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MONT SAINT-MICHEL – 16 > 18 MAI 2018

Life at Sea – the big unknowns

THE MISSING SALMON PROJECT

Ken Whelan and Walter Crozier
Atlantic Salmon Trust
Wednesday , 16th May 2018

ATLANTIC SALMON TRUST

Interreg France (Channel Manche) England
SAMARCH
Gestion des salmonidés dans la Manche
Fonds européen de développement régional

NORMANDIE Grands Migrateurs

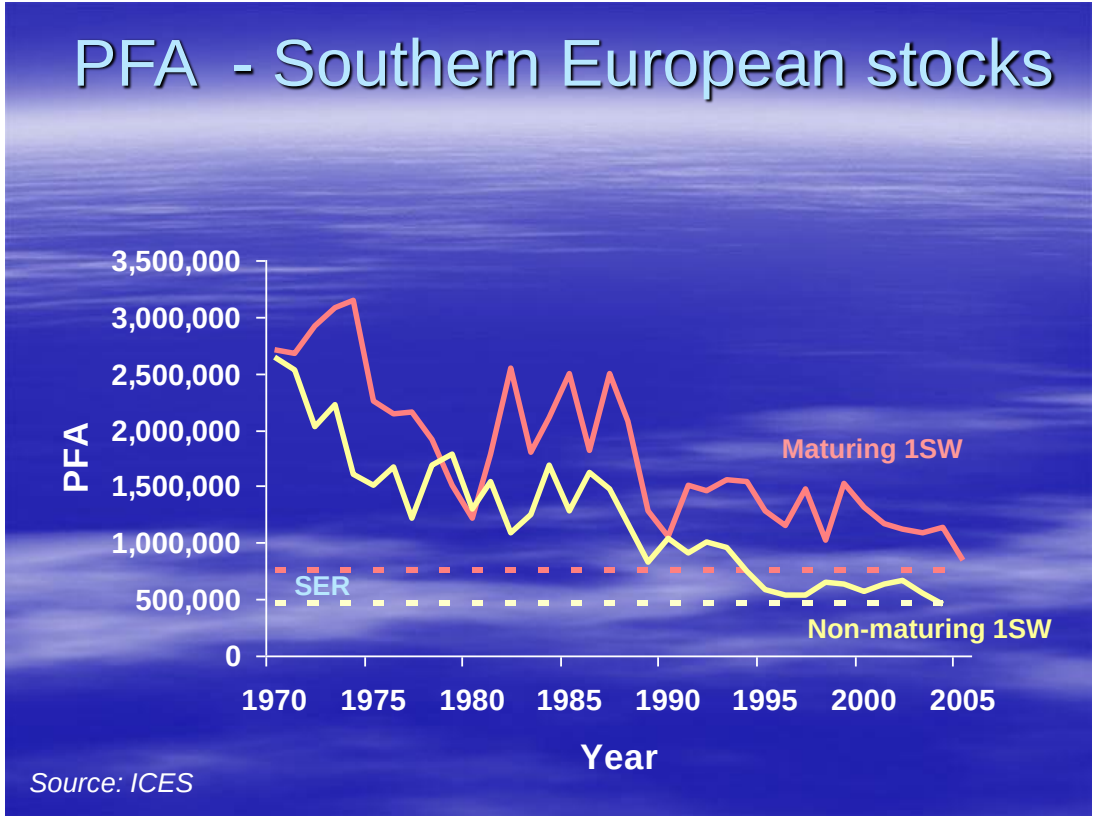
Agence de l'eau eau seine NORMANDIE

FÉDÉRATION NATIONALE PÊCHE

LA MANCHE CONSEIL DÉPARTEMENTAL

RÉGION NORMANDIE

The Problem – emerges!



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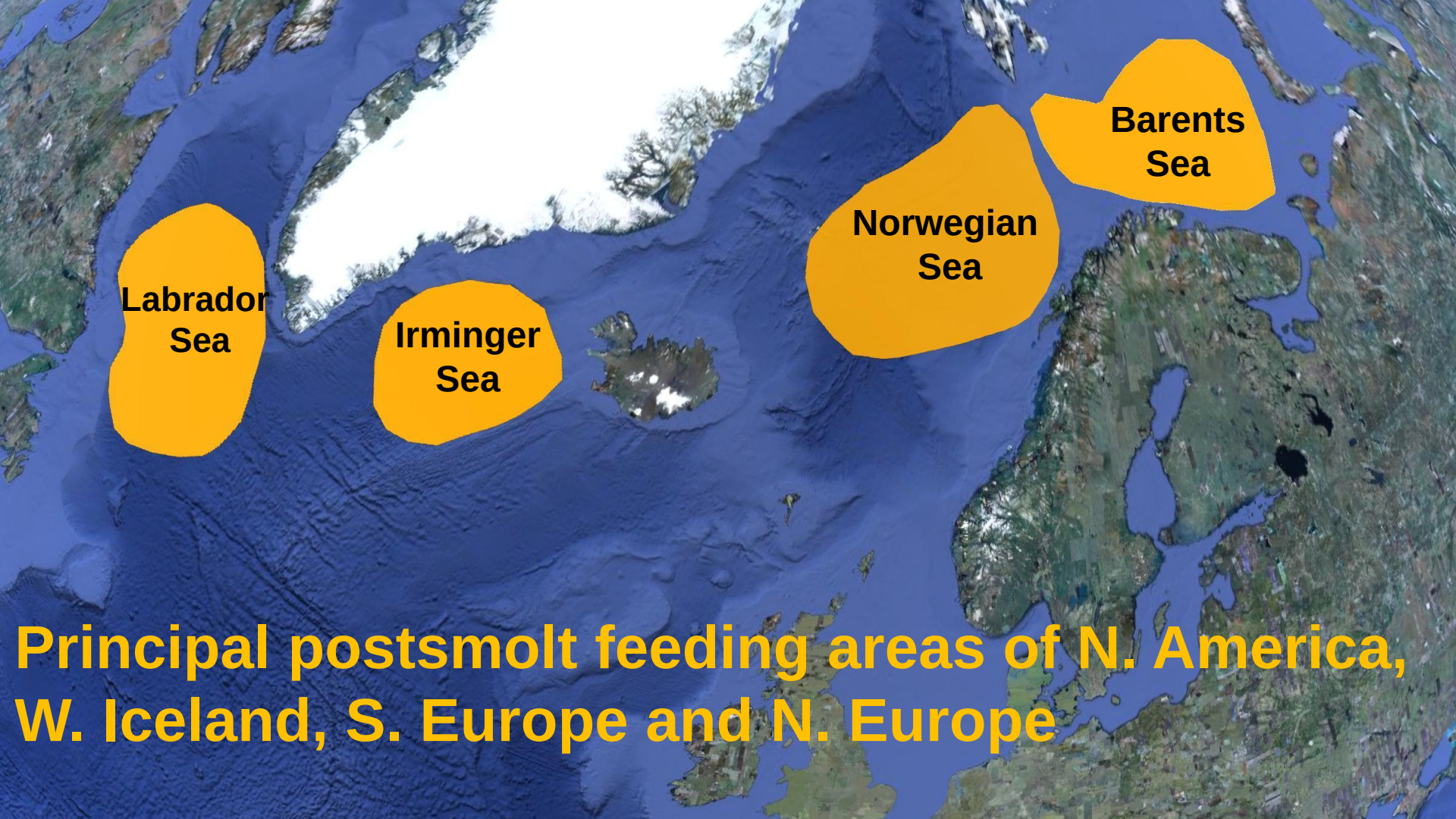

