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CNL(24)56

# ICES Advice Highlights

*Photo by Nick Hawkins*



An underwater photograph showing several salmon swimming in clear blue water. The fish are silhouetted against the bright light filtering down from the surface. The water is clear, and the fish are in various positions, some swimming towards the camera and others away from it. The overall scene is serene and captures the natural behavior of the fish.

*sal.oth.all*

## North Atlantic Salmon Stocks

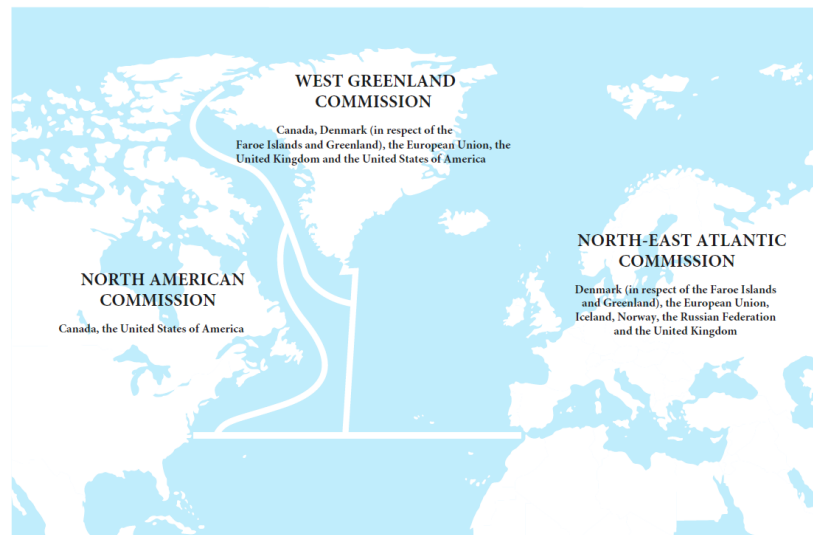
*Photo by Nick Hawkins*



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# Background

- NASCO Commissions: North American (NAC), West Greenland (WGC) and North-East Atlantic (NEAC)
- Management framework for Atlantic salmon in the North Atlantic



## 1. With respect to Atlantic salmon in the North Atlantic area:

- 1.1 provide an overview of salmon catches and landings by country, including unreported catches and catch and release, and production of farmed and ranched Atlantic salmon in 2023
- 1.2 report on significant new or emerging threats to, or opportunities for, salmon conservation and management
- 1.3 provide a compilation of tag releases by country in 2023
- 1.4 identify relevant data deficiencies, monitoring needs and research requirements
- 1.5 provide an update on the distribution and abundance of pink salmon across the North Atlantic through 2023.

Published as 'sal.oth.all' advice sheet for North Atlantic salmon (*Salmo salar*) stocks



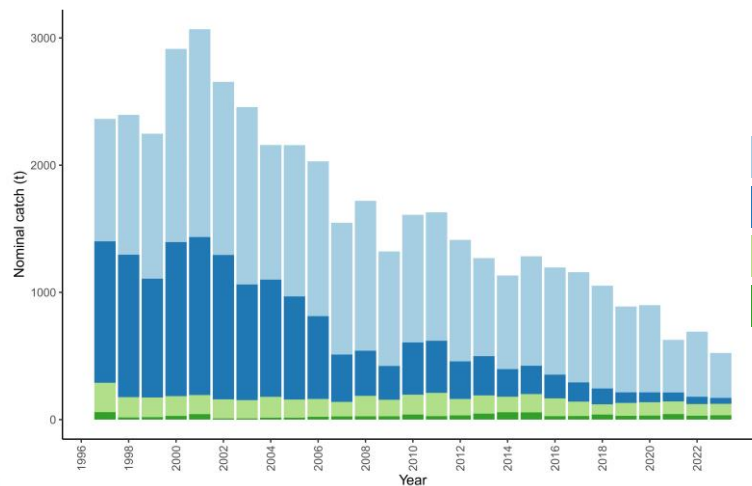
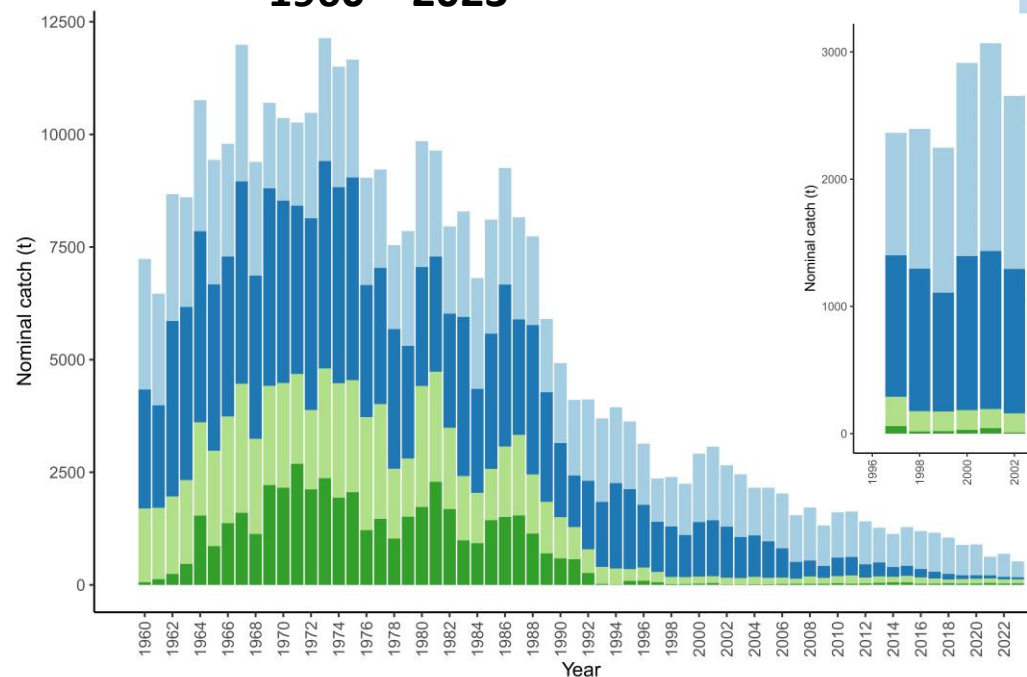
# ToR 1.1 Nominal Catch

- Reported whole weight of fish caught and retained
- Released fish not included

from Table 1: *sal.oth.all*

Year	2020	2021	2022	2023
NEAC	761	487	569	452
NAC	105	100	91	89
WGC	32	43	31	34
Total	898	630	691	576

1960 – 2023



1998 – 2023

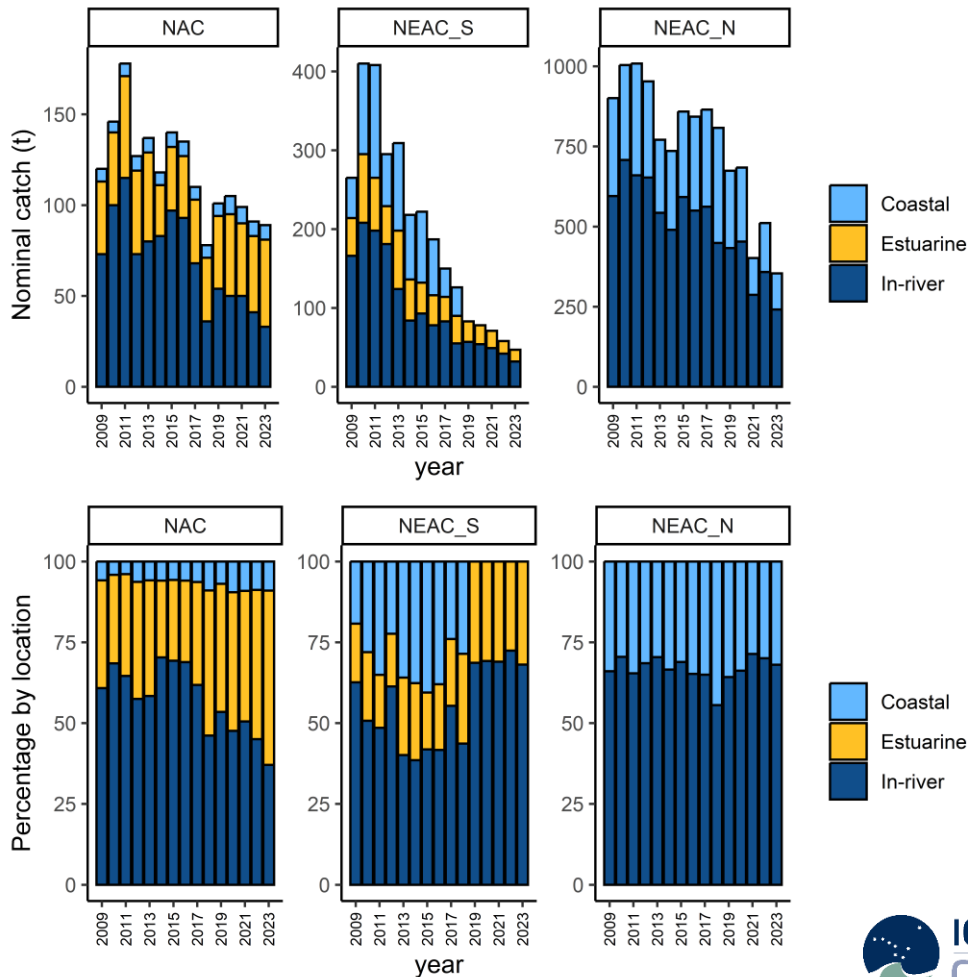
Figure 1: *sal.oth.all*



# ToR 1.1 Location of Catches

## Coastal Catches (~mixed stocks) (Figure 2: sal.oth.all)

- N-NEAC: 29% - 44% since 2008
- S-NEAC: 0% since 2021
- NAC: < 10% since 2007





## ToR 1.1 Unreported Catches

- Legal under-reporting, non-reporting and illegal catch (tonnes)

from Table 3: *sal.oth.all*

Area	2021	2022	2023
NEAC	134	174	95
NAC	19	18	16
WGC	10	10	10
Total	163 t	202 t	121 t

## ToR 1.1 Catch-and-Release (C&R)



Photo by Aaron Krick

- > 144 000 salmon released in 2023
- Percentage released in 2023 ranged from:
  - 4% in France to 96% UK (Scotland)
- Reflects varying management practices and angler attitudes
- Practice of C&R generally increasing

# ToR 1.1 Farming and Sea Ranching

## Farmed

- North Atlantic 2023: > 1.9 million tonnes
  - 79% in Norway and 10% in UK (Scotland)
- Worldwide - > 2.8 million tonnes

