REPORT OF ICES ADVISORY COMMITTEE

ON

NORTH ATLANTIC SALMON STOCKS

TO

NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION

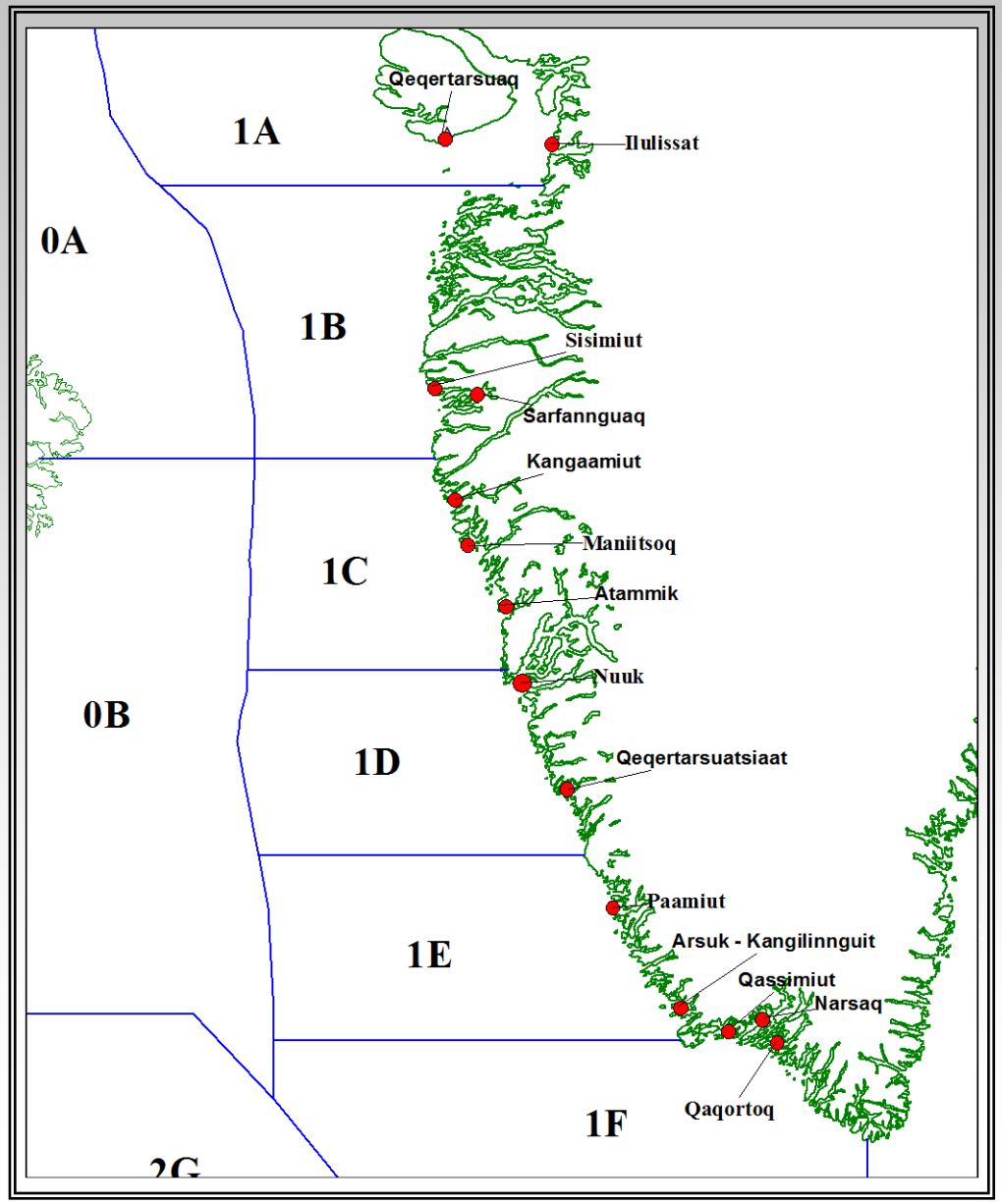
WGC(12)11

Advice generated by ICES in response to terms of reference from NASCO

10.4 With respect to Atlantic salmon in the West Greenland Commission area:

1. describe the key events of the 2011 fisheries
2. describe the status of the stocks
3. provide catch options or alternative management advice for 2012-2014 with an assessment of risk
4. update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice
5. advise on possible explanations for variations in fishing patterns observed in the Greenland fishery in recent years

10.4 With respect to Atlantic salmon in the West Greenland Commission area



- Atlantic salmon from NAC and NEAC in their 2nd summer and fall at sea go to West Greenland to feed

- Fishery occurs August to November

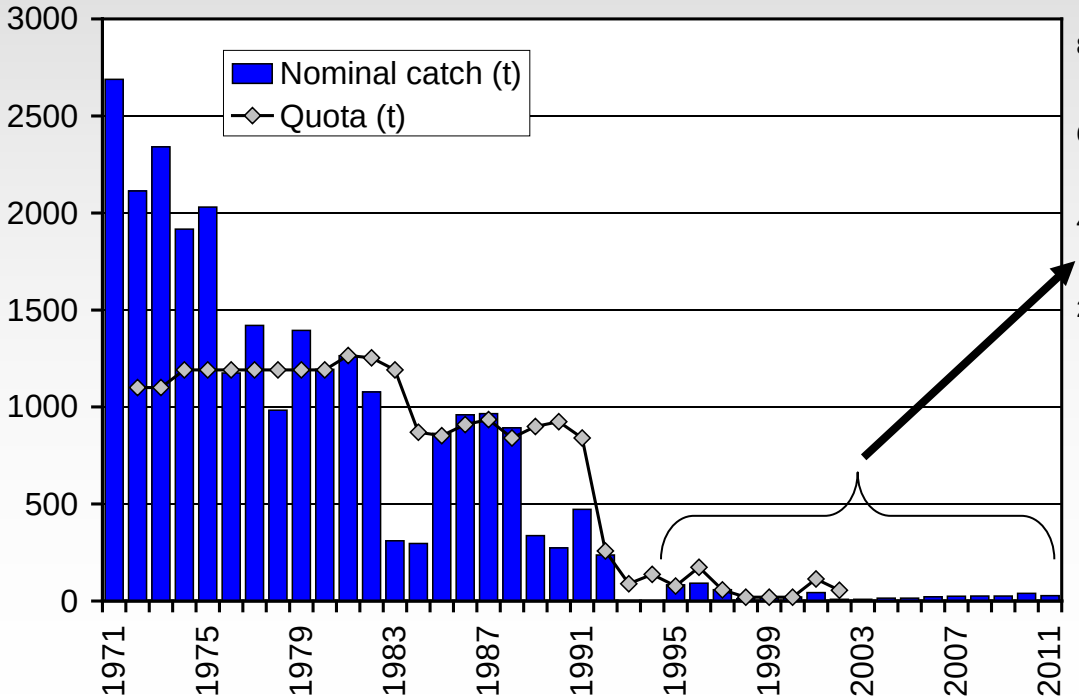
- Most of the salmon are 1SW non-maturing, destined to become 2SW or older if not caught and survived

