Council

CNL(09)44

ICES Scientific Advice to NASCO Presentation

## ICES Scientific Advice to NASCO

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## Catches of North Atlantic Salmon - Nominal catches in 2008

### 2008: 1696 t

- 2<sup>nd</sup> lowest in the time series
- 148 t above updated catch for 2007
- Below 5 and 10-yr averages



### **Partitioned nominal catches of salmon**

#### **North American Commission**

• Total catch relatively constant, majority in riverine fisheries

#### **Northern North-East Atlantic Commission**

• Appr. 50:50 river vs. coast

#### **Southern North-East Atlantic Commission**

- Large declines over time period
  - Reflects widespread measures to reduce exploitation, especially in coastal fisheries



## **Catch and release**

- Not included in nominal catch
- No formal reporting by all countries
- Large differences by country
  - $\sim$ 0% in Finland, 100% in USA
  - Tending to increase with time
- 204 000 fish released in 2008
  - 26 000 more than 2007
  - 14% increase

![](_page_5_Picture_9.jpeg)

![](_page_6_Picture_0.jpeg)

## **Unreported catches**

- 443 t in 2008\*
- 433 t NEAC
  - 23 t decrease from 2007
- 10 t WG
  - same as 2007

\*No NAC estimate

• 56 t in 2006

![](_page_6_Figure_9.jpeg)

### Farming and Sea Ranching of Atlantic Salmon

![](_page_7_Figure_1.jpeg)

#### **Farmed salmon**

- North Atlantic: 981 kt
- Worldwide: > 1.4 million t =~900 times nominal catch

#### **Ranched salmon**

 70 t, majority taken by Icelandic 'ranching to the rod' fisheries NASCO has asked ICES to report on significant, new or emerging threats to, or opportunities for, salmon conservation and management

### **Development of forecast models**

Existing forecast models for non-maturing NA and sNEAC stocks  $\rightarrow$  Quantitative catch advice for WG

- No previous forecast models for 1SW sNEAC stocks, nor nNEAC stocks (1SW, MSW)
- → Qualitative catch advice for Faroes based on status of stock complexes relative to their conservation limits

SGSAFE (Study Group on Salmon Stock Assessment and Forecasting)

- Met in March 2009, back to back with WGNAS meeting
- Developed alternate models for NA and NEAC
- PFA modeled separately for each NAC region (NF, Lab, Qué, Gulf, S-F, USA) (2SW only) and all NEAC stock complexes (both 1SW and MSW components)
- Bayesian approach (OpenBUGS 3.0.3)
- Based on established approaches and consistent Bayesian framework
- Allows complex dynamics and uncertainties accounted for, learning from previous experience, use of other prior information

### **Development of forecast models**

- Introduction of the new alternate models in 2009, review by ICES
- Advice 2009 based on existing ICES models

#### **Further work**

- Need for further diagnostic evaluations and model exploration for the data sets in NAC and NEAC
- NAC: combined sea age (1SW & 2SW) model
- NEAC: disaggregation to below stock complex level
- → ICES recommends that SGFISSA continue to develop new modeling approaches

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Genetic population structure
and potential for local
adaptation in Atlantic salmon
(Dionne et al.)
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- Seven regional groups of 51 salmon rivers in Québec, Labrador and New Brunswick
- Influence of gene flow and thermal regime adaptation in maintaining genetic differentiation
- Immigrants less successful in establishing in the new environment compared to residents
- Various levels of genetic structure within some rivers
- Diversity in immunocompetence gene increased with temperature and bacterial diversity contrary to neutral markers

 $\rightarrow$  Evidence of local adaptation, highlight the importance of retaining genetic diversity at small spatial scales, and maintaining the capacity for adapting to environmental change

## Salmon feeding ecology at West Greenland

 As part of International Sampling Programme at WG, salmon stomach sampling was conducted in 2006-2007 (n=249)

• Predominantly pelagic prey, mostly:

Capelin

![](_page_12_Figure_4.jpeg)

Parathemisto

![](_page_12_Picture_6.jpeg)

Diet similar between stock complexes (Europe, N-America)

- In 2006, females preferred Parathemisto, males capelin
- Contemporary feeding conditions similar to historical
- Energy content of capelin has decreased!?
- $\rightarrow$  Changes in salmon body condition and productivity over time?