## Ranched

- North Atlantic 2023: 15 t
  - 76% in Iceland
  - 24% in Sweden

Figure 4: *sal.oth.all*

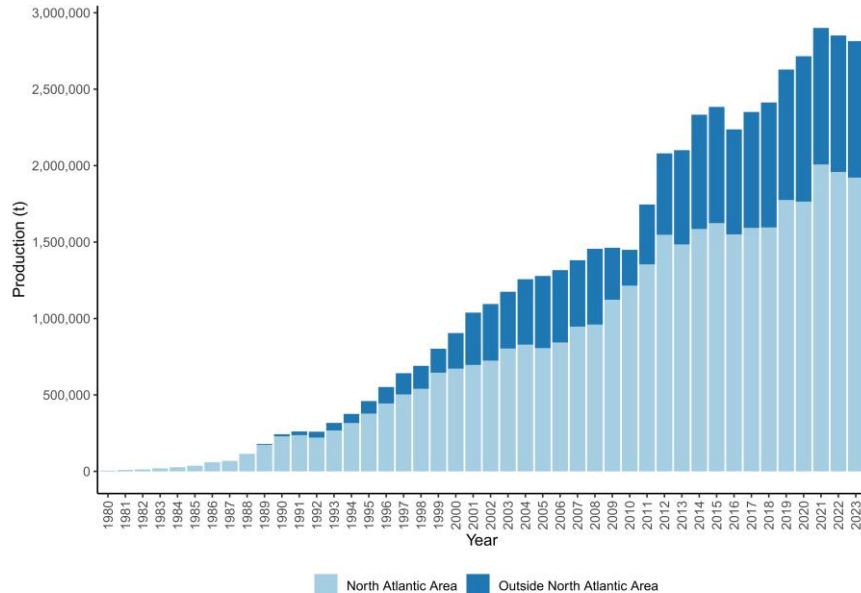
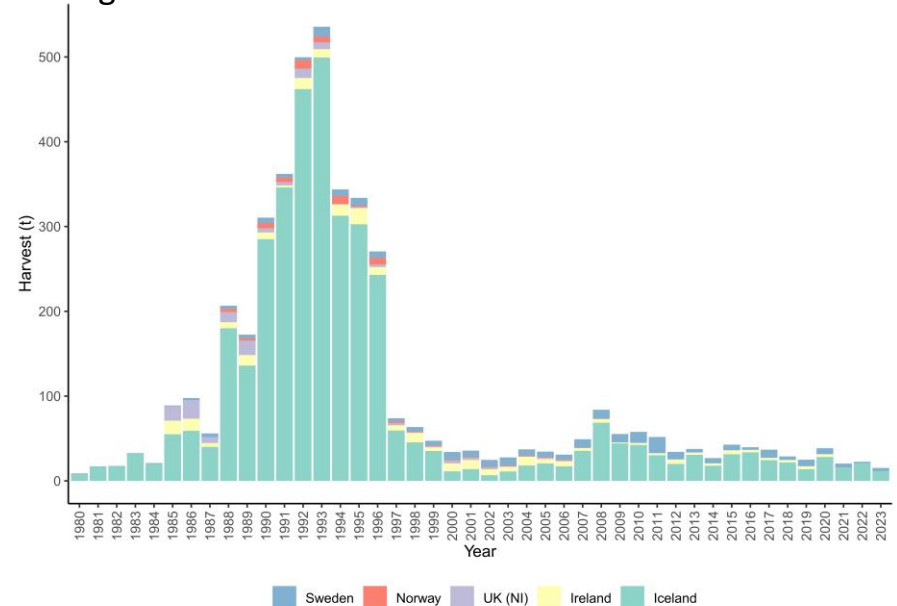


Figure 5: *sal.oth.all*





# ToR 1.2 Emerging Threats and Opportunities

## Threats

- Offshore aquaculture (Norway)
- Urban runoff mortality syndrome (Pacific salmon)

## Opportunities

- Enhanced spatial resolution stock ID baseline for eastern Atlantic – in development
- New method for estimating salmon returns to rivers in UK (England & Wales)
- Updates on Eastern Canadian offshore, and West Greenland, tracking programs

# ToR 1.3 Tag Releases

Summary in Table 4: *sal.oth.all*

- 2023: 1.1 million salmon marked
- mainly adipose fin clips: 0.8 million
- mainly hatchery juveniles: 0.985 million
- ~78 000 wild juveniles and ~2000 wild adults
- ~80 000 external tags/marks

## ToR 1.5 Data Deficiencies, Monitoring Needs, and Research Requirements

- Complete and timely reporting of catch statistics, including by-catch, recommended for all
- All countries/jurisdictions to submit salmon data through the ICES data call process (all but Faroes & Portugal now).
- No direct Russian data for 2021-2023. Catches estimated from reports to NASCO, but catch advice based on extrapolations for stock units. Without data, uncertainty will increase to a level that negates this procedure.



## ToR 1.4 Pink Salmon

Pink salmon numbers are reported from catches, removals, counts and observations, in both fresh- and marine waters.

- Norway and Finland: substantial increases in 2023 compared to previous 'odd' years in northern region of Troms and Finnmark, and the Tana/Teno river systems.
- Iceland and Greenland also reported an increase in numbers.
- All other jurisdictions reported similar or lower numbers compared to previous years.





*sal.neac.all*

Atlantic salmon from Northeast Atlantic

*Photo by Alan Walker*



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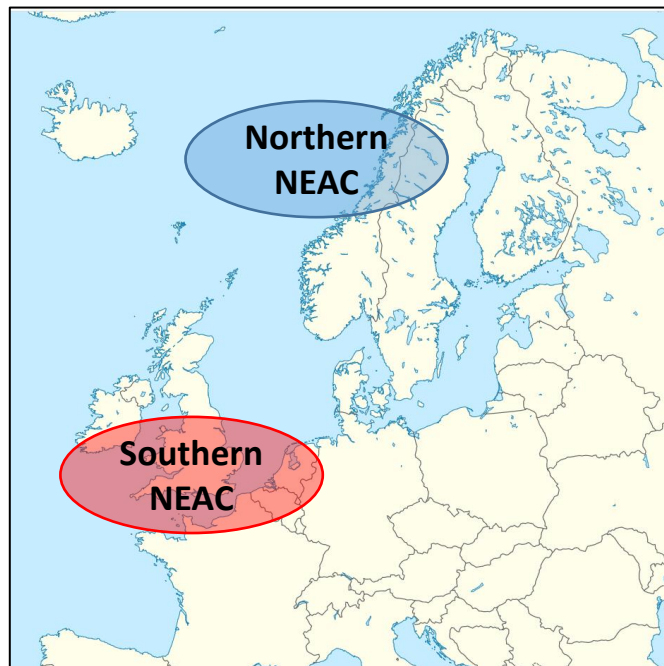


## **2. With respect to Atlantic salmon in the North-East Atlantic Commission area:**

- 2.1 describe the key events of the 2023 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 2024/2025–2026/2027 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

# Background

- Northeast 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 and Wales)
- UK (N. 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

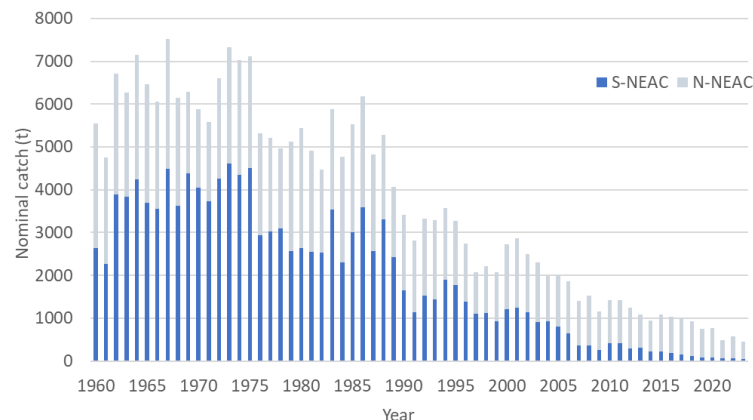
## 2.1 Key Events 2023 Fisheries: Catch



- No significant changes in the gear types used
- No fishery Faroes since 2000
- NEAC Reported Nominal Catch 2023 lowest in the time series for both Northern and Southern areas
- Sea age split:
  - Southern NEAC (~84% 1SW)
  - Northern NEAC (~58% 1SW)

Table 1a,b: sal.neac.all

2023	Southern NEAC	Northern NEAC	Total NEAC
Catch (t)	47	405	452
Catch as % of NEAC total	11	89	
Unreported catch			95
Location of catches			
% in-river	68	68	68
% in estuaries	32	0	3
% coastal	0	32	29

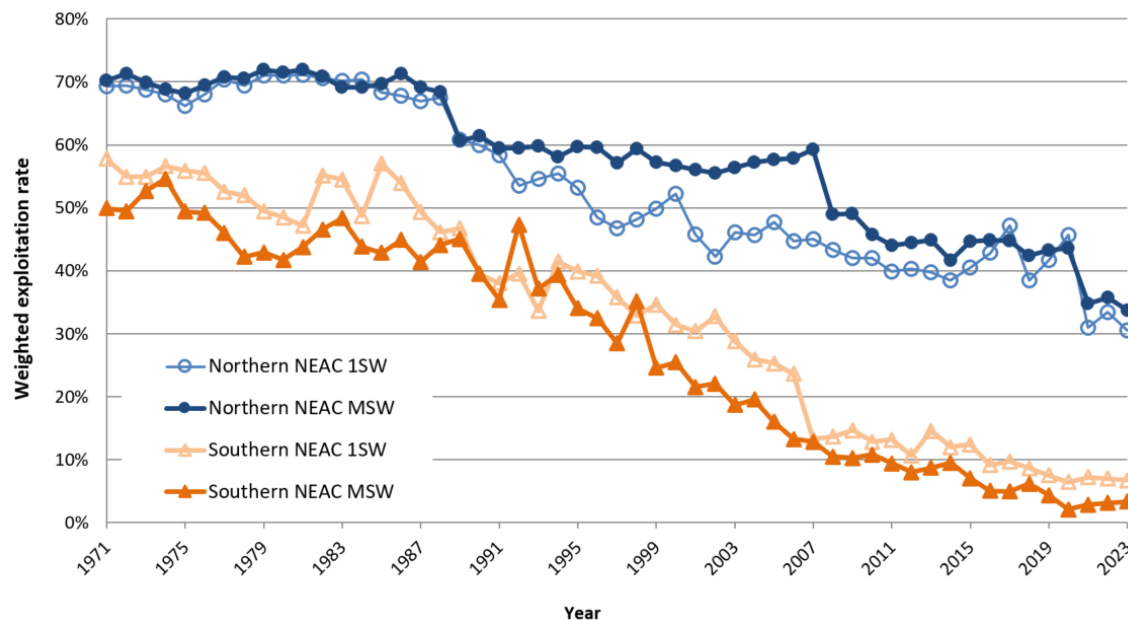




## 2.1 Key Events 2023 Fisheries: Exploitation Rate

- Exploitation rates have decreased since the early 1970s
- Rates on 1SW and MSW salmon have become similar

Figure 3: sal.neac.all



## 2.2 Stock Conservation Limits (CLs): development & updating the number of river stocks with CLs

- Nine jurisdictions with river-specific CLs
- Russia & Iceland – all/several rivers but not used for national assessments

