



Gytefelt i Nordsjøen - ny kunnskap fra KINO-prosjektet

Svein Sundby

Fisk og seismikk 2017
Radisson Blu Hotel Tromsø, 5. – 6. april 2017



HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

- **Fangster og artssammensetning i Nordsjøen**
- **Økosystemstruktur**
- **Virkninger av klimaendringer**
- **Gyteperioder**
- **Gyteområder**



Fangster i Nordsjøen generelt



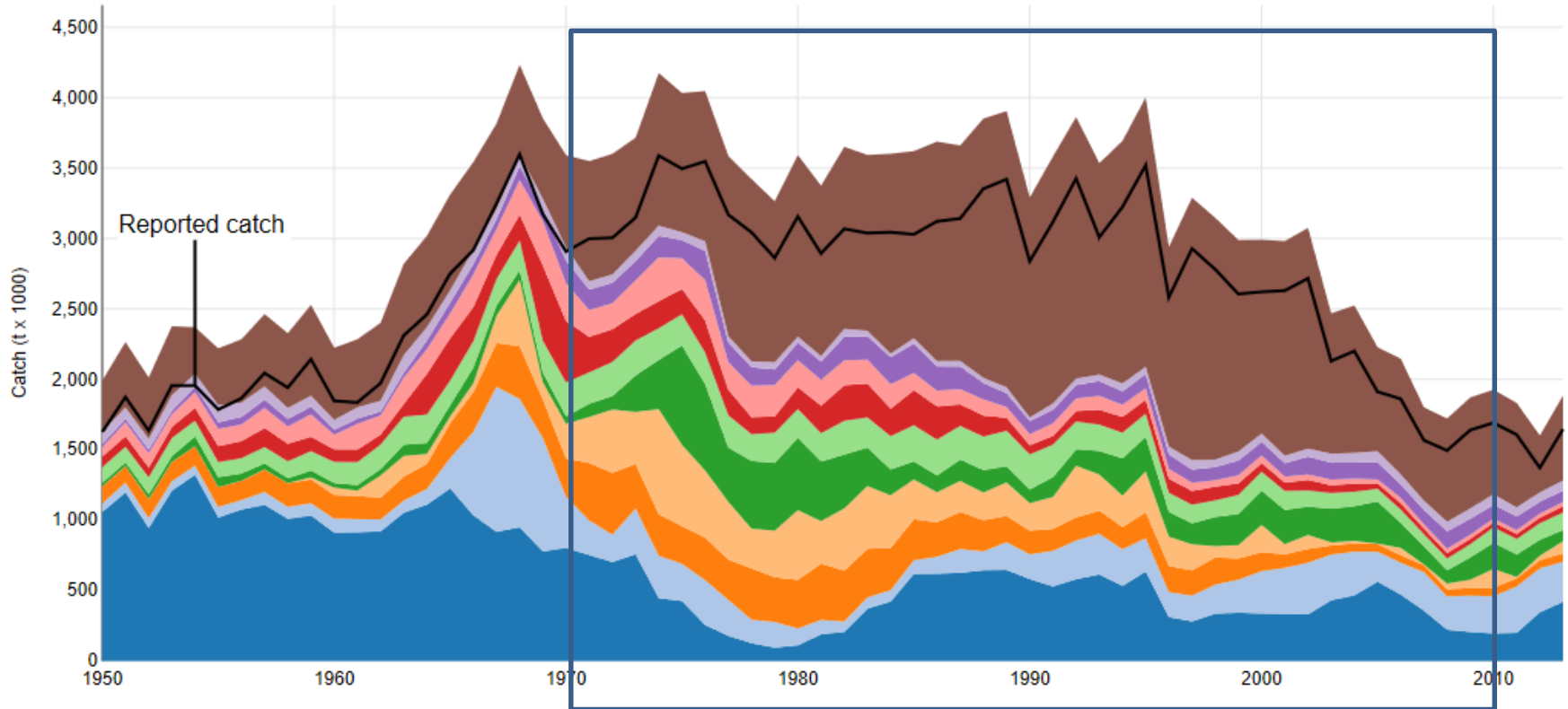
Fangster i Nordsjøen fordelt på arter for perioden 1970-2010

			Groups
Species	Catch	Catch	Catch
	1000 tonnes	Percent	Percent
Sandeel	614,3	20,4	20,4
Herring	390,4	13,0	
Sprat	241,9	8,1	27,6
Mackerel	196,3	6,5	
Cod	200,1	6,7	
Haddock	140,5	4,7	
Saithe	139,2	4,6	23,1
Whiting	112,6	3,8	
Norway pout	98,8	3,3	
Plaice	181,7	6,1	6,1
Shrimps	55,1	1,8	1,8
Others	633,8	21,1	21,1
SUM	3004,7	100	100

Kilder: Ulike ICES-rapporter og fra prosjektet The Sea Around Us

Fangster i Nordsjøen 1950-2014

Atlantic herring Atlantic mackerel Atlantic cod Norway pout European sprat European plaice Haddock Whiting Saithe
Common shrimp Others



141 arter i Nordsjøen

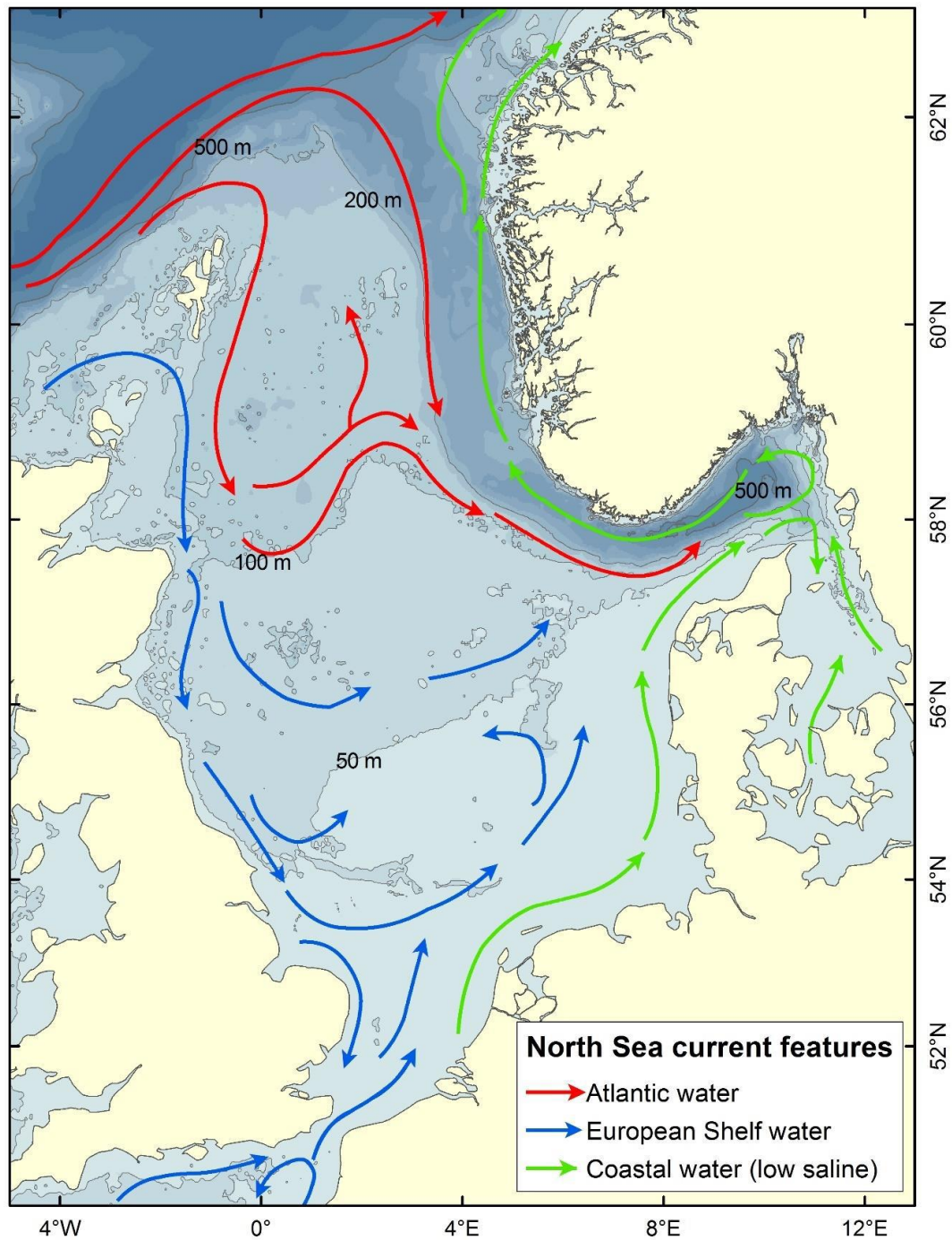
19 av dem finnes spredt over hele Nordsjøen, i alle 6 økosystem underområder