Principal postsmolt feeding areas of N. America, W. Iceland, S. Europe and N. Europe

What was Found ??

- Distribution pattern of specific populations of salmon, were spatially mapped at different genetic assignment levels
- Likely migration routes were assembled for some individual river stocks: e.g. Loire Allier (France) and Bann River (Northern Ireland)
- Distribution of post-smolts was clearly linked to ocean currents
- Increased mortality strongly linked to impacts of climate change (++C^0), SSC's and changes in the food supply in the ocean
- Marine growth rates varied among years, highest growth rates 2002, followed by 2003 and 2009. Lowest growth rates in 2008
- Growth rates during the first period at sea were lowest for salmon of southernmost origin
- Inter-annual variation in wind fields, and thus the surface currents, altered the migration pathways
- Several key areas in the migration routes where shifts in the migration direction may occur due to climate change were also identified

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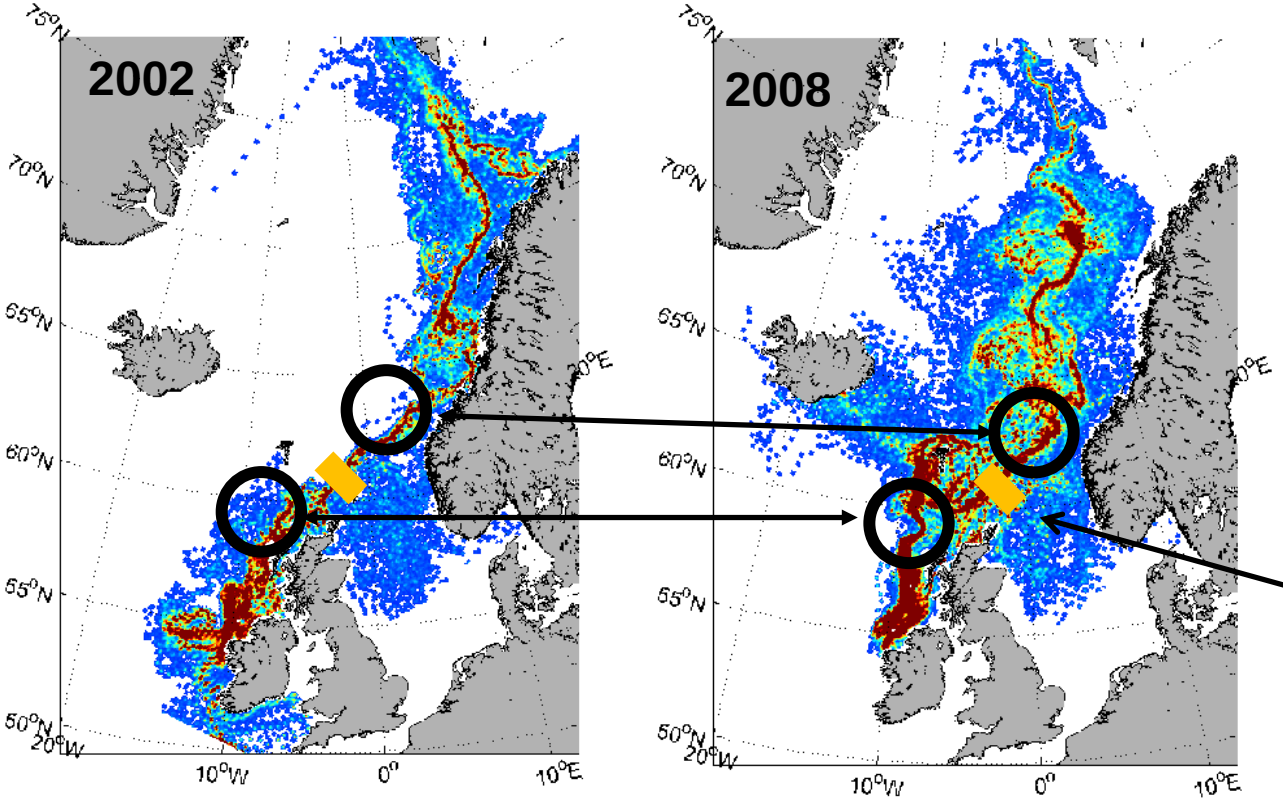
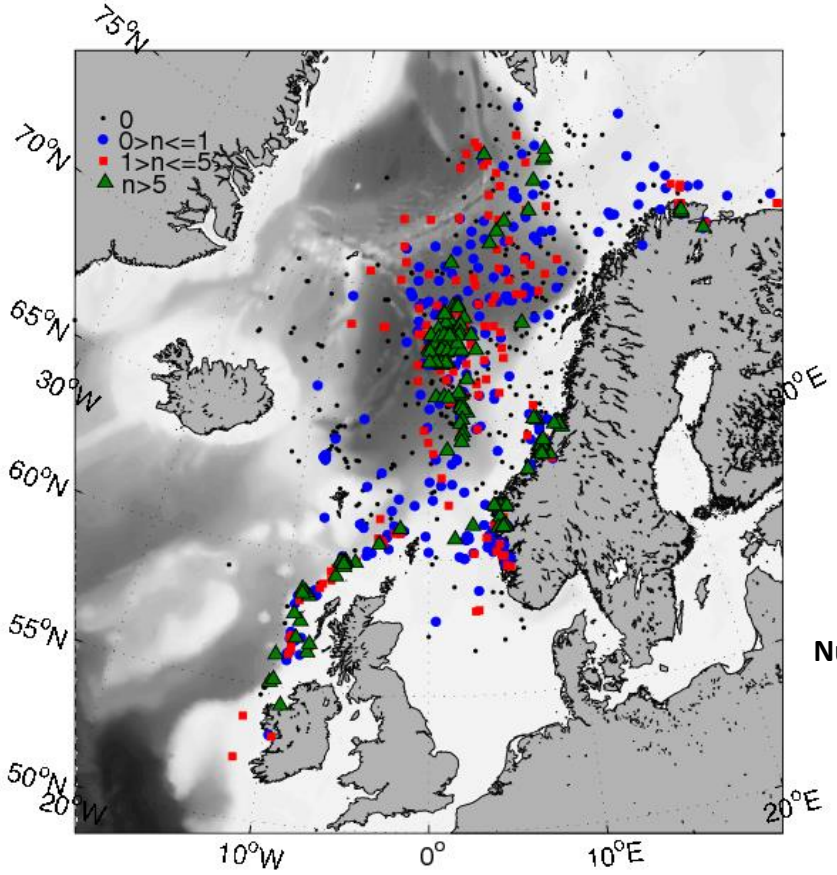
Migration corridors

