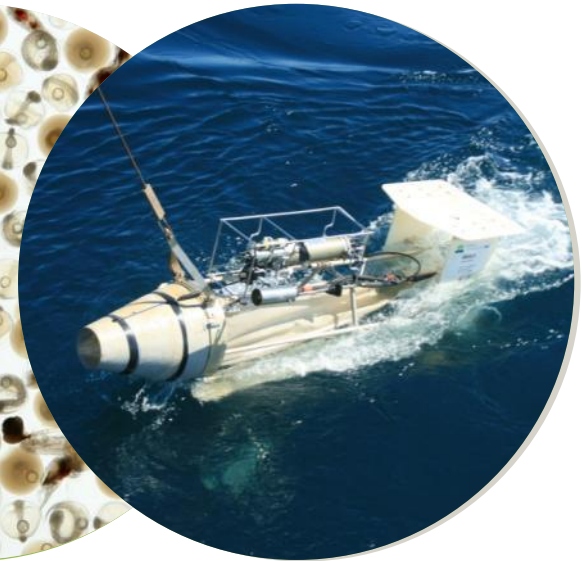
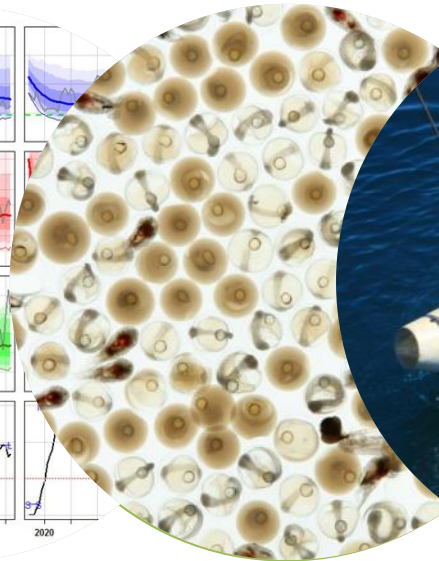
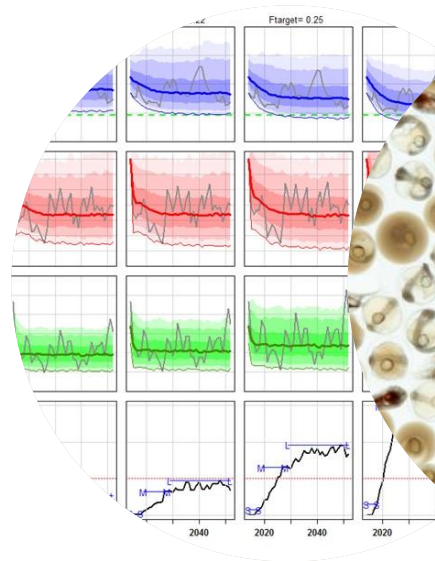


North-East Atlantic Mackerel

The biology, assessment and recent dynamics of Northeast Atlantic mackerel

Thomas Brunel

Wageningen Marine Research, The Netherlands



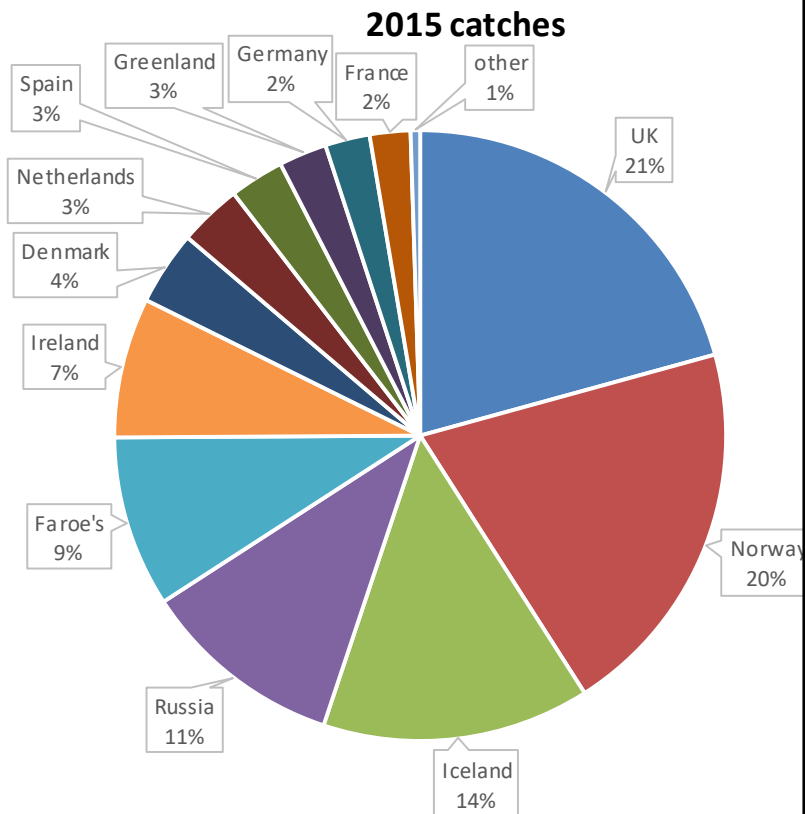
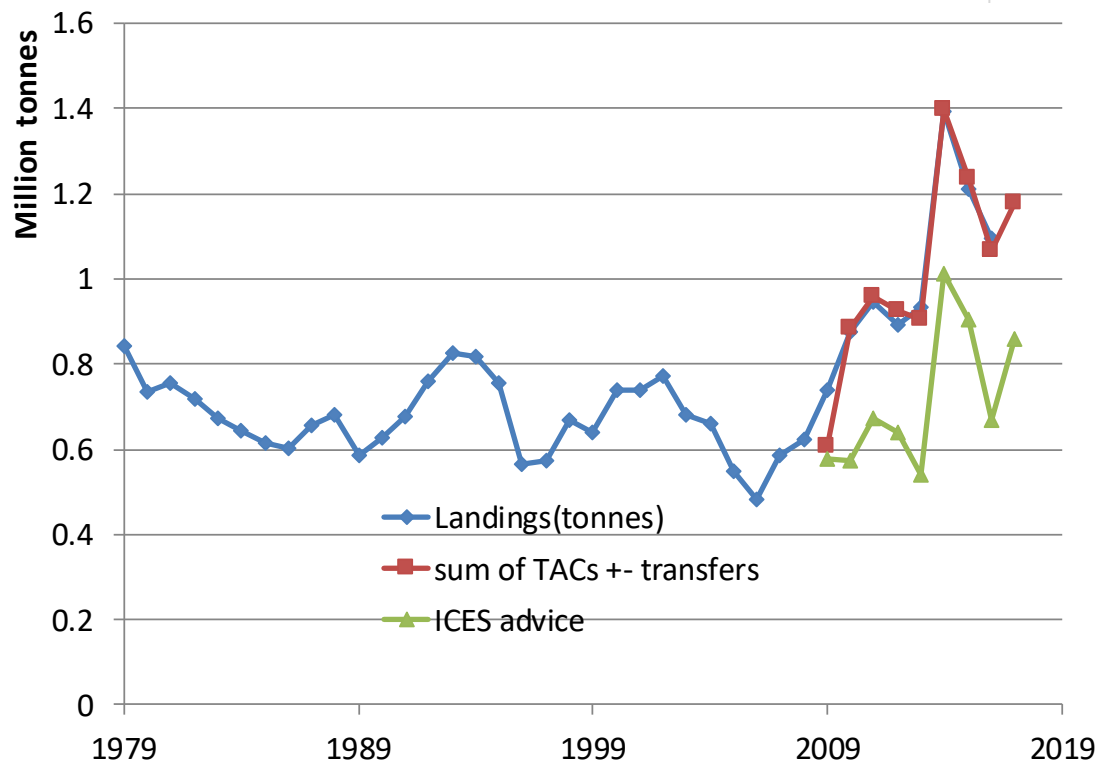
Key facts



