Atlantic salmon from the Northeast Atlantic

Summary of advice provided in 2022

ICES has evaluated the advice published in 2021 (see below) and ICES confirms that this advice conforms to our standards of best available science. ICES considers it suitable to inform management actions and it remains valid.

Summary of advice for fishing seasons 2021/2022 to 2023/2024*

ICES advises that when the MSY approach is applied, fishing should only take place on salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, because of the different status of individual stocks within stock complexes, mixed-stock fisheries present particular threats. The management of a fishery should ideally be based on the individual status of all stocks exploited in the fishery.

In the absence of any fisheries in the fishing seasons 2021/2022 to 2023/2024, there is a less than 95% probability of spawner escapement reserves (SERs) being met for potential 1-sea-winter (1SW) and multi-sea-winter (MSW) salmon from the Southern NEAC stock complex and for the 1SW salmon from the Northern NEAC stock complex. Therefore, in the absence of specific management objectives, ICES advises that the catch on both NEAC complexes at the Faroes in the fishing seasons 2021/2022 to 2023/2024 should be zero. In the absence of any fisheries over these three seasons, the probabilities of individual countries meeting their SERs range from 22% to 97% for maturing 1SW salmon and 17% to 99% for salmon maturing as MSW. Some of the management units (countries/juristictions) are exploited at very low levels; however, in the absence of a management decision on which units should be included in the catch options analysis, all management units are currently included.

A Framework of Indicators (FWI) has previously been developed in support of the multi-year catch advice and the potential approval of multi-year regulatory measures for the Faroes. The FWI has been updated and can be applied at the beginning of 2022, using the returns or return rate data for 2021 to evaluate the appropriateness of the advice for 2022/2023, and again at the beginning of 2023, using the returns or return rate data for 2022 to evaluate the appropriateness of the advice for 2023/2024.

NASCO 2.1 Describe the key events of the 2020 fisheries

No significant changes in gear type used were reported in the NEAC area in 2020.

No fishery for salmon has been prosecuted at the Faroes since 2000.

The reported (i.e nominal) catch in the NEAC area in 2020 is 778 t, with 93 t reported in the Southern NEAC area and 685 t in the Northern NEAC area. Estimates of unreported catches in the NEAC area were 238 t in total. As in previous years, the location of the reported catches differed between the Southern and Northern NEAC areas (Table 1). In 2020, in-river and estuarine fisheries accounted for 76% and 24%, respectively, of the catches in the Southern NEAC area. In the Northern NEAC area, coastal fisheries accounted for 34% of the catches, with the remaining 66% of the catches coming from in-river fisheries.

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* This advice was originally published in May 2021, and ICES *has evaluated this advice and ICES confirms that it conforms to the ICES standard of providing advice based on the best available science to decision makers. ICES considers it suitable to inform management actions and it remains valid.*

Table 1 Salmon catch by area and location in the NEAC area in 2018. Catches of NEAC origin salmon at Greenland are reported in the West Greenland Commission area. For Iceland all catches are reported in Northern NEAC.

Salmon catches	Southern NEAC	Northern NEAC	Faroes	Total NEAC
2020 reported catch (tonnes)	93	685	0	778
Catch as % of NEAC total	12	88	0	
Unreported catch (tonnes)	8	231	-	239
Location of catches	Southern NEAC	Northern NEAC	Faroes	Total NEAC
% in-river	76	66	-	67
% in estuaries	24	0	-	3
% coastal	0	34	-	30

The NEAC area has seen a general reduction in catches since the 1980s (Figure 1; Table 2). This reflects a decline in fishing effort as a consequence of management measures as well as a reduction in the size of stocks. The reported catch for 2020 (778 t) was slightly higher than for 2019 (755 t) but was below the previous five-year (by 19%) and ten-year (by 29%) means, and the second lowest in the time-series in both areas. The catch in Southern NEAC, which constituted around two-thirds of the total NEAC catch in the early 1970s, has been lower than that in Northern NEAC area since 1999 (Figure 1).

1SW salmon constituted 59% of the total catch in the Northern NEAC area in 2020 (Figure 2). For Southern NEAC countries, the overall percentage of 1SW fish in the catch in 2020 was estimated at 49%.

The contribution of escaped farmed salmon to national catches in the NEAC area in 2020 was generally low in most countries and similar to the values that have been reported in previous years. The estimated proportion of farmed salmon in Norwegian angling catches in 2020 (2%) was the lowest value in the time-series; the proportion in samples taken from Norwegian rivers in autumn (3%) was also the lowest value in the time-series. No current data are available for the proportion of farmed salmon in coastal fisheries in Norway. A small number of escaped farmed salmon (seven) were also reported from catches in Icelandic rivers in 2020. Three of these, caught in rod fisheries, have been confirmed to be of farmed origin by genetic analysis, while the other four, caught during a monitoring survey, have yet to be confirmed as farmed. A small number (nine) of farmed salmon were also reported in catches by all methods from UK (England and Wales).

Estimated exploitation rates have decreased since the early 1980s in both the Northern and Southern NEAC areas (Figure 3). The exploitation rate on 1SW salmon in the Northern NEAC area was 45% in 2020, which was over the previous five-year (41%) and ten-year (41%) means. Exploitation on 1SW fish in the Southern NEAC complex was 7% in 2020, which was lower than the previous five-year (9%) and ten-year (10%) means. Exploitation on MSW salmon in the Northern NEAC area was 43% in 2020, which was at the same level as the previous five-year (43%) and ten-year (43%) mean. Exploitation on MSW fish in Southern NEAC was 3% in 2020, which was clearly lower than the previous five-year (7%) and ten-year (9%) means.

Estimates of the number of salmon caught and released in angling fisheries are not complete for all NEAC countries. There are large differences between countries in the percentage of the total angling catch that is released: in 2020 this ranges from 16% in Sweden to 93% in UK (England and Wales), reflecting varying management practices and angler attitudes among these countries. Catch and release mortality is also estimated for some countries, but these data are not included in the reported catch.

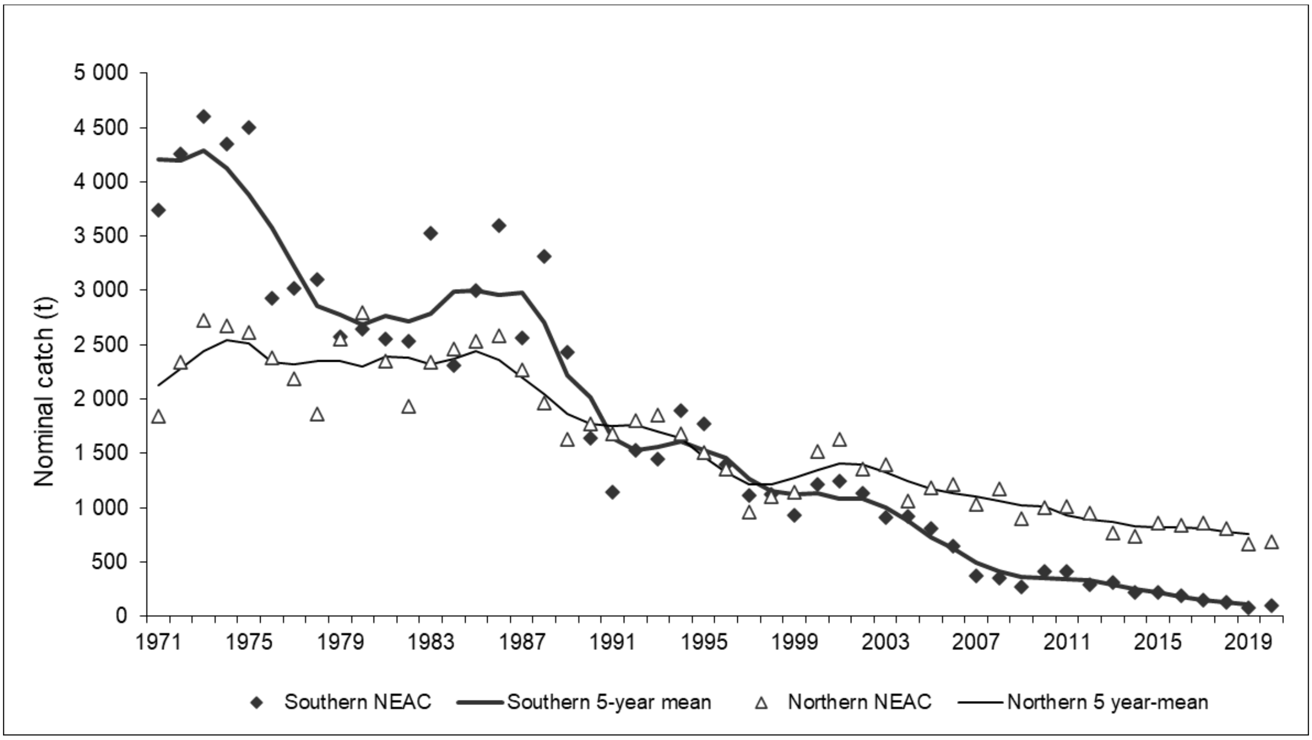

Figure 1 Reported catches of salmon and five-year running means in the Southern and Northern NEAC areas (1971–2020).

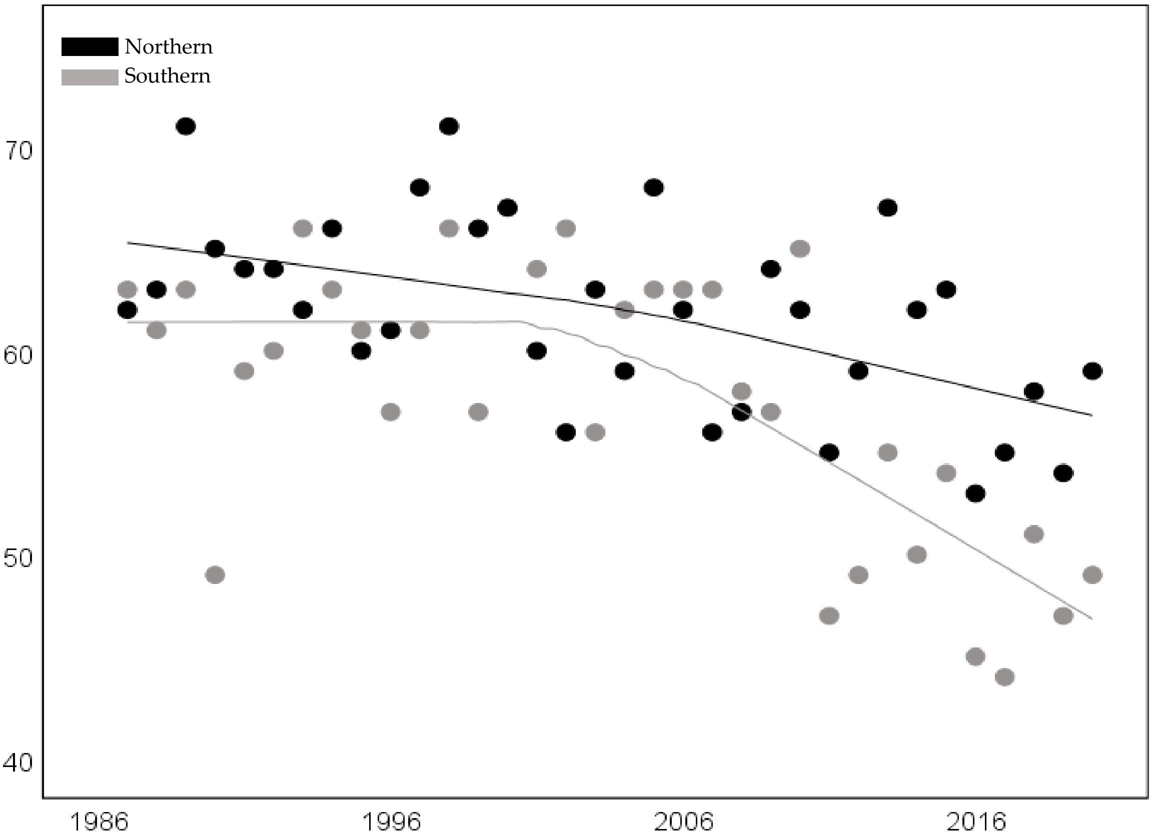

Figure 2 Percentage of 1SW salmon in the reported catch for the Northern (black dots) and Southern (grey dots) stock complexes, 1987–2020. Curves represent the Northern (black line) and Southern (grey line) stock complexes with a Loess smoother (span = 85%) applied to the data.