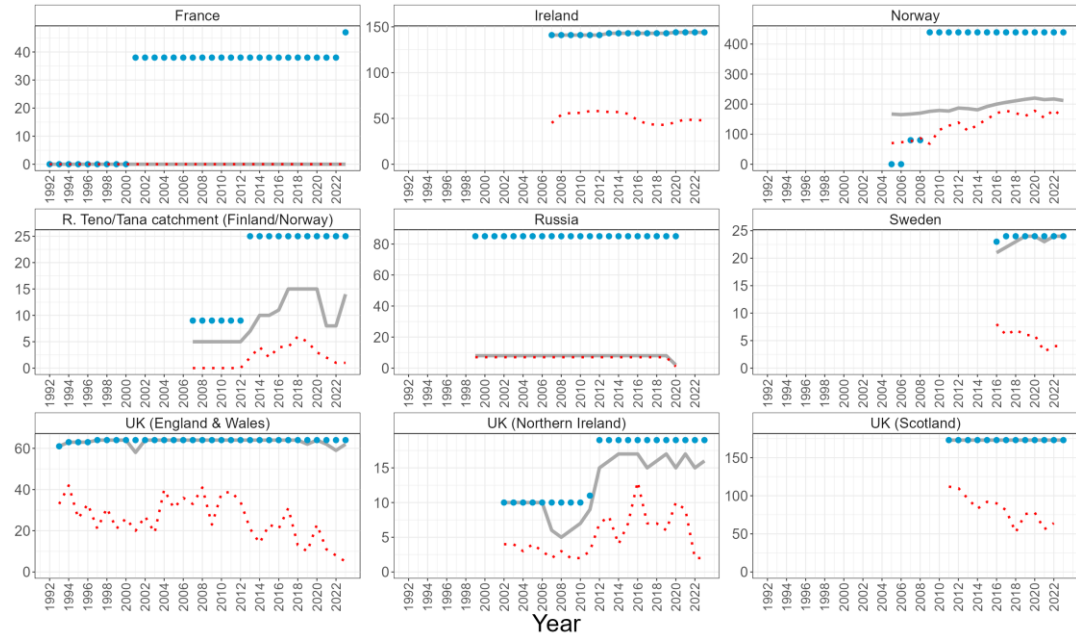
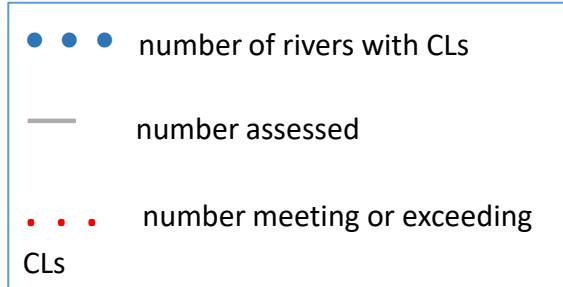


Figure 4: sal.neac.all

Teno/Tana values are for tributaries with separate CLs

## 2.3 Stock Status: Trends in Rivers Meeting CLs

Table 4: sal.neac.all 2023

Country /Jurisdiction	Rivers with CLs (number)	Rivers assessed for compliance (number)	Rivers attaining CL (number)	Assessed rivers attaining CL (%)	Trend in the last 10 years
Northern NEAC					
Russian Federation	*	*	*	*	Unknown
Norway/Finland (Tana/Teno)	25	14	1	7	Variable
Norway	439	212	153	72	Increasing
Sweden	24	24	4	17	Decreasing
Southern NEAC					
UK (Scotland)	173	173	64	37	Decreasing
UK (Northern Ireland)	19	16	2	12	Variable
UK (England & Wales)	64	62	5	8	Decreasing
Ireland	144	144	48	33	Minor variability
France	47	0	n/a	n/a	n/a

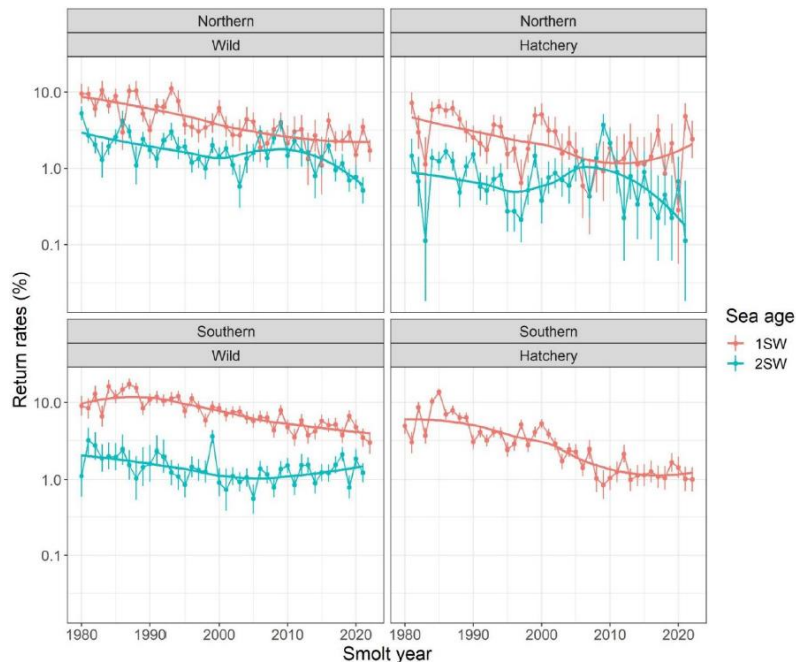
\* No data available.



## 2.3 Stock Status: Return Rates (Marine Survival proxy)

Figure 5: sal.neac.all

- Wild and hatchery rates available
- 1SW declining trend since 1980 though wild flattening
- 2SW N-NEAC very variable but declining
- 2SW S-NEAC (wild) increasing
- Little improvement of stock status over time
- Mainly a consequence of continuing poor survival in the marine environment

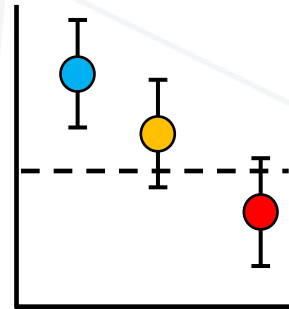


## 2.3 Stock Status

- The status of stocks in the Northeast Atlantic was assessed relative to the probability of returns and spawners exceeding CLs at the stock complex and national levels, using
  - Run-Reconstruction (1971 to 2023)
  - Life-cycle Model forecasts (2024/25-2026/27)

### 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: Countries/jurisdictions: returns & spawners



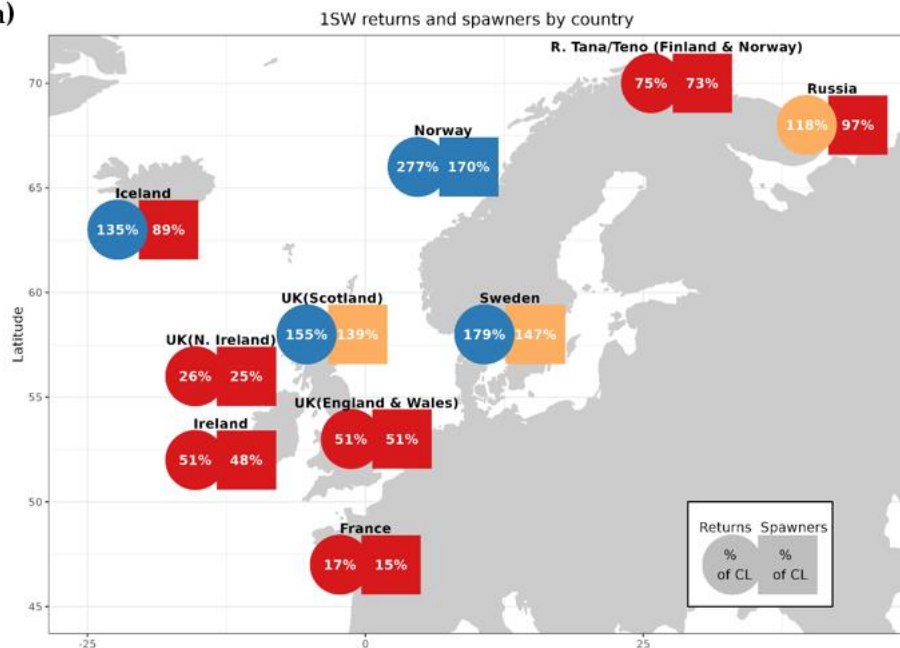
- Two main patterns apparent:
  - More stocks in Southern NEAC countries were suffering, or at risk of suffering, reduced reproductive capacity compared to Northern NEAC countries.
  - 1SW stocks were more likely to be suffering, or at risk of suffering, reduced reproductive capacity compared to MSW stocks.
- Within Northern NEAC countries
  - Returning 1SW and MSW stocks in Norway, Sweden and Iceland (northeast) were at full reproductive capacity in 2023; elsewhere either suffering, or at risk of suffering, reduced reproductive capacity.
  - Changes between returns and spawners in Iceland (1SW & MSW), Sweden (1SW) and Russia (1SW & MSW) show the impact of homewater exploitation.
  - 1SW return and spawner estimates were among the lowest in the time-series. Similar for MSW returns in most countries, but spawner estimates not ranked among the lowest values.
- Within Southern NEAC countries:
  - All 1SW and MSW stocks were suffering reduced reproductive capacity in 2023, except for UK (Scotland) and MSW UK (England & Wales).
  - Changes between returns and spawners in UK (Scotland) 1SW component.
  - 1SW return and spawner estimates were lowest, or second lowest, in the time-series. MSW return and spawner estimates were among the lowest in the time-series for all countries except UK (England & Wales)



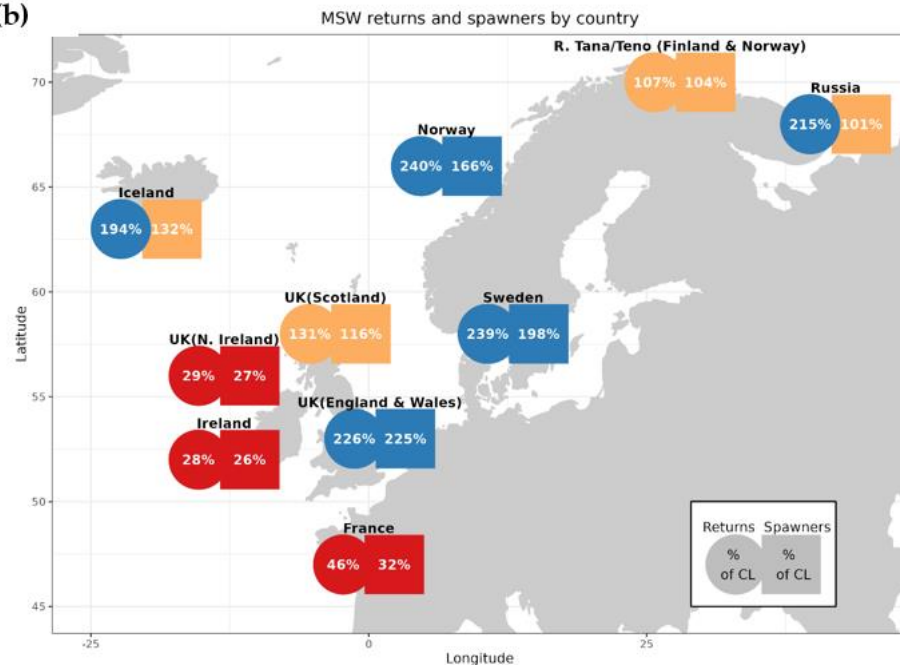
## 2.3 Stock Status: returns & spawners

Figure 6: sal.neac.all

(a)