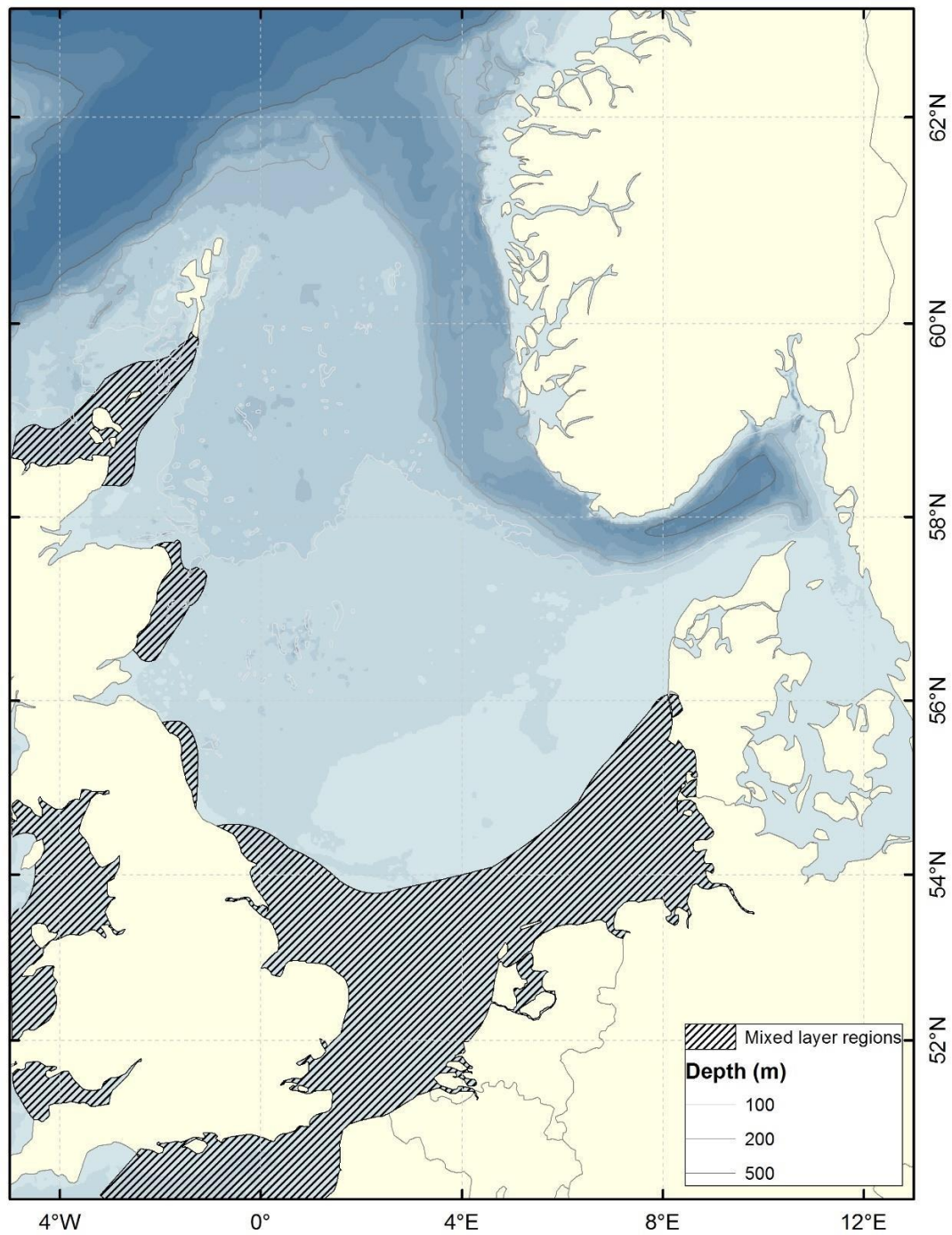
	Southern	German Bight-	Central	Northern	Norwegian Tr.	Kattegat	SUM
Species	Sub Region	Jutland	Sub Region	Sub Region	Sub Region	Sub Region	Sub Regions
Plaice	1	1	1	1	1	1	6
Lemon sole	1	1	1	1	1	1	6
Dab	1	1	1	1	1	1	6
Long rough dab	1	1	1	1	1	1	6
Saithe	1	1	1	1	1	1	6
Whiting	1	1	1	1	1	1	6
Haddock	1	1	1	1	1	1	6
Cod	1	1	1	1	1	1	6
Poor cod	1	1	1	1	1	1	6
Four-bearded rockling	1	1	1	1	1	1	6
Mackerel	1	1	1	1	1	1	6
Atlantic horse mackerel	1	1	1	1	1	1	6
Herring	1	1	1	1	1	1	6
Sprat	1	1	1	1	1	1	6
Anchovy	1	1	1	1	1	1	6
Lumpsucker	1	1	1	1	1	1	6
Grey gurnard	1	1	1	1	1	1	6
Snake pipefish	1	1	1	1	1	1	6
Striped red mullet	1	1	1	1	1	1	6

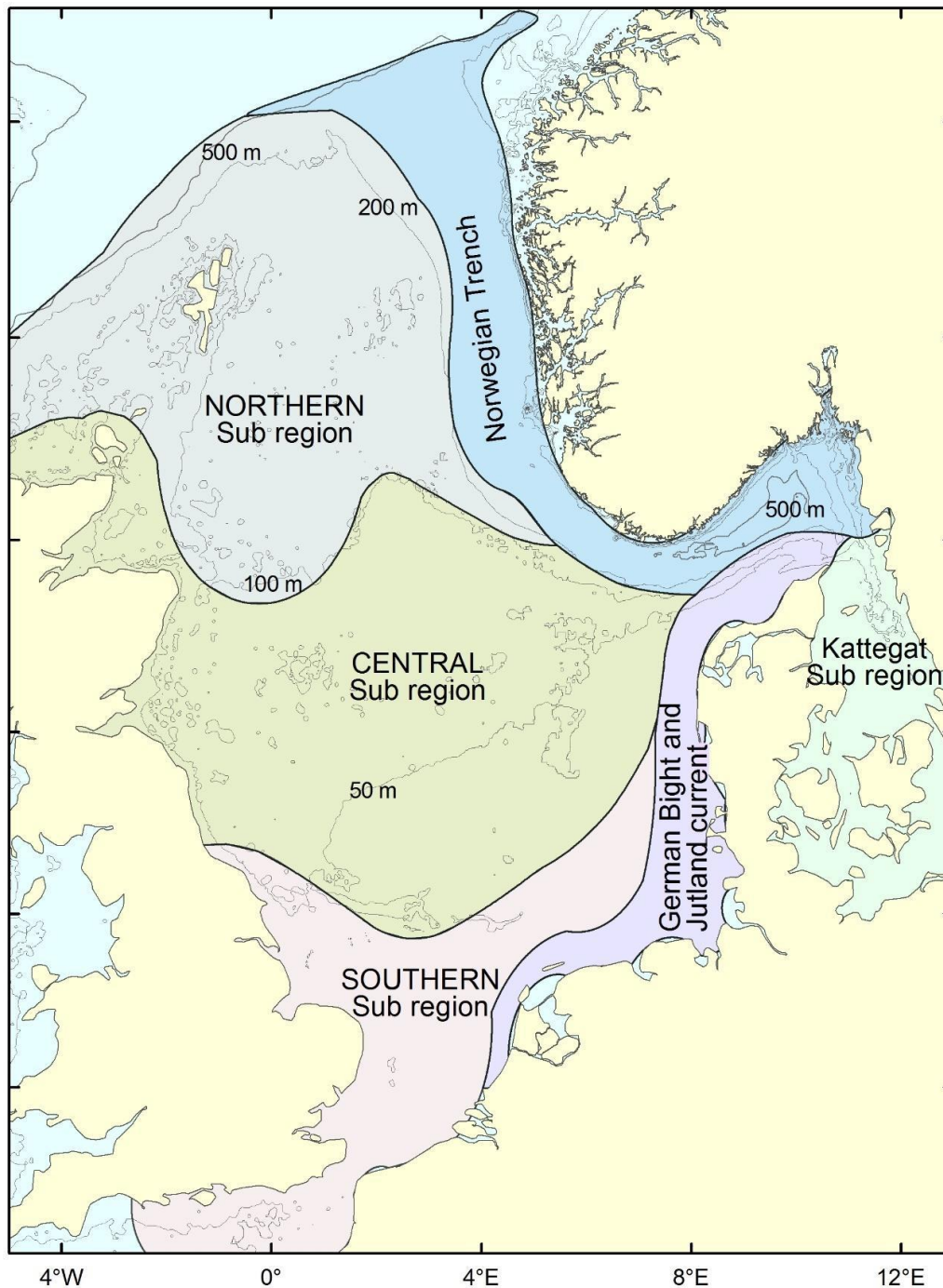
12 av disse er økonomisk viktige arter som utgjør ca. 2/3 av Nordsjøens fangstvolum