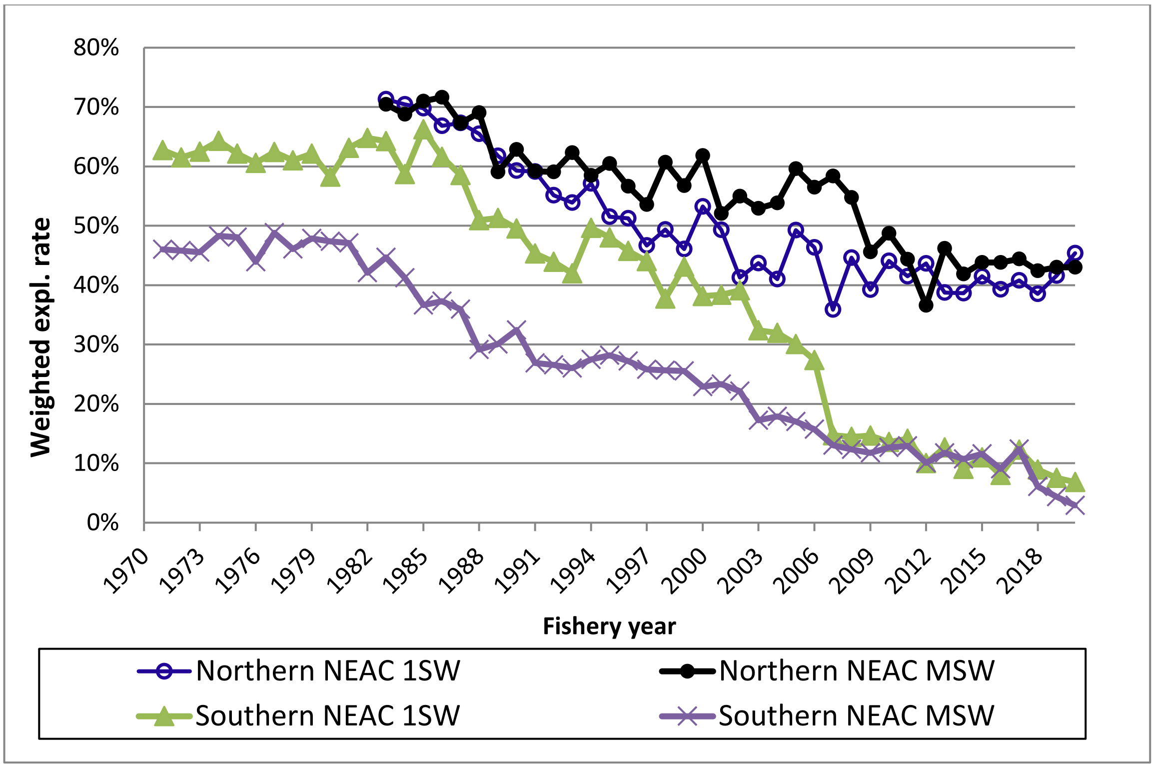

Figure 3 Mean annual exploitation rate of wild 1SW and MSW salmon by fisheries in the Northern (1983–2020) and Southern (1971–2020) NEAC areas.

Table 2 Reported catch of salmon in the NEAC Area (in tonnes round fresh weight), 1960–2020 (2020 values are provisional).

Year	Southern NEAC countries	Northern NEAC countries*	Faroes**	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area ***	International waters^
1960	2641	2899	-	-	5540	-	-
1961	2276	2477	-	-	4753	-	-
1962	3894	2815	-	-	6709	-	-
1963	3842	2434	-	-	6276	-	-
1964	4242	2908	-	-	7150	-	-
1965	3693	2763	-	-	6456	-	-
1966	3549	2503	-	-	6052	-	-
1967	4492	3034	-	-	7526	-	-
1968	3623	2523	5	403	6554	-	-
1969	4383	1898	7	893	7181	-	-
1970	4048	1834	12	922	6816	-	-
1971	3736	1846	-	471	6053	-	-
1972	4257	2340	9	486	7092	-	-
1973	4604	2727	28	533	7892	-	-
1974	4352	2675	20	373	7420	-	-
1975	4500	2616	28	475	7619	-	-
1976	2931	2383	40	289	5643	-	-
1977	3025	2184	40	192	5441	-	-
1978	3102	1864	37	138	5141	-	-
1979	2572	2549	119	193	5433	-	-
1980	2640	2794	536	277	6247	-	-
1981	2557	2352	1025	313	6247	-	-
1982	2533	1938	606	437	5514	-	-
1983	3532	2341	678	466	7017	-	-
1984	2308	2461	628	101	5498	-	-
1985	3002	2531	566	-	6099	-	-

Year	Southern NEAC countries	Northern NEAC countries*	Faroes**	Other catches in international waters	Total reported catch	Unreported catches	
						NEAC Area ***	International waters^
1986	3595	2588	530	-	6713	-	-
1987	2564	2266	576	-	5406	2554	-
1988	3315	1969	243	-	5527	3087	-
1989	2433	1627	364	-	4424	2103	-
1990	1645	1775	315	-	3735	1779	180–350
1991	1145	1677	95	-	2917	1555	25–100
1992	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	-
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	83	671	0	-	755	237	-
2020	93	685	0	-	778	239	-
Mean							
2015–2019	154	808	0	-	961	286	-
2010–2019	241	851	0	-	1092	306	-

* All Icelandic catches have been included in Northern NEAC countries.
** Since 1991, fishing carried out at the Faroes has only been for research purposes.
*** No unreported catch estimate available for Russia since 2008.
^ Estimates refer to season ending in given year.

NASCO 2.2 Review and report on the development of age-specific stock conservation limits

National stocks within the NEAC area are combined into two geographic groups for the provision of management advice for the distant-water fisheries at West Greenland and the Faroes. The Northern group consists of Finland, Norway, Russia, Sweden, and the northeastern region of Iceland. The Southern group consists of France, Ireland, UK (England and Wales), UK (Northern Ireland), UK (Scotland), and the southwestern region of Iceland. Four stock complexes are then defined; each comprised of one of the two sea ages (1SW or MSW) per geographic group (N-NEAC and S-NEAC).

River-specific conservation limits (CLs; in terms of either egg or spawner requirements) have been estimated for salmon stocks in most countries/jurisdictions 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/jurisdictions. River-specific CLs have also been estimated 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/jurisdictions that do not use river-specific CLs in their national assessments. This approach is based on a model (pseudo-stock–recruitment relationships) for salmon stocks that are updated annually and for which, as a result, the CLs may change slightly from year to year.

To provide catch advice to NASCO, CLs are also required for stock complexes. These have been derived either by summing individual river CLs to country/jurisdiction level or by taking overall the CLs provided by the model and summing to the level of the four NEAC stock complexes. Spawner escapement reserves (SERs) are CLs (expressed in terms of spawner numbers) which are adjusted to take account of natural mortality (0.03 per month) between 1 January of the first winter at sea and return time to homewaters. The homewaters are defined as the river of origin including the estuary and associated coastal waters. This was done for each of the maturing (6–9 months) and non-maturing (16–21 months) 1SW salmon components from the Northern NEAC and Southern NEAC stock complexes.

CLs and SERs are provided for the four stock complexes (Table 3) by summing country/jurisdiction CLs to the level of the four NEAC stock complexes.

Table 3 Conservation limits (CL) and spawner escapement reserves (SER) for the salmon stock complexes in the NEAC area in 2020. Values are in numbers of fish.

Geographic group	Age group	CL	SER
Northern NEAC	1SW	138086	174727
	MSW	122268	209236
Southern NEAC	1SW	436992	553846
	MSW	174735	295582

The CLs and SERs for the Southern NEAC complexes have been revised downwards substantially compared to last year due to changes in the UK (Northern Ireland) and particularly the UK (Scotland) estimates.

For the nine countries/jurisdictions where river-specific CLs are available, time-series indicating the development in the definition of these CLs, the number of rivers annually assessed against CLs, and the number of rivers that annually meet or exceed CLs (based on the number of spawners after fisheries have taken place) are provided in Figure 4. In addition, Iceland has set provisional CLs for all salmon-producing rivers and continues to work towards finalizing an assessment process for determining CL attainment.

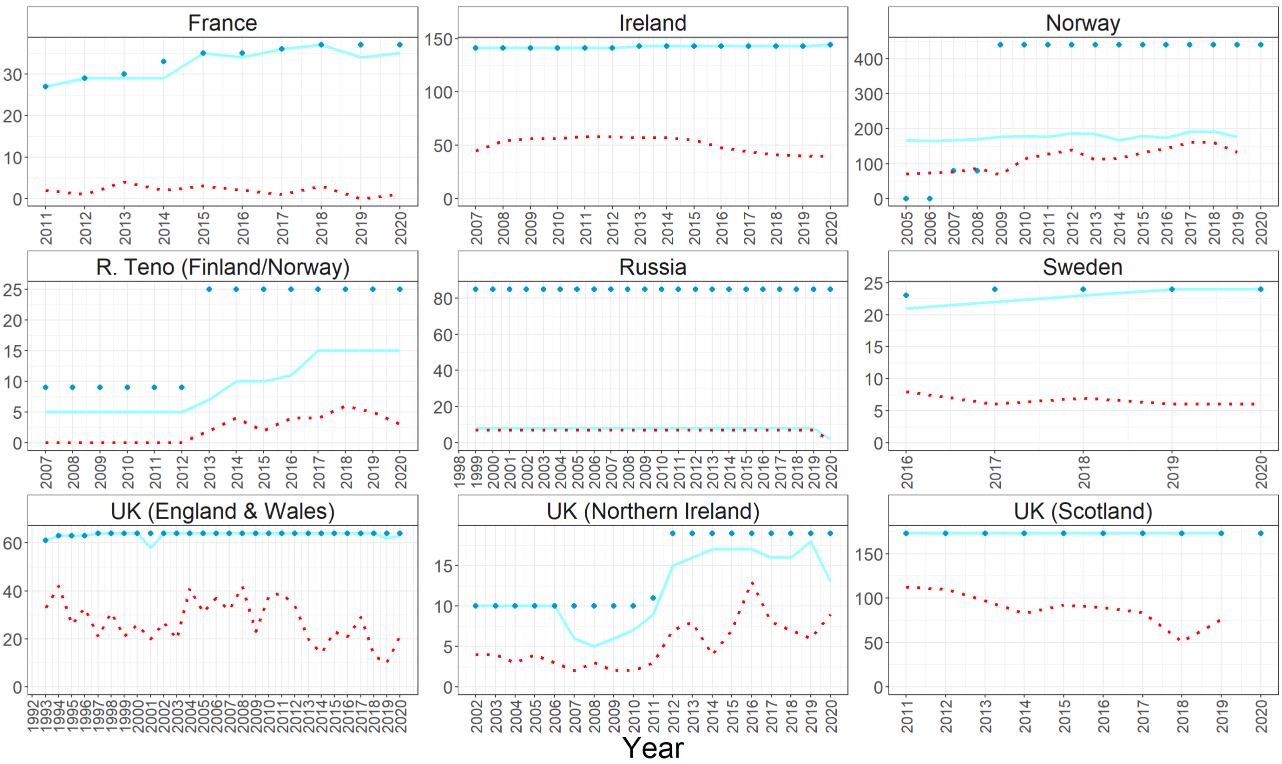

Figure 4 Time-series showing the number of rivers with established CLs (blue dotted lines), the number of rivers assessed annually (light blue solid lines), and the number of rivers meeting CLs annually (red dotted lines) for countries/jurisdictions in the NEAC area.

NASCO 2.3 Describe the status of the stocks

Recruitment, expressed as pre-fishery abundance (PFA; split into maturing and non-maturing 1SW salmon at 1 January of the first winter at sea) is estimated by geographic groups (Northern NEAC and Southern NEAC) and individual country/jurisdiction and is assessed relative to the spawner escapement reserve (SER).

The assessment of PFA against SER for the four complexes over the time-series is shown in Figure 5, and by country/jurisdiction for the most recent year in Figure 6. The time-series of returns and spawners against CLs are shown by sea age groups for the Northern NEAC and Southern NEAC geographic groups (Figure 5) and for 2020 by individual countries/jurisdictions for 1SW maturing and MSW (1SW non-maturing at the PFA stage) salmon (Figure 7 and Figure 8, respectively).

PFA relative to SER and spawners relative to CLs

For the Northern NEAC area, PFAs of both maturing 1SW and non-maturing 1SW salmon show a general decline over the time period (since 1983), with the decline being more marked in the maturing 1SW stock (Figure 5; tables 5 and 6). Both stock complexes have, however, been at full reproductive capacity prior to the commencement of the distant-water fisheries (i.e. they have met the SER with at least 95% probability) throughout the time-series. The 1SW spawners in the Northern NEAC stock complex have been at full reproductive capacity throughout the time-series. MSW spawners, on the other hand, while generally being at full reproductive capacity, have for some years been at risk of suffering reduced reproductive capacity.

For all countries in the Northern NEAC area, 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 year, except for maturing 1SW stocks in the Rive Tana/Teno (Norway and Finland) and Russia and non-maturing stock in the Tana/Teno that were suffering reduced reproductive capacity (Figure 6). Returning and spawning 1SW and MSW stocks in Sweden and Norway were at full reproductive capacity. However, both 1SW and MSW returns and spawner stock components in the Tana/Teno (Norway and Finland) and in Russia were suffering reduced reproductive capacity, except for MSW returns in Russia that were at full reproductive capacity. In addition, 1SW spawners in Iceland were at risk of suffering reduced reproductive capacity (Figures 7 and 8).