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100years
1918 — 2018



A complex and not fully understood

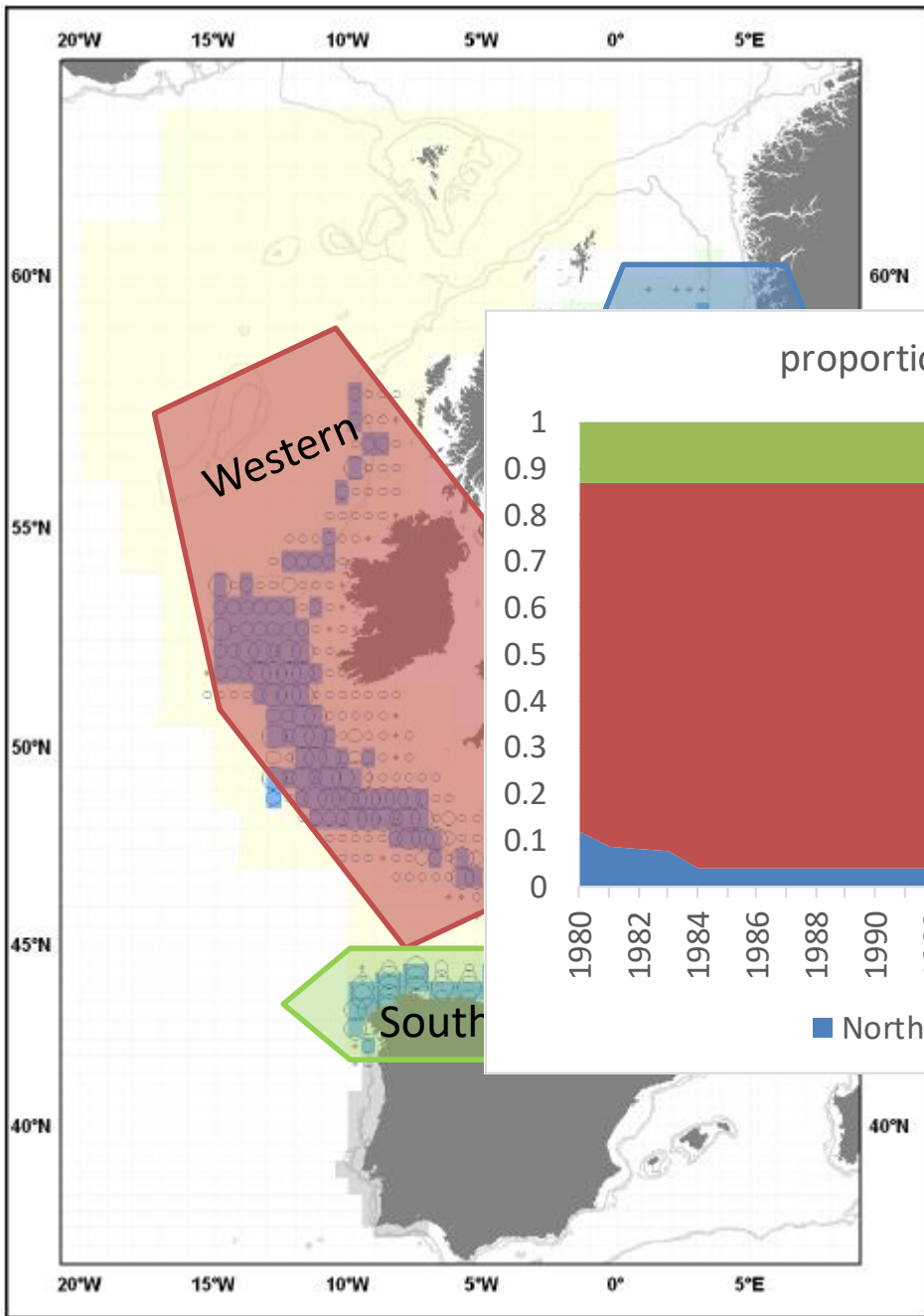
Stock Structure



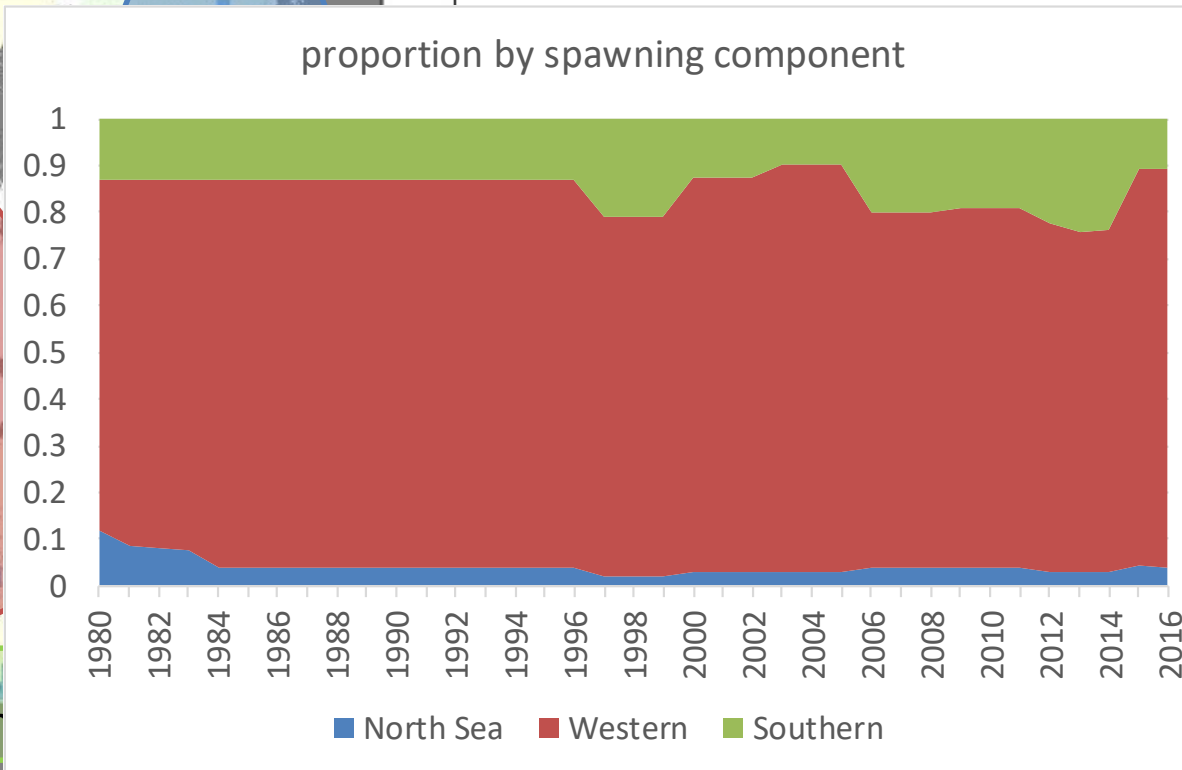
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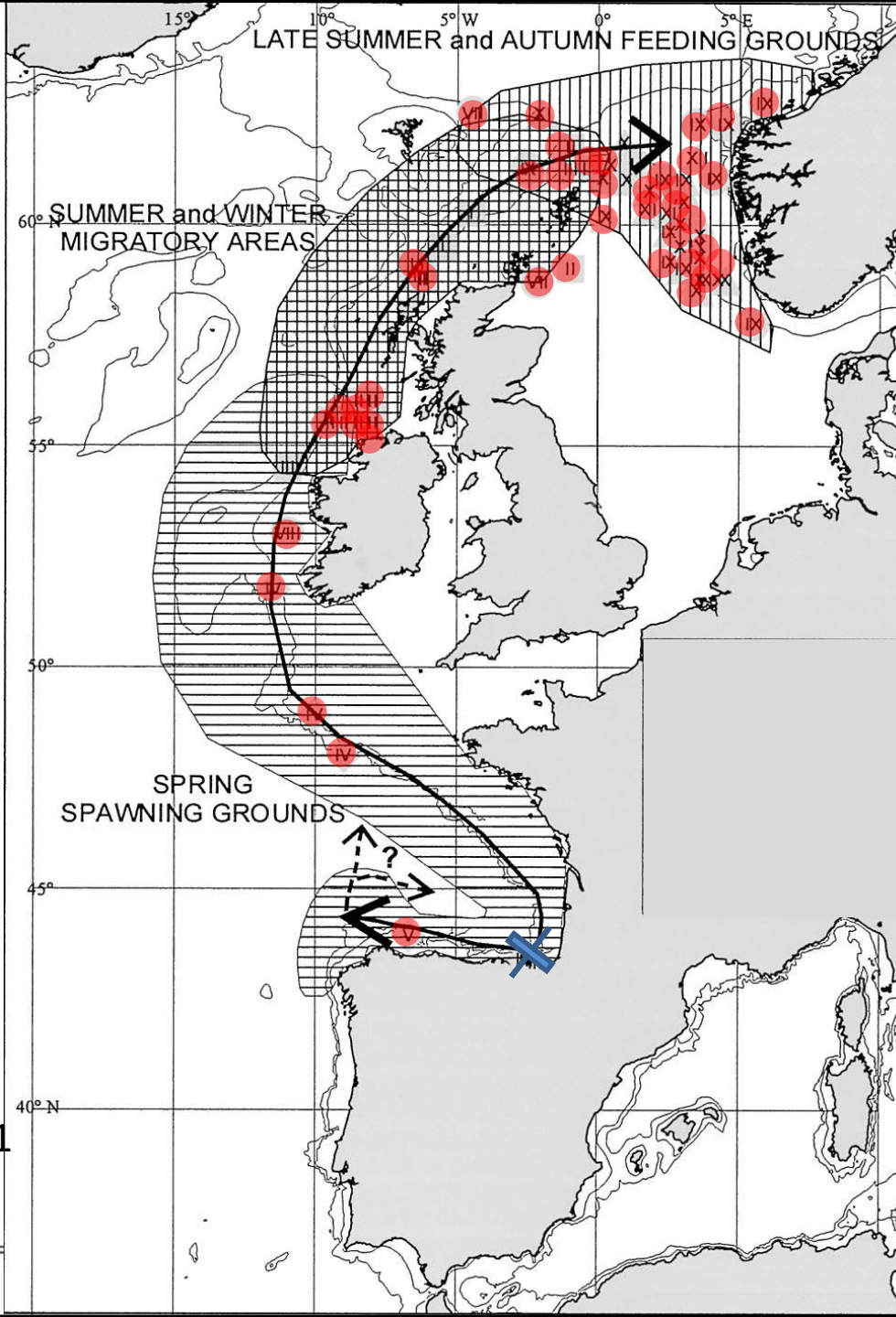
100years
1918 — 2018



proportion by spawning component

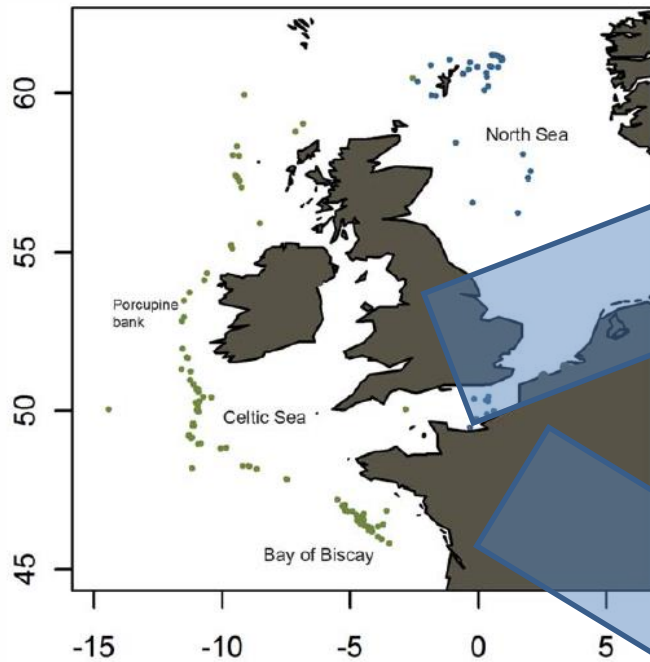


Ices, 2013

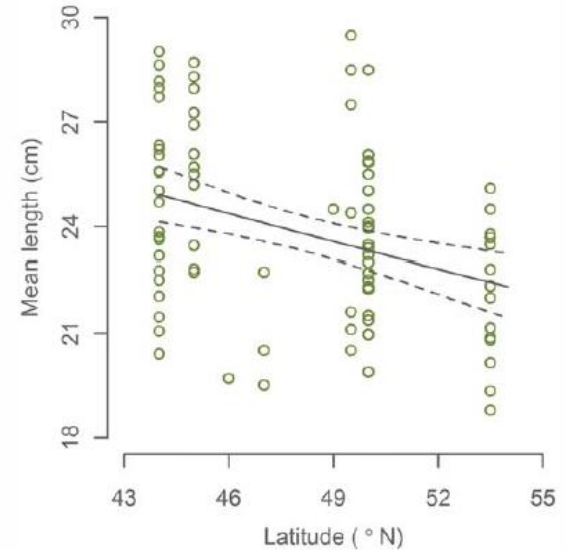


Uriarte and Lucio, 2001

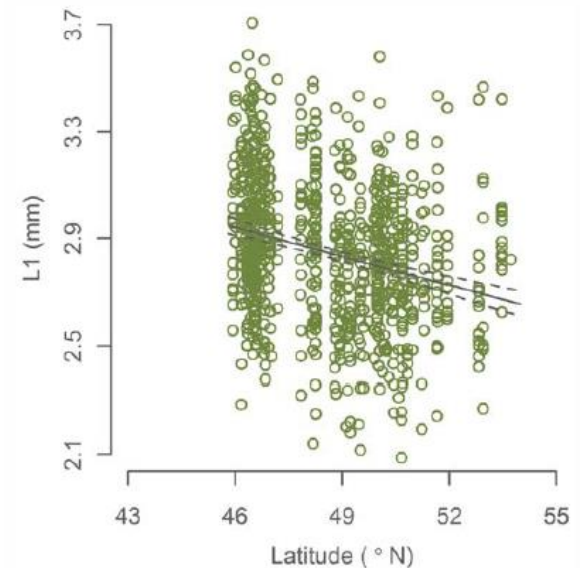
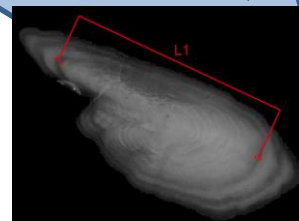
Some degree of spatial segregation



