10.2 Atlantic salmon from the Northeast Atlantic

10.2.1 Summary of the advice for fishing seasons 2016/2017 to 2018/2019

In 2015, ICES advised that there were no mixed-stock fisheries options on the NEAC stock complexes at the Faroes for the fishing seasons 2015/2016 to 2017/2018 (ICES, 2015). NASCO subsequently agreed a multi-annual (3-year) regulatory measure for the Faroes fishery stipulating no catch for these seasons. The measure for 2016/2017 and 2017/2018 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. Application of the FWI in January 2016 suggested that the forecast for the Northern NEAC multi-sea winter stock complex may have been underestimated. This, therefore, signalled a full reassessment in 2016.

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 2016/2017 to 2018/2019, there is a less than 95% probability of meeting the conservation limits (CLs) for the two age groups (potential 1-sea-winter (1SW) and multi-sea-winter (MSW) spawners) of the Southern NEAC stock complex. Therefore, in the absence of specific management objectives, ICES advises that there are no mixed-stock fisheries options on the NEAC complexes at the Faroes in the fishing seasons 2016/2017 to 2018/2019. In the absence of any fisheries in these seasons, the probabilities of individual countries meeting their CLs range from 17% to 99% for maturing 1SW salmon and 14% to 100% for salmon maturing as MSW. Some of the management units 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.

The FWI previously developed has been updated in support of the multiyear catch advice and the potential approval of multiyear regulatory measures for the Faroes. This updated format can be applied at the beginning of 2017, with the returns or return rate data for 2016, to evaluate the appropriateness of the advice for 2017/2018, and again at the beginning of 2018, with the returns or return rate data for 2017, to evaluate the appropriateness of the advice for 2018/2019.

10.2.2 NASCO has asked ICES to describe key events of the 2015 fisheries

No fishery for salmon has been prosecuted at the Faroes since 2000. No significant changes in gear type used were reported in the NEAC area in 2015. The NEAC area has seen a general reduction in catches since the 1980s (Figure 10.2.2.1; Table 10.2.2.1). This reflects the decline in fishing effort as a consequence of management measures, as well as a reduction in the size of stocks. The nominal catch for 2015 (1091 t) was above that in 2014 (954 t), but remained among the 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 since 1999 (Figure 10.2.2.1).

2015 nominal catch	Southern NEAC reported	Northern NEAC reported	Faroes	Total reported catch	Unreported catch
	226 t	865 t	0 t	1091 t	298 t

1SW salmon constituted 63% of the total catch in Northern NEAC in 2015 (Figure 10.2.2.2). For the Southern NEAC countries, the overall percentage of 1SW fish in the catch in 2015 was estimated at 52%. In both areas, 1SW fish have generally constituted a smaller proportion of the catch in the last decade than earlier in the time-series. There is considerable variability in the proportions among individual countries (Figure 10.2.2.2).

The contribution of escaped farmed salmon to national catches in the NEAC area in 2015 was again generally low in most countries, with the exception of Norway, Iceland, and Sweden, and is similar to the values that have been reported in previous years. Estimates of farmed fish in Norwegian angling catches were in the lower range of observed values in the time-series (5%), while the proportion of farmed salmon estimated in Norwegian rivers in the autumn was the lowest in the time-series (provisionally estimated at 10%).

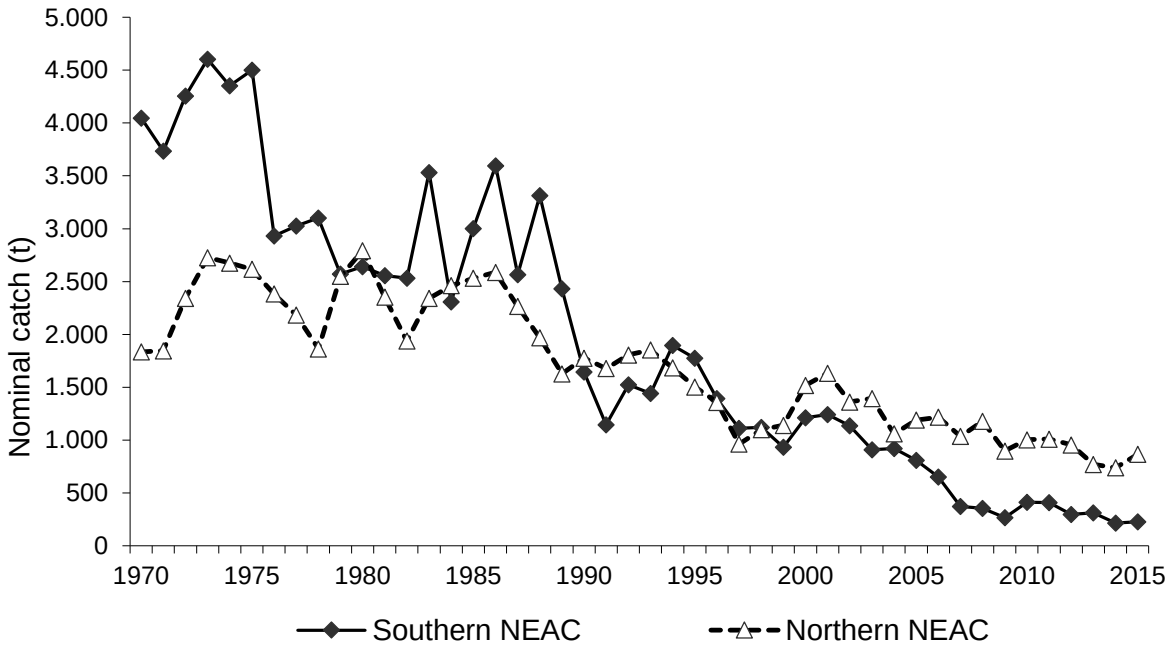

Figure 10.2.2.1 Nominal catches of salmon in the Southern NEAC and Northern NEAC areas (1971–2015).

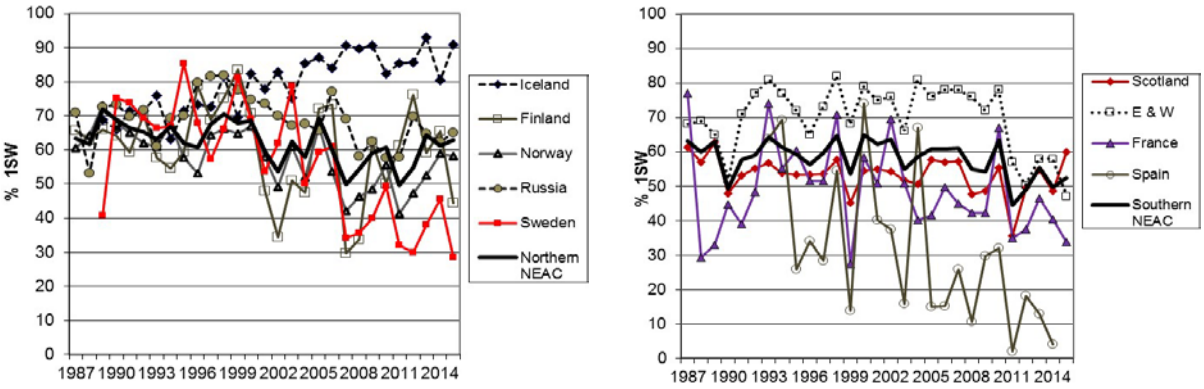

Figure 10.2.2.2 Percentage of 1SW salmon in the reported catch for Northern NEAC countries (left panel) and Southern NEAC countries (right panel). Solid bold line denotes mean value from catches in all countries within the complex.

Table 10.2.2.1 Nominal catches of salmon in the NEAC area (in tonnes, round fresh weight), 1960 to 2015 (2015 figures are provisional).

Year	Southern countries	Northern countries (1)	Faroes (2)	Other catches in international waters	Total Reported Catch	Unreported catches NEAC Area (3)	Unreported catches International waters (4)
1960	2,641	2,899	-	-	5,540	-	-
1961	2,276	2,477	-	-	4,753	-	-
1962	3,894	2,815	-	-	6,709	-	-
1963	3,842	2,434	-	-	6,276	-	-
1964	4,242	2,908	-	-	7,150	-	-
1965	3,693	2,763	-	-	6,456	-	-
1966	3,549	2,503	-	-	6,052	-	-
1967	4,492	3,034	-	-	7,526	-	-
1968	3,623	2,523	5	403	6,554	-	-
1969	4,383	1,898	7	893	7,181	-	-
1970	4,048	1,834	12	922	6,816	-	-
1971	3,736	1,846	-	471	6,053	-	-
1972	4,257	2,340	9	486	7,092	-	-
1973	4,604	2,727	28	533	7,892	-	-
1974	4,352	2,675	20	373	7,420	-	-
1975	4,500	2,616	28	475	7,619	-	-
1976	2,931	2,383	40	289	5,643	-	-
1977	3,025	2,184	40	192	5,441	-	-
1978	3,102	1,864	37	138	5,141	-	-
1979	2,572	2,549	119	193	5,433	-	-
1980	2,640	2,794	536	277	6,247	-	-
1981	2,557	2,352	1,025	313	6,247	-	-
1982	2,533	1,938	606	437	5,514	-	-
1983	3,532	2,341	678	466	7,017	-	-
1984	2,308	2,461	628	101	5,498	-	-
1985	3,002	2,531	566	-	6,099	-	-
1986	3,595	2,588	530	-	6,713	-	-
1987	2,564	2,266	576	-	5,406	2,554	-
1988	3,315	1,969	243	-	5,527	3,087	-
1989	2,433	1,627	364	-	4,424	2,103	-
1990	1,645	1,775	315	-	3,735	1,779	180-350
1991	1,145	1,677	95	-	2,917	1,555	25-100
1992	1,523	1,806	23	-	3,352	1,825	25-100
1993	1,443	1,853	23	-	3,319	1,471	25-100
1994	1,896	1,684	6	-	3,586	1,157	25-100
1995	1,775	1,503	5	-	3,283	942	-
1996	1,392	1,358	-	-	2,750	947	-
1997	1,112	962	-	-	2,074	732	-
1998	1,120	1,099	6	`	2,225	1,108	-
1999	934	1,139	0	-	2,073	887	-
2000	1,210	1,518	8	-	2,736	1,135	-
2001	1,242	1,634	0	-	2,876	1,089	-
2002	1,135	1,360	0	-	2,496	946	-
2003	908	1,394	0	-	2,303	719	-
2004	919	1,059	0	-	1,978	575	-
2005	809	1,189	0	-	1,998	605	-
2006	650	1,217	0	-	1,867	604	-
2007	373	1,036	0	-	1,408	465	-
2008	355	1,178	0	-	1,533	433	-
2009	266	898	0	-	1,164	317	-
2010	411	1,003	0	-	1,414	357	-
2011	410	1,009	0	-	1,419	382	-
2012	295	955	0	-	1,250	363	-
2013	310	770	0	-	1,081	272	-
2014	216	738	0	-	954	256	-
2015	226	865	0	-	1,091	298	-
Average							
2010-2014	328	895	0	-	1224	326	-
2005-2014	410	999	0	-	1409	405	-

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

10.2.3 NASCO has asked ICES to review and report on the development of age-specific stock conservation limits

River-specific CLs have been derived for salmon stocks in most countries in the NEAC area (France, Ireland, UK (England & Wales), UK (Northern Ireland), Finland, and Norway). Preliminary results are also available for Sweden and a small number of rivers in Russia. Where sufficient numbers of CL estimates are available for individual rivers, these are summed to provide estimates at a country level. For countries that do not have sufficient river-specific CLs (Russia, UK (Scotland), and Iceland), an interim approach has been developed for estimating national CLs. This approach is based on the establishment of pseudo-stock–recruitment relationships for national salmon stocks (Potter *et al.*, 1998).

To provide catch options to NASCO, CLs are required for stock complexes. These have been derived either by summing individual river CLs to national level or by taking overall national CLs as provided by the national model, and then summing to the level of the four NEAC stock complexes. River-specific CLs were applied for the first time in 2015 in Finland and Sweden. The CLs have also been used to estimate the spawner escapement reserves (SERs), which are the CLs (expressed in terms of spawner numbers) increased to take account of natural mortality (M = 0.03 per month) between 1 January of the first winter at sea and return time to home waters 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.

Complex	Age group	CL (number)	SER (number)
Northern NEAC	1SW	151 832	192 348
	MSW	125 788	216 422
Southern NEAC	1SW	569 460	724 023
	MSW	272 964	465 465

10.2.4 NASCO has asked ICES to describe the status of the stocks

National stocks within the NEAC area are combined into two groupings for the provision of management advice for the distant-water fisheries at West Greenland and the Faroes. The Northern group consists of: Russia, Finland, Norway, Sweden, and the northeastern regions of Iceland. The Southern group consists of: UK (Scotland), UK (England and Wales), UK (Northern Ireland), Ireland, France, and the southwestern regions of Iceland.

