

Presentation of the ICES Advice on Atlantic Salmon from the North-East Atlantic to
the North-East Atlantic Commission
NEA(21)13

sal.neac.all

Atlantic salmon in the North-East Atlantic Commission Area in 2020

Photo by Cliff Mason



ICES
CIEM

Terms of Reference



2. With respect to Atlantic salmon in the North-East Atlantic Commission area:

- 2.1 describe the key events of the 2020 fisheries;
- 2.2 review and report on the development of age-specific stock conservation limits, including updating the time-series of the number of river stocks with established CLs by jurisdiction;
- 2.3 describe the status of the stocks, including updating the time-series of trends in the number of river stocks meeting CLs by jurisdiction;
- 2.4 provide catch options or alternative management advice for the 2021 / 2022 – 2023 / 2024 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 rebuilding⁴; and
- 2.5 update the Framework of Indicators used to identify any significant change in the previously provided multi-annual management advice.

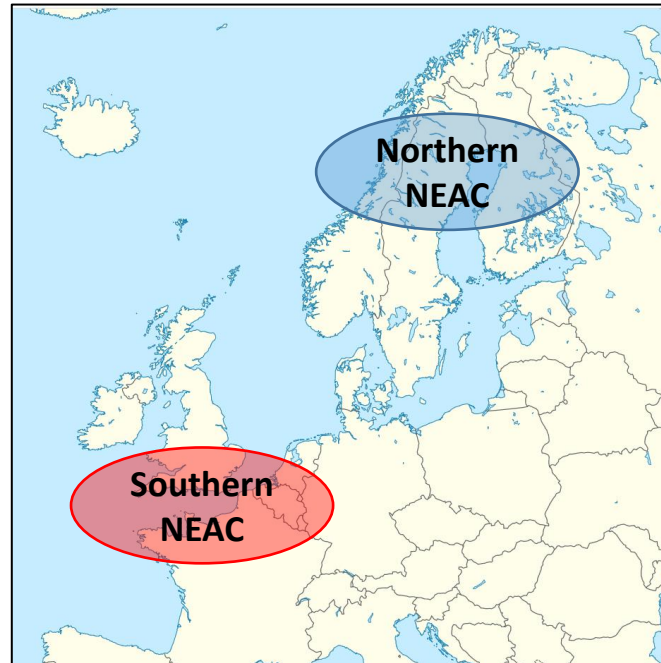
Background

- North-East Atlantic Commission (NEAC) stocks are combined into two groups for the provision of management advice for fisheries at West Greenland and Faroes

Southern group (Southern NEAC) :

- UK (Scotland)
- UK (England & Wales)
- UK (Northern Ireland)
- Ireland
- France
- Spain
- Iceland (south/west region)

- Total of 7 stock units



Northern group (Northern NEAC) :

- Russia
- Finland
- Norway
- Sweden
- Denmark
- Iceland (north/east region)

- Total of 11 stock units

2.1 Key Events 2020 Fisheries: Catch

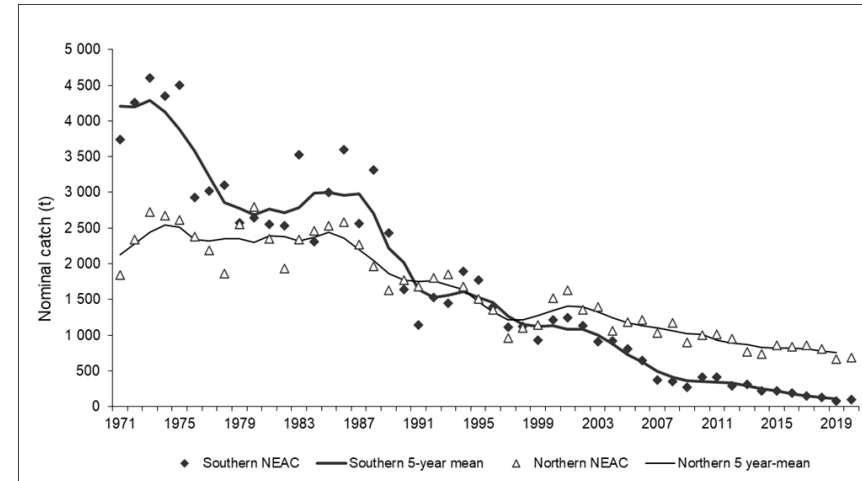


- No significant changes in the gear types used. No fishery Faroes since 2000
- NEAC Reported (i.e. nominal) Catch: 778 t
 - 93 t Southern NEAC
 - 685 t Northern NEAC
- Unreported catch: 239 t

Table 1: sal.neac.all

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

Figure 1: sal.neac.all



2.2 Stock Conservation Limits (CLs) and Spawner Escapement Reserves (SERs)

- National CLs summed to four NEAC stock complexes
- **SER** (Spawner Escapement Reserves)
 - Number of fish prior to fisheries to meet CLs when they return to homewaters
 - CLs increased to account for natural mortality ($M = 0.03$ per month) between 1 January of first winter and return to homewaters

Table 3: sal.neac.all

Complex	Sea age group	CL (number of fish)	SER (number of fish)
Northern NEAC	1SW	138 086	174 727
	MSW	122 268	209 236
Southern NEAC	1SW	436 992	553 846
	MSW	174 735	295 582