Juvenile size after 1st year of growth

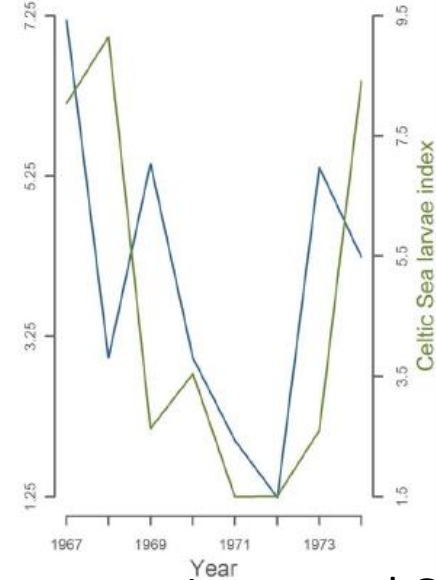
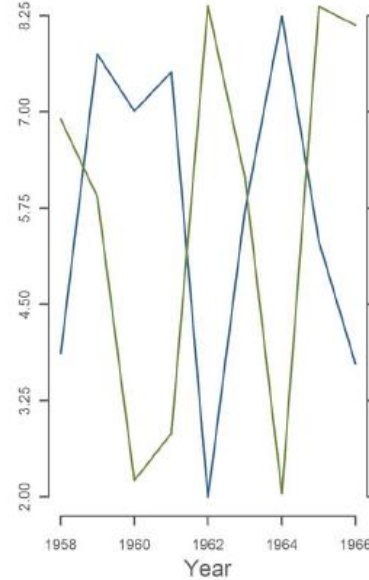
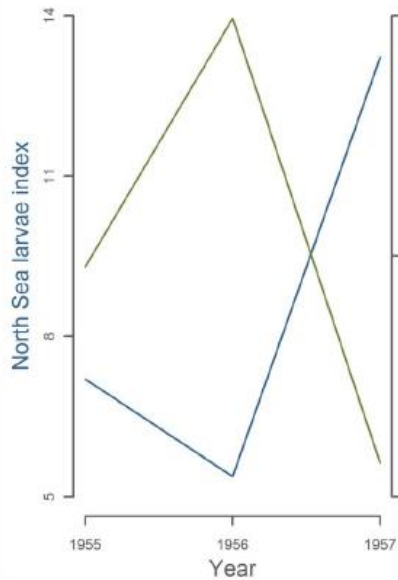
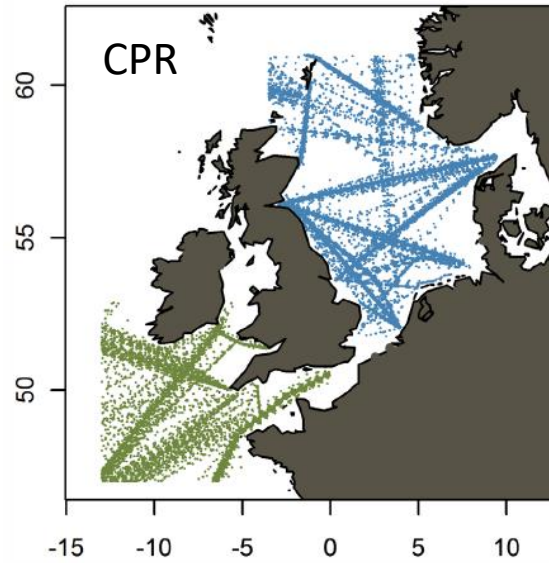


Adults (otolith) size growth ring 1st year of life



Jansen et al. 2013

And some degree of mixing



A decade of changes



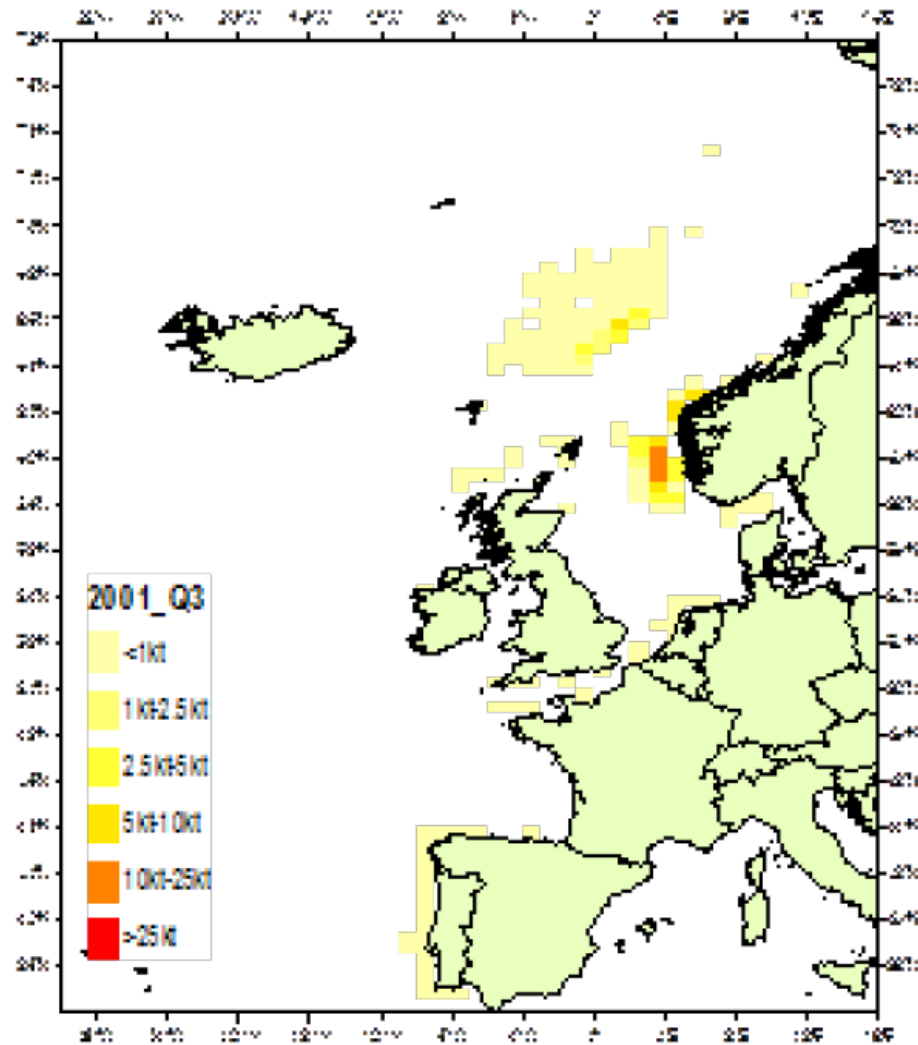
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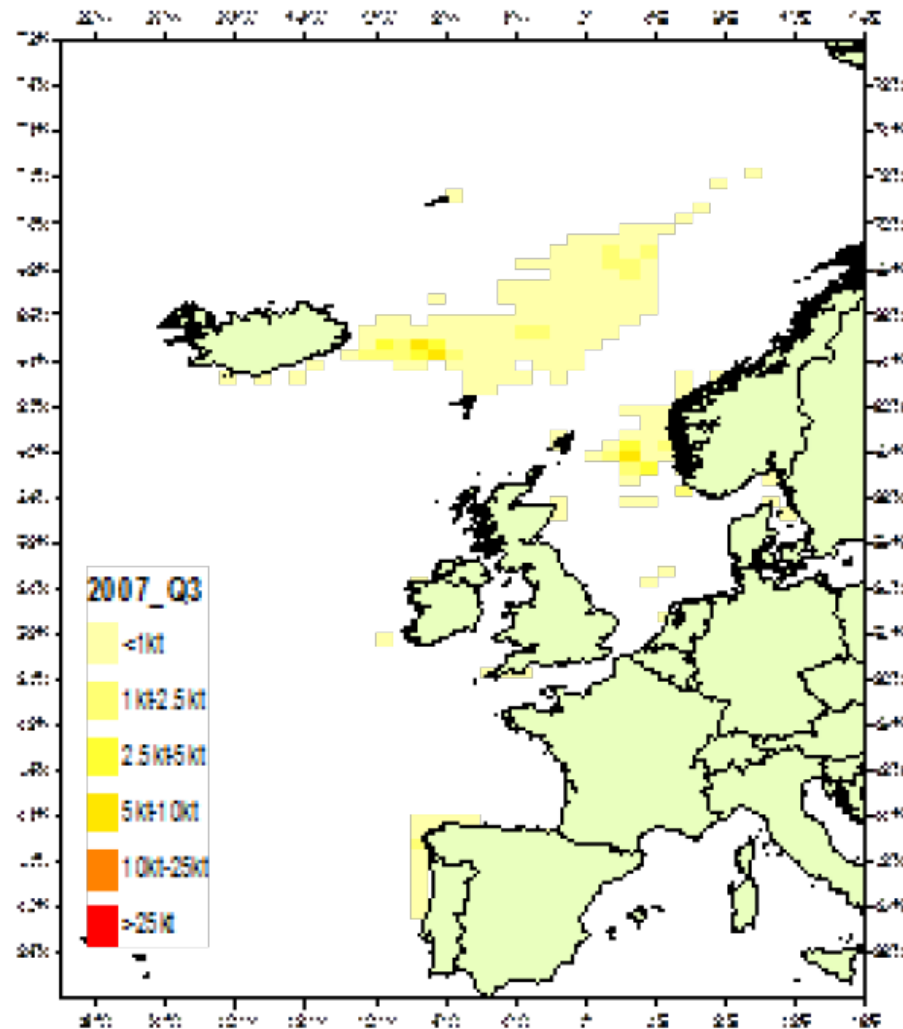
Summer catches