### **Red vent syndrome**

- Returning salmon with swollen and/or bleeding vents
  - Noted since 2005, increase across Southern NEAC and Iceland in 2007
  - Levels lot lower in 2008 (not in UK(E&W))
- Linked to presence of a nematod worm (*Anisakis simplex*)
  - Common marine fish parasite
- Mainly effects grilse, can be at high rate
- Affects on survival or spawning unknown
- Preliminary investigations: no difference in condition factor between afftected and non-affected fish, successfully stripped eggs develop normally

![](_page_13_Picture_9.jpeg)

![](_page_13_Picture_10.jpeg)

#### Reduced sensibility and development of resistance towards treatment in salmon louse (*Lepeophtheirus salmonis*)

- Reduced sensitivity to emamectin benzoate in Norwegian salmon farms in 2008
- N of lice in 2008 and early 2009 higher than in previous two years
- Cause for concern, potential for severe consequences for wild salmon smolts

![](_page_14_Picture_4.jpeg)

### Atlantic salmon stock assessment using sonar

- Reports on use of DIDSON (Dual Frequency Identification Sonar) for monitoring Atlantic salmon escapement
- Produces almost video quality images, software can be used to aid processing
- Ongoing projects in Ireland and Canada demonstrate high efficiency and accuracy
- Preliminary tests elswhere, e.g. River Tana/Teno (Norway/Finland)
- Provides opportunities for assessing salmon in large rivers presently not monitored
- Has successfully been used for Baltic salmon in Finland and other salmonid species in North America

### **River Rhine:** - Reintroduction of salmon stocks - Smolt migration

- Reintroduction of salmon started 20 yrs ago, first returning recorded in the R. Sieg in 1990
- Stocking of juveniles continue, fish passage and water quality expected to improve after implementation of European Water Framework Directive
- 2008: Study on smolt migration and passage prior to passage improvements (re-opening Haringvliet dam) scheduled for 2010
  - 18 % survival to North Sea
  - Higher loss than in 2007
- Will be repeated post-restoration

![](_page_16_Picture_7.jpeg)

![](_page_16_Figure_8.jpeg)

![](_page_17_Picture_0.jpeg)

## European Regulations

- Implications on salmon stocks from Habitat Directive and Water Framework Directive
- EU Data Collection Regulation has been updated and expanded
  - Salmon and eels added
  - Data collection concerning various fisheries, aquaculture, fish processing in industries

NASCO has asked ICES to continue work already initiated to investigate associations between changes in biological characteristics of all life stages of Atlantic salmon, environmental changes and variations in marine survival with a view to identifying predictors of abundance

### Study Group on the Identification of Biological Characteristics for use as Predictors of Salmon Abundance (SGBICEPS)

![](_page_19_Figure_1.jpeg)

### SGBICEPS

#### Wider geographic patterns

• Smolt age in NAC, sNEAC  $\downarrow$ 

#### Two way plots

• Size of 1SW salmon correlated with that of 2SW the same year and year after

#### **Case studies**

- R. Frome, UK(E&W): Smolt size, 1SW %  $\uparrow$ , Smolt age  $\downarrow$
- R. Bush, UK (N-I): 1SW %  $\uparrow$ , 1SW length  $\downarrow$ ,
- Norway:
  - general positive correlation between PFA of 1SW and PFA of 2SW a year after
  - in recent years, more 2SW than expected from 1SW year before
  - delay in age at maturity, better survival during the 2nd year?

#### **Baltic Sea**

- year effect among stocks, common factors applying at the Baltic Sea level
- survival affected by seals

#### SGBICEPS made progress, further co-ordinated efforts recommended

NASCO has asked ICES to evaluate the results of studies that estimate the level of pre-spawning mortality of salmon caught and released by anglers and the implications for stock assessments

Information reviewed from a number of countries

- large variation in mortality rates
- lower C&R mortality in lower temperatures
- lack of data on survival to repeat spawning
- mortality by less experienced anglers?