2.2 Stock Conservation Limits (CLs) and Spawner Escapement Reserves (SERs)



- Nine jurisdictions with river-specific CLs
- Time-series of CLs
- Iceland – one river since 2000

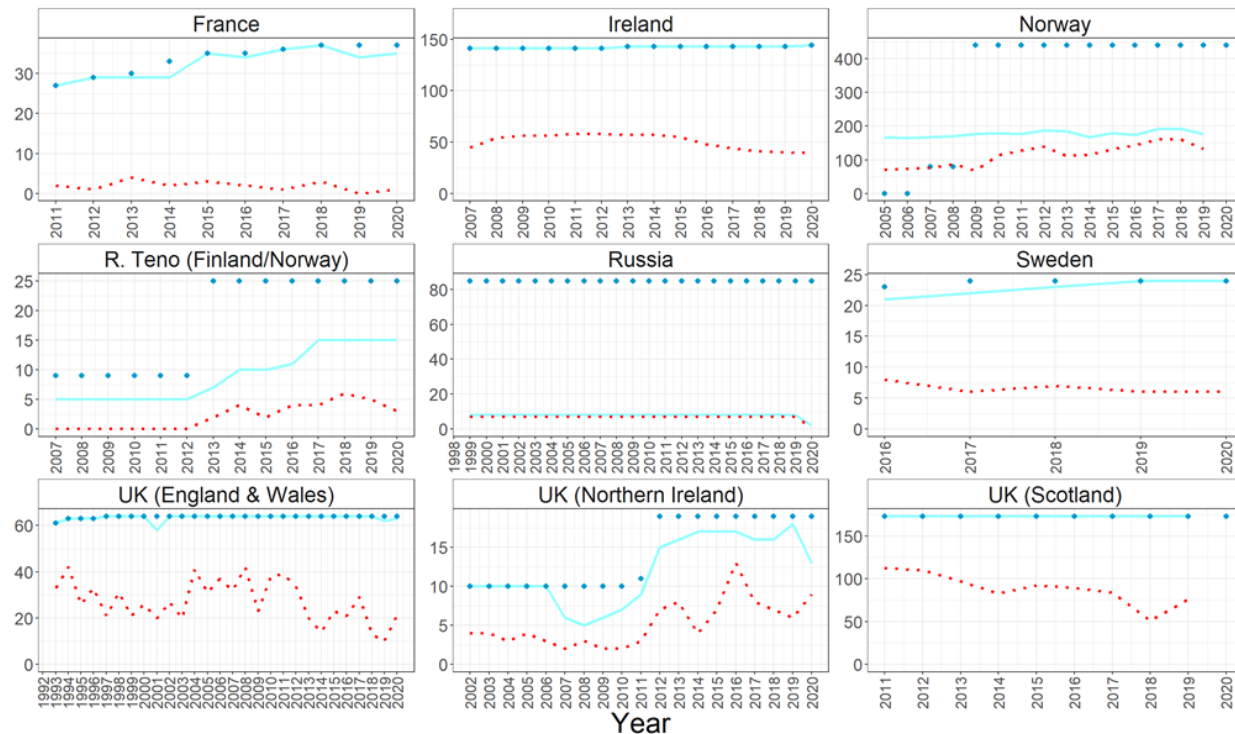
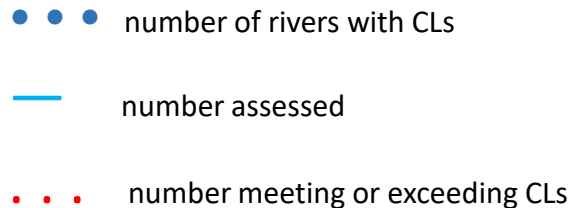


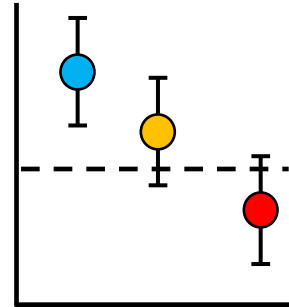
Figure 4: sal.neac.all

2.3 Stock Status

- Pre-Fishery Abundance (PFA) : abundance at 1 January of first winter at sea
 - by sea age group (maturing 1SW and non-maturing 1SW (MSW) salmon)
 - by stock complex (Northern NEAC and Southern NEAC) and individual country
- PFA relative to SER (Spawner Escapement Reserve = CL adjusted for natural mortality)
- Spawners relative to CLs