(b)



Full reproductive capacity



Risk of suffering reduced reproductive capacity



Suffering reduced reproductive capacity

## 2.3 Stock Status: 2023 Northern NEAC stock complex

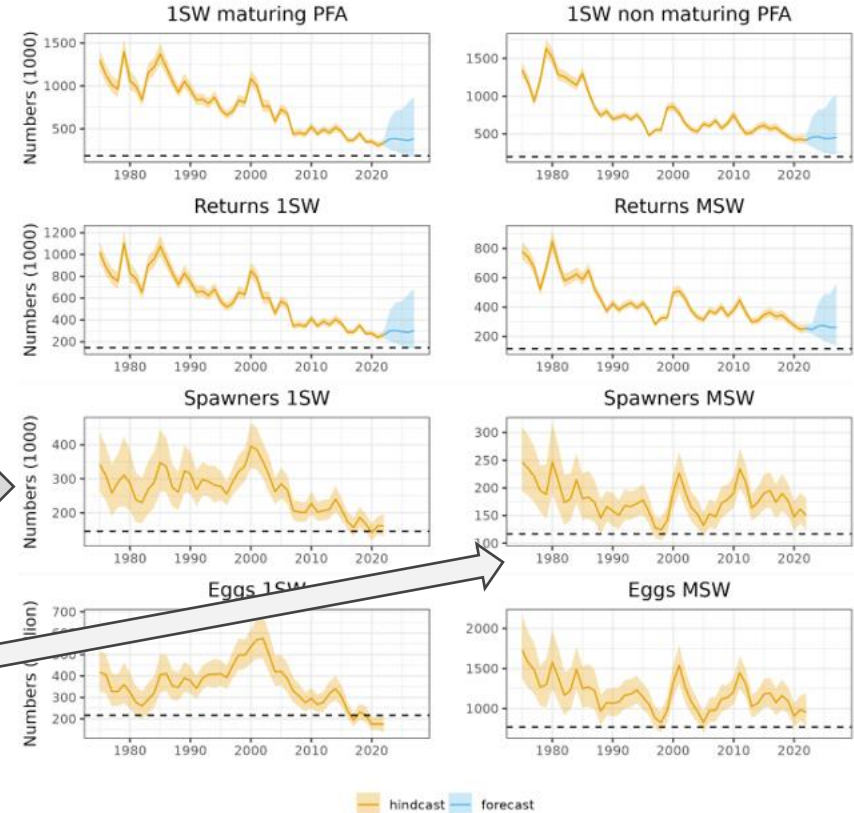


Figure 7: sal.neac.all

- General decline in both age classes, more pronounced in 1SW

In 2023,

- both returning age classes at full reproductive capacity, but lower than previous 5y mean, and 2<sup>nd</sup> lowest in time series
- 1SW spawners at risk of suffering reduced reproductive capacity, amongst lowest in time series.
- MSW spawner abundance similar to last 5y mean, and at full reproductive capacity



## 2.3 Stock Status: 2023 Southern NEAC stock complex

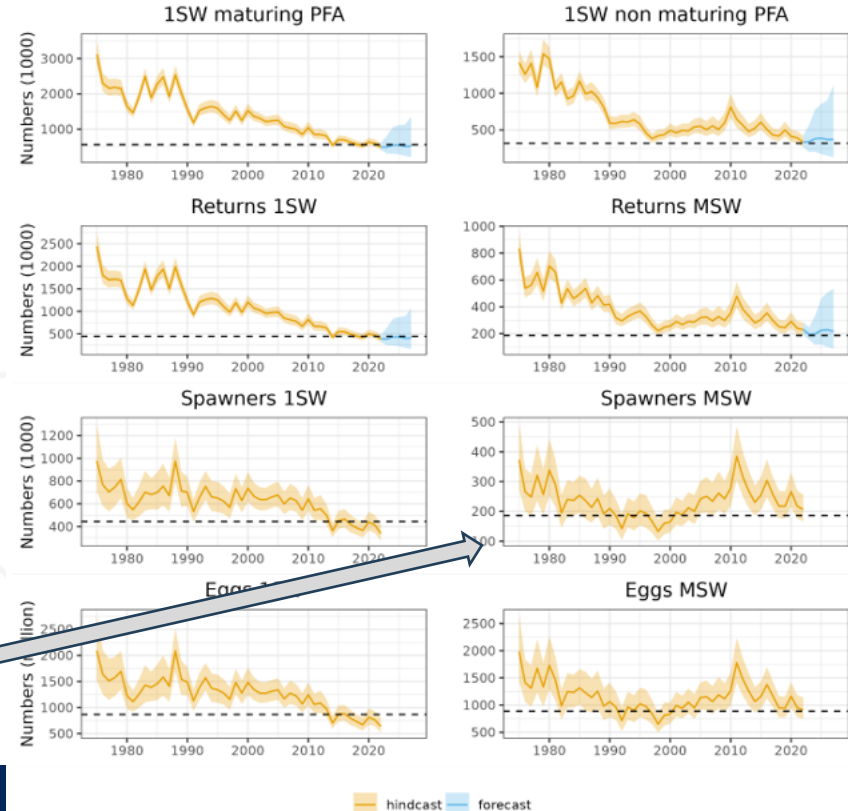


Figure 8: sal.neac.all

- General decline in both age classes, more pronounced in 1SW

In 2023,

- 1SW returns suffering reduced reproductive capacity, lowest in time series
- MSW returns at risk of suffering reduced reproductive capacity, 2<sup>nd</sup> lowest in time series
- 1SW spawners suffering reduced reproductive capacity, lowest in time series.
- MSW spawner abundance at risk of suffering reduced reproductive capacity, decreased 25% from last 5y mean



## ToR 2.4 Catch Options for 2024/25 to 2026/27

- Forecasts until 2027 for the Southern and Northern NEAC complexes were developed within the LCM.
- The probabilities of meeting CLs are higher in the Northern than in the Southern complex and are generally higher for the Northern countries than the Southern countries.
- In the absence of a NASCO-agreed risk level for Faroes fishery, ICES uses a 95% probability of meeting individual CLs, applied at the level of the European stock complexes (Southern and Northern NEAC) and the NEAC countries/jurisdictions for 1SW and MSW components separately.
- In the absence of any fisheries in the Faroes in 2024/2025 to 2026/2027, there is a less than 95% probability of meeting the CLs for the Southern NEAC complex for both the 1SW and MSW components, and for the Northern NEAC 1SW component.
- Among countries/jurisdictions, only Norway meets its CL for the 1SW component (2024/2025 to 2026/2027 for TACs  $\leq 200$  t), and only Russia and Norway meets their CLs for the MSW component (2024/2025 season for TACs  $\leq 160$  t and  $\leq 20$  t for Russia and Norway, respectively).
- Therefore, in the absence of specific management objectives, there are no mixed-stock fisheries options at the Faroes in 2024/2025 to 2026/2027.





*Photo by Stephen Gregory*



*sal.nac.all*

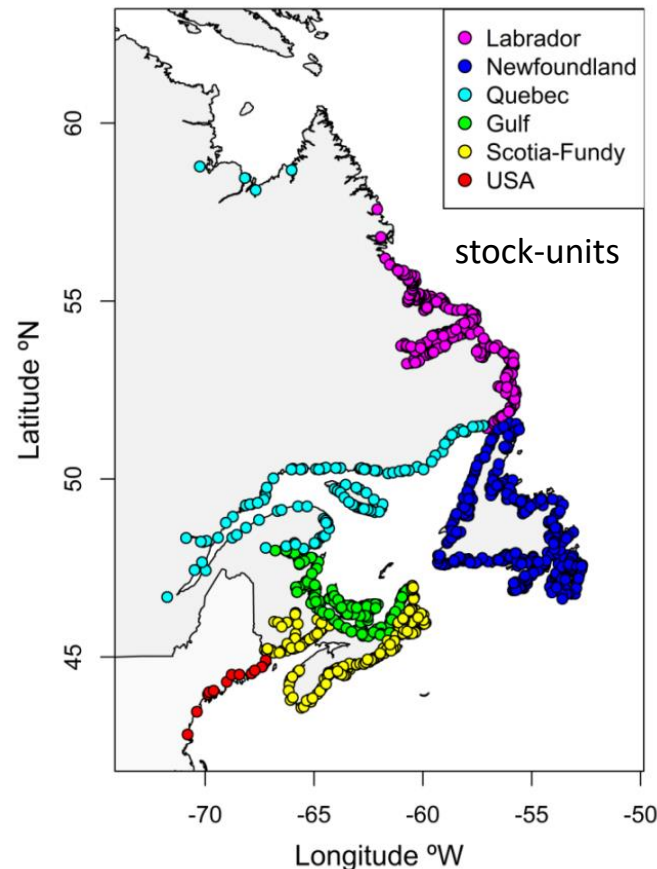
Atlantic salmon from North America



# Terms of Reference

## 3. With respect to Atlantic salmon in the North American Commission area:

- 3.1 describe the key events of the 2023 fisheries (including the fishery at Saint Pierre and Miquelon);
- 3.2 update age-specific stock conservation limits based on new information as available, including updating the time-series of the number of river stocks with established CLs by jurisdiction;
- 3.3 describe the status of the stocks, including updating the time-series of trends in the number of river stocks meeting CLs by jurisdiction;
- 3.4 provide catch options or alternative management advice for 2024–2027 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