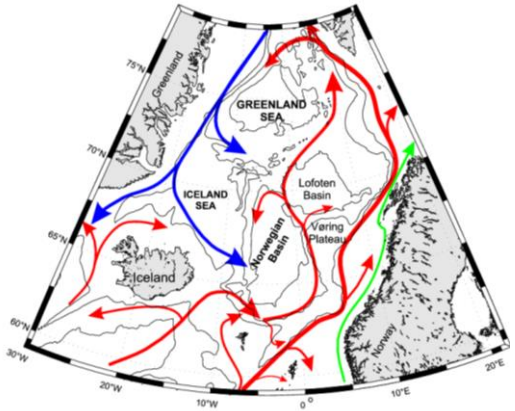


Key areas in the migration routes where shifts in pathways may occur

Passage in the migration route

Distribution of salmon post smolts





Main surface currents:

Red arrows: Warm and salt Atlantic Water

Blue arrows: Cold and less saline Arctic Water

Number of captured post smolts (n) per trawl hour

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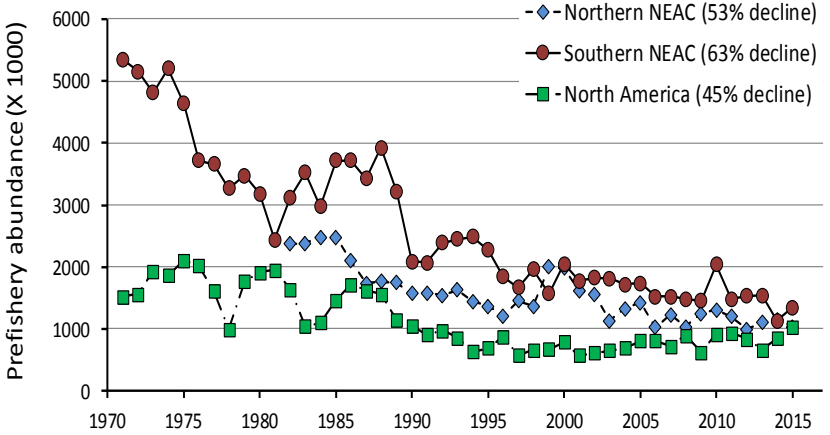
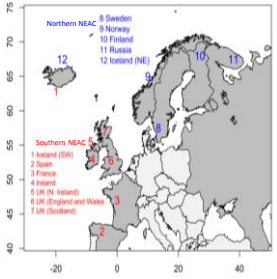
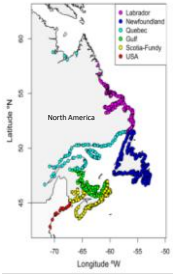
Status of Atlantic Salmon - 2015

- Atlantic salmon abundance stuck at historic low levels since late 1970s.
- Important declines in estimated pre-fishery abundance (as of Jan. 1 of first winter at sea) of Atlantic salmon in 3 major stock complexes of North Atlantic.
- Peak estimated abundance that likely exceeded 10 million fish at sea in the 1970s to an average less than 3.5 million fish in past ten years.