Risk Assessment Framework

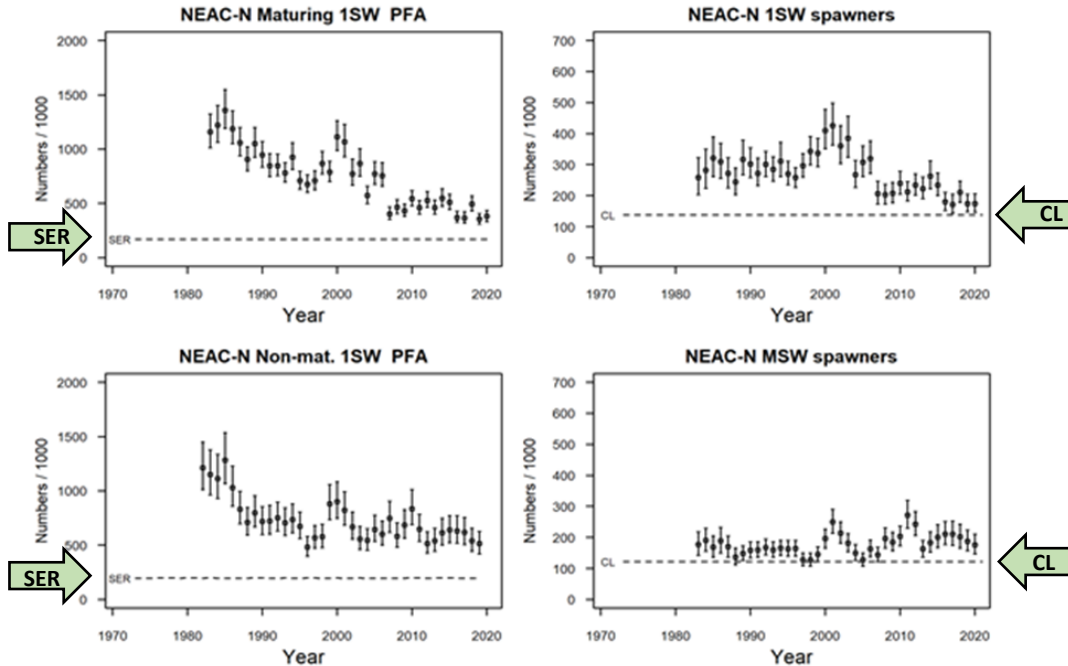
- Full Reproductive Capacity :
 - lower bound of the 90% confidence interval of the estimate above reference point
 - equivalent to a probability of at least 95% of meeting reference point
- At Risk of Suffering Reduced Reproductive Capacity:
 - lower bound of the confidence interval is below reference point, but the midpoint is above
- Suffering Reduced Reproductive Capacity:
 - midpoint is below reference point



2.3 Stock Status: 2020 Northern NEAC (N-NEAC)

PFA N-NEAC:

- Declining trend
- PFA > SER
- Both complexes at full reproductive capacity



Spawners N-NEAC:

- Spawners > CLs
- Both complexes at full reproductive capacity

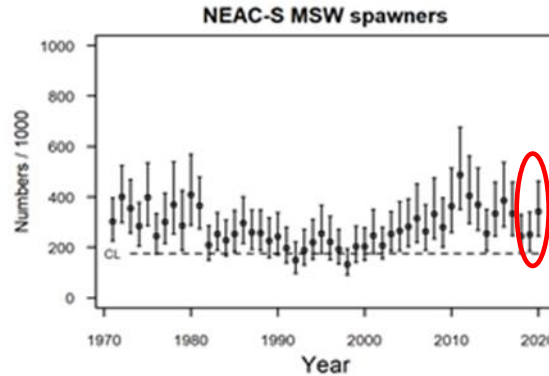
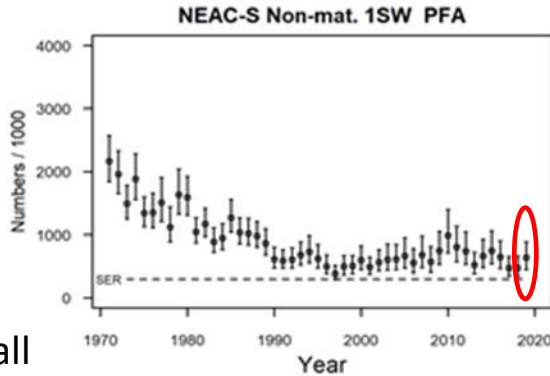
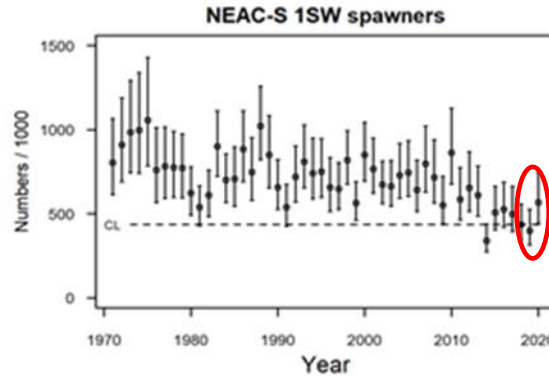
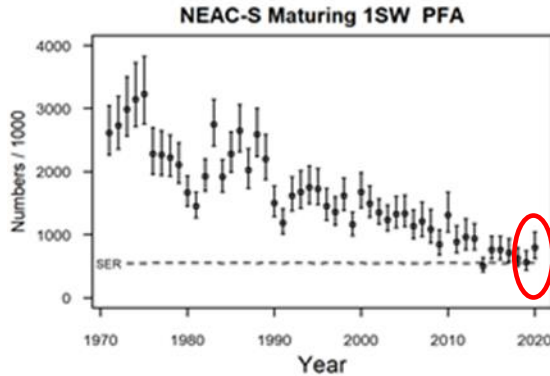
Figure 5: sal.neac.all

2.3 Stock Status: 2020 Southern NEAC (S-NEAC)



PFA S-NEAC:

- PFA > SER
- Thus, both complexes at full reproductive capacity in 2020
- Effects of reduction of national SER/CL for UK (Scotland)



Spawners S-NEAC:

- Spawners > CLs in 2020
- Thus, both complexes at full reproductive capacity in 2020
- Effects of reduction of national CL for UK (Scotland)