Økosystemstrukturen i Nordsjøen









NORTHERN Sub region:
 Deepest part of the shelf.
 Atlantic inflow

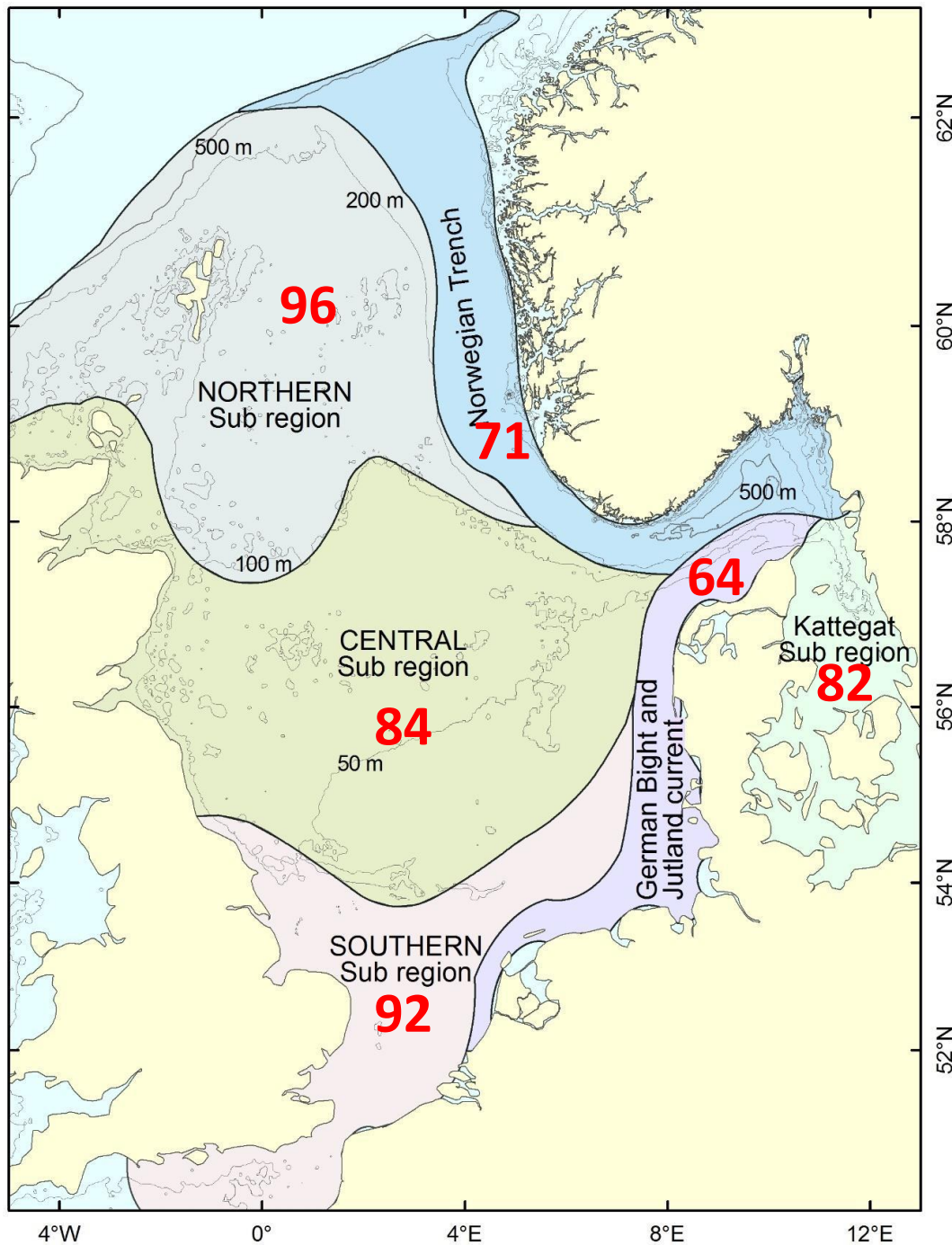
Norwegian Trench:
 Deepest region.
 Atlantic inflow and outflow of
 Coastal water

CENTRAL Sub region:
 Less influenced by both Atlantic
 and coastal waters

German Bight and Jutland C:
 Shallow and strongly influenced
 by fresh water runoff.

Kattegat Sub region:
 Shallow and strongly influenced
 Baltic water outflow

SOUTHERN Sub region:
 Shallow and strongly influenced
 by tidal mixing



**141 ARTER I HELE
NORDSJØEN**

31 fiskearter finnes bare i 2 økosystem underområder

	Southern	German Bight-	Central	Northern	Norwegian Tr.	Kattegat	SUM
Species	Sub Region	Jutland	Sub Region	Sub Region	Sub Region	Sub Region	Sub Regions
Imperial scaldfish	1			1			2
Common topknot			1			1	2
Fries's goby				1		1	2
Reticulated dragonet	1	1					2
Spotted wolffish				1	1		2
Spotted snake blenny					1	1	2
Sars's eelpout				1	1		2
Corkwing	1					1	2
Ballan wrasse	1					1	2
Goldsinny	1					1	2
Black sea-bream	1		1				2
Sea bass	1					1	2
Atlantic hook-ear sculpin			1		1		2
Redfish				1	1		2
Fifteen-spined stickleback		1				1	2
Black-bellied anglerfish			1	1			2
Pearlfish				1	1		2
Greater fork-beard				1	1		2
Blue ling				1	1		2
Tusk				1	1		2
Shagreen ray				1	1		2
Sandy ray				1	1		2
Long-nosed skate				1	1		2
Sail ray				1	1		2
Roundnose grenadier				1	1		2
Barracudinas				1	1		2
European conger eel	1			1			2
Velvet belly				1	1		2
Black-mouth dogfish				1	1		2
Porbeagle shark				1	1		2
Rabbit fish				1	1		2

16 fiskearter finnes bare i ett økosystem underområde

	English Ch. -	German Bight-	Tidal Front-	Northern	Norwegian T.-	Kattegat	SUM
Species	Tidal Front	Jutland Current	Dooley C.	North Sea	Skagerrak		Sub Regions
Grey Triggerfish	1						1
Sand sole	1						1
Ekstrøm's topknot	1						1
Boarfish				1			1
Pandora	1						1
Red sea-bream	1						1
Ray's bream			1				1
Norway bullhead		1					1
Seahorses	1						1
Grey mullets	1						1
Hollowsnout grenadier					1		1
Round skate					1		1
Undulate ray	1						1
Norwegian skate					1		1
Lanternfish					1		1
Smooth-head				1			1

Virkningene av klimaendringer i Nordsjøen



Climate Change and Distribution Shifts in Marine Fishes

Allison L. Perry,^{1*} Paula J. Low,^{2†} Jim

We show that the distributions of both exploited fish species have responded markedly to recent climate change, with nearly two-thirds of species shifting in mean latitude. For species with northerly or southerly distributions, half have shown boundary shifts with warming. Species with shifting distributions have smaller body sizes than nonshifting species. Further, there are profound impacts on commercial fisheries through changes in community interactions and alterations in community interactions.