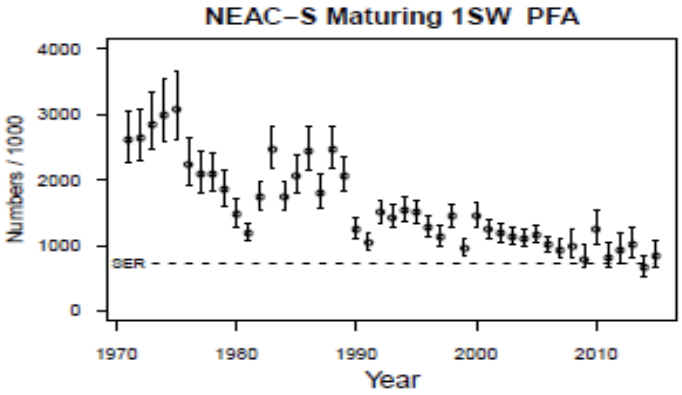


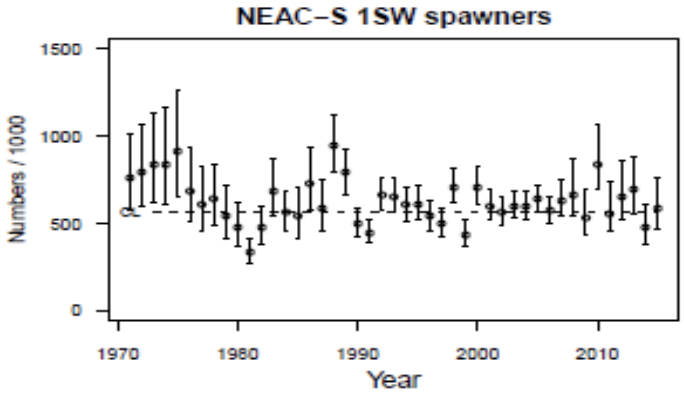


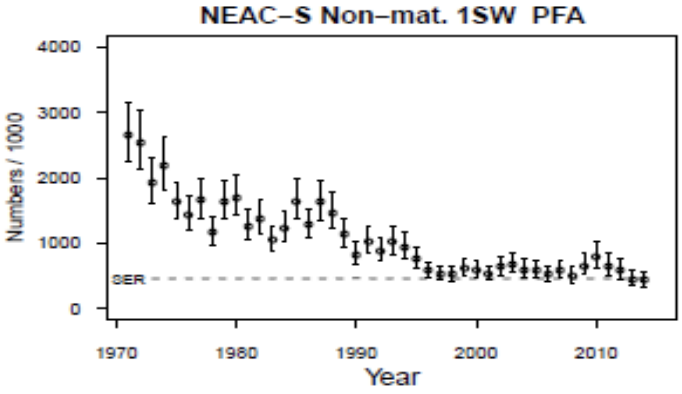


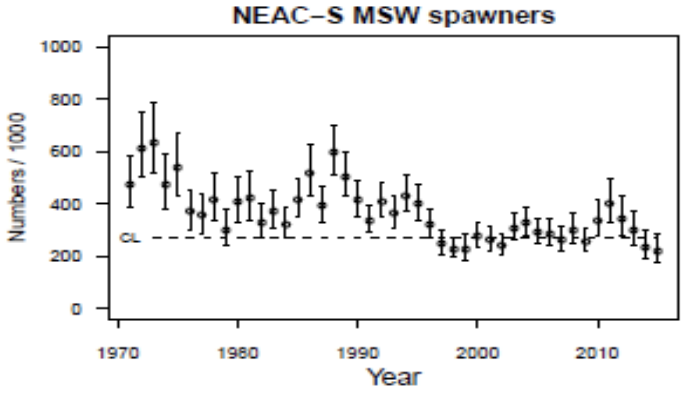
Courtesy of : Gerald Chaput – DFO, Canada

The Scale of the Challenge









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SALSEA Track
Partitioning the Ocean

- SALSEA Programme 2006 to 2011 – migration and distribution patterns; regional stock discrimination and identified relevant changes in the ocean
- SALSEA Track
  - Identify where mortality is taking place & the level of mortality at various stages in the ocean
  - Partition out the ocean: near shore; post-smolt migration routes; feeding at sea in year 1; feeding at sea – years 2 to 4; returning adults and near shore / estuarine mortality

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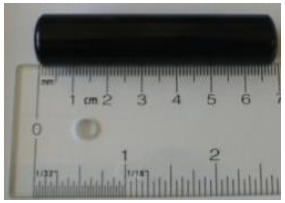
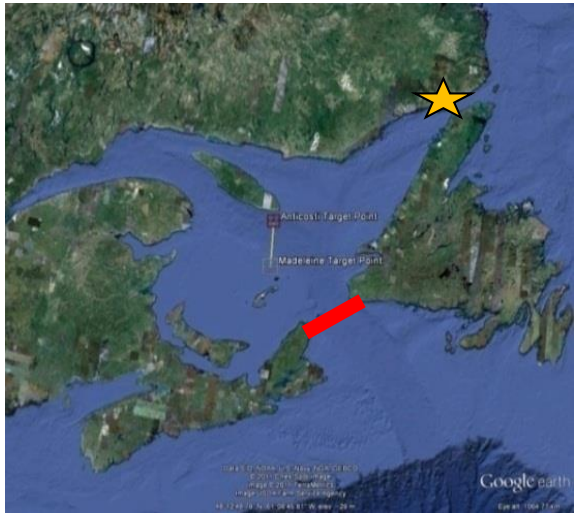
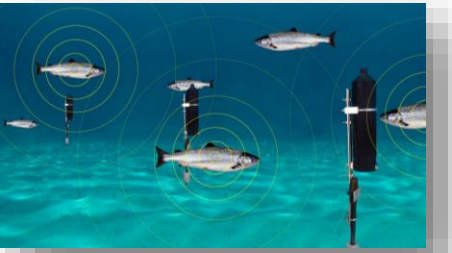
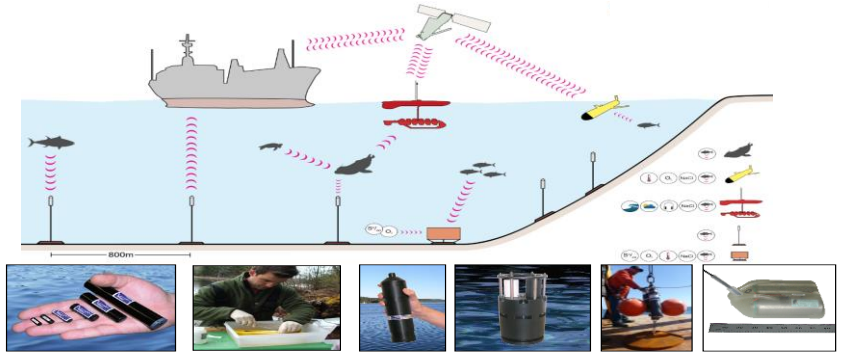
Atlantic Salmon Federation