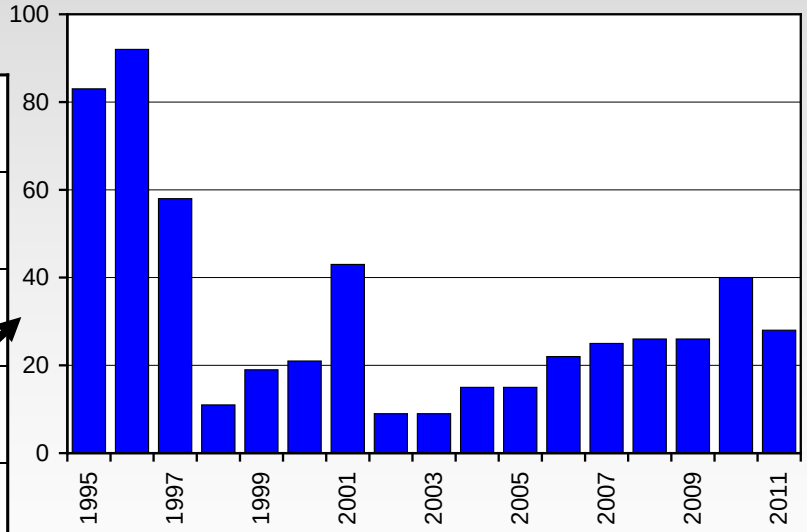
- Assessment models address abundance of 2SW salmon in home countries, excluding 1SW maturing salmon as these are not fished at West Greenland

Key events of the 2011 fisheries

Catch and effort in 2011

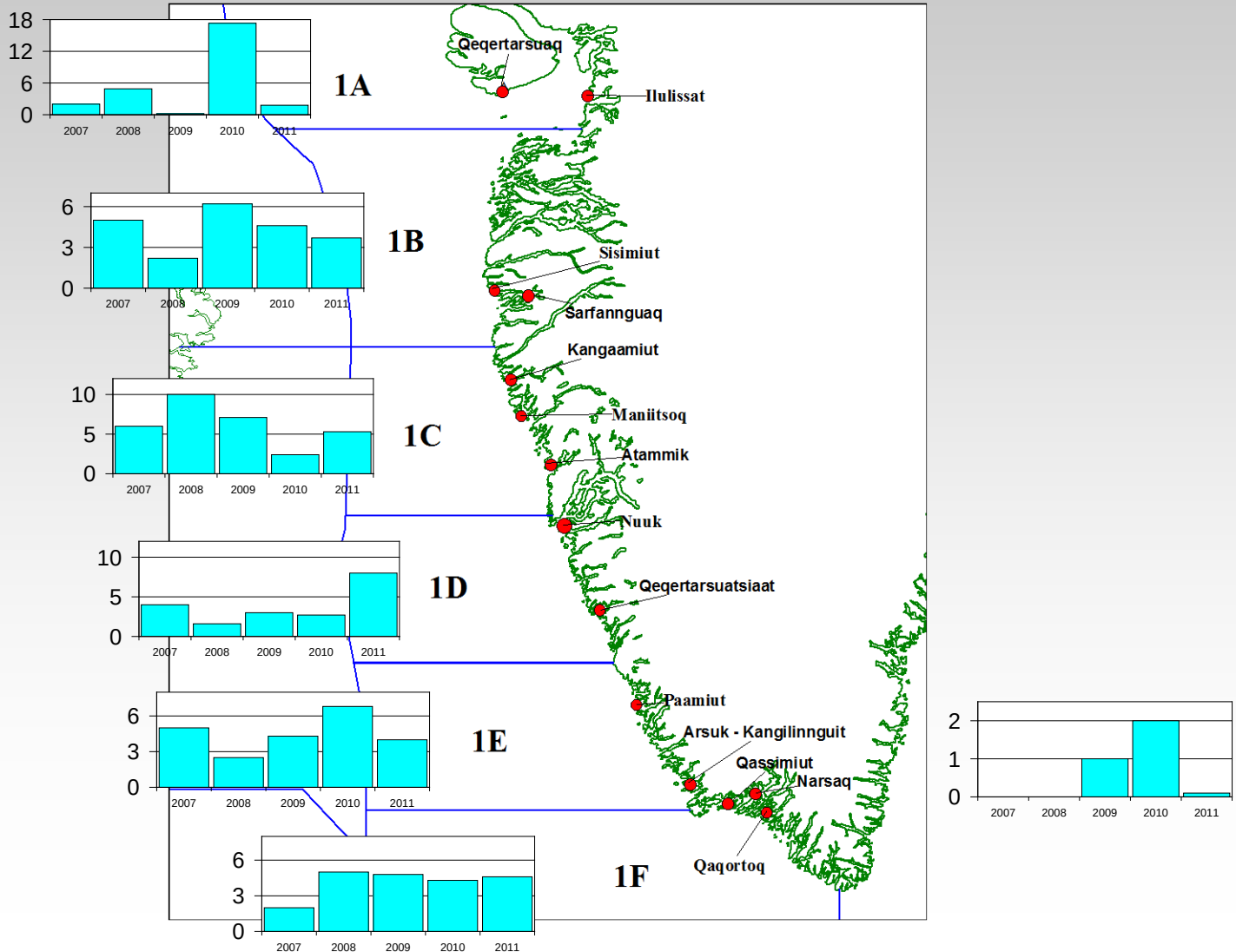
- **Reported catch of 27.5 t**
  - **27.4 t, West Greenland**
  - **0.1 t in East Greenland**
- **Unreported catch of 10 t**





Catch and Effort in 2011

- **catch distributions were similar to previous years (note exception for 2010 in Div. 1A)**



Effort and Landings

- 234 reports of salmon catches from 117 fishers
  - in 2010, 389 reports of salmon catches from 309 fishers
- in some years and in some divisions where international samplers were present, the sampling team saw more fish than were reported as being landed
  - in 2010 total discrepancy equaled 5.1 t and the adjusted catch used in the assessment was 43.1 t
  - in 2011, there was no discrepancy

Year		1A	1B	1C	1D	1E	1F	Total
2007	Reported	2019	5089	6148	4470	4828	2093	24 647
	Adjusted						2252	*24 806*
2008	Reported	4882	2210	10024	1595	2457	4979	26 147
	Adjusted				3577		5478	*28 627*
2009	Reported	195	6151	7090	2988	4296	4777	25 496
	Adjusted				5466			*27 975*
2010	Reported	17263	4558	2363	2747	6766	4252	37 949
	Adjusted		4824		6566		5274	*43 056*
2011	Reported	1858	3662	5274	7977	4021	4613	27 407
	Adjusted							

