Factors Affecting Atlantic Salmon at Sea

Atlantic Salmon Summit

- Bottlenecks and Solutions

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Atlantic Salmon Trust
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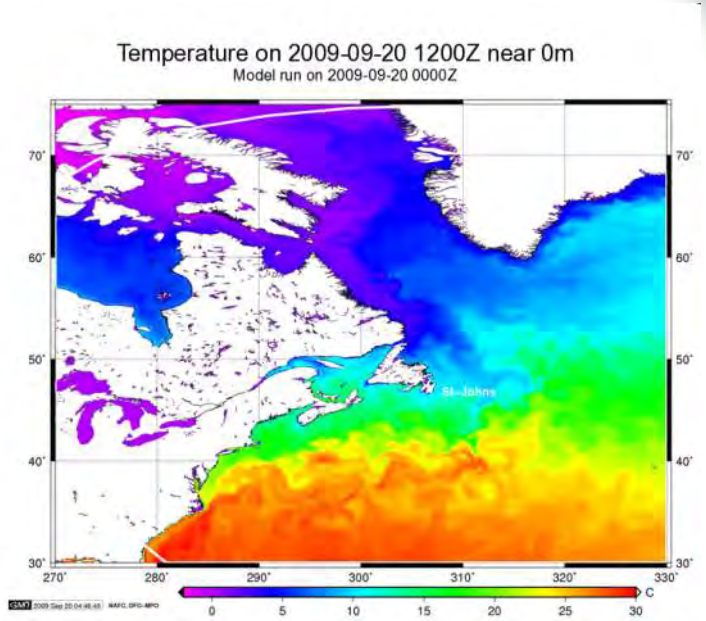
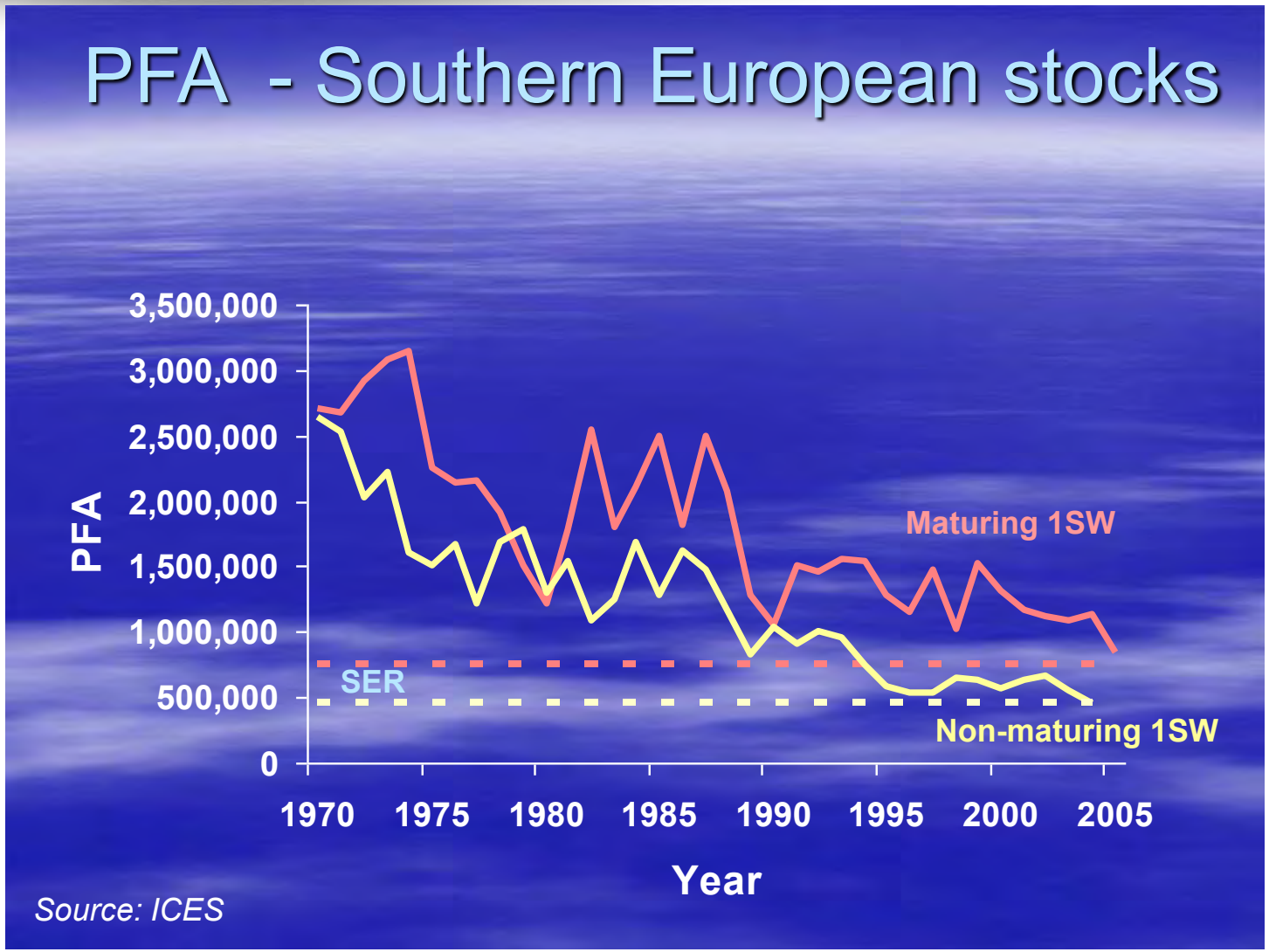
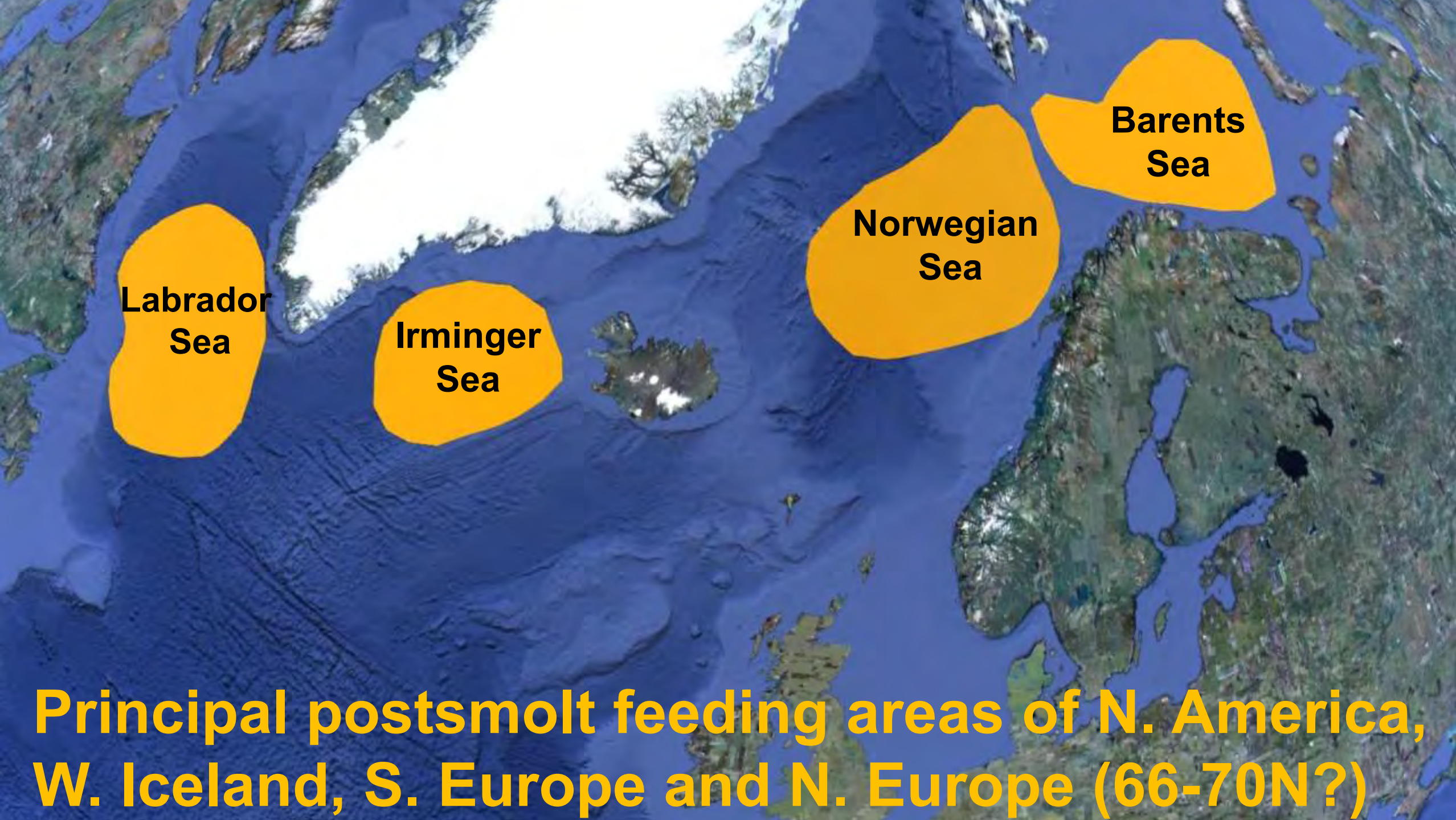
Salmon at Sea