2001



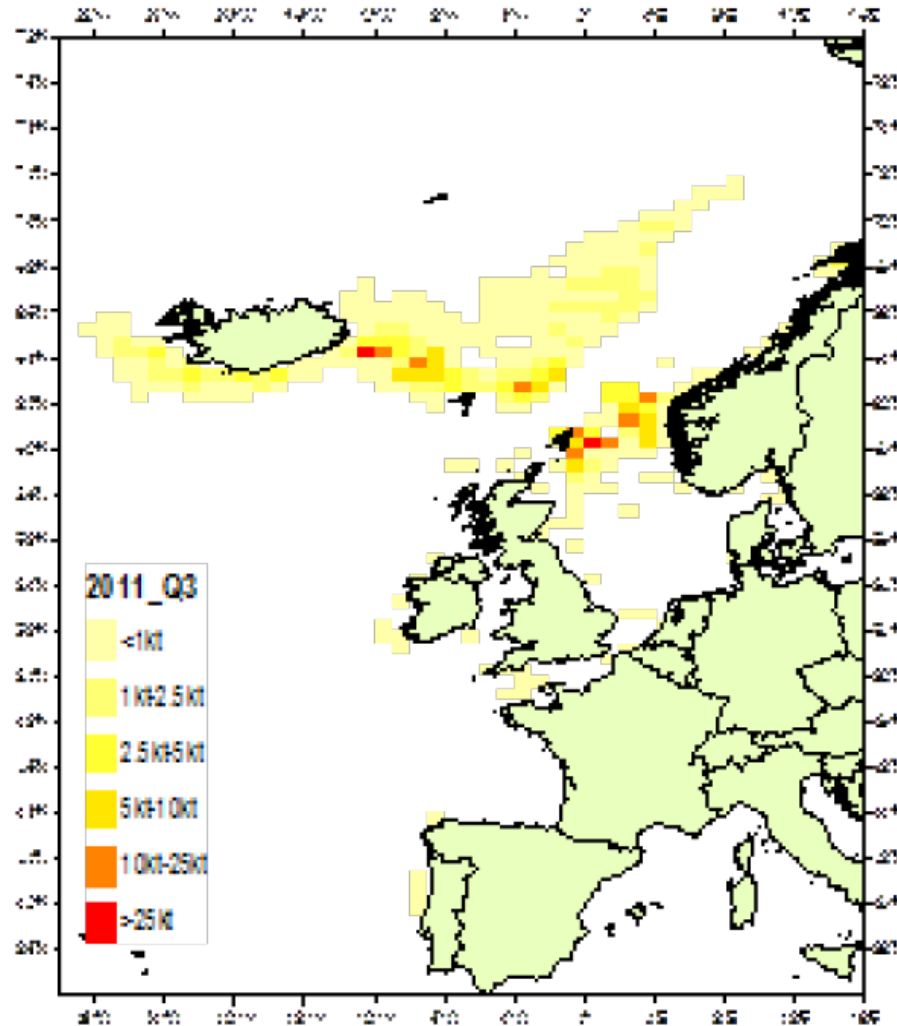
Summer catches

2007



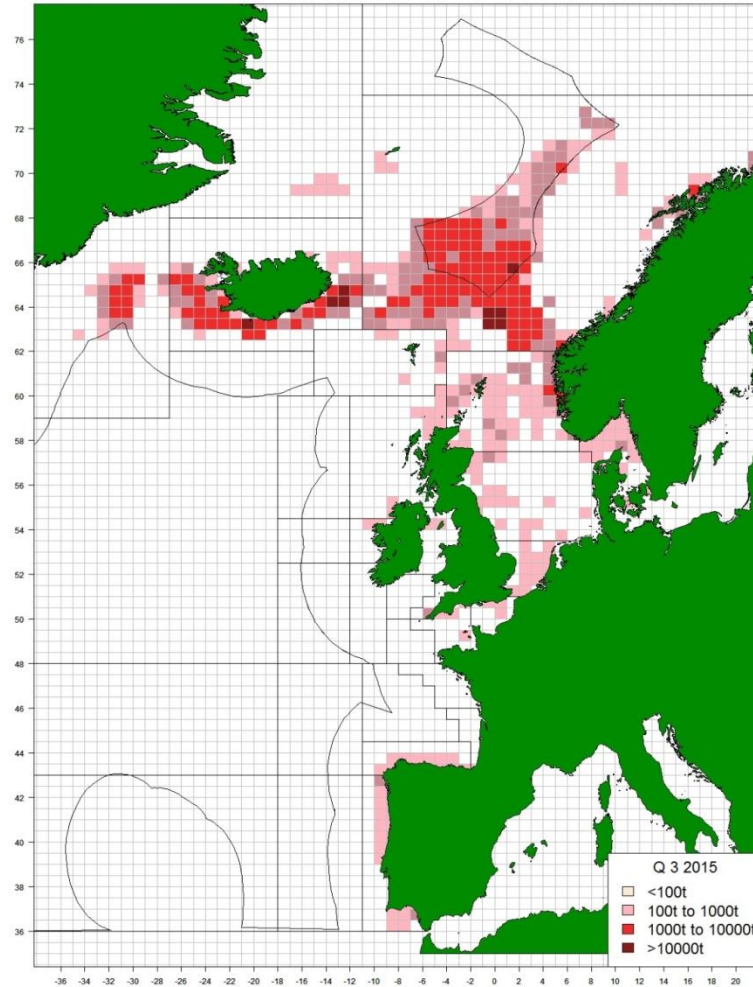
Summer catches

2011

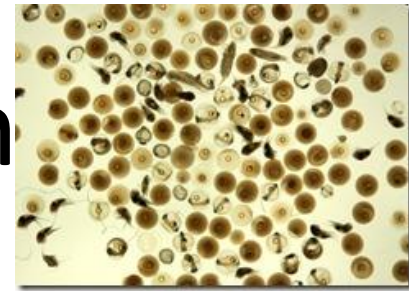


Summer catches

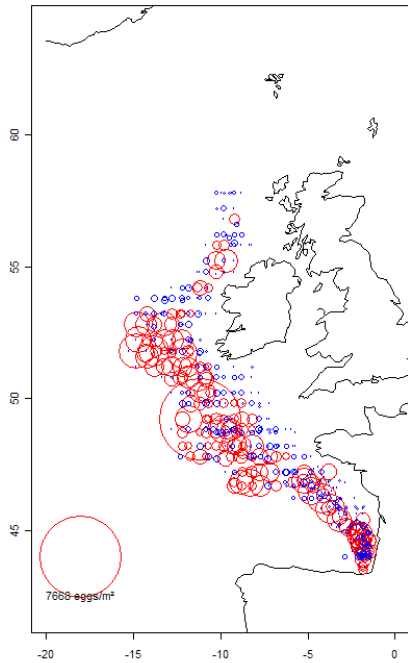
2015



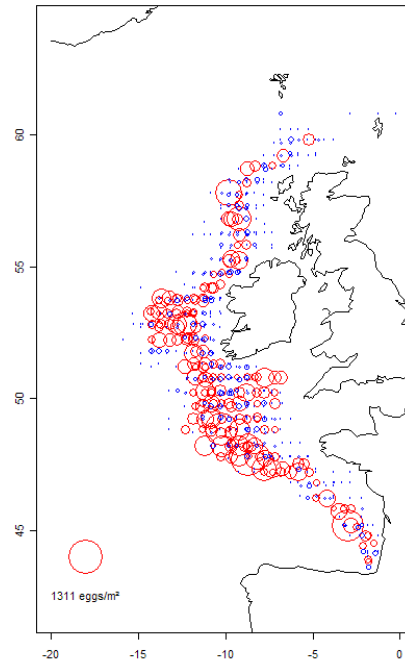
Spawning distribution



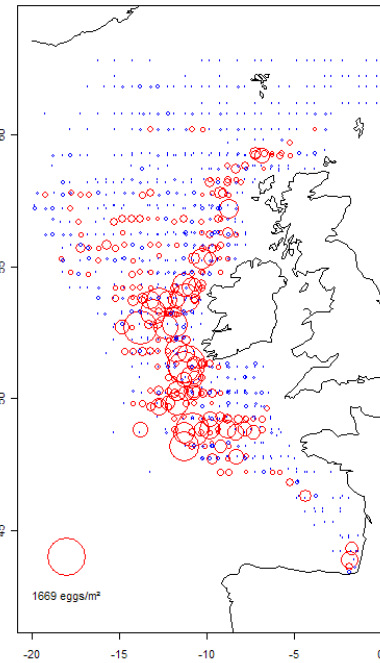
1995



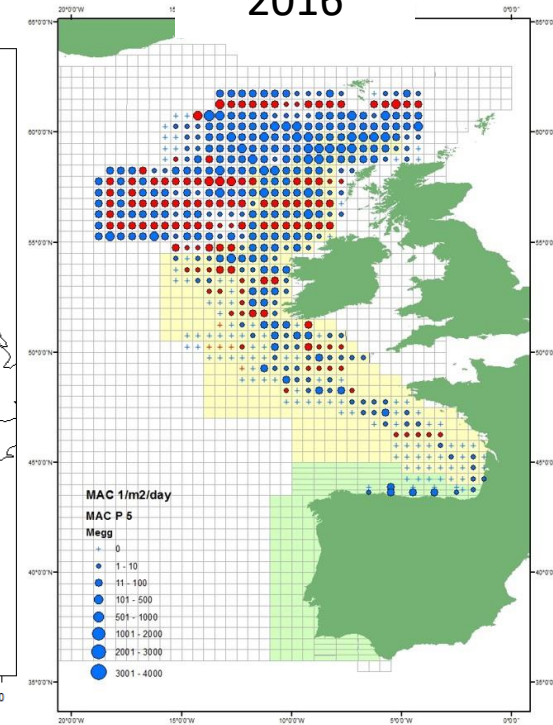
2004



2010



2016

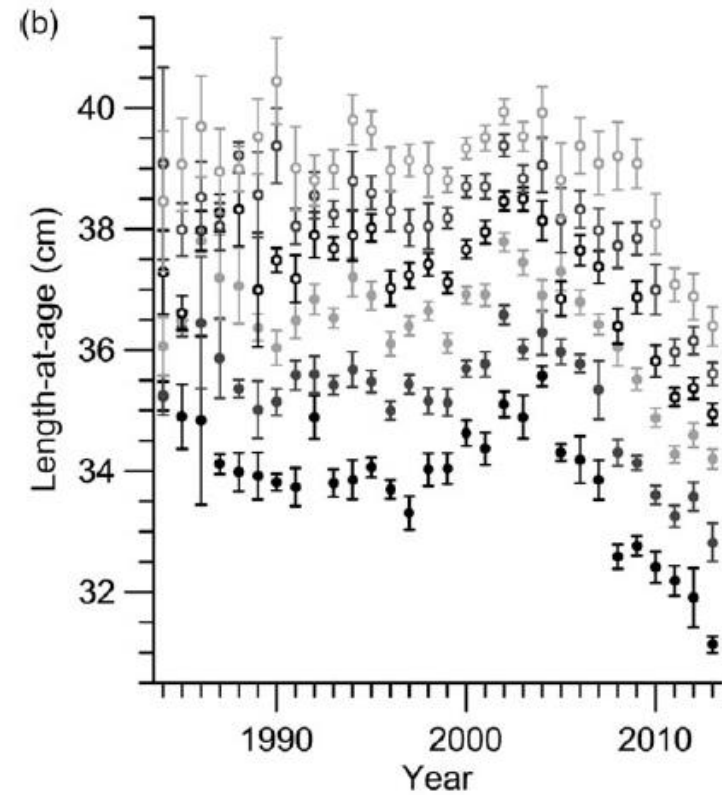
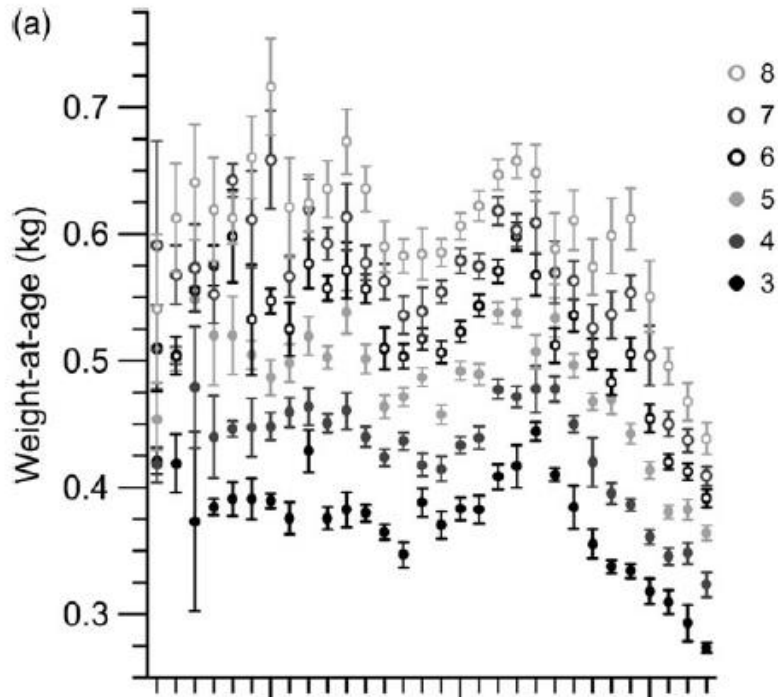