Har fiskeartene generelt sett forflyttet seg nordover i Nordsjøen?

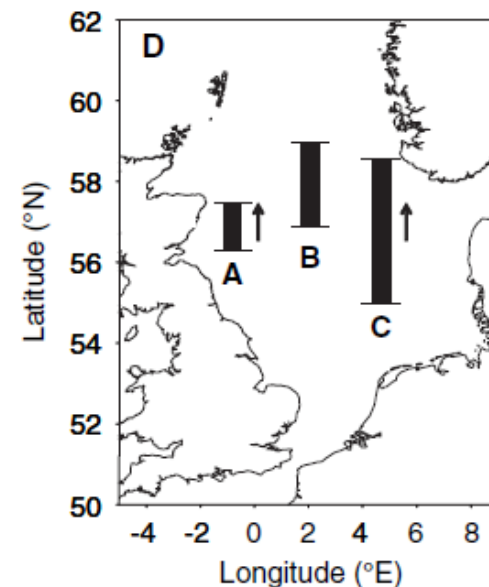
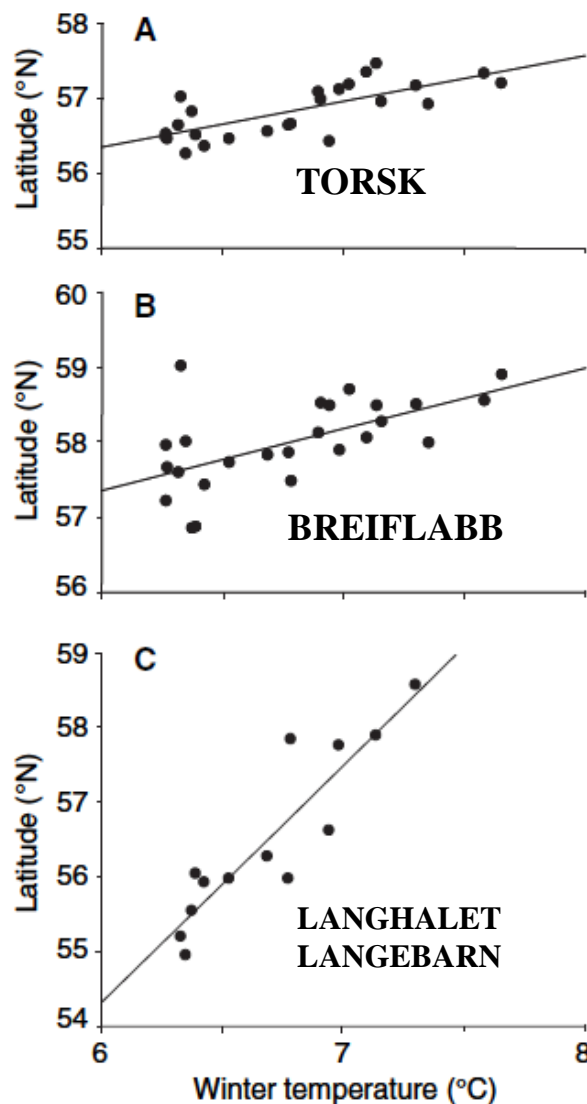
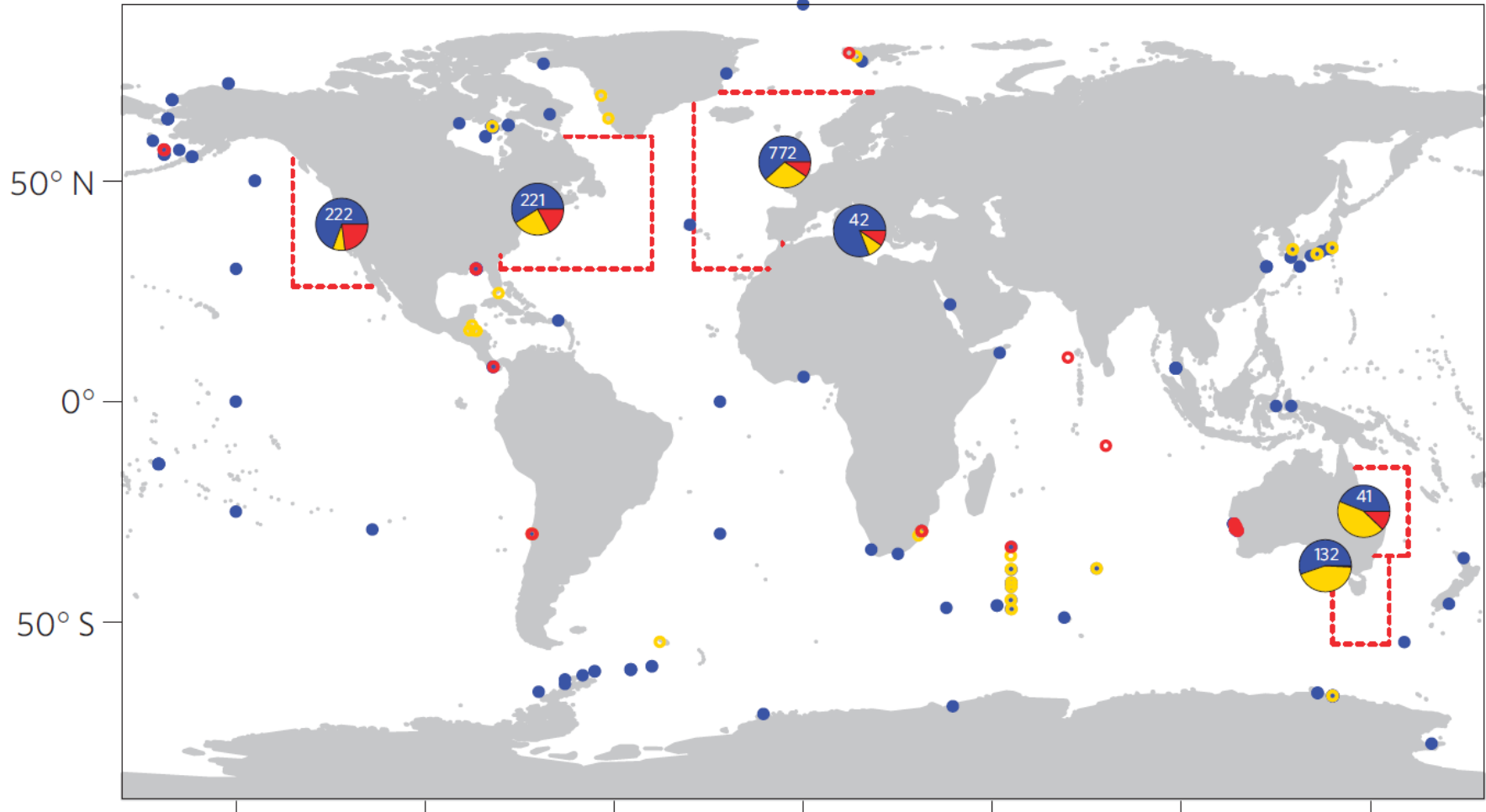
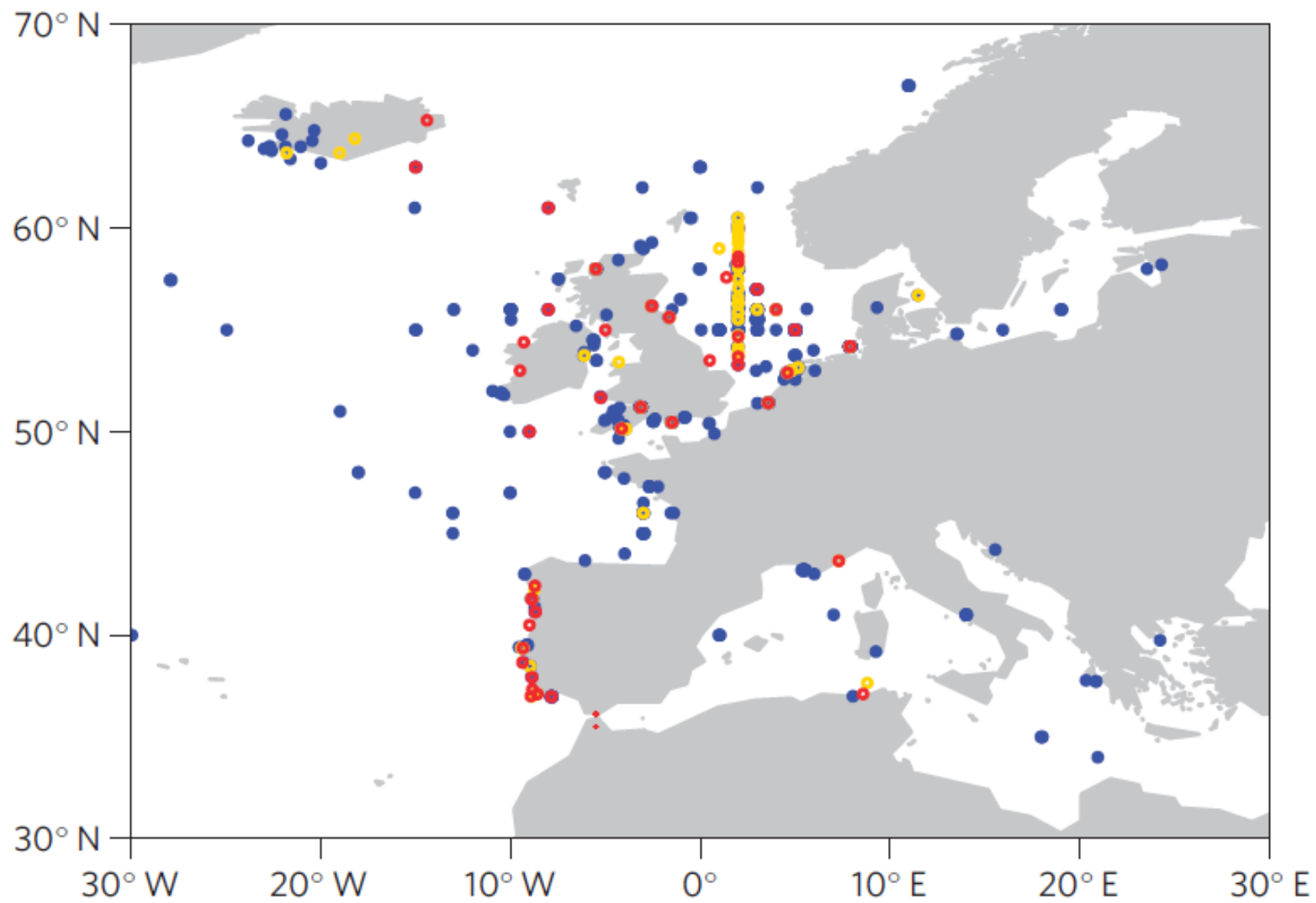