Over the past three decades, an increasing proportion of North Atlantic salmon are dying at sea during their oceanic feeding migration. Arguably the greatest challenge in salmon conservation is to gain insight into the spatial and ecological use of the marine environment by different regional and river stocks.

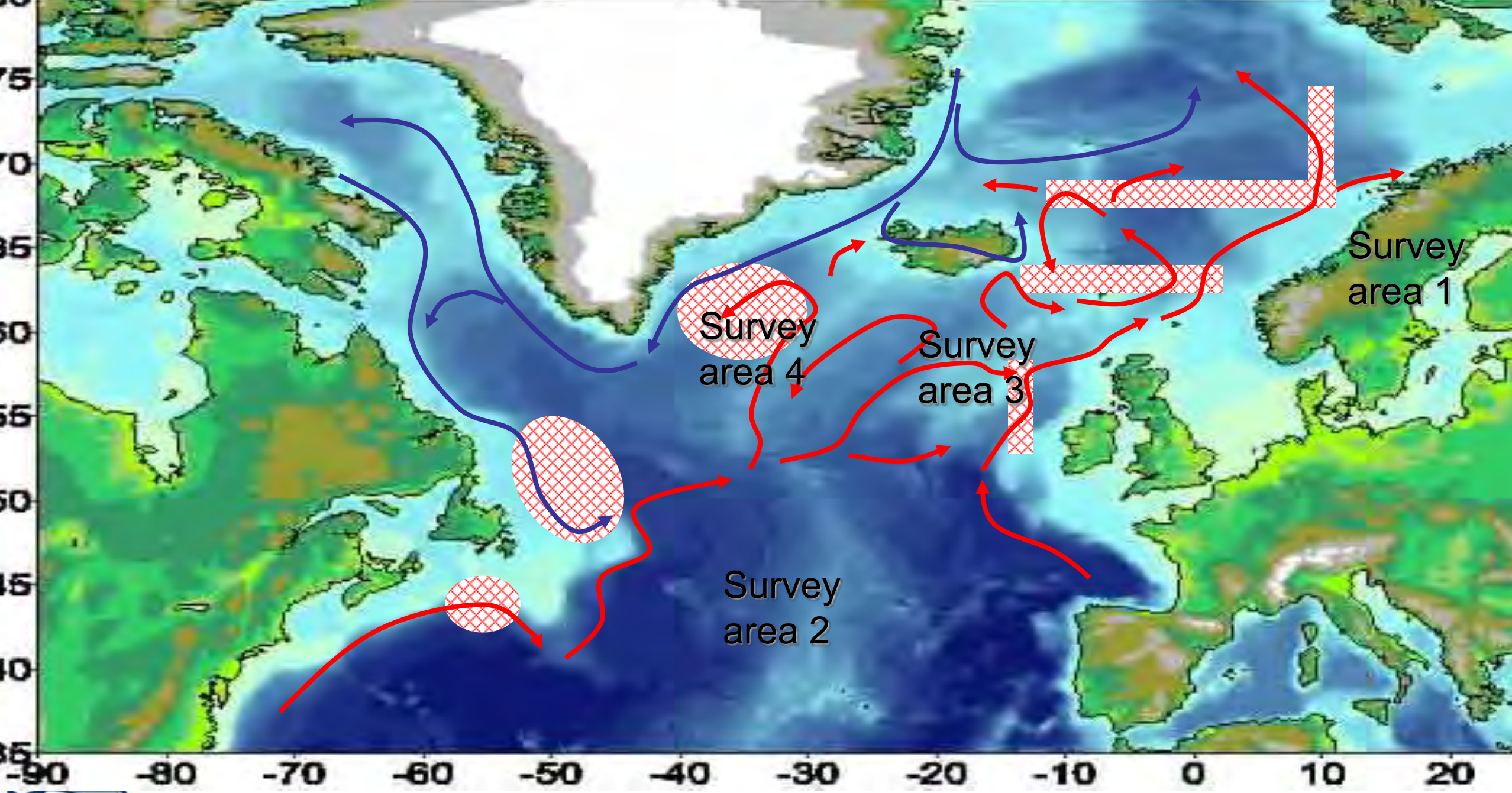


The Problem