1SW and MSW stocks in the Southern NEAC complex were considered to be at full reproductive capacity prior to the commencement of distant-water fisheries in the latest available PFA year (Figure 5; Tables 5 and 6), although this is due, at least in part, to changes in the UK (Northern Ireland) and UK (Scotland) SERs and CLs. The abundance of maturing 1SW recruits (PFA) for Southern NEAC (Figure 5, Table 5) demonstrates a declining trend over the time period. Both maturing and non-maturing 1SW stocks have, however, been at full reproductive capacity prior to the commencement of distant-water fisheries for all but three and one years, respectively (Figure 5; tables 5 and 6). The 1SW spawners in the Southern NEAC stock complex have either been at risk of suffering reduced reproductive capacity or have suffered reduced reproductive capacity for six of the most recent ten years (Figure 5). In contrast, MSW spawners in the Southern NEAC stock complex have been at full reproductive capacity for all of the most recent ten years (Figure 5).

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 (Figure 6; Tables 5 and 6). In contrast, maturing and non-maturing stocks in UK (Scotland) were at full reproductive capacity both prior to the commencement of distant-water fisheries and at spawning. In UK (England and Wales), the maturing stock was suffering reduced reproductive capacity both prior to the commencement of distant-water fisheries and at spawning, whereas the non-maturing 1SW stock and MSW spawners were at full reproductive capacity throughout (Figures 6, 7, and 8).

Trends in rivers meeting CLs

In the NEAC area, all jurisdictions except Iceland currently assess salmon stocks using river-specific CLs (Figure 4, Table 4). The attainment of CLs is assessed based on the number of spawners after fisheries have taken place.

Table 4 Summary of the attainment of CLs in 2020 (2019 for Norway and UK [Scotland]) and trends based on all available data in the NEAC area. Further details can be found in ICES (2021a).

Country /Jurisdiction	Number of rivers with CLs	Number of rivers assessed for compliance	Number of rivers attaining CL	% of assessed rivers attaining CL	Trend in %
Northern NEAC					
Russia	85	2	1	50	Stable (fewer rivers assessed in 2020)
Norway/Finland (Tana/Teno)	25	15	3	20	Decreasing
Norway	439	177	133	75	Minor variability
Sweden	24	24	6	25	Minor variability
Southern NEAC					
UK (Scotland)	173	173	76	44	Decreasing (upturn in 2019)
UK (Northern Ireland)	19	13	9	69	Variable (fewer rivers assessed in 2020)
UK (England and Wales)	64	63	21	33	Decreasing (upturn in 2020)
Ireland	144	144	39	27	Decreasing
France	37	35	1	3	Variable

Return rates

Return rate estimates, proxies for marine survival, are derived for a limited number of rivers and have time-series of different durations. Return rates of wild and hatchery smolts to Northern NEAC are variable. They have generally decreased since 1980, although rates of 1SW returns of wild smolts have stabilized since 2010, while those of hatchery smolts have increased since 2005. Rates of 2SW returns of wild and hatchery smolts to the Northern NEAC area are highly variable but have continued to decline in 2019, especially for hatchery 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 rates of 2SW returns of wild smolts have started to increase since 2005, a trend that continued in 2019 (Figure 9).

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

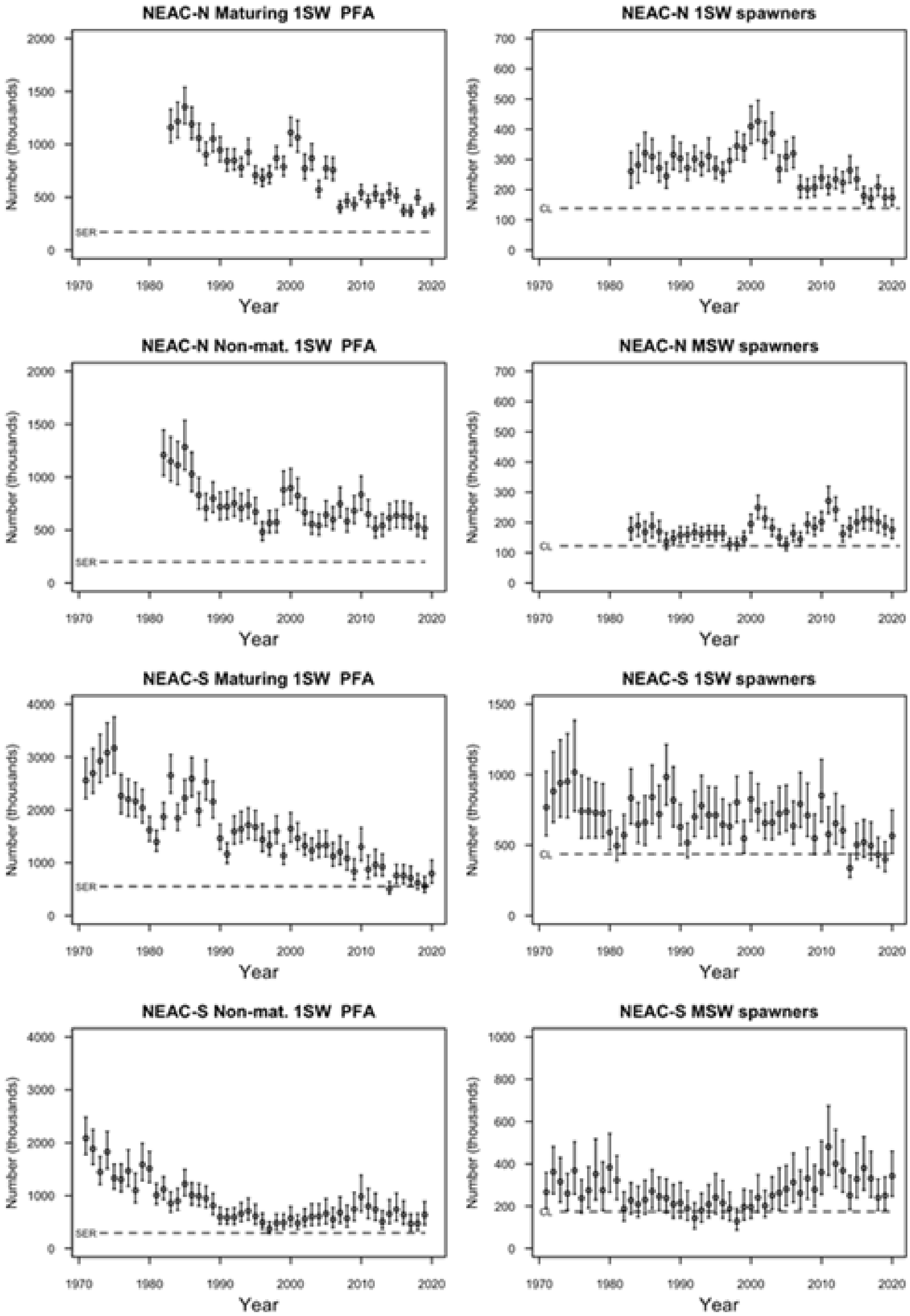

Figure 5 Estimated pre fishery abundance (PFA – recruits; left panels) and spawner escapement (right panels) with 90% confidence limits, for maturing 1SW (1SW spawners) and non-maturing 1SW (MSW spawners) salmon in Northern(NEAC-N) and Southern (NEAC-S) NEAC stock complexes. The dashed horizontal lines in the left panels are the respective 2020 spawner escapement reserve (SER) values and in the right panels the CL values.

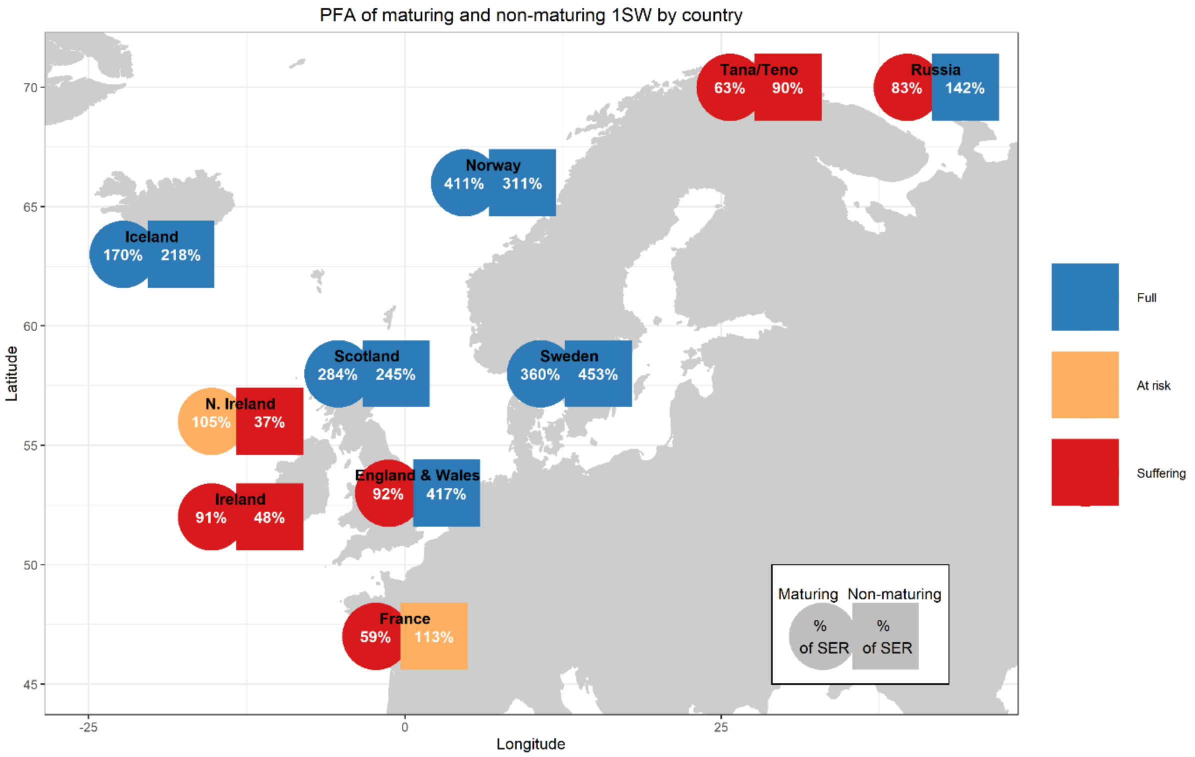

Figure 6 PFA of maturing (2020) and non-maturing (2019) in percent of spawner escapement reserve (% of SER). The percent of SER is based on the median of the Monte Carlo distribution. The three colours used as shading represent the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the SER), At risk (at risk of suffering reduced reproductive capacity: the median spawner estimate is above but the 5th percentile is below the SER), and Suffering (suffering reduced reproductive capacity: the median spawner estimate is below the SER).

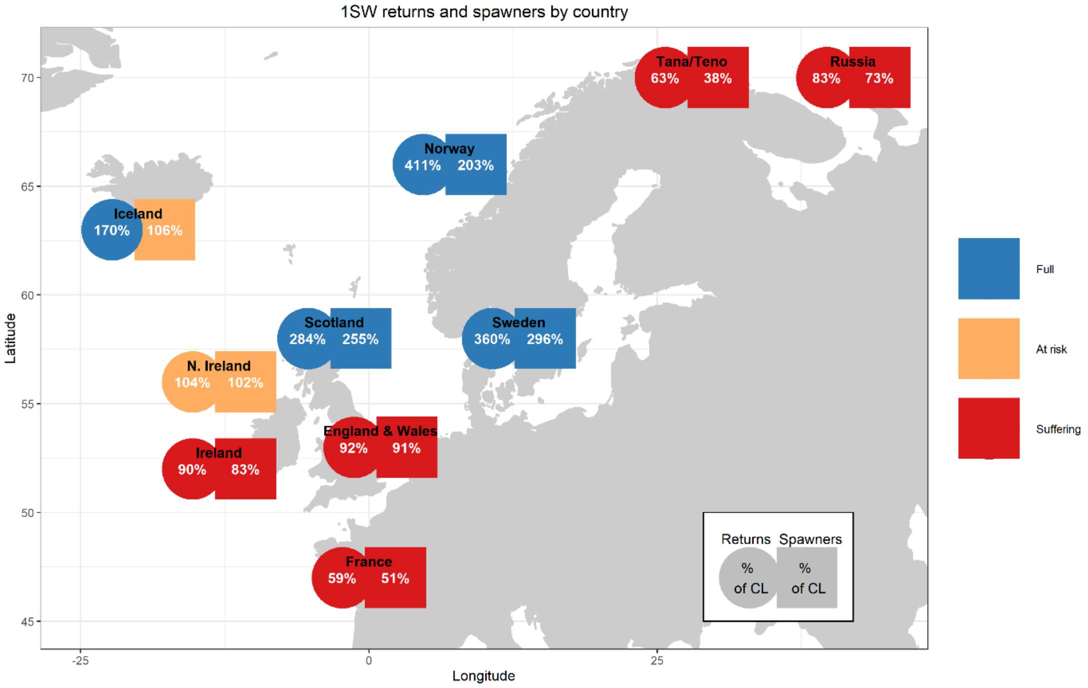

Figure 7 1SW returns and spawners in percent of conservation limit (% of CL) for 2020. The percent of CL is based on the median of the Monte Carlo distribution. The three colours used as shading represent the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At risk (at risk of suffering reduced reproductive capacity: the median spawner estimate is above but the 5th percentile is below the CL), and Suffering (suffering reduced reproductive capacity: the median spawner estimate is below the CL).

