAC area has exhibited a downward trend since and has been consistently below 1000 t since 2012. Thus, the catch in the Southern NEAC area, which comprised around $^2/_3$ of the total NEAC catch in the early 1970s, has been lower than that in the Northern NEAC area since 1999, and has been around $^1/_5$ of the total catch in the NEAC area in recent years.

3.1.5 Catch per unit of effort (CPUE)

CPUE can be influenced by various factors, such as fishing conditions, perceived likelihood of success and experience. Both CPUE of net and rod fisheries might 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, gear-day, licence-tide, trap-month or crew-month.

In the latest years, several CPUE data time-series have been discontinued because of fishery regulations or information being otherwise not available (Tables 3.1.5.1. to 3.1.5.6). Therefore, the Figure 3.1.5.1 shows long-term trends for only eight CPUE datasets in contrast to the 18 trends that were earlier presented from various fisheries in the NEAC area.

In the Northern NEAC area, a general increasing trend was observed for the CPUE in the Norwegian net fisheries (Figure 3.1.5.1). In Finland, the CPUE per angler-season in 2021-2022 has been estimated only for the river Näätämöjoki because of the recent salmon fishery moratorium at the River Teno. The CPUE of the Näätämöjoki rod fishing has been relatively stable over time (Figure 3.1.5.1).

In the Southern NEAC area, UK (England and Wales) measures introduced under the Salmon and Sea Trout Byelaws since 2019 required the closure of several net fisheries and mandatory C&R in others, and therefore, CPUE figures have not been calculated for 2019-2022 (Table 3.1.5.3). The CPUE for the net and coble fisheries in UK (Scotland) show a general decline over the time-series (Figure 3.1.5.1). Another time-series in UK (Scotland) for CPUE has been available from the fixed engine fisheries, but in recent years data exclude both reported catch and effort from the Solway region and therefore CPUE estimates are not available since 2016. (Table 3.1.5.5). The CPUE values for rod fisheries in UK (England and Wales) show a general positive trend (Figure 3.1.5.1) and an increase in 2022 from the previous year (Table 3.1.5.4). In France, the CPUE for rod fisheries shows an overall decline over the time series (Figure 3.1.5.1), and the 2022 figure was slightly lower than in the previous year and the long-term means (Table 3.1.5.1).

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 percentage of 1SW salmon has declined for all countries over the period 1987–2022, especially so for Sweden and Spain. The decline in the percentage of 1SW salmon is evident in both stock complexes, particularly after 2000 (Figure 3.1.6.1). The overall percentage of 1SW fish in Northern NEAC catches remained reasonably consistent in the period 1987–2000 (mean 66%, range 63% to 71%), but has fallen in more recent decades (2001–2022) to 60% (range 53% to 68%), when greater variability among countries and years has also been evident. Comparing the two periods, the percentage of 1SW fish has decreased in Russia, Norway, Finland, and Sweden, whereas an increase is apparent for Iceland. On average, 1SW fish comprise a higher percentage of the catch in Iceland than in the other Northern NEAC countries in the period 2001–2022 (Table 3.1.6.1), this may be related to increased catch and release of MSW fish in Iceland. In the Southern NEAC area, the percentage of 1SW fish in catches averaged 61% (range 49% to 67%) in 1987–2000 and 54% (range 44% to 66%) in 2001–2022. Comparing the two periods, the percentage of 1SW salmon has decreased in all Southern NEAC countries presented (Table 3.1.6.1), especially so for Spain.

3.1.7 Farmed and ranched salmon in catches

The contribution of farmed and ranched salmon to national catches in the NEAC area in 2021 and 2022 was again generally low in most countries. Farmed and ranched fish are included in assessments of the status of national stocks (Section 3.3) for Norway.

The number of farmed salmon that escaped from Norwegian farms in 2021 and 2022 was reported to be approximately 67 000 fish and 56 000 fish (provisional figure) respectively.). Both numbers are well below the average of the previous ten years (141 000 fish). An assessment of the likely effect of these fish on the estimates of PFA has been reported previously (ICES, 2001).

The estimated proportion of farmed salmon in Norwegian angling catches in 2021 and 2022 were the lowest in the time-series (1% in both years), and the proportion in samples taken from Norwegian rivers in autumn in both 2021 and 2022 (4%), were also among the lowest values in the time-series. No data are available for the proportion of farmed salmon in coastal fisheries in Norway. A small number of escaped farmed salmon was also reported from catches in Icelandic rivers in 2021 (five individuals) and 2022 (32 individuals). A small proportion of the catch in UK (Scotland) (0.23% of retained, 0.02 of all catch including catch and released salmon) in 2022 were reported to be of farmed origin.

The release of smolts for commercial ranching purposes ceased in Iceland in 1998 but ranching for rod fisheries in two Icelandic rivers continued in 2021 and 2022. Icelandic catches have traditionally been split into two separate categories, wild and ranched (Table 2.2.2.1). In 2021, 15 t of catch were reported as ranched salmon in contrast to 32 t harvested as wild. In 2022, 21 t of catch were reported as ranched salmon in contrast to 29 t harvested as wild. Similarly, Swedish catches have been split into two separate categories, wild and ranched (Table 2.2.2.1). In 2021, 7 t of catch were reported as ranched salmon in contrast to 4 t harvested as wild. In 2022, 4 t of catch were reported as ranched salmon in contrast to 4 t harvested as wild. Ranching occurs on a much smaller scale in Ireland and UK (Northern Ireland).

3.1.8 National origin of catches

3.1.8.1 Catches of Russian salmon in northern Norway

The Working Group has previously reported on catches of Russian salmon in northern Norway based on results from the Kolarctic Salmon project (Kolarctic ENPI CBC programme 2007–2013) (ICES, 2020). No new information was presented to the Group in 2021.

There was no meeting in 2022 of the Working Group on Atlantic salmon in Finnmark County and the Murmansk Region, established under the Memorandum of Understanding between the Ministry of Climate and Environment (Norway) and the Federal Agency for Fishery (the Russian Federation).

In 2020 the Kolarctic ENI CBC project CoASal "*Conserving our Atlantic salmon as a sustainable resource for people in the North; fisheries and conservation in the context of growing threats and a changing environment* (KO4178)" was started. The project aimed to document and examine the effect of new coastal salmon fishery regulations, study the effects of growing threats Atlantic salmon populations face today with climate change, growing cage culture industry and emerging diseases. Project partners were from Norway: the County Governor of Troms and Finnmark (Lead Partner) and Institute of Marine Research, from Russia: Polar branch of VNIRO (PINRO), from Finland: University of Turku, Biodiversity Unit and from Sweden: Swedish University of Agricultural Sciences. The project was conducted in the period from January 2020 to January 2023. The project was funded through EU's Kolarctic ENI CBC programme, national funding and funding from the partners. The project followed up and built on the results from the "Kolarctic salmon (KO197)" project (2011–2013).

Results from the project have been provisionally reported at a website hosted by the county governor of Troms and Finnmark (https://www.statsforvalteren.no/nb/troms-finnmark/miljo-klima/internasjonalt-samarbeid/atlantisk-laks-i-barentsregionen--atlantic-salmon-in-the-barents-region/). In these reports, the contribution of Russian populations to the coastal fishery in northern Norway is reported and compared to earlier results from the Kolarctic salmon project.

Due to the conflict in Ukraine, Russia's participation in the project was suspended, and no new data or samples were received from Russia.

3.1.9 Exploitation indices of NEAC stocks

Exploitation rates for 1SW and MSW salmon from the Northern NEAC (1983 to 2022) and Southern NEAC (1994 to 2022) areas are displayed 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.

The exploitation rates for 1SW salmon in both Northern NEAC and Southern NEAC areas have shown a general decline over the time-series (Figure 3.1.9.1). There was a notable sharp decline in 2007, as a result of the closure of the Irish driftnet fisheries in the Southern NEAC area, and in 2021 in the Northern NEAC area, in Norway, because of the reduction in effort in the bagnet fisheries as well as the likely influence of the presence of large numbers in pink salmon in the northernmost part of the country. In addition, the cessation of bend-net fisheries in Norway in 2022 also influenced the decline in overall exploitation for Northern NEAC areas. The weighted exploitation rate on 1SW salmon in the Northern NEAC area was 31% in 2021 and 34% in 2022, which was lower than the previous five-year (43%) and ten-year (41%) means. Exploitation on 1SW fish in the Southern NEAC complex was 7% in 2021 and 2022, which was at the same level as the previous five-year mean (8%) but lower than the previous ten-year mean (10%).

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), with a notable sharp decline in 2008 and 2021 in Northern NEAC. Exploitation on MSW salmon in the Northern NEAC area was 35% in 2021 and 2022, which was lower than the previous five-year mean (44%) and the ten-year mean (44%). Exploitation on MSW fish in Southern NEAC was 3% in 2021 and 2022, which was lower than the previous five-year (5%) and ten-year (6%) means.

The rate of change of exploitation of 1SW and MSW salmon in NEAC countries over the time periods 1983 to 2022 for Northern NEAC and 1994 to 2022 for Southern NEAC 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). The greatest rate of decrease in Northern countries was shown for MSW fish in Iceland (Northeast) and 1SW fish in Russia, while lowest rate of decrease was shown for MSW fish in Russia during the time-series. The Southern NEAC countries have also shown a general decrease in exploitation rate (Figure 3.1.9.2) on both 1SW and MSW components, except for 1SW salmon in France where exploitation for 1SW salmon has increased over the time-series. The greatest rate of decrease was shown in UK (England and Wales and Northern Ireland), while France (MSW) and Iceland (both 1SW and MSW) showed relative stability in exploitation rates during the time-series.

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 (England and Wales), UK (Northern Ireland), UK (Scotland), 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 the national level for these countries.

River-specific CLs have also been derived for a number of rivers in Russia and Iceland, 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 their 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 5).

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 of 1st January in the first sea winter and return to home waters). SERs are estimated for maturing and non-maturing 1SW salmon from individual countries as well as the 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 for evaluating the historical status of stocks (e.g. pre-1985), which in many cases have been estimated with less precision.

3.2.2 Progress with setting river-specific conservation limits

3.2.2.1 France

A management-oriented research project (Rénovation de la stratégie de gestion du saumon en Bretagne, RENOSAUM) was undertaken to lay the foundation to revise the rationale of CL setting in Brittany (France) using three decades (1987-2020) of data for 18 salmon rivers. During the project, hierarchical models were built to: (i) estimate the numbers of adult returns and young-of-the-year (YOY) recruitment, (ii) model the exploitation regime of Atlantic salmon by the recreational fishery, and (iii) the generation renewal process for each river.

The new CL definition is based on the premise that conservation should aim at avoiding, i.e. controlling the risk of low recruitment. The CL is set at the egg deposition equivalent to a risk of 25% of producing less than half of the carrying capacity. The CL values are derived from river-specific stock-recruitment (SR) relationships, relating the number of eggs produced by prespawning females (stock) to the abundance of the resulting young-of-the-year juveniles (recruitment). A hierarchical SR model, based on a Beverton-Holt type relationship with a mixture of lognormal process errors, was used for the joint analysis of all populations. Relying on the Bayesian framework for statistical inference, the risk associated to the CLs fully integrates the major sources of uncertainty, which are recruitment stochasticity, measurement errors of the stock and recruitment, and estimation of the SR relationship.

Compared to the previous CLs based on MSY, the new CL values are higher for rivers of low productivity, which means that salmon fisheries management is more cautious for these rivers than before. The new CLs have been implemented for the 18 salmon rivers in Brittany from 2019, and they will be used to assess CL compliance on river-by-river basis and to update the national CL.

3.2.2.2 Finland/Norway

A CL was set for the River Näätämöjoki/Neidenelva, which is a transboundary river that crosses northern Finland and Norway. The CL was estimated as a spawning target following the Norwegian methodology (Forseth *et al*., 2013). Based on the stock-recruitment relationship, the female biomass necessary to attain carrying capacity (yielding average maximum recruitment) was established as a CL for the population. Data compilation and preparations to undertake a CL compliance assessment for the stock are underway in collaboration between Finnish and Norwegian experts.

3.3 Status of stocks

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 1 January in their first winter at sea. The model is generally based on the annual retained catches 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 further to take account of the natural mortality between 1 January 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 regional blocks and is 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/Tana, and the Norwegian catches from this river are not included in the input data for Norway.

A Monte Carlo simulation (9999 resamples) is used to estimate confidence intervals on the stock estimates. Further details of the model are provided in the Stock Annex, including a step-by-step walkthrough of the modelling process.

3.3.2 Changes to the national input data for the NEAC PFA run–reconstruction model

Model inputs are described in detail in Section 2.2 of the Stock Annex. In addition to adding new data for 2021 and 2022, the following changes were made to the national/regional input data for the model:

UK (England andWales): The UK (England and Wales) run-reconstruction model input data for 2020 were updated to account for reduced angling activity due to the coronavirus (COVID-19) pandemic and associated lockdown to prevent its spread. The 2020 data were updated using a statistical model to derive expected angler rod released catch and effort from the preceding six years, as well as revisions to 1SW and MSW salmon catch proportions and exploitation rates along with their error terms.

River Teno/Tana (Finland and Norway): A salmon fishing moratorium was implemented in 2021 and hence there was no reported catch in the 2021 and 2022 fishing seasons. Data from a sonar counter, which is assumed to count 96% of all fish and can separate between 1SW and MSW salmon by length, was used to calculate the numbers of returns. The exploitation rate (illegal fishing) was assumed to be uniformly distributed between 2% and 4%. To implement this in the run-reconstruction model, reported catch was set to one fish for both 1SW and MSW salmon, and the unreported catch was altered accordingly so the total returns produced by the run-reconstruction model would equal the sonar count estimate for the average exploitation rate of 3%. There is currently ongoing work in Finland and Norway to make a Bayesian model for providing better estimates of the number of returns to Teno/Tana.

Ireland: Exploitation rates along with their error terms were revised for 1SW salmon in 2018 to account for reduced recreational angling due to summer drought, and for MSW salmon in 2020 and 2021 to account for reduced recreational angling due to COVID in spring of each year.

Russia: Data on catch numbers, exploitation rates and unreported catch rates were not available to the Working Group for the years 2021 and 2022 for any of the four Russian stock units. In the absence of data, exploitation rates and unreported catch rates together with their associated errors were assumed unchanged from previous years. With respect to catches, the total catch for Russia in wet mass for all stock units and sea ages combined was available for both 2021 (55.38 t) and 2022 (48.82 t) (NASCO, 2023). The ratios of the total catch for Russia in 2021 and 2022 to the mean total catch for the last five years of available stock unit data (2016 to 2020) were used to scale the mean catches by sea age and stock unit for the same five-year period to derive estimated catches for 2021 and 2022.

A variance adjustment parameter was added to the data for each Russian stock unit and sea age. This parameter captures the necessary increase in the variance in return estimates to ensure that they reflect the expected uncertainty arising from the method of estimating catches as described above. The scaling parameters were derived numerically by considering the error between the returns derived from observed catches and the returns derived from catches estimated using the above method applied to the period 2016 to 2020. Additional details on the estimation of catches in 2021 and 2022 and the adjustment to the uncertainty in the returns can be found in Annex 9.

3.3.3 Changes to the NEAC PFA run–reconstruction model

Russia: To accommodate the use of an estimated catch in the absence of observed data, changes were made to the run-reconstruction model to allow for the scaling of the variance in the returns to reflect the additional uncertainty expected from the catch estimation process described in section 3.3.2. Due to the increased uncertainty in the returns, and the way in which spawner abundances are derived, the distribution of spawner abundance estimates in some Russian stock units could include negative values as a result of this change. To prevent this, the distributions of spawner abundance estimates were truncated at a value of 1. Additional details on the estimation of catches in 2021 and 2022 and the adjustment to the uncertainty in the returns can be found in Annex 9.

3.3.4 Description of national stocks and NEAC stock complexes as derived from the NEAC 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) is used to estimate CLs in countries (i.e. Iceland and Russia) that do not provide one based upon river-specific estimates (Section 3.2). This panel also includes the sum of the river-specific CLs where this is used in the assessment.

Tables 3.3.4.1–3.3.4.6 summarize 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 on 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 (as such, it should be noted that the 2021 results are obtained from the 2022 analyses).

In this regard, changes to the data inputs for UK (Scotland) resulted in alterations to the PFA and spawner time-series, and changes to the data inputs for UK (Northern Ireland) and UK (Scotland) resulted in changes in their CL and SER values and those for the Southern NEAC stock complex. For 2021 and 2022, no exploitation occurred in the Teno/Tana owing to fisheries closure, and Russian estimates are derived from total reported catches provided in tonnes (NASCO, 2023) and split into the four Russian regions and the two sea age classes using a method detailed in Annex 9.

Status of stocks is assessed relative to the probability of returns 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 (i.e. above the SER; Section 1.5; 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 period, with the decline more marked in the maturing 1SW stock. In 2021, the numbers of maturing 1SW and non-maturing 1SW recruits (PFA) are at their lowest point since the start of the time-series. The 1SW spawners in the Northern NEAC stock complex have been at full reproductive capacity throughout the time-series with the exception of 2021. MSW spawners, on the other hand, have periodically been at risk of suffering reduced reproductive capacity, but not in the last 10 years (Figure 3.3.4.2).

The status of the two age groups of the Southern 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 for 1SW non-maturing stocks and at risk of suffering reduced reproductive capacity for the 1SW maturing stocks. The status of the two age groups of Southern NEAC stock complex at spawning were considered to be at full reproductive capacity for MSW stocks and suffering reduced reproductive capacity for the 1SW stocks.

The abundances of both maturing 1SW and non-maturing 1SW recruits (PFA) show a general decline over the period (Figure 3.3.4.2). The decline was more marked in the maturing 1SW stock with five of the most recent 10 years being at risk of suffering or suffering reduced reproductive capacity (i.e. below or overlapping the SER). MSW stocks (non-maturing 1SW PFA) were considered to be at full reproductive capacity prior to the commencement of distant-water fisheries in the latest available PFA year (Figure 3.3.4.2). The 1SW spawners in the Southern NEAC stock complex have been mainly at full reproductive capacity throughout the time-series, but in eight of the ten last years have been at risk of suffering or suffering reduced reproductive capacity. In contrast, MSW spawners have been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity for most of the time-series, although they have been at full reproductive capacity for all of the most recent ten years (Figure 3.3.4.2).

3.3.4.1 Individual country stocks

The assessment of PFA against SER (Figure 3.3.4.3a-b) and returns and spawners against CL are shown for individual countries (Figures 3.3.4.4a-b and 3.3.4.5a-b) and by regional blocks (Figures 3.3.4.6a-b and 3.3.4.7a-b) for the most recent PFA and for 2021 (a) and 2022 (b) return years. These assessments show the same broad contrasts between Northern and Southern NEAC stocks as was apparent in the stock complex data.

For all countries in Northern NEAC, 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 most recent PFA years, except for maturing and non-maturing 1SW stocks in the Tana/Teno (Finland and Norway) and 1SW maturing stocks in Russia, which were at risk of suffering or suffering reduced reproductive capacity (Figure 3.3.4.3 a-b). Note that for 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023) and should be taken with caution. Returning and spawning 1SW and MSW stocks in Sweden and Norway as well as 1SW returning stocks in Iceland were at full reproductive capacity in 2021 and 2022. However, both 1SW and MSW returns and spawner stocks in the River Teno/Tana (Finland and Norway) and in Russia were at risk of suffering or suffering reduced reproductive capacity, except for MSW returns in Russia (which are based on data derived from reported catches in NASCO, 2023) which were at full reproductive capacity (Figures 3.3.4.4 a-b and 3.3.4.5 a-b). In addition, 1SW and MSW spawners in Iceland were at risk of suffering or suffering reduced reproductive capacity in 2021 and 2022 (Figures 3.3.4.4 a-b and 3.3.4.5 a-b).

In Southern NEAC, maturing and non-maturing stocks in UK (Northern Ireland), Ireland and France were suffering or at risk of suffering reduced reproductive capacity both prior to the commencement of distant-water fisheries and at spawning (Figures 3.3.4.3–3.3.4.5). 1SW returns and spawners were all suffering reduced reproductive capacity in 2021 and 2022, apart from UK (Scotland). Here, maturing and non-maturing stocks were at full reproductive capacity prior to the commencement of distant water fisheries (Figure 3.3.4.3a-b), and for returns and spawners (Figures 3.3.4.4a-b–3.3.4.5a-b) with the sole exception of MSW spawners in 2021 which were at risk of suffering reduced reproductive capacity (Figure 3.4.4.5a). In addition, in UK (England and Wales), the 1SW maturing stock was suffering reduced reproductive capacity both prior to the commencement of distant water fisheries and at spawning in 2021 and 2022 (Figure 3.3.4.3a-b), whereas the non-maturing 1SW stock and MSW returns and spawners were at full reproductive capacity for both years (Figures 3.3.4.4a-b–3.3.4.5a-b).

Figures 3.3.4.6(a-b) and 3.3.4.7(a-b) 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, for 2021 (a) and 2022 (b).

3.3.5 Compliance with river-specific conservation limits

In the NEAC area, nine jurisdictions have established river-specific CLs. Compliance with these and associated trends per jurisdiction are summarized below and presented in Figure 3.3.5.1 and Tables 3.3.5.1 and 3.3.5.2. Attainment of CLs is assessed based on spawners, after fisheries, unless otherwise indicated.

- 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 (25 including the main stem) since 2013 (with seven to 15 assessed against CL). No stocks met CL prior to 2013. A declining trend is evident in assessed stocks attaining CL from 40% in 2018 to 12% (a single stock) in 2022. The cessation of fisheries since 2021 has reduced the number of stocks available for assessment to eight as there are no catches available to inform stock size.
- 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 182 stocks are assessed since 2009. A mean of 66% of river stocks have met CL over the time-series. In 2021, 71% of assessed stocks met CL, which is the lowest level of attainment since 2014. However, in 2022, 83% of assessed stocks attained CL, albeit with 20 less stocks assessed than the preceding year.
- Since 1999, CLs have been established for 85 river stocks in Russia (Murmansk region). In the period 1999 to 2019, eight of these have been annually assessed for CL attainment, of which 88% have consistently met their CL. However, in 2020, only two stocks were assessed with one of these meeting CL. No data are available for 2021 and 2022.
- Sweden established CLs in 2016 for 23 stocks which rose to 24 stocks since 2017. Eight of the 21 stocks assessed (38%) met CL in 2016. In 2021 and 2022, 13% and 17% of assessed stocks, respectively, met CL, which is lower than the preceding mean attainment of 29%.

- In France, CLs were established for 27 river stocks in 2011, rising to 37 since 2018. A mean of 5% of assessed stocks have met CL over the time-series with 3% attaining CL in 2021 and 0% in 2022. However, note that the number of rivers that met the CL corresponds to the number of rivers for which the TAC have been reached. France will review this methodology for 2024 by assessing the compliance to CL for egg deposition.
- Ireland established CLs for all 141 stocks in 2007, rising to 144 since 2020. The mean percentage of stocks meeting CLs is 36% over the time-series, with the highest attainment of 41% achieved in 2011 and 2012. In 2021 and 2022, 34% and 33% of assessed stocks, respectively, attained CL.
- UK (England and Wales) established CLs in 1993 for 61 rivers, increasing to 64 from 1997 with an overall mean of 41% assessed stocks meeting CL over the time-series. In 2021 and 2022, only 18% and 12%, respectively, of assessed stocks met CL, the latter which is the lowest since assessments began.
- Data on UK (Northern Ireland) river-specific CLs are presented from 2002, when CLs were assigned to ten river stocks. Since 2012, 19 stocks have established CLs with up to 17 of these assessed annually for CL attainment. A mean of 41% have met their CLs over the time-series. A downward trend in CL attainment is evident from 2020 (67%) to 2022 (13%), with 2022 the lowest level of attainment in the time series.
- UK (Scotland) have established CLs for 173 assessment groups (rivers and small groups of rivers) with retrospective assessment conducted to 2011. For domestic management, stock status is expressed as the probability of achieving CL and attainment is set at 60%. Mean attainment over the time-series was 49%. In 2021, the most recent reporting year available, 32% of assessment groups met CL, a decrease of 13% on the two preceding years.

No river-specific CLs have been established for Denmark, Germany and Spain. Iceland has set provisional CLs for several salmon producing rivers representing almost half of the annual catch, and continues to work towards finalizing an assessment process for determining CL attainment.

3.3.6 Return rates

An overview of the trends of marine return rates for wild- and hatchery-reared smolts returning to homewaters (i.e. before homewater exploitation) is presented in Figure 3.3.6.1. The figure shows the proportional change in five-year mean return rates for smolt to 1SW (smolt years 2017-2021, inclusive) and smolt to 2SW (smolt years 2016-2020, inclusive) returns to rivers of Northern and Southern NEAC areas compared to their mean returns for the previous five-year period. It should be noted that: (1) Northern NEAC is represented only by the River Imsa (1SW and 2SW) in Norway, but smolt Passive Integrated Transponder (PIT)-tagging started in three rivers in Norway in 2016 and more rivers are likely to be added in future; (2) the proportional change of return rates for hatchery smolts from Southern NEAC again includes the River Bush from UK (Northern Ireland), together with Ireland and Iceland rivers; and (3) that the scale of change in some rivers is influenced by low return numbers creating high uncertainty, which might have a large consequence on the proportional change.

In Northern NEAC, the recent five-year mean return rate of wild smolts to the River Imsa (Norway) as 1SW returns has increased compared to the previous five-year mean, from 2.85% to 3.54%. In contrast, the 2SW returns have decreased over the same period from 1.84% to 0.90%. The same pattern is seen in hatchery smolts returning to the River Imsa, with 1SW hatchery returns increasing from 2.02% to 3.20% and 2SW hatchery returns decreasing from 0.56% to 0.34%.

In Southern NEAC, the pattern in five-year mean return rate of wild smolts as 1SW returns compared to the previous five-year mean was mixed, with four rivers decreasing and four rivers increasing. The largest decrease was on the Scorff (France), from 6.93% to 4.64%, and the largest increase was on the Ellidaar (Iceland), from 2.33% to 4.54%. The pattern in hatchery smolts returning as 1SW returns compared to the previous five-year mean was also mixed, with three rivers increasing and five rivers decreasing. Five-year mean return rates of wild smolts as 2SW returns decreased compared to the previous five-year mean in all but the Bresle (France) and the River Corrib (Ireland), although the change on the Corrib is influenced by very low return numbers and should be treated cautiously. The largest decrease in wild 2SW returns was again on the Scorff (France), from 1.34% to 0.81%.

The annual return rates for different rivers and experimental facilities are presented in Tables 3.3.6.1 and 3.3.6.2. From these data, least squared (or marginal) mean annual return rates were estimated to provide indices of survival for Northern and Southern NEAC 1SW and 2SW returning adult wild and hatchery salmon groups (Figure 3.3.6.2). To account for variation due to the number of contributing experimental groups, mean annual return rates were estimated using a GLM (Generalized Linear Model) with return rates related to smolt year and river, each as factors, with a quasi-Poisson distribution (log-link function). All reported annual return rates were used to estimate the mean annual return rates, i.e. there was no restriction on the numbers of years reported, to ensure the maximum number of rivers could contribute. Note that estimated year effects are presented on a log-scaled y-axis.

Return rates of wild and hatchery smolts to Northern NEAC are variable (additional information is provided in Section 2.4). They have generally decreased since 1980, although rates of 1SW returns from wild smolts have stabilized since 2010, and from hatchery smolts have increased since 2005 (Figure 3.3.6.2). Rates of 2SW returns from wild and hatchery smolts to Northern NEAC are also highly variable, but have continued to decline in the most recent years, especially for wild smolts. Mean return rates of wild and hatchery smolts to Southern NEAC are less variable, primarily because they are estimated from more rivers. They too have generally decreased since 1980, although also appear to have stabilized since 2010 with an upward trend in rates of 2SW returns from wild smolts apparent since 2005.

The overall 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 that abundance is strongly influenced by factors in the marine environment.

3.4 Advice on the risks of salmon bycatch occurring in pelagic and coastal fisheries and effectiveness and adequacy of current bycatch monitoring programmes

The following is a summary in response to ToR Question 2.4. The corresponding report is in Annex 10.

There are two main methods of analysing the risk of bycatch for salmon.

First, through the **risk of exposure.** This is defined as the risk of salmon being in the same place as commercial vessels with a specific gear type or targeting a particular species that is likely to intercept (catch or kill) salmon, and at a depth where the salmon would be. This approach to analysing risk requires the identification of fisheries that will have a higher risk of overlap in space and time with known salmon migration (e.g. Table 4 from the report in Annex 10). Using the matrix of fisheries with higher overlap, an exposure analysis of fishing effort from at-risk fisheries needs to be modelled with information on the at-sea salmon probability of presence (e.g. Queiroz et al., 2019).

Second, salmon bycatch **risk to stock** can be analysed. ICES Working Group on Bycatch (WGBYC) developed a Bycatch Evaluation and Assessment Matrix (BEAM) which considers species abundance estimates, species variability in space, gear capture variability, and species density (Appendix 3; ICES 2022b). This method could be applied to salmon taking into consideration spatial-temporal variability at a finer resolution given their migration routes. It has, however, been reported that for species with very low detectability such as salmon the BEAM process may not be sufficiently robust.

ICES (2004) recommended that knowledge of the migration routes of salmon needed to be improved. Much progress has been made in this area (e.g. Gilbey et al., 2021; Rikardsen et al., 2021), but gaps in describing their precise migration still exist. For example, the migration routes and time spent in areas such as the North Sea, and the Barents Sea are unknown. Furthermore, although the Norwegian Sea is an important migratory pathway for post-smolt originating in southern NEAC areas, it is not known if other important migration pathways may be used for a proportion of the post-smolts. Information on adult migration is also scarce.

Equally, since the ICES Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries (SGBYSAL) undertook an analysis of pelagic fisheries bycatch of Atlantic salmon (ICES, 2004), the Working Group has reviewed pelagic and coastal fisheries bycatch risk. It should be noted that because gear and métier (including targeted fisheries) -specific fisheries data were not available at the time of writing this text, certain fisheries may have been missed. From our review, it was clear that at present salmon are caught as bycatch in coastal areas when they migrate to and from their natal rivers, but insufficient information exists on coastal fisheries to be able to evaluate coastal bycatch risk (Sumner, 2015; Elliott et al., 2023).

To understand how bycatch is being monitored and the effectiveness of that monitoring, existing national programmes and whether these programmes were efficient at detecting and reporting salmon bycatch were reviewed. Although nation-specific onboard and onshore fisheries observer programs exist, salmon bycatch monitoring appears to be more complex to appropriately record than that for larger marine mammals, birds, and reptiles (ICES, 2019b). For example:

- For pelagic fisheries few catches are monitored for bycatch, and this monitoring normally only screens a small proportion of the total catch. This is in part due to the nature of those fisheries (catching 100s of tonnes of a specific species), and in part due to the difficulties of detecting salmon among other pelagic fish in the catch (ICES, 2023b)
- At present monitoring programs focus more on demersal fisheries which are known to have high overall bycatch levels, albeit less likely to capture pelagic salmon.
- It is difficult to obtain sufficient information on the country and fishery-specific observer effort (e.g. number of observed vessel-day/total days fished, per fishery/year). In addition, this information is variable between countries but seldom exceeds 5% of a nation's total annual fishing effort (https://datacollection.jrc.ec.europa.eu/wp/2020-2021).
- There appears to be underreporting of bycatch. For example, it has been noted that salmon and diadromous fish in general, may not be reported at present through national sampling programs (Annex 10, Report Section 2.2.6.1; Charbonnel et al., 2022; 2023).
- It should also be noted that access to bycatch records and precise monitoring methods can be difficult to obtain and in numerous cases these were not available to the Working Group at the time of writing this report.

From the information collated on pelagic fisheries, a qualitative bycatch risk of exposure matrix was initiated taking into consideration certainty (Table 4 from this chapter). Too little information was available to include coastal fisheries risk of exposure to the matrix. It should also be noted that since spatial and temporal gear and métier-specific data were not available at the time of writing the report, certain fisheries may have been missed in the matrix. From the exposure matrix, the mackerel fishery, during summer in the Norwegian Sea and south of Iceland is a high-risk fishery because of multiple levels of bycatch recorded and its overlap in space, depth, and time with migration routes and feeding areas for salmon. Furthermore, the total landings of mackerel caught in the Norwegian Sea has increased the last 10-15 years. In addition, there is a medium risk of bycatch in the fishery for herring and blue whiting in the Norwegian Sea, for herring and sandeel in the North Sea, and for capelin in the Barents Sea, horse mackerel west of the British Isles and sardine and anchovy in the Bay of Biscay.

From this review of literature on salmon bycatch the Working Group has identified the following data deficiencies, monitoring needs and research requirements:

1. Improved understanding of post-smolt and adult salmon migration route in time.
2. Move to a quantitative analysis of the risk of exposure and bycatch risk to stocks which requires access to gear and fisheries specific fishing effort data (both inshore and offshore data) at an ICES rectangle by month.
3. Include salmon on ICES WGBYC list of species and data calls. The WGBYC undertake data calls for the data required to analyse bycatch that WGNAS does not have access to. The WGBYC also undertakes similar and overlapping analysis.
4. Standardize salmon bycatch monitoring programmes across countries, including minimum effort per fishery and standards for data recording and reporting.
5. Improve at-sea and onshore observer screening, including better salmon identification guidance. Minimum data to be collected are: date, fishery, catch location, number of salmon bycatch, fork length (preferably) and/or weight. The screening of discards from factories should also be explored (recommendation from ICES, 2004) by having close collaborations with factories operators.
6. Since at present bycatch data collection is difficult to access, eDNA data collection from scientific and commercial pelagic trawls may help improve detection of salmon and improve knowledge of their migratory pathways. Uncertainty estimates from these analyses are required.

Table 3.1.3.1.a. Number of gear units licensed or authorized by country and gear type (UK (England & Wales, Scotland, N.Ireland); Ireland; France)

Year	UK (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	Commercial nets in freshwater (5)	Driftnet licences in estu-ary (6,7)
1971	437	230	294	79	-	3080	800	142	305	18	916	697	213	10 566	-	-	-
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	11 660	-	-	-
1974	280	240	329	69	-	3188	782	129	307	18	1048	681	211	12 845	-	-	-
1975	269	243	341	69	-	2985	773	127	314	20	1046	672	212	13 142	-	-	-
1976	275	247	355	70	-	2862	760	126	287	18	1047	677	225	14 139	-	-	-
1977	273	251	365	71	-	2754	684	126	293	19	997	650	211	11 721	-	-	-
1978	249	244	376	70	-	2587	692	126	284	18	1007	608	209	13 327	-	-	-
1979	241	225	322	68	-	2708	754	126	274	20	924	657	240	12 726	-	-	-
1980	233	238	339	69	-	2901	675	125	258	20	959	601	195	15 864	-	-	-
1981	232	219	336	72	-	2803	655	123	239	19	878	601	195	15 519	-	-	-
1982	232	221	319	72	-	2396	647	123	221	18	830	560	192	15 697	4145	55	82
1983	232	209	333	74	-	2523	668	120	207	17	801	526	190	16 737	3856	49	82

Year	UK (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	Commercial nets in freshwater (5)	Driftnet licences in estuary (6,7)
1984	226	223	354	74	-	2460	638	121	192	19	819	515	194	14 878	3911	42	82
1985	223	230	375	69	-	2010	529	122	168	19	827	526	190	15 929	4443	40	82
1986	220	221	368	64	-	1955	591	121	148	18	768	507	183	17 977	5919	58 (8)	86
1987	213	206	352	68	-	1679	564	120	119	18	768	507	183	17 977	5724 (9)	87 (9)	80
1988	210	212	284	70	-	1534	385	115	113	18	836	507	183	11 539	4346	101	76
1989	201	199	282	75	-	1233	353	117	108	19	801	507	183	16 484	3789	83	78
1990	200	204	292	69	-	1282	340	114	106	17	756	525	189	15 395	2944	71	76
1991	199	187	264	66	-	1137	295	118	102	18	707	504	182	15 178	2737	78	71
1992	203	158	267	65	-	851	292	121	91	19	691	535	183	20 263	2136	57	71
1993	187	151	259	55	-	903	264	120	73	18	673	457	161	23 875	2104	53	55
1994	177	158	257	53	37 278	749	246	119	68	18	732	494	176	24 988	1672	14	59
1995	163	156	249	47	34 941	729	222	122	68	16	768	512	164	27 056	1878	17	59
1996	151	132	232	42	35 281	643	201	117	66	12	778	523	170	29 759	1798	21	69

Year	UK (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	Commercial nets in freshwater (5)	Driftnet licences in estuary (6,7)
1997	139	131	231	35	32 781	680	194	116	63	12	852	531	172	31 873	2953	10	59
1998	130	129	196	35	32 525	542	151	117	70	12	874	513	174	31 565	2352	16	63
1999	120	109	178	30	29 132	406	132	113	52	11	874	499	162	32 493	2225	15	61
2000	110	103	158	32	30 139	381	123	109	57	10	871	490	158	33 527	2037	16	51
2001	113	99	143	33	24 350	387	95	107	50	6	881	540	155	32 814	2080	18	63
2002	113	94	147	32	29 407	426	102	106	47	4	833	544	159	35 024	2082	18	65
2003	58	96	160	57	29 936	363	109	105	52	2	877	549	159	31 809	2048	18	60
2004	57	75	157	65	32 766	450	118	90	54	2	831	473	136	30 807	2158	15	62
2005	59	73	148	65	34 040	381	101	93	57	2	877	518	158	28 738	2356	16	59
2006	52	57	147	65	31 606	364	86	107	49	2	875	533	162	27 341	2269	12	57
2007	53	45	157	66	32 181	238	69	20	12	2	0	335	100	19 986	2431	13	59
2008	55	42	130	66	33 900	181	77	20	12	2	0	160	0	20 061	2401	12	56
2009	50	42	118	66	36 461	162	64	20	12	2	0	146	38	18 314	2421	12	37
2010	51	40	118	66	36 159	189	66	2	1	2	0	166	40	17 983	2200	12	33

Year	UK (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	Commercial nets in freshwater (5)	Driftnet licences in estuary (6,7)
2011	53	41	117	66	36 991	201	74	2	1	2	0	154	91	19 899	2540	12	29
2012	51	34	115	73	35 135	237	79	1	1	2	0	149	86	19 588	2799	12	25
2013	49	29	111	62	33 301	238	59	0	0	0	0	181	94	19 109	3010	12	25
2014	48	34	109	65	31 605	204	56	0	0	0	0	122	37	18 085	2878	12	20
2015	52	33	102	63	30 847	127	65	0	0	0	0	100	6	18 460	2850	12	20
2016	49	34	105	62	30 214	13	43	0	0	0	0	98	4	18 303	3015	19	20
2017	46	32	112	57	35 162	10	41	0	0	0	0	105	5	18 212	4214	20	20
2018	38	30	87	57	31 655	0	26	0	0	0	0	97	8	16 755	3937	19	20
2019 (10)	14	13	60	49	29 126	2	18	0	0	0	0	67	10	17 238	3786	19	20
2020	17	13	64	43	28 387	3	17	0	0	0	0	68	10	14 138	3379	19	17
2021	17	15	73	40	23 530	11	34	0	0	0	0	87	10	15 547	3526	-	17
2022	16	14	61	39	21 574	0	19	0	0	0	0	76	18	16 407	3237	-	17
Mean																	
2017-2021	26	21	79	49	29 572	5	27	0	0	0	0	85	9	16 378	3768	19	17

Year	UK (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	Commercial nets in freshwater (5)	Driftnet licences in estuary (6,7)
% change (3)	-38.5	-33.3	-22.8	-20.4	-27.0	-100.0	-29.6	0.0	0.0	0.0	0.0	-10.6	100.0	0.2	-14.1	-	-10.5
Mean																	
2012-2021	38	27	94	57	30 896	84	44	0	0	0	0	107	27	17 544	3339	16	20
% change (3)	-57.9	-59.4	-38.2	-30.6	-14.0	-100.0	-56.8	0.0	0	0.0	0.0	-29.0	-33.3	-6.5	-3.1	-	-15.0

Notes:

1. Number of gear units expressed as trap months.
2. Number of gear units expressed as crew months.
3. (2022/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 fishers or boats using driftnets: overestimates the actual number of fishers 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.
10. Allowable effort in 2019 was zero throughout England and 1025 days were utilized in Wales

Table 3.1.3.1.b. Number of gear units licensed or authorized by country and gear type (Norway; Finland; Russia)

Year	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational Fishery Tourist anglers		Local rod and net fishery (fishers)	Recreational fishery (fishers)		Commercial number of gears	
	Bagnet	Bend-net	Lift-net	Driftnet (No. nets)	Fishing days	Fishers			Catch and release (fishing days)	Coastal	In-river
1971	4608	2421	26	8976	-	-	-	-	-	-	-
1972	4215	2367	24	13 448	-	-	-	-	-	-	-
1973	4047	2996	32	18 616	-	-	-	-	-	-	-
1974	3382	3342	29	14 078	-	-	-	-	-	-	-
1975	3150	3549	25	15 968	-	-	-	-	-	-	-
1976	2569	3890	22	17 794	-	-	-	-	-	-	-
1977	2680	4047	26	30 201	-	-	-	-	-	-	-
1978	1980	3976	12	23 301	-	-	-	-	-	-	-
1979	1835	5001	17	23 989	-	-	-	-	-	-	-
1980	2118	4922	20	25 652	-	-	-	-	-	-	-
1981	2060	5546	19	24 081	16 859	5742	677	467	-	-	-
1982	1843	5217	27	22 520	19 690	7002	693	484	-	-	-
1983	1735	5428	21	21 813	20 363	7053	740	587	-	-	-
1984	1697	5386	35	21 210	21 149	7665	737	677	-	-	-

Year	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational Fishery Tourist anglers		Local rod and net fishery (fishers)	Recreational fishery (fishers)		Commercial number of gears	
	Bagnet	Bend-net	Lift-net	Driftnet (No. nets)	Fishing days	Fishers			Catch and release (fishing days)	Coastal	In-river
1985	1726	5848	34	20 329	21 742	7575	740	866	-	-	-
1986	1630	5979	14	17 945	21 482	7404	702	691	-	-	-
1987	1422	6060	13	17 234	22 487	7759	754	689	-	-	-
1988	1322	5702	11	15 532	21 708	7755	741	538	-	-	-
1989	1888	4100	16	0	24 118	8681	742	696	-	-	-
1990	2375	3890	7	0	19 596	7677	728	614	-	-	-
1991	2343	3628	8	0	22 922	8286	734	718	1711	-	-
1992	2268	3342	5	0	26 748	9058	749	875	4088	-	-
1993	2869	2783	-	0	29 461	10 198	755	705	6026	59	199
1994	2630	2825	-	0	26 517	8985	751	671	8619	60	230
1995	2542	2715	-	0	24 951	8141	687	716	5822	55	239
1996	2280	2860	-	0	17 625	5743	672	814	6326	85	330
1997	2002	1075	-	0	16 255	5036	616	588	6355	68	282
1998	1865	1027	-	0	18 700	5759	621	673	6034	66	270

Year	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational Fishery Tourist anglers		Local rod and net fishery (fishers)	Recreational fishery (fishers)		Commercial number of gears	
	Bagnet	Bend-net	Lift-net	Driftnet (No. nets)	Fishing days	Fishers			Catch and release (fishing days)	Coastal	In-river
1999	1649	989	-	0	22 935	6857	616	850	7023	66	194
2000	1557	982	-	0	28 385	8275	633	624	7336	60	173
2001	1976	1081	-	0	33 501	9367	863	590	8468	53	121
2002	1666	917	-	0	37 491	10 560	853	660	9624	63	72
2003	1664	766	-	0	34 979	10 032	832	644	11 994	55	84
2004	1546	659	-	0	29 494	8771	801	657	13 300	62	56
2005	1453	661	-	0	27 627	7776	785	705	20 309	93	69
2006	1283	685	-	0	29 516	7749	836	552	13 604	62	72
2007	1302	669	-	0	33 664	8763	780	716		82	53
2008	957	653	-	0	31 143	8111	756	694		66	62
2009	978	631	-	0	29 641	7676	761	656		79	72
2010	760	493	-	0	30 646	7814	756	615		55	66
2011	767	506	-	0	31 269	7915	776	727		78	52
2012	749	448	-	0	32 614	7930	785	681		72	53

Year	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational Fishery Tourist anglers		Local rod and net fishery (fishers)	Recreational fishery (fishers)		Commercial number of gears	
	Bagnet	Bend-net	Lift-net	Driftnet (No. nets)	Fishing days	Fishers			Catch and release (fishing days)	Coastal	In-river
2013	786	459	-	0	33 148	8074	785	558		110	71
2014	700	436	-	0	32 852	7791	746	396		57	74
2015	724	406	-	0	33 435	7809	765	232		81	62
2016	798	438	-	0	31 923	7273	712	512		42	59
2017	854	419	-	0	10 074	2468	506	405		29	54
2018	900	411	-	0	10 556	2586	507	512		56	58
2019	936	418	-	0	10 476	2931	481	524		53	25
2020	975	419	-	0	10 360	2462	490	541		41	22
2021	522	212	-	0	0	0	0	557		-	-
2022	461	0	-	0	0	0	0	509		-	-
Mean											
2017-2021	837	376		0	8293	2089	397	508		45	40
% change (3)	-44.9	-100		0.0	-100.0	-100.0	-100.0	0.2		-	-
Mean											

Year	Norway				Finland				Russia		
					The Teno River			R. Näätämö	Kola Peninsula	Archangel region	
					Recreational Fishery Tourist anglers		Local rod and net fishery (fishers)	Recreational fishery (fishers)		Commercial number of gears	
	Bagnet	Bend-net	Lift-net	Driftnet (No. nets)	Fishing days	Fishers			Catch and release (fishing days)	Coastal	In-river
2012-2021	794	407		0	20 544	4932	578	492		60	53
% change (3)	-41.9	-100		0.0	-100.0	-100.0	-100.0	3.5		-	-

Notes:

3. (2022/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), 1960–2022 (2022 figures are provisional).

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area (3)	International waters (4)
1960	2641	2899	-	-	5540	-	-
1961	2276	2477	-	-	4753	-	-
1962	3894	2815	-	-	6709	-	-
1963	3842	2434	-	-	6276	-	-
1964	4242	2908	-	-	7150	-	-
1965	3693	2763	-	-	6456	-	-
1966	3549	2503	-	-	6052	-	-
1967	4492	3034	-	-	7526	-	-
1968	3623	2523	5	403	6554	-	-
1969	4383	1898	7	893	7181	-	-
1970	4048	1834	12	922	6816	-	-
1971	3736	1846	-	471	6053	-	-
1972	4257	2340	9	486	7092	-	-
1973	4604	2727	28	533	7892	-	-
1974	4352	2675	20	373	7420	-	-
1975	4500	2616	28	475	7619	-	-

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area (3)	International waters (4)
1976	2931	2383	40	289	5643	-	-
1977	3025	2184	40	192	5441	-	-
1978	3102	1864	37	138	5141	-	-
1979	2572	2549	119	193	5433	-	-
1980	2640	2794	536	277	6247	-	-
1981	2557	2352	1025	313	6247	-	-
1982	2533	1938	606	437	5514	-	-
1983	3532	2341	678	466	7017	-	-
1984	2308	2461	628	101	5498	-	-
1985	3002	2531	566	-	6099	-	-
1986	3595	2588	530	-	6713	-	-
1987	2564	2266	576	-	5406	2554	-
1988	3315	1969	243	-	5527	3087	-
1989	2433	1627	364	-	4424	2103	-
1990	1645	1775	315	-	3735	1779	180-350
1991	1145	1677	95	-	2917	1555	25-100

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area (3)	International waters (4)
1992	1524	1806	23	-	3353	1825	25-100
1993	1443	1853	23	-	3319	1471	25-100
1994	1896	1684	6	-	3586	1157	25-100
1995	1775	1503	5	-	3283	942	-
1996	1394	1358	-	-	2752	947	-
1997	1112	962	-	-	2074	732	-
1998	1120	1099	6	-	2225	1108	-
1999	934	1139	0	-	2073	887	-
2000	1210	1518	8	-	2736	1135	-
2001	1242	1634	0	-	2876	1089	-
2002	1135	1360	0	-	2496	946	-
2003	908	1394	0	-	2303	719	-
2004	919	1059	0	-	1978	575	-
2005	809	1189	0	-	1998	605	-
2006	650	1217	0	-	1867	604	-
2007	372	1036	0	-	1407	465	-
2008	355	1178	0	-	1533	433	-

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area (3)	International waters (4)
2009	266	898	0	-	1164	317	-
2010	410	1003	0	-	1414	357	-
2011	410	1009	0	-	1419	382	-
2012	295	955	0	-	1250	363	-
2013	310	770	0	-	1080	272	-
2014	217	736	0	-	953	256	-
2015	222	859	0	-	1081	298	-
2016	186	842	0	-	1028	298	-
2017	151	863	0	-	1015	318	-
2018	125	804	0	-	929	279	-
2019	76	671	0	-	747	237	-
2020	79	689	0	-	768	238	-
2021	72	419	0	-	491	134	-
2022	58	510	0	-	568	174	-
Mean							
2017–2021	100	689	0	-	790	241	-
2012–2021	173	760	0	-	934	269	-

Notes:

1. All Iceland catches have 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, Näätämö), France, and UK (N. Ireland) (Bush).

Year	Finland (R. Teno)		Finland (R. Näätämö)		France	UK (N. Ireland) (Bush)
	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (number)	Catch per rod day (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

Year	Finland (R. Teno)		Finland (R. Näätämö)		France	UK (N. Ireland) (Bush)
	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (number)	Catch per rod day (number)
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	0.27
2000	5.0	1.5	0.9	0.2	1.06	0.26
2001	5.9	1.7	1.2	0.3	0.97	0.44
2002	3.1	0.9	0.7	0.2	0.84	0.18

Year	Finland (R. Teno)		Finland (R. Näätämö)		France	UK (N. Ireland) (Bush)
	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (number)	Catch per rod day (number)
2003	2.6	0.7	0.8	0.2	0.76	0.24
2004	1.4	0.4	0.9	0.2	1.25	0.25
2005	2.7	0.8	1.3	0.2	0.74	0.32
2006	3.4	1.0	1.9	0.4	0.89	0.46
2007	2.9	0.8	1.0	0.2	0.74	0.60
2008	4.2	1.1	0.9	0.2	0.77	0.46
2009	2.3	0.6	0.7	0.1	0.50	0.14
2010	3.0	0.8	1.3	0.2	0.87	0.23
2011	2.4	0.6	1.0	0.2	0.65	0.12
2012	3.6	0.9	1.7	0.4	0.61	0.15
2013	2.5	0.6	0.7	0.2	0.57	0.27
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	0.60	0.05
2017	5.7	1.4	0.8	0.2	0.35	-
2018	2.6	0.6	0.9	0.2	0.25	-

Year	Finland (R. Teno)		Finland (R. Näätämö)		France	UK (N. Ireland) (Bush)
	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (kg)	Catch per angler day (kg)	Catch per angler season (number)	Catch per rod day (number)
2019	2.7	0.8	1.3	0.3	0.31	-
2020	3.2	0.8	0.7	0.2	0.28	-
2021	n/a (3)	n/a (3)	0.5	0.1	0.27	-
2022	n/a (3)	n/a (3)	0.8	0.2	0.22	-
Mean (2)	**3.1**	**1.0**	**1.0**	**0.2**	**0.7**	**0.3**
2017–2021	**3.6**	**0.9**	**0.8**	**0.2**	**0.3**	**-**

Notes:

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

2. Mean of the time-series.

3. For the 2021 and 2022 seasons, all salmon fishing has been closed at R. Teno / Tana including the entire catchment.

Table 3.1.5.2. CPUE for salmon in coastal and in-river fisheries the Archangelsk region (tonnes/gear) and catch and release rod fishery (fish/rod-day) in rivers of the Russian Kola peninsula.

Year	Archangelsk region commercial fishery		Barents Sea basin			White Sea basin
	Coastal	In-river	Rynda	Kharlovka	Eastern Litsa	Ponoi
1992			2.37	1.45	2.95	4.50
1993	0.34	0.04	1.18	1.46	1.59	3.57
1994	0.35	0.05	0.71	0.85	0.79	3.30
1995	0.22	0.08	0.49	0.78	0.94	3.77
1996	0.19	0.02	0.70	0.85	1.31	3.78
1997	0.23	0.02	1.20	0.71	1.09	6.09
1998	0.24	0.03	1.01	0.55	0.75	4.52
1999	0.22	0.04	0.95	0.77	0.93	3.30
2000	0.28	0.03	1.35	0.77	0.89	3.55
2001	0.21	0.04	1.48	0.92	1.00	4.35
2002	0.21	0.11	2.39	0.99	0.89	7.28
2003	0.16	0.05	1.16	1.14	1.04	8.39
2004	0.25	0.08	1.07	0.98	1.31	5.80
2005	0.17	0.08	1.18	0.82	1.63	4.42
2006	0.19	0.05	0.92	1.46	1.46	6.28
2007	0.14	0.09	0.92	0.78	1.46	5.96

Year	Archangelsk region commercial fishery		Barents Sea basin			White Sea basin
	Coastal	In-river	Rynda	Kharlovka	Eastern Litsa	Ponoi
2008	0.12	0.08	1.27	1.14	1.52	5.73
2009	0.09	0.05	1.18	1.29	1.35	5.72
2010	0.21	0.08	1.10	0.99	0.98	4.78
2011	0.15	0.07	0.60	0.90	0.99	4.01
2012	0.17	0.09	1.10	0.87	0.97	5.56
2013	0.12	0.09	0.98	0.85	1.09	4.37
2014	0.22	0.10	1.25	1.42	1.55	5.20
2015	0.16	0.09	1.04	1.33	1.70	3.94
2016	0.31	0.08	1.05	1.28	1.42	3.35
2017	0.36	0.07	1.07	1.88	2.03	3.83
2018	0.29	0.09	1.07	1.54	1.92	3.62
2019	0.18	na	2.11	1.95	2.38	3.17
2020	0.28	0.02	2.54	1.82	2.69	9.58
2021 (1)	n/a	n/a	n/a	n/a	n/a	n/a
2022 (1)	n/a	n/a	n/a	n/a	n/a	n/a
Mean (2)	**0.22**	**0.06**	**1.22**	**1.12**	**1.40**	**4.89**
2017–2022	**0.28**	**0.06**	**1.70**	**1.80**	**2.26**	**5.05**

Notes: No Russian data available for 2021 and 2022. Mean of the time-series.

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

Year	Northeast driftnets	Region (aggregated data, various methods)				
		Northeast	Southwest	Midlands	Wales	Northwest
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

Year	Northeast driftnets	Region (aggregated data, various methods)				
		Northeast	Southwest	Midlands	Wales	Northwest
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
2017	7.58	5.64	0.58		0.15	0.26
2018	6.27	6.05	1.07		0.15	0.92
2019					0.15	
2020 (2)						

Year	Northeast driftnets	Region (aggregated data, various methods)				
		Northeast	Southwest	Midlands	Wales	Northwest
2021 (2)						
2022 (2)						
Mean (1)	8.98	5.73	0.77	0.84	0.11	0.60
2017–2021	6.93	5.85	0.83		0.15	0.59

Notes:

1. Mean of the whole time-series.

2. Since 2020, no CPUE for net fisheries was available because there was no fishing effort for salmon.

Table 3.1.5.4. Catch per unit of effort (CPUE) for salmon rod fisheries in each region in UK (England & Wales), 1997–2022. [CPUE is expressed as number of salmon (including released fish) caught per 100 days fished.

Year	Region						NRW Wales	England & Wales
	NE	Thames	Southern	SW	Midlands	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

Year	Region						NRW Wales	England & Wales
	NE	Thames	Southern	SW	Midlands	Wales		
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	13.5	0.0	16.8	7.8	9.5	8.5	6.4	9.1
2017	13.5	0.0	13.6	8.7	8.0	9.3	6.6	9.4
2018	10.5	0.0	5.0	4.9	6.7	9.0	4.0	7.2
2019	12.0	1.6	6.6	4.2	5.4	7.7	3.4	7.0
2020	13.2	0.0	13.7	6.6	10.4	7.0	12.5	10.4

Year	Region						NRW Wales	England & Wales
	NE	Thames	Southern	SW	Midlands	Wales		
2021	9.1	0.0	7.6	5.6	5.7	6.4	3.9	6.3
2022	13.8	0.0	7.4	4.7	4.8	4.3	8.7	8.5
Mean (1)	**11.8**	**0.2**	**12.5**	**7.1**	**5.7**	**5.8**	**5.4**	**8.3**
2017–2021	**11.7**	**0.3**	**9.7**	**6.0**	**7.2**	**7.9**	**6.1**	**8.1**

Notes:

1. Mean of the time-series.

Table 3.1.5.5. CPUE data for UK (Scotland) net fisheries. Catch in numbers of fish per unit of effort.

Year	Fixed engine CPUE Catch/trap month (1)	Net and coble CPUE 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

Year	Fixed engine CPUE Catch/trap month [1]	Net and coble CPUE Catch/crew month
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

Year	Fixed engine CPUE Catch/trap month [1]	Net and coble CPUE Catch/crew month
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

Year	Fixed engine CPUE Catch/trap month [1]	Net and coble CPUE Catch/crew month
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

Year	**Fixed engine CPUE** **Catch/trap month** (1)	**Net and coble CPUE** **Catch/crew month**
2014	60.6	79.2
2015	74.8	50.2
2016	0*	65.4
2017	0*	52.4
2018	0*	147.1
2019	0*	23.2
2020	0*	47.3
2021	0*	17.3
2022	0*	25.0
Mean (2)	**50.8**	**144.9**
2017–2021	-	**57.4**

Notes:

1. Excludes catch and effort for Solway Region.
2. Mean of the time-series.
*** No information on effort for fixed engine presented due to fishery regulation.**

Table 3.1.5.6. CPUE (number of salmon in three size groups caught per gear day) in marine fisheries in Norway.

Year	Bagnet			Bend-net		
	< 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

Year	Bagnet			Bend-net		
	< 3kg	3-7 kg	>7 kg	< 3kg	3-7 kg	>7 kg
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
2017	1.65	1.35	0.30	1.02	1.49	0.45
2018	2.05	1.56	0.30	1.08	1.51	0.41
2019	0.97	1.59	0.26	0.72	1.02	0.28
2020	1.18	1.12	0.21	0.37	0.96	0.34
2021	1.02	0.76	0.19	0.54	0.71	0.32
2022	2.06	1.16	0.27	n/a (2)	n/a (2)	n/a (2)
Mean (1)	**1.23**	**1.14**	**0.28**	**0.74**	**1.00**	**0.32**
2017–2021	**1.37**	**1.28**	**0.25**	**0.75**	**1.14**	**0.36**

Notes:

1. **Mean of the time-series.**
2. **In 2022, bend-net fisheries were banned for whole of Norway.**

Table 3.1.6.1. Percentage of 1SW salmon in catches from countries in the Northeast Atlantic, 1987–2022.

Year	Iceland	Finland	Norway	Russia [2]	Sweden	Northern countries	UK (Scot)	UK (E&W)	France	Spain[1]	Southern countries
1987	64	60	60	65	91	63	61	68	77		63
1988	78	55	62	55	89	64	57	69	29		61
1989	69	73	72	70	41	71	63	65	33		63
1990	66	64	66	69	75	67	48	52	45	71	49
1991	72	64	67	62	74	67	53	71	39	37	59
1992	73	72	61	71	69	66	55	77	48	45	60
1993	77	63	62	66	67	65	57	81	74	33	66
1994	66	50	69	69	67	68	54	77	55	61	63
1995	77	60	58	69	85	63	53	72	60	22	61
1996	75	72	51	81	68	63	53	65	51	22	57
1997	75	66	64	84	57	68	54	73	51	21	61
1998	83	71	65	84	66	71	58	82	71	49	66
1999	70	77	62	79	81	67	45	68	27	13	57
2000	85	66	66	77	69	68	54	79	58	63	67
2001	78	51	59	77	54	61	55	75	51	36	64
2002	83	40	51	72	62	57	54	76	69	33	66
2003	78	48	62	73	79	63	52	66	51	14	56

Year	Iceland	Finland	Norway	Russia [2]	Sweden	Northern countries	UK (Scot)	UK (E&W)	France	Spain[1]	Southern countries
2004	84	46	52	66	50	59	51	81	40	59	62
2005	87	70	63	67	59	68	58	76	41	15	63
2006	87	72	53	76	61	63	57	78	50	16	63
2007	90	34	42	68	34	56	57	78	45	25	63
2008	89	36	47	55	36	57	48	76	42	11	58
2009	91	70	47	57	40	64	49	72	31	30	57
2010	83	53	56	54	49	63	55	78	65	33	65
2011	85	63	41	58	32	55	36	57	31	2	47
2012	86	71	46	75	30	59	49	50	38	18	49
2013	89	59	52	67	38	67	55	58	46	13	55
2014	77	65	59	66	46	62	49	54	38	4	50
2015	90	55	51	70	30	63	60	47	33	4	54
2016	79	47	42	72	36	53	50	42	51	30	45
2017	86	41	49	43	35	55	46	40	54	29	44
2018	83	74	51	57	48	58	60	45	39	21	50
2019	79	40	49	65	26	54	57	44	29	10	47
2020	88	49	54	75	40	60	51	43	41	25	46

Year	Iceland	Finland	Norway	Russia [2]	Sweden	Northern countries	UK (Scot)	UK (E&W)	France	Spain[1]	Southern countries
2021	89	46	53	63	47	60	56	39	30	2	48
2022	90	60	55	63	40	61	54	41	30	7	45
Means											
1987–2000	73	65	63	72	71	66	55	71	51	40	61
2001–2020	85	54	52	65	44	60	53	60	43	20	54

Notes:

1. Asturias Region only.

2. Since 1989, only three rivers are included for Russia rather than four rivers previous to this. For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

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. Spawner Escapement Reserve (SERs) based on the CLs used are also shown. All values are given in numbers of fish.

Country and Complex	National Model CLs		River-specific CLs		Conservation Limit used		Spawner Escapement Reserve (SER)	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
Finland			15 259	9502	15 259	9502	18 528	16 267
Iceland (north and east)	4721	1926			4721	1926	5819	3297
Norway			54 822	73 647	54 822	73 647	69 619	122 368
Russia	63 050	32 012			63 050	32 012	80 299	57 312
Sweden			1830	2679	1830	2679	2358	4655
Northern NEAC Stock Complex					139 681	119 766	176 623	203 899
France			17 400	5100	17 400	5100	22 429	9408

Country and Complex	National Model CLs		River-specific CLs		Conservation Limit used		Spawner Escapement Reserve (SER)	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
Iceland (south and west)	15 889	1931			15 889	1931	19 584	3306
Ireland			211 471	46 943	211 471	46 943	268 548	77 998
UK (England & Wales)			53 988	29 918	53 988	29 918	68 560	51 217
UK (N. Ireland)			35 695	5757	35 695	5757	43 531	9608
UK (Scotland)			103 653	86 612	103 653	86 612	131 630	145 468
Southern NEAC Stock Complex					438 096	176 261	554 282	297 005

Table 3.3.4.1. Estimated number of returning 1SW salmon by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	24 373	9 424		154 191	17 187		49 329	62 277	1 052 688	82 671	181 599	567 276	2 007 411 (1 778 909; 2 298 077)	
1972	94 768	8 588		117 547	13 661		99 108	50 541	1 124 618	79 894	158 810	586 047	2 116 780 (1 867 136; 2 435 355)	
1973	44 042	10 325		172 942	16 885		60 694	54 331	1 224 218	94 082	139 035	708 470	2 296 912 (2 021 941; 2 643 511)	
1974	61 284	10 311		172 573	24 549		28 239	38 662	1 392 823	116 466	151 651	681 250	2 421 530 (2 122 204; 2 806 666)	
1975	73 196	12 568		264 965	26 609		56 360	60 202	1 536 158	121 113	124 508	569 652	2 483 026 (2 163 485; 2 911 737)	
1976	66 332	12 623		183 899	14 949		51 154	47 562	1 044 539	80 093	86 657	452 433	1 773 804 (1 554 321; 2 064 475)	
1977	37 455	17 547		117 538	6 733		39 960	48 388	906 134	92 040	85 313	547 198	1 734 002 (1 513 664; 1 996 652)	
1978	35 664	17 803		118 737	8 018		41 049	63 672	791 430	104 515	111 230	574 956	1 701 622 (1 499 024; 1 945 535)	
1979	31 990	17 061		164 578	8 254		47 023	58 711	726 258	99 910	78 003	580 380	1 604 130 (1 409 722; 1 838 210)	
1980	25 580	2 594		117 261	10 596		98 718	26 700	553 709	93 351	98 871	379 647	1 265 899 (1 120 113; 1 437 020)	
1981	22 910	13 390		96 947	19 440		77 891	34 582	291 430	98 428	77 353	491 599	1 083 310 (963 721; 1 226 800)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1982	13 619	6 136		84 784	17 090		47 886	35 333	603 728	83 949	111 910	561 705	1 457 265 (1 306 030; 1 626 067)	
1983	33 262	9 047	699 246	142 055	22 696	908 658 (813 052; 1 021 279)	51 489	44 806	1 062 342	122 038	156 730	622 873	2 076 158 (1 857 360; 2 333 871)	2 989 440 (2 741 500; 3 268 467)
1984	36 307	3 288	732 256	152 674	32 017	958 331 (855 388; 1 077 110)	84 651	27 483	559 945	107 276	61 749	593 062	1 445 695 (1 292 716; 1 621 811)	2 407 297 (2 225 460; 2 613 943)
1985	48 174	22 710	742 161	209 217	38 138	1 064 747 (963 216; 1 182 491)	31 319	44 486	928 201	107 450	79 920	544 231	1 747 332 (1 550 065; 1 976 186)	2 815 586 (2 587 390; 3 071 384)
1986	38 036	28 349	645 486	179 503	39 867	933 826 (847 681; 1 033 187)	48 815	73 268	1 039 892	123 729	90 050	634 178	2 031 061 (1 801 635; 2 296 182)	2 969 191 (2 723 002; 3 244 900)
1987	45 955	16 651	542 331	190 884	31 615	832 046 (756 088; 916 340)	86 533	45 548	667 352	128 423	49 041	543 012	1 549 407 (1 362 015; 1 780 286)	2 383 747 (2 180 981; 2 630 065)
1988	26 871	24 017	498 160	132 007	26 528	709 037 (647 841; 780 907)	29 398	81 526	907 096	176 007	115 844	661 034	1 991 813 (1 756 090; 2 260 761)	2 703 851 (2 458 578; 2 982 019)
1989	59 023	12 981	549 195	196 490	7 727	827 253 (750 967; 919 112)	16 010	45 745	650 727	119 226	111 470	739 760	1 697 942 (1 478 132; 1 963 461)	2 529 991 (2 290 530; 2 806 451)
1990	58 783	9 686	492 564	163 441	18 017	744 483 (678 001; 822 818)	26 800	41 957	407 250	84 969	92 133	479 333	1 145 981 (997 130; 1 330 468)	1 894 681 (1 727 921; 2 092 410)
1991	58 040	14 100	429 243	138 619	22 504	665 176 (605 877; 738 129)	19 463	46 270	291 076	84 124	51 596	411 825	914 577 (795 831; 1 074 826)	1 584 226 (1 447 039; 1 754 768)
1992	81 422	26 546	361 833	171 100	25 135	670 780 (612 440; 733 933)	35 588	53 180	421 845	88 069	104 319	537 538	1 256 889 (1 093 701; 1 467 335)	1 928 458 (1 753 906; 2 149 588)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1993	55 105	21 834	363 184	146 913	24 905	615 688 (565 131; 672 576)	51 285	52 101	344 256	121 892	122 283	579 407	1 291 810 (1 112 899; 1 530 798)	1 908 371 (1 718 538; 2 152 157)
1994	30 661	6 986	491 405	173 718	19 188	725 472 (656 286; 807 315)	39 929	42 946	439 347	135 988	83 850	585 974	1 346 324 (1 167 833; 1 578 031)	2 074 906 (1 882 073; 2 319 007)
1995	30 527	18 283	320 546	155 855	28 078	556 897 (509 835; 609 890)	13 444	52 712	491 064	103 322	77 890	573 846	1 320 835 (1 147 550; 1 545 827)	1 880 942 (1 699 360; 2 109 144)
1996	46 969	9 737	244 615	212 536	16 820	533 929 (488 235; 584 812)	16 540	45 651	457 233	76 640	80 588	447 730	1 134 937 (973 803; 1 342 473)	1 670 739 (1 501 984; 1 880 254)
1997	42 835	13 351	282 483	208 536	7 615	558 182 (509 122; 613 085)	8 501	33 305	455 169	68 937	95 767	382 701	1 056 277 (914 837; 1 231 798)	1 615 711 (1 464 663; 1 797 565)
1998	53 642	22 682	367 692	227 256	6 182	682 944 (621 319; 748 483)	16 542	45 644	480 367	75 923	208 000	428 501	1 270 063 (1 106 677; 1 467 565)	1 952 992 (1 780 320; 2 160 400)
1999	78 680	11 480	342 279	176 500	9 674	622 279 (568 350; 679 821)	5 519	37 056	446 476	59 942	54 181	286 656	898 763 (776 034; 1 039 939)	1 521 786 (1 388 701; 1 676 020)
2000	85 514	12 120	563 482	192 525	17 854	877 087 (797 468; 964 326)	14 459	32 938	619 885	91 910	79 548	439 292	1 293 362 (1 120 047; 1 509 507)	2 173 225 (1 979 499; 2 404 204)
2001	62 018	11 042	486 570	260 606	11 079	838 094 (749 898; 947 719)	12 361	29 614	493 316	79 808	63 255	465 854	1 156 420 (1 001 692; 1 362 066)	1 998 794 (1 817 414; 2 222 895)
2002	38 384	19 097	297 476	236 036	10 608	605 900 (537 810; 699 592)	27 571	36 808	432 030	75 403	112 063	347 179	1 045 318 (925 203; 1 195 019)	1 656 472 (1 511 701; 1 825 135)
2003	37 980	10 118	412 486	211 272	5 775	682 459 (606 130; 769 999)	18 418	43 988	422 679	57 602	70 341	343 168	969 119 (847 418; 1 135 677)	1 656 182 (1 507 241; 1 838 429)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2004	16 072	27 290	249 973	147 794	4 843	449 167 (403 521; 505 658)	22 359	44 031	310 720	104 317	67 468	475 100	1 041 008 (888 024; 1 247 398)	1 493 169 (1 332 356; 1 703 271)
2005	35 209	24 427	371 081	168 499	4 717	607 812 (548 467; 680 639)	14 468	65 088	309 769	85 584	84 751	476 011	1 050 208 (900 544; 1 257 696)	1 661 010 (1 497 312; 1 878 893)
2006	57 691	25 774	299 956	204 907	5 285	597 338 (535 906; 673 999)	20 383	45 883	237 230	83 856	57 326	430 591	890 255 (749 321; 1 083 012)	1 492 524 (1 332 563; 1 695 071)
2007	16 921	19 017	168 040	110 198	1 649	317 764 (284 286; 359 390)	15 987	52 523	239 019	80 338	84 977	440 188	947 412 (772 567; 1 186 831)	1 265 961 (1 087 111; 1 509 510)
2008	18 302	17 386	210 022	114 652	2 557	365 318 (328 107; 411 892)	15 654	63 665	253 204	78 669	53 176	356 944	854 195 (690 958; 1 084 828)	1 220 836 (1 053 489; 1 457 978)
2009	32 292	28 110	168 504	108 767	2 717	342 261 (308 470; 381 250)	4 489	72 008	205 959	49 205	33 181	275 599	664 687 (543 641; 839 654)	1 008 027 (880 510; 1 185 243)
2010	26 013	22 444	249 620	123 447	4 655	429 287 (386 475; 476 418)	15 146	74 047	274 611	98 098	33 060	489 468	1 022 249 (830 168; 1 290 080)	1 452 573 (1 255 994; 1 720 628)
2011	29 515	18 479	175 435	131 684	5 077	362 702 (326 919; 404 409)	10 280	52 018	236 158	66 219	23 848	278 881	693 979 (564 726; 884 804)	1 058 612 (921 860; 1 251 432)
2012	51 045	9 614	195 769	152 879	5 545	417 537 (375 771; 471 012)	11 200	29 540	242 552	37 821	54 848	353 581	760 853 (609 416; 978 232)	1 182 568 (1 022 427; 1 404 577)
2013	29 502	22 936	184 586	118 610	3 250	362 292 (324 415; 408 805)	15 820	88 007	203 747	53 347	60 635	277 093	729 343 (603 115; 910 651)	1 094 848 (961 129; 1 280 732)
2014	41 983	10 800	251 373	111 445	8 954	429 783 (381 219; 486 298)	13 889	21 636	124 811	31 365	27 405	161 030	396 570 (327 724; 497 164)	829 607 (742 418; 940 164)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2015	26 058	30 449	221 573	116 396	2 557	401 216 (359 529; 451 097)	12 936	60 020	178 789	38 462	29 468	253 913	596 311 (487 519; 753 537)	1 000 477 (880 452; 1 163 624)
2016	20 433	12 930	172 242	82 971	2 303	293 321 (263 700; 328 408)	11 655	35 395	180 807	41 234	55 539	247 741	596 308 (482 620; 762 330)	892 942 (771 425; 1 060 169)
2017	13 023	12 597	227 038	29 939	2 955	287 111 (256 830; 324 251)	14 817	36 816	195 799	29 770	46 904	220 300	568 400 (458 593; 740 942)	857 873 (741 610; 1 031 309)
2018	32 863	13 491	231 754	99 713	7 913	390 342 (348 510; 438 742)	12 339	31 790	155 638	38 560	41 218	211 294	513 276 (414 092; 653 126)	906 173 (794 822; 1 053 558)
2019	10 828	8 114	181 065	71 547	3 842	278 389 (249 128; 312 173)	12 696	21 141	132 132	25 733	22 863	214 380	444 839 (352 591; 577 694)	724 755 (627 034; 859 904)
2020	9 294	9 816	222 387	52 047	4 219	298 974 (268 051; 335 691)	10 263	26 414	161 703	48 238	36 250	286 714	587 422 (464 618; 757 456)	888 448 (760 289; 1 059 129)
2021	19 662	8 086	154 353	62 322	4 966	255 396 (209 124; 332 278)	6 212	21 365	167 047	25 817	27 534	208 442	470 985 (370 878; 627 613)	734 578 (615 821; 898 986)
2022	10 303	9 292	207 546	73 779	4 058	310 674 (253 778; 400 126)	6 468	27 853	154 890	36 311	9 692	225 061	476 997 (373 828; 627 943)	795 834 (668 700; 961 341)
Mean 10-year	21 395	13 851	205 392	81 877	4 502	330 750 (291 428; 381 787)	11 709	37 044	165 536	36 884	35 751	230 597	538 045 (433 558; 690 846)	872 553 (756 370; 1 030 892)

Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

Table 3.3.4.2. Estimated number of returning MSW salmon by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	22 687	9 651		132 666	639		10 846	24 435	158 216	90 552	21 909	328 449	641 478 (557 557; 741 601)	
1972	23 770	15 056		134 421	510		21 650	37 518	169 449	149 417	19 169	434 143	840 598 (729 435; 970 866)	
1973	38 393	14 099		222 374	2 264		13 284	33 776	183 439	114 081	16 734	429 502	798 676 (695 967; 921 683)	
1974	65 300	13 396		209 750	1 425		6 157	29 185	205 746	85 012	18 309	311 026	663 520 (580 803; 763 779)	
1975	82 839	14 741		225 648	402		12 351	30 916	232 011	113 469	15 006	416 807	830 578 (709 731; 981 092)	
1976	65 587	12 180		194 846	1 215		8 970	26 786	160 286	61 016	10 441	234 577	508 107 (432 357; 604 624)	
1977	45 847	16 975		134 305	520		6 932	26 136	139 614	76 424	10 295	325 013	591 617 (497 516; 712 494)	
1978	23 104	21 870		116 093	640		7 113	33 762	120 671	63 946	13 395	444 985	690 439 (556 820; 868 152)	
1979	22 952	14 415		101 684	1 666		8 159	21 660	109 109	31 661	9 395	353 713	538 640 (430 462; 689 286)	
1980	22 540	20 080		169 287	3 244		16 902	30 390	119 787	103 558	11 911	461 271	751 436 (622 455; 926 510)	
1981	26 691	7 037		96 536	715		11 655	20 333	88 037	145 296	9 331	413 705	695 102 (595 951; 820 619)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1982	35 360	8 074		85 379	3 490		7 205	14 323	51 288	55 902	13 502	276 041	421 814 (355 959; 510 848)	
1983	39 333	6 150	428 980	124 092	2 277	602 683 (546 298; 667 727)	7 715	23 999	106 526	64 463	18 964	297 042	522 884 (451 353; 611 915)	1 128 272 (1 033 932; 1 234 657)
1984	32 886	7 938	438 487	123 773	3 192	608 049 (552 460; 671 583)	12 729	20 312	76 400	51 218	7 440	261 179	432 374 (365 051; 524 772)	1 044 121 (951 898; 1 153 049)
1985	31 832	5 115	404 963	135 485	1 187	580 295 (527 378; 639 663)	9 570	14 744	83 811	75 517	9 653	271 257	468 007 (394 076; 565 544)	1 051 132 (956 569; 1 162 278)
1986	26 251	13 940	486 134	133 478	604	662 724 (600 587; 735 326)	9 716	12 301	94 637	103 647	10 834	336 128	573 278 (487 604; 686 031)	1 238 074 (1 129 919; 1 368 964)
1987	34 349	14 443	366 380	99 366	2 743	519 429 (472 593; 574 660)	5 156	10 915	117 729	82 793	5 560	237 203	463 728 (390 611; 558 402)	985 725 (896 086; 1 091 535)
1988	24 232	9 304	306 235	99 778	2 913	444 219 (405 052; 487 799)	14 172	12 429	84 709	107 854	15 626	237 064	478 193 (403 008; 576 951)	924 198 (838 023; 1 030 435)
1989	23 732	7 905	219 054	97 065	10 170	359 478 (330 360; 392 821)	6 466	11 084	77 486	86 920	12 426	236 150	434 413 (363 746; 531 542)	795 653 (717 218; 895 619)
1990	26 317	8 326	259 721	124 693	5 307	425 816 (391 124; 466 947)	6 715	10 989	37 232	106 647	11 334	248 009	425 832 (348 492; 531 730)	853 328 (767 142; 965 426)
1991	35 255	5 785	220 021	122 190	7 207	392 092 (361 310; 427 693)	6 056	10 982	55 971	46 601	5 811	194 192	322 719 (260 357; 415 086)	716 365 (645 009; 813 557)
1992	34 014	8 627	239 149	116 347	9 895	409 478 (376 682; 447 079)	7 616	12 366	42 846	36 133	13 322	183 860	298 365 (244 239; 374 970)	709 706 (644 851; 792 566)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1993	35 589	9 744	229 431	137 671	11 229	425 146 (395 730; 458 384)	3 586	6 042	42 196	39 435	31 405	189 574	317 642 (255 670; 407 695)	744 236 (674 090; 836 896)
1994	33 574	8 259	224 484	121 791	8 581	398 894 (368 523; 433 292)	7 617	9 831	67 526	55 670	11 053	228 887	383 869 (312 839; 483 491)	784 075 (705 752; 888 779)
1995	22 163	5 237	240 687	138 769	4 234	412 579 (381 822; 447 486)	3 648	10 076	65 240	55 912	9 348	265 639	413 432 (327 855; 539 429)	827 895 (735 110; 956 427)
1996	20 473	6 843	241 065	104 549	6 959	381 821 (351 898; 414 877)	6 465	6 490	43 590	57 449	10 231	219 536	347 915 (271 516; 462 986)	731 357 (647 735; 851 169)
1997	24 629	3 859	159 539	85 385	5 048	279 823 (258 141; 303 838)	3 335	7 310	56 186	35 585	12 724	161 283	284 173 (222 821; 369 769)	564 668 (499 406; 653 108)
1998	23 595	5 618	191 095	105 554	2 782	330 382 (304 967; 357 168)	2 809	4 519	32 793	23 376	17 469	132 525	215 907 (171 547; 282 752)	547 220 (495 205; 618 175)
1999	28 039	6 463	204 635	92 948	1 975	335 330 (306 922; 367 303)	6 123	8 806	50 898	46 804	7 971	151 964	284 105 (219 366; 373 579)	620 962 (547 561; 713 998)
2000	53 299	3 784	282 836	162 336	7 095	511 964 (473 616; 554 586)	4 266	2 402	64 069	48 513	9 713	154 551	289 391 (231 396; 369 693)	803 166 (732 433; 891 937)
2001	64 470	4 346	332 778	114 733	8 428	527 003 (482 202; 575 940)	4 950	4 212	57 115	52 116	6 610	206 454	338 219 (260 896; 449 430)	866 972 (775 927; 988 414)
2002	56 461	4 099	289 008	125 220	5 757	482 764 (442 525; 528 739)	4 620	4 554	65 784	46 526	8 310	144 899	281 756 (224 334; 362 971)	767 134 (694 216; 854 963)
2003	40 861	4 317	255 908	87 100	1 376	391 534 (358 979; 426 823)	6 644	7 271	69 232	59 932	5 078	171 609	328 156 (258 821; 422 656)	719 807 (643 325; 823 223)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2004	18 523	4 241	231 642	67 240	4 242	326 761 (298 015; 359 745)	12 398	5 889	38 005	51 133	5 349	233 386	352 737 (268 104; 480 428)	681 775 (589 254; 810 038)
2005	15 310	5 255	213 490	80 571	2 850	318 209 (291 968; 347 567)	7 639	5 212	49 241	55 883	6 740	226 118	358 679 (275 895; 480 710)	677 873 (589 352; 802 999)
2006	22 608	5 057	270 255	77 184	2 974	379 156 (348 375; 415 142)	7 756	4 313	35 833	50 389	5 312	279 266	391 353 (290 518; 539 725)	771 924 (666 068; 924 497)
2007	32 823	4 807	230 171	80 457	2 782	351 806 (324 605; 382 292)	7 286	2 650	25 106	48 605	5 513	226 805	323 011 (242 041; 442 659)	676 256 (587 353; 798 074)
2008	32 973	6 237	265 254	125 984	3 900	436 923 (398 437; 481 335)	8 031	3 023	18 772	53 444	4 296	305 516	400 000 (292 705; 562 624)	839 868 (723 098; 1 005 850)
2009	14 166	5 031	207 697	106 983	3 447	338 904 (309 002; 374 302)	3 703	4 680	23 545	41 087	4 348	252 024	334 475 (250 196; 464 552)	675 582 (583 331; 806 001)
2010	22 762	7 130	228 578	132 410	4 029	396 853 (361 439; 436 600)	3 063	9 735	22 008	60 582	6 341	331 460	441 086 (328 554; 604 138)	838 452 (718 213; 1 007 533)
2011	17 458	7 950	318 887	131 708	9 381	487 944 (440 764; 541 712)	8 675	4 943	23 727	100 715	8 117	418 920	578 806 (433 855; 784 268)	1 068 532 (913 500; 1 277 794)
2012	21 113	4 471	279 472	64 963	10 726	381 940 (344 105; 424 831)	6 830	2 809	20 898	80 662	19 050	331 767	472 938 (352 290; 648 901)	856 462 (728 240; 1 037 559)
2013	20 460	5 132	197 142	74 322	4 521	302 477 (274 594; 333 685)	7 086	7 756	23 785	78 081	6 130	300 253	433 517 (324 938; 594 535)	737 220 (624 300; 901 431)
2014	22 167	6 191	202 613	73 415	9 169	314 679 (283 500; 351 036)	8 796	4 738	20 027	52 656	3 292	203 877	300 095 (228 469; 404 232)	616 846 (535 586; 724 175)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2015	21 230	5 875	256 053	69 198	5 925	359 351 (322 729; 402 911)	9 855	4 319	20 751	85 607	4 246	247 136	383 108 (287 740; 521 027)	744 072 (640 547; 887 032)
2016	22 703	8 286	280 948	59 057	4 035	375 582 (338 223; 419 578)	4 208	6 181	20 577	112 429	7 812	269 193	435 058 (322 349; 596 846)	812 845 (691 947; 977 658)
2017	16 530	4 686	284 775	54 576	5 385	367 203 (328 600; 412 393)	4 799	5 243	18 873	89 858	6 315	234 335	370 370 (277 955; 501 447)	739 173 (636 915; 878 567)
2018	10 117	5 083	268 492	71 956	6 733	363 577 (325 283; 408 233)	7 197	5 624	19 363	89 150	5 992	134 495	271 256 (208 283; 363 702)	637 671 (560 375; 737 853)
2019	14 243	3 909	226 383	56 279	10 590	313 147 (281 187; 351 145)	11 535	4 579	17 672	70 765	3 765	169 426	280 882 (209 786; 375 862)	595 804 (517 212; 695 587)
2020	8 502	3 473	228 537	48 387	6 486	296 150 (264 312; 333 622)	5 621	6 404	18 818	128 132	2 251	219 659	385 444 (282 438; 517 687)	682 628 (573 002; 820 392)
2021	9 025	2 569	171 100	52 571	5 662	243 018 (207 492; 284 817)	5 400	2 710	21 942	80 917	2 254	151 083	266 688 (199 410; 354 544)	511 583 (432 609; 606 725)
2022	11 268	2 735	209 423	60 223	6 233	293 331 (248 409; 351 584)	5 658	3 087	16 807	104 705	1 150	160 530	295 240 (218 293; 390 906)	592 063 (499 608; 699 795)
Mean 10-year	15 624	4 794	232 546	61 998	6 474	322 852 (287 433; 364 900)	7 016	5 064	19 862	89 230	4 321	208 999	342 166 (255 966; 462 079)	666 991 (571 210; 792 922)
Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).														