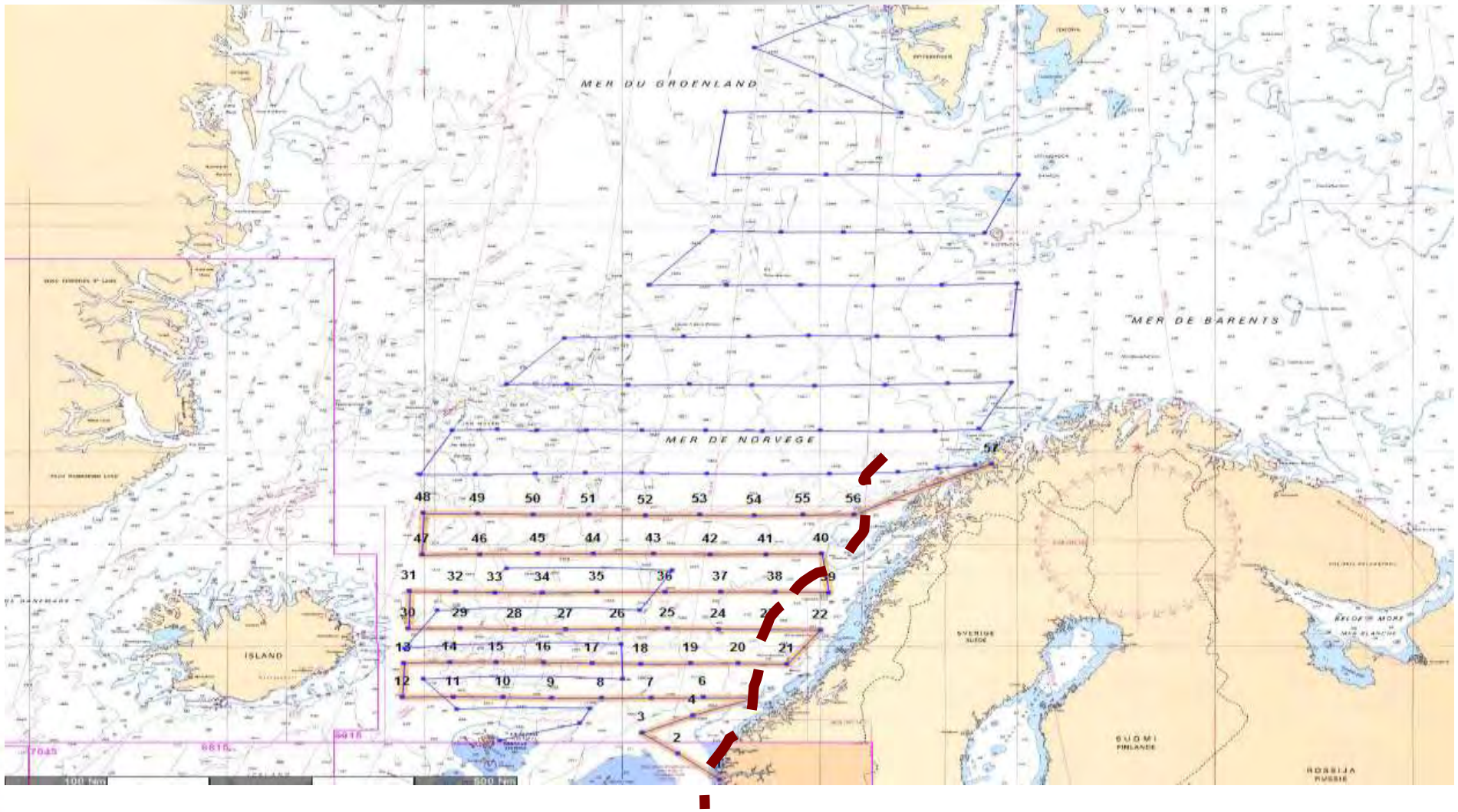

PFA - Southern European stocks
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
PFA
SER
Maturing 1SW
Non-maturing 1SW
1970
1975
1980
1985
1990
1995
2000
2005
Year
Source: ICES



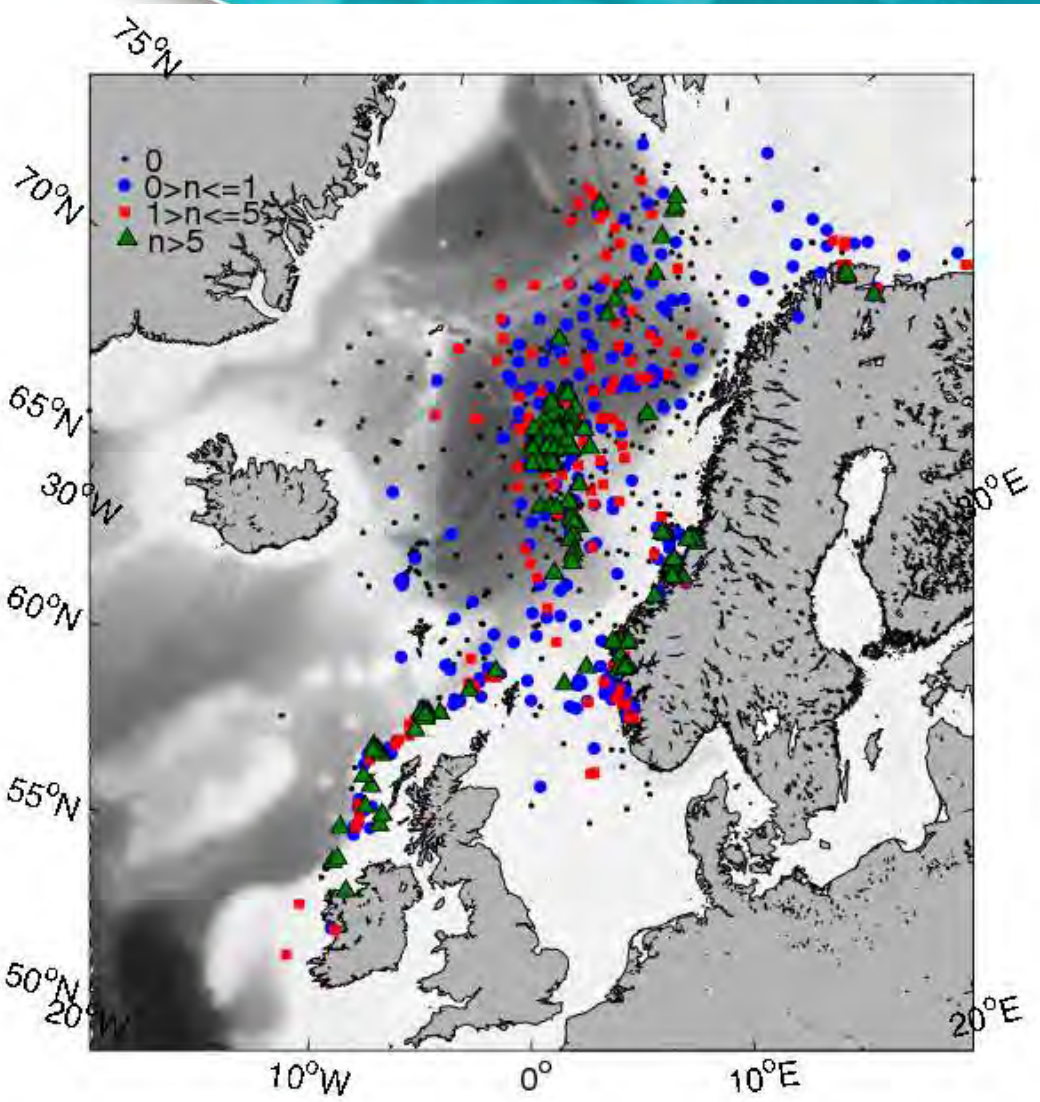
Principal postsmolt feeding areas of N. America, W. Iceland, S. Europe and N. Europe (66-70N?)