Figure 5: sal.neac.all

2.3 Stock Status: 2020 PFA by Jurisdiction

Northern NEAC PFA

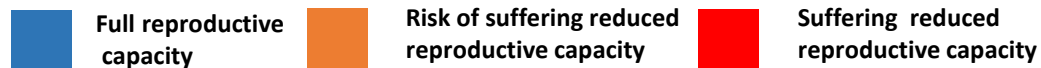
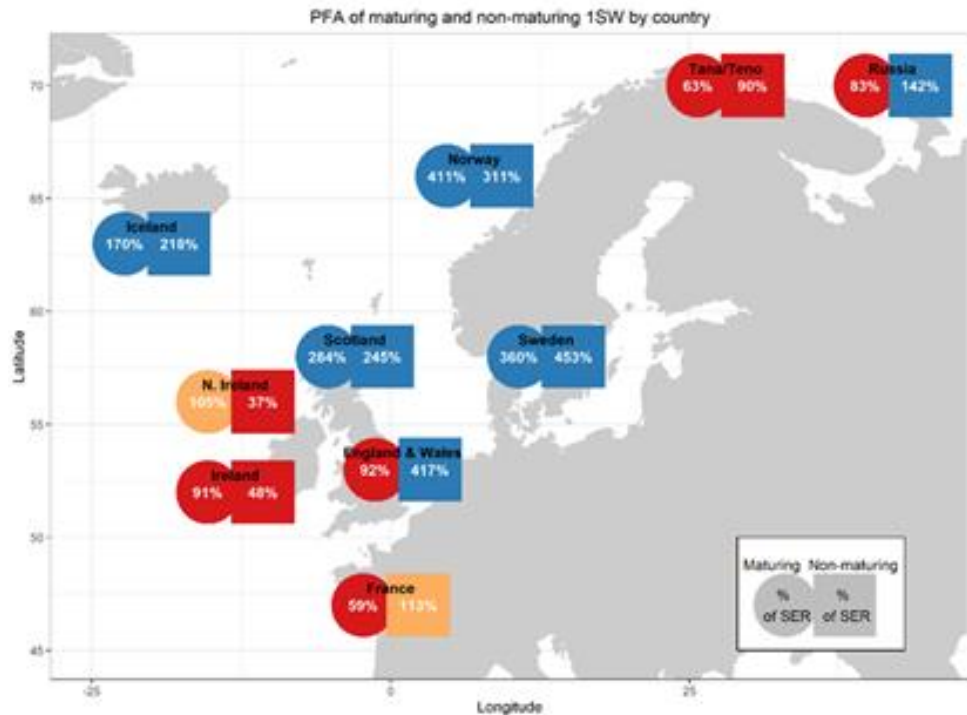
- Maturing 1SW:
 - full reproductive capacity Norway, Sweden, and Iceland
 - suffering Teno/Tana, Russia
- Non-maturing 1SW:
 - full reproductive capacity, except Teno/Tana (suffering)

Southern NEAC PFA

- Maturing 1SW:
 - full reproductive capacity in UK (Scotland)
 - others at risk or suffering
- Non-maturing 1SW:
 - full reproductive capacity in UK (E&W and Scotland)
 - others at risk or suffering

Note: changes to UK (Scotland) CLs in 2020

Figure 6: sal.neac.all



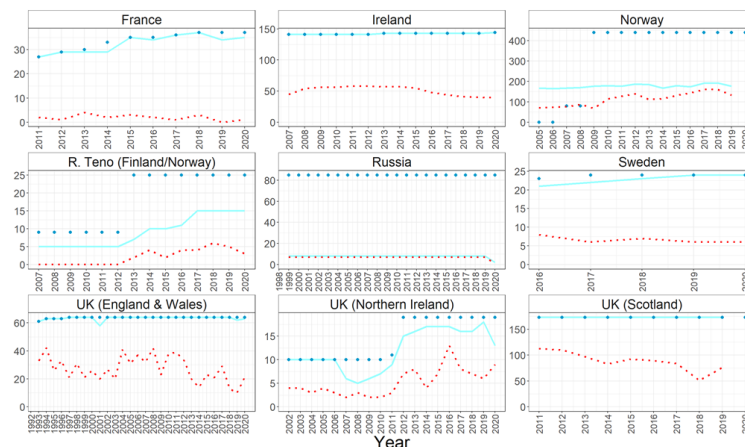
2.3 Stock Status: Trends in Rivers Meeting CLs



Table 4: sal.neac.all Spawners assessed against CLs

Country /Jurisdiction	Number of rivers with CLs	Number of rivers assessed for compliance	Number of rivers attaining CL	% of assessed rivers attaining CL	Trend statement
Northern NEAC					
Russia	85	2	1	50	Stable (less rivers assessed in 2020)
Finland/Norway (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 (less 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

Figure 4: sal.neac.all



- • • number of rivers with CLs
- number assessed
- ... number meeting or exceeding CLs

2.3 Stock Status: Return Rates (Marine Survival)

- 1SW declining trend since 1980
- 2SW no trend
- Little improvement of stock status over time
- Mainly a consequence of continuing poor survival in the marine environment