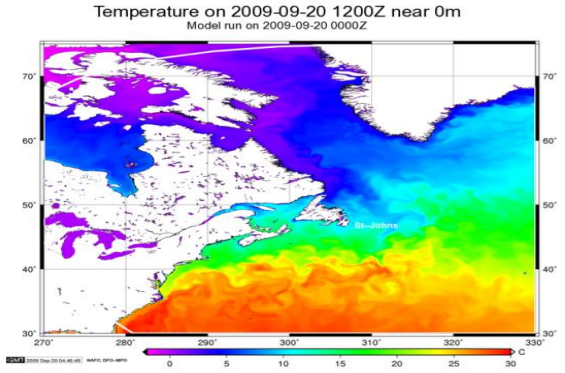


Trout & Salmon December 2011

"Freshwater temperatures are also rising, smolts are growing faster and the smolt age is dropping. Younger smolts are often smaller and therefore do poorly at sea. ……We have long talked about the impacts from forestry, pollution, aquaculture in the marine and freshwater environments, and perhaps in the past believed that we had the luxury of time to deal with these issues. In the face of what we learned ….. about the stocks which are under pressure and the stocks at risk at sea, ***taking urgent management action in these areas is no longer a choice - it is an imperative*** *"*

What has caused such an unprecedented decline?

- Over Fishing ?
- Habitat Destruction ?
- Barriers ?
- Drop in Water Quality ?
- Increase in Predators ?
- Aquaculture ?
- Relative importance of these impacts will vary.
- Warming oceans and warming freshwaters ?
- Impacts at x4 scales: local, national, regional and transnational



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What has been achieved ??

- High seas and near shore netting – greatly reduced
- Improved water quality
- Habitat protection and restoration
- Increasingly better management of aquaculture impacts…(still a way to go to reverse the damage!)
- But ….salmon populations are not responding ?
- Marine survival at stubbornly low levels – dropped from 25%+ to 5% !
- WHY???
- Where do we focus our research and management funding

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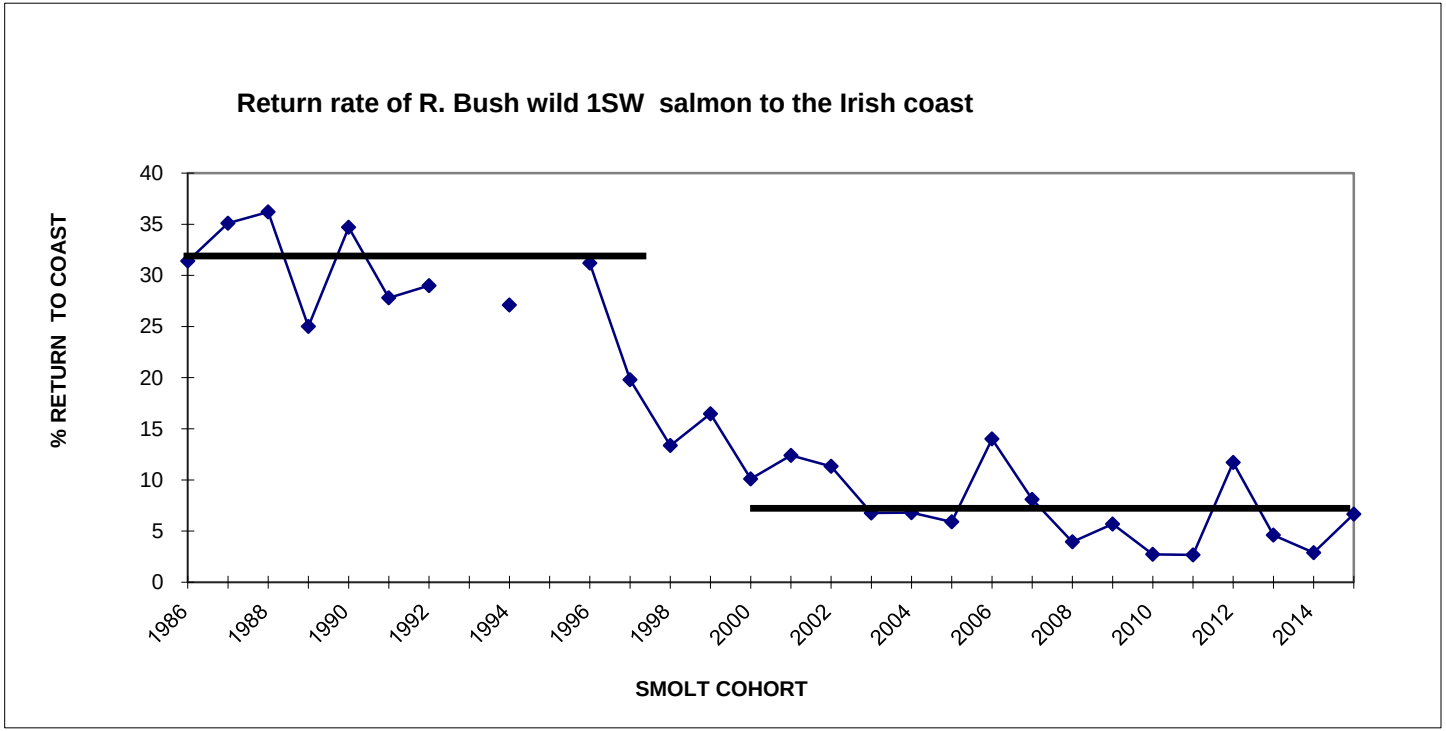
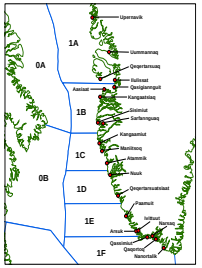
The Scale of the Problem 2015: River Bush - Complex !! - but how can research be targeted and prioritised?