Survey area 1
Survey area 2
Survey area 3
Survey area 4
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

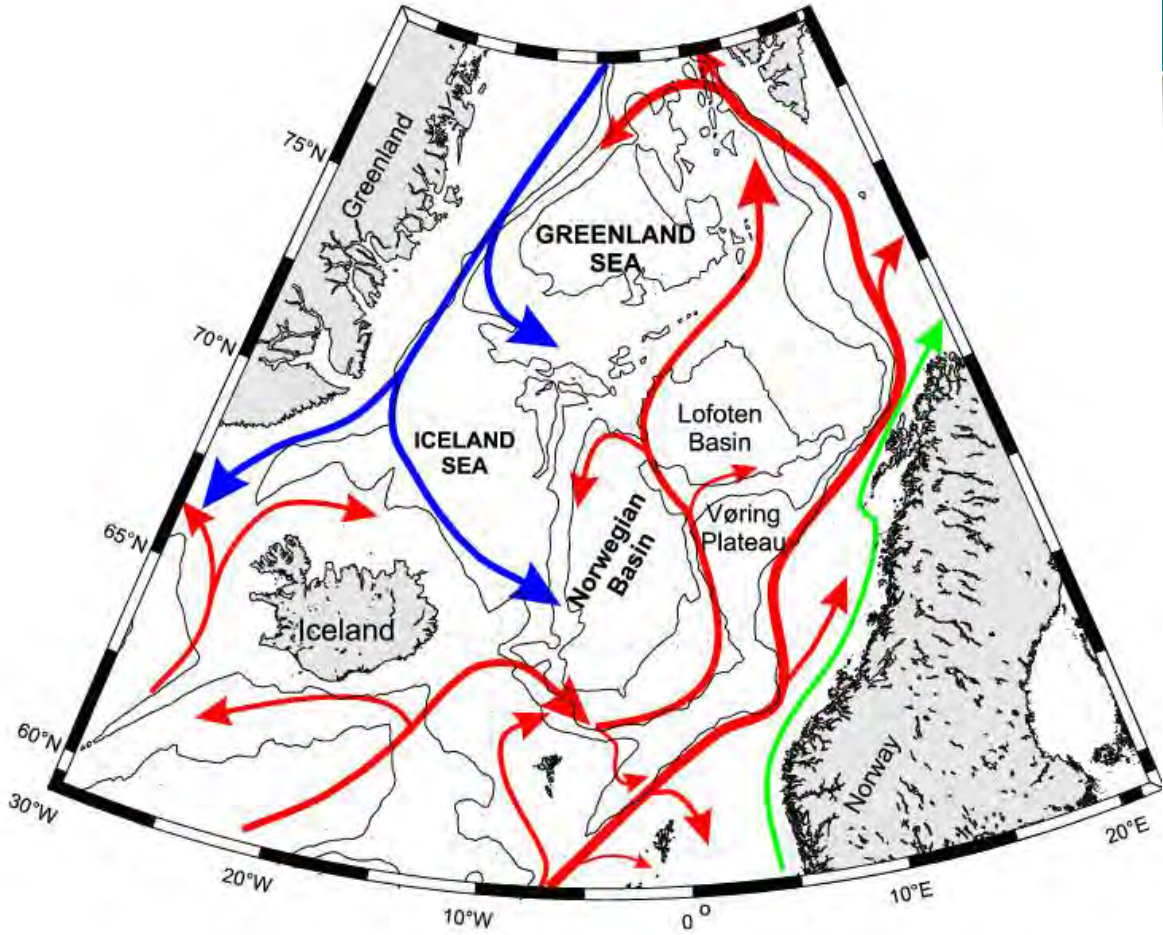

CELTIC EXPLORER
GALWAY
CELTIC EXPLORER


MER DU GROENLAND
MER DE BARENTS
MER DE NORVEGE
ISLAND
SVERIGE
SUOMI
FINLANDE
ROSSIJA
RUSSIE
48 49 50 51 52 53 54 55 56
47 46 45 44 43 42 41 40
31 32 33 34 35 36 37 38 39
30 29 28 27 26 25 24 23 22
13 14 15 16 17 18 19 20 21
12 11 10 9 8 7 6
4
3
2
1