Table 3.3.4.3. Estimated pre-fishery abundance of maturing 1SW salmon (potential 1SW returns) by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	29 700	11 676			22 138		63 797	77 055	1 340 550	105 555	222 340	724 642	2 547 239 (2 209 773; 2 979 419)	
1972	115 434	10 704		151 002	17 619		128 477	62 631	1 437 535	102 429	194 815	749 574	2 698 666 (2 326 890; 3 153 030)	
1973	53 727	12 867		222 437	21 784		78 836	67 393	1 565 737	120 843	170 785	907 268	2 927 284 (2 516 010; 3 444 468)	
1974	74 665	12 778		221 116	31 659		36 683	47 966	1 778 610	149 017	185 653	869 421	3 082 327 (2 632 600; 3 632 067)	
1975	88 920	15 561		340 134	34 248		72 965	74 474	1 957 900	154 489	152 577	725 929	3 158 615 (2 694 075; 3 762 663)	
1976	80 627	15 655		237 354	19 291		66 202	58 841	1 334 480	102 428	106 222	576 914	2 255 451 (1 934 979; 2 675 026)	
1977	45 568	21 684		151 145	8 680		51 698	59 887	1 153 716	117 388	104 528	697 865	2 201 487 (1 883 421; 2 597 422)	
1978	43 413	22 031		152 695	10 351		53 317	78 666	1 009 231	133 593	136 113	731 767	2 162 374 (1 862 605; 2 518 482)	
1979	38 856	21 132		211 764	10 665		60 816	72 601	924 367	127 686	95 677	740 493	2 041 307 (1 755 856; 2 388 091)	
1980	31 250	3 352		150 882	13 699		127 796	33 431	711 807	120 459	121 799	491 092	1 625 082 (1 406 751; 1 882 211)	
1981	28 002	16 681		125 233	25 071		100 554	43 125	377 092	126 977	95 880	633 942	1 392 784 (1 210 637; 1 609 433)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1982	16 667	7 689		109 332	22 078		62 163	43 921	773 143	107 870	137 472	720 561	1 858 490 (1 626 150; 2 120 049)	
1983	40 626	11 393	890 791	183 221	29 245	1 158 942 (1 011 093; 1 328 229)	67 354	55 965	1 362 454	157 969	193 657	807 212	2 664 184 (2 324 171; 3 048 481)	3 829 210 (3 409 498; 4 283 621)
1984	44 102	4 167	930 274	196 255	41 251	1 219 172 (1 064 391; 1 401 391)	109 548	34 244	715 691	137 946	76 405	759 975	1 853 821 (1 617 682; 2 124 632)	3 075 276 (2 752 277; 3 433 705)
1985	58 472	28 147	946 298	269 729	49 181	1 355 544 (1 193 524; 1 543 316)	40 855	55 044	1 183 513	137 753	98 485	696 827	2 225 333 (1 937 150; 2 577 728)	3 587 936 (3 208 904; 4 026 412)
1986	46 277	35 135	820 721	230 464	51 456	1 189 130 (1 051 167; 1 350 607)	63 306	90 576	1 325 869	158 637	110 918	811 268	2 588 090 (2 246 610; 2 993 915)	3 779 936 (3 363 846; 4 250 591)
1987	55 795	20 613	691 129	244 981	40 746	1 057 777 (935 785; 1 200 003)	112 371	56 415	851 179	164 376	60 508	693 445	1 974 887 (1 698 070; 2 319 778)	3 036 336 (2 702 654; 3 436 643)
1988	32 793	29 781	634 092	169 305	34 219	902 556 (800 163; 1 022 695)	38 141	100 807	1 156 800	224 822	142 325	846 084	2 534 057 (2 185 125; 2 942 678)	3 443 851 (3 045 918; 3 895 462)
1989	71 718	16 072	698 058	251 267	9 978	1 050 014 (928 848; 1 199 094)	20 913	56 739	828 865	151 932	136 380	942 276	2 161 841 (1 837 552; 2 538 849)	3 218 659 (2 833 573; 3 649 771)
1990	71 526	12 034	626 862	208 498	23 315	945 343 (836 339; 1 071 942)	34 744	51 961	518 910	108 652	112 721	613 054	1 461 385 (1 242 528; 1 722 769)	2 409 343 (2 138 780; 2 730 739)
1991	70 407	17 411	546 478	177 907	29 001	845 171 (747 985; 960 841)	25 284	57 231	370 288	107 044	63 046	525 049	1 160 177 (990 238; 1 384 432)	2 009 348 (1 787 201; 2 279 119)
1992	98 952	32 816	460 131	218 735	32 484	848 748 (753 789; 955 246)	46 024	65 723	537 208	112 350	127 420	683 858	1 595 877 (1 355 722; 1 894 027)	2 450 105 (2 160 848; 2 788 751)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1993	66 949	27 039	461 894	187 946	32 308	780 385 (695 727; 877 914)	66 138	64 357	438 020	155 537	149 179	736 221	1 635 797 (1 386 381; 1 977 939)	2 420 111 (2 130 084; 2 793 197)
1994	37 233	8 641	624 814	223 201	24 829	923 592 (815 518; 1 052 713)	51 803	53 140	558 920	173 195	102 392	745 513	1 709 994 (1 454 973; 2 044 338)	2 637 952 (2 326 807; 3 026 432)
1995	37 105	22 569	408 267	200 013	36 171	707 821 (629 705; 796 596)	17 439	65 243	624 547	131 672	95 242	730 272	1 678 741 (1 426 829; 1 995 891)	2 388 970 (2 098 995; 2 736 507)
1996	57 071	12 053	311 291	272 706	21 729	678 825 (602 567; 766 135)	21 395	56 476	582 088	97 633	98 602	569 699	1 441 142 (1 214 358; 1 730 542)	2 121 082 (1 858 787; 2 443 108)
1997	51 960	16 510	359 481	267 359	9 840	708 238 (628 475; 800 793)	10 972	41 186	578 581	87 706	117 014	487 495	1 338 970 (1 132 596; 1 588 212)	2 051 188 (1 802 161; 2 337 143)
1998	65 232	28 032	468 379	293 017	7 998	866 734 (767 545; 978 935)	21 335	56 263	609 810	96 772	253 746	545 062	1 601 103 (1 373 290; 1 889 517)	2 471 800 (2 192 630; 2 801 646)
1999	95 593	14 202	435 354	225 986	12 496	787 959 (700 119; 886 424)	7 123	45 856	566 543	76 474	66 114	364 899	1 138 129 (965 980; 1 344 578)	1 928 360 (1 711 384; 2 178 835)
2000	103 929	14 945	716 106	246 868	23 055	1 110 950 (984 079; 1 257 392)	18 737	40 591	787 113	117 103	97 010	560 495	1 640 111 (1 389 597; 1 939 527)	2 755 886 (2 437 969; 3 121 973)
2001	75 115	13 625	618 397	333 381	14 321	1 064 811 (927 437; 1 232 217)	15 996	36 526	627 645	101 709	77 252	592 215	1 465 153 (1 243 192; 1 755 706)	2 536 739 (2 242 120; 2 887 997)
2002	46 639	23 592	377 872	302 572	13 713	771 749 (667 588; 908 493)	35 632	45 453	549 234	96 000	136 833	440 558	1 320 221 (1 145 237; 1 541 883)	2 096 529 (1 864 959; 2 377 023)
2003	46 044	12 531	524 764	269 744	7 468	866 881 (752 440; 1 001 986)	23 762	54 308	537 803	73 720	85 875	435 165	1 229 221 (1 050 646; 1 461 459)	2 103 445 (1 861 837; 2 391 233)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2004	19 484	33 708	318 015	189 976	6 259	571 249 (499 531; 659 618)	28 862	54 445	395 772	133 009	82 404	604 346	1 319 988 (1 105 942; 1 602 525)	1 895 627 (1 650 525; 2 203 684)
2005	42 788	30 144	471 431	215 930	6 088	772 196 (677 277; 885 740)	18 704	80 387	394 345	108 458	103 347	604 923	1 329 334 (1 117 743; 1 616 867)	2 106 207 (1 851 226; 2 425 908)
2006	70 166	31 766	381 365	261 989	6 830	756 666 (662 247; 872 431)	26 341	56 653	302 350	106 781	70 013	546 436	1 125 747 (934 262; 1 389 409)	1 889 202 (1 648 304; 2 188 444)
2007	20 562	23 500	213 518	140 708	2 127	403 204 (351 408; 467 019)	20 607	64 904	304 273	102 366	103 849	559 557	1 197 333 (961 938; 1 519 920)	1 604 110 (1 354 047; 1 941 735)
2008	22 226	21 504	267 272	146 361	3 307	464 877 (405 163; 536 517)	20 273	78 593	322 656	100 031	65 206	454 311	1 083 332 (862 307; 1 391 971)	1 552 949 (1 309 623; 1 878 147)
2009	39 315	34 643	214 174	137 283	3 514	431 615 (379 804; 491 938)	5 819	88 940	262 525	62 732	40 527	350 641	841 333 (677 673; 1 076 826)	1 275 738 (1 089 843; 1 521 919)
2010	31 619	27 735	317 816	156 338	6 027	542 816 (475 163; 619 531)	19 550	91 539	350 205	124 838	40 397	622 799	1 294 605 (1 037 186; 1 660 460)	1 840 644 (1 560 279; 2 222 663)
2011	35 846	22 815	223 625	167 224	6 569	458 607 (403 350; 522 814)	13 309	64 324	302 246	84 192	29 156	354 347	878 633 (703 966; 1 135 708)	1 340 733 (1 143 533; 1 612 349)
2012	62 201	11 857	248 690	195 107	7 173	528 794 (463 930; 610 726)	14 474	36 462	308 872	48 235	66 766	448 311	962 232 (758 770; 1 252 003)	1 494 146 (1 265 861; 1 802 549)
2013	35 919	28 411	234 742	152 314	4 199	459 556 (400 782; 530 752)	20 414	108 517	259 956	67 788	73 943	351 870	921 697 (751 518; 1 165 613)	1 385 066 (1 192 022; 1 646 429)
2014	51 164	13 350	320 117	143 215	11 558	544 988 (472 246; 632 104)	17 987	26 684	159 302	40 058	33 504	204 275	502 391 (409 689; 637 200)	1 052 872 (917 114; 1 216 540)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2015	31 701	37 653	282 200	149 734	3 313	509 305 (445 049; 585 639)	16 761	74 306	227 052	49 074	36 065	322 343	755 674 (610 109; 966 525)	1 268 998 (1 092 373; 1 499 650)
2016	24 833	15 962	219 085	106 708	2 985	372 399 (326 330; 426 130)	15 099	43 624	230 086	52 411	68 039	314 531	755 318 (601 434; 974 708)	1 131 757 (958 888; 1 359 546)
2017	15 838	15 570	288 545	38 361	3 817	363 985 (317 391; 420 604)	19 129	45 483	249 994	37 983	57 281	279 383	718 529 (571 795; 949 419)	1 087 877 (920 180; 1 325 943)
2018	39 948	16 618	294 595	127 977	10 213	495 129 (432 088; 570 254)	15 910	39 299	197 711	49 122	50 213	268 734	649 252 (514 748; 837 450)	1 148 073 (983 871; 1 357 475)
2019	13 189	10 046	230 493	91 713	4 955	353 959 (309 472; 406 709)	16 411	26 130	168 346	32 696	28 017	273 320	564 389 (442 452; 741 401)	921 129 (779 549; 1 111 422)
2020	11 311	12 120	282 730	66 054	5 445	379 580 (332 571; 435 177)	13 276	32 628	205 267	61 307	44 833	364 353	746 050 (579 552; 970 283)	1 127 878 (944 133; 1 365 137)
2021	23 934	9 976	196 458	79 609	6 400	324 978 (260 270; 425 972)	8 043	26 425	212 324	32 761	33 989	265 353	599 488 (464 691; 804 760)	932 870 (770 567; 1 161 949)
2022	12 536	11 486	263 883	93 902	5 237	394 707 (318 794; 515 485)	8 367	34 297	197 469	46 115	11 965	286 618	605 737 (466 327; 801 604)	1 009 918 (833 837; 1 237 251)
Mean 10-year	26 037	17 119	261 285	104 959	5 812	419 858 (361 499; 494 883)	15 140	45 739	210 751	46 932	43 785	293 078	681 853 (541 231; 884 896)	1 106 644 (939 253; 1 328 134)

Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

Table 3.3.4.4. Estimated pre-fishery abundance of non-maturing 1SW salmon (potential MSW returns) by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	47 342	27 036		264 705	4 733		59 221	65 579	384 328	363 956	32 690	1 181 439	2 100 629 (1 782 655; 2 493 454)	
1972	72 820	25 396		427 371	7 566		39 573	59 175	384 650	281 731	28 709	1 076 675	1 879 781 (1 586 314; 2 242 292)	
1973	117 095	23 884		396 160	5 095		22 259	51 026	402 574	208 401	31 197	782 311	1 507 211 (1 267 331; 1 805 579)	
1974	148 210	26 414		428 330	3 799		34 986	54 242	452 346	264 841	25 753	985 761	1 832 116 (1 521 082; 2 225 266)	
1975	116 550	21 665		366 089	4 752		29 992	46 758	338 763	180 334	17 932	710 539	1 334 393 (1 125 003; 1 598 276)	
1976	81 133	29 723		252 437	2 606		20 826	45 473	275 283	176 116	17 569	735 041	1 282 726 (1 047 640; 1 573 701)	
1977	41 937	38 046		218 527	2 602		21 065	58 531	243 036	153 957	22 707	929 670	1 439 333 (1 152 284; 1 831 734)	
1978	43 198	25 398		198 502	4 582		20 403	37 718	209 783	85 448	16 176	719 638	1 096 904 (868 453; 1 407 671)	
1979	48 691	36 010		343 923	9 472		40 348	53 657	245 170	232 788	21 018	988 942	1 591 217 (1 290 849; 1 988 237)	
1980	62 146	14 328		235 065	6 905		31 000	37 106	193 215	309 620	17 412	921 286	1 520 511 (1 260 186; 1 847 201)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1981	75 840	15 956		209 804	11 249		21 418	26 556	125 406	148 398	24 236	661 242	1 013 688 (842 103; 1 235 227)	
1982	79 213	12 151	839 227	265 512	7 974	1 206 925 (1 012 882; 1 446 225)	20 626	42 708	208 146	151 782	32 966	652 242	1 114 694 (924 681; 1 353 963)	2 325 253 (1 969 557; 2 757 126)
1983	64 147	14 678	810 291	249 721	8 069	1 151 202 (960 703; 1 378 499)	26 778	35 927	143 113	109 672	13 268	519 540	854 357 (694 084; 1 071 562)	2 013 039 (1 688 417; 2 399 629)
1984	62 587	9 858	760 628	274 091	4 683	1 115 755 (928 502; 1 337 898)	20 606	26 390	152 600	149 994	16 986	527 624	900 194 (726 020; 1 128 032)	2 017 083 (1 693 125; 2 411 861)
1985	54 731	25 347	915 851	277 415	4 502	1 279 645 (1 067 772; 1 536 332)	24 512	22 405	190 399	218 590	19 178	723 619	1 208 734 (988 509; 1 485 256)	2 492 052 (2 098 246; 2 969 407)
1986	68 041	26 122	707 669	212 654	7 870	1 024 699 (860 856; 1 226 627)	14 695	19 908	220 668	175 019	10 277	523 119	972 728 (791 938; 1 201 470)	2 000 160 (1 685 429; 2 384 355)
1987	46 308	16 660	561 212	196 276	6 920	829 476 (694 619; 994 091)	31 586	22 010	167 964	217 384	26 634	521 167	997 299 (814 923; 1 236 040)	1 827 148 (1 540 374; 2 188 047)
1988	46 494	14 404	429 120	195 745	20 063	708 584 (593 697; 842 833)	18 620	19 871	162 929	188 619	21 390	554 971	973 456 (799 918; 1 203 454)	1 683 789 (1 418 262; 2 009 068)
1989	49 380	14 936	478 728	240 802	10 774	796 569 (665 742; 956 305)	14 886	19 472	73 810	198 887	19 418	474 581	809 630 (635 591; 1 042 678)	1 610 110 (1 335 039; 1 948 438)
1990	63 310	10 346	396 309	230 686	13 527	717 766 (596 061; 854 123)	12 681	19 286	100 002	89 374	10 049	358 784	595 979 (462 372; 787 936)	1 319 994 (1 088 949; 1 594 910)
1991	59 812	15 018	413 516	213 651	17 936	722 026 (601 212; 865 057)	16 488	21 448	83 649	75 512	22 419	363 488	586 668 (466 677; 754 337)	1 312 769 (1 095 574; 1 578 093)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1992	62 237	16 973	395 852	252 298	20 211	751 361 (629 421; 897 152)	8 291	10 593	79 016	77 718	52 682	355 841	594 178 (465 045; 780 875)	1 349 730 (1 121 079; 1 628 935)
1993	58 905	14 371	387 172	225 110	15 404	705 062 (587 700; 843 623)	14 505	17 081	113 729	97 730	18 633	390 229	659 272 (505 893; 866 426)	1 367 148 (1 120 986; 1 665 024)
1994	39 688	9 223	417 560	257 601	7 937	733 277 (611 957; 879 242)	7 104	17 562	110 251	98 922	15 791	452 645	708 507 (535 355; 966 512)	1 448 347 (1 181 449; 1 790 373)
1995	36 461	11 946	414 364	194 435	12 588	671 377 (559 499; 807 322)	12 714	11 304	75 790	103 314	17 339	384 491	611 805 (459 752; 838 530)	1 290 617 (1 051 224; 1 594 157)
1996	42 581	6 643	266 486	154 810	8 870	480 741 (398 502; 579 688)	6 565	12 596	96 245	63 559	21 461	278 877	489 857 (368 857; 664 657)	977 672 (794 057; 1 206 469)
1997	40 613	9 678	319 758	192 015	4 921	569 342 (473 386; 680 513)	5 422	7 788	55 536	41 128	29 310	226 998	370 661 (279 351; 503 621)	943 359 (775 632; 1 148 514)
1998	48 023	11 143	340 231	168 671	3 471	573 197 (476 153; 690 743)	11 487	15 164	85 534	80 600	13 387	255 568	481 150 (354 151; 661 107)	1 058 721 (860 666; 1 308 593)
1999	91 477	6 530	471 599	295 451	12 429	879 683 (733 579; 1 058 067)	7 946	4 149	106 897	83 793	16 347	260 051	490 041 (369 220; 655 133)	1 374 955 (1 134 986; 1 662 452)
2000	110 574	7 484	554 264	207 302	14 704	898 538 (744 669; 1 080 014)	9 358	7 251	96 163	90 362	11 104	347 087	573 591 (422 340; 790 384)	1 478 171 (1 206 096; 1 805 931)
2001	96 817	7 056	482 115	226 355	10 127	825 841 (684 091; 994 844)	8 777	7 836	111 256	81 117	13 918	246 921	481 714 (364 437; 646 936)	1 307 925 (1 082 062; 1 593 266)
2002	69 887	7 431	425 179	158 139	2 423	664 766 (553 275; 801 938)	12 444	12 506	116 057	103 636	8 515	288 236	555 323 (418 594; 751 129)	1 225 039 (1 003 927; 1 505 866)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2003	31 733	7 330	386 594	121 857	7 473	555 570 (460 574; 671 121)	23 207	10 158	64 011	88 947	9 012	392 949	600 530 (435 670; 839 980)	1 164 646 (928 581; 1 461 304)
2004	26 301	9 075	354 670	146 196	5 004	541 767 (450 747; 654 926)	14 307	8 969	82 759	97 237	11 315	381 368	607 924 (443 259; 842 858)	1 155 912 (925 493; 1 450 202)
2005	38 819	8 716	449 140	139 450	5 196	642 901 (536 771; 773 136)	14 436	7 402	60 329	87 092	8 920	467 698	659 957 (471 399; 945 563)	1 310 240 (1 050 827; 1 662 774)
2006	56 432	8 323	382 441	145 195	4 891	598 171 (501 213; 719 262)	13 732	4 554	42 356	84 562	9 250	381 312	548 206 (393 104; 779 495)	1 151 202 (929 850; 1 449 181)
2007	56 764	10 775	440 987	229 037	6 870	746 949 (619 141; 909 978)	15 083	5 219	31 692	92 884	7 184	512 546	677 297 (475 702; 983 345)	1 431 244 (1 140 934; 1 817 349)
2008	24 364	8 684	346 768	194 296	6 070	581 605 (480 013; 704 971)	6 964	8 076	39 689	70 997	7 321	423 225	565 167 (407 005; 811 184)	1 155 809 (923 525; 1 459 365)
2009	39 112	12 305	379 791	240 466	7 072	679 916 (563 427; 826 263)	5 707	16 721	37 058	104 920	10 692	555 525	741 554 (527 192; 1 059 197)	1 429 414 (1 133 378; 1 819 008)
2010	30 024	13 724	531 293	240 181	16 486	834 299 (684 961; 1 011 891)	16 188	8 519	40 202	173 851	13 686	704 084	980 555 (704 235; 1 382 910)	1 820 335 (1 446 391; 2 313 057)
2011	36 360	7 712	465 710	117 520	18 763	648 254 (534 010; 787 605)	12 768	4 849	35 178	139 772	31 819	556 513	800 933 (569 387; 1 134 154)	1 456 691 (1 147 409; 1 853 565)
2012	35 107	8 883	328 081	134 055	7 925	515 411 (427 493; 623 403)	13 229	13 385	40 287	135 211	10 324	505 547	733 455 (527 878; 1 041 935)	1 253 912 (990 535; 1 609 241)
2013	38 102	10 690	337 263	133 233	16 074	537 419 (441 964; 653 818)	16 478	8 204	34 162	91 335	5 542	344 602	510 873 (370 664; 716 574)	1 054 073 (846 501; 1 319 280)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	**Iceland (N&E)**	**Norway**	**Russia**	**Sweden**	**Northern NEAC (5%; 95%)**	**France**	**Iceland (S&W)**	**Ireland**	**UK(EW)**	**UK(NI)**	**UK(Scot)**	**Southern NEAC (5%; 95%)**	**NEAC (5%; 95%)**
2014	36 554	10 142	427 318	125 616	10 368	611 796 (501 146; 747 781)	18 621	7 454	36 131	149 682	7 201	420 035	656 383 (472 812; 926 842)	1 273 289 (1 013 481; 1 615 375)
2015	39 072	14 303	468 007	107 419	7 100	637 243 (524 648; 772 282)	7 975	10 697	35 214	194 192	13 307	454 733	737 967 (525 689; 1 056 233)	1 382 182 (1 094 003; 1 764 014)
2016	28 393	8 083	474 731	99 201	9 453	621 687 (508 623; 758 797)	9 085	9 051	32 382	155 934	10 753	396 650	630 868 (453 360; 888 018)	1 257 616 (1 005 688; 1 592 133)
2017	17 422	8 775	446 833	130 734	11 813	619 015 (505 732; 754 291)	13 493	9 668	32 959	154 516	10 159	227 321	463 737 (339 039; 644 708)	1 087 883 (878 079; 1 350 103)
2018	24 552	6 759	375 921	101 502	18 623	529 338 (437 595; 649 935)	21 564	7 886	30 008	120 892	6 402	285 461	477 909 (346 928; 667 406)	1 010 008 (815 499; 1 268 896)
2019	14 663	6 006	381 500	87 774	11 421	503 216 (411 635; 616 722)	10 603	11 082	32 410	219 850	3 848	371 564	656 918 (460 043; 917 897)	1 164 137 (914 333; 1 479 824)
2020	15 479	4 436	285 363	94 678	9 971	413 660 (328 110; 521 576)	10 208	4 691	37 799	138 575	3 820	256 652	456 623 (328 127; 632 850)	874 369 (690 390; 1 104 024)
2021	19 437	4 713	351 021	108 988	10 949	500 536 (394 622; 637 919)	10 675	5 347	28 768	178 672	1 969	271 757	502 149 (357 964; 694 277)	1 006 915 (797 504; 1 271 114)
2022														
Mean 10-year	25 964	8 212	394 217	109 905	11 752	552 657 (450 453; 679 236)	13 189	8 231	33 315	155 961	7 000	336 531	565 937 (406 069; 793 867)	1 123 386 (895 053; 1 418 307)

Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

Table 3.3.4.5. Estimated number of 1SW spawners by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	12 150	4 718			8 114		47 589	31 052	391 003	35 208	36 447	208 662	763 014 (569 437; 1 020 573)	
1972	47 291	4 275		71 915	6 462		95 628	25 204	421 423	38 628	31 858	251 515	883 136 (665 096; 1 160 361)	
1973	21 976	5 161		78 284	7 936		58 564	27 165	458 284	46 121	27 907	305 681	939 448 (700 336; 1 244 830)	
1974	30 787	5 159		93 771	11 511		27 249	19 300	517 988	57 812	30 400	283 076	950 715 (694 048; 1 288 328)	
1975	36 647	6 293		111 963	12 583		54 380	30 178	572 299	60 669	24 948	252 993	1 009 014 (742 737; 1 383 177)	
1976	33 029	6 312		109 670	7 051		49 334	23 857	389 335	39 603	17 368	208 332	737 463 (551 773; 992 352)	
1977	18 658	8 781		74 514	3 166		38 560	24 115	338 842	45 585	17 097	260 554	739 152 (547 481; 973 839)	
1978	17 808	8 885		58 930	3 760		39 614	31 832	297 564	52 935	22 281	272 568	730 417 (551 120; 946 085)	
1979	15 978	8 525		75 023	3 902		45 378	29 380	270 456	51 960	15 666	296 027	724 591 (552 035; 931 998)	
1980	12 742	1 299		73 509	4 996		95 288	13 363	207 420	48 573	19 792	192 437	592 184 (462 111; 747 091)	
1981	11 392	6 733		53 963	9 126		75 171	17 356	70 085	51 685	15 495	255 285	496 197 (389 924; 625 685)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1982	6 792	3 069		49 883	8 008		46 206	17 641	170 247	44 121	22 471	261 188	573 873 (444 151; 720 224)	
1983	16 531	4 517	160 269	64 862	10 643	259 015 (203 294; 324 059)	49 689	22 455	357 487	64 325	31 453	290 046	832 454 (652 198; 1 046 226)	1 093 469 (899 532; 1 312 640)
1984	18 023	1 644	165 074	80 713	15 060	282 620 (222 602; 350 852)	81 691	13 738	197 244	56 613	12 339	273 365	647 933 (514 164; 799 232)	932 730 (785 224; 1 095 318)
1985	23 912	11 358	171 467	92 974	17 967	320 213 (261 082; 391 269)	30 219	22 208	234 247	56 267	16 021	292 399	664 741 (499 301; 853 550)	987 190 (810 805; 1 187 548)
1986	18 956	14 237	152 169	102 228	18 634	308 892 (255 967; 368 727)	45 415	36 633	325 835	65 614	18 087	327 707	841 542 (645 027; 1 066 674)	1 153 536 (949 162; 1 381 302)
1987	22 756	8 343	127 234	95 767	14 943	271 548 (225 623; 322 127)	80 520	22 787	200 640	68 921	15 223	300 201	716 869 (556 042; 919 371)	990 578 (822 340; 1 197 012)
1988	13 293	11 999	117 011	86 657	12 513	243 830 (203 188; 289 300)	27 335	40 672	344 163	95 454	41 227	413 047	985 027 (786 842; 1 210 878)	1 230 479 (1 026 553; 1 461 121)
1989	23 642	6 504	184 838	96 288	3 640	316 574 (266 241; 378 716)	14 886	22 910	221 361	65 015	12 352	468 339	819 226 (630 523; 1 053 537)	1 138 446 (941 120; 1 381 739)
1990	23 410	4 841	165 358	97 082	9 937	302 635 (257 920; 355 899)	24 914	20 935	159 517	46 545	34 990	326 510	627 657 (496 771; 790 796)	932 635 (792 387; 1 104 425)
1991	23 134	7 063	143 730	83 211	12 335	271 780 (231 938; 320 903)	18 101	23 110	118 038	46 903	18 389	282 657	517 764 (410 540; 659 147)	791 996 (676 322; 938 280)
1992	32 297	13 282	122 106	116 201	13 824	300 629 (261 542; 344 268)	33 098	26 672	159 530	49 805	45 866	371 555	703 238 (559 361; 891 674)	1 004 584 (853 460; 1 196 201)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1993	21 877	10 934	120 714	113 758	13 668	283 383 (246 599; 325 359)	47 704	26 097	141 872	71 915	72 187	399 732	781 603 (618 224; 996 717)	1 065 096 (895 954; 1 284 733)
1994	12 241	3 504	165 805	115 809	10 503	310 159 (262 768; 369 109)	37 119	21 537	126 026	81 161	25 134	401 639	710 626 (553 120; 918 352)	1 024 160 (856 035; 1 237 571)
1995	12 103	9 134	107 804	121 252	17 474	270 328 (235 092; 308 867)	11 775	26 280	178 873	64 446	25 741	398 171	714 882 (561 771; 915 021)	986 590 (829 760; 1 189 328)
1996	21 096	4 863	80 794	138 523	10 505	257 900 (226 972; 291 441)	14 477	22 838	182 394	49 007	34 841	330 557	646 026 (504 268; 828 529)	903 929 (759 831; 1 089 317)
1997	19 197	6 676	105 382	158 755	4 747	296 409 (259 490; 336 997)	7 441	16 621	225 819	45 836	38 559	288 236	634 585 (509 719; 790 136)	932 378 (801 006; 1 090 832)
1998	24 020	11 314	137 839	163 053	3 862	342 800 (298 447; 390 614)	14 477	22 831	221 019	52 131	156 106	323 083	805 520 (660 761; 980 486)	1 149 237 (998 353; 1 330 427)
1999	31 294	5 936	127 892	162 339	6 031	336 334 (293 023; 382 960)	4 829	18 863	232 023	42 296	20 039	220 511	548 090 (442 265; 673 601)	885 426 (770 885; 1 018 832)
2000	34 145	6 296	213 932	141 364	11 144	409 641 (350 687; 476 778)	12 667	16 790	350 542	64 783	33 984	328 735	823 802 (671 376; 1 015 159)	1 235 121 (1 068 414; 1 435 083)
2001	24 699	5 854	186 497	198 326	6 916	426 074 (362 725; 497 202)	10 817	15 451	256 866	57 672	32 209	359 740	744 978 (599 847; 932 948)	1 172 681 (1 013 678; 1 369 340)
2002	17 158	10 313	111 799	210 941	6 602	358 660 (303 551; 424 827)	24 076	19 162	217 499	54 407	61 355	265 305	655 638 (542 992; 795 236)	1 016 973 (889 068; 1 165 301)
2003	16 989	5 449	156 976	198 381	3 598	384 349 (321 758; 455 719)	16 100	22 864	248 191	45 149	33 004	276 574	655 250 (540 823; 810 144)	1 042 852 (909 326; 1 209 427)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2004	7 229	14 970	93 826	145 607	3 026	266 813 (225 835; 314 154)	19 546	22 871	156 844	81 161	39 720	386 868	723 920 (581 914; 913 445)	992 567 (843 222; 1 185 944)
2005	15 734	13 691	140 693	132 889	2 941	308 037 (262 268; 360 144)	12 650	33 852	172 148	66 905	50 865	386 722	737 914 (598 819; 928 481)	1 046 980 (900 174; 1 244 657)
2006	25 809	14 217	111 292	162 583	3 310	319 010 (270 628; 374 328)	17 838	23 822	126 855	67 568	38 795	348 697	638 852 (508 296; 816 108)	959 722 (818 054; 1 142 756)
2007	7 596	10 638	62 184	123 900	1 029	206 512 (172 513; 246 648)	13 955	27 784	220 177	66 068	67 810	361 353	790 435 (624 569; 1 019 251)	998 008 (829 524; 1 231 528)
2008	8 267	10 071	87 717	93 215	1 851	202 934 (173 036; 237 068)	13 675	33 694	230 873	64 730	42 679	295 913	713 350 (558 311; 939 142)	916 746 (758 341; 1 146 332)
2009	14 504	16 880	71 593	100 835	1 970	207 599 (176 611; 242 502)	3 935	37 414	189 541	40 628	26 392	228 548	549 422 (434 187; 720 612)	758 909 (637 958; 930 463)
2010	11 702	13 472	116 068	92 288	3 371	239 029 (204 137; 277 189)	13 253	39 358	252 243	80 950	27 826	398 325	849 027 (666 853; 1 104 551)	1 088 822 (903 128; 1 345 652)
2011	13 285	11 443	80 266	102 701	3 301	212 767 (183 814; 244 893)	8 979	27 577	216 929	52 477	20 680	228 906	580 490 (457 314; 768 868)	794 384 (665 987; 983 486)
2012	22 894	5 761	90 216	109 525	4 005	234 796 (202 113; 270 777)	9 807	15 682	220 488	31 426	49 983	298 226	656 008 (511 851; 868 863)	891 763 (742 907; 1 108 350)
2013	13 225	14 219	90 884	100 401	2 280	223 155 (190 830; 259 666)	13 832	46 743	186 514	44 123	55 543	225 030	601 650 (481 250; 778 390)	826 860 (700 391; 1 005 947)
2014	18 876	6 683	137 624	90 949	6 258	263 167 (222 548; 310 760)	12 111	11 680	114 991	26 404	25 351	129 699	336 242 (270 934; 434 669)	602 162 (522 610; 708 239)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2015	11 701	19 816	108 961	89 764	1 789	234 196 (200 490; 271 814)	11 303	32 869	164 061	32 583	27 449	211 584	501 870 (398 530; 653 956)	737 296 (627 804; 894 366)
2016	9 210	8 519	82 944	76 625	1 726	180 803 (153 777; 211 399)	10 183	19 466	166 682	35 165	52 319	215 514	522 724 (414 902; 683 738)	705 817 (592 584; 866 183)
2017	7 797	8 425	109 880	39 660	2 217	170 143 (142 280; 203 990)	12 951	20 227	180 775	26 274	43 355	193 842	500 298 (395 678; 670 469)	672 502 (561 627; 842 857)
2018	19 660	9 047	120 774	51 687	6 340	210 900 (179 044; 246 950)	10 771	17 472	145 131	34 959	38 303	184 960	453 709 (359 178; 589 631)	665 818 (564 277; 805 159)
2019	6 487	5 842	87 386	69 344	3 074	174 708 (148 299; 203 939)	11 082	11 854	122 108	25 161	21 440	190 785	397 521 (310 561; 525 388)	573 649 (481 598; 703 041)
2020	5 562	6 867	109 963	45 588	3 474	172 936 (145 572; 206 180)	8 975	15 044	150 138	47 859	35 513	256 981	531 736 (415 989; 694 328)	706 625 (586 781; 869 200)
2021	19 088	5 823	92 660	41 029	4 086	167 722 (131 356; 213 673)	5 438	13 259	154 790	25 691	27 043	187 051	427 026 (332 118; 580 269)	598 471 (494 137; 754 622)
2022	10 009	7 422	121 435	59 497	3 340	205 929 (155 759; 268 995)	5 649	16 420	144 203	36 184	9 426	201 950	429 548 (332 097; 575 842)	639 759 (526 359; 793 594)
Mean 10-year	12 162	9 266	106 251	66 454	3 458	200 366 (166 995; 239 737)	10 229	20 503	152 939	33 440	33 574	199 740	470 232 (371 124; 618 668)	672 896 (565 817; 824 321)

Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

Table 3.3.4.6. Estimated number of MSW spawners by year for NEAC countries (50% quantile of the Monte Carlo distribution only) and region (50% (5%; 95%)) quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1971	10 090	2 889			270		6 786	7 353	82 933	51 729	10 965	100 794	268 032 (191 277; 359 187)	
1972	10 629	4 510		58 843	216		13 530	11 262	89 188	92 237	9 589	135 800	361 720 (259 497; 481 328)	
1973	17 019	4 225		65 870	959		8 314	10 106	96 179	71 630	8 376	112 121	315 566 (220 298; 429 772)	
1974	29 223	4 032		98 657	606		3 847	8 765	107 358	53 277	9 177	69 363	259 854 (183 666; 353 688)	
1975	36 659	4 402		86 672	169		7 731	9 213	121 774	71 503	7 512	141 098	369 392 (257 826; 507 981)	
1976	29 228	3 663		86 817	514		5 590	8 025	84 037	38 344	5 226	90 310	238 289 (167 832; 326 201)	
1977	20 466	5 107		71 701	219		4 332	7 848	72 982	47 933	5 148	130 274	275 920 (189 288; 386 917)	
1978	10 290	6 569		50 519	270		4 448	10 103	62 846	40 725	6 716	220 923	352 171 (230 470; 514 573)	
1979	12 401	4 312		44 397	699		5 104	6 521	57 438	20 404	4 696	177 446	276 767 (177 808; 413 615)	
1980	12 350	6 001		47 977	1 378		10 532	9 121	62 579	66 847	5 967	220 252	384 293 (264 625; 542 209)	
1981	14 525	2 112		66 279	304		7 575	6 122	46 134	94 290	4 672	156 713	323 170 (231 426; 438 062)	

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1982	19 237	2 421		40 585	1 477		4 685	4 297	32 341	36 415	6 759	101 944	190 191 (130 084; 271 010)	
1983	21 454	1 837	101 199	49 252	958	177 201 (141 967; 216 909)	5 015	7 246	63 747	41 963	9 489	97 494	229 304 (163 151; 311 523)	408 087 (331 860; 496 270)
1984	17 966	2 379	103 205	62 159	1 348	189 456 (154 409; 229 066)	8 289	6 101	43 131	33 295	3 722	111 455	209 167 (148 332; 292 606)	400 526 (326 881; 492 747)
1985	17 405	1 533	95 306	51 152	500	167 638 (135 990; 203 848)	6 240	4 437	53 626	49 237	4 828	108 518	230 503 (162 864; 319 358)	400 012 (323 695; 494 546)
1986	14 406	4 167	114 881	52 423	256	188 211 (149 681; 231 777)	6 316	3 698	50 886	67 919	5 423	128 951	269 497 (190 309; 372 428)	458 441 (369 580; 569 424)
1987	18 818	4 329	89 265	53 024	1 161	169 180 (136 688; 205 613)	3 350	3 279	79 755	54 542	3 012	97 860	246 483 (179 302; 332 921)	416 843 (341 728; 508 614)
1988	13 239	2 791	72 800	44 760	1 227	136 311 (111 940; 164 586)	9 208	3 734	52 890	71 498	10 006	85 277	239 238 (170 418; 329 988)	376 812 (301 968; 470 140)
1989	10 671	2 377	77 296	50 934	4 307	147 040 (125 351; 170 808)	4 184	3 322	40 848	57 728	4 976	94 620	210 187 (145 432; 299 267)	358 536 (289 573; 448 284)
1990	11 809	2 496	91 142	48 052	2 648	157 769 (133 093; 186 565)	4 383	3 290	14 902	71 070	7 029	111 142	216 666 (145 677; 314 191)	374 903 (299 906; 475 911)
1991	15 810	1 736	76 522	60 567	3 610	159 749 (136 707; 186 078)	3 931	3 317	41 082	31 475	3 313	103 654	189 735 (132 455; 273 527)	350 412 (288 734; 438 115)
1992	15 238	2 606	84 617	58 296	4 926	167 133 (142 901; 194 634)	4 945	3 712	20 795	24 663	8 921	79 147	144 317 (94 763; 213 991)	312 450 (256 706; 386 823)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
1993	15 910	2 938	78 071	55 746	5 617	159 894 (136 852; 185 295)	2 332	1 803	24 487	27 685	27 634	92 442	181 804 (125 297; 264 772)	342 230 (280 205; 427 245)
1994	14 936	2 489	76 945	65 253	4 282	165 246 (141 946; 190 812)	5 327	2 955	40 241	39 182	6 637	112 050	209 473 (145 011; 301 082)	375 886 (306 539; 469 978)
1995	9 946	1 578	83 582	64 334	2 423	163 213 (138 675; 190 697)	2 553	3 018	37 974	40 741	5 428	149 084	242 132 (163 620; 356 722)	406 446 (323 077; 523 156)
1996	10 214	2 047	82 750	63 334	3 987	163 510 (138 935; 190 336)	4 522	1 943	19 585	42 643	6 802	135 225	214 665 (144 425; 319 425)	379 069 (304 026; 488 169)
1997	12 250	1 154	57 862	52 838	2 900	128 398 (109 093; 149 410)	2 334	2 194	38 800	27 075	8 419	100 554	186 837 (130 023; 266 091)	315 931 (255 686; 397 332)
1998	11 705	1 681	69 734	41 931	1 600	127 876 (107 424; 149 661)	1 963	1 357	12 512	18 182	13 554	78 112	128 165 (87 045; 189 392)	256 799 (210 527; 320 706)
1999	13 972	2 266	72 482	54 616	1 126	145 020 (122 441; 169 567)	4 292	2 810	33 526	38 489	5 402	99 460	195 230 (133 991; 279 068)	340 899 (274 961; 428 153)
2000	26 598	1 365	102 954	58 853	4 084	195 115 (165 895; 227 157)	2 989	820	44 196	41 223	6 274	95 356	196 889 (142 518; 270 941)	393 464 (330 272; 473 794)
2001	28 758	1 652	122 186	89 435	4 843	248 589 (212 539; 288 660)	3 461	1 391	37 175	44 747	4 272	143 928	241 983 (169 933; 343 686)	491 797 (410 216; 601 859)
2002	25 278	1 634	107 309	74 456	3 300	213 797 (182 097; 249 769)	3 243	1 592	47 712	39 915	4 494	97 951	202 049 (148 076; 277 086)	417 394 (352 837; 498 698)
2003	18 203	2 033	95 928	63 442	792	182 005 (154 583; 212 137)	4 656	2 316	54 387	53 472	2 269	123 957	249 520 (184 898; 337 548)	431 821 (361 100; 525 509)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2004	8 263	1 909	87 439	48 100	2 432	149 586 (126 094; 176 489)	8 669	1 946	24 715	45 698	3 262	170 590	261 542 (183 645; 378 542)	412 706 (329 032; 530 131)
2005	6 861	2 418	79 326	36 510	1 630	127 336 (107 081; 150 491)	5 330	1 835	37 643	49 963	4 189	172 478	279 042 (202 461; 391 543)	407 058 (326 658; 521 571)
2006	10 147	2 784	101 008	46 570	1 706	163 137 (137 359; 192 177)	5 437	1 512	25 289	45 762	3 917	222 248	313 049 (220 206; 448 860)	477 194 (380 263; 616 025)
2007	14 750	3 066	83 892	39 851	1 600	144 067 (121 775; 168 205)	5 097	901	21 696	44 513	4 416	178 029	261 661 (186 727; 371 091)	406 885 (326 591; 518 144)
2008	14 821	3 433	126 040	47 353	2 623	195 221 (164 916; 230 835)	5 614	1 295	15 992	49 084	3 583	247 398	329 612 (231 686; 478 510)	527 076 (422 744; 678 315)
2009	6 362	3 226	100 112	69 993	2 326	183 694 (155 495; 217 496)	2 583	1 726	20 107	37 734	3 592	205 795	276 512 (199 094; 395 374)	462 544 (377 363; 582 828)
2010	10 234	4 420	122 590	61 088	2 720	202 026 (172 287; 236 215)	2 139	3 424	18 961	55 709	5 759	266 710	361 059 (257 509; 509 884)	563 303 (452 939; 717 158)
2011	7 813	5 244	178 556	72 683	5 606	271 545 (229 811; 320 178)	6 084	1 886	20 094	90 357	7 062	341 711	480 765 (346 194; 668 886)	754 179 (612 156; 946 363)
2012	9 476	2 994	156 909	63 949	7 241	242 291 (205 915; 282 963)	4 779	1 320	17 819	74 221	17 436	276 025	402 600 (290 971; 563 666)	646 701 (526 315; 811 490)
2013	9 200	3 539	111 427	33 620	2 935	161 551 (136 831; 189 486)	4 976	3 478	20 410	71 447	5 628	248 629	365 267 (264 062; 512 472)	527 533 (423 276; 676 921)
2014	9 961	4 337	124 068	36 603	5 942	181 969 (152 491; 216 614)	6 164	2 364	17 065	48 413	3 065	166 764	250 580 (183 922; 346 742)	434 141 (359 678; 534 066)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC (5%; 95%)	France	Iceland (S&W)	Ireland	UK(EW)	UK(NI)	UK(Scot)	Southern NEAC (5%; 95%)	NEAC (5%; 95%)
2015	9 506	3 998	147 458	33 743	4 139	199 875 (166 724; 240 932)	6 877	2 033	17 696	78 992	3 993	208 329	328 945 (240 203; 456 633)	530 952 (434 591; 663 724)
2016	10 179	5 889	159 795	31 697	3 033	211 437 (176 848; 251 225)	2 949	3 280	17 866	103 967	7 454	231 777	381 670 (276 242; 532 678)	595 213 (482 362; 750 019)
2017	9 083	3 661	162 517	25 146	4 039	205 286 (170 245; 246 609)	3 345	2 822	16 356	84 629	5 964	202 953	326 902 (240 930; 448 843)	533 888 (438 969; 662 602)
2018	5 554	4 013	160 605	25 125	5 051	201 253 (166 121; 241 359)	5 027	2 756	16 616	84 755	5 665	115 060	238 867 (179 211; 326 848)	442 686 (370 977; 537 115)
2019	7 853	3 050	130 839	31 701	8 438	183 767 (153 902; 219 323)	8 084	2 382	15 510	70 019	3 585	149 536	252 555 (185 693; 339 965)	437 706 (363 709; 530 287)
2020	4 647	2 881	133 108	23 942	5 357	170 728 (141 361; 205 595)	3 924	4 100	18 047	127 626	2 158	195 625	356 208 (257 779; 477 790)	527 707 (423 641; 655 160)
2021	8 763	2 185	115 575	20 272	4 661	152 794 (123 083; 189 853)	3 785	1 757	20 194	80 720	2 217	134 314	245 437 (181 727; 326 826)	400 157 (327 519; 487 447)
2022	10 958	2 408	139 257	25 922	5 143	186 928 (146 256; 241 851)	3 959	1 971	15 009	104 517	1 121	142 775	272 746 (199 572; 361 821)	462 277 (375 440; 562 684)
Mean 10-year	8 570	3 596	138 465	28 777	4 874	185 559 (153 387; 224 285)	4 909	2 694	17 477	85 509	4 085	179 576	301 918 (220 934; 413 062)	489 226 (400 016; 606 003)

Note: For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

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

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	25	7	2	29	439	185	111	60	85	8	7	88				
2014	25	10	4	40	439	167	116	69	85	8	7	88				

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
2015	25	10	2	20	439	179	132	74	85	8	7	88				
2016	25	11	4	36	439	174	143	82	85	8	7	88	23	21	8	38
2017	25	15	4	27	439	191	161	84	85	8	7	88	24	22	6	27
2018	25	15	6	40	439	193	161	83	85	8	7	88	24	23	7	30
2019	25	15	5	33	439	177	133	75	85	8	7	88	24	24	6	25
2020	25	15	3	20	439	199	159	80	85	2	1	50	24	24	6	25
2021	25	8	2	25	439	194	138	71	NA	NA	NA	NA	24	23	3	13
2022	25	8	1	12	439	174	144	83	NA	NA	NA	NA	24	24	4	17

*** CL attainment retrospectively assessed; NA = data not available.**

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

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	42	67								
1995									63	63	26	41								
1996									63	63	33	52								

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
1997									64	64	21	33								
1998									64	64	31	48								
1999									64	64	21	33								
2000									64	64	26	41								
2001									64	58	20	34								
2002									64	64	27	42	10	10	4	40				
2003									64	64	19	30	10	10	4	40				
2004									64	64	40	62	10	10	3	30				
2005									64	64	31	48	10	10	4	40				
2006									64	64	36	56	10	10	3	30				
2007					141	141	45	32	64	64	33	52	10	6	2	33				
2008					141	141	54	38	64	64	41	64	10	5	3	60				
2009					141	141	56	40	64	64	23	36	10	6	2	33				
2010					141	141	56	40	64	64	38	59	10	7	2	29				
2011	27	27	2	7	141	141	58	41	64	64	39	61	11	9	3	33	173	173	112	65
2012	29	29	1	3	141	141	58	41	64	64	34	53	19	15	7	47	173	173	110	64
2013	30	29	4	14	143	143	57	40	64	64	21	33	19	16	8	50	173	173	97	56

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
2014	33	29	2	7	143	143	57	40	64	64	14	22	19	17	4	24	173	173	83	48
2015	35	35	3	9	143	143	55	38	64	64	23	36	19	17	7	41	173	173	92	53
2016	35	34	2	6	143	143	48	34	64	64	21	33	19	17	13	76	173	173	90	52
2017	36	36	1	3	143	143	44	31	64	64	31	48	19	15	7	47	173	173	80	46
2018	37	37	3	8	143	143	43	30	64	64	13	20	19	16	7	44	173	173	52	30
2019	37	34	0	0	143	143	43	30	64	62	10	16	19	17	6	35	173	173	77	45
2020	37	35	1	3	144	144	46	32	64	63	23	37	19	15	10	67	173	173	77	45
2021	37	35	1	3	144	144	49	34	64	62	11	18	19	17	9	53	173	173	55	32
2022	37	35	0	0	144	144	48	33	64	59	7	12	19	15	2	13	173	173	NA	NA

NA = data pending.

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

Smolt migration year	Iceland(1)			Norway(2)		France(8)			
	Ellidaar	R.Vesturdalsa(4)		R. Imsa		Scorff		Bresle	
	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1975	20.80								
1980									
1981				17.30	4.00				
1982				5.30	1.20				1.17
1983				13.50	1.30			1.69	0.83
1984				12.10	1.80			3.75	1.31
1985	9.40			10.20	2.10			3.78	0.88
1986				3.80	4.20			6.60	1.45
1987				17.30	5.60			5.93	2.41
1988	12.70			13.30	1.10				
1989	8.10			8.70	2.20				
1990	5.40			3.00	1.30				
1991	8.80			8.70	1.20				
1992	9.60			6.70	0.90			2.73	0.95
1993	9.80			15.60				2.52	0.40

Smolt migration year	Iceland[1]			Norway[2]		France[8]			
	Ellidaar	R.Vesturdalsa[4]		R. Imsa		Scorff		Bresle	
	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1994	9.00							4.64	1.1
1995	9.40		1.45	1.80	1.50	9.10	0.48	2.01	0.75
1996	4.60	2.51	0.37	3.50	0.90	20.22	1.10	1.50	0.68
1997	5.30	1.00	1.51	1.70	0.30	4.91	0.69	3.58	0.87
1998	5.30	1.53	1.04	7.20	1.00	4.80	0.10	1.67	0.72
1999	7.70	1.30	1.22	4.20	2.20	10.26	1.19	7.43	2.09
2000	6.30	1.14	0.68	12.50	1.70	8.63	0.69	5.48	1.91
2001	5.10	3.40	1.32	3.60	2.23	4.67	0.32		
2002	4.40	1.11	2.31	5.50	0.90	18.17	4.18	1.50	0.78
2003	9.10	5.47	0.59	3.50	0.70	10.12	0.95	2.77	1.65
2004	7.70	5.68	0.60	5.90	1.40	5.36	0.92	3.42	1.56
2005	6.40	2.47	0.91	3.70	1.80	7.60	0.73	2.03	0.40
2006	7.10	1.75	0.95	0.80	5.80	6.05	1.01	2.70	0.44
2007	19.25	0.89	0.30	0.80	0.60	3.66	1.35	2.37	0.86
2008	14.90	2.59	1.07	1.10	2.30	2.49	0.59	1.28	0.68
2009	14.20	1.33	1.57	2.40	3.10	5.12	1.41	11.89	2.97

Smolt migration year	Iceland[1]			Norway[2]		France[8]			
	Ellidaar	R.Vesturdalsa[4]		R. Imsa		Scorff		Bresle	
	1SW	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
2010	8.60	1.97	1.11	1.70	1.10	3.36	1.07	4.57	1.19
2011	6.10	1.31	0.57	3.90	2.90	3.98	1.11	2.01	1.15
2012	10.90	2.06		3.50	1.70	7.09	1.51	2.08	0.83
2013	4.30		0.33	2.20	2.40	7.62	1.66	4.00	2.50
2014	7.20	1.62		3.00	0.80	5.11	0.66	5.85	1.07
2015	10.90			1.40	1.40	7.47	1.88	3.08	0.84
2016	7.90		2.00	4.10	1.30	7.93	1.29	4.04	0.96
2017	10.80	2.30		3.50	1.60	4.59	0.53	8.94	2.07
2018	7.80		0.35	3.10	0.80	4.37	0.78	3.15	1.00
2019	14.10	0.90	0.30	2.10	0.50	8.51	0.73	3.77	0.50
2020	11.8	0.60		0.30	0.30	4.35	0.80	7.50	2.46
2021	11	0.60		8.70		1.87		2.20	
Mean[10]	9.21	1.97	0.97	5.78	1.79	6.91	1.06	3.83	1.21
five-year	11.10	1.10	0.88	3.54	0.90	4.63	0.81	5.10	1.42
ten-year	9.67	1.34	0.74	3.19	1.20	5.78	1.08	4.39	1.35

Notes:

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 returns to freshwater.

9. Bush 2SW data based on returns to freshwater.

10. Time-series mean.

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

Smolt migration year	Ireland			UK(Scotland)(2)		UK(N. Ireland)(5)		UK(England & Wales)					
	R. Corrib		B'shoole	North Esk		R. Bush		R. Dee		R. Tamar		R. Frome	
	1SW	2SW	1SW	1SW	MSW	1SW(3)	2SW(9)	1SW	MSW	1SW	MSW	1SW	MSW
1975													
1980	17.90	1.06	5.3				0.59						
1981	9.20	3.76	12.3	8.24	3.79		0.92						
1982	20.90	3.33	12.2	11.22	4.95								
1983	10.00	1.84	8.6				1.69						
1984	26.20	1.98	19.8	6.00	4.00		1.45						
1985	18.90	1.75	19.3	13.63	5.35		1.92						
1986			20.0			31.30	1.94						
1987	16.60	0.71	26.9	10.43	3.89	35.10	0.44						
1988	14.60	0.69	22.9			36.20	0.85						

Smolt migration year	Ireland			UK(Scotland)[2]		UK(N. Ireland)[5]		UK(England & Wales)					
	R. Corrib		B'shoole	North Esk		R. Bush		R. Dee		R. Tamar		R. Frome	
	1SW	2SW	1SW	1SW	MSW	1SW[3]	2SW[9]	1SW	MSW	1SW	MSW	1SW	MSW
1989	6.70	0.71	7.1	6.62	4.15	25.00	1.44						
1990	5.00	0.63	16.0	5.98	3.13	34.70	1.76						
1991	7.30	1.26	21.7	7.61	3.11	27.80	2.22						
1992	7.30		15.9	10.87	6.46	29.00	1.99						
1993	10.80	0.07	23.9	14.45	6.09		1.99	6.30	2.50				
1994	9.80	1.35	26.9	10.93	3.58	27.10	0.75	1.30	1.20				
1995	8.40	0.07	14.6	8.44	3.82		2.50	2.70	0.40				
1996	6.50	1.17	18.3	5.86	2.70	31.00	2.14	4.80	2.10				
1997	12.70	0.75	15.6	7.19	4.19	19.80	0.72	6.20	3.40				
1998	5.50	1.06	12.4	2.55	1.35	13.40	0.52	2.30	3.70				
1999	6.40	0.91	14.9	6.78	3.78	16.50	0.75	5.00	12.40				
2000	9.40		22.5	6.04	2.80	10.10	0.15	2.00	0.90				
2001	7.20	1.08	16.6	4.70	2.86	12.40	0.27	4.30	0.00				
2002	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
2003	8.30	2.10	19.4			6.80	0.35	2.60	0.40	6.10	1.80	4.83	0.94
2004	6.30	0.80	12.8			6.80	0.44	4.50	1.00	6.00	1.50	5.29	2.90

Smolt migration year	Ireland			UK(Scotland)[2]		UK(N. Ireland)[5]		UK(England & Wales)					
	R. Corrib		B'shoole	North Esk		R. Bush		R. Dee		R. Tamar		R. Frome	
	1SW	2SW	1SW	1SW	MSW	1SW[3]	2SW[9]	1SW	MSW	1SW	MSW	1SW	MSW
2005			8.1	6.66	2.78	5.90	0.61	5.10	0.50	6.40	1.20		
2006	3.60	0.70	12.9	3.28	3.40	14.00	0.82	4.30	1.50	3.50	2.40	5.11	2.22
2007	1.30	1.60	8.4	4.99	3.98	8.30	0.80	1.30	0.70	3.50	3.40	5.69	1.30
2008	1.70	1.00	8.2	6.40	5.30	3.97	0.69	2.50	1.30	1.70	0.90	3.13	1.63
2009	6.00	1.00	8.9	9.00	8.65	5.92	0.95	4.80	1.10	8.20	1.90	7.68	2.58
2010	2.90	1.20	7.5			3.96	1.34	1.90	1.00	3.40	5.00	8.64	2.40
2011	2.36	0.00	10.8			2.67	0.53	0.00	0.30	1.10	1.90	1.50	1.80
2012	1.49	0.00	9.4			11.70	1.79	4.80		2.50		3.20	2.10
2013	2.23	0.30	4.5			4.60	0.91	1.90	1.40		4.70	1.50	2.10
2014	2.85	0.50	8.00			2.90	0.33		0.50			2.00	2.70
2015	5.50	0.60	7.80			6.70	0.51	0.50	1.80	4.20	2.30	5.90	3.00
2016	6.90	0.20	7.50			3.80	0.66	0.40	3.90	3.50	1.60	4.40	2.00
2017	3.60	0.40	7.10			3.20	0.68			5.00	5.20	2.60	1.90
2018	2.25	2.19	8.03			2.80	0.09	1.00	6.20	3.70	3.20	1.60	1.90
2019	2.55	1.35	8.21			7.10	0.38	2.10		6.30	1.50	4.70	1.80
2020	4.70	2.82	7.80			4.60	0.46					2.20	2.50

Smolt migration year	Ireland			UK(Scotland)[2]		UK(N. Ireland)[5]		UK(England & Wales)					
	R. Corrib		B'shoole	North Esk		R. Bush		R. Dee		R. Tamar		R. Frome	
	1SW	2SW	1SW	1SW	MSW	1SW[3]	2SW[9]	1SW	MSW	1SW	MSW	1SW	MSW
2021			7.50			2.90				2.40		1.70	
Mean[10]	7.89	1.12	13.30	7.50	4.00	13.80	0.98	3.02	2.03	4.18	2.49	4.06	2.08
five-year	3.27	1.39	7.73			4.12	0.45			4.35	2.87	2.56	2.02
ten-year	3.56	0.93	7.58			5.03	0.64	1.78	2.76	3.94	3.08	2.98	2.21

Notes:

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 returns to freshwater.

9. Bush 2SW data based on returns to freshwater.

10. Time-series mean.

Table 3.3.6.2. Estimated return rates of hatchery smolts (%) to homewaters (prior to coastal fisheries) for various monitored rivers in the NE Atlantic area.

Smolt migration year	Iceland[1]		Norway[2]				Sweden[2]	
	R. Ranga		R. Imsa[3]		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1980								
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			9.80	1.00	1.70	0.70	8.40	2.40
1988			9.50	0.70	0.50	0.30	4.30	0.60
1989	1.58	0.08	3.00	0.90	1.90	1.30	5.00	1.30
1990	0.84	0.19	2.80	1.50	0.30	0.40	5.20	3.10
1991	0.02	0.04	3.20	0.70	0.10	0.10	3.60	1.10
1992	0.37	0.05	3.80	0.70	0.40	0.60	1.50	0.40
1993	0.66	0.05	6.50	0.50	3.00	1.00	2.60	0.90
1994	1.22	0.16	6.20	0.60	1.20	0.90	4.00	1.20

Smolt migration year	Iceland[1]		Norway[2]				Sweden[2]	
	R. Ranga		R. Imsa[3]		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
1995	1.09	0.10	0.40	0.00	0.70	0.30	3.90	0.60
1996	0.17	0.03	2.10	0.20	0.30	0.20	3.50	0.50
1997	0.32	0.06	1.00	0.00	0.50	0.20	0.60	0.50
1998	0.46	0.02	2.40	0.10	1.90	0.70	1.60	0.90
1999	0.36	0.04	12.00	1.10	1.90	1.60	2.10	
2000	0.91	0.06	8.40	0.10	1.10	0.60		
2001	0.37	0.10	3.30	0.30	2.50	1.10		
2002	0.35		4.50	0.80	1.20	0.80		
2003	0.20		2.60	0.70	0.30	0.60		
2004	0.60		3.60	0.70	0.40	0.40		
2005	1.04		2.80	1.20	0.30	0.70		
2006	1.00		1.00	1.80	0.10	0.60		
2007	1.80		0.60	0.70	0.20	0.10		
2008	2.40		1.80	2.20	0.10	0.30		
2009			1.30	3.30				
2010	0.49		2.60	1.90				

Smolt migration year	Iceland[1]		Norway[2]				Sweden[2]	
	R. Ranga		R. Imsa[3]		R. Drammen		R. Lagan	
	1SW	2SW	1SW	2SW	1SW	2SW	1SW	2SW
2011	0.93		1.70	0.80				
2012	0.90		1.90	0.20				
2013	0.29		3.00	0.70				
2014	1.10		1.60	0.30				
2015	0.30		1.60	0.80				
2016	0.30		2.00	0.30				
2017	0.70		4.30	0.20				
2018	0.30		1.20	0.40				
2019	0.60		3.00	0.20				
2020	0.60		0.40	0.60				
2021	1.00		7.00					
Mean[4]	0.72	0.08	3.73	0.76	1.34	0.82	4.86	1.20
five-year	0.64		3.20	0.34				
ten-year	0.61		2.61	0.41				

Notes:

1. Microtagged.

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

3. Since 1999 only one-year old smolts included.

4. Time-series mean.

Table 3.3.6.2 Cont'd. Estimated return rates of hatchery smolts (%) to homewaters (prior to coastal fisheries) for various monitored rivers in the NE Atlantic area.

Smolt migration year	Ireland										UK(N. Ireland)[3]	
	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

Smolt migration year	Ireland										UK(N. Ireland)[3]	
	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
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		0.19	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

Smolt migration year	Ireland										UK(N. Ireland)[3]	
	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
2012	0.50		3.20		1.80		0.22	6.60		1.90	2.19	3.46
2013	0.20	0.30	3.20		1.70		0.05	1.40	0.92	0.73	1.34	1.21
2014	0.10	0.70	4.40		2.30		0.10	1.60	1.20	0.12	0.75	0.67
2015	0.40		3.50		0.30		0.10	2.20	1.10	0.11	2.89	1.44
2016	0.60		3.50		2.40		0.03	2.20		0.08	0.52	2.61
2017	0.40		3.50		0.80		0.02	1.30	0.70	1.52	0.51	0.89
2018	0.21		4.50		0.40		0.02	1.80		1.34	0.31	0.42
2019	0.33		4.71		0.76		0.01	2.10		1.38	0.92	1.04
2020	0.10		2.10		1.1		0.02	1.70		2.20		
2021	0.10		3.50		1.8		0.02				0.28	0.42
Mean[4]	2.54	2.93	8.24	10.79	3.10	3.75	3.18	2.58	3.93	2.82	3.15	5.12
five-year	0.22		3.66		0.90		0.01	1.72		1.61	0.50	0.69
ten-year	0.29	0.30	3.61		1.30		0.06	2.32	0.97	1.04	1.07	1.35

Notes:

1. Return rates to rod fishery with constant effort.

2. Different release sites.

3. Microtagged.

4. Time-series mean.

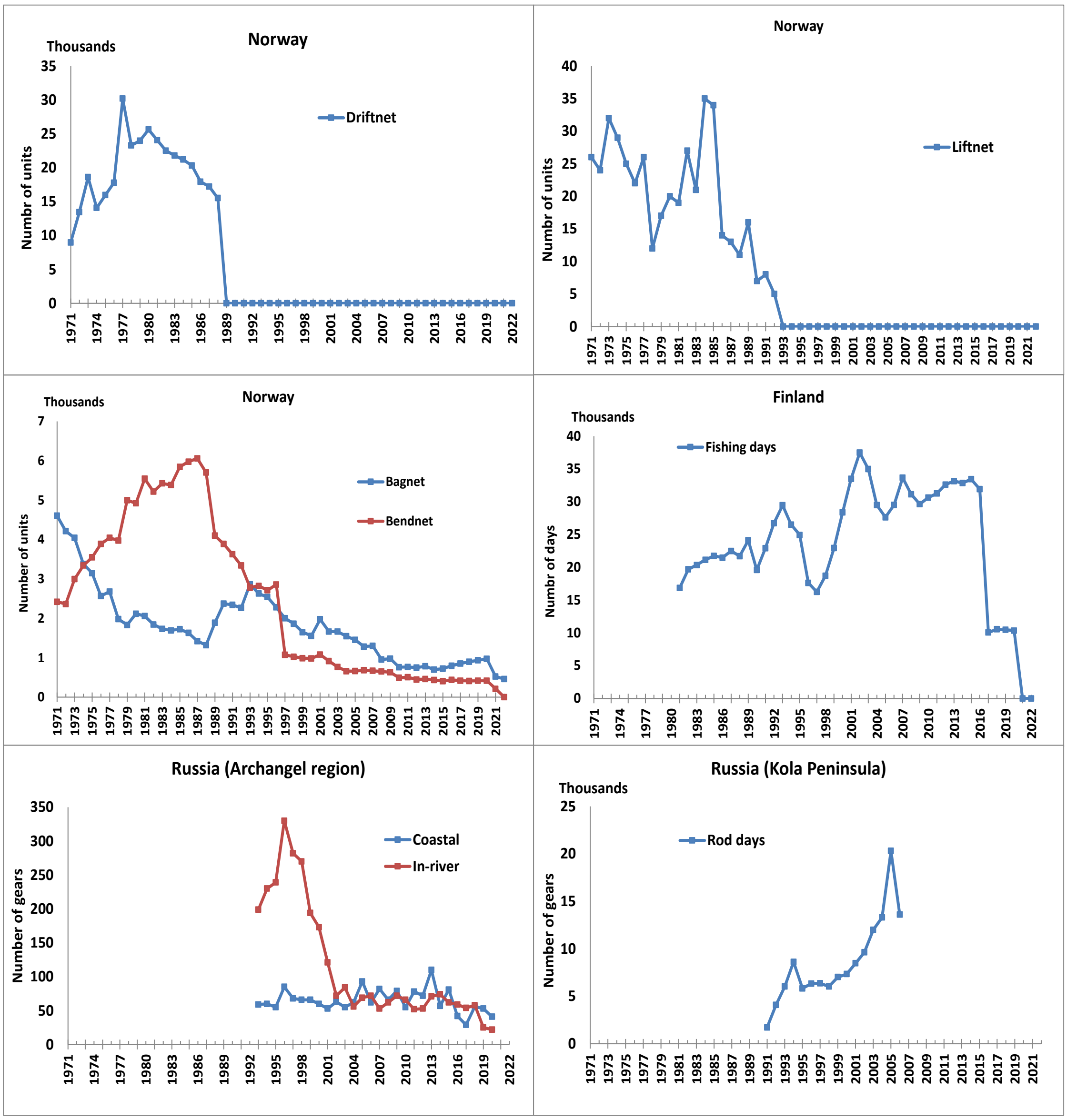


Figure 3.1.3.1. Overview of effort as reported for various fisheries and countries in the Northern NEAC area, 1971-2022. Notice that some of the y-axes are given in thousands. No data is available from Russia (Archangel region) since 2020.

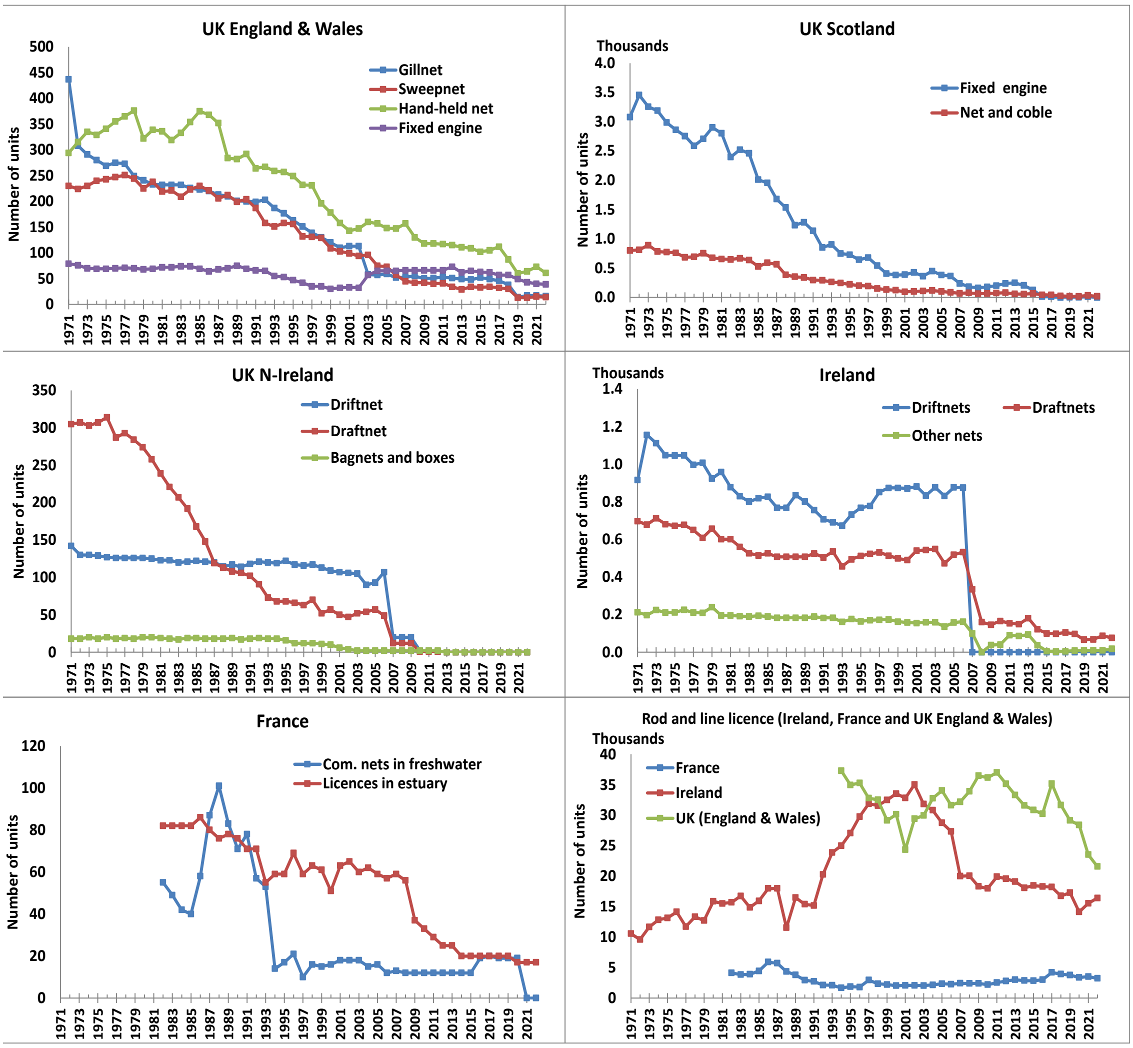


Figure 3.1.3.2. Overview of effort as reported for various fisheries and countries in the Southern NEAC area, 1971-2022. Notice all the y-axes on the right panel are given in thousands.

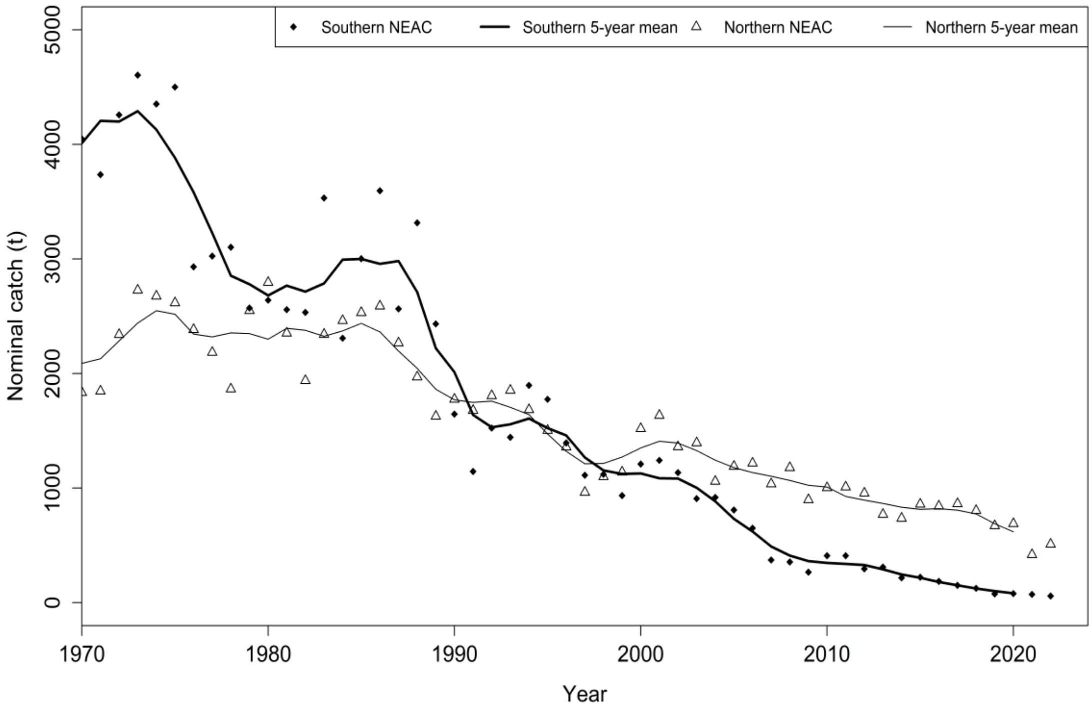


Figure 3.1.4.1. Nominal catches of salmon and five-year running means in the Southern and Northern NEAC areas, 1971–2022

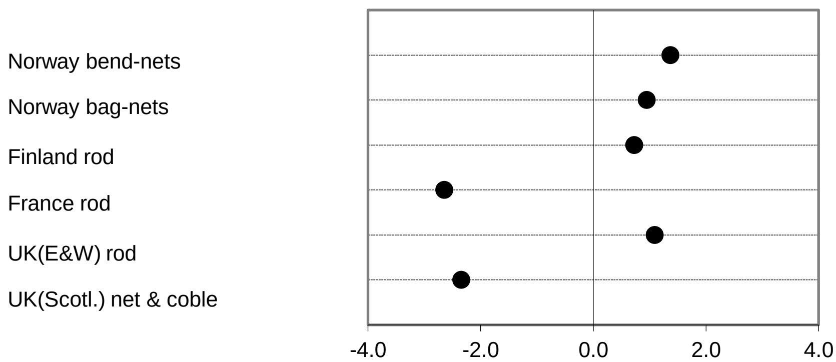


Figure 3.1.5.1. Proportional change (%) over years in CPUE estimates in various rod and net fisheries in Northern and Southern NEAC area.

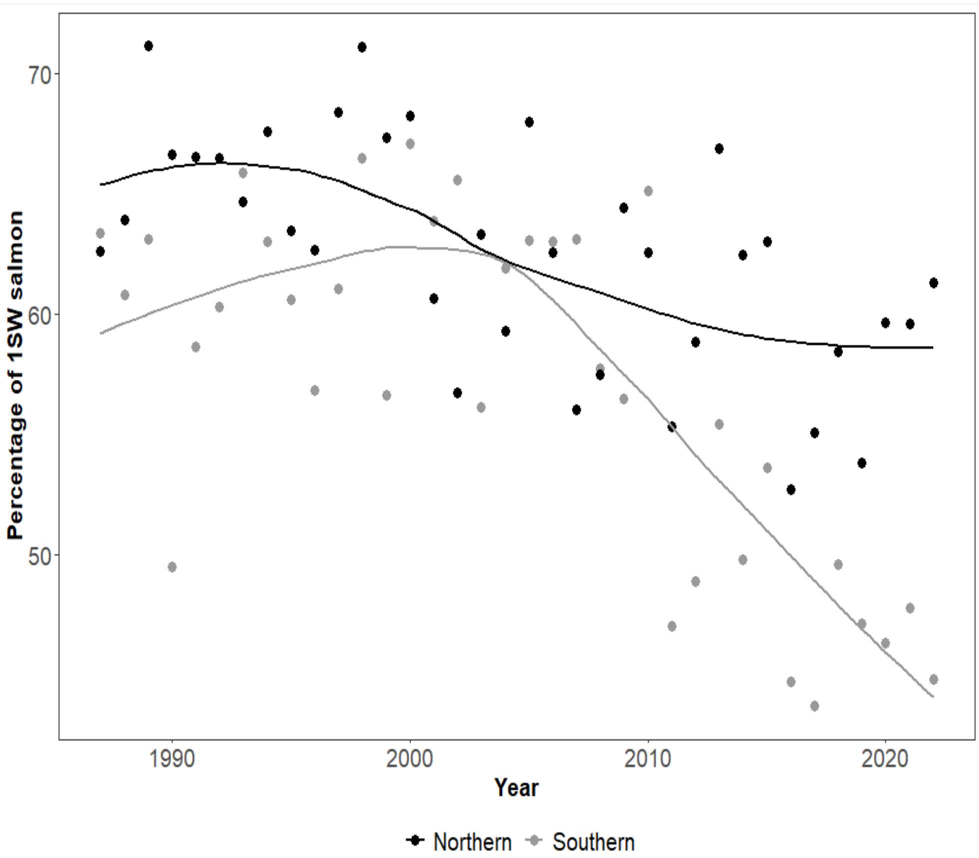


Figure 3.1.6.1. Percentage of 1SW salmon in the reported catch for the Northern (black dots) and Southern (grey dots) stock complexes, 1987–2022. Curves represent Northern (black line) and Southern (grey line) stock complexes with a Loess smoother (span =85%) applied to the data. For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023)

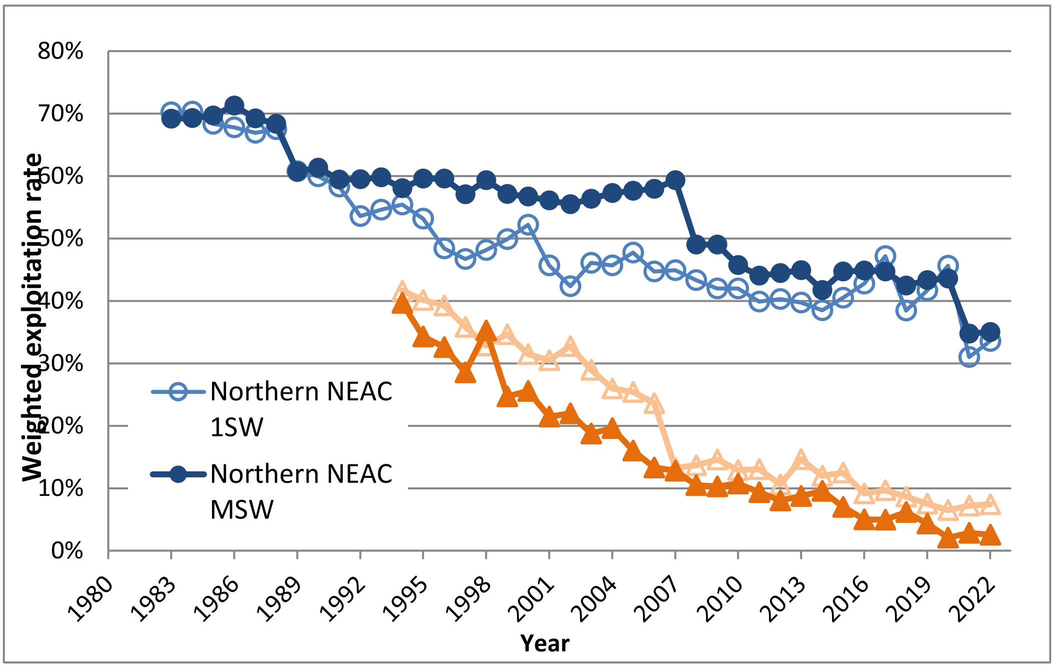


Figure 3.1.9.1. Mean annual exploitation rate of wild 1SW and MSW salmon by fisheries in Northern and Southern NEAC countries. For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

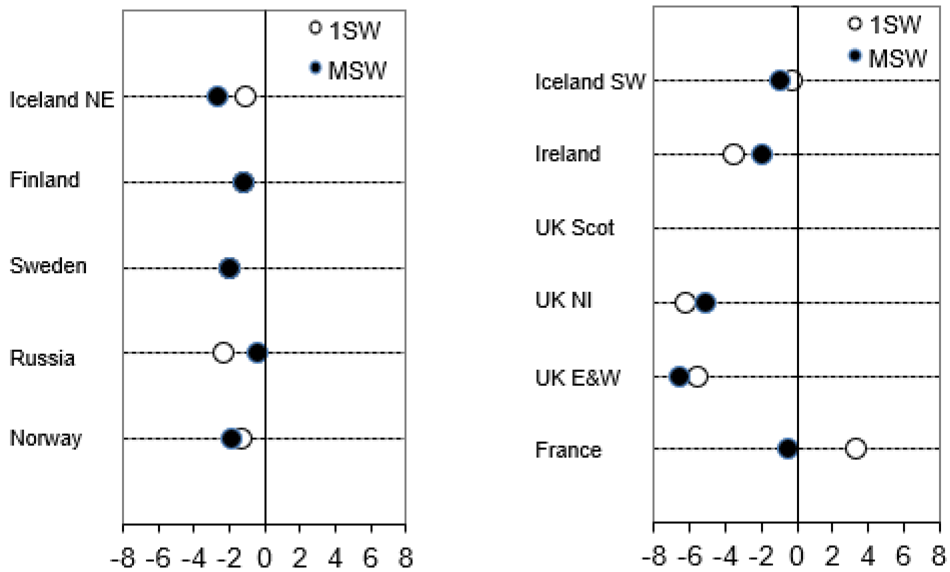


Figure 3.1.9.2. The rate of change (%) of exploitation of 1SW and MSW salmon in Northern NEAC (left) and Southern NEAC (right) countries. For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

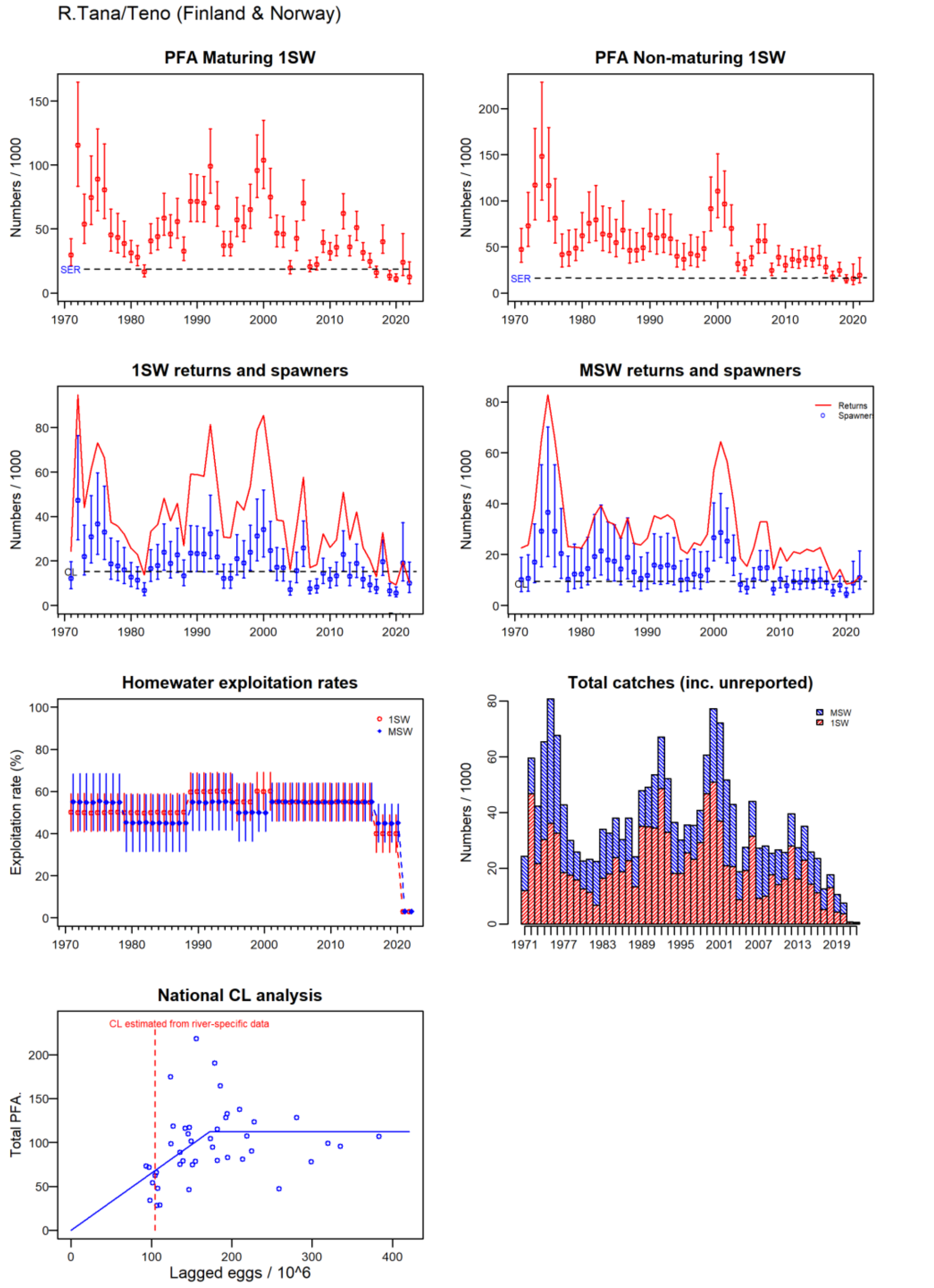


Figure 3.3.4.1a. Summary of fisheries and stock description, River Teno / Tana (Finland and Norway combined). The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point). No exploitation occurred in 2021 and 2022 owing fisheries closure in the Teno/Tana.

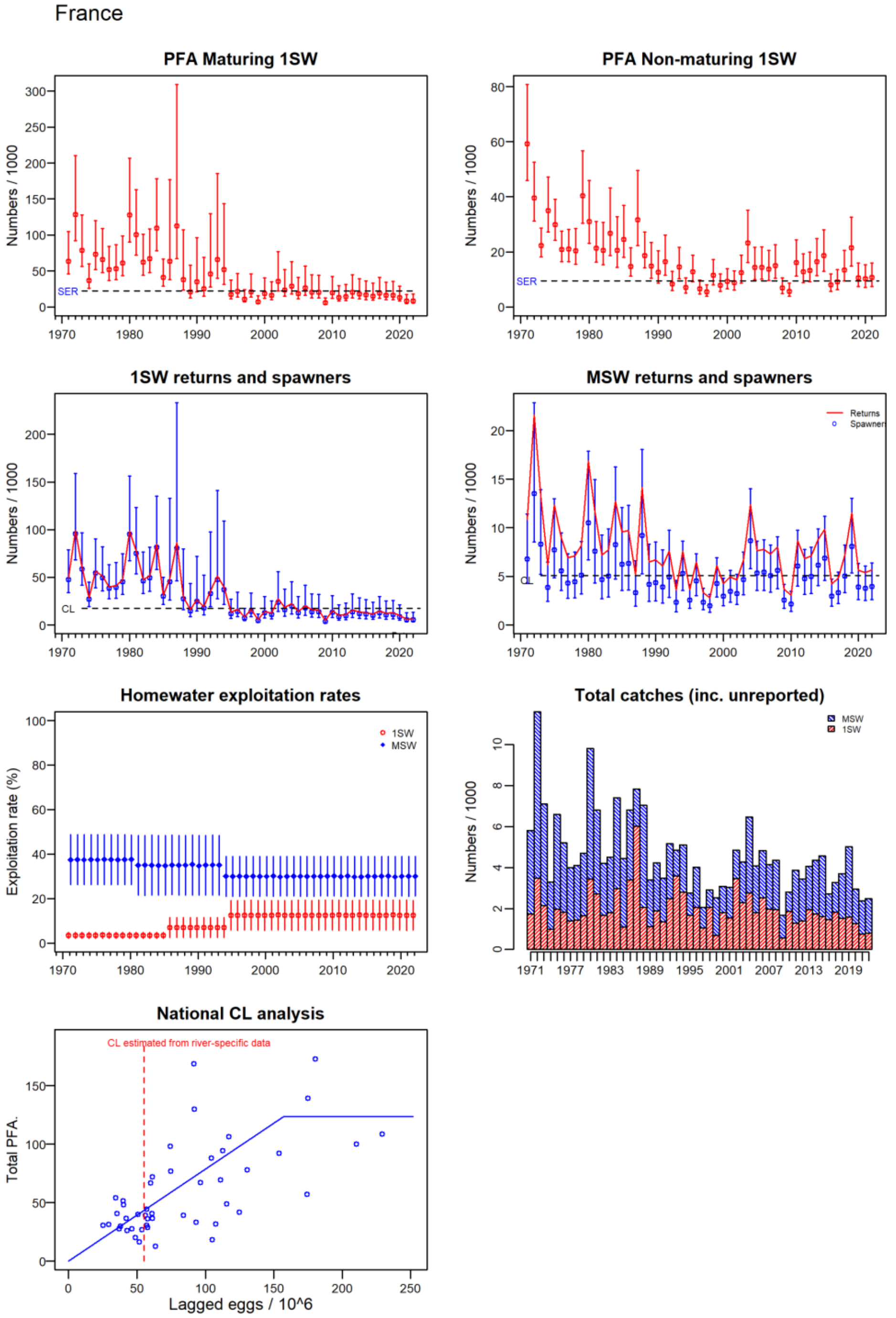


Figure 3.3.4.1b. Summary of fisheries and stock description, France. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

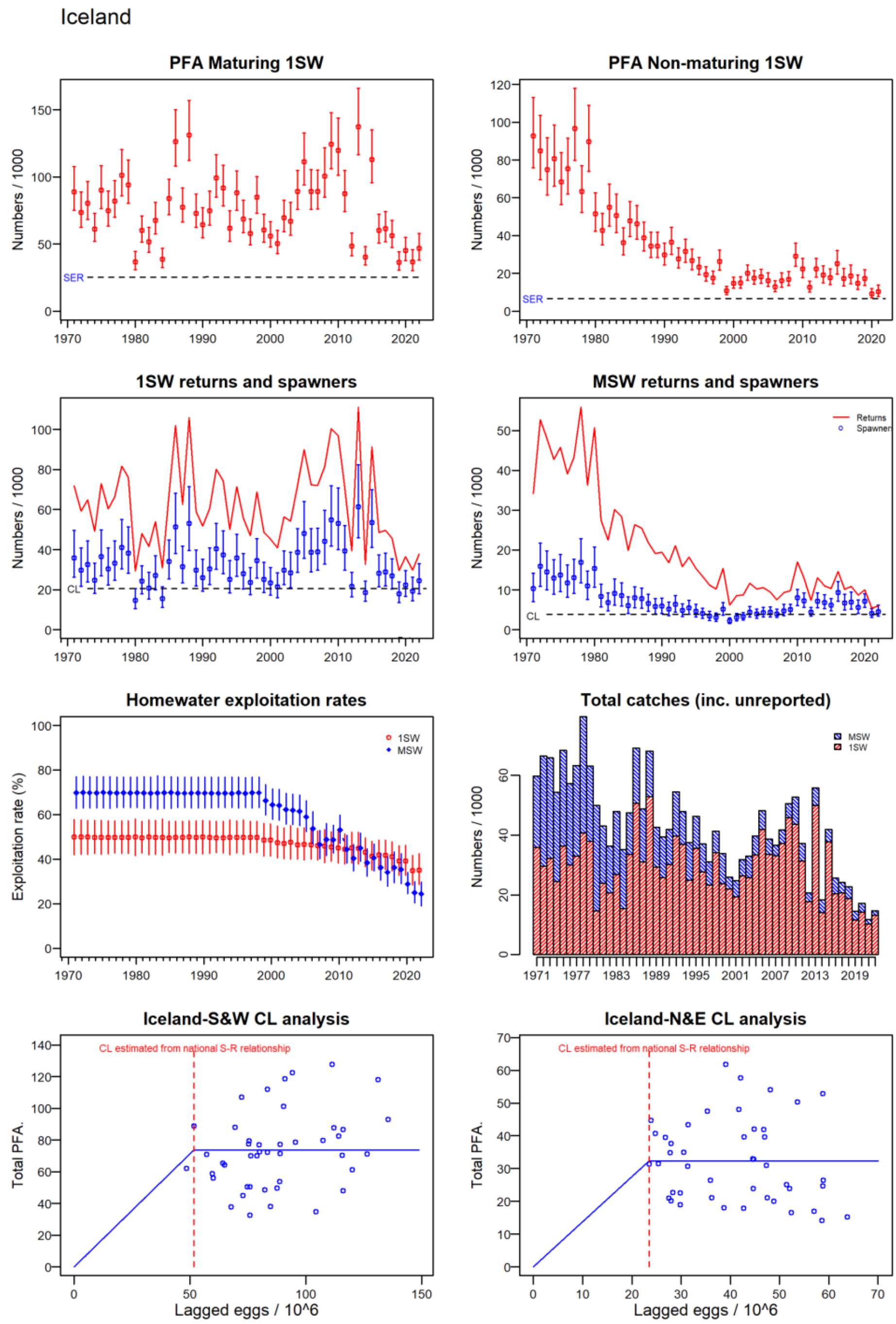


Figure 3.3.4.1c. Summary of fisheries and stock description, Iceland. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

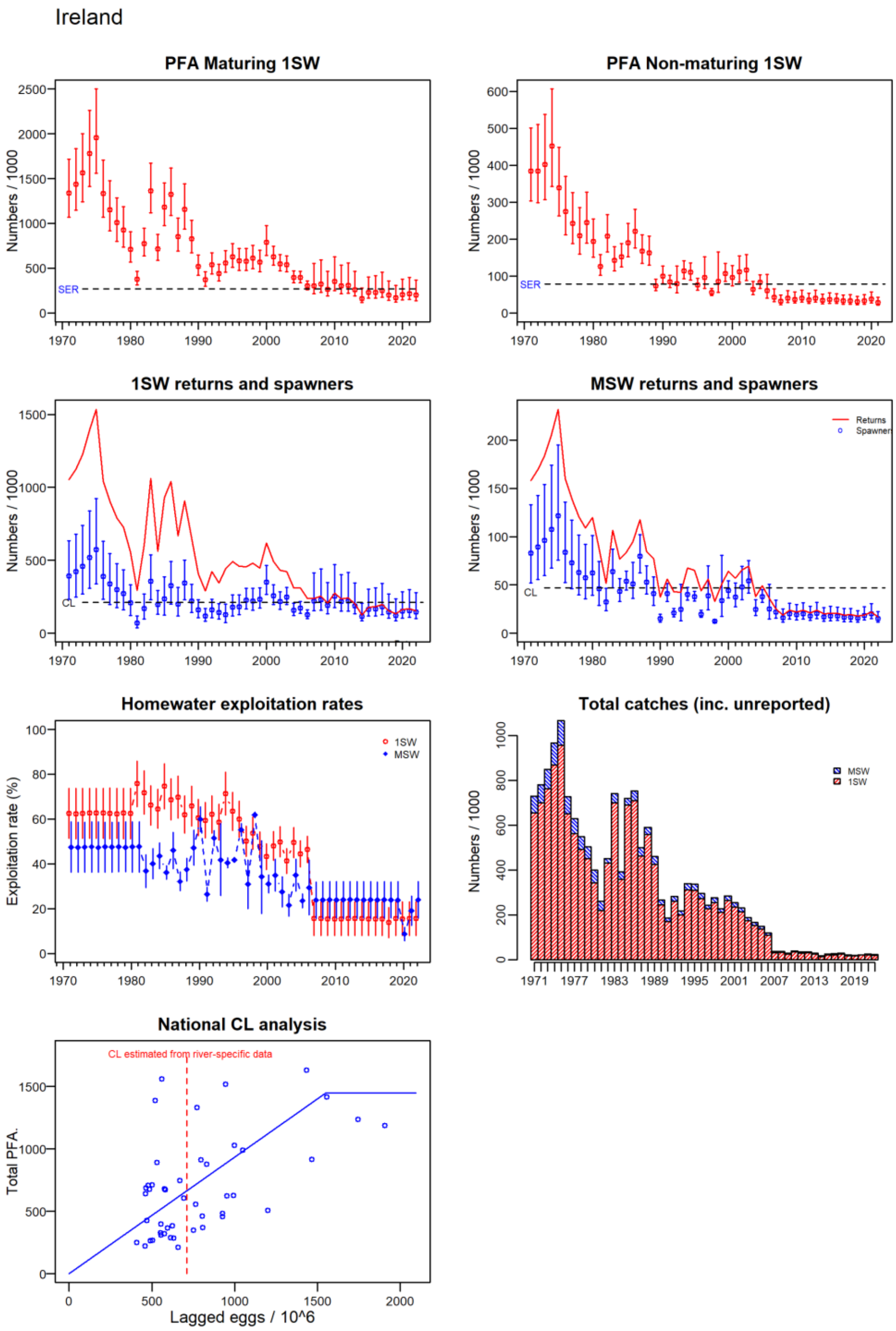


Figure 3.3.4.1d. Summary of fisheries and stock description, Ireland. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

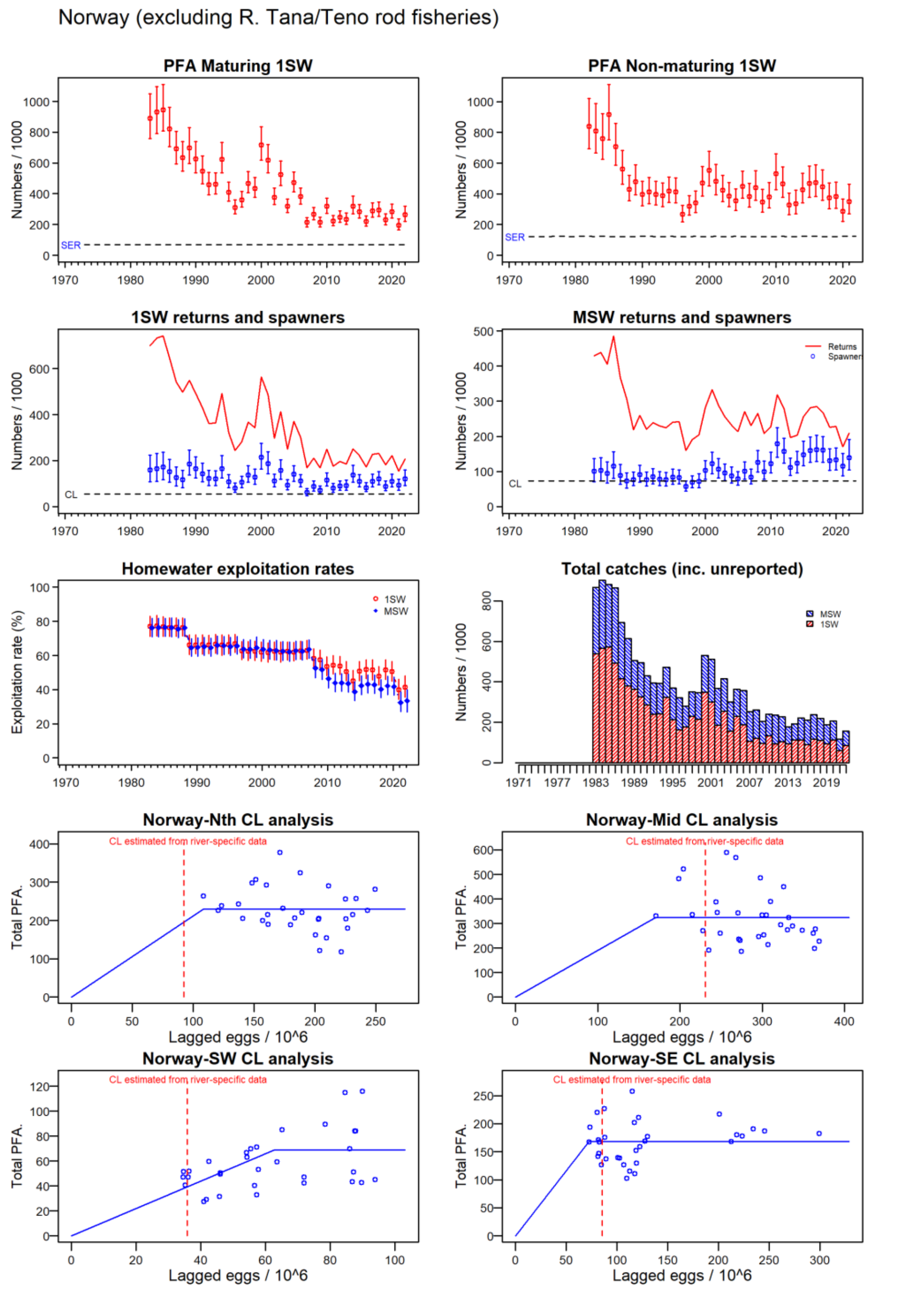


Figure 3.3.4.1e. Summary of fisheries and stock description, Norway (minus Norwegian catches from the R. Teno / Tana). The river-specific CLs, which are used for assessment purposes, are included on the regional CL analysis plots (for comparison, the CLs estimated from the regional S–R relationships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

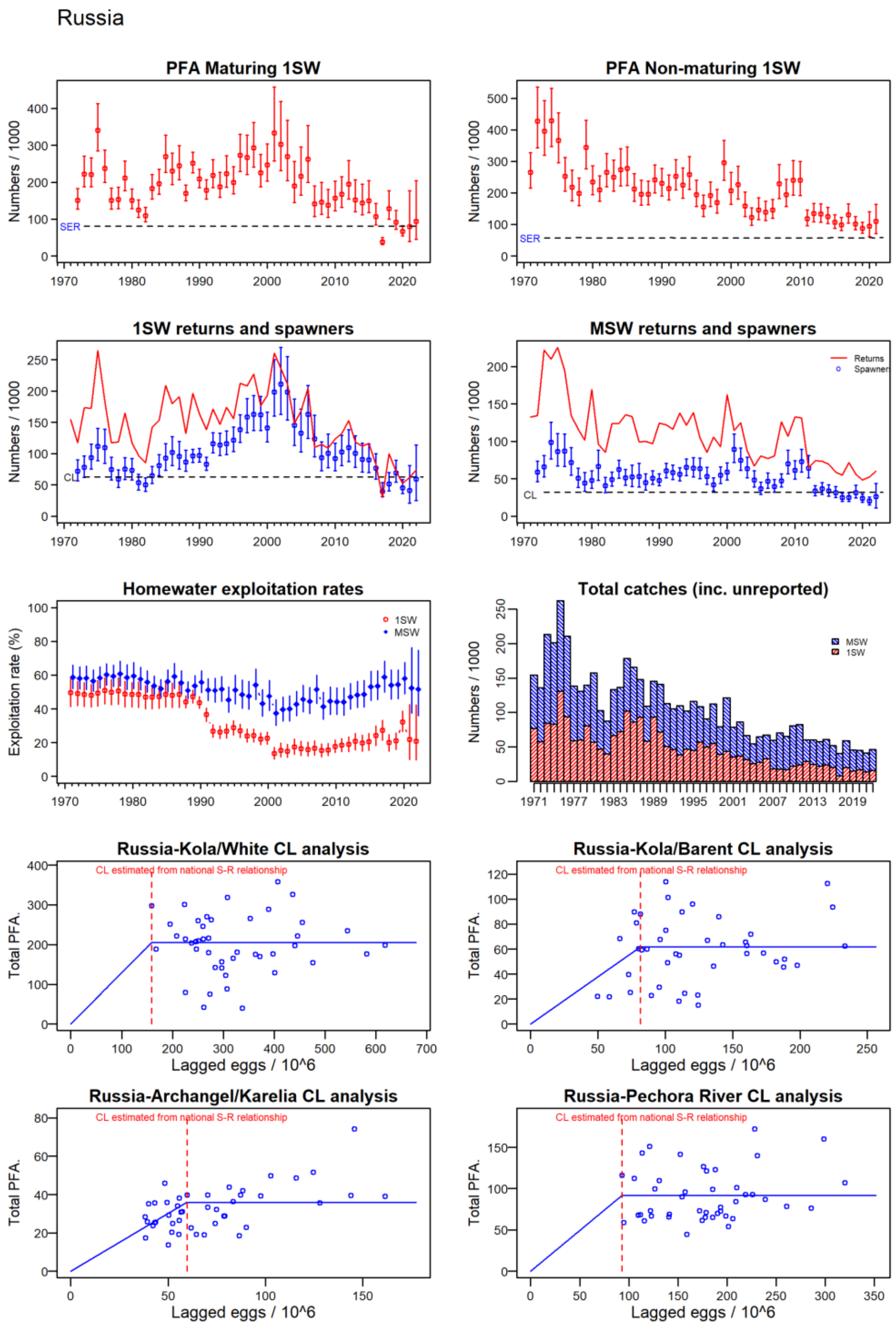


Figure 3.3.4.1f. Summary of fisheries and stock description, Russia. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point). is at the inflection point). For 2021 and 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

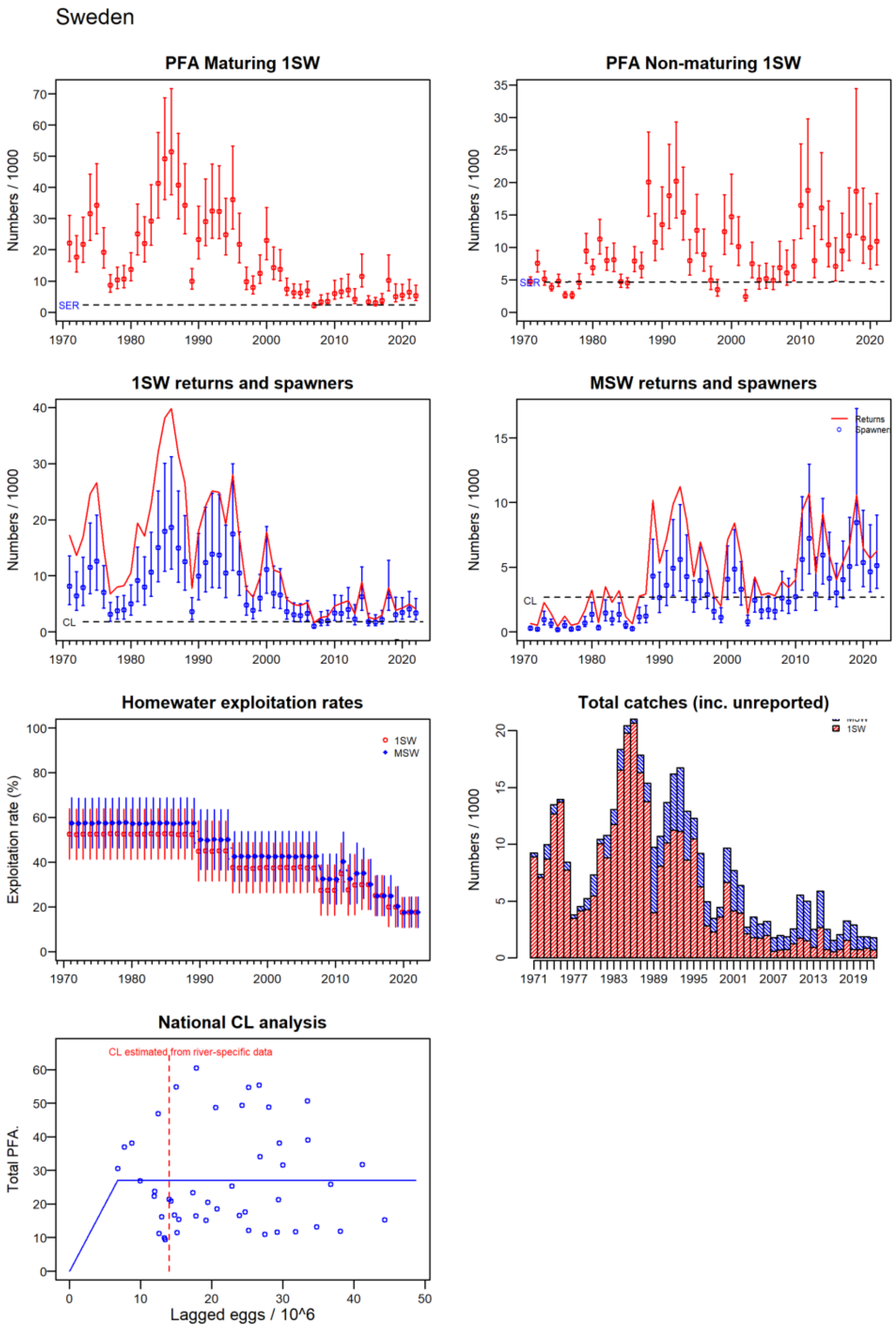


Figure 3.3.4.1g. Summary of fisheries and stock description, Sweden. The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

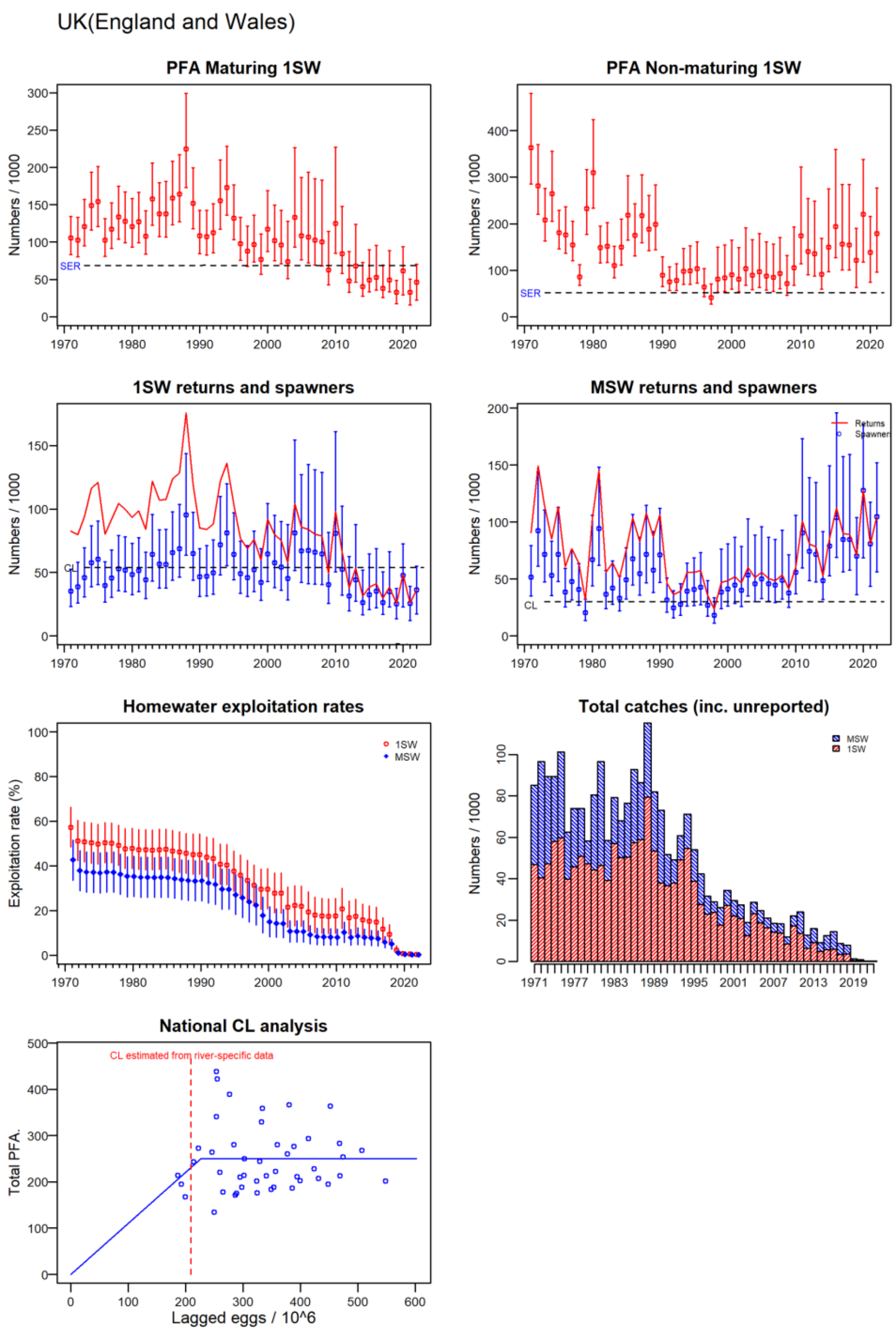


Figure 3.3.4.1h. Summary of fisheries and stock description, UK (England & Wales). The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

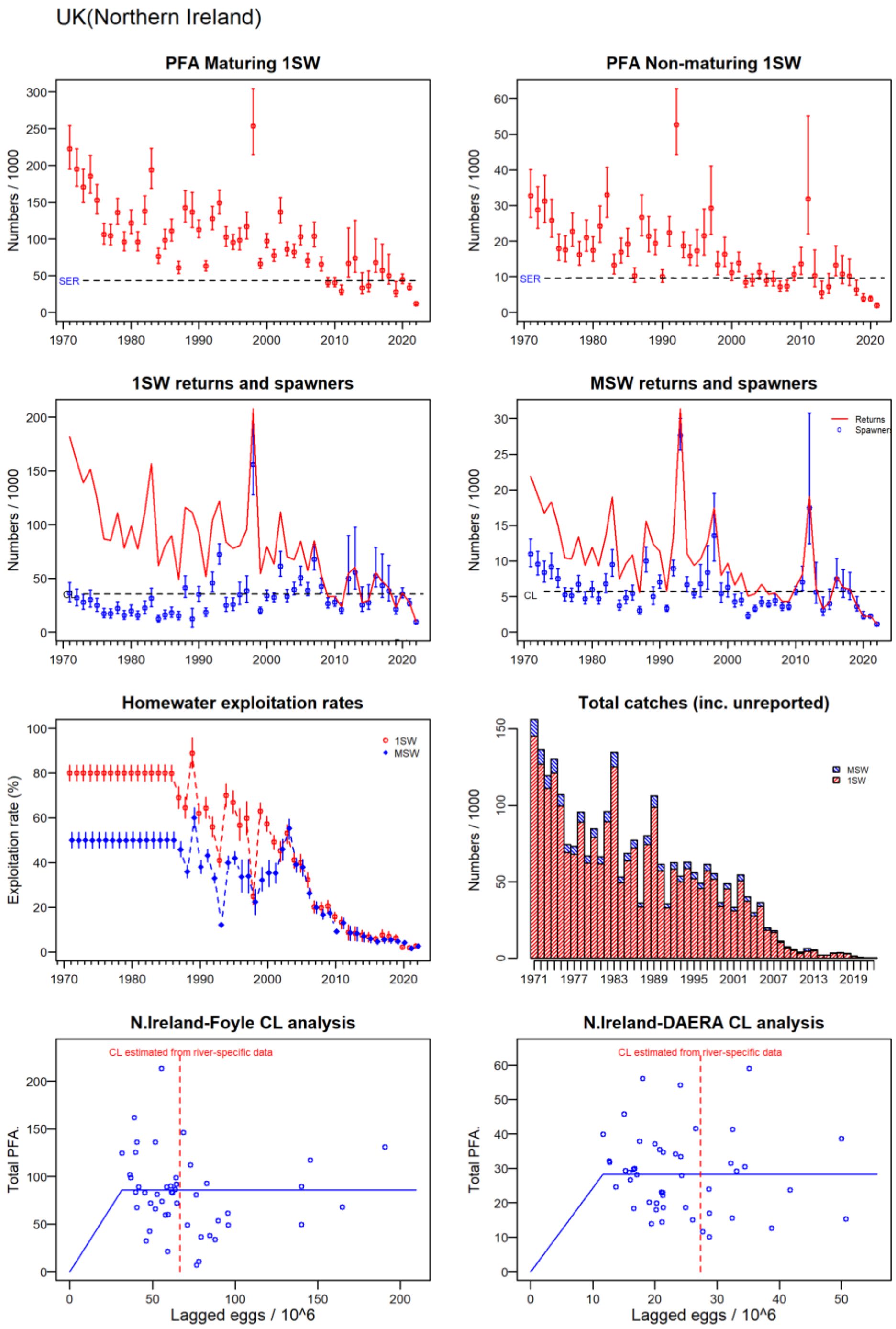


Figure 3.3.4.1i. Summary of fisheries and stock description, UK (Northern Ireland). The river-specific CLs, which are used for assessment purposes, are included on the regional CL analysis plots (for comparison, the CLs estimated from the regional S–R relationships are at the inflection points).