![](_page_21_Figure_6.jpeg)

### Catch & release (cont'd)

- Little information on multiple recaptures:
   <25% of fish marked after 1<sup>st</sup> capture
- C&R is an intermediate management strategy between retention fishery and fishery closure
- If C&R salmon counted as survivors
   → Overestimation of n of spawners
- Handled differently in different countries

   → ICES recognises the need to correct for C&R mortality
   However, river-specific conditions and situations vary a lot

![](_page_22_Figure_5.jpeg)

NASCO has asked ICES to provide a compilation of tag releases by country in 2008 and advice on progress with compiling historical tag recovery data from oceanic area

Compilation of tag releases by ICES member countries in 2008

• Provided in a separate report

Workshop on salmon historical information – new investigations from old tagging data (WKSHINI), Sep 2008 Halifax

- West Greenland
  - NA fish recovered further north than NEAC fish
  - CAN fish further north than US fish
  - nNEAC fish further north than sNEAC fish
  - Both NA and NEAC fish further south after 1989 than before that year
- NE Atlantic
  - North of Faroes: recoveries clumped around two main areas
  - More MSW salmon in the northern area
  - Salmon with northern origin more frequently in the northern area

![](_page_23_Picture_13.jpeg)

NASCO has asked ICES to provide a compilation of tag releases by country in 2008 and advice on progress with compiling historical tag recovery data from oceanic area

ICES recommended that additional Workshop be held to complete compilation of data and analyses

Workshop on Learning from Salmon Tagging Records (WKLUSTRE)

- Will meet in Sep 2009 in London
  - Further develop the international database of marine tagging and tag recovery data
  - Use the database to investigate the distribution of salmon of different origins and assess changes in distribution over time in relation to hydrographical factors
  - Investigate the use of tagging database to verify outputs from migration models
  - Make recommendations in relation to future salmon tagging studies and investigations of salmon mortality at sea

NASCO has requested ICES to identify relevant data deficiencies, monitoring needs and research requirements

### List of ICES recommendations (North Atlantic area)

#### **ICES recommends that**

- Study Group on Salmon Stock Assessment and Forecasting (SGSSAFE) meet to continue the efforts to
  - develop the models for the NAC and NEAC areas, particularly with regard to combining sea age classes and in the spatial disaggregation below the stock complex level
  - incorporate physical and biological variables into the models, prediction of survival, realistic simulation of recruitment
- further study group (after SGBICEPS) is held to collate additional data from stocks throughout the biogeographical range of Atlantic salmon and to continue with development of hypothesis and subsequent data analysis. Further investigations into the potential associations between biological characteristics of all life stages of salmon, environmental data, marine survival, and measures of abundance should be developed.
- Other recommendations within ICES presentations for each Commission Area

## ICES Scientific Advice to NASCO

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### Composition of NEAC stock complexes Northern NEAC vs Southern NEAC

![](_page_28_Picture_1.jpeg)

### Assessment of Stock Status, ICES definitions

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### **Status of stocks**

(Prior to the commencement of distant water fisheries)

![](_page_30_Figure_2.jpeg)

![](_page_30_Figure_3.jpeg)

Northern European 1SW and MSW stock complexes are considered to be at full reproductive capacity

# **Status of stocks** (Prior to the commencement of distant water fisheries)

![](_page_31_Figure_1.jpeg)

![](_page_31_Figure_2.jpeg)

**Southern European 1SW** and **MSW** stock complexes are considered to be at risk of suffering reduced reproductive capacity

### Status of stocks - exploitation

- A decreasing trend in exploitation throughout
  - Currently among the lowest in the time period

![](_page_32_Figure_3.jpeg)

 Exploitation on both 1SW and MSW higher in nNEAC than in sNEAC

![](_page_32_Figure_5.jpeg)

### **Reference points**

- No changes to national conservation limits model
- River-specific CLs implemented in France, UK(E&W), Ireland
- Progress with setting river-specific CLs
  - UK (NI) CLs established for a number of important salmon rivers, adult returns monitored.
  - UK (Scotl.) continued work for setting catchment-specific CLs, preliminary estimates of spawning escapement in 63 districts, compliance with CL assessed
  - Iceland progress in deriving river specific CLs, wide range in salmon production and spawning requirements within rivers
  - Norway transportation of SR models from data rich to data poor, CLs for 180 rivers in 2007, work in progress to estimate CLs for additional 200 rivers