Distribution of salmon post smolts



Number of captured post smolts (n) per trawl hour



Main surface currents:

Red arrows: Warm and salt Atlantic Water

Blue arrows: Cold and less saline Arctic Water

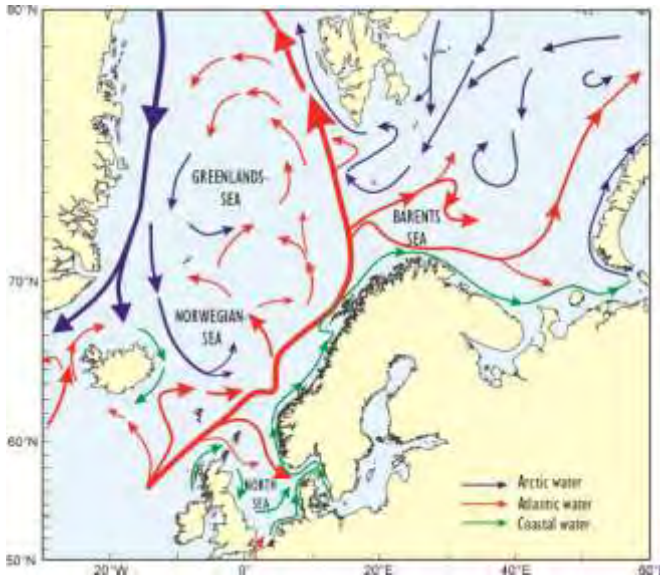
Salmon at Sea – What was found!

- 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) and changes in the food supply in the ocean