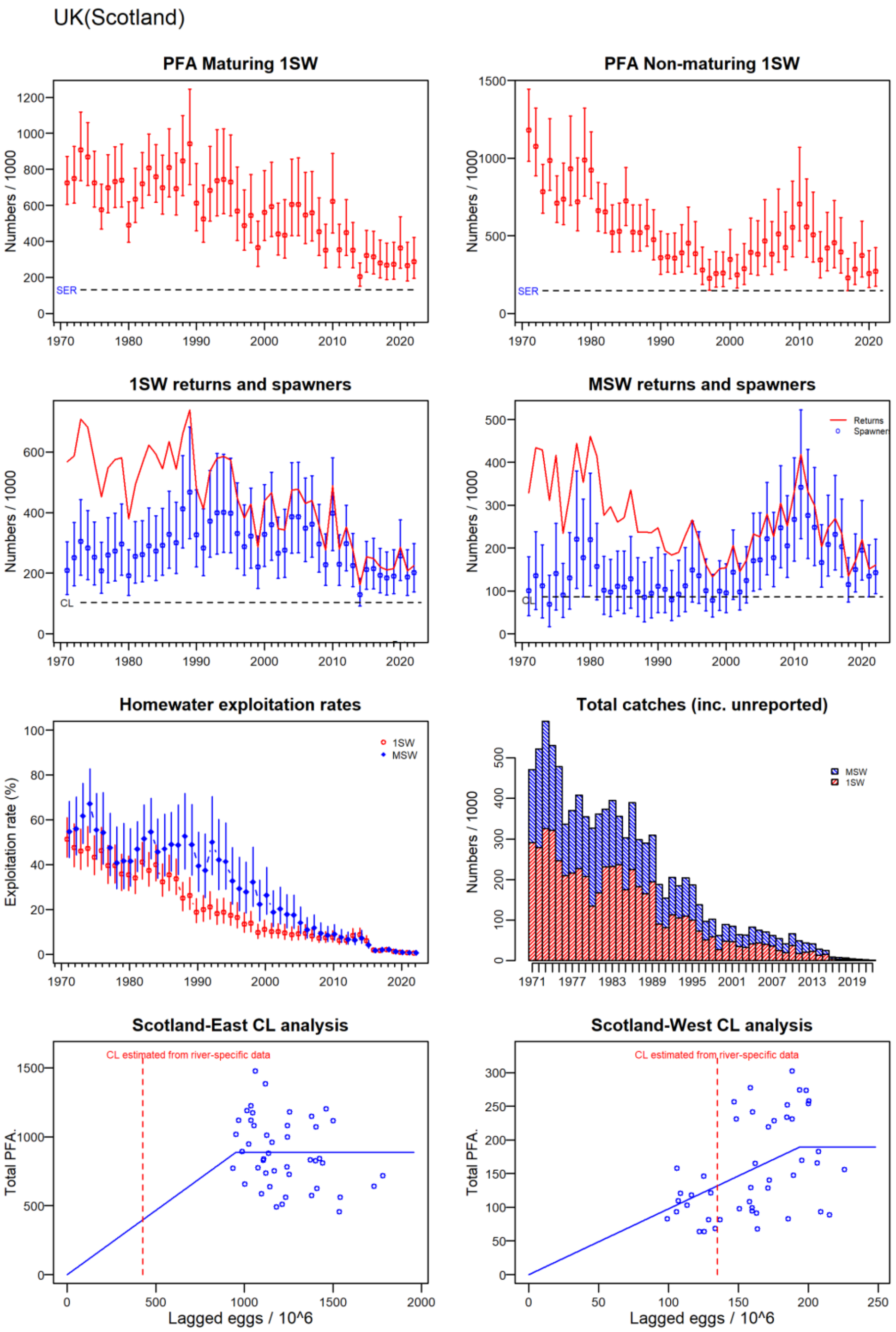


Figure 3.3.4.1j. Summary of fisheries and stock description, UK (Scotland). The river-specific CL, which is used for assessment purposes, is included on the national CL analysis plot (for comparison, the CL estimated from the national S–R relationship is at the inflection point).

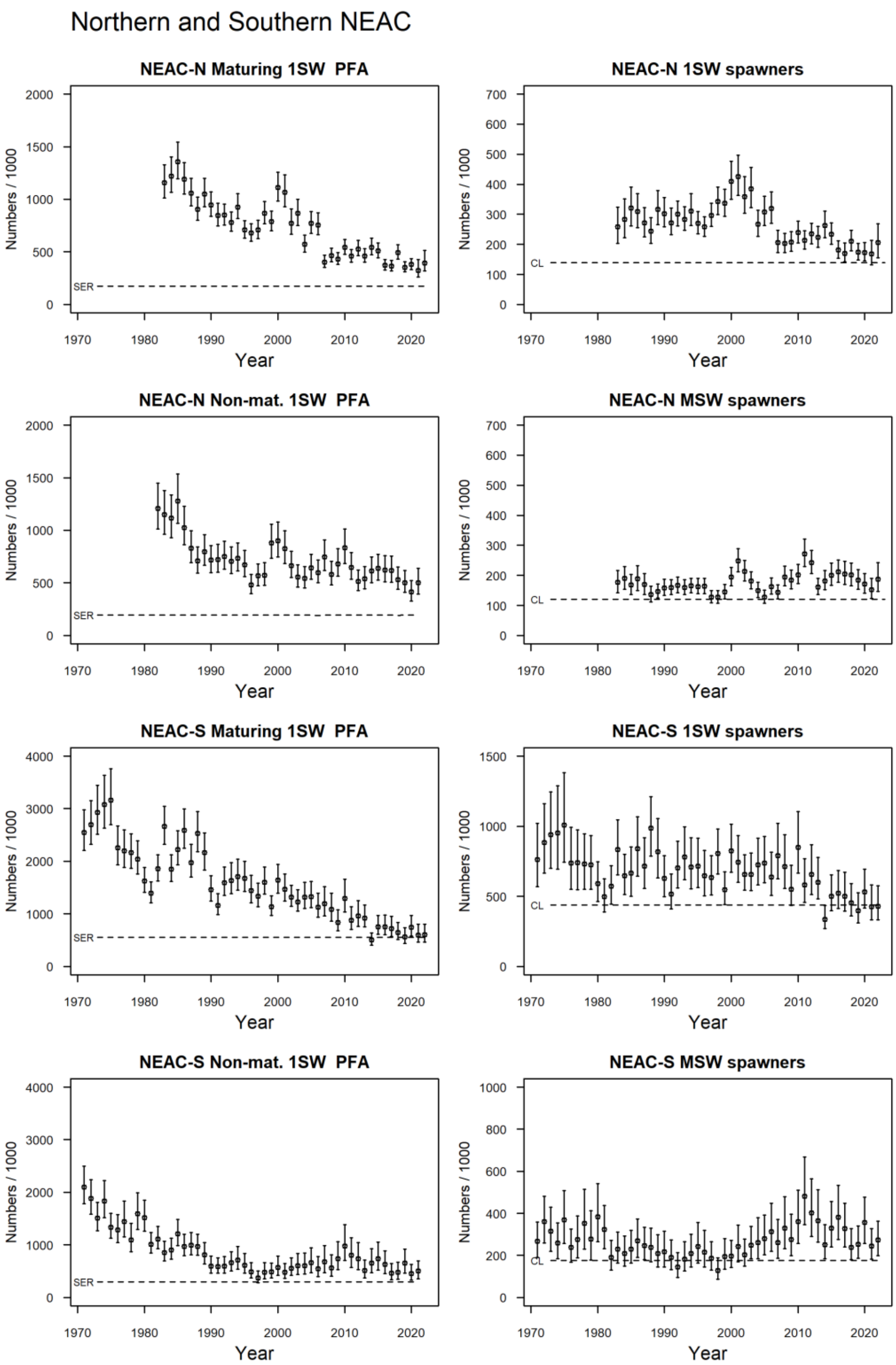


Figure 3.3.4.2. Estimated PFA (left panels) and spawning escapement (right panels) with 90% confidence limits, for maturing 1SW (1SW spawners) and non-maturing 1SW (MSW spawners) salmon in Northern (NEAC-N) and Southern (NEAC-S) NEAC stock complexes.

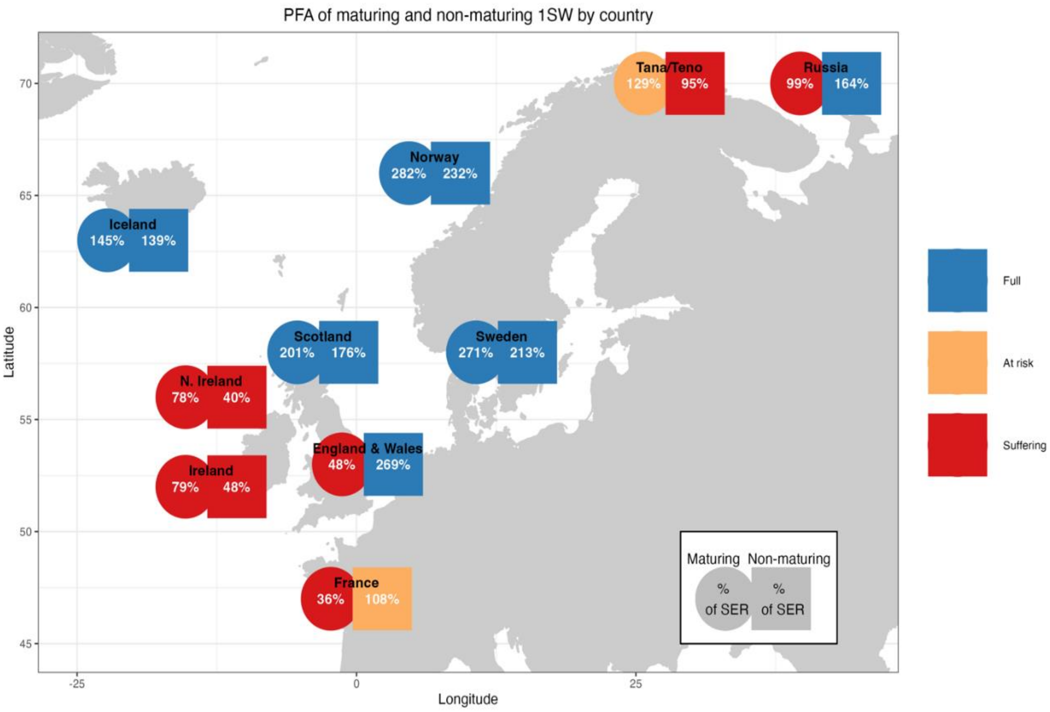


Figure 3.3.4.3a. PFA of maturing (2021) and non-maturing (2020) in percent of spawner escapement reserve (% of SER). The percent of SER is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the SER), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the SER, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the SER). For 2021, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

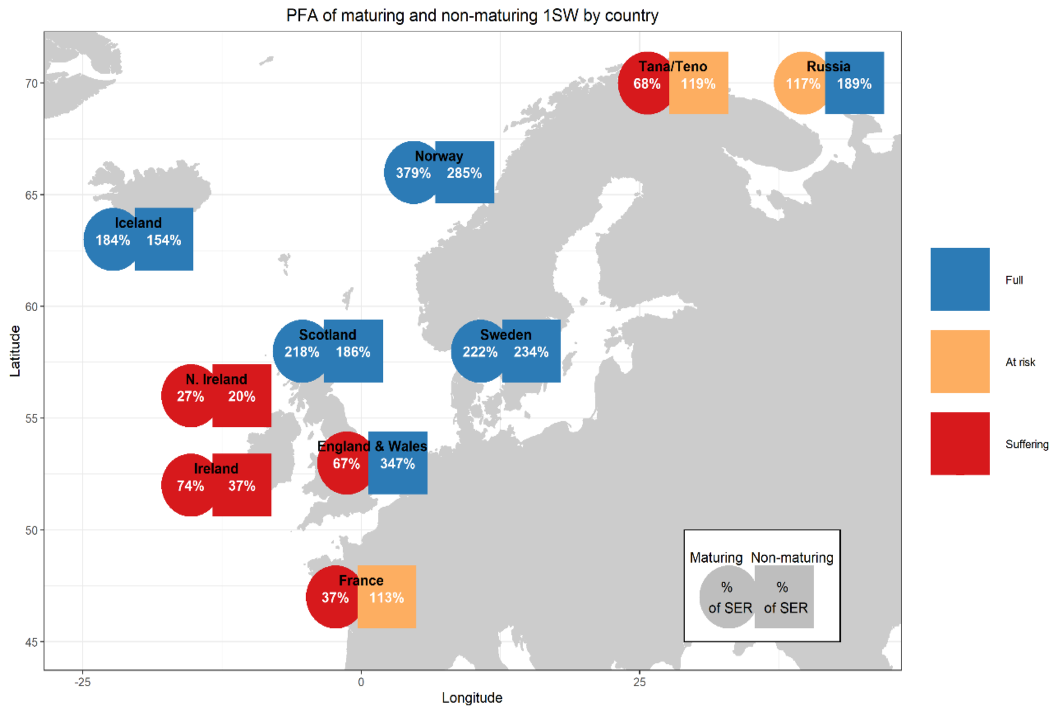


Figure 3.3.4.3b. PFA of maturing (2022) and non-maturing (2021) in percent of spawner escapement reserve (% of SER). The percent of SER is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the SER), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the SER, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the SER). For 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

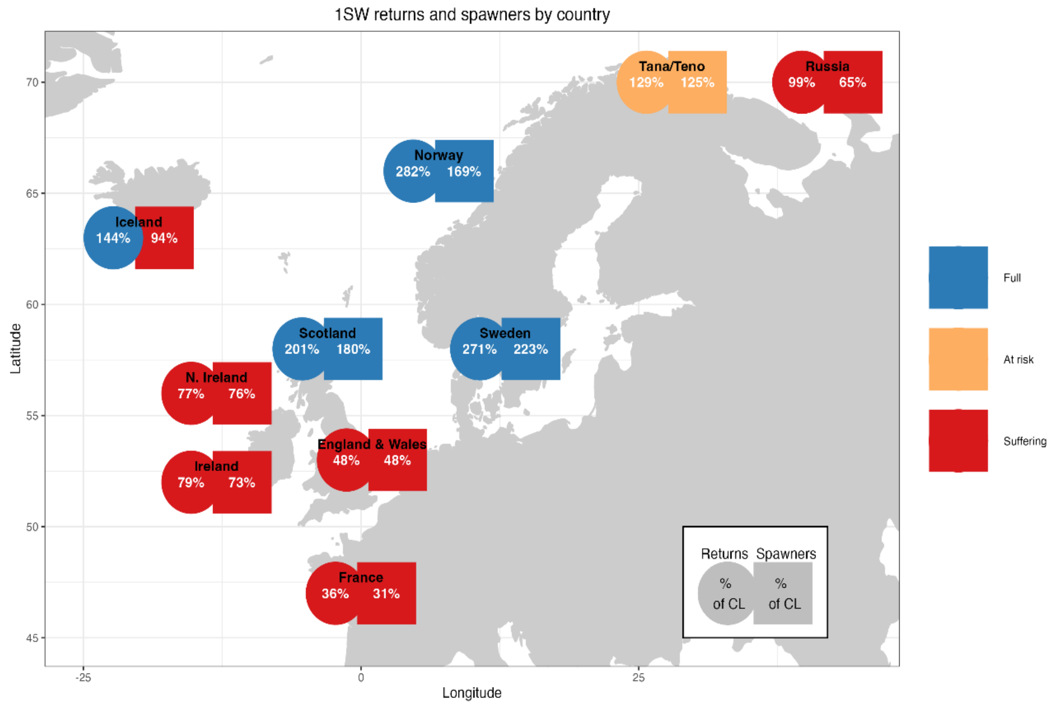


Figure 3.3.4.4a. 1SW returns and spawners in percent of conservation limit (% of CL) for 2021. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2021, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

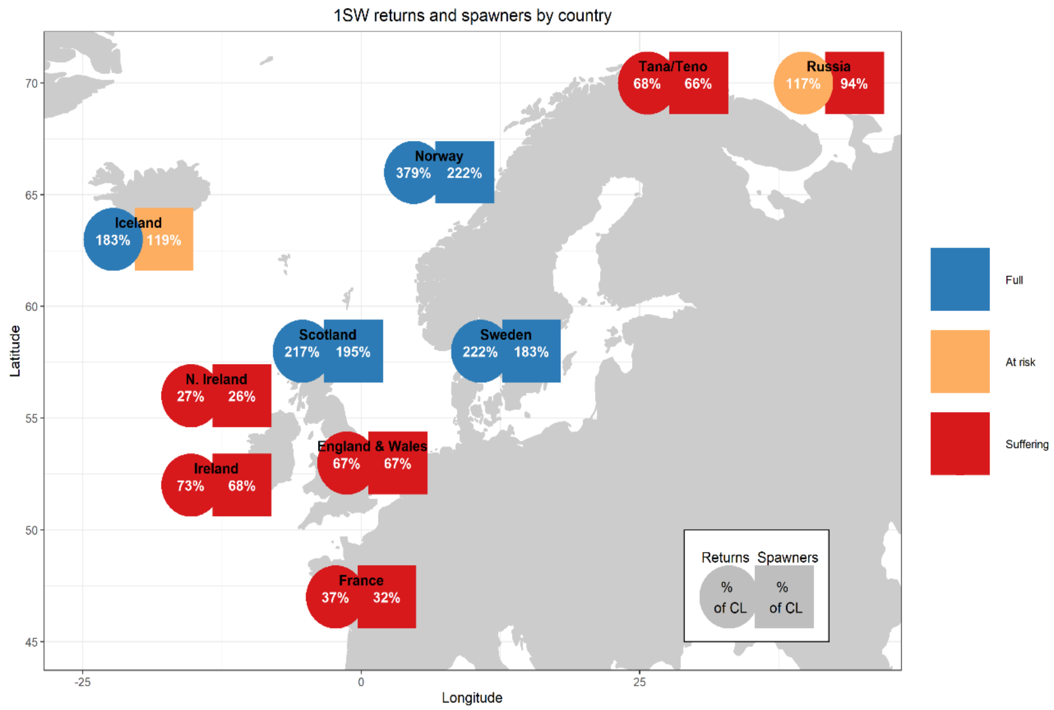


Figure 3.3.4.4b. 1SW returns and spawners in percent of conservation limit (% of CL) for 2022. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

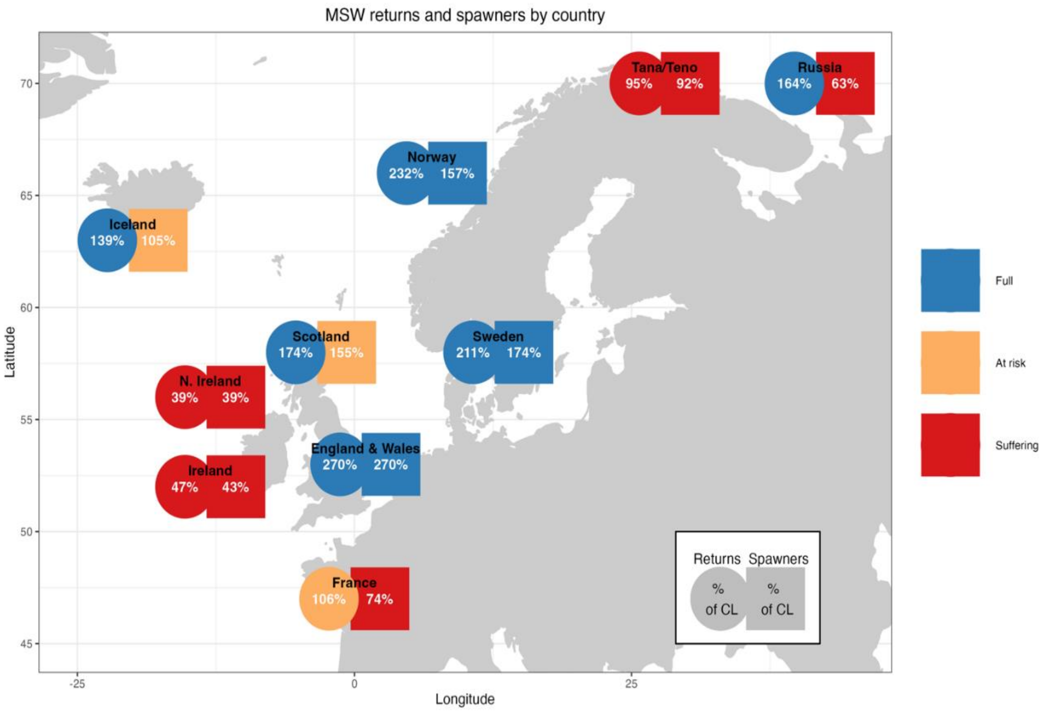


Figure 3.3.4.5a. MSW returns and spawners in percent of conservation limit (% of CL) for 2021. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2021, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

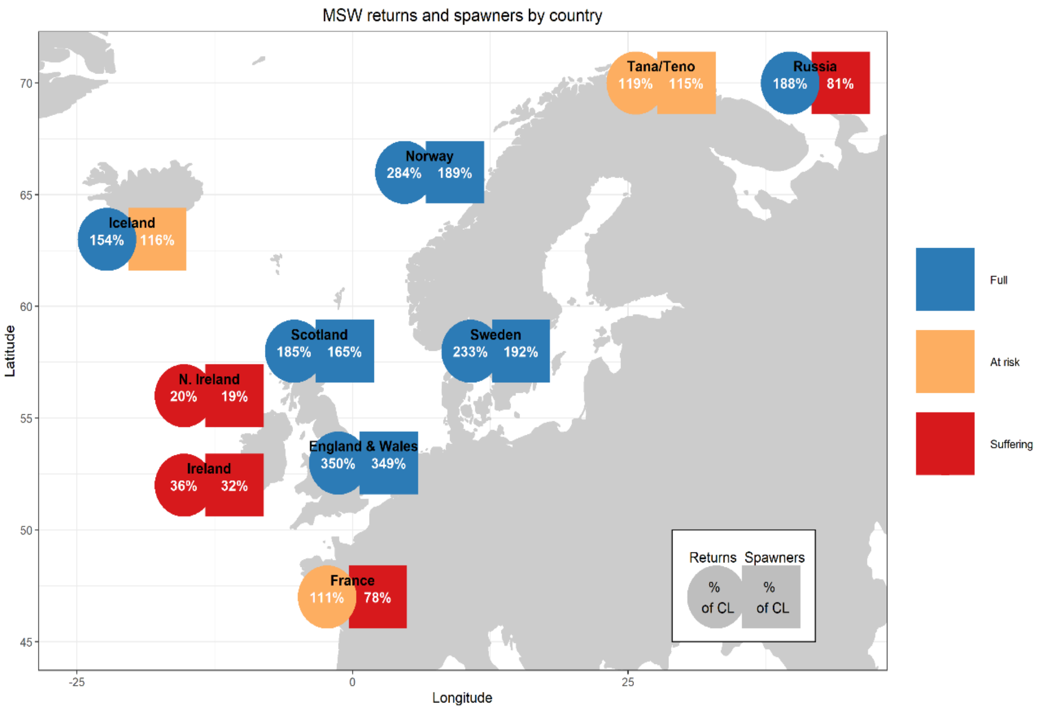


Figure 3.3.4.5b. MSW returns and spawners in percent of conservation limit (% of CL) for 2022. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

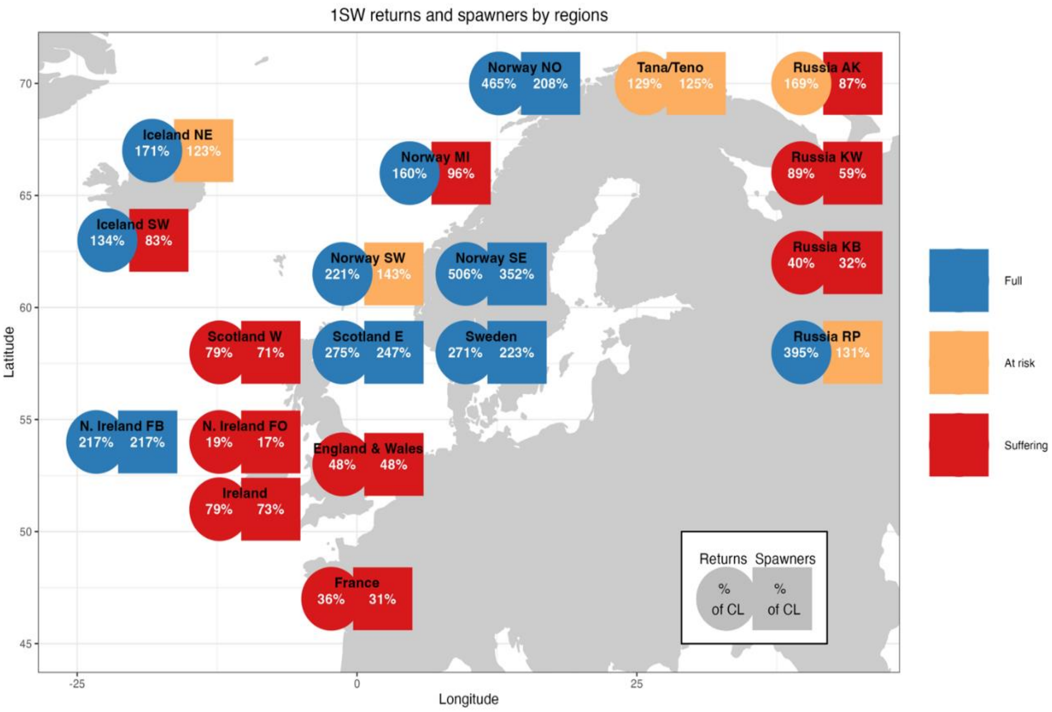


Figure 3.3.4.6a. 1SW returns and spawners in percent of region-specific conservation limit (% of CL) for 2021. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2021, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

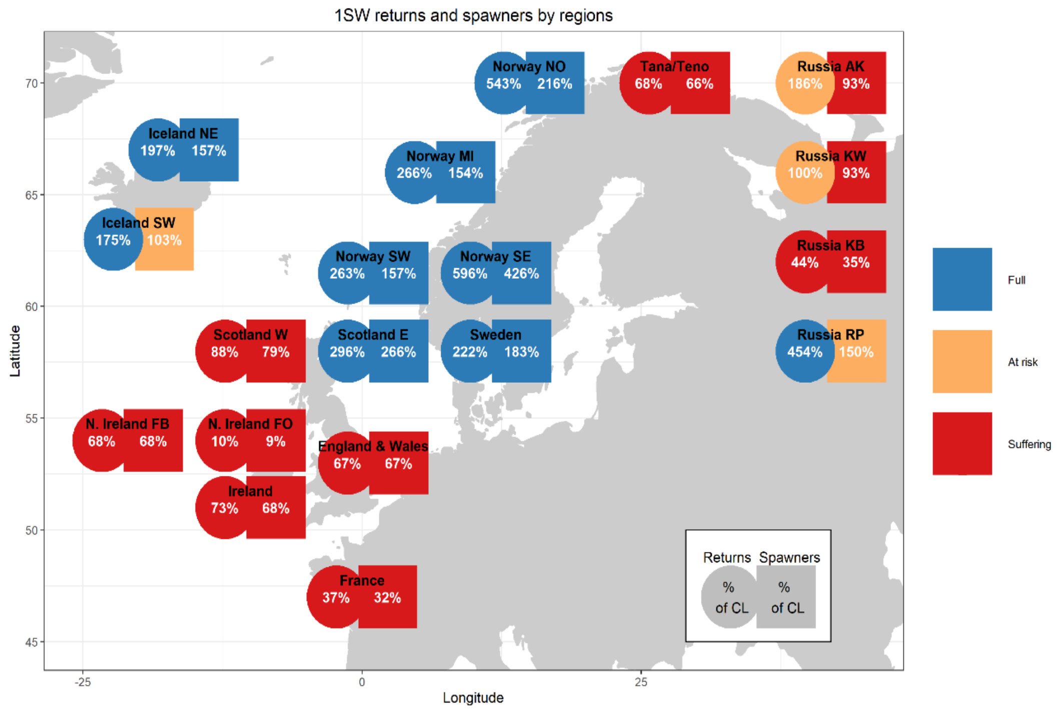


Figure 3.3.4.6b. 1SW returns and spawners in percent of region-specific conservation limit (% of CL) for 2022. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

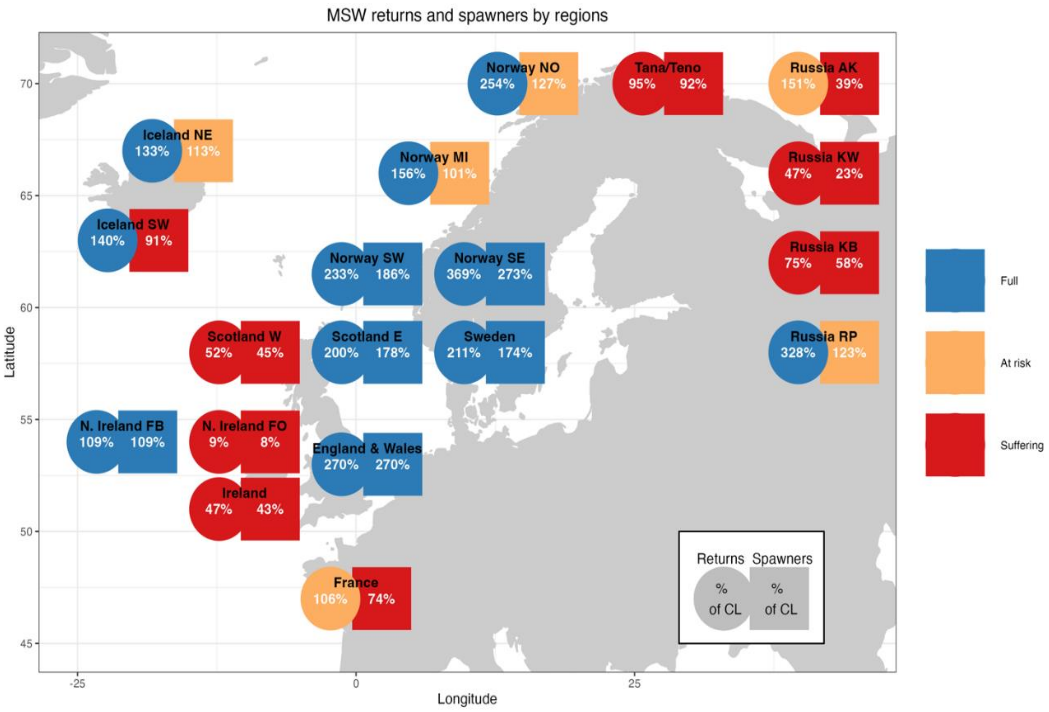


Figure 3.3.4.7a. MSW returns and spawners in percent of region-specific conservation limit (% of CL) for 2021. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2021, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

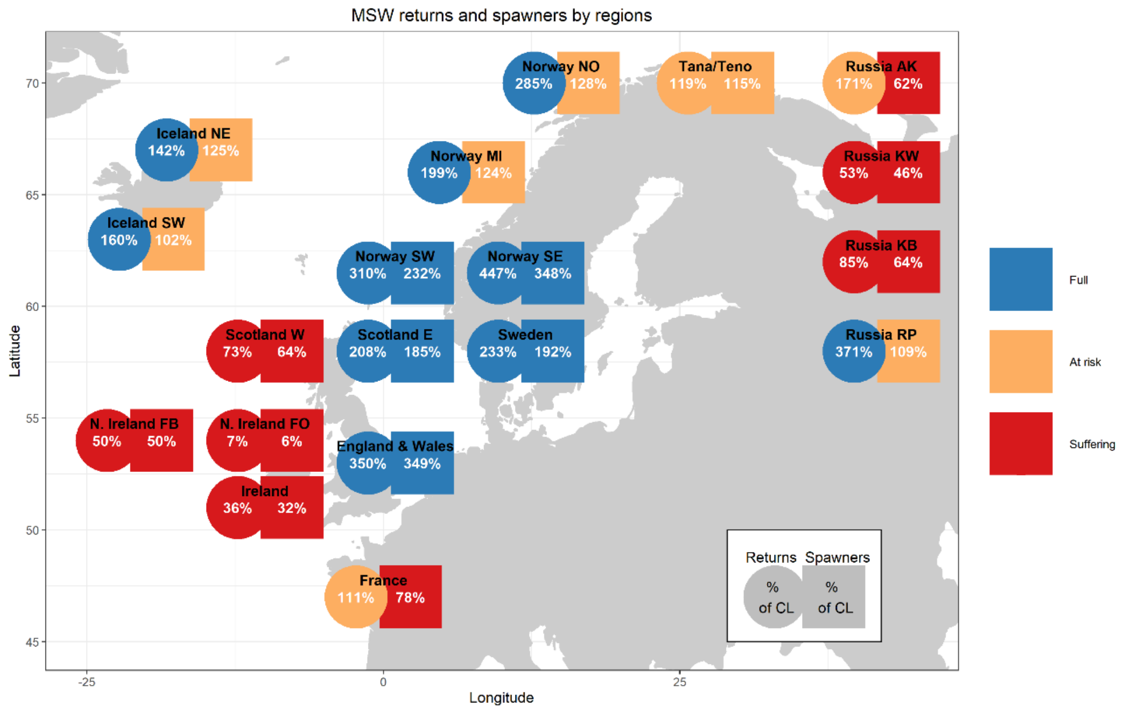


Figure 3.3.4.7b. MSW returns and spawners in percent of region-specific conservation limit (% of CL) for 2022. The percent of CL is based on the median of the Monte Carlo distribution. The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL). For 2022, values for Russia are derived from total reported catches provided in tonnes (NASCO, 2023).

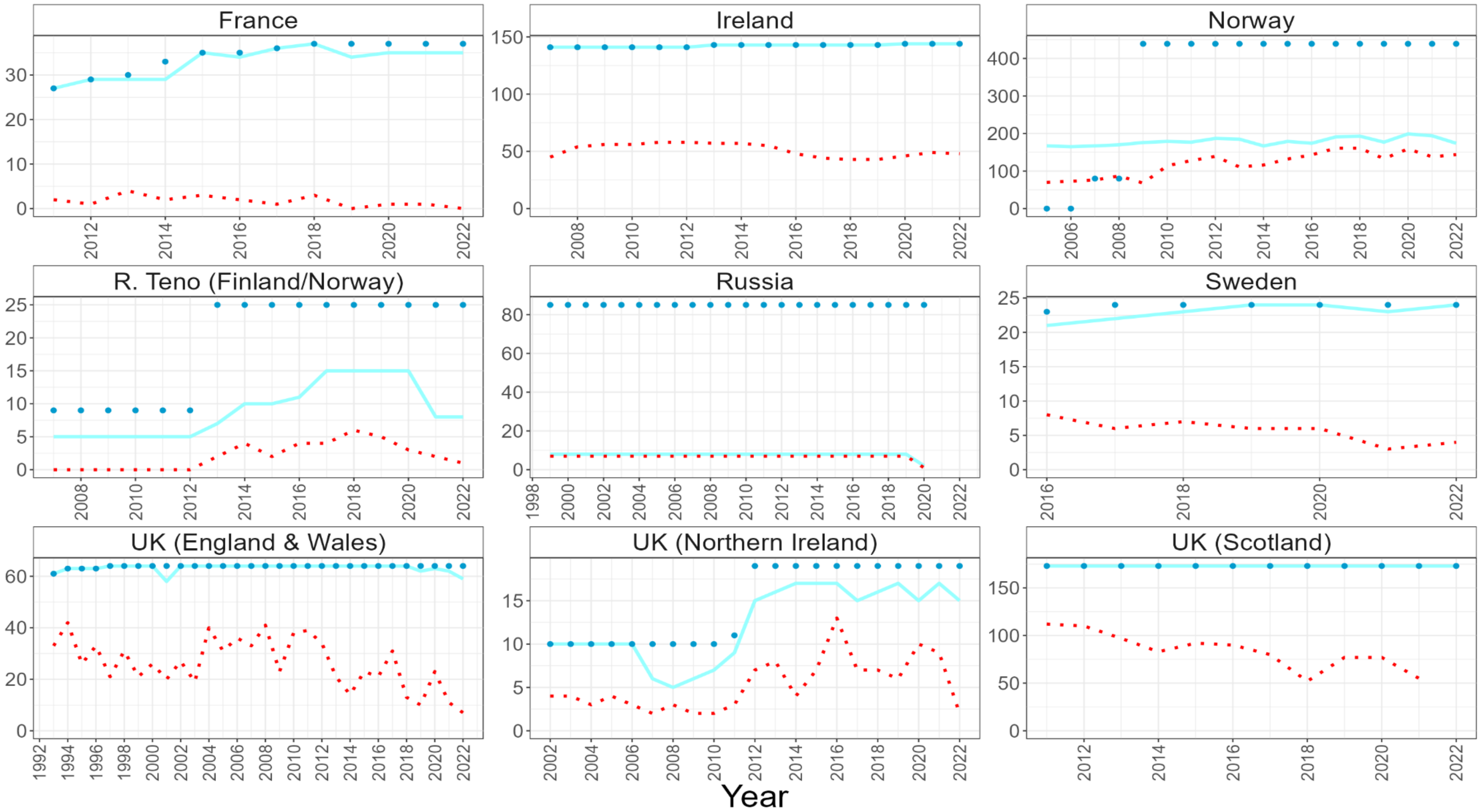


Figure 3.3.5.1 Time-series showing the number of rivers with established CLs (light blue dotted lines), the number of rivers assessed annually (light blue solid lines), and the number of rivers meeting CLs annually (red dotted lines) for jurisdictions in the NEAC area.

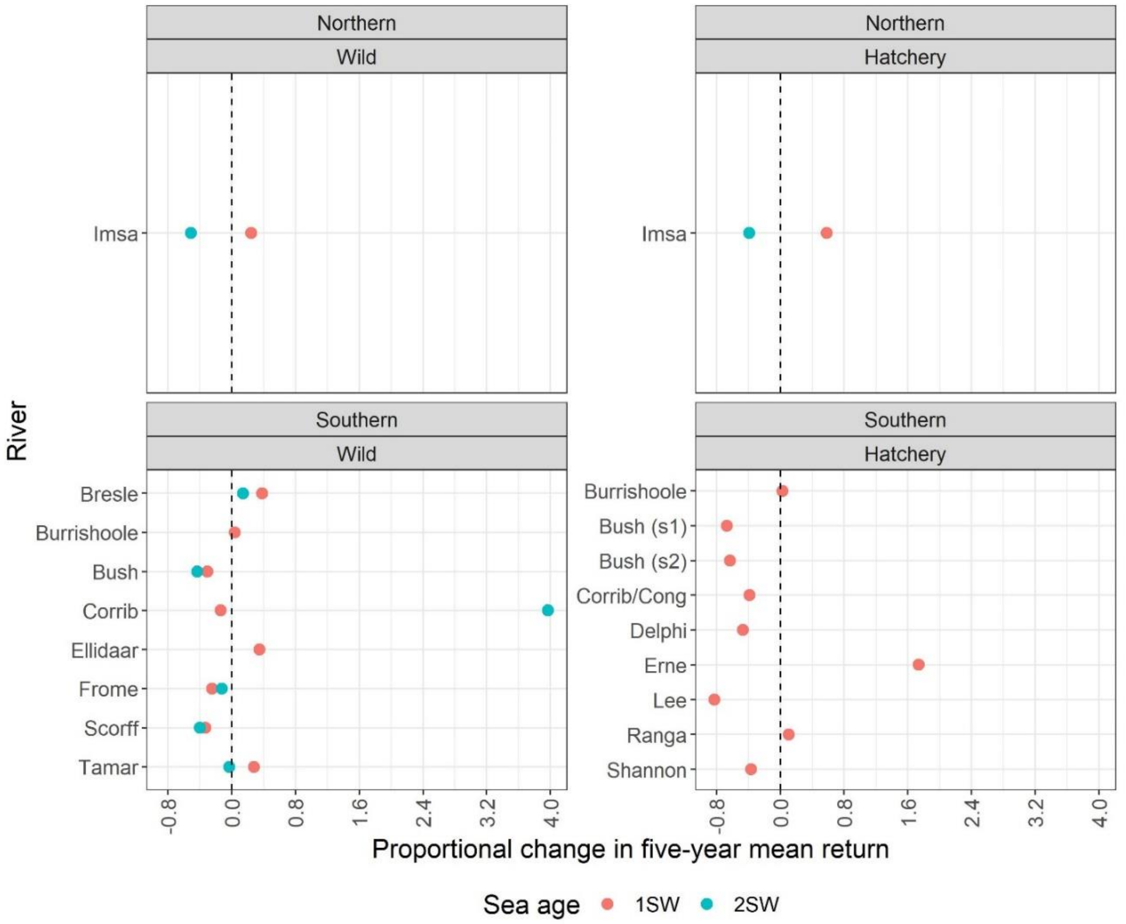


Figure 3.3.6.1. Comparison of the proportional change in the most recent five-year mean return rates compared to the previous five-year mean return rates for 1SW and 2SW wild (left hand panels) and hatchery (right hand panels) smolts to rivers of Northern (upper panels) and Southern NEAC (lower panels) areas. Populations with at least three data-points in each of the two time periods are included in the analysis. The scale of change in some rivers is influenced by very low return numbers creating high uncertainty, which may have a large consequence on the proportional change.

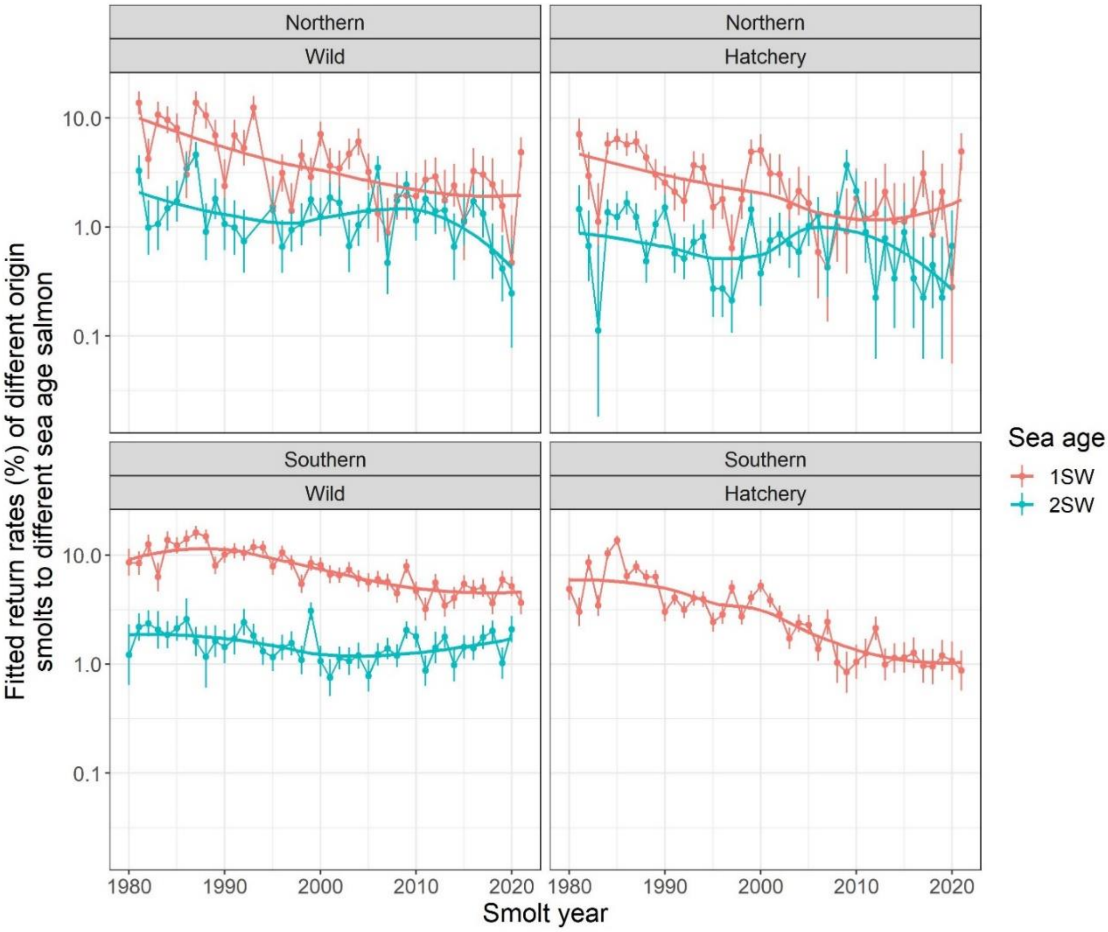


Figure 3.3.6.2. Least squared (marginal mean) average annual survival indices (%) of wild (left hand panels) and hatchery origin smolts (right hand panels) of 1SW and 2SW salmon to Northern (top panels) and Southern NEAC areas (bottom panels). For most rivers in Southern NEAC, the values are returns to the coast prior to the homewater coastal fisheries. Mean annual return rates for each origin and area were estimated from a general linear model assuming quasi-Poisson errors (log-link function). Error bars represent standard errors. Trend lines are from locally weighted polynomial regression (LOESS) and are meant to be a visual interpretation aid. 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.

4 North American Commission

4.1 NASCO has requested ICES to describe the key events of the 2021 and 2022 fisheries

4.1.1 Key events of the 2021 and 2022 fisheries

There were no significant changes in the 2021 or 2022 fisheries.

4.1.2 Gear and effort

4.1.2.1 Canada

The 23 areas for which Fisheries and Oceans Canada (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs). Inner Bay of Fundy Atlantic salmon, SFA 22 and part of SFA 23, have been federally listed as endangered under the Canadian Species at Risk Act and information for these stocks are not included in the information and advice provided to NASCO, as with the exception of one population, these stocks have a localized migration strategy while at sea and a high incidence of maturity after one winter at sea. In Quebec, the management of Atlantic salmon is delegated to the province (Ministère de l'Environnement, de la Lutte contre les changements climatiques, 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 subsistence fisheries refer to salmon less than 63 cm fork length. In historic commercial fisheries small salmon refer to fish less than 2.7 kg whole weight. Large salmon, generally MSW and repeat spawners, in recreational and subsistence fisheries are greater than or equal to 63 cm fork length. In historic commercial fisheries large salmon refer to fish greater than or equal to 2.7 kg whole weight.

Three groups exploited salmon in Canada in 2021 and 2022: Indigenous, Labrador resident subsistence, and recreational fishers. There are no commercial salmon fisheries in Canada and retaining bycatch of salmon in commercial fisheries targeting other species is not permitted. Salmon discards from these fisheries are not estimated, however, previous analyses by ICES indicated the extent was low (ICES, 2004). The sale of Atlantic salmon caught in any Canadian fishery is prohibited.

In 2021 and 2022, four subsistence fisheries harvested salmon in Labrador: 1) Nunatsiavut Government (NG) members fishing in northern Labrador communities (Rigolet, Makkovik, Hopedale, Postville, and Nain); and in Lake Melville communities (Northwest River, Happy Valley – Goose Bay) 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 (Licences issued from the communities of Happy Valley – Goose Bay, Cartwright and Port Hope Simpson) and, 4) Labrador residents fishing in Lake Melville and northern and southern coastal communities. The NG, Innu, and NCC fisheries were jointly monitored by Indigenous Fishery Guardians/Conservation Officers and DFO. Nylon twine is only permitted in nets, monofilament nets are strictly prohibited. The maximum length of net permitted per household is approximately 27–46 metres, depending on management area. Only nets with a minimum mesh size of 89 mm (3.5 inches) and a maximum of 102 mm (4 inches) may be used in Upper Lake Melville and southern Labrador by the NCC. Nets are generally set in estuaries and coastal bays within headlands. Catch statistics are based on logbook reports.

Most catches (92% in 2021 and 93% in 2022, Figure 2.1.1.2) in Canada take place in rivers or estuaries. Fisheries are principally managed on a river-by-river basis and in areas where retention of large salmon in recreational fisheries is 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 have remained closed since 2000 and the Labrador coastal subsistence fisheries are mainly located in bays generally inside headlands. Sampling of the Labrador subsistence fisheries continued in 2021 and 2022.

The following management measures were in effect in 2021 and 2022:

4.1.2.2 Indigenous food, social, and ceremonial (FSC) fisheries

In Quebec, Indigenous 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 Indigenous group. However, catches under a convention, such as for Inuit in Ungava, do not have to be reported. In the Maritimes (SFAs 15 to 23), FSC agreements were signed with several Indigenous groups in 2021 and 2022. 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 Indigenous groups. In Labrador (SFAs 1-2), FSC agreements 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 in Newfoundland (SFAs 3-14B) in 2021 and 2022. When fisher reports are not available, catches are estimated based on the most reliable information available (i.e. observer reports or historical data). Catch by Indigenous recreational fishers were reported under recreational fisheries.

4.1.2.3 Labrador resident subsistence fisheries

DFO is responsible for regulating the Labrador resident fishery. A licensed gillnet subsistence trout and charr fishery for Labrador residents takes place in estuaries and coastal areas of Labrador. A total of 260 and 248 licences were issued in 2021 and 2022, respectively. Conditions restrict a seasonal catch of three salmon of any size while fishing for trout and charr; three salmon tags accompanied each licence. Resident fishers were required to remove their nets from the water once their catch of salmon was caught. Catches exceeding three salmon must be discarded. All licensed resident fishers were requested to complete and return logbooks to DFO.

4.1.2.4 Recreational fisheries

Licences are required to fish recreationally for Atlantic salmon in Canada. Gear is restricted to fly fishing and there are daily and seasonal bag limits. Recreational fisheries management in 2021 and 2022 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. Fishing for salmon was prohibited on 34 rivers. Large salmon could be retained throughout the season on eight rivers and for part of the season on an additional 10 rivers in 2021 and nine rivers in 2022. Small salmon could be retained during the entire season on 54 rivers in 2021 and 52 rivers in 2022. Catch and release only fishing was permitted on eight rivers in 2021 and 11 rivers in 2022. Since 2018, a seasonal permit allows a total retention of four salmon for the season, of which only one could be a large salmon. The only exception is for the four rivers located in the Ungava Bay region, where anglers could retain four salmon of any size under the seasonal permit. A three-day permit allows for the retention of one salmon of any size. Under these permits, retention of large salmon is allowed only from rivers which are open to retention of large salmon. A catch and release permit allows fishing for catch and release only. Retention of large salmon is only permitted in Quebec.

Mandatory catch and release measures including a daily limit of two salmon were in effect in the Maritime provinces of Canada in 2021 and 2022. Newfoundland and Labrador had retention fisheries for small salmon in 2021 and 2022 with a seasonal limit of one or two salmon depending on river classification and a daily catch and release limit of three salmon.

In all areas of eastern Canada, there is no estimate of salmon released as bycatch in recreational fisheries targeting other species.

4.1.2.5 USA

There were no recreational or commercial fisheries for anadromous Atlantic salmon in the USA in 2021 or 2022.

4.1.2.6 France (Islands of Saint Pierre and Miquelon)

Four professional and 80 recreational gillnet licences were issued in 2021 and 2022 (Table 4.1.2.1). Professional licences had a maximum authorization of three nets of 360 metres maximum length each whereas recreational licences were restricted to one net of 180 metres. The selling of Atlantic salmon was only allowed by professional licence holders and was restricted to within Saint Pierre and Miquelon.

4.1.3 Catches

4.1.3.1 Canada

The provisional harvest of salmon in 2022 by all users is 99.9 t (97.9 in 2021), approximately 2% higher than the previous five year mean of 97.8 t (2017-2021) and 23% lower than the previous 20 year mean of 129.9 t (2002-2021) (Tables 2.1.1.1, 2.1.1.2; Figure 4.1.3.1). Canada's harvest prior to the closure of all commercial fisheries in 2000 averaged 1557 t from 1960-1999 (range: 152 t to 2863 t).

4.1.3.2 Indigenous FSC fisheries

The provisional harvest by Indigenous groups in 2022 was 58.1 t (56.6 t in 2021), similar to the previous five year and 20 year means of 57.2 t and 57.5 t, respectively (Table 4.1.3.1).

In Labrador, total catch from Indigenous fishers was estimated by raising the reported catch from logbooks to the total number of fishers (64% reporting rate in 2022). For Quebec, catches from the Indigenous fisheries were to be reported collectively by each Indigenous community. As in Quebec, Indigenous groups with fishing agreements in the DFO Gulf and Maritimes regions were expected to report their catches. When reports were not available, the catches were estimated based on the most reliable information available (i.e. local enforcement officer or biologist reports or average from the last five years of available data). The reliability of the catch estimates varies among user groups. Reports in most years were incomplete or missing.

4.1.3.3 Labrador resident subsistence fisheries

The provisional harvest by Labrador resident fishers was 1.4 t in 2022 (1.8 t in 2021) (88% reporting rate in 2022), approximately 10% lower than the previous five year mean of 1.6 t and 42% less than the previous 20 year mean of 2.5 t (Table 4.1.3.2).

4.1.3.4 Recreational fisheries

The recreational fisheries harvest in 2022 was 40.2 t (approximately 22 344 fish and 96% small salmon by number) and similar to the 2021 harvest of 39.5 (Table 4.1.3.3; Figure 4.1.3.2).

The estimated numbers of salmon caught and released in the recreational fisheries of Canada were 67 056 salmon (47 969 small and 19 087 large) in 2021 and 53 002 salmon (29 650 small and 23 351 large) in 2022, representing 62% and 56% of the total catch by number, respectively.

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, except in Quebec where reporting of harvested salmon is an enforced legal requirement.

4.1.3.5 Commercial fisheries

All commercial fisheries for Atlantic salmon have remained closed since 2000 and the catch in 2021 and 2022 therefore was zero.

4.1.3.6 Unreported catches

The unreported catch for Canada was 18.4 t in 2022 (19.3 t in 2021) and represents an estimated catch from illegal fisheries directed at salmon (Tables 2.1.3.1, 2.1.3.2). Unreported catch for Canada was not received from all regions in 2021 and 2022 and therefore considered incomplete.

4.1.3.7 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.

4.1.3.8 France (Islands of Saint Pierre and Miquelon)

The harvest in Saint Pierre and Miquelon was 1.2 t (478 fish) in 2022 (1.6 t or 600 fish in 2021), 29% lower than the previous five year mean (2017-2021) of 1.8 t and 57% less than the previous 20 year mean (2002-2021) of 2.9 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 2022) of salmon, expressed as 2SW salmon equivalents in the 2SW return year 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 Indigenous (since 1998) and resident (since 2000) fisheries in Labrador are 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 and Miquelon. Data inputs were updated to 2022.

Total 2SW harvest equivalents of North American origin salmon in all fisheries peaked at 557 300 fish in 1976 and was above 200 000 fish in most years until 1990 (Table 4.1.4.1; Figure 4.1.4.1). Harvest equivalents within North America peaked at about 362 500 in 1976 and have remained below 12 000 2SW salmon equivalents for most years between 2000 and 2022 (Table 4.1.4.1; Figure 4.1.4.1). The percentage of the 2SW harvest equivalents taken in North America has varied from 42% to 63% of the total removals in all fisheries during 2008 to 2022 (Figure 4.1.4.1).

In the most recent 2SW harvest year (2022), the losses of 2SW salmon in terminal areas of North America was estimated at 8500 fish (median), 46% of the total North American catch of 2SW salmon. The percentages of harvests occurring in terminal fisheries ranged from 17% to 44% during 1973 to 1992 and 42% to 87% during 1993 to 2022 (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 2022 is 50% (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 2002 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 36% to 51%. For similar years, the harvests in the Labrador subsistence fisheries have been 26% to 33% of the total harvests and 19% to 25% 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; Saint Pierre and Miquelon) are used to determine region of origin of harvested salmon.

4.1.5.1 Labrador subsistence fisheries sampling programme

Salmon harvested in the Labrador subsistence fisheries (SFAs 1 and 2, Figure 4.1.2.1) 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 2021, a total of 1126 samples were collected from the Labrador subsistence fisheries: 222 from northern Labrador (SFA 1A), 265 from Lake Melville (SFA 1B), and 639 from southern Labrador (SFA 2). The samples represent 7.9% of the catch by number (8.7% of small salmon, 5.4% of large salmon) (31 samples did not have size information).

In 2022, a total of 900 samples were collected from the Labrador subsistence fisheries: 103 from northern Labrador (SFA 1A), 88 from Lake Melville (SFA 1B), and 709 from southern Labrador (SFA 2). The samples represent 6.4% of the catch by number (7.8% of small salmon, 3.3% of large salmon) (24 samples did not have size information).

Size group	Statistics	2021	2022
Small salmon (<63 cm)	Samples (#)	853	712
	Catch (#)	9758	9130
	% of catch	8.7%	7.8%
Large salmon (≥63 cm)	Samples (#)	242	164
	Catch (#)	4500	5037
	% of catch	5.4%	3.3%
Total	Samples (#)	1126	900
	Catch (#)	14 258	14 167
	% of catch	7.9%	6.4%

Not all scales can be interpreted for age. In 2021, the percent sea age composition was 80% 1SW, 17% 2SW, 2% 3SW and 1% previously spawned salmon. In 2022, the percent sea age composition was 84% 1SW, 12% 2SW and 4% previously spawned salmon. In both years, all salmon samples interpreted for river age were 2 to 7 years (modal age 4). There was no river age 1 and few river-age 2 salmon sampled suggesting that very few salmon from southern stocks of North America (USA, Scotia-Fundy) are exploited in these fisheries.

Labrador: Sample summary 2021 and 2022								
Area	Number of Scale Samples	River Age (percent)						
		1	2	3	4	5	6	7
2021								
Northern Labrador (SFA 1A)	195	0.0	1.5	11.3	47.2	33.8	6.2	0.0
Lake Melville (SFA 1B)	253	0.0	0.4	14.6	63.6	20.2	0.8	0.4
Southern Labrador (SFA 2)	603	0.0	1.5	11.8	54.2	28.7	3.8	0.0
Total	1051	0.0	1.2	12.4	55.2	27.6	3.5	0.1
2022								
Northern Labrador (SFA 1A)	100	0.0	0.0	8.0	66.0	24.0	1.0	1.0
Lake Melville (SFA 1B)	85	0.0	0.0	10.6	60.0	25.9	3.5	0.0
Southern Labrador (SFA 2)	691	0.0	0.3	8.8	55.3	33.7	1.7	0.1
Total	876	0.0	0.2	8.9	57.0	31.8	1.8	0.2

The majority of tissue samples collected in 2021 (96%) and 2022 (97%) from the Labrador subsistence fisheries were analysed for genetic origin (Figure 4.1.5.3). A total of 1079 tissue samples were analysed from 2021 and 872 from 2022 using the SNP panel with 31 range-wide reporting groups (Table 4.1.5.1; Figures 4.1.5.1, 4.1.5.2). The estimated percent contributions (and associated 95% credible interval) to each reporting group in 2021 and 2022 are shown in Tables 4.1.5.2 and 4.1.5.3, respectively, and summarized in Figures 4.1.5.4 and 4.1.5.5. As in previous years, the estimated origin of the samples was dominated (>95%) by the Labrador reporting groups. The dominance of the Labrador reporting groups is consistent with previous analyses conducted since 2006 which estimated >95% of the catch was attributable to Labrador stocks (ICES, 2019, 2020). Furthermore, assignment of harvest within the Labrador genetic reporting groups suggest largely local harvest within salmon fishing areas.

4.1.5.2 Saint Pierre and Miquelon fisheries sampling programme

The number of samples collected in the Saint Pierre and Miquelon fishery was 116 in 2020 (19% of the catch), 51 in 2021 (9% of the catch) and 29 in 2022 (6% of the catch). Based on the interpretation of the scale samples, 100% of the small salmon samples were 1SW and the majority of large salmon samples were 2SW (90% - 100%). River ages ranged from one to five years (modal age 3).

Saint Pierre and Miquelon: Sample summary 2020 to 2022									
Size group	Number of Samples (#)	Percent of Samples (%)	Virgin Sea Age (%)		River Age (%)				
			1SW	2SW	1	2	3	4	5
2020									
Small salmon (<63 cm)	65	57.0	100.0	0.0	0.0	20.0	44.6	32.3	3.1
Large salmon (≥63 cm)	49	43.0	8.2	91.8	2.0	44.9	44.9	8.2	0.0
Total	114	100.0	60.5	39.5	0.9	30.7	44.7	21.9	1.8
2021									
Small salmon (<63 cm)	33	64.7	100.0	0.0	0.0	12.1	72.7	12.1	3.0
Large salmon (≥63 cm)	18	35.3	0.0	100.0	0.0	33.3	61.1	5.6	0.0
Total	51	100.0	64.7	35.3	0.0	19.6	68.6	9.8	2.0
2022									
Small salmon (<63 cm)	9	31.0	100.0	0.0	0.0	33.3	55.6	11.1	0.0
Large salmon (≥63 cm)	20	69.0	10.0	90.0	0.0	45.0	50.0	5.0	0.0
Total	29	100.0	37.9	62.1	0.0	41.4	51.7	6.9	0.0

All of the tissue samples collected in the Saint Pierre and Miquelon fishery 2020 to 2022 were analysed for genetic origin (Figure 4.1.5.3) using the SNP panel with 31 range-wide reporting groups (Table 4.1.5.1; Figures 4.1.5.1, 4.1.5.2). The estimated percent contributions (and associated 95% credible interval) to each reporting group from 2020 to 2022 are shown in Tables 4.1.5.4 and summarized in Figures 4.1.5.6 to 4.1.5.8. The estimated origin of the samples was dominated (>94%) by the reporting groups in Quebec (4 groups), Gulf (one group) and Newfoundland (7 groups). Large salmon were mainly (>77%) from the Quebec and Gulf groups and the largest portion (>48%) of the small salmon were from Newfoundland groups.

4.1.6 Exploitation rates

4.1.6.1 Canada

For Newfoundland, mean exploitation rate in the recreational fishery for retained small salmon was 4.9% in 2021 (ten rivers: range of 0% to 14.5%). Provisional mean exploitation rate in the 2022 recreational fishery for retained small salmon was 8.8% (ten rivers; range of 0% to 19.8%), an increase from the previous five-year mean of 11%. In Quebec, total fishing exploitation rate was estimated at 13.6% in 2021 and 12.9% in 2022, the lowest values since 1984. Exploitation rate for the Indigenous fishery was 5.6% in 2021 and 6.1% in 2022. Exploitation rate for the recreational fishery was 7.3% in 2021 and 6.8% in 2022. The recreational exploitation rate for large salmon in Quebec was 2.1% in 2021 and 2.7% in 2022, among the lowest values since 1984; it is mostly influenced by the increase in the number of released fish in recent years. Retention of small and large salmon in the recreational fisheries of Nova Scotia, New Brunswick and Prince Edward Island was not permitted in 2021 and 2022.

4.1.6.2 USA

There was no exploitation of anadromous salmon in homewaters.

4.1.6.3 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 2022 time period were calculated by dividing annual estimated losses (harvests, estimated mortality from catch and release (ICES, 2010), broodstock removals) in all areas of North America 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 ten years, exploitation rates on small salmon and large salmon have remained at the lowest in the time-series, averaging 9% for large salmon and 11% for small salmon. 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 Section 1.5.

Fisheries and Oceans Canada (DFO) undertook a revision of reference points for Atlantic salmon in Canada that conform to the Precautionary Approach (ICES, 2016). The Limit Reference Points in all cases are defined by total eggs from all sizes and sea ages of salmon. DFO Newfoundland Region retained the current conservation requirement based on 240 eggs per 100 m^2 of fluvial rearing habitat, and in addition for insular Newfoundland 368 eggs per ha of lacustrine habitat (or 150 eggs per ha for stocks on the northern peninsula of Newfoundland), as equivalent to their Limit Reference Point and have defined the Upper Stock Reference as 150% of the Limit Reference Point (DFO, 2017). DFO Maritimes Region (Scotia-Fundy) has retained the current conservation requirement based on 240 eggs per 100 m^2 as the Limit Reference Point (DFO, 2012; Gibson and Claytor, 2013). DFO Gulf Region revised and defined the Limit Reference Point in that region of Canada using the proportion of eggs from MSW salmon as a covariate in the Bayesian Hierarchical Model (DFO, 2018) and defined the Upper Stock Reference as 3.78 times the Limit Reference point (Chaput et al., 2023). The Province of Quebec revised the Limit Reference point and Upper Stock Reference point using a Bayesian hierarchical analysis of stock–recruitment data (Dionne *et al.*, 2015; MFFP, 2016; ICES, 2017). For Quebec, the management plan for recreational fishery provides river-specific Upper Stock Reference points, expressed in number of eggs, to regulate large salmon retention (MFFP, 2016). As previously described (ICES 2019a), this Upper Stock Reference point is also used to establish the 2SW spawner requirement for advice on the management of the 1SW non-maturing fisheries at Greenland.

Country and Commission Area	Stock Area	2SW spawner requirement (number of fish)	2SW Management Objective (number of fish)
Canada	Labrador (LAB)	34 746	
	Newfoundland (NFLD)	4022	
	Quebec (QC)	32 085	
	Southern Gulf of St Lawrence (GULF)	18 737	
	Scotia-Fundy (SF)	24 705	10 976
Canada Total		114 295	
USA Total		29 199	4549
North America Total		143 494	

4.2.1 Recommendations for future activities of the Working Group

The Working Group recommends evaluating how 2SW spawner requirement should be estimated and applied, especially for jurisdictions that have both Limit Reference Points and Upper Stock Reference points. Currently in NAC, some jurisdictions' 2SW spawner requirements are based on a Limit Reference Point while others are based on an Upper Stock Reference point. These varying approaches raise consistency issues and should be addressed.

4.3 Status of stocks

Based on information provided in the update (2018) of the NASCO Database of Salmon Rivers, a total of 857 rivers have been identified in eastern Canada. There are 21 rivers in eastern USA where salmon are or were present within the last half century. Conservation requirements have been defined for 498 (58%) 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 73 rivers in eastern North America in 2020.

4.3.1 Smolt abundance

4.3.1.1 Canada

Wild smolt production was estimated in eight rivers in 2021 and ten rivers in 2022 (Table 4.3.1.1). In 2022, the relative smolt production, standardized to the size of the river using the CL egg requirements, was highest in St Jean River (Quebec) and lowest in Rocky River (Newfoundland) (Figure 4.3.1.1). Trends in smolt production over the time-series declined ($p < 0.05$) in the Nashwaak River (Scotia-Fundy, 1998–2022), St Jean River (Quebec 1989–2022), de la Trinité River (Quebec, 1984–2022) and Conne River (Newfoundland, 1987–2022), whereas production significantly increased ($p < 0.05$) in Western Arm Brook (Newfoundland, 1971–2022). No other rivers showed statistically significant long-term trends (Figure 4.3.1.1).

4.3.1.2 USA

Wild Smolt production was estimated on the Narraguagus River in 2021 and 2022 (Table 4.3.1.1; Figure 4.3.1.1). Smolt production has declined over time ($p < 0.05$) on this river (1997–2022).

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 5). 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 mixed stock commercial and subsistence fisheries. This avoided double counting fish because commercial catches in Newfoundland and Labrador and subsistence 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. 2014–2021 data were corrected and finalized). In 2020, some regions were affected by the COVID-19 global pandemic and had to either modify the way returns estimates were produced (e.g. SFA15 using snorkel counts of spawners instead of angling data) or could not provide returns estimates (e.g. SFA 16, 17, 18, 19–21 and 23). When no data were available, the previous five-year mean was used for all SFAs, except for Newfoundland where the previous six-year mean was used.

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, 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 combined production areas in SFA 2 and 14B. The uncertainty in the estimates of returns and spawners has been relatively high compared with other regions in recent years.

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.

4.3.2.1 Small salmon returns

- The total estimate of small salmon returns to North America in 2022 (540 700) ranks seventh highest of the 52-year time-series.
- Small salmon returns in 2022 decreased from the previous year in all regions (-25% to -62%) but in Labrador and the USA
- Small salmon returns in 2022 were the highest in the time-series for Labrador and among the lowest for Gulf and Scotia-Fundy (both fourth lowest).
- In 2022 (and similarly to the last five years), small salmon returns to Labrador (335 500) and Newfoundland (160 400) combined represented 92% of the total small salmon returns to North America.

Increased estimated abundance of small salmon in Newfoundland over the time-series is not reflected in all areas of Newfoundland (Figure 4.3.2.5). Estimated abundance has increased in the salmon fishing areas of the northeast coast of Newfoundland (SFA 3–5) and the western portion of the island (SFA 13 and 14A) while estimated abundances have declined on the south coast (SFA 10–12) and the eastern portion of the island (SFA 6–9). Changes in the recreational fisheries management measures in recent years have resulted in lower catches and as a result increased the uncertainty in the Salmon Fishing Area-specific estimates of abundance.

4.3.2.2 Large salmon returns

- The total estimated large salmon return to North America in 2022 of 188 800 fish was the thirteenth of the 52-year time-series beginning in 1971.
- Large salmon returns in 2022 increased from the previous year in Labrador (72%), Quebec (10%), Gulf (69%), Scotia-Fundy (179%) and USA (159%).
- Large salmon returns in 2022 were the second highest (84 700) of the 52-year time-series for Labrador.
- On average (2018-2022), large salmon returns to USA and Scotia-Fundy combined represented less than 2% of the total large salmon returns to North America.

4.3.2.3 2SW salmon returns

- The total estimate of 2SW salmon returns to North America in 2022 was 114 000.

- 2SW salmon returns increased from the previous year in Labrador (71%), Quebec (10%), Gulf (61%), Scotia-Fundy (169%), and USA (163%).
- On average (2018-2022), the majority of 2SW salmon returns (92%) to NAC were from Labrador (36%), Quebec (28%), and Gulf (28%). There are few 2SW salmon returns to Newfoundland (5%), as the majority of the large salmon returns to that region are comprised of previously spawned 1SW salmon. Scotia-Fundy and USA each represent less than 1% of NAC 2SW returns respectively.

4.3.3 Estimates of spawning escapements

Updated estimates for small, large and 2SW salmon spawners (1971 to 2022) 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. For Quebec, 2SW CL correspond to the Upper Stock Reference point.

4.3.3.1 Small salmon spawners

- The total estimate of small salmon spawners in 2022 for North America (515 400) ranks fourth highest of the 52-year time-series.
- Estimates of small salmon spawners decreased in 2022 from the previous year in all areas (-27% to -65%) but Labrador and the USA (77% and 60%, respectively).
- Small salmon spawners in 2022 were the highest on record for Labrador.
- On average of the previous five years, small salmon spawners for Labrador (222 400) and Newfoundland (211 500) combined represented 88% of the total small salmon spawners estimated for North America.

4.3.3.2 Large salmon spawners

- The total estimate of large salmon spawners in North America for 2022 (183 700), the third highest amount in the 52-year time-series.
- Estimates of large salmon spawners increased from 2021 in all areas (11% to 238%) but Newfoundland Labrador (-43%).
- Large salmon spawners in 2022 were the second highest on record for Labrador.

4.3.3.3 2SW salmon spawners

- The total estimate of 2SW salmon spawners in North America for 2022 was 110 400 and was below the combined 2SW CL for NAC (143 494).
- Estimates of 2SW salmon spawners increased from 2021 in in all areas (11% to 243%) but Newfoundland (-53%).
- 2SW salmon spawners to NAC in 2020 were the sixth highest on record (1971–2022; 52 years).
- Estimates (median) of 2SW salmon spawners were below the region-specific 2SW CLs in Newfoundland (93% of CL), Quebec (72% of CL), Scotia-Fundy (8% of CL) and USA (5% of CL). The estimated 2SW spawners in Labrador have exceeded the 2SW CL seven times since 2011. The 2SW CLs were last exceeded in 2021 for Newfoundland, in 1982 for Quebec. The 2SW CLs have never been exceeded for Scotia-Fundy and USA over the entire time-series.
- The 2SW management objectives have not been met since 1991 for Scotia-Fundy, and 2013 for USA. For USA, 2SW returns are assessed relative to the management objective

as adult stocking programmes for restoration efforts contribute to the number of spawners.

4.3.4 Egg depositions

Egg depositions by all sea ages combined in 2021 exceeded or equalled the river-specific CLs in 39 of the 87 assessed rivers (45%) and were less than 50% of CLs in 37 rivers (43%) (Figure 4.3.4.1). Egg depositions by all sea ages combined in 2022 exceeded or equalled the river-specific CLs in 45 of the 83 assessed rivers (54%) and were less than 50% of CLs in 25 rivers (30%) (Figure 4.3.4.1). Large deficiencies in egg depositions (<10% CLs) were noted in 18 assessed rivers (21%) in 2021 and in 12 assessed rivers (14%) in 2022.

- In 2021, CLs were met or exceeded in three of four (75%) assessed rivers in Labrador, seven of 14 rivers (50%) in Newfoundland, 27 of 36 rivers (75%) in Quebec and two of 12 rivers (17%) in Gulf and zero of seven in Scotia-Fundy.
- In 2022, CLs were met or exceeded in three of four (75%) assessed rivers in Labrador, six of 15 rivers (40%) in Newfoundland, 32 of 36 rivers (89%) in Quebec and three of seven rivers (43%) in Gulf and one of seven rivers (14%) in Scotia-Fundy.
- Large deficiencies in egg depositions were noted in the USA. All 14 rivers for which proportion of their CLs was assessed were below 30% of their CLs (with the exception of Kennebec River). All anadromous Atlantic salmon fisheries in the USA are closed.

CLs for the US were first estimated by ICES (1995) and were representative of accessible habitat at that time. As such, the CL for the Kennebec River in southern US is estimated as 67 2SW spawners. The Kennebec River contains a significant amount of spawning and rearing habitat within the drainage and in recent years significant restoration activities involving trucking prespawned adult salmon captured at the lowermost main-stem dam and egg planting activities has resulted in modest number of spawners being located within the Sandy River, a tributary to the Kennebec. The habitat within the Sandy River was not considered within the estimated CL for the Kennebec estimated in 1995, which is why the percent CL achieved is so high for this system. Given situations like this and other evolving management activities and priorities, the US is working to update the CLs based on the best available information and these updated CLs will be used to track attainment of CLs in the future.

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 and an additional three 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 and to 498 since 2018. The number of rivers assessed annually has ranged from 57 to 91 and the annual percentages of these rivers achieving CL has ranged from 26% to 70% 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. The proportion of the conservation requirement attained is only presented in Figure 4.3.4.1 for the fourteen rivers with the most precise adult abundance estimates.

4.3.5 Return rates

In 2022, return rate estimates were available from nine wild and one hatchery populations from rivers distributed among Newfoundland, Quebec, Scotia-Fundy, and USA (Tables 4.3.5.1 to 4.3.5.4). In 2021, return rate estimates were available from two wild populations from rivers in Quebec and one hatchery population from the USA.

In 2022, the return rates of wild 2SW salmon to the Saint Jean and de la Trinité River (Quebec) were 3.14% and 0.57%, respectively (Table 4.3.5.2; Figure 4.3.5.1). The return rates of wild small salmon to these rivers in 2022 were 0.74% and 0.48%, respectively. The return rate of small salmon in 2022 was 1.1% for LaHave River (Scotia-Fundy) and rates ranged from 1.2% (Conne River) to 10.7% (Western Arm Brook) for rivers in Newfoundland (Table 4.3.5.1; Figure 4.3.5.1).

In 2022, the return rate of hatchery-origin 2SW salmon to the Penobscot River (USA) was 0.17% (Table 4.3.5.4; Figure 4.3.5.2). The return rate of hatchery-origin small salmon to this river was 0.06% in 2022 (Table 4.3.5.3; Figure 4.3.5.2).

Regional least squared (or marginal mean) mean 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). The time-series of regional return rates of wild and hatchery smolts to small salmon and 2SW salmon by area for the period of 1970 to 2021 (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 smolts exceed those of hatchery released smolts;
- Small salmon return rates in 2022 for Newfoundland populations, with the exception of Conne River, were greater than those for other populations in eastern North America;
- Small salmon return rates to rivers in Newfoundland have been stable over the period 1970 to 2022 (1SW).
- Small salmon (1SW) return rates of wild smolts for Quebec vary annually and have declined over the period 1983/1984 to 2021/2022 (1SW, $p < 0.05$). Large salmon return rates of wild smolts in this region vary annually without a statistically significant trend;
- 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 2021. However, individual river trends for Scotia-Fundy may vary from the overall trend (e.g. declines in return rates to Southern Upland index rivers; DFO, 2013);
- In USA, hatchery-origin smolt return rates to 2SW salmon have decreased over the period 1970 to 2022 (2SW, $p < 0.001$) while 1SW return rates have remained low without any statistically significant trend.

4.3.6 Pre-fisheries abundance (PFA)

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 5). Estimates of returns and spawners to regions were provided for the time-series to 2022. The full set of data inputs are included in the Stock Annex 5 and the summary output tables of returns and spawners by sea age or size group are provided in Tables 4.3.2.1 to 4.3.2.3 and 4.3.3.1 to 4.3.3.3.

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 PFA estimate for year i designated as PFANAC1SW. This annual PFA is the estimated number of salmon in the North Atlantic on 1 August of the second summer at sea. As the PFA estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate of PFA is available is 2021. This is because PFA estimates for 2022 require 2SW returns to rivers in North America in 2023.

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 2021 was 176 00 salmon (90% C.I. range 138 900 to 218 400). This value is 42% higher than the revised value for 2020 (124 400) and 27% higher than the previous five-year mean (138 900). The estimated non-maturing 1SW salmon in 2021 is the twenty seventh highest of the 51-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 2022 was 566 200 fish, 12% above the previous five-year mean (505 400). Maximum abundance of the maturing cohort was estimated at over 910 700 fish in 1981 and the recent estimate is the ninth highest of the 52-year time-series of estimated abundance.

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 1971–2021 (2022 PFA requires 2SW returns in 2023) 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 2021, was 886 900 fish, 40% higher than the previous five-year mean (633 800). The 2021 PFA estimate is the eighteenth highest in the 51-year time-series. The abundance of the 1SW cohort has declined by 48% over the time-series from a peak of 1 706 300 fish in 1975.

4.3.7 Summary on status of stocks

The status of Atlantic salmon stocks in North America to 2022 shows a steady increase in the number of small salmon, mainly driven by returns to the Labrador region, and no apparent trend for large salmon.

In 2021, the median estimates of 2SW returns and spawners to rivers were below the respective 2SW CLs in five assessment regions of NAC, and are therefore suffering reduced reproductive capacity whereas Newfoundland was the only region that was above the 2SW CL (Figure 4.3.7.1). In 2022, four assessment regions of NAC were suffering reduced reproductive capacity whereas estimates in Labrador and Gulf were above the 2SW CLs (Figure 4.3.7.2). It should be noted that the 2SW CL for Quebec corresponds to the Upper Stock Reference whereas other regions use the Lower Stock Reference. The percentage (based on medians) of CLs attained from 2SW spawners in 2022 ranged from less than 10% in Scotia-Fundy and the USA to 158% in Labrador. For 2SW salmon returns to rivers prior to in-river exploitation, the percentages of CL attained were minimally higher. The returns of 2SW salmon to the two southern areas (Scotia-Fundy and USA) were 33% and 19%, respectively, of the management objectives for these areas. 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 2022 time-series and the proportions of the 2SW CLs achieved in 2022 for six assessment regions in North America are shown below.

Region	**Rank of 2022 returns in 1971 to 2022 (51=lowest rank)**		**Rank of 2022 returns in 2013 to 2022 (10=lowest rank)**		**Median estimate of 2022 2SW spawners as percentage of Conservation Limit (% of management objective)**
	1SW	2SW	1SW	2SW	(%)
Labrador	1	2	1	2	158
Newfound-land	33	24	9	6	93
Quebec	29	28	5	6	72
Gulf	46	28	7	5	134
Scotia-Fundy	49	39	8	2	8 (19)
USA	21	29	2	2	5 (33)

Estimates of PFA indicate continued low abundance of North American adult Atlantic salmon. The total population of 1SW and 2SW Atlantic salmon in the Northwest Atlantic has shown an overall declining trend since the 1970s with a period of persistent low abundance since the early 1990s. During 1992 to 2021 (moratorium in effect), the total population of 1SW and 2SW Atlantic salmon was 622 700 fish, less than half of the mean abundance (1 252 000 fish) during 1971 to 1991.

The estimated maturing 1SW salmon abundance in 2022 of 566 200 fish is 20% lower than the 2021 estimate and the ninth highest abundance of the 52-year time-series, beginning in 1971. Overall, 92% of 1SW (small) salmon returns to NAC in 2022 were from two regions (Labrador and Newfoundland).

The non-maturing 1SW PFA for 2021 (fish mostly destined to be 2SW salmon in 2022) increased by 41.9% from 2020, and is the twenty fifth lowest of the 51-year time-series. Over the previous five years, 92% of 2SW salmon returns to NAC were from three regions (Gulf, Labrador and Québec).

The estimates of 1SW (small) salmon returns in 2022 increased from 2021 in Labrador and in the USA (the abundance in the USA are in hundreds of fish vs. hundreds of thousands in Labrador). Returns to rivers (after commercial fisheries in Newfoundland and Labrador) of 1SW salmon have generally increased over the time-series for the NAC, mainly as a result of the commercial fishery closures in 1992 and subsequently in 1998. Important variations in annual abundances continue to be observed, such as the low returns of 2009 and 2013 and the high returns of 2011, and 2021 (Figure 4.3.2.2). Increased returns in recent years were estimated for Labrador and Newfoundland, which have contributed to this increasing trend for NAC. The estimated 1SW salmon returns in Labrador have increased substantially over the time-series, the estimated returns in 2022 were the highest of the 52-year time-series. Estimated returns of 1SW salmon to Newfoundland was the ninth lowest of the last ten years.

The abundances of large salmon (MSW salmon including maiden and repeat spawners) returns in 2022 relative to 2021 increased in all areas but Newfoundland.

Wild smolt-to-adult return rates to monitored rivers in eastern North America remain low, with 2021 smolt to 1SW salmon returns ranging from 0.5% for multi-sea-winter salmon stocks to 10.7% for 1SW salmon stocks and return rates of smolts in 2020 to 2SW salmon for the two rivers with data ranging from 0.6% to 3.1%. A number of monitoring programs have been impacted by COVID-19 pandemic, in particular in 2020, which weakens the critical metrics of adult return rates for the few monitored populations.

Egg depositions by all sea ages combined in 2022 exceeded or equalled the river-specific CLs in 45 of the 83 assessed rivers (54%) and were less than 50% of CLs in 25 rivers (30%). Large deficiencies in egg depositions (≤10% CLs) were noted in multiple (12) rivers 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 Designable Units of salmon in Scotia-Fundy as well as for one Designable 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).

Based on previous five years, regional return estimates are reflective of the overall return estimates for NAC, as Labrador and Newfoundland collectively comprised 92% of the small salmon returns, whereas Labrador, Québec, and Gulf collectively comprised 77% of the large salmon returns and 92% of the 2SW salmon returns to NAC.

Overall, the estimated PFA of 1SW non-maturing salmon in 2021 was the twenty fifth lowest of the 51-year time-series and the estimated PFA of 1SW maturing salmon was the ninth highest of the 51-year time-series. The continued low and declining 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. Declines in smolt production in some rivers of eastern North America are now being observed and are also contributing to lower adult abundance.

Table 4.1.2.1. The number of professional and recreational gillnet licences issued and reported landings in Saint Pierre and Miquelon, 1990 to 2022. The data for 2022 are provisional.

Year	Number of licences		Reported landings (t)		
	Professional	Recreational	Professional	Recreational	Total
1990			1.15	0.734	1.88
1991			0.63	0.530	1.16
1992			1.30	1.024	2.32
1993			1.90	1.041	2.94
1994			2.63	0.790	3.42
1995	12	42	0.39	0.445	0.84
1996	12	42	0.95	0.617	1.57
1997	6	36	0.76	0.729	1.49
1998	9	42	1.04	1.268	2.31
1999	7	40	1.18	1.140	2.32
2000	8	35	1.13	1.133	2.27
2001	10	42	1.54	0.611	2.16
2002	12	42	1.22	0.729	1.95
2003	12	42	1.62	1.272	2.89
2004	13	42	1.50	1.285	2.78
2005	14	52	2.24	1.044	3.29
2006	13	52	1.73	1.825	3.56
2007	13	53	0.97	1.062	2.03
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

Year	Number of licences		Reported landings (t)		
	Professional	Recreational	Professional	Recreational	Total
2017	8	80	0.59	2.22	2.82
2018	9	80	0.16	1.13	1.29
2019	7	80	0.07	1.21	1.29
2020	5	81	0.09	1.65	1.74
2021	4	80	0.22	1.38	1.60
2022	4	80	0.10	1.14	1.24

Table 4.1.3.1. Harvests (by weight, t), and the percent large by weight and by number in the Indigenous food, social, and ceremonial (FSC) fisheries in Canada, 1990 to 2022. The data for 2022 are provisional.

Indigenous 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

Indigenous FSC fisheries			
Year	**Harvest (t)**	**% Large**	
		by Weight	**by Number**
2016	64.0	72	50
2017	61.3	72	51
2018	52.5	64	44
2019	54.7	72	50
2020	60.7	73	52
2021	56.6	62	42
2022	58.1	64	44

Table 4.1.3.2. Harvests (by weight, t), and the percent large by weight and number in the Labrador resident subsistence fishery, Canada, for the period 2000 to 2022. The data for 2022 are provisional.

Labrador resident subsistence 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

Labrador resident subsistence fishery			
Year	Harvest (t)	% Large	
		by Weight	by Number
2014	1.6	46	41
2015	2.0	54	38
2016	1.6	57	39
2017	1.4	58	40
2018	1.5	43	26
2019	1.6	67	47
2020	1.7	56	38
2021	1.8	46	32
2022	1.4	46	32

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 2022. The data for 2022 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

Year	Small	Large	Both size groups	% Large
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	35 303	1 823	37 126	5

Year	Small	Large	Both size groups	% Large
2017	22 015	1 886	23 901	8
2018	11 757	979	12 736	8
2019	22 171	1 226	23 397	5
2020	20 760	916	21 676	4
2021	21 222	736	21 958	3
2022	21 370	1 016	22 344	4
Previous five-year mean	19 585	1 149	20 734	6

Table 4.1.3.4. Numbers of salmon caught and released in Eastern Canadian salmon angling fisheries, for the period 1984 to 2022. 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. Values for 2022 are provisional.

	Newfoundland and 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	1655	2594	851	14 479	15 330							1790	16 134	17 924
1985		315	315	1323	6346	7669	3963	17 815	21 778			67				5286	24 476	29 762
1986		798	798	1463	10 750	12 213	9333	25 316	34 649							10 796	36 864	47 660
1987		410	410	1311	6339	7650	10 597	20 295	30 892							11 908	27 044	38 952
1988		600	600	1146	6795	7941	10 503	19 442	29 945	767	256	1023				12 416	27 093	39 509
1989		183	183	1562	6960	8522	8518	22 127	30 645							10 080	29 270	39 350
1990		503	503	1782	5504	7286	7346	16 231	23 577			1066				9128	22 238	31 366
1991		336	336	908	5482	6390	3501	10 650	14 151	1103	187	1290				5512	16 655	22 167
1992	5893	1423	7 316	737	5093	5830	8349	16 308	24 657			1250				14 979	22 824	37 803
1993	18 196	1731	19 927	1076	3998	5074	7276	12 526	19 802							26 548	18 255	44 803
1994	24 442	5032	29 474	796	2894	3690	7443	11 556	18 999	577	147	724				33 258	19 629	52 887
1995	26 273	5166	31 439	979	2861	3840	4260	5220	9480	209	139	348		922	922	31 721	14 308	46 029
1996	34 342	6209	40 551	3526	5661	9187				472	238	710		1718	1 718	38 340	13 826	52 166
1997	25 316	4720	30 036	713	3363	4076	4870	8874	13 744	210	118	328	182	1643	1 825	31 291	18 718	50 009
1998	31 368	4375	35 743	688	2476	3164	5760	8298	14 058	233	114	347	297	2680	2 977	38 346	17 943	56 289
1999	24 567	4153	28 720	562	2186	2748	5631	8281	13 912	192	157	349	298	2693	2 991	31 250	17 470	48 720
2000	29 705	6479	36 184	407	1303	1710	6689	8690	15 379	101	46	147	44e	4008	4 453	37 347	20 526	64 482
2001	22 348	5184	27 532	527	1199	1726	6166	11 252	17 418	202	103	305	809	4674	5 483	30 052	22 412	59 387
2002	23 071	3992	27 063	829	1100	1929	7351	5349	12 700	207	31	238	852	4918	5 770	32 310	15 390	50 924
2003	21 379	4965	26 344	626	2106	2732	5375	7981	13 356	240	123	363	1238	7015	8 253	28 858	22 190	53 645
2004	23 430	5168	28 598	828	2339	3167	7517	8100	15 617	135	68	203	1291	7455	8 746	33 201	23 130	62 316

	Newfoundland and 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
2005	33 129	6598	39 727	933	2617	3550	2695	5584	8279	83	83	166	1116	6445	7 561	37 956	21 327	63 005
2006	30 491	5694	36 185	1014	2408	3422	4186	5538	9724	128	42	170	1091	6185	7 276	36 910	19 867	60 486
2007	17 719	4607	22 326	896	1520	2416	2963	7040	10 003	63	41	104	951	5392	6 343	22 592	18 600	41 192
2008	25 226	5007	30 233	1016	2061	3077	6361	6130	12 491	3	9	12	1361	7713	9 074	33 967	20 920	54 887
2009	26 681	4272	30 953	670	2665	3335	2387	8174	10 561	6	25	31	1091	6180	7 271	30 835	21 316	52 151
2010	27 256	5458	32 714	717	1966	2683	5730	5660	11 390	42	27	69	1356	7683	9 039	35 101	20 794	55 895
2011	26 240	8119	34 359	1157	4320	5477	6537	12 466	19 003	46	46	92	3100	9327	12 427	37 080	34 278	71 358
2012	20 940	4089	25 029	339	1693	2032	2504	5330	7834	46	46	92	2126	6174	8 300	25 955	17 332	43 287
2013	19 962	6770	26 732	480	2657	3137	2646	8049	10 695	12	23	35	2238	7793	10 031	25 338	25 292	50 630
2014	20 553	4410	24 963	185	1127	1312	2806	5884	8690	68	68	136	1580	4932	6 512	25 192	16 421	41 613
2015	24 861	6943	31 804	548	1260	1808	11 552	7489	19 041	68	68	136	3078	9573	12 651	40 107	25 333	65 440
2016	26 145	10 206	36 351	362	1550	1912	7130	7958	15 088	68	68	136	3905	11 533	15 438	37 610	31 315	68 925
2017	22 544	8137	30 681	330	732	1062	5935	6179	12 114	68	68	136	3191	10 173	13 364	32 068	25 289	57 357
2018	26 403	3562	29 965	526	2180	2706	4703	6978	11 681	68	68	136	2747	8776	11 523	34 447	21 564	56 011
2019	30 784	6937	37 721	508	1564	2072	4506	3507	8013	68	68	136	2845	9849	12 694	38 711	21 925	60 636
2020	25 964	8359	34 323	346	1446	1792	5401	5197	10 598	68	68	136	1620	8149	9769	33 399	23 219	56 618
2021	39 465	6183	45 648	844	1222	2066	5551	3271	8822	68	68	136	2041	8343	10 384	47 969	19 087	67 056
2022	22 044	4905	26 949	495	1639	2134	4026	5234	9260	68	68	136	3017	11 506	14 523	29 650	23 352	53 002

Table 4.1.4.1. Reported harvests and losses expressed as 2SW salmon equivalents (number of fish X 1000) in North American salmon fisheries for the period 1972 to 2022, year of 2SW harvests in North America. Only midpoints of the Monte Carlo simulated values are shown. Geographic locations are: SPM = Saint-Pierre and Miquelon, LAB = Labrador, NF = Newfoundland, QC = Quebec, GF = Gulf, SF = Scotia-Fundy.

	Mixed-stock fisheries in North America					Canada – losses from all sources (terminal fisheries, catch and release mortality, bycatch mortality) in year i													
Year (i)	NF-LAB comm / subs 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-LAB Comm / subs 2SW (Year i) (a)	NF-LAB Comm / subs total (Year i)	SPM (Year i)	LAB	NF	QC	GF	SF	Total	USA	North America-Total Losses	Terminal losses as % of NA Total	Greenland Total (Year i - 1)	NW Atlantic Total	Harvest in home-waters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rate in North America
1972	21.9	13	144.2	166.2	0	0.4	0.6	27.4	20.2	5.6	54.3	0.3	220.8	25	197.8	418.6	53	292.4	0.76
1973	18.7	8	205.8	224.6	0	1	0.8	32.8	15.6	6.2	56.4	0.3	281.3	20	148	429.4	66	363.3	0.77
1974	23.7	9	236	259.7	0	0.8	0.5	47.9	18.1	13.1	80.3	0.2	340.3	24	186.7	527	65	449.6	0.76
1975	23.4	9	237.7	261.1	0	0.3	0.5	41.1	14.2	12.5	68.6	0.4	330.1	21	154.6	484.7	68	417	0.79
1976	34.9	12	256.7	291.6	0.3	0.8	0.4	41.9	16.1	11.1	70.3	0.2	362.5	19	194.7	557.2	65	431.3	0.84
1977	26.6	10	241.4	268	0	1.3	0.8	42.1	28.9	13.5	86.5	1.4	355.8	25	113	468.9	76	473.4	0.75
1978	26.9	15	157.4	184.3	0	0.8	0.5	37.6	20.4	9.4	68.7	0.9	253.9	27	142.9	396.8	64	317.5	0.8
1979	13.5	13	92.1	105.6	0	0.6	0.1	25.2	6.3	3.9	36.1	0.4	142.1	26	103.7	245.7	58	172.1	0.83
1980	20.6	9	217.3	237.9	0	0.9	0.6	53.6	25.4	17.4	97.9	1.5	337.3	29	141.9	479.2	70	451.9	0.75
1981	33.6	14	201.5	235.1	0	0.5	0.4	44.2	14.5	12.8	72.5	1.3	308.9	24	120.9	429.7	72	365.5	0.85
1982	33.5	20	134.5	168	0	0.6	0.4	35.1	20.6	8.9	65.6	1.4	235	29	161.2	396.2	59	291.2	0.81
1983	25.2	18	111.6	136.8	0.3	0.4	0.4	34.5	17.3	12.3	64.9	0.4	202.5	32	145.9	348.3	58	237.5	0.85
1984	19	19	82.9	101.9	0.3	0.5	0.2	19.2	3.6	3.9	27.4	0.7	130.3	22	26.8	157.2	83	199.5	0.65
1985	14.3	15	78.8	93.1	0.3	0.3	0	22.1	0.8	5.1	28.3	0.6	122.3	24	32.4	154.8	79	213.1	0.57
1986	19.5	16	105	124.5	0.3	0.5	0	27.1	1.9	3	32.5	0.6	157.9	21	99	256.9	61	266.9	0.59
1987	24.7	16	132.3	157	0.2	0.6	0	27.1	1.9	1.4	31.1	0.3	188.6	17	123.7	312.3	60	260	0.73
1988	31.5	28	81.2	112.7	0.2	0.7	0	27.4	1.4	1.4	30.9	0.2	144.1	22	123.8	267.8	54	215.2	0.67
1989	21.9	21	81.4	103.3	0.2	0.5	0	23.6	1.2	0.3	25.5	0.4	129.4	20	84.9	214.2	60	195.8	0.66
1990	19.2	25	57.4	76.6	0.2	0.4	0	22.8	1.3	0.6	25.1	0.7	102.6	25	43.6	146.2	70	176	0.58
1991	11.8	23	40.5	52.3	0.1	0.1	0	23.4	1.1	1.4	26	0.2	78.7	33	52.2	130.9	60	148.4	0.53

	Mixed-stock fisheries in North America					Canada – losses from all sources (terminal fisheries, catch and release mortality, bycatch mortality) in year i													
Year (i)	NF-LAB comm / subs 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-LAB Comm / subs 2SW (Year i) (a)	NF-LAB Comm / subs total (Year i)	SPM (Year i)	LAB	NF	QC	GF	SF	Total	USA	North America-Total Losses	Terminal losses as % of NA Total	Greenland Total (Year i - 1)	NW Atlantic Total	Harvest in home-waters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rate in North America
1992	9.8	28	25.1	34.9	0.3	0.8	0.1	23.9	1.1	1.1	27.1	0.2	62.5	44	79.5	142	44	145.9	0.43
1993	3.1	19	13.3	16.4	0.3	0.4	0	18.4	0.7	1.2	20.7	0.2	37.6	56	29.8	67.4	56	122.1	0.31
1994	2.1	15	11.9	14	0.4	0.5	0.1	19.1	0.7	0.8	21.2	0	35.6	60	1.9	37.5	95	107.2	0.33
1995	1.2	12	8.7	9.9	0.1	0.5	0.1	17.8	0.5	0.4	19.3	0	29.2	66	1.9	31.1	94	134.3	0.22
1996	1	15	5.6	6.7	0.2	0.4	0.2	17.1	0.9	0.8	19.4	0	26.2	74	19.2	45.4	58	113.8	0.23
1997	0.9	14	5.6	6.5	0.2	0.2	0.2	14.1	0.8	0.6	15.9	0	22.6	70	19.3	41.9	54	93.9	0.24
1998	1.2	40	1.8	2.9	0.3	0.2	0.1	7.9	0.5	0.3	9	0	12.2	74	13	25.2	48	64.5	0.19
1999	0.2	17	0.8	1	0.3	0.3	0.1	6.6	0.7	0.5	8.2	0	9.4	86	4.3	13.8	69	68.3	0.14
2000	0.1	12	1.1	1.2	0.3	0.3	0.2	6.3	0.6	0.2	7.6	0	9	84	6.4	15.5	58	70.1	0.13
2001	0.3	17	1.3	1.6	0.2	0.3	0.1	6.8	0.9	0.3	8.4	0	10.2	82	5.9	16.2	63	80.9	0.13
2002	0.3	19	1.1	1.3	0.2	0.2	0	4.2	0.5	0.2	5.2	0	6.7	77	8.6	15.3	44	51	0.13
2003	0.3	15	1.7	2	0.3	0.2	0.1	6.1	0.7	0.2	7.3	0	9.6	76	3.2	12.9	75	78.3	0.12
2004	0.3	11	2.9	3.2	0.2	0.3	0.1	6	0.9	0.1	7.3	0	10.7	68	3.5	14.2	76	76	0.14
2005	0.5	17	2.2	2.7	0.3	0.3	0.1	5.3	1	0.1	6.7	0	9.7	69	4.3	14.1	69	78.2	0.12
2006	0.6	19	2.4	3	0.5	0.2	0.1	4.9	0.8	0.2	6.1	0	9.5	64	4.2	13.7	69	74.7	0.13
2007	0.6	21	2.1	2.6	0.2	0.2	0.1	4.7	0.9	0.1	6	0	8.9	68	4.9	13.8	64	69.7	0.13
2008	0.5	14	3	3.5	0.4	0.2	0.1	4.5	0.8	0.1	5.7	0	9.7	59	6.6	16.3	59	76.8	0.13
2009	0.5	17	2.6	3.1	0.4	0.2	0.1	4.6	0.9	0.1	6	0	9.5	63	7.5	17	56	90.4	0.11
2010	0.4	13	2.9	3.3	0.5	0.2	0.1	4.2	0.8	0.1	5.4	0	9.2	59	6.7	15.9	58	73.3	0.13
2011	0.5	13	3.5	4	1	0.1	0.1	5.9	1.5	0.1	7.7	0	12.7	61	8.8	21.5	59	146.1	0.09
2012	0.6	16	3.3	3.9	0.2	0.1	0	4.5	0.7	0.1	5.3	0	9.4	57	6.9	16.2	58	76	0.12
2013	0.5	10	5	5.6	1.2	0.2	0.1	4.9	1	0	6.1	0	12.9	47	7.1	20	65	113.3	0.11
2014	0.4	12	3.1	3.5	0.6	0.1	0	3.5	0.6	0	4.3	0	8.4	51	9.6	18	47	83.9	0.1

	Mixed-stock fisheries in North America					Canada – losses from all sources (terminal fisheries, catch and release mortality, bycatch mortality) in year i													
Year (i)	NF-LAB comm / subs 1SW (Year i-1) (a)	% 1SW of total 2SW equivalents (Year i)	NF-LAB Comm / subs 2SW (Year i) (a)	NF-LAB Comm / subs total (Year i)	SPM (Year i)	LAB	NF	QC	GF	SF	Total	USA	North America-Total Losses	Terminal losses as % of NA Total	Greenland Total (Year i - 1)	NW Atlantic Total	Harvest in home-waters as % of total NW Atlantic	Estimated abundance in North America (2SW)	Exploitation rate in North America
2015	0.5	9	4.8	5.3	0.4	0.1	0.1	4.1	0.8	0	5.1	0	10.8	47	11.4	22.2	49	121.6	0.09
2016	0.5	11	4.3	4.9	0.3	0.2	0.1	4.3	0.7	0	5.3	0	10.5	51	11.7	22.2	47	116.2	0.09
2017	0.4	9	4.5	5	0.1	0.2	0.1	3.8	0.7	0	4.8	0	9.8	49	5.6	15.4	63	115.1	0.09
2018	0.4	11	3.2	3.6	0.2	0.1	0	3.1	0.7	0	3.9	0	7.7	51	5.4	13.1	59	92.2	0.08
2019	0.5	10	4.5	5	0.2	0.2	0.1	3.1	0.3	0	3.7	0	8.9	42	9.6	18.5	48	70.5	0.13
2020	0.4	8	4.9	5.3	0.2	0.2	0.1	3.2	0.7	0	4.2	0	9.7	43	6.4	16.1	60	105.6	0.09
2021	0.4	12	3.3	3.7	0.2	0.1	0.1	3	0.5	0	3.6	0	7.6	48	4.3	11.9	64	87.3	0.09
2022	0.5	12	3.9	4.4	0.1	0.1	0	3.2	0.6	0	3.9	0	8.5	46	8.6	17	50	121.5	0.07

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

NF-LAB comm / subs 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 / subs 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 / subs fisheries).