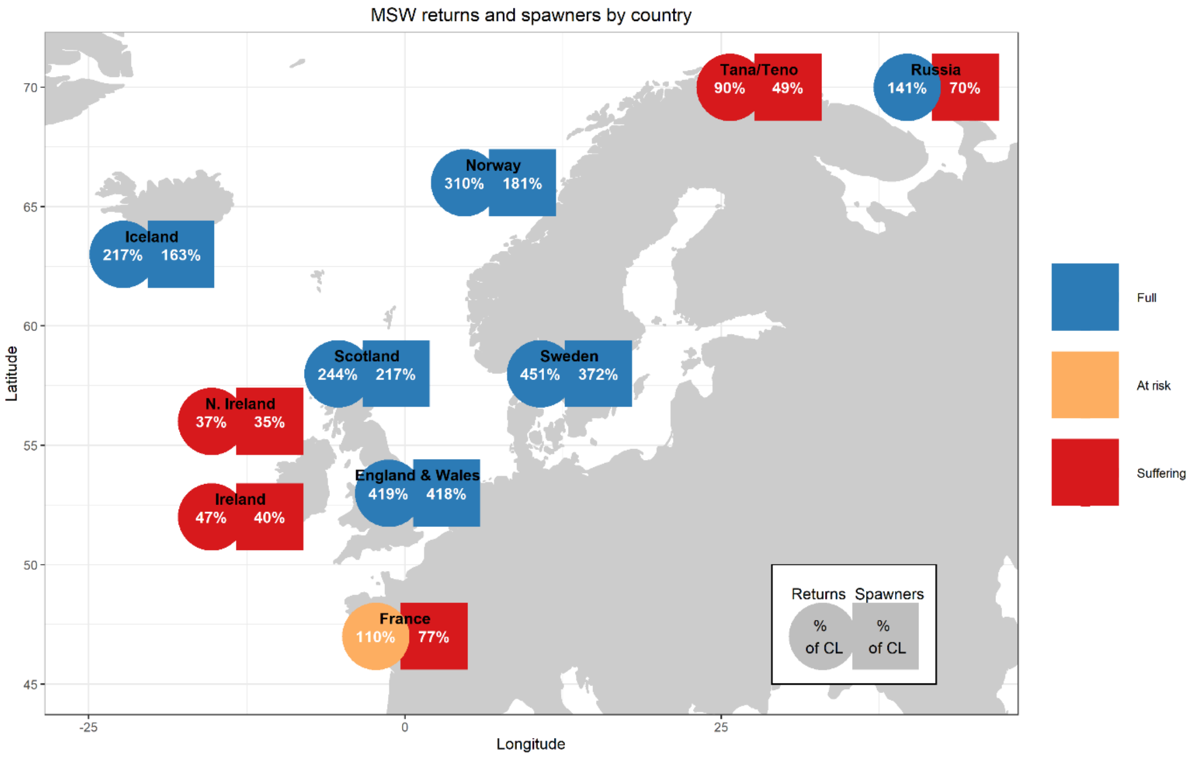

Figure 8 MSW returns and spawners in percent of conservation limit (% of CL) for 2020. The percent of CL is based on the median of the Monte Carlo distribution. The colours used as shading represent the three ICES stock status designations: Full (at full reproductive capacity: the 5th percentile of the spawner estimate is above the CL), At risk (at risk of suffering reduced reproductive capacity: the median spawner estimate is above but the 5th percentile is below the CL), and Suffering (suffering reduced reproductive capacity: the median spawner estimate is below the CL).

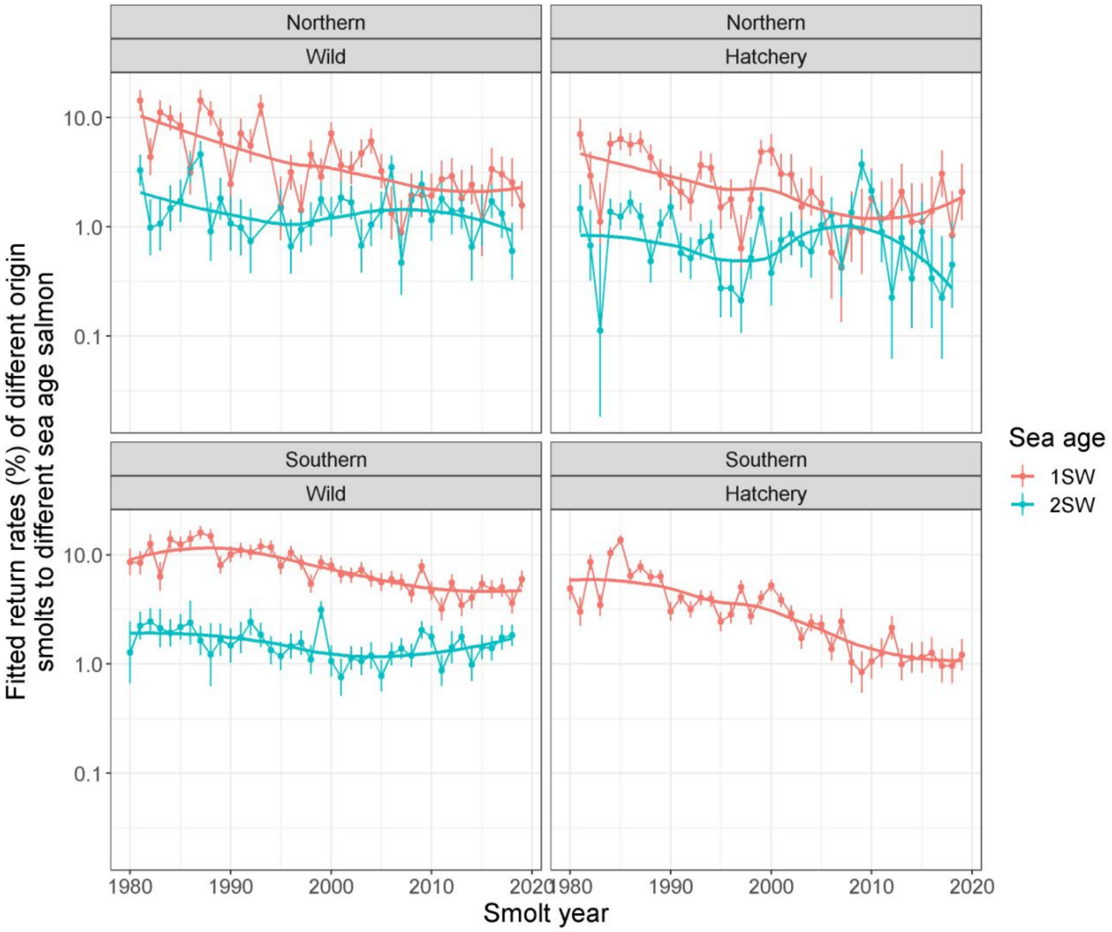

Figure 9 Least squared (marginal mean) average annual return rates (in %) of wild (left-hand panels) and hatchery origin smolts (right-hand panels) of 1SW and 2SW salmon to Northern (top panels) and Southern NEAC areas (bottom panels). For most rivers in Southern NEAC, the values represent returns to 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 ICES (2021a; Tables 3.3.6.1 and 3.3.6.2), the analyses included estimated return rates (in %) for 1SW and 2SW returns by smolt year.

Table 5 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%, and 95% quantiles of the Monte Carlo distribution).

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC 50% (5%; 95%)	France	Iceland (S & W)	Ireland	UK (E & W)	UK (NI)	UK (Scot)	Southern NEAC 50% (5%; 95%)	NEAC 50% (5%; 95%)
1971	29931	11698			22176		64342	77642	1347718	105942	222542	723847	2556809 (2215373; 2984956)	
1972	115020	10693		150843	17714		128570	62774	1433839	102038	195001	749042	2692510 (2317010; 3162087)	
1973	53678	12813		222247	21838		79171	67103	1564035	120301	170066	905739	2926114 (2514956; 3430804)	
1974	74352	12781		221060	31577		36890	48130	1777173	149480	185753	868989	3083233 (2638707; 3646536)	
1975	88931	15604		339093	34159		73030	74338	1966250	154667	152816	729709	3170257 (2691890; 3758307)	
1976	81059	15694		236582	19326		67533	58647	1336338	102248	106249	577573	2263820 (1932650; 2676781)	
1977	45815	21656		150659	8782		52116	59880	1152219	116599	104537	697427	2203178 (1882807; 2582860)	
1978	43469	22030		152258	10361		52836	78611	1008375	133847	136402	734033	2162322 (1865770; 2519368)	
1979	39055	21082		210950	10650		60815	72944	926457	127433	95716	737996	2040472 (1755445; 2388810)	
1980	31285	3323		150688	13746		126609	33248	710875	120038	121784	491839	1621777 (1407296; 1879538)	
1981	28039	16643		125338	24982		101061	42956	379959	127616	96368	637339	1399647 (1219221; 1616036)	
1982	16751	7797		110188	22060		63029	44230	776429	108808	138516	725224	1869332 (1641456; 2136780)	
1983	40599	11353	892441	182842	29318	1159105 (1014965; 1330582)	67329	55656	1358385	156570	192876	803075	2650974 (2318527; 3043876)	3817301 (3411808; 4279460)
1984	44250	4119	927270	195876	41239	1215273 (1060321; 1398012)	109019	33994	715073	136962	75931	755696	1844087 (1611346; 2115712)	3062410 (2738055; 3425653)
1985	58664	28089	942411	269254	49323	1352600 (1192347; 1540004)	40579	55414	1183468	137158	98355	695103	2224649 (1937137; 2572965)	3583556 (3197931; 4018259)
1986	46209	35000	822392	230247	51518	1190859 (1049826; 1353184)	63176	90673	1328352	158514	110851	814566	2592257 (2252374; 2993774)	3787360 (3373327; 4261659)
1987	55856	20623	691807	245674	40898	1058712 (938415; 1198733)	112353	56338	855597	165244	60915	698053	1986780 (1703573; 2326474)	3052999 (2708409; 3453989)
1988	32971	29721	634769	169326	34216	903606 (802486; 1021110)	38207	101252	1155545	225444	141969	845526	2532374 (2187832; 2941221)	3440380 (3045913; 3899579)
1989	71453	16057	698626	251638	9965	1051107 (928403; 1193514)	21257	56540	829347	151937	136557	943402	2157735 (1848045; 2545738)	3212659 (2842660; 3656437)
1990	71463	12030	627419	208584	23241	946746 (837536; 1072303)	34826	52226	521116	108995	112906	613253	1461277 (1250782; 1729836)	2414017 (2139409; 2733687)
1991	70538	17443	545940	177967	29023	844193 (747168; 959113)	25090	57266	369823	106893	63033	525167	1164257 (989768; 1378856)	2012269 (1785958; 2274568)
1992	99081	32804	460751	219165	32515	848263 (756603; 957739)	45837	65629	537747	112169	127285	682531	1594307 (1359020; 1888935)	2445408 (2169433; 2779913)
1993	66920	26929	462225	188314	32186	780588 (695535; 876336)	65755	64190	437068	155615	148973	736155	1635991 (1382610; 1973167)	2420268 (2125066; 2783889)
1994	37253	8625	625495	222582	24833	924043 (811797; 1055249)	52127	53059	560343	172766	102491	749709	1715229 (1450920; 2038836)	2642836 (2330504; 3016762)
1995	37159	22580	407245	199532	36336	706632 (631379; 795355)	17548	65295	622688	132401	95077	727394	1675501 (1425355; 1992873)	2384778 (2097836; 2731836)
1996	57073	12063	310814	272306	21660	677536 (602794; 764646)	21522	56341	582181	97619	98350	568157	1438131 (1211597; 1737229)	2120484 (1861995; 2447120)
1997	51817	16460	359314	267601	9859	708748 (628263; 799636)	10892	41219	580224	88073	116416	484954	1332884 (1134722; 1593565)	2046604 (1808844; 2338171)
1998	65193	28090	468716	293944	7962	868378 (770223; 982700)	21381	56261	610929	96639	253198	543393	1598754 (1369974; 1891888)	2473103 (2189329; 2812493)
1999	95524	14306	434658	225876	12477	786888 (699699; 886358)	7118	45803	565892	76390	66127	363839	1137299 (968464; 1344751)	1926741 (1711565; 2175118)
2000	103685	15068	716486	247566	23059	1112276 (986653; 1258805)	18586	40752	789569	116772	97059	563924	1644193 (1391237; 1949857)	2762652 (2443258; 3127731)
2001	75357	13607	618308	332972	14271	1064312 (926591; 1226537)	16001	36446	625684	100917	77307	593771	1463485 (1246676; 1757590)	2532371 (2245460; 2892327)
2002	46794	23633	377473	302812	13704	771934 (666966; 906817)	36007	45370	549142	95817	136947	440124	1321102 (1139535; 1546073)	2098635 (1859394; 2383651)
2003	46102	12499	525103	269915	7462	867956 (754302; 1005895)	23654	54291	537363	74079	85918	440845	1233344 (1050564; 1467609)	2106104 (1863817; 2390961)
2004	19612	33830	317984	189595	6218	571000 (499835; 658117)	28633	54439	396060	132449	82459	601582	1317884 (1102630; 1601939)	1892648 (1646329; 2205554)
2005	42813	30032	471723	216142	6138	772726 (677128; 884834)	18856	80084	393423	108484	103397	607123	1329420 (1116814; 1610722)	2108646 (1850975; 2429667)
2006	70218	31749	381051	261599	6810	756685 (659432; 876172)	26258	56805	301876	106765	70358	544846	1124984 (933369; 1382608)	1887962 (1645579; 2188571)
2007	20528	23509	213473	140819	2120	403026 (351838; 466432)	20609	64912	304380	101986	103740	561348	1201913 (964936; 1511586)	1606346 (1352578; 1941107)