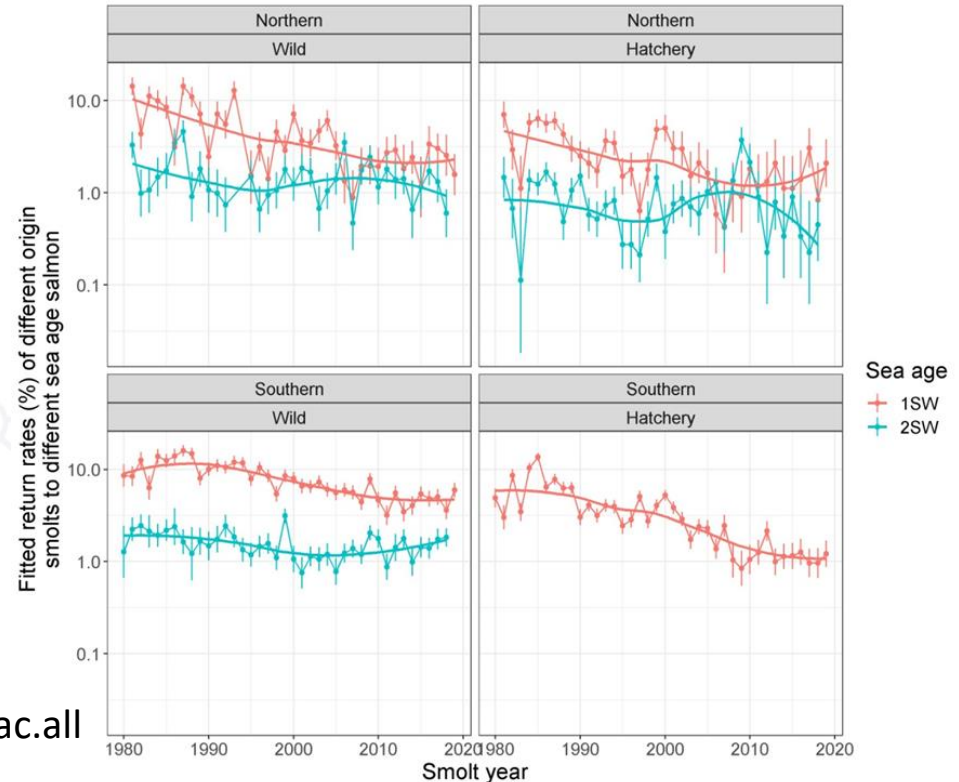


Figure 9: sal.neac.all

3.4 Catch options or alternative management advice



N NEAC

PFA Forecast N. NEAC

- 1SW maturing and 1SW non-maturing currently at full reproductive capacity
- But forecast indicates could both be at risk of suffering reduced reproductive capacity (lower 95th percentile Bayesian credible intervals below SERs)

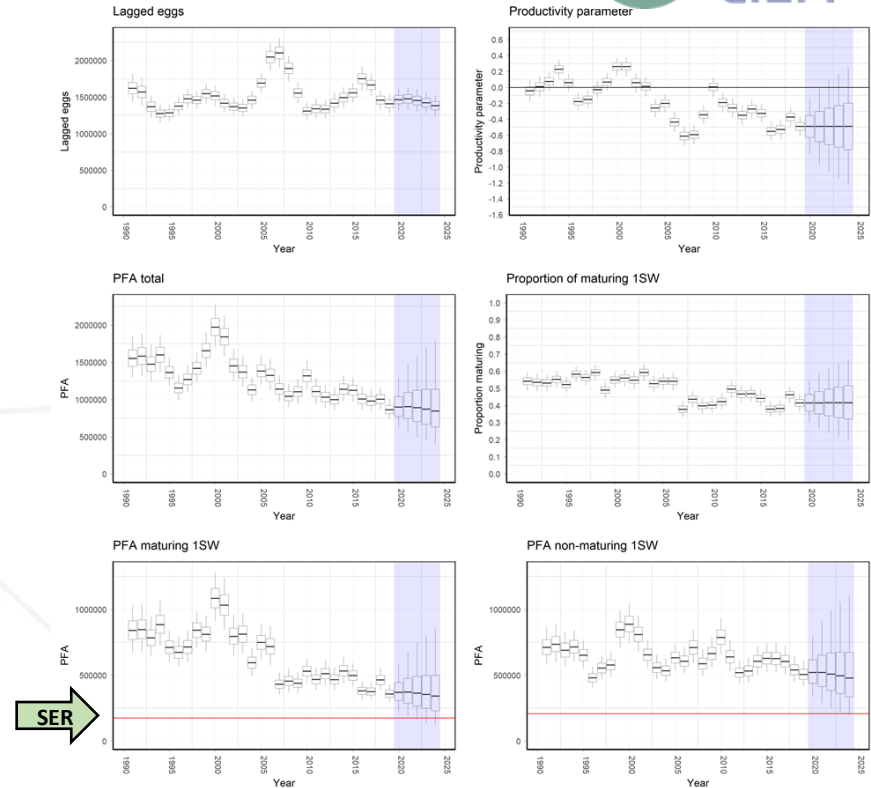


Figure 10: sal.neac.all

3.4 Catch options or alternative management advice



S NEAC

PFA Forecast S. NEAC

- 1SW maturing currently at risk of suffering reduced reproductive capacity
- 1SW non-maturing currently at full reproductive capacity
- Forecast indicates 1SW maturing could be suffering reduced reproductive capacity in future
- Forecast indicates 1SW non-maturing could at risk of suffering reduced reproductive capacity in future