## **Management Advice**

### Northern European 1SW and MSW stocks

- In absence of management objectives for these stocks:
  - Precautionary approach is to only fish from rivers at full reproductive capacity
- New Bayesian forecast model
  - Lower bounds of PFA for 2009 to 2012 are below SER
     → at risk of suffering reduced reproductive capacity
- Mixed stock fisheries present particular threats to stock status

## **Management Advice**

### Southern European 1SW stocks

- In absence of management objectives:
  - Precautionary approach is to only fish maturing 1SW fish from rivers where stock is at full reproductive capacity
- New Bayesian forecast model
  - Lower bounds of PFA for 2009 to 2012 are below SER → at risk of suffering reduced reproductive capacity
- Mixed stock fisheries present particular threats to stock status
# **Management Advice**

#### Southern European MSW stocks

- In absence of management objectives, except for the West Greenland fishery:
  - Precautionary approach is to only fish non-maturing 1SW fish from rivers where stock is at full reproductive capacity
- PFA midpoints (2009-2012) are below SER:
  - No catch options at West Greenland that would allow mgmt objectives to be met for this stock complex
- New Bayesian forecast model
  - Lower bounds of PFA for 2009 to 2012 are below SER → at risk of suffering reduced reproductive capacity
- Mixed stock fisheries present particular threats to stock status

# Recommendation:

ICES recommends that specific management objectives for NEAC be developed to allow ICES to develop quantitative catch advice

## Pre-Fishery Abundance Forecast for 2009-2012 using the existing regression model

Southern NEAC non-maturing 1SW stock complex



Pre-Fishery Abundance Forecast for 2008-2012 using the new Bayesian models

- No earlier forecasts for nNEAC 1SW+MSW and sNEAC 1SW
- 2009: WGNAS explored alternate Bayesian forecast models for all four stock complexes
- Forecasts for 1SW 2009 2012, for MSW 2008 2012



## Pre-Fishery Abundance Forecast for 2008-2012 using the new Bayesian models

**Southern NEAC** 

**Northern NEAC** 



# Comparisons between Bayesian and regression forecast models for Southern NEAC MSW salmon



Prob. that PFA will be above SER in 2009-2012 is

0.36 – 0.59 for regression model 0.61 – 0.68 for Bayesian model

## **Comparison with previous assessment**

#### National PFA model and national conservation limit model

• Provisional 2007 catch data updated

#### **PFA forecast model**

• Updated midpoint forecasts of the sNEAC MSW PFA (2008-2011) were all within 2% of last year's forecasts

#### Fishing at Faroes in 2007/2008

• No fishing since 2000

# Significant events in NEAC homewater fisheries

- IRE no drift net licenses issued 2007 and 2008
- IRE & UK(NI) voluntary net buyout in Foyle area 2007, marked reduction in n of driftnet licenses
- UK (E&W) continued net reductions
- Norway continued reductions in net fishing season

#### Gear and effort

- No significant changes in gear
- General downward trend in net effort
- Variable for rod effort, mostly stable or increasing

# Catches

- NEAC 1519 t
- 8% increase from 2007 (south: -8%, north: +13%)



# Catch per unit effort (CPUE)

- South: down and lower than 5 yr mean in most fisheries
- North: up and higher than 5 yr mean in most fisheries

# Farmed and ranched salmon in catches

- Remains low in most countries (<2% of catch), ignored in assessments</li>
- Exception is Norway: coast (23%), fjord (30%) and river (9%)

#### Age composition of catches

- North: 1SW 54%
  - below 5 and 10 yr means
  - among the lowest in time series in most countries
- South: 1SW 53%
  - below 5 and 10 yr means