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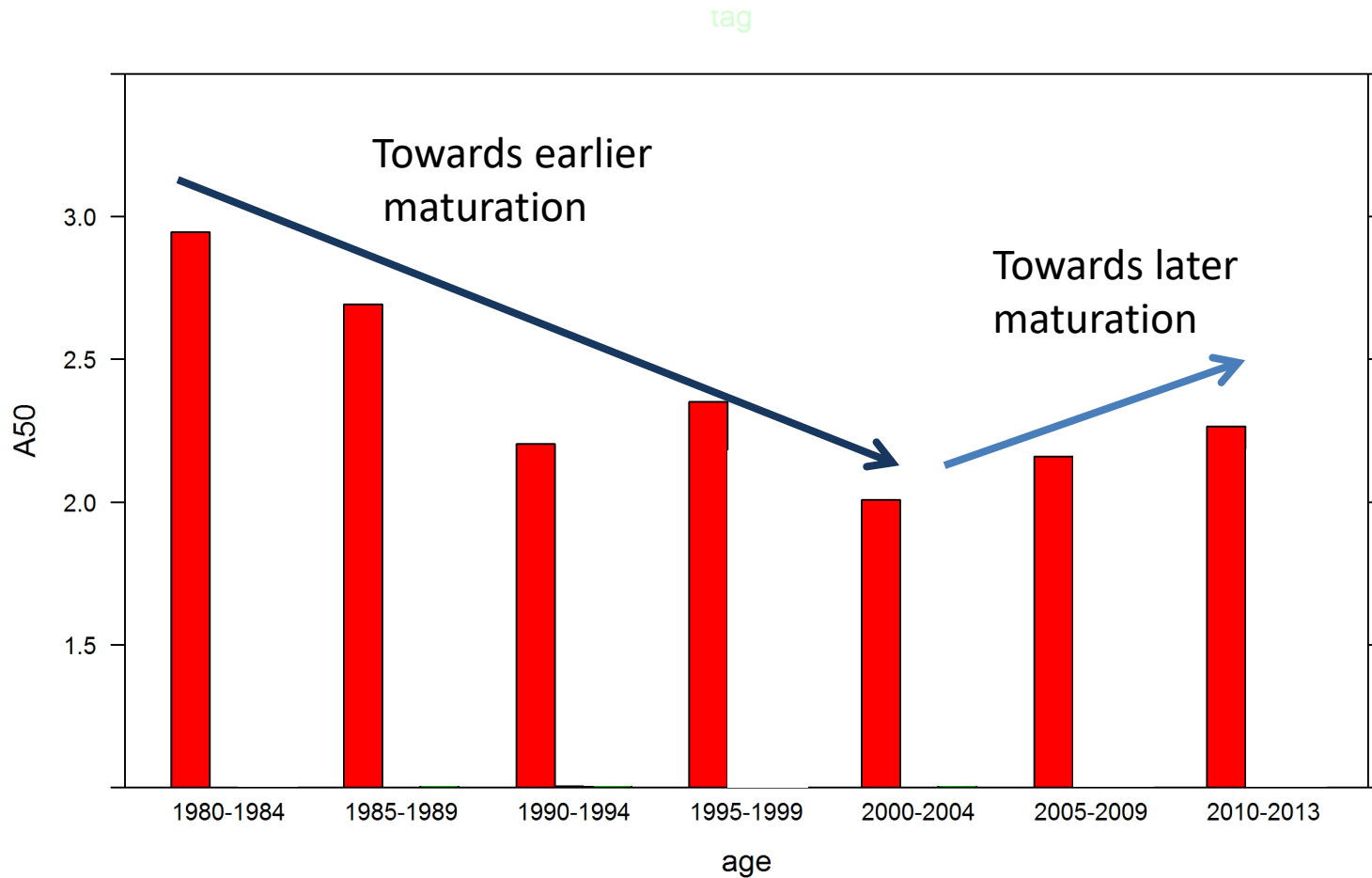


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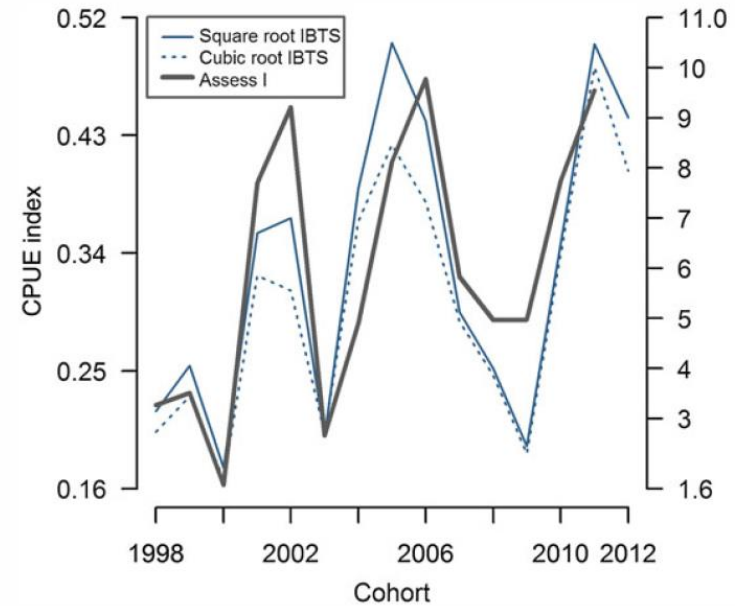
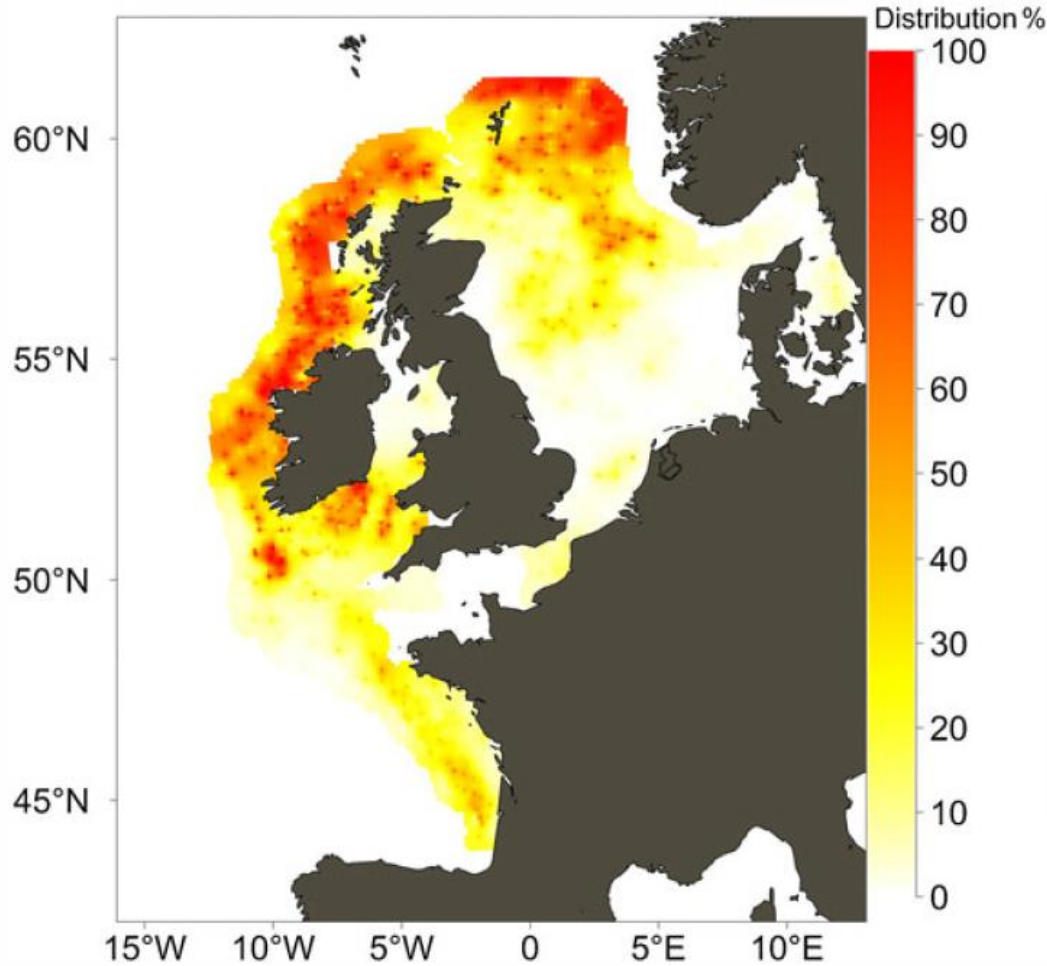
Changes in growth



... and maturation



... and recruitment



A decade of changes

- A series of strong recruitments
- Triggered an increase in stock size from historical low in 2004 to historical high in 2011
- changes in the biology and migration patterns
- Development of new fisheries and the collapse of the management system
- Drivers of the changes are poorly understood



Monitoring the NEA mackerel



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Mackerel is caught in many scientific surveys...