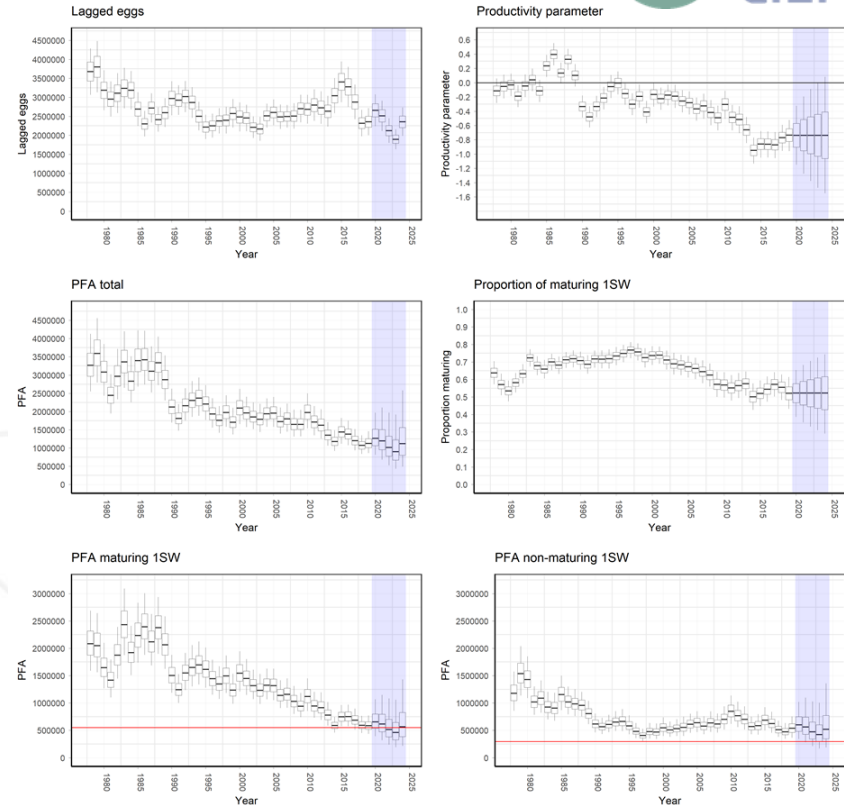


Figure 11: sal.neac.all



3.4 Catch options or alternative management advice



- No probabilities that the NEAC 1SW and MSW will meet or exceed the SER simultaneously for both regions at any TAC option
- No 2021-2024 catch options**

Catch options season	TAC option (t)	NEAC-N-1SW	NEAC-N-MSW	NEAC-S-1SW	NEAC-S-MSW	All complexes simultaneous
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 7: sal.neac.all

3.4 Catch options or alternative management advice



- No probabilities (0% or close to 0%) that the 1SW (L) and MSW (R) will meet or exceed the SER simultaneously at country level for any TAC option