#### **National origin of catches**

- Catches of Russian salmon in Norway
  - Historical (pre-1974) tagging experiments in Norway: bycatch of Russian salmon in marine fisheries was relatively high in Northern Norway
- Catches of EU salmon in Norway
  - Historical tagging experiments: recaptures in Finland (two border rivers with Norway)
  - Swedish salmon captured in 1970s on W and SW coast of Norway
- Catches of Norwegian salmon in other countries
  - NOR smolt tagging 1990-1996: small % recovered in Sweden, Denmark, Ireland



Distribution of recoveries of adult salmon tagged and released at Breivik, Northern Norway in 1962-1974

#### Northern European stocks (recruits)

- Maturing and non-maturing: broadly similar patterns
- General decline, brief increase around 2000
- Full reproductive capacity throughout



#### Northern European stocks (spawners)

- 1SW and MSW: broadly similar patterns
- Full or at risk of suffering reduced reproductive capacity in most years
- 2007 and 2008 1SW was suffering reduced reproductive capacity



#### Southern European stocks (recruits)

- Maturing and non-maturing: broadly similar declining patterns
- Maturing has mostly been at full reproductive capacity until recent years
- Non-maturing was at full reproductive capacity until 1997



#### Southern European stocks (spawners)

- Declining trends
- 1SW at risk or suffering reduced reproductive capacity most of the time series
- MSW at full capacity till 1997
- Broadly consistent with patterns of decline in marine survival



## **Survivel indices for NEAC stocks**

○ 2SW● 1SW

- Annual rates of change in marine survival
- Overall annual decline (1-20%)
- Most 2008 estimates were lower than 2007 estimate and the 5 and 10 yr means
- Exception: some rivers in Iceland



NASCO has requested ICES to provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved

Most management measures introduced in recent years have aimed to reduce levels of exploitation on NEAC stocks, to increase freshwater escapement and in some countries specifically to meet river-specific CLs

Summary of national objectives, recent management measures and attainment of objectives is provided in Table 3.9.1 of the Report of the ICES Advisory Committee, CNL (09)8



#### NASCO has requested ICES to further investigate opportunities to develop a framework of indicators that could be used to identify any significant change in previously provided multi-annual management advice

- In 2006, ICES provided multi-annual advice for all three NASCO Commission areas, and presented a preliminary FWI
- FWI was adopted for WG fishery based on 7 contributing regions/stock complexes with direct links to mgmt objectives for WG fishery
- ICES unable to develop a FWI for Faroese fishery
  - Lack of quantitative catch advice
  - Absence of specific mgmt objectives
  - Absence of sharing agreement for Faroese fishery
  - None of the available data sets met the criteria for inclusion in the FWI
- 2009 ICES updated the data sets
  - Still did not meet the criteria as being informative of significant change
  - PFA estimates mostly remained above the SER
  - Alternative approaches should be explored
  - Full assessment for NEAC preferred, given PFAs remain close to SERs

# ICES Scientific Advice to NASCO

# Atlantic salmon in the West Greenland Commission

# **Management objectives**

# Precautionary management plan: at least 75% probability of achieving management objectives:

- Meeting CLs simultaneously in Labrador, Newfoundland, Québec, Gulf of St. Lawrence
- Achieve 25% increase in returns relative to 1992-1996 in Scotia–Fundy, USA
- Meeting CL for Southern NEAC MSW complex

# **Reference points**

- CL: number of spawners required to achieve MSY
  - number of spawners required to fully seed the wetted area of the river (some regions in NA)
  - pseudo stock-recruitment observations (many countries in NEAC)
  - adult-to-adult stock and recruitment relationship (remaining areas)
- CL is a limit reference point and falling below it should be avoided with high probability
  - 75% risk level for catch advice
- CLs limited to 2SW (all North American complexes) and MSW (Southern European complex)
  - >90% of harvest in WG is 1SW non-maturing salmon

# Exploitation

- A long term decline
- Exploitation has increased in recent years (2008: 3.7% above the 5-yr mean)



# **Status of stocks**

#### NORTH AMERICAN STOCK

- Newfoundland:
- Labrador:
- Québec:
- Gulf of St. Lawrence:
- Scotia-Fundy:
- United States:

EUROPEAN STOCK

• Southern Europe:

suffering reduced reproductive capacity (98% of 2SW CL) suffering reduced reproductive capacity (50% of 2SW CL) suffering reduced reproductive capacity (74% of 2SW CL) suffering reduced reproductive capacity (56% of 2SW CL) suffering reduced reproductive capacity (12% of 2SW CL) suffering reduced reproductive capacity (7% of 2SW CL)

at risk of suffering reduced reproductive capacity (102% of 2SW CL)

# Pre-fishery abundance forecasts 2009 - 2011

#### **Based on existing ICES models**

#### **North American stock complex** (phase shift model)

- 2009 107 500
- 2010 117 300 SER for NA: 212 189
- 2011 110 200

#### **Southern European MSW stock complex** (regression model)

- 2009 431 220
- 2010 419 733
  - SER for sNEAC: 501 086

• 2011 – 392 235

# **Management advice**

#### None of the stated management objectives which would allow a fishery at West Greenland would be met in 2009, 2010, or 2011

• Given zero marine fishing mortality in 2009-2011:

- 2-3% probability of meeting CL in 4 northern NA regions
- ~0% probability of 25% increase to 2 southern NA regions
- 54%, 49% and 36% probability (respectively) of meeting the southern NEAC MSW CL
- NA all regions: 45%, 45% and 42% probability of lower returns in 2009-2011 (respectively) compared to mean 2004-2008 returns

#### **Comparison with previous assessment and advice**

- Management advice for WG fishery for 2009 based in models previously used by ICES
- Current model has provided stable comparisons of NAC PFA (predictions vs. updates)
  - 2008 NAC PFA update decreased to 107 500 from 114 200
  - 2008 sNEAC PFA update decreased to 483 700 from 489 000
- Forecasts based on alternate Bayesian model more optimistic (median)
- NA: 25th percentile of Bayesian credible intervals (=75% threshold for evaluating status vs. CL) remain below SER for 2009 to 2011
- sNEAC: 25th percentile below SER for 2009 to 2011

 $\rightarrow$  Both models provide similar predictions of the lower bound in 2009-2011

#### NASCO has requested ICES to describe the events of the 2008 fishery

#### Catch and effort in 2008

- Reported catch 26 t, distributed across all NAFO divisions
- N of people reporting has increased (41 people in 2002, 143 in 2008)
  - Reporting rate has increased?
  - Possible effect of a TV campaign
- Estimated unreported catch of 10 t









# 2003 International sampling programme

#### **Baseline Sampling Programme**

Sampling teams from Canada, USA, Ireland, UK(Scotland), UK(England & Wales), Denmark(Greenland)

2086 salmon inspected from 3 NAFO divisions, ~1900 sampled (fl, wt, scales, tissue, diseases, tags...)

### **Enhanced Sampling Programme**

=SALSEA West Greenland: broader, more detailed sampling Concerns raised  $\rightarrow$  no enhanced sampling in 2009

# **Biological characteristics of the catches**

#### River Age

Continent of Origin	1	2	3	4	5	6
North American	0.9%	25.1%	51.9%	16.8%	4.7%	0.6%
European	7.0%	72.8%	19.3%	0.8%	-	-

#### Sea Age

Continent of Origin	1SW	2SW	Previous Spawners
North American	93.0%	0.8%	5.6%
European	98.8%	-	1.2%

# 2008 salmon origins by NAFO Divisions



# Salmon origin proportions (1982-2008)



year

# 2008 Tag Recoveries (n=6)

- 1 Carlin
  - Penobscot River (USA)
- 1 Streamer
  - Restigouche River (Canada)

- 1 PIT
  - unreadable
- 3 CWT
  - Ason River (Spain)
  - North Esk (UK Scotl.)
  - 1 unreadable





# Oversampling

More salmon sampled than reported (shaded cells) Reported catches adjusted according to the weight of salmon sampled