Year	Northern NEAC						Southern NEAC							NEAC Area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC 50% (5%; 95%)	France	Iceland (S & W)	Ireland	UK (E & W)	UK (NI)	UK (Scot)	Southern NEAC 50% (5%; 95%)	NEAC 50% (5%; 95%)
2008	22192	21413	267133	146763	3305	464182 (406843; 533616)	20469	78747	320901	101054	65339	451138	1081604 (862866; 1390360)	1548962 (1308900; 1870761)
2009	39310	34652	214516	138074	3511	431866 (379646; 492590)	5774	88700	261739	63493	40536	350028	840840 (678105; 1075921)	1275467 (1091743; 1526198)
2010	31522	27780	317132	156964	5964	542641 (476736; 620147)	19325	91174	349689	125738	40313	626374	1301112 (1038713; 1663217)	1846383 (1558652; 2229191)
2011	35891	22848	223115	166622	6566	457864 (401964; 524167)	13460	64266	299835	83565	29196	352355	875492 (703183; 1138486)	1338423 (1141384; 1614828)
2012	62096	11887	248715	194812	7240	529113 (462885; 610589)	14422	36444	309756	47861	67304	448035	959923 (760546; 1253608)	1492583 (1269427; 1808097)
2013	35715	28337	234391	152266	4203	459914 (401220; 530986)	20284	108431	261211	68259	74043	354402	923723 (753037; 1166556)	1387930 (1189545; 1647576)
2014	50725	13315	319552	143435	12389	545660 (472872; 631208)	18127	26814	160933	40185	33456	205420	506023 (408946; 644413)	1055567 (918677; 1227887)
2015	31678	37627	281921	149469	4011	510489 (445614; 586614)	16603	74576	226818	49121	35928	323817	757567 (610412; 971286)	1272414 (1092070; 1505339)
2016	24728	16037	218706	106027	2151	370665 (325167; 425625)	15121	43889	227763	52387	68023	313948	753969 (601599; 968201)	1127043 (957891; 1355330)
2017	15916	15598	288410	38343	5762	365788 (318646; 421315)	19108	45442	248545	37705	57299	275058	714175 (565970; 937068)	1083458 (918099; 1319872)
2018	39964	16596	295086	128057	9405	494596 (431287; 570165)	16037	39196	180246	49303	50236	259476	621950 (497348; 791831)	1121456 (966574; 1314335)
2019	13143	9964	230409	91821	5441	354395 (309762; 406622)	16486	26174	172970	33057	27875	268949	565484 (443498; 744088)	922213 (782635; 1113570)
2020	11389	10612	282647	65763	8041	380768 (333212; 435908)	13264	34492	243607	63201	44868	370434	796463 (616157; 1051103)	1179197 (983857; 1443812)
Mean 10-year	32124	18282	262295	123661	6521	446925 (390263; 514320)	16291	49972	233168	52464	48823	317189	747477 (596070; 966664)	1198029 (1022016; 1435065)

Table 6 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%, and 95% quantiles of the Monte Carlo distribution). Estimates for 2020 will only be available in 2021 for this component.

Year	Northern NEAC						Southern NEAC							NEAC area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC 50% (5%; 95%)	France	Iceland (S & W)	Ireland	UK (E & W)	UK (NI)	UK (Scot)	Southern NEAC 50% (5%; 95%)	NEAC 50% (5%; 95%)
1971	47317	27022		265414	4704		59281	65478	381580	363532	32712	1172472	2089205 (1776962 ;2480546)	
1972	72571	25376		427818	7574		39600	59257	384173	282376	28741	1077158	1883748 (1590079 ;2247874)	
1973	117047	23832		395323	4882		20527	50954	393763	199254	31201	739585	1444737 (1208560 ;1735522)	
1974	149119	26452		428729	3793		34795	54176	448124	264750	25795	985693	1829217 (1510427 ;2215123)	
1975	115827	21679		366109	4748		30110	46830	337949	180263	17883	709943	1328269 (1123056 ;1593368)	
1976	80916	29727		253372	2678		21468	45484	280139	179330	17534	749008	1303279 (1071460 ;1597006)	
1977	42011	38016		218480	2687		21847	58607	248265	158551	22748	947042	1467948 (1174689 ;1866293)	
1978	43499	25426		197866	4596		20463	37803	209702	86421	16166	720180	1097973 (865145 ;1422249)	
1979	48555	36021		343278	9419		40099	53759	244014	231591	21006	982034	1585524 (1283292 ;1989719)	
1980	61915	14322		235429	6854		30671	37064	192822	307394	17413	912831	1513387 (1248965 ;1833149)	
1981	76120	15969		209941	11248		21242	26668	124691	147564	24205	658556	1009087 (836195 ;1228395)	
1982	79323	12172	839919	266375	8038	1208952 (1013662; 1444975)	20764	42750	207880	152409	32915	653174	1117846 (928943 ;1356825)	2331235 (1978013; 2758444)
1983	64086	14677	811223	249804	8050	1149995 (960236; 1380119)	26931	35883	142996	109897	13265	521607	857709 (689733 ;1070197)	2013417 (1690147; 2392326)
1984	62790	9881	758239	274182	4656	1112540 (929944; 1336787)	20373	26277	152155	150016	17016	526415	899015 (722888 ;1133907)	2016884 (1689810; 2419030)
1985	54724	25325	918016	278159	4525	1284581 (1066726; 1537767)	24691	22390	191739	220382	19237	729894	1218947 (996569 ;1495664)	2507235 (2107450; 2969248)
1986	67949	26166	710208	212980	8007	1029329 (862989; 1235473)	15730	19958	225988	181112	10268	548200	1009517 (826643 ;1240521)	2041610 (1725178; 2425088)
1987	46433	16714	562374	196252	6942	829930 (695859; 995763)	31527	22026	166943	213946	26668	517601	988233 (804341 ;1226473)	1820208 (1529195; 2176648)
1988	46332	14383	428045	195937	19912	705770 (593480; 844460)	17955	19894	159208	185331	21418	536852	947944 (773741 ;1178129)	1658428 (1391852; 1984051)
1989	49257	14934	480416	240855	10832	798187 (666888; 954127)	14869	19555	74142	199399	19387	474599	810808 (641096 ;1041242)	1612283 (1337008; 1951170)
1990	63275	10338	395976	230885	13536	717590 (596743; 857273)	12713	19219	100070	89814	10050	360071	596616 (464008 ;787041)	1320181 (1086834; 1595883)
1991	59830	14976	412273	213644	17903	720508 (603184; 865654)	16427	21446	83343	74794	22409	360040	583208 (462088 ;750742)	1309551 (1089986; 1575663)
1992	62444	16958	396602	252511	20267	750857 (628607; 897059)	8240	10569	78308	77197	52618	355204	591811 (457040 ;772784)	1346840 (1115332; 1629206)
1993	59028	14399	387486	225622	15455	704370 (585982; 845612)	14429	17069	113833	98249	18596	388397	657069 (507000 ;869716)	1365695 (1123135; 1667842)
1994	39570	9191	417058	257666	7884	733096 (610914; 880187)	7089	17535	110230	99038	15832	452892	709071 (536935 ;951389)	1447941 (1182423; 1776250)
1995	36367	11961	414995	193911	12650	671996 (561076; 808020)	12700	11310	75942	102819	17315	385104	612421 (458509 ;837721)	1289080 (1050442; 1591721)
1996	42563	6639	265845	154731	8907	480919 (399123; 578028)	6558	12591	96204	63891	21515	281904	494033 (372417 ;665661)	979476 (794422; 1212523)
1997	40670	9702	319102	192068	4917	568101 (473435; 684295)	5443	7776	55705	41612	29416	227539	372929 (279631 ;505806)	944165 (776876; 1150861)

Year	Northern NEAC						Southern NEAC							NEAC area
	Finland	Iceland (N&E)	Norway	Russia	Sweden	Northern NEAC 50% (5%; 95%)	France	Iceland (S & W)	Ireland	UK (E & W)	UK (NI)	UK (Scot)	Southern NEAC 50% (5%; 95%)	NEAC 50% (5%; 95%)
1998	48124	11141	340753	169407	3485	574255 (476180; 692421)	11451	15172	86766	80785	13371	255975	482201 (355445 ;654194)	1061839 (862784; 1302533)
1999	91475	6509	471852	294837	12418	879718 (735824; 1058215)	7961	4135	107114	82765	16381	258151	487535 (369977 ;653475)	1374341 (1134402; 1663152)
2000	110724	7455	554317	207146	14745	897548 (746385; 1081067)	9377	7253	95944	89462	11076	347808	572296 (422207 ;795083)	1475953 (1207065; 1815143)
2001	97100	7071	481346	225564	10132	823194 (685454; 991091)	8753	7855	110976	81406	13896	246440	480586 (364154 ;638223)	1309751 (1083128; 1586140)
2002	69556	7439	425616	158271	2410	664748 (551697; 802413)	12440	12520	116269	104694	8497	288772	557385 (418585 ;754795)	1225911 (998269; 1512312)
2003	31810	7316	386999	121535	7483	556551 (459969; 671312)	23139	10127	64174	89178	9011	393716	600438 (434620 ;848061)	1160609 (930360; 1467230)
2004	26307	9074	354733	145820	5004	542374 (450611; 653141)	14352	8932	82850	96818	11290	382329	609315 (445723 ;846100)	1156366 (928989; 1448610)
2005	38999	8674	449903	139471	5226	643363 (536254; 776516)	14410	7395	59594	86919	8913	468280	658883 (467740 ;945254)	1308739 (1044880; 1665291)
2006	56402	8373	382726	145555	4868	598341 (502232; 719133)	13597	4567	42432	84462	9220	382838	548554 (395356 ;776284)	1153869 (932717; 1447446)
2007	56843	10742	442265	228627	6892	747696 (619228; 906381)	15110	5228	31688	92392	7190	514112	678225 (480319 ;978532)	1433584 (1143169; 1818097)
2008	24351	8673	347971	194598	6059	582970 (480597; 703664)	6994	8082	39737	71466	7290	424979	567612 (403844 ;819022)	1155901 (921816; 1465846)
2009	39044	12330	381388	239485	7063	682300 (563296; 823614)	5736	16717	36994	104517	10698	554227	742176 (523065 ;1059078)	1431349 (1131328; 1821612)
2010	30096	13716	531721	239945	16447	835497 (688148; 1010644)	16084	8479	40406	175750	13712	703407	981269 (698846 ;1384653)	1822928 (1442991; 2321822)
2011	36343	7732	465615	117537	18673	648368 (534839; 787670)	12857	4853	35306	137904	31926	555105	797199 (566741 ;1133112)	1450815 (1147292; 1849837)
2012	35092	8838	328292	134222	7973	516569 (427084; 625722)	13238	13396	40403	134813	10285	507459	737100 (529528 ;1042874)	1260198 (991999; 1614819)
2013	37896	10677	337988	133538	17060	540506 (442625; 655349)	16415	8240	33996	91605	5594	342702	510960 (373134 ;714765)	1052930 (847916; 1323455)
2014	36659	10168	427872	125685	11711	614777 (502771; 750812)	18557	7451	36038	147492	7180	419621	654559 (473789 ;922575)	1273701 (1015980; 1610589)
2015	39226	14234	469406	107098	4561	636909 (521914; 771549)	7972	10681	35446	193878	13298	456380	739414 (523810 ;1045933)	1381255 (1090213; 1760808)
2016	28303	8011	473854	99187	19273	630637 (516697; 771059)	9053	9069	32540	155157	10727	403016	637820 (457812 ;904803)	1274801 (1017364; 1605705)
2017	17409	8805	445323	130346	12747	617138 (506762; 755886)	13502	9694	32846	156437	10149	228518	468208 (338600 ;651671)	1089862 (879156; 1356314)
2018	24448	6704	376527	101423	25451	537611 (442165; 657288)	21436	7875	25881	120498	6394	285664	473053 (340842 ;661174)	1016217 (817601; 1268609)
2019	14733	5165	382780	87988	21468	514204 (420717; 627706)	10683	7648	37663	214878	3852	351709	636018 (446530 ;888260)	1153181 (908755; 1464141)
2020														
Mean 10-year	30012	8926	411962	115225	15435	584080 (479508; 711449)	13746	8768	34458	150296	11045	394464	628259 (450087 ;885019)	1216996 (968475; 1539364)

NASCO 2.4. Provide catch options or alternative management advice for the 2021/22–2023/24 fishing seasons, with an assessment of risks relative to the objective of exceeding stock conservation limits, or pre-defined NASCO Management Objectives, and advise on the implications of these options for stock rebuilding

PFA forecasts until 2024 for the Southern and Northern NEAC complexes were developed within a Bayesian model framework (Figures 10 and 11). The probabilities of meeting SERs under different catch scenarios in the Faroes in seasons 2021/2022 to 2023/2024, assuming that the agreed catch allocation is fully taken in homewaters, are provided in Table 7 for the stock complexes. The corresponding forecast exploitation rates, for fish taken at the Faroes, are presented in Table 8. The probabilities of meeting SERs in the individual NEAC countries are presented in Tables 9 and 10. The probabilities of meeting SERs are higher in the Northern than in the Southern complex and are generally higher for the Northern countries than the Southern countries.