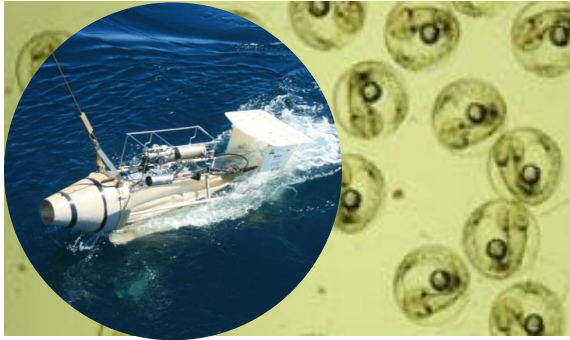
Overview of data available

ICES, 2013

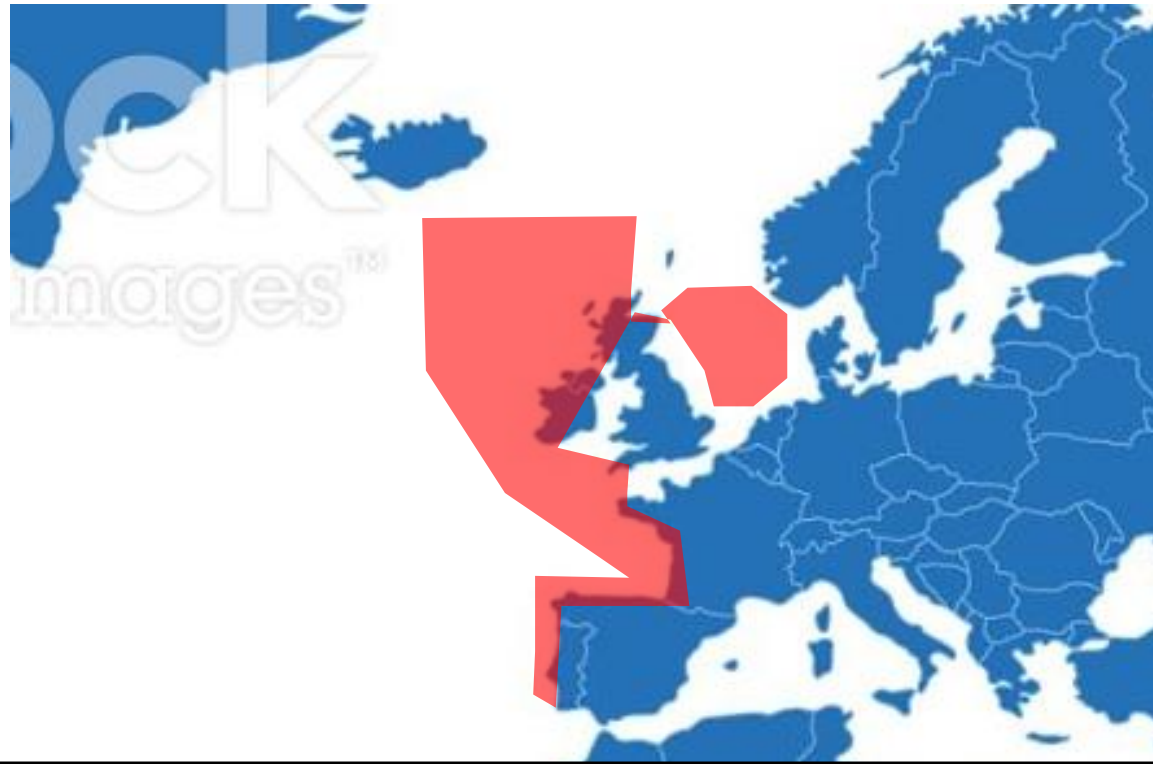
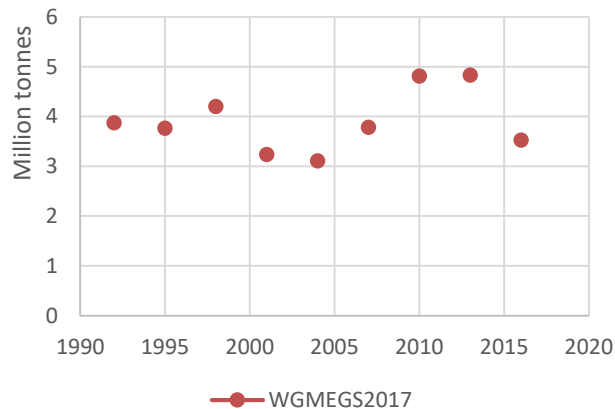
Source	Data Type	Time	Frequency	Dates	Area	Applicability to AGDMM/Comments
Commercial Catch & Sampling (International)	Catch in tonnes	All year	Quarterly/ Monthly	1977-Present	All where catches reported	Catch distribution (ICES area and statistical rectangle) Monthly up to 1997
	Catch-at -age	All Year	Quarterly	1972-Present	All where substantial catches reported	Age structure of commercial catches
	CPUE	Jan - Jun	Annual	1983 - Present	VIIIc	Only provided for selected fleets in VIIIc
Egg Survey (International)	Egg density	Jan-Jul	Triennial	1977 - Present	Western & Southern	SSB estimate of western component. Geographical distribution of spawning activity
		May-Jul	Annual/ Triennial	1968 - Present	North Sea	SSB estimate of North Sea component. Geographical distribution of spawning activity. Triennial since 1996
NS-IBTS (International)	Bottom Trawl	Q1	Annual	1985 - Present	North Sea	Juvenile index Candidate for acoustic recording
		Q2	Annual	1991 - 1996	North Sea	Juvenile index Ceased in 1996
		Q3	Annual	1991 - Present	North Sea	Juvenile index Candidate for acoustic recording
		Q4	Annual	1991 - 1996	North Sea	Juvenile index Ceased in 1996
WS-IBTS (International)	Bottom Trawl	Q1	Annual	1985-Present	Western & Southern	Juvenile index (1-group) Candidate for acoustic recording
		Q3	Annual/ Biennial	1985 - Present	Rockall	Juvenile index (1-group) and adults. Biennial since 1998. Carried out by Scotland
		Q4	Annual	1985-Present	Western & Southern	Juvenile index (0-group) Candidate for acoustic recording
IMR Mackerel (NO)	Mackerel Acoustic + Scouting	Oct-Nov	Annual	1999-2007	Northern North Sea	Acoustic estimate of abundance Overwintering distribution
FRS Mackerel (UKS)	Mackerel Acoustic + Scouting	January	Once?	2000	Northern North Sea	Acoustic estimate of abundance Overwintering distribution

Surveys informative on total stock size

Spring : Triennial egg survey



Mackerel spawning biomass



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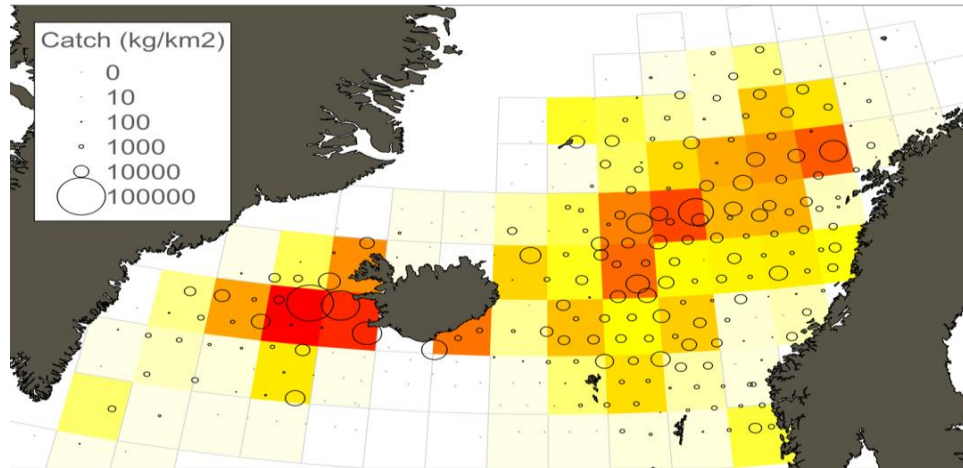
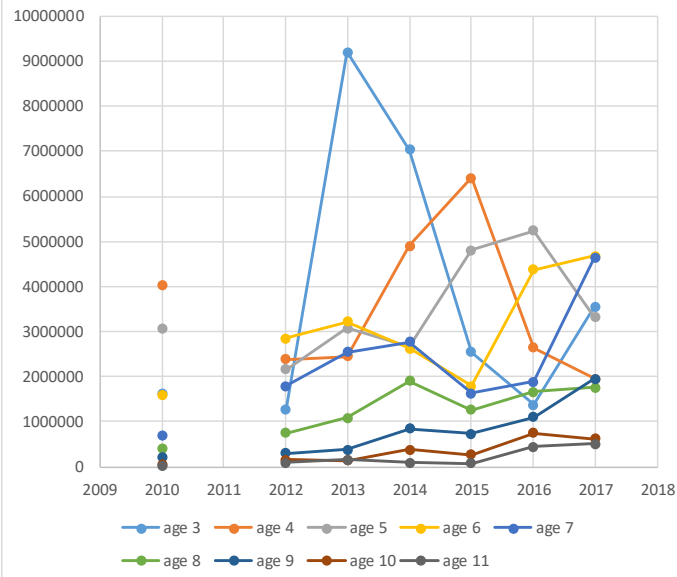
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Surveys informative on total stock size