## ToR 3.1: NAC Catch

No commercial fisheries in Canada since 2000

Canada has Indigenous, Labrador resident  
subsistence & recreational fisheries

SPM professional & recreational licenses

No fisheries in USA since 1999

**2023**

NAC Total: 89.4 t

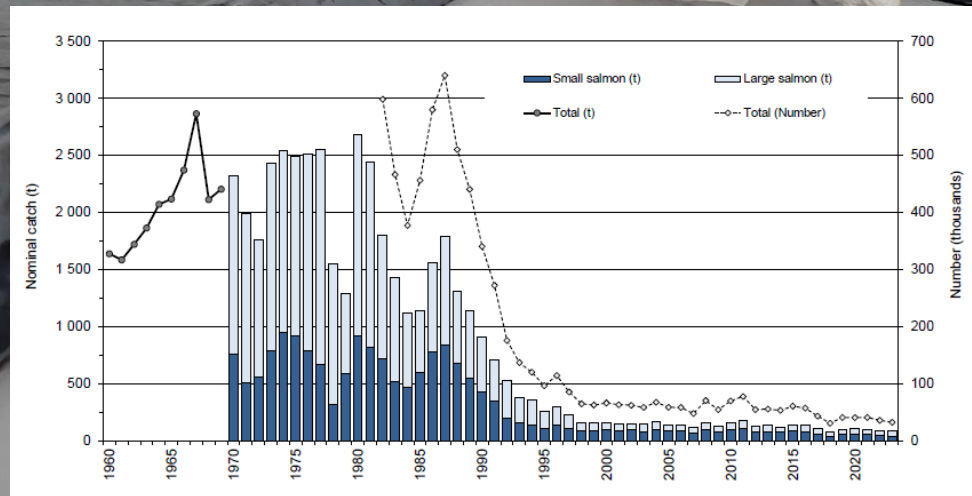
CA: 88 t    SPM: 1.4 t    USA: 0 t

CA: 8% coastal, 54% estuarine, 38% in-river

SPM: all coastal

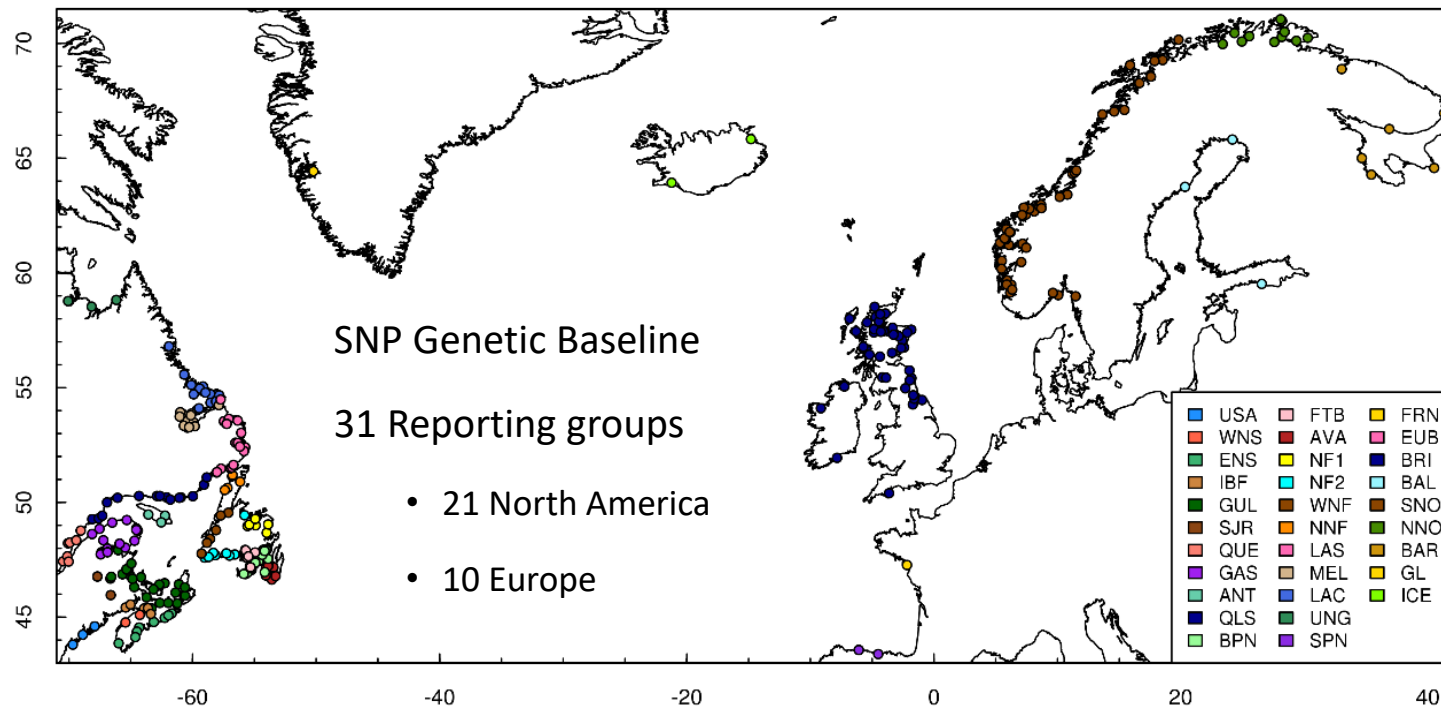
Unreported: 16 t

Catch details in Table 1: *sal.nac.all*



### 3.1 Origin and Composition of Catches (mixed-stock)

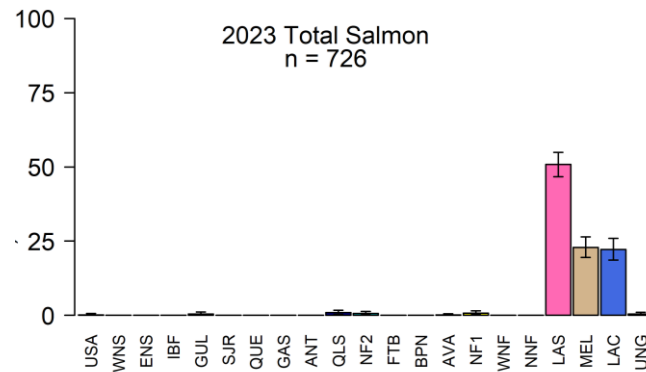
Figure 4: sal.nac.all





## ToR 3.1 Origin and Composition of Catches: Labrador Indigenous and Subsistence Fisheries

- 4.7% of the catch sampled
- >95% samples from the three Labrador groups
- USA origin salmon: 1 fish



from Figures 5: *sal.nac.all*



Photo: Melita Paul



Photo: Charlene Kippenhuck



Photo: Amanda Normore



Photo: Wanda Lee Mesher

# ToR 3.1 Origin and Composition of Catches: Saint Pierre and Miquelon

>94% samples from Quebec, Gulf and Newfoundland

- Large salmon mainly from the Gulf group (82%).
- Small salmon from Newfoundland (52%) and Quebec groups (38%).

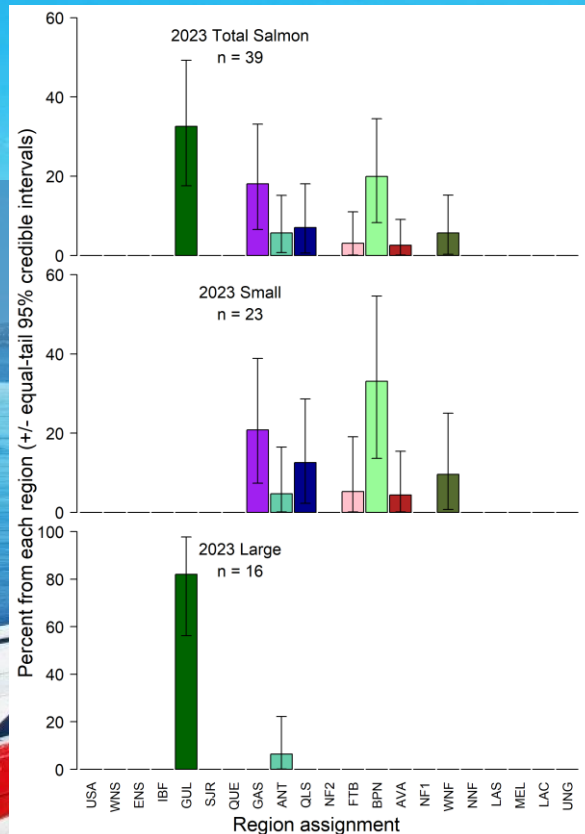
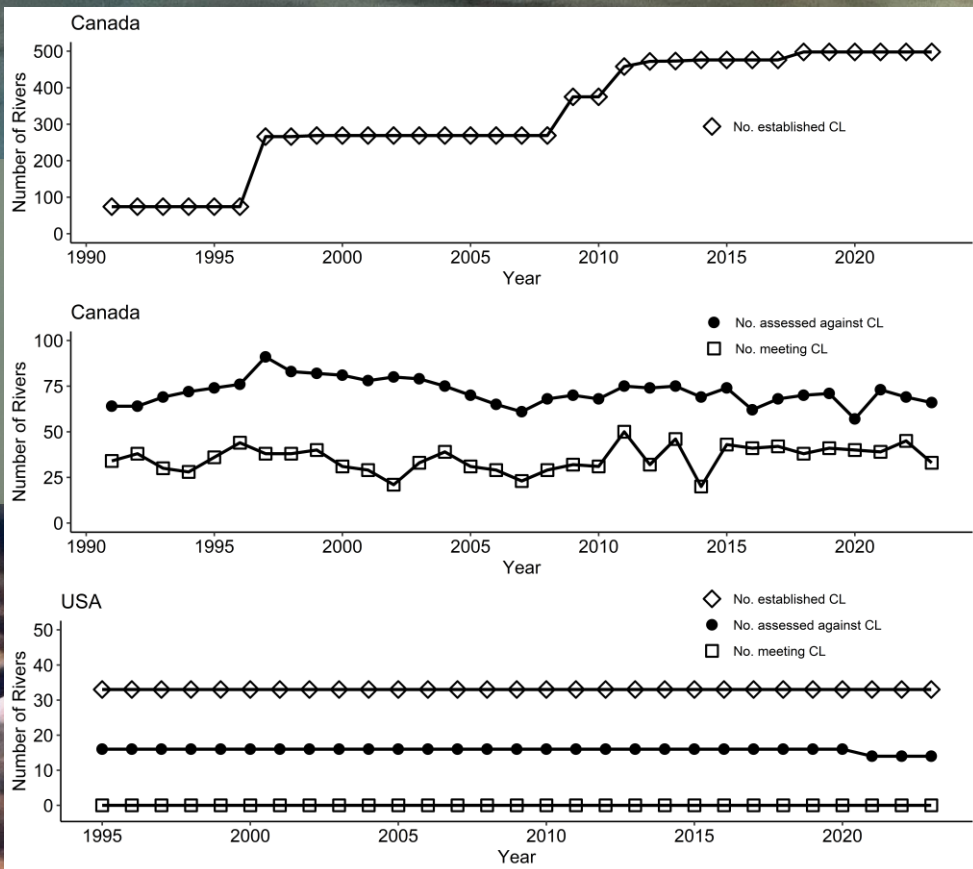


Figure from ICES WGNAS 2024



## ToR 3.2 River Stocks with Established Conservation Limits (CLs)



### Canada: 498 rivers since 2018

- 57 to 91 rivers assessed annually from 1991-2022
- percent achieving CL ranged from 26% to 70% with no temporal trend.