MSY approach

ICES considers that to be consistent with the MSY and the precautionary approach, fisheries should only take place on salmon from stocks that can be shown to be at full reproductive capacity. Due to the different status of individual stocks, mixed-stock fisheries present particular threats.

No specific risk level has so far been agreed by NASCO for the provision of catch advice for the Faroes fishery; in the absence of this, ICES uses a 95% probability of meeting individual SERs, applied at the level of the European stock complexes (two areas and two age classes) and the NEAC countries (ten countries and two age classes). In the absence of any fisheries in the Faroes in 2021/2022 to 2023/2024, there is a less than 95% probability of meeting the SERs for the two Southern NEAC complexes (potential 1SW and MSW spawners) and for the Northern NEAC potential 1SW spawners (Table 7). There is also a less than 95% probability of most individual countries meeting their SERs for MSW fish in the absence of any fisheries (Table 10); only Norway meets its SER for 1SW fish for 2021/2022 and for 2022/2023 up to its 60 t TAC option (Table 9). Therefore, in the absence of specific management objectives, ICES advises that there are no mixed-stock fisheries options for the NEAC complexes/countries at the Faroes in 2021/2022 to 2023/2024.

Additional considerations

ICES emphasizes that the national stock SERs discussed above are not appropriate for the management of homewater fisheries, particularly where these exploit separate river stocks. This is because the SERs will not take account of differences in the status of different river stocks or sub-river populations. Management at finer scales should take account of individual river stock status. Nevertheless, given that not all stocks are currently at full reproductive capacity, the combined SERs for the main stock groups (national stocks) exploited by the distant-water fisheries can be used to provide general management advice to the distant-water fisheries.

Fisheries on mixed-stocks pose particular difficulties for management when they cannot only target stocks that are at full reproductive capacity. The management of a fishery should ideally be based on the status of all stocks exploited in the fishery. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and especially rivers are more likely to meet this requirement. While the abundance of stocks remains low, even in the absence of a fishery at the Faroes, particular care should be taken to ensure that fisheries in home waters are managed to protect river stocks that are below their CLs.

The probabilities of meeting SERs for the 1SW salmon are hardly affected by the catch options at the Faroes (within the range considered in Table7), principally because the exploitation rates on the 1SW stock components in the fishery are expected to be very low (Table 8).

Data and methods

The input data used to estimate the historical PFAs are the catch in numbers of 1SW and MSW salmon in each country, unreported catch levels, and exploitation rates; error values are included to account for uncertainties. A natural mortality value of 0.03 (range 0.02 to 0.04) per month is applied during the second year at sea. Data beginning in 1971 are available for most countries. In addition, catches at the Faroes (equal to 0 since 2000) and catches of NEAC-origin salmon at West Greenland are included.

The Bayesian inference and forecast models for the Southern NEAC and Northern NEAC complexes have the same structure and are run independently through R. For both Southern and Northern NEAC complexes, PFA forecasts were derived based on lagged spawners and productivity (Figures 10 and 11).

The risk framework was used to evaluate TAC options for the Faroes fishery in the 2021/2022, 2022/2023, and 2023/2024 fishing seasons, based on the NEAC stock complex and countries/jurisdictions. For any TAC option being evaluated, the number of fish that would be caught at the Faroes from each management unit is estimated. These values are divided by the Faroes share allocation to estimate the total harvest that can be taken by each participating country at Faroes and in homewater fisheries combined (ICES, 2016). The risk analysis then estimates the probability of each management unit achieving its management objectives for each TAC option, assuming that the total estimated harvest is taken.

The large uncertainty in the PFA forecasts (Figures 10 and 11) results in increased risk of not achieving the CLs in the forecasts. As a result, the advice is more cautious regarding fishing opportunities.

Comparison with previous assessment and catch options

The most recent catch advice in 2018 concluded that there were no catch options at the Faroes for 2018/2019 to 2020/2021 (ICES, 2018). The current assessment and forecast results in similar advice.

The advice this year is based on the risk assessment framework, as in 2018. This framework directly evaluates the risk (probability) of meeting SERs in the 1SW and MSW Southern and Northern NEAC complexes, as well as at country level, under different catch scenarios. Managers can choose the risk level which they consider appropriate. ICES considers, however, that to be consistent with the MSY and precautionary approach, and given that the SERs (as CLs increased to take account of natural mortality between the recruitment date and the date of return to homewaters) are considered to be limit reference points to be avoided with high probability, managers should choose a risk level that results in a low chance of failing to meet the SERs. ICES still considers that management decisions be based principally on a 95% probability of attainment of SERs in each stock complex or country individually (ICES, 2013).

Assessment and management area

National stocks are combined into Southern NEAC and Northern NEAC groups. The groups fulfilled an agreed set of criteria for defining stock groups for the provision of management advice (ICES, 2005). At that time, consideration of the level of exploitation of national stocks resulted in the advice for the Faroes fishery (both 1SW and MSW) being based on all NEAC area stocks and the advice for the West Greenland fishery being based on the Southern NEAC non-maturing 1SW stock only.

ICES (2012) previously emphasized the problem of basing a risk assessment and catch advice for the Faroes fishery on management units comprising large numbers of river stocks. In providing catch advice at age and stock complex or country levels for the Northern and Southern NEAC areas, consideration needs to be given to the recent performance of the stocks within individual countries. At present, insufficient monitoring occurs to assess the performance of individual stocks in all countries or jurisdictions in the NEAC area, and in some instances river-specific CLs are in the process of being developed. Nonetheless, Figure 4 indciates that there are many rivers in the NEAC area that are not meeting their CLs.

Quality considerations

Uncertainties in input variables to the stock status and stock forecast models are incorporated in the assessment. Provisional catch data for 2019 were updated where appropriate, and the assessment was extended to include data for 2020. Further development of the Faroes risk framework would benefit from new data on the biological characteristics and origin of the catch (ICES, 2016).

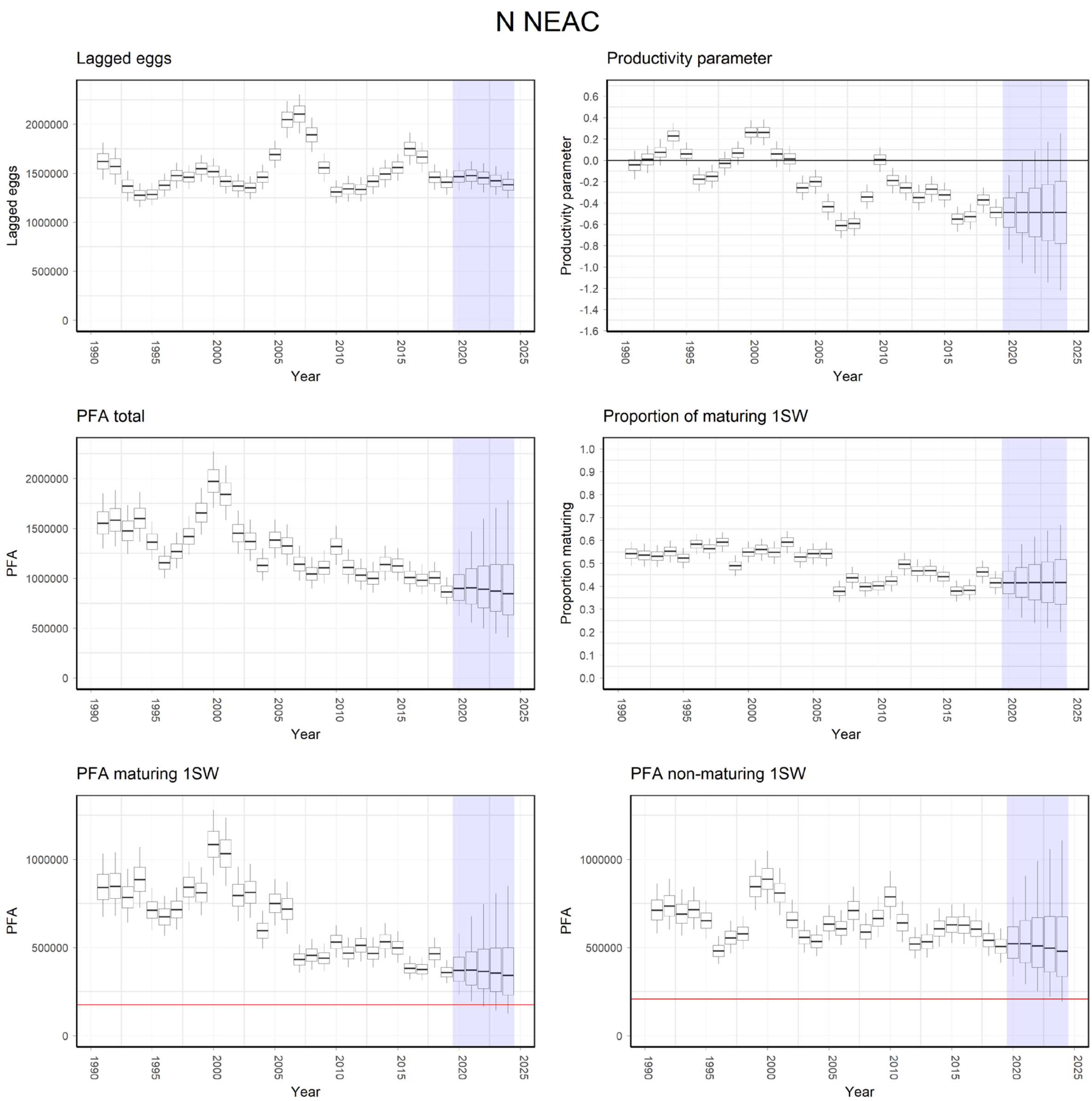

Figure 10 Northern NEAC: lagged eggs (in thousands) from 1SW and MSW spawners combined, productivity parameter from eggs to PFA, total PFA, proportion of maturing 1SW spawners, and PFA of maturing and non-maturing stocks for PFA years 1978 to 2024. For PFAs, the proportion of maturing fish and productivity parameter for the last five years (2020 to 2024) are forecasts (as indicated by the blue shaded region). The red horizontal lines in the bottom panels are the age-specific SER values. Box and whiskers plots show the 5th, 25th, 50th, 75th, and 95th Bayesian credible intervals (BCIs).