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

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

Table 4.1.5.1. Correspondence between ICES areas used for the assessment of status of North American salmon stocks and the reporting groups (Figure 4.1.5.1 and Figure 4.1.5.2) defined using the SNP range wide baseline (Jeffery *et al.*, 2018).

ICES region	Reporting group	Group acronym
Quebec (North)	Ungava	UNG
Labrador	Labrador Central	LAC
	Lake Melville	MEL
	Labrador South	LAS
Quebec	St Lawrence North Shore Lower	QLS
	Anticosti	ANT
	Gaspe Peninsula	GAS
	Quebec City Region	QUE
Gulf	Gulf of St Lawrence	GUL
Scotia-Fundy	Inner Bay of Fundy	IBF
	Eastern Nova Scotia	ENS
	Western Nova Scotia	WNS
	Saint John River & Aquaculture	SJR
Newfoundland	Northern Newfoundland	NNF
	Western Newfoundland	WNF
	Newfoundland 1	NF1
	Newfoundland 2	NF2
	Fortune Bay	FTB
	Burin Peninsula	BPN
	Avalon Peninsula	AVA
USA	Maine, United States	USA
Europe	Spain	SPN
	France	FRN
	European Broodstock	EUB
	United Kingdom/Ireland	BRI
	Barents-White Seas	BAR
	Baltic Sea	BAL
	Southern Norway	SNO
	Northern Norway	NNO
	Iceland	ICE
	Greenland	GL

Table 4.1.5.2. Genetic mixture analysis of Labrador subsistence fisheries for 2021 using the SNP range wide baseline (Jeffery *et al.*, 2018). Mean percent values (and 95% credible interval) by range wide reporting groups (Figure 4.1.5.1 and Figure 4.1.5.2) by size (Small <63 cm, Large >=63 cm; 29 samples did not have size data) and SFA. Reporting groups with zero support have been excluded from the table. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

Reporting group	Total	Small	Large	SFA 1A	SFA 2	SFA 1B
Maine, United States	0.3 (0.1, 0.7)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.5 (0.1, 1.3)	0 (0.0, 0.0)
Gulf of St Lawrence	0.5 (0.1, 1.0)	0 (0.0, 0.0)	0.9 (0.0, 3.3)	0.5 (0.0, 1.9)	0.6 (0.1, 1.4)	0 (0.0, 0.0)
Quebec City Region	0.1 (0.0, 0.3)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.1 (0.0, 0.6)	0 (0.0, 0.0)
	0.7	0.3	0	0.5	1	0

Reporting group	Total	Small	Large	SFA 1A	SFA 2	SFA 1B
St Lawrence North	(0.3, 1.3)	(0.0, 1.0)	(0.0, 0.0)	(0.5, 1.9)	(0.3, 2)	(0.0, 0.0)
Newfoundland 2	0.3 (0.0, 0.7)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.4 (0.0, 1.3)	0 (0.0, 0.0)
Newfoundland 1	0.3 (0.1, 0.8)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.6 (0.1, 1.4)	0 (0.0, 0.0)
Western Newfoundland	0.2 (0.0, 0.5)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.3 (0.0, 0.9)	0 (0.0, 0.0)
Northern Newfoundland	0.4 (0.1, 0.8)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.6 (0.1, 1.4)	0 (0.0, 0.0)
Labrador South	**51.2** **(47.8, 54.7)**	**9.9** **(6.5, 13.7)**	**6.9** **(2.3, 13.5)**	**0** **(0.0, 0.0)**	**87.6** **(84.5, 90.4)**	**0** **(0.0, 0.0)**
Lake Melville	**26.4** **(23.6, 29.3)**	**51.4** **(45.9, 57)**	**53.4** **(43.5, 63.2)**	**7.1** **(3.1, 12.3)**	**4.3** **(2.6, 6.3)**	**96.9** **(93.4, 99.7)**
Labrador Central	**19.1** **(16.2, 22.1)**	**38** **(32.5, 43.6)**	**38.1** **(28.4, 48.5)**	**89.8** **(83.4, 95)**	**2.9** **(1.3, 5.0)**	**0** **(0.0, 0.0)**
Ungava	0.5 (0.1, 0.9)	0.3 (0.0, 1.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.6 (0.2, 1.4)	0.4 (0.0, 1.4)
Total samples	**1079**	**814**	**236**	**193**	**629**	**257**

Table 4.1.5.3. Genetic mixture analysis of Labrador subsistence fisheries for 2022 using the SNP range wide baseline (Jeffery *et al.*, 2018). Mean percent values (and 95% credible interval) by range wide reporting groups (Figure 4.1.5.1 and Figure 4.1.5.2) by size (Small <63 cm, Large >=63 cm; 20 samples did not have size data) and SFA. Reporting groups with zero support have been excluded from the table. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

Reporting group	Total	Small	Large	SFA 1A	SFA 2	SFA 1B
Maine, United States	0.1 (0.0, 0.4)	0.1 (0.0, 0.5)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.1 (0.0, 0.5)	0 (0.0, 0.0)
Quebec City Region	0.4 (0.0, 1.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	2.1 (0.0, 5.9)	0 (0.0, 0.0)	0 (0.0, 0.0)
Gaspe Peninsula	0.3 (0.0, 0.9)	0.3 (0.0, 0.8)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.4 (0.0, 1.0)	0 (0.0, 0.0)
St Lawrence North Shore Lower	1.1 (0.5, 2.0)	1.0 (0.4, 1.9)	1.9 (0.3, 4.8)	0 (0.0, 0.0)	1.4 (0.6, 2.5)	0 (0.0, 0.0)
Newfoundland 2	1.1 (0.4, 2.0)	1.0 (0.3, 2.1)	1.5 (0.2, 4.0)	0 (0.0, 0.0)	1.3 (0.5, 2.4)	0 (0.0, 0.0)
Newfoundland 1	1.2 (0.5, 2.1)	1.3 (0.5, 2.5)	0.7 (0.0, 2.4)	0 (0.0, 0.0)	1.5 (0.7, 2.7)	0 (0.0, 0.0)
Northern Newfoundland	0.5 (0.0, 1.1)	0.6 (0.1, 1.4)	0 (0.0, 0.0)	0 (0.0, 0.0)	1.5 (0.7, 2.7)	0 (0.0, 0.0)
Labrador South	**69.7** **(66.2, 73.2)**	**75.5** **(71.8, 79.1)**	**57.5** **(48.2, 66.6)**	**6.2** **(0.6, 14.3)**	**86.7** **(83.5, 89.6)**	**3.9** **(0.8, 9.2)**
Lake Melville	12.3 (9.9, 15.0)	10.1 (7.7, 12.8)	13.1 (6.5, 20.6)	0 (0.0, 0.0)	3.6 (2.2, 5.4)	91.5 (84.4, 96.8)
Labrador Central	**12.9** **(10.1, 15.8)**	**9.5** **(6.7, 12.7)**	**22.3** **(14.4, 31.3)**	**85.2** **(72.4, 94.6)**	**3.7** **(2.2, 5.4)**	**3.5** **(0.5, 9.0)**
Ungava	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.3 (0.0, 0.8)	0 (0.0, 0.0)
Total samples	**872**	**695**	**157**	**96**	**692**	**84**

Table 4.1.5.4. Genetic mixture analysis of Saint Pierre and Miquelon for 2020 to 2022 using the SNP range wide baseline (Jeffery et al., 2018). Mean percent values (and 95% credible interval) by range wide reporting groups (Figure 4.1.5.1 and Figure 4.1.5.2) by size (Small <63 cm, Large >=63 cm). Reporting groups with zero support have been excluded from the table. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

	2020			2021			2022		
Reporting group	**Total**	**Small**	**Large**	**Total**	**Small**	**Large**	**Total**	**Small**	**Large**
Maine, USA	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0.1 (0.0, 0.5)	0 (0.0, 0.0)
Gulf of St Lawrence	**26.1** **(18.1, 34.9)**	**13.93** **(6.5, 23.6)**	**38.42** **(24.2, 53.1)**	**17.9** **(7.9, 31.3)**	**14.9** **(3.1, 30.5)**	**34.9** **(14.6, 585)**	**27.8** **(12.9, 45.7)**	**20.7** **(2.2, 49.7)**	**23.3** **(6.9, 45.7)**
Quebec City Region	2.44 (0.0, 6.8)	3.08 (0.2, 8.5)	0 (0.0, 0.0)	7.4 (0.0, 18.0)	6.03 (0.0, 17.1)	0 (0.0, 0.0)	11.4 (0.5, 27.1)	15.1 (0.0, 45.3)	5.1 (0, 19.4)
Gaspe Peninsulas	**16.83** **(9.9, 24.9)**	**6.04** **(1.4, 13.6)**	**34.31** **(20.9, 49.1)**	**26.7** **(13.9, 41.7)**	**14.1** **(3.6, 29.8)**	**42.4** **(15.8, 68.8)**	**23.4** **(8.6, 42.1)**	**0** **(0.0, 0.0)**	**41** **(20.1, 63.0)**
Anticosti	0.91 (0.0, 3.5)	0 (0.0, 0.0)	2.19 (0.0, 8.3)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)
St Lawrence North Shore Lower	5.47 (2.0, 10.5)	3.13 (0.2, 8.8)	7.32 (1.6, 16.5)	2 (0.0, 7.4)	3.1 (0.0, 11.0)	0 (0.0, 0.0)	5.9 (0.2, 18.3)	0 (0.0, 0.0)	8.1 (0.4, 23.3)
Newfoundland 2	**8.4** **(3.0, 16.0)**	**18.05** **(7.7, 30.5)**	**0** **(0.0, 0.0)**	**10.8** **(2.9, 22.8)**	**16.8** **(4.4, 34.4)**	**0** **(0.0, 0.0)**	**3.7** **(0.0, 13.4)**	**12.8** **(0.2, 40.9)**	**0** **(0.0, 0.0)**
Fortune Bay	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**7.2** **(1.0, 17.1)**	**10.5** **(1.4, 25.7)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**
Burin Peninsula	**3.19** **(0.0, 11.3)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**
Avalon Peninsula	**4.62** **(1.6, 9.2)**	**8.43** **(2.9, 16.7)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**
Newfoundland 1	**12.0** **(5.8, 18.3)**	**19.66** **(9.6, 31.1)**	**0** **(0.0, 0.0)**	**4.5** **(0.3, 12.2)**	**6.6** **(0.5, 17.8)**	**0** **(0.0, 0.0)**	**6.5** **(0.3, 17.8)**	**9.7** **(0.0, 33.5)**	**0** **(0.0, 0.0)**
Western Newfoundland	**11.32** **(5.8, 18.3)**	**14.27** **(6.5, 24.1)**	**8.62** **(2.3, 18.4)**	**17.5** **(8.1, 29.5)**	**22.7** **(10.0, 38.6)**	**0** **(0.0, 0.0)**	**18.3** **(5.6, 35.3)**	**25.8** **(0.0, 57.9)**	**11.3** **(1.2, 29.0)**
Northern Newfoundland	**5.47** **(0.8, 12.1)**	**5.0** **(1.0, 12.6)**	**5.14** **(0.0, 13.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0** **(0.0, 0.0)**	**0.5** **(0.0, 1.1)**	**0** **(0.0, 0.0)**	**3.8** **(0.0, 16.0)**
Labrador South	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	2.1 (0.0, 7.5)	0 (0.0, 0.0)	5.8 (0.1, 19.7)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)
Labrador Central	0.84 (0.8, 12.1)	0 (0.0, 0.0)	1.93 (0.0, 7.3)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)	0 (0.0, 0.0)
Total	**116**	**65**	**51**	**51**	**33**	**18**	**29**	**9**	**20**

Table 4.3.1.1. Estimated smolt production by smolt migration year in monitored rivers of eastern North America 1991 to 2022.

Smolt Migration Year	USA	Scotia-Fundy				Gulf				
	Narraguagus	Nashwaak	LaHave	St Mary's (West)	Middle	Margaree	NW Miramichi	SW Miramichi	Restigouche	Kedgwick
1991										
1992										
1993										
1994										
1995										
1996			20 510							
1997	2869		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	1 066 584	172 325
2003	1201	9 000	14 034			83 100	286 000	48 500	799 021	69 295
2004	1284	13 600	21 613			105 800	368 000	1 167 000	608 750	85 675
2005	1287	5200	5270	7350		94 200	151 200		805 667	78 297
2006	2339	25 400	22 971	25 100		113 700	435 000	1 330 000	591 776	125 446
2007	1177	21 550	24 430	16 110		112 400		1 344 000	1 129 024	116 300
2008	962	7310	14 450	15 217		128 800		901 500	547 733	52 055
2009	1176	15 900	8643	14 820		96 800		1 035 000	621 321	142 908
2010	2149	12 500	16 215					2 165 000	726 058	101 233
2011	404	8750		8066			768 000		795 124	254 577
2012	969	11 060							883 417	167 911
2013	1237	10 120	7159		11103				1 008 650	121 250
2014	1615	11 100	29 175		11907				302 987	58 008
2015	1201	7900	6664		24110				1 065 469	236 891
2016		7150	25 849	4394	14848				597 926	74 996
2017				15 190					536 615	56 586
2018	604			4171	9554				315 037	64 338
2019	829	8710		1742					379 137	57 707
2020									834 414	103 445
2021	1426		5293	3289						
2022	1031	15 400							385 945	108 118

Table 4.3.1.1 Cont`d. Estimated smolt production by smolt migration year in monitored rivers of eastern North America 1991 to 2022.

Smolt Migration Year	Quebec			Newfoundland				
	St Jean	De la Trinité	Vieux-Fort	Conne	Rocky	Campbellton	Western Arm Brook	Garnish
1991	113 927	40 863		74 645	7732		13 453	
1992	154 980	50 869		68 208	7813		15 405	
1993	142 972	86 226		55 765	5115	31 577	13 435	
1994	74 285	55 913		60 762	9781	41 663	9 283	
1995	60 227	71 899		62 749	7577	39 715	15 144	
1996	104 973	61 092		94 088	14 261	58 369	14 502	
1997		31 892		100 983	16 900	62 050	23 845	
1998	95 843	28 962		69 841	12 163	50 449	17 139	
1999	114 255	56 557		63 658	8625	47 256	13 500	
2000	50 993	39 744		60 777	7616	35 596	12 706	
2001	109 845	70 318		86 898	9392	37 170	16 013	
2002	71 839	44 264		81 806	10 144	32 630	14 999	
2003	60 259	53 030		71 479	4440	35 089	12 086	
2004	54 821	27 051		79 667	13 047	32 780	17 323	
2005	96 002	34 867		66 196	15 847	30 123	8 607	
2006	102 939			35 146	13 200	33 304	20 826	
2007	135 360	42 923		63 738	12 355	35 742	16 621	
2008	45 978	35 036		68 242	18 338	40 390	17 444	
2009	37 297	32 680		63 512	14 041	36 705	18 492	
2010	47 187	37 500		54 392	15 098	41 069	19 044	
2011	45 050	44 400		50 701	9311	37 033	20 544	
2012	40 787	45 108		51 220	5673	44 193	13 573	
2013	36 849	42 378		66 261	6989	44 928	19 710	
2014	56 456	30 741	30 873	56 224	9901	45 634	19 771	
2015		47 566	25 096	32 557	6454	32 747	14 278	
2016	58 307	42 269	28 234		4542	44 785	14 255	
2017	34 261	27 433	34 447	58 803	5233	36 005	15 439	11 903
2018	38 356	35 519	16 046		3600	38 485	13 317	10 425
2019	36 988	28 230		25 241	1149	40 848	12 732	16 405
2020	38 110	38 892						
2021	60 655	42 679		22 163	5267	20 412	11 285	8 494
2022	43 634	28 991		22 695	5880	50 024	11 926	20 368

Table 4.3.2.1. Estimated small salmon returns (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Returns for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	49.1	135.7	23.7	62.8	26.5	NA	298.8	34.1	119.7	19.4	53.9	22.8	NA	272.8	72.6	150.7	27.9	71.9	30.3	NA	328.6
1971	64.4	118.5	18.7	49.9	18.9	0	271.2	44.6	105.5	15.3	42.7	16.1	0	244.2	95.4	131.9	22.1	57	21.7	0	305.2
1972	48.5	110.6	15.6	62.7	17	0	255.4	33.7	97.6	12.8	53.6	14.1	0	231.4	71.6	123.4	18.4	72	19.8	0	283.2
1973	13.9	159.9	20.7	63.3	24.4	0	282.4	9.4	142	17	54.2	20.8	0	260.8	19.8	177.7	24.4	72.2	28.1	0	304
1974	54	120.6	21	98.5	43.7	0.1	338.7	37.5	106.9	17.2	83.8	37.2	0.1	309.1	79.4	134.2	24.8	112.9	50	0.1	372
1975	103.4	151.1	22.5	88.4	33.9	0.1	400.9	71.4	133.2	18.6	75.6	30.5	0.1	358.3	153.7	169	26.7	101.2	37.3	0.1	454.9
1976	73.6	158.8	25	128.9	53	0.2	440.7	51.1	138.9	20.5	110.9	46.7	0.2	401.8	109.1	178.5	29.4	146.7	59.2	0.2	485.8
1977	65.7	159.4	22.7	46.3	46.2	0.1	341.6	45.8	140.1	18.6	39.9	40.2	0.1	310.2	97.1	179.4	26.8	52.6	52.1	0.1	379
1978	32.7	139.4	21.3	41.2	15.8	0.2	251.5	23	121.9	17.4	36.2	14.5	0.2	228.9	48.1	157.1	25	46.1	17.1	0.2	275
1979	42.2	152.1	27	72.5	48.9	0.2	344	29.2	133	22.2	62.4	42.3	0.2	315.8	63.1	170.7	32	82.1	55.4	0.3	374.4
1980	96.1	172.5	37.2	63.3	70.6	0.8	441.9	66.2	152.6	30.5	54.5	62.7	0.8	401.1	143.1	192.7	43.9	71.9	78.5	0.8	493.6
1981	105.6	225.4	51.9	106.1	59.3	1.1	551.7	72.6	197.2	42.7	85.4	50.9	1.1	497.9	157.8	253.3	61.5	127.2	67.7	1.1	614.8
1982	73.8	200.4	29.5	120.6	36.1	0.3	463.2	50.9	177.1	24.3	95.9	31.4	0.3	416.8	108.9	223.9	34.9	145.8	40.7	0.3	511.8
1983	45.7	156.6	22.5	37.2	22.6	0.3	286.2	31.8	137.5	18.4	29.6	19.9	0.3	259	68.1	175.4	26.6	44.7	25.3	0.3	316.1
1984	24.4	206.8	25.5	54	42.8	0.6	354.8	16.8	179.4	24.5	44.5	36.6	0.6	323.6	35.8	233.7	26.5	63.5	48.8	0.6	385.7
1985	43.1	195.6	27.5	85.9	47.5	0.4	401.7	29.9	168.8	26.4	68.1	40.2	0.4	363	63.9	222.7	28.7	103.9	54.8	0.4	440.8
1986	66.1	200.1	38.5	160.3	49.1	0.8	516.9	45.2	174.8	37.1	125.7	41.7	0.8	463.7	97.6	225.7	40	194.1	56.8	0.8	569.8
1987	82.7	135.5	44.1	122	51.4	1.1	438.6	56.6	118.5	42.3	97.2	43.4	1.1	393.6	122.7	152.5	45.9	147.5	59.2	1.1	488.7
1988	75.7	217.5	50.6	172.2	51.8	1	571.3	51.7	190.5	48.8	136.3	44.1	1	515.1	112.9	244.4	52.5	207.5	59.6	1	629.1
1989	52	107.7	40.1	103.6	54.6	1.3	360.8	35.9	95	38.6	81.7	46.6	1.2	326.4	77.2	120.5	41.5	125.3	62.8	1.3	397.1
1990	30.4	152.3	45.4	117.2	55.3	0.7	402.4	21	138.3	43.9	92.9	46.3	0.7	369.1	45	166.3	47.1	141.7	64.1	0.7	435.9
1991	24.4	105.6	36.4	85.7	28.2	0.3	281.4	16.6	96.4	35.3	68.1	24.6	0.3	258.1	36.3	114.7	37.7	103.4	31.9	0.3	305.2
1992	33.9	229	40	193.2	34	1.2	532.2	24.1	199.4	38.6	164.2	29.3	1.2	487.9	50.9	257.5	41.5	221.5	38.6	1.2	577.1
1993	45.6	265.6	34.5	137.2	25.7	0.5	511	33.3	235.4	33.4	89.4	21.9	0.5	450.3	66.7	296	35.7	184.7	29.5	0.5	570.9
1994	33.9	161	33	67.2	10.5	0.4	307.3	25.1	138.6	32	57.2	9.3	0.4	279.9	48.3	183.1	34	77.2	11.6	0.4	334.7
1995	47.7	204	26.6	60.9	20	0.2	360.8	36.1	173.3	25.7	52.1	17.5	0.2	325.5	66.8	234.8	27.4	69.8	22.5	0.2	397.6
1996	90.2	313.1	35.2	57.2	31.8	0.7	530.6	67.8	269	34.2	47.9	27.5	0.6	477.1	127.2	357.4	36.1	66.4	36.1	0.7	586.8
1997	95.6	176.8	27.6	30.6	9.4	0.4	341.7	73.7	159.1	26.7	24.9	8.2	0.4	310	130.6	194.6	28.5	36.3	10.5	0.4	380.1

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1998	150.4	183.6	28.7	39.9	20.4	0.4	423.7	102.7	171.3	27.6	34.2	18.7	0.4	373.5	199.6	196.4	29.7	45.6	22	0.4	474.8
1999	147.9	201.2	30	35.5	10.6	0.4	425.4	100.2	185.7	28.9	31	9.8	0.4	374.9	194.6	216.9	31.1	40	11.4	0.4	475.5
2000	182.3	228.9	27.9	50.9	12.4	0.3	502.8	123.9	216.9	26.1	44.7	11.3	0.3	442.9	240.1	240.8	29.8	57.1	13.4	0.3	562.1
2001	144.4	156.2	18.9	43	5.4	0.3	368.5	99	148.3	18.2	37.7	5	0.3	321.5	192.1	164.3	19.6	48.5	5.8	0.3	416.6
2002	102.7	155.7	30.3	69.2	9.9	0.5	368.2	66.4	143.4	29.4	60.3	9	0.4	328.3	139	168	31.2	78.1	10.7	0.5	407.9
2003	86	242.4	25.2	41.7	5.8	0.2	401.5	52.4	232.9	24.5	36.1	5.3	0.2	365.9	119.1	252	26.1	47.4	6.3	0.2	436.1
2004	95.2	210.4	34.2	76.5	8.4	0.3	424.7	72.2	192.3	32.4	65.9	7.6	0.3	393	117.6	228.2	35.9	87.3	9.2	0.3	456.8
2005	220.7	221.8	23	47.4	7.5	0.3	521.2	166.1	176.9	21.9	39.4	6.8	0.3	447.3	275.4	266.6	24.1	55.6	8.2	0.3	595.1
2006	213.6	212.8	28.1	59.7	10.3	0.4	524.6	140.5	194.3	27	49.3	9.3	0.4	449	285.9	231.7	29.3	69.7	11.3	0.5	599.5
2007	194.8	183.8	21.4	41.1	7.7	0.3	448.9	138.4	158.5	20.3	33	7	0.3	386	250.6	208.7	22.4	49.1	8.5	0.3	511.1
2008	203.9	247.7	35.7	61.9	15.4	0.8	565.9	149	222.6	34.3	49.9	13.9	0.8	503	258.7	272.9	37.2	74	16.9	0.8	628.6
2009	102.1	223.3	20.8	25.8	4.2	0.2	376	60	194.3	19.8	20.7	3.8	0.2	323.3	144.4	251.1	21.9	30.9	4.6	0.2	430
2010	122	267.8	27.5	73.3	14.9	0.5	505.8	83.1	256.1	26.1	64	13.4	0.5	463.5	160.8	279.2	28.8	82.4	16.4	0.5	547.8
2011	247.6	242.9	36.9	74.6	9.5	1.1	613.5	147.3	216.1	35.4	61	8.5	1.1	509	345.9	270.1	38.4	89	10.4	1.1	715.3
2012	174.3	270.9	23.1	18.8	0.6	0	487.3	112.2	250.8	22.1	15.1	0.5	0	422.6	235	290.6	24.2	22.5	0.7	0	551.6
2013	156.5	187.6	18.8	24.8	2.1	0.1	389.8	90.5	172.3	17.8	19.3	1.9	0.1	321.5	220.5	203.3	19.7	30.1	2.3	0.1	455.3
2014	267.1	170.1	22	12.5	1.4	0.1	473.2	185.4	155.2	21	10.3	1.3	0.1	390.7	350.6	184.8	23	14.9	1.6	0.1	557.9
2015	257.4	283.2	36.8	39.6	4.2	0.1	621.4	183.4	253	35.4	35	3.8	0.1	540.1	331.9	313.4	38.2	44.4	4.6	0.2	702.5
2016	206.5	208.8	33.2	24	2.6	0.2	474.9	118.3	184.2	31.7	19.7	2.3	0.2	383.6	294.4	233.2	34.7	28.3	2.8	0.2	565.7
2017	164.9	175.3	24.4	22.4	3.9	0.4	391.1	90.4	148.3	23.2	18.7	3.5	0.4	311.7	238.2	201.9	25.5	26.1	4.3	0.4	470
2018	275.1	94.3	23.7	17.6	1.3	0.3	412.7	176.4	77.7	22.7	14.8	1.3	0.3	312.8	377.4	110.8	24.8	20.4	1.4	0.3	516.1
2019	118.5	257.9	20.9	15.8	3.5	0.4	416.5	67.1	199	19.9	12.9	3.2	0.4	336.7	168.5	316.2	21.8	18.7	3.8	0.4	496.2
2020	198.2	202.9†	26.1	26.7†	3.1†	0.2	457.1†	139.5	154.4	24.9	22.8	2.8	0.2	378.5	258.6	252.1	27.2	30.7	3.4	0.2	538.1
2021	190.7	422.4	34	29.1	3.6	0.2	679	114.1	317.2	32.6	21.3	3.3	0.2	545.4	268.2	524.9	35.3	36.6	4	0.2	815.1
2022	335.5	160.4	25.4	18	1.5	0.4	540.7	171.1	138.6	24.4	13.7	1.3	0.4	377.2	505.7	182.8	26.4	22.6	1.6	0.4	712.1
% Change [(2022–2021)/2021]																					
	76%	-62%	-25%	-38%	-60%	60%	-20%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					
	1	35	32	49	49	22	7														

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

Table 4.3.2.2. Estimated large salmon returns (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Returns for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	10	14.9	103.5	69.5	20.3	NA	218.6	5	11.8	84.9	67.1	18	NA	198.3	17	17.9	122.1	71.9	22.6	NA	238.8
1971	14.3	12.6	59.2	40	15.9	0.7	143.1	7.1	10	48.5	37.6	14.1	0.6	128.5	24.3	15.1	69.8	42.5	17.6	0.7	158.4
1972	12.4	12.6	77.3	57	19	1.4	180.2	6.1	10	63.3	48.9	17.1	1.4	161.4	20.9	15.2	91.1	65	20.9	1.4	198.8
1973	17.2	17.3	85.4	53.4	14.8	1.4	190.1	8.5	13.8	70	45.6	13.4	1.4	169.1	29.1	20.9	100.6	61.3	16.1	1.4	211.6
1974	17	14.3	114	77.7	28.6	1.4	253.7	8.3	12.7	93.9	66	26.3	1.4	227	28.8	15.8	134.9	89.4	30.9	1.4	281.3
1975	15.7	18.4	97.3	50.5	30.6	2.3	215.5	7.8	16.1	79.6	43.1	28	2.3	192.7	26.7	20.7	114.6	57.8	33.2	2.4	237.8
1976	18.2	16.6	96.3	48.7	28.8	1.3	210.7	9	14.6	79	41.4	25.9	1.3	188.3	30.8	18.6	114	56.1	31.6	1.3	234.1
1977	16.2	14.6	113.5	87.8	38.1	2	273.1	8	13	93.3	75.3	34.6	2	245.9	27.3	16.3	134.2	100.5	41.5	2	300.2
1978	12.6	11.4	102.5	43.9	22.2	4.2	197.3	6.2	10.4	84	39	20.6	4.2	176.3	21.4	12.3	120.9	48.9	23.9	4.2	218.6
1979	7.3	7.2	56.5	17.4	12.8	1.9	103.3	3.6	6.3	46.4	15.2	11.6	1.9	91.7	12.3	8.1	66.7	19.6	14	2	115.2
1980	17.4	12.1	134.1	62.4	43.7	5.8	276.1	8.5	11.1	110	54.7	39.5	5.7	247.6	29.2	13	158.5	70.2	47.8	5.8	304.8
1981	15.6	28.9	105.5	39.3	28.2	5.6	223.9	7.7	25.3	86.5	33	25.4	5.6	200.5	26.4	32.4	124.5	45.7	31	5.7	246.8
1982	11.5	11.6	93.4	54	23.7	6.1	200.9	5.6	10.1	76.7	42.7	21.5	6	177.8	19.5	13.1	110.6	65.4	25.8	6.1	223.5
1983	8.4	12.4	77	40.9	20.6	2.2	161.6	4.1	11.3	63	34	18.4	2.1	144.6	14.1	13.6	90.7	47.8	22.8	2.2	178.5
1984	6	12.4	64	32.7	24.6	3.2	143	2.9	9.2	62.2	23.4	21.2	3.2	131.5	10.1	15.7	65.8	42	27.8	3.3	154.7
1985	4.7	10.9	66.7	44.4	34.1	5.5	166.7	2.3	7.6	64.6	32	29.3	5.5	152.4	8	14.2	68.9	57	39	5.6	181.2
1986	8.2	12.3	78.3	68.1	28.2	6.2	201.7	4	9.5	76.4	49.1	23.8	6.1	180.8	13.7	15.1	80.2	87.5	32.7	6.2	222.7
1987	11	8.4	73.7	46.1	17.7	3.1	160.4	5.4	6.4	71.8	33.6	15	3.1	145.6	18.7	10.4	75.6	58.4	20.3	3.1	175.4
1988	6.9	13	81.3	53.1	16.4	3.3	174.2	3.4	9.9	78.9	38.8	13.7	3.3	158.5	11.7	16	83.6	67	19.1	3.3	189.4
1989	6.7	6.9	74	42.1	18.5	3.2	151.7	3.3	5.4	72	31.2	15.7	3.2	139.2	11.2	8.5	75.9	53.3	21.4	3.2	164.3
1990	3.8	10.3	72.7	56.4	16.1	5.1	164.4	1.9	8.4	70.1	39.3	13.5	5	146.7	6.5	12.2	75.4	73.2	18.5	5.1	182.1
1991	1.9	7.5	65.7	56.9	15.7	2.6	150.5	0.9	6.1	63.3	39.4	13.4	2.6	132.4	3.2	9	68.1	74.5	17.9	2.7	168.7
1992	7.6	31.5	65.9	59.6	14.3	2.5	181.5	4	22.1	63.5	50.9	12.3	2.4	167.7	12.8	41	68.2	68.4	16.2	2.5	195.7
1993	9.5	17.1	50.6	63.4	10.1	2.2	153.3	6	13.8	49.6	34.4	8.9	2.2	123.6	15.1	20.4	51.7	93.1	11.2	2.3	183.3
1994	13.1	17.3	51.2	40.9	6.3	1.3	130.8	8.6	13.8	50.3	32.9	5.7	1.3	120.1	20.6	21	52.1	49.2	7	1.4	142.4
1995	25.9	19	59.3	48.1	7.5	1.7	162	18.3	14.7	58.2	41.2	6.6	1.7	149.9	37.8	23.4	60.3	55.1	8.4	1.8	176.1
1996	18.6	28.9	53.7	40.7	10.9	2.4	155.7	13.2	23.7	52.6	32.5	9.6	2.4	144	26.8	34.2	54.8	48.8	12.2	2.4	167.9

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1997	16.1	28	44.4	35.6	5.6	1.6	131.8	11.6	22.9	43.6	28.1	5	1.6	121.4	23.6	33.1	45.3	43.1	6.2	1.6	143.1
1998	13.4	35.2	34	30.7	3.8	1.5	118.7	8	27.4	33.2	25.2	3.5	1.5	107.6	18.8	43.3	34.8	36.3	4.2	1.5	129.9
1999	16.1	32.1	37.2	27.6	4.9	1.2	119	9.6	25	36	23.3	4.6	1.2	108	22.6	39.2	38.4	32	5.3	1.2	130.3
2000	21.7	27	35.5	30.1	2.9	0.5	117.7	13.1	23	34	25.5	2.6	0.5	106.8	30.8	31	37	34.6	3.1	0.5	128.9
2001	23.2	17.8	37.3	40.1	4.7	0.8	123.8	13.8	15.2	36	35	4.3	0.8	112.6	32.6	20.6	38.6	45.1	5.1	0.8	135.1
2002	16.9	16.8	26.4	23.6	1.6	0.5	85.8	9.8	13.7	25.5	19.9	1.4	0.5	77.1	24	19.9	27.4	27.4	1.7	0.5	94.8
2003	14.1	24.5	42.1	40.1	3.5	1.2	125.4	7.4	19.4	40.5	33.7	3.2	1.2	114.5	21	29.5	43.8	46.3	3.9	1.2	136.3
2004	17.1	22.3	36.6	39.8	3.1	1.3	120.2	11.6	17	35.3	32.6	2.8	1.3	109.6	22.5	27.5	37.8	46.8	3.4	1.3	130.8
2005	21	28.3	35.5	38.6	2	1	126.5	12.1	20.4	34.3	31.7	1.8	1	112.2	29.8	36.2	36.6	45.5	2.2	1	140.4
2006	21.2	35.7	32.9	37.3	3	1	131.1	13.3	30	31.9	30.8	2.7	1	119.2	29	41.4	33.9	43.8	3.3	1	143.2
2007	21.8	29.6	30.2	35	1.6	1	119	12.8	23.4	29.2	29.5	1.5	0.9	106.9	31	35.7	31.1	40.4	1.7	1	131.7
2008	26.2	28.9	36.3	29.1	3.3	1.8	125.7	15.9	22.5	34.8	23.2	2.9	1.8	111.4	36.5	35.2	37.7	34.8	3.6	1.8	139.6
2009	38.9	34.3	35.1	36.3	3.1	2.1	150	20.7	23.9	33.9	30.7	2.8	2.1	127.5	57.8	45	36.3	41.9	3.4	2.1	173.3
2010	18.9	35.3	37.8	33.2	2.5	1.1	128.6	11.6	28.8	36.7	27.8	2.3	1.1	117.4	26.1	42.1	38.9	38.5	2.7	1.1	140.4
2011	57.2	43.5	47.8	64.8	4.8	3.1	221	33.1	31.5	46.4	52.4	4.3	3.1	190.5	82	55.4	49.1	76.9	5.3	3.1	252
2012	33.5	28.8	33.6	27.1	1.3	0.9	125.2	20.5	23.3	32.5	22.3	1.2	0.9	109.9	47	34.4	34.7	32	1.4	0.9	141
2013	64.3	37.7	38.5	35.9	3.2	0.5	180.1	39.7	25.9	37.4	28.8	2.8	0.5	150.7	88.7	49.7	39.7	43.1	3.6	0.5	208.9
2014	62	20.2	22.1	22.9	0.8	0.3	128.4	38.7	16.4	21.5	18.3	0.7	0.3	104.1	85.5	23.9	22.8	27.5	0.8	0.3	152.7
2015	88.5	36.9	36.4	33.3	0.7	0.8	197	53.8	29.1	35.4	27.5	0.7	0.8	160.4	124.2	44.7	37.5	39.2	0.8	0.8	233
2016	72	35	39.3	38.2	1.6	0.4	186.4	39.2	27.8	38	30.2	1.4	0.4	151.6	103.8	42.5	40.6	46.3	1.7	0.4	220.1
2017	75.2	19.9	38.1	35.6	1.2	0.7	170.8	35.3	15.3	36.8	30.4	1.1	0.7	130.2	116.4	24.4	39.5	41.1	1.3	0.7	212.1
2018	46.4	8.8	28.6	39.5	1.6	0.5	125.2	25.3	6.3	27.7	31	1.4	0.5	101.9	67.2	11.3	29.5	47.9	1.7	0.5	148.5
2019	27.5	36.9	30.6	23.2	0.7	1.1	120	14.4	25.4	29.7	17.9	0.7	1.1	101	40.5	48.3	31.5	28.3	0.8	1.1	138.8
2020	45.9	29.6†	38.8	44.6†	1.2†	1.5	161.6†	44.4	19.5	37.7	36.3	1	1.5	148.3	47.3	39.2	39.8	53.1	1.3	1.5	174.3
2021	49.3	53.6	32.7	20.3	0.8	0.4	157.2	46.2	34.9	31.8	14.5	0.7	0.4	137.7	52.4	72.2	33.6	26.1	0.9	0.4	176.9
2022	84.7	30.4	36	34.3	2.3	1.2	188.8	46.5	20	35	27.5	2	1.1	148.6	123.5	41	36.9	41.1	2.6	1.2	230
Change [(2022–2021)/2021]																					
	72%	-43%	10%	69%	179%	159%	20%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
	2	13	40	39	40	35	13														

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

Table 4.3.2.3. Estimated 2SW salmon returns (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Returns for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	10	4.1	75.6	59.5	17.1	NA	166.7	5	3.1	62	57.5	15	NA	151.4	17	5.2	89.1	61.6	19.2	NA	182.4
1971	14.3	3.6	43.2	34.8	13.5	0.7	110.6	7.1	2.6	35.4	32.6	11.9	0.6	98.1	24.3	4.6	51	37	15.2	0.7	123.7
1972	12.4	3.7	56.4	49.4	16	1.4	139.7	6.1	2.7	46.2	42.4	14.3	1.4	124.6	20.9	4.8	66.5	56.5	17.7	1.4	155.1
1973	17.2	4.6	62.3	47.6	12.9	1.4	146.6	8.5	3.5	51.1	40.6	11.7	1.4	129.6	29.1	5.8	73.5	54.7	14.1	1.4	164.9
1974	17	3.7	83.2	67.4	27.1	1.4	200.3	8.3	2.9	68.5	56.9	24.9	1.4	178.9	28.8	4.4	98.4	77.3	29.4	1.4	222.6
1975	15.7	5.2	71	43	28.9	2.3	166.5	7.8	3.9	58.1	36.6	26.3	2.3	148.5	26.7	6.5	83.7	49.3	31.5	2.4	185.1
1976	18.2	4.4	70.3	40.4	26.6	1.3	161.8	9	3.3	57.7	34.3	23.8	1.3	143.4	30.8	5.4	83.2	46.2	29.4	1.3	181
1977	16.2	3.5	82.9	80.6	32.3	2	218	8	2.9	68.1	69	28.9	2	196	27.3	4.2	98	92.3	35.7	2	241.2
1978	12.6	3.6	74.8	36.3	18.8	4.2	150.9	6.2	2.9	61.3	32.2	17.2	4.2	134.2	21.4	4.2	88.2	40.5	20.4	4.2	167.7
1979	7.3	1.7	41.2	11.6	10.5	1.9	74.5	3.6	1.3	33.8	10.1	9.4	1.9	65.4	12.3	2.1	48.7	13	11.6	2	83.8
1980	17.4	3.9	97.9	56.9	38.7	5.8	221	8.5	3.2	80.3	49.7	34.7	5.7	198.6	29.2	4.6	115.7	64	42.6	5.8	243.9
1981	15.6	7	77	24.4	23.2	5.6	153.5	7.7	5.5	63.2	20.4	20.8	5.6	135.4	26.4	8.6	90.9	28.4	25.6	5.7	171.8
1982	11.5	3.2	68.2	41.9	16.7	6.1	148.2	5.6	2.5	56	32.7	14.8	6	130	19.5	3.8	80.7	51	18.6	6.1	166
1983	8.4	3.7	56.2	31.4	16.5	2.2	118.6	4.1	3	46	25.9	14.5	2.1	105.1	14.1	4.4	66.2	36.9	18.5	2.2	131.9
1984	6	3.4	46.7	29.5	21.5	3.2	110.6	2.9	2.5	45.4	20.8	18.3	3.2	100.2	10.1	4.3	48.1	38.2	24.6	3.3	120.9
1985	4.7	2.7	48.7	35.9	29.7	5.5	127.5	2.3	1.9	47.1	25.1	25.4	5.5	115	8	3.6	50.3	46.7	34	5.6	139.5
1986	8.2	3.3	57.2	56.7	21.4	6.2	153.3	4	2.4	55.8	40.4	18.2	6.1	135.8	13.7	4.1	58.6	73.3	24.7	6.2	171.1
1987	11	2.3	53.8	35.6	13.7	3.1	119.9	5.4	1.7	52.4	25.5	11.6	3.1	107	18.7	3	55.2	45.6	15.7	3.1	132.8
1988	6.9	3.4	59.3	42	11.8	3.3	127	3.4	2.4	57.6	30.6	9.9	3.3	114.5	11.7	4.4	61	53.4	13.6	3.3	139.5
1989	6.7	1.7	54	27.9	14.6	3.2	108.3	3.3	1.2	52.6	20.4	12.4	3.2	99.2	11.2	2.1	55.4	35.5	16.9	3.2	117.3
1990	3.8	2.7	53.1	36.6	11.7	5.1	113.1	1.9	2	51.2	26	9.9	5	101.7	6.5	3.4	55.1	47.3	13.4	5.1	124.4
1991	1.9	2.1	48	35.7	13	2.6	103.4	0.9	1.6	46.2	24.5	11.1	2.6	91.7	3.2	2.5	49.7	46.9	14.9	2.7	114.9
1992	7.6	8.1	48.1	37.6	12	2.5	116.1	4	5.5	46.4	31.9	10.3	2.4	108.1	12.8	10.9	49.8	43.5	13.7	2.5	124.6

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1993	9.5	4.4	37	43.3	8.1	2.2	104.9	6	3.2	36.2	23.1	7.2	2.2	83.7	15.1	5.5	37.7	63.4	9	2.3	125.7
1994	13.1	4	37.4	30.1	5.2	1.3	91.5	8.6	2.9	36.7	23.9	4.7	1.3	83.1	20.6	5.2	38	36.3	5.7	1.4	100.9
1995	25.9	3.8	43.3	39.4	6.8	1.7	121.3	18.3	2.6	42.5	33.5	6	1.7	110.6	37.8	5.1	44	45.3	7.6	1.8	134.5
1996	18.6	5.7	39.2	29.2	9.2	2.4	104.7	13.2	4.1	38.4	23	8.1	2.4	95.6	26.8	7.3	40	35.4	10.3	2.4	114.7
1997	16.1	6	32.4	23.9	4.6	1.6	85.2	11.6	4.3	31.8	18.2	4.1	1.6	76.9	23.6	7.8	33.1	29.7	5	1.6	94.3
1998	8.7	6.5	24.8	16.5	2.6	1.5	60.7	5.2	4.5	24.3	12.9	2.4	1.5	55.2	12.5	8.4	25.4	20.1	2.8	1.5	66.3
1999	10.5	6.3	27.1	16	4.2	1.2	65.3	6.3	4.4	26.3	13.1	3.9	1.2	59.5	15	8.2	28	19	4.5	1.2	71.2
2000	14.2	6.3	25.9	17	2.4	0.5	66.4	8.5	4.5	24.8	14	2.2	0.5	59.4	20.4	8.2	27	19.9	2.6	0.5	73.6
2001	15.1	2.5	27.2	27.1	4.3	0.8	77	9	1.7	26.3	23.4	3.9	0.8	69.6	21.5	3.3	28.2	30.8	4.6	0.8	84.6
2002	11	2.4	19.3	14.1	1	0.5	48.4	6.5	1.6	18.6	11.6	0.9	0.5	42.9	15.9	3.3	20	16.6	1	0.5	54.1
2003	9.2	3.4	30.8	26.1	3.3	1.2	73.9	4.9	2.2	29.6	21.4	3	1.2	67.1	13.8	4.5	31.9	30.7	3.6	1.2	80.9
2004	11.1	3.3	26.7	25.7	2.7	1.3	70.9	7.6	2.1	25.8	20.5	2.5	1.3	64.2	14.9	4.6	27.6	30.9	2.9	1.3	77.6
2005	13.7	4.4	25.9	26.9	1.7	1	73.7	7.9	2.6	25	21.7	1.5	1	65.2	19.7	6.3	26.7	32.1	1.8	1	82.1
2006	13.8	5.4	24	22.5	2.5	1	69.3	8.7	3.5	23.3	18.1	2.3	1	62.1	19.3	7.2	24.8	26.9	2.8	1	76.7
2007	14.2	4.2	22	22.5	1.4	1	65.3	8.4	2.6	21.3	18.8	1.3	0.9	58	20.5	5.7	22.7	26.3	1.5	1	72.8
2008	17.2	3.9	26.5	19.1	3.1	1.8	71.4	10.4	2.4	25.4	14.8	2.7	1.7	62.8	24.3	5.3	27.6	23.3	3.4	1.8	80
2009	25.3	4.6	25.7	24.1	2.7	2.1	84.5	13.4	2.8	24.8	20.1	2.4	2.1	71.6	37.7	6.4	26.5	28.2	2.9	2.1	97.8
2010	12.2	4.7	27.6	20.4	2	1.1	68	7.5	3.2	26.8	16.4	1.8	1.1	61.3	17.1	6.2	28.4	24.4	2.2	1.1	74.7
2011	37.1	3.7	34.9	51.9	4.6	3	135.1	21.5	2.4	33.9	41.5	4.2	3	116.1	53.7	4.9	35.8	61.8	5.1	3.1	155.1
2012	21.7	2.3	24.5	19.3	1.1	0.9	69.8	13.3	1.6	23.7	15.9	1	0.9	60.6	30.9	3	25.3	22.8	1.2	0.9	79.9
2013	41.7	4.8	28.1	25.6	2.9	0.5	103.5	25.7	3.1	27.3	20.4	2.6	0.5	86.5	58.3	6.6	29	30.9	3.3	0.5	121.2
2014	40.2	2.9	16.1	16.9	0.7	0.3	77.1	25	1.9	15.7	13.3	0.6	0.3	61.4	56.1	3.8	16.6	20.5	0.8	0.3	93.4
2015	57.4	4.9	26.6	22	0.7	0.8	112.3	34.9	3.3	25.8	17.7	0.6	0.8	89.4	81.6	6.6	27.3	26.1	0.7	0.8	136.9
2016	46.8	3.1	28.7	27.7	1.5	0.4	108.2	25.5	2.3	27.7	21.6	1.4	0.4	85.8	68	4	29.7	33.8	1.7	0.4	130.7
2017	48.8	2.1	27.8	26.6	1.1	0.7	107.1	22.9	1.4	26.8	22.3	1	0.7	80.7	75.8	2.7	28.8	31	1.3	0.7	134.6
2018	30.1	1.5	20.9	31.6	1.4	0.5	86.1	16.4	0.8	20.2	24.5	1.3	0.5	70.1	44	2.1	21.6	38.8	1.6	0.5	102
2019	17.9	4.7	22.3	17.1	0.7	1.1	63.8	9.4	2.8	21.7	12.9	0.7	1.1	53.9	26.5	6.7	23	21.4	0.8	1.1	74
2020	29.8	3.9†	28.3	32.7†	1.1†	1.5	97.3†	27.5	2.3	27.5	25.8	1	1.4	89.7	32.2	5.6	29.1	39.6	1.2	1.5	104.8
2021	32	8.1	23.9	16	0.8	0.4	81.2	28.9	4.4	23.2	11.1	0.7	0.4	74.3	35.3	11.8	24.5	20.8	0.8	0.4	88.2

Year	Median of estimated returns (X 1000)							5th percentile of estimated returns (X 1000)							95th percentile of estimated returns (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
2022	54.9	3.8	26.3	25.8	2.1	1.1	114	30.1	2.3	25.6	20	1.8	1.1	88.4	80.9	5.2	27	31.5	2.3	1.2	140.7
% Change [(2022–2021)/2021]																					
	71%	-54%	10%	61%	169%	163%	40%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					
	2	26	40	33	39	35	19														

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

Table 4.3.3.1. Estimated small salmon spawners (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Spawners for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	45.1	105.2	13.8	39.3	18.4	NA	222.5	30.1	89.9	11.3	30.3	14.6	NA	197.4	68.5	120.6	16.3	48.3	22.2	NA	252.1
1971	60.5	92.2	11.7	32.6	12.2	0	209.9	40.7	79	9.6	25.6	9.3	0	182.9	91.5	105.4	13.8	39.7	15	0	243.8
1972	45.5	86.3	10.3	40.1	10.8	0	194	30.7	73.2	8.4	31.1	8	0	169.8	68.7	99.1	12.1	49.4	13.7	0	222.3
1973	6.5	124.3	13.7	45.9	18.3	0	208.8	1.9	106.7	11.3	36.7	14.6	0	187.6	12.3	142	16.2	54.5	22	0	230.2
1974	51.5	94.2	12.6	76.4	33	0	268.5	35	80.7	10.3	61.6	26.7	0	239.9	76.9	107.9	14.8	90.7	39.5	0	301.1
1975	99.5	117.5	14.5	67.5	26.2	0.1	326.3	67.4	99.5	11.9	54.5	22.7	0.1	283.8	149.7	135.7	17.1	80.2	29.6	0.1	381.1
1976	67.8	124.3	16.2	90	40.7	0.2	341	45.4	104.6	13.3	72	34.5	0.1	301.3	103.4	144	19.2	107.9	47	0.2	385.8
1977	61.1	125.3	15	24.8	32.2	0.1	259.7	41.2	106.2	12.3	18.6	26.3	0.1	228	92.5	144.9	17.7	30.9	38	0.1	296.6
1978	30	110.8	14.4	22.8	9	0.1	188.1	20.3	93	11.7	18	7.7	0.1	166	45.4	128.5	16.9	27.6	10.4	0.1	211.8
1979	38	120.8	19.8	49.6	36.5	0.2	266.5	25.1	102	16.3	40	30.1	0.2	238.3	59	139.7	23.4	59.1	43.1	0.2	296.4
1980	92.3	136.4	26.1	43.5	49.6	0.7	349.9	62.4	116.5	21.3	35	41.8	0.7	308.9	139.3	156.4	30.7	51.9	57.6	0.7	402
1981	100.4	178.8	38.7	69.8	40.4	1	430.7	67.4	151.2	31.7	49.5	32	1	377.2	152.6	206.4	45.7	90.7	48.6	1	493.3
1982	69.7	158.7	21.1	88.8	24.4	0.3	364.8	46.8	135.8	17.3	63.8	19.7	0.3	319.2	104.8	181.8	24.9	113.8	29.2	0.3	413.4
1983	41.3	124.4	15	23.6	14.8	0.3	220.7	27.4	105.6	12.3	16.1	12.1	0.3	194	63.7	143.2	17.8	31.3	17.6	0.3	250.1
1984	21.4	167	20.8	21.6	32.8	0.5	264.9	13.9	140.3	19.8	12	26.6	0.5	233.5	32.9	193.4	21.8	31	38.8	0.5	296.1
1985	40	159.2	21.1	59.4	36.1	0.4	317.3	26.8	132.2	20	41.9	28.9	0.4	279.4	60.8	186.7	22.3	77.5	43.4	0.4	357
1986	62.6	162.8	28.2	121.8	39.5	0.7	416.7	41.8	137.2	26.7	86.6	31.9	0.7	364.8	94.2	188.5	29.6	154.9	47.1	0.7	470.5
1987	77.3	111	33.2	89.2	41.1	1.1	354.4	51.2	93.7	31.4	64.5	33.2	1.1	310.2	117.4	127.7	35	113.9	49	1.1	404

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1988	70.2	177.3	36.8	126	42.3	0.9	456.1	46.2	151.1	35	91.1	34.4	0.9	400.3	107.3	204.6	38.7	161.4	50	0.9	514.6
1989	47.3	89.2	31.2	69.5	43.7	1.1	283.6	31.2	76.3	29.8	47.7	35.5	1.1	248.9	72.5	101.9	32.6	91.2	51.7	1.1	319.4
1990	27.1	122.3	33.3	84.3	44	0.6	312.7	17.6	108.2	31.8	60.3	35.2	0.6	280.4	41.7	136.6	34.9	108.3	52.9	0.6	345.5
1991	22.1	85.1	26.6	66.2	22.3	0.2	223.3	14.3	75.7	25.4	48.8	18.6	0.2	200.4	34	94.4	27.8	83.9	26	0.2	246.9
1992	31.1	205.4	27.8	159.8	26.4	1.1	453	21.3	176.4	26.4	131.7	21.7	1.1	408.9	48.1	234.4	29.2	187.7	31	1.1	497.3
1993	42.9	239.1	22.6	112.8	20.5	0.4	440.2	30.6	209	21.4	65.9	16.7	0.4	379.3	64	268.9	23.7	160.2	24.3	0.4	501.1
1994	31	130.1	21.2	44.8	9.1	0.4	237.6	22.2	107.8	20.3	35.1	8	0.4	210.6	45.4	152	22.2	54.4	10.2	0.4	265.4
1995	44.9	171.1	18	48.2	17.9	0.2	301.8	33.2	140.3	17.2	39.4	15.3	0.2	266.2	63.9	201.7	18.9	56.9	20.4	0.2	338.2
1996	87.3	274.3	23.2	35.2	28.2	0.7	451.3	64.9	230.7	22.3	28.6	24	0.6	398	124.2	318.1	24.2	41.6	32.5	0.7	506.8
1997	93	151.7	18.9	19	8.3	0.4	292.3	71.2	133.8	18	14.6	7.2	0.4	261.5	128.1	169.4	19.7	23.5	9.5	0.4	331.3
1998	147.9	158.4	21.6	25.5	19.9	0.4	373.9	100.2	145.9	20.6	21.2	18.3	0.4	324	197.1	170.6	22.7	29.9	21.5	0.4	424.7
1999	145.4	176.4	23.8	21.4	10.2	0.4	377.9	97.7	161	22.7	17.9	9.4	0.4	327	192.1	191.8	24.9	24.8	11	0.4	427.4
2000	179	204.7	21.4	31.2	12	0.3	448.5	120.6	192.7	19.6	26.4	11	0.3	388.7	236.9	216.7	23.3	36	13	0.3	507.7
2001	141.8	133.5	13.9	26.6	5.1	0.3	321.2	96.4	125.4	13.2	22.5	4.7	0.3	275.1	189.6	141.8	14.6	30.6	5.5	0.3	369.2
2002	100.1	133.1	21.4	44.3	9.6	0.5	308.8	63.8	120.6	20.5	37.2	8.7	0.4	269	136.4	145.3	22.3	51.4	10.4	0.5	347.8
2003	83.4	219.6	19.4	25.9	5.6	0.2	353.8	49.8	210	18.6	21.7	5.1	0.2	318.5	116.5	229.4	20.2	30	6.1	0.2	389
2004	92.8	188.4	26.3	49.4	8.1	0.3	365.5	69.8	170.2	24.6	41.1	7.4	0.3	334.5	115.2	206.5	28.1	57.4	8.9	0.3	395.6
2005	218	197.3	18.3	29.6	7.3	0.3	471.7	163.4	151.9	17.2	23.8	6.6	0.3	395.3	272.7	241.8	19.4	35.4	8	0.3	543.9
2006	211.4	191.3	21.6	38.7	10	0.4	473.8	138.3	172.7	20.5	31	9.1	0.4	397.1	283.6	209.8	22.7	46.5	11	0.5	548.6
2007	192.6	167.9	16.7	26.4	7.5	0.3	411.2	136.2	142.7	15.6	20.7	6.8	0.3	348.7	248.3	193	17.8	32.2	8.3	0.3	473.2
2008	201.3	217.4	26.9	39.5	15.1	0.8	500.9	146.5	192	25.5	30.3	13.7	0.8	439.3	256.2	242.7	28.3	48.8	16.6	0.8	563.1
2009	100.4	197.2	16.2	15.8	4.1	0.2	334.1	58.3	169	15.2	11.9	3.7	0.2	281.6	142.8	225.5	17.2	19.7	4.5	0.2	386.9
2010	120.1	235.1	21.5	47	14.8	0.5	439.3	81.1	223.7	20.1	40	13.3	0.5	397.2	158.8	246.8	22.8	53.9	16.2	0.5	480.3
2011	245.5	214.2	28.2	48.8	9.4	1.1	546.8	145.1	187.8	26.7	38.5	8.4	1.1	442.2	343.7	241.2	29.7	59	10.3	1.1	650.1
2012	172.6	246.9	17.8	11.5	0.6	0	449.4	110.5	226.8	16.7	8.6	0.5	0	383.8	233.3	266.9	18.8	14.4	0.6	0	514.6
2013	154.7	163.4	14.6	15.1	2.1	0.1	349	88.7	148	13.6	11.1	1.9	0.1	282	218.7	178.7	15.5	19.1	2.3	0.1	415.4
2014	265.1	146.1	16.8	8.8	1.4	0.1	438.4	183.4	131.2	15.8	7.1	1.3	0.1	355.9	348.6	160.8	17.8	10.5	1.5	0.1	523.2
2015	255.6	251.8	28.1	37.7	4.2	0.1	577.3	181.6	222.1	26.7	33.2	3.8	0.1	495.9	330.1	281.8	29.5	42.1	4.6	0.2	658
2016	204.6	178.8	26.3	23	2.5	0.2	435.6	116.4	154.6	24.7	18.7	2.3	0.2	344.6	292.6	203.3	27.7	27.2	2.8	0.2	526.6

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
2017	162.9	156.2	19.1	21.3	3.9	0.4	363.3	88.4	129	17.9	17.7	3.5	0.4	283.6	236.3	183.3	20.2	25	4.3	0.4	442.5
2018	274.2	91.8	18.1	17.1	1.3	0.3	403.3	175.5	74.2	17.1	14.3	1.2	0.3	302.9	376.5	109.3	19.2	19.9	1.4	0.3	506
2019	117.1	238.2	16.5	15.4	3.5	0.4	390.6	65.7	180.2	15.5	12.5	3.2	0.4	310.2	167.1	297.3	17.4	18.3	3.8	0.4	470.7
2020	197.2	183.9†	21.1	25.8†	3.1†	0.2	431.6†	138.5	135.3	20	21.9	2.8	0.2	351.4	257.6	231.8	22.2	29.8	3.4	0.2	512.6
2021	189.2	402.4	28	28.5	3.6	0.2	652.1	112.6	297.5	26.5	20.9	3.3	0.2	515	266.7	505.2	29.3	36.2	4	0.2	788.8
2022	334.2	141.4	20.5	17.5	1.5	0.4	515.4	169.8	119.9	19.6	13.1	1.3	0.4	351.2	504.4	163.8	21.5	21.9	1.6	0.4	687.3
Change [(2022–2021)/2021]																					
	77%	-65%	-27%	-39%	-60%	60%	-21%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					
	1	33	29	46	49	21	4														

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

Table 4.3.3.2. Estimated large salmon spawners (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Spawners for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	9.5	12.7	39.1	11.8	7.9	NA	81.4	4.4	9.7	32.1	9.6	5.5	NA	70.9	16.5	15.7	46.2	14.1	10.2	NA	92.3
1971	13.9	11	20.3	11.8	8.2	0.5	65.8	6.6	8.4	16.6	9.4	6.4	0.5	56.1	23.8	13.6	23.9	14.2	10	0.5	77.3
1972	12	11.3	39.8	33.3	11.9	1	109.6	5.7	8.7	32.6	25.5	10.1	1	96.3	20.5	13.9	46.8	41.1	13.9	1	123.5
1973	16.1	15.4	40.4	35.4	7.6	1.1	116.4	7.5	11.8	33	27.8	6.3	1.1	101.2	28.1	18.9	47.5	43	8.9	1.1	132.9
1974	16.2	13	49.1	55.8	15.2	1.1	150.9	7.5	11.4	40.2	44.5	13	1.1	132.7	28	14.6	57.9	67.4	17.5	1.2	169.9
1975	15.4	17.1	40.9	33.7	17.8	1.9	127.3	7.4	14.9	33.4	26.5	15.2	1.9	112.6	26.4	19.5	48	41	20.5	2	142.6
1976	17.4	15.6	38.9	29.2	17	1.1	119.5	8.1	13.6	31.8	22	14.1	1.1	104.3	30	17.6	45.8	36.3	19.8	1.1	135.8
1977	14.9	11.8	55.9	55.4	21.6	0.6	160.9	6.7	10.2	45.8	43.3	18.1	0.6	141.2	26	13.5	65.8	67.8	25	0.6	180.5
1978	11.9	9.8	51.2	19.3	10.9	3.3	106.8	5.5	8.8	42	14.5	9.2	3.3	93.2	20.7	10.8	60.4	24.1	12.5	3.3	120.4
1979	6.7	6.6	22	8.8	7.9	1.5	53.7	2.9	5.7	18	6.7	6.7	1.5	47	11.6	7.5	25.9	10.9	9.2	1.5	60.7
1980	16.5	10.1	60.9	34.5	24	4.3	150.6	7.6	9.2	50	26.9	19.8	4.2	132.9	28.3	11.1	71.9	42	28	4.3	169.2
1981	15.1	27.5	44.8	16	12.7	4.3	120.9	7.2	23.9	36.7	9.9	9.9	4.3	106.1	25.9	31.1	52.8	22.3	15.5	4.4	136.3
1982	10.9	10.4	45.5	26.8	10.4	4.6	109	5	8.8	37.2	15.8	8.3	4.6	92.5	18.8	11.9	53.6	38.3	12.5	4.7	125.6

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1983	8	11.1	29.6	18.2	5.7	1.8	74.7	3.7	9.9	24.3	11.4	3.5	1.8	63.7	13.7	12.3	34.9	25.2	7.9	1.8	85.5
1984	5.5	11.9	37.6	28.7	20	2.5	106.3	2.4	8.6	35.9	19.3	16.7	2.5	94.9	9.6	15.1	39.5	37.8	23.4	2.6	117.7
1985	4.4	10.9	36.5	43.1	28.6	4.9	128.7	2	7.6	34.4	30.6	23.7	4.8	114.3	7.7	14.2	38.7	55.9	33.4	4.9	143.3
1986	7.8	12.2	41.2	65.9	24.9	5.6	157.7	3.6	9.4	39.2	46.8	20.5	5.5	136.8	13.2	15.1	43.1	85.5	29.3	5.6	178.9
1987	10.4	8.4	36.5	43.5	16	2.8	117.9	4.7	6.4	34.6	30.9	13.4	2.8	103.3	18	10.4	38.5	55.8	18.7	2.8	132.9
1988	6.2	13	43.7	51.1	14.8	3	132.2	2.7	9.8	41.3	37.3	12.1	3	116.6	11	16.1	46	65	17.5	3.1	147.5
1989	6.2	6.9	41.7	40.2	18.2	2.8	116.1	2.8	5.4	39.8	29.1	15.2	2.8	103.4	10.7	8.4	43.6	51.2	21	2.8	128.7
1990	3.5	10.2	41.5	54.5	15.2	4.4	129.5	1.5	8.3	38.8	37.8	12.8	4.3	111.8	6.1	12.1	44.2	71.4	17.8	4.4	147.1
1991	1.8	7.5	33.6	55.5	14.1	2.4	115	0.8	6.1	31.2	38.2	11.9	2.4	97.2	3.1	8.9	35.9	73.2	16.3	2.4	133.4
1992	6.8	31.2	33	57.6	13	2.3	144.4	3.2	21.9	30.6	49.1	11	2.3	130.3	12	40.5	35.3	66.2	15	2.3	158.2
1993	9.1	17	25.4	62.7	8.8	2.1	125.6	5.6	13.6	24.5	33.6	7.6	2	95.7	14.7	20.2	26.4	91.9	9.9	2.1	155.1
1994	12.6	16.9	25	40	5.4	1.3	101.9	8.1	13.4	24.1	31.9	4.8	1.3	91	20.2	20.4	26	48	6.1	1.4	113.1
1995	25.4	18.6	34.9	47.3	7.1	1.7	135.4	17.8	14	33.8	40.4	6.2	1.7	123.3	37.4	23	35.9	54.3	8	1.8	149.7
1996	18.2	28.4	30.2	39.4	10	2.4	129	12.9	23.3	29.2	31.5	8.7	2.4	117.6	26.5	33.6	31.3	47.4	11.3	2.4	141.4
1997	15.9	27.6	25.1	34.3	4.9	1.6	109.8	11.4	22.5	24.2	26.9	4.3	1.6	99.2	23.4	32.6	26	41.8	5.5	1.6	121.1
1998	13.1	34.8	23.2	29.8	3.5	1.5	105.9	7.7	27	22.4	24.3	3.2	1.5	94.6	18.5	42.8	24	35.2	3.8	1.5	117.1
1999	15.7	31.8	28.1	26.2	4.4	1.2	107.4	9.1	24.6	26.9	21.9	4.1	1.2	96.4	22.2	38.9	29.3	30.5	4.8	1.2	118
2000	21.3	26.5	26.8	28.9	2.7	1.6	108	12.6	22.5	25.3	24.3	2.4	1.6	97	30.4	30.6	28.4	33.6	2.9	1.6	119.2
2001	22.7	17.5	28	38.5	4.4	1.5	112.7	13.3	14.8	26.7	33.6	4	1.5	101.3	32.1	20.2	29.3	43.5	4.8	1.5	123.8
2002	16.6	16.5	20.7	22.7	1.4	0.5	78.4	9.5	13.5	19.8	19	1.2	0.5	69.6	23.7	19.7	21.6	26.4	1.5	0.5	87.2
2003	13.7	24.2	33.8	38.8	3.3	1.2	115	7	19	32.2	32.5	3	1.2	104.1	20.6	29.1	35.4	45.1	3.6	1.2	125.8
2004	16.7	21.8	28.4	38.5	3	1.3	109.6	11.2	16.7	27.1	31.4	2.7	1.3	99	22	26.9	29.6	45.6	3.2	1.3	120.1
2005	20.6	27.8	28.2	37.1	1.9	1.1	116.6	11.7	20	27	30.3	1.7	1.1	102.4	29.4	35.8	29.3	44.1	2.1	1.1	131
2006	20.9	35.2	26.2	35.9	2.8	1.4	122.4	12.9	29.5	25.2	29.4	2.5	1.4	110.4	28.6	40.9	27.2	42.3	3.1	1.4	134.5
2007	21.4	29.2	23.7	33.5	1.5	1.2	110.6	12.5	23.2	22.7	28.2	1.3	1.2	98	30.6	35.5	24.6	38.9	1.6	1.2	123.2
2008	25.9	28.2	30.1	27.7	3.2	2.2	117.5	15.6	22	28.7	21.9	2.8	2.2	103.4	36.2	34.5	31.6	33.5	3.5	2.3	131.1
2009	38.6	34	28.8	34.9	3	2.3	141.9	20.3	23.5	27.6	29.3	2.7	2.3	119.2	57.5	44.7	30	40.7	3.3	2.3	165
2010	18.6	34.8	32	31.6	2.4	1.5	120.7	11.3	28.1	30.9	26.3	2.1	1.5	109.3	25.8	41.5	33.1	37	2.6	1.5	132.1
2011	56.9	42.8	39.7	62.9	4.7	3.9	210.9	32.9	30.7	38.3	50.9	4.2	3.9	180.9	81.8	54.7	41	74.9	5.2	3.9	242

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
2012	33.4	28.6	27.5	26.1	1.2	2.1	118.9	20.4	23	26.4	21.4	1.1	2	103.7	46.9	34.2	28.6	30.9	1.4	2.1	134.7
2013	64.1	37.4	31.8	34.4	3.1	5.3	175.9	39.5	25.5	30.7	27.3	2.8	5.2	147	88.4	49	33	41.5	3.5	5.3	205.1
2014	61.9	19.9	17.4	22.4	0.7	0.6	122.9	38.5	16.2	16.7	17.8	0.7	0.6	98.9	85.3	23.7	18	26.9	0.8	0.6	147
2015	88.4	36.3	30.9	32.6	0.7	1.5	190.2	53.7	28.5	29.8	26.7	0.7	1.5	154.7	124.1	44	31.9	38.3	0.8	1.5	227.3
2016	71.7	34.4	33.3	37.2	1.5	0.9	179.4	38.9	27	32	29.3	1.4	0.9	144.4	103.5	41.9	34.7	45.1	1.7	0.9	213
2017	74.8	20.4	32.9	34.8	1.2	1.5	165.5	35	15.4	31.6	29.5	1.1	1.4	125.4	116.1	25.5	34.2	40.1	1.3	1.5	207.4
2018	46.3	8.4	24.4	38.7	1.5	0.9	120.1	25.2	6.2	23.5	30.2	1.3	0.9	97	67.1	10.5	25.3	47.1	1.7	0.9	143.2
2019	27.3	36.2	26.3	22.5	0.7	1.2	114.3	14.1	24.8	25.4	17.3	0.7	1.2	95.8	40.3	47.9	27.3	27.7	0.8	1.2	133.2
2020	45.6	30.7†	34.4	43.6†	1.1†	1.5	157†	44.1	20.1	33.4	35.1	1	1.5	143.6	47.1	41	35.5	51.9	1.3	1.5	170.2
2021	49.2	52.9	28.6	19.7	0.8	0.4	151.7	46.1	34.6	27.6	14	0.7	0.4	132	52.3	71.7	29.5	25.4	0.9	0.4	171.6
2022	84.5	30.4	31.7	33.3	2.3	1.5	183.7	46.4	19.9	30.7	26.7	2	1.5	143.5	123.4	40.9	32.6	40.2	2.6	1.5	225
Change [(2022–2021)/2021]																					
	72%	-43%	11%	69%	181%	238%	21%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					
	2	14	28	33	40	29	3														

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

Table 4.3.3.3. Estimated 2SW salmon spawners (medians, 5th percentile, 95th percentile; X 1000) to the six geographic areas and overall, for NAC 1970 to 2022. Spawners for Scotia-Fundy (SF) do not include those from SFA 22 and a portion of SFA 23.

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1970	9.5	3.2	28.6	9.9	6.5	NA	58	4.4	2.3	23.4	8.2	4.7	NA	49.5	16.5	4.2	33.7	11.7	8.3	NA	67.2
1971	13.9	3	14.8	10.4	7.1	0.5	49.8	6.6	2.1	12.1	8.3	5.6	0.5	40.9	23.8	3.9	17.5	12.5	8.5	0.5	60.3
1972	12	3.1	29.1	29.1	10.4	1	84.9	5.7	2.2	23.8	22.3	8.7	1	73.4	20.5	4.1	34.2	36	12	1	97.2
1973	16.1	3.8	29.5	32.2	6.7	1.1	89.9	7.5	2.8	24.1	25.2	5.5	1.1	76.3	28.1	4.9	34.7	39.1	7.8	1.1	104.6
1974	16.2	3.1	35.8	49	14.1	1.1	119.9	7.5	2.4	29.3	38.9	11.9	1.1	103.8	28	3.8	42.3	58.9	16.2	1.2	136.8
1975	15.4	4.7	29.8	28.9	16.3	1.9	97.3	7.4	3.4	24.4	22.7	13.9	1.9	84.6	26.4	6	35.1	35.1	18.8	2	111.4

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
1976	17.4	4	28.4	24.1	15.5	1.1	90.7	8.1	3	23.2	18.3	12.9	1.1	77.6	30	5	33.4	29.9	18.1	1.1	105.6
1977	14.9	2.8	40.8	51.5	18.8	0.6	129.8	6.7	2.2	33.4	40	15.7	0.6	112.4	26	3.4	48.1	62.9	21.9	0.6	148
1978	11.9	3.1	37.3	16	9.4	3.3	81.4	5.5	2.5	30.7	12.1	7.9	3.3	70	20.7	3.6	44.1	19.9	10.9	3.3	93.1
1979	6.7	1.6	16	5.8	6.7	1.5	38.4	2.9	1.2	13.1	4.4	5.6	1.5	32.9	11.6	2	18.9	7.2	7.7	1.5	44.5
1980	16.5	3.3	44.5	31.5	21.3	4.3	121.7	7.6	2.6	36.5	24.7	17.6	4.2	106.1	28.3	3.9	52.5	38.3	24.9	4.3	137.7
1981	15.1	6.6	32.7	9.8	10.4	4.3	79	7.2	5.1	26.8	5.9	8.3	4.3	67.3	25.9	8.1	38.5	13.7	12.5	4.4	92.4
1982	10.9	2.8	33.2	21.2	7.8	4.6	80.8	5	2.2	27.1	12.2	6.2	4.6	67.3	18.8	3.4	39.1	30.2	9.4	4.7	94.7
1983	8	3.3	21.6	14	4.2	1.8	53.1	3.7	2.7	17.8	8.6	2.7	1.8	44.2	13.7	3.9	25.5	19.6	5.7	1.8	62.3
1984	5.5	3.2	27.5	25.9	17.5	2.5	82.4	2.4	2.3	26.2	17.3	14.5	2.5	72.1	9.6	4.1	28.8	34.7	20.5	2.6	92.9
1985	4.4	2.7	26.7	35.1	24.6	4.9	98.6	2	1.9	25.1	24.2	20.6	4.8	86.3	7.7	3.5	28.3	45.8	28.8	4.9	110.7
1986	7.8	3.2	30	55.1	18.4	5.6	120.4	3.6	2.4	28.6	38.9	15.3	5.5	102.8	13.2	4.1	31.4	71.6	21.6	5.6	138.2
1987	10.4	2.3	26.7	33.5	12.2	2.8	88.3	4.7	1.6	25.3	23.5	10.2	2.8	75.7	18	3	28.1	43.2	14.2	2.8	100.9
1988	6.2	3.4	31.9	40.7	10.3	3	95.9	2.7	2.4	30.2	29.4	8.5	3	83.4	11	4.4	33.6	52	12.1	3.1	108.4
1989	6.2	1.7	30.4	26.6	14.3	2.8	82.3	2.8	1.2	29.1	19.1	12.1	2.8	73.2	10.7	2.1	31.8	34.1	16.6	2.8	91.4
1990	3.5	2.7	30.3	35.5	11	4.4	87.5	1.5	2	28.4	24.8	9.2	4.3	76	6.1	3.3	32.3	46	12.8	4.4	98.8
1991	1.8	2	24.5	34.8	11.6	2.4	77.3	0.8	1.6	22.8	23.7	9.8	2.4	65.8	3.1	2.5	26.2	45.8	13.5	2.4	88.6
1992	6.8	8.1	24.1	36.5	10.8	2.3	88.7	3.2	5.4	22.3	30.7	9.2	2.3	80.8	12	10.8	25.8	42.3	12.5	2.3	97.3
1993	9.1	4.3	18.6	42.7	6.9	2.1	83.9	5.6	3.2	17.9	22.3	6	2	63	14.7	5.4	19.3	62.5	7.8	2.1	104.8
1994	12.6	3.9	18.3	29.4	4.4	1.3	70.4	8.1	2.8	17.6	23.2	3.9	1.3	61.9	20.2	5	18.9	35.7	4.9	1.4	79.9
1995	25.4	3.7	25.5	38.9	6.5	1.7	101.9	17.8	2.4	24.7	33	5.6	1.7	91.5	37.4	5	26.2	44.8	7.3	1.8	115.2
1996	18.2	5.5	22.1	28.3	8.4	2.4	85.2	12.9	3.9	21.3	22	7.3	2.4	76.1	26.5	7.1	22.9	34.5	9.4	2.4	95.5
1997	15.9	5.9	18.3	23.1	4	1.6	69.3	11.4	4.1	17.7	17.4	3.5	1.6	61	23.4	7.6	18.9	28.9	4.4	1.6	78.4
1998	8.5	6.3	16.9	15.9	2.3	1.5	51.6	5	4.4	16.3	12.5	2.1	1.5	46.1	12.3	8.3	17.5	19.5	2.5	1.5	57.2
1999	10.2	6.2	20.5	15.2	3.7	1.2	57.1	6	4.3	19.7	12.3	3.5	1.2	51.4	14.7	8.1	21.4	18.1	4	1.2	62.8
2000	13.9	6.2	19.6	16.3	2.2	1.6	59.9	8.3	4.4	18.5	13.4	2	1.6	53	20.1	8	20.7	19.3	2.4	1.6	67.2
2001	14.8	2.4	20.5	26.2	4	1.5	69.4	8.7	1.7	19.5	22.5	3.7	1.5	62	21.1	3.2	21.4	29.8	4.4	1.5	77

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC	LAB	NF	QC	GF	SF	US	NAC
2002	10.8	2.4	15.1	13.6	0.8	0.5	43.2	6.3	1.6	14.4	11.1	0.7	0.5	37.7	15.7	3.2	15.8	16.1	0.9	0.5	48.8
2003	9	3.3	24.7	25.3	3.1	1.2	66.7	4.6	2.2	23.5	20.7	2.8	1.2	59.8	13.6	4.5	25.9	29.9	3.4	1.2	73.4
2004	10.8	3.2	20.7	24.9	2.6	1.3	63.6	7.3	2	19.8	19.7	2.4	1.3	56.9	14.6	4.5	21.6	29.9	2.8	1.3	70.1
2005	13.4	4.3	20.6	25.9	1.6	1.1	66.9	7.6	2.5	19.7	20.8	1.4	1.1	58.7	19.5	6.2	21.4	30.9	1.7	1.1	75.2
2006	13.6	5.3	19.1	21.7	2.4	1.4	63.5	8.4	3.5	18.4	17.4	2.1	1.4	56.2	19	7.1	19.9	26	2.6	1.4	71
2007	14	4.1	17.3	21.7	1.3	1.2	59.5	8.1	2.6	16.6	18	1.2	1.2	52.1	20.2	5.6	18	25.3	1.4	1.2	67.1
2008	16.9	3.8	22	18.2	3	2.8	66.8	10.1	2.4	20.9	14	2.6	2.8	58.1	24	5.2	23	22.4	3.3	2.8	75.4
2009	25	4.5	21	23.2	2.5	2.3	78.7	13.2	2.7	20.1	19.1	2.3	2.3	65.7	37.5	6.4	21.9	27.3	2.8	2.3	92.1
2010	12	4.6	23.3	19.5	1.9	1.5	62.9	7.3	3.1	22.5	15.6	1.7	1.5	56.2	16.9	6.1	24.1	23.5	2.1	1.5	69.6
2011	37	3.6	28.9	50.4	4.6	3.9	128.4	21.3	2.4	27.9	40.3	4.1	3.8	109.2	53.5	4.9	29.9	60.3	5	3.9	148.1
2012	21.6	2.3	20	18.6	1	2	65.7	13.2	1.6	19.2	15.2	0.9	2	56.3	30.8	3	20.9	22.1	1.1	2	75.6
2013	41.5	4.8	23.2	24.5	2.9	5.2	102.1	25.5	3	22.4	19.2	2.6	5.2	85	58.2	6.5	24.1	29.6	3.3	5.3	119.9
2014	40.1	2.8	12.7	16.4	0.7	0.6	73.3	24.9	1.9	12.2	12.8	0.6	0.6	57.5	56	3.8	13.1	20.1	0.7	0.6	89.6
2015	57.3	4.8	22.5	21.4	0.7	1.5	108.4	34.8	3.2	21.8	17.2	0.6	1.5	85.3	81.5	6.4	23.3	25.6	0.7	1.5	132.7
2016	46.6	3.1	24.3	27	1.5	0.9	103.3	25.3	2.2	23.4	21.1	1.3	0.9	81.1	67.8	3.9	25.3	33	1.6	0.9	125.7
2017	48.6	2	24	26	1.1	1.4	103.2	22.7	1.4	23	21.7	1	1.4	76.8	75.6	2.7	25	30.3	1.2	1.5	130.7
2018	30	1.4	17.8	31	1.4	0.9	82.5	16.4	0.8	17.1	23.9	1.2	0.9	66.8	44	2.1	18.5	38.2	1.6	0.9	98.7
2019	17.7	4.6	19.2	16.8	0.7	1.2	60.1	9.2	2.7	18.5	12.6	0.6	1.2	50.3	26.3	6.5	19.9	21	0.7	1.2	70.1
2020	29.7	3.8†	25.1	32†	1.1†	1.5	93.2†	27.3	2.2	24.4	25.2	1	1.4	85.8	32	5.5	25.9	38.8	1.2	1.5	100.5
2021	32	8	20.8	15.5	0.8	0.4	77.6	28.9	4.3	20.2	10.7	0.7	0.4	70.7	35.2	11.7	21.5	20.4	0.8	0.4	84.5
2022	54.8	3.7	23.1	25.2	2.1	1.5	110.4	30	2.3	22.4	19.5	1.8	1.5	84.9	80.8	5.2	23.8	30.8	2.3	1.5	137.3
Change [(2022–2021)/2021]																					
	71%	-53%	11%	62%	170%	243%	42%														
Rank (highest = 1 to lowest) over 52 years (1971 to 2022)																					
	2	248	28	28	39	29	6														
2SW CL																					
	34.7	4.0	32.1	18.7	24.7	29.2															

Year	Median of estimated spawners (X 1000)							5th percentile of estimated spawners (X 1000)							95th percentile of estimated spawners (X 1000)						
	LAB	**NF**	**QC**	**GF**	**SF**	**US**	**NAC**	**LAB**	**NF**	**QC**	**GF**	**SF**	**US**	**NAC**	**LAB**	**NF**	**QC**	**GF**	**SF**	**US**	**NAC**
% 2SW CL attained in most recent year (2022)																					
	158%	93%	72%	134%	8%	5%															
2SW management objective																					
					11.0	4.5															
% 2SW management objective attained in most recent year (2022)																					
					19%	33%															

†: In 2020, some regions were affected by the COVID-19 global pandemic and monitoring programs could not operate. For this area previous 5-year average were used.

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 2022. In 2016, Quebec implemented a new Atlantic salmon management plan which changed their river-specific LRP values (Dionne *et al.*, 2015) and DFO Gulf Region revised the river-specific reference points in 2018 (DFO 2018).

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
2017	476	68	42	62	33	16	0	0
2018	498	70	38	54	33	16	0	0
2019	498	71	41	58	33	16	0	0
2020	498	57	40	70	33	16	0	0
2021	498	73	39	53	33	14	0	0
2022	498	69	45	65	33	14	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 2021 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**					**Quebec**				**Newfoundland**						
Smolt year	Narraguagus	Nashwaak	La Have	St Mary's	Middle	Margaree	NW Miramichi	SW Miramichi	Miramichi	À la Barbe	Saint Jean	Bec scie	de la Trinité	Highlands	Conne	Rocky	NE Trepassey	Campbellton	Garnish	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

	USA		Scotia-Fundy				Gulf				Quebec					Newfoundland				
Smolt year	Narraguagus	Nashwaak	La Have	St Mary's	Middle	Margaree	NW Miramichi	SW Miramcihi	Miramichi	À la Barbe	Saint Jean	Bec scie	de la Trinité	Highlands	Conne	Rocky	NE Trepassey	Campbellton	Garnish	WAB
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		0.2						0.9		0.6		1.9	5.3		10.0		7.2
2014	0.32	2.9	0.6		0.4						0.9		1.9		4.1			8.8		8.2
2015	0.09	5.0	0.4		0.2								1.2		3.6			8.4		9.4
2016		2.8	0.7		1.1						0.2		0.5			7.7		3.7		5.7
2017											0.8		0.7		0.8	6.2		8.5	2.8	9.3
2018	1.99				0.4						0.5		0.4			14.7		7.0	2.5	3.4
2019	0.27										1.4		0.8		0.6	17.0		7.3	0.9	5.6
2020											1.2		2.0							
2021	0.49		1.1								0.7		0.5		1.2	5.4		7.5	3.9	10.7

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 2020 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				Quebec				Nfld
Smolt year	Narraguagus	Nashwaak	LaHave	St Mary's	Middle	Margaree	NW Miramichi	SW Miramichi	Miramichi	À la Barbe	Saint Jean	Bec scie	de la Trinité	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	

Smolt year	USA	Scotia-Fundy				Gulf					Quebec			Nfld
	Narraguagus	Nashwaak	LaHave	St Mary's	Middle	Margaree	NW Miramichi	SW Miramchi	Miramichi	À la Barbe	Saint Jean	Bec scie	de la Trinité	Highlands
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	0.51	0.6	0.2		1.5						1.2		0.6	
2015	0.62	1.2	0.4		2.0								0.4	
2016		0.4	0.2		2.2						0.7		0.2	
2017											1.9		0.3	
2018	3.31				3.8						2.0		0.3	
2019	0.40	0.5									1.9		0.3	
2020											3.1		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 2021 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	Quebec			
	Connecticut	Penobscot	Merrimack	Saint John	La Have	East Sheet	Liscomb	Morell	Mill	West	Valleyfield	Aux Rochers
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

	USA			Scotia-Fundy				Gulf	Quebec			
Smolt year	Connecticut	Penobscot	Merrimack	Saint John	La Have	East Sheet	Liscomb	Morell	Mill	West	Valleyfield	Aux Rochers
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								
2016		0.05		0.54								

Smolt year	USA			Scotia-Fundy				Gulf	Quebec			
	Connecticut	Penobscot	Merrimack	Saint John	La Have	East Sheet	Liscomb	Morell	Mill	West	Valleyfield	Aux Rochers
2017		0.05		0.25								
2018		0.05		0.15								
2019		0.04		0.67								
2020		0.04										
2021		0.06										

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 2020 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				Quebec
	Connecticut	Penobscot	Merrimack	Saint John	La Have	East Sheet	Liscomb	Morell	Mill	West	Valleyfield	Aux Rochers
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

SMOLT YEAR	USA			Scotia Fundy				Gulf				Quebec
	Connecticut	Penobscot	Merrimack	Saint John	La Have	East Sheet	Liscomb	Morell	Mill	West	Valleyfield	Aux Rochers
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								
2015		0.12		0.04								
2016		0.08		0.00								
2017		0.16		0.00								
2018		0.22		0.06								
2019		0.06										
2020		0.17										

Table 4.3.6.1. Estimates (medians, 5th percentiles, 95th percentiles; X 1000) of Pre-fishery Abundance (PFA) for 1SW maturing salmon (PFA1SWmat), 1SW non-maturing salmon (PFA1SWnmat) and the total cohort of 1SW salmon (PFA1SWcohort) as of 1 August of the second summer at sea for NAC for the years of Pre-fishery Abundance 1971 to 2022.

Year	Median of estimated PFA (X 1000)			5th percentile of estimated PFA (X 1000)			95th percentile of estimated PFA (X 1000)		
	PFA1SWcohort	PFA1SWnmat	PFA1SWmat	PFA1SWcohort	PFA1SWnmat	PFA1SWmat	PFA1SWcohort	PFA1SWnmat	PFA1SWmat
1971	1239.2	702.6	535.6	1170.1	639.9	500.6	1309.2	766.7	575.9
1972	1256.2	724	532.1	1199.2	670.6	502.4	1319	781.6	565.3
1973	1568.9	901.1	666.8	1486.8	821.6	636.4	1652	984.2	697.6
1974	1511.7	811.9	699.4	1445.4	751.5	662.4	1582.1	877.2	739.6
1975	1706.3	904.8	798.8	1626.6	838.2	747	1788.8	974.8	862.4
1976	1634.4	835.2	797.8	1555.6	766.1	751.6	1719	910.2	851
1977	1304.5	667.4	636.4	1234.8	606.1	595.3	1373.6	729.2	681.7
1978	806.8	395.9	410.5	769	367.9	383	846.1	425.9	439.9
1979	1426.9	837.2	589.7	1356.2	771.9	557.5	1503.9	907.6	624
1980	1545.1	711.2	832.5	1477	655.7	782.5	1621.5	771.6	893.2
1981	1578.5	666.5	910.7	1506.3	621.2	849.8	1659.1	715.6	982.3
1982	1326.4	560.5	765.3	1265.9	523.6	714.7	1391	599.9	819.4
1983	845.9	334.8	510.6	805.1	305.2	479.5	889	366.6	545
1984	892.7	353.4	539.3	848.5	323	505.2	939.5	386.8	573.6
1985	1183.8	525.8	657.8	1125.5	484.2	615.5	1245	571.5	700.3
1986	1391.4	559.6	832.4	1320.7	512	776	1464.6	608.2	890.1
1987	1308.5	508.6	799.3	1250.3	472.2	747.9	1371.8	546.8	855.4
1988	1261.6	414.8	847.2	1194.9	382.5	786.6	1329.9	447.8	908.9
1989	921.2	326.6	594.5	875.5	298.3	556.7	968.3	355.6	634.5
1990	850.1	290.2	560.5	807.2	265.4	524.9	894.6	316.8	596
1991	737.6	321.9	415.3	704.1	300.5	390.5	771.8	345.3	441
1992	785.8	210.6	575.1	728.9	178.9	529.5	845.1	245	621.7

Year	Median of estimated PFA (X 1000)			5th percentile of estimated PFA (X 1000)			95th percentile of estimated PFA (X 1000)		
	PFA1SWcohort	**PFA1SWnmat**	**PFA1SWmat**	**PFA1SWcohort**	**PFA1SWnmat**	**PFA1SWmat**	**PFA1SWcohort**	**PFA1SWnmat**	**PFA1SWmat**
1993	695.2	150.2	544.8	629.4	133.2	482.4	760.8	169.2	606.4
1994	513.8	185.5	327.5	476	164.3	299	551.6	210.4	355.9
1995	562.8	182	380.5	520.3	163.8	343.8	607.2	202.4	418.7
1996	709.6	154.5	554.8	651.9	139.2	499.9	771.6	172.3	613.1
1997	469.9	106.9	362.2	434.1	96.4	329.5	511.9	118.8	402.3
1998	539	98.5	440.3	485.7	87.6	388.5	593.9	110.8	493.3
1999	545.1	103.3	441.4	490.8	90.8	389.3	600.1	117	493.7
2000	641.9	118	524.2	577.9	104.1	462.1	706.5	133.1	585.3
2001	466.5	81.4	384.9	416.7	72	336.5	517.8	91.8	434.7
2002	495.9	110.5	385.4	452.1	97.8	344.5	540.6	124.9	426.8
2003	529.1	108	420.8	489.2	95.4	384.2	569	121.9	456.9
2004	559.8	112.4	447.1	522.7	98.2	413.8	596.8	128.5	480
2005	655.6	106.8	548.4	576.2	94	472	733	121.5	624
2006	653.4	101.5	551.7	573.7	88.6	473.8	733.2	115.9	629.2
2007	586.2	113.9	472.2	518.7	99.6	406.8	653.3	130.2	536.6
2008	727	132.8	593.9	657.3	112.3	528.5	796.6	155.5	658.7
2009	506.1	109.2	396.5	449.4	96.8	342.1	562.6	122.8	452.1
2010	738.9	206.9	531.8	683.3	176.6	488.1	797.1	241.8	575.4
2011	754.9	112.1	643.4	645.4	96.8	535.7	863.9	129.9	748.6
2012	676.1	163.1	512.3	601.1	136.2	445.4	751	192.3	578.9
2013	536.2	126.1	409.8	460.1	102.9	339.7	611.2	152.5	477.9
2014	677.4	179.8	496.9	582	145.3	412.2	773.9	218.9	584.2
2015	824.8	173.7	651	732.2	140.3	566.5	917.2	209.4	734.3

Year	Median of estimated PFA (X 1000)			5th percentile of estimated PFA (X 1000)			95th percentile of estimated PFA (X 1000)		
	PFA1SWcohort	PFA1SWnmat	PFA1SWmat	PFA1SWcohort	PFA1SWnmat	PFA1SWmat	PFA1SWcohort	PFA1SWnmat	PFA1SWmat
2016	662.5	163.6	498.8	557	125.1	404.7	769.1	206.2	592.5
2017	544	132.3	411.3	458.1	108.2	329.7	631.1	158.3	493.1
2018	543.8	109.4	434.6	439.3	93.6	331.4	651.7	126.5	541.2
2019	589.4	151.8	437.1	505	136.1	354.8	674.2	168.9	519.7
2020	604.7	124.4	479.6	521.2	110.5	398.6	690.5	139.6	563.6
2021	886.9	176.6	709.9	741.8	138.9	571.5	1033.9	218.4	850.4
2022	NA	NA	566.2	NA	NA	398.6	NA	NA	743.7
Prev. 5-year	633.8	138.9	505.4						
Change (recent year relative to previous year)									
	46.7%	41.9%	-20.2%						
Change (recent year relative to previous 5-year mean) (in 2020 as some inputs to derive PFA are based on previous years mean)									
	39.9%	27.1%	12%						
Rank (highest = 1 to lowest) over time-series (1971 to most recent year)									
	18 / 51	27 / 51	9 / 52						

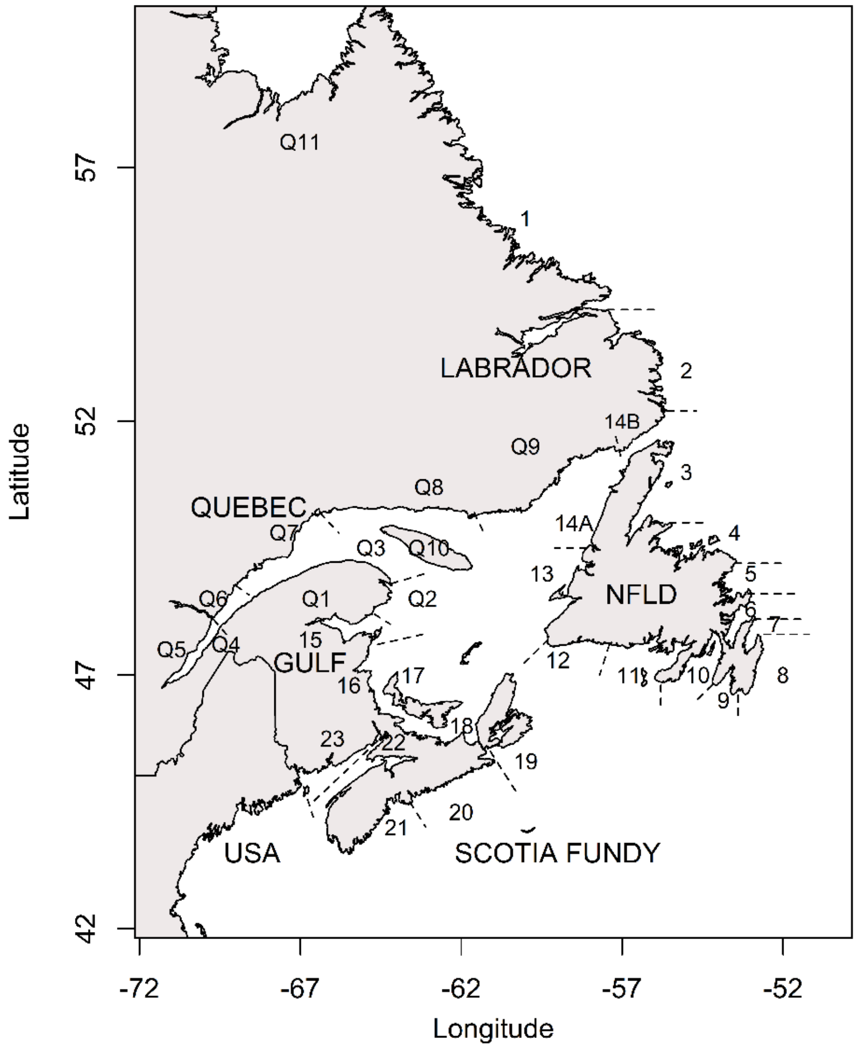


Figure 4.1.2.1. Map of Salmon Fishing Areas (SFAs) and Quebec Management Zones (Qs) in Canada.