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

PFAs of both maturing 1SW and non-maturing 1SW salmon for Northern NEAC show a general decline over the time period (since 1983), with the decline being more marked in the maturing 1SW stock (Figure 10.2.4.1). Both stock complexes have, however, been at full reproductive capacity prior to the commencement of distant-water fisheries (i.e. meeting the SER with at least 95% probability) throughout the time-series. PFA of maturing 1SW and of non-maturing 1SW salmon for Southern NEAC demonstrate broadly similar declining trends over the time period (since 1971). Both stock complexes were at full reproductive capacity prior to the commencement of distant-water fisheries throughout the early part of the time-series. However, in around half of the years since the mid-1990s, the non-maturing 1SW stock has been at risk of suffering reduced reproductive capacity before any fisheries took place. The maturing 1SW stock, on the other hand, was first assessed as being at risk of suffering reduced reproductive capacity in 2009, and has been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity in around half of the years since then.

1SW spawners in the Northern NEAC stock complex have been at full reproductive capacity (i.e. meeting the CL with at least 95% probability) throughout the time-series, albeit at reduced levels since 2007 (Figure 10.2.4.1). MSW spawners, on the other hand, while generally remaining at full reproductive capacity, have spent limited periods at risk of suffering reduced reproductive capacity, most recently in 2007. Since 2000, MSW spawners have generally been above values in the early part of the time-series. Both 1SW and MSW stock complexes were at full reproductive capacity in 2015.

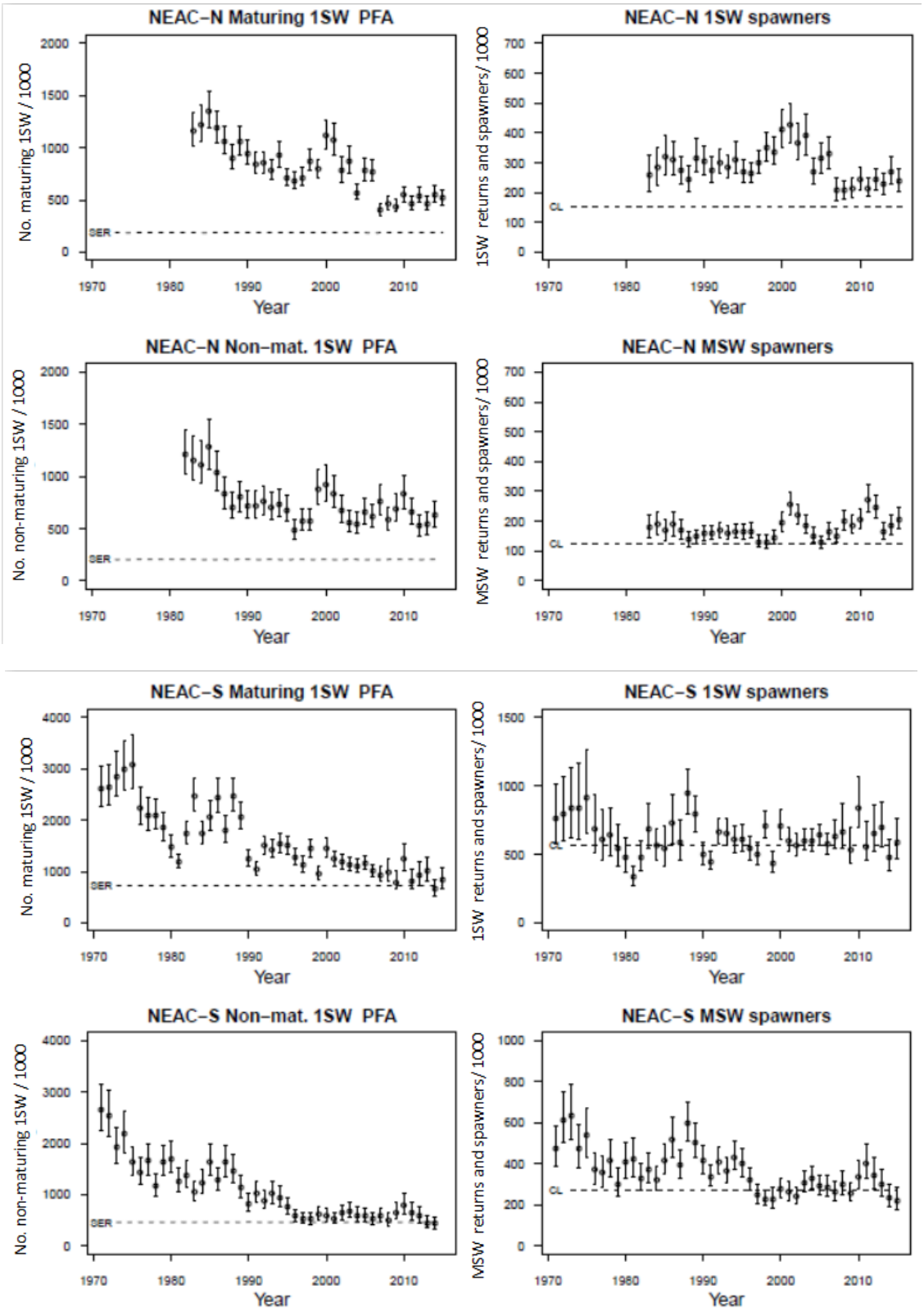

Figure 10.2.4.1 Pre-fishery abundance (PFA – recruits; left panels) and spawners (right panels), with 90% confidence limits, for maturing 1SW (spawning as 1SW) and non-maturing 1SW (spawning as MSW) salmon in Northern Europe (NEAC-N) and Southern Europe (NEAC-S). The dashed horizontal lines in the left panels are the spawning escapement reserve (SER) values, and in the right panels the conservation limit (CL) values.

Declines in spawner numbers are evident for both 1SW and MSW salmon in the Southern NEAC stock complex. The 1SW spawning stock has been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity for most of the time-series. In contrast, the MSW stock was at full reproductive capacity for most of the time-series until 1996. After this point, however, the MSW stock has been either at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity in almost every year. In 2015, the MSW stock complex was suffering reduced reproductive capacity and the 1SW stock complex was at risk of suffering reduced reproductive capacity.

Nominal catches (Figure 10.2.2.1) and estimated exploitation rates (Figure 10.2.4.2) have been decreasing over the time period in Northern and Southern NEAC areas. Despite management measures aimed at reducing exploitation in recent years, there has been little improvement in the status of stocks over time. This is mainly a consequence of continuing poor survival in the marine environment.

There has been an overall declining trend since 1980 in the return rates (marine survival) of both wild and hatchery-origin smolts to 1SW returns for both Northern and Southern NEAC areas (Figure 10.2.4.3). Results from these analyses are consistent with the information on estimated returns and spawners as derived from the PFA model, and suggest that returns are strongly influenced by factors in the marine environment. The declining trend is not evident for the 2SW wild components in either area, or for hatchery-origin smolts to 2SW in Northern NEAC (no data are available for hatchery-origin 2SW return rates for Southern NEAC).

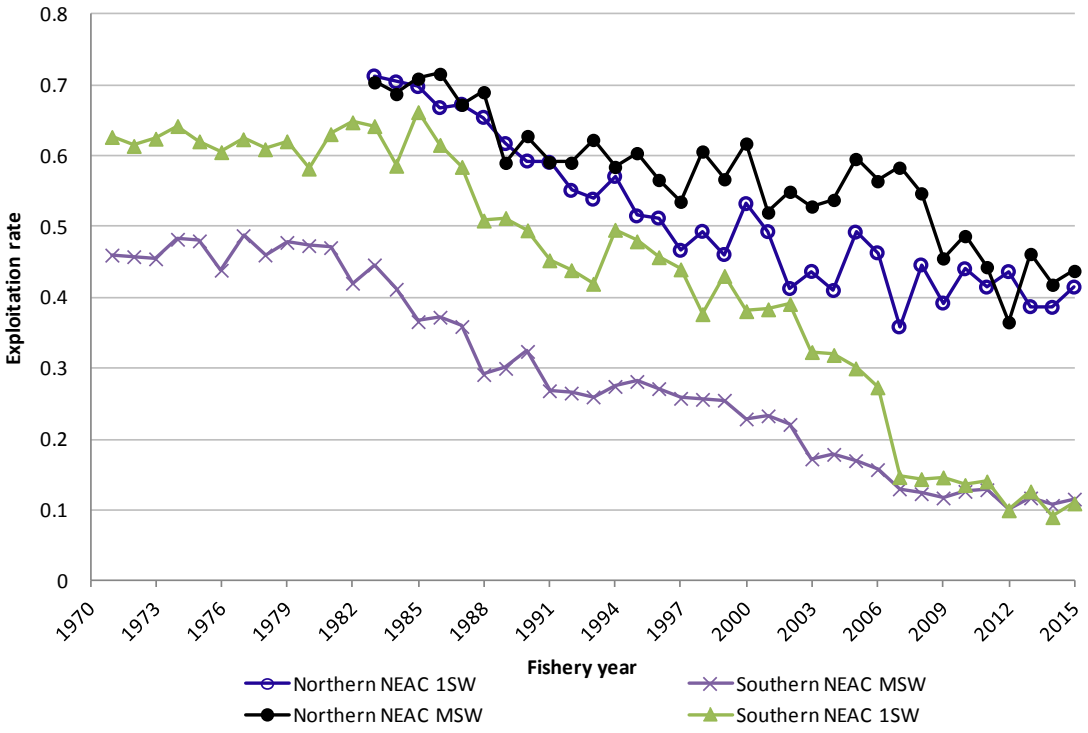

Figure 10.2.4.2 Exploitation rates of wild 1SW and MSW salmon in home water fisheries in the Northern (1983–2015) and Southern (1971–2015) NEAC areas.

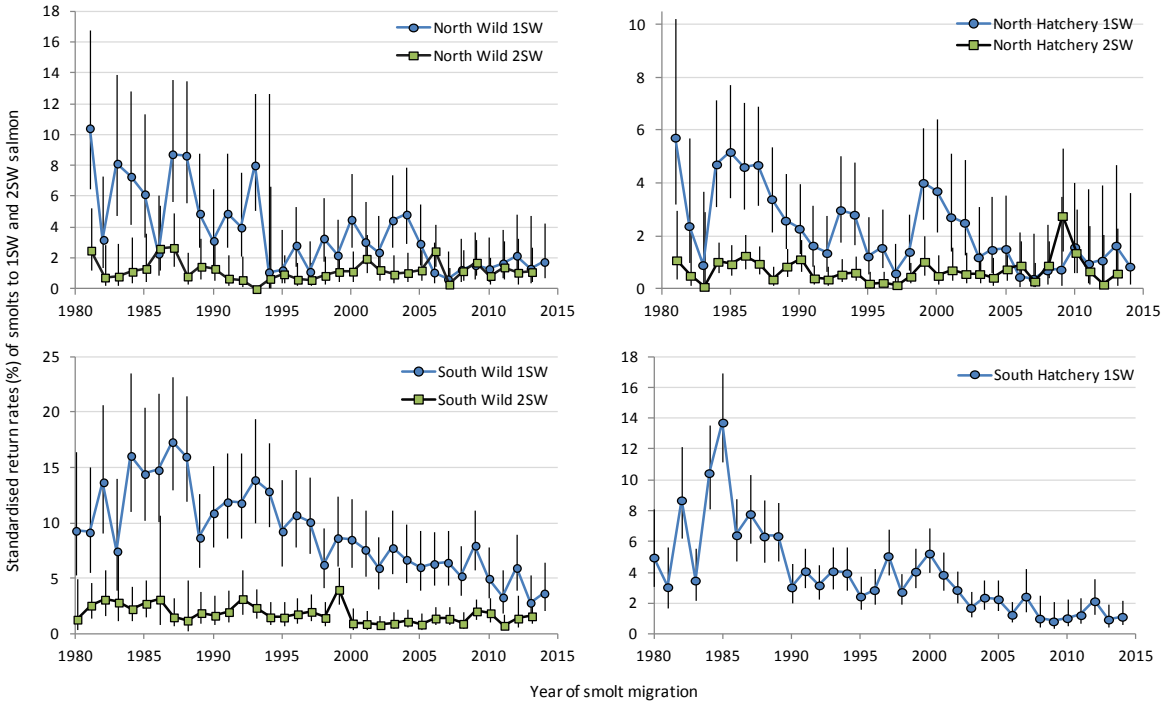

Figure 10.2.4.3 Standardized mean annual survival indices (%) of wild (left panels) and hatchery-origin (right panels) smolts to 1SW and 2SW adult salmon to Northern (top panels) and Southern (bottom panels) NEAC areas. The standardized values are derived from a general linear model analysis of rivers in a region. Note differences in scales of *y*-axes among panels. The *x*-axis denotes the smolt migration year.

10.2.5 NASCO has asked ICES to advise on the sources of uncertainties and possible biases in the assessment of catch options for the Faroes fishery resulting from the use of samples and data collected in the fishery in the 1980s and 90s. Should it be considered that biases are likely to compromise the catch advice, advise on any new sampling which would be required to improve these assessments

The catch options model

The catch options model used by ICES for the Faroes fishery is based on the following management assumptions (ICES, 2013); these factors have yet to be formally adopted by NASCO:

- Total allowable catch (TAC) options are assessed for fishing seasons (October to May) and not calendar years; and
- the share arrangement for the Faroes fishery is set at 0.084.