- No 2021-2024 catch options

Catch options season	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	UK (Scotland)	UK (N. Ireland)	Ireland	UK (England & Wales)	France	All ISW/MUS simultaneous	Catch options season	TAC option (t)	Russia	Finland	Norway	Sweden	Iceland	UK (Scotland)	UK (N. Ireland)	Ireland	UK (England & Wales)	Probability
2021/22	0	28%	38%	97%	82%	74%	70%	30%	25%	22%	40%	0.0%	0	62%	40%	99%	96%	93%	89%	20%	24%	97%	57%	0.5%
	20	28%	38%	97%	82%	74%	69%	30%	25%	22%	40%	0.0%	20	47%	32%	98%	94%	90%	87%	19%	23%	96%	56%	0.3%
	40	28%	38%	97%	82%	73%	69%	30%	24%	22%	40%	0.0%	40	34%	26%	95%	92%	87%	85%	18%	22%	95%	54%	0.1%
	60	28%	38%	97%	82%	73%	68%	29%	24%	21%	40%	0.0%	60	24%	21%	92%	89%	83%	82%	18%	22%	94%	52%	0.0%
	80	28%	38%	97%	82%	73%	67%	29%	24%	21%	40%	0.0%	80	17%	17%	87%	87%	80%	79%	17%	21%	93%	51%	0.0%
	100	28%	37%	97%	81%	73%	67%	29%	24%	21%	40%	0.0%	100	12%	14%	81%	84%	76%	76%	16%	20%	91%	49%	0.0%
	120	28%	37%	97%	81%	72%	66%	29%	24%	21%	39%	0.0%	120	8%	11%	75%	81%	73%	73%	16%	20%	90%	48%	0.0%
	140	27%	37%	97%	81%	72%	65%	29%	23%	21%	39%	0.0%	140	6%	9%	68%	79%	69%	70%	15%	19%	89%	46%	0.0%
	160	27%	37%	97%	81%	72%	65%	28%	23%	21%	39%	0.0%	160	3%	7%	55%	74%	62%	64%	14%	18%	86%	44%	0.0%
	180	27%	37%	97%	81%	72%	64%	28%	23%	21%	39%	0.0%	180	2%	6%	48%	71%	59%	61%	14%	18%	84%	43%	0.0%
	200	27%	37%	97%	81%	71%	63%	28%	23%	20%	39%	0.0%	200	2%	5%	43%	66%	53%	55%	13%	17%	82%	42%	0.0%
2022/23	0	27%	33%	95%	84%	66%	63%	25%	24%	23%	28%	0.0%	0	43%	41%	98%	95%	87%	78%	18%	22%	94%	64%	0.2%
	20	27%	33%	95%	84%	65%	63%	25%	24%	23%	28%	0.0%	20	31%	34%	96%	93%	83%	74%	18%	21%	92%	63%	0.1%
	40	27%	33%	95%	84%	65%	62%	24%	24%	23%	28%	0.0%	40	21%	28%	93%	91%	80%	71%	17%	21%	91%	62%	0.0%
	60	27%	33%	95%	84%	65%	61%	24%	23%	22%	28%	0.0%	60	15%	24%	89%	89%	76%	67%	16%	20%	90%	60%	0.0%
	80	27%	33%	94%	84%	65%	61%	24%	23%	22%	28%	0.0%	80	10%	20%	85%	87%	72%	64%	16%	20%	89%	59%	0.0%
	100	27%	33%	94%	84%	64%	60%	24%	23%	22%	28%	0.0%	100	7%	17%	80%	84%	69%	60%	15%	19%	87%	58%	0.0%
	120	26%	33%	94%	84%	64%	60%	24%	23%	22%	28%	0.0%	120	5%	15%	74%	82%	65%	57%	15%	19%	86%	57%	0.0%
	140	26%	33%	94%	84%	64%	59%	23%	23%	22%	28%	0.0%	140	4%	13%	68%	80%	62%	53%	15%	18%	84%	55%	0.0%
	160	26%	32%	94%	84%	64%	58%	23%	22%	22%	27%	0.0%	160	3%	11%	63%	78%	59%	50%	14%	18%	83%	54%	0.0%
	180	26%	32%	94%	84%	63%	58%	23%	22%	21%	27%	0.0%	180	2%	10%	57%	76%	56%	47%	14%	18%	81%	53%	0.0%
	200	26%	32%	94%	84%	63%	57%	23%	22%	21%	27%	0.0%	200	1%	8%	52%	73%	53%	43%	13%	17%	80%	52%	0.0%
2023/24	0	37%	29%	92%	83%	55%	68%	34%	32%	34%	32%	0.1%	0	40%	36%	97%	95%	81%	70%	17%	22%	90%	49%	0.1%
	20	37%	28%	92%	83%	54%	67%	33%	32%	34%	32%	0.0%	20	29%	30%	94%	94%	77%	66%	16%	22%	89%	48%	0.0%
	40	36%	28%	92%	83%	54%	67%	33%	32%	34%	32%	0.0%	40	21%	25%	90%	92%	73%	63%	16%	21%	87%	47%	0.0%
	60	36%	28%	92%	83%	54%	66%	33%	32%	33%	32%	0.0%	60	15%	21%	85%	90%	70%	59%	15%	21%	86%	46%	0.0%
	80	36%	28%	92%	83%	54%	66%	33%	31%	33%	32%	0.0%	80	11%	18%	80%	89%	66%	56%	15%	20%	84%	45%	0.0%
	100	36%	28%	92%	83%	54%	65%	32%	31%	33%	31%	0.0%	100	8%	16%	75%	87%	63%	52%	14%	20%	82%	43%	0.0%
	120	36%	28%	91%	83%	53%	65%	32%	31%	33%	31%	0.0%	120	6%	14%	70%	85%	60%	49%	14%	19%	81%	42%	0.0%
	140	36%	28%	91%	83%	53%	64%	32%	31%	33%	31%	0.0%	140	4%	12%	65%	84%	57%	46%	13%	19%	79%	41%	0.0%
	160	36%	28%	91%	83%	53%	64%	32%	31%	33%	31%	0.0%	160	3%	11%	59%	82%	54%	43%	13%	19%	77%	40%	0.0%
	180	36%	28%	91%	83%	53%	63%	31%	31%	32%	31%	0.0%	180	3%	10%	54%	81%	51%	40%	13%	18%	76%	39%	0.0%
	200	35%	28%	91%	82%	52%	63%	31%	30%	32%	31%	0.0%	200	2%	8%	49%	79%	48%	37%	13%	18%	74%	38%	0.0%

Table 9/10: sal.neac.a II

3.5 Update the Framework of Indicators

- Used to identify any significant change in the previously provided multi-annual management advice
- Used in NEAC and WGC (only 5 NEAC indicators used)

- ✓ Updating indicator variables
- ✓ Running the objective function spreadsheet for each indicator variable and the variable of interest relative to the management objectives
- ✓ Quantifying the threshold values for the indicator variables
- ✓ Revising/adding the indicator variables
- ✓ Providing the spreadsheet for FWI assessment
- ✓ 23 variables, 13 rivers