International sampling program

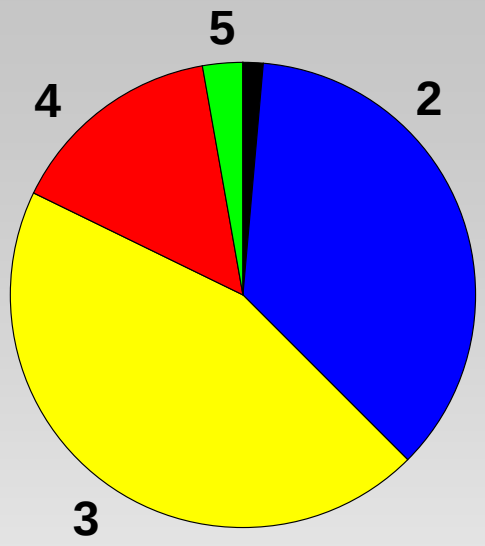
- Samplers from Greenland Institute of Natural Resources, USA, Canada, Ireland, UK (Scotland), and UK (England & Wales)
- Sampling August through October
- Samplers in Ilulissat (1A), Sisimiut (1B), Nuuk (1D), Qaqortoq (1F)
  - No sampling in East Greenland

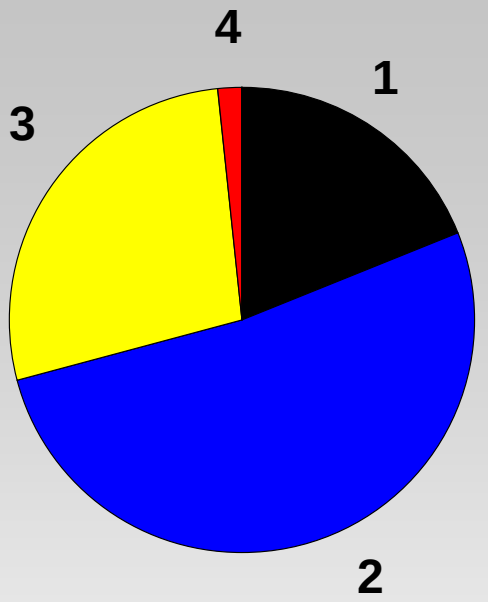
- 970 salmon inspected for tags
  - 12% by weight of reported landings
- 967 for fork length
- 964 for gutted weight
- 965 for scales samples
- 964 tissues for DNA analysis

- *Enhanced Sampling Progam in 2011 (IASRB report)*
  - *430 salmon detailed autopsies for SALSEA WG*