ICES has also advised that the catch advice for the Faroes fishery should be based on the 20 national management units (1SW and MSW stocks in ten countries) and that the management objective should be to have at least a 95% probability of meeting the CL for each of these management units. However, in the absence of any formal decision on these two points by NASCO, ICES currently provides catch advice based on both the four NEAC stock complexes (Northern and Southern NEAC, 1SW and MSW stocks) and the 20 national management units (ten countries and two sea-age groups). The catch options analysis currently takes no account of the status of stocks in Denmark or Spain, for which insufficient data are provided for ICES to conduct stock assessments. ICES also tabulates the results in such a way that NASCO can consider alternative probability levels for achieving the management objective. The following discussion is based on the assessment at the country level.

ICES has previously based the catch advice on the status of all four stock complexes and all 20 national management units regardless of the impact that the Faroes fishery would be expected to have on them (e.g. ICES, 2015). ICES has noted that some of the management units are exploited at very low levels and in the

absence of a management decision on which units should be included in the framework, all management units are included in this analysis.

Uncertainties and biases in the assessment of Faroes catch options

The "accuracy" of a set of parameter values is the measure of their closeness to the true values and is a combination of their "precision", which is a description of the random errors among a set of measurements, and their "trueness", which is a description of the systematic errors or the closeness of the mean of a set of measurements to the actual (true) value. Uncertainties and biases in the question from NASCO are taken to refer to precision and trueness, respectively, in the discussion below.

The catch options assessment is based on the following equation which is applied to each management unit:

Surplus = Forecast PFA – expected number of fish harvested (for a specific TAC) – SER

The equation is run for 20 000 simulations, taking account of the uncertainties in both the stock forecasts and expected harvest (SER is estimated without uncertainty), and the proportion of the surplus values that are greater than zero determines the probability that the management unit will meet its CL.

It will always be necessary to use historical data to estimate the expected number of fish harvested because this relates to fisheries that may occur in the future. Ideally, such data might be derived from very recent fisheries and be based on well-planned sampling programmes. However, as no fishery has operated at Faroes for more than 15 years, it has been necessary to use data and samples collected in the Faroes fishery in the 1980s and 90s. The parameters that are estimated in this way, along with the data sources, are listed below.

PARAMETERS ESTIMATED FROM HISTORICAL DATA/SAMPLES	SOURCE OF DATA/SAMPLES:
Mean weight of all fish caught	Sampling of commercial catches 1985/86 to 1990/91 seasons (ICES, 1997).
Proportion of 1SW in catch [NB: Proportion MSW = 1 - proportion 1SW]	Sampling of commercial catches 1985/86 to 1990/91 seasons (ICES, 1992).
Proportion of total catch discarded	Sampling of commercial catches 1985/86 to 1990/91 seasons (ICES, 1992).
Proportion of discards that die	Expert judgement by observers on commercial fishing vessels in early 1980s.
Proportion of farmed fish in catch multiplied by correction factor	Estimated proportion of farmed fish in catches at Faroes between 1980/81 and 1990/91 seasons (Hansen and Jacobsen, 2003); estimated proportion of farmed fish in catches in Norwegian coastal fisheries (ICES, 2011).
Proportion of 1SW fish not maturing	Experimental studies in early 1980s based on proportion of 1SW fish with raised vitellogenin in blood (ICES, 1994).
Mid-dates of the 1SW and MSW fisheries	Estimates from total catches in 1983/84 to 1985/86 fishing seasons (ICES, 1985, 1986, 1987).
Proportion of catch of North American origin	Genetic analysis of scale samples collected in 1993/94 and 1995/96 fishing seasons (ICES, 2015).
Composition of catches	Stock complexes: Genetic analysis of scale samples collected in 1993/94 and 1995/96 fishing seasons (ICES, 2015). National management units: PFA proportions applied to stock complex composition.

Most of these values only affect the estimates of the expected number of fish harvested in the earlier equation. The exception is the data on stock composition which are also used in the run-reconstruction assessment of PFA to allocate the Faroes catch to the national PFA estimates and could therefore affect the

stock forecast estimates. However, as there has been no fishery at Faroes for the past 15 years, the effect on current stock forecasts will be negligible or zero.

The precision of the historical parameter values will be affected by a range of factors, including:

- sampling error (e.g. resulting from small sample sizes) when samples are collected from the fishery;
- natural year-to-year variability in biological characteristics (e.g. due to environmental conditions);
- variation in the pattern of exploitation of available NEAC stocks in the fishery;
- year-to-year variability in the way the fishery is prosecuted (e.g. due to weather conditions).

The trueness of these values may be affected by biases in the sampling programmes and systematic shifts in stock or fishery characteristics between that time and the present.

A sensitivity analysis was conducted to assess the effects of variation in the precision and trueness of the input parameters above. The catch options model was run to estimate the probabilities of the national 1SW and MSW management units achieving their SERs if a 200 t TAC had been allocated to the Faroes fishery, using the 2015 input data sets. Parameter values were then adjusted by increasing or decreasing the mean, to test trueness effects, and by increasing or decreasing the spread of values, to test precision effects. The second column in Tables 10.2.5.1, 10.2.5.2, and 10.2.5.3 show the baseline estimate of the probability of each management unit (country and age group) achieving its SER, and the remaining columns show the increase or decrease in this value when each input parameter is modified. The size of the effect is roughly proportional to the TAC being assessed, so the effects would be halved for a TAC option of 100 t and divided by four for a TAC option of 50 t.

Effects of parameter precision and trueness on the catch advice

It is important to note that if the catch options model forecasts that one or more management units has less than a 95% probability of achieving its SER with a TAC option of zero (i.e. in the absence of a Faroes fishery), the advice will be that there should be no fishery. Under the above condition, this advice would not be affected by uncertainty or bias in any of the above model parameters, except potentially those relating to the stock composition.

Stock composition

The genetic stock assignment of scale samples collected between 1993 and 1995 is currently used to estimate the proportion of North American fish in the Faroes catch and then to split the remainder of the catch between Northern and Southern NEAC countries and Iceland. In the catch options model at the country level, the Northern and Southern NEAC proportions are then divided between countries in proportion to the recent PFA estimates. If the estimated contribution of a country to the Faroes fishery is increased, the probability of that complex or country achieving its SER will be decreased and the probability of the remaining countries achieving their SERs will be increased.

If data on the stock composition of the catches indicated that salmon from one or more countries were not exploited in the Faroes fishery, then those countries might be excluded from the catch advice decisions. However, both tagging studies and genetic stock identification have shown that salmon from the full range of NEAC countries have been exploited in the fishery in the past. With a lack of recent information, this is assumed to be the current situation.

Three sensitivity analysis scenarios were run with the proportion of North American fish increased and decreased by 50% and set to zero (Table 10.2.5.1). These changes generally had minimal effect on the probability of 1SW stocks achieving their SERs (range −0.1% to 0.1%). The effects on MSW stocks were slightly larger. A 50% decrease in the proportion North American decreased the probability of all NEAC countries meeting their SERs by an average of 2.6% (range 0.3% to 7.5%) and setting the NAC proportion to zero had approximately twice this effect. A 50% increase in the NAC proportion had an approximately equal but opposite effect to the 50% decrease.

Decreasing the estimated proportion of the catch originating from Southern NEAC from 0.88 to 0.78 for 1SW fish and from 0.29 to 0.19 for MSW stocks and increasing the Northern NEAC contribution by the same, increased the probability of Southern NEAC countries achieving the SERs by averages of 0.2% for 1SW stocks (range 0% to 0.3%) and 4.1% for MSW stocks (range 0.8% to 8.4%) (Table 10.2.5.1). At the same time, the probabilities of Northern NEAC stocks achieving SERs were decreased by averages of 0.5% for 1SW (range 0.3% to 0.9%) and 4.1% for MSW stocks (range 2.4% to 8.4%).

Further simulations were run in which the proportion of the catch originating from countries furthest from the Faroes area (Russia, UK (England and Wales), and France) were halved and the remaining proportions adjusted up accordingly (Table 10.2.5.1). This resulted in an increase in the probability of these countries achieving their SERs for both 1SW stocks (range 0.4% to 1.1%) and MSW stocks (range 6.2% to 32.2%). The probabilities of the remaining countries achieving their SERs decreased by a small amount for 1SW stocks (range 0.1% to 0.3%) and from 0.3% to 9.6% for MSW stocks. The effect of doubling the proportion of the catches derived from the distant countries had approximately double the effect in the opposite direction.

Finally, the uncertainty in the estimated stock composition was increased by doubling the standard error of the country proportions entered into the model (Table 10.2.5.1). This resulted in only very small changes (−0.2% to 0.2%) in the estimated probabilities of most management units achieving their SERs, although the probability for Icelandic MSW stocks decreased by 3.7%.

The sensitivity analyses indicate that biases in the estimates of stock composition could have the largest effects on the estimated probability of individual countries achieving their SERs for any TAC option. However, increases in the probability for one (or more) countries will be balanced by decreases in the probabilities for other countries, and so it is not clear that these uncertainties compromise the catch advice.

Obtaining new data on the stock composition could be achieved through further genetic analysis of scale samples taken from salmon caught in the Faroes fishery area. As a first step, it would be appropriate to analyse all the historical scale samples collected in the 1980s and 1990s to look for evidence of systematic spatial or temporal variation in the stock composition and to validate the current approach of attributing abundance at Faroes by national stock within the complexes using the PFA proportions. Depending on the nature of any variations in stock composition observed among these samples, decisions could be made about the need for new sampling programmes. However, it is likely to require an extensive research fishery to sample the stocks in the Faroes area effectively in both space and time.

Discard rate, discard mortality, and delayed maturation

Simulations run with changes to the discard rate, discard mortality, or delayed maturation all had zero or negligible effects on the probability of MSW stocks achieving their SERs and only small effects on 1SW stocks (Table 10.2.5.2). Reducing the discard rate to 0 increased the probability of 1SW stocks achieving their SERs by an average of 1.1% (range 0.2% to 2.5%) and increasing the discard rate values by two standard deviations had an approximately equal effect in the opposite direction. Increasing the uncertainty in the discard rate by a factor of three had a similar effect to the increase in the discard rate by two standard deviations.

Increasing the discard mortality from 80% to 100% decreased the estimated probability of 1SW management units achieving their SERs by an average of 0.3% (range 0% to 0.7%), and decreasing the discard mortality from 80% to 60% had the opposite effect. Increasing the proportion of 1SW fish maturing from 0.22 to 0.5 increased the estimated probability of 1SW management units achieving their SERs by an average of 0.4% (range 0% to 0.8%) and had negligible effect on the MSW stocks; decreasing the proportion maturing to zero had an approximately equal, but opposite effect (Table 10.2.5.2).

Given recent initiatives to limit or ban discarding, it is possible that the treatment of discards in any future fishery would be changed. If it could be assumed that there would be a requirement to land all fish caught, this could be incorporated into the current catch options model and there would be no need to obtain new data on the discard rate or discard mortality. The sensitivity analysis shows that large changes in the proportion of 1SW fish that mature have relatively little effect on the assessment of catch options, and so a new sampling programme to obtain these data is not recommended.

Mean weight of fish in the catches

Data on the mean weight of fish in the catch at Faroes have been obtained for the 1985/1986 to 1990/1991 seasons (ICES, 1997). Simulations were run with the mean weights increased and decreased by two standard deviations and with the precision decreased by multiplying the standard deviation by five (Table 10.2.5.3). The decrease in the mean weights decreased the probability of MSW management units achieving their SERs by an average of 2.5% (range 0.4% to 8.6%) and the probability of 1SW management units achieving their SERs by up to 0.3%. Increasing the mean weights had similar, but slightly smaller effects in the opposite direction. Increasing the uncertainty in the weight data decreased the probability of management units achieving their SERs by an average of 1.3% (range 0 to 3.4%).

Data provided from home-water fisheries in Norway and Iceland suggest that mean weights of both 1SW and MSW salmon have probably decreased since the 1980s and 1990s. This suggests that the probabilities of stocks achieving their SERs may be overestimated in the current assessments. New data could be obtained on the mean weights of fish in the Faroes area through a research fishery, although data would be required for a number of years. This could provide an improved (updated) estimate of the mean weight of the expected catch, but is unlikely to affect the precision of the estimates (i.e. annual variability). Given the relative insensitivity of the advice to this parameter, it would be more sensible to include a weight correction factor in the model, based on changes in mean weights in home waters. This could be implemented in the catch options model before the next round of catch advice is requested.

Age composition of catches

Data on age composition of the catch at Faroes have been obtained for the 1985/1986 to 1990/1991 seasons (ICES, 1997). In all but one of the seasons, 1SW fish comprised a very small (< 2%) proportion of the landed catch, although in the remaining season they comprised about 9%. Running the catch options model with these proportions doubled, decreased the probability of 1SW management units achieving their SERs by an average of 0.3% (range 0.1% to 0.7%) and increased the probability of MSW management units achieving their SERs by an average of 0.6% (range 0.1% to 1.6%) (Table 10.2.5.3). Increasing the proportions of 1SW fish by two standard deviations approximately doubled the above effects.

While new data on the proportion of 1SW fish in catches could be obtained from a research fishery at Faroes, it is also possible to obtain estimates of changes in the relative abundance of 1SW and MSW stocks from the estimates of PFA. There have been both increases and decreases in the proportions of maturing 1SW fish in the national PFA in both the Northern and Southern NEAC areas between 2009 and 2015 compared to 1985–1990. There has been no overall change in the proportion of 1SW in all Southern NEAC countries combined, but a 20% reduction in all Northern NEAC countries combined. As for the weights, these changes could be incorporated into the catch options model as a correction to the input data.