	2002 Landings		2003 Landings		2004 Landings		2005 Landings	
NAFO	Reporte	Adjuste	Reporte	Adjuste	Reporte	Adjuste	Reporte	Adjuste
Division	d	d	d	d	d	d	d	d
1A	14	14	619	619	3,476	3,476	1,294	1,294
1B	78	78	17	17	611	611	3,120	3,120
1C	2,100	2,100	1,621	1,782	3,516	3,516	2,240	2,240
1D	3,752	3,752	648	2,709	2,433	4,929	756	2,730
1E	1,417	1,417	1,274	1,274	2,609	2,609	2,937	2,937
1F	1,661	2,408	4,516	5,912	2,068	2,068	4,956	4,956
Total	9,022	9,769	8,694	12,312	14,712	17,209	15,303	17,276

	2006 Landings		2007 Landings		2008 Landings	
NAFO	Reporte	Adjuste	Reporte	Adjuste	Reporte	Adjuste
Division	d	d	d	d	d	d
1A	5,427	5,427	2,019	2,019	4,882	4,882
1B	2,611	2,611	5,089	5,089	2,210	2,210
1C	3,424	3,424	6,148	6,148	10,024	10,024
1D	4,731	4,731	4,470	4,470	1,595	3,577
1E	2,636	2,636	4,828	4,828	2,457	2,457
1F	4,192	4,192	2,093	2,252	4,979	5,478
Total	23,021	23,021	24,647	24,806	26,147	28,627

NASCO has requested ICES to provide a detailed explanation and critical examination of any changes to the models used to provide catch options

#### **Run-reconstruction models**

• Same as those used since 2003

#### Forecast models for PFA of 2SW salmon

- NAC same as those used since 2004
- NEAC same as those used since 2002
- Management advice based on models previously used by ICES
- Alternate models for both NAC and NEAC
- Conclusions the same from both models: no catch options which provide a 75% chance of attaining the management objectives

#### **Risk assessment of catch options model**

• No changes
NASCO has requested ICES to provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved

- 1<sup>st</sup> measurable outcome of NASCO management at WG: Decrease in exploitation
- Other measures relate to increasing spawning escapement in homewaters
  - Influenced by measures taken in homewaters
  - None of the objectives (NAC, sNEAC) have been achieved





#### NASCO has asked ICES to update the framework of indicators used to identify any significant change in the previously provided multi-annual management advice

#### Background

- 2007: ICES developed a FWI that could be used to identify any significant change in the previously provided multi-annual management advice for WG fishery
- 2009 assessment begins the cycle of forecasting and catch advice for 2009-2011 → update the FWI in support of the multi-annual advice
- If the output of FWI is accepted at 2009 NASCO meeting, it will be applied in January 2010 for 2010 fishery and January 2011 for 2011 fishery

#### ICES updated the FWI in support of the WG fishery management

- Included most recent years
- Quantifying threshold values and probabilities of true high and true low state (correct classification against a threshold levels) for those variables retained for FWI
- Revising/adding indicator variables and functions for evaluating the indicator score to the FW spreadsheet
- Provided an updated spreadsheet for doing the FWI assessment

#### Framework of Indicators



## rsuoijepueuuosei SEOI

Additional information be requested from fishers in WG, provide information on fishing site, time, effort

Continue broad geographic sampling program for WG fishery, Enhanced Sampling Programme should be applied in 2009

# ICES Scientific Advice to NASCO

## Atlantic salmon in North American Commission



Geographical regions in North American Commission area:

Labrador Newfoundland Québec Gulf of St. Lawrence Scotia-Fundy USA

Salmon Fishing Areas (SFAs) and Québec Management Zones (Qs) in Canada

#### Summary on status of stocks

- All six areas below their CL and suffering reduced reproductive capacity
- PFA: continued low abundance of salmon
- Some increases in returns 2007 $\rightarrow$ 2008, some down
- Mostly close to the lower end of time series



## Exploitation

- Dramatic decline in exploitation rate since 1970s-80s
  - 79%  $\rightarrow$  14% for 2SW
  - $69\% \rightarrow 14\%$  for 1SW
- 2008: exploitation rates among lowest in time series



#### **Reference points**

- No changes recommended in the 2SW salmon conservation limits
- Canada 123 349, USA 29 199, total 152 548

#### **Management advice**

- Predicted n of 2SW salmon returning to NA in 2009 is substantially lower than the 2SW CL
  - → No catch options for the composite North American fisheries
- Mixed stock fisheries pose particular risks
- Single stock fisheries should be based on local status and assessments
- Conservation best achieved by fisheries in estuaries and rivers on stocks at full reproductive capacity