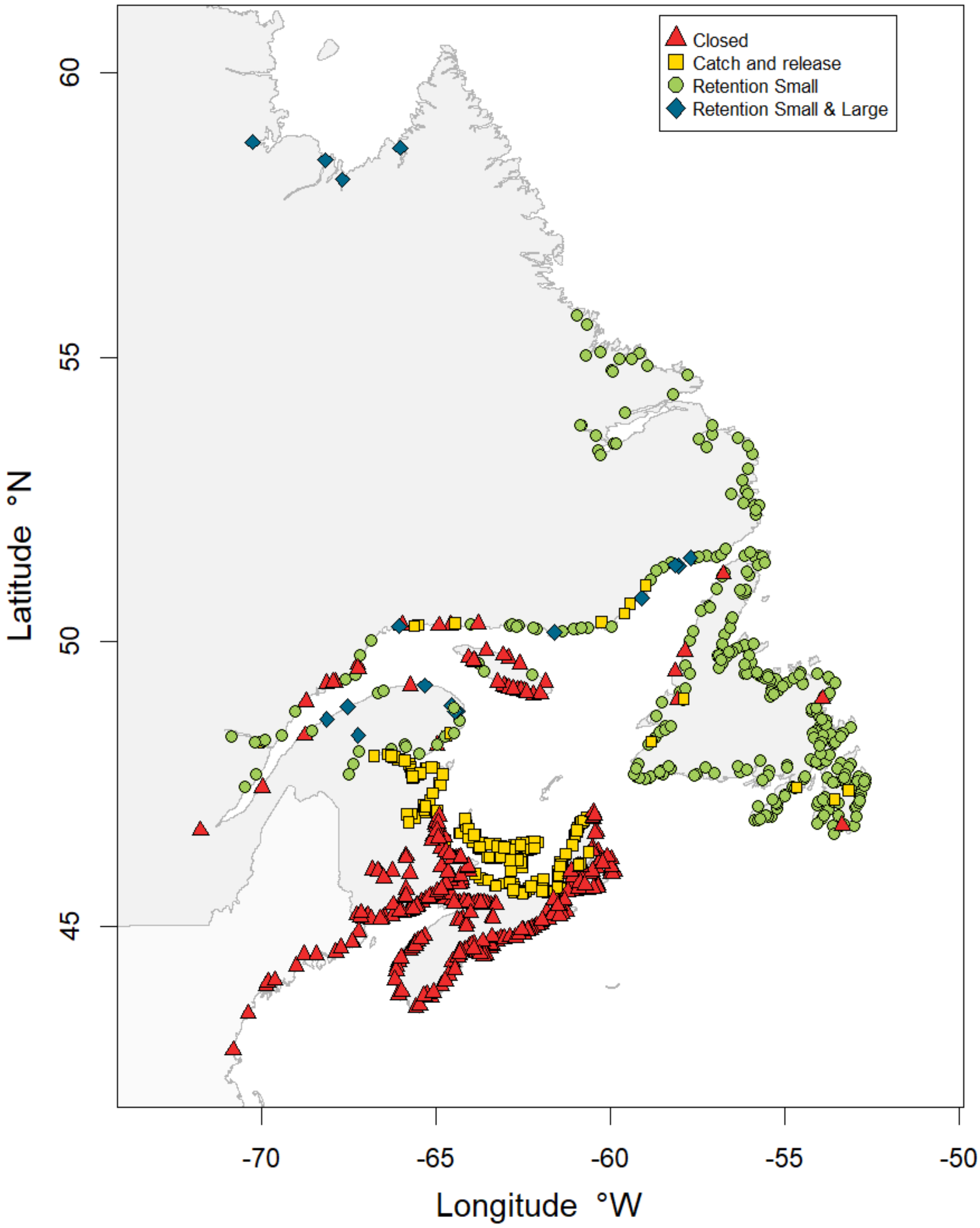
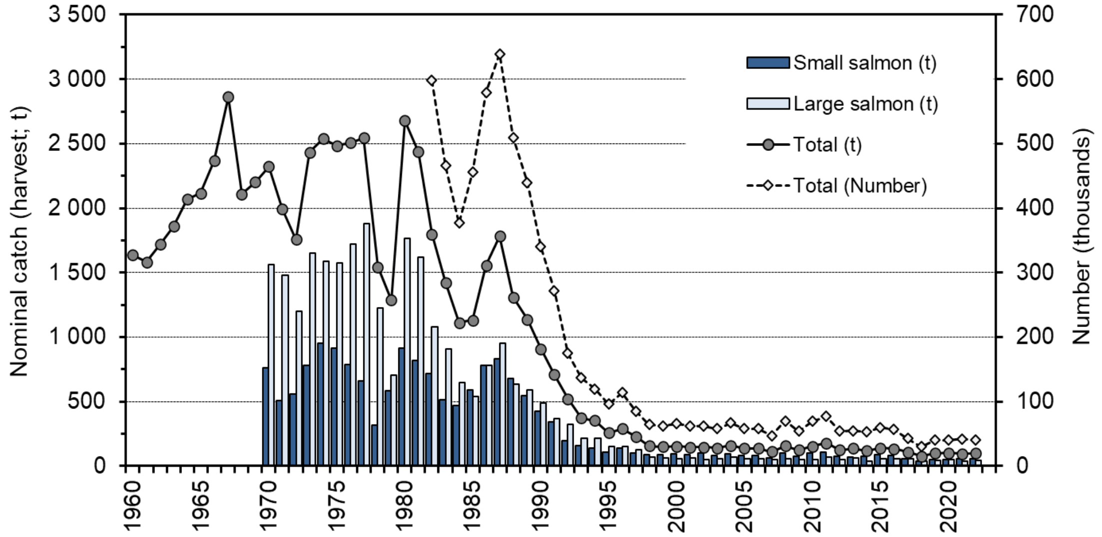


Figure 4.1.2.2. Summary of recreational fisheries management measures in Canada in 2022. Note: details on specific regions are available in the text and may not appear on the figure.



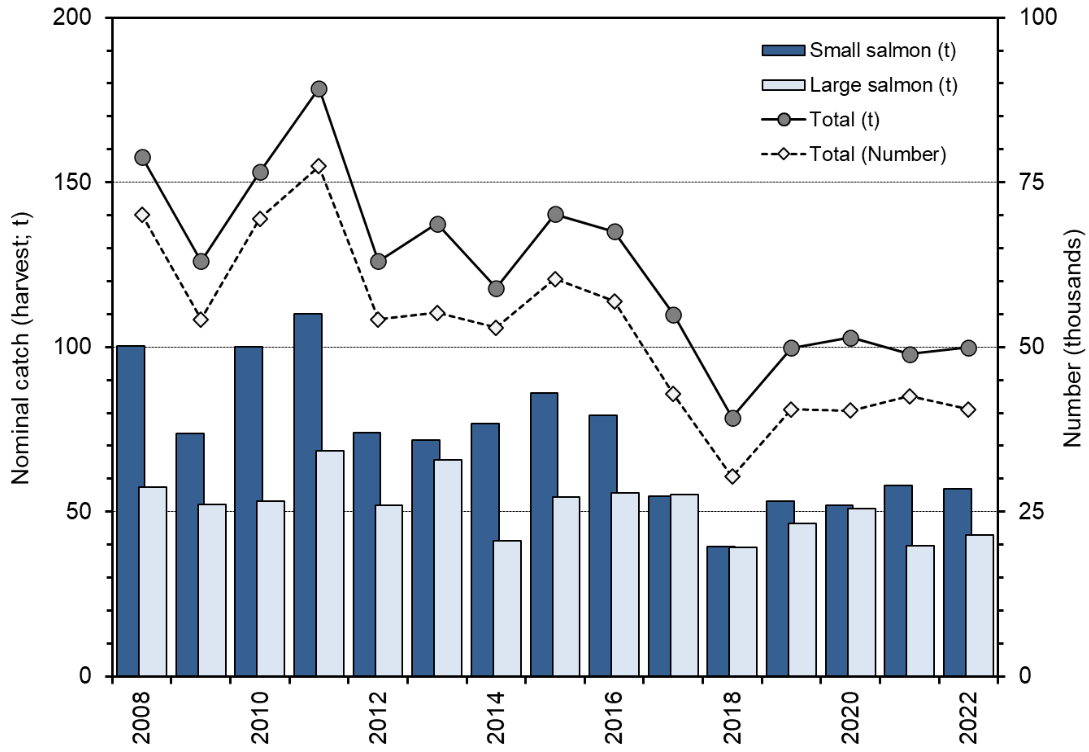


Figure 4.1.3.1. Nominal catch (harvest; t) of small salmon, large salmon and both sizes combined (weight and number) for Canada, 1960 to 2022 (top panel) and 2008 to 2022 (bottom panel) by all users.

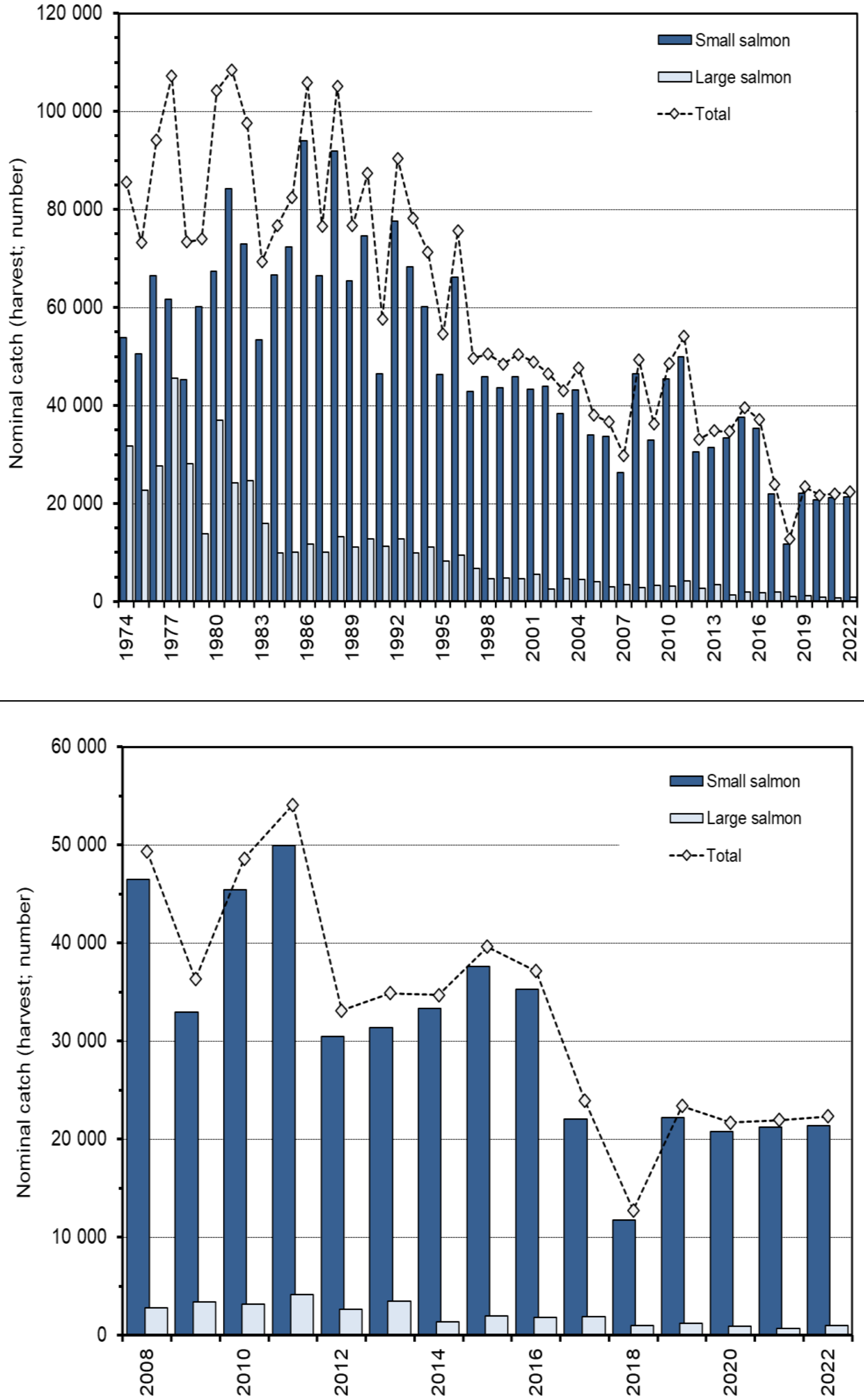


Figure 4.1.3.2. Nominal catch (harvest; number) of small salmon, large salmon, and both sizes combined in the recreational fisheries in Canada, 1974 to 2022 (top panel) and 2008 to 2022 (bottom panel).

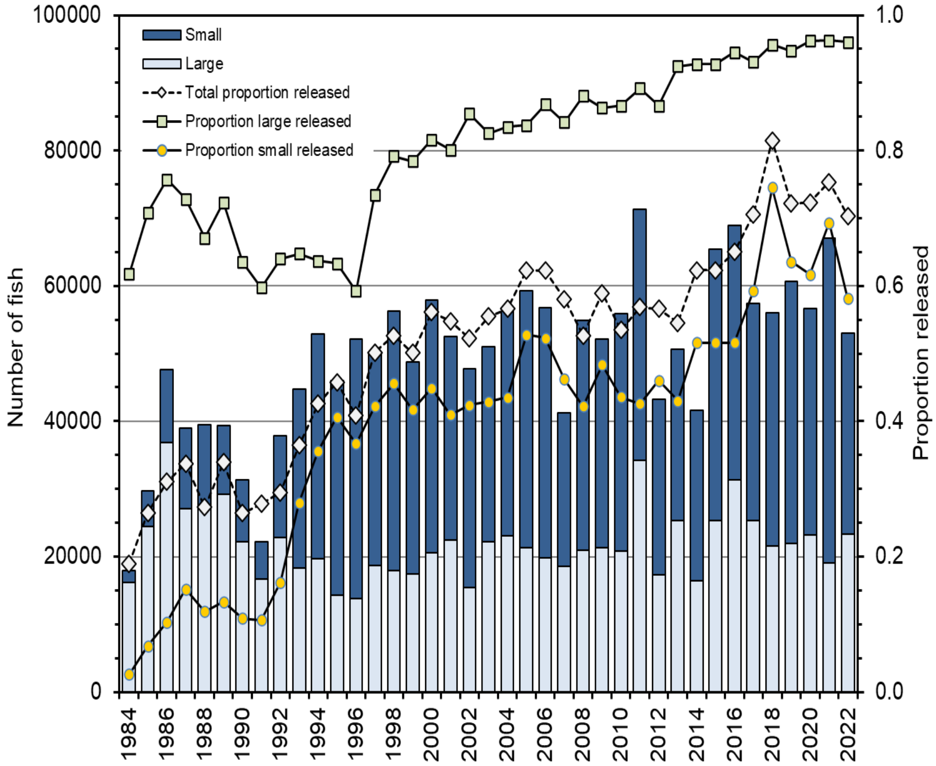


Figure 4.1.3.3. The number (bars) of caught and released small salmon and large salmon in the recreational fisheries of Canada, 1984 to 2022. Black lines represent the proportion released of the total catch (released and retained) (grey diamond); small salmon (yellow circle) and large salmon (grey square).

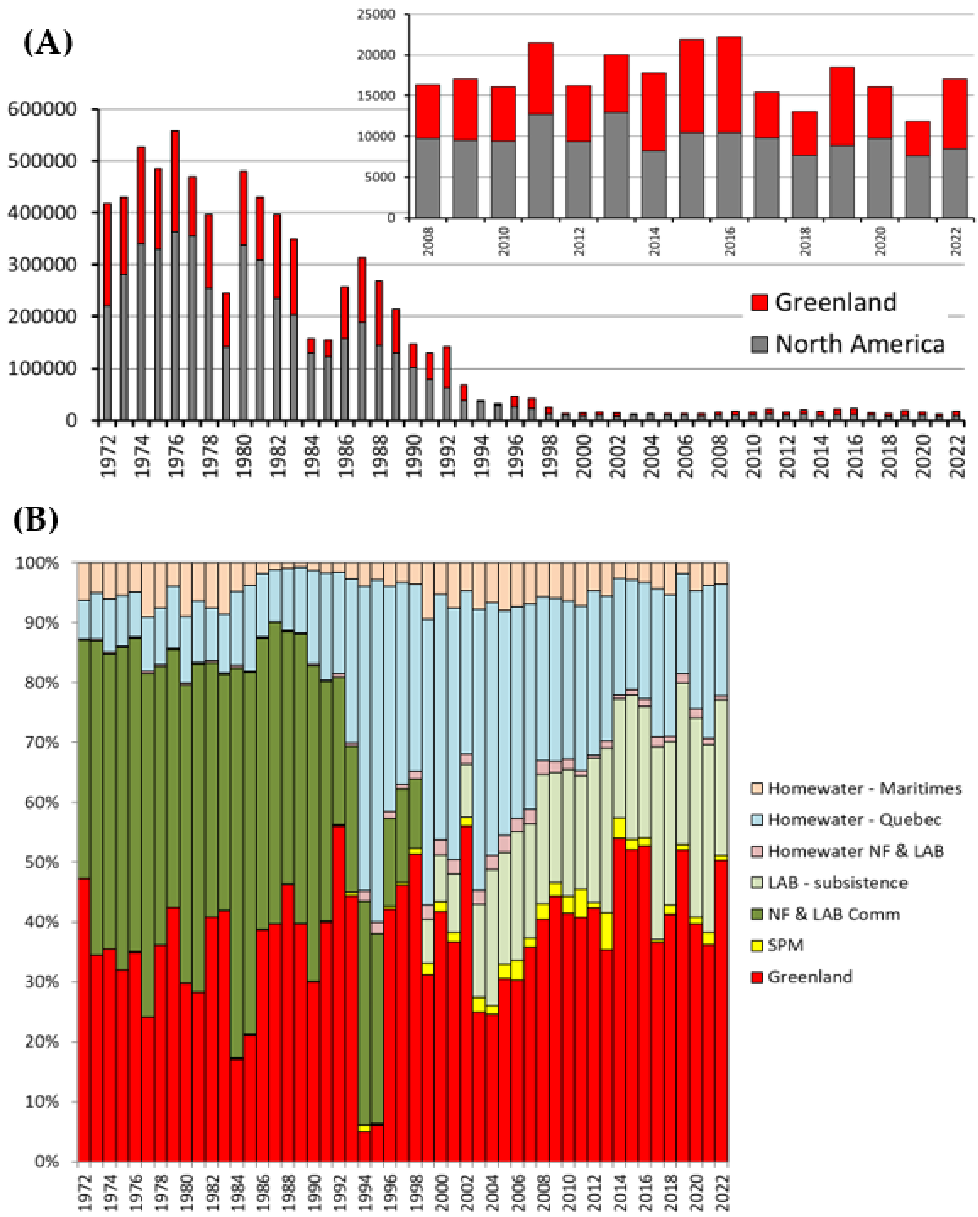


Figure 4.1.4.1. Estimates of 2SW salmon harvest equivalents (number of fish; year of 2SW harvests) taken at Greenland (year – 1) and in North America (upper panel A) and the percentages of the North American origin 2SW salmon harvest equivalents taken in various fishing areas of the North Atlantic (lower panel B) 1972 to 2022.

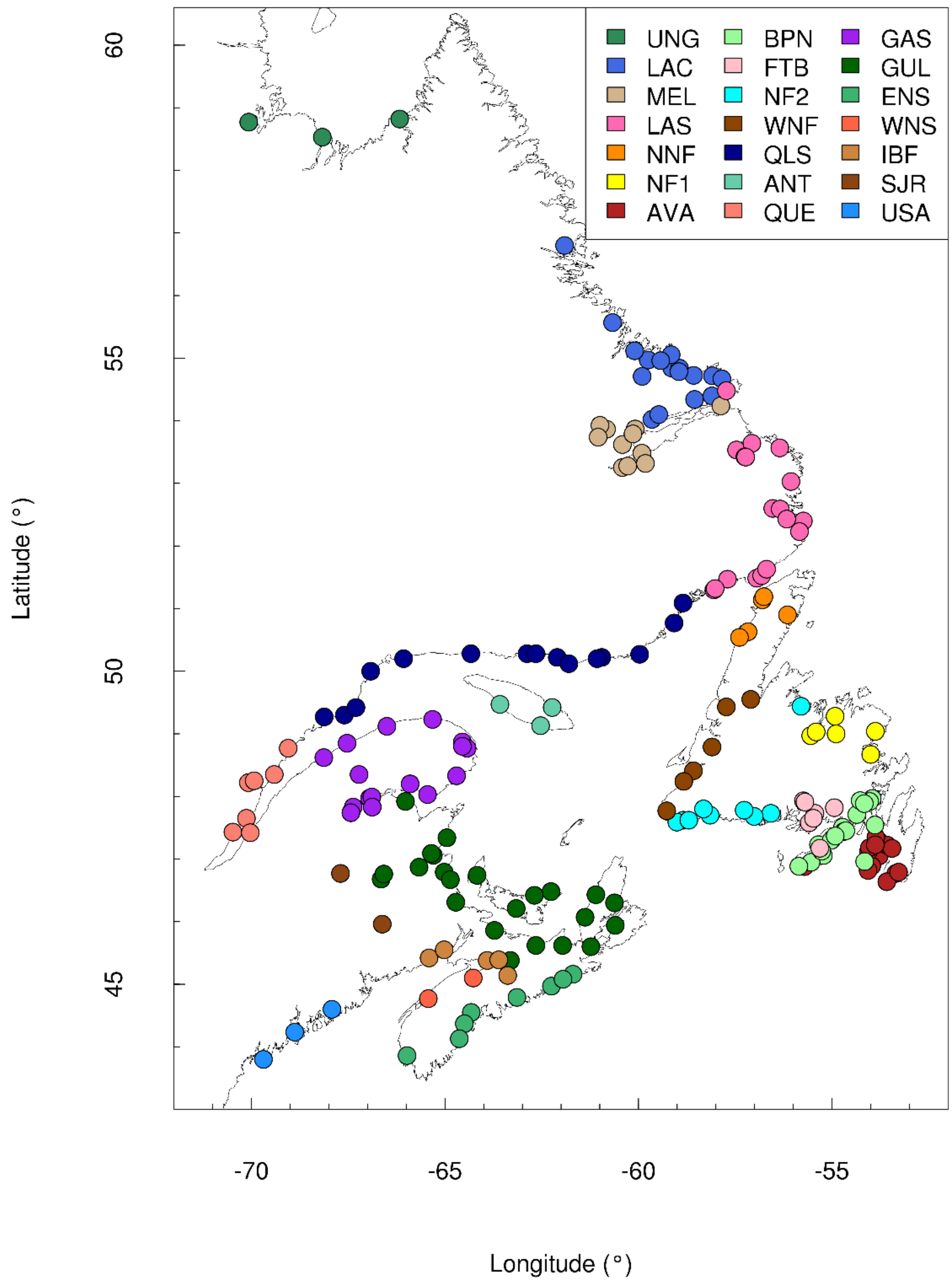


Figure 4.1.5.1 Map of North American sample locations used in the development of the SNP range wide baseline for Atlantic salmon (Jeffery *et al.*, 2018). The 21 North American reporting groups are labelled and identified by colour). See Figure 4.1.5.2 for full range wide baseline sampling locations.

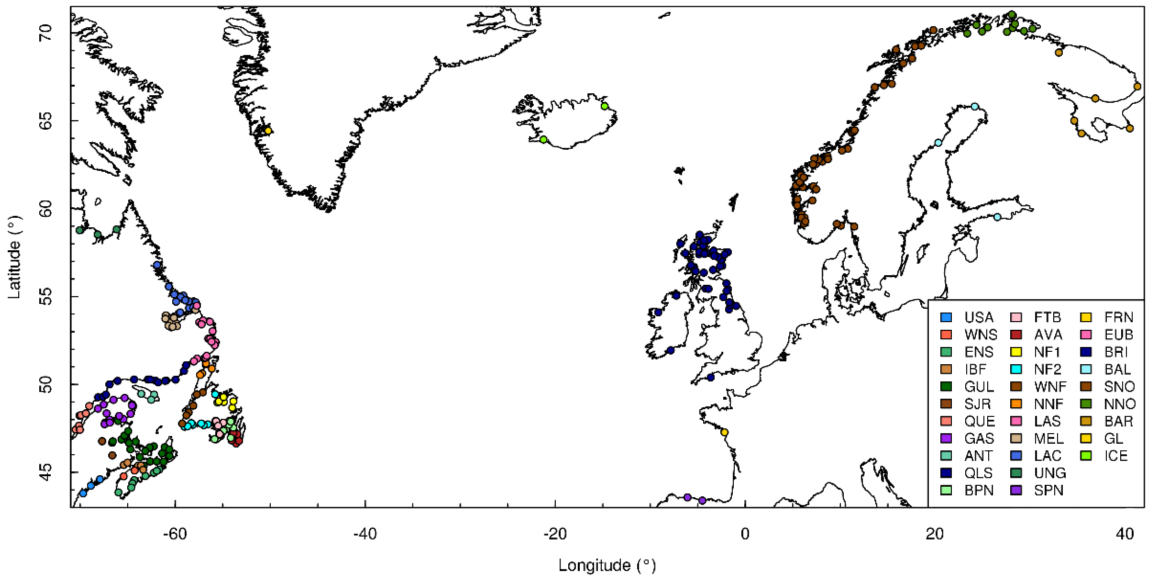
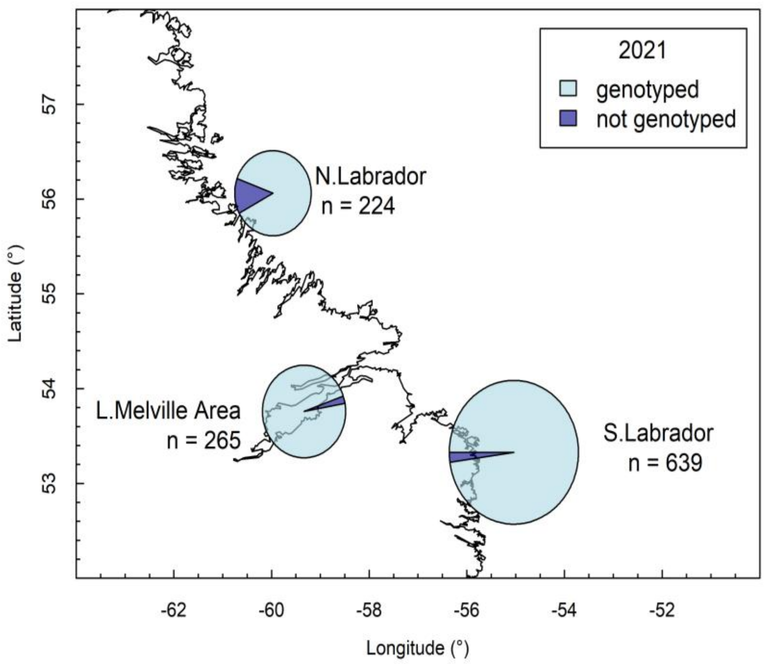


Figure 4.1.5.2. Map of range wide sample locations used in the development SNP baseline for Atlantic salmon and the 31 defined reporting groups (labelled and identified by colour) (Jeffery *et al.*, 2018). See Figure 4.1.5.1 for finer resolution of North American locations.



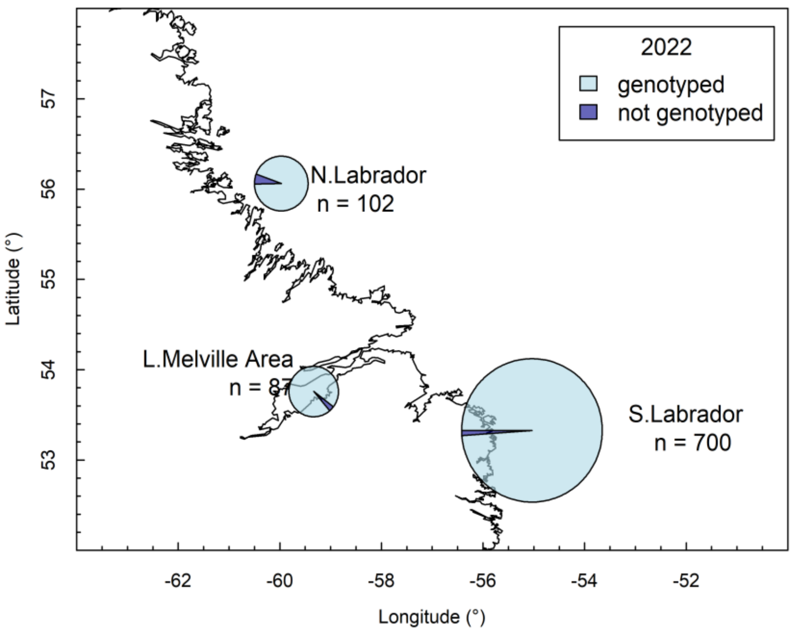


Figure 4.1.5.3. Total tissue samples available and proportions of samples genotyped by Salmon Fishing Area in the Labrador Atlantic salmon subsistence fisheries in 2021 and 2022.

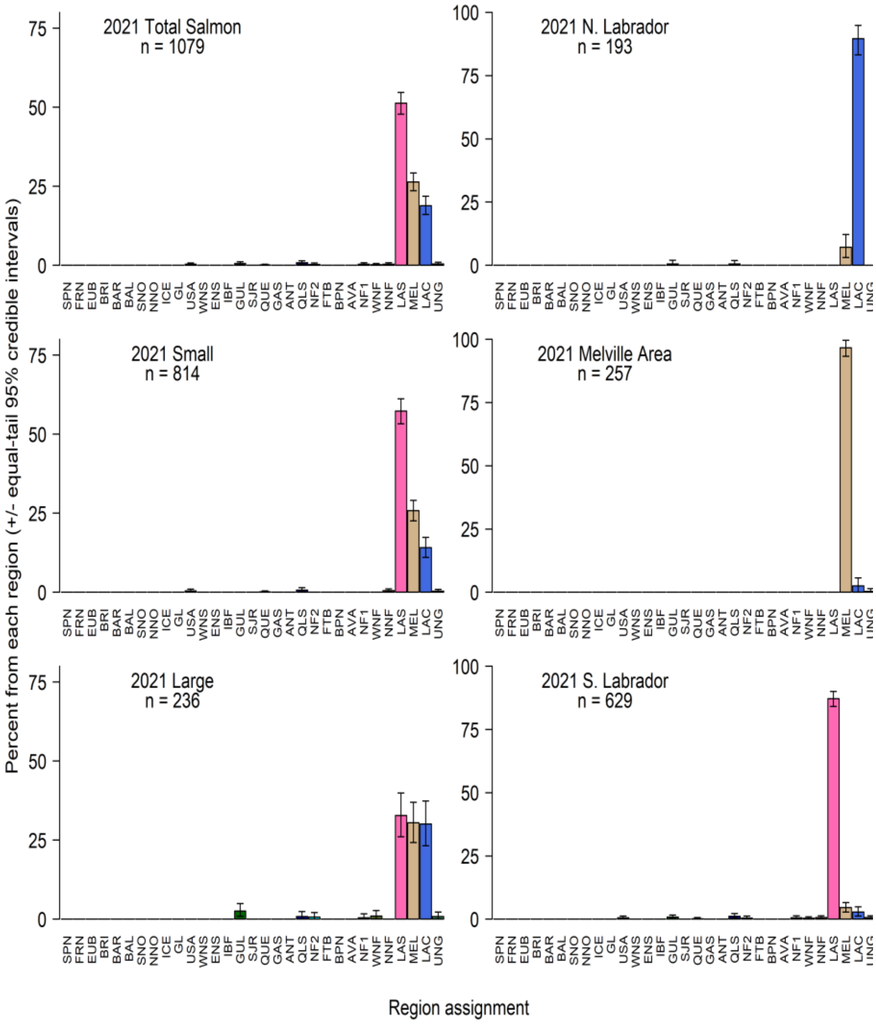


Figure 4.1.5.4. Bayesian estimate of mixture composition of samples from the Labrador Atlantic salmon subsistence fisheries for 2021 by size group (small <63 cm, large ≥63 cm) and region (Figure 4.1.2.1: SFA 1A – N. Labrador, SFA 1B – Lake Melville, and SFA 2 –S. Labrador) using the SNP range wide baseline for Atlantic salmon (Jeffery *et al.* 2018). Baseline locations refer to regional reporting groups identified in Figure 4.1.5.1 and Figure 4.1.5.2. Regional assignment acronyms are explained in Table 4.1.5.1. Data are summarized in Table 4.1.5.2. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

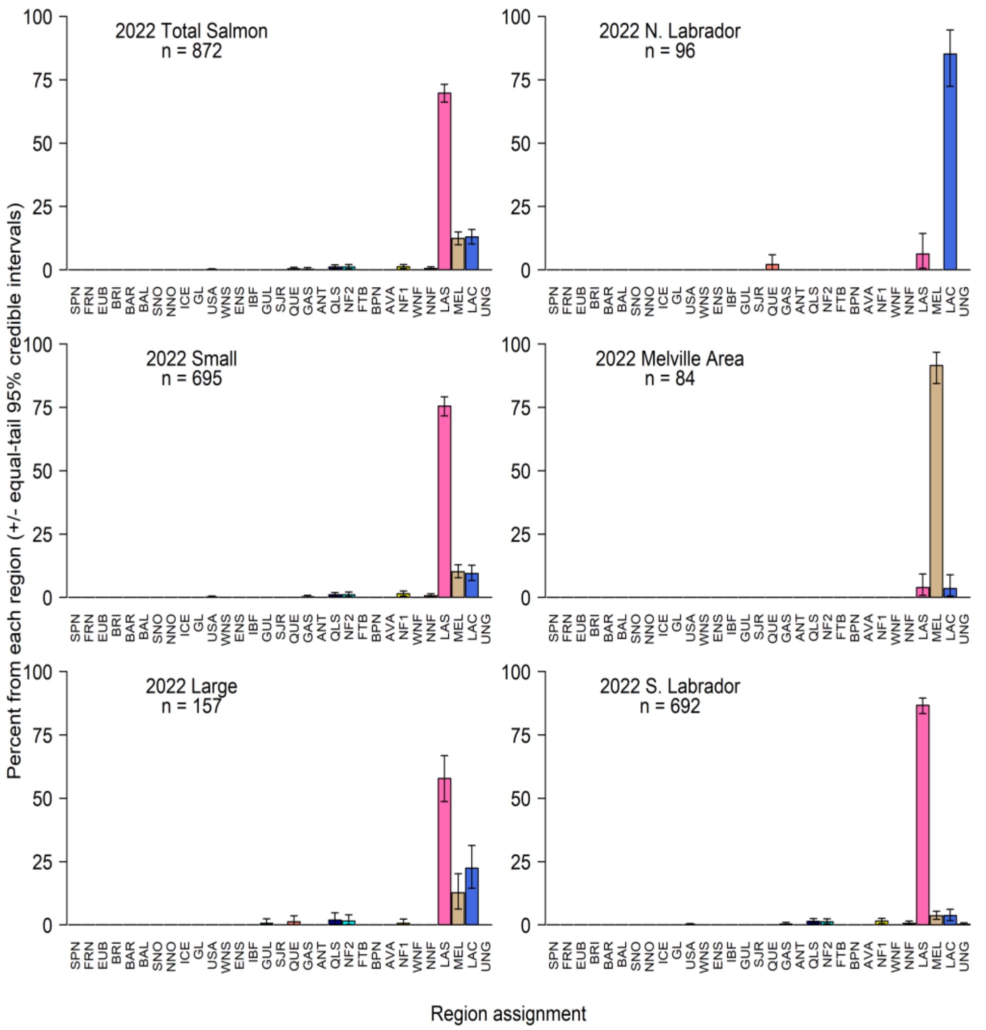


Figure 4.1.5.5. Bayesian estimate of mixture composition of samples from the Labrador Atlantic salmon subsistence fisheries for 2022 by size group (small <63 cm, large ≥63 cm) and region (Figure 4.1.2.1: SFA 1A – N. Labrador, SFA 1B – Lake Melville, and SFA 2 –S. Labrador) using the SNP range wide baseline for Atlantic salmon (Jeffery et al. 2018). Baseline locations refer to regional reporting groups identified in Figure 4.1.5.1 and Figure 4.1.5.2. Regional assign-ment acronyms are explained in Table 4.1.5.1. Data are summarized in Table 4.1.5.3. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

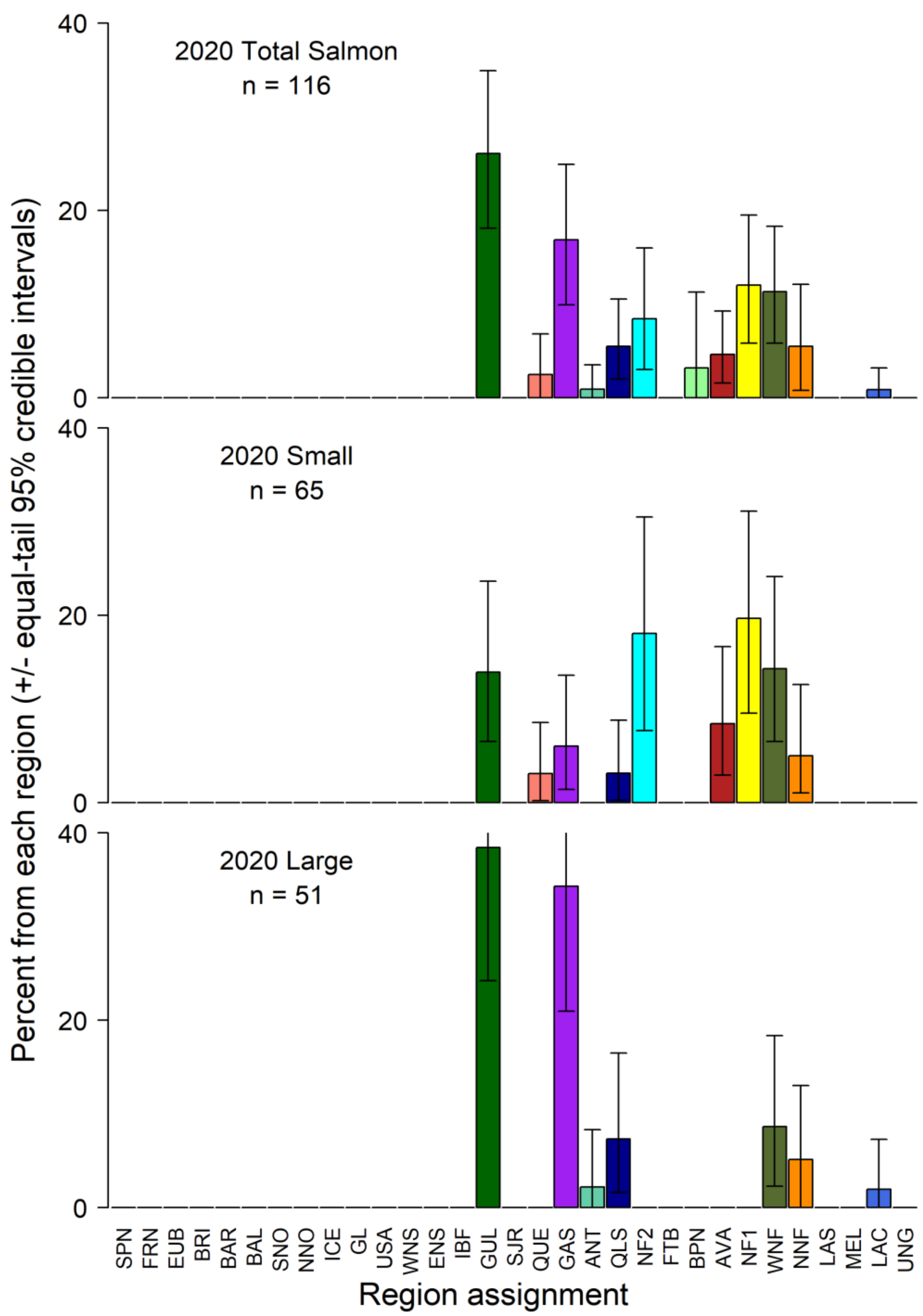


Figure 4.1.5.6. Bayesian estimate of mixture composition of samples from the Saint Pierre and Miquelon Atlantic salmon fishery for 2020 by size group (small <63 cm, large ≥63 cm) using the SNP range wide baseline for Atlantic salmon (Jeffery *et al.* 2018). Baseline locations refer to regional reporting groups identified in Figure 4.1.5.1 and Figure 4.1.5.2. Regional assignment acronyms are explained in Table 4.1.5.1. Data are summarized in Table 4.1.5.4. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

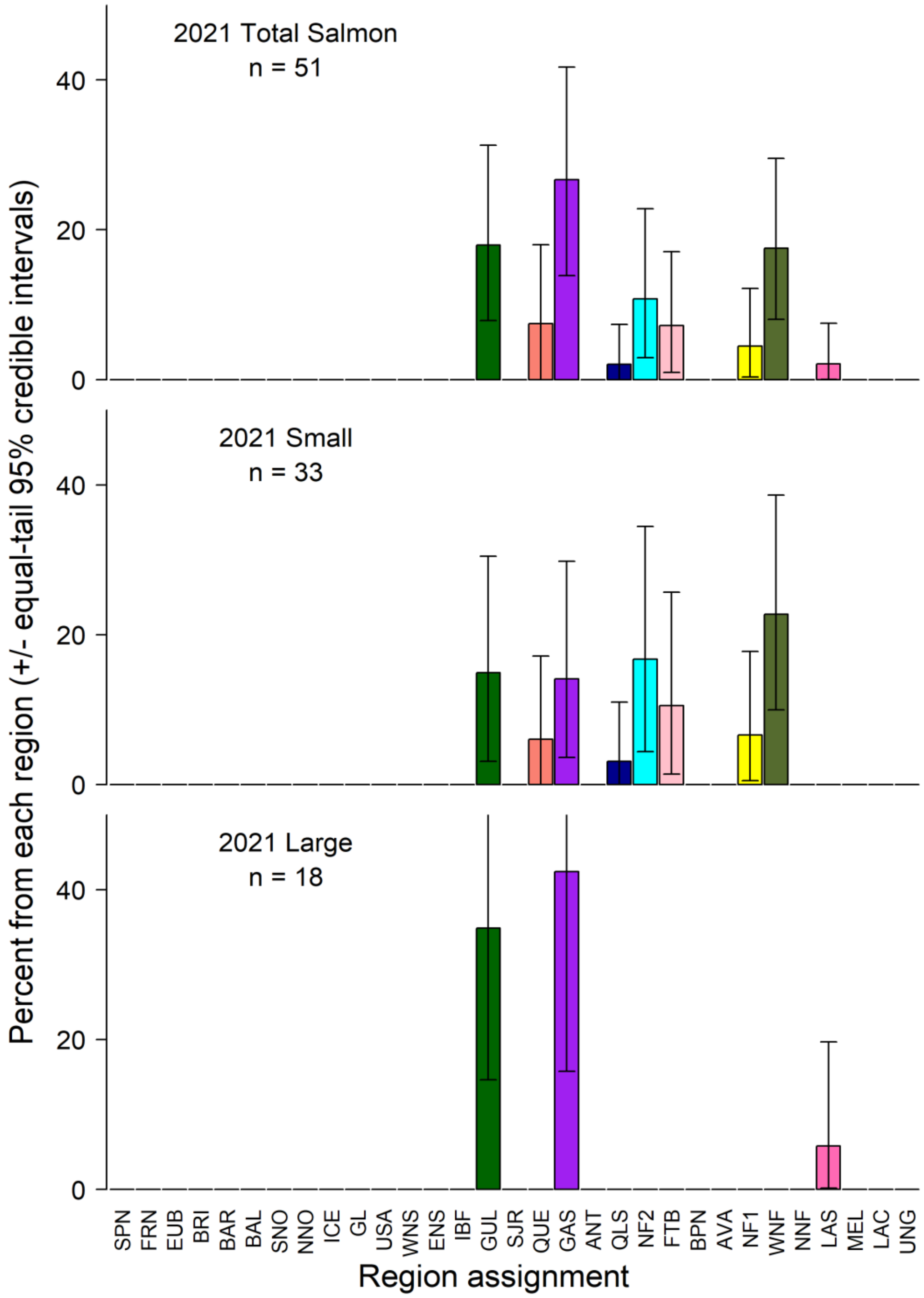


Figure 4.1.5.7. Bayesian estimate of mixture composition of samples from the Saint Pierre and Miquelon Atlantic salmon fishery for 2021 by size group (small <63 cm, large ≥63 cm) using the SNP range wide baseline for Atlantic salmon (Jeffery *et al.* 2018). Baseline locations refer to regional reporting groups identified in Figure 4.1.5.1 and Figure 4.1.5.2. Regional assignment acronyms are explained in Table 4.1.5.1. Data are summarized in Table 4.1.5.4 Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

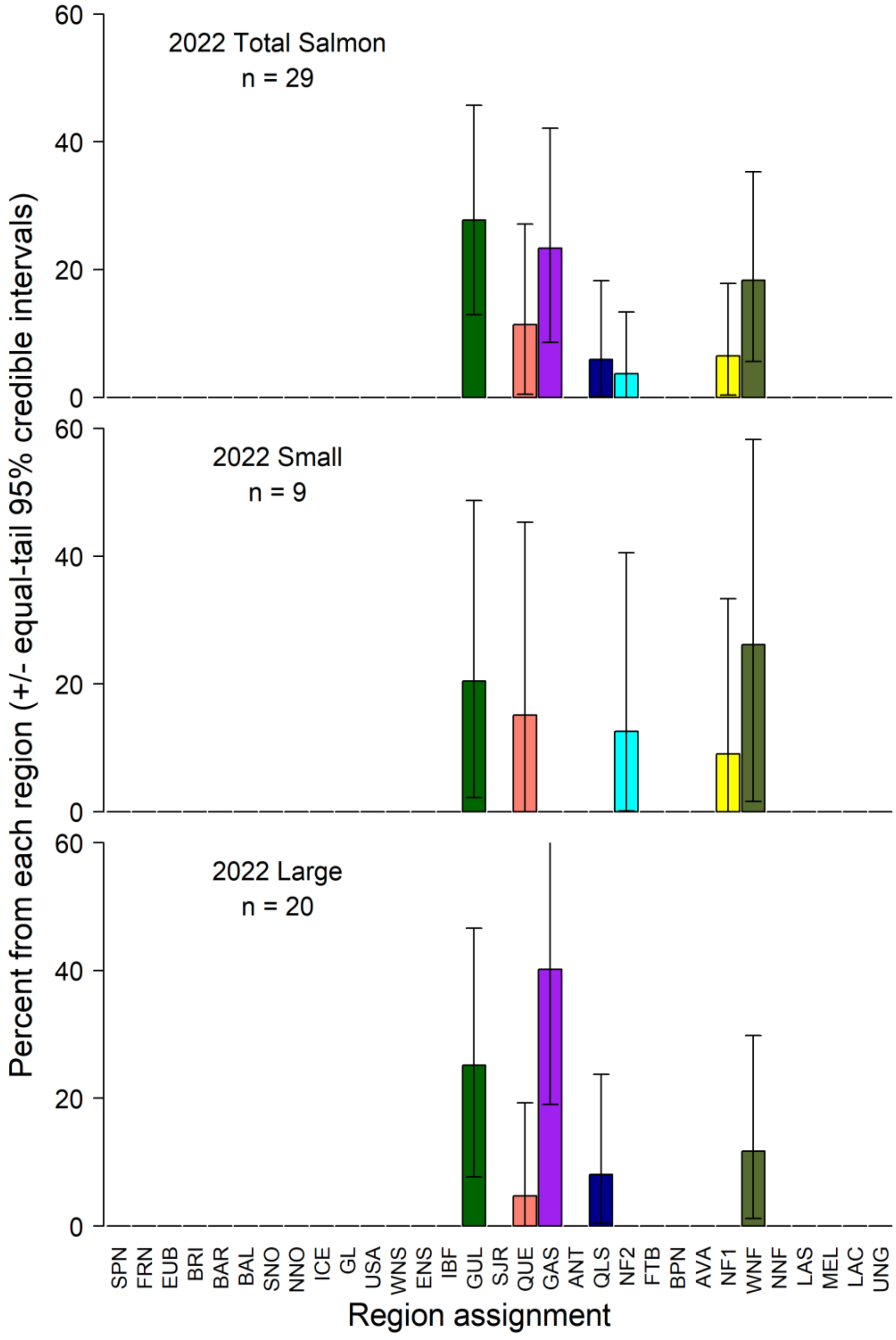


Figure 4.1.5.8. Bayesian estimate of mixture composition of samples from the Saint Pierre and Miquelon Atlantic salmon fishery for 2022 by size group (small <63 cm, large ≥63 cm) using the SNP range wide baseline for Atlantic salmon (Jeffery *et al.* 2018). Baseline locations refer to regional reporting groups identified in Figure 4.1.5.1 and Figure 4.1.5.2. Regional assignment acronyms are explained in Table 4.1.5.1. Data are summarized in Table 4.1.5.4. Note that credible intervals with a lower bound including zero indicate little support for the mean assignment value.

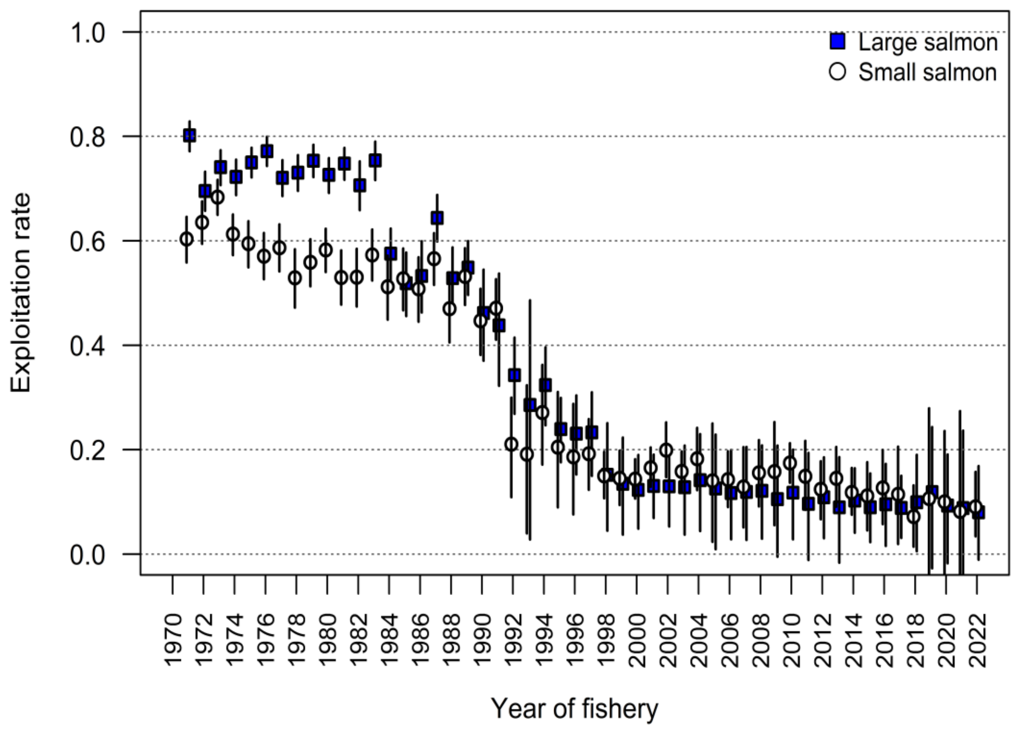


Figure 4.1.6.1. Exploitation rates in North America on the North American stock complex of small and large salmon 1971 to 2022. The symbols are the median and the error bars are the 5th to 95th percentiles of the distributions from Monte Carlo simulation.

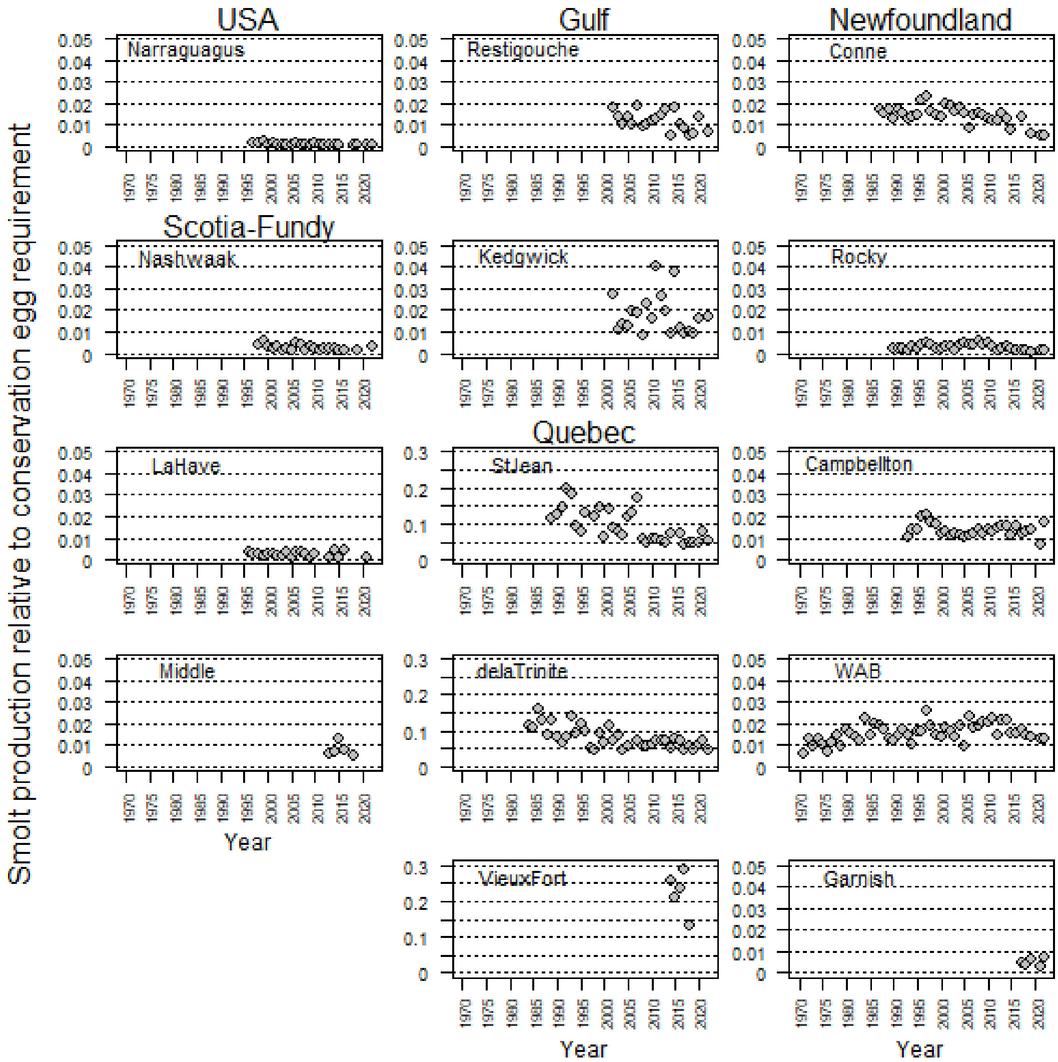


Figure 4.3.1.1. Time-series of wild smolt production from thirteen monitored rivers in eastern Canada and one river in eastern USA, 1970 to 2022. Smolt production is expressed as a proportion of the conservation egg requirements for the river. Note y-axis range change for the St Jean River, de la Trinité River and Vieux-Fort River relative to other rivers.

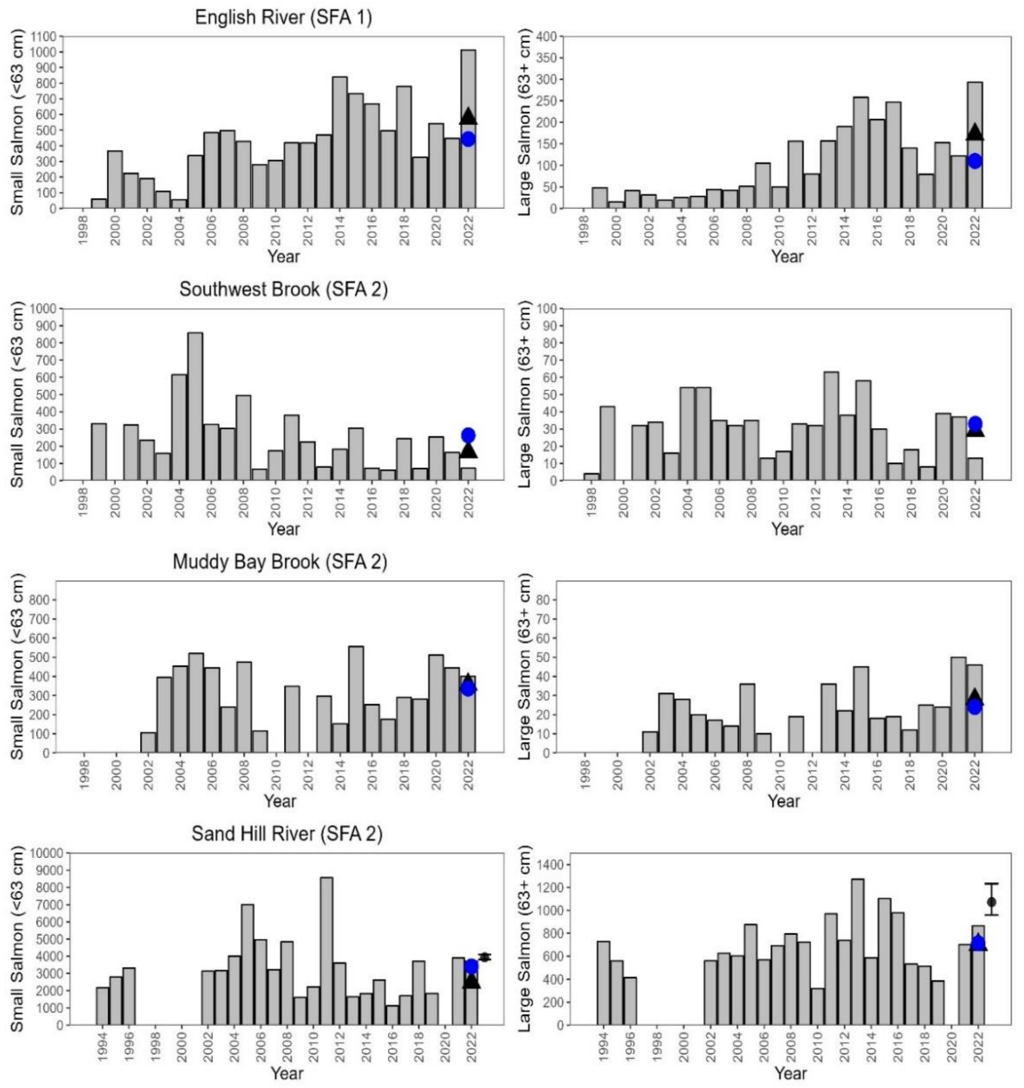


Figure 4.3.2.1. Total returns of small salmon (left column) and large salmon (right column) to English River (SFA 1), Southwest Brook (Paradise River) (SFA 2), Muddy Bay Brook (SFA 2), and Sand Hill River (SFA 2) Labrador, 1994–2022. The black triangle represents the previous generation mean and the blue circle represents the previous three generation mean. The data point with error bars for Sand Hill River in 2022 shows the estimated number of salmon if adjusted due to the delayed start of the monitoring program.

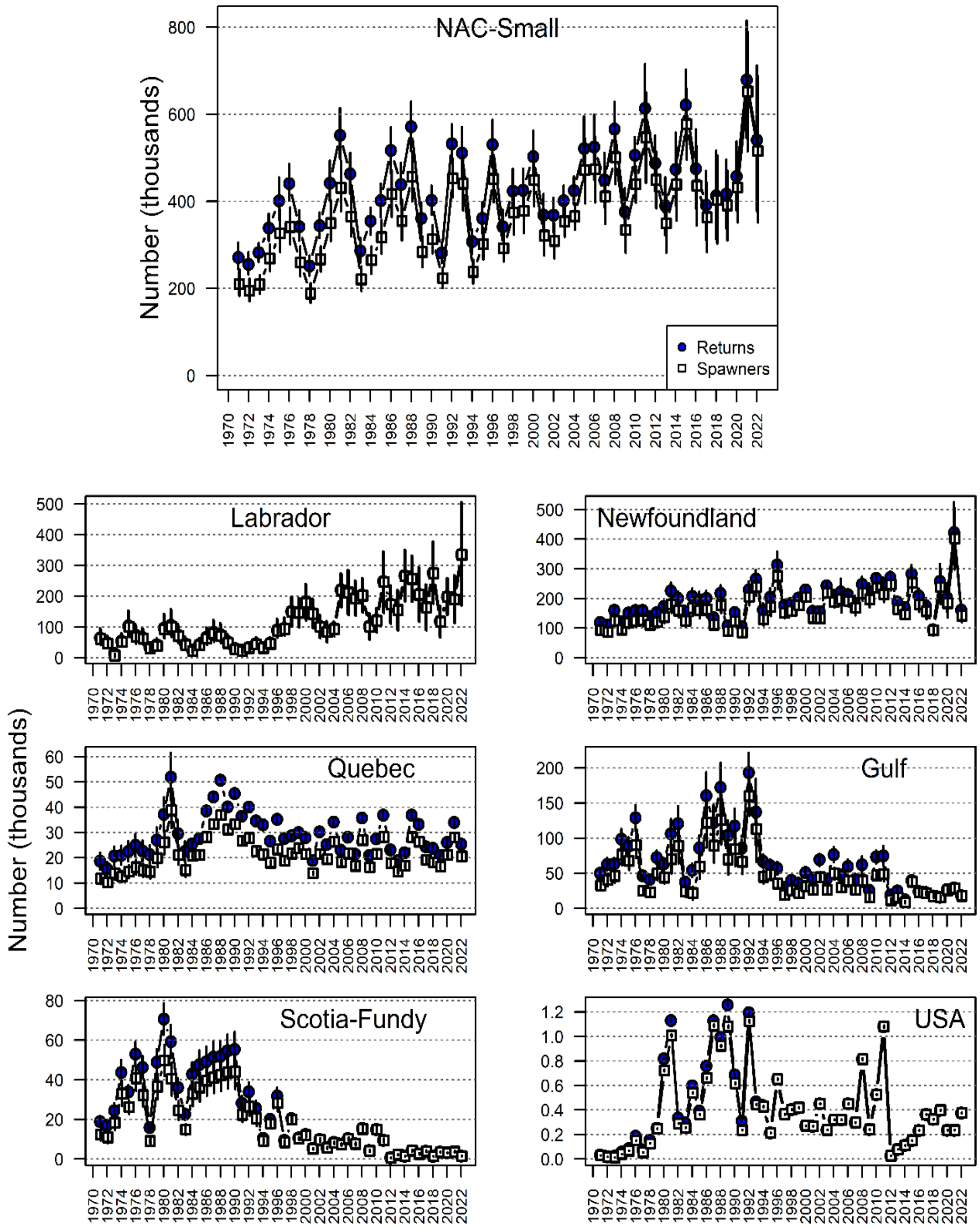


Figure 4.3.2.2. Estimated (median 5th to 95th percentile range, X 1000) returns (shaded circles) and spawners (open squares) of small salmon for NAC and to each of the six assessment regions 1971 to 2022. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

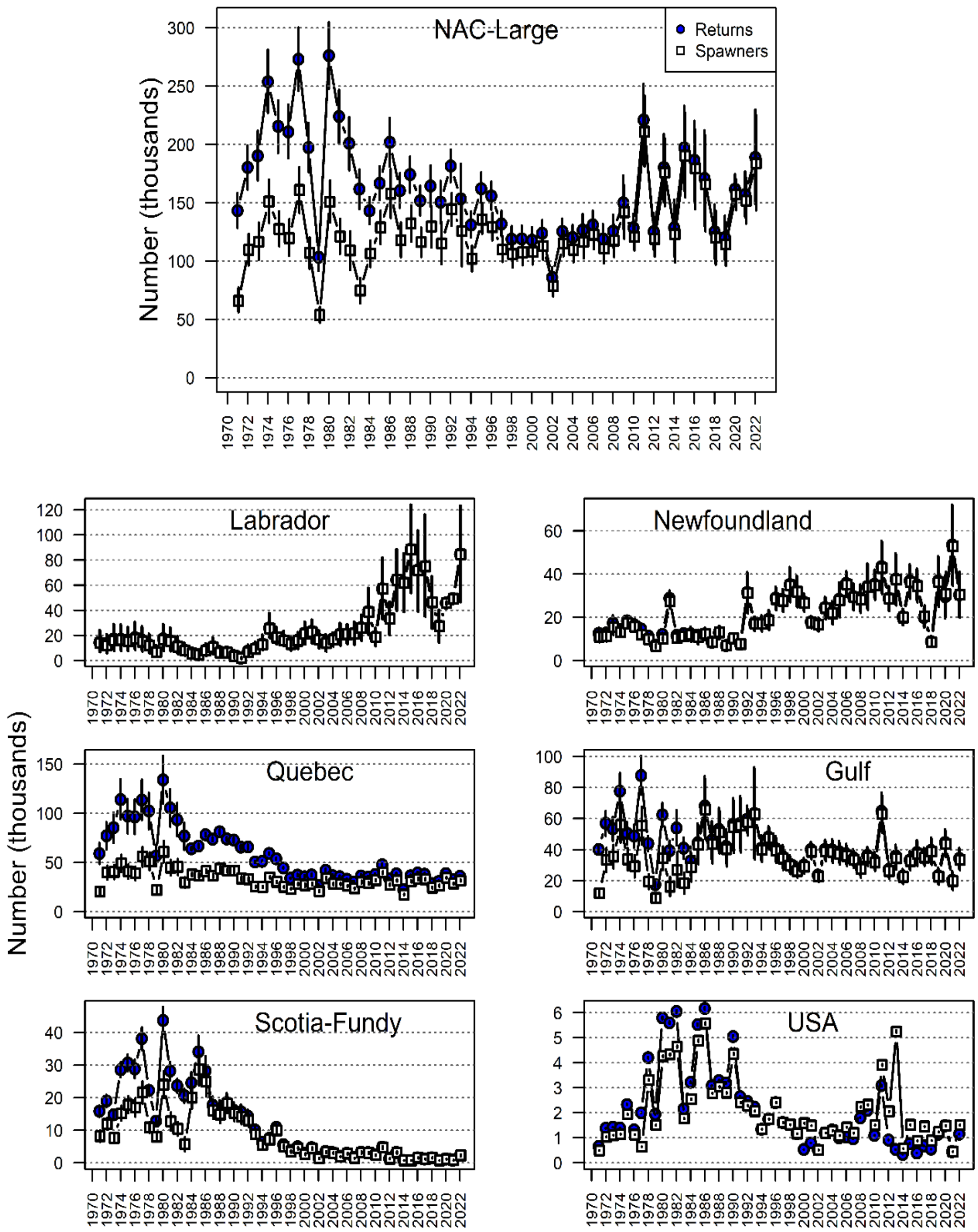


Figure 4.3.2.3. Estimated (median 5th to 95th percentile range, X 1000) returns (shaded circles) and spawners (open squares) of large salmon for NAC and to each of the six assessment regions 1971 to 2022. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23. For USA, estimated spawners exceed the estimated returns due to adult stocking restoration efforts.

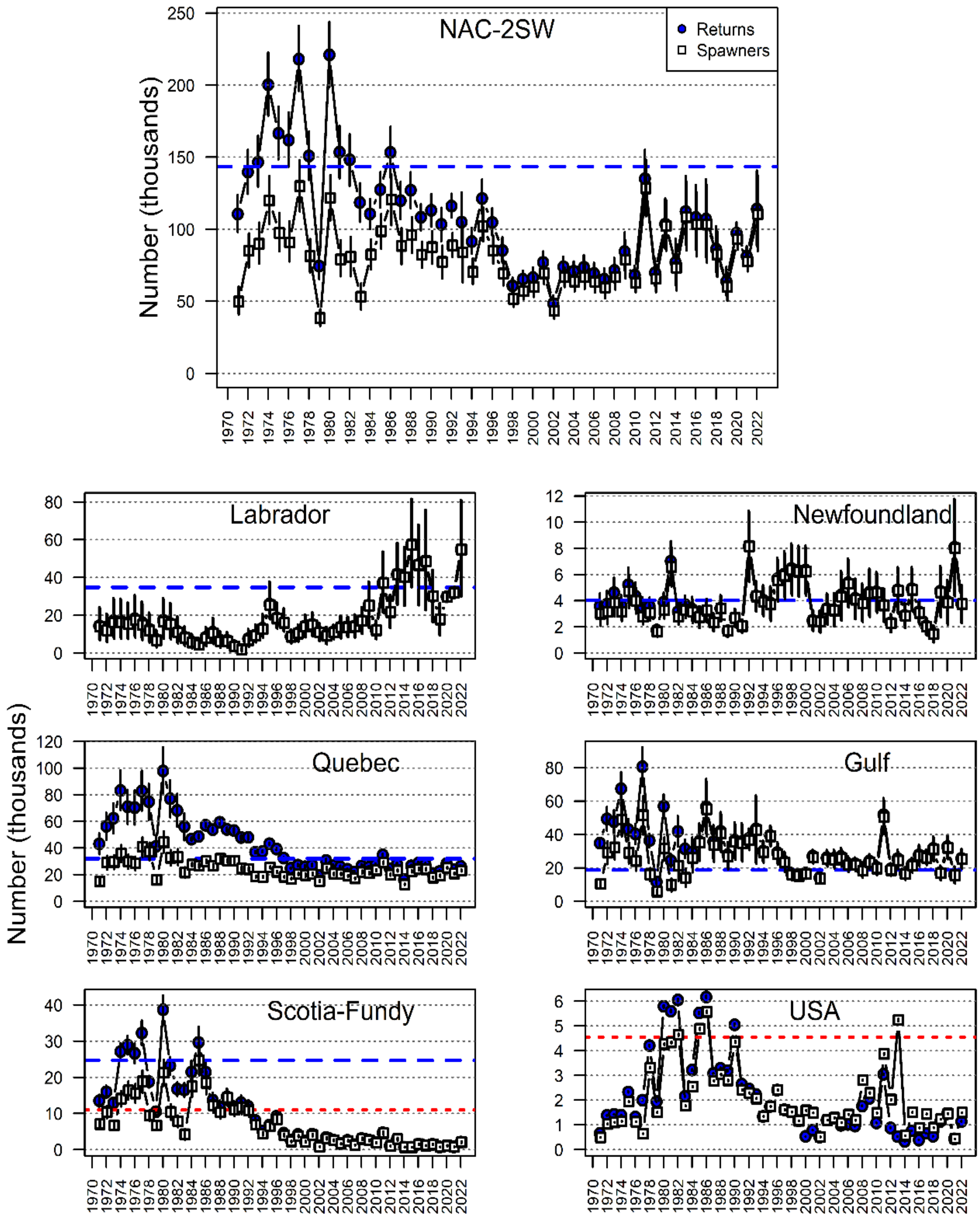


Figure 4.3.2.4. Estimated (median 5th to 95th percentile range, X 1000) returns (shaded circles) and spawners (open squares) of 2SW salmon for NAC and to each of the six assessment regions 1971 to 2022. The dashed line is the corresponding 2SW Conservation Limit for NAC overall and for each region; the 2SW CL for USA (29 990 fish) is off the scale in the plot for USA. For Quebec, 2SW Conservation Limit correspond to the Upper Stock Reference point. 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 in the later years due to adult stocking restoration efforts; therefore, 2SW returns are assessed relative to the management objective for USA.

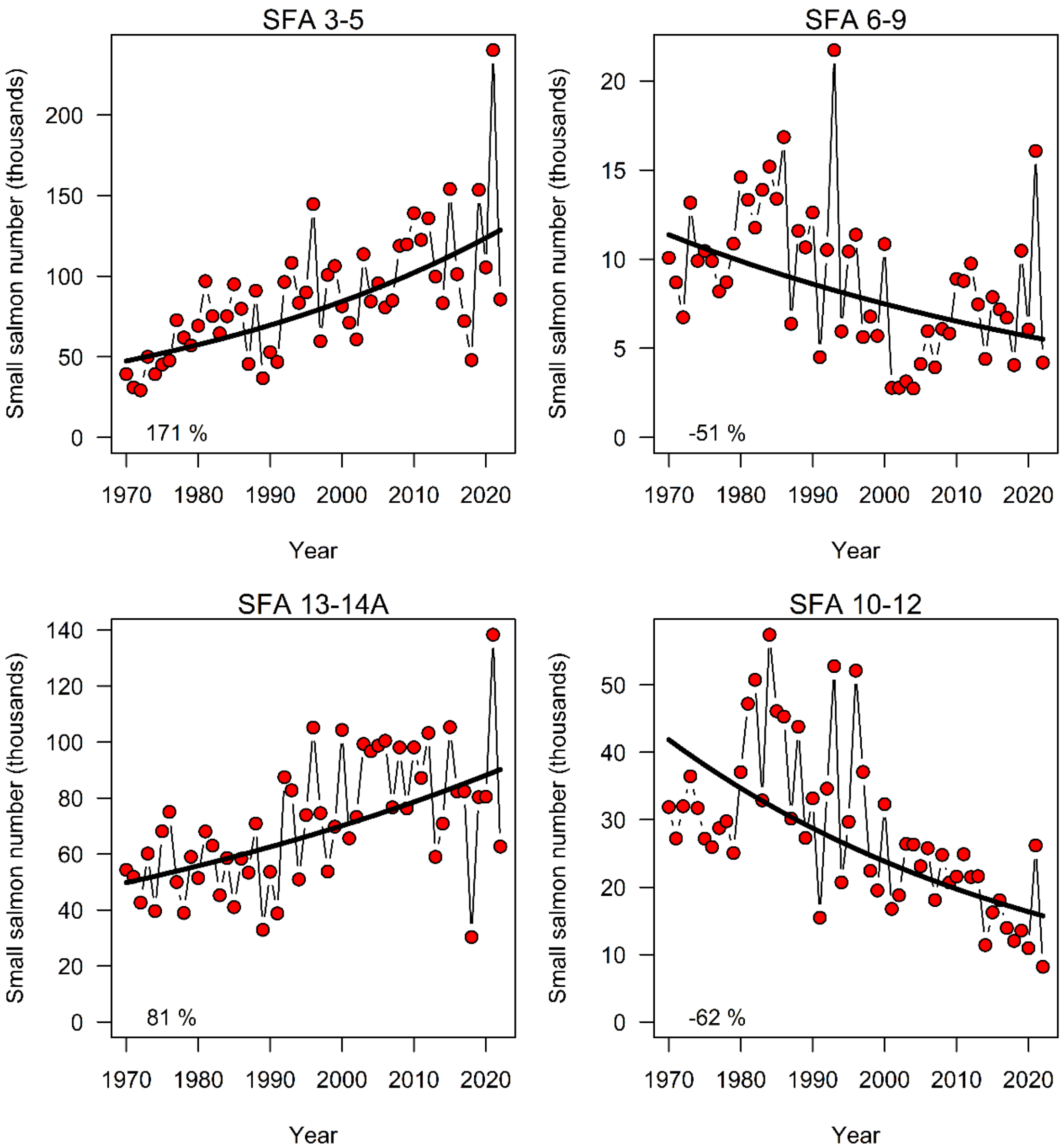


Figure 4.3.2.5. Estimated (median, X 1000) returns of small salmon to subregions of Newfoundland (SFA locations are shown in Figure 4.1.2.1) over the period 1971 to 2022. The exponential trend line and the percent change over the time-series are shown in each panel.

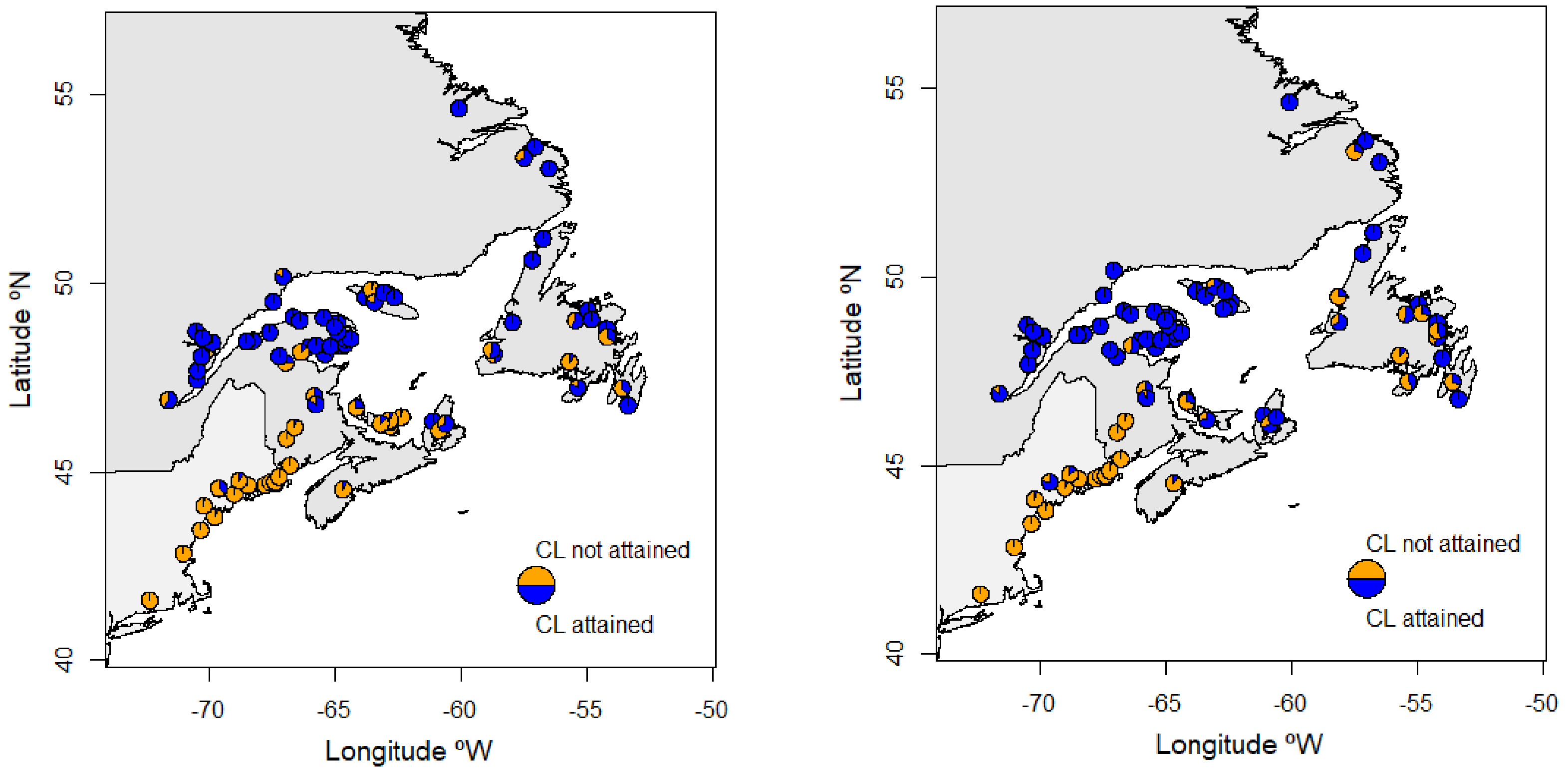


Figure 4.3.4.1. Proportion of the conservation requirement attained in the 79 assessed rivers in 2021 (left panel) and the 80 assessed rivers in 2022 (right panel) of the North American Commission area.

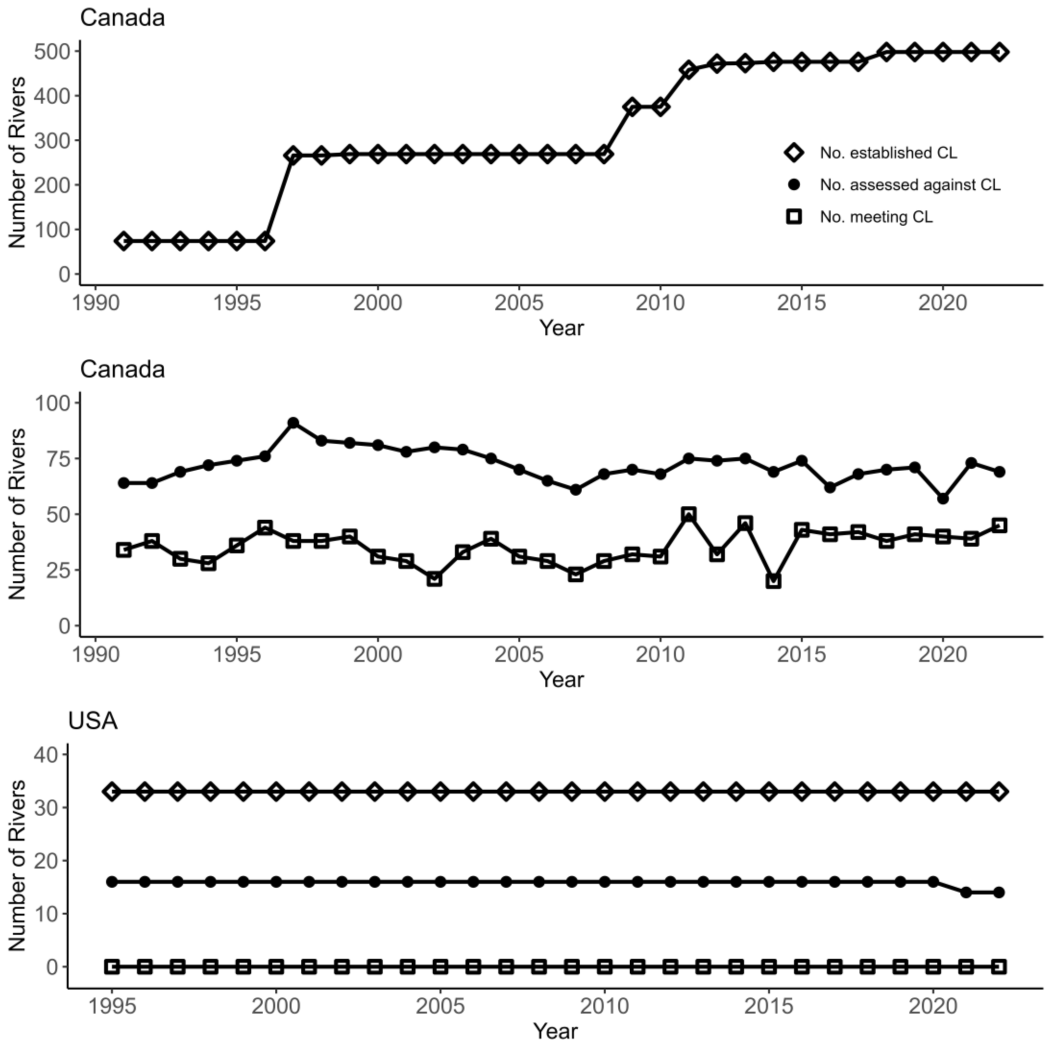


Figure 4.3.4.2. Time-series for Canada and the USA showing the number of rivers with established CLs, the number rivers assessed, and the number of assessed rivers meeting CLs for the period 1991 to 2022.

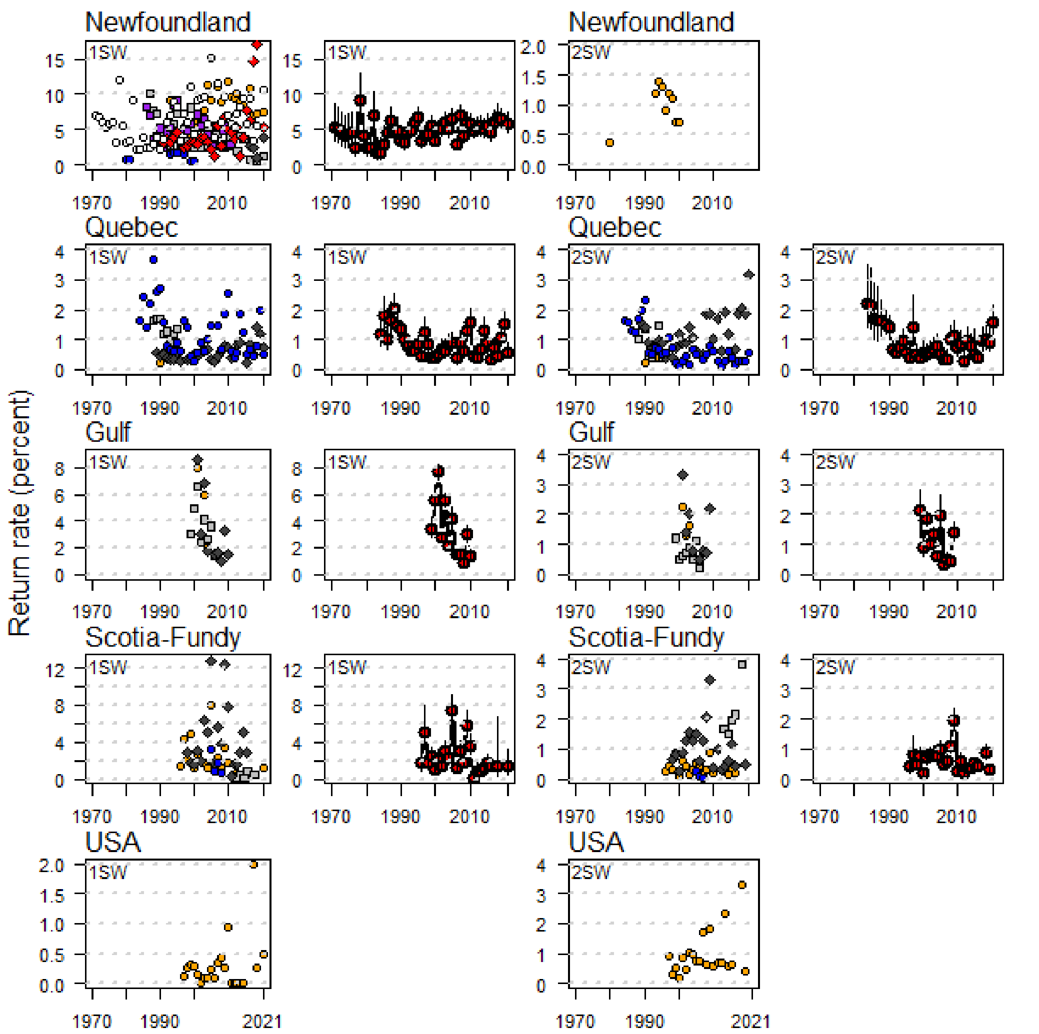


Figure 4.3.5.1. Estimated annual return rates (left and third column of panels; individual rivers are shown with different symbols and colours) and least squared (or marginal mean) mean annual return rates (with one standard error bars) (second and right column of panels) of wild origin smolts to 1SW 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.

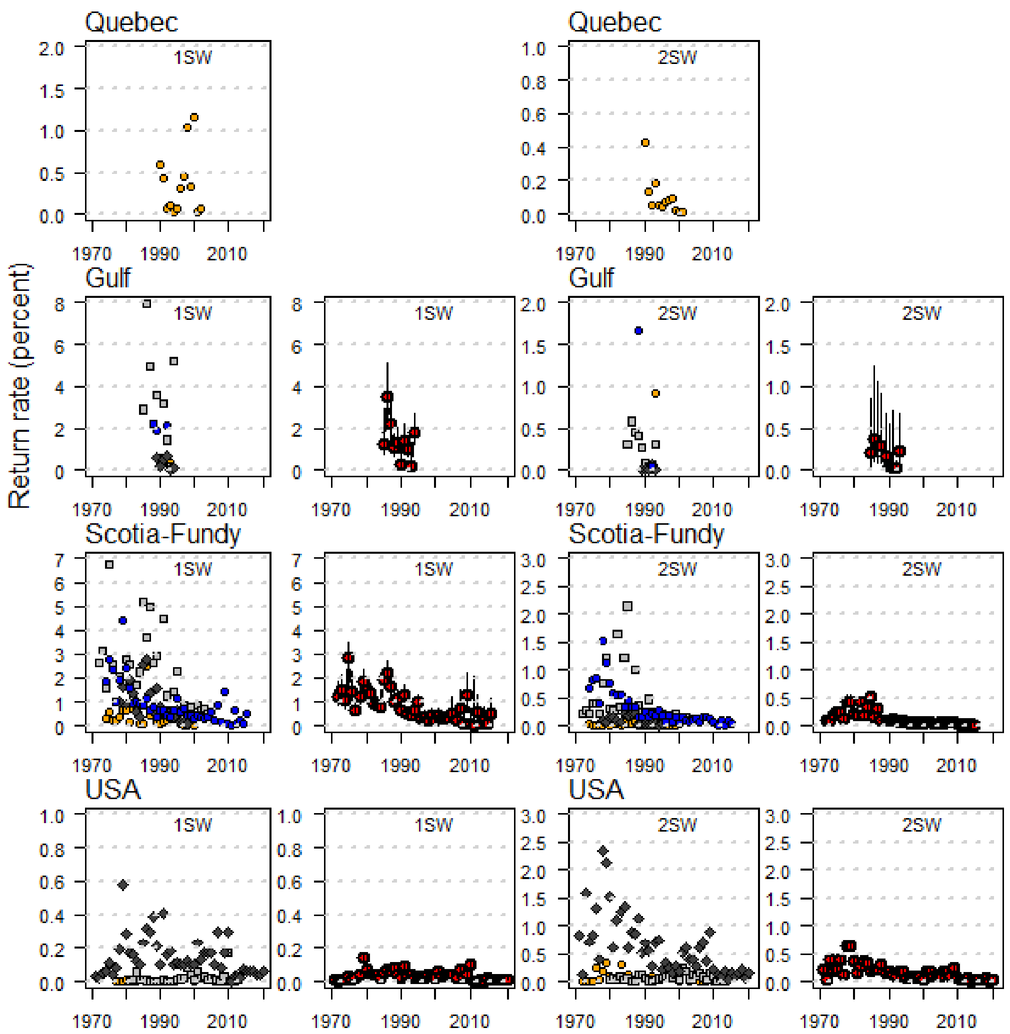


Figure 4.3.5.2. Estimated annual return rates (left and third column of panels; individual rivers are shown with different symbols and colours) and least squared (or marginal mean) mean annual return rates (with one standard error bars) of hatchery origin smolts to 1SW and 2SW salmon to the geographic 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.

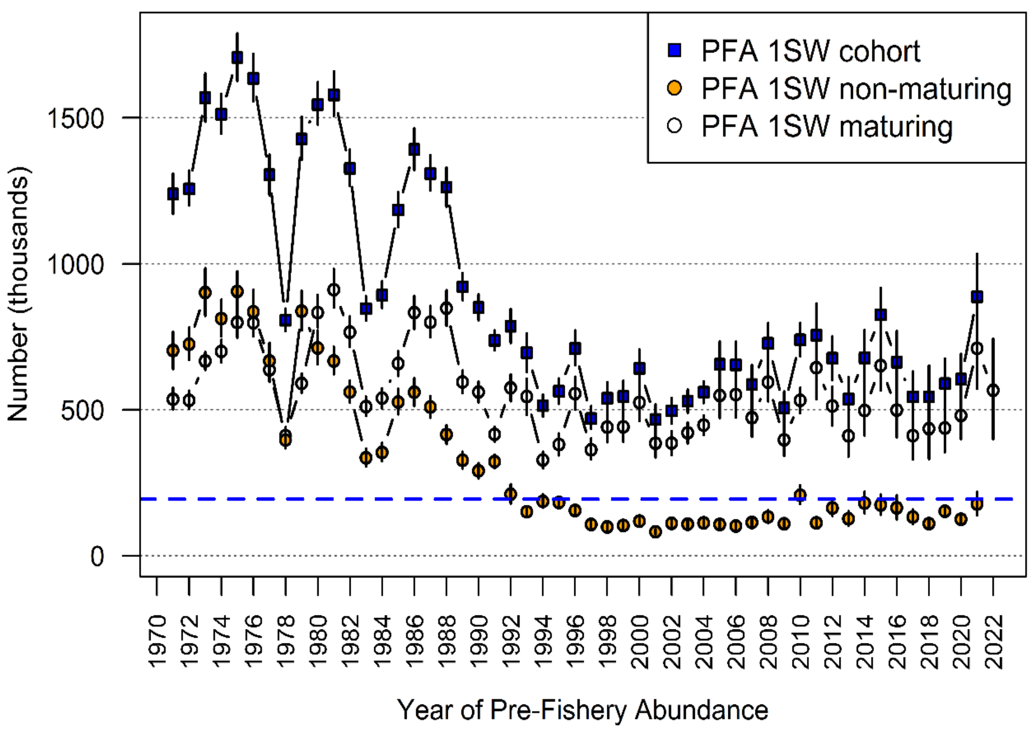


Figure 4.3.6.1. Estimated (median, 5th to 95th percentile range, X 1000) Pre-fishery Abundance (PFA) for 1SW maturing, 1SW non-maturing, and total cohort of 1SW salmon for NAC, PFA years 1971 to 2022. The dashed blue horizontal line is the corresponding sum of the 2SW conservation limits for NAC (143 494) corrected for 11 months of natural mortality (193 697) against which 1SW non-maturing are assessed.

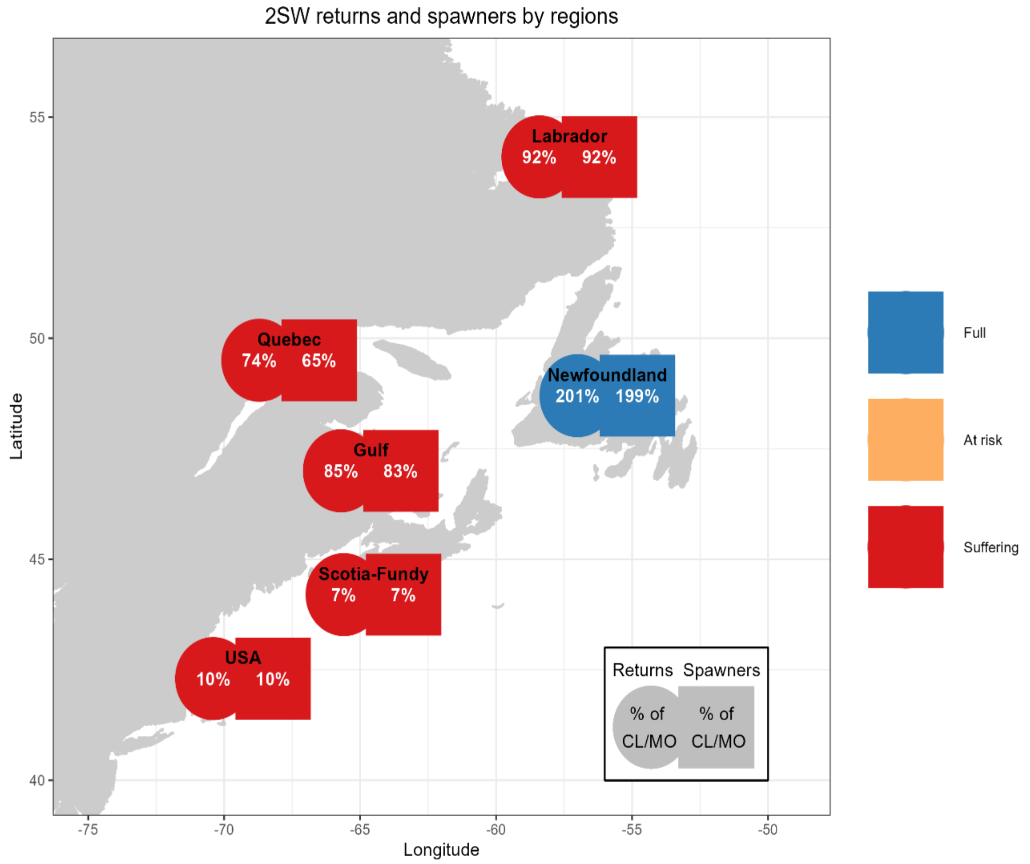


Figure 4.3.7.1. Estimated returns (circle symbol) and spawners (square symbol) of 2SW salmon in 2021 to six assessment regions of North America relative to ICES stock status categories. The percentage of the 2SW CLs for the four northern regions and to the rebuilding management objectives (MO) for the two southern areas are shown based on the median of the Monte Carlo distribution. For Quebec, 2SW CL correspond to the Upper Stock Reference point. The colour shading is interpreted as follows: blue refers to the stock being at full reproductive capacity (median and 5th percentile of the Monte Carlo distributions are above the CL), orange refers to the stock being at risk of suffering reduced reproductive capacity (median is above but the 5th percentile is below the CL), and red refers to the stock suffering reduced reproductive capacity (the median is below the CL).

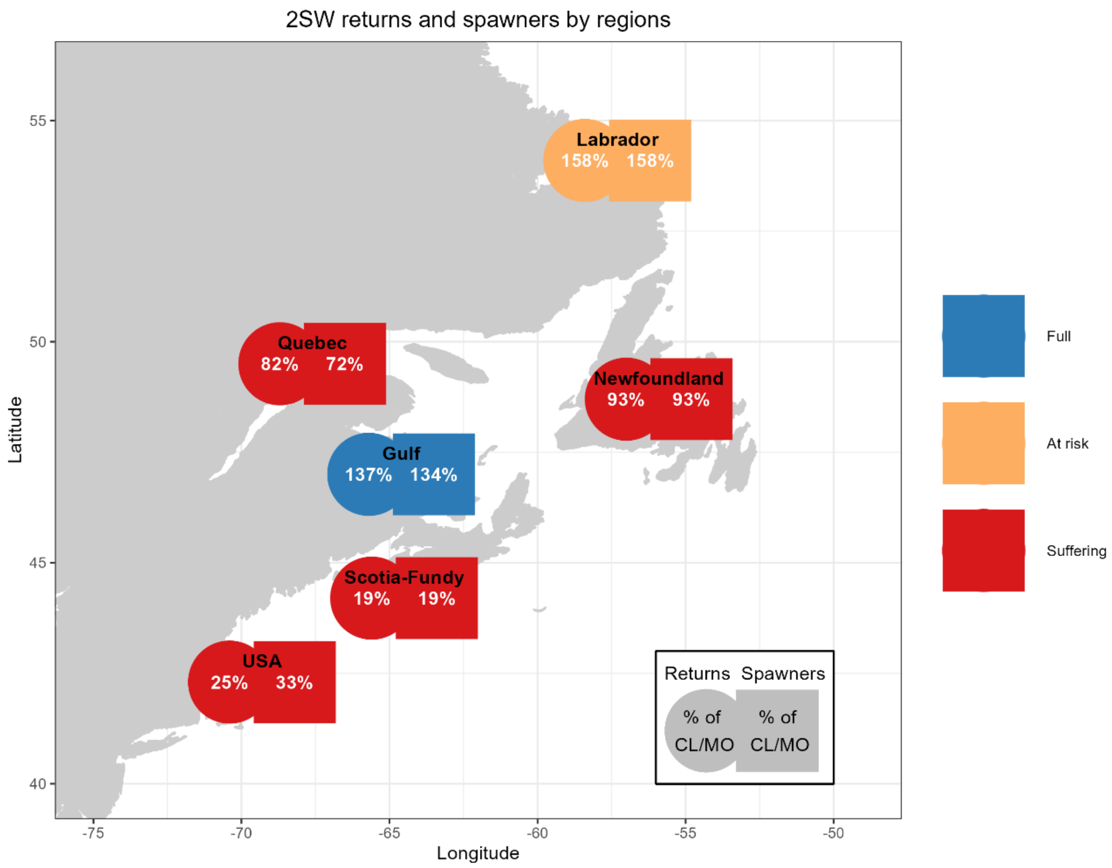


Figure 4.3.7.2. Estimated returns (circle symbol) and spawners (square symbol) of 2SW salmon in 2022 to six assessment regions of North America relative to ICES stock status categories. The percentage of the 2SW CLs for the four northern regions and to the rebuilding management objectives (MO) for the two southern areas are shown based on the median of the Monte Carlo distribution. For Quebec, 2SW CL correspond to the Upper Stock Reference point. The colour shading is interpreted as follows: blue refers to the stock being at full reproductive capacity (median and 5th percentile of the Monte Carlo distributions are above the CL), orange refers to the stock being at risk of suffering reduced reproductive capacity (median is above but the 5th percentile is below the CL), and red refers to the stock suffering reduced reproductive capacity (the median is below the CL).

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5 Atlantic salmon in the West Greenland Commission

5.1 NASCO has requested ICES to describe the key events of the 2021 and 2022 fisheries

The Atlantic salmon fishery is regulated according to the Government of Greenland's Executive Order no. 29 of 28 July 2022. Since 1998, with the exception of 2001, the export of Atlantic salmon has been banned. There are two landing categories reported for the fishery: commercial landings where professional licensed fishers can sell salmon to hotels, institutions and local markets and recreational landings where both professional fishers and non-professional fishers fish for private consumption. Since 2018, all fishers are required to have a license to fish for Atlantic salmon.

In 2021, the Government of Greenland published a "Management Plan for Atlantic Salmon in Greenland" (GoG 2021), which is to remain in force from July 1, 2021 through December 31, 2025. The management plan recognizes three separate management areas and specifies fishing seasons for each. The plan also outlines two different users groups and outlines how established total allowable catches (TAC) will be distributed according to historical catch data. The purpose of the management plan is to ensure access for the Greenlandic population to the utilization of Atlantic salmon while taking into account the international agreements that Greenland has negotiated.

Management Areas	Fishing season	User Group	% of TAC by area	% of TAC by user group
Northwest	01 Sep – 31 Oct		40%	
		Commercial		28%
		Recreational		12%
Southwest	01 Aug – 30 Sep		60%	
		Commercial		42%
		Recreational		18%
East Greenland	15 Aug – 15 Oct		3 t annually	
		Commercial		50%
		Recreational		50%

In 2021, parties of the West Greenland Commission of NASCO could not agree to a multiyear regulatory measure and instead agreed to an "Interim Regulatory Measure for Fishing for Atlantic Salmon at West Greenland in 2021" (NASCO 2021; see WGC(21)18). The interim agreement maintained many of the provisions that were in the preceding measures such as a continuation of a ban on the export of wild Atlantic salmon, restricting the fishery to August through November, requiring all fishers to have a license, requiring fishers to allow samplers access to their catch and requiring fishers to report their catch, even zero harvest. As outlined in the measure, the Government of Greenland set a total quota for all components of the 2021 fishery at West Greenland to 27 t.