The Likely Suspects Framework Concept

- This approach places **candidate mortality factors** within an overall Framework, covering the freshwater migration phase and the marine phase.
- The overall objective is to quantify the potential of each factor to influence survival (the **“likely suspects”**).
- Identify the likely impact both individually and cumulatively of the “suspects”…..an exercise in accounting.
- Can we narrow this down to the really important “suspects” and decide what to do about it?
- A particular focus would be on identifying **where and how mortality factors had changed** between earlier periods of higher marine survival and the more recent/current low survival phase – why up to 25% marine survival in the 1970s?



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Atlantic Salmon Federation
Fédération du Saumon Atlantique

INTERNATIONAL YEAR OF THE SALMON

ATLANTIC SALMON TRUST

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Department for Environment Food & Rural Affairs

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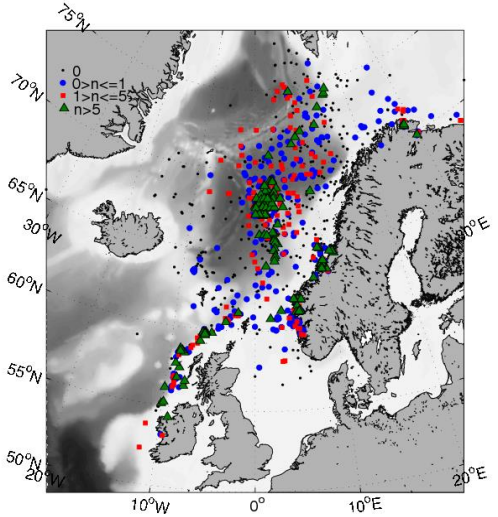
Likely Suspects Framework – where does the mortality take place?

- There is evidence for where salmon migrate to, and for the existence of numerous mortality candidates.
- Start by identifying the main potential locations/times of mortality and make them **“ecosystem domains”** in the Framework
- Domains can be placed at geographical locations that we suspect may be significant in the various phases of the life cycle.
- Domains are not by any means all in the marine!
- The freshwater migration phase influences subsequent survival at sea.



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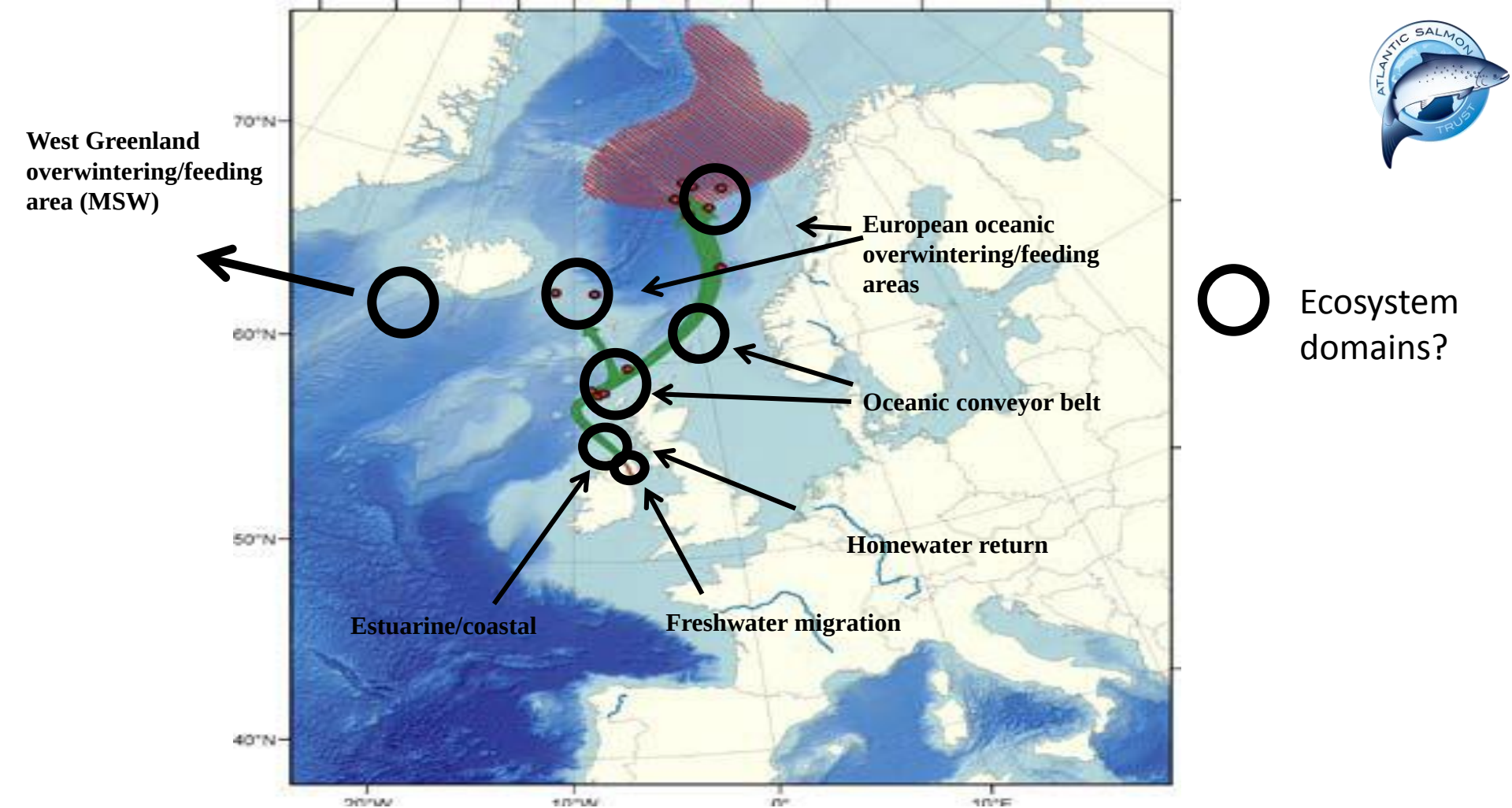
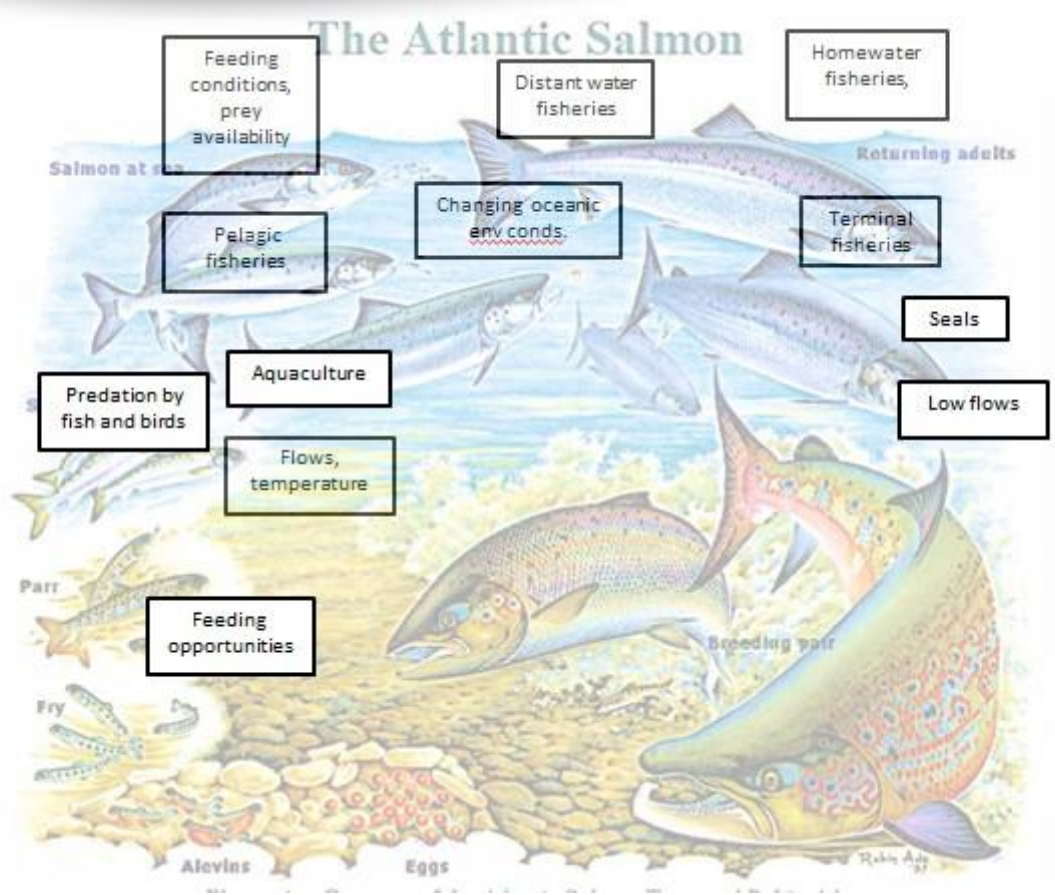