Mid-dates of the Faroes fishery

Mid-dates of the fishery have been obtained from records of catch-by-age reported by ICES (1984, 1985, and 1986) and are based on years when a full commercial fishery operated. A simulation was run in which these values were increased by one month (i.e. a one-month delay in the mid-date of the 1SW and MSW fisheries; Table 10.2.5.3). This had a negligible (≤ 0.1%) effect on the probability of any 1SW stocks achieving their SERs and decreased the probability of MSW stocks achieving their SERs by an average of 0.7% (range 0.1% to 2.0%). Advancing the season would have an approximately equal effect in the opposite direction.

If a TAC was allocated for a future fishery at Faroes, it is quite likely that it would be lower than the catch in the 1983/1984 to 1985/1986 seasons, and this may result in the fishery being prosecuted for a shorter period. While this might result in a change in the mid-date of the fishery it is not possible to predict this change. In addition, it is not clear that a reliable estimate of the mid-point of a commercial fishery could be estimated from a directed research fishery. Thus, unless managers could indicate the period in which a fishery would be permitted to operate, this parameter value is unlikely to be improved. If managers determined that any fishery

would operate earlier than the historical fisheries, the estimated probability of stocks achieving their SERs would be increased.

Proportion of fish farm escapees in the catches

Data on the proportion of farmed fish in the catches at Faroes were obtained for the years 1980/1981 and 1990/1991 (Hansen and Jacobsen, 2003). Surveys conducted in Norwegian coastal fisheries have indicated that the proportion of farm escapees in catches had declined by a factor of 0.63 between the 1990s and the early 2000s, and so this value has been applied as a correction to the historical estimates. Decreasing the proportion of farm escapees in the catches would be expected to decrease the probability of all stocks achieving their SERs.

Increasing the correcting factor to 0.73 had a negligible (≤ 0.1%) effect on the probability of any 1SW management unit achieving its SER and increased the probability of the MSW management units achieving their SERs by an average of 0.8% (range 0.1% to 2.7%). Decreasing the correction factor to 0.53 had an approximately equal, but opposite effect on each management unit (Table 10.2.5.3). Increasing the precision of the farm proportions (halving the standard deviation) or decreasing the precision (doubling the standard deviation) had a negligible effect on the probability of both 1SW stocks (≤ 0.1%) and MSW stocks (≤ 0.2%) achieving their SERs.

No new data are available on the proportion of farm escapees in coastal fisheries in Norway, but based on recent surveys in Norwegian rivers, it is thought that the proportion of farm escapees in the Faroes area may have declined slightly from the values currently used in the assessment. Based on the above sensitivity analysis this would be expected to have a negligible effect on the assessment results.

Need for new sampling

The parameter values used in the catch options model to estimate the numbers of fish from each management unit that would be caught in any future fishery at Faroes will always have to be based upon historical data. More up-to-date estimates than those currently used could be obtained by conducting a research fishery in the Faroes area, but to provide reliable data this would need to cover the extent of any expected fishery in both space and time, and data would need to be collected for a number of years. It would not be worth conducting such surveys to improve the precision of the parameter values because the above simulations have indicated that improving the precision of the inputs has negligible effects on the assessment results. New surveys may improve the trueness of the parameter values, but alternative methods are available to correct the values currently used in the assessment. ICES therefore considers that the following initial steps should be undertaken to improve the current parameter inputs before any research fishery is undertaken.

- Mean weight: apply a correction based on changes in the meant weights of 1SW and MSW salmon caught in home waters between the 1980s and the present time.
- Age composition: apply adjustments based on changes in the ratios of the estimated maturing to non-maturing PFA for the contributing management units.
- Proportion maturing: no adjustment required.
- Stock composition: undertake genetic analysis of all historical scale samples collected in the fishery area.
- Discards: seek input from managers on how discards would be expected to be handled in any future fishery.
- Mid-date of fishery: seek input from managers on when any future fishery might operate.

Should any fishery be authorized at Faroes in the future, it is, of course, important that there should be a comprehensive data collection and sampling programme.

Table 10.2.5.1 Sensitivity of the Faroes catch advice (for a TAC of 200 t in 2016, based on the 2015 assessment) to changes in the precision and trueness of model parameter values relating to the composition of the catches.

		Change from baseline probability with revised data input:						
Management unit	Baseline probability of achieving SERs	Propportion from NAC minus 50%	Proportion from NAC plus 50%	Proportion from NAC = 0	Proportion from S(NEAC) plus 0.1	Proportion from S(NEAC) plus 2 x sd	Prop. from each mgmt unit + 2 x sd	Prop's from Russia, France and Eng.&Wales doubled
FR_1SW	39.6	0	0.0	-0.1	0.1	0.0	0.0	0.5
EW_1SW	42.1	0	0.0	-0.1	0.2	0.0	0.1	1.1
IR_1SW	45.4	-0.1	0.0	-0.2	0.3	0.1	0.1	-0.2
NI_1SW	66.8	-0.1	0.1	-0.2	0.3	0.0	0.0	-0.2
SC_1SW	71.5	-0.1	0.0	-0.2	0.3	0.1	0.0	-0.2
IC_1SW	99	0	0.1	0.0	0.0	-0.1	-0.1	0.0
SW_1SW	93.2	0	0.0	0.0	-0.3	0.0	0.0	-0.1
NO_1SW	97	-0.1	0.0	-0.1	-0.3	-0.1	-0.1	-0.1
FI_1SW	62	0	0.0	-0.1	-0.9	-0.2	-0.1	-0.3
RU_1SW	87	0	0.1	0.0	-0.6	-0.1	-0.1	0.4
av. all MSW	70.4	0.0	0.0	-0.1	-0.1	0.0	0.0	0.1
FR_MSW	57.9	-1.5	1.5	-3.1	4.2	0.0	-0.1	6.3
EW_MSW	63	-2.3	2.3	-4.5	6.1	-0.1	-0.2	9.2
IR_MSW	8.1	-0.3	0.3	-0.7	0.8	0.0	0.0	-0.3
NI_MSW	89.2	-1.1	1.1	-2.2	2.7	-0.3	-0.3	-1.0
SC_MSW	39	-2.3	2.5	-4.6	6.7	0.0	0.1	-2.1
IC_MSW	94.2	-1.5	1.2	-3.2	0.9	-3.4	-3.7	-1.9
SW_MSW	87	-2.6	2.5	-5.0	-2.7	0.0	-0.2	-3.5
NO_MSW	46.9	-7.5	7.9	-14.1	-8.4	0.2	0.4	-9.6
FI_MSW	14.1	-2	2.6	-3.9	-2.4	0.2	0.4	-2.4
RU_MSW	18.4	-4.7	5.9	-8.2	-5.3	0.0	0.8	32.5
av. all MSW	51.8	-2.6	2.8	-5.0	0.3	-0.3	-0.3	2.7

Table 10.2.5.2 Sensitivity of the Faroes catch advice (for a TAC of 200 t in 2016, based on the 2015 assessment) to changes in the precision and trueness of model parameter values relating to discarding and maturation of 1SW fish.

		Change from baseline probability with revised data input:						
Management unit	Baseline probability of achieving SERs	Discard rate = 0	Discard rate plus 2 x sd	Standard deviation of discard rate x 3	Disc mortality = 0.6	Disc mortality = 1.0	Prop.Delayed = 0	Prop.Delayed = 0.5
FR_1SW	39.6	0.9	-1.0	-0.8	0.2	-0.2	-0.3	0.4
EW_1SW	42.1	1.8	-2.1	-1.4	0.3	-0.4	-0.6	0.7
IR_1SW	45.4	1.9	-2.4	-1.7	0.5	-0.6	-0.8	0.8
NI_1SW	66.8	2.5	-2.8	-1.8	0.6	-0.7	-1.0	1.1
SC_1SW	71.5	2.0	-2.5	-2.1	0.5	-0.6	-0.8	0.9
IC_1SW	99	0.2	-0.2	-0.1	0.1	0.0	0.0	0.1
SW_1SW	93.2	0.3	-0.3	-0.2	0.1	-0.1	-0.1	0.2
NO_1SW	97	0.2	-0.3	-0.3	0.1	-0.1	-0.1	0.1
FI_1SW	62	0.6	-0.9	-0.7	0.1	-0.2	-0.3	0.3
RU_1SW	87	0.7	-0.6	-0.4	0.2	-0.1	-0.2	0.4
av. all MSW	70.4	1.1	-1.3	-0.9	0.3	-0.3	-0.4	0.5
FR_MSW	57.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EW_MSW	63	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IR_MSW	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NI_MSW	89.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SC_MSW	39	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IC_MSW	94.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW_MSW	87	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NO_MSW	46.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FI_MSW	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RU_MSW	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
av. all MSW	51.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 10.2.5.3 Sensitivity of the Faroes catch advice (for a TAC of 200 t in 2016, based on the 2015 assessment) to changes in the precision and trueness of model parameter values relating to the weight and age composition of the catches, numbers of farm escapees, and timing of the fishery.

		Change from baseline probability with revised data input:										
Management unit	Baseline probability of achieving SERs	Mean weight plus 2 x s.d.	Mean weight minus 2 x s.d.	S.d. of weight halved	S.d. of weight x 5	Prop. 1SW plus 2 x s.d. 2sd	Prop. 1SW doubled	Mid-dates + 1 month	Farm correction = 0.53	Farm correction = 0.73	S.d. of farm prop. halved	S.d. of farm prop. doubled
FR_1SW	39.6	0.1	-0.1	0.0	-0.2	-0.6	-0.2	0.0	0.0	0.0	0.0	0.0
EW_1SW	42.1	0.2	-0.3	0.0	-0.4	-1.2	-0.5	-0.1	-0.1	0.1	0.0	0.0
IR_1SW	45.4	0.3	-0.5	0.0	-0.4	-1.4	-0.6	-0.1	-0.1	0.1	0.0	0.0
NI_1SW	66.8	0.3	-0.5	0.0	-0.5	-1.8	-0.7	-0.1	-0.1	0.1	0.0	0.0
SC_1SW	71.5	0.3	-0.4	0.0	-0.4	-1.4	-0.6	-0.1	-0.1	0.0	-0.1	0.0
IC_1SW	99	0.1	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.1	0.0
SW_1SW	93.2	0.1	0.0	0.0	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0
NO_1SW	97	0.0	-0.1	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0
FI_1SW	62	0.1	-0.1	0.0	-0.2	-0.5	-0.3	-0.1	-0.1	0.0	0.0	0.0
RU_1SW	87	0.1	-0.1	0.1	-0.1	-0.3	-0.1	0.0	0.0	0.1	0.0	0.0
av. all MSW	70.4	0.2	-0.2	0.0	-0.2	-0.8	-0.3	-0.1	-0.1	0.1	0.0	0.0
FR_MSW	57.9	1.3	-1.7	0.0	-1.2	0.7	0.3	-0.4	-0.4	0.4	0.0	0.0
EW_MSW	63	2.0	-2.6	0.0	-1.5	1.1	0.4	-0.6	-0.7	0.6	0.0	0.0
IR_MSW	8.1	0.2	-0.4	0.0	-0.3	0.2	0.1	-0.1	-0.1	0.1	0.0	0.0
NI_MSW	89.2	1.0	-1.3	0.0	-0.7	0.6	0.2	-0.2	-0.3	0.3	-0.1	0.0
SC_MSW	39	2.2	-2.6	0.1	-1.5	1.2	0.6	-0.5	-0.6	0.8	0.0	0.1
IC_MSW	94.2	1.1	-1.8	-0.1	-1.2	0.6	0.3	-0.4	-0.4	0.3	0.0	-0.1
SW_MSW	87	2.3	-2.9	0.1	-1.9	1.2	0.5	-0.6	-0.7	0.7	0.0	-0.1
NO_MSW	46.9	6.9	-8.6	0.1	-3.4	3.7	1.6	-2.0	-2.2	2.1	-0.2	-0.1
FI_MSW	14.1	2.3	-2.3	0.1	-0.4	1.2	0.5	-0.5	-0.6	0.7	0.1	0.2
RU_MSW	18.4	5.2	-5.3	0.0	-0.6	2.7	1.2	-1.2	-1.5	1.5	-0.2	0.2
av. all MSW	51.8	2.5	-3.0	0.0	-1.3	1.3	0.6	-0.7	-0.8	0.8	0.0	0.0

10.2.6 NASCO has asked ICES to provide catch options or alternative management advice for the 2016/2017 to 2018/2019 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 2019 for the Southern and Northern NEAC complexes were developed within a Bayesian model framework (Figures 10.2.6.1–10.2.6.2). The probabilities of meeting CLs under different catch scenarios in the Faroes in seasons 2016/2017 to 2018/2019, assuming the full catch allocation is also taken in home waters, are provided in Table 10.2.6.1 for the stock complexes. The corresponding forecast exploitation rates, for fish taken at the Faroes, are presented in Table 10.2.6.2. The probabilities of meeting CLs in the individual NEAC countries are presented in Tables 10.2.6.3–10.2.6.4. Probabilities of meeting CLs are higher in the Northern than in the Southern complex and are generally higher for Northern countries than 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 conservation limits, which can be 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 2016/2017 to 2018/2019, there is less than 95% probability of meeting the CLs for the two Southern NEAC complexes (potential 1SW and MSW spawners; Table 10.2.6.1). There is also less than a 95% probability of many individual countries meeting their CLs for 1SW or MSW fish in the absence of any fisheries (Tables 10.2.6.3–10.2.6.4). Therefore, in the absence of specific management objectives, ICES advises that there are no mixed-stock fisheries options on the NEAC complexes/countries at the Faroes in 2016/2017 to 2018/2019.