In 2022, parties of the West Greenland Commission of NASCO were able to agree to a "Multi-Annual Regulatory Measure for Fishing for Atlantic Salmon at West Greenland" to cover the time period of 2022-2025 (NASCO 2022; see WGC(22)10). The agreement also maintained many of the provisions that were in the preceding measures while also outlining a new measure to minimize the likelihood of overharvest. At least for the first year of the agreement, it was agreed that the fishery would be closed when the registered catch had reached no more than 49% of the overall TAC to help ensure that the TAC would not be exceeded. In subsequent years, the percentage could be adjusted, in consultation with the Commission, based on previous experiences and the expected effect of new management measures. As outlined in the measure, the Government of Greenland set a total quota for all components of the 2022 fishery at West Greenland to 27 t.

The total catch was first reported to NASCO as 41 t (40 t at West Greenland and 1 t at East Greenland) for the 2021 fishery and 28 t (28 t at West Greenland and <1 t at East Greenland) for the 2022 fishery. Detailed statistics on the opening and closing dates, quotas and quota uptake by each region and user group are provided below.

Management Areas	Opening Dates	User Groups	2021/2022 Quotas (t)	2021 Closing Dates	2021 Catch (t)	2022 Closing Dates	2022 Catch (t)
Northwest	01 Sep						
		Commercial	7.56	22 Sep	15.86	19 Oct	8.62
		Recreational	3.24	01 Oct	3.26	31 Oct	1.49
Southwest	01 Aug						
		Commercial	11.34	15 Sep	14.95	22 Aug	11.23
		Recreational	4.86	22 Sep	5.90	11 Sep	6.36
East Greenland	15 Aug						
		Commercial	1.5	15 Oct	0.45	15 Oct	0.27
		Recreational	1.5	15 Oct	0.56	15 Oct	0.36

Updated catch figures for 2021 and 2022 have since been reported to ICES resulting in small increases in the total landings (increase of 2.24 t in 2021 and 1.46 t in 2022). The updated catch totals are reported in the following sections and used for assessment purposes.

5.1.1 Catch and effort in 2021 and 2022

Only hooks, fixed gillnets and driftnets are allowed to target salmon directly and the minimum mesh size has been 140 mm (stretched mesh) since 1985. Commercial fishers are allowed to use up to 20 gillnets at a time either as single gillnets fixed to the shore or up to 20 sections (~70 m per section) connected and used as a driftnet. Recreational licensed fishers can only use one gillnet fixed to the shore or rod and reel. All nets must be tended regularly and marked with name and contact information. Gillnets are only allowed in the inshore areas.

Nets are the preferred gear in Greenland and very little rod and reel fishing in salt water takes place. However, a small recreational fishery directly targeting salmon via rod and reel has been noted in the Nuuk and Qaqortoq regions. Reports from recreational fishers fishing with rod and reel are received annually and are included in the reported landings. Landings from this gear type are considered insignificant at this time.

As in past years, Officers from the Greenland Fisheries License Control Authority (GFLK) have patrolled areas with known salmon fishing activity during and after the season to remove gillnets if they lack name information or are not set in accordance with regulations. In 2022, two untended gillnets were removed by GFLK just south of Nuuk. Officers also continue to visit local markets and public institutions to maintain a presence at these locations and to encourage adherence to the fishing regulations.

Catch data were collated from fisher reports. The reports were screened for errors and missing values. Catches were assigned to a NAFO/ICES Division 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 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. It was noted that errors in reported catch data have been decreasing given improved catch reporting since 2018, given the mandatory requirement for all fishers to report catches.

The total updated catch figures are 43.2 t (41.8 t for West Greenland and 1.4 t for East Greenland) for 2021 and 29.8 t (29.0 t for West Greenland and 0.8 t for East Greenland) for 2022 (Table 5.1.1.1). Reported catch was distributed among the six NAFO Divisions on the west coast of Greenland and in ICES Division XIV on the east coast of Greenland (Table 5.1.1.2; Figure 5.1.1.1). The 2021 reported landings is the highest value since 2015 while the 2022 value is a decrease of over 13 t from the 2021 value. 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. Reported landings of Atlantic salmon increased from 60 t in 1960 to a peak of 2689 t reported in 1971 and generally decreased until the closure of the export commercial fishery in 1998. Reported landings for the internal use only fishery peaked at 57.9 t in 2014 and have averaged 39.2 t over the past ten years (2013–2022; Table 5.1.1.1; Figure 5.1.1.2). The majority of the catch in 2021 and 2022 was reported by commercial fishers as in previous years (Figure 5.1.1.2).

Reported Landings					
	Reported Landings (t (%))			Landings Type (t (%))	
	West Greenland only	East Greenland only	Total	Commercial	Recreational
2022	30.9 (97.5%)	0.8 (2.5%)	31.7	20.6 (69.3%)	9.2 (30.7%)
2021	41.8 (96.8%)	1.4 (3.2%)	43.2	32.2 (74.6%)	11.0 (25.4%)
2020	29.0 (97.3%)	0.8 (2.7%)	29.8	22.0 (69.5%)	9.7 (30.5%)

There is currently no quantitative approach for estimating the unreported catch for the fishery, but the 2022 value is likely to have been at the same level as reported by the Greenlandic authorities in recent years (10 t). The 10 t estimate was historically meant to account for recreational fishers in smaller communities fishing for recreational use, but not reporting landings. This estimate was not meant to represent non-reporting by commercial fishers.

The Working Group has employed two different approaches to estimate unreported catch from commercial fishers: comparisons of the sampling programme statistics and reported landings and utilizing results from the previously implemented phone surveys. The need for an adjustment for some unreported catch, primarily for commercial landings, has been assessed annually 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 (see Section 5.2). However, sampling only occurs during a portion of the fishing season and therefore these adjustments are considered minimum unreported catch adjustments.

The seasonal distribution of catches has previously been reported to the Working Group (ICES, 2002), but since 2002 this has generally 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 GFLK.

Greenland Authorities issued 939 licences (360 for commercial fishers and 579 for recreational fishers) and received 1840 reports from 671 fishers in 2021 and issued 757 licences (291 for commercial fishers and 466 for recreational fishers) and received 1266 reports from 504 fishers in 2022 (Tables 5.1.1.3 and 5.1.1.4; Figure 5.1.1.3). The number of licences issued, the number of fishers who reported, and the number of reports received have increased greatly since 2017 as a result of the new regulations requiring all fishers to receive a licence and mandatory reporting requirements. The levels are among the highest in the time-series and the number of fishers reporting landings matches the levels recorded during the commercial export fishery from 1987 to 1991. The number of licences issued and the number of fishers who reported catches in 2021 were the highest level recorded, but both decreased in 2022. The percentage of fishers that reported catches peaked in 2019 at 91% for commercial and 87% for recreational, but has decreased each year since with 68% of commercial fishers reporting catches and 67% of recreational fishers in 2022.

Licenses and Reporting						
	Licenses Issued			Number of Fishers Reporting (%)		
	Commercial	Recreational	Total	Commercial	Recreational	Total
2022	339	418	757	277 (82%)	341 (82%)	618 (82%)
2021	360	579	939	281 (78%)	424 (73%)	668 (71%)
2020	291	466	757	199 (68%)	312 (67%)	511 (68%)

The Working Group previously reported on the procedures for reporting salmon harvested in Greenland (ICES, 2014; ICES, 2016) and modifications to these procedures were made by the Government of Greenland in 2018. In summary, all fishers are required to have a licence to fish for Atlantic salmon and all licence holders are required to report catches. Reports can be made to GFLK by e-mail, phone, fax, or return logbook on a daily basis. Factory landings, when allowed, are submitted to GFLK either on a daily or weekly basis, depending on the likelihood of exceeding a quota. No factory landings have been allowed since 2015.

5.1.2 Phone surveys

Phone surveys were conducted in 2015, 2016, and 2017 to assess the 2014, 2015, and 2016 fisheries, respectively. The number of fishers contacted, the questions asked, and the method to estimate unreported catch differed from year to year. Based on the results from these surveys, estimated ‘adjusted landings (survey)’ of 12.2 t for the 2014 fishery, 5.0 t for the 2015 fishery, and 4.2 t for the 2016 fishery were added to the ‘adjusted landings (sampling)’ as described in Section 5.2, and ‘reported landings’ to estimate the ‘landings for assessment’. A phone survey was initiated for the 2017 fishery, but only nine fishers were contacted and no landings adjustment were estimated. Phone surveys have not been conducted since the 2017 fishery and therefore no landing adjustments have been estimated since that time. A summary of the reported landings, adjusted landings (sampling), and adjusted landings (survey) is presented in Table 5.1.2.1. Adjusted ‘landings for assessment’ do not replace the official reported statistics.

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 2021 PFA years (Figure 5.1.3.1). The most recent estimate of exploitation available is for the 2021 fishery as the 2022 exploitation rate estimates are dependent on the 2022 PFA estimates derived from 2023 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 seven months (1 January to 1 August) of natural mortality at 0.03 per month. The 2020 and 2021 NAC exploitation rates were 4.8% and 6.7% respectively. These values are in line with the mean estimate (7.0%) for the 2002-2021 time period and remain among the lowest in the time-series. NAC exploitation rate peaked in 1971 at approximately 40%. The 2020 and 2021 Southern NEAC exploitation rates were 1.4% and 0.5% respectively. The 2020 estimate was a doubling from the previous three years, but the 2021 value decreased back to the mean estimate (0.6%) for the 2002-2021 time period. Southern NEAC exploitation rate at Greenland peaked in 1975 at 33%. 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 4.3.6 and 3.3.1).

5.2 International sampling programme

Although some results from the 2020 International Sampling Programme have previously been reported on (ICES 2021a), not all sample processing had been completed at that time. All sampling processing and analysis have since been finalized and these updated results are presented below and all tables and figures have been updated as appropriate. Care should be taken when interpreting results from the 2020 sampling as the overall sample size was relatively low given challenges associated with sampling the fishery during the COVID-19 pandemic (ICES 2021a).

The international sampling programme for the fishery at West Greenland agreed by the parties at NASCO continued in 2021 (NASCO 2021; see WGC(21)15). The sampling was undertaken by participants from France (1), Ireland (1), and UK (Northern Ireland; 1). Additional samplers from Canada (1), UK (England & Wales; 1) and USA (1) were scheduled to participate, but travel restrictions associated with the COVID-19 pandemic prevented them from participating. To increase the sampling coverage, a local resident from Qaqortoq, Greenland was hired to provide sampling in that community throughout the fishing season. Samplers were stationed in three communities (Figure 5.1.1.1) representing three NAFO Divisions: Sisimiut (NAFO division 1B), Maniitsoq (1C), and Qaqortoq (1F). Samples were also collected in Nuuk (1D) by an employee of the Greenland Institute of Natural Resources (GINR). Sampling was conducted from August 2nd through October 4th in 2021.

A Citizen Science Programme was also conducted in 2021 by the GINR. A Citizen Science Programme had been initiated in 2020 with limited success given unforeseen complication associated with the COVID-19 pandemic (ICES 2021a). The 2021 effort involved sending a mailing to all license holders who had reported catches of five or more salmon in 2020. The mailing contained a letter requesting the fishers help to collect biological characteristics data and scale and tissue samples from their catch, an instruction sheet and 5 scale envelopes. It was requested that any collected samples and data be returned to the GINR at the conclusion of the fishing season.

The international sampling programme for the fishery at West Greenland agreed by the parties at NASCO continued in 2022 (NASCO 2022; see WGC(22)10). The sampling was undertaken by participants from France (1), Ireland (1), UK (England & Wales; 1) and USA (1). To increase the sampling coverage, a local resident from Qaqortoq, Greenland was again hired to provide sampling in that community throughout the fishing season. Samplers were set to be stationed in four communities (Figure 5.1.1.1) representing four NAFO Divisions: Sisimiut (NAFO division 1B), Maniitsoq (1C), Paamiut (1E) and Qaqortoq (1F). However, one of the samplers was unable to travel from Nuuk to Paamiut given weather complications and instead collected samples from the local market in Nuuk. No additional samples were collected in Nuuk by the GINR and a Citizen Science Programme was not pursued. Sampling was conducted from August 1st through September 15th in 2022.

In 2020, a total of 197 salmon were sampled, which represents 1% of the reported landings. Samples were provided from three sources and originated from three NAFO Divisions. A total of 140 fork lengths, 44 weights, 76 scale samples for age determination and 197 tissue samples were collected (Table 5.2.1). As noted prior, sampling in 2020 was particularly challenging given the COVID-19 pandemic and the low samples size is reflective of that.

2020	**NAFO Division/ICES Statistical Area**							
Sample Source	1A	1B	1C	1D	1E	1F	XIV	Total
Citizen Science				18	10	3		31
GFLK				9	6	11		26
GINR				140				140
Total				167	16	14		197

In 2021, a total of 1548 salmon were observed by the sampling teams, approximately 17% by weight of the reported landings. Samples were provided from three sources and originated from six NAFO Divisions and from ICES Statistical Area XIV. A total of 1293 fork lengths, 1184 weights, 1308 scale samples for age determination, and 1532 tissue samples were collected (Table 5.2.1).

2021	**NAFO Division/ICES Statistical Area**							
Sample Source	1A	1B	1C	1D	1E	1F	XIV	Total
Citizen Science	6	60	55	19	33	65	14	252
GINR				393				393
Sampling Programme		131	653			119		903
Total	6	191	708	412	33	184	14	1548

In 2022, a total of 1170 salmon were observed by the sampling teams, approximately 11% by weight of the reported landings. A total of 672 fork lengths, 672 weights, 631 scale samples for age determination, and 670 tissue samples were collected (Table 5.2.1).

2022	**NAFO Division/ICES Statistical Area**							
Sample Source	1A	1B	1C	1D	1E	1F	XIV	Total
Sampling Programme		29	308	282	31	22		672
Total		29	308	282	31	22		672

The International Sampling Programme has been successful at sampling the harvest of Atlantic salmon at Greenland annually and the data collected has contributed valuable inputs to the assessment models used by the Working Group. Prior to any sampling, the sampler always obtains permission from the market manager or fisher before sampling the catch. This arrangement has generally been successful for all samplers, although there have been a small number of issues in some years in some communities. In 2022 access to landed salmon was denied to the sampler in Qaqortoq after only a few days of sampling. Intervention by the Government of Greenland was initiated, but the situation was not remedied during the fishing season. Intervention continued after the fishing season and access is expected to be restored in 2023.

In 2021, six adipose fin clipped fish were recorded, no internal or external tags were identified by the samplers. In 2021, three tags were provided directly to the GINR (a PIT tag, an acoustic tag and a carlin tag). The carlin tag was from an adult fish tagged in the Margaree River (Canada) in 2020. In 2022, four adipose fin clipped fish were recorded and a single cwt tag was recovered and no other internal or external tags were identified by the samplers. The cwt tag is still being processed and the origins of the PIT and acoustic tag remain unknown.

Starting in 2002, non-reporting of harvest was evident based on a comparison of reported landings and sample data. When there is this type of discrepancy, the reported landings are adjusted ("Adjusted landings (sampling)") according to the estimated total weight of the fish identified as being landed 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). Landings for assessment are presented in Table 5.1.2.1. No adjustments have been made since 2017 and details of all adjustments made to date have been reported previously (ICES 2021a).

5.2.1 Biological characteristics of the catches

In 2020, the mean length and whole weight of North American 1SW salmon were 66.6 cm and 3.20 kg and the means for European 1SW salmon were 65.6 cm and 3.38 kg. In 2021, the mean length and whole weight of North American 1SW salmon were 66.2 cm and 3.34 kg and the means for European 1SW salmon were 65.9 cm and 3.34 kg. In 2022, the mean length and whole weight of North American 1SW salmon were 63.9 cm and 2.79 kg and the means for European 1SW salmon were 62.4 cm and 2.73 kg. The 2020 values are similar to the 2021 values whereas the 2022 values decreased from the 2021 values and are all below the previous 10-year means (2012-2021; Table 5.2.1.1). The mean length and weight data reported in Table 5.2.1.1 have not been adjusted for the period of sampling and it is known that salmon grow quickly during the period of feeding at West Greenland. Preliminary analyses to adjust for period of sampling have been previously reported (ICES 2011; ICES 2015) and therefore caution is urged when interpreting the uncorrected data.

North American salmon sampled from the fishery at West Greenland were predominantly river age two (28.2%, 27.3% and 24.9%), three (23.1%, 38.3% and 38.7%) and four (28.2%, 21.7% and 24.1%) year old fish in 2020, 2021 and 2022 respectively (Table 5.2.1.2). European salmon were predominantly river age two (74.2%, 58.2% and 53,8%) and three (9.7%, 19.1% and 17.9%) year old fish in 2020, 2021 and 2022 respectively (Table 5.2.1.3). As expected, the 1SW age group dominated the sample collection for both the North American (92.3%, 95.5% and 94.7%) and European (97.1%, 97.9% and 90.0%) origin fish in 2020, 2021and 2022 respectively (Table 5.2.1.4).

5.2.2 Continent and region of origin of catches at West Greenland

In 2020, 196 of 197 tissue samples collected from three NAFO Divisions were genetically analysed: 1B (n = 167), 1E (n = 16) and 1F (n = 13; Figure 5.2.2.1). In 2021, 1518 of 1532 tissue samples collected from six NAFO Divisions and from ICES Statistical Area XIV were genetically analysed: 1A (n=6), 1B (n = 187), 1C (n=702), 1D (n=408), 1E (n=33) 1F (n = 182) and XIV (n=14; Figure 5.2.2.2). In 2022, 669 of 670 tissue samples collected from five NAFO Divisions were genetically analysed: 1B (n = 29), 1C (n=307), 1D (n=280), 1E (n = 31) and 1F (n = 22; Figure 5.2.2.3).

Since 2017, a Single Nucleotide Polymorphism (SNP) rangewide baseline (Jeffery *et al*., 2018) providing 21 North American and ten European reporting groups has been used for continent and region of origin analysis. The baseline has been revised, resulting in 21 North American and ten European reporting groups (Table 5.2.2.1 and Figure 5.2.2.4; ICES 2019a). A Bayesian approach is used to estimate mixture composition or assign individuals to continent and region of origin. The approach uses the R package rubias (Anderson *et al*., 2008).

In 2020, 55.6% of the salmon sampled were of North American origin and 44.4% were of European origin (Table 5.2.2.2). In 2021, samples collected from West Greenland were 82.3% North American origin and 17.7% European origin (Table 5.2.2.3). Samples collected from East Greenland (ICES Statistical Area XIV) were 71.4% North American and 28.6% European). These represent the first genetic samples analysed from the East Greenland fishery as previously analysed historical samples originated from research surveys (Bradbury et al. 2015). In 2022, 93.7% of the salmon sampled were North American origin and 6.37% were European origin (Table 5.2.2.4). These findings show that large proportions of fish from the North American stock complex continue to contribute to the fishery (Table 5.2.2.5 and Figure 5.2.2.5). The proportion North American was fairly low in 2020, but sample size was also low and therefore the results may be skewed. The 2021 and 2022 values both increased from the 2020 value and the 2022 estimate is the highest proportion North American recorded in the time-series. The NAFO division-specific continent of origin assignments for 2001-2022 are presented in Figure 5.2.2.6. The annual variation in the continental representation among divisions within the recent time-series 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 salmon caught at West Greenland (excluding unreported catch and reported harvest from ICES Statistical Area XIV) are provided in Table 5.2.2.5 and Figure 5.2.2.7. Approximately 5200 (17.2 t) North American origin fish and 3600 (13.7 t) European origin fish were harvested in 2020. Approximately 10 300 (34.4 t) North American origin fish and 2000 (7.4 t) European origin fish were harvested in 2021 and approximately 9200 (27.2 t) North American origin fish and 900 (1.8 t) European origin fish were harvested in 2022.

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, 2019). Region of origin estimates for the 2020-2022 fisheries, based on the updated rangewide SNP baseline, are provided in Tables 5.2.2.6, 5.2.2.7, 5.2.2.8 and Figures 5.2.2.8, 5.2.2.9, 5.2.2.10.

As in previous years, the North American contributions to the West Greenland fishery are dominated by the Gaspe Peninsula, the Gulf of St Lawrence, and the Labrador South reporting groups. These three groups accounted for 78% of the North American contributions in 2020, 88% in 2021 and 60% in 2022. The Northeast Atlantic contributions were dominated by the United Kingdom/Ireland reporting group (93%, 92% and 88% of the European contributions in 2020, 2021 and 2022 respectively). From North America, there are smaller, but consistent contributions to the harvest for a number of other reporting groups (e.g. Lake Melville, St. Lawrence North

Shore-Lower, Maine, United States, Labrador Central; Tables 5.2.2.6, 5.2.2.7, and 5.2.2.8 and Figures 5.2.2.8, 5.2.2.9 and 5.2.2.10). These results support the previous conclusion by ICES (2017) that stocks from Northern NEAC do not contribute a significant amount to the harvest at West Greenland. Further, the variation in NAFO division-specific region of origin assignments highlight the variation of region-specific contributions across years and NAFO divisions.

In 2022, a single sample collected from Nuuk (NAFO Division 1D) was identified as having originated from the Greenland (i.e. Kapisillit River) reporting group. This is the second time a sample has been assigned the Greenland reporting group. The first time was in 2018 and the sample originated from Maniitsoq (NAFO Division 1C). The SNP baseline, which includes the Greenland reporting group has only been in operation since 2017.

5.3 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 four of the seven stock complexes exploited at West Greenland were below CLs in 2022 (Figure 5.3.1) . 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).

5.3.1 North American stock complex

The total estimate of 2SW salmon spawners in North America for 2022 increased in all areas (11% to 243%) except for Newfoundland (-53%) and were the 6th highest on record (1971-2022; 52 years). The midpoints of the spawner abundance estimates were 158% of the 2SW CL for Labrador, 93% for Newfoundland, 72% for Quebec, 134% for Gulf, 8% for Scotia-Fundy and 5% for USA. The region is considered to be at full reproductive capacity, Labrador is considered to be at risk of suffering full reproductive capacity and Quebec, Newfoundland, Scotia-Fundy and USA are suffering reduced reproductive capacity (Figure 4.3.7.1b). Scotia-Fundy and USA met 19% and 33% of their Management Objective in 2022 respectively. Within each of the geographic areas, there are individual river stocks which are failing to meet CLs (Table 4.3.4.1 and Figures 4.3.4.1 and 4.3.4.2). 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 salmon in North American fisheries has declined (Figure 4.1.6.1) from a peak of 81% in 1971 for 2SW salmon to a mean of 9% over the past ten years.

5.3.2 MSW Southern European stock complex

The midpoint of the spawner abundance estimate for the Southern NEAC MSW stock complex was above the CL and is therefore is at full reproductive capacity (Figure 3.3.4.2). Individual countries stock status within the NEAC MSW stock complex varied across all three stock status designations (Figure 3.3.4.5). Note that rivers in the south and west of Iceland are included in the assessment of the Southern NEAC stock complex. Within individual jurisdictions, there are large numbers of rivers not meeting CLs after homewater fisheries (Table 3.3.5.1 and Figure 3.3.5.1). 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 3% in 2021 and 2022, which was lower than the previous five year (4%) and ten year (5%) means.

Table 5.1.1.1. 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 available, 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
1983	-	-	-	-	310	310	1191	

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
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

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
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
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

Year	Norway	Faroes	Sweden	Denmark	Greenland	Total	Quota	Comments
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
2017	-	-	-	-	28	28	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 are used for the assessments
2018	-	-	-	-	40	40	30	No factory landing allowed and fishery restricted to catches used for internal consumption in Greenland
2019	-	-	-	-	30	30	20	Same as previous year
2020	-	-	-	-	32	32	21	Same as previous year
2021	-	-	-	-	43	43	30	Overall quota segregated across 3 management areas and 2 user groups with 27 t allocated for the fishery at West Greenland
2022	-	-	-	-	30	30	30	Same as previous year

Table 5.1.1.2. Distribution of nominal catches (t) by Greenland fishers 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. Rounding issues are evident for some totals.

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

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
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

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
1992	-	4	23	5	75	130	-	237	5	242
1993 [1]	-	-	-	-	-	-	-	-	-	-
1994 [1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	5	-	15	-	15
2006	6	2	3	4	2	4	-	22	-	22
2007	2	5	6	4	5	2	-	25	-	25
2008	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
2017	1.1	1.7	9.3	6.9	3.2	5.6	0	27.8	0.3	28.0
2018	2.4	5.7	13.7	8.2	4.2	4.8	0	39.0	0.8	39.9
2019	0.8	3.0	4.4	8.0	4.8	7.3	0	28.3	1.4	29.8
2020	0.9	3.6	6.6	9.7	3.0	7.1	0	30.9	0.8	31.7

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
2021	1.3	5.1	13.8	10.5	3.4	7.4	0.3	41.8	1.4	43.2
2022	1.4	3.0	5.3	8.2	4.1	7.0	0.8	29.0	0.8	29.8

1 The fishery was suspended.

+ Small catches <5 t.

- No catch.

Table 5.1.1.3. Total number of licences issued and number of fishers reporting catches of Atlantic salmon in the Greenland fishery by NAFO (1A-1F)/ICES divisions. Reports received by fish factories prior to 1997 and to the Licence Office from 1998 to present. Blanks cells indicate that the data were not reported or available. Starting in 2018, a new regulation was enacted which required all fishers to have a licence to fish for Atlantic salmon. Prior to 2018, only commercial fishers were required to have a licence.

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	

Year	Licences	1A	1B	1C	1D	1E	1F	ICES	Unk.	Number of fishers reporting	Number of reports received
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	3	143	503
2017	282	17	9	40	24	23	28	2	0	143	631
2018	786	98	78	81	143	44	105	8	0	557	1536
2019	717	96	70	117	169	54	108	24	0	638	1531
2020	757	100	89	103	151	47	118	10	0	618	1321
2021	939	97	91	117	197	51	103	12	3	671	1840
2022	757	77	67	70	147	35	99	9	0	504	1266

Table 5.1.1.4. Total number of licences issued, number and percent of people reporting catches and reported catch by fisher type in the Greenland Atlantic salmon fishery 1987-present. Average values for different time periods are also provided for comparison. Prior to 2018, only commercial fishers were required to have a licence.

	Commercial Fishers				Recreational Fishers				Total			
Year	No. Licenses	No. reporting	%	Catch (kg)	No. Licenses	No. reporting	%	Catch (kg)	No. Licenses	No. reporting	%	Catch (kg)
1987										579		
1988										516		
1989										393		
1990										362		
1991										410		
1992										212		
1993												

Year	Commercial Fishers				Recreational Fishers				Total			
	No. Li-censes	No. re-porting	%	Catch (kg)	No. Li-censes	No. re-porting	%	Catch (kg)	No. Li-censes	No. re-porting	%	Catch (kg)
1994												
1995										145		
1996										163		
1997		185								185		59 333
1998	405	46	11%	7463		24				70		11 059
1999	424	110	26%	15 551						110		19 464
2000	179	45	25%	19 900		1				46		20 504
2001	451	57	13%	34 184		30				87		42 514
2002	480	24	5%	5753		19				43		8119
2003	150	23	15%	6008		19				42		8694
2004	157	32	20%	11 342		32				64		15 945
2005	185	55	30%	7133		20				75		13 788
2006	166	69	42%	12 023		67				136		20 836
2007	261	102	39%	14 919		28				130		22 204
2008	262	78	30%	11 303		173				251		26 000
2009	293	100	34%	21 955		45				145		26 278
2010	309	110	36%	27 332		98				208		39 696
2011	242	61	25%	21 397		56				117		27 524
2012	276	79	29%	29 056		43				122		33 178
2013	328	66	20%	45 600		29				95		46 961
2014	320	98	31%	56 246		16				114		57 836
2015	310	114	37%	50 841		75				189		56 847
2016	263	71	27%	19 395		69				140		27 120
2017	282	93	33%	24 919		50				143		28 042
2018	329	235	71%	32 597	457	322	70%	7268	786	557	71%	39 865
2019	302	276	91%	21 869	415	361	87%	7879	717	638	89%	29 769
2020	339	277	82%	22 000	418	341	82%	9669	757	618	82%	31 670

Year	Commercial Fishers No. Licenses	No. reporting	%	Catch (kg)	Recreational Fishers No. Licenses	No. reporting	%	Catch (kg)	Total No. Licenses	No. reporting	%	Catch (kg)
2021	360	281	78%	32 245	579	424	73%	10 972	939	668	71%	43 216
2022	291	199	68%	20 640	466	312	67%	9154	757	511	68%	29 794
Ave 1998-2008	284	58	22%	13 234		41		5475		85		19 012
Ave 2009-2017	291	88	30%	32 971		53		5193		142		38 165
Ave 2018-2022	324	254	78%	25 870	467	352	76%	8988	755	598	76%	34 863

Table 5.1.2.1. 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 that a phone surveys was not conducted. Adjusted landings (sampling and surveys) are added to the reported landings for assessment purposes. Adjusted landings do not replace official reported statistics. Rounding issues are evident for some totals.

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

2017	27.8	0.3	-	28.0
2018	39.0	-	-	39.0
2019	28.3	-	-	28.3
2020	30.9	-	-	30.9
2021	41.8	-	-	41.8
2022	29.0	-	-	29.0

Table 5.2.1. 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). Parenthetical sample numbers represent the number of samples available. Genetic-based continent of origin assignments are considered to be 100% accurate.

Source	**Year**	**Sample Size**			**Continent of Origin (%)**			
		Length	Scales	Genetics	North 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)

Source	Year	Sample Size			Continent of Origin (%)			
		Length	Scales	Genetics	North American	(95% CI)[1]	European	(95% CI)[1]
	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	490	70		30	
	2002	501	501	501 (1001)	68		32	
	2003	1743	1743	1779	68		32	
	2004	1639	1639	1688	73		27	
	2005	767	767	767	76		24	
	2006	1209	1209	1193	72		28	
	2007	1116	1110	1123	82		18	
	2008	1854	1866	1853	86		14	
	2009	1662	1683	1671	91		9	
	2010	1261	1265	1240	80		20	
	2011	967	965	964	92		8	
	2012	1372	1371	1373	82		18	
	2013	1155	1156	1149	82		18	

Source	Year	Sample Size			Continent of Origin (%)			
		Length	Scales	Genetics	North American	(95% CI)[1]	European	(95% CI)[1]
	2014	892	775	920	72		28	
	2015	1708	1704	1674	80		20	
	2016	1300	1240	1302	66		34	
	2017	1369	1328	986 (1367)	74		26	
	2018	1064	1048	979 (1111)	83		17	
	2019	1117	1049	1071 (1119)	72		28	
	2020	140	76	197	56		44	
	2021	1293	882 (1308)	1532	82		18	
	2022	672	623	669	94		6	

[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 5.2.1.1. 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 the present, excluding 1977, 1993 and 1994 (NA = North America and E = Europe). These data have not been adjusted for the period of sampling and it is known that salmon grow quickly during the period of feeding at West Greenland. Caution is urged when interpreting these uncorrected data. In addition, some estimates, especially with the older sea age fish are based on a small number of samples.

	Whole Weight (kg)									Fork Length (cm)					
	1SW		2SW		PS		All Sea Ages		Total	1SW		2SW		PS	
Year	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-

	Whole Weight (kg)									Fork Length (cm)					
	1SW		2SW		PS		All Sea Ages		Total	1SW		2SW		PS	
Year	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.9	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
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

	Whole Weight (kg)									Fork Length (cm)					
	1SW		2SW		PS		All Sea Ages		Total	1SW		2SW		PS	
Year	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
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
2017	3.42	3.31	6.50	3.69	4.94	8.00	3.50	3.36	3.26	66.6	64.8	85.1	72.4	76.7	81.9
2018	2.91	2.93	9.27	5.59	4.53	-	2.97	3.00	2.97	63.8	63.9	87.5	76.3	77.1	-
2019	2.93	2.89	6.62	6.27	4.01	2.76	3.01	2.83	2.96	63.9	63.4	78.4	76.8	72.1	62.1
2020	3.20	3.38	-	-	7.90	-	3.59	3.38	3.50	66.6	65.6	-	-	85.0	-
2021	3.34	3.34	7.92	4.02	4.72	-	3.44	3.35	3.42	66.2	65.9	86.9	70.1	74.7	-
2022	2.79	2.73	6.51	6.05	3.25	-	2.83	3.05	2.85	63.9	62.4	80.9	81.5	69.0	-
Prev. 10-yr mean	**3.23**	**3.13**	**7.29**	**5.21**	**4.74**	**4.73**	**3.35**	**3.17**	**3.30**	**65.5**	**64.5**	**83.3**	**75.1**	**74.8**	**72.6**
Overall mean	**2.92**	**3.15**	**6.74**	**6.07**	**4.20**	**4.73**	**3.06**	**3.23**	**3.15**	**63.7**	**65.1**	**82.2**	**80.1**	**72.3**	**75.5**

Table 5.2.1.2. River age distribution (%) and mean river age for all North American origin salmon caught at West Greenland from 1968 to the present, excluding 1977, 1993 and 1994.

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

Year	1	2	3	4	5	6	7	8
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
2010	1.6	21.7	47.9	21.7	6.3	0.8	0	0

Year	1	2	3	4	5	6	7	8
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
2017	0.3	31.0	41.6	19.6	7.2	0.3	0	0
2018	0.5	29.8	38.4	24.1	6.5	0.7	0	0
2019	0.6	26.9	32.5	25.4	13.7	0.8	0	0
2020	2.6	28.2	23.1	28.2	17.9	0	0	0
2021	0.4	27.3	38.3	21.7	10.1	2.0	0.1	0
2022	0.4	24.9	38.7	24.1	10.3	1.6	0	0
Previous 10-yr Mean	**0.5**	**28.5**	**37.9**	**23.3**	**9.1**	**0.7**	**0.0**	**0.0**
Overall Mean	**2.2**	**30.9**	**39.3**	**19.2**	**7.2**	**1.0**	**0.1**	**0.0**

Table 5.2.1.3. River age distribution (%) and mean river age for all European origin salmon caught in West Greenland 1968 to the present, excluding 1977, 1993 and 1994.

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

Year	1	2	3	4	5	6	7	8
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

Year	1	2	3	4	5	6	7	8
2008	7.0	72.8	19.3	0.8	0.0	0	0	0
2009	14.3	59.5	23.8	2.4	0.0	0	0	0
2010	11.3	57.1	27.3	3.4	0.8	0	0	0
2011	19.0	51.7	27.6	1.7	0	0	0	0
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
2017	10.0	73.0	15.4	1.7	0	0	0	0
2018	13.7	62.1	19.0	5.2	0	0	0	0
2019	7.5	60.5	24.2	7.5	0.4	0	0	0
2020	9.7	74.2	9.7	3.2	3.2	0	0	0
2021	15.6	58.2	19.1	5.7	1.4	0	0	0
2022	17.9	53.8	17.9	5.1	5.1	0	0	0
Previous 10-yr Mean	**8.6**	**63.8**	**22.5**	**4.4**	**0.6**	**0.0**	**0.0**	**0.0**
Overall Mean	**16.1**	**61.2**	**19.2**	**3.1**	**0.5**	**0.0**	**0.0**	**0.0**

Table 5.2.1.4. Sea age composition (%) of samples from fishery landings in West Greenland by continent of origin from 1985 to present, excluding 1977, 1993 and 1994.

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

Year	**North American**				**European**		
	1SW	2SW	Previous Spawners		1SW	2SW	Previous Spawners
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
2017	92.5	1.5	6.0	93.1	5.7		1.2

Year	North American				European		
	1SW	2SW	Previous Spawners		1SW	2SW	Previous Spawners
2018	97.4	0.4	2.2	97.4	2.6		0.0
2019	95.9	1.4	2.7	97.9	1.7		0.3
2020	92.3	0.0	7.7	97.1	0.0		2.9
2021	95.5	1.2	3.3	97.9	2.1		0.0
2022	94.7	0.7	4.6	90.0	10.0		0.0
Previous 10-yr mean	**94.4**	**1.1**	**4.5**	**96.8**	**2.3**		**0.9**
Overall Mean	**95.2**	**1.9**	**2.9**	**96.5**	**2.6**		**0.8**

Table 5.2.2.1. SNP baseline reporting groups and codes used for continent and region of origin assignments. See Figure 5.2.2.4 for location details.

ICES region	Reporting group	Group acronym	ICES region	Reporting group	Group acronym
Quebec (North)	Ungava	UNG	Europe	Spain	SPN
Labrador	Labrador Central	LAC		France	FRN
	Lake Melville	MEL		European Broodstock	EUB
	Labrador South	LAS		United Kingdom / Ireland	BRI
Quebec	St Lawrence North Shore Lower	QLS		Barents-White Seas	BAR
	Anticosti	ANT		Baltic Sea	BAL
	Gaspe Peninsula	GAS		Southern Norway	SNO
	Quebec City Region	QUE		Northern Norway	NNO
Gulf	Gulf of St Lawrence	GUL		Iceland	ICE
Scotia-Fundy	Inner Bay of Fundy	IBF		Greenland	GL
	Eastern Nova Scotia	ENS			
	Western Nova Scotia	WNS			
	Saint John River & Aquaculture	SJR			

ICES region	Reporting group	Group acronym	ICES region	Reporting group	Group acronym
Newfoundland	Northern Newfoundland	NNF			
	Western Newfoundland	WNF			
	Newfoundland 1	NF1			
	Newfoundland 2	NF2			
	Fortune Bay	FTB			
	Burin Peninsula	BPN			
	Avalon Peninsula	AVA			
USA	Maine, United States	USA			

Table 5.2.2.2. The number of samples and continent of origin of Atlantic salmon by NAFO Division sampled in West Greenland in 2020.

NAFO Division	Sample dates	Numbers			Percentages	
		North American	European	Total	North American	European
1D	Sep 3 - Sep 22	95	72	167	56.9	43.1
1E	Sep 7 - Sep 11	3	13	16	18.8	81.3
1F	Sep 9	11	2	13	84.6	15.4
TOTAL		**109**	**87**	**196**	**55.6**	**44.4**

Table 5.2.2.3. The number of samples and continent of origin of Atlantic salmon by NAFO Division sampled in West Greenland in 2021. Result for ICES Statistical Area XIV (East Greenland) are shown in the last row of the table.

NAFO Division	Sample dates	Numbers			Percentages	
		North American	European	Total	North American	European
1A	Aug 10 - Sep 15	2	4	6	33.3	66.7
1B	Aug 6 - Oct 12	158	29	187	84.5	15.5
1C	Aug 7 - Sep 23	594	108	702	84.6	15.4
1D	Aug 11 - Sep 8	318	90	408	77.9	22.1
1E	Aug 4 - Sep 9	27	6	33	81.8	18.2
1F	Aug 7 - Sep 22	151	31	182	83.0	17.0
TOTAL		**1250**	**268**	**1518**	**82.3**	**17.7**
XIV	*Aug 16-Sep 29*	*10*	*4*	*14*	*71.4*	*28.6*

Table 5.2.2.4. The number of samples and continent of origin of Atlantic salmon by NAFO Division sampled in West Greenland in 2022.

NAFO Division	Sample dates	Numbers			Percentages	
		North American	European	Total	North American	European
1B	Sep 1 - Sep 13	27	2	29	93.1	6.9
1C	Sep 5 - Sep 14	282	25	307	91.9	8.1
1D	Aug 19 - Aug 22	271	9	280	96.8	3.2
1E	Aug 17 - Aug 19	29	2	31	93.5	6.5
1F	Aug 1 - Aug 3	18	4	22	81.8	18.2
TOTAL		**627**	**42**	**669**	**93.7**	**6.3**

Table 5.2.2.5. The estimated percentage and numbers of North American (NA) and European (E) Atlantic salmon caught in the West Greenland fishery based on NAFO Division continent of origin estimates weighted by catch weight (1982 to the present, excluding 1993 and 1994). Numbers are rounded to the nearest 100 fish. Unreported catch is not included in this assessment.

	Percentage by continent weighted by catch		Numbers of salmon by continent	
Year	N	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

	Percentage by continent weighted by catch		Numbers of salmon by continent	
Year	N	E	NA	E
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
2017	74	26	6100	2200
2018	80	20	10 600	2600
2019	72	28	6800	2600
2020	59	41	5200	3600
2021	83	17	10 300	2000
2022	91	9	9200	900

Table 5.2.2.6. Bayesian estimates of mixture composition for West Greenland Atlantic Salmon fishery by region and overall for 2020. Baseline locations refer to regional reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. Sample locations are identified by NAFO Divisions. Mean estimates provided with 95% credible interval in parentheses. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are represented as zero and

therefore all columns may not add up to 100. Credible intervals with a lower bound of zero, or close to zero, may indicate little support for the mean assignment value.

Reporting Group	COO	NAFO 1D	NAFO 1E	NAFO 1F	Overall
Baltic Sea	EUR	0.0	0.0	0.0	0.0
Barents-White Seas	EUR	0.0	0.0	0.0	0.0
European Broodstock	EUR	0.0	0.0	0.0	0.0
UK/Ireland	EUR	39.9 (32.4, 47.5)	77.3 (55.6, 93.4)	14.9 (1.9, 37.4)	41.7 (34.9, 48.8)
France	EUR	0.0	0.0	0.0	0.0
Greenland	EUR	0.0	0.0	0.0	0.0
Iceland	EUR	0.0	0.0	0.0	0.0
Northern Norway	EUR	0.0	0.0	0.0	0.0
Southern Norway	EUR	4 (1.4, 7.7)	0.0	0.0	3.3 (1.1, 6.4)
Spain	EUR	0.0	0.0	0.0	0.0
Anticosti	NA	0.0	0.0	0.0	0.0
Avalon Peninsula	NA	0.0	0.0	0.0	0.0
Burin Peninsula	NA	0.0	0.0	0.0	0.0
Eastern Nova Scotia	NA	0.0	0.0	0.0	0.0
Fortune Bay	NA	0.0	0.0	0.0	0.0
Gaspé Peninsula	NA	21 (14.7, 27.8)	12.1 (1.7, 30.7)	25 (6.3, 51.1)	20.4 (14.8, 26.7)
Gulf of St Lawrence	NA	7.8 (3.7, 13)	0.0	0.0	7.3 (3.7, 11.8)
Inner Bay of Fundy	NA	0.0	0.0	0.0	0.0
Labrador Central	NA	1.1 (0, 3.5)	0.0	0.0	0.7 (0.0, 2.7)
Labrador South	NA	14.6 (9.5, 20.7)	0.0	16.7 (0, 42.5)	13.5 (8.9, 18.8)
Lake Melville	NA	1.5 (0.1, 4.1)	0.0	17.9 (0.9, 46)	2.9 (0.9, 6)
Newfoundland 1	NA	0.0	0.0	0.0	0.0
Newfoundland 2	NA	0.0	0.0	0.0	0.0
Northern Newfoundland	NA	0.0	0.0	6.5 (0, 24)	0.0
St. Lawrence North Shore-Lower	NA	3.6 (1.2, 7.1)	0.0	7.5 (0.2, 25.2)	3.6 (1.4, 6.8)
Québec City Region	NA	0.0	0.0	0.0	0.0
Saint John River & Aquaculture	NA	0.0	0.0	0.0	0.0
Ungava Bay	NA	3.7 (1.3, 7)	5.9 (0.2, 20.6)	0.0	3.6 (1.5, 6.7)
Maine, United States	NA	0.6 (0, 2.2)	0.0	0.6 (0, 2.2)	0.5 (0.0, 1.9)
Western Newfoundland	NA	0.0	0.0	0.0	0.0
Western Nova Scotia	NA	0.0	0.0	0.0	0.0

Table 5.2.2.7 Bayesian estimates of mixture composition for West Greenland Atlantic Salmon fishery by region and overall for 2021. Baseline locations refer to regional reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. Sample locations are identified by NAFO Divisions. Mean estimates provided with 95% credible interval in parentheses. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are represented as zero and therefore all columns may not add up to 100. Credible intervals with a lower bound of zero, or close to zero, may indicate little support for the mean assignment value. Results for ICES Statistical Area XIV are also shown.

Reporting Group	CO	NAFO 1A	NAF	NAF	NAF	NAF	NAFO 1F	ICES XIV	Overall
Baltic Sea	EU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barents-White Seas	EU	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1 (0, 0.2)
European Broodstock	EU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UK/Ireland	EU	58.9 (23.6,	14.9	14.8	18.3	17.8	16.9 (11.8,	28.7 (9.3,	16.3 (14.5,
France	EU	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1 (0, 0.4)
Greenland	EU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iceland	EU	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.1 (0.0, 0.4)
Northern Norway	EU	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Southern Norway	EU	0.0	0.6	0.0	3.1	0.0	0.0	0.0	1 (0.5, 1.5)
Spain	EU	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2 (0.0, 0.4)
Anticosti	NA	0.0	1 (0,	0.9	1.9	0.0	1.1 (0.1, 3.2)	0.0	1.1 (0.6, 1.8)
Avalon Peninsula	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burin Peninsula	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 (0.0, 0.2)
Eastern Nova Scotia	NA	0.0	0.0	1	0.6	0.0	0.0	0.0	0.7 (0.3, 1.2)
Fortune Bay	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 (0.0, 0.2)
Gaspé Peninsula	NA	0.0	19.9	23.2	18.3	18.2	13 (7.8,	28 (0.7,	20.3 (18,
Gulf of St Lawrence	NA	12.7 (0,	18.8	17.6	11.4	14.6	23 (16.6,	0.0	15.9 (13.8,
Inner Bay of Fundy	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labrador Central	NA	0.0	1.5	3.3	7.3	6.6	0.0	0.0	3.8 (2.6, 5.2)
Labrador South	NA	0.0	16.7	10.9	15.4	25.6	22.9 (16.9,	15.7 (0,	14.5 (12.7,
Lake Melville	NA	0.0	6	3.8	3.8	0.0	4.5 (1.7, 8.5)	0.0	3.9 (2.9, 5.1)
Newfoundland 1	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2 (0.0, 0.6)
Newfoundland 2	NA	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.5 (0.1, 1.1)
Northern Newfoundland	NA	0.0	0.5	0.0	0.6	0.0	0.6 (0, 2.1)	0.0	0.5 (0.2, 0.9)
St. Lawrence North Shore-	NA	15 (0.5,	4.5	8.4	4.8	6	4.1 (1.5, 7.7)	0.0	6.6 (5.4, 8)
Québec City Region	NA	0.0	0.0	2.6	2.3	0.0	0.0	0.0	2.7 (1.7, 3.8)
Saint John River & Aqua-	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 (0.0, 0.4)
Ungava Bay	NA	0.0	8	7.5	6.6	8.8	7.6 (4.3,	6.7 (0.2,	7.4 (6.1, 8.7)
Maine, United States	NA	0.0	4.4	2.1	1.8	0.0	1.7 (0.4, 4.1)	0.0	2.1 (1.4, 3)
Western Newfoundland	NA	0.0	2	2.1	2	0.0	2.3 (0.4, 5.1)	0.0	2 .0 (1.3,
Western Nova Scotia	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.2.2.8 Bayesian estimates of mixture composition for West Greenland Atlantic Salmon fishery by region and overall for 2022. Baseline locations refer to regional reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. Sample locations are identified by NAFO Divisions. Mean estimates provided with 95% credible interval in parentheses. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are represented as zero and therefore all columns may not add up to 100. Credible intervals with a lower bound of zero, or close to zero, may indicate little support for the mean assignment value.

Reporting Group	ROO	NAFO	NAFO	NAFO	NAFO 1E	NAFO 1F	Overall
Baltic Sea	EUR	0.0	0.0	0.0	0.0	0.0	0.0
Barents-White Seas	EUR	0.0	0.0	0.0	0.0	0.0	0.0
European Broodstock	EUR	0.0	0.0	0.0	0.0	0.0	0.0
UK/Ireland	EUR	0.0	7.8	2.5	9.7 (2.2, 21.7)	13.5 (3.1, 29.8)	5.6 (4, 7.5)
France	EUR	0.0	0.0	0.0	0.0	0.0	0.0
Greenland	EUR	0.0	0.0	0.4	0.0	0.0	0.2 (0.0, 0.6)
Iceland	EUR	0.0	0.3	0.0	0.0	4.3 (0.1, 15.2)	0.3 (0.0, 0.8)
Northern Norway	EUR	0.0	0.0	0.0	0.0	0.0	0.0
Southern Norway	EUR	3.8	0.0	0.0	0.0	0.0	0.2 (0.0, 0.8)
Spain	EUR	3.4	0.0	0.0	0.0	0.0	0.0
Anticosti	NA	0.0	0.0	0.0	0.0	0.0	0.0
Avalon Peninsula	NA	0.0	0.0	0.0	0.0	0.0	0.0
Burin Peninsula	NA	3.2	0.4	0.0	0.0	0.0	0.3 (0.0, 1)
Eastern Nova Scotia	NA	0.0	0.8	0.0	0.0	0.0	0.6 (0.1, 1.5)
Fortune Bay	NA	0.0	1.2	0.0	0.0	0.0	0.4 (0, 1.2)
Gaspé Peninsula	NA	15.9	22.2	32	20.4 (7.5, 36.6)	22.9 (6.9, 45.2)	26.9 (23.2, 30.7)
Gulf of St Lawrence	NA	24.2	12.7	13.5	26.4 (12.5, 44.2)	22.1 (5.7, 42.7)	14.5 (11.7, 17.6)
Inner Bay of Fundy	NA	0.0	0.0	0.0	0.0	0.0	0.0
Labrador Central	NA	0.0	5.3	7	0.0	0.0	5.3 (3.3, 7.7)
Labrador South	NA	15.5	17.2	12.3	18.6 (6.7, 33.9)	4.6 (0.1, 15.9)	14.2 (11.3, 17.4)
Lake Melville	NA	3.9	1.2	7.5	3.5 (0, 13.5)	0.0	4.5 (2.9, 6.4)
Newfoundland 1	NA	0.0	0.0	1.5	0.0	0.0	0.7 (0.1, 1.6)
Newfoundland 2	NA	3 (0,	0.4	0.0	0.0	0.0	0.2 (0.0, 0.9)
Northern Newfoundland	NA	3.5	3.8	0.0	0.0	0.0	2.4 (1.3, 3.7)
St. Lawrence North Shore-Lower	NA	0.0	4.8	3.9	2.8 (0, 11.1)	0.0	4.2 (2.7, 5.9)
Québec City Region	NA	19.4	3.2	6	0.0	0.0	3.9 (2.3, 6)
Saint John River & Aquaculture	NA	0.0	0.0	0.0	0.0	0.0	0.0
Ungava Bay	NA	0.0	11.7	2.5	9.4 (2.1, 21.3)	8.8 (1.2, 22.7)	7.2 (5.4, 9.3)
Maine, United States	NA	0.0	1.3	4.4	3.3 (0.1, 12.1)	8.7 (1.1, 22.7)	3 (1.8, 4.5)
Western Newfoundland	NA	0.0	5.4	5.6	0.0	5.3 (0, 18.7)	5.1 (3.5, 7.1)
Western Nova Scotia	NA	0.0	0.0	0.0	0.0	0.0	0.0

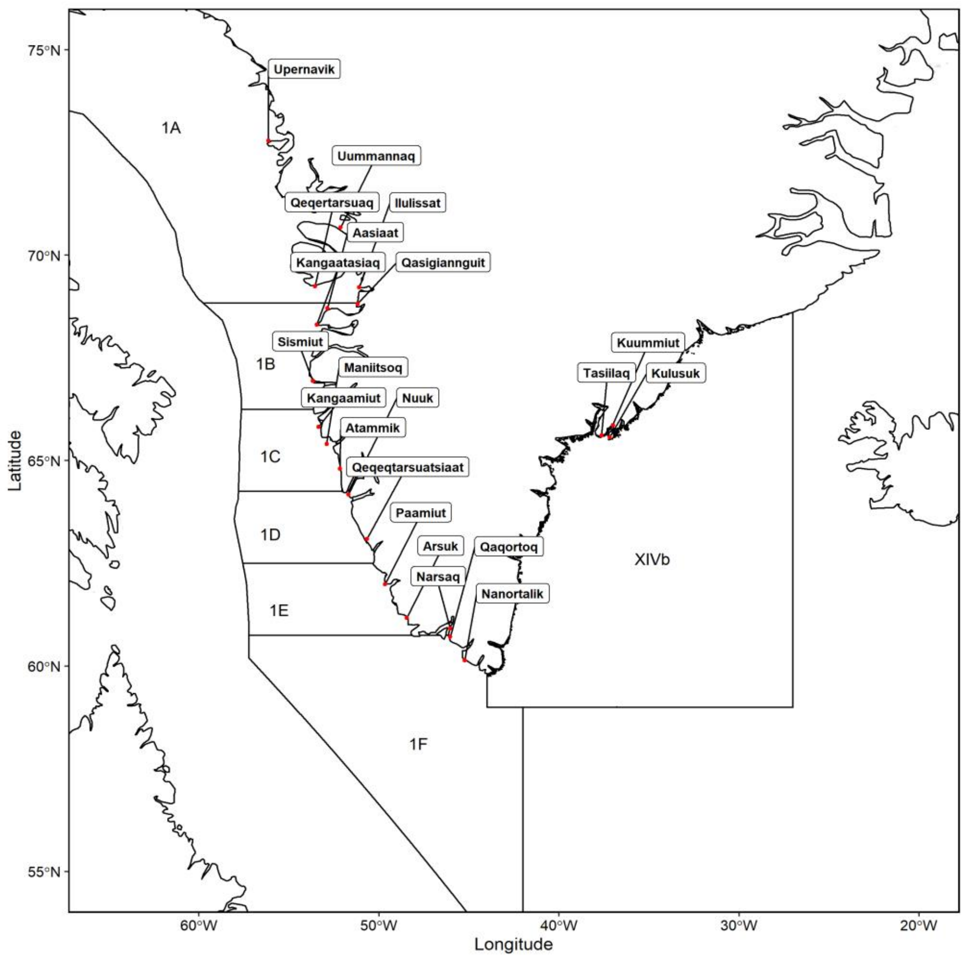


Figure 5.1.1.1. Map of south Greenland showing communities to which Atlantic salmon have historically been landed and corresponding NAFO divisions and ICES Statistical Areas.

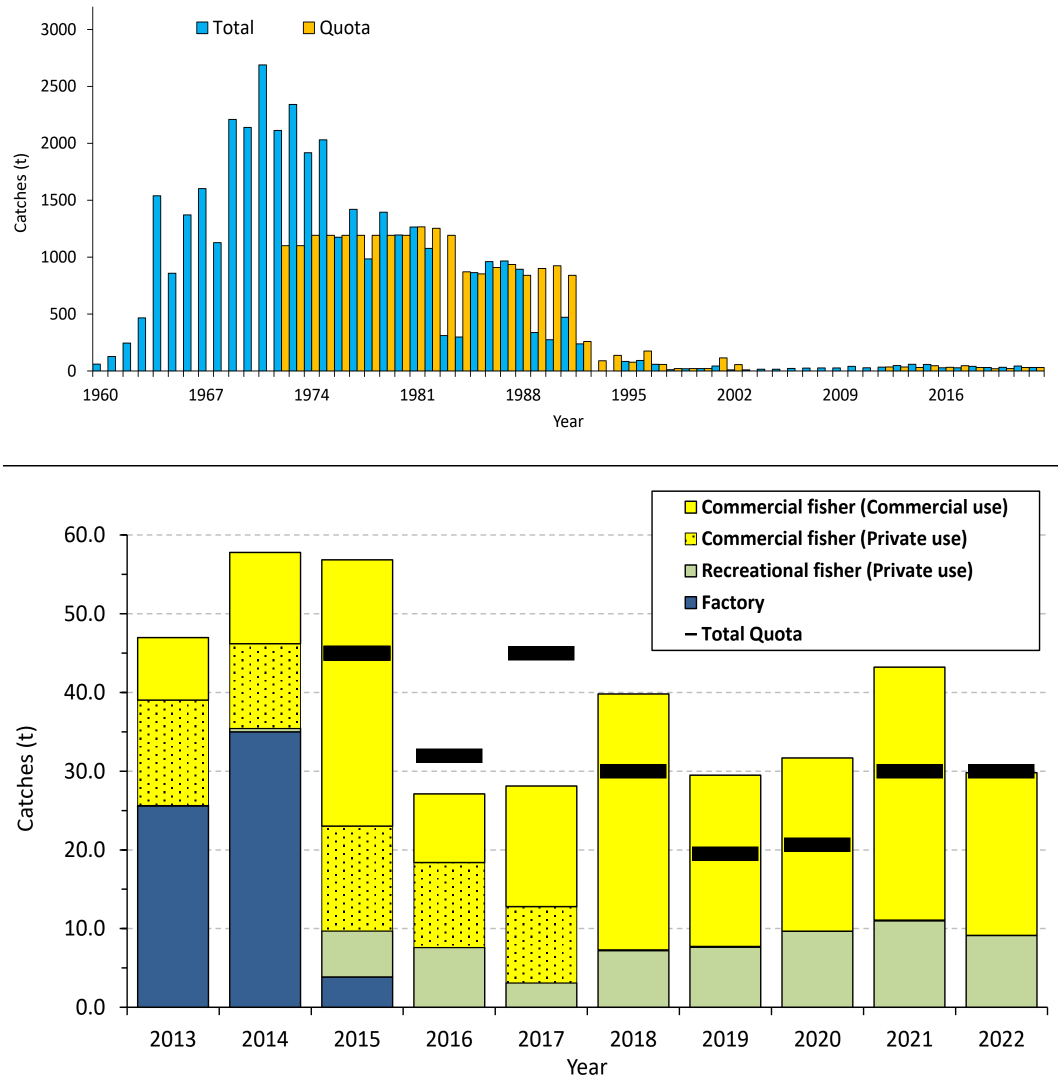


Figure 5.1.1.2. Nominal catches and commercial quotas (t, round fresh weight) of salmon at Greenland for 1960–2022 (top panel) and 2013–2022 (bottom panel). Total reported landings from 2013–2022 are displayed by landings type. A factory only quota was set from 2012–2014 and a single quota for all components of the fishery was applied starting in 2015. From 2016-2020 the overall quota was adjusted annually to account for overharvest the previous year. All fishers are required to have a licence to fish for Atlantic salmon starting in 2018.

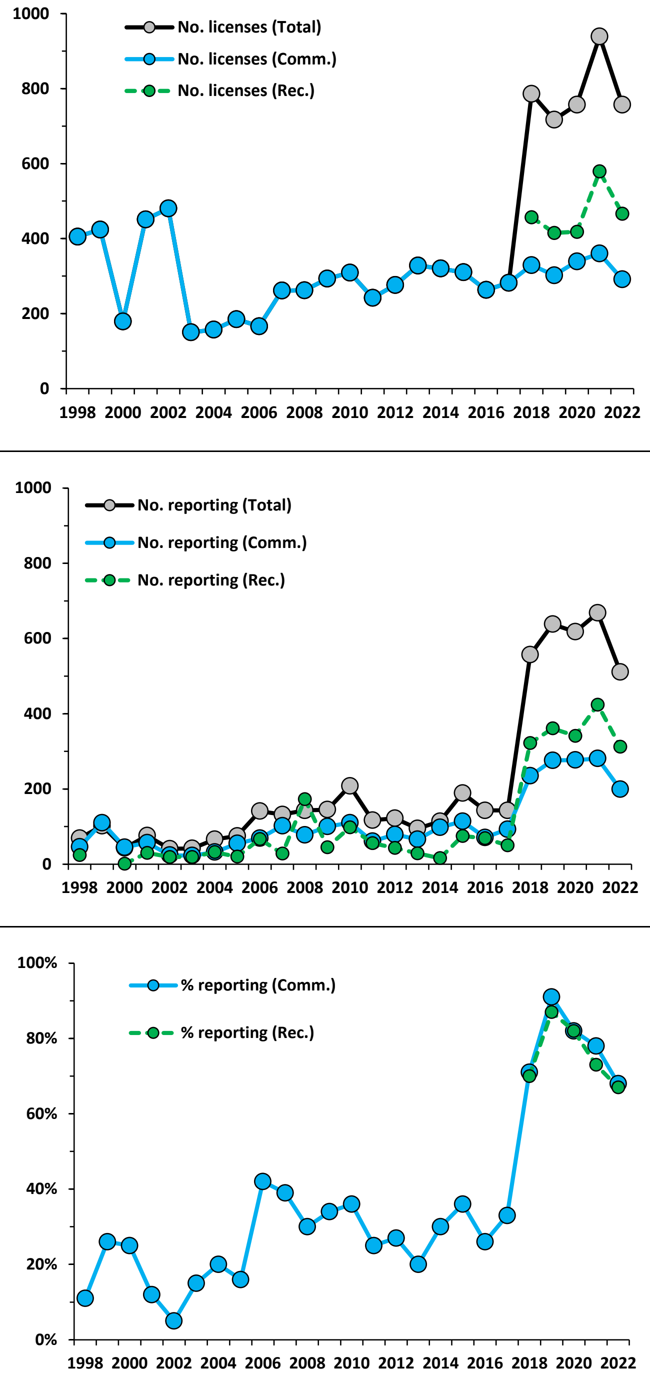
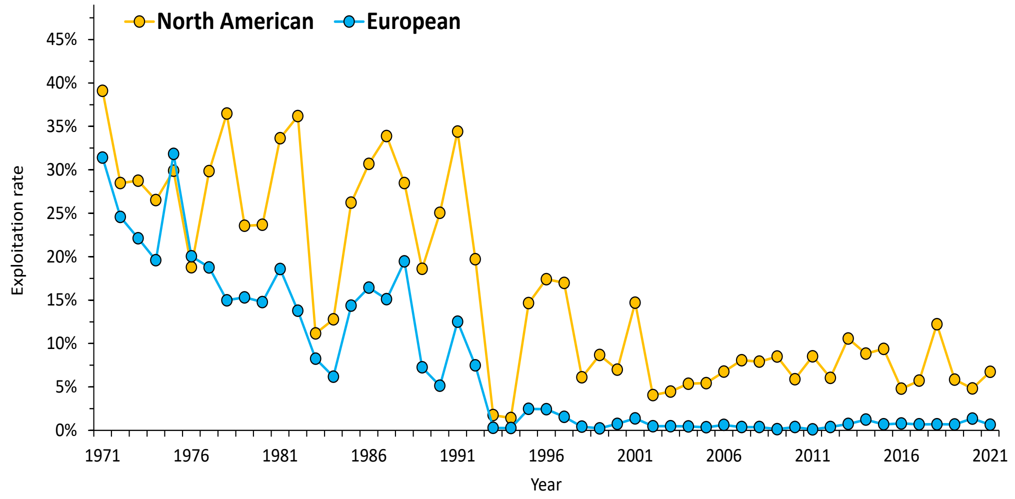


Figure 5.1.1.3. Number of licences issued by license type (top), number of fishers reporting by license type (middle) and percent of licensed fishers reporting by license type (bottom). Detailed statistics are available from 1998 to the present. Starting in 2018 all fishers were required to have a license.



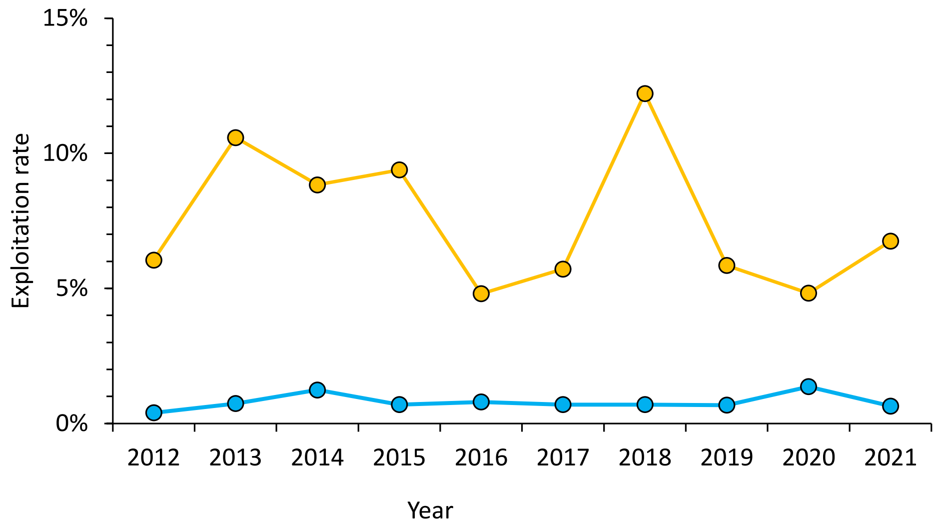


Figure 5.1.3.1. Exploitation rate (%) for NAC 1SW non-maturing and Southern NEAC non-maturing Atlantic salmon at West Greenland, 1971–2021 (top) and 2012–2021 (bottom). Exploitation rate estimates are only available to 2021, as 2022 exploitation rates are dependent on 2023 returns. Unreported catch is included.

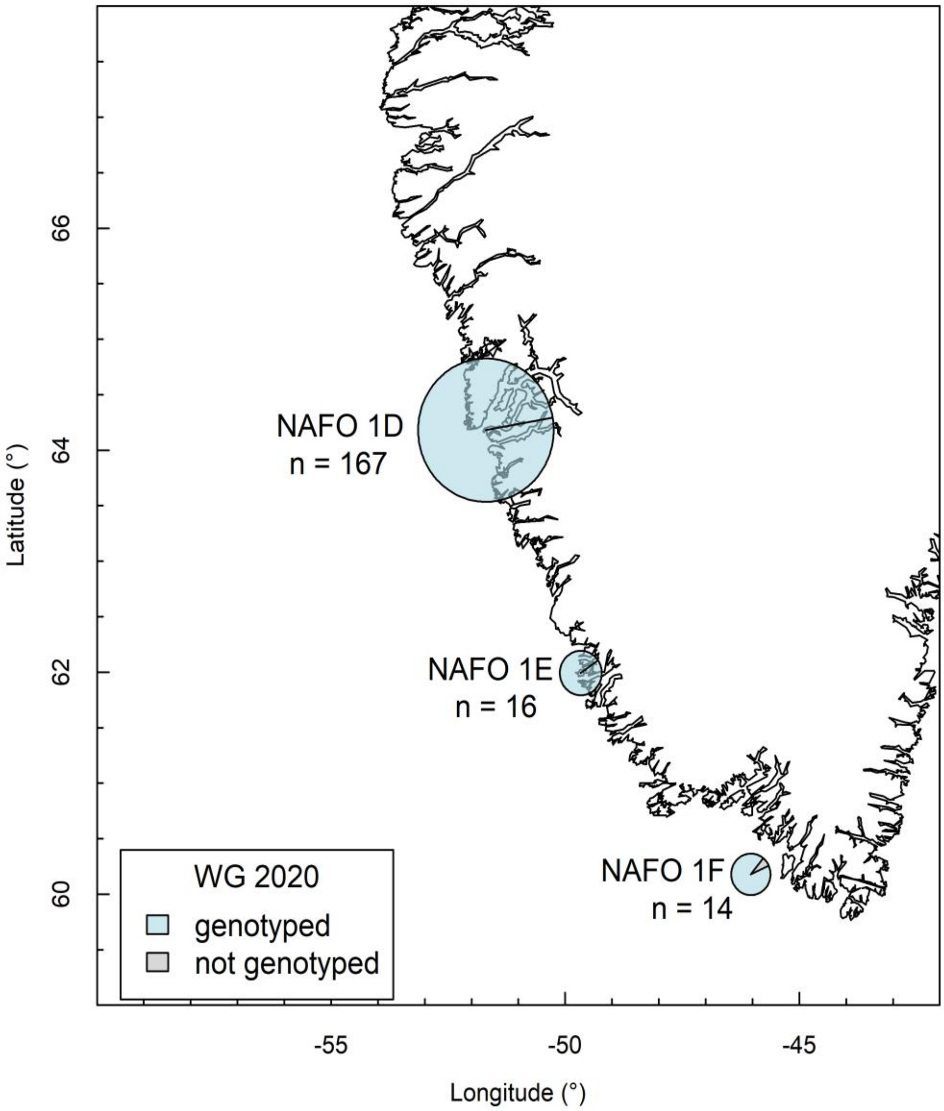


Figure 5.2.2.1. Map showing total samples and subsamples for West Greenland Atlantic Salmon fishery 2020 SNP-based analyses to estimate continent and region of origin. Pie charts are scaled to sample size and blue and grey areas represent the proportions genotyped and not genotyped.

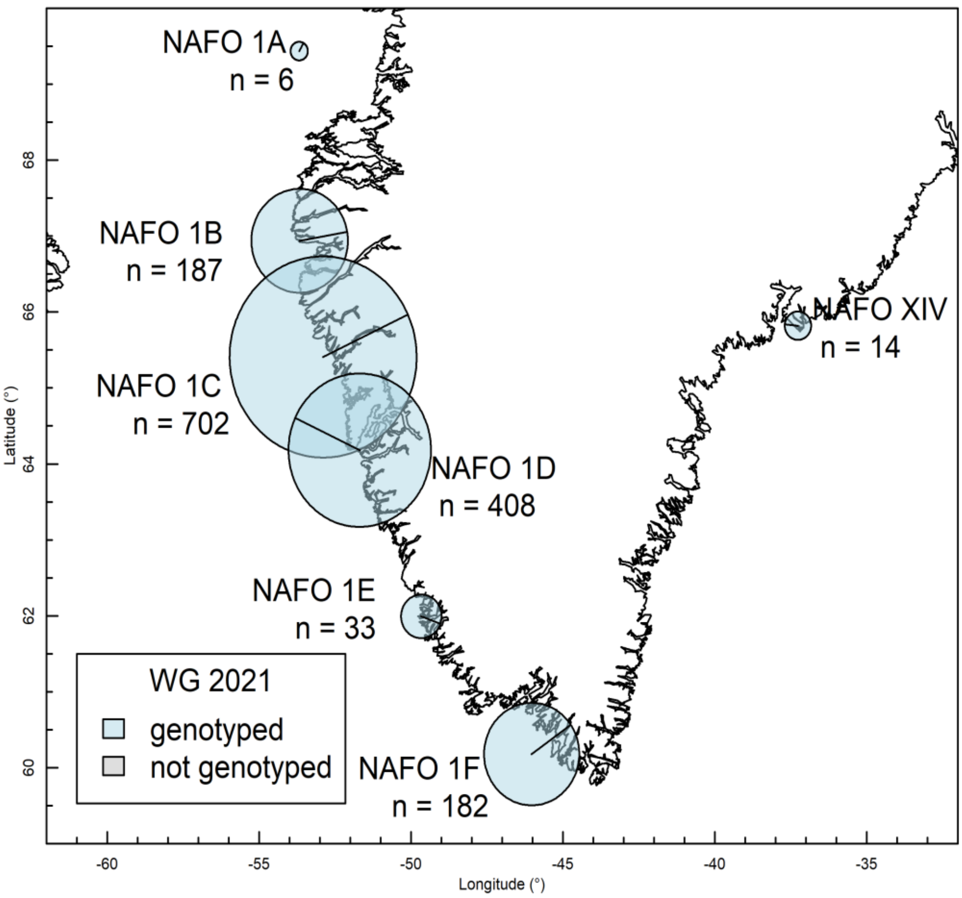


Figure 5.2.2.2. Map showing total samples and subsamples for West Greenland Atlantic Salmon fishery 2021 SNP-based analyses to estimate continent and region of origin. Pie charts are scaled to sample size and blue and grey areas represent the proportions genotyped and not genotyped.

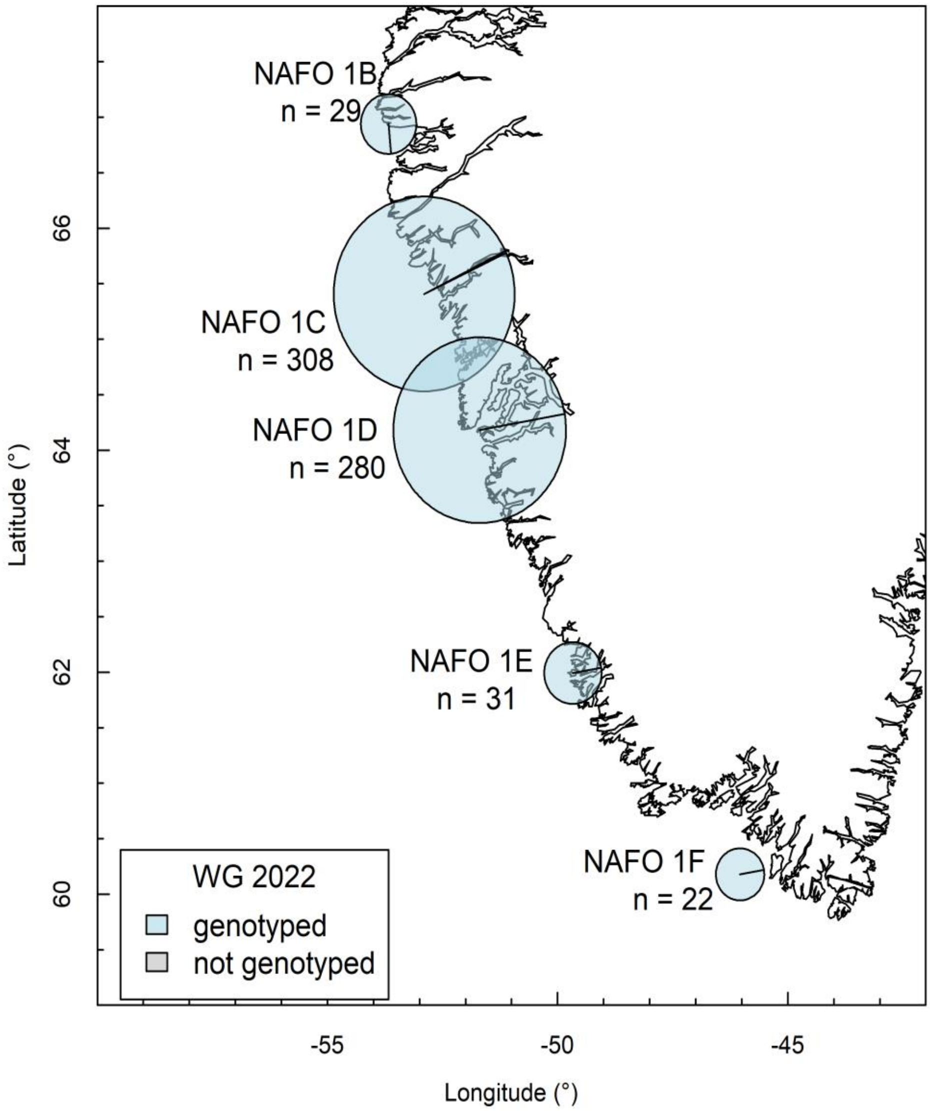


Figure 5.2.2.3. Map showing total samples and subsamples for West Greenland Atlantic Salmon fishery 2022 SNP-based analyses to estimate continent and region of origin. Pie charts are scaled to sample size and blue and grey areas represent the proportions genotyped and not genotyped.

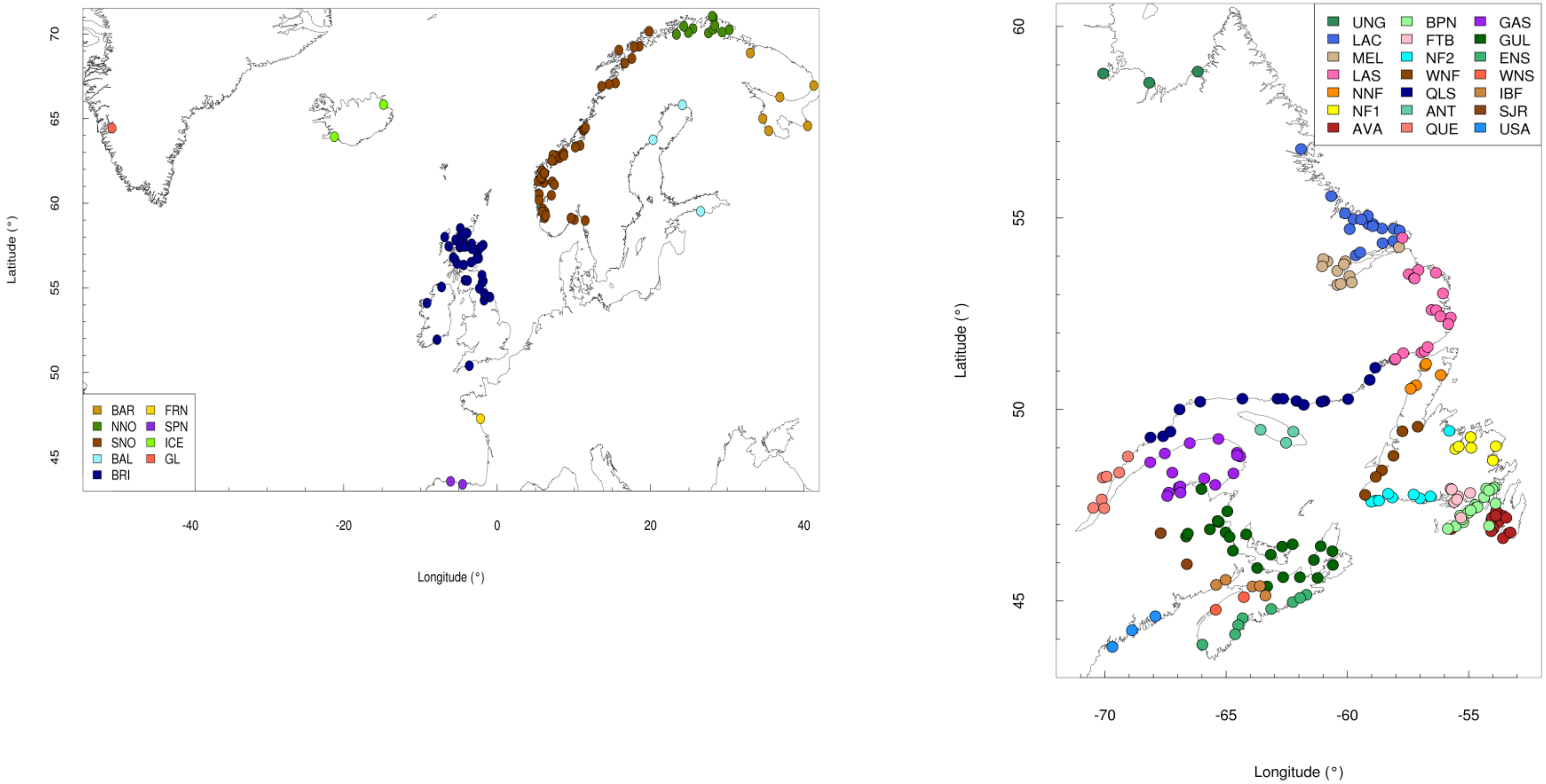


Figure 5.2.2.4. Map of sample locations for the SNP-based genetic baseline for European (top) and North American (bottom) reporting groups. The EUB (European Broodstock) reporting group does not have a geographic location and is therefore not represented on the top map. See Table 5.2.2.1 for location abbreviations.

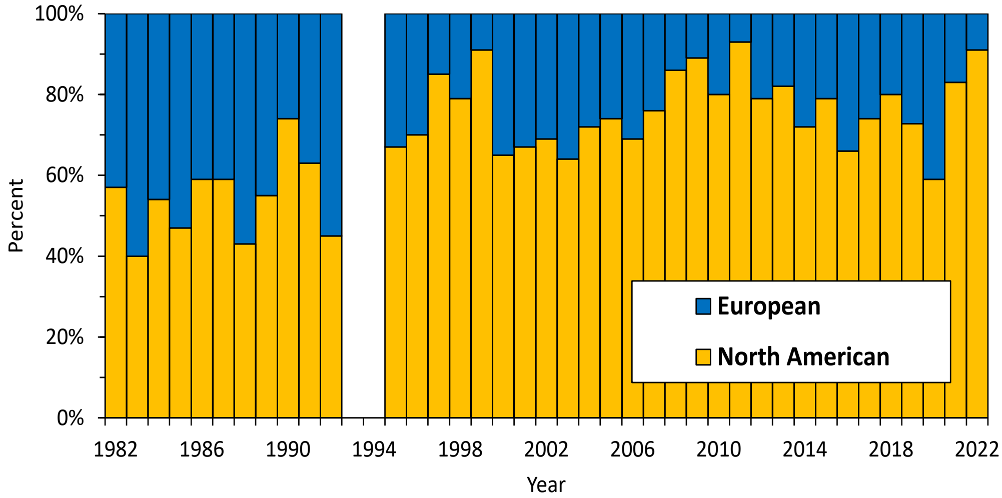
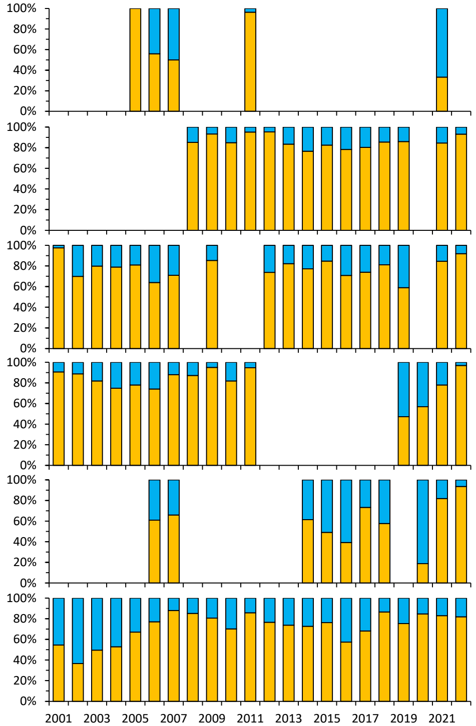


Figure 5.2.2.5. Percent of the sampled catch by continent of origin for 1982 to the present. Sampling did not occur in 1993 and 1994.



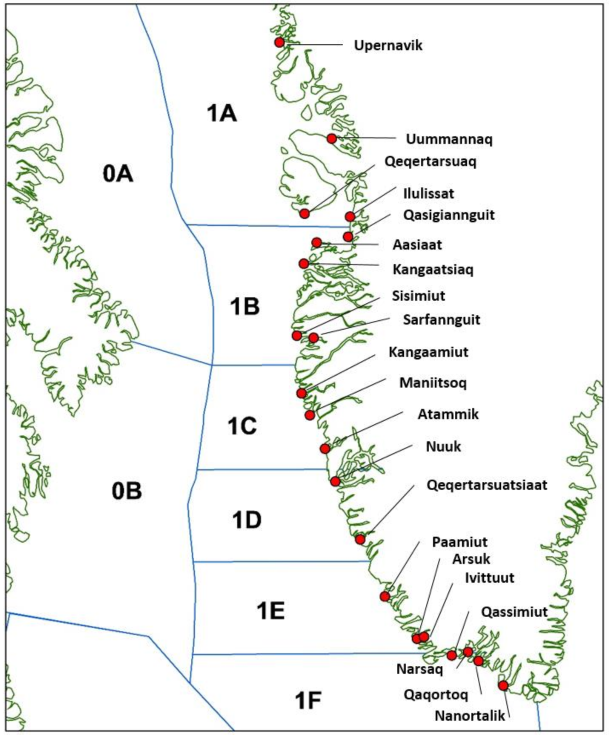
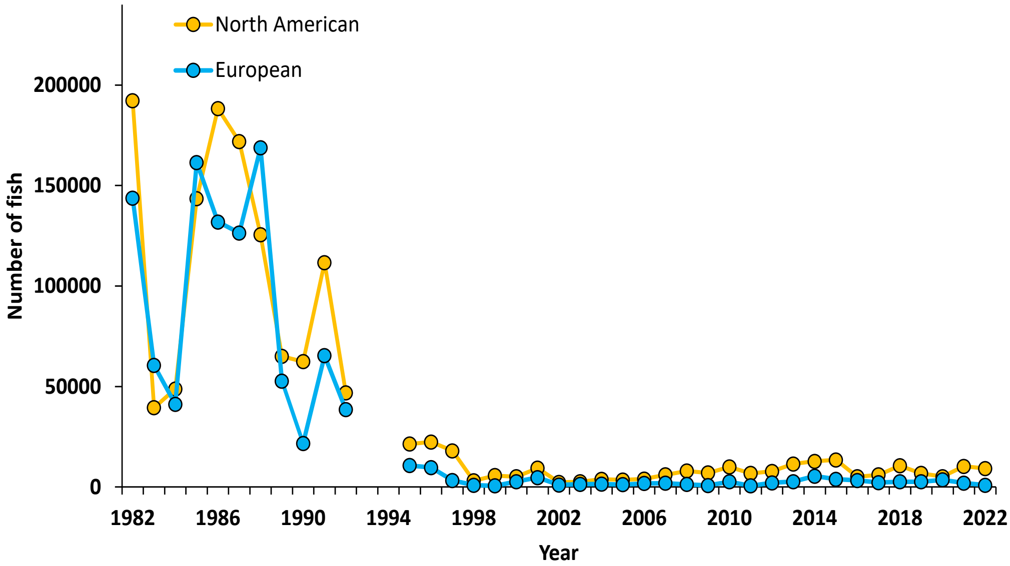


Figure 5.2.2.6. Percentage of North American (orange) and European (blue) origin Atlantic salmon sampled from Greenland fisheries by year (2001–2022) and NAFO Division. The northernmost NAFO Division (1A) is the top graph and southernmost (1F) is the bottom graph. Where data are presented, samples were collected during that year and within that NAFO Division.



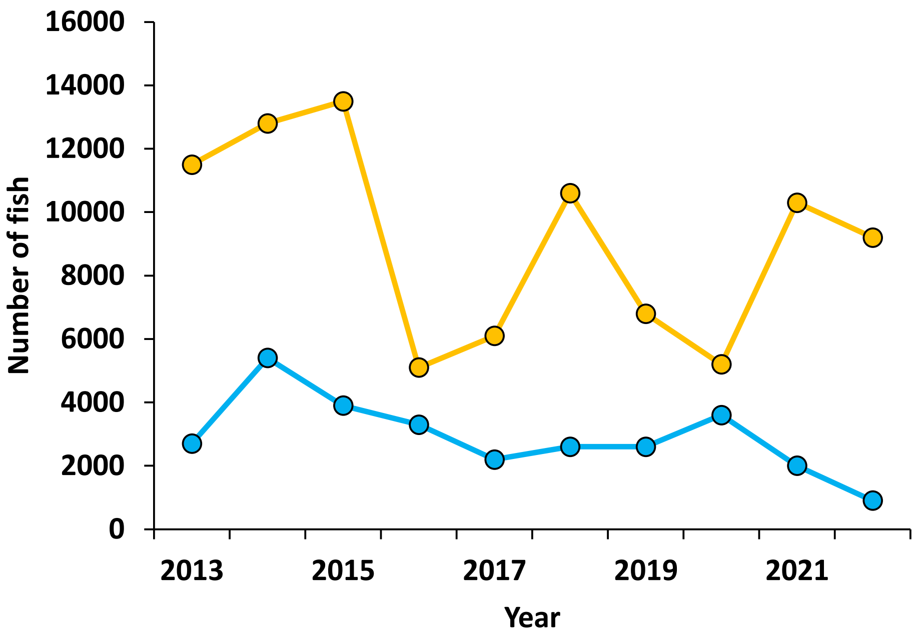


Figure 5.2.2.7. Number of North American and European Atlantic salmon caught at West Greenland from 1982–2022 (top) and 2013–2022 (bottom). Estimates are based on continent of origin by NAFO division, weighted by catch (weight) in each division. Numbers are rounded to the nearest 100 fish. Unreported catch not included.

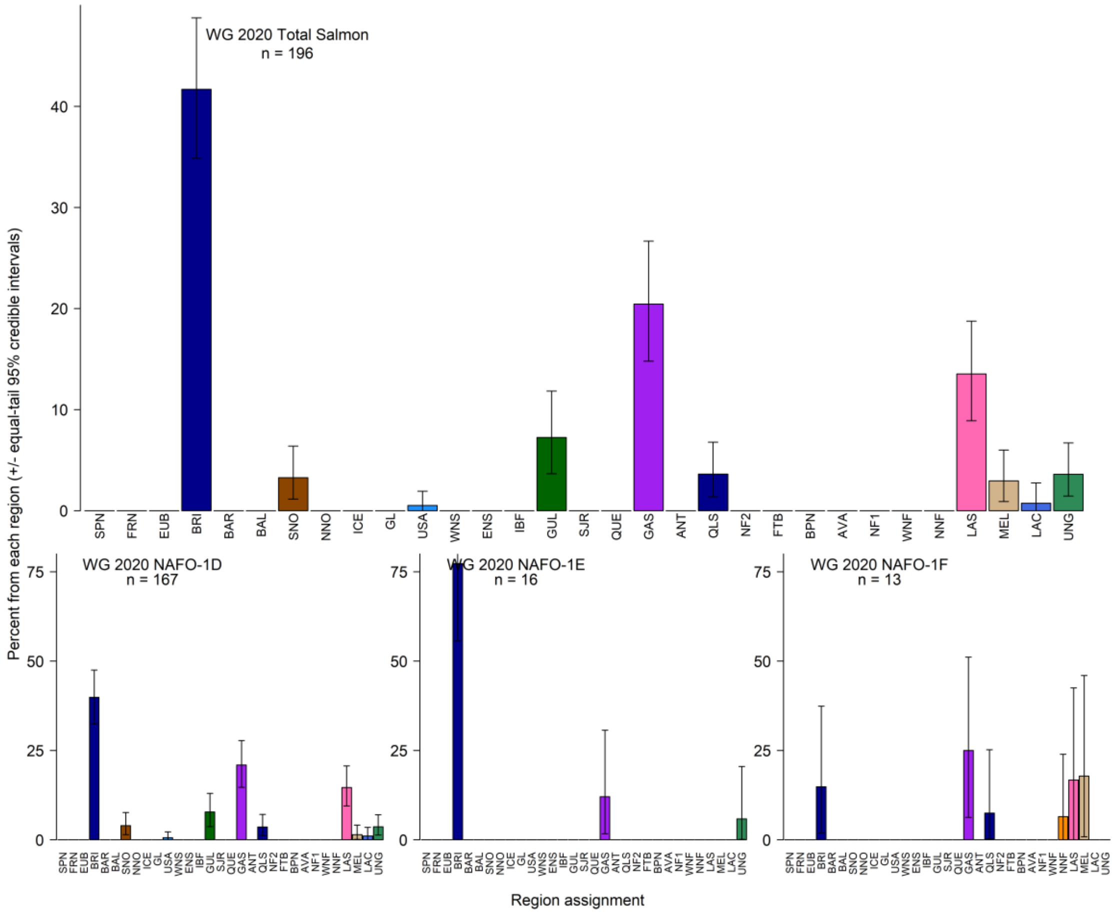


Figure 5.2.2.8. Bayesian estimates of mixture composition of samples from the West Greenland Atlantic salmon fishery for 2020 by region and overall using the SNP baseline. Baseline locations refer to genetic reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. See Table 5.2.2.6 for detailed results. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are not included.

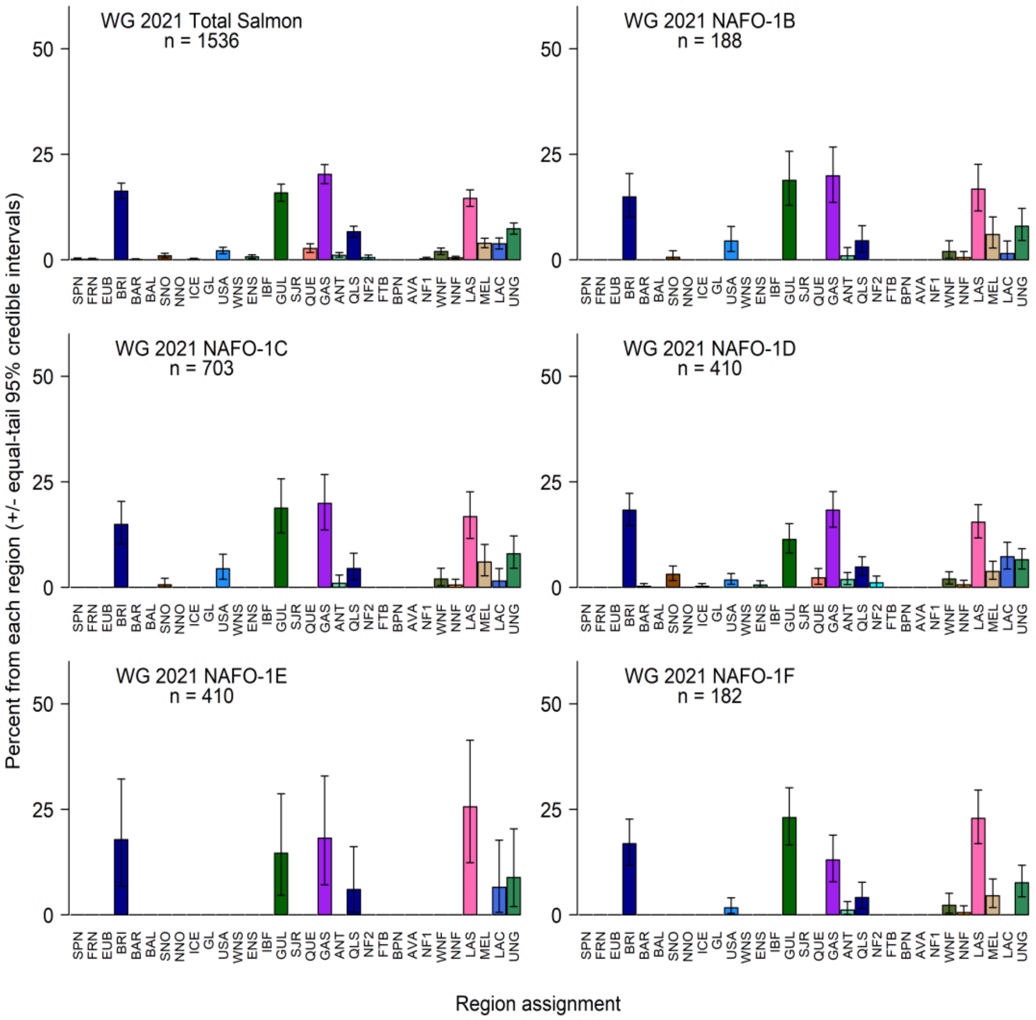


Figure 5.2.2.9. Bayesian estimates of mixture composition of samples from the West Greenland Atlantic salmon fishery for 2021 by region and overall using the SNP baseline. Baseline locations refer to genetic reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. See Table 5.2.2.7 for detailed results. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are not included.

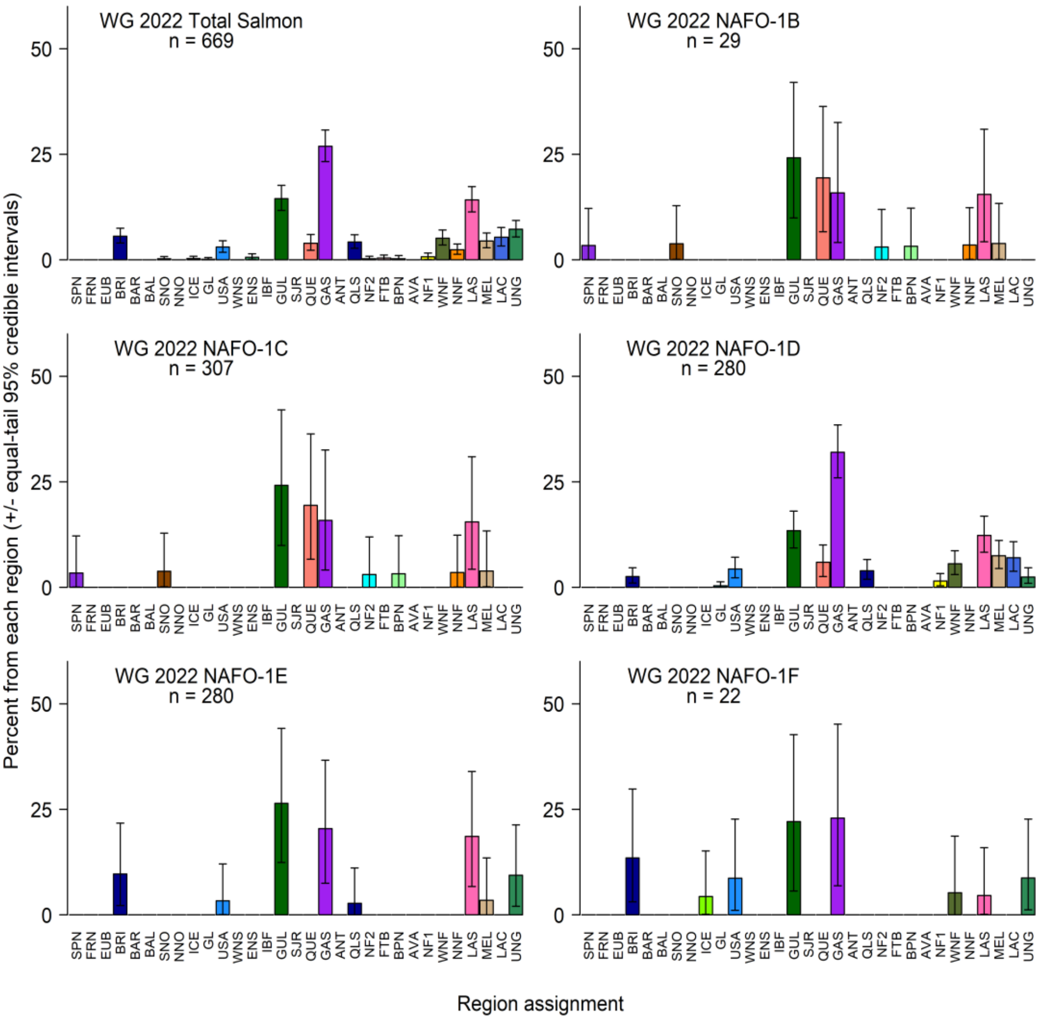


Figure 5.2.2.10. Bayesian estimates of mixture composition of samples from the West Greenland Atlantic salmon fishery for 2022 by region and overall using the SNP baseline. Baseline locations refer to genetic reporting groups identified in Table 5.2.2.1 and Figure 5.2.2.4. See Table 5.22.8 for detailed results. Estimates of mixture contributions not supported by significant individual assignments (P>0.8) are not included.

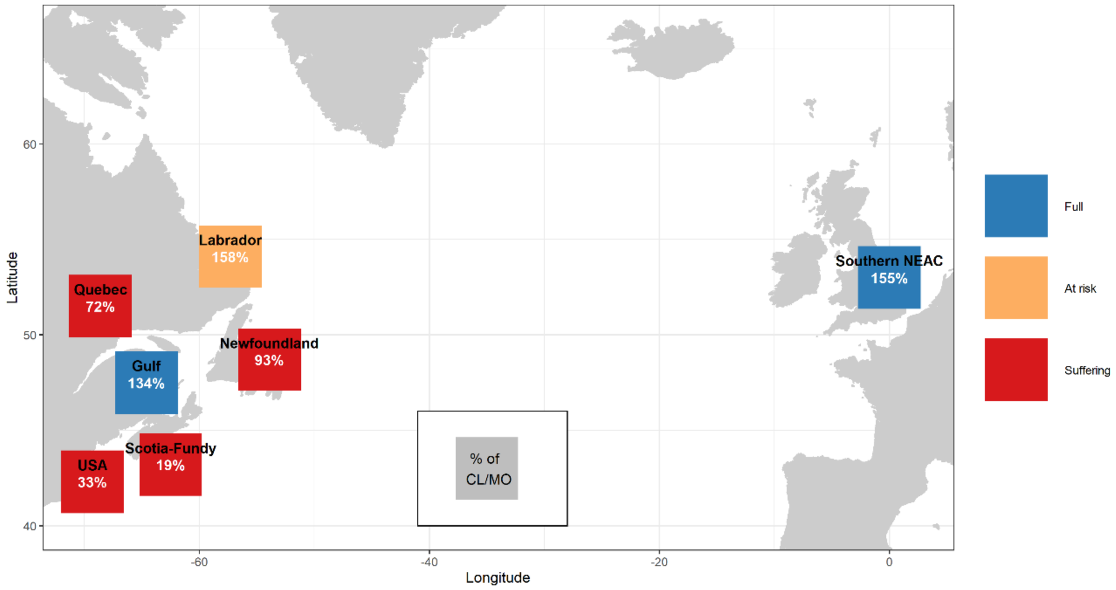


Figure 5.3.1. Summary 2SW (NAC regions) and MSW (Southern NEAC) 2022 median (from the Monte Carlo posterior distributions) spawner estimates in relation to Conservation Limits/Management Objectives (CL/MO). The colour shading represents the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At Risk (at risk of suffering reduced reproductive capacity: median spawner estimate is above the CL, but the 5th percentile is below) and Suffering (suffering reduced reproductive capacity: median spawner estimate is below the CL)

6 Generic ToRs

ToR 5 was to "Address relevant points in the Generic ToRs for Regional and Species Working Groups for each salmon stock complex".