Biological Characteristics

River ages of samples

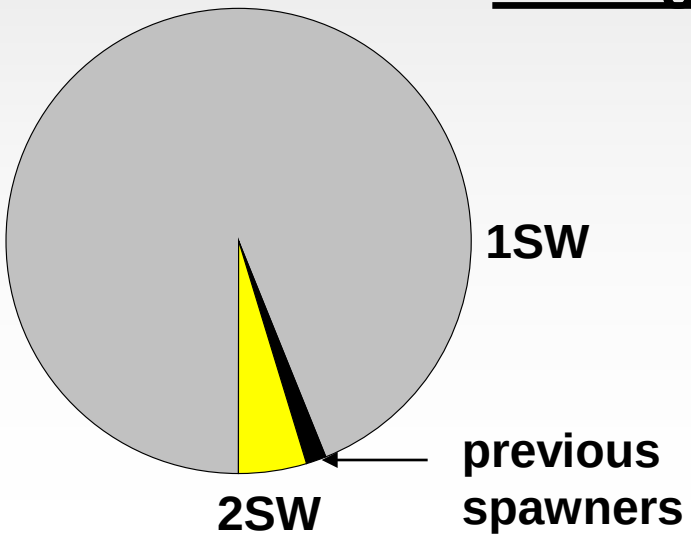


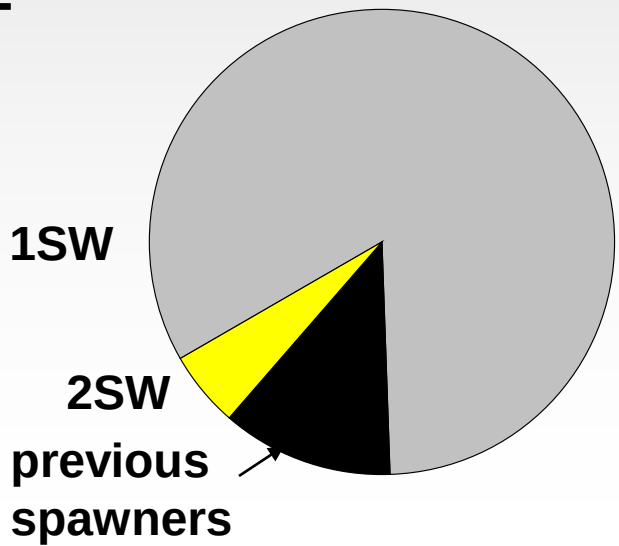


NAC
45% age 3
98% 1SW

NEAC
52% age 2
83% 1SW

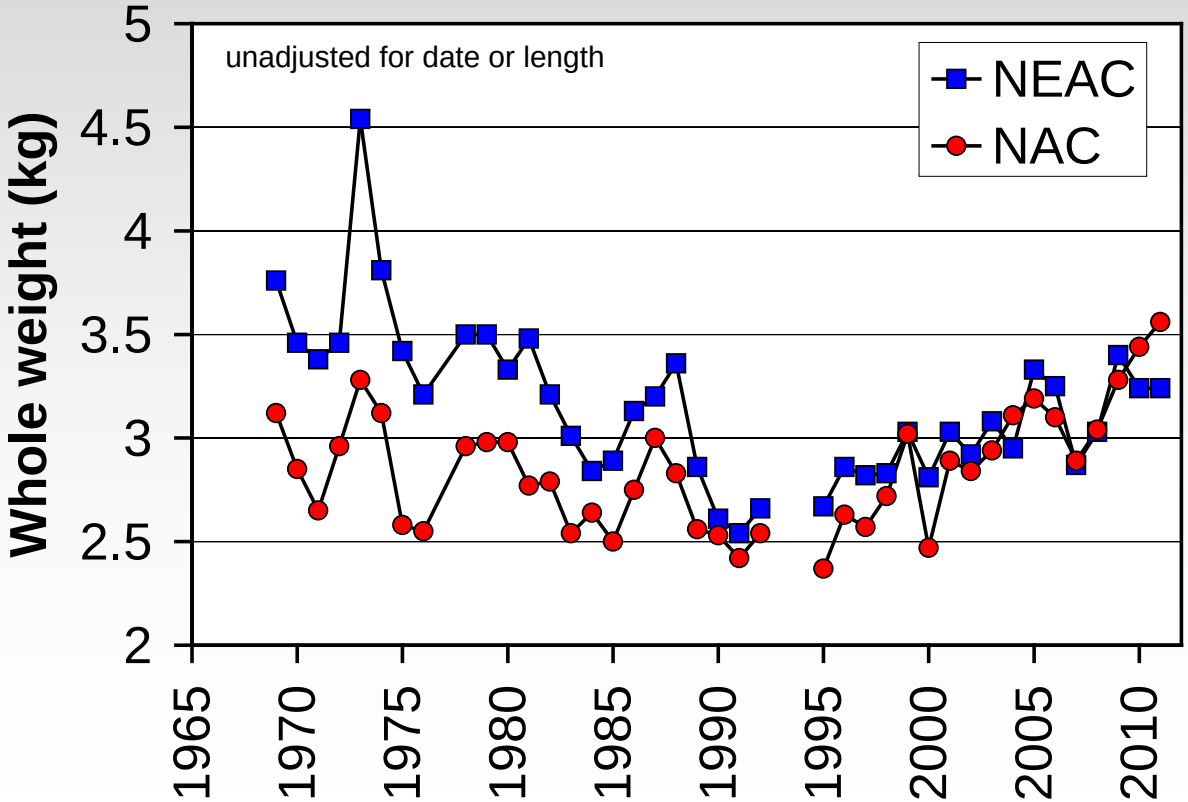
Sea ages of samples





Biological Characteristics

- Mean weights of NAC origin 1SW salmon in 2011 were the highest of the time series (1969 to present)
- Mean weights of NEAC origin 1SW salmon are lower than for NAC, in contrast to 1970's to 1990 when NEAC salmon were heavier
- Time series of weight data to be analyzed to account for date of the fishery and length of fish, to better describe condition of fish

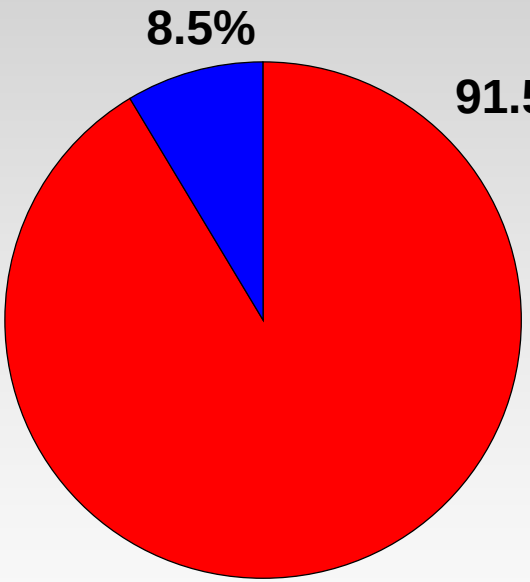


Tag recoveries and tag reports in 2011

- 15 adipose-clipped salmon sampled, none carried tags
- Six tags recovered or returned in 2011
- Two tags returned by fishers in 2011 were from the 2010 fishery
  - smolts tagged in Gulf Region rivers of Canada in 2009
- Two repeat spawner tags from Miramichi River – Canada
  - tagged as adults in 2010
- One acoustic tag from kelt in St. Jean River (Quebec)
  - tagged in June 2010 as kelt
- One PIT tag – origin still unknown