Fig. 1. Examples of North Sea fish distributions that have shifted north with climatic warming. Relationships between mean latitude and 5-year running mean winter bottom temperature for (A) cod, (B) anglerfish, and (C) snake blenny are shown. In (D), ranges of shifts in mean latitude are shown for (A), (B), and (C) within the North Sea. Bars on the map illustrate only shift ranges of mean latitudes, not longitudes. Arrows indicate where shifts have been significant over time, with the direction of movement. Regression details are in Table 1.

a

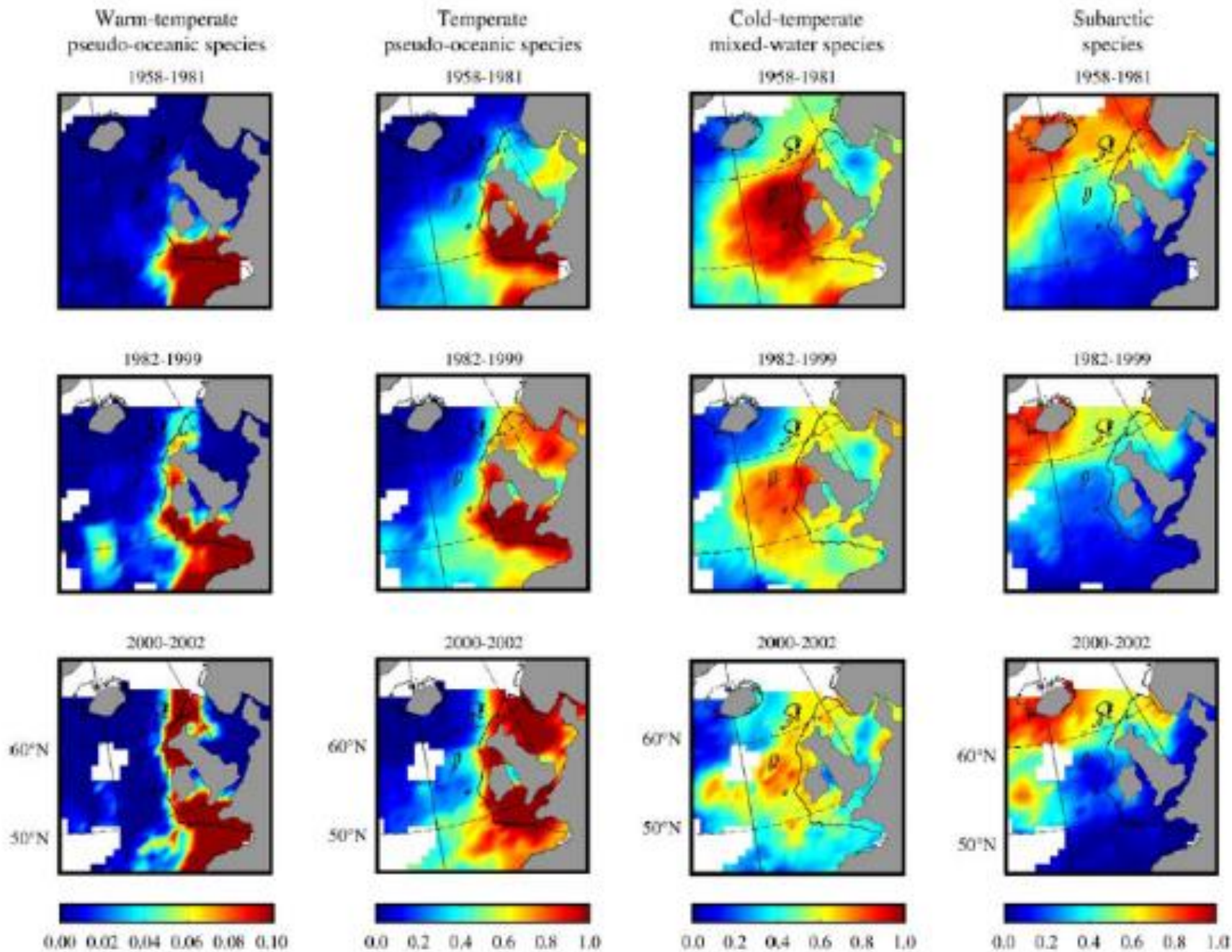
● Consistent ● No change ● Opposite



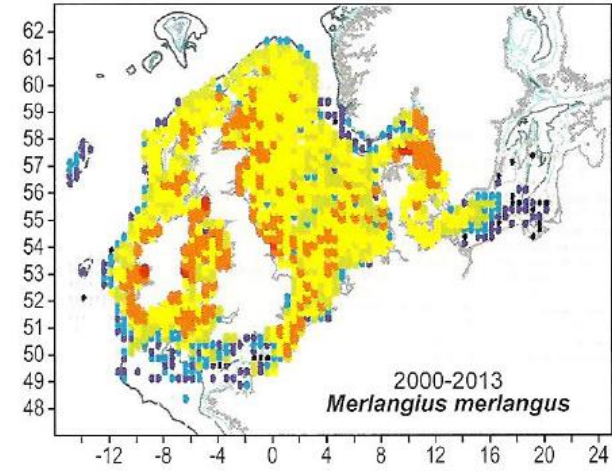
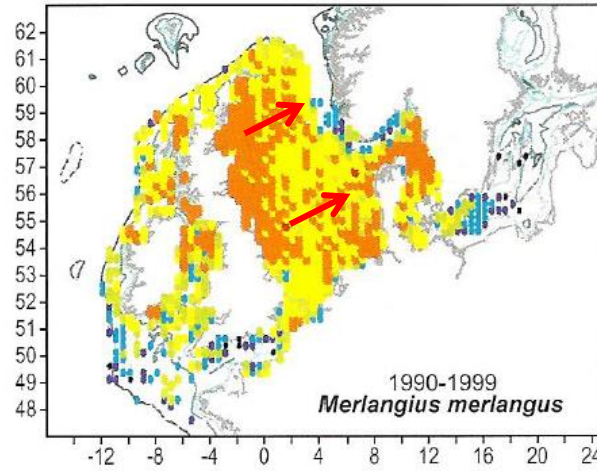