Additional considerations

ICES emphasizes that the national stock CLs discussed above are not appropriate for the management of home-water fisheries, particularly where these exploit separate river stocks. This is because of the relative imprecision of the national CLs and because they 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, the combined CLs 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 target only 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.

The probabilities of meeting CLs for the 1SW salmon is hardly affected by the catch options at the Faroes, within the range considered in Table 10.2.6.1, principally because the exploitation rates on the 1SW stock components in the fishery are very low (Table 10.2.6.2).

Data and methods

Input data to estimate the historical PFAs are the catch in numbers of 1SW and MSW salmon in each country, unreported catch levels, and exploitation rates. Uncertainties are accounted for using minimum and maximum ranges for unreported catches and exploitation rates. 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 and catches of NEAC-origin salmon at West Greenland are incorporated. Estimated PFA values are presented in Tables 10.2.6.5 and 10.2.6.6.

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. PFA was forecast from 2016 to 2019 for maturing 1SW salmon and from 2015 to 2019 for non-maturing 1SW salmon (Figures 10.2.6.1–10.2.6.2).

The risk framework was used to evaluate TAC options for the Faroes fishery in the 2016/2017, 2017/2018, and 2018/2019 fishing seasons, based on the NEAC stock complex and national management units. For any TAC option being evaluated, the number of fish that would be caught at 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 at Faroes and in home-water fisheries combined. 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 10.2.6.1 and 10.2.6.2) 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 2015 concluded that there were no catch options at the Faroes for 2015/2016 to 2017/2018 (ICES, 2015). The Framework of Indicators (FWI) applied in January 2016 triggered a reassessment, as the indicators for one of the stock complexes (Northern NEAC MSW salmon) suggested that the previous forecast of PFA may have been underestimated. However, the current assessment and forecast remain unchanged relative to the 2015 advice.

The advice this year is based on the risk assessment framework, as in 2015. This framework directly evaluates the risk (probability) of meeting CLs in the 1SW and MSW Southern and Northern NEAC complexes, and 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 the precautionary approach, and given that the CLs 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 CLs. ICES recommends that management decisions be based principally on a 95% probability of attainment of CLs 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 (2010, 2011, 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 the age and stock complex or country levels for Northern and Southern NEAC areas, consideration needs to be given to the recent performance of the stocks within individual countries. At present, insufficient data are available to assess performance of individual stocks in all countries in the NEAC area. In some instances, river-specific CLs are in the process of being developed.

Quality considerations

Uncertainties in input variables to the stock status and stock forecast models are incorporated in the assessment. Provisional catch data for 2014 were updated, where appropriate, and the assessment extended to include data for 2015. Further development of the Faroes risk framework would benefit from new data on the biological characteristics and origin of the catch; this is discussed further in Section 10.2.5.

Scientific basis

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	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 2016.
Working group	Working Group on North Atlantic Salmon (WGNAS) (ICES, 2016).

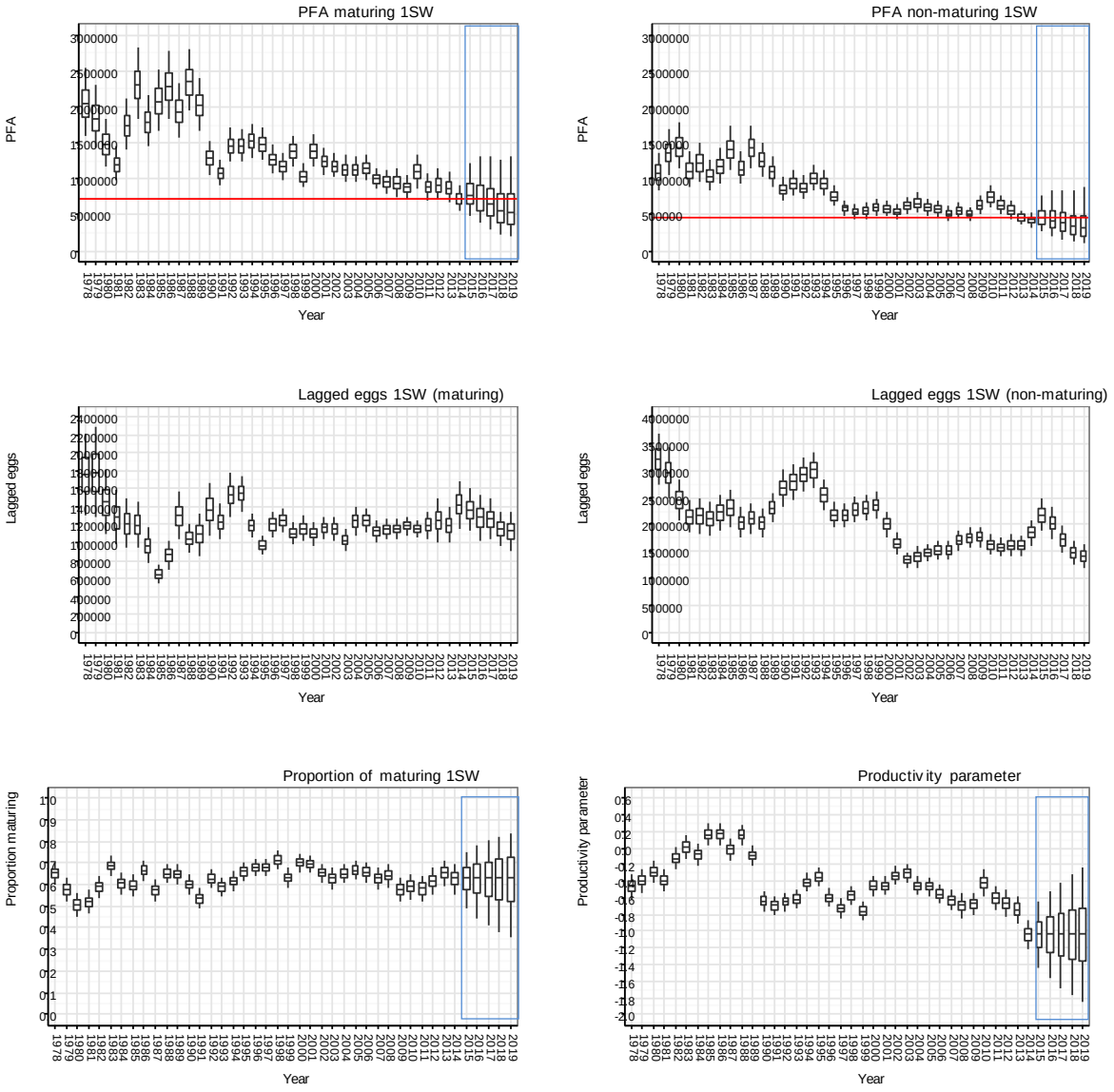

Figure 10.2.6.1 Southern NEAC PFA for maturing (top left) and non-maturing (top right) 1SW fish, lagged eggs, productivity parameter, and proportion maturing as 1SW. The last five years are forecasts (indicated by rectangles). The horizontal lines in the upper panels are the SER values. Box and whiskers show the 5th, 25th, 50th, 75th, and 95th percentiles of the estimated or forecast distribution.

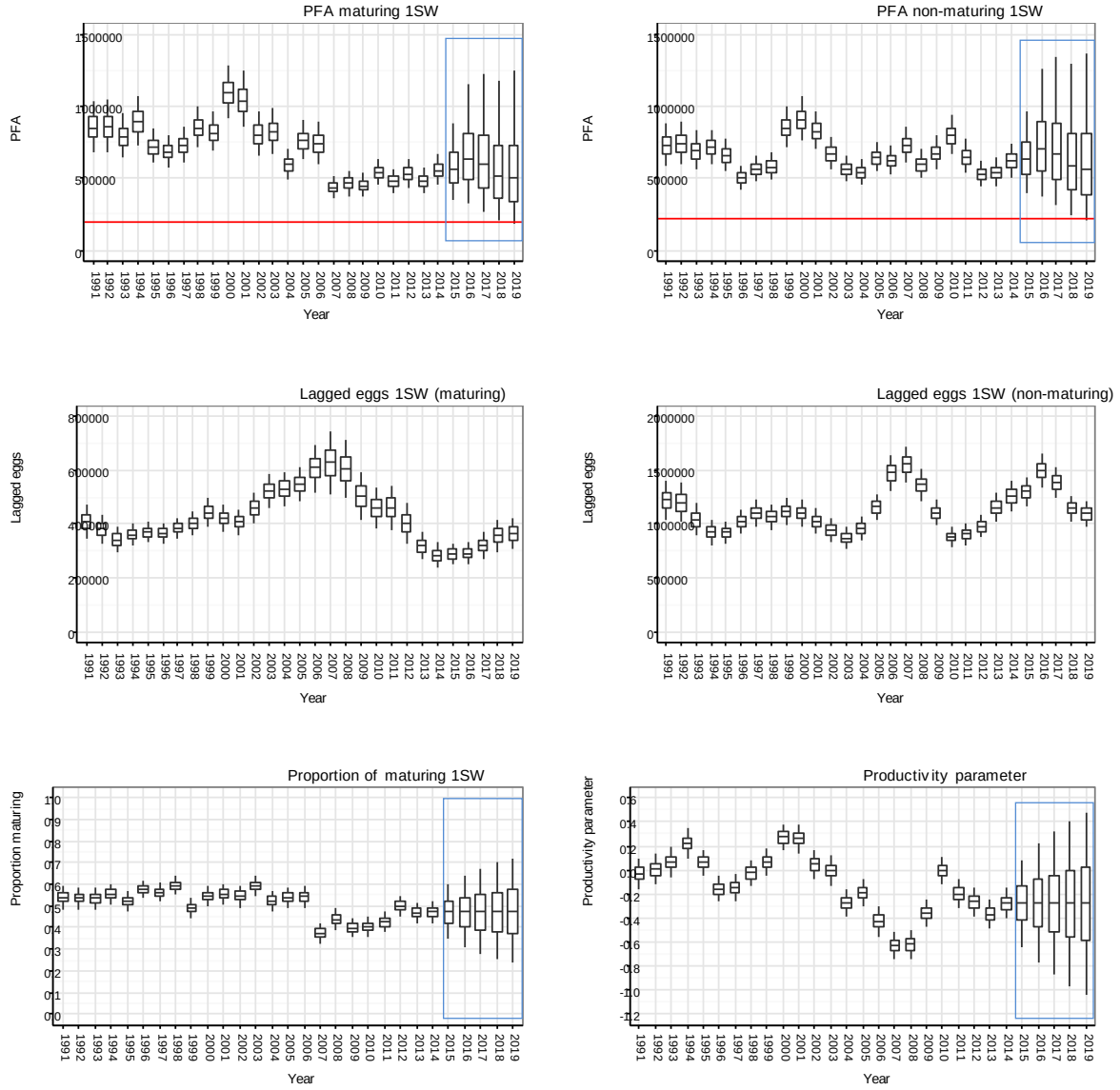

Figure 10.2.6.2 Northern NEAC PFA for maturing (top left) and non-maturing (top right) 1SW fish, lagged eggs, productivity parameter, and proportion maturing as 1SW. The last five years are forecasts (indicated by rectangles). The horizontal lines in the upper panels are the SER values. Box and whiskers show the 5th, 25th, 50th, 75th, and 95th percentiles of the estimated or forecast distribution.

Table 10.2.6.1 Probability (%) of 1SW and MSW salmon spawner abundance in northern and southern NEAC areas being at or above the CLs for different catch options in the Faroes (assuming the full catch allocation is also taken in home waters) for the 2016/2017, 2017/2018, and 2018/2019 fishing seasons. Shaded cells denote achievement of SERs with ≥95% probability. Catch options for the first year assume no catch in the preceding year while catch options in subsequent years assume that the full, equivalent TAC in the preceding year was taken.

Catch options for 2016/17	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW	All complexes simultaneous
	0	99%	100%	40%	41%	22%
	20	99%	99%	40%	38%	20%
	40	99%	98%	39%	34%	18%
	60	99%	96%	39%	31%	16%
	80	99%	93%	38%	28%	14%
	100	99%	88%	38%	25%	12%
	120	99%	82%	37%	23%	10%
	140	99%	75%	37%	20%	8%
	160	99%	67%	36%	19%	7%
	180	99%	60%	36%	17%	6%
	200	99%	52%	35%	15%	4%

Catch options for 2017/18	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW	All complexes simultaneous
	0	96%	99%	32%	35%	16%
	20	96%	98%	32%	32%	14%
	40	96%	95%	31%	29%	13%
	60	96%	92%	31%	26%	11%
	80	96%	86%	30%	24%	10%
	100	96%	81%	30%	22%	8%
	120	96%	74%	30%	20%	7%
	140	96%	67%	29%	18%	6%
	160	96%	60%	29%	16%	5%
	180	96%	53%	29%	15%	4%
	200	96%	47%	28%	13%	3%

Catch options for 2018/19	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW	All complexes simultaneous
	0	94%	97%	31%	28%	12%
	20	94%	94%	30%	26%	11%
	40	94%	89%	30%	24%	10%
	60	94%	83%	29%	21%	8%
	80	94%	76%	29%	20%	7%
	100	94%	69%	29%	18%	6%
	120	94%	62%	28%	16%	5%
	140	94%	55%	28%	15%	4%
	160	94%	49%	28%	14%	3%
	180	94%	43%	27%	13%	3%
	200	94%	37%	27%	12%	2%

Table 10.2.6.2 Forecast exploitation rates in the Faroes fishery for 1SW and MSW salmon from Northern and Southern NEAC areas in all fisheries (assuming full catch allocations are taken) for different TAC options in the Faroes fishery in the 2016/2017, 2017/2018, and 2018/2019 fishing seasons. Catch options for the first year assume no catch in the preceding year while catch options in subsequent years assume that the full, equivalent TAC in the preceding year was taken.