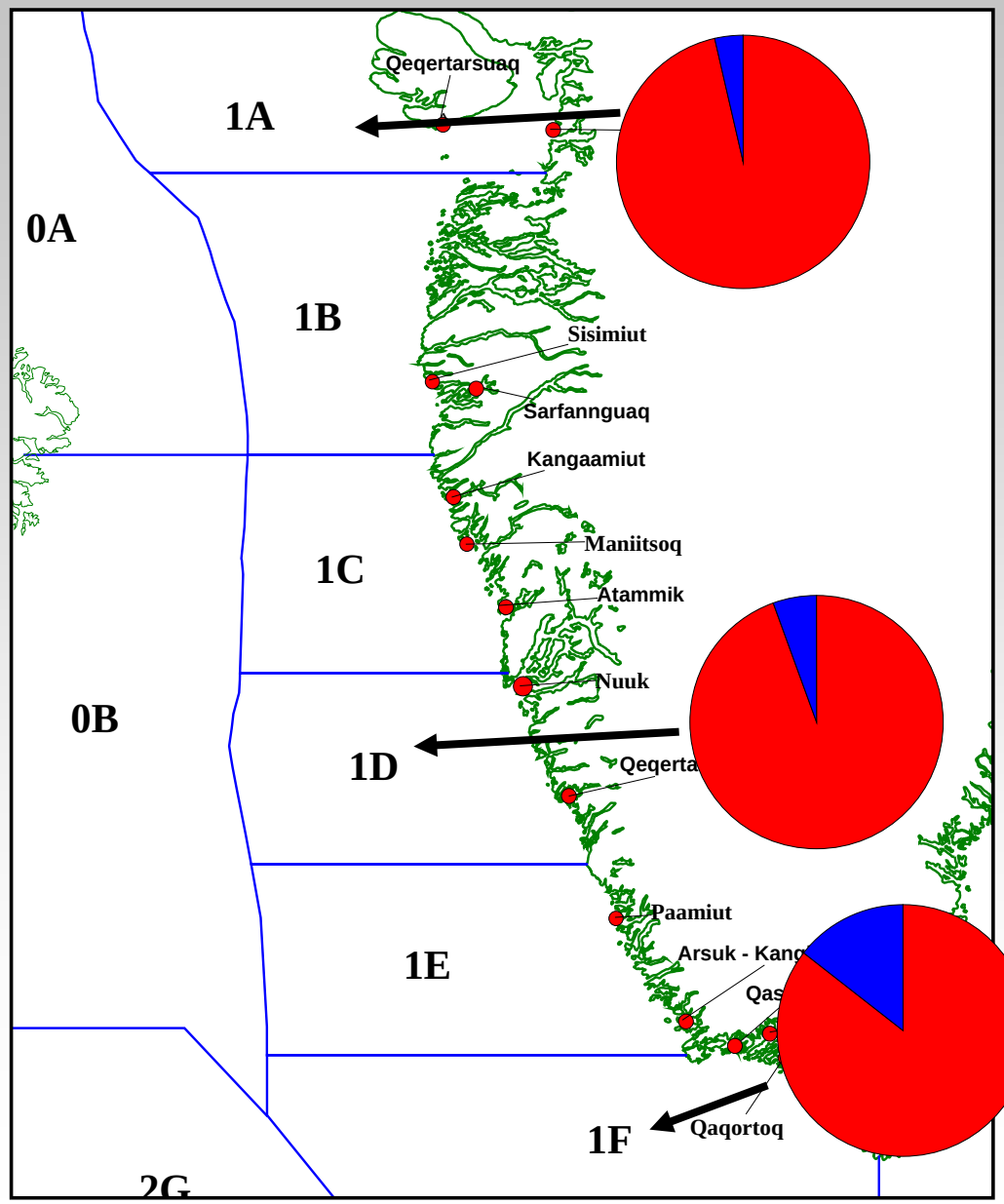
Origin of catches

2011 Continent of Origin by NAFO Divisions

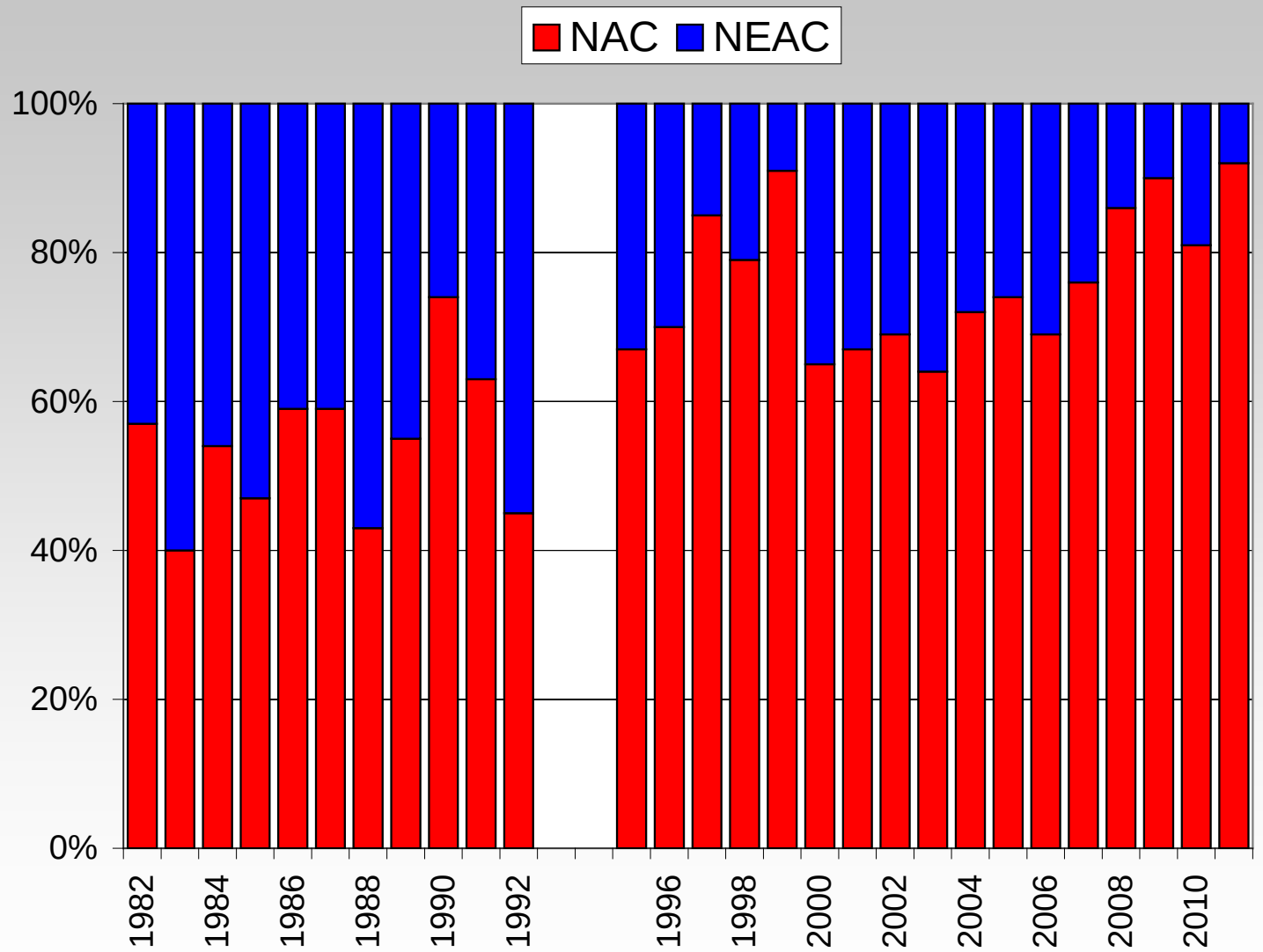


North American Origin

European Origin



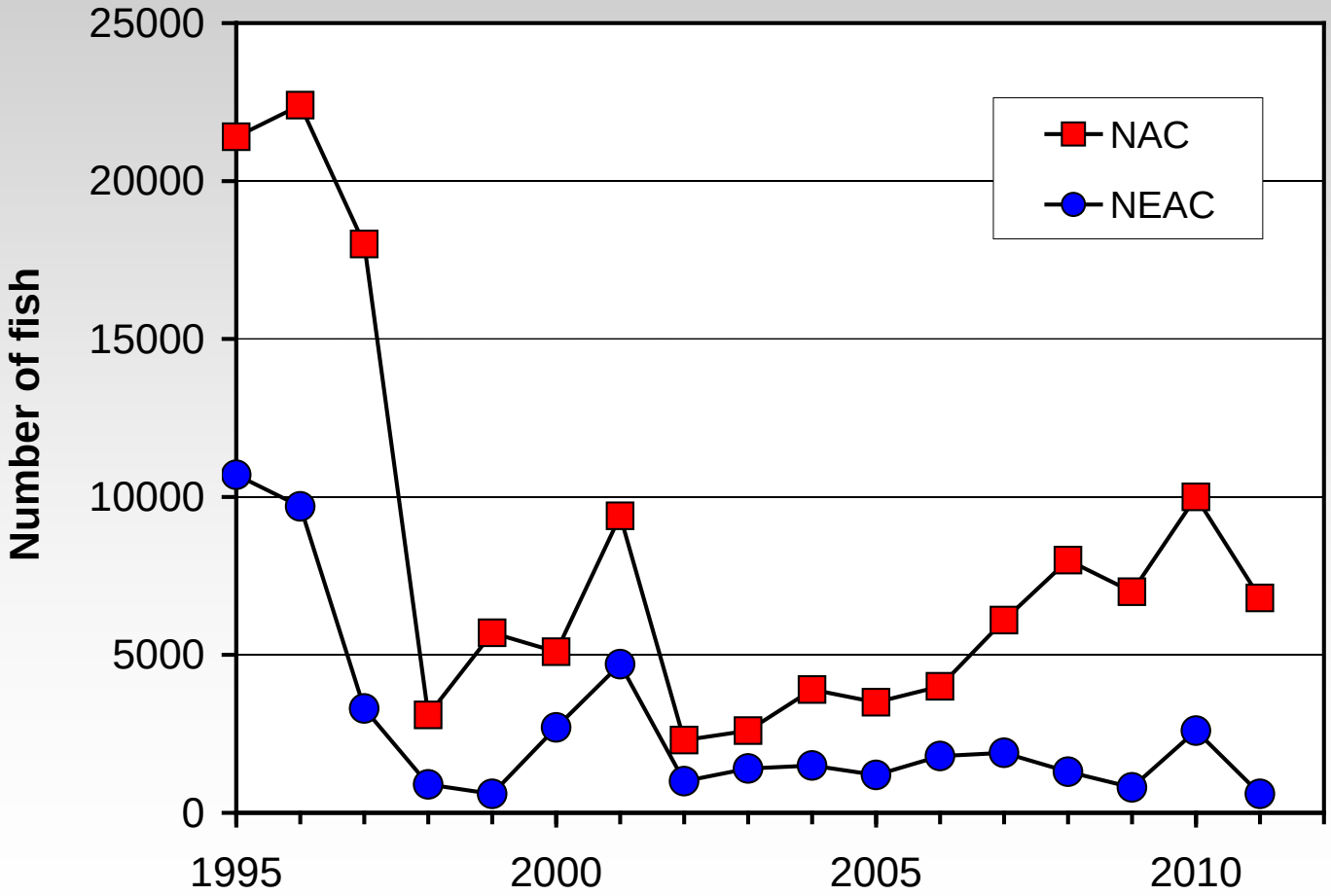
Origin of catches



- **Proportion NAC has been increasing since the early 1980's**

Number of salmon caught at WG

- Number of salmon caught at WG in 2011
  - 6 800 from NAC
  - 600 from NEAC



NASCO has requested ICES to advise on possible explanations for the variations in fishing patterns (e.g. effort, licenses and landings) observed in the Greenland fishery in recent years