### USA: 33 rivers since 1995

- 13 rivers assessed annually since 2021
- none have met CLs to date

## 4.2 Status of Stocks: Risk Assessment Framework



- Management advice for North American mixed stock fisheries based on non-maturing 1SW salmon (return as 2SW/MSW) from North America (NAC)
  - Returns and Spawners (2 SW NAC) relative to Conservation Limits (CLs)
  - Pre-Fishery Abundance (PFA)

- **Full Reproductive Capacity**

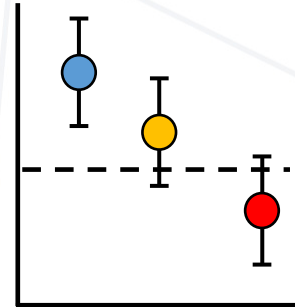
- lower bound of the 90% confidence interval of the estimate above reference point
  - equivalent to a probability of at least 95% of meeting reference point

- **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





## ToR 3.3 Status of Stocks

### Salmon Returns:

- Run-reconstruction (1971 to 2023)
- Life-cycle Model forecasts 2024-2026 (Figures 7 to 13: *sal.nac.all*)

#### 2023: 1SW (mainly small salmon)

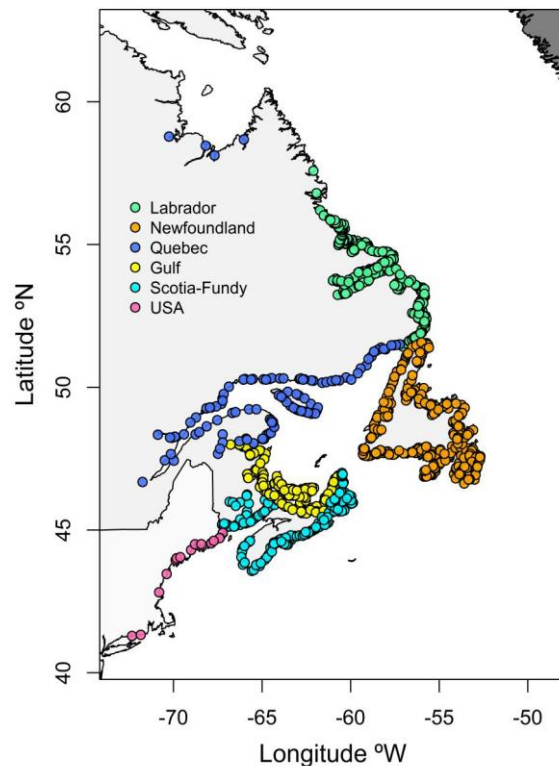
- 499 900 fish returning to NAC
- 95% return to Newfoundland and Labrador
- highest in time-series for Labrador
- lowest in time-series for Gulf and Quebec

#### 2023: MSW (including maiden and repeats)

- 168 700 fish returning to NAC
- 65% return to Labrador and Quebec
- highest in time-series for Labrador; increased USA; decreased elsewhere
- <2% to Scotia-Fundy and USA

#### 2023: 2SW (subset of MSW)

- 112 100 fish returning to NAC
- mainly to Labrador (36%), Quebec (30%) and Gulf (27%)
- 2% to Scotia-Fundy and USA, combined
- 5% to Newfoundland (as predominantly 1SW populations)

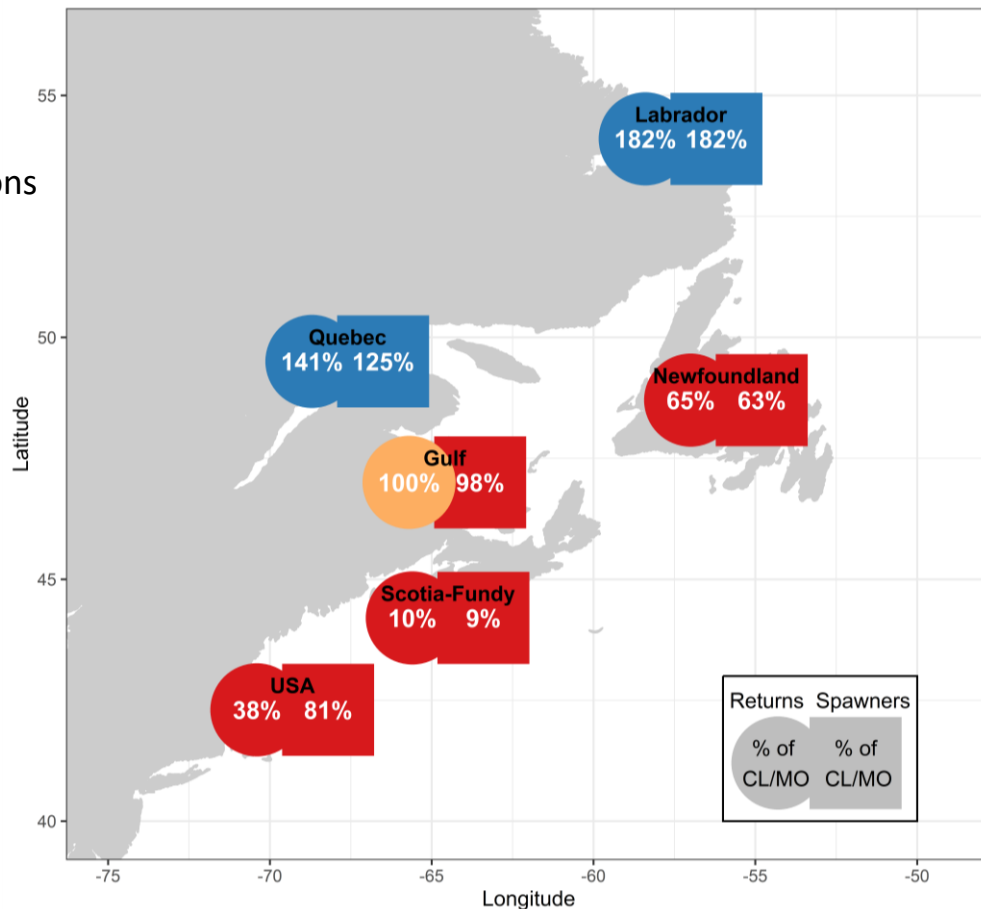
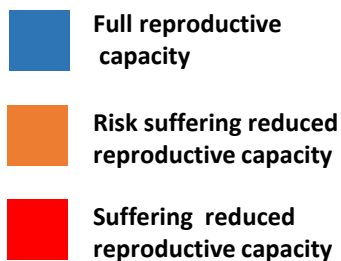


**Figure 2: *sal.nac.all***  
**Map of salmon rivers by stock unit**

## ToR 3.3 Status of Stocks: 2SW Returns and Spawners

- 2023: median returns & spawners <CLs 4 of 6 Regions
- Large deficits in returns for Scotia-Fundy and USA
- USA increased spawner stocking efforts in 2023.

Figure 14: sal.nac.all



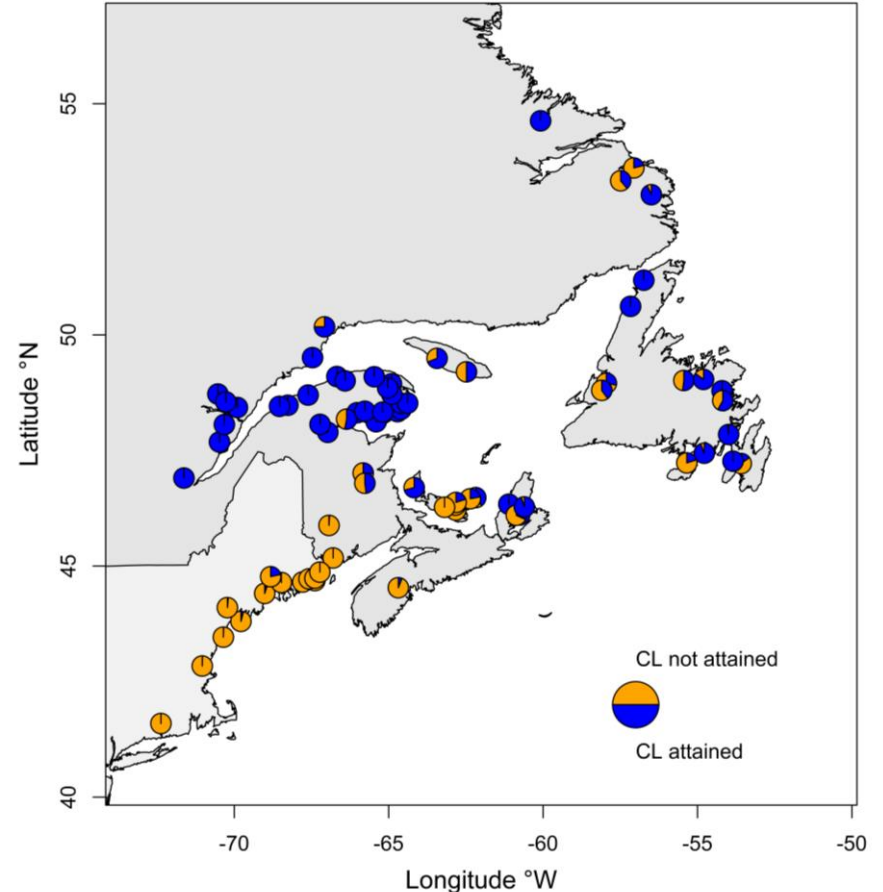
# ToR 3.3 Status of Stocks: River-Specific CL Attainment

**Proportion CL Attained = egg deposition / CL**

2023 – 79 assessed rivers

- 33 (42%) achieved or exceeded CLs
- 33 (42%) were less than 50% CL
- 14 assessed rivers were at <10% CL

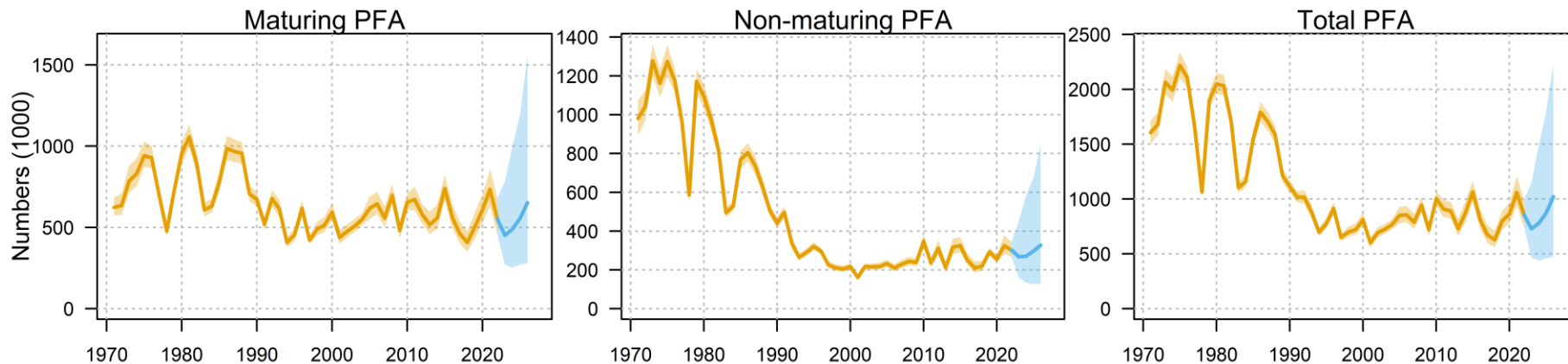
Figure 16: *sal.nac.all*



## ToR 3.3 Pre-Fishery Abundance (PFA)

**PFA: salmon at sea prior to all marine fisheries (01 January of the first winter at sea )**

- Life-cycle Model output: PFA time-series hindcast 1971-2022 and forecasts 2023-2026 PFA years
- two components:
  - 1SW maturing that return as 1SW salmon
  - 1SW non-maturing that return as MSW salmon
- declining trend PFA 1SW non-maturing since the 1970s and persistent low abundance since the early 1990s



from Figure 7: *sal.nac.all*



## ToR 3.4 Catch Options for 2024 to 2027

- Catch options are only considered for non-maturing 1SW and maturing 2SW components as the maturing 1SW component is not fished outside homewaters.
- In the absence of any fishing on 1SW non-maturing salmon and 2SW salmon in North America, there is a less than 75% probability in the period 2024 to 2027 that the numbers of 2SW salmon returning to the six stock-units of North America will be above the defined management objectives simultaneously for the six stock-units.
- ICES advises that, in line with the management objectives agreed by NASCO and consistent with the MSY approach, the catch of one-sea-winter (1SW) non-maturing salmon and two-sea-winter (2SW) salmon in mixed-stock fisheries in North America should be zero in the period 2024 to 2027.
- ICES advises that when the MSY approach is applied, fishing should only take place on salmon from rivers where stocks are at full reproductive capacity.
- Mixed-stock fisheries present particular threats and should be managed based on the individual status of all stocks exploited in the fishery.