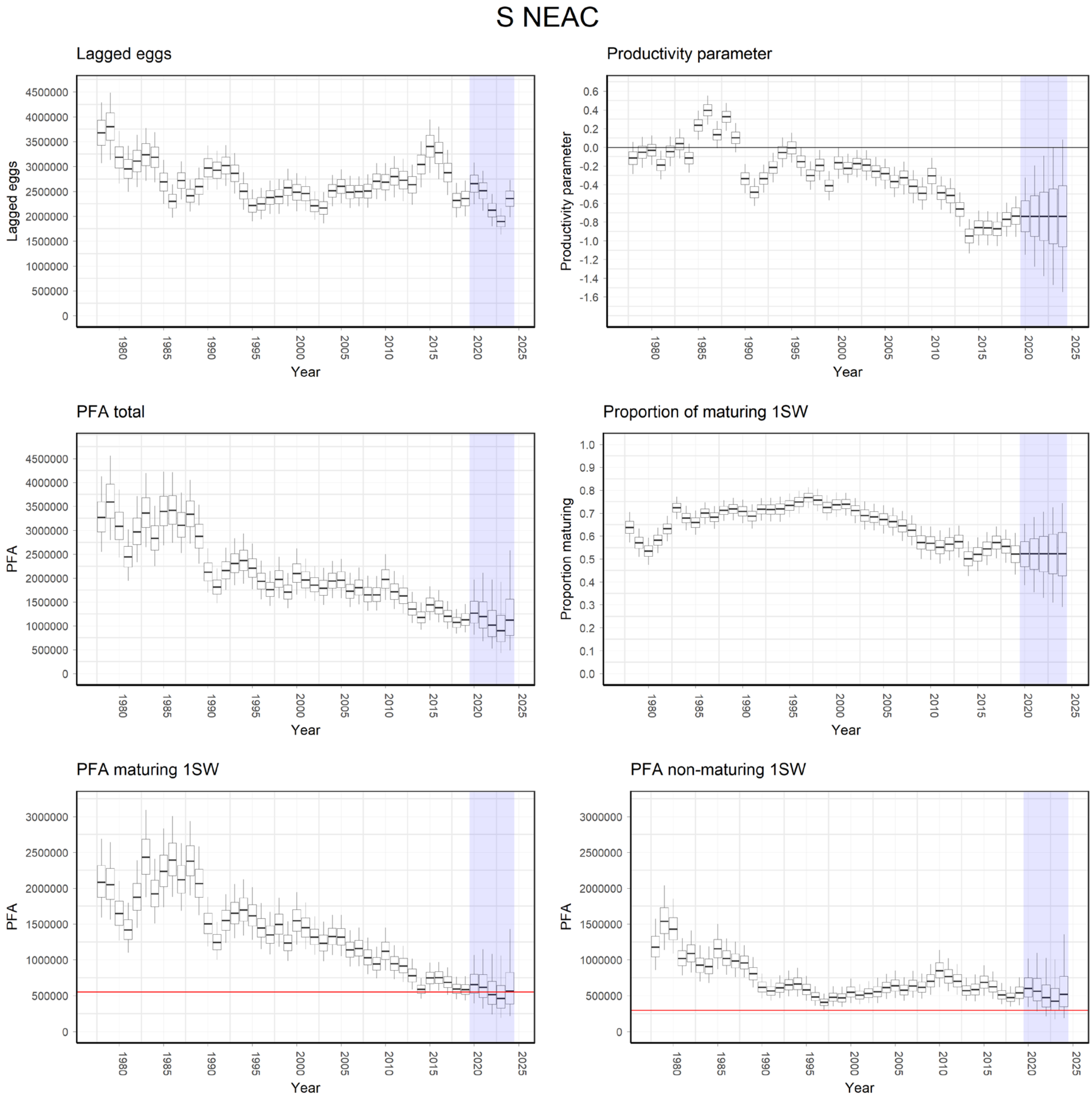

Figure 11 Southern NEAC: lagged eggs (in thousands) from 1SW and MSW spawners combined, productivity parameter from eggs to PFA, total PFA, proportion of maturing 1SW spawners, and PFA of maturing and non-maturing stocks for PFA years 1978 to 2024. For PFAs, the proportion of maturing fish and productivity parameter for the last five years (2020 to 2024) are forecasts (as indi-cated by the blue shaded region). The horizontal lines in the bottom panels are the age-specific SER values. Box and whiskers plots show the 5th, 25th, 50th, 75th, and 95th Bayesian credible intervals (BCIs).

Table 7 Probabilities (in %) of Northern and Southern NEAC 1SW and MSW stock complexes achieving their SERs both independently and simultaneously for different catch options for the Faroes fishery in the 2021/2022 to 2023/2024 fishing seasons (assuming full catch allocations are taken). Cells shaded yellow denote attainment of SERs with ≥ 95% probability.

Catch options season	TAC option (t)	NEAC-N-1SW (%)	NEAC-N-MSW (%)	NEAC-S-1SW (%)	NEAC-S-MSW (%)	All complexes simultaneously (%)
2021/22	0	94	99	45	94	40
	20	94	98	44	92	38
	40	94	94	43	89	36
	60	94	87	42	87	32
	80	94	78	42	84	28
	100	94	67	41	81	23
	120	93	56	40	78	19
	140	93	46	40	75	15
	160	93	37	39	71	11
	180	93	29	38	68	9
	200	93	23	38	64	7
2022/23	0	91	98	36	84	30
	20	91	94	35	80	28
	40	90	89	35	77	25
	60	90	81	34	73	22
	80	90	72	34	69	19
	100	90	63	33	66	15
	120	90	53	32	62	13
	140	90	45	32	58	10
	160	90	37	31	55	8
	180	90	31	31	51	6
	200	90	25	30	48	5
2023/24	0	87	96	52	75	37
	20	87	91	52	71	34
	40	87	85	51	67	30
	60	87	77	51	63	26
	80	87	67	50	59	22
	100	86	59	50	56	18
	120	86	51	49	52	15
	140	86	43	49	49	12
	160	86	36	48	45	10
	180	86	30	47	42	8
	200	86	26	47	39	6

Table 8 Forecast exploitation rates (in %) for 1SW and MSW salmon from Northern and Southern NEAC areas in all fisheries for different TAC options in the Faroes fishery in the 2021/2022 to 2023/2024 fishing seasons (assuming catch allocations are fully taken).

Catch options season	TAC option(t)	NEAC-N-1SW (%)	NEAC-N-MSW (%)	NEAC-S-1SW (%)	NEAC-S-MSW (%)	All complexes simultaneously (%)
2021/22	0	0.0	0.0	0.0	0.0	0.0
	20	0.0	0.8	0.1	0.3	0.0
	40	0.0	1.6	0.1	0.6	0.0
	60	0.0	2.4	0.2	0.9	0.0
	80	0.1	3.1	0.3	1.2	0.1
	100	0.1	3.9	0.3	1.5	0.1
	120	0.1	4.7	0.4	1.7	0.1
	140	0.1	5.5	0.5	2.0	0.1
	160	0.1	6.3	0.6	2.3	0.1
	180	0.1	7.1	0.6	2.6	0.1
	200	0.1	7.9	0.7	2.9	0.1
2022/23	0	0.0	0.0	0.0	0.0	0.0
	20	0.0	0.8	0.1	0.4	0.0
	40	0.0	1.6	0.2	0.7	0.0
	60	0.0	2.4	0.2	1.0	0.0
	80	0.1	3.2	0.3	1.4	0.1
	100	0.1	4.0	0.4	1.7	0.1
	120	0.1	4.8	0.5	2.1	0.1
	140	0.1	5.6	0.5	2.4	0.1
	160	0.1	6.4	0.6	2.8	0.1
	180	0.1	7.2	0.7	3.1	0.1
	200	0.1	8.0	0.8	3.5	0.1
2023/24	0	0.0	0.0	0.0	0.0	0.0
	20	0.0	0.8	0.1	0.4	0.0
	40	0.0	1.7	0.1	0.8	0.0
	60	0.0	2.5	0.2	1.2	0.0
	80	0.1	3.3	0.3	1.6	0.1
	100	0.1	4.1	0.3	2.0	0.1
	120	0.1	5.0	0.4	2.3	0.1
	140	0.1	5.8	0.4	2.7	0.1
	160	0.1	6.6	0.5	3.1	0.1
	180	0.1	7.4	0.6	3.5	0.1
	200	0.2	8.3	0.6	3.9	0.2

Table 9 Probability (in %) of national NEAC 1SW stock complexes achieving their SERs (in numbers) both individually and simultaneously for different catch options (in tonnes) for the Faroes fishery in the 2021/2022 to 2023/2024 fishing seasons. Cells shaded yellow denote attainment of SERs with ≥ 95% probability. MUs are management units.

Catch options season	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	UK (Scotland)	UK (N. Ireland)	Ireland	UK (England & Wales)	France	All 1SW MUs simultan-eously
SER		79291	18174	68831	2235	26761	130514	42587	269026	68682	22471	
2021/22	0	28%	38%	97%	82%	74%	70%	30%	25%	22%	40%	0.0%
	20	28%	38%	97%	82%	74%	69%	30%	25%	22%	40%	0.0%
	40	28%	38%	97%	82%	73%	69%	30%	24%	22%	40%	0.0%
	60	28%	38%	97%	82%	73%	68%	29%	24%	21%	40%	0.0%
	80	28%	38%	97%	82%	73%	67%	29%	24%	21%	40%	0.0%
	100	28%	37%	97%	81%	73%	67%	29%	24%	21%	40%	0.0%
	120	28%	37%	97%	81%	72%	66%	29%	24%	21%	39%	0.0%
	140	27%	37%	97%	81%	72%	65%	29%	23%	21%	39%	0.0%
	160	27%	37%	97%	81%	72%	65%	28%	23%	21%	39%	0.0%
	180	27%	37%	97%	81%	72%	64%	28%	23%	21%	39%	0.0%
	200	27%	37%	97%	81%	71%	63%	28%	23%	20%	39%	0.0%
2022/23	0	27%	33%	95%	84%	66%	63%	25%	24%	23%	28%	0.0%
	20	27%	33%	95%	84%	65%	63%	25%	24%	23%	28%	0.0%
	40	27%	33%	95%	84%	65%	62%	24%	24%	23%	28%	0.0%
	60	27%	33%	95%	84%	65%	61%	24%	23%	22%	28%	0.0%
	80	27%	33%	94%	84%	65%	61%	24%	23%	22%	28%	0.0%
	100	27%	33%	94%	84%	64%	60%	24%	23%	22%	28%	0.0%
	120	26%	33%	94%	84%	64%	60%	24%	23%	22%	28%	0.0%
	140	26%	33%	94%	84%	64%	59%	23%	23%	22%	28%	0.0%
	160	26%	32%	94%	84%	64%	58%	23%	22%	22%	27%	0.0%
	180	26%	32%	94%	84%	63%	58%	23%	22%	21%	27%	0.0%
	200	26%	32%	94%	84%	63%	57%	23%	22%	21%	27%	0.0%
2023/24	0	37%	29%	92%	83%	55%	68%	34%	32%	34%	32%	0.1%
	20	37%	28%	92%	83%	54%	67%	33%	32%	34%	32%	0.0%
	40	36%	28%	92%	83%	54%	67%	33%	32%	34%	32%	0.0%
	60	36%	28%	92%	83%	54%	66%	33%	32%	33%	32%	0.0%
	80	36%	28%	92%	83%	54%	66%	33%	31%	33%	32%	0.0%
	100	36%	28%	92%	83%	54%	65%	32%	31%	33%	31%	0.0%
	120	36%	28%	91%	83%	53%	65%	32%	31%	33%	31%	0.0%
	140	36%	28%	91%	83%	53%	64%	32%	31%	33%	31%	0.0%
	160	36%	28%	91%	83%	53%	64%	32%	31%	33%	31%	0.0%
	180	36%	28%	91%	83%	53%	63%	31%	31%	32%	31%	0.0%
	200	35%	28%	91%	82%	52%	63%	31%	30%	32%	31%	0.0%

Table 10 Probability (%) of national NEAC MSW stock complexes achieving their SERs (in numbers) both individually and simultaneously for different catch options (in tonnes) for the Faroes fishery in the 2021/2022 to 2023/2024 fishing seasons. Cells shaded yellow denote attainment of SERs with ≥ 95% probability. MUs are management units.

Catch options season	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	UK (Scotland)	UK (N. Ireland)	Ireland	UK (England & Wales)	France	All MSW MUs simultaneously
SER		61918	16365	123036	4735	5988	143293	10316	78294	51423	9451	
2021/22	0	62%	40%	99%	96%	93%	89%	20%	24%	97%	57%	0.5%
	20	47%	32%	98%	94%	90%	87%	19%	23%	96%	56%	0.3%
	40	34%	26%	95%	92%	87%	85%	18%	22%	95%	54%	0.1%
	60	24%	21%	92%	89%	83%	82%	18%	22%	94%	52%	0.0%
	80	17%	17%	87%	87%	80%	79%	17%	21%	93%	51%	0.0%
	100	12%	14%	81%	84%	76%	76%	16%	20%	91%	49%	0.0%
	120	8%	11%	75%	81%	73%	73%	16%	20%	90%	48%	0.0%
	140	6%	9%	68%	79%	69%	70%	15%	19%	89%	46%	0.0%
	160	4%	8%	61%	76%	66%	67%	15%	19%	87%	45%	0.0%
	180	3%	7%	55%	74%	62%	64%	14%	18%	86%	44%	0.0%
	200	2%	6%	48%	71%	59%	61%	14%	18%	84%	43%	0.0%
2022/23	0	43%	41%	98%	95%	87%	78%	18%	22%	94%	64%	0.2%
	20	31%	34%	96%	93%	83%	74%	18%	21%	92%	63%	0.1%
	40	21%	28%	93%	91%	80%	71%	17%	21%	91%	62%	0.0%
	60	15%	24%	89%	89%	76%	67%	16%	20%	90%	60%	0.0%
	80	10%	20%	85%	87%	72%	64%	16%	20%	89%	59%	0.0%
	100	7%	17%	80%	84%	69%	60%	15%	19%	87%	58%	0.0%
	120	5%	15%	74%	82%	65%	57%	15%	19%	86%	57%	0.0%
	140	4%	13%	68%	80%	62%	53%	15%	18%	84%	55%	0.0%
	160	3%	11%	63%	78%	59%	50%	14%	18%	83%	54%	0.0%
	180	2%	10%	57%	76%	56%	47%	14%	18%	81%	53%	0.0%
	200	1%	8%	52%	73%	53%	43%	13%	17%	80%	52%	0.0%
2023/24	0	40%	36%	97%	95%	81%	70%	17%	22%	90%	49%	0.1%
	20	29%	30%	94%	94%	77%	66%	16%	22%	89%	48%	0.0%
	40	21%	25%	90%	92%	73%	63%	16%	21%	87%	47%	0.0%
	60	15%	21%	85%	90%	70%	59%	15%	21%	86%	46%	0.0%
	80	11%	18%	80%	89%	66%	56%	15%	20%	84%	45%	0.0%
	100	8%	16%	75%	87%	63%	52%	14%	20%	82%	43%	0.0%
	120	6%	14%	70%	85%	60%	49%	14%	19%	81%	42%	0.0%
	140	4%	12%	65%	84%	57%	46%	13%	19%	79%	41%	0.0%
	160	3%	11%	59%	82%	54%	43%	13%	19%	77%	40%	0.0%
	180	3%	10%	54%	81%	51%	40%	13%	18%	76%	39%	0.0%
	200	2%	8%	49%	79%	48%	37%	13%	18%	74%	38%	0.0%

NASCO 2.5 Update the Framework of Indicators used to identify any significant change in the previously provided multiannual management advice

The Framework of Indicators (FWI) previously used in support of multiannual catch options was updated in 2021. In 2018, the FWI was revised such that only stock complexes that would be appropriate to changing the multiyear advice were included; i.e. those stock complexes which had predicated the zero catch option for the Faroes when catch advice was last provided (ICES, 2016). As future catch advice could be determined by the status of stocks in any of the four stock complexes, indicators for each of these have been retained in the FWI in 2020. All existing indicators were updated and examined to see if they still met the criteria for inclusion in the framework (ICES, 2012).