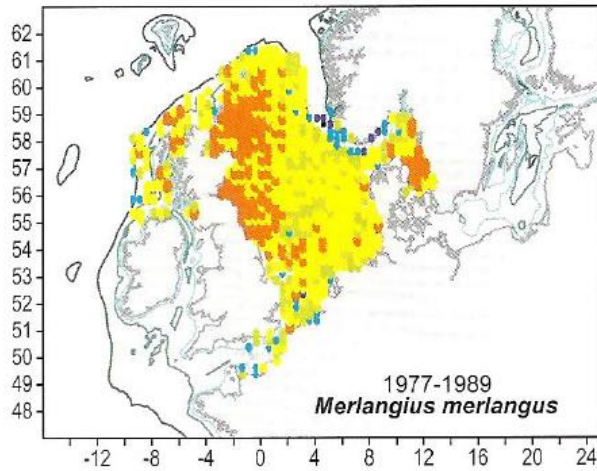
d

Poloczanska et al. (2013)

Spatial changes in zooplankton species (Beaugrand 2005)

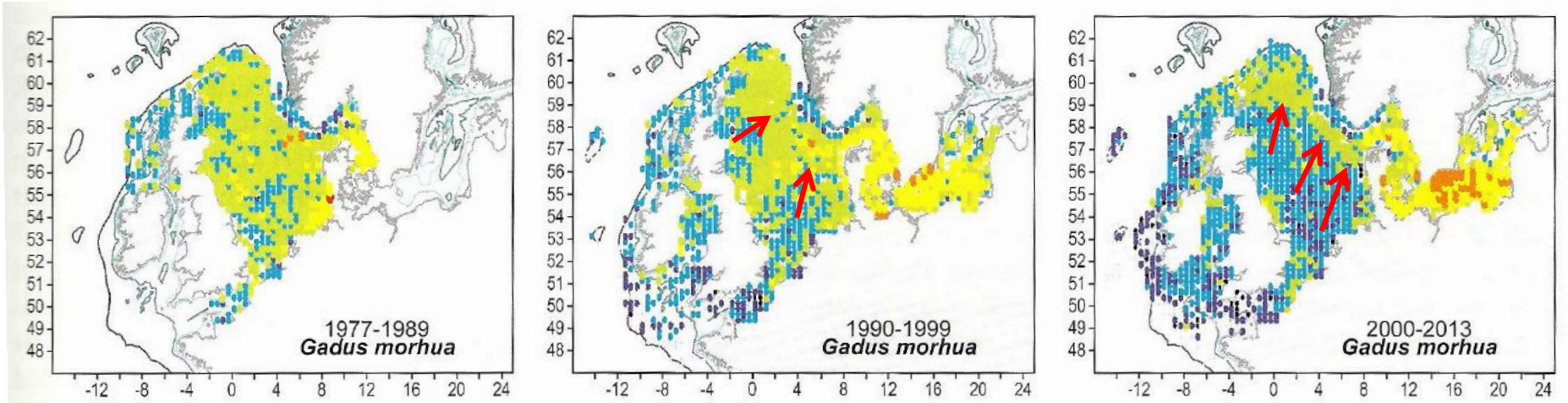


Whiting: first abundance increased and distribution expanded eastwards
Thereafter abundance decreased and distribution "collapsed" to the British east coast (British coastal water)



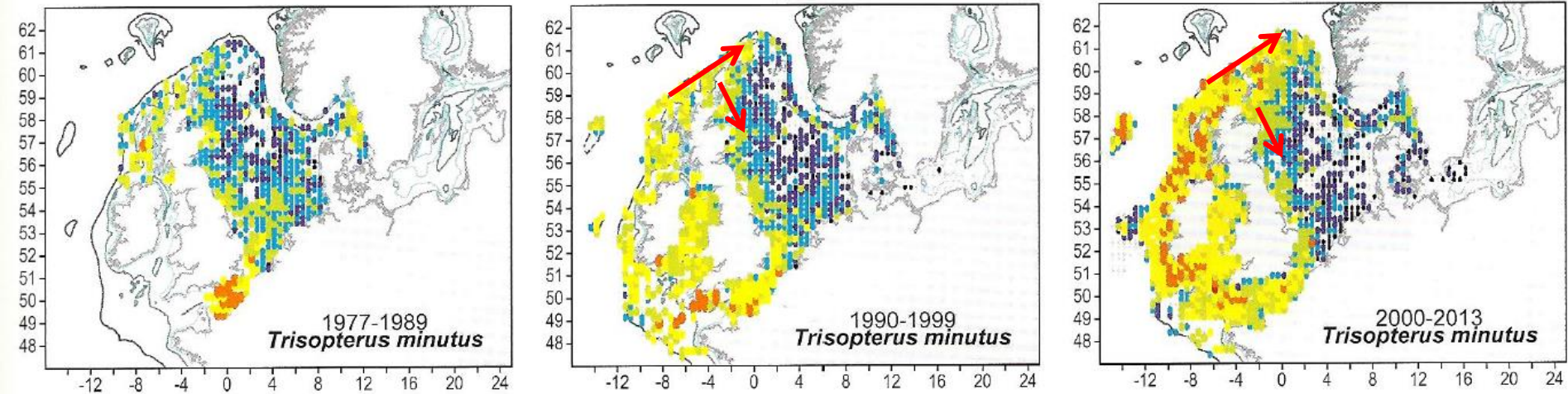
Catch rates of whiting by period.

Cod abundance has decreased and distribution "collapsed" to the northeastern North Sea shelf (Atlantic water)



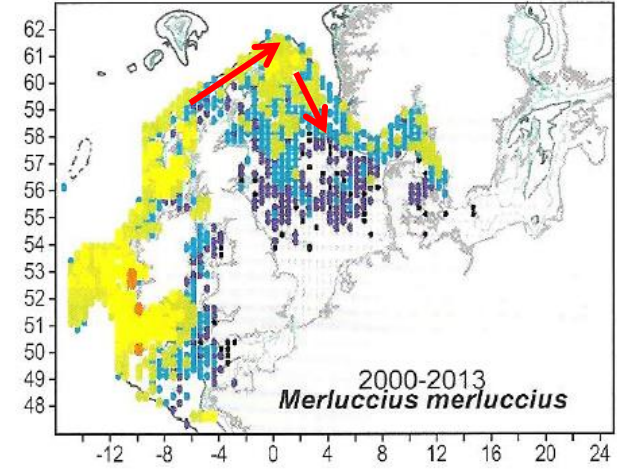
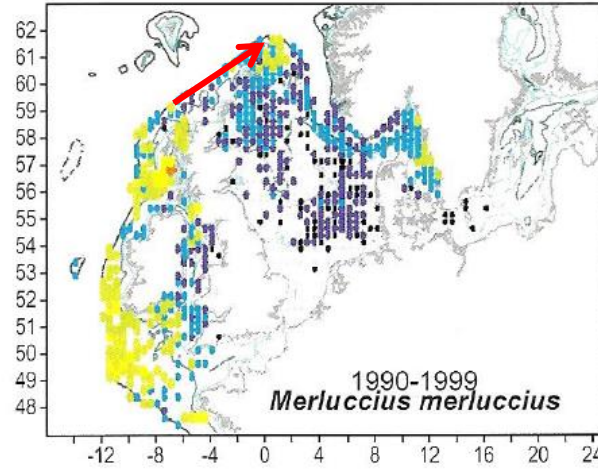
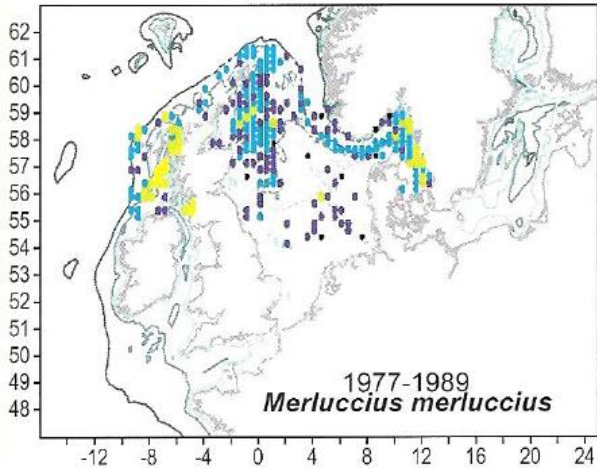
Catch rates of cod by period.