- 2010 harvest of 40 t was a large increase over 2009 and primarily due to increased effort and landings in Div. 1A
  - increased landings in 2010 could have been due to increased abundance of salmon, especially in Div. 1A
  - if true, then more salmon were available to a larger part of the population, which may have resulted in increased effort and landings
- 2011 harvest of 28 t more normal level of harvest
  - over the past ten years, reported harvests have mostly remained within the 15-25 t range
  - this range may well represent the internal market in Greenland within the salmon season

NASCO has requested ICES to advise on possible explanations for the variations in fishing patterns (e.g. effort, licenses and landings) observed in the Greenland fishery in recent years

- regulations prevent the exporting of salmon for sale or the freezing of salmon for shipping to other communities
- likely an internal market limit for salmon in Greenland
- new logbook initiative in 2011provided supplementary information to characterize the internal use fishery
- ICES recommends the continuation and increased participation of the logbook program which will allow a better assessment of annual variations in reported harvest and fishing patterns

Summary of Stock Status

For West Greenland, stock status for 1SW non-maturing salmon (destined to be 2SW salmon) of North America and the Southern NEAC MSW complex are relevant

Stock status summarized in terms of:

- recruitment
- spawners
- exploitation rates

Summary of Stock Status

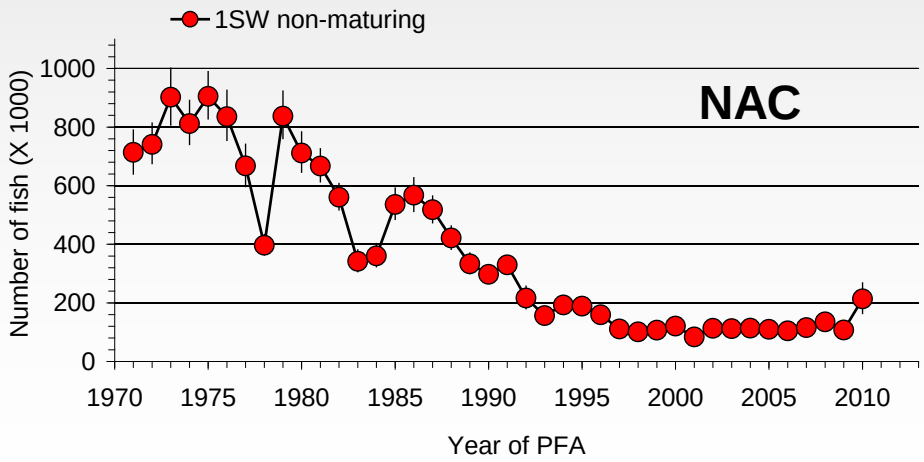
Recruitment (expressed as Pre-Fishery Abundance or PFA)

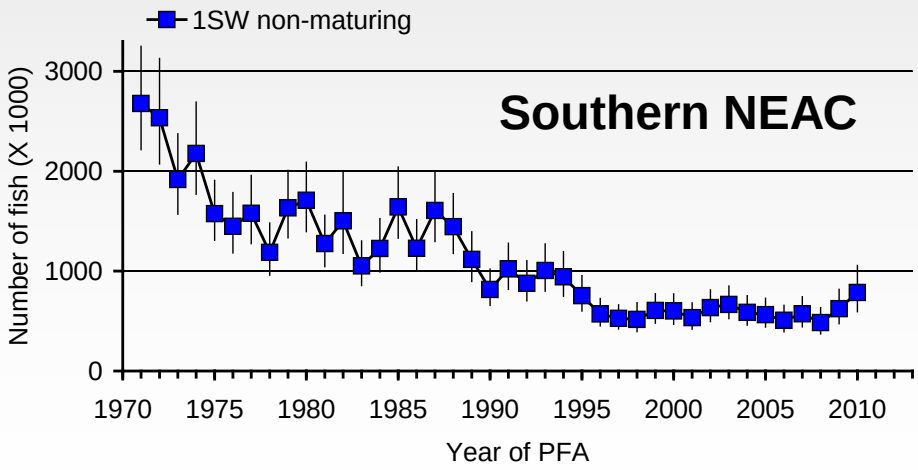
NAC: PFA of non-maturing 1SW suggest continued low abundance

- PFA in 2010 increased by 100% over the 2009 but ranked 23rd of 40-year time series

NEAC: Southern NEAC non-maturing 1SW complex has declined to low levels over the period 1996 to 2008

- PFA increased in 2009 and 2010
- 2010 value ranked 25th of 40-year time series





Summary of Stock Status

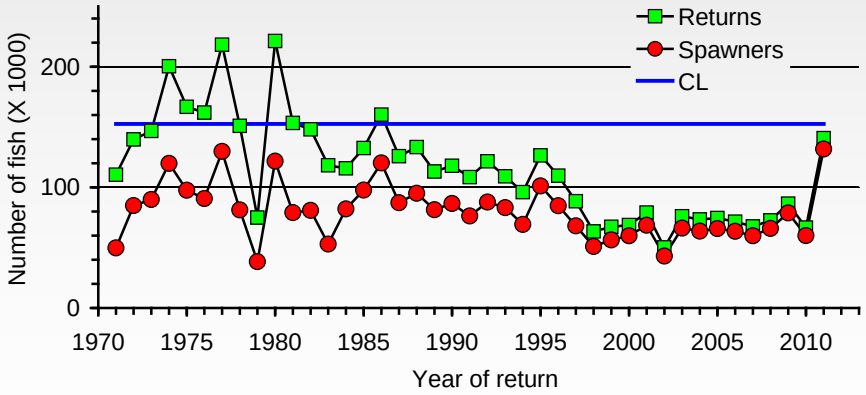
Spawners

NAC: 2SW spawner estimates below CLs in four of the six regions in 2011 and for NAC overall during the entire time series

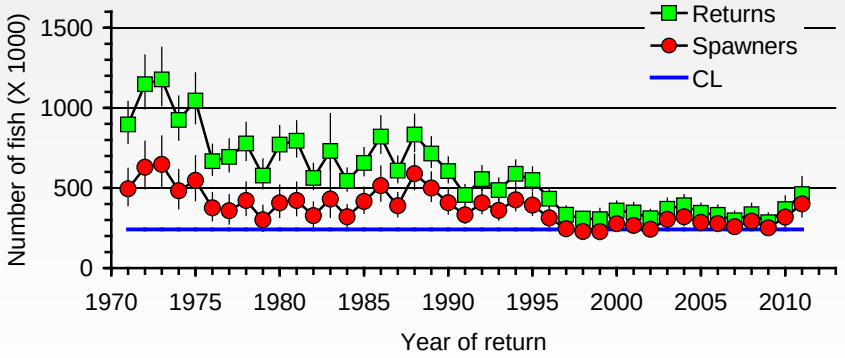
- varying numbers of river stocks failing to meet CLs, particularly in Scotia-Fundy and USA