Assuming a new multiannual agreement is confirmed, the updated FWI has been structured such that it could be applied for the next two years, in January 2022 and 2023, based on new indicator values for 2021 and 2022, respectively. The updated FWI will be made available to NASCO to enable the organization to facilitate intermediate assessments in 2022 and 2023 in order to determine whether new catch advice might be required. The FWI will then need to be updated and a new three-year cycle started in 2024 (Figure 12).

FWI NEAC	2022	Indicators suggest:	REASSESS

Indicators for Northern NEAC 1SW PFA

		Insert data from 2021 here	N reg	Slope	Intercept	r^2	Median PFA in 2021	12.5%ile	87.5%ile	Reassess in year 2022? Outside 75% conf.lim. below	above	Outside 75% confidence limits below	above
1	Returns all 1SW NO PFA est		37	0.514780	-27673.84	0.92	371561	111272.56	215924.28	0	0	Uninformative	Uninformative
2	Survivals W 1SW NO Imsa		37	0.000011	-2.55	0.47	371561	-2.48	5.45	0	0	Uninformative	Uninformative
3	Survivals H 1SW NO Imsa		38	0.000005	-0.43	0.31	371561	-1.17	4.31	0	0	Uninformative	Uninformative
4	Counts all Akujoki (1SW)		18	0.000151	-16.38	0.38	371561	2.77	76.58	0	0	Uninformative	Uninformative
5	Counts all NO Nausta (1SW)		23	0.001608	302.93	0.22	371561	49.48	1751.08	0	0	Uninformative	Uninformative
6	Catch rT&N 1SW FI		22	0.0168897	-672.3621	0.51	371561	-2565.78	13772.15	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Northern NEAC MSW PFA

		Insert data from 2021 here	N reg	Slope	Intercept	r^2	Median PFA in 2021	12.5%ile	87.5%ile	Reassess in year 2022? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1	PFA-MSW-CoastNorway		37	0.328645	17743.77	0.79	521052	148154.03	229815.63	0	0	Uninformative	Uninformative
2	Orkla counts		17	0.013480	-3420.75	0.55	521052	1593.48	5612.91	0	0	Uninformative	Uninformative
3	Counts all NO Nausta		23	0.003829	-1199.20	0.33	521052	5.92	1585.55	0	0	Uninformative	Uninformative
4	Returns all 2SW NO PFA est		27	0.2051312	37948.148	0.31	521052	69947.74	219716.58	0	0	Uninformative	Uninformative
5	Catch W rT&N 2SW FI		22	0.0080952	-2358.398	0.36	521052	-571.96	4291.25	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Southern NEAC 1SW PFA

		Insert data from 2021 here	N reg	Slope	Intercept	r^2	Median PFA in 2021	12.5%ile	87.5%ile	Reassess in year 2022? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1	Ret. 1SW UK(E&W) Tamar M		27	0.001914	1101.95	0.31	616416	998.67	3564.69	0	0	Uninformative	Uninformative
2	Ret. W 1SW UK(E&W) Frome M		48	0.000534	-78.84	0.43	616416	-251.66	752.60	0	0	Uninformative	Uninformative
3	Ret. W 1SW UK(Sc.) North Esk M		40	0.006883	2807.30	0.68	616416	3877.19	10223.23	0	0	Uninformative	Uninformative
4	Surv. W 1SW UK(NI) Bush M		32	1.945E-05	-9.699526	0.64	616416	-6.22	10.80	0	0	Uninformative	Uninformative
5	Ret. Freshw 1SW UK(NI) Bush		46	0.000649	433.07	0.29	616416	73.98	1592.24	0	0	Uninformative	Uninformative
6	Ret. W 1SW UK(E&W) Dee M		29	0.0036297	-1008.336	0.58	616416	-193.60	2651.74	0	0	Uninformative	Uninformative
7	Count 1SW UK(E&W) Fowey M		26	0.0004136	171.28444	0.30	616416	155	698	0	0	Uninformative	Uninformative
8	Surv. 1SW UK(E&W) Frome		17	4.424E-06	0.2044226	0.32	616416	1	5	0	0	Uninformative	Uninformative
9	Surv coast 1SW UK(E&W) Dee M		24	2.984E-06	-0.319153	0.35	616416	-0.33	3.37	0	0	Uninformative	Uninformative
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation. REASSESS

Indicators for Southern NEAC MSW PFA

		Insert data from 2021 here	N reg	Slope	Intercept	r^2	Median PFA in 2021	12.5%ile	87.5%ile	Reassess in year 2022? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above	
1	Ret. W 2SW UK(Sc.) Baddoch NM		33	0.000060	-12.15	0.37	565441	7.76	36.00	0	0	Uninformative	Uninformative	
2	Ret. W 2SW UK(Sc.) Girnoch NM		49	0.000049	2.19	0.40	565441	0.39	59.17	0	0	Uninformative	Uninformative	
3	Ret. W MSW UK(E&W) Itchen NM		33	0.000307	-63.78	0.26	565441	16.49	202.63	0	0	Uninformative	Uninformative	
4	Ret. W 1SW UK(E&W) Itchen NM		32	0.001016	-289.72	0.41	565441	83.41	485.80	0	0	Uninformative	Uninformative	NB use 2020 data
5	Ret. W MSW UK(E&W) Frome NM		48	0.000847	74.39	0.31	565441	-12.74	1119.57	0	0	Uninformative	Uninformative	
6	Ret. W 1SW UK(E&W) Frome NM		47	0.000741	154.34	0.22	565441	-6.85	1154.04	0	0	Uninformative	Uninformative	NB use 2020 data
7	Catch W MSW Ice Ellidaar NM		49	0.000120	-33.32	0.53	565441	-21.11	90.63	0	0	Uninformative	Uninformative	
8	Ret W 1SW UK(Sc.) North Esk NM		39	0.011622	4214	0.25	565441	5949	15622	0	0	Uninformative	Uninformative	NB use 2020 data
9	Ret. W 2SW UK(Sc.) North Esk NM		40	0.0089909	948.40233	0.53	565441	3598.83	8465.63	0	0	Uninformative	Uninformative	
								Sum of scores		0	0	Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation. REASSESS	

Figure 12 Framework of indicators (FWI) spreadsheet for the Faroes fishery. The Northern NEAC stock complexes are shaded out since only the two Southern NEAC stock complexes are currently determining the outcome of the FWI. The Northern NEAC stock complexes are still retained in the spreadsheet because they may influence the advice in future.

Scientific basis

Table 11 The basis of the assessment.

ICES stock data category	1 (ICES 2021b)
Assessment type	Run-reconstruction models and Bayesian forecasts, taking into account uncertainties in data and process error. Results presented in a risk analysis framework.
Input data	Reported (i.e. nominal) catches (by sea-age class) for commercial and recreational fisheries Estimates of unreported/illegal catches Estimates of exploitation rates Natural mortalities (from earlier assessments)
Discards and bycatch	Discards included in risk-based framework for the Faroes fishery Not relevant for other NEAC assessments
Indicators	Framework of Indicators (FWI) is used to indicate if a significant change has occurred in the status of stocks in intermediate years where multi-annual management advice applies
Other information	Advice subject to annual review. Stock annex developed in 2014 and updated in 2021 (ICES, 2021c).
Working group	Working Group on North Atlantic Salmon (WGNAS) (ICES, 2021a; 2022)

Identify relevant data deficiencies, monitoring needs, and research requirements

A database is needed that lists individual PIT tag numbers or codes identifying the origin, source, or programme of the tags on a North Atlantic basin-wide scale. This is needed to facilitate identification of individual tagged fish taken in marine fisheries or surveys. Data on individual PIT tags used in Norway have now been compiled; however, there is a need for an ICES coordinated database where the data could be stored.

PIT 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.

The full list of data deficiencies, monitoring needs, and research requirements for North Atlantic salmon is presented in Section 1.4 of the sal.oth.nasco advice (ICES, 2021d).

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Annex 1 Glossary of acronyms and abbreviations

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.

CL(s) *conservation limit(s),* **i.e. S_{lim}**. 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. .

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.

ICES *International Council for the Exploration of the Sea*

MSY *Maximum Sustainable Yield*. The largest average annual catch that may be taken from a stock continuously without affecting the catch of future years; a constant long-term MSY is not a reality in most fisheries, where stock sizes vary with the strength of year classes moving through the fishery.

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

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.

NEAC *North-East Atlantic Commission.* The commission within NASCO with responsibility for Atlantic salmon in the Northeast Atlantic.

PFA *pre-fishery abundance.* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time.

SER *spawner escapement reserve.* The CL increased to take account of natural mortality between the recruitment date (assumed to be 1st January) and the date of return to homewaters.

TAC *total allowable catch*. The TAC is the quantity of fish that can be taken from each stock each year.

Annex 2 General considerations

Management plans

The North Atlantic Salmon Conservation Organization (NASCO) has adopted an Action Plan for Application of the Precautionary Approach, which stipulates that management measures should be aimed at maintaining all stocks above their conservation limits (CLs) by the use of management targets. CLs for North Atlantic salmon stock complexes have been defined by ICES as the level of a stock (number of spawners) that will achieve long-term average MSY. NASCO has adopted the region-specific CLs as limit reference points (S_{lim}); having populations fall below these limits should be avoided with high probability. Advice for the Faroes fishery (which historically harvested both 1SW and MSW salmon) is currently based upon all NEAC area stocks. The advice for the West Greenland fishery (ICES, 2021e) is based upon the Southern NEAC non-maturing 1SW stock and the non-maturing 1SW salmon from North America. A 75% risk level (probability) of achieving the management objectives (CLs) simultaneously in four regions (Labrador, Newfoundland, Quebec, and Gulf), as well as being above the management objectives for Scotia-Fundy and USA, has been agreed by NASCO for the provision of catch advice at West Greenland. No specific risk level has so far been agreed by NASCO for the provision of catch advice for the Faroes fishery; in the absence of this, ICES uses a 95% probability of meeting individual CLs, applied at the level of the European stock complexes (two areas and two age classes) and for the ten NEAC countries and two age classes. A Framework of Indicators (FWI) has been developed in support of the multiannual catch options.

Biology

Atlantic salmon (*Salmo salar*) is an anadromous species found in rivers of countries bordering the North Atlantic. In the Northeast Atlantic area, its current distribution extends from the Lima River (41°69’) in northern Portugal to the Pechora River (68°20’) in Northwest Russia and west to Iceland (66°44’). Juveniles migrate to the ocean at the ages of one to eight years (dependent on latitude) and generally return after one or two years at sea. Long-distance migrations to ocean feeding grounds take place, with adult salmon from the Northeast Atlantic stocks being exploited in waters near both Greenland and the Faroes.

Environmental and other influences on the stock

Environmental conditions in both freshwater and marine environments have a marked effect on the status of salmon stocks. Across the North Atlantic, a range of problems in the freshwater environment play a significant role in explaining the poor status of stocks. In many cases, river damming and habitat deterioration have had a devastating effect on freshwater environmental conditions. In the marine environment, return rates of adult salmon have declined since the 1980s and, for some stocks, are now at their lowest levels in the time-series, even after closure of marine fisheries. Climatic factors modifying ecosystem conditions and the impact of predators of salmon at sea are considered to be the main contributing factors of lower productivity, which is expressed almost entirely in terms of lower return rates.

Effects of the fisheries on the ecosystem

Salmon fisheries have no, or only minor, influence on the marine ecosystem. The exploitation of salmon in freshwater may affect the riverine ecosystem through changes in species composition. There is limited knowledge of the magnitude of these effects.

Quality considerations

Uncertainties in input variables to the stock status and stock forecast models are incorporated in the assessment.
In 2020, some countries were affected by the COVID-19 global pandemic and had to modify the way return and spawner estimates were produced (e.g. UK [Scotland] using ‘expected-catch estimates’ to mitigate against an underestimate of abundance as a result of reduced effort due to COVID-19) or could not provide certain data for 2020, such as juvenile densities in UK (England and Wales). In UK (Scotland) the pandemic delayed the collection of fishery statistics in 2020, although these statistics were collated in time for ICES WGNAS. These data had not yet been officially published by the Scottish Government at the start of the 2021 WGNAS meeting. As an interim measure, 2019 catch statistics were provided for publication in the WGNAS report. However, the 2020 data were used for stock assessment analyses within the run-reconstruction PFA and forecast models.