**sal.wgc.all**

# **Atlantic Salmon at West Greenland**



## **4. With respect to Atlantic salmon in the West Greenland Commission area:**

4.1 describe the key events of the 2023 fisheries

4.2 describe the status of the stocks

4.3 provide catch options or alternative management advice for 2024-2026 with an assessment of risk 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

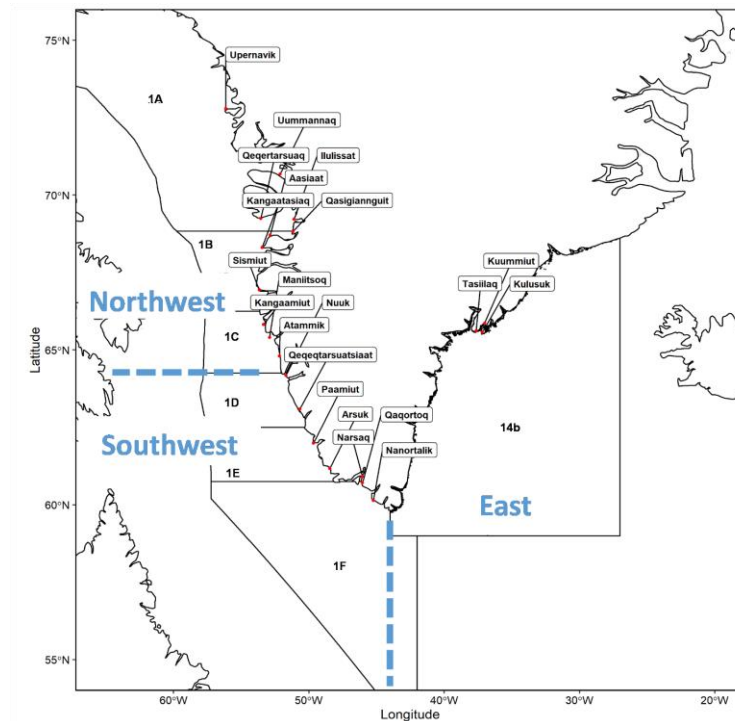


## 4.1 Key Events 2023 Fisheries

Figure 1: sal.wgc.all

- *Management Plan for Atlantic Salmon in Greenland (2022-2025)*
  - 3 areas with specified seasons and 2 user groups
  - area/user group-specific quotas

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





## 4.1 Key Events 2023 Fisheries

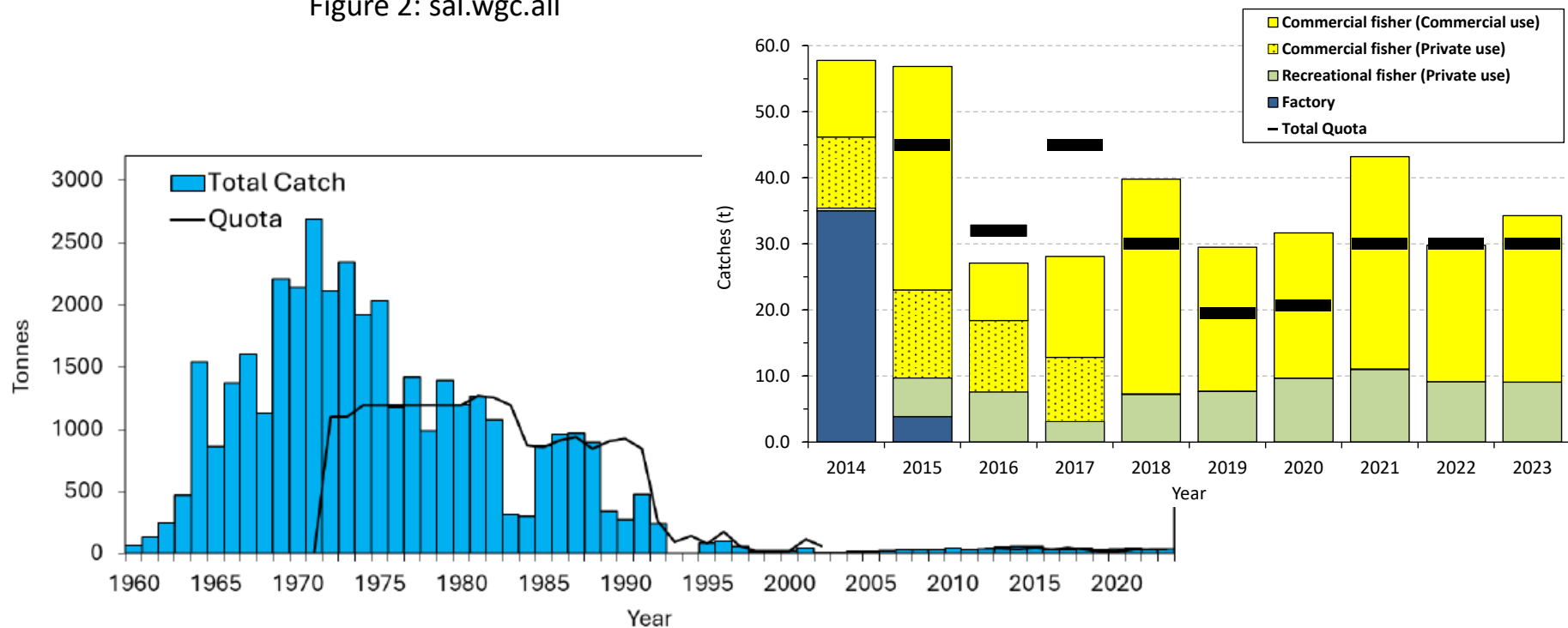
- **2023**

- 27 t quota for West Greenland (3 t EG)
- 33.0 t landings at West Greenland (1.3 t EG)
- Landings - 73.5% commercial, 26.5% recreational
- Unreported catch estimate 10 t



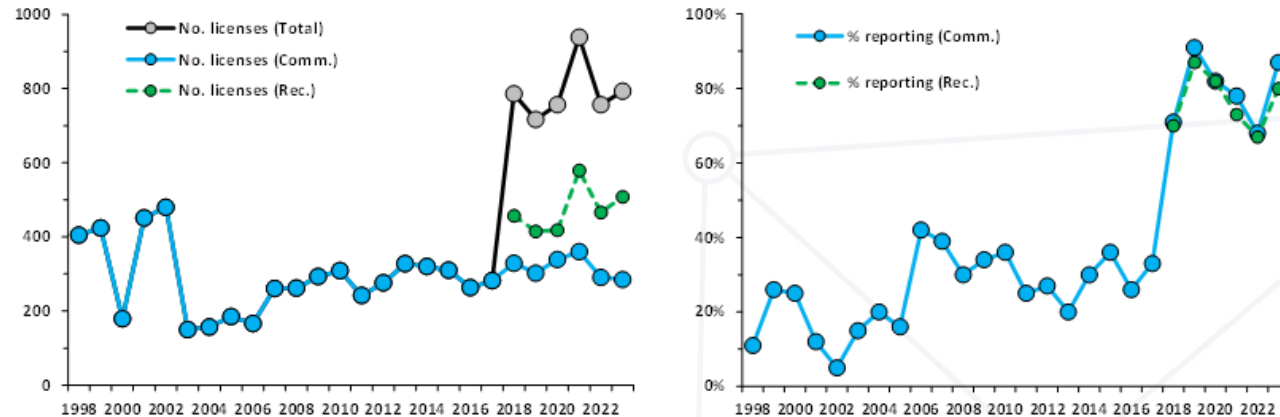
## 4.1 Key Events 2023 Fisheries: Catch

Figure 2: sal.wgc.all



## 4.1 Key Events 2023 Fisheries: Licenses & Reporting

Figure 3: sal.wgc.all



## 4.1 Key Events 2023 Fisheries: Sampling

### 2023

- 4 International Samplers, GINR, Citizens
- 1281 samples collected, 10% of catch

### 2022

- 4 International Samplers + 1 local resident (672 samples)

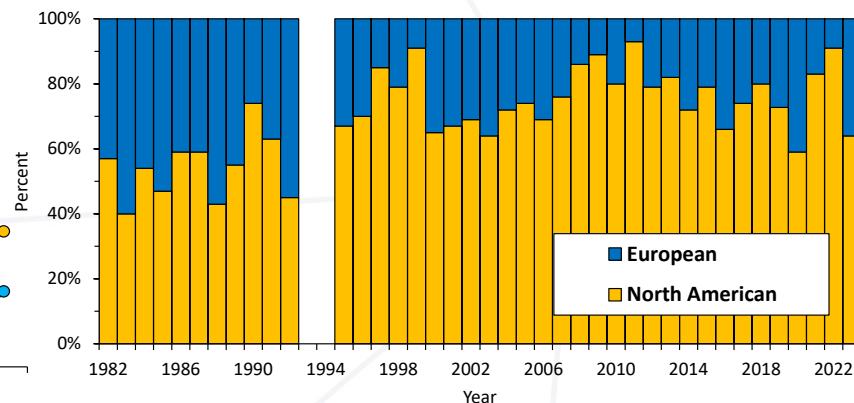
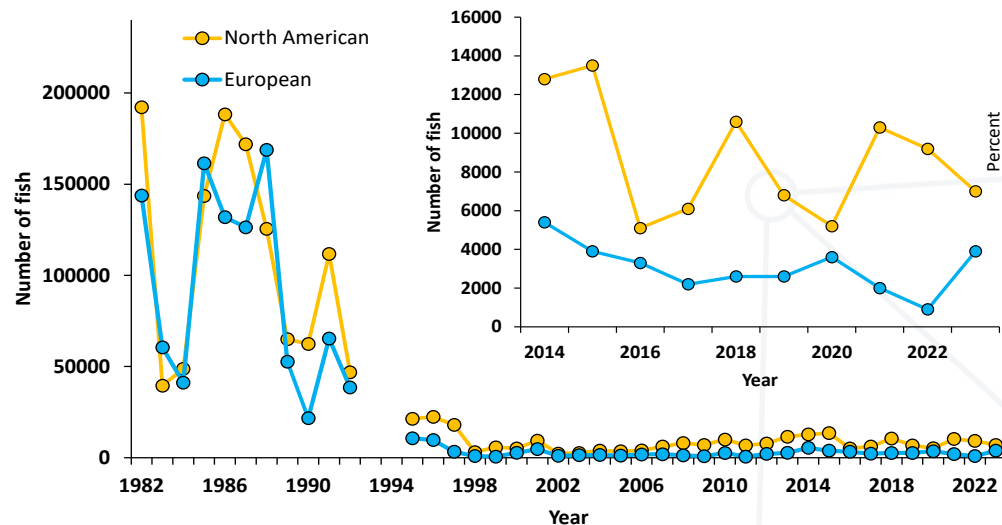