Poor cod (*sypike*) has increased in the North Sea, invasion from the western part of the British Isles to the western part of the North Sea

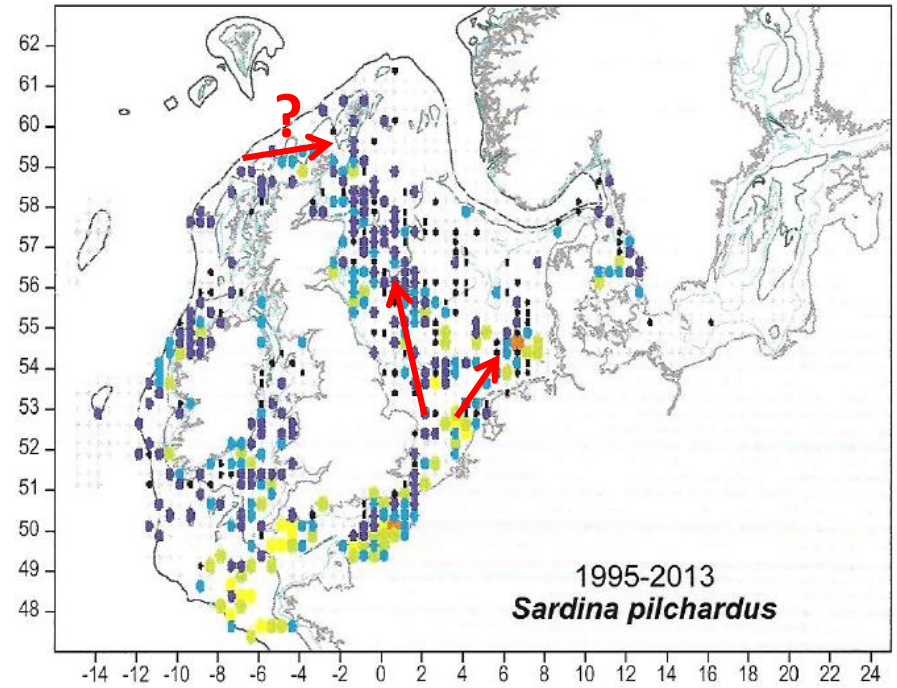
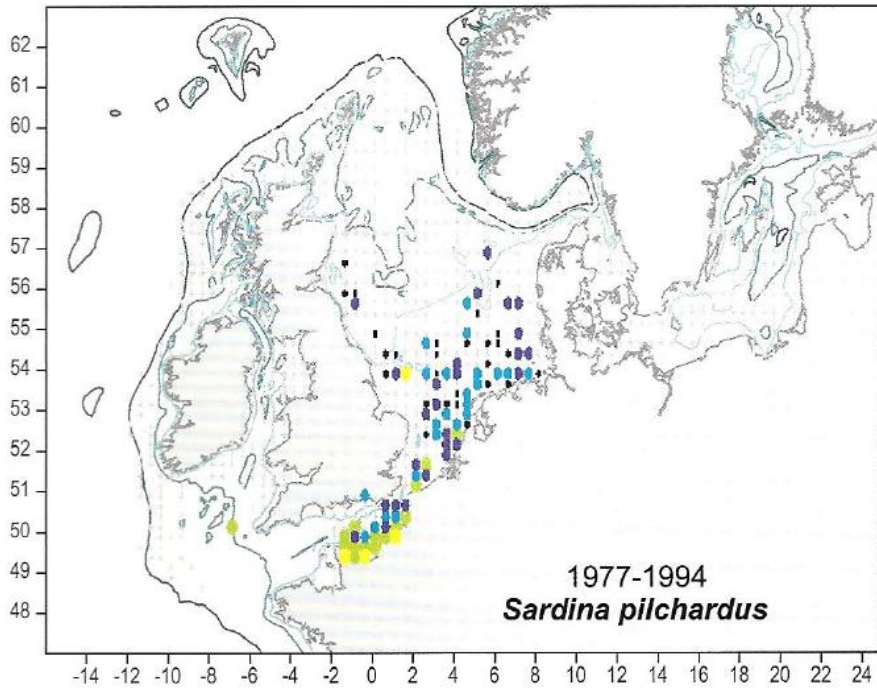


Catch rates of poor cod by period.

Hake has increased in the North Sea,
invasion from the western part of the British Isles
to the northeastern shelf of the North Sea (along the Atlantic inflowing water)

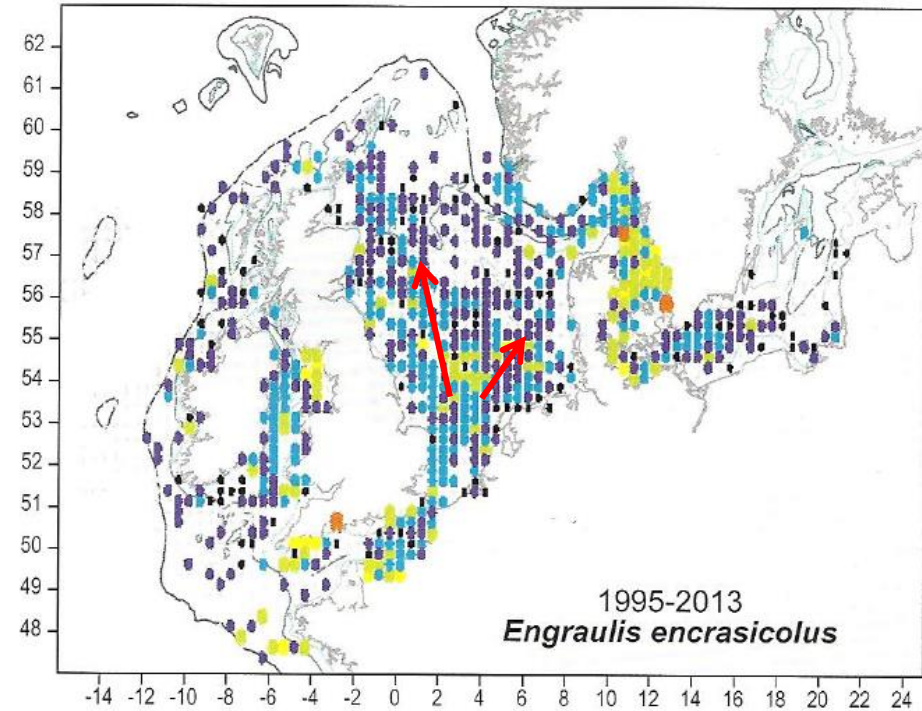
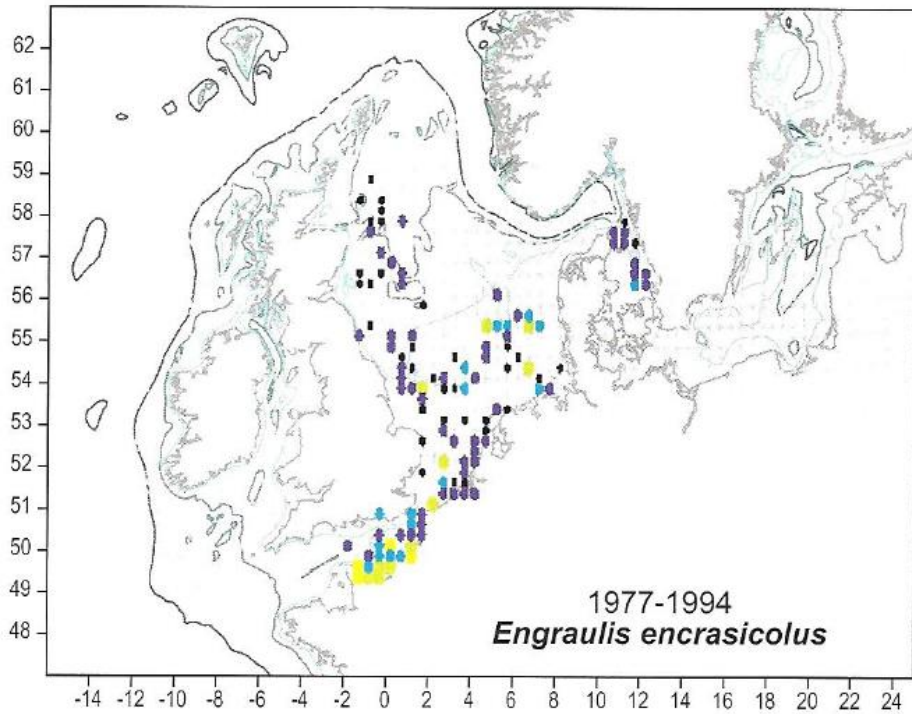