Catch options for 2016/17 season:	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW
	0	0.0%	0.0%	0.0%	0.0%
	20	0.0%	0.6%	0.1%	0.4%
	40	0.0%	1.2%	0.1%	0.8%
	60	0.0%	1.8%	0.2%	1.2%
	80	0.0%	2.3%	0.2%	1.6%
	100	0.0%	2.9%	0.3%	1.9%
	120	0.1%	3.5%	0.3%	2.3%
	140	0.1%	4.1%	0.4%	2.7%
	160	0.1%	4.7%	0.4%	3.1%
	180	0.1%	5.3%	0.5%	3.5%
	200	0.1%	5.8%	0.6%	3.9%

Catch options for 2017/18 season:	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW
	0	0.0%	0.0%	0.0%	0.0%
	20	0.0%	0.6%	0.1%	0.4%
	40	0.0%	1.2%	0.1%	0.9%
	60	0.0%	1.8%	0.2%	1.3%
	80	0.0%	2.5%	0.3%	1.7%
	100	0.1%	3.1%	0.3%	2.2%
	120	0.1%	3.7%	0.4%	2.6%
	140	0.1%	4.3%	0.4%	3.0%
	160	0.1%	4.9%	0.5%	3.5%
	180	0.1%	5.5%	0.6%	3.9%
	200	0.1%	6.2%	0.6%	4.3%

Catch options for 2018/19 season:	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW
	0	0.0%	0.0%	0.0%	0.0%
	20	0.0%	0.7%	0.1%	0.5%
	40	0.0%	1.4%	0.1%	1.0%
	60	0.0%	2.1%	0.2%	1.5%
	80	0.0%	2.8%	0.3%	2.0%
	100	0.1%	3.5%	0.3%	2.5%
	120	0.1%	4.2%	0.4%	3.0%
	140	0.1%	4.9%	0.5%	3.4%
	160	0.1%	5.6%	0.5%	3.9%
	180	0.1%	6.3%	0.6%	4.4%
	200	0.1%	7.0%	0.7%	4.9%

Table 10.2.6.3 Probability (%) of national NEAC 1SW stock complexes achieving their CLs individually and simultaneously for different catch options for the Faroes fishery (assuming the full catch allocation is also taken in home waters) in the 2016/2017 to 2018/2019 fishing seasons. Shaded cells denote achievement of SERs with ≥95% probability. Catch options for the first year assume no catch in the preceding year while catch options in subsequent years assume that the full, equivalent TAC in the preceding year was taken.

Catch options for 2016/17 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All 1SW MUs simultaneous
	0	86%	85%	99%	82%	60%	55%	56%	26%	20%	36%	0.2%
	20	86%	85%	99%	82%	60%	55%	56%	26%	20%	36%	0.2%
	40	86%	85%	99%	82%	59%	54%	56%	26%	19%	36%	0.2%
	60	86%	85%	99%	82%	59%	54%	55%	26%	19%	36%	0.2%
	80	86%	84%	99%	82%	59%	54%	55%	25%	19%	36%	0.2%
	100	86%	84%	99%	82%	58%	53%	54%	25%	19%	36%	0.2%
	120	86%	84%	99%	82%	58%	53%	54%	25%	19%	36%	0.2%
	140	86%	84%	99%	82%	58%	52%	53%	25%	19%	35%	0.2%
	160	86%	84%	99%	82%	58%	52%	53%	25%	18%	35%	0.2%
	180	85%	84%	99%	82%	57%	52%	53%	24%	18%	35%	0.1%
	200	85%	84%	98%	82%	57%	51%	52%	24%	18%	35%	0.1%

Catch options for 2017/18 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All 1SW MUs simultaneous
	0	75%	83%	97%	84%	76%	47%	57%	19%	17%	38%	0.1%
	20	75%	83%	96%	84%	76%	47%	56%	19%	17%	38%	0.1%
	40	75%	83%	96%	84%	76%	46%	56%	19%	17%	38%	0.1%
	60	75%	83%	96%	84%	76%	46%	56%	18%	16%	37%	0.1%
	80	75%	83%	96%	84%	75%	46%	55%	18%	16%	37%	0.1%
	100	75%	83%	96%	84%	75%	45%	55%	18%	16%	37%	0.1%
	120	75%	83%	96%	84%	75%	45%	54%	18%	16%	37%	0.1%
	140	75%	82%	96%	84%	75%	45%	54%	18%	16%	37%	0.1%
	160	75%	82%	96%	84%	75%	45%	54%	18%	16%	37%	0.1%
	180	74%	82%	96%	84%	74%	44%	53%	17%	16%	37%	0.1%
	200	74%	82%	96%	84%	74%	44%	53%	17%	16%	37%	0.1%

Catch options for 2018/19 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All 1SW MUs simultaneous
	0	66%	80%	95%	84%	63%	40%	54%	23%	26%	36%	0.1%
	20	66%	80%	95%	84%	63%	39%	54%	23%	26%	36%	0.1%
	40	66%	80%	95%	84%	63%	39%	53%	23%	26%	36%	0.1%
	60	66%	80%	95%	84%	62%	39%	53%	23%	25%	36%	0.1%
	80	66%	80%	95%	84%	62%	38%	53%	23%	25%	35%	0.1%
	100	66%	80%	95%	84%	62%	38%	52%	23%	25%	35%	0.1%
	120	66%	80%	95%	84%	62%	38%	52%	23%	25%	35%	0.1%
	140	65%	80%	95%	84%	62%	38%	52%	22%	25%	35%	0.1%
	160	65%	80%	95%	84%	61%	37%	51%	22%	25%	35%	0.1%
	180	65%	80%	95%	84%	61%	37%	51%	22%	25%	35%	0.1%
	200	65%	79%	95%	84%	61%	37%	51%	22%	24%	35%	0.1%

Table 10.2.6.4 Probability (%) of national NEAC MSW stock complexes achieving their CLs individually and simultaneously for different catch options for the Faroes fishery (assuming the full catch allocation is also taken in home waters) in the 2016/2017 to 2018/2019 fishing seasons. Shaded cells denote achievement of SERs with ≥95% probability. Catch options for the first year assume no catch in the preceding year while catch options in subsequent years assume that the full, equivalent TAC in the preceding year was taken.

Catch options for 2016/17 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All MSW MUs simultaneous
	0	89%	80%	100%	98%	98%	33%	83%	16%	84%	69%	1.8%
	20	81%	72%	100%	97%	96%	31%	81%	15%	82%	67%	1.2%
	40	72%	64%	99%	96%	95%	29%	80%	15%	79%	66%	0.8%
	60	63%	56%	98%	95%	92%	27%	79%	14%	77%	64%	0.5%
	80	53%	49%	96%	94%	90%	25%	77%	14%	75%	63%	0.3%
	100	44%	44%	93%	93%	87%	23%	76%	13%	72%	61%	0.2%
	120	36%	39%	90%	92%	84%	21%	74%	13%	70%	60%	0.1%
	140	30%	34%	87%	91%	81%	20%	73%	12%	68%	58%	0.0%
	160	24%	30%	83%	89%	78%	18%	72%	12%	65%	57%	0.0%
	180	19%	27%	78%	88%	75%	17%	70%	12%	63%	56%	0.0%
	200	15%	24%	73%	86%	71%	16%	69%	11%	61%	54%	0.0%

Catch options for 2017/18 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All MSW MUs simultaneous
	0	85%	75%	99%	93%	93%	31%	70%	17%	75%	68%	1.2%
	20	78%	67%	98%	91%	90%	29%	69%	17%	73%	66%	0.8%
	40	71%	60%	96%	89%	87%	28%	67%	17%	70%	65%	0.5%
	60	62%	53%	93%	87%	84%	26%	65%	16%	67%	64%	0.3%
	80	55%	48%	90%	85%	80%	24%	64%	16%	65%	62%	0.2%
	100	47%	43%	86%	84%	76%	22%	62%	15%	63%	61%	0.1%
	120	41%	38%	82%	82%	73%	21%	60%	15%	60%	60%	0.1%
	140	35%	35%	78%	80%	69%	19%	59%	15%	58%	59%	0.1%
	160	30%	31%	73%	78%	66%	18%	58%	14%	56%	58%	0.0%
	180	25%	28%	68%	76%	62%	17%	56%	14%	54%	56%	0.0%
	200	21%	26%	64%	74%	59%	16%	55%	14%	52%	55%	0.0%

Catch options for 2018/19 season:	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	Scotland	N. Ireland	Ireland	England & Wales	France	All MSW MUs simultaneous
	0	74%	74%	97%	93%	93%	28%	69%	14%	64%	66%	0.6%
	20	65%	67%	94%	92%	91%	27%	68%	14%	62%	65%	0.4%
	40	56%	61%	91%	90%	88%	25%	66%	14%	59%	63%	0.2%
	60	48%	55%	87%	89%	85%	24%	64%	13%	56%	62%	0.1%
	80	42%	50%	82%	87%	83%	22%	63%	13%	54%	61%	0.1%
	100	35%	46%	78%	86%	80%	21%	62%	13%	51%	60%	0.1%
	120	30%	42%	73%	84%	77%	19%	60%	13%	49%	59%	0.0%
	140	25%	39%	68%	83%	74%	18%	59%	12%	47%	58%	0.0%
	160	21%	36%	63%	81%	71%	17%	58%	12%	45%	57%	0.0%
	180	18%	33%	58%	80%	69%	16%	57%	12%	43%	56%	0.0%
	200	15%	31%	53%	78%	66%	15%	56%	11%	41%	55%	0.0%

Table 10.2.6.5 Estimated pre-fishery abundance (median values) of maturing 1SW salmon (potential 1SW returns) by NEAC country or region and year.