Summer : International Ecosystem survey

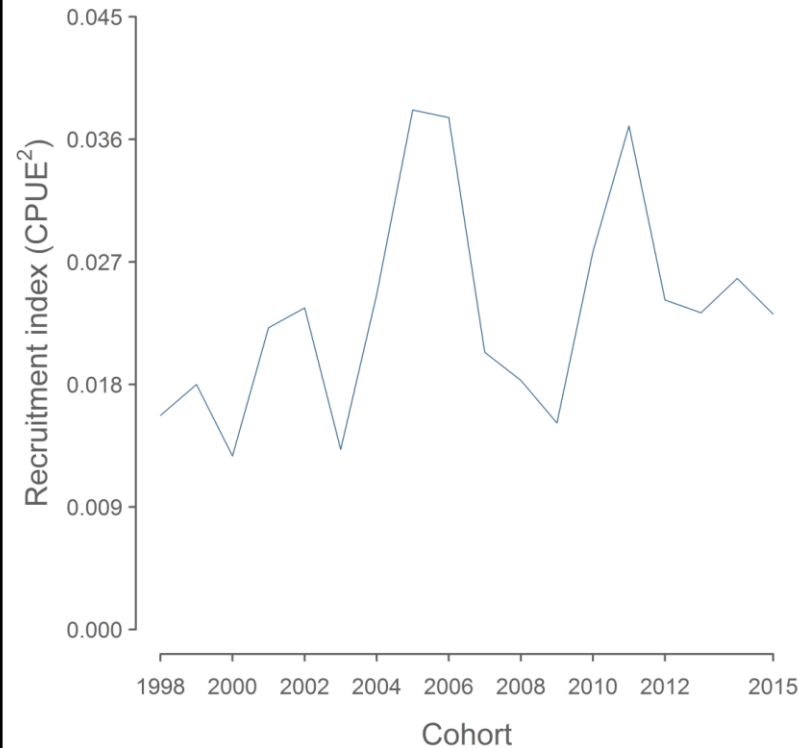


IESSNS age3-11



Surveys informative on total stock size

Winter : International Bottom trawl surveys



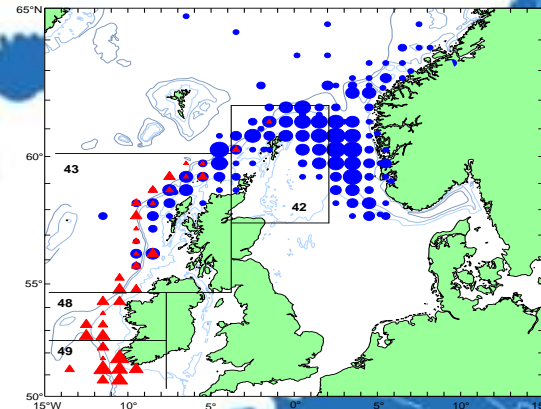
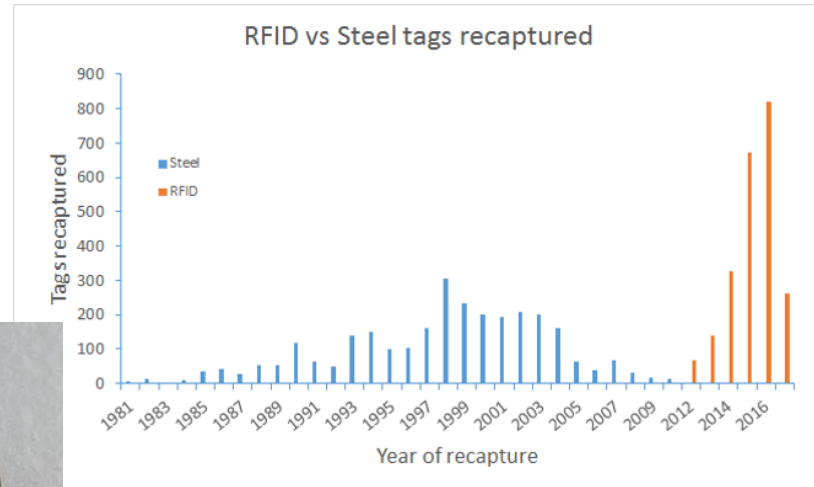
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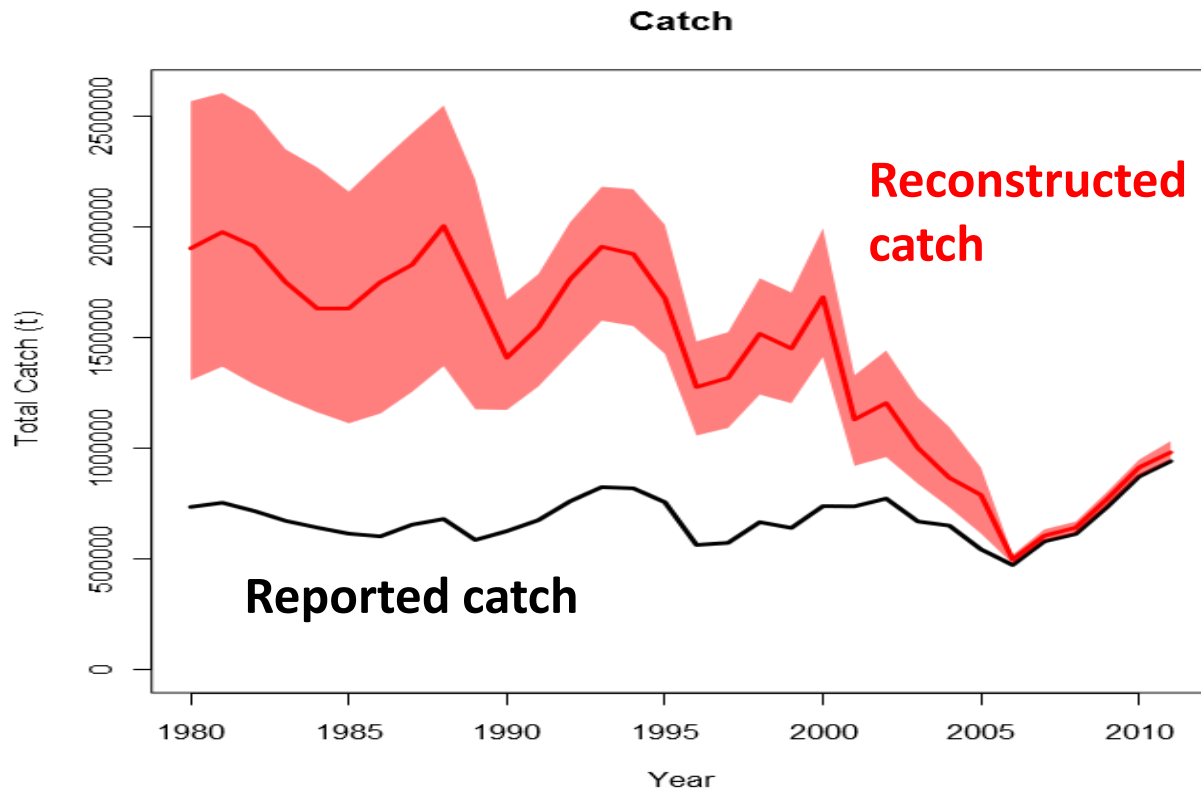
Surveys informative on total stock size

Year round : tag recaptures



Catch data

Bad quality of historic catch data (catch misreporting, underestimate of discards, unknown slippage)



ICES , 2014



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Assessment and stock development