NEAC: Declining trends in spawner numbers for the Southern NEAC MSW complex

- since 1997, generally either at risk of or suffering reduced reproductive capacity
- within all countries, individual river stocks are not meeting CLs



NAC



Southern NEAC

Summary of Stock Status

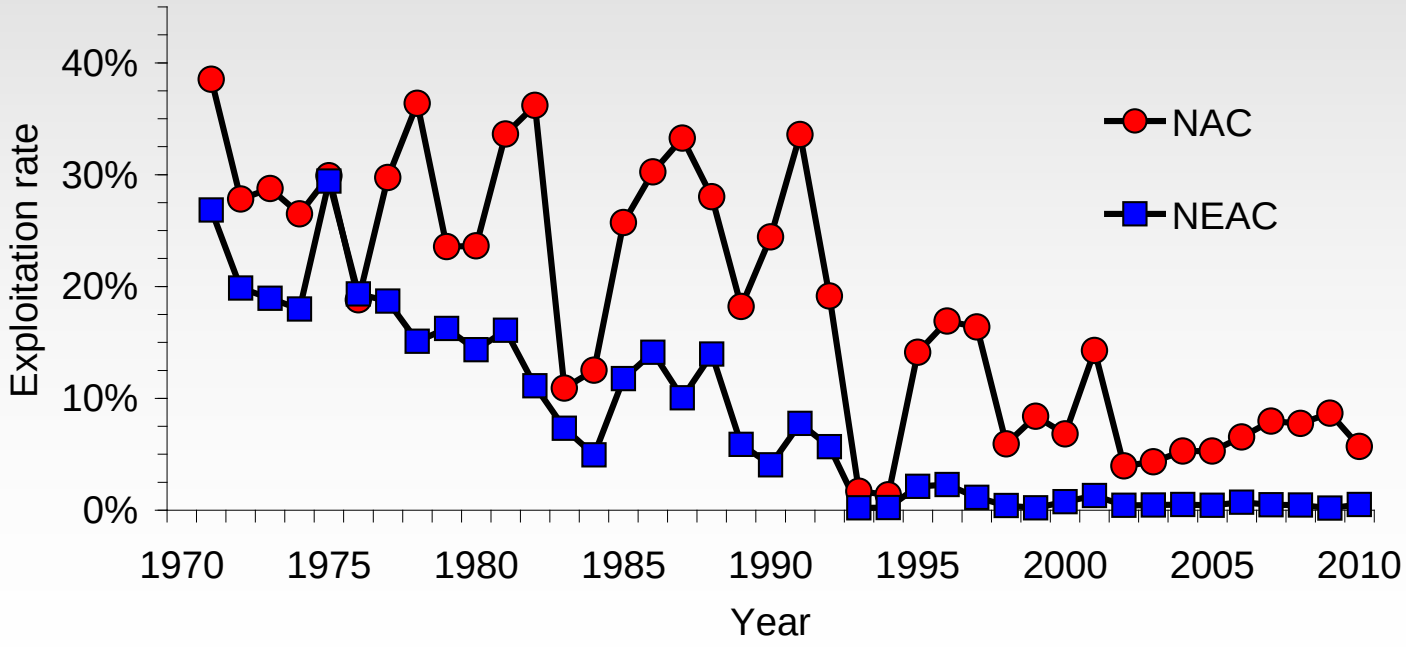
Exploitation Rate (catch in Greenland / PFA)

NAC: exploitation rate in 2010 was about 6%, among the lowest in the time series

- exploitation rate peaked in 1971 at 39%

NEAC: exploitation rate in 2010 was less than 1%, among the lowest in the time series

- exploitation rate peaked in 1975 at 29%



Summary of Stock Status

Conclusion

- overall abundance of stocks contributing to West Greenland fishery has recently increased
- however abundance is low compared to historical levels
- despite major changes in fisheries management 18 to 25 years ago and increasingly more restrictive fisheries measures since, returns in many regions have remained near historical lows and many populations are currently threatened with extirpation
- continued low abundance of salmon stocks across North America and in the North East Atlantic, despite significant fishery reductions, further strengthens the conclusions that factors other than fisheries are constraining production

catch options or alternative management advice for 2012-2014 with an assessment of risk

Management objectives

- requires at least 75% probability of simultaneously meeting the 2SW CLs for the four northern areas of the NAC (Labrador, Newfoundland, Quebec, Gulf), of achieving a 25% increase in returns of 2SW salmon from the average returns in 1992–1996 for the Scotia–Fundy and USA regions, and of meeting the southern NEAC MSW CL

Region	Unit	Management objective (number of fish)
Labrador	2SW CL	34 746
Newfoundland	2SW CL	4 022
Quebec	2SW CL	29 446
Gulf	2SW CL	30 430
Scotia-Fundy	2SW Return	10 976
USA	2SW Return	2 548
Southern NEAC	MSW CL	241 269

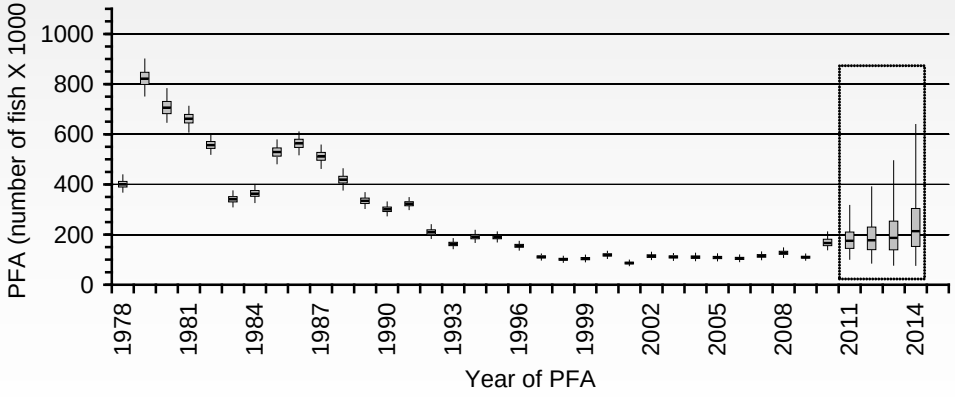
catch options or alternative management advice for 2012-2014 with an assessment of risk: forecasts

NAC:

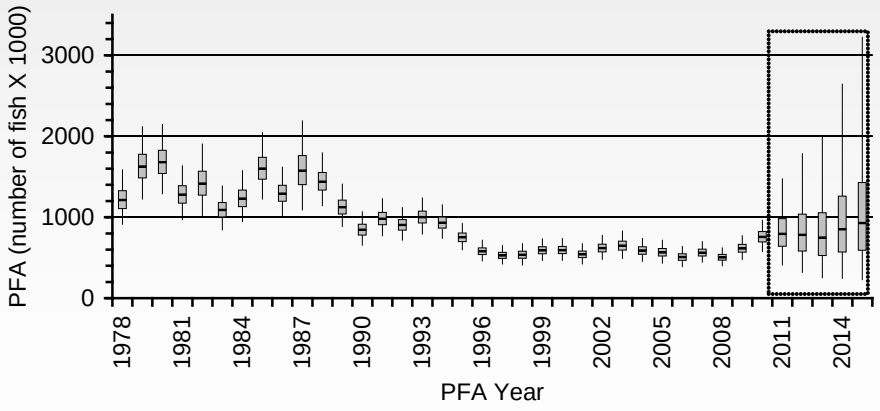
- following on improvements in productivity and sustained / improved lagged spawners, PFAs overall and to the regions are expected to remain at recent levels or increase over 2011 to 2014
- forecasts have very high uncertainty and uncertainties increase forward in time

NEAC:

- following on improved productivity and sustained / improved lagged eggs, median PFA abundances are expected to remain at recent levels or increase over 2011 to 2015
- forecasts have large uncertainties
- increased uncertainty results in increased risk of not meeting CLs



NAC 1SW non-maturing



Southern NEAC 1SW non-maturing

catch options or alternative management advice for 2012-2014 with an assessment of risk: risk assessment

In the absence of fishing mortality there is only a 6% to 8% chance (2012 to 2014) of simultaneously meeting or exceeding the management objectives of the seven management units in 2012 to 2014

	LAB	NFLD	QC	GLF	SF	USA	NEAC-S	
Management objective	2SW CL	2SW CL	2SW CL	2SW CL	2SW Return	2SW Return	MSW CL	
	34746	4022	29446	30430	10976	2548	241269	
Fishery year: catch option = 0 t	Probability (%) of meeting or exceeding management objectives							
	LAB	NFLD	QC	GLF	SF	USA	NEAC-S	Simulta-neously
2012	45	86	71	50	15	89	92	6
2013	48	78	73	50	25	75	86	8
2014	56	78	75	55	20	86	87	8

catch options or alternative management advice for 2012-2014 with an assessment of risk: catch advice

On the basis of the MSY approach, ICES advises that fishing should only take place on non-maturing 1SW salmon from rivers where stocks have been shown to be at full reproductive capacity

- due to the different status of individual stocks within the stock complex, mixed stock fisheries present particular threats to stock status
- management of a fishery should ideally be based upon the status of all stocks exploited in the fishery

There are no mixed-stock fisheries catch options at West Greenland in 2012, 2013, and 2014

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

Framework of Indicators:

- tool to determine if there is an expectation that the previously provided multi-year advice for the Greenland fishery is likely to change in subsequent years
- a significant change in management advice would be an unforeseen increase in stock abundance to a level that would allow a fishery in the case where no catch had been previously advised or
- a decrease in stock abundance when catch options had been chosen
- consequence of a significant change indication is to conduct a full assessment and provide new catch advice

Framework of Indicators (FWI) was first accepted by NASCO in June 2007 and applied for the 2008 fishery at West Greenland

- FWI indicated no significant change in management advice and pre-agreed regulatory measure for 2008 was retained

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

In 2009 the FWI was updated, accepted by NASCO, and applied in January 2010 and 2011 for the 2010 and 2011 fisheries

- for 2010 and 2011, no significant change was indicated and the pre-agreed regulatory measures were retained

ICES (2009) advised that there were no catch options at West Greenland in 2009, 2010, and 2011 that would be consistent with a 75% or greater chance of simultaneously meeting the seven management objectives

The assessment of April 2012 confirmed the validity of that advice and the utility of the FWI in the intervening years of multi-year advice and pre-agreed multi-year regulatory measures

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

The 2012 assessment begins the cycle of forecasting and catch advice for the 2012 to 2014 fishing years

Updating the FWI in support of West Greenland fishery management
- Adding values of the indicator variables for the most recent years;
- Quantifying the threshold value for the indicator variables and the probabilities of a true high state and a true low state for those indicator variables retained for the framework
- Revising/adding the indicator variables and the functions for evaluating the indicator score to the framework spreadsheet; and
- Providing the spreadsheet for doing the framework of indicators assessment

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

Total of 40 indicator variables, represented by 22 different rivers, were retained for the NAC area

Origin	Wild	Wild	Wild	Wild	Hatchery	Hatchery	
TYPE OF DATA	Return	Return	Survival	Survival	Survival	Survival	
SIZE/AGE GROUP	Small/1SW	Large/2SW/ MSW	Small/1SW	Large/2SW	Small/1SW	Large/2SW	Total
Labrador							0
Newfoundland	3						3
Quebec	4	10	1	2			17
Gulf	1	1					2
Scotia-Fundy	3	4			2	4	13
USA[1]	1	2[2]			1	1	5
Total	12	17	1	2	3	5	40

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

The updated FWI spreadsheet provides one of two conclusions for the user:

1) No significant change identified by the indicators

2) Reassess

If no significant change has been identified by the indicators, then the multi-year catch advice for the year of interest could be retained.

If a significant change is signalled by the indicators, the response is to reassess

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

The framework spreadsheet is designed to capture both fishing and non-fishing scenarios:

1. Multi-year advice provides no catch options greater than zero but indicators are suggesting that the management objectives may be met (conclusion: Reassess)
2. Multi-year advice provides catch options greater than zero but the indicators suggest the management objectives may not be met (conclusion: Reassess)

update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

Process of running the FWI spreadsheet is identical to what was done by NASCO in January 2008, January 2010 and January 2011.

- returns or return rate data for 2012 will be added to the spreadsheet to evaluate the appropriateness of the 2013 advice
- returns or return rate data for 2013 will be used to evaluate the appropriateness of the 2014 advice

It is anticipated that the data for the indicator variables to populate the framework would be available in January of the year of interest

The framework will be updated whenever a new set of multi-year catch advice is provided

Recommendations

- ICES supports the efforts of the Greenlandic authorities for the expansion of the logbook reporting system as a condition of the licensing system for the salmon fishery at West Greenland

- ICES recommends a continuation and expansion of the broad geographic sampling programme (multiple NAFO divisions) to more accurately estimate continent of origin and biological characteristics of the salmon in the West Greenland mixed-stock fishery.
    - ICES recommends that arrangements be made to enable sampling in Nuuk as an important proportion of the catch is landed in this community on an annual basis

Advice generated by ICES in response to terms of reference from NASCO

- **supporting information and details in the report of the ICES Working Group on North Atlantic Salmon available at: http://www.ices.dk/reports/ACOM/2012/WGNAS/wgnas_2012_final.pdf**

Acknowledgements

Members (25) of participating countries (12) to Working Group on North Atlantic Salmon, March 26 – April 4, 2012

WGC subgroup chair: Tim Sheehan (USA)