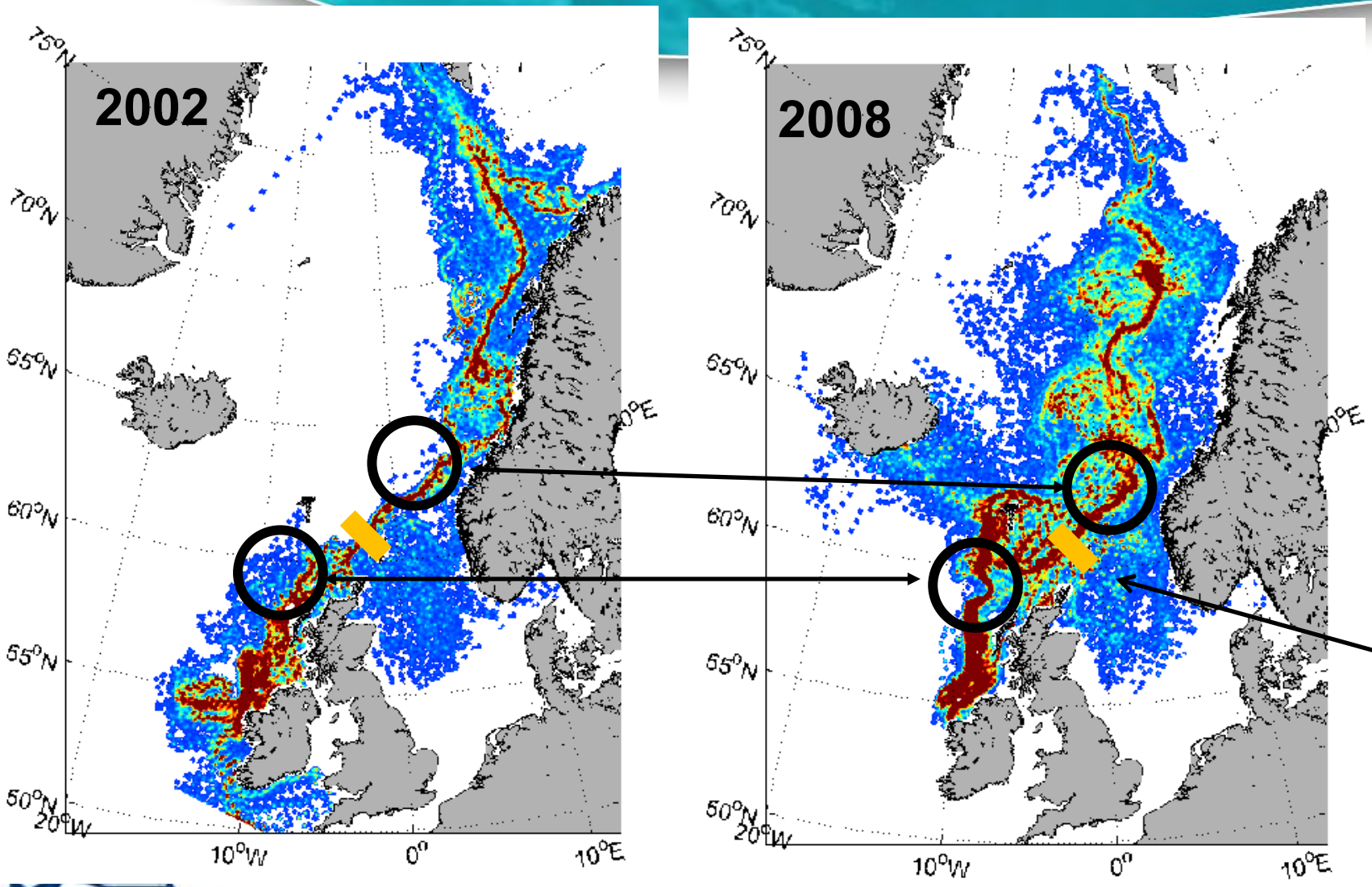
Loire Allier, France

Salmon at Sea – What we found

- 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



Migration corridors



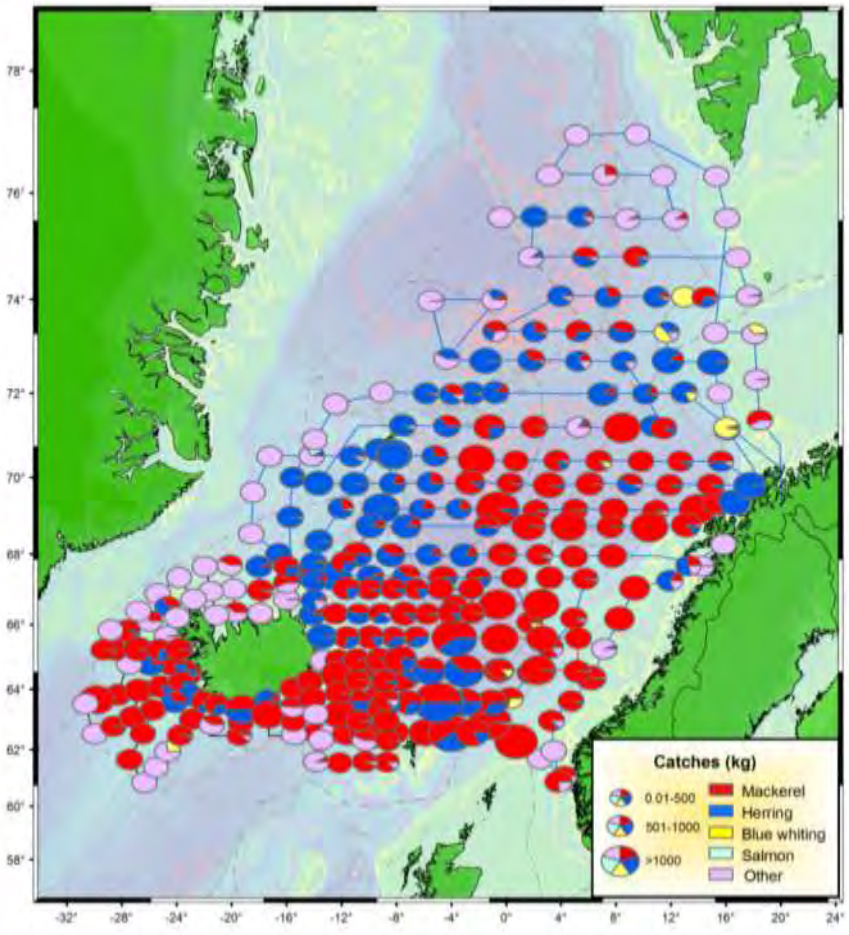
Key areas in the migration routes where shifts in pathways may occur