	Northern Europe								Southern Europe										NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		S&W					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	31 626	11 730	NA	NA	22 119	NA	NA	NA	64 082	77 347	1 339 867	105 897	223 248	792 133	2 274 376	**2 617 214**	3 056 800	NA	NA	NA
1972	123 032	10 716	NA	150 974	17 585	NA	NA	NA	128 515	62 895	1 437 297	101 894	194 934	693 727	2 280 242	**2 636 395**	3 091 453	NA	NA	NA
1973	57 264	12 837	NA	223 057	21 880	NA	NA	NA	79 249	67 297	1 564 960	120 299	170 380	831 615	2 456 276	**2 851 691**	3 344 030	NA	NA	NA
1974	78 866	12 821	NA	221 291	31 629	NA	NA	NA	36 659	48 159	1 773 507	150 623	185 268	790 211	2 577 356	**2 998 205**	3 550 537	NA	NA	NA
1975	94 163	15 607	NA	339 433	34 279	NA	NA	NA	73 368	74 575	1 965 469	154 192	152 999	647 391	2 623 484	**3 086 470**	3 663 848	NA	NA	NA
1976	86 589	15 658	NA	236 843	19 267	NA	NA	NA	66 969	58 721	1 333 336	103 155	106 362	554 902	1 919 579	**2 237 819**	2 648 670	NA	NA	NA
1977	48 735	21 756	NA	151 146	8 737	NA	NA	NA	51 994	60 061	1 153 801	116 260	104 510	577 477	1 786 740	**2 077 762**	2 434 889	NA	NA	NA
1978	46 308	22 026	NA	152 616	10 370	NA	NA	NA	53 063	78 556	1 008 798	133 088	136 066	662 015	1 816 139	**2 083 744**	2 416 455	NA	NA	NA
1979	41 656	21 165	NA	211 868	10 663	NA	NA	NA	60 677	72 713	927 501	127 525	95 708	547 973	1 607 615	**1 845 960**	2 146 945	NA	NA	NA
1980	32 974	3 346	NA	151 545	13 761	NA	NA	NA	127 255	33 256	714 084	120 954	122 107	347 757	1 284 344	**1 478 464**	1 712 353	NA	NA	NA
1981	29 698	16 670	NA	125 704	24 995	NA	NA	NA	100 745	42 973	380 139	126 641	96 310	428 086	1 059 995	**1 186 322**	1 331 600	NA	NA	NA
1982	17 638	7 715	NA	109 734	22 095	NA	NA	NA	62 326	44 027	771 687	107 213	137 692	607 501	1 542 949	**1 742 212**	1 967 616	NA	NA	NA
1983	42 898	11 353	892 433	182 547	29 363	1 013 815	**1 161 373**	1 333 536	66 913	55 544	1 367 038	157 659	193 125	624 081	2 173 452	**2 474 482**	2 831 689	3 259 742	**3 638 824**	4 085 041
1984	46 646	4 150	928 455	196 003	41 399	1 061 900	**1 220 934**	1 408 084	109 831	34 145	714 977	137 356	76 408	652 488	1 541 358	**1 739 449**	1 969 264	2 665 573	**2 963 848**	3 302 758
1985	62 183	28 101	941 428	269 802	49 155	1 195 738	**1 356 079**	1 547 489	40 956	55 028	1 184 918	136 658	98 308	540 847	1 811 069	**2 066 027**	2 372 638	3 076 805	**3 425 959**	3 832 647
1986	48 854	35 058	823 076	230 337	51 335	1 050 427	**1 193 278**	1 354 710	63 192	90 755	1 324 954	158 592	110 760	671 105	2 135 562	**2 445 479**	2 813 022	3 255 430	**3 642 410**	4 077 613
1987	58 951	20 587	691 609	246 526	40 853	943 214	**1 062 067**	1 201 579	111 406	56 368	857 666	164 501	61 053	518 036	1 561 860	**1 803 486**	2 101 597	2 558 533	**2 871 795**	3 228 386
1988	34 821	29 857	635 654	169 266	34 372	804 298	**906 046**	1 025 561	38 161	101 371	1 156 650	224 638	141 713	781 196	2 166 412	**2 464 506**	2 812 445	3 018 841	**3 375 346**	3 773 981
1989	75 802	16 059	699 003	251 541	10 017	931 950	**1 055 433**	1 202 300	20 977	56 317	828 508	151 351	136 471	855 106	1 825 848	**2 063 588**	2 344 234	2 813 688	**3 123 240**	3 476 937
1990	75 753	12 044	626 533	208 822	23 246	838 048	**948 551**	1 076 022	34 861	52 110	521 004	109 244	113 109	411 041	1 107 364	**1 256 323**	1 426 295	1 990 423	**2 207 756**	2 446 867
1991	74 335	17 423	545 129	177 988	29 143	751 453	**847 474**	961 432	25 236	57 404	370 376	107 188	63 115	406 326	925 549	**1 042 143**	1 178 056	1 711 961	**1 892 688**	2 096 045
1992	105 110	32 772	460 929	219 234	32 460	762 388	**855 757**	958 864	46 273	65 681	537 612	111 711	127 229	592 386	1 332 902	**1 498 518**	1 694 671	2 135 314	**2 355 228**	2 606 293
1993	70 957	26 973	462 178	187 840	32 215	699 492	**784 290**	880 072	66 269	64 191	436 381	155 914	148 995	531 335	1 266 178	**1 426 682**	1 615 872	1 998 991	**2 212 349**	2 451 489
1994	39 267	8 650	625 206	223 191	24 957	814 452	**925 816**	1 057 139	51 957	52 958	560 132	172 285	102 445	566 846	1 357 488	**1 526 730**	1 727 820	2 217 402	**2 457 131**	2 725 513
1995	39 452	22 650	408 372	200 296	36 367	633 554	**710 979**	800 061	17 408	65 357	623 412	131 988	95 031	555 757	1 329 491	**1 499 490**	1 696 360	1 998 562	**2 211 815**	2 454 534
1996	66 570	12 102	311 308	271 540	21 679	611 591	**687 661**	773 808	21 225	56 392	581 034	98 023	98 333	399 939	1 116 435	**1 265 189**	1 438 482	1 761 456	**1 954 862**	2 170 279
1997	60 569	16 425	359 949	267 618	9 870	637 826	**717 804**	809 573	10 863	41 149	580 764	87 685	116 546	286 999	994 944	**1 131 508**	1 294 904	1 667 155	**1 850 125**	2 060 599
1998	75 746	28 041	468 761	292 439	7 948	778 971	**877 447**	994 762	21 260	56 327	609 347	96 276	254 184	391 757	1 275 668	**1 442 040**	1 630 090	2 097 422	**2 323 138**	2 573 361
1999	101 522	14 226	435 236	226 167	12 529	705 182	**793 147**	892 229	7 059	45 767	567 594	76 456	66 157	193 971	838 012	**962 686**	1 114 685	1 580 827	**1 758 446**	1 960 542
2000	109 906	14 950	716 222	247 342	23 031	990 020	**1 116 647**	1 264 322	18 444	40 754	788 802	115 795	95 994	378 354	1 267 399	**1 449 843**	1 662 972	2 307 049	**2 569 055**	2 861 705
2001	79 747	13 644	617 920	335 208	14 325	935 000	**1 068 722**	1 235 789	15 934	36 455	627 066	101 057	77 286	370 995	1 103 574	**1 239 100**	1 397 443	2 085 236	**2 311 648**	2 569 244
2002	54 282	23 559	377 617	303 488	13 736	675 546	**779 969**	916 582	35 472	45 369	547 240	95 960	139 801	299 370	1 051 268	**1 176 860**	1 324 136	1 765 452	**1 961 728**	2 181 213
2003	53 476	12 581	524 539	270 289	7 442	762 290	**875 664**	1 014 628	23 460	54 416	537 713	74 317	85 938	338 595	1 005 558	**1 128 184**	1 269 039	1 808 712	**2 006 354**	2 229 523
2004	22 684	33 825	317 872	189 002	6 222	502 525	**573 769**	660 768	28 730	54 487	394 809	133 367	82 459	402 210	988 309	**1 114 342**	1 259 050	1 522 608	**1 690 122**	1 880 665
2005	49 793	30 083	471 444	217 460	6 147	684 069	**780 464**	895 180	18 653	80 157	394 582	108 944	103 462	436 682	1 037 072	**1 157 236**	1 294 893	1 755 033	**1 940 916**	2 143 994
2006	87 369	31 582	381 087	260 580	6 808	677 127	**772 682**	889 236	26 146	56 736	300 923	106 972	70 063	423 581	887 381	**1 001 738**	1 136 142	1 603 100	**1 777 147**	1 977 255
2007	25 571	23 486	213 423	140 624	2 114	355 787	**408 170**	470 720	20 480	64 804	200 269	102 910	103 465	415 761	801 987	**937 191**	1 110 025	1 187 972	**1 348 349**	1 542 341
2008	27 589	21 510	267 461	146 548	3 310	410 186	**470 410**	542 431	20 245	78 777	324 472	101 144	65 199	358 953	813 951	**978 493**	1 256 054	1 258 216	**1 455 281**	1 748 465
2009	48 841	34 759	213 770	137 657	3 527	389 359	**441 834**	504 355	5 739	88 625	263 830	62 858	40 541	306 436	658 692	**793 045**	1 000 538	1 078 497	**1 239 973**	1 464 387
2010	39 331	27 684	318 076	156 615	6 000	484 352	**551 744**	627 041	19 495	91 063	348 048	124 426	46 626	562 007	1 026 517	**1 234 665**	1 544 916	1 553 429	**1 789 577**	2 118 348
2011	44 626	22 780	223 484	167 324	5 130	409 002	**466 114**	531 591	13 245	64 103	298 714	72 892	41 390	299 065	676 334	**816 092**	1 056 435	1 116 843	**1 286 947**	1 538 602
2012	77 126	11 881	249 155	195 025	7 225	477 625	**545 245**	627 090	14 398	36 339	311 089	44 812	67 095	397 799	736 420	**918 393**	1 193 331	1 257 121	**1 469 720**	1 763 989
2013	44 515	28 253	234 009	152 169	4 195	408 589	**468 605**	539 643	20 263	108 239	258 333	57 772	47 477	463 015	820 597	**1 007 841**	1 270 007	1 265 608	**1 478 723**	1 760 740
2014	63 123	13 372	319 987	143 092	11 572	484 840	**558 001**	645 723	18 118	26 780	173 569	34 002	26 396	353 219	531 860	**664 572**	845 355	1 057 741	**1 227 380**	1 435 476
2015	39 405	38 218	282 342	149 557	5 088	453 090	**520 433**	599 541	16 678	72 729	233 875	41 102	51 575	375 080	668 611	**841 047**	1 066 328	1 165 746	**1 363 456**	1 616 063
10yr Av.	49 750	25 352	270 280	164 919	5 497	454 996	**520 324**	597 737	17 481	68 820	271 312	74 889	55 983	395 492	762 235	**919 308**	1 147 913	1 254 427	**1 443 655**	1 696 567

Table 10.2.6.6 Estimated pre-fishery abundance (median values) of non-maturing 1SW salmon (potential MSW returns) by NEAC country or region and year.