FWI NEAC		2022		Indicators suggest		REASSESS					
Indicators for Northern NEAC 1SW PFA											
Insert data from 2021 here					Median PFA in 2021		Reassess in year 2022		Outside 75% conf. lim.		
	N:reg	Slope	Inter:ced	f	12.5%ile	87.5%ile	below	above	below	above	
1 Returns all 1SW NO PFA est	37	0.514762	-27073.84	0.82	371981	11272.83	21694.28	0	0	Uniformative	Uniformative
2 Survival W 1SW NO Impa	37	0.000011	-2.95	0.47	371981	-2.48	6.45	0	0	Uniformative	Uniformative
3 Survival H 1SW NO Impa	38	0.000005	-0.43	0.31	371981	-1.17	4.31	0	0	Uniformative	Uniformative
4 Counts all Anghin (1SW)	18	0.000101	-16.38	0.38	371981	2.77	76.08	0	0	Uniformative	Uniformative
5 Counts all NO Nautea (1SW)	23	0.001068	302.92	0.22	371981	49.48	1751.08	0	0	Uniformative	Uniformative
6 Catch T&N 1SW R	22	0.016887	-672.3621	0.51	371981	-2965.78	1372.16	0	0	Uniformative	Uniformative
						Sum of scores		0	0		
										Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation.
Indicators for Northern NEAC MSW PFA											
Insert data from 2021 here					Median PFA in 2021		Reassess in year 2022		Outside 75% conf. lim.		
	N:reg	Slope	Inter:ced	f	12.5%ile	87.5%ile	below	above	below	above	
1 PFA-MSW-Coastforway	37	0.328948	17743.77	0.79	621052	149154.03	238816.26	0	0	Uniformative	Uniformative
2 Orka counts	17	0.013480	-3420.75	0.56	621052	1593.48	8612.91	0	0	Uniformative	Uniformative
3 Counts all NO Nautea	23	0.003329	-1189.20	0.33	621052	5.92	1685.55	0	0	Uniformative	Uniformative
4 Returns all 2SW NO PFA est	27	0.2051312	37948.148	0.31	621052	698477.54	2187161.88	0	0	Uniformative	Uniformative
5 Catch W T&N 2SW F	22	0.008092	-2368.398	0.36	621052	-571.96	4291.26	0	0	Uniformative	Uniformative
						Sum of scores		0	0		
										Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation.
Indicators for Southern NEAC 1SW PFA											
Insert data from 2021 here					Median PFA in 2021		Reassess in year 2022		Outside 75% conf. lim.		
	N:reg	Slope	Inter:ced	f	12.5%ile	87.5%ile	below	above	below	above	
1 Ret. 1SW UKE&W Tamer M	27	0.001914	1101.95	0.31	616418	968.67	3504.69	0	0	Uniformative	Uniformative
2 Ret. W 1SW UKE&W Frome M	45	0.000354	-78.81	0.43	616418	-261.69	712.03	0	0	Uniformative	Uniformative
3 Ret. W 1SW UKE&W North Esk M	40	0.006883	2807.30	0.68	616418	3877.19	10223.23	0	0	Uniformative	Uniformative
4 Surv. W 1SW UKE&W Bush M	32	1.845E-05	-9.69956	0.64	616418	-8.22	10.80	0	0	Uniformative	Uniformative
5 Ret. Freshw 1SW UKE&W Bush	45	0.000349	633.07	0.29	616418	73.98	1522.24	0	0	Uniformative	Uniformative
6 Ret. W 1SW UKE&W Dee M	29	0.0038297	-1028.336	0.58	616418	-189.00	2951.74	0	0	Uniformative	Uniformative
7 Count 1SW UKE&W Forney M	26	0.0004136	171.28444	0.30	616418	155	658	0	0	Uniformative	Uniformative
8 Surv. 1SW UKE&W Frome	17	4.428E-06	0.204425	0.32	616418	1	8	0	0	Uniformative	Uniformative
9 Surv.coast 1SW UKE&W Dee M	24	2.884E-06	-0.319153	0.35	616418	-0.33	0.37	0	0	Uniformative	Uniformative
						Sum of scores		0	0		
										Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation.
Indicators for Southern NEAC MSW PFA											
Insert data from 2021 here					Median PFA in 2021		Reassess in year 2022		Outside 75% conf. lim.		
	N:reg	Slope	Inter:ced	f	12.5%ile	87.5%ile	below	above	below	above	
1 Ret. W 2SW UKE&S Baddoch NIM	33	0.000092	-12.55	0.37	956441	7.76	26.00	0	0	Uniformative	Uniformative
2 Ret. W 2SW UKE&S Girnoch NIM	49	0.000049	2.19	0.40	956441	0.39	69.17	0	0	Uniformative	Uniformative
3 Ret. W MSW UKE&W Inchon NIM	33	0.000307	-63.78	0.26	956441	16.49	202.05	0	0	Uniformative	Uniformative
4 Ret. W 1SW UKE&W Inchon NIM	32	0.001036	-289.12	0.41	956441	63.41	446.88	0	0	Uniformative	Uniformative
5 Ret. W MSW UKE&W Frome NIM	48	0.000847	74.39	0.31	956441	-12.74	119.67	0	0	Uniformative	Uniformative
6 Ret. W 1SW UKE&W Frome NIM	47	0.000741	154.34	0.22	956441	-0.85	1154.04	0	0	Uniformative	Uniformative
7 Catch W MSW in Bilspar NIM	49	0.000120	-33.32	0.53	956441	-21.11	68.63	0	0	Uniformative	Uniformative
8 Ret. W 1SW UKE&S North Esk NIM	39	0.011622	4214	0.25	956441	59.49	15622	0	0	Uniformative	Uniformative
9 Ret. W 2SW UKE&S North Esk NIM	40	0.008909	848.40233	0.53	956441	3988.83	8496.65	0	0	Uniformative	Uniformative
						Sum of scores		0	0		
										Indicators suggest that the PFA forecast is an overestimation.	Indicators suggest that the PFA forecast is an underestimation.

Figure 12: sal.neac.all