The Working Group considered each of these requests in turn. Table 6.1 summarizes the responses, including reference to report sections where requests have been addressed.

Table 6.1. Summary of the WGNAS considerations of the Generic ToRs.

ToR	WGNAS response
a) Consider and comment on Ecosystem and Fisheries Overviews with a focus on:	
a.i) identifying and correcting mistakes and errors (both in the text, tables and figures), and	WG has not examined the EOs or FOs
a.ii) proposing concrete evidence-based input that is considered essential for the advice but is currently underdeveloped or missing (with references and Data Profiling Tool entries, as appropriate).	WG has not examined the EOs or FOs
b) Conduct an assessment on the stock(s) to be addressed in 2023 using the method (assessment, forecast or trends indicators) as described in the stock annex; - complete and document an audit of the calculations and results; and produce a brief report of the work carried out regarding the stock, providing summaries of the following where relevant:	
b.i) Input data and examination of data quality; in the event of missing or inconsistent survey or catch information refer to the ACOM document for dealing with missing data and the linked template that formulates how deviations from the stock annex are to be reported.	N/A for Covid but WG has resolved missing RF data
b.ii) Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;	See Section 3.3, Annex 9
b.iii) For relevant stocks (i.e. all stocks with catches in the NEAFC Regulatory Area), estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2022.	N/A
b.iv) For category 3 and 4 stocks requiring new advice in 2023, implement the methods recommended by WKLIFE X (e.g. SPiCT, rfb, chr, rb rules) to replace the former 2 over 3 advice rule (2 over 5 for elasmobranchs). MSY reference points or proxies for the category 3 and 4 stocks (guidelines)	N/A, cat 1 stocks
b.v) Evaluate spawning stock biomass, total stock biomass, fishing mortality, catches (projected landings and discards) using the method described in the stock annex;	See Sections 3.3, 4.3, 5.3
b.v.1) for category 1 and 2 stocks, in addition to the other relevant model diagnostics, the recommendations and decision tree formulated by WKFORBIAS (see Annex 2 of https://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/Fisheries%20Resources%20Steering%20Group/2020/WKFORBIAS_2019.pdf) should be considered as guidance to determine whether an assessment remains sufficiently robust for providing advice.	N/A, not requested by NASCO, checked with NEAC FWI, not required for NAC or WGC
b.v.2) If the assessment is deemed no longer suitable as basis for advice, provide advice using an appropriate Category 2- 5 approach as described in ICES technical guidance for harvest control rules and stock assessments for stocks in categories 2 and 3 or ICES.	N/A, cat 1 stocks
b.v.3) If the assessment has been moved to a Category 2-5 approach in the past year consider what is necessary to move back to a Category 1 and develop proposal for the appropriate benchmark process.	N/A, cat 1 stocks

b.vi) Catch scenarios for the year(s) beyond the terminal year of the data for the stocks for which ICES has been requested to provide advice on fishing opportunities;	N/A until year of new catch advice
b.vii) Historical and analytical performance of the assessment and catch options with a succinct description of associated quality issues. For the analytical performance of category 1 and 2 age-structured assessments, report the mean Mohn's rho (assessment retrospective bias analysis) values for time series of recruitment, spawning stock biomass, and fishing mortality rate. The WG report should include a plot of this retrospective analysis. The values should be calculated in accordance with the "Guidance for completing ToR viii) of the Generic ToRs for Regional and Species Working Groups - Retrospective bias in assessment" and reported using the ICES application for this purpose.	No time to do this in 2023.
c) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines.	Completed
d) Review progress on benchmark issues and processes of relevance to the Expert Group.	
d.i) update the benchmark issues lists for the individual stocks in SID;	Benchmark 2023 will do this
d.ii) review progress on benchmark issues and identify potential benchmarks to be initiated in 2024 for conclusion in 2025;	Benchmark 2023 will do this
d.iii) determine the prioritization score for benchmarks proposed for 2024–2025;	Benchmark 2023 will do this
d.iv) as necessary, document generic issues to be addressed by the Benchmark Oversight Group (BOG)	Benchmark 2023 will do this
e) Prepare the data calls for the next year's update assessment and for planned data evaluation workshops;	Postponed until after benchmark 23, normally done Dec/Jan
f) Identify research needs of relevance to the work of the Expert Group.	See Annex 7
g) Review and update information regarding operational issues and research priorities on the Fisheries Resources Steering Group SharePoint site.	After the WG and ADG
h) If not completed previously, complete the audit spread sheet 'Monitor and alert for changes in ecosystem/fisheries productivity' for the new assessments and data used for the stocks. Also note in the benchmark report how productivity, species interactions, habitat and distributional changes, including those related to climate-change, could be considered in the advice.	Not in 2023; defer to the benchmark
i) Deliver conservation status advice in accordance with the "Technical Guidelines on the conservation status advice".	Drafted for ADG consideration
j) Update SAG and SID with final assessment input and output	N/A until next catch advice year

Annex 1: List of Working Papers submitted to WGNAS 2023

The table below lists the working documents presented to WGNAS 2023.

WP No.	Authors	Title
01	Nygaard, R.	The salmon fishery in Greenland 2022
02	Sheehan, T. F., Coyne, J., Davies, G., Deschamps, D., Haas-Castro, R., Quinn, P., Vaughn, L., Nygaard, R., Bradbury, I. R., Robertson, M. J., Ó Maoiléidigh, N. and Carr, J.	The International Sampling Program: Continent of Origin and Biological Characteristics of Atlantic Salmon Collected at West Greenland in 2021 and 2022
03	Bardarson, H., Gudbergsson, G., Jonsson, I.R., and Sturlaugsson, J.	National Report for Iceland: The 2022 Salmon Season
05	Erkinaro, J., Orell, P., Falkegård, M., Kylmäaho, M., Johansen, N., Haantie, J., Pohjola, J.-P. and Kuusela, J.	Status of Atlantic salmon stocks in the rivers Teno/Tana and Näätämöjoki/Neidenelva, Finland/Norway
06	Fiske, P., Wennevik, V., Jensen, A.J., Utne, K.R., and Bolstad, G.	Atlantic salmon; National Report for Norway 2021 and 2022
07	Ahlbeck Bergendahl, I. and Jones, D.	Fisheries, Status and Management of Atlantic Salmon stocks in Sweden: National Report for 2022
09	Jacobsen, J.A.	Status of the fisheries for Atlantic salmon and production of farmed salmon in 2022 for the Faroe Islands
10	Kelly, S., Millane, M., Maxwell, H., Ó Maoiléidigh, N., Gargan, P., White, J., O'Higgins, K., Fitzgerald, C., Dillane, M., McGrory, T., Bond, N. McLaughlin, D., Rogan, G., Cotter, D. & Poole, R..	National Report for Ireland - The 2022 Salmon Season
11	Marine Scotland Science, Salmon and Freshwater Fisheries	National Report for UK (Scotland): 2022 season
12	Cefas, Environment Agency and Natural Resources Wales	Salmon stocks and fisheries in UK (England and Wales), 2022
13	Ensing, D., and Kennedy, R.	Summary of Salmon Fisheries and Status of Stocks in Northern Ireland for 2022
14	Buoro, M.	National report France including Saint Pierre and Miquelon 2022
16	de la Hoz, J.	Salmon Fisheries and Status of Stocks in Spain (Asturias-2022)
17	April, J. and Cauchon, V.	Status of Atlantic salmon Stocks in Québec in 2022
18	Cauchon, V., Giacomazzo, M. and April, J..	Evolution of freshwater and marine survival for the two index populations in Québec

WP No.	Authors	Title
19	Kelly, N.I., Robertson, M.J., Burke, C., Duffy, S., Poole, R., Bradbury, I., Van Leeuwen, T., Dempson, J.B., Lehnert, S., Lancaster, D. and Loughlin, K.	Status of Atlantic Salmon (*Salmo salar*) Stocks within the Newfoundland and Labrador Region (Salmon Fishing Areas 1–14B), Canada in 2022
20	G. Dauphin, C. Breau, A. Daigle, S. Douglas, G. Goguen, M. Horsman, S. Roloson	Status of Atlantic salmon in Gulf Region (Canada) Salmon Fishing Areas 15 to 18 to 2022
21	Taylor, A.D. and D. Hogan	Status of Atlantic salmon in Canada's Maritimes Region (Salmon Fishing Areas 19 to 21, and 23).
22	Hawkes, J., Kocik, J., Atkinson, E., Sweka, J. and Sheehan, T.F.	National Report for the United States, 2022
23	Robertson, M. *et al*.	Catch Statistics and Aquaculture Production Values for Canada: preliminary 2022, final 2021
24	Kennedy, R. et al	SeaMonitor Project update
25	Staveley, T., Ahlbeck Bergendahl, I.	Pink salmon in Sweden
26	Gregory, S. & Rivot, E.	SAMARCH Project Update
27	Robertson M.J. et al.	Canadian ESRF Migration Project Update
28	Sheehan, T.F., Gargan, P., Kerr, B., Nevoux, M., Ravn, M., Nygaard, R., Bradbury, I.R., 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 2020 and 2021
29	Sheehan, T.F., Carr, J., Chafe, G., Perry, H., Robertson M.J. and Bradbury, I.R.	Update on Pop-off Satellite Tagging Atlantic Salmon at Greenland (2018-2022)
30	Meerburg, D.J.	Update on Atlantic Salmon Federation Acoustic Tagging Program in Gulf of St. Lawrence, Canada
31	Ounsley et al	Data deficiencies: Russian data

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Annex 3: List of participants

Member	Country
Ida Ahlbeck Bergendahl	Sweden
Julien April	Canada
Jan Arge Jacobsen	Faroe Islands
Hlynur Bárðarson	Iceland
Geir Bolstad	Norway
Cindy Breau	Canada
Colin Bull	UK
Mathieu Buoro	France
Gérald Chaput	Canada
Anne Cooper	Denmark (ICES)
Guillaume Dauphin	Canada
Sophie Elliott	Chair-invited Member
Dennis Ensing	UK (Northern Ireland)
Jaakko Erkinaro	Finland
Peder Fiske	Norway
Marko Freese	Germany
Jonathan Gillson	UK (England and Wales)
Stephen Gregory	UK (England and Wales)
Derek Hogan	Canada
Niels Jepsen	Denmark
Séan Kelly	Ireland
Richard Kennedy	Northern Ireland
MacKenzie Kermoade	Denmark (ICES)
Clément Lebot	France
Hugo Maxwell	Ireland
David Meerburg	Canada
Michael Millane	Ireland

Member	Country
Rasmus Nygaard	Greenland
James Ounsley	UK (Scotland)
Rémi Patin	France
Etienne Rivot	France
Martha Robertson (Chair)	Canada
Kjell Rong Utne	Norway
Timothy Sheehan	USA
Tom Staveley	Sweden
Andrew Taylor	Canada
Alan Walker (Chair)	UK (England and Wales)
Vidar Wennevik	Norway
Jonathan White	Ireland

Annex 4: Reported nominal catch of salmon in numbers and weight

Reported nominal catch of salmon in numbers and weight (tonnes round fresh weight) by sea-age class. Catches reported for 2022 may be provisional. Methods used for estimating age composition given in footnote.

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Canada (6)																	
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Canada (6)	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	157
	2009	42943	74									11226	52			54169	126
	2010	58531	100									10972	53			69503	153

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Canada (6)	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			52927	118
	2015	48838	86									11473	54			60311	140
	2016	45265	79									11716	56			56981	135
	2017	31314	55									11563	55			42877	110
	2018	21802	39									8548	39			30350	78
	2019	30759	53									9774	47			40533	100
	2020	63156										33825				96981	
	2021	80128										27472				107600	
	2022	61684										32502				94186	
Denmark																	
	2020															1946	9
	2021	2225										2849				5774	
	2022	1571										3900				5935	
Faroes																	

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Faroes	1983	9086		101227		21663		448		29						132453	625
	1984	4791		107199		12469		49								124508	651
	1985	324		123510		9690								1653		135177	598
	1986	1672		141740		4779		76						6287		154554	545
	1987	76		133078		7070		80								140304	539
	1988	5833		55728		3450		0								65011	208
	1989	1351		86417		5728		0								93496	309
	1990	1560		103407		6463		6								111436	364
	1991	631		52420		4390		8								57449	202
	1992	16		7611		837										8464	31
	1993			4212		1203										5415	22
	1994			1866		206										2072	7
	1995			1807		156										1963	6
	1996			268		14										282	
	1997																
	1998	339		1315		109										1763	6
	1999																

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Faroes	2000	225		1560		205										1990	8
	2001	0		0		0										0	
	2002	0		0		0										0	
	2003	0		0		0										0	
	2004	0		0		0										0	
	2005	0		0		0										0	
	2006	0		0		0										0	
	2007	0		0		0										0	
	2008	0		0		0										0	
	2009	0		0		0										0	
	2010	0		0		0										0	
	2011	0		0		0										0	
	2012	0		0		0										0	
	2013	0		0		0										0	
	2014	0		0		0										0	
	2015	0		0		0										0	
	2016	0		0		0										0	

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Faroes	2017	0		0		0										0	
	2018	1		1		1										0	
	2019	0		0		0										0	
	2020	0	0	0	0	0	0									0	0
	2021	0	0	0	0	0	0									0	0
	2022	0	0	0	0	0	0									0	0
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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Finland	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	45
	1997	10341	15	2419	10	1674	15	141	2	22	1			418	3	15015	46
	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	93
	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	38
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Finland	2009	9960	13	1585	5	1252	11	223	3	0	0			899	5	13919	37
	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	57
	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	50
	2017	2533	5	1642	7	1349	14	116	2	3	0			530	3	28973	31
	2018	6699	11	849	4	393	4	43	1	0	0			719	5	8703	25
	2019	2628	4	2205	8	310	3	27	1	4	0			727	5	5901	21
	2020	2064	3	477	2	746	7	30	0					488	3	4293	19
	2021	90	0									120	1			210	2
	2022	191	0									125	1			316	1
France (4,7)																	
	1987	6013	18									1806	9			7819	27
	1988	2063	7									4964	25			7027	32

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
France (4,7)	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	9
	1996	2063	5	1891	9	52	0									4006	14
	1997	1060	3	964	5	37	0									2061	8
	1998	2065	5	824	4	22	0									2911	9
	1999	690	2	1799	9	32	0									2521	11
	2000	1792	4	1253	6	24	0									3069	10
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
	2006	1763	3									1785	9			3548	12
	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	8
	2011	1145	3									2126	9			3271	12
	2012	1010	2									1669	7			2679	9
	2013	1457	3									1679	7			3136	10
	2014	1469	3									2159	9			3628	12
	2015	1239	3									2435	9			3674	12
	2016	1017	2									972	4			1989	6
	2017	1524	4									986	5			2510	9
	2018	1071	4									1678	7			2749	11
	2019	472	2	1094	4	42	0					4	0			3810	14
	2020	469	2	451	2	33	0					1	0			2150	8
	2021	437	2	286	1	20	0					3	0			1550	6
	2022	229	1	622	2	10	0					784	3			1806	7

Country	Year	1SW No.	1SW Wt	2SW No.	2SW Wt	3SW No.	3SW Wt	4SW No.	4SW Wt	5SW No.	5SW Wt	MSW(1) No.	MSW(1) Wt	PS No.	PS Wt	Total No.	Total 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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Greenland	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	14
	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	27
	2009	7442	27	268	1	0	0							328	1	8038	29
	2010															11579	40
	2011															8088	28
	2012															9622	33
	2013															14030	47
	2014															17440	58

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
	2015															16855	57
	2016															8522	27
	2017															8023	28
	2018															12864	40
	2019																30
	2020															10138	32
	2021															14136	43
	2022															9712	31
Iceland (3)																	
	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	146
	1996	26927	66	9785	52											36712	118
	1997	21684	56	8178	41											29862	97
	1998	32224	81	7272	37											39496	118

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Iceland (3)	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	98
	2004	32600	84	6128	28											38728	112
	2005	39980	101	5941	28											45921	129
	2006	29857	71	5635	23											35492	94
	2007	31899	74	3262	15											35161	89
	2008	44391	106	5129	26											49520	132
	2009	43981	103	4561	24											48542	127
	2010	43457	105	9251	43											52708	148
	2011	28550	74	4854	24											33404	98
	2012	17011	39	2848	12											19859	51
	2013	40412	97	4274	19											44686	116
	2014	13593	29	3317	22											16910	51
	2015	33713	78	3201	16											36914	94

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Iceland (3)	2016	19528	49	5082	23											24610	72
	2017	20229	51	3726	15											23955	66
	2018	18753	48	2661	12											21414	60
	2019	11102	267	2932	10											14034	37
	2020	12875	33	2368	9											15243	42
	2021	28089	73									6864	37			39373	122
	2022	35655	84									7635	41			45648	131
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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Ireland	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Ireland	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
	2017															26714	72
	2018															17866	58
	2019															16521	44
	2020	27168	73									2014	5			52330	141
	2021	28983	78									3997	11			32980	89
	2022	24792	67									3826	10			28618	77

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Norway (6)																	
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Norway (6)	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	806
	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	697
	2012	81638	162	63985	289	26689	245									172312	696
	2013	70059	117	49264	227	14367	131									133690	475

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Norway (6)	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
	2017	83032	164	67761	307	20913	196									171706	667
	2018	84348	167	62447	289	15247	138									162042	594
	2019	67097	122	53239	244	15889	147									136225	513
	2020	79612	143	52344	239	15868	145									147824	527
	2021	52335	97									50643	289			102978	387
	2022	70899	138									64833	375			135732	513
Russia (5)																	
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Russia (5)	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	132
	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	108
	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	83
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Russia (5)	2011	13779	31	9030	44	747	5	51	0	0	0			171	1	23778	81
	2012	17484	42	6560	34	738	5	53	0	0	0			173	1	25008	82
	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
	2017	5592	14	5930	28	644	4	7	0	0	9			90	0	12263	55
	2018	12626	30	9355	43	820	5	13	0	0	0			232	1	23046	79
	2019	8720	21	6145	30	588	4	15	0	0	0			136	1	15604	113
	2020	8870	20	4399	23	605	5	13	0	0	0			71	0	13958	97
	2021																49
	2022																55
SPM																	
	2019															506	1
	2020															616	2
	2021															690	2
	2022															478	1

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**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	2
	1998	481	1									403	2			884	3
	1999	157	0									986	5			1143	5
	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	7
	2004	1053	3									731	4			1784	7
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Spain (2)	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	7
	2013	111	0									725	4			836	4
	2014	48	0									1160	6			1208	6
	2015	46	0									1048	5			1094	5
	2016	332	1									806	4			1138	5
	2017	140	0									358	2			498	2
	2018	123	0									477	3			600	3
	2019	125	0									866	4			991	4
	2020	244	1									816	4			1060	5
	2021	21	0	492	3							74	0			649	4
	2022	34	0	52	0	3	0					382	2			488	3
Sweden																	
	1990	7430	18									3135	15			10565	33
	1991	8990	20									3620	18			12610	38

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
Sweden	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	19

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
Sweden	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			4287	17
	2016	742	2									1389	7			2131	9
	2017	1093	3									2674	15			4447	18
	2018	1712	4									2027	12			4545	20
	2019	981	2									3168	18			4896	24
	2020	976	2									2082	12			3058	14
	2021	1130	3									1452	8			3262	14
	2022	681	2									1229	7			2645	11
UK (E&W)																	
	1985	62815										32716				95531	361
	1986	68759										42035				110794	430

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
UK (E&W)	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
UK (E&W)	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	9447										13047				22494	86
	2017	4866										7298				12164	49
	2018	5052										6174				11226	42
	2019	497										642				1139	5
	2020	5470	23									7000	29			12470	55

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
UK (E&W)	2021	2512	11									4023	17			6535	28
	2022	2779	12									4089	18			6868	29
UK (NI)																	
	2020															8221	18
	2021															5756	14
	2022															4136	10
UK (Scot)																	
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
UK (Scot)	1992	101676	238									82841	361			184517	599
	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	200
	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	193
	2004	37631	88									36856	159			74033	245
	2005	39093	91									28666	126			67117	215
	2006	36668	75									27620	118			63848	193
	2007	32335	71									24098	100			56433	171
	2008	23431	51									25745	110			49176	161

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
UK (Scot)	2009	18189	37									19185	83			37374	120
	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									9165	39			22824	68
	2016	4220	8									4163	19			8383	27
	2017	3727	8									4419	19			8146	27
	2018	3834	8									2578	12			6412	20
	2019	2480	5									1890	8			4370	13
	2020	19653	41									27532	120			47185	162
	2021	14876	31									22862	102			37738	133
	2022	18742	37									24500	112			43242	149
USA																	
	1982	33		1206		5								21		1265	6
	1983	26		314	1	2								6		348	1

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	**Year**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**	**No.**	**Wt**
USA	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	1
	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

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
USA	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
	2017	0	0	0	0	0	0									0	0

		1SW		2SW		3SW		4SW		5SW		MSW(1)		PS		Total	
Country	Year	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt	No.	Wt
USA	2018	0	0	0	0	0	0									0	0
	2019	0	0	0	0	0	0									0	0
	2020	0	0	0	0	0	0									0	0
	2021															0	0
	2022															0	0

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; 63 cm 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) 1993-2018, and on catches for all Spain in 2019-2020 with 2SW, MSW and Not-Specified assigned to MSW.

3. Iceland catches of wild fish only, i.e. excluding ranched fish.

4. France data for 2019 and 2020 show catch number only, as reported by the recreational fishery that doesn't report catch weight.

5. Russian data extracted from NASCO website at https://nasco.int/conservation/third-reporting-cycle-2/

6. For Norway and Canada, fish reported as Small are assigned to 1SW whereas those reported as Large are assigned to MSW

7. For France, fish reported as Small are assigned to 1SW whereas those reported as Large are assigned to NS

8. N.B. Totals include NS values which are not shown.

Annex 5: WGNAS Stock Annex for Atlantic salmon

The table below provides an overview of 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.27.neac	Salmon (*Salmo salar*) in Northeast Atlantic	April 2021	Salmo salar

Annex 6: Glossary of acronyms used in this report

Note that this list does not contain SI units or terms used in formulae or some of the tables and figures.

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.

ASC - Annual Science Conference of ICES.

ASF – Atlantic Salmon Federation.

ASRJV - Atlantic Salmon Research Joint Venture of Canada.

BEAM – Bycatch Evaluation and Assessment Matrix, developed by WGBYC.

Bpa - Biomass for precautionary approach.

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 undesirable levels are avoided, i.e. that stock levels exceed the undesirable levels.

CoASal "Conserving our Atlantic salmon as a sustainable resource for people of the North; fisheries and conservation in the context of growing threats and a changing environment". A project under the EU's Kolarctic project.

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).

COVID-19 - Coronavirus pandemic.

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.

DCF (Data Collection Framework). Framework under which EU Member States collect, manage and make available a wide range of fisheries data needed for scientific advice.

DC-MAP (Data Collection Multi-Annual Programme). European Union multiannual programme which includes the Data Collection Framework.

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.

DSG (diadromous subgroup). Pan-regional subgroup within the Regional Coordination Groups to coordinate and identify data collection needs for diadromous species in relation to the EU data collection regulation Data Collection Framework/Data Collection-Multi-Annual Programme.

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

eDNA - Environmental DNA.

EG - Expert Group of ICES.

ESRF - Canada's Environmental Studies Research Fund.

EU - European Union.

FAO - Food and Agriculture Organization of the United Nations.

FSC (Food, Social and Ceremonial fishery). Indigenous 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.

GINR – Greenland Institute of Natural Resources.

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

GoSL or GoStL - Gulf of St. Lawrence, Canada.

ICES (International Council for the Exploration of the Sea). A global organization 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.

IMR – Institute of Marine Research, Norway.

Interreg – European Union research funding scheme.

ISA - Infectious Salmon Anaemia

ISSG Diad – The Intersessional Sub Group Diadromous Fish of the Regional Coordination Groups (RCG's).

IYS – The International Year of the Salmon.

KNAPK - Kalaallit Nunaanni Aalisartut Piniartullu Kattuffiat, the Organization of Fishermen and Hunters in Greenland.

LAB / Lab (Labrador). Labrador, Canada.

LCM – The North Atlantic wide Life Cycle Model or Bayesean Life Cycle Model.

MSA – Missing Salmon Alliance, UK.

MSW (Multi-Sea-Winter). A MSW salmon is an adult salmon which has spent two or more winters at sea. These include 'maiden' fish that have yet to spawn for the first time, and repeat spawners.

MSY - Maximum Sustainable Yield.

MSY.Bescapement – A target based on the amount of biomass left to spawn.

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

NAFO (Northwest Atlantic Fisheries Organization). 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 Organization). An international organization, 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 or N-NEAC (North Eastern Atlantic Commission- northern area). The northern portion of the North-East Atlantic Commission area of NASCO. Also described as 'Northern or northern NEAC'.

NEAC–S or S-NEAC (North Eastern Atlantic Commission – southern area). The southern portion of the North-East Atlantic Commission area of NASCO. Also described as 'Southern or southern NEAC'.

NF (Newfoundland). Newfoundland, Canada.

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

NOAA – The National Ocean and Atmospheric Administration of the USA.

NPAFC – The North Pacific Anadromous Fish Commission.

PICES – The North Pacific Marine Science Organization.

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).

PFANAC1SW (PFA NAC 1SW). The non-maturing component of 1SW salmon, destined to be 2SW returns (excluding 3SW and previous spawners) is represented by the PFA estimate for year i.

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 micro-chip's non-volatile memory.

PSAT - pop-off satellite tag.

R - a computer programming language.

RCG (Regional Coordination Group). Group(s) that coordinate and identify data collection needs in relation to the EU data collection regulations.

RDB – A Regional Database.

RDBES - Regional Database and Estimation System.

RENOSAUM (Rénovation de la stratégie de gestion du saumon en Bretagne) – A French management-orientated research project.

RSD - red skin disease.

SAMARCH – A major research project with full title "SAlmonid MAnagement Round the CHannel". https://www.samarch.org

SeaMonitor – A major research project.

SeaSalar – A major research project with full title "ATLANTIC SALMON AT SEA - factors affecting their growth and survival". https://www.seasalar.no

SER (Spawner Escapement Reserve). The CL increased to take account of natural mortality between the recruitment date (assumed to be 1st January after first entering the sea) and the date of return to homewaters.

SEUPB – Special EU Programmes Body.

SFA (Salmon Fishing Areas). Areas for which the Department of Fisheries and Oceans (DFO) Canada manages the salmon fisheries.

SGBYSAL – ICES Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries.

Slim (limit reference point).

SLU – Swedish University of Agricultural Sciences.

SMOLTRACK – A major NASCO-coordinated, EU-funded major research project.

SNP (Single Nucleotide Polymorphism). Type of genetic marker used in stock identification and population genetic studies.

Spa - ICES Precautionary target reference point.

St P & M or SPM - St Pierre and Miquelon, Islands of France south of Newfoundland.

SoBI - Strait of Belle Isle, Canada.

SU – Stock units.

TAC - Total Allowable Catch.

ToR - Terms of reference.

UK (United Kingdom of Great Britain and Northern Ireland). Salmon stocks are grouped and managed according to three UK jurisdictions: Scotland, England and Wales; Northern Ireland.

USA (United States of America).

VNIRO (PINRO) – Russian Federal Research Institute of Fisheries and Oceanography.

WGBAST – ICES Working Group for Baltic Salmon and Trout.

WGBYC – ICES Working Group on Bycatch.

WGC (West Greenland Commission). The West Greenland Commission of NASCO or the West Greenland Commission area of NASCO.

WGDIAD (Working Group on the Science Requirements to Support Conservation, Restoration and Management of Diadromous Species) A Working Group of ICES.

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.

WKBaltSalMP I and II (ICES Workshop on Evaluating Draft Baltic Salmon Management Plan).

WKSALMODEL – ICES Salmon Life Cycle Modelling Workshop

WKSALMON II - ICES/NASCO Workshop 2 for North Atlantic Salmon At-Sea Mortality

YOY – Young of the year.

Annex 7: Data deficiencies, monitoring needs and research requirements

The Working Group recommends that it should meet in 2024 (Chair, Alan Walker (UK)) 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 11-20 March 2024.

The following relevant data deficiencies, monitoring needs, and research requirements were identified:

North Atlantic (Section 2)

Overview of predation by cormorants: No Atlantic salmon studies met the criteria for inclusion in a global meta-analysis of the effect of predation from cormorants (multiple *Phalacrocorax* species) on fish in general (Ovegård et al. 2021), and therefore, the range-wide effect of cormorant predation on Atlantic salmon populations remains unclear. More studies are required, and these must be statistically robust, with clear treatment-control setups so that confident conclusions can be made.

The creation of a database listing individual PIT tag numbers or codes identifying the origin, source or programme of the tags should be implemented on a North Atlantic basin-wide scale. This is needed to facilitate identification of individual tagged fish, taken in marine fisheries or surveys, back to the source. A database has been designed by Missing Salmon Alliance UK (MSA) and IMR in Norway, and hosted and maintained by Missing Salmon Alliance (https://shiny.missingsalmonalliance.org/tag-database/). The database provides a central, searchable tag data repository against which unknown PIT detections can be searched. It also holds information on tag detections from pelagic marine fish species in the eastern Atlantic region with a network of over 20 PIT detector stations operated at fish processing plants in several countries. Tag users should be encouraged to include these tags or tagging programmes as this greatly facilitates identification of the origin of tags recovered in fisheries or tag scanning programmes in other jurisdictions.

Northeast Atlantic Commission (Section 3)

Data call submissions were not received for the following NEAC jurisdictions with known/historic salmon fisheries or farmed salmon production: Ireland, Russia, Faroe Islands, Portugal, Germany. Equivalent data from Ireland and Faroe Islands were received via national reports to the Working Group. The Working Group understands there was no commercial catch in Germany in 2022, but that there may have been a small amount of recreational catch but the amount has not been reported. ICES recommends that all countries submit salmon data through the data call process as this is the most effective and efficient way for the Working Group to automate the data collation, quality assurance, analyses and reporting.

Data on catch numbers, exploitation rates and unreported catch rates were not available to the Working Group for the years 2021 and 2022 for any of the four Russian stock units. In the absence of data, exploitation rates and unreported catch rates together with their associated errors were assumed unchanged from previous years. With respect to catches, the total catch for Russia in wet mass for all stock units and sea ages combined was available for both 2021 (55.38 t) and 2022 (48.82 t) (NASCO, 2023). The ratios of the total catch for Russia in 2021 and 2022 to the mean total catch for the last five years of available stock unit data (2016 to 2020) were used to scale the mean catches by sea age and stock unit for the same five-year period to derive estimated catches for

2021 and 2022. The method developed to fill these data gaps might be improved with time, but if the true data cannot be used in future years then the levels of uncertainty in the derived data will increase and at some time point will reach a level that means the process should not be applied.

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

The review of risk of bycatch conducted by the Working Group identified that although it was clear that at present salmon are caught as bycatch in coastal areas when they migrate to and from their natal rivers, but insufficient information exists on coastal fisheries to be able to evaluate coastal bycatch risk.

From this review of literature on salmon bycatch the Working Group has identified the following data deficiencies, monitoring needs and research requirements:

1. Improved understanding of post-smolt and adult salmon migration route in time.
2. Move to a quantitative analysis of the risk of exposure and bycatch risk to stocks which requires access to gear and fisheries specific fishing effort data (both inshore and offshore data) at an ICES rectangle by month.
3. Include salmon on ICES WGBYC list of species and data calls. WGBYC undertake data calls for the data required to analyse bycatch that WGNAS does not have access to. WGBYC also undertakes similar and overlapping analysis.
4. Standardize salmon bycatch monitoring programmes across countries, including minimum effort per fishery and standards for data recording and reporting.
5. Improve at-sea and onshore observer screening, including better salmon identification guidance. Minimum data to be collected are: date, fishery, catch location, number of salmon bycatch, fork length (preferably) and/or weight. The screening of discards from factories should also be explored (recommendation from ICES, 2004) by having close collaborations with factories operators.
6. Since at present bycatch data collection is difficult to access, eDNA data collection from scientific and commercial pelagic trawls may help improve detection of salmon and improve knowledge of their migratory pathways. Uncertainty estimates from these analyses are required.

North American Commission (Section 4)

Complete and timely reporting of catch statistics from all fisheries for all areas of eastern Canada is recommended.

Improved catch statistics and sampling of the Labrador and SPM fisheries is recommended. Improved catch statistics and sampling of all aspects of the fishery across the fishing season will improve the information on biological characteristics and stock origin of salmon caught in these mixed-stock fisheries. A sampling rate of at least 10% of catches across the fishery season would be required to achieve a relatively unbiased estimate.

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

In all areas of eastern Canada, there is no estimate of salmon released as bycatch in recreational fisheries targeting other species.

The Working Group recommends for future meetings evaluating how 2SW spawner requirement should be estimated and applied, especially for jurisdictions that have both Limit Reference Points and Upper Stock Reference points. Currently in NAC, some jurisdictions' 2SW spawner requirements are based on a Limit Reference Point while others are based on an Upper Stock Reference point. These varying approaches raise consistency issues and should be addressed.

West Greenland Commission (Section 5)

No recommendations specific to this section were made.

Annex 8: ICES WGNAS Data call review

Data submitted to ICES

Data were sent to ICES and the files were collated and provided in a directory on the Expert Group SharePoint site.

Data Call template schema

The Data Call provided a template schema (Excel spreadsheet DC_Annex_7.12.1 WGNAS Template) with a glossary and vocabulary codes plus predefined columns and descriptions of data fields and codes (drop-down menus) for several of the data fields.

Several revisions were made to the 2023 template prior to publication. These are described below, along with some further revisions to be implemented in the 2024 template.

Geographic area descriptors

The Atlantic Salmon Data Call schema currently has a hierarchical structure to define the stock units according to:

1. Commission: defined as the NASCO Commissions (NAC, NEAC, WGC)
   - 1.1 Major Stock Unit: defined as countries or jurisdictions
     - 1.1.1 Minor Stock Unit: not prescribed
       - 1.1.1.1 River_Name: not prescribed

NASCO requires parties to report catches at the scale of Commission and Major Stock Unit as defined in the schema.

NASCO also requests estimates of worldwide aquaculture production of Atlantic salmon. A Major Stock Unit category (exNA) to describe activities outside the North Atlantic is provided.

The catch data are also used in the run reconstruction, stock status, and the development of catch advice by the Working Group. Future consideration could be made to compiling the catch data using a "Minor Stock Unit" category that corresponds to the stock units used in the North Atlantic wide Life Cycle Model; six stock units in NAC, seven stock units for southern NEAC, and eleven stock units for northern NEAC.

There was no Major Stock Unit code for the Netherlands in the 2023 template, so NL will be added to the drop-down options for 2024.

The NS option for Major Stock Unit will be removed from next year's template.

Time period (YEAR)

The data were requested for the previous two calendar years (1 January to 31 December 2021, and 2022). This was because WGNAS had not collated the catch statistics in 2022.

Codes for countries and jurisdictions (COUNTRY)

ICES is moving towards adopting the ISO_3166 list of country codes (https://vocab.ices.dk/?ref=337). This list has separate codes for the four nations of the United Kingdom, but also a code for the England and Wales jurisdiction, which means that WGNAS can adopt these and move to that ISO-compliant scheme. These codes will also be adopted for Major Stock Units.

The codes changes will apply to the United Kingdom jurisdictions (GB-SCT, GB-EAW, GB-NIR), and St Pierre and Michelon (PM).

Exceptions to this apply to Iceland and Sweden that have Wild and Ranched stock units, and Greenland that has East and West stock units which have been retained with WGNAS codes because there are no ISO_3166 codes for these.

A new Gear Type column (G_TYPE)

This new data descriptor was created to specify catches by rod, for table 2.1.2.1 and figure 2.1.2.1 which present data for Rod Fisheries. Previously, it had been assumed that all Recreational and Ranched catches were by rod. As well as ROD, drop down options were created for OTHER to capture all gears other than rods, and NS for farmed production since production weight is reported but these salmon are not fished (except escapees but these are included in some national rod and/or net catch data).

Table 3.1.3.1 in the NEAC section presents data for a larger range of fishing gears. If a future datacall is used to generate tables and figures for commission areas, then the drop down options for GEAR will be expanded.

Sea age/Size class (SEA_AGE_SIZE_CLASS)

The PS (Repeat spawner) code was missing from the Sea-Age section in the Vocabulary sheet. This has been added to the drop down lists.

Norway reported catches as Small or Large salmon, having converted from their national reporting scheme of Small, Medium and Large salmon. The latter is equivalent to 1, 2 and 3 SW age classes. Reporting against these age classes would not affect data presentation in Section 2, and would simplify the data generation for Annex 4 (catches by sea age), and therefore Norway will report against sea age from 2024 onwards.

Fishing Area (F_AREA)

Some countries had recorded their Farmed salmon production as being COASTAL. While spatially correct, this causes an error in the calculation of catches by fishing area. Therefore, the option to report Fishing Area as Not Pertinent (NP) has been added.

Missing data descriptors

Entries were not provided for all data descriptors in this year's submissions. Blank data descriptors risk that those data are not recognized by the script that generates the tables and figures. Therefore, all data descriptors must be completed, and this will be emphasized in the 2024 Datacall guidance.

Not all catch data, in number or weight, can be reported. An explanation for missing data for catch weight or catch number (empty cells) should be provided using codes in the variable called "DATA_QUALITY", as defined below.

DATA_QUALITY	
NR	Not reported: data or activity exist but numbers are not reported to authorities (for example for commercial confidentiality reasons).
ND	No data: where there are insufficient data to estimate a derived parameter.
NC	Not collected: activity / habitat exists but data are not collected by authorities (for example where a fishery exists but the catch data are not collected at the relevant level or at all).
NP	Not Pertinent: where the question asked does not apply to the individual case (for example where catch data are absent as there is no fishery or where a habitat type does not exist).

When no Atlantic salmon fishery is authorized

At present, fisheries that are closed can be identified using the DATA_QUALITY field (code = NP). To be complete, each submission would minimally contain one row for each F_TYPE (REC, COM, RAN, FARM, INDG, SUBS). If any of these activities do not occur because they are not authorized, the catch data fields would be blank, the DATA_QUALITY field would be coded NP, and data fields for F_AREA, SEA_AGE/size class, FATE, and Reporting_class would all be coded NS (non-specific).

Reporting was not as complete as this specification, i.e. some countries only reported rows where fisheries existed. This was not an issue while the data were extracted manually, and has not been an issue for the automated extraction this year, but will need annual review.

Quality control / quality assurance

All countries/jurisdictions in the North Atlantic with present or historic catches of Atlantic salmon or farmed salmon productionare expected to respond to the Data Call request from ICES. The date for response, one week ahead of the start of WGNAS meeting, should be sufficient to allow checking of the entries in the days before or at the start of the meeting, prior to running the collation, analyses and reporting. An earlier request date could not be accommodated by all jurisdictions. For most jurisdictions, the data for the most recent year provided are provisional.

ICES will maintain the Data Call submissions for each year on the Working Group SharePoint site.

If countries need to resubmit data from previous years, ICES will provide the most current data sheet to a requesting party to which revisions could be made and returned to ICES.

Annex 9: Working Paper 1 - Data deficiencies – Russian Federation data

Authors: James Ounsley, Etienne Rivot, Geir Bolstad, Hugo Maxwell, Jonathan Gillson, Alan Walker

Introduction

In the absence of data from the Russian Federation being reported to ICES for 2021 or 2022, the Working Group investigated alternative published sources of data and developed an approach to make those data usable for the assessment model.

The national total catch weights for fisheries in coastal waters, estuaries and in-river, the numbers of salmon caught and released, and this number expressed as a percentage of the total catch retained and released, are annually reported to NASCO in the Russian Federation's Annual Progress Report (APR). These reports are published on the NASCO website (at https://nasco.int/conservation/third-reporting-cycle-2/) and therefore the Working Group used these data to collate catch summaries for the North Atlantic, as reported in section 2 of the Working Group report, and the draft 'sal.other.all' advice.

In addition, however, the Working Group requires catch numbers by stock unit (4 stock units considered in Russia) and sea age class, to conduct the pre-fishery abundance and run reconstruction analyses. Data disaggregated to these levels are not reported to NASCO and therefore the Working Group developed an approach to derive estimated values for 2021 and 2022. The following text describes that approach, considers the strengths and weaknesses of this approach, makes suggestions for alternative approaches that might be examined in the future, and outlines issues with all of these.

Absence of Russian data

There are four regional stock units (SU) within Russia: Pechora River (RP), Archangel / Karelia (AK), Kola / White Sea (KW) and Kola / Barents Sea (KB). This split in the Russian stock is based on biological characteristics and the resolution of catch statistics reporting.

For each of the four SU, the NEAC Run Reconstruction model requires the following annual input data: catches by sea age (and additionally catches on delayed spawners for KW); declared returns for RP by sea age; exploitation rates and associated error by SU and sea age and unreported catch rates and associated error by SU and sea age.

WGNAS agreed upon an approach for accounting for the deficiency by constructing estimated values for the affected years (2021 and 2022) based on a set of assumptions given historic data.

Exploitation rates and unreported catch rates

For all four regional stock units, the exploitation rates and unreported catch rates, together with their associated errors, have been unchanged for at least the last ten years for which they have been provided to WGNAS. These values were assumed unchanged for the 2021 and 2022 stock years.

Estimating the catch

For the three stock units AK, KB and KW, the estimated catches for 2021 and 2022 were based on the five years mean of the most recent reported catches (i.e. catches for the period 2016 to

2020). Total catches for the entire Russian stock are available for 2021 and 2022 (NASCO, 2023), and provide information on the aggregate trend in catches at the country level. This information is incorporated into the estimated catches by scaling the five years mean for each stock unit by the relative change in catches observed in the total catch between 2021 and 2022 and the five-year mean of total catch for the period 2016 to 2020.

Given total catch for Russia T_y in years $y = 2021{,}2022$, we derive the scaling factor α_y for year y as follows.

$$\alpha_y \quad = \frac{T_y}{\frac{1}{5}\sum_{i=2016}^{2020} T_i}.$$

The catches $C_{s,a,y}$ for each stock unit (s) and sea age (a) are then estimated by:

$$C_{s,a,y} \quad = \alpha_y \frac{1}{5} \sum_{i=2016}^{2020} C_{s,a,i}\,.$$

For RP, the declared returns $R_{a,y}^{\text{dec}}$ were estimated using the same method

$$R_{a,y}^{\text{dec}} = \alpha_y \frac{1}{5} \sum_{i=2016}^{2020} R_{a,i}^{\text{dec}}.$$

The resultant estimates can be seen in Figure 1.

The catches on delayed spawners in KW for 2021 and 2022 were estimated using the same approach. These values are used in the derivation of spawners for this region, but are not influential on the variance in any of the derived values of the NEAC run-reconstruction and are not considered in the following analysis.

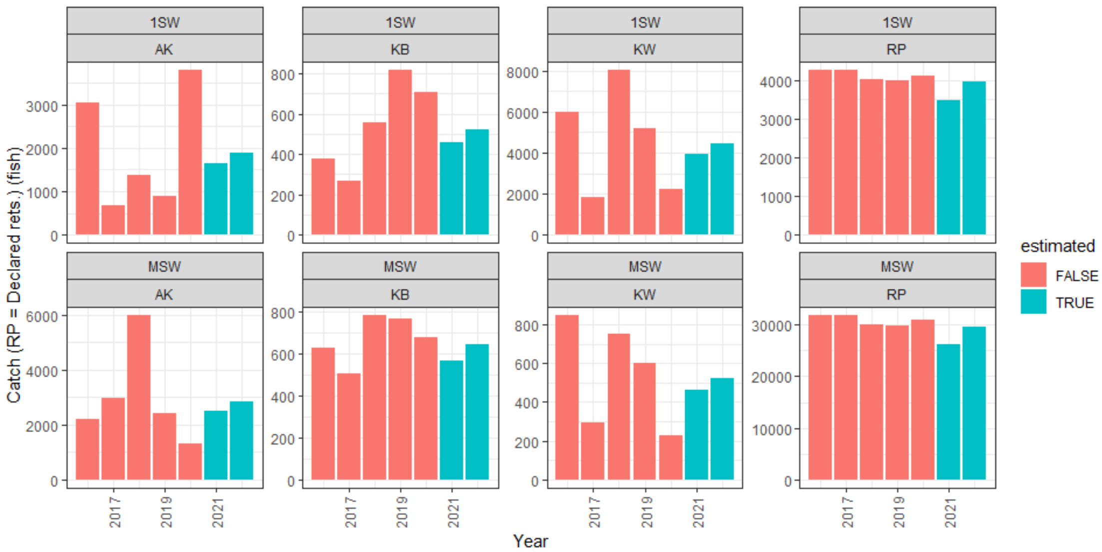

Figure 1. Reported (2016 - 2020) and estimated (2021, 2022) catches for the regional stock units AK, KB and KB and declared returns for RP

Accounting for additional uncertainty

The NEAC run-reconstruction model uses the catches (and declared returns for RP) to derive returns to home-waters and thereafter spawning abundances and PFA. Uncertainty in these values is introduced by integrating over uncertainty in the exploitation rates and unreported catch rates when deriving returns to home-waters. Uncertainty is integrated out using Monte Carlo numerical simulations.

For AK, KB & KW, the returns ($R_{s,a,y}$) are derived as follows:

$$\begin{aligned} R_{s,a,y} &= \frac{C_{s,a,y}}{E_{s,a,y}\left(1 - U_{s,a,y}\right)} \\ E_{s,a,y} &\sim \text{unif}\left(\mu^E_{s,a,y} - \epsilon^E_{s,a,y}, e + \epsilon^E_{s,a,y}\right) \\ U_{s,a,y} &\sim \text{unif}\left(\mu^U_{s,a,y} - \epsilon^U_{s,a,y}, e + \epsilon^U_{s,a,y}\right). \end{aligned}$$

Where $E_{s,a,y}$ and $U_{s,a,y}$ are the distributions of the exploitation rates and unreported catch rates as defined by uniform distributions defined by their respective means ($\mu^E_{s,a,y}, \mu^U_{s,a,y}$) and half range ($\epsilon^E_{s,a,y}, \epsilon^U_{s,a,y}$).

For RP, the returns are defined as

$$\begin{aligned} R_{s,a,y} &= R^{dec}_{a,y}(1 + U) \\ U_{s,a,y} &\sim \text{unif}\left(\mu^U_{s,a,y} - \epsilon^U_{s,a,y}, e + \epsilon^U_{s,a,y}\right). \end{aligned}$$

To account for the fact that the catches (or declared returns for RP) were not available as data in 2021 and 2022 but first derived from the total catch in weight based on the method describe above, an approach was developed to scale up the variance of the probability distribution of the returns (and by extension spawner abundances and PFA) for 2021 and 2022. This was to ensure that the confidence intervals around the returns estimates for these years were more likely to include the mean value of the returns based on the true data had it been available (Figure 2, a and b).

Let $R^{est}_{l,y}$ be the estimated returns for year y with lag l. The lag defines the number of years since the year of the most recent reported data used in the derivation of the estimated catches (or declared returns for RP). For example, for 2021 with a lag of $l = 1$, the returns are relative to the five years average of data for 2016 to 2020, and for 2022 with a lag of $l = 2$, the returns are relative to the five years average for the same period. For clarity, the following derivation is for a single stock unit and age class. The derivation is the same of all four stock units and sea ages.

Let $R^{adj}_{l,y}$ be the adjusted returns after scaling up the variance of the estimated returns. The variance of the log returns can be scaled by multiplying the centered log returns by some scaling factor q as follows:

$$\ln\left(R^{adj}_{l,y}\right) = q_l\left(\ln\left(R^{est}_{l,y}\right) - E\left[\ln\left(R^{est}_{l,y}\right)\right]\right) + E\left[\ln\left(R^{est}_{l,y}\right)\right]$$

such that

$$\text{var}\left[\ln R^{adj}_{l,y}\right] = \text{var}\left[q_l \ln R^{est}_{l,y}\right] = {q_l}^2 \text{var}\left[\ln R^{est}_{l,y}\right]$$

To capture the additional uncertainty resulting from the use of estimated data, it remains to find the scaling factor q such that

$$\text{var}\left[\ln R^{adj}_{l,y}\right] = r_l + \gamma_l$$

where γ_l is the expected variance of the estimated log-returns and r_l is the expected mean squared error between the estimated log-returns and the observed log returns, i.e. the returns derived from observed catches (or declared returns for RP), denoted R^{obs}_y .

The required adjustment of the variance is then given by:

$$q_l = \sqrt{\frac{r_l + \gamma_l}{\gamma_l}}.$$

In the absence of R_y^{obs} for the years 2021 and 2022, a one step ahead "cross-validation" approach was developed to numerically quantify the expected r_l and γ_l, denoted $\widehat{r_l}$ and $\widehat{\gamma_l}$, based on R_y^{obs} for the y in 2016 to 2020 and $R_{l,y}^{est}$ derived for the same y and for l=1 and l=2. Giving the numerically estimated $\widehat{q_l}$

$$\widehat{q_l} = \sqrt{\frac{\widehat{r_l} + \widehat{\gamma_l}}{\widehat{\gamma_l}}}.$$

Thus, $\widehat{r_l}$ was calculated as the mean of the squared difference between the means of the estimated and observed returns on the log scale, calculated over a 5 years window:

$$\widehat{r_l} = \frac{1}{5}\sum_{y=2016}^{2020}\left(E\left[\ln\left(R_{l,y}^{est}\right)\right] - E\left[\ln\left(R_y^{obs}\right)\right]\right)^2$$

Similarly, $\widehat{\gamma_l}$, was calculated as the mean of the variance of the estimated returns on the log scale, calculated over a 5 year window:

$$\widehat{\gamma_l} = \frac{1}{5}\sum_{y=2016}^{2020} Var\left(\ln\left(R_{l,y}^{est}\right)\right)$$

A comparison of R_y^{obs}, $R_{l,y}^{est}$ and R_y^{obs} for the time period 2016 to 2020 are shown in Figure 2 a, with l = 1 and Figure 2 b. with l = 2.

Results. Adjusted returns compared to observed returns (years 2016-2020)

For the 1SW components of AK, KB and KW the observed returns are not well captured by the estimated returns. This discrepancy is mostly driven by large variability in observed 1SW returns for those stock units, which is not captured by the five year averages underpinning the estimated returns. The result of this is a large increase in the variance of the adjusted returns relative to the estimated returns, which successfully captures the observed returns. A similar dynamic is present in the MSW component of the KW stock unit.

For the RP stock unit, the variation in the observed returns is small. This is due to the declared returns being directly observed, and uncertainty in the returns being introduced by integration over the uncertainty in the unreported catch rate only. This results in a substantial increase in the variance when deriving the adjusted returns. Again, the adjusted returns successfully capture the observed returns.

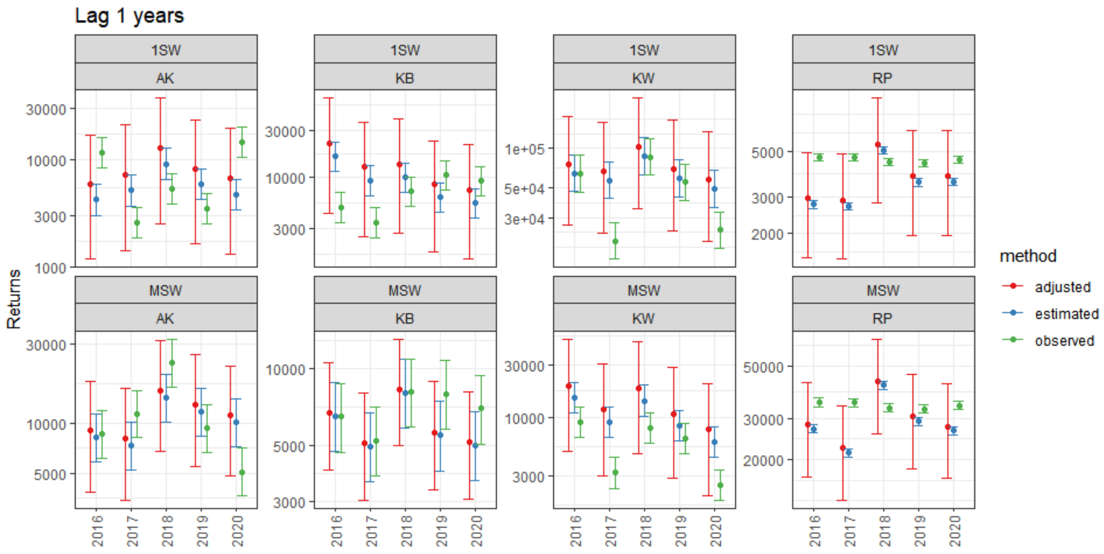

Figure 2 a. Distribution of 'observed' returns based on reported values for catches (declared returns for RP), returns based on estimated values and returns based on estimated values with adjusted variance for the four regional stock units of Russia and 1SW and MSW stocks. Estimated catches and declared returns are based on five years average lagged by 1 year. Points show the mean value, error bars show the 5th and 9th quantiles, y-axis on the log scale.

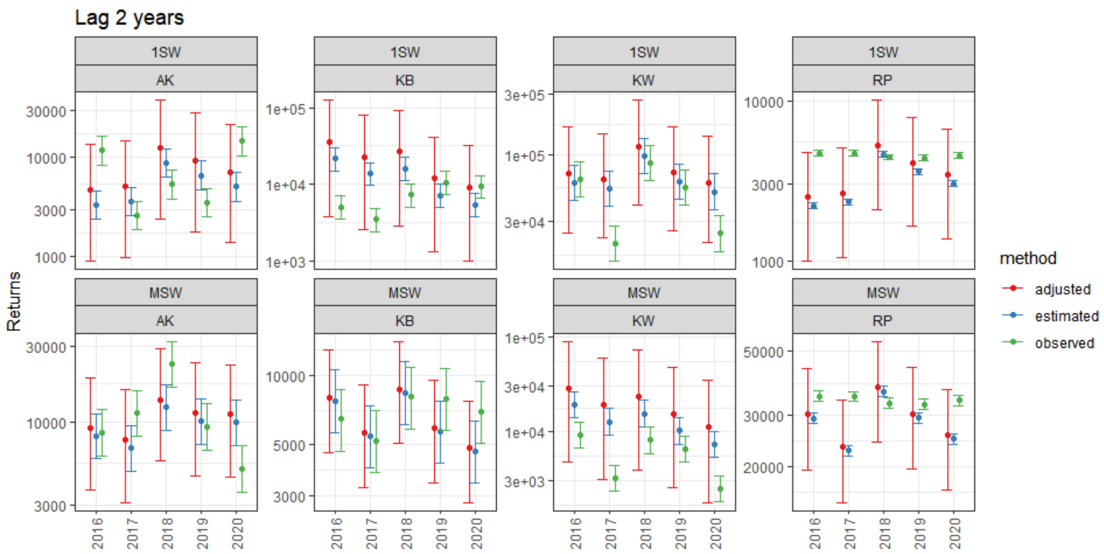

Figure 2 b. Distribution of 'observed' returns based on reported values for catches (declared returns for RP), returns based on estimated values and returns based on estimated values with adjusted variance for the four regional stock units of Russia and 1SW and MSW stocks. Estimated catches and declared returns are based on five years average lagged by 2 years. Points show the mean value, error bars show the 5th and 9th quantiles, y-axis on the log scale.

Results. Adjusted prediction of returns, years 2021 and 2022

Figures 3 shows the returns for 2021 and 2022 based on estimated catches (or declared returns for RP) before and after adjusting the variance to account for the additional uncertainty, together with the historic estimates of returns based on reported catch (or declared returns for RP).

As expected from the prior analysis, the increase in the variance is most pronounced for the RP region and where historic returns estimates have high variability. While the uncertainty adjustments are large, this is reflective of genuine additional uncertainty in the returns in the absence of data and represents a conservative approach.

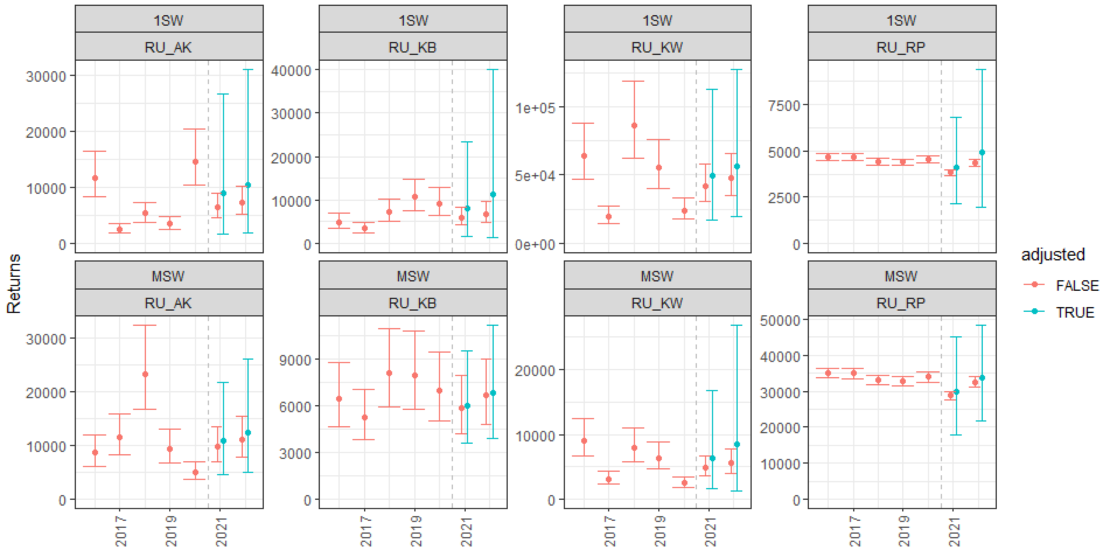

Figure 3. Returns based on reported values (2016 to 2020) and estimated returns with and without adjusted variance (2021, 2022) for the four regional stock units in Russia and the 1SW and MSW stocks. Error bars show the 5th and 95th quantiles

Discussion

The proposed method constitutes one approach for providing the input data needed for the run-reconstruction and PFA models based on the total catches in weights reported by Russia to NASCO. It was developed by the Working Group in 2023 for the purposes of assessing the Russian stocks in 2021 and 2022. However, the approach is based on strong hypotheses and has limitations. If this situation continues, a robust approach to handling this deficiency going forward is desired. The Working Group anticipates exploration of the following issues; some of which could be addressed during the WGNAS benchmark process (BWKSalmon).

- The method used to scale the variance relies on the last five years of available data, and all years in this five-year window have the same weight in the analysis. The choice of a five-year window was made based on the assumption that more recent data would be more representative of the present. Alternative methods could consider data from additional years in the time-series, weighting the influence of each year by recency. Using time-series-based statistical models to capture the influence of previous years while avoiding the strong hypothesis of a simple average could also be investigated.
- Implicit in this approach is the assumption that each stock unit covaries with the total catch in tonnage. Indeed, the approach scales the expected catches in each of the four regions using the same scaling factor (the ratio of the total catches in weight between the last years of data and the predicted years). To address this limitation, alternatives approaches could be developed to stochastically model the split between the four regions (and the same holds for the split between sea-ages within regions). Modelling the split using Multinomial or Multinomial-Dirichlet distributions would allow for stochasticity in the split while ensuring that estimated catches for each stock unit and age class sum to the total reported tonnage of fish at the scale of Russia.
- Any method used to disaggregate the catch in Russia that is based on historic data will become less applicable the more time passes since the data were last updated. Hence, to

enhance robustness, an alternative method would be to modify the assessment model by aggregating the four stock units of Russia to a single stock unit. The implications of this approach, given a biological basis for the current split, should be considered.

Annex 10: Working Paper 2 - Risks of salmon bycatch occurring in pelagic and coastal fisheries, and the effectiveness and adequacy of current bycatch monitoring programmes

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Background

This chapter addresses terms of reference which was set to answer the following request put forward by NASCO 2022 (ToR) 2.4: "*advise on the risks of salmon bycatch occurring in pelagic and coastal fisheries, and report on effectiveness and adequacy of current bycatch monitoring programmes*". The spatial scope of the ToR was the North East Atlantic Commission (NEAC) area.

Anadromous Atlantic salmon undertake lengthy oceanic migrations through the North Atlantic, growing for 1-4 years at sea before returning to their natal rivers to spawn. Although descriptions of their migratory behaviour and their distribution in time and space are not precisely known, observations indicate that they occupy the pelagic zones of the water column as they move out of coastal waters and throughout their oceanic migration (Gilbey et al., 2021; Rikardsen et al., 2021; Utne et al., 2022). Once an important commercial species, salmon have suffered serious population declines throughout their distribution (ICES 2022a). Much research has been dedicated to improving stocks during their freshwater life-history phases, yet little improvement has been observed for salmon abundance (ICES 2022a). Reduced marine survival has been implicated as a key reason for their decline (Olmos et al., 2020; Thorstad et al., 2021).

During some periods of their at-sea feeding migration and on their return migration the post-smolt, pre-adult and adult salmon are likely to pass through areas with intensive commercial fishing (ICES 2005). The potential risk of interception by fisheries has long been recognized. ICES examined risk from pelagic oceanic fisheries in the early-2000s, prompted by observations of large number of post-smolt Atlantic salmon taken together with large catches of mackerel in Norwegian research surveys in the Norwegian Sea fisheries in the late 1990s. In addition, in 2003 WGNAS received indications that the herring fisheries occurring in August in northerly areas of ICES areas might intercept adult salmon. ICES Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries (ICES 2004, 2005) reviewed and analysed the spatial and temporal distribution of migrating salmon against the major pelagic fisheries in the Norwegian Sea, the North Sea, and areas west and south of UK and Ireland.

SGBYSAL 2004 made a series of recommendations, from screening research and commercial catches and discards for salmon to the development of methods for estimating salmon post-smolt bycatches (ICES 2004). The application of a range of bycatch estimates to known data on salmon abundance and survival trends in the stocks in question is recommended to determine whether crude levels of potential bycatch can account for recent changes in abundance or survival at sea. Nonetheless little has been done since these recommendations and some of the pelagic fisheries have changed their spatial and temporal distributions and fishing capacity since then prompting the call for a re-examination of the risk.

While the spatial scope of ICES (2004, 2005) focused on Northern oceanic waters, the coastal corridors between natal rivers and oceanic feeding waters have a range of fisheries with gears that have the potential to intercept salmon, both on their outward and return journeys. More recently, WKSALMON2 has proposed further investigations of the spatial and temporal distributions of fisheries using pelagic gears that might intercept salmon at sea, and ICES has published a data call (ICES 2023a – WKSalmon). The data from that call will not be available within the timing of the WGNAS 2023 meeting, and therefore we would anticipate further analyses and investigations later in 2023. A better understanding of coastal pressures is yet to be examined as requested by NASCO.

ICES (2005) noted that one major drawback for evaluating the potential of salmon being intercepted by pelagic fisheries is that their distribution throughout the year and migration routes in certain areas still are relatively poorly known. Here we review advancements in this area and the overlap between recorded landings from pelagic and coastal fisheries and recorded salmon distribution. A separate draft advice document has been prepared by WGNAS, for consideration of the Advice Drafting Group for Salmon (ADGSalmon).

Advise on the risk of bycatch

Salmon are mainly bycaught in pelagic trawls and static net fisheries such as gillnets (Elliott et al., 2023a; Gilbey *et al.*, 2021; ICES 2005). They are, however, also caught by bottom trawls, bottom longlines, and purse-seine fisheries (Elliott *et al.*,2023a; ICES 2005; ICES 2020). Although it is known that salmon can be bycaught by a range of gear, the risk of salmon bycatch is unknown.

ICES Working Group on Bycatch (WGBYC) has a detailed plan to monitor the bycatch of Protected Endangered and Threatened Species (PETS; ICES 2022b). Through this working group, official data calls have been undertaken yearly since 2018 to report incidental bycatch data at a regional scale through the EU Data Collection Framework (DCF). Although nations can refuse to provide data, WGBYC also ensures linkups with other working groups which require information on the bycatch of PETS species. Despite salmon being listed as 'Vulnerable' on the IUCN EU red-list and protected through various national and international conventions and Directives (Habitat Directive, Bern and convention, OSPAR, etc.), it is not listed on WGBYC at present, since WGNAS is responsible for salmon assessment. Discussions with ICES secretariates are in place to add salmon to their list in 2025 at the earliest.

Bycatch definition

Since salmon is a protected and threatened species, we have adopted a modified version ICES WGBYC definition for bycatch: According to ICES Roadmap for bycatch advice on PETS **incidental bycatch** is defined as all catches of species (including species not landed or released) "not targeted in fisheries operations (incidentally/accidentally caught), including those not taken on board, regardless of later treatment." (ICES 2022c). This modified version of WGBYC definition was adopted with the addition of non-catch losses.

If we were to qualify this definition according to whether the bycatch influences stock status, we might define the **"material bycatch"** as the mortality (directly or indirectly) of salmon arising from contact with fishing gears targeting other species with the potential of impacting the reproductive capacity of a salmon stock.

To keep in mind, the Food and Agricultural Organization (FAO) definition for bycatch and related definitions are:

- **Bycatch**: "Component of the catch which represents non-targeted fish associated with the catch of the target species or group towards which fishing effort is directed, or other aquatic organisms taken incidentally during the course of fishing (e.g. birds, mammals, reptiles, invertebrates). Some or all of the bycatch may be returned to the sea as discarded catch, either dead or alive. The catch taken incidentally is also referred to as incidental catch" (https://www.fao.org/cwp-on-fishery-statistics/handbook/capture-fisheries-statistics/catch-and-landings/en/).

- **Discarded catch**: "Estimated component of the catch which is the total live weight of undersized, unsaleable, or otherwise undesirable whole fish and other aquatic organisms which are discarded at the time of the capture or shortly afterwards. Discarded catch refers to whole fish and other aquatic organisms discarded dead or alive, and may include species taken as bycatch. Discarding in some fisheries is prohibited".
- The **total catch** "is that quantity taken by the fishing gear and which reaches the deck of the fishing vessel. DISCARDS is that portion thrown away at sea (for one reason or another). The remainder is the **landed catch** or **retained catch** (i.e. that which is brought ashore) which can be further subdivided into **target catch** and **incidental catch**, bearing in mind the volume, value, the incidence of species caught and the nature of the fishing operations"(https://www.fao.org/3/w6602e/w6602E03.htm).

Collecting data on salmon bycatch

"*Although bycatch of salmon is difficult to access (particularly at a fine resolution), it can provide key information on mortality, their spatial distribution and migratory pathways (Elliott et al., 2023a; Gilbey et al., 2021; ICES 2005). With enough and sufficiently detailed bycatch data, estimations of bycatch can also be undertaken (ICES 2004; ICES 2005; ICES 2020; ICES 2022a). Methods of recording and calculating discards can also vary between fisheries (e.g. Ulleweit et al., 2010; Couperus et al., 2004). These biases may therefore lead to underreporting (ICES 2022c; ICES 2013; Olafsson et al., 2016)*" (text from ICES 2023a).

"*As part of the EU data collection framework, bycatch monitoring is mandatory. Most fish species have low bycatch survival rates, and for some gears are not easily observed, and therefore are not recorded. Various methods exist to log bycatch, including fisheries observer records, logbook data (also referred to as landings data) and fish market data collection methods (Table 3.5; ICES 2022a). Bycatch data are, however, not openly accessible, and an ICES data call is required to access such data*" (text from ICES 2023a).

Risk of bycatch

There are two types of risk which need to be considered to understand salmon bycatch risk:

The Risk of Exposure

Here we define risk of exposure as the "risk depends on the salmon being in the same place as a vessel fishing a type of gear that would intercept (catch or kill) salmon and at a depth where the salmon would be. In an ideal world, we would know the instantaneous positions of the salmon and these fishing gears." The risk of exposure to fisheries is therefore spatially and temporally dependent. Through WKSALMON, a data call has been requested to improve understanding of the potential overlap in space and time between salmon migration and pelagic fisheries (ICES 2023a). Through this data request, monthly pelagic (Mackerel, Herring, Blue whiting, Horse mackerel, Capelin, Chub mackerel, and Sardine) fishing activity data (derived from aggregated Vessel Monitoring System (VMS) and landings information) has been requested from WGWIDE at an ICES rectangle scale from 2000 to 2022 to be able to try to overlap the migration of salmon with the pelagic fishing effort.

Through work undertaken by WGBYC (ICES 2022c), an understanding of the spatial fishing effort (Days at Sea) by different gear categories is possible to gauge from the ICES division scale map (Figure 1, fishing effort for 2019 and 2021). However, for this to be of use to understanding salmon bycatch, this fishing effort information is required on a finer spatial (ICES rectangle 1x0.5 decimal degrees) and temporal (monthly) scale to match to salmon migrations.

If accessing such temporal (monthly) fishing effort data at the spatial scale (ICES rectangle) required to understand the bycatch risk of salmon is complicated to access, the risk of exposure can be gauged through freely accessible Global Fishing Watch (GF W) data from 2012 to 2022 (https://globalfishingwatch.org/). Fine-scale fishing activity data are particularly important for coastal and inshore (<6nm from the coast) fisheries to be able to link the activities to salmon rivers. GFW fishing effort data are derived from Automatic Identification System (AIS) data which is required for all vessels (>6 m long) to avoid a collision (see Appendix 2). Apparent fishing activity at 100th of a degree resolution is calculated from fishing movement activity (Kroodsma et al., 2018a) in a similar way to VMS data. Due to difficulties in identifying precise gear types, fishing categories of similar movement types are grouped together for each data point (e.g. set gillnets, drifting longlines, trawlers, fixed gears, purse-seines, seiners, etc.). Although AIS can be turned off, and coverage for smaller vessels (<12m long) is lower, a comparison of these data with ICES BYC fishing effort data, could provide insightful information into potential Illegal Unreported and Unregulated Fisheries (Kroodsma et al., 2018; Welch et al., 2022; Appendix 2).

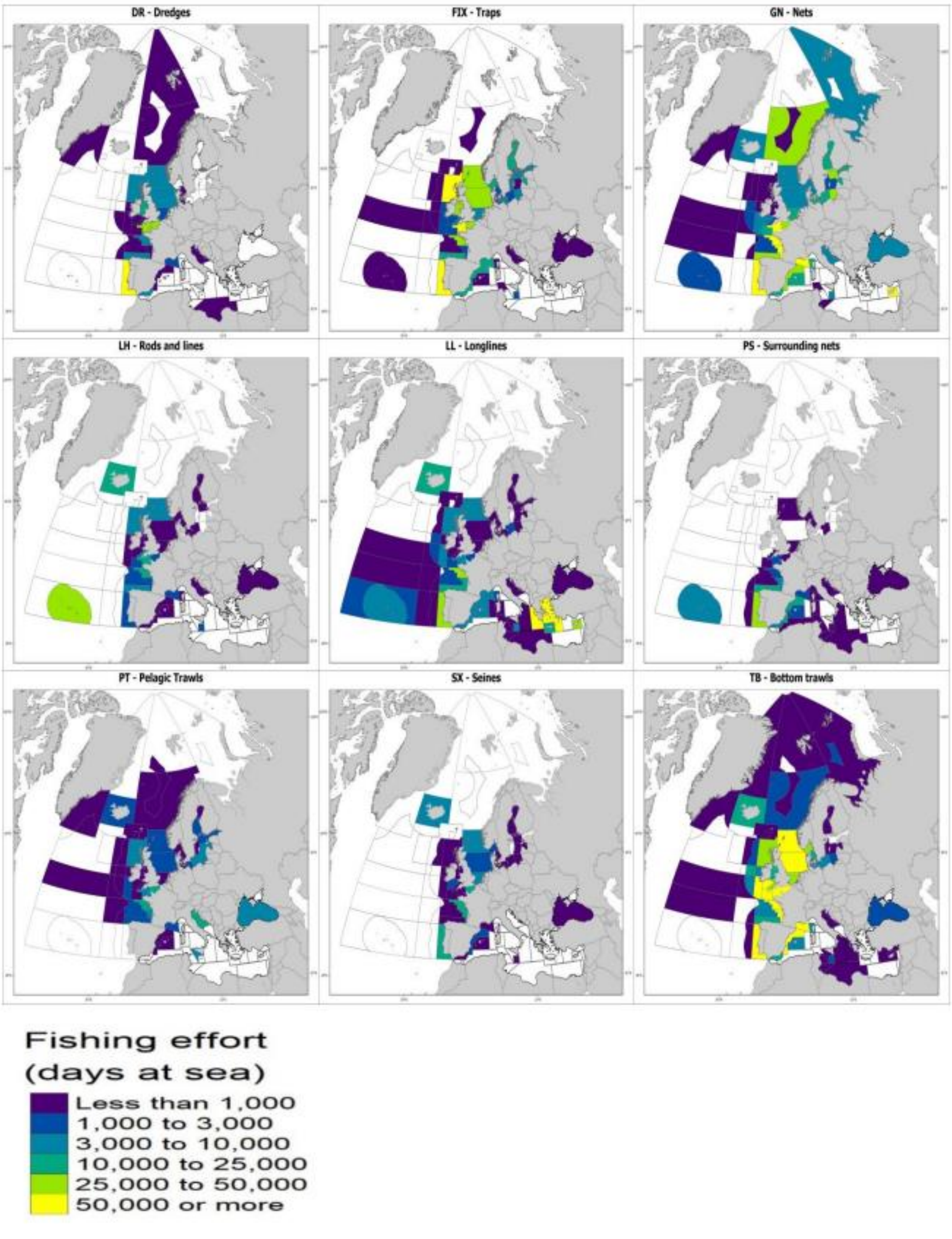

Figure 1. Métier level 3 fishing effort (days at sea) submitted to the WGBYC database (Figure from ICES 2022c)

The Risk to the Stocks

According to the latest report of the WG on catch advice for the Faroes fishery which was developed for the 2021/2022 to 2023/2024 fishing seasons, the status of the stocks do not allow any catch – and therefore the risk of any bycatch is high (ICES 2021a). In the Northern NEAC stock complex, over the forecast period, the non-maturing 1SW component has a high probability (≥95%) of achieving its Spawner Escapement Reserves (SER) for Total Allowable Catch (TACs) at Faroes solely for a catch option of ≤20 t in the 2021/2022 season. The maturing 1SW component in the Northern NEAC stock complex and both Southern NEAC stock complex components each have less than 95% probability of achieving their SERs with any TAC option in any of the forecast seasons. Therefore, there are no catch options that ensure a greater than 95% probability of each stock complex achieving its SER.

The probabilities of the non-maturing 1SW national management units achieving their SERs in 2021/2022 vary between 20% (UK, Northern Ireland) and 99% (Norway) with zero catch allocated for the Faroes fishery and decline with increasing TAC options. The only countries to have a greater than 95% probability of achieving their SERs with catch options for Faroes are Norway (TACs ≤40 t) and UK (England & Wales) (TACs ≤40 t). In most countries, these probabilities are lower in the subsequent two seasons. There are, therefore, no TAC options at which all management units would have a greater than 95% probability of achieving their SERs. All bycatch must in same principal be considered as proposing a high-risk to the salmon stocks – especially in mixed-stock fisheries where stocks from both Northern- and Southern NEAC are present.

In coastal fisheries, the mixture of stock components is not the issue, but the status of stocks for individual countries, and even to the river-specific level becomes more relevant. An assessment of Pre-Fisheries Abundance (PFA) of salmon against Spawner Escapement Requirements (SER) and returns and spawners against Conservation Limits (CL) are estimated by the Working Group and shown for individual countries and by regional blocks in WGNAS reports (see e.g. ICES 2022d). In some coastal areas the surrounding stocks might be estimated at being "at-risk" or "suffering" full reproductive capacity, while in others the stocks might be estimated to be at full reproductive capacity. The risk to stocks from bycatch in coastal fisheries should be made by considering these particular stock estimates.

Salmon bycatch risk

To be able to understand salmon bycatch risk, **risk of exposure** needs to be considered in combination with **risk to stock**. A study by Queiroz et al., (2019) estimated risk of exposure by modelling the overlap of sharks with fishing effort data. By combining information on salmon known presence at sea with the precise timing of their migration and fishing effort, an understanding of risk of exposure could be calculated similar to Queiroz et al., (2019). Since salmon can be caught by a range of gear types, a bycatch risk per gear type evaluation is initially required (e.g. Acou et al., 2021; ICES 2019), taking into consideration regional differences in gear use and salmon migration (risk of bycatch as they leave estuaries to risk of bycatch as they migrate north to their feeding habitat).

Through ICES WGBYC, annual PETS bycatch per unit effort (BPUE; number of fishing days monitored) is calculated (ICES 2022c). However, since bycatch probability distribution can be variable in space, according to gear type, and PETS density, Bycatch Evaluation and Assessment Matrix (BEAM) have been trialled (Appendix 3). BEAM considers bias-correction factors given known fisheries bycatch programmes, PETS abundance estimates, etc. (Appendix 3; ICES 2022c). Such a process could be adapted and trialled for salmon taking into consideration spatial-temporal variability at a finer resolution. ICES 2022c report does, however, note that for very low abundance species and species with low detectability (such as Salmon; Elliott et al., 2023a) the BEAM process may not be sufficiently robust.

Given the little understanding of bycatch risk at present, a combination of bycatch risk on stock (i.e. using the BEAM method) and exposure analysis (e.g. Queiroz et al., 2019) in space and time, would enable a finer understanding of salmon bycatch risk.

Summary of what we understand about migrations at sea

Post-smolt phase

One of the major limitations to understand bycatch of salmon at sea is lack of knowledge of their migration pattern at sea. The onset of emigration from river to the sea occurs in late March in Spain, and gradually starts later in the year further north with an onset in late July for smolts emigrating from rivers in northern Norway, Russia, Finland and northern Iceland (Otero et al., 2013). For post-smolts, a recent study by Gilbey et al. (2021) presented the geographic location of >9000 post-smolts sampled over nearly 25 years in the Northeast-Atlantic. The work identified a main migration route of post-smolts west of the British Isles in the period May-June and further north in the Norwegian Sea in June-August (Figure 2). A high proportion of individuals originating in southern NEAC among post-smolts sampled in the Norwegian Sea indicate that this is an important migration route for post-smolts from many European countries (Gilbey et al., 2021). Post-smolts from Iceland, Russia and Finland were however absent from the samples from the Norwegian Sea suggesting that individuals originating in these countries migrate elsewhere. A study of smolts tagged with archival tags and released in Iceland indicated that the estimated migration path was from spending the first summer as post-smolts west of Iceland, over the Icelandic continental shelf and in the Irminger Sea, to an eastward migration towards the ridge between Iceland and the Faroes during autumn (Gudjonsson et al., 2015).

Smolts from northern Norway, Finland and Russia enter the White Sea or the Barents Sea. The migration pattern in the Barents Sea is unknown, but eastward-going surface currents in the southern Barents Sea could transport post-smolts into the eastern Barents Sea (Russian territory). Due to the lack of knowledge, one must assume that post-smolts can migrate through any part of the Barents Sea from July and onwards. The migration pattern for smolts emigrating into the North Sea is also not known in detail and post-smolts could migrate through any part of the North Sea in the period April-July.

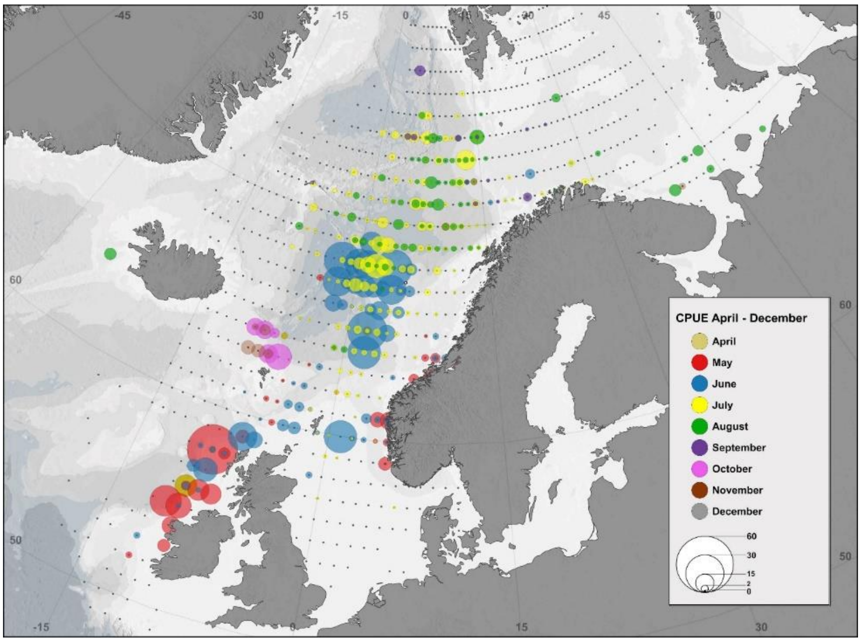

Figure 2. Catch per unit effort (CPUE) in targeted surveys for each 1° latitude x 1° longitude grid square containing at least one trawl. Points represent mean post-smolt captures per trawl within the grid unit. Small grey points represent grid squares with trawl coverage but no captures (Figure from Gilbey et al., 2021).

Adults

Knowledge of migration patterns of salmon in the northeast-Atlantic after the first post-smolt phase (first summer and autumn in the sea) is limited. A recent study has described the annual migrations routes of kelt from several European countries, which were tagged and tracked with pop-up tags when leaving the rivers after spawning (Rikardsen et al., 2021; Figure 3a). Salmon from Denmark and middle part of Norway mainly migrated towards the polar front east of

Greenland, between Iceland and Svalbard. Salmon from northern Norway either migrated towards northwest and the region east of Greenland or northeast into the Barents sea. In contrast, salmon from Ireland, Spain and Iceland mainly migrated westward towards the Irminger Sea and the areas south of Iceland. The migration routes presented in Rikardsen et al., (2021) are supported by migration routes estimated in other tagging studies (Gudjonsson et al., 2015, Strøm et al., 2018). Furthermore, results from genetic assignment of origin of salmon caught as bycatch in mackerel fisheries south and east of Iceland indicated that the sea south and east of Iceland are important as feeding areas for migrating Atlantic salmon, particularly for salmon originating in the UK, Ireland, and southern Europe (Olafsson et al., 2016). The lack of adult Icelandic fish so close to Iceland was pointed out by the authors as an indication that Atlantic salmon from Icelandic stocks are using different feeding grounds. The results of tagging studies using coded-wire tags conducted on Icelandic salmon stocks between 1967 and 1995 have indicated that there might be a difference in the migration routes used by stock from North and East part of Iceland compared to the south and west. Most of the recoveries north of the Faroes were 2SW tagged in northern and eastern Iceland, whereas recoveries in West-Greenland were recoveries from 2SW salmon tagged as smolts in southern and western Iceland. This pattern suggested that 2SW salmon from the south and west coast of Iceland tend to migrate west towards Greenland, whereas 2SW salmon from the north and east coast migrated to a large extend into the Denmark Strait and the Norwegian Sea (Isaksson et al., 2002). The historic commercial fishery targeting salmon in Faroes waters were further south during autumn than during winter (Jacobsen et al., 2012) (Figure 3b). Multi-sea winter fish dominated the catches taken in the Faroes fishery (O'Sullivan et al., 2022). Some sea winter salmon were also caught as bycatch during the IESSNS survey in the Nordic Sea (ICES 2022e), indicating that also the central Norwegian Sea is used a feeding area during summer.

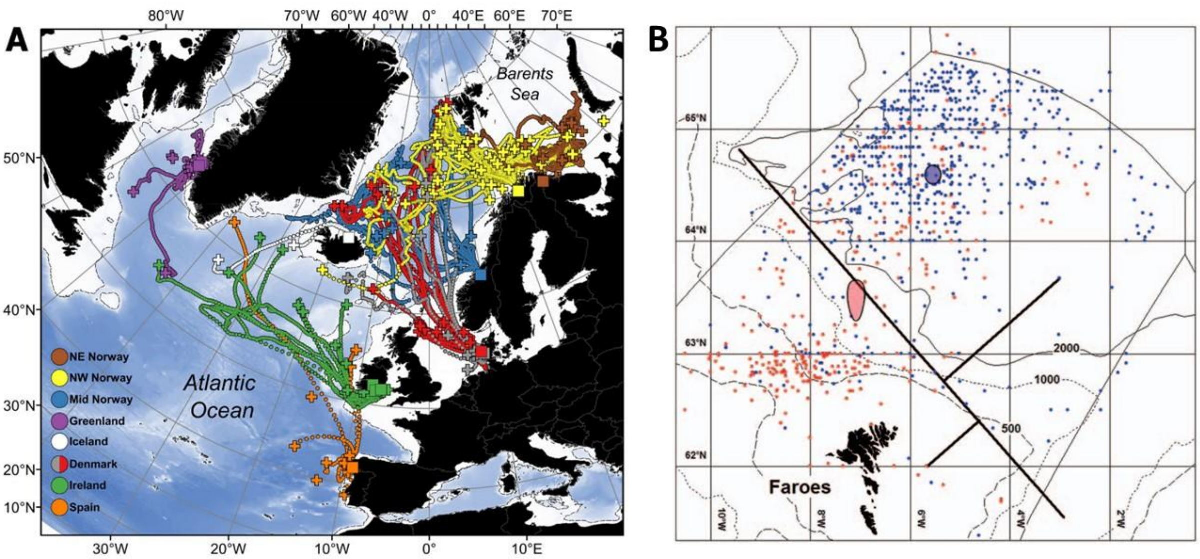

Figure 3. a) Migration of post-spawning Atlantic salmon tagged in eight different geographical areas (figure from Rikarden et al., 2021), b) Recapture locations of tagged salmon during autumn (red dots, November–December) and winter (blue dots, January–April) north of the Faroes the years 1968-2000. The dividing line in a northwest–southeast direction was drawn by hand (figure from Jacobsen et al., 2012).

Pelagic fisheries and potential for salmon bycatch

Pelagic fisheries are fisheries that target commercially important fish, such as herring and mackerel, that inhabit the water column (not near the seabed or shore), with specific gear types (e.g. purse-seine, midwater pelagic trawls, etc.; Appendix 4; He et al., 2021). As can be seen within Figure 1 (spatial fishing effort of pelagic fisheries by ICES divisions) and Appendix 2 - Figure A1 pelagic fisheries take place both within inshore and offshore waters (ICES 2022c). Large-scale pelagic fisheries which are at risk of bycatching salmon include mackerel, sardine, herring, blue whiting, capelin, and sprat (ICES 2005; ICES 2022e; Sumner 2015). Below major pelagic fisheries which are thought to overlap with salmon migration have been summarized (2.2.5.1-2.2.5.8).

Access to weekly catches from large pelagic fisheries in key locations for Northeast Atlantic stocks was analysed by ICES study groups in 2004 and 2005 salmon (ICES 2004, 2005). Here, SGBYSAL examined the disaggregation of commercial catch data of mackerel and herring within the Norwegian Sea, the norther of the North Sea and the northwest of Ireland and Scotland by ICES Division and standard week. While it was suggested that there were certain areas and times of concern for salmon post-smolt migration where there was potential overlap with commercial fishing activity, the catches were small at the time when the salmon were thought to move through these areas. Unfortunately, the SGBYSAL commercial pelagic activity dataset is not currently available post 2005, leaving doubt over the potential influence of shifts in the distribution and intensity of more recent fishing fleet activity.

It should be noted that "*Discarding from pelagic fisheries is more sporadic than from demersal fisheries since target species are schooling fish which often have a low diversity in species and sizes (Borges et al., 2008; Ulleweit et al., 2010; ICES 2022c). Fish caught by these fisheries are taken straight below deck and frozen in large holding tanks due to the quantity of catch (Borges et al., 2008). Only a small and variable proportion of hauls are therefore sampled for bycatch (ICES 2004, 2005). Bycatch of smolts is particularly difficult to observe (because of their small size and the loss of scales), and variable according to the timing and location of the haul (ICES 2005). In 2015 the EU introduced landings obligations for small pelagic fish. This obligation has been generally effective since 2019 (ICES 2022b) and so bycatch within pelagic fisheries may now be easier to monitor.*" (text from ICES 2023a).

"*In addition to bycatch recordings from observers on pelagic vessels, slippage (when part of the catch is released back out to sea prior to sorting) sometimes occurs. This sort of bycatch can be qualitatively recorded as it is released back to sea and species length and composition is determined by samples from the hold or from the following or previous haul (Borges et al., 2008). It is thought that slippage might be an important component of discards in pelagic trawlers but it is frequently not recorded due to estimation difficulties (e.g. ~3000 t of fish a year, mainly from the North Sea; Borges et al., 2008).*" (text from ICES 2023a). Work under ICES Working Group for Technology Integration for Fishery-Dependent Data (ICES 2023b) have suggested new imagery methods to monitor slippage from pelagic vessels. It is, however, likely to be difficult to detect Salmon bycatch from such video images.

"*Catch data from the Norwegian Sea can be combined with scientific survey data from the mackerel survey (IESSNS) in the region in July for the years 2010-2021. The probability to catch salmon, or the catch rates from the scientific survey, can be used to estimate the total potential bycatch for the mackerel fishery in the Norwegian Sea considering the temporal and spatial dynamics of both Salmon migrations and the commercial mackerel fishery. IESSNS trawl data are stored in the PGNAPES database at the Faroe Islands and are not available as open-access. The countries participating in this survey have nevertheless indicated that salmon catch data from trawl hauls can be made available for a study on salmon bycatch from pelagic trawling in the area*" (text from ICES 2023a).

Mackerel fishery

There is a substantial mackerel trawl fishery around Britain and Ireland during winter (December-March). The fishing effort during spring (April-May), when most smolts in Southern NEAC leave the rivers, is however limited. The first period of the post-smolt migration does therefore not overlap in space and time with a large mackerel fishery (Figure 4). Mackerel migrate into the Norwegian Sea from June onwards, supporting a large trawl fishery in this region. Furthermore, mackerel has expanded north- and westwards in recent years (Figure 5, Nøttestad et al., 2016), and the total landings of mackerel from this fishery have increased. In 2021, vessels from Russia, Iceland and Greenland landed more than 300 000 t of mackerel, with most of the catches taken in the Norwegian Sea (ICES 2022e). This is a substantial increase from ~54 000 t landed in this region in 2005 (ICES 2006). Norway and Faroe Islands also target mackerel in the Norwegian Sea, but these countries take most of the catches during autumn (August and onwards). A quality assured estimate is currently not possible due to lack of observations and samples from the fishery. A sampling programme at land-based freezing plant was initiated in 2011 to investigate salmon bycatch in the mackerel fishery (pelagic pair-trawls). Salmon were only observed in May and June (76 individuals among 31 315 t of mackerel) although the fishery lasted until September (ICES 2012), probably reflecting a lower geographic overlap between the Faroes mackerel fishery and post-smolts later in summer. Similar screening of Icelandic mackerel landings in 2010, 2011 and 2012 resulted in 170, 233 and 48 salmon, respectively (Olafsson et al., 2016, ICES 2013a). Most of these individuals were sea-winter salmon, and the estimated bycatch was 5.5 salmon per 1000 t of mackerel caught in the 2010 – 2013 fisheries. The westerly distribution of mackerel, into Icelandic Exclusive Economic Zone (EEZ), continued from 2013 and salmon bycatch has been reported to the Directorate of Fisheries to be between five and 92 a year. However, in the most recent years the abundance of mackerel south and west of Iceland has decreased and since 2020, majority of the catch from the Icelandic fleet has been in international waters east of Iceland. The pelagic fishery close to Iceland is normally west of the main post-smolt migration route in the Norwegian Sea (Gilbey et al., 2021) but probably overlap with the feeding areas for sea-winter fish (see Jacobsen et al., 2012). Screening of Russian catches in June-August 2002 and 2003 in the central Norwegian Sea recorded a bycatch of 13 post-smolts and 30 sea-winter salmon among 11 560 t of mackerel (ICES 2005). Both Russian and Norwegian research surveys in the Norwegian Sea have substantial higher proportions of salmon among mackerel than estimated by screening commercial mackerel catches (ICES 2005, ICES 2022e). There is also a substantial autumn fishery in the North Sea and the southern Norwegian Sea, but the autumn fishery has a low spatio-temporal overlap with known post-smolt migration routes. There is however a potential overlap with sea-winter salmon feeding in these areas, but data on this issue is very limited.

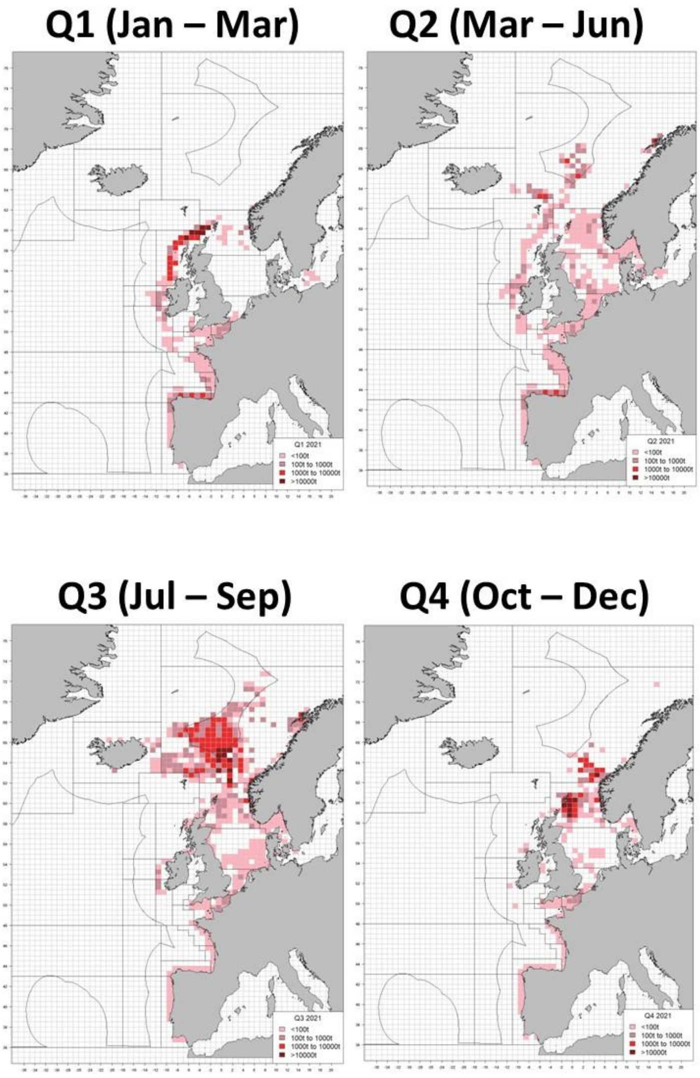

Figure 4. Maps of total commercial catches of NEA-mackerel in 2021 per quarter of the year (Figure modified from ICES 2022e).

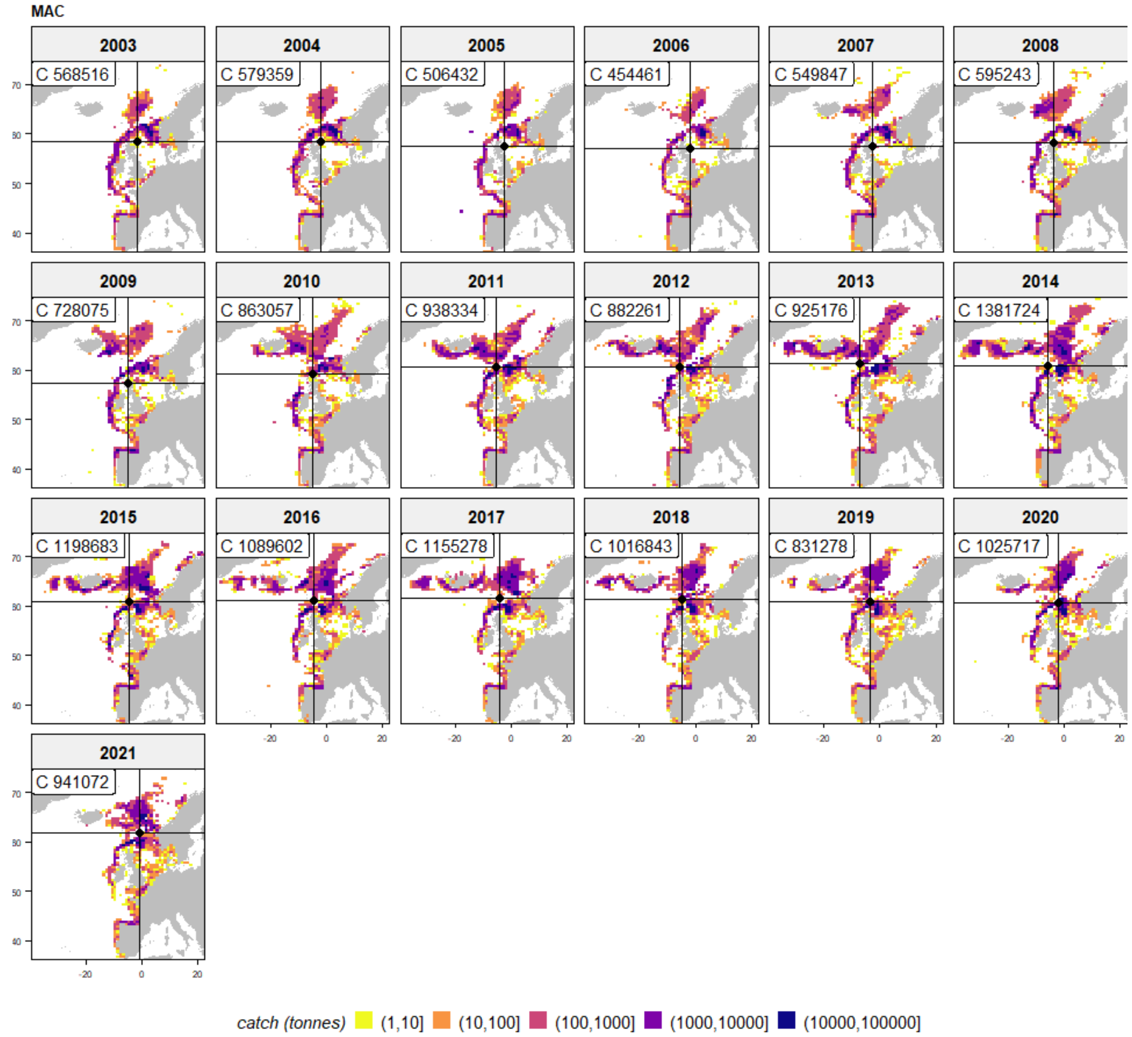

Figure 5. Catch of mackerel (t) by year and rectangle. Catch by rectangle data do not represent the official catches and cannot be used for management purposes. In general, the total annual catches by rectangle are within 10% from the official catches (Figure retrieved from ICES 2022e).

Norwegian Spring Spawning Herring

The main fishery take place during the 4th and 1st quarter of the year. The fishing fleet target NSSH in the Norwegian Sea during in October-December when herring migrate towards over-wintering grounds, in December-January along the northern Norwegian coast or during the spawning migrations in February-March (Figure 6), and both pelagic trawl and purse-seines are applied. Bycatch of salmon can occur, but the risk is probably low. The western location of the herring fishery during late autumn can overlap with historic feeding grounds for adult salmon in northern Faroes (Jacobsen and Hansen 2001) and eastern Icelandic Waters. There is only a limited fishery for NSS-herring during April-June, in the period when the majority of post-smolt migrate along the Norwegian coast or in the Norwegian Sea. There is a trawl fishery during July-August east of Icelandic and north of Faroe Islands (Figure 6), which may spatially overlap with both post-smolts and sea-winter salmon. The SGBYSAL report (ICES 2004) describes an incident with 200 sea-winter salmon caught among 800 t of herring in the Norwegian Sea southwest of Svalbard in august 2002. There has not been a fishery for herring in the northern Norwegian Sea in recent years.