	Northern Europe								Southern Europe									NEAC Area		
Year	Finland	Iceland	Norway	Russia	Sweden	Total			France	Iceland	Ireland	UK(EW)	UK(NI)	UK(Scot)	Total			Total		
		N&E				5.0%	**50.0%**	95.0%		S&W					5.0%	**50.0%**	95.0%	5.0%	50.0%	95.0%
1971	52 164	27 073	NA	266 905	4 433				60 414	65 451	389 524	370 376	32 838	1 718 304	2 242 753	**2 649 919**	3 137 487			
1972	78 919	25 467	NA	428 906	7 103				39 871	59 153	385 797	282 129	28 908	1 720 339	2 120 732	**2 526 043**	3 032 128			
1973	125 183	23 852	NA	397 819	4 645				21 485	50 953	398 075	200 916	31 273	1 203 644	1 604 529	**1 917 984**	2 309 557			
1974	159 738	26 493	NA	430 866	3 353				34 803	54 323	448 725	264 942	26 000	1 344 192	1 826 218	**2 186 195**	2 624 971			
1975	124 390	21 713	NA	367 256	4 548				30 698	46 724	341 267	182 488	17 993	998 750	1 379 642	**1 624 913**	1 922 730			
1976	86 734	29 721	NA	253 841	2 360				20 363	45 436	272 674	173 990	17 616	905 786	1 206 939	**1 445 102**	1 723 790			
1977	45 159	38 124	NA	218 640	2 641				22 723	58 636	252 342	163 618	22 693	1 130 047	1 386 714	**1 658 435**	1 989 151			
1978	47 003	25 474	NA	198 897	4 297				20 326	37 669	208 548	84 044	16 307	791 708	964 537	**1 165 530**	1 413 193			
1979	54 311	36 045	NA	346 416	8 794				40 341	53 548	246 528	230 383	21 213	1 034 773	1 371 727	**1 638 364**	1 951 335			
1980	69 782	14 406	NA	239 355	5 781				31 232	37 066	193 684	306 881	17 778	1 106 984	1 423 275	**1 705 416**	2 038 546			
1981	84 869	16 014	NA	214 143	10 241				21 648	26 586	126 099	146 535	24 582	908 590	1 058 279	**1 258 581**	1 509 164			
1982	87 350	12 234	831 348	268 975	7 186	1 017 161	**1 210 309**	1 448 448	20 790	42 584	208 599	149 592	33 185	922 754	1 157 415	**1 383 412**	1 657 508	2 208 459	**2 599 441**	3 064 984
1983	69 803	14 695	807 832	251 433	7 539	963 273	**1 153 692**	1 380 915	26 932	35 765	142 698	109 429	13 475	720 870	877 482	**1 053 530**	1 272 533	1 868 843	**2 210 938**	2 612 845
1984	68 239	9 900	754 336	276 046	4 127	935 840	**1 116 103**	1 337 236	20 685	26 282	152 376	148 949	17 182	860 057	1 017 197	**1 231 831**	1 491 694	1 985 394	**2 349 473**	2 787 590
1985	60 269	25 371	906 933	280 223	3 847	1 070 741	**1 280 637**	1 540 298	24 508	22 385	190 681	217 550	19 427	1 165 188	1 366 666	**1 647 181**	1 985 561	2 478 796	**2 930 135**	3 473 352
1986	74 357	26 180	705 608	215 875	7 443	865 268	**1 032 668**	1 236 800	16 230	19 968	228 625	181 250	10 465	815 723	1 073 822	**1 276 608**	1 535 784	1 962 894	**2 310 649**	2 737 029
1987	49 974	16 682	559 935	197 686	6 683	696 570	**834 415**	997 973	31 559	22 040	168 512	216 100	26 660	1 153 214	1 345 991	**1 627 314**	1 959 800	2 072 029	**2 463 869**	2 926 051
1988	50 575	14 412	427 602	197 480	19 690	597 027	**710 840**	847 821	19 059	19 804	164 585	189 183	21 549	1 058 421	1 237 017	**1 479 018**	1 785 394	1 855 875	**2 190 641**	2 603 087
1989	53 209	14 906	476 970	241 668	10 480	667 714	**799 743**	955 699	14 816	19 503	73 951	198 631	19 490	805 844	937 512	**1 138 291**	1 379 164	1 629 876	**1 939 300**	2 303 115
1990	67 847	10 369	394 656	231 747	13 264	601 364	**720 250**	860 475	12 627	19 264	100 429	88 950	10 127	602 624	689 425	**839 410**	1 015 748	1 309 452	**1 561 599**	1 848 240
1991	63 814	14 963	412 401	213 993	17 893	606 642	**725 972**	869 192	16 478	21 437	83 787	74 981	22 435	810 382	853 342	**1 033 017**	1 256 571	1 482 387	**1 758 773**	2 096 622
1992	66 635	16 940	396 082	252 805	20 235	632 293	**755 482**	901 215	8 177	10 586	78 358	76 725	52 674	655 802	731 143	**890 268**	1 084 406	1 381 861	**1 647 651**	1 959 918
1993	62 822	14 390	386 118	225 722	15 348	590 911	**707 891**	847 513	14 526	17 062	113 534	97 784	18 646	757 127	837 302	**1 024 275**	1 252 188	1 450 670	**1 733 543**	2 069 152
1994	42 479	9 205	416 801	257 841	7 850	614 827	**736 175**	884 510	7 109	17 535	110 023	98 322	15 857	700 008	775 871	**953 888**	1 177 752	1 412 544	**1 689 748**	2 029 694
1995	42 849	11 948	413 710	194 300	12 587	566 965	**678 404**	815 126	12 686	11 324	76 016	103 517	17 401	545 988	632 897	**772 939**	947 624	1 220 340	**1 453 305**	1 735 026
1996	49 646	6 658	266 047	154 880	8 844	405 916	**488 570**	588 343	6 595	12 591	96 438	63 609	21 472	374 009	474 525	**583 330**	718 452	896 431	**1 072 532**	1 287 563
1997	48 026	9 673	319 531	192 337	4 880	479 179	**576 716**	691 226	5 441	7 784	55 745	41 209	29 428	391 714	438 409	**535 848**	656 752	932 793	**1 113 827**	1 326 209
1998	50 974	11 095	340 224	169 067	3 477	480 079	**576 256**	696 818	11 451	15 198	85 964	81 001	13 402	298 553	413 017	**521 226**	659 436	912 548	**1 098 193**	1 325 528
1999	96 853	6 513	470 766	295 867	12 424	738 386	**884 965**	1 063 418	8 044	4 131	107 127	83 536	17 811	382 653	498 615	**612 016**	755 307	1 258 505	**1 497 340**	1 791 795
2000	129 013	7 490	555 326	207 520	14 840	761 896	**916 171**	1 106 002	9 667	7 240	97 585	91 275	13 080	372 932	487 762	**601 104**	743 795	1 273 095	**1 519 809**	1 818 249
2001	113 618	7 090	481 572	225 713	10 156	701 374	**840 418**	1 012 411	8 799	7 841	111 524	82 143	14 204	302 537	435 265	**536 362**	660 996	1 156 397	**1 377 016**	1 648 366
2002	81 869	7 443	424 894	158 083	2 447	563 460	**676 739**	817 525	12 647	12 537	117 108	105 704	8 513	377 468	517 963	**645 220**	801 443	1 105 773	**1 324 604**	1 588 847
2003	37 112	7 304	386 360	121 583	7 499	465 229	**562 032**	677 847	23 301	10 145	64 090	89 319	9 008	484 573	557 075	**691 040**	857 112	1 042 356	**1 255 380**	1 504 977
2004	30 810	9 075	355 562	145 897	5 022	455 900	**547 497**	660 079	14 341	8 911	82 823	96 286	11 308	380 796	487 251	**604 562**	752 519	962 252	**1 155 249**	1 386 241
2005	48 353	8 699	450 853	139 583	5 227	544 008	**654 694**	785 169	14 329	7 404	59 891	87 155	8 900	394 893	468 886	**583 863**	732 004	1 034 768	**1 240 163**	1 485 760
2006	70 416	8 383	382 832	145 606	4 911	512 779	**613 426**	738 094	13 651	4 561	23 763	83 983	9 224	380 731	418 883	**523 857**	657 575	950 311	**1 138 369**	1 368 107
2007	70 783	10 792	443 096	229 405	6 934	631 414	**762 374**	924 168	15 085	5 221	31 663	92 117	7 182	427 034	467 322	**589 376**	743 581	1 122 954	**1 352 576**	1 631 880
2008	30 297	8 696	346 301	194 354	6 069	484 750	**587 685**	711 327	7 021	8 103	39 680	70 533	7 312	362 732	399 478	**504 317**	637 403	905 599	**1 092 414**	1 319 506
2009	48 879	12 267	381 647	239 815	7 029	572 376	**691 974**	835 266	5 739	16 709	36 934	104 228	11 667	476 174	523 355	**663 436**	844 110	1 124 292	**1 360 513**	1 643 304
2010	37 591	13 703	531 761	239 692	13 242	691 394	**839 251**	1 015 784	16 190	8 493	40 440	153 309	19 371	537 568	620 035	**790 864**	1 016 616	1 347 821	**1 633 783**	1 984 409
2011	45 278	7 748	465 965	117 515	18 774	541 513	**657 961**	794 954	12 740	4 855	35 356	127 320	32 095	424 129	511 332	**657 631**	854 391	1 083 137	**1 318 979**	1 604 883
2012	43 572	8 866	328 248	134 323	7 939	433 158	**524 680**	634 983	13 205	13 427	40 339	116 165	6 615	374 392	446 819	**578 530**	754 424	904 430	**1 107 241**	1 356 133
2013	47 316	10 652	337 418	133 289	16 091	448 518	**547 750**	663 061	16 389	8 208	22 844	78 578	4 442	318 254	355 246	**458 764**	600 106	828 207	**1 009 142**	1 226 254
2014	45 747	10 568	427 609	125 742	17 084	516 797	**630 398**	765 219	18 677	6 424	30 587	125 866	9 047	233 969	337 508	**437 825**	576 216	878 943	**1 070 100**	1 301 745
10yr Av.	48 823	10 037	409 573	169 932	10 330	537 671	**651 019**	786 802	13 302	8 340	36 150	103 925	11 586	392 988	454 887	**578 846**	741 643	1 018 046	**1 232 328**	1 492 198

10.2.7 NASCO has asked ICES to update the Framework of Indicators used to identify any significant changes in the previously provided multi-annual management advice

The framework of indicators previously used in support of multi-annual catch options was updated. In 2016, the FWI signaled that the PFA of the Northern NEAC MSW stock complex was higher than forecast by ICES in 2015 and that a reassessment was necessary. However, in the catch advice provided in 2015 (ICES, 2015) it was the status of the Southern NEAC stock complexes which indicated a zero catch option for Faroes. As there was no indication from the FWI analysis that the forecast PFAs for these stocks had been underestimated, a change in the status of the Northern NEAC MSW stock complex alone would not have led to a change in the previous advice.

To address this issue, ICES developed an alternative FWI where only stock complexes that would be appropriate for changing the multiyear advice are included in the framework in the years between the provisions of full catch advice. If the FWI signals that the forecast underestimated the PFA for any of these stock complexes, a new assessment would be signaled. For 2017 and 2018, for example, this would mean that only the indicators for the Southern NEAC 1SW and MSW should be considered. As future catch advice may be determined by the status of stocks in any of the four stock complexes, it will be necessary to retain indicators for all four stock complexes. ICES recommends that this alternative FWI (Figure 10.2.7.1) should be applied in future. The current format of the FWI was also updated and is available for use should the recommended alternative not be adopted.

The FWI has been structured such that it could be applied for the next two years (2017 and 2018). However, if NASCO decides that the assessment cycle for the Greenland and Faroes fisheries should continue to operate over synchronous periods, then full catch advice could be required in 2018 together with an update of the FWI at the start of a new three-year-cycle.

Table 10.2.7.1 Framework of indicators spreadsheet for the Faroes fishery. In this version only the two Southern NEAC stock complexes determine the outcome of the FWI. The Northern NEAC stock complexes are still retained in the spreadsheet because they may influence the advice in the future. For illustrative purposes, indicator variable values for the 27 retained indicators are entered in the input (green shaded) cells, and the conclusion reflects these values.

FWI NEAC 2017 Indicators suggest: **PFA forecast OK or overestimated**

Indicators for Northern NEAC 1SW PFA

	Insert data from 2016 here	N reg	Slope	Intercept	r^2	Median PFA in 2016	12.5%ile	87.5%ile	Reassess in year 2017? Outside 75% conf.lim. below	above	Outside 75% confidence limits below	above
1 Returns all 1SW NO PFA est	255260	32	0.574829	-88479.71	0.95	630816	230948.47	317314.48	-1	-1	NO	NO
2 Survivals W 1SW NO Imsa	2.9	32	0.000012	-3.75	0.46	630816	-0.32	8.01	0	-1	Uninformative	NO
3 Survivals H 1SW NO Imsa	1.5	33	0.000006	-1.12	0.30	630816	-0.16	5.55	0	-1	Uninformative	NO
4 Counts all NO Øyensåa (1SW)	3215	17	0.002353	574.91	0.27	630816	1004.81	3114.11	-1	1	NO	YES
5 Counts all NO Nausta (1SW)	1744	18	0.002012	-34.97	0.28	630816	333.48	2134.62	-1	-1	NO	NO
6 Catch rT&N 1SW FI	8255	17	0.0139136	1689.7437	0.39	630816	1851.30	19081.99	-1	-1	NO	NO
								Sum of scores	-4	-4		
											Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

Indicators for Northern NEAC MSW PFA

	Insert data from 2016 here	N reg	Slope	Intercept	r^2	Median PFA in 2016	12.5%ile	87.5%ile	Reassess in year 2017? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1 PFA-MSW-CoastNorway	211073	32	0.358088	-14199.06	0.87	631049	176983.63	246560.65	-1	-1	NO	NO
2 Orkla counts	6131	17	0.013501	-3554.83	0.57	631049	3071.09	6859.07	-1	-1	NO	NO
3 Counts all NO Nausta	1744	18	0.003915	-1315.88	0.34	631049	294.82	2014.50	-1	-1	NO	NO
4 Returns all 2SW NO PFA est	166963	22	0.2436223	1221.1683	0.49	631049	88946.43	220971.12	-1	-1	NO	NO
5 Catch W rT&N 2SW FI	3562	17	0.0068946	-1388.331	0.32	631049	103.49	5821.54	-1	-1	NO	NO
								Sum of scores	-5	-5		
											Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

Indicators for Southern NEAC 1SW PFA

	Insert data from 2016 here	N reg	Slope	Intercept	r^2	Median PFA in 2016	12.5%ile	87.5%ile	Reassess in year 2017? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1 Ret. W 1SW UK(E&W) Itchen M	359	28	0.000283	8.58	0.23	724326	-37.02	464.44	0	-1	Uninformative	NO
2 Ret. W 1SW UK(E&W) Frome M	156	43	0.000540	-25.75	0.37	724326	-172.41	902.87	0	-1	Uninformative	NO
3 Ret. W 1SW UK(Sc.) North Esk M	8211	35	0.006730	4017.16	0.61	724326	5683.84	12100.57	-1	-1	NO	NO
4 Surv. W 1SW UK(NI) Bush M	10.8	27	2.153E-05	-10.18085	0.56	724326	-4.24	15.07	0	-1	Uninformative	NO
5 Ret. Freshw 1SW UK(NI) Bush	1387	41	0.000684	450.65	0.26	724326	165.10	1726.39	-1	-1	NO	NO
6 Ret. W 1SW UK(E&W) Dee M	5000	24	0.0035444	-418.4296	0.31	724326	425.69	3871.99	-1	1	NO	YES
								Sum of scores	-3	-4		
											Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

Indicators for Southern NEAC MSW PFA

	Insert data from 2016 here	N reg	Slope	Intercept	r^2	Median PFA in 2016	12.5%ile	87.5%ile	Reassess in year 2017? Outside 75% conf.lim. below	above	Outside 75% conf.lim. below	above
1 Ret. W 2SW UK(Sc.) Baddoch NM	25	28	0.000034	3.21	0.47	459472	5.81	31.69	-1	-1	NO	NO
2 Ret. W 2SW UK(Sc.) Girnoch NM	60	44	0.000037	8.50	0.43	459472	-3.68	54.37	0	1	Uninformative	YES
3 Ret. W 1SW UK(Sc.) North Esk NM	8211	35	0.007469	6670.32	0.46	459472	6378.71	13825.63	-1	-1	NO	NO
4 Ret. W MSW UK(E&W) Itchen NM	120	28	0.000095	51.90	0.09	459472	-15.53	206.87	0	-1	Uninformative	NO
5 Ret. W 1SW UK(E&W) Itchen NM	524	28	0.000353	89.89	0.21	459472	1.38	502.49	-1	1	NO	YES
6 Ret. W MSW UK(E&W) Frome NM	104	43	0.000779	32.17	0.48	459472	-116.34	896.88	0	-1	Uninformative	NO
7 Ret. W 1SW UK(E&W) Frome NM	156	43	0.000666	113.77	0.39	459472	-107.23	946.97	0	-1	Uninformative	NO
8 Catch W MSW Ice Ellidaar NM	17	44	0.000094	-26.25	0.57	459472	-39.19	73.07	0	-1	Uninformative	NO
9 Ret. Freshw 2SW UK(NI) Bush	257	40	0.000144	58.98	0.23	459472	-9.86	259.70	0	-1	Uninformative	NO
10 Ret. W 2SW UK(Sc.) North Esk NM	99	35	0.0036431	4586.9979	0.21	459472	3042.31	9479.53	1	-1	YES	NO
								Sum of scores	-2	-6		
											Indicators do not suggest that the PFA forecast is an overestimation.	Indicators do not suggest that the PFA forecast is an underestimation.

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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 (or **CLs**)**, i.e. S_{lim}** *(conservation limit).* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that undesirable levels are avoided.

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 multi-annual 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*).

NEAC (*Northeast 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. 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).

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

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

UK (*United Kingdom and Northern Ireland*).