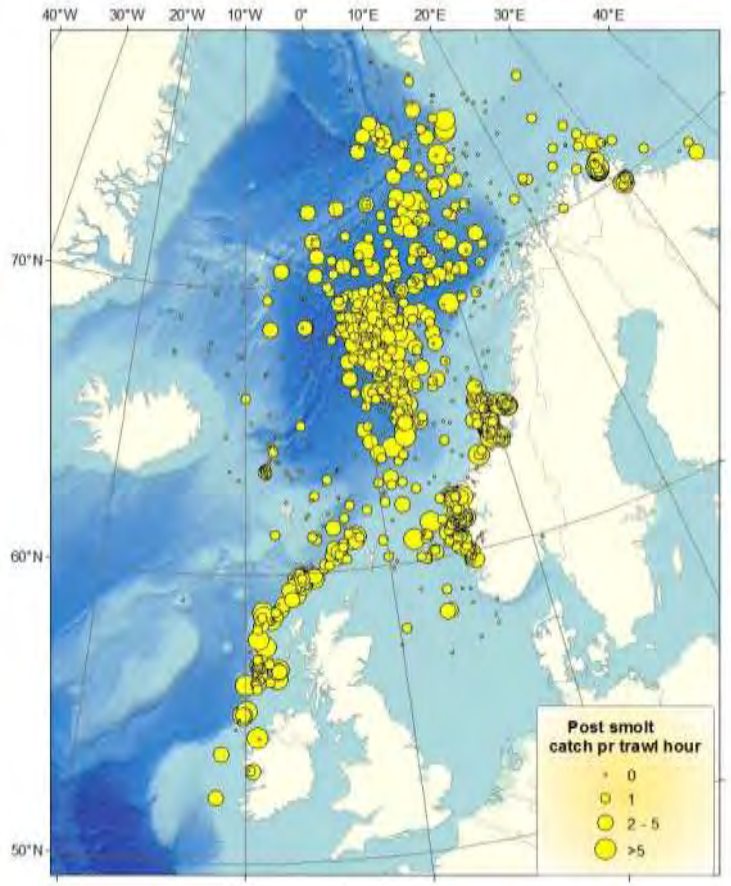
Passage in the migration route

Overlap, the key to understand competition and predation

Sharing the ocean and the resources:

mackerel, herring, blue whiting and post-smolt salmon





Stock Abundance

- In the 1960s and 70s - 8m to 10m salmon at sea
- In more recent years this number has reduced to 3 million.
- The abundance of salmon gathering at sea, prior to their arrival in freshwater (pre-fishery abundance levels), dropped by 66% for southern European grilse and 81% for the larger, multi-sea winter salmon.
- The drivers of this decline are complex
- Catch down and better management but return rates from the ocean have stayed stubbornly low.

- 70’s and early 80’s, when 20% or more of smolts were returning as grilse. Lately, grilse gsurvival rates have struggled to reach 8% and at times have dipped to 5%.
- Catches of salmon have been greatly curtailed, dropping from around 12,000 tonnes in the 60s to their current levels of a little over 1,000 tonnes.
- North-east Atlantic slowly shifted to a warmer regime.
- The distribution of the plankton, altering at a significant rate.
- Species adapted to the colder waters, in which salmon smolts thrive, are moving north and new, exotic forms from the south now inhabiting those vacated ecological niches.

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- *The Southern NEAC non-maturing 1SW stock complex was considered to be at risk …*
- *At a country level, stocks from several jurisdictions were below CLs.*

- *The probability of simultaneous attainment of CLs, in all of the ten maturing 1SW national stock complexes, is less than 2.2% in every year …..and for the ten non-maturing 1SW stock complexes it is less than 1.8% in every year.*

- *Marine survival indices for individual index stocks in the North Atlantic in recent years are somewhat variable. However, the overall declining trend has persisted and survival indices remain low. The continued low abundance of salmon stocks in many parts of the North Atlantic, despite significant fishery reductions, strengthens the view that factors acting on survival in the first and second years at sea are constraining the abundance of Atlantic salmon.*

What is now required ?

1. Why and at what stage are salmon dying at sea?
2. Designation of marine corridors as MPAs
3. Quantify and tackle pelagic by-catch issue
4. Regular moniroing of post-smolts at sea – growth and condition – last full survey 2010!

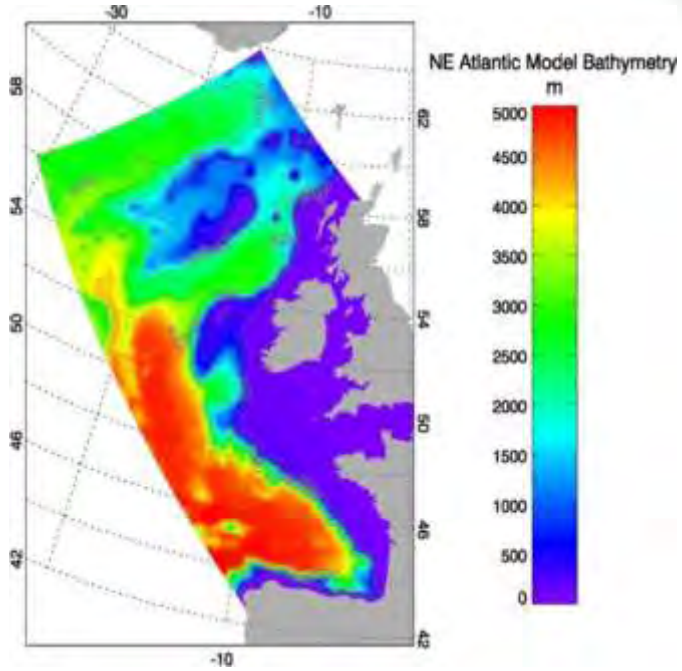
Summary - The SALSEA PROGRAMME

Salmon Summit:
http://www.nasco.int/sas/salmonsummit.htm

Salsea Merge papers:
http://www.nasco.int/sas/salseamerge_documents.htm

Ocean Silver:
http://www.atlanticsalmontrust.org/oceansilver/

Atlantic salmon at sea: Findings from recent research and their implications for management
http://www.nasco.int/pdf/reports_other/Salmon_at_sea.pdf



ICES Journal of Marine Science (2012): International Symposium on Salmon at Sea: *Scientific Advances and their Implications for Management. Volume 69, Issue 9,* November *2012.*