West Greenland overwintering/feeding area (MSW)
European oceanic overwintering/feeding areas
Oceanic conveyor belt
Homewater return
Freshwater migration
Estuarine/coastal
Ecosystem domains?
70°N
60°N
50°N
40°N

What are the Likely Suspects ?



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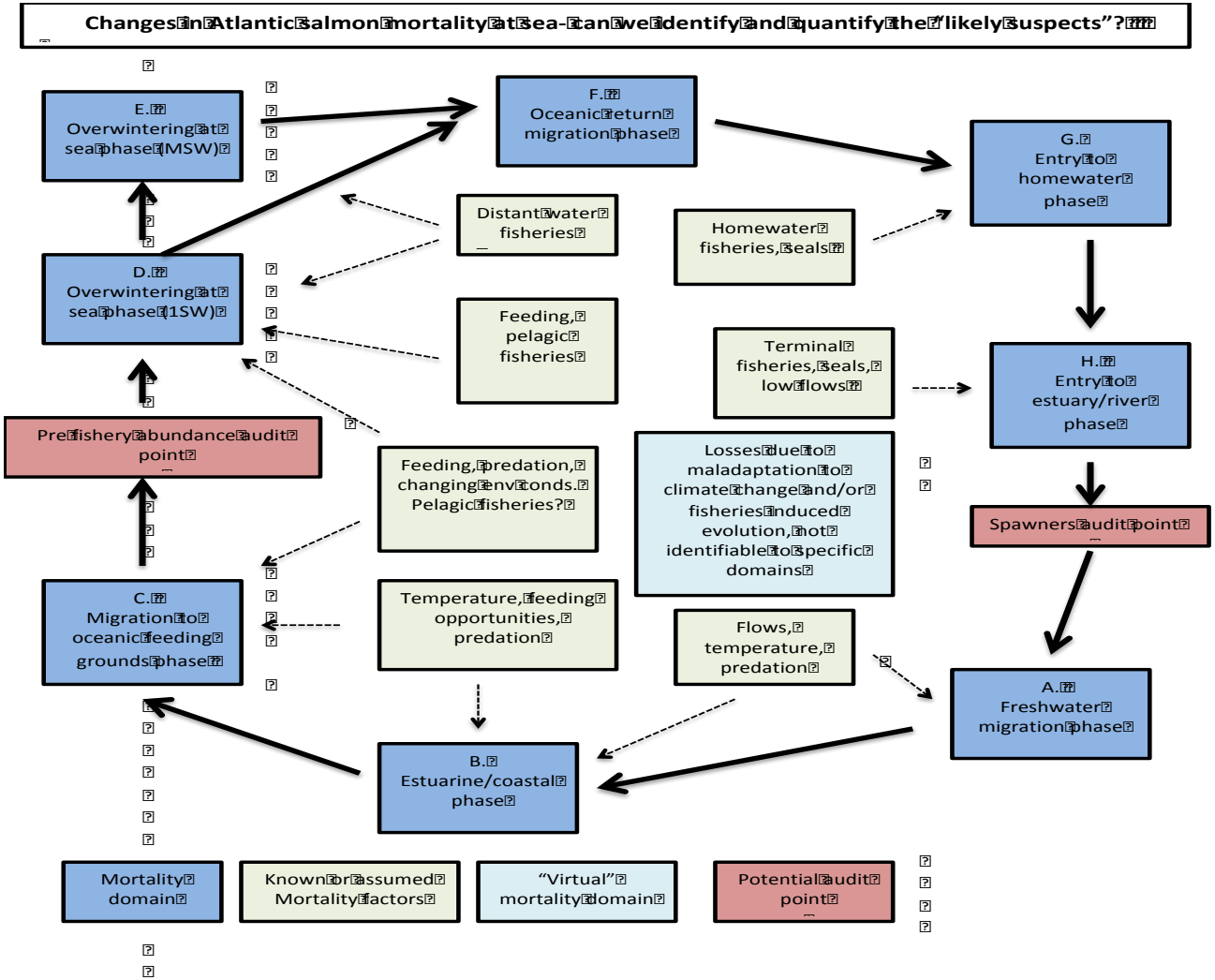
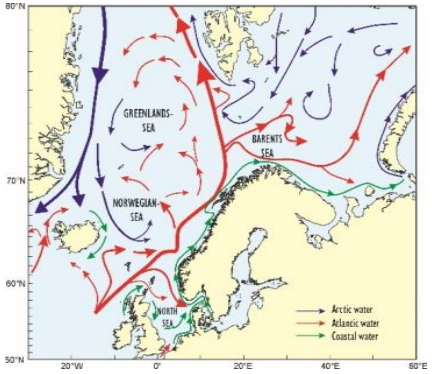

Changes in Atlantic salmon mortality at sea - can we identify and quantify the "likely suspects"?
E. Overwintering at sea phase (MSW)
F. Oceanic return migration phase
G. Entry to homewater phase
Distant water fisheries
Homewater fisheries, seals
D. Overwintering at sea phase (1SW)
Feeding, pelagic fisheries
Terminal fisheries, seals, low flows
H. Entry to estuary/river phase
Pre fishery abundance audit point
Feeding, predation, changing env conds. Pelagic fisheries?
Losses due to maladaptation to climate change and/or fisheries induced evolution, not identifiable to specific domains
Spawners audit point
C. Migration to oceanic feeding grounds phase
Temperature, feeding opportunities, predation
Flows, temperature, predation
A. Freshwater migration phase
B. Estuarine/coastal phase
Mortality domain
Known or assumed Mortality factors
"Virtual" mortality domain
Potential audit point

Likely Suspects Framework – 2018: constructing the Framework

There will potentially be quite a few **domains**, reflecting areas where **salmon pass through** on their journey from pre-smolt to returning adult:

- Parr to smolt transformation
- Smolt migration from freshwater and through estuaries
- Estuary/sea interface and early marine life (coastal/near shore)
- Migration pathways to oceanic feeding grounds
- Overwintering/feeding areas
- Return migration and entry to home waters and home river



Some domains may occupy large areas of ocean where many stocks coalesce and face similar pressures, while **others will be very localised** where perhaps one or a few stocks pass through and hence the pressures impact fewer stocks

The **Framework can work at various scales**, from stock complex (= transnational management units) to individual stocks- Europe and N America.

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The Likely Suspects Framework Balance Sheet

What it might look like!

- UK Pre-Fishery Abundance: avg. 1971 to 1975: 1.061m
- Pre-Fishery Abundance: avg. 20012 to 2016: 495k
- Fish to account for: 566k

- Nearshore: Estuarine, Coastal, Homewater Mortalities: 244k
  (seals ,sea lice, avian predation etc)
- Conveyor Belt Mortality: 266k
- Pelagic by-catch 56k
  (eDNA – SeaSalar)

- Tackle *Nearshore* and *Pelagic*, …. you tackle 53% of the marine “suspects”!

March 2018- Set up online operating Framework between Atlantic and Pacific. Co-ordinating and sharing information on research bids and funding opportunities – BaseCamp / Long Live the Kings

April 2018 - Review of progress/ support from ICES / WGNAS

May 2018- Publish AST "Blue Book" on the Likely Suspects Framework Workshop

June 2018 - Report progress to NASCO International Atlantic Salmon Research Board

Ongoing - Develop collaborative research funding bid(s) through IYS and Local / Regional sources /EU Funding / Galway Agreement – EU and North America

Atlantic Salmon Trust Likely Suspects Workshop- 2017

Atlantic salmon mortality at sea: Developing an evidence-based *"Likely Suspects"* Framework

Walter Crozier, Ken Whelan, Mathieu Buoro, Gerald Chaput, Jason Daniels, Sue Grant, Kim Hyatt, James Irvine, Niall Ó'Maoiléidigh, Etienne Prévost, Etienne Rivot, Ian Russell, Michael Schmidt and Brian Wells

Based on a workshop organised by the Atlantic Salmon Trust, held in Edinburgh Tuesday, 6th November – Thursday, 8th November 2017.

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IT'S TIME TO
SOLVE THE MYSTERY
OF OUR MISSING SALMON
THE MISSING
SALMON
PROJECT

The Missing Salmon Project will work with all the relevant agencies to approve stock recovery plans & recommendations which will be presented to policy makers to enact change & save wild salmon from becoming an endangered species.

THE MISSING SALMON PROJECT

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