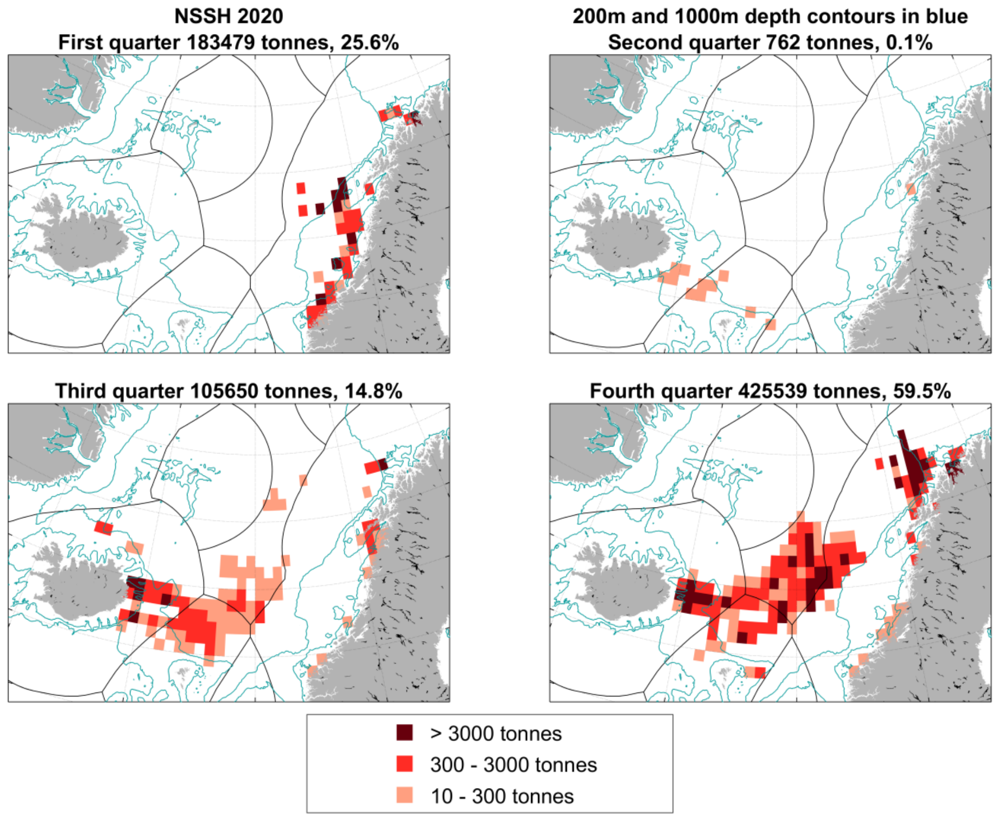

Figure 6. Total reported landings (ICES estimates) of Norwegian spring-spawning herring in 2020 by quarter and ICES rectangle. Landings below 10 t per statistical rectangle are not included. The landings with information on statistical rectangle constitute 99.2% of the reported landings. Figure taken from ICES 2021b.

Icelandic summer-spawning herring

The distribution of Icelandic summer-spawning herring has shown a large variation between periods which is reflected in the changes of catch locations. For example, the herring fishery 2021/2022 took place in offshore waters west and east of Iceland whereas majority of the catches in 2007-2010 were caught in shallow waters inside Breiðafjörður in the west of Iceland (Figure 7; MFRI 2022). The fisheries for Icelandic summer-spawning herring are done by purse-seines and usually is an autumn fishery (September–December) but continues into January or February in some years. The risk of overlap is therefore limited for post-smolt because their migration happens outside the timing of the fisheries. There might be an overlap with sea-wintering fish, however, the risk varies between years due to the shift in distribution patterns mentioned above.

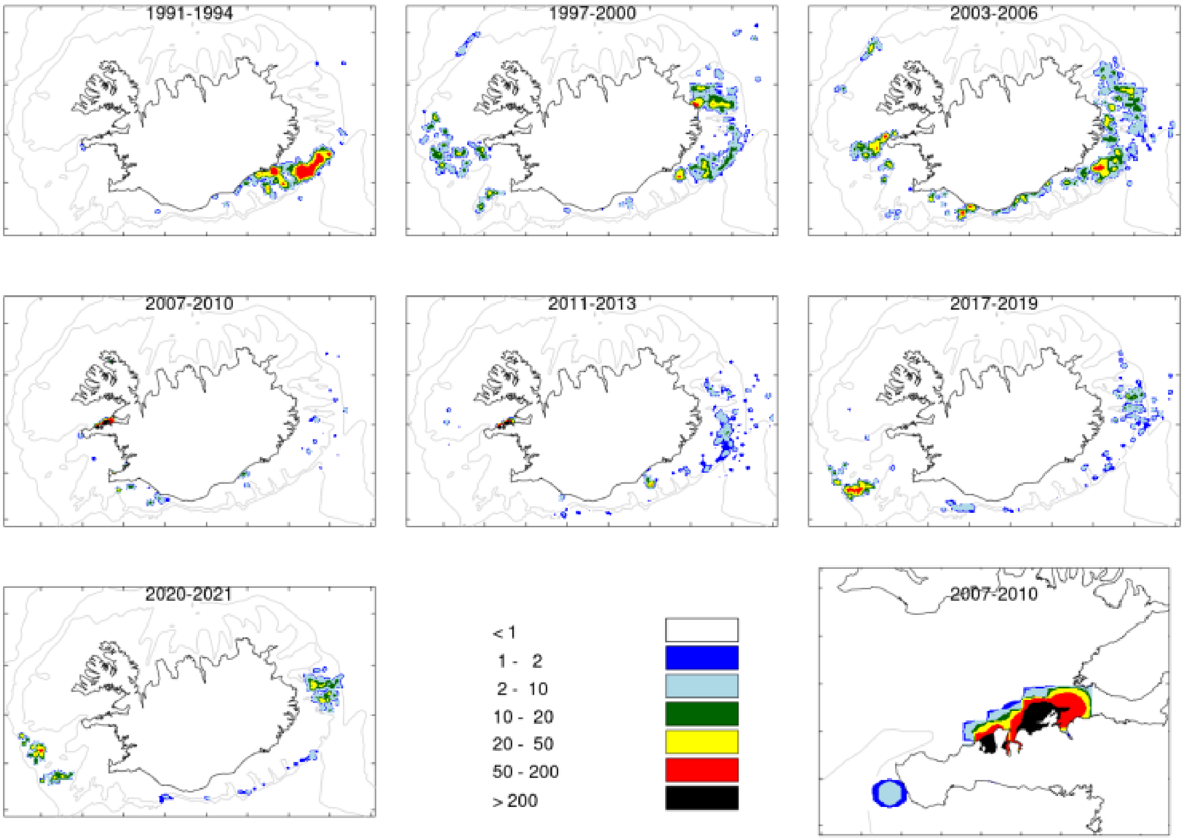

Figure 7. The distribution of catches of Icelandic summer-spawning herring given in tonnes for different periods from 1991-2021. For the years 2007-2010 the distribution inside Breiðafjörður is shown in the right-bottom corner. Figure from MFRI 2022.

North Sea herring and adjacent areas

Herring fisheries occur over a wide spatial area (Figure 8). The largest fishery is within the North Sea with an estimated Spawning Stock Biomass of 1.35 million t in 2021. A Celtic Sea and Channel autumn and winter stock also exists with landings of just 34 000 t (ICES 2022f). The Irish Sea autumn stocks has a spawning stock biomass of just under 40 000 t, and a west coast of Scotland herring (ICES division 6) spring and autumn fishery also occurs (ICES 2022f).

The North Sea herring pelagic trawl and purse-seine fishery takes place late April, May, and June. The fishery occurs in northern parts of the North Sea and can potentially have bycatch of both post-smolt and returning adult salmon from British, Swedish, Danish, German, and Norwegian rivers. The fishery during summer is limited, but there is an autumn fishery in central and western parts of the North Sea from August to December. The risk of salmon taken as by-catch in the autumn fishery is limited but cannot be excluded due to salmon potentially feeding in the North Sea during autumn and winter. The fishery for North Sea herring during winter is very limited.

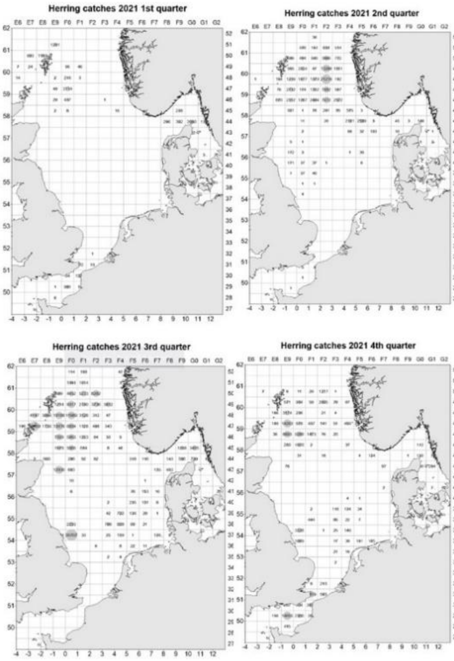

Figure 8. Catch by statistical rectangles of North Sea herring each quarter of the year in 2021. Figure taken from ICES 2022f.

Capelin

Barents Sea capelin: Landings of capelin in the Barents Sea has large interannual and decadal variation due to the large fluctuation in stock size. During the 70s and early 80s, annual landings were within the range 1-3 million t (ICES 2021c) and the fishery had two seasons: August-October and January-April. Due to several collapses of the stock, annual landings have ranged from 0 to 360 000 t since year 2003 and there is no longer an autumn fishery. The fishery has in recent years been carried out in the Barents Sea close to the coast off northern Norway (Figure 9), but the fishery was completely closed in 2016-2017 and in 2019-2021. Bycatch of sea-winter salmon have occurred in the capelin fishery (ICES 2004). The fishery has limited risk of bycatch of salmon due to the relatively small total landings in most years, but there may be a spatio-temporal overlap with salmon feeding in the Barents Sea. There is anecdotal information about salmon taken as bycatch in the winter capelin fishery.

Icelandic capelin: The distribution of capelin around Iceland has changed following warming of the ocean both for the adult spawning stock as well as for the immature stock. Both juveniles and adults have moved west and north towards Greenland from 2000 (Bardarson et al., 2021). The fishing of capelin in Icelandic Waters is mostly taking place in winter during January - March and the distribution of the catch has been moving to the north along with the changes in stock distribution, but the catch follows the spawning migration and begins east of Iceland and then moves along the southern coast and ends on the western coast of Iceland (Figure 10, Singh et al., 2020). The capelin fishery has a risk of bycatch of salmon but may be limited due to timing which does not coincide with post-smolt migration. Capelin is, however, a common prey-item for salmon, and recent tagging of kelts from various countries (Rikardsen et al., 2021 see figure 3) might be indicating that post-spawning salmon from southern Norway and from Denmark migrate up to the coast of Eastern-Greenland and overlap with the feeding grounds of Icelandic capelin during autumn – early winter. Whether the salmon follows the capelin on their spawning migration south and would therefore be subjected to fisheries of the Icelandic fleet is unknown. Bycatch reports from capelin fisheries of the Icelandic fleet are less common than the bycatch of the mackerel fleet.

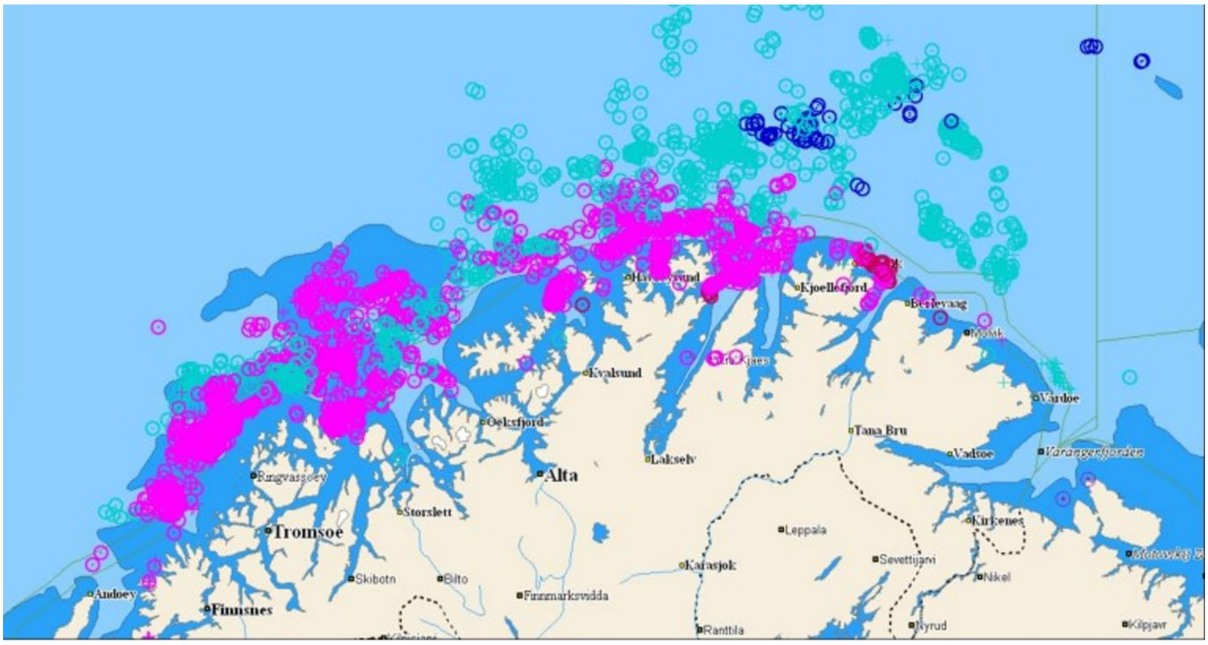

Figure 9. The geographic distribution of Norwegian capelin catches in the Barents Sea the years 2012-2018. Circles represents purse-seine catches while crosses represents trawl catches, and colour coding represents the catch month (January-blue, February-green, March-pink, April-red; Figure produced by Are Salthaug).

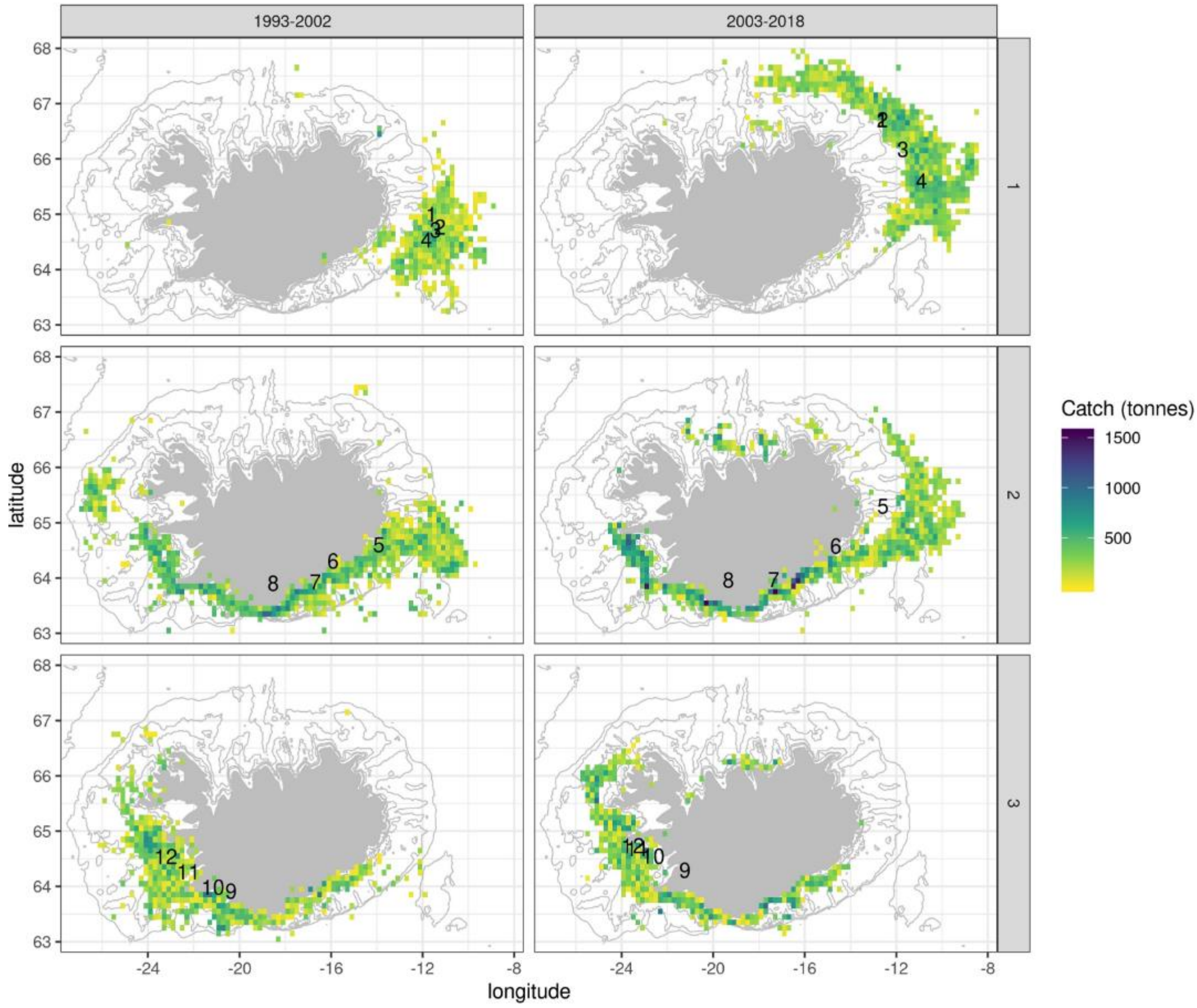

Figure 10. Distribution of catch intensities from the winter capelin fisheries separated by months (1–3; representing January – March) and two time periods (1993–2002 and 2003–2018). Position of the centre of gravity of weekly catches is indicated by numbers corresponding to calendar weeks. Figure from Singh et al., 2020.

Horse mackerel

Horse mackerel are fished in the North Sea, the English Channel, west of Scotland and Ireland and in the bay of Biscay. There is a trawl fishery potentially overlapping with migrating post-smolts west of France and Ireland and in the English Channel in the period April-June (Figure 11). The total landings in 2021 was ~93 000 t with ~8000 t landed in the period April-June, which makes it a small fishery compared to several of the other pelagic fisheries in the North Atlantic (ICES 2022e).

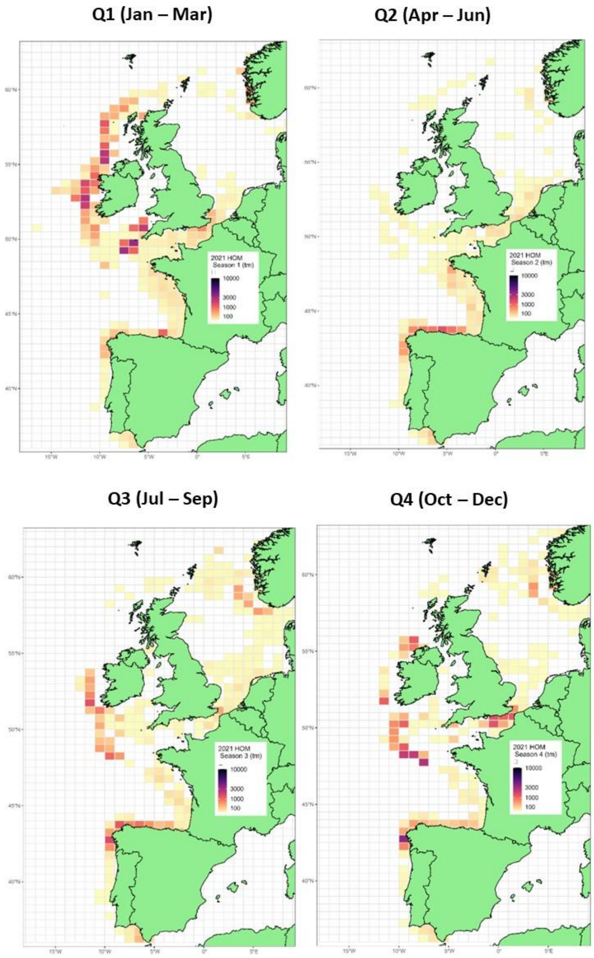

Figure 11. Maps of total commercial catches of horse mackerel in 2021 per quarter of the year (Figure modified from ICES 2022e).

Blue whiting

The risk of salmon occurring as bycatch in the blue whiting fishery was evaluated by SGBYSAL (ICES 2004) and WGNAS (ICES 2017). The main fishery target spawning blue whiting southeast of the Faroes Islands and west of Scotland and Ireland during the period January-April (Figure 12). During January-April, blue whiting are fished with pelagic trawl at 250-600 m depth. The risk of bycatch of salmon in this winter-fishery has previously been evaluated to be low (ICES 2004, 2017). Blue whiting is also fished with pelagic trawl at the feeding grounds in the Norwegian Sea during late spring and summer. This is often a mixed fishery targeting other pelagic fish, but the fishery can also be a single-species fishery targeting blue whiting. The fishery in the Norwegian Sea increase in years when a lack of coastal state agreements on how to share quotas restricts some nations to fish blue whiting at the spawning grounds. A directed trawl fishery for blue whiting in the Norwegian Sea have a higher risk of catching salmon as bycatch due to the spatio-temporal overlap with both post-smolt and sea-winter salmon, although trawling is normally not done at the surface. SGBYSAL did not report any observations of salmon taken as bycatch in the blue whiting fishery (2004), but there was a catch of 5 kg salmon among a commercial catch of blue whiting taken within the Icelandic EEZ in 2015 (ICES 2017).

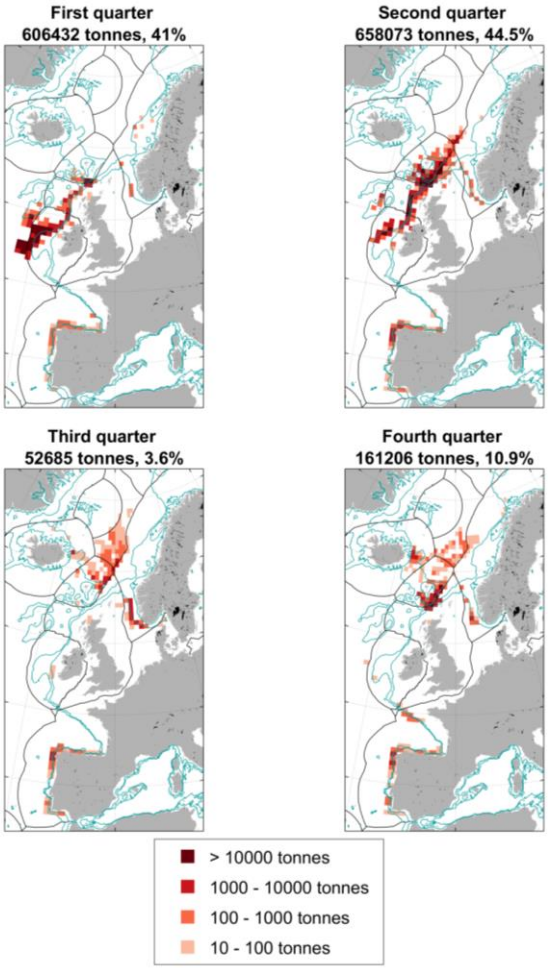

Figure 12. Blue whiting catches per quarter 2020. The catches on the map are based on logbook data and constitute 98.9 % of the ICES estimated catches. The total catches and percentages shown on each panel are also based on logbook data, and therefore deviate slightly from the ICES estimated catches pr. quarter. The 200 m and 1000 m depth contours are indicated in blue (Figure modified from ICES 2021b).

Anchovy and sardine

Southern anchovy and sardine fisheries occur in the Bay of Biscay (ICES division 8.a, b and c) and northern Atlantic Iberian waters (9.a). The sardine fishery also extends north to southern Celtic seas and the English Channel (ICES divisions 7). Both fisheries consist of purse-seine and pelagic fleets (ICES 2022g).

The Bay of Biscay anchovy purse-seine fleet mainly takes place in autumn, whereas the purse-seine Basque fishery mainly operates in spring. The pelagic trawlers largely operate during the second half of the year (July-October), but with less catches. In 2021 catches were 27 982 t which has reduced following the anchovy fishery closure (2005-2019). Anchovy catches in 2021 within division 9.a was estimated at 17 837 t. This Iberian anchovy fishery is almost exclusively harvested by purse-seine fleets (ICES 2022g).

The sardine fishery takes place in Celtic Seas (7.a, b, c, f, g, j, k), English Channel (7.d, e, h) and in Bay of Biscay (8.a, b, c). The Spanish sardine purse-seine fishery (8.c) takes place during March and April and in the fourth quarter of the year. Sardine catches have declined from 8000 t in the late 90s to just under 6000 t in 2021. In France (ICES divisions 8.a-b) just over 20 000 t of sardine were landed in 2021 and mainly from coastal waters (< 10nm from the coast) from purse-seine fisheries. Highest catches are usually during summer, but winter catches can also be important (ICES 2022g).

Greenland halibut, cod, and redfish in East Greenland

The pelagic fisheries in East Greenland have been absent in the two most recent years since Atlantic mackerel has moved further east in the North Atlantic. Offshore bottom trawling for cod, redfish, and Greenland halibut (*Reinhardtius hippoglossoides*) is unlikely to have salmon bycatch. Salmon were never caught in bottom-trawl surveys.

North Sea sandeel

Sandeel fisheries occur throughout their range with the main fishery occurring in the North Sea between 1st of April and the end of July. Sandeel populations have declined in recent years after peak catches in the late 1990s reaching to more than 1 million t (primarily from Norwegian and Dutch vessels). After a period of declined effort in the early 2000s, effort in recent years has increased again with the fourth highest CPUE of the time-series occurring in 2021 (ICES 2022f). Sandeels are primarily caught by pelagic trawls with a small mesh (<32 mm codend) but also by demersal trawls (ICES 2022h). In recent years the fleet size and distribution has changed to fewer but larger vessels (>40m; ICES 2022f, 2022h). The spatial distribution of this fishery is variable from year to year (Figure 13; ICES 2022f).

Figure 13. Sandeel in ICES Subarea 4 and Div. 3.a. Catch by ICES rectangles 2006–2021. Area of the circles is proportional to catch by rectangle (ICES 2022f).

The overlap with Coastal fisheries

"Since salmon migrate out from and back to their natal rivers, bycatch from coastal fisheries can occur, and have been primary observed in gillnet fisheries targeting fish such mullet, sea bass, and sea trout (Sumner, 2015; Elliott et al., 2023a). Adult salmon are more likely to be caught than smolts by static gear due to their size, and because return timings can span a larger proportion of the year (Gillson et al., 2022)" (paragraph from ICES 2023a).

Here we define coastal fisheries as fisheries that take place within 12nm of countries. This is because stricter nation-specific fisheries restrictions occur within 12nm of each country's coast allowing only certain non-native vessels to fish within these waters (Historic fishing rights). Within this limit, a range of fishing activities can take place by country based as well as foreign vessels depending on each country's rules and regulations.

Few studies exist on the risk of salmon bycatch from coastal fisheries. This is because reporting of coastal bycatch can be cumbersome for smaller (<12m) vessels, and they are not required to have VMS installed. A distribution modelling study by Elliott et al., (2023a) used imperfect detection from different fishing gear types from the French fisheries observer programme covering vessels >12m and ICES divisions 3.a, 4.b-c, 7.d-h, 8.a-b. From this study, a higher gear capture was found from static fishing gear types (i.e. gillnets) followed by pelagic trawls (i.e. midwater pelagic trawls and midwater otter trawls; Figure 14). It should be noted that there are differences in fisheries, gear use, and onboard observer effort between countries (Ifremer, 2021; Cloatre et al., 2021; UK Data coordination group, 2022). Inshore VMS are now being enforced for vessels under 12m and so monitoring of coastal fishing effort in future years will be more easily accessible.

Figure 6.1 (1) from WGBYC 2022 indicates potential coastal fisheries by métier level 3 gear categories (Appendix 4) which can be cross-verified with finer spatio-temporal scale fishing from GFW courser gear categories in Appendix 2. For the risk of bycatch to be considered, temporal coastal fisheries bycatch risk needs to be considered given the migration of salmon. Finer scale monthly VMS fishing effort per métier level 3 gear categories would, however, help better identify fisheries which overlap in space and time with salmon migration. Critical periods to look at are between April and June for smolts with more southerly stocks migrating earlier than northerly stock. Between May and July for returning adults, between March and May for MSW returning adults (more southerly stocks migrating earlier than northerly populations). For 1SW fish migrating back to sea following spawning, migrations occur from late winter to early spring (Gilbey et al., 2021; Rikardsen et al., 2021).

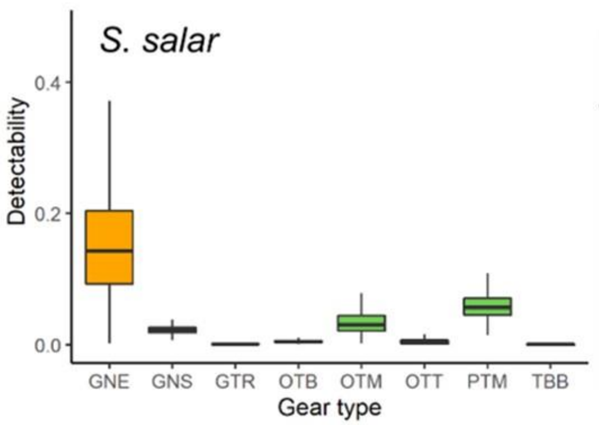

Figure 14. Salmon bycatch detectability from a distribution model containing French fisheries observer data covering waters in ICES divisions 3. a, 4.b-c, 7.d-h, 8.a-b (modified from Elliott et al., 2023a).

Country specific coastal fishing summary

Iceland: Ocean fishery for salmon in Icelandic Waters was banned by law in 1932. However, prior fishing rights for salmon at five costal locations at the west coast of Iceland were operated until 1997 when a terminating buy-out agreement was accepted. Since that time, no legal fishery for salmon has been in operation. Coastal fishery for seatrout and sea-run Arctic charr are operated at few locations around the Icelandic coast. The fishing time is from 1st of April through to September and the weekly fishing hours are 84 from Thursday morning at 10AM to Friday evening at 10PM. There are strict regulations on allowable fishing gear such as mesh size (40 mm knot to not), the thread thickness limit is set at 0,4 mm, and the total length limit is 50m with a depth of 2.5m. This is to minimize the risk of adult salmon bycatch. Release of salmon is obligatory for both dead and life fish. This is also the regulation for salmon taken as bycatch in other fisheries. Despite these strict regulations, bycatches can happen and are in some cases reported to the Directorate of Fisheries.

Norway: Norway has a long coastline with a diverse fleet targeting a variety of species. The use of gillnets with mesh size larger than 32 mm (knot to nearest knot) above 3 m depth is prohibited to avoid bycatch of anadromous species. The use of gillnets in close vicinity to river mouths are for the same reason also illegal. The coastal gillnet fishery targeting species such as cod, saithe, monkfish and hake is normally carried out with bottom nets at >30 m depth. Longlines are applied in the coastal fishery targeting the same species as the gillnet fishery. The risk of catching salmon at the longline or gillnet fishery is relatively small, although such bycatch has occurred (ICES 2017 and this report).

There is a small-scale purse-seine fishery within Norwegian fjords targeting pelagic species. The coastal fishery for mackerel (Figure 4), horse mackerel and herring (Figure 6) is carried out in autumn, although sporadic catches are taken throughout the year, and therefore have limited spatio-temporal overlap with both post-smolts and returning adult salmon. The coastal fishery for sprat is also carried out in autumn as its prohibited until 31st of July. The coastal purse-seine fishery for saithe is carried out in spring-autumn and can potentially overlap in time and space with salmon in the Norwegian coastal zone. There are unverified reports of bycatch of salmon in the coastal purse-seine fishery for saithe and sprat (pers. comm and regional reports by the county governor). Bycatch in these fisheries may in some years overlap with late returning salmon which can remain in fjords and wait for increasing river discharge levels.

UK: Most of the UK's fleet comprises of <10 m vessels (>4000 vessels), with the Northern Irish and Scottish vessels have the most >10m vessels. Nonetheless larger vessels (>24 m) hold up to 65% of the fleet's capacity. Landings of pelagic, demersal and shellfish species occurs in both inshore and offshore waters within UK waters (MMO, 2021).

UK - England and Wales: Very little information exists on salmon bycatch in English and Welsh *observer data*, but salmon bycatch from the English and Welsh offshore stratified random sampling programme of vessels >7m have been recorded by gillnets and demersal trawls. Although salmon at sea is not specifically targeted in England and Wales, landings collated data indicate captures from a range of gear types (static nets, pots, lines, demersal and pelagic trawls) since 2009.

Marine *recreational fisheries* are an important economic activity in English and Welsh waters, but they can have impacts on fish stocks (Hyder et al., 2021). Sea angling surveys began in 2016 to meet DCF requirements using a method described in UK DCF technical report (2016; EU DCF report 2021). In the England and Wales an estimated 437 000 sea anglers were reporting in 2019 (Hyder et al., 2021). Since 2018 zero salmon have been recorded to be kept (Hyder et al., 2021). Unreported catch within recreational sea angling is unknown.

UK - Scotland: In addition to both inshore and offshore pelagic and demersal fisheries, a small net fishery targeting sea trout operates in Scotland.

UK - Northern Ireland: The coastal fisheries around N. Ireland are dominated by crustacean fisheries inclusive of potting/trapping for *Cancer pagurus* and *Homarus gammerus* and bottom trawling for *Nephrops norvegicus*. These fisheries offer virtually no chance of salmonid bycatch. The only notable inshore pelagic fishery in N. Ireland is a small-scale coastal fishery for herring (*Clupea harengus*) operated opportunistically along the coastline of County Down in the Irish sea. Analysis of records for this fishery indicate that, when undertaken, it is operated in autumn (c. Sep-Nov) and employs gillnets to target herring. The timing of this fishery is outside the local smolt emigration window (April-June) and therefore unlikely to capture smolts or post-smolts as bycatch. No records of bycatch are available.

Unavailable country-coastal level information: Information about coastal fisheries in Portugal, Netherland, Germany, Belgium, East Greenland, Denmark, France, Ireland, Spain, Sweden, Russia, and Faroes was not available at the time of meeting but, would be required for a complete risk assessment.

Report on Effectiveness of Monitoring

What other monitoring happens that might detect salmon bycatch?

Within this section knowledge of existing monitoring methods (Table 1) are outlined. Note that these are not exhaustive but information which was available at the time of completing this report. It is also important to keep in mind that salmon and sea trout are frequently confused.

Table 1. Monitoring methods provided in the 2022 data call-template and their suitability for inclusion in bycatch assessments as considered by WGBYC (ICES 2022c).

	Monitoring Method	Summary
SO	At-Sea Observer	Data collected by independent observers using appropriate protocols for quantifying bycatch are currently considered by WGBYC to be the most reliable source of data for the calculation of bycatch rates across the full range of sensitive taxa for inclusion in detailed bycatch assessments.
PO	Port Observer	Data collected by independent observers in port are not currently considered reliable enough by WGBYC for the calculation of bycatch rates for inclusion in detailed bycatch assessments, though they may have value for highlighting bycatch occurrence in fisheries with no other monitoring.
EM	Electronic Monitoring	Data collected with electronic monitoring systems with appropriately placed cameras and suitable species identification methods are currently considered by WGBYC to be reliable for calculating bycatch rates for inclusion in detailed bycatch assessments.
VO	Vessel Crew Observer	Data collected by fishers following specific sampling protocols are currently considered by WGBYC to be moderately reliable for calculation of bycatch rates, particularly if data accuracy can be validated against independent monitoring data from the same fishery.
LB	Logbooks	Data recorded by fishers as part of mandatory bycatch reporting in official logbooks are currently considered by WGBYC to be unreliable for calculation of bycatch rates and inclusion in detailed bycatch assessments (see Basran & Már Sigurðsson 2021). Logbook data may have value for highlighting bycatch occurrence in fisheries with no other monitoring and/or for sensitive fish species that are permitted for sale.
OTH	Other	Other unspecified monitoring methods, e.g., interviews with fishers, are currently considered by WGBYC to be generally unsuitable for the calculation of bycatch rates for inclusion in detailed bycatch assessments as underlying biases are difficult to evaluate and estimate.

Country-specific monitoring programmes:

East Greenland: There have been reports that people in Tasiilaq catches a few salmon when jigging for cod during winter from the sea ice, but the local fishery for cod, Greenland halibut and char is insignificant.

France: In 2011, a synthesis of coastal salmon bycatch in the Bay of Biscay (Basque-Landes coast) was conducted using several sources of information (at sea observations, reporting system, market sales data) gathered from 2000 to 2001 and then from 2005 to 2010 (Morandeau & Caill-Milly 2011). Salmon were not a target species for this fleet, according to observers at sea and logbook analysis, but they were occasionally caught in small quantities. Only gillnets were used to catch salmon, accounting for less than 2% of the total catch of the observed vessels (18-200kg) and 0.1% of the total catch of all observations. Coastal vessels are likely to have a higher proportion. In fact, because it is not a mandatory marketing method, data from the onshore-market network are only partially representative of actual catches (direct sales are possible). Marine recreational fisheries occasionally catch salmon, but their proportion of the total annual catch remains small (less than 1%). It is also important to keep in mind that salmon and sea trout are frequently confused. In addition, France has an onboard observer programme (ObsMer) which has existed since 2003, where approximately 4% of vessels are boarded and recordings of bycatch are undertaken.

Ireland: Official fisheries statistics from the Irish Marine Institute from the Irish sea, Celtic Sea and Aran grounds regions, ICES Subdivision 27.6 and 27.7, show no reports of salmon caught as bycatch. All coastal salmon target fisheries ceased from 2006. Salmon caught as bycatch must be reported if they end up in the discard sample, however there are currently no records of any bycatch/discard observations in Irish demersal and pelagic fisheries. The frequency of salmon being caught as bycatch is believed to be exceedingly low and as such may explain the lack of reporting in national demersal and pelagic discard databases. Unreported catch within recreational sea angling is unknown.

Norway: The fishery for anadromous fish is managed by the Norwegian Environment Agency, and salmon caught at sea is therefore not a part of the Norwegian legislation regulating the commercial fishery and sales of marine fish. Hence, salmon caught as bycatch in marine fisheries do not need to be reported to the marine fishery sales organizations. Furthermore, bycatch is not the focus when monitoring commercial catches from the pelagic and coastal fishery, although bycatch is one of several criteria used when performing a risk assessment of fisheries. Such risk assessment can lead to fishing activity being prohibited in restricted geographic areas and periods. It was not possible to retrieve data on landings screened for bycatch within the deadline of this report.

Some salmon caught as bycatch in other marine fisheries are sold to, and thereby being registered by, the marine fish sales organizations. This includes salmon caught in the licenced bag- and bend-net fishery as well as salmon caught as bycatch when targeting other marine fish. After removing the salmon that most likely were caught in the licenced salmon fishery, a total of 175 salmon caught at sea were registered by marine fish sales organizations in the period 2013-2022 (Table 2). The majority of these (100 individuals) were caught by gillnet, and these individuals were taken throughout the year and along the entire Norwegian coastline. For the other gear categories, the landed salmon was mostly caught in coastal waters off southern Norway. It is reasonable to assume that a large proportion of the salmon caught along the Norwegian coast is escaped farmed salmon as especially escaped adults tend to remain in the coastal region after escaping the pens (Skilbrei et al., 2015).

Table 2. Salmon caught at sea and sold through the Norwegian sales organizations for marine fish in the period 2013-2022.

Fishery	Region	Number	Months
Purse-seine	Southwestern Norway	20	Aug-Dec
Gillnet	Entire Norway	100	Jan-Dec
Trawl (shrimps)	Southern Norway	12	Mar-Jul
Lines	Entire Norway	14	June-Sep
Traps	Southern Norway	29	Mar-Aug

Spain: Since 2010, bycatch statistics only show two sales of salmon (two fish) in the Asturian markets, both corresponding to year 2011. There is no other reported salmon bycatch.

Sweden: Official fisheries statistics from the Swedish Agency for Marine and Water Management (SWaM) from the Kattegat and Skagerrak regions, ICES Subdivision 20-21, show very small amounts of salmon caught as bycatch. Since all salmon target fisheries ceased from 2015, all reports (max. 79 kg) after this date are presumed to be bycatch, however, not officially reported as bycatch. It is also unknown in which fishery these salmon were caught as bycatch. The gear reported for salmon was gillnets, traps and fykenets.

The Swedish Agency for Marine and Water Management (SWaM) has the overall responsibility for Swedish implementation of the EU's fisheries control in Sweden. SWaM are responsible for controlling the fish that is caught, landed, imported, exported, transported, and sold in Sweden. This is conducted, among other things, by monitoring quotas and effort (fishing days at sea), document control, landing control, transport control and decisions on fishing stops. However, documentation of bycaught salmon, especially on the west coast of Sweden, is not prioritized. Catch reporting is mandatory but the reported catch statistics needs better follow-up and bycatch statistics needs improvement. The term 'bycatch' is not consistently used and can refer to landed non-target species, 'discard' (fish thrown back in the sea) or bycatches of mammals or birds. Salmon can also be reported as regular catch, even when you fish for other species. Since 2015 there are no commercial licenses for salmon fishery in the sea, hence all caught salmon after 2015 should be considered bycatch.

The EU has decided that vessels over 12 meters must report their activities electronically. The aim is to get real-time information of fishing activities, to ensure sustainable fishing and to carry out effective supervision. Every commercial fisher is responsible for having the technology and permits required according to EU directives and Swedish law.

SWaM do not have a specific monitoring programme that specifically applies to bycatch. Targeted bycatch studies exist in Sweden's DCF WP (SLU Aqua – Swedish University of Agricultural Sciences), called Discard sampling. In the Discard sampling, SLU Aqua measures catches on-board fishing boats, with the aim to quality assure catch reports to SWaM, by comparing the catch composition when SLU is present on-board with the reported catch composition when SLU is not present, to better estimate bycatch on all trips. Observer trips have occurred on longline and gillnet vessels between 2017-2019.

UK (England & Wales): England and Welsh onboard sampling programme undertakes stratified random sampling (by region, fishing methods and occasionally by vessel size) of vessels >7m. Vessels specializing in fishing methods, fishing in foreign ports, unsafe for observers or smaller than 7m are excluded from the sampling framework. Each observer collects information for each sampled haul, specifically: gear type and mesh size, tow duration, shot and haul position, species catch composition and quantity of the landings and discards in the catch. In cases where it is not possible to process all the samples, the measured volume is estimated relative to the total catch to get a raising factor and estimate the total catch. Specifically, during each trip numbers at length are raised to the haul and then to the whole trip, which can result in rare species such as some diadromous fishes being underrepresented.

Commercial fisheries reporting of catch returns through logbooks by licensed netsmen is mandatory. To address concerns about the reliability of catch return data, and to comply with international obligations to reduce the levels of illegal and unreported catch, a carcass tagging scheme was introduced in 2009. Furthermore, fisheries are required to report the monthly numbers and total weights of salmon and grilse taken (MMO et al., 2021).

An *onshore market* sampling programme also exists for demersal, crustacean, and pelagic species. The programme estimate length and or age composition of landed components. The sampling framework comprises of auction ports and ports of sale, and days of the year. Very small ports and ports where access is denied are excluded. None-response and refusal to provide information are also recorded (UK Data coordination group, 2022). No, or very little, salmon has been recorded from this sampling plan but may be interesting to monitor. Such a sampling programme exists in other EU nations for PETS species.

UK (Scotland): All salmon taken as bycatch by this fishery are recorded by fishers in logbooks and reported to MSS. This bycatch is published as part of the Scottish governments official Salmon and Sea Trout fishery statistics (https://data.marine.gov.scot/dataset/salmon-and-sea-trout-fishery-statistics-1952-2021-season-reported-catch-district-and-method). Marine Scotland Science (MSS) oversees an at-sea scientific observer scheme for sampling biological information on catch under the (https://www.gov.uk/guidance/data-collection-framework). This observer scheme is carried out jointly by MSS and Scottish Fishermen's Federation (SFF) observers. This is a statistical survey which covers around 1-2% of >10m demersal otter trawl and seine fishing trips per year with most effort on demersal species (91%) to provide parameters for stock assessments and fishery management (MMO, 2021).

The scientific observers obtain a sample of unwanted catch at the time of sorting, from which they obtain biological information. This information is used in the statistical estimation of weights and numbers of unwanted catch by species, area, and fishery. These estimates for each calendar year are submitted to ICES for use in stock assessments. Any salmon found in the sample would be measured and recorded. The data are stored in Marine Scotland's database.

The planned number of fishing trips on which scientific observers conduct sampling each year is as follows: 36 whitefish fishing trips (36 MSS, 52 SFF). In recent years, due to covid restrictions, these plans have not been attainable, and in practice, the number of fishing trips has been substantially reduced, but is hoped the scheme will be fully operational by the end of 2023.

An additional at-sea observer scheme, the UK Bycatch Monitoring Programme (BMP), is conducted by the Sea Mammal Research Unit (SMRU). This is a monitoring programme originally designed to monitor cetacean bycatch but has since been extended to cover other protected species, including salmon. The programme targets UK fisheries considered to have high bycatch rates, including longlines and gillnets. Monitoring of pelagic fisheries was reduced due to the lower risk of bycatch observations. The data are stored in databases held by SMRU and are submitted to WGBYC data calls as required.

Scotland also has an onshore sampling design for pelagic landings (mackerel, herring, and blue whiting with horse mackerel and sprat). For this process a bucket of unsorted fish from the vessels tanks is sampled per landing. Fish length, otoliths, sex, and maturity are recorded for the first three individuals from each cm length class.

UK (Northern Ireland): No monitoring for salmonid bycatch in the coastal herring fishery. It is conducted outside the local smolt migration window and unlikely to capture salmon.

Bycatch of PIT-tagged Atlantic salmon in pelagic fisheries detected at fish processing plants

Northeast-Atlantic mackerel and Norwegian Spring spawning herring have been tagged with passive integrated transponder (PIT) tags since 2011 and 2016, respectively. Antennas at commercial fish processing plants automatically detect tagged fish, but these antennas can also detect PIT-tagged salmon among commercial catches of pelagic fish. This requires the detected PIT-tag ID's to be crosschecked against lists of PIT-tags applied to wild salmon. Automatic detections of PIT-tags can provide new knowledge on bycatch of salmon in pelagic fisheries (ICES 2017).

Locations of tagged smolt – 560 787 Norwegian smolts were tagged with PIT-tags during the period 2014-2021 and released in rivers or river estuaries. The smolts were released during the smolt migration period for the respective rivers, which is in the period April-June for rivers along western and middle Norway (Vollset et al., 2021). The tags applied to salmon vary with the institutions in charge of the tagging and include both full-duplex (FDX) and half duplex (HDX) tags of 12, 12.5, 16, 22, 23 or 32 mm length. Most of the tags were 23 mm HDX tags. Relatively few salmon were tagged with 12.5, 22 mm or 32 mm tags, and these tags are considered equivalent to 12 mm or 23 mm tags in this report. In addition, PIT-tagged smolts are also released from Scotland and Ireland although with a smaller number of individuals and over fewer years than in Norway. These data were not included in the analyses presented here.

Detection of PIT-tags in fish processing plants - The tags applied to mackerel and NSS-herring are full-duplex 23 mm tags. The tag detection antennas in commercial fish processing plants can always detect these tags, but the ability to detect various other tags are determined by tag size, duplex and manufacturer and vary between plants. There is in general a higher probability to detect FDX compared to HDX, and 23 mm tags compared to 12 mm tags.

Screened commercial catches of pelagic fish - Data on all commercial catches of mackerel, NSS-herring and North Sea herring handled by Norwegian fish processing plants during 2014-2021 were delivered by "the Norwegian Fishermen's Sales Organization for Pelagic fish". In addition, data on mackerel landings in 2014-2021 screened by other processing plants capable of detecting PIT-tags were also retrieved (ICES 2022e). The total annual biomass of screened fish is summarized in Table 3 considering the ability of the respective fish processing plant's abilities to detect different PIT-tags. The catch location of each commercial landing per ICES statistical rectangle is given in Figure 15-18.

Table 3. Annual total landings of mackerel, North Sea herring and NSS herring (t) and the biomass screened for fish tags at the fish processing plants (Full duplex (FDX) or half duplex (HDX) 12 or 23 mm tags). A) Mackerel b) North Sea Herring c) Norwegian Spring Spawning herring.

a)

Year	Total landings	FDX23	HDX23	FDX12	HDX12
2014	1 395 337	232274	165056	204435	154596
2015	1 205 396	271760	213756	247603	202191
2016	1 094 163	261121	221259	245478	213364
2017	1 156 809	233363	197946	228519	193103
2018	1 020 254	258842	178921	230538	178921
2019	831 920	171042	92384	144378	92384
2020	1 030 232	383564	275394	352349	383564
2021	1 078 411	1361	1361	1361	1361

b)

Year	Total landings	FDX23	HDX23	FDX12	HDX12
2014	517 593	43032	26948	39682	26948
2015	494 072	58126	23594	54961	23594
2016	564 880	67182	19793	58721	19793
2017	499 145	47747	24054	47747	24054
2018	604 449	86321	81047	86321	81047
2019	451 542	62154	46707	62154	46707
2020	434 000	66255	50660	66255	50660
2021	370 667	58893	44362	58893	44362

c)

Year	Total landings	FDX23	HDX23	FDX12	HDX12
2014	461 306	110 870	40 847	107 130	40 847
2015	328 740	79 552	24 144	77 617	24 144
2016	383 174	94 394	32 525	94 394	32 525
2017	721 566	192 214	75 572	192 214	75 572

a)

Year	Total landings	FDX23	HDX23	FDX12	HDX12
2018	592 899	68 934	68 934	68 934	68 934
2019	777 165	216 890	89 056	216 890	89 056
2020	720 937	195 948	63 381	195 948	63 381
2021	881 097	234 037	91 675	234 037	91 675

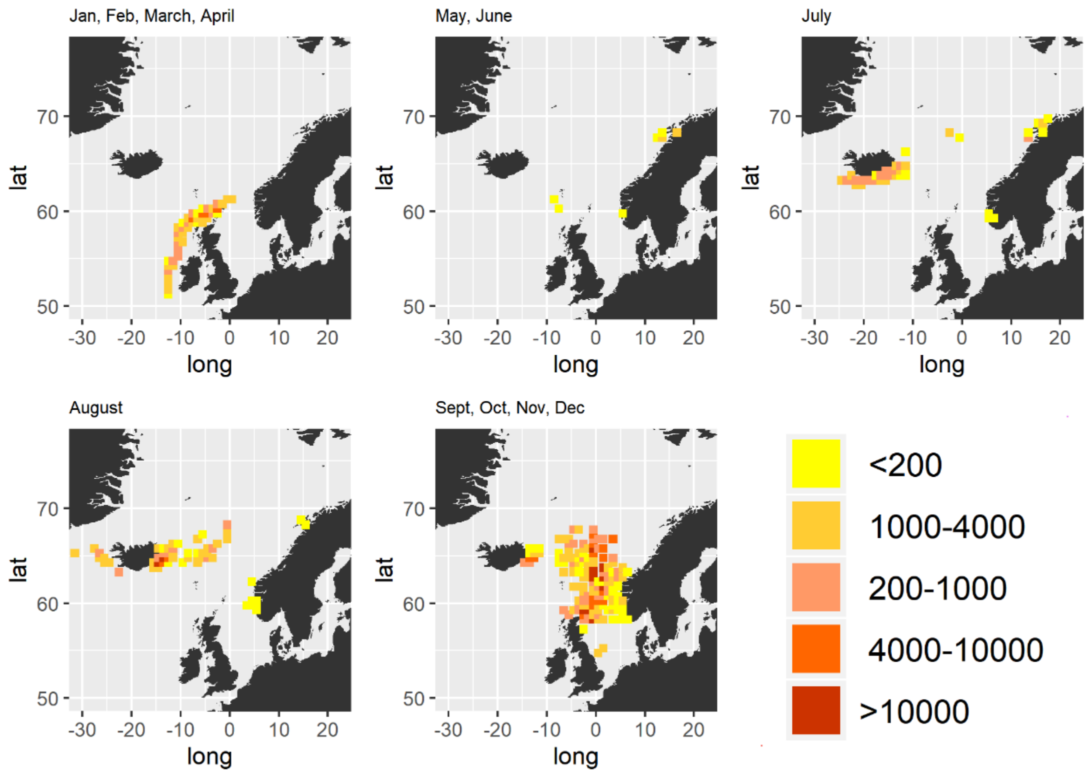

Figure 15. The catch locations of mackerel screened for PIT-tags for the years 2014-2021. The colour scaling represents total biomass of screened fish (t) per rectangle.

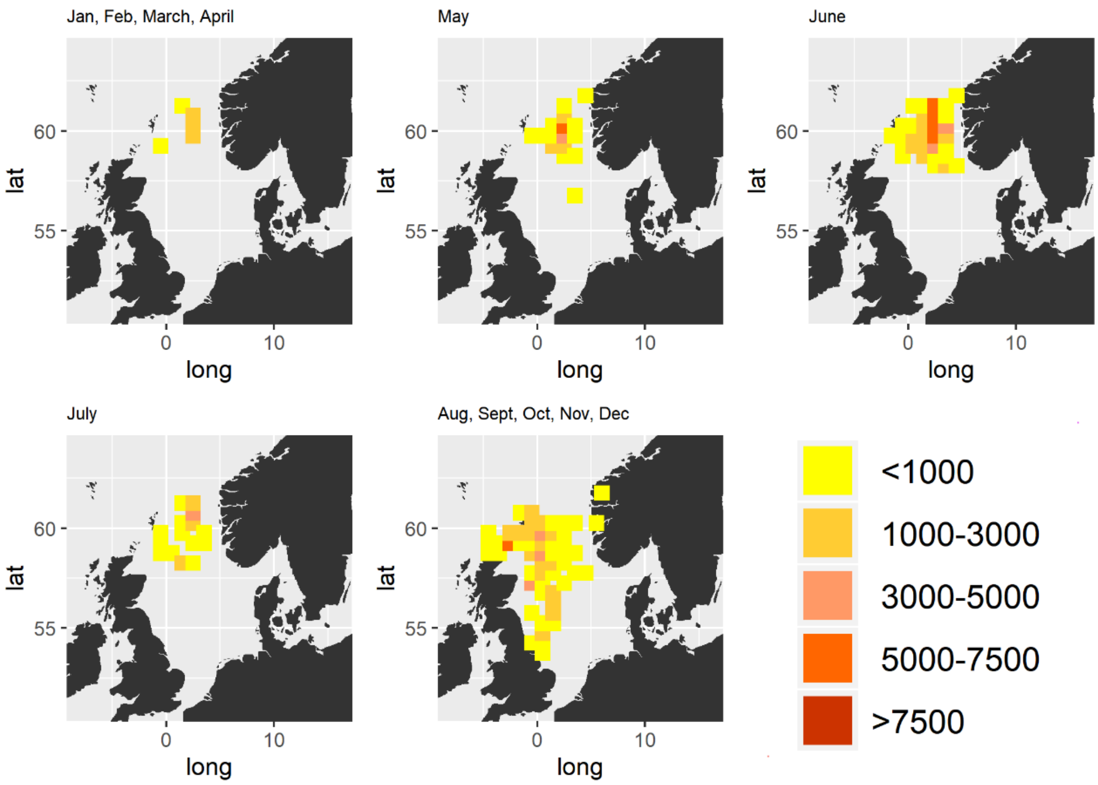

Figure 16. The catch locations of North Sea herring screened for PIT-tags for the years 2014-2021. The colour scaling represents total biomass of screened fish (t) per rectangle.

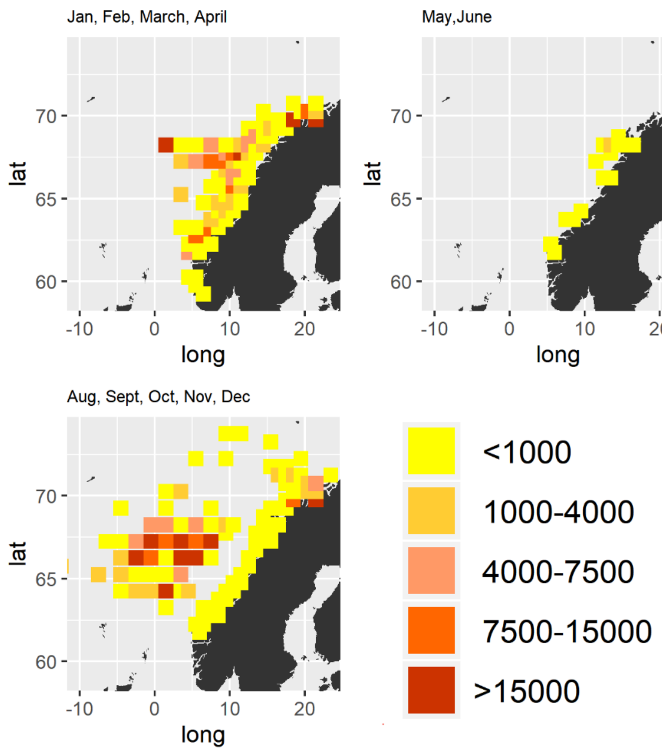

Figure 17. The catch locations of Norwegian Spring Spawning herring screened for PIT tags for the years 2014-2021. The colour scaling represents total biomass of screened fish (t) per rectangle.

Detections of PIT-tagged salmon - Three tagged salmon were automatically detected among the screened commercial catches of pelagic fish. Two individuals were post-smolts caught during their first summer at sea while the last individual had spent 2 ½ years in the sea. Two individuals were taken as bycatch in the mackerel fishery while one individual was caught in the fishery for North Sea herring. The first fish was tagged in spring 2017 at "Etneelva" with a 23 mm FDX tag. The individual was recaptured on the 16 October 2019 in the mackerel fishery. Possible recapture locations are close to the Norwegian coast or west in the North Sea close to Scotland (Figure 18). The second fish was tagged at "Vosso" in spring 2018 with a 23 mm HDX tag. It was recaptured further west in the North Sea on 26 June the same year. The individual was recaptured in the fishery for North Sea herring where the fishing gear was either purse-seine or pelagic trawl. The third fish was tagged at "Årdalselva" in spring 2015 with a 23 mm HDX tag and recaptured on 8 July the same year in the fishery for mackerel. Possible recapture locations are in close vicinity of the home river (Figure 17). The individual was caught in a coastal fishery among 20-25 t of mackerel.

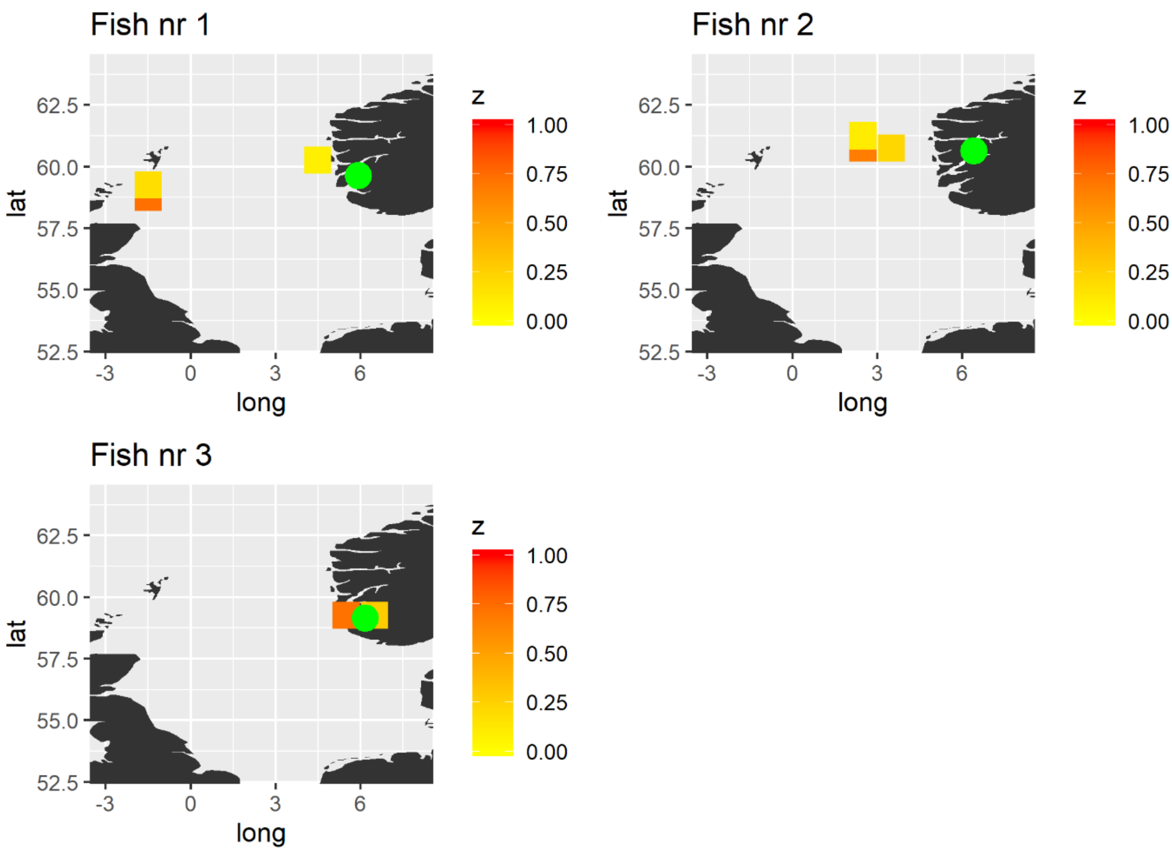

Figure 18. Tagging location at their home river (green circle) and possible recapture locations (coloured rectangles). The colour scale represents probability for recapture location, given that this is correlated to landing size of the pelagic fish.

Three tagged salmon were automatically detected as bycatch among ~1.8 million t of mackerel and ~490 000 t of North Sea herring during the years 2014-2019. Around 1 192 000 t of NSSH were screened without any automatic detections of tagged salmon. Two of the three detected salmon were post-smolts while the last salmon had spent two winters in the sea. The last individual was caught in October as bycatch in the mackerel fishery in the North Sea. The results, indicating that relatively few salmon are caught as bycatch in the pelagic fisheries in the Northeast Atlantic, is sensitive to several variables: the geographic location of released tagged smolts, the type of PIT-tags used for salmon, the detection probability of salmon tags in fish processing plants and the catch location and period of screened pelagic landings. The most common PIT-tags used for salmon, 12 mm half-duplex tags, have a low probability of being detected by PIT-recording antennae in fish processing plants. Furthermore, the fishery targeting mackerel in the Norwegian Sea in June-August, where the risk of bycatch of salmon is assumed to be high, is not delivering catches to the fish processing plants that can detect PIT-tags. It can also be mentioned that large salmon, especially those taken in smaller catches of pelagic fish, will most likely be removed directly by the fishermen. The method is therefore more reliable for post-smolt caught as bycatch in large pelagic trawl or purse-seine catches.

Risk

Risk of exposure matrix in pelagic fisheries (not risk to the stock)

Risk of exposure in coastal fisheries could not be undertaken here because information on fishing seasons was lacking. A risk of exposure matrix in pelagic fisheries, where data were available, is provided in Table 4. This is the WGNAS qualitative evaluation of the risk based on the incomplete information presented above (2.2.5).

Levels of risk exposure were defined as follows:

- Low risk: no bycatch, limited overlap of salmon presence in space, depth and time with a particular fishery;
- Medium risk: some bycatch recorded or potential overlap of salmon presence in in space, depth and in time with fisheries;
- High risk: multiple recorded bycatch and known overlap of salmon presence in in space, depth and in time with fisheries.

Levels of uncertainties were defined as follows:

- **Low certainty**: no existing information;
- **Medium certainty:** occasional bycatch observation or assumed low spatio-temporal overlap between the pelagic fishery and known migration routes and feeding areas for salmon.
- **High certainty**: multiple and regular recordings through official scheme.

Table 4. Pelagic fisheries risk of exposure matrix from literature. Note, this is not a comprehensive matrix as quantitative analysis would be required for this. Risk to stocks has not been considered either. Inshore fishing activities has not been added to this as a result of too little information at present to complete.

Country	Species	FAO subcategory	Period	Main ICES Division	Risk	Certainty level (H,M,L)
EU/FO /UK	mackerel		Jan-Apr	4a, 6a, 7 ,8	Medium	Low
EU/FO/NOR/ICE/ RU/GNLD	mackerel		May-Aug	2a, 4ab,5ab	High	Medium
EU/FO/NOR/	mackerel		Sep-Dec	2a, 4a	Medium	Low
NOR	NSS-herring		Dec-Jun	2a,	Low	Low
EU/FO/NOR/ICE/ RU/GNLD	NSS-herring		July-Nov	2a, 5ab	Medium	Low
EU/FO/NOR/ICE/RU /UK	Blue whiting		Jan-April	5b, 6, 7	Low	Low

Country	Species	FAO subcategory	Period	Main ICES Division	Risk	Certainty level (H,M,L)
EU/FO/NOR/ICE/RU	Blue whiting		May-Dec	2a, 5b	Medium	Low
EU/NOR/UK	NS-herring		May-Aug	4ab	Medium	Low
EU/NOR/UK	NS-herring		Sep-Dec	4ab	Medium	Low
EU/NOR/UK	NS-Sandeel		April-July	4,3	Medium	Low
NOR/RU	BS-capelin		Jan-Mar	1b, 2a	Medium	Low
ICE	Capelin		Jan-Mar	5a	Medium	Medium
ICE	ISS-herring		Sept-Dec	5a	Low	Medium
UK, EU, NOR	Horse mackerel	Trawling & purse-seine	Oct-March	6a, 7	Low	Low
UK, EU, NOR	Horse mackerel		April-Sept	4,7,8	Medium	Low
FR / SP	Anchovy	Purse-seine	Autumn	8a-b	Low	Medium
FR / SP	Anchovy	Purse-seine	Spring	8c	Medium	Low
FR / SP	Anchovy	Pelagic trawl	July-Oct	8a-c	Low	Medium
SP/FR	Sardine	Purse-seine	Spring and summer	8a,b,c	Medium	Low
SP/FR	Sardine	Purse-seine	winter	8a,b,c	low	Low

Other matters of interest

Targeted bycatch information

Dedicated targeted data collection programmes may be able to provide more information on bycatch of PETS species than non-targeted data such as from observer programmes. This was observed in the case of the EU IUCN critically endangered, red-listed European sturgeon (*Acipenser sturio*). From French fisheries observer data 11 *A. sturio* were recorded from 2003-2021 (Elliott et al., 2023b), but from a targeted *A. sturio* bycatch database (STURWILD; Centre for Aquaculture, Fisheries, and the Environment in New Aquitaine 142 - CAPENA, National Committee of Maritime Fisheries and Marine Fish Farming - CNPMEM, French 143 National Research Institute for Agriculture, Food and Environment - INRAE) just over 300 observations at sea from 2012 to 2021 were recorded within a reduced area than that from the fisheries observer data (Charbonnel et al., 2022a; 2022b).

Bycatch risk analysis

The French Office for Biodiversity have undertaken a bycatch risk analysis for all Habitat Directive listed species. Together with the French, a UK Fisheries Industry Scientific Partnership (FISP) project proposal (Minimising Interactions between protected Diadromous Fish and marine quota Fisheries (MInDiFF)) has been submitted to DEFRA to improve understanding of bycatch risk of diadromous fish. For this project, UK and French fisheries-dependent and -independent data are planned to be used to model the habitat of diadromous fish during the marine phases of their life cycles (Elliott et al., 2023a). Outputs from the species habitat models, in conjunction with a gear-specific bycatch matrix derived from the fisheries-dependent data (Acou et al., 2021) will be developed and used to quantify bycatch risk using gear-specific fishing effort data (Quemmerais-Amice et al., 2020; Toison et al., 2021). Upscaling such a project could provide more detailed information on bycatch risk and salmon distribution.

eDNA analysis

Since salmon bycatch data are difficult to fully understand, in part due to very low abundances, and their non-shoaling behaviour relative to other pelagic species, even a small amount of bycatch may impact their populations (Elliott et al., 2023a). eDNA analysis could therefore be used to monitor bycatch and improve understanding of salmon migratory pathways (Atkinson et al., 2018; Bracken et al., 2018; Jenrette et al., 2023).

Gaps and future developments

If NASCO wishes further precision, the following should be undertaken by the member countries and appropriate agencies:

i. Improve understanding of post-smolts and adult salmon migration route in time.

ii. Move towards more quantitative bycatch risk analysis through:
   - An analysis of risk of exposure, e.g. using information on salmon probability of presence across their migratory paths and modelling this with fishing effort data from higher risk gear types (taking into consideration both coastal and pelagic fishing effort) at an ICES rectangle and monthly scale to match the migratory timings (e.g. Queiroz et al., (2019)).
   - Analysing risk to the stock (e.g. trialling and modifying ICES WGBYC BEAM method on selected fishing gears in selected regions).

iii. Recommendation to ICES that salmon be included in the list of WGBYC species and data calls, and that WGBYC contributes to future salmon advice. If salmon is included, it is recommended that a salmon experts join WGBYC. Work with WGRFS to monitor catch and mortality of salmon sea angling. Links between WGRFS and WGBYC already exist (WGRFS latest report).

iv. Standardize salmon bycatch monitoring programmes across countries, including minimum standards for data recording and reporting.

v. Ensure descriptions of the sampling effort and sampling plan relative to total effort for the various fisheries per country (e.g. number of observed vessel-day/total days fished, per fishery/year) are easily accessible.

vi. Improve screening for salmon. Basic priorities for screening include:
   - Where not already recorded, salmon bycatch should be monitored, data collected and reported by country;
   - More salmon identification guidance is needed (confusions occur with the sea trout (*Salmo trutta*));
   - Minimum data to be collected are: date, fishery, catch location, number of salmon bycatch, fork length (preferably) and/or weight;
   - The screening of discards from factories should be explored (recommendation from ICES 2004) by having close collaborations with factories operators.

vii. Later priorities for full and effective screening include:
   - data to be collected on: date, vessel size category, gear type and target species, effort, catch location, number of salmon bycatch (including zeros in known salmon bycatch fisheries), fork length and weight, screen and record tag number (if present), scale samples;

- The screening of commercial catches on board commercial fishing vessels in pelagic (recommendation from ICES 2004, 2023a) and gillnet fisheries (recommendation from ICES 2023a);
- For fisheries that are of relevance to potential salmon bycatch, protocols should be established for screening herring and mackerel fisheries, as these are likely to require special screening methods (recommendation from ICES 2004).

viii. Trial eDNA sampling with salmon detection analysis both scientific and commercial pelagic trawls ensuring uncertainty is taken into consideration. This could be undertaken as part of observer data collection and thereby being of use to detect other PETS.

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Glossary of terms used in this annex

- Bycatch = (defined at the start)
- Offshore = 12 to 200 nm which is within the Exclusive Economic Zone as defined under UNCLOS
- Coastal = 0 to 12 nm which equates to FAO’s definition of territorial seas
- Inshore = <6nm from the coast. This definition is used since in < 6nm from the coast only vessels from their own nations (where allowed) can fish in these waters.
- High seas = >200 nm
- Gear codes have used FAO definitions and gear categories (see Appendix 4)

Appendix 1. Summary of SGBYSAL 2004

"The major pelagic fisheries in the Norwegian Sea, the North Sea and areas west and south of UK and Ireland were described and potential areas of interaction were identified based on time (quarters) space (ICES statistical rectangles) and gear type in use in the various fisheries (ICES 2004c). Information on salmon movements at sea were used to indicate that the period of potential overlap in the Norwegian Sea mackerel fishery was probably limited to a relatively short period, centred around the latter half of June and early July, confirming the need for access to weekly disaggregated catch data to fully assess potential bycatch. Disaggregated data for landings to the UK and Germany enabled a closer study of mackerel and herring fisheries in the western (VIa) and northern North Sea areas (IVa) per week and statistical rectangle. Possible areas of interception were detected also in these areas (ICES 2004c).

A model for estimating progress in time and space of post smolt cohorts in the Norwegian Sea, based on data on distribution from research surveys was also examined and projected northward with estimated progression speeds of salmon. The Study Group recommended that with further development and using appropriate data, this model could form a useful tool to assess the risk of post smolts being intercepted by commercial fisheries in the area of passage.

A review of available information on detection of salmon during screening of catches by various countries was also carried out, revealing small but consistently occurring bycatches, mainly in various types of trawl fisheries. The advantages and constraints of various methods of screening pelagic catches for bycatch of salmon were evaluated and it was concluded that observer-based onboard screening programmes were the most effective method.

Analytical methods to estimate post-smolt bycatch in commercial fisheries were also explored, using the Norwegian Sea mackerel fishery as the only example where salmon catch rate data had been obtained. Based on quarterly catch data, the overlap between post smolts and the fisheries in the Norwegian Sea appeared high, but the absence of disaggregated data (by week and statistical rectangle), impeded an assessment of the true overlap of post smolts with the fisheries.

In the absence of data on intercalibration between research catch methods and commercial catch methods, the Study Group concluded that the best method presently available would be based on direct observation on board commercial fishing vessels according to agreed protocols. Thus, estimates would be based on consistent gear types and fishing methods and would not depend on transferability of data from research catches. However, it was stressed that disaggregated catch data for week and standard rectangle for the areas in question was still a priority."

Appendix 2. Global fishing watch fishing effort information

Global fishing watch (GFW) data are measured in fishing hours per day and the data are provided at 100th of a degree (Kroodsma et al., 2018b). Figures A1 - A5 are calculated by using the total fishing effort per 0.2x0.2 decimal degrees per month, year and GFW gear category. The mean monthly fishing effort was then calculated across the years the data were collected (2012 and 2022) by gear categories which are most relevant to salmon bycatch. Mean monthly fishing effort was calculated to gauge potential overlap with salmon migratory pathways and fishing effort by gear category. Results appear to match summarized data from ICES fisheries overviews and mixed fisheries advice

(https://www.ices.dk/advice/Fisheries-overviews/Pages/fisheries-overviews.aspx#:~:text=Fisheries%20overviews%20summarize%20the%20services%20derived%20from%20fishing,methods%20being%20used%2C%20and%20how%20stocks%20are%20managed).

Figure A1. Purse-seine fishing effort per month

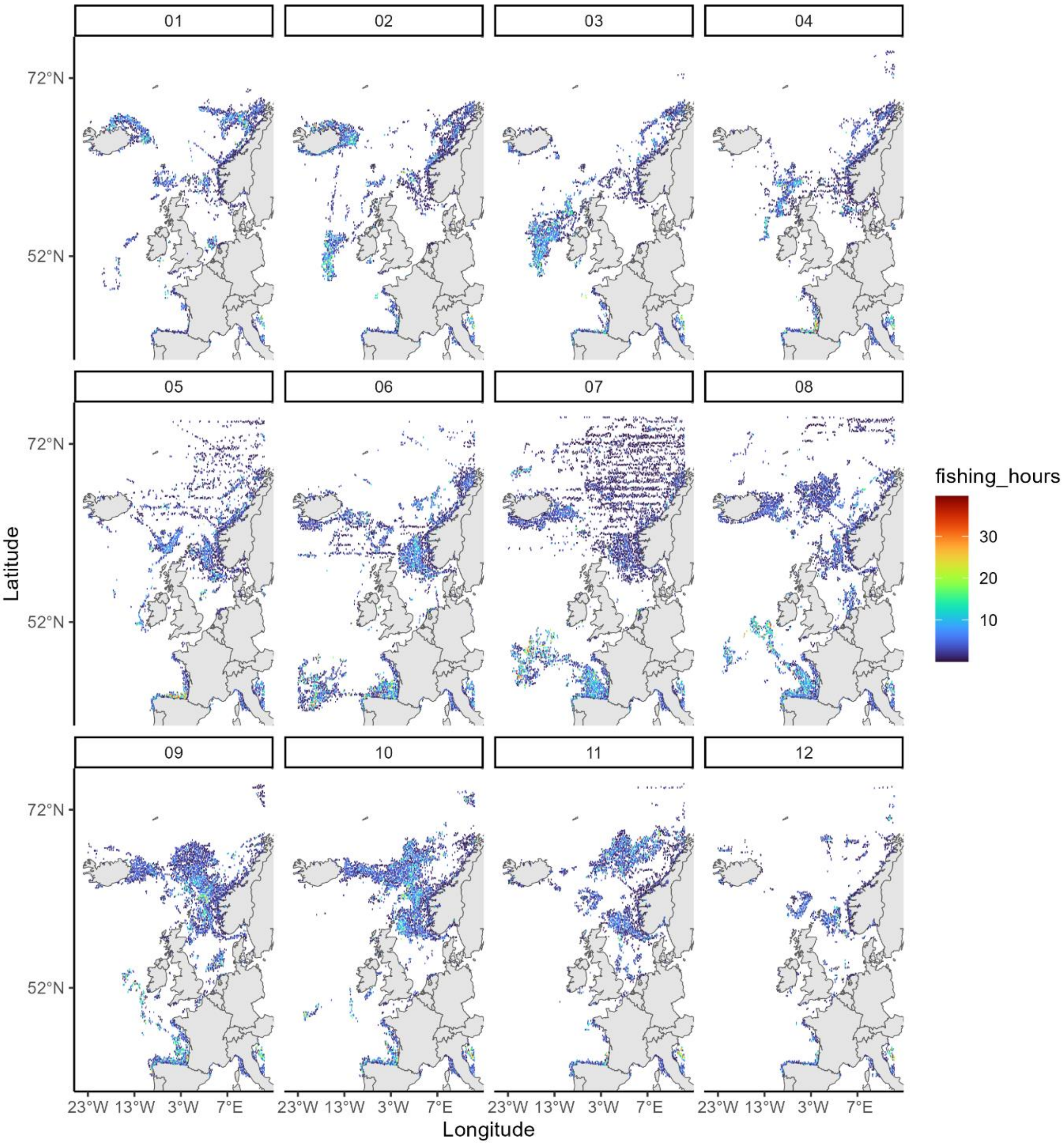


Figure A2. Seine netting fishing effort per month

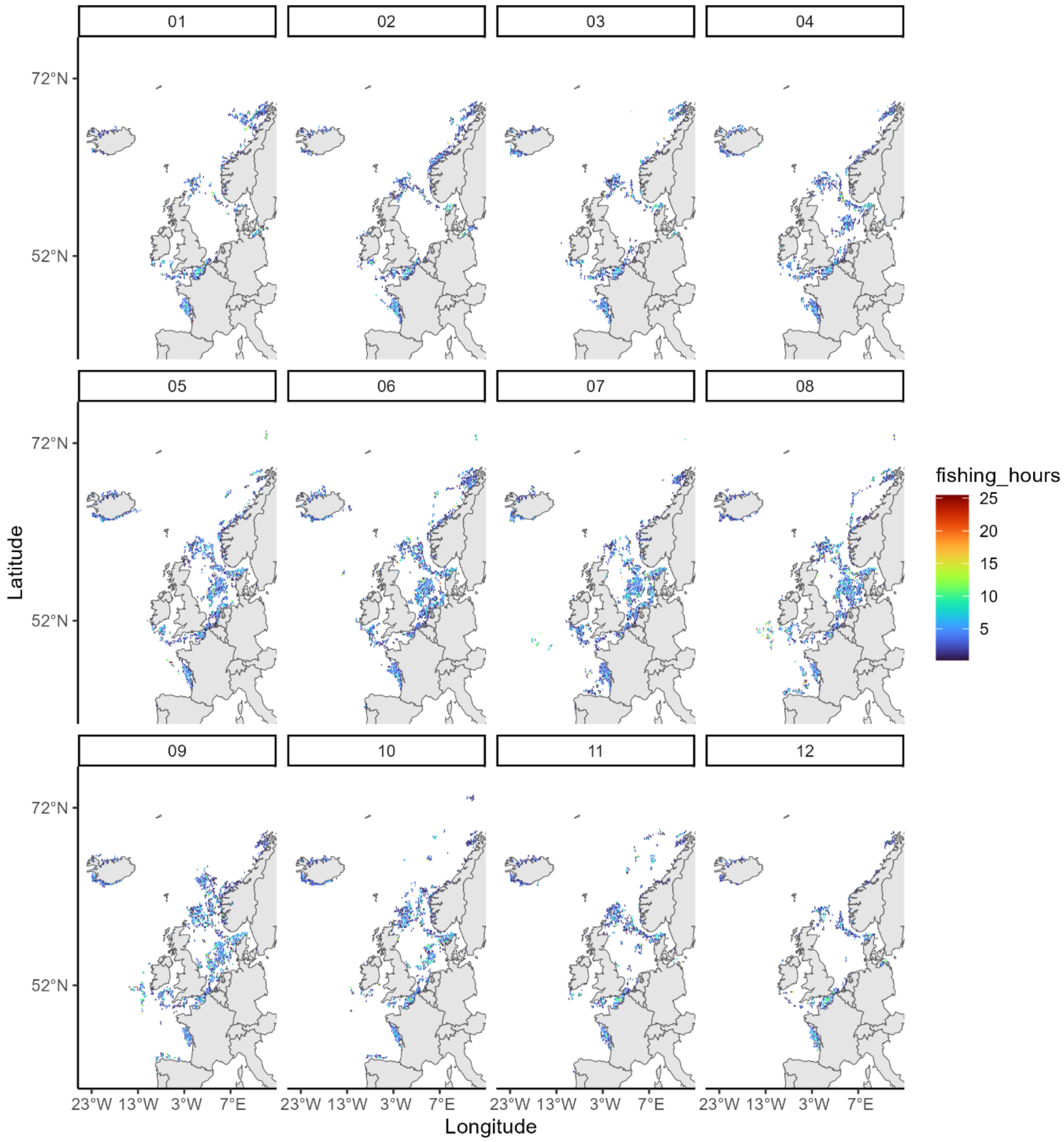


Figure A3. Trawling effort per month

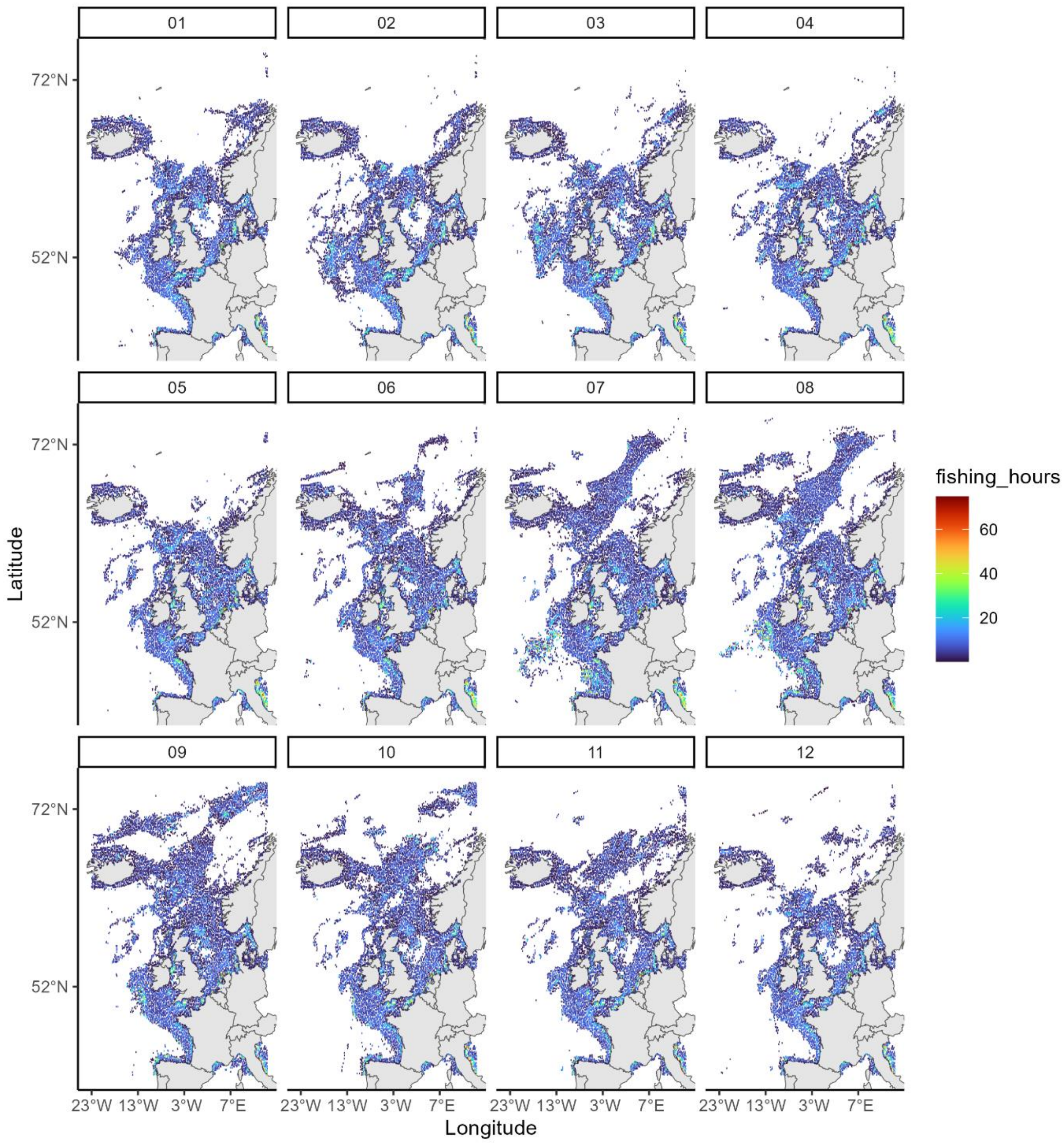


Figure A4. Set gillnetting effort per month

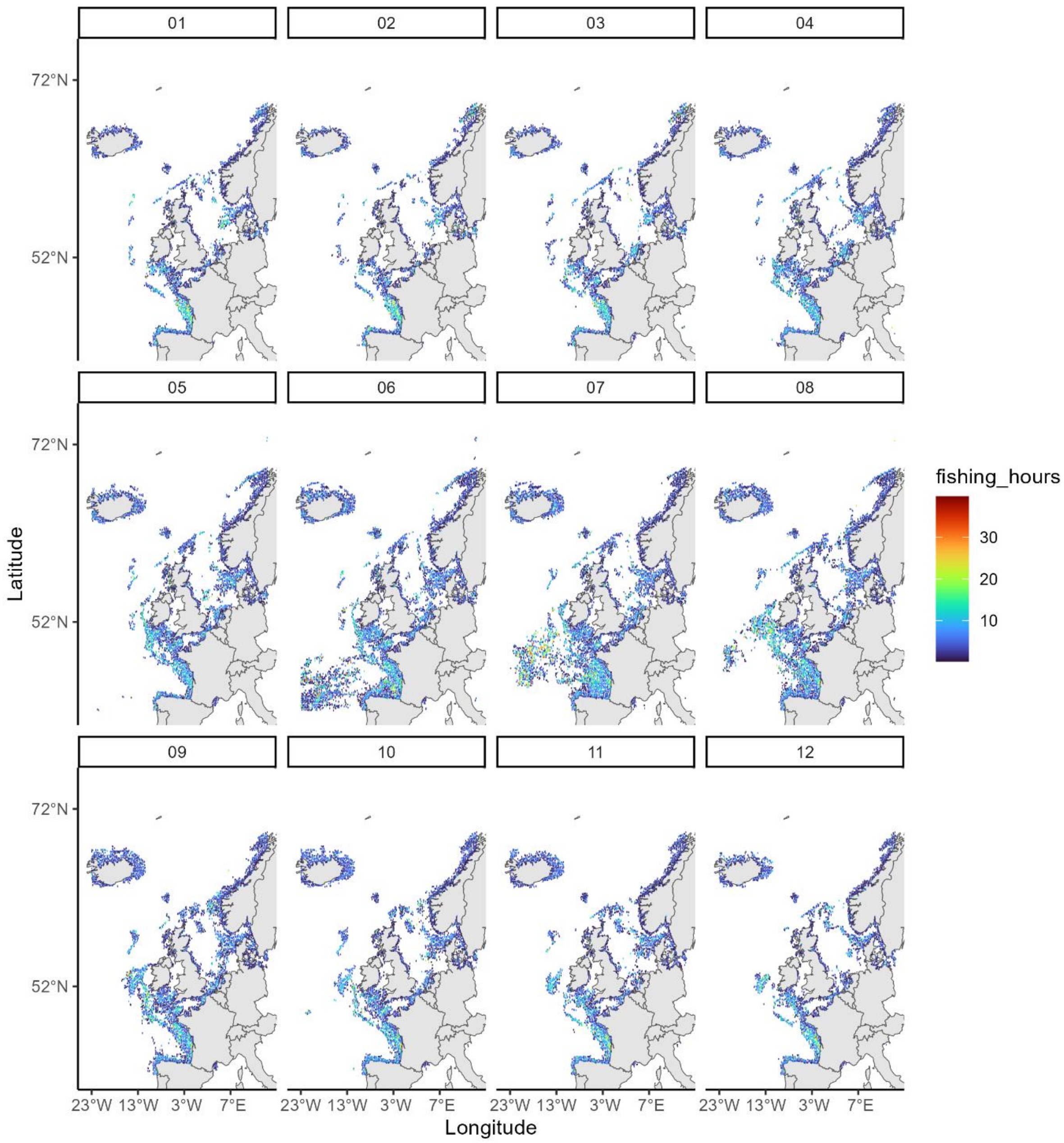
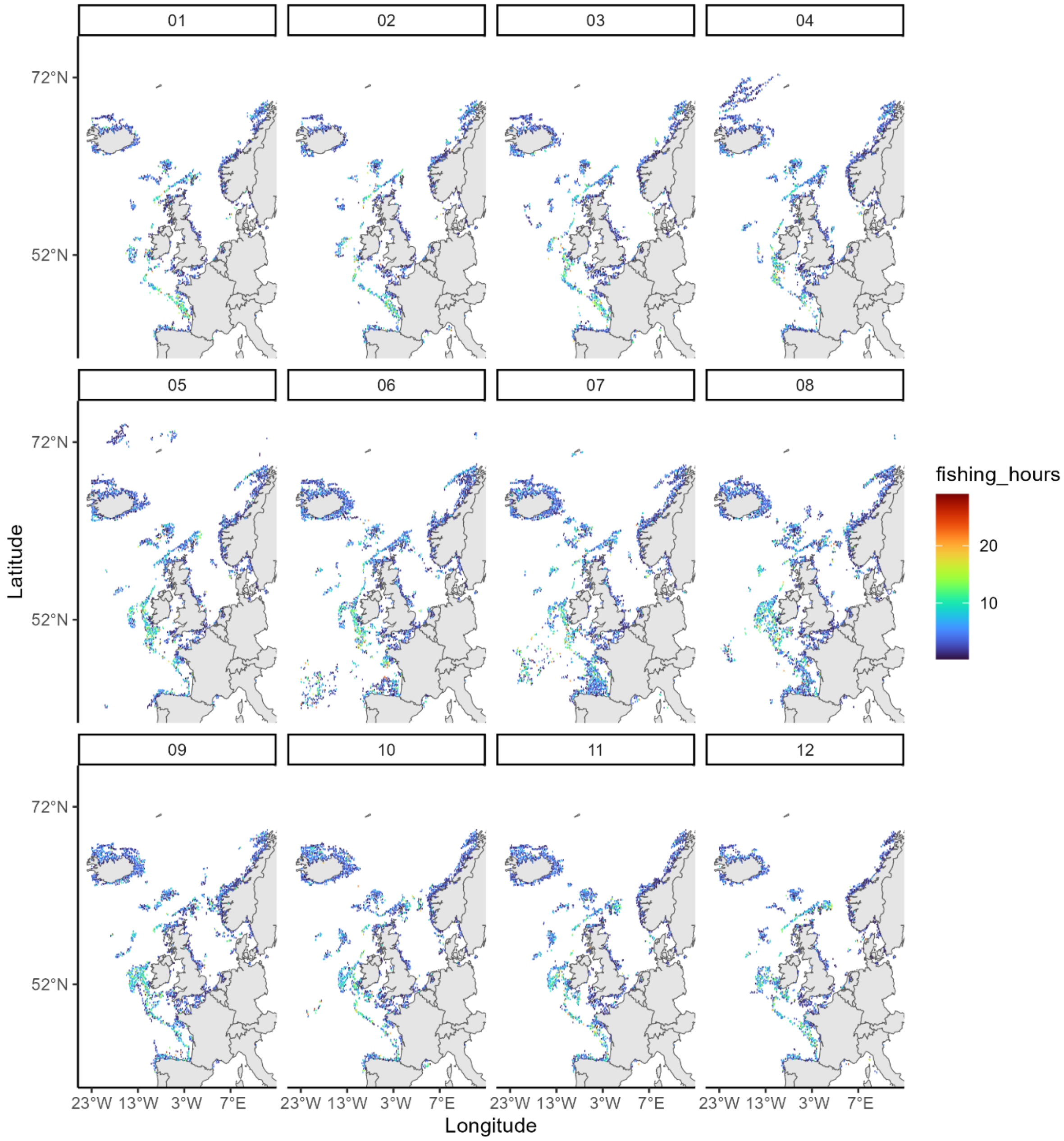


Figure A5. Fixed gear fishing effort per month



Appendix 3. ICES WGBYC Bycatch Evaluation and Assessment Matrix (BEAM) criteria classification

5.3.4 The BEAM: criteria classifications

Table 5.2. Categories and classifications contained within the beam.

1	**Monitoring Data Quality**	<=10% bias; green	Bias in estimated bycatch per unit effort (animals/DAS)
		>10% bias; red	Bias in estimated bycatch per unit effort (animals/DAS)
2	**Total Effort**	Yes	Yes=sourced from either RDB, WGBYC or combination of the two
		No	No=complete effort data not available
3	**Population Abundance Estimate**	Yes	Yes=there is a published source and include the citation.
		No	No=no published abundance estimate
4	**M (Bycatch Estimate)**	calculate the value	product of bycatch rate * total effort when monitoring data quality is good
		unknown?	not available because total effort = no OR monitoring data quality is poor
5	**Estimate 95% CIs**	calculate the value	product of bycatch rate 95%CI * total effort
		unknown?	not available because total effort = no OR monitoring data quality is poor
6	**PBR**	Yes	**Yes=there is a published PBR or other ICES reviewed & accepted threshold (include refere**
		No	**No=no published PBR or ICES accepted threshold**
7	**M > PBR**	Yes	bycatch estimate is above PBR as defined by the US Marine Mammal Protection Act (driven b
		No	bycatch estimate is below PBR as defined by the US Marine Mammal Protection Act (driven b
		Unknown	No US-MMPA defined PBR or other ICES accepted Threshold
8	**SME (subject matter expertise)**	Yes	WGBYC has complete SME
		Partial	WGBYC has partial SME
		No	WGBYC has minimal or no SME
	Population Risk	M < PBR	minimal risk to the population
		No PBR	unknown level of risk to the population
		M > PBR	risk of population decline due to bycatch
NOTE:	**Assessment of Population Risk:**		
	We did not have enough time to work through all the different combinations of the 7 criterion to arrive at a final traffic light determination.		
	Use your SME, consult with other experts/colleagues as necessary to arrive at a determination and explain how you arrived at your final determinatio		
	Hopefully we can have a deeper discussion next year about how to use the criteria for defining the traffic lights to assess population risk		
NOTE:	**Recommendations:**	If some type of action is to be recommended please put it in the report text for	

Appendix 4

FAO gear types and categories (He et al., 2021) and EC (2010/93/EU) gear classes. Gear categories from Elliott et al., 2023b have been added since when trying to assess bycatch by gear categories FAO subcategories do not separate demersal from pelagic gears. Grey cells indicate no information from that data source.

FAO Standard abbreviation / ICES BYC Métier L4	FAO subcategory	FAO gear category	Data collection framework classification		Gear Group (Elliott et al., 2021)
	(second tier)	(first tier)	Level 2 Gear class	Level 3 Gear group	
DRB	Boat dredges	Dredges	Dredge	Dredges	Benthic mobile
DRH	Hand dredges	Dredges	Dredge	Dredges	Benthic mobile
DRM	Mechanized dredges	Dredges	Dredge	Dredges	Benthic mobile
DRX	Dredges	Dredges	Dredge	Dredges	Benthic mobile
GTN	Combined gillnets-trammelnets	Gillnets and entangling nets			Static net
GND	Driftnet	Gillnets and entangling nets	Nets	Nets	Static net
GNC	Encircling gillnet	Gillnets and entangling nets			Pelagic mobile
GN	Gillnet	Gillnets and entangling nets			Static net
GEN	Gillnet and entangling net	Gillnets and entangling nets			Static net
GNE	Set gillnet	Gillnets and entangling nets			Static net
GNS	Set gillnet (anchored)	Gillnets and entangling nets	Nets	Nets	Static net
GTR	Trammelnet	Gillnets and entangling nets	Nets	Nets	Static net
GNF	Fixed gillnets (on stakes)	Gillnets and entangling nets			Static net
LLD	Drift longline	Hooks and lines			Line
LLF	Fixed floating longline	Hooks and lines			Line
LHM	Han and pole lines (mechanized)	Hooks and lines	Hooks and lines	Rods and Lines	Line

FAO Standard abbreviation / ICES BYC Métier L4	FAO subcategory	FAO gear category	Data collection framework classification		Gear Group (Elliott et al., 2021)
LH	Handline	Hooks and lines	Hooks and lines	Rods and Lines	Line
LHP	Handlines and pole-lines (hand operated)	Hooks and lines	Hooks and lines	Rods and Lines	Line
LX	Hooks and lines (nei)	Hooks and lines			Line
LL	Longlines	Hooks and lines			Line
LLS	Set longline	Hooks and lines	Hooks and lines	Longlines	Line
LTS	Surface longline	Hooks and lines			Line
LTL	Trolling lines	Hooks and lines			Line
LVS/T	Vertical longline	Hooks and lines			Line
LX	Hooks and lines (nei)	Hooks and lines			Line
PS	Purse-seine	Surrounding nets	Seines	Surrounding	Pelagic mobile
LA	Surrounding nets without purse lines	Surrounding nets			NA
SUX	Surrounding nets (nei)	Surrounding nets			NA
SB	Beach-seine	Surrounding nets	Seines	Seines	Static net
SV	Boat seine	Surrounding nets	Seines	Seines	NA
SUX	Seine nets (nei)	Surrounding nets			NA
FPO	Pots	Traps	Traps	Traps	Traps
FPN	Stationary uncovered poundnets	Traps			Traps
FYK	Fykenets	Traps	Traps	Traps	Traps
FSN	Stow nets	Traps			Traps
FWR	Barriers, fences, weirs, etc.	Traps			Traps
FAR	Aerial traps	Traps			Traps
FIX	Traps (nei)	Traps			Traps
TBB	Bottom beam trawl	Trawls	Trawls	Bottom trawls	Benthic mobile
PTB	Bottom pair trawl	Trawls	Trawls	Bottom trawls	Demersal mobile

FAO Standard abbreviation / ICES BYC Métier L4	**FAO subcategory**	**FAO gear category**	**Data collection framework classification**		**Gear Group (Elliott et al., 2021)**
SDN	Danish seine net	Trawls	Seines	Seines	Demersal mobile
PTT	Demersal pair trawl	Trawls			Demersal mobile
PTM	Midwater pair trawl	Trawls	Trawls	Pelagic trawls	Pelagic mobile
OTB	Otter beam trawl	Trawls	Trawls	Bottom trawls	Demersal mobile
OTM	Otter midwater trawl	Trawls	Trawls	Pelagic trawls	Pelagic mobile
OTT	Otter twin trawl	Trawls	Trawls	Bottom trawls	Demersal mobile
SSC	Scottish seine net	Trawls	Seines	Seines	Demersal mobile
SPR	Vessel pair seine	Trawls	Seines	Seines	Pelagic mobile
OTP	Multiple bottom otter trawls	Trawls			Demersal mobile
TBB	Bottom trawls (nei)	Trawls	Trawls	Bottom trawls	Demersal mobile
TM	Midwater trawls (nei)	Trawls			Pelagic mobile
TSP	Semi-pelagic trawls	Trawls			Pelagic mobile
TX	Trawls (nei)	Trawls			Mobile
LNP	Portable lift nets	Lift nets			Static net
LNB	Boat-operated lift nets	Lift nets			Static net
LNS	Shore-operated stationary lift nets	Lift nets			Static net
LN	Lift nets (nei)	Lift nets			Static net
FCN	Castnets	Falling gear			Static net
FCO	Cover pots/Lantern nets	Falling gear			Static net
FG	Falling gear (nei)	Falling gear			Static net
HAR	Harpoons	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MHI	Hand implements (Wrenching gear, Clamps, Tongs, Rakes, Spears)	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear

FAO Standard abbreviation / ICES BYC Métier L4	FAO subcategory	FAO gear category	Data collection framework classification		Gear Group (Elliott et al., 2021)
MPM	Pumps	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MEL	Electric fishing	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MPN	Pushnets	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MSP	Scoopnets	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MDR	Drive-in nets	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MDV	Diving	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
MIS	Gear nei	Miscellaneous gear	Misc.	Misc.	Miscellaneous gear
NK	Gear not known	Gear not known			Gear not known