Sardine has increased in the North Sea,
invasion probably from the English Channel
to the western part of the British Isles and to the German Bight

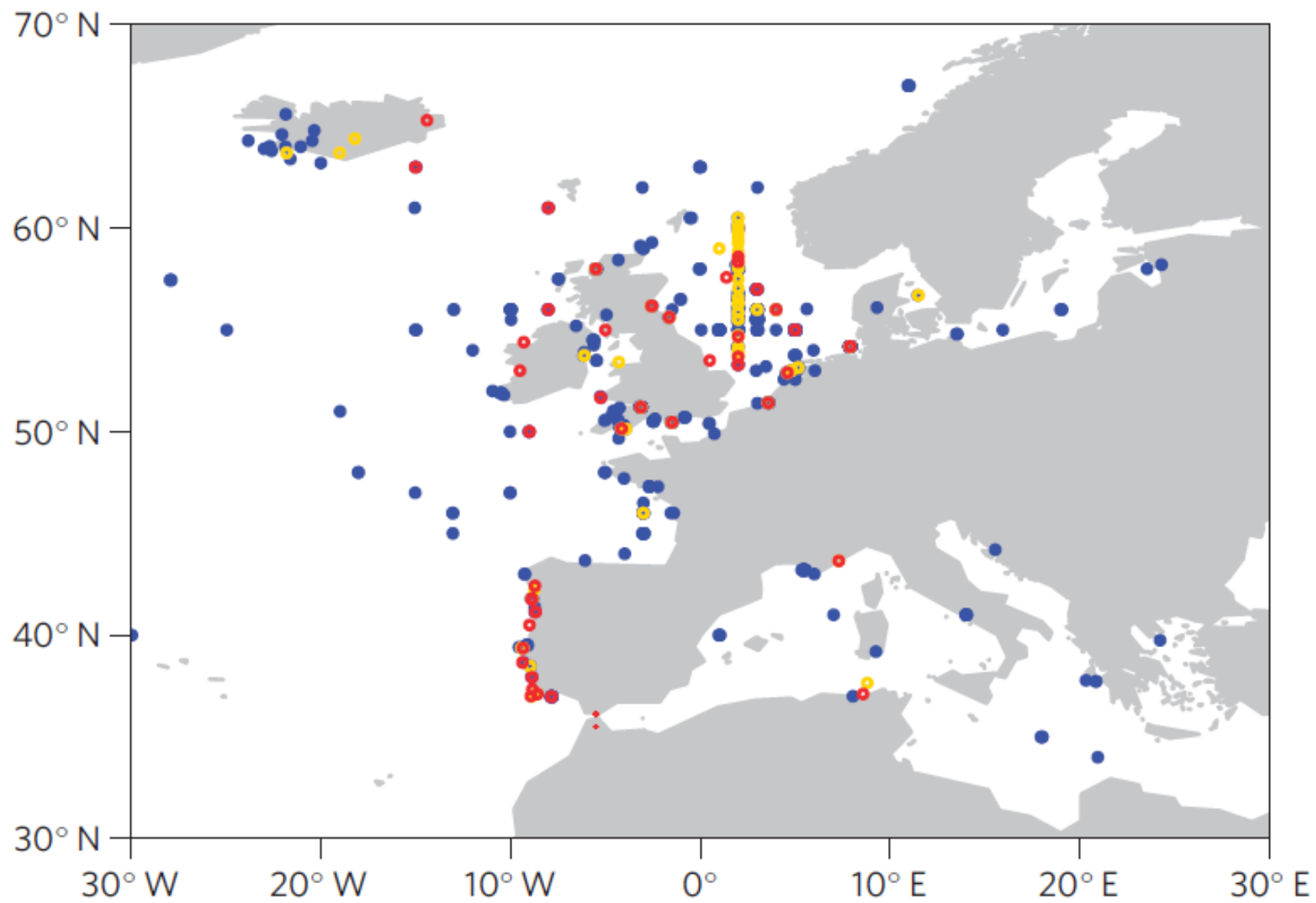


Catch rates of pilchard by period.

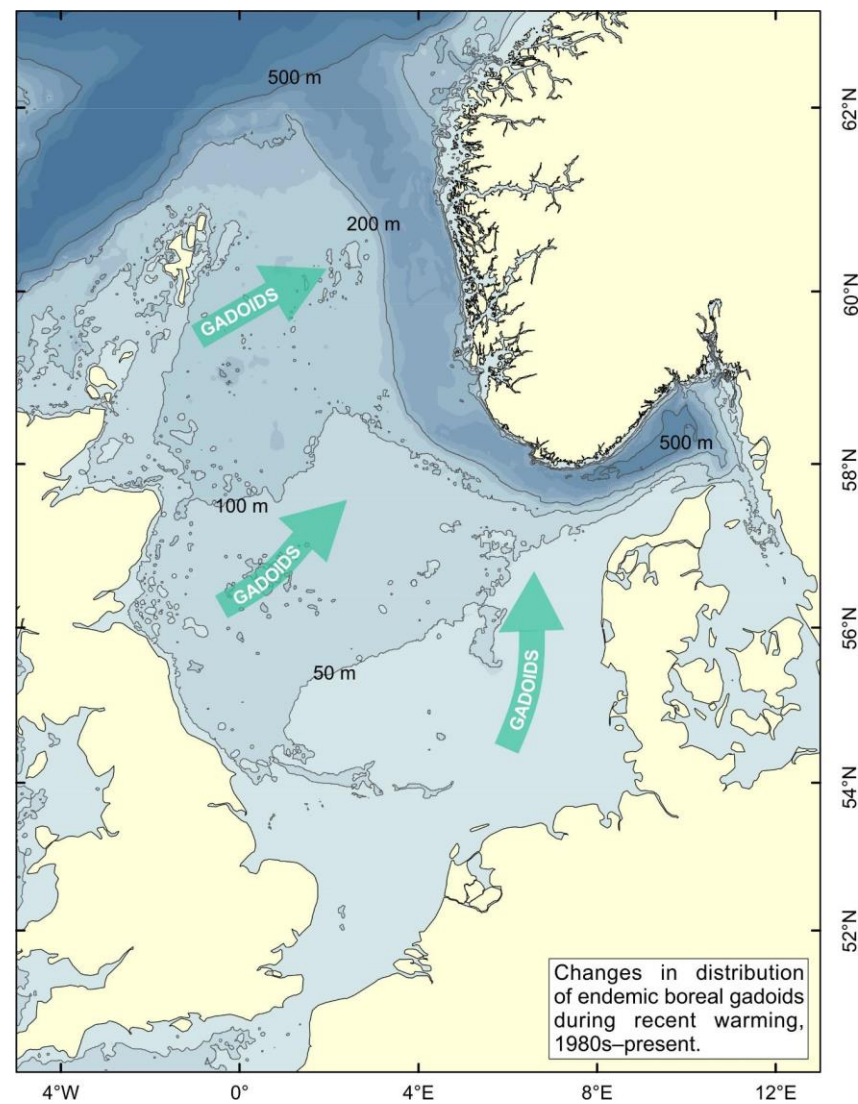