#### Pre-fishery abundance of 2SW salmon for 2009 - 2011

- Existing ICES model: two-phase regression between PFA and lagged spawners
  - Modelling dynamics of PFA, providing forecasts
  - >99% probability of being in lower productivity phase
- Alternative Bayesian model was examined by ICES in 2009
  - Considered regionally-disaggregated lagged spawners and returns for the six regions

	MEDIAN (95% CREDIBLE IN TERVAL RANGE)	
Forecasts of PFA <sub>NA</sub>	SPATIALLY AGGREGATED PHASE-SHIFT MODEL	REGION-DISAGGREGATED RANDOM WALK MODEL
2008	110,100 (67,250 – 180,700)	137,500 (80,000 – 242,000)
2009	107,500 (59,600 – 193,500)	137,500 (66,000 – 294,000)
2010	107,300 (60,000 – 194,600)	140,000 (58,000 – 355,000)
2011	110,200 (61,300 – 199, 500)	149,000 (55,000 – 430,000)

#### **Catch options**

2SW CL for NA 152 548 → No catch options for 2010 – 2012 for returning 2SW salmon



Run reconstructed PFA (1971 to 2007) and forecasts of PFA of 2SW salmon for 2008 to 2011 in North America.

**Forecasts:** 

- a= regionally disaggregated alternate model presented in 2009
- **b= existing phase shift model by ICES**

#### **Comparison with previous assessment and advice**

- Updated forecasts of PFA were provided both using the existing ICES model and an alternative regionally-disaggregated Bayesian model
- No change in interpretation of stock status and expected abundance based on updated data and the two models
- Catch advice remain unchanged from previous year

# NASCO has requested ICES to describe key events of the 2008 fisheries

#### Canada

- No commercial harvest
- 3 user groups with salmon catches:
  - Aboriginal peoples' food fisheries
  - Residents fishing for food in Labrador
  - Recreational fishers
- Total catch: 148 t, 32% higher than in 2007
  - 52 362 small salmon (+41%)
  - 11 737 large salmon (+14%)

#### **Saint-Pierre and Miquelon**

- No information on n of net licenses for 2008
- Salmon catch: 3.5 t

#### USA

• No harvest

62 t 2 t 83 t

Pre-fishery abundance of NAC salmon:

- Declining trend
- Non-maturing 1SW salmon: decline 93% over time series
- Maturing 1SW salmon: decline 72%



Estimated mid-points of 2SW returns to and 2SW spawners in six geographic areas of North America

→ All areas below CLs, suffering reduced reproductive capacity



- conservation requirements
- 2SW spawners
- 2SW returns

#### Estimates of returns in 2008 by geographic area

relative to 2007 and previous 5-year mean

#### **1SW**

#### Labrador

- 5% increase, 3rd highest in time series
  Newfoundland
- 36% increase, 16% > 5-yr mean **Québec**
- 59% increase, 27% > 5-yr mean **Gulf**
- 55% increase, 10% > 5-yr mean
  Scotia Fundy
- 99% increase, 94% > 5-yr mean **USA**
- 174% increase, 151% > 5-yr mean

## Labrador

19% increase and 38% > 5-yr mean
 Newfoundland

**2SW** 

• 4% decrease and 3% < 5-yr mean

#### Québec

- 22% increase and 3% >5-yr mean **Gulf**
- 19% decrease and 22% < 5-yr mean

#### Scotia Fundy

- 121% increase and 32% > 5-yr mean USA
- 85% increase and 62% > 5-yr mean



## **Marine survival rates**

- Available from 11 wild and 3 hatchery stocks
- All wild and 2 hatchery 1SW return rates up from 2007
- 2SW mostly down
- Overall annual decline in hatchery fish, wild mixed



NASCO has requested ICES to evaluate the extent to which the objectives of any significant management measures introduced in recent years have been achieved

No significant management measures introduced within the NAC in recent years

## Recommendation:

ICES recommends that sampling in the Labrador subsistence fishery be continued and expanded in 2009 and future years