# 4.1 Key Events 2023 Fisheries: Continent of Origin

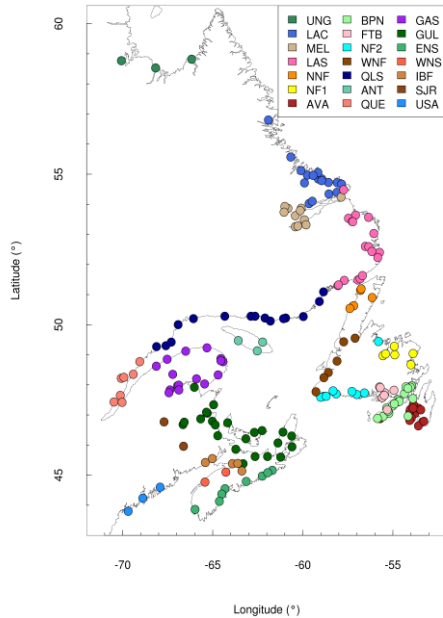
Figures 4 and 5: sal.wgc.all

- 62.5 % North American (~7000 salmon)
- 37.5 % European (~3900 salmon)

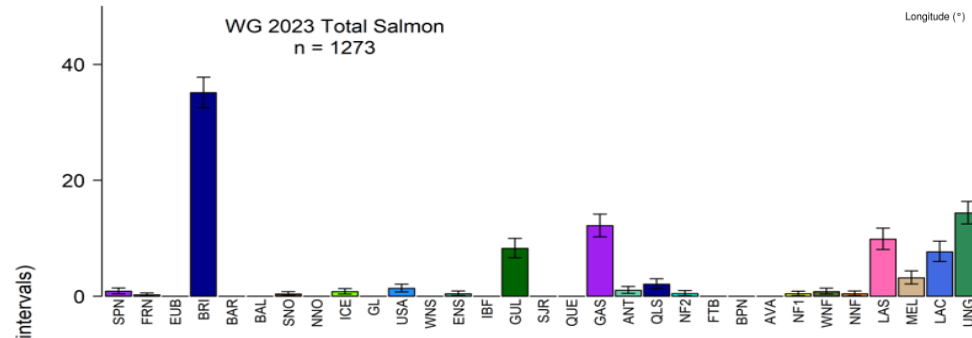
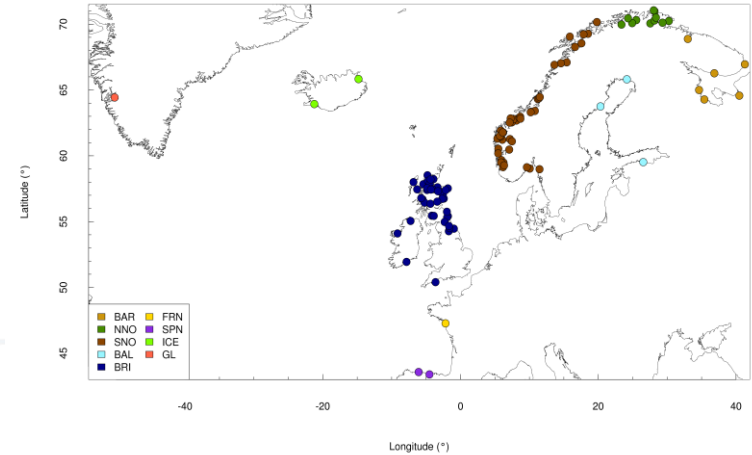


# 4.1 Key Events 2023 Fisheries: Region of Origin

Section 5 Figures 5.2.2.2, 5.2.2.6



## Genetic baselines



## 4.2 Status of Stocks: Risk Assessment Framework



- Management advice for West Greenland fishery based on non-maturing 1SW salmon (return as 2SW/MSW) from North America (NAC) and Southern-Northeast Atlantic (S-NEAC)
  - Spawners (2 SW NAC and MSW S-NEAC) relative to Conservation Limits (CLs)

- **Full Reproductive Capacity**

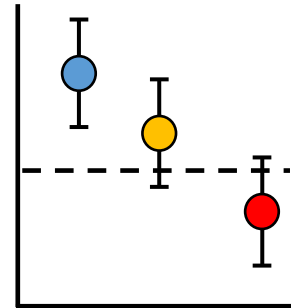
- lower bound of the 90% confidence interval of the estimate above reference point
  - equivalent to a probability of at least 95% of meeting reference point

- **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

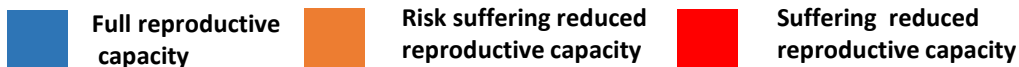
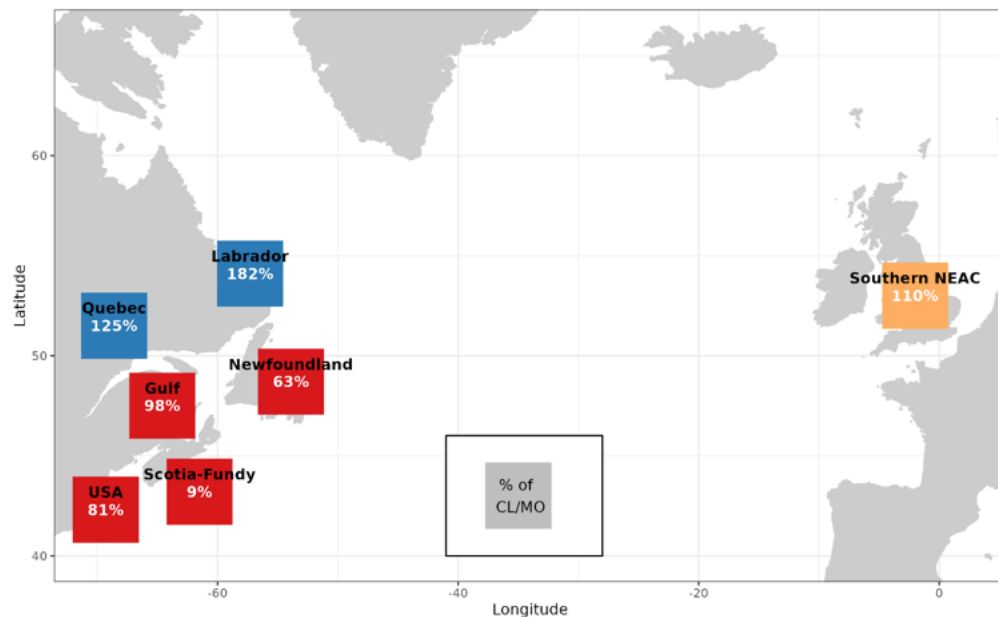


## 4.2 Status of Stocks: Spawners

Figure 7: sal.wgc.all

### 2023 Spawners Median

- 4 of 7 Stock complexes < CLs/MOs
- NAC – Gulf, Newfoundland < CL; Scotia-Fundy, US < MO
- Southern-NEAC MSW stock – at risk

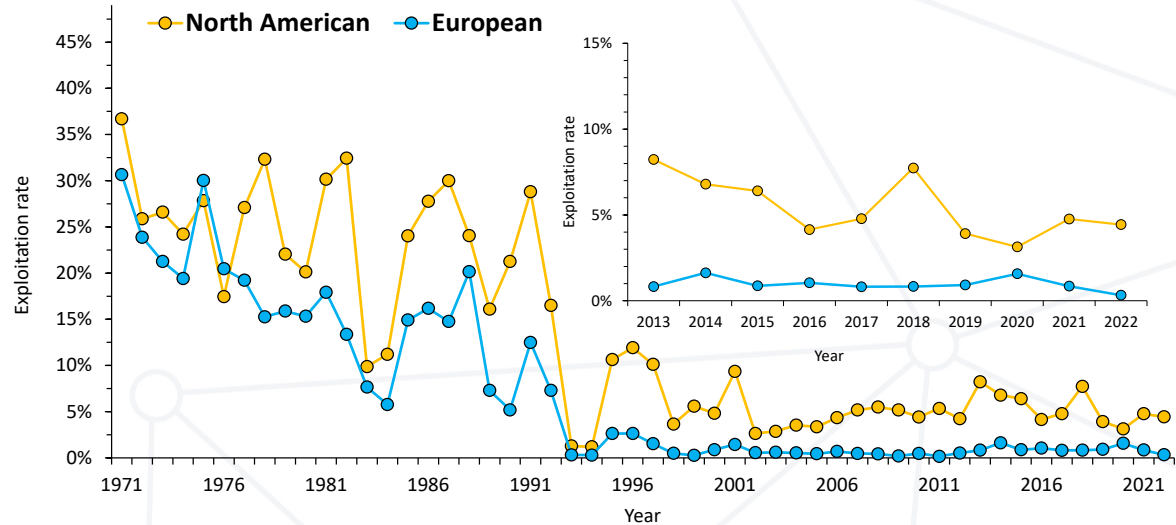




## 4.2 Status of Stocks: Exploitation

Figure 8: sal.wgc.all

- Exploitation rates (catch/PFA) remain low
  - North American: 4.4 %
  - European: 0.3%



## 4.2 Status of Stocks: Summary

- Despite major changes in fisheries management in the past few decades and increasingly more restrictive fisheries measures, salmon returns have remained near historical lows
- It is likely, therefore, that other factors besides fisheries are constraining production



## ToR 4.3 Catch Options for 2024 to 2026

- Catch options based on a risk analysis framework considering CLs or alternate MOs of the NAC and NEAC areas. The risks to these stock complexes are developed in parallel and combined into a single catch options table.
- In summary, none of the stated management objectives would allow a mixed-stock fishery at West Greenland to take place in 2024, 2025, or 2026.
- In the absence of any marine mixed-stock fishing mortality at Greenland and North America, the lowest probabilities that the returns of 2SW salmon to North America will meet conservation requirements of any one of the four northern regions (Labrador, Newfoundland, Québec, and Gulf) were 0.18, 0.34, and 0.43 for the years 2024, 2025, and 2026.
- In the absence of ....., there is a low probability (from 0.01 to 0.06) that returns in the southern region of Scotia-Fundy will meet stock rebuilding objective 2024 to 2026. The probability of meeting or exceeding the stock rebuilding objective of the USA region is estimated at 0.04 to 0.30 over the three years.
- In the absence of any marine mixed-stock fishing mortality at Greenland and in NEAC, the probabilities of meeting or exceeding the CL for the Southern NEAC MSW complex are 0.57, 0.57, and 0.53 in 2024 to 2026, respectively.
- In the absence of any marine mixed-stock fishing mortality on these stocks, there is a near zero probability (0.0 to 0.02) of meeting or exceeding the seven management objectives simultaneously in 2024 to 2026.