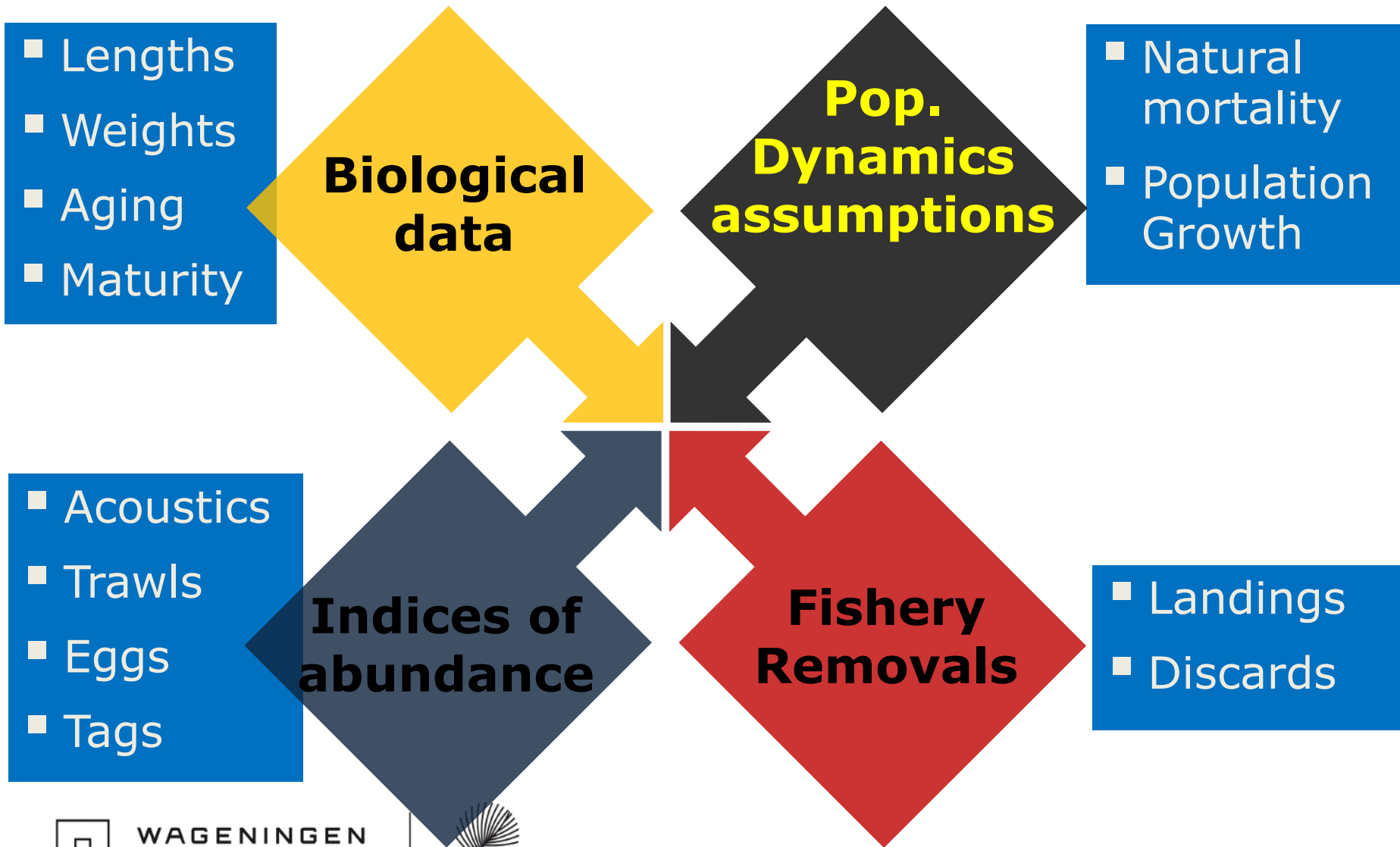


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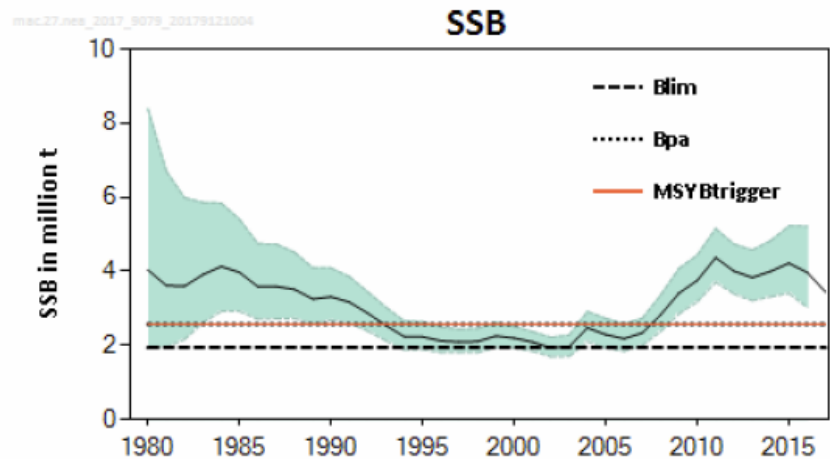
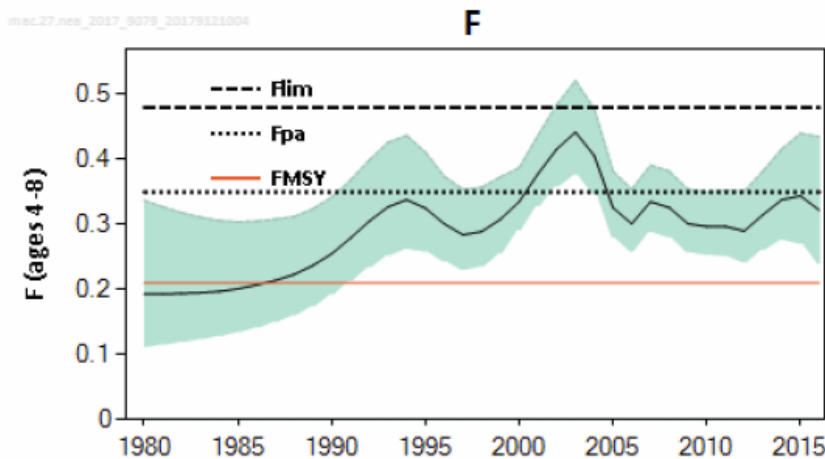
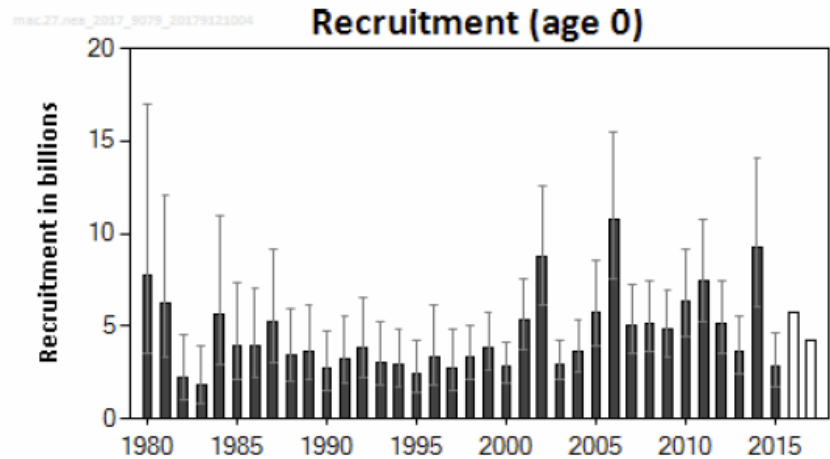
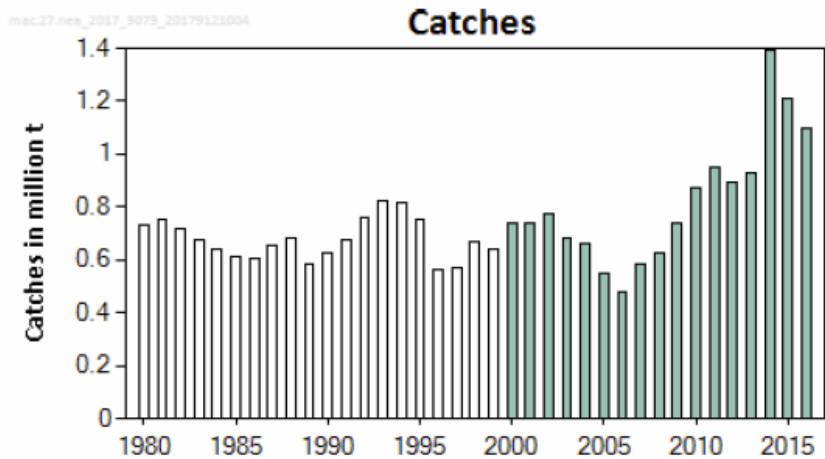


100years
1918 — 2018

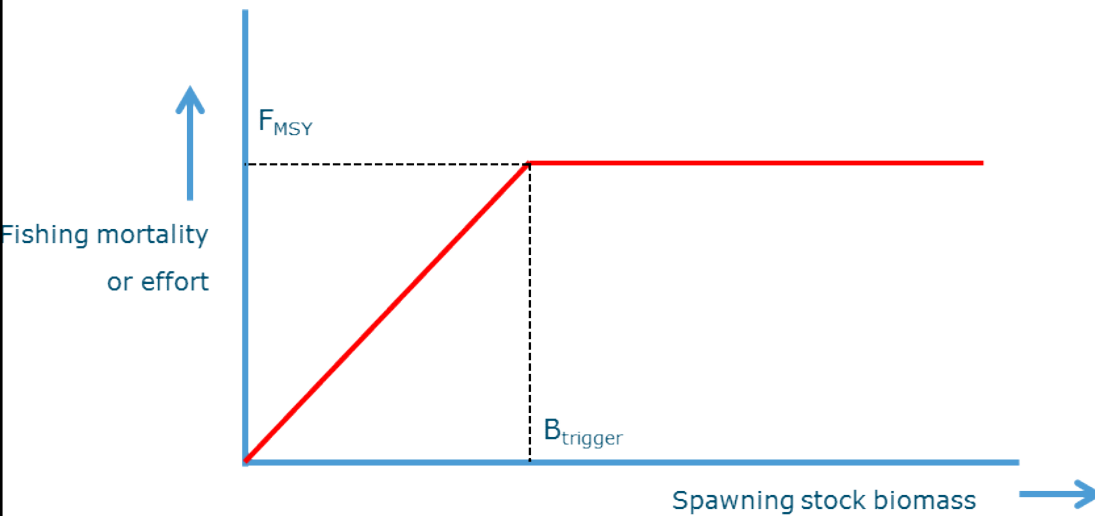
Numerical stock assessment



Historic stock development



Basis for the advice

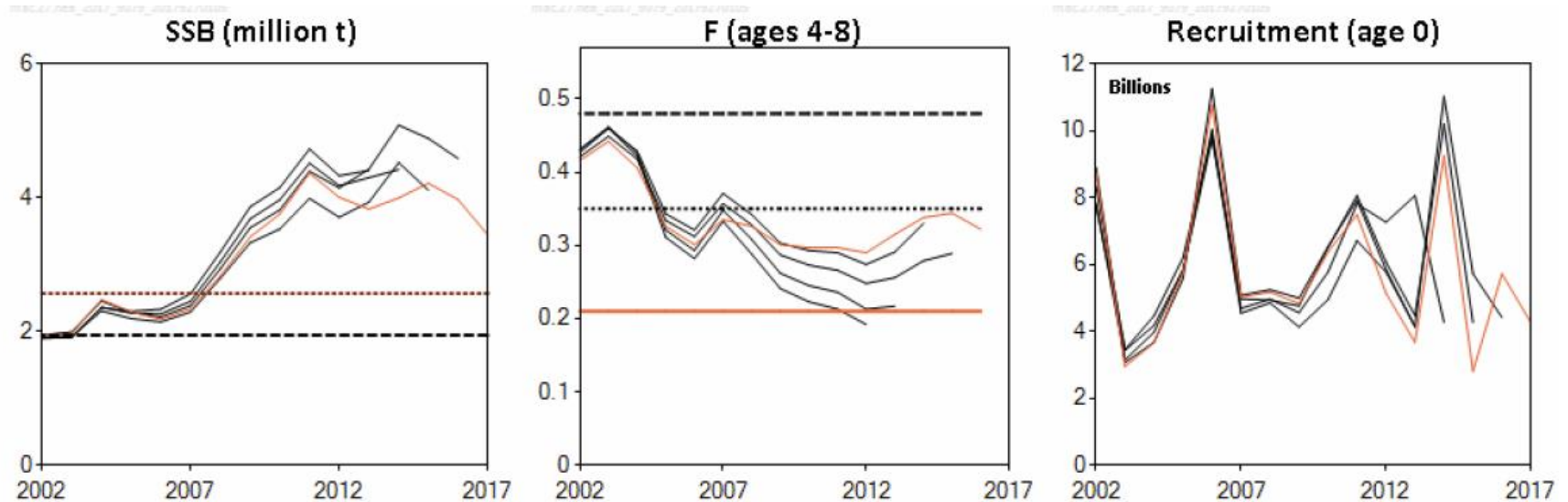


Framework	Reference point	Value
MSY approach	MSY B_{trigger}	2 570 000 t
	F_{MSY}	0.21
Precautionary approach	B_{lim}	1 940 000 t
	B_{pa}	2 570 000 t
	F_{lim}	0.48
	F_{pa}	0.35

27



An unstable basis



Management



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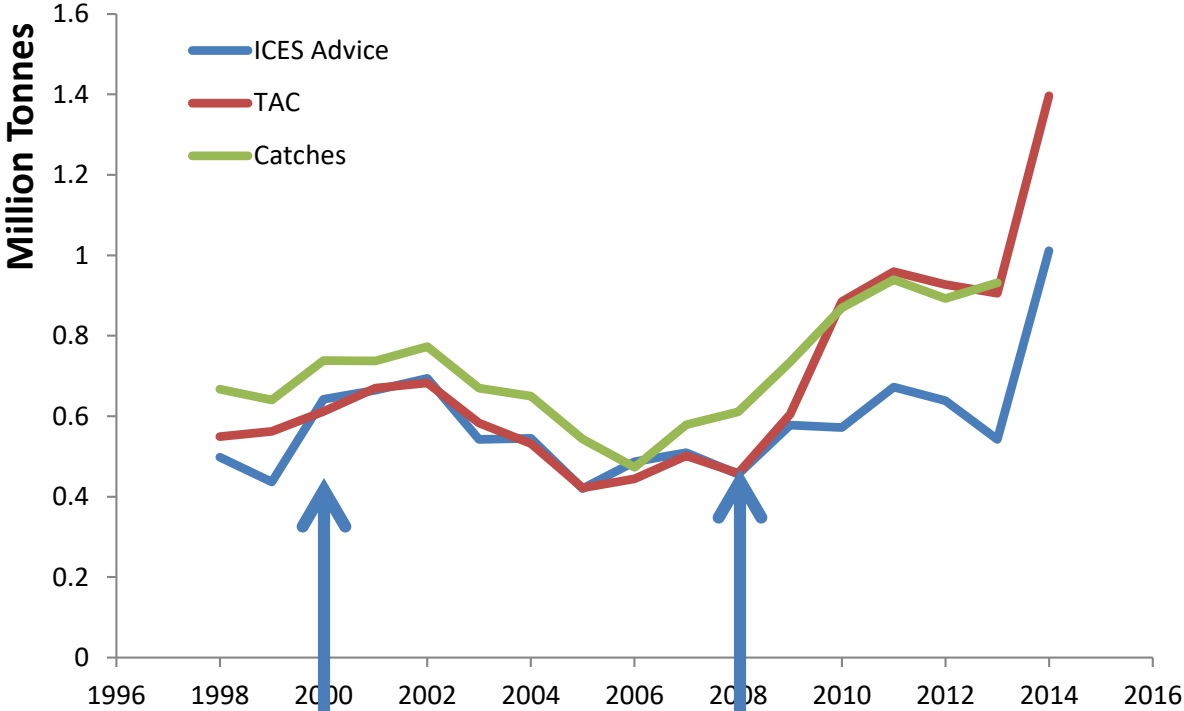


100years
1918 — 2018

Development of News fisheries



Stock (increasingly) mismanaged



Management plan 1 Management plan 2



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Conclusions:

- Many challenges in monitoring and managing widely distributed and migratory stocks :
 - Difficulty to get reliable data (indices and catches)
 - Need to cope with strong changes
 - Affect scientific operations
 - Affect the management system
- Paradox of a very valuable resource, with a uncertain assessment, and a lack of agreed management
- Potentially dangerous situation, but the stock is currently in a high production regime



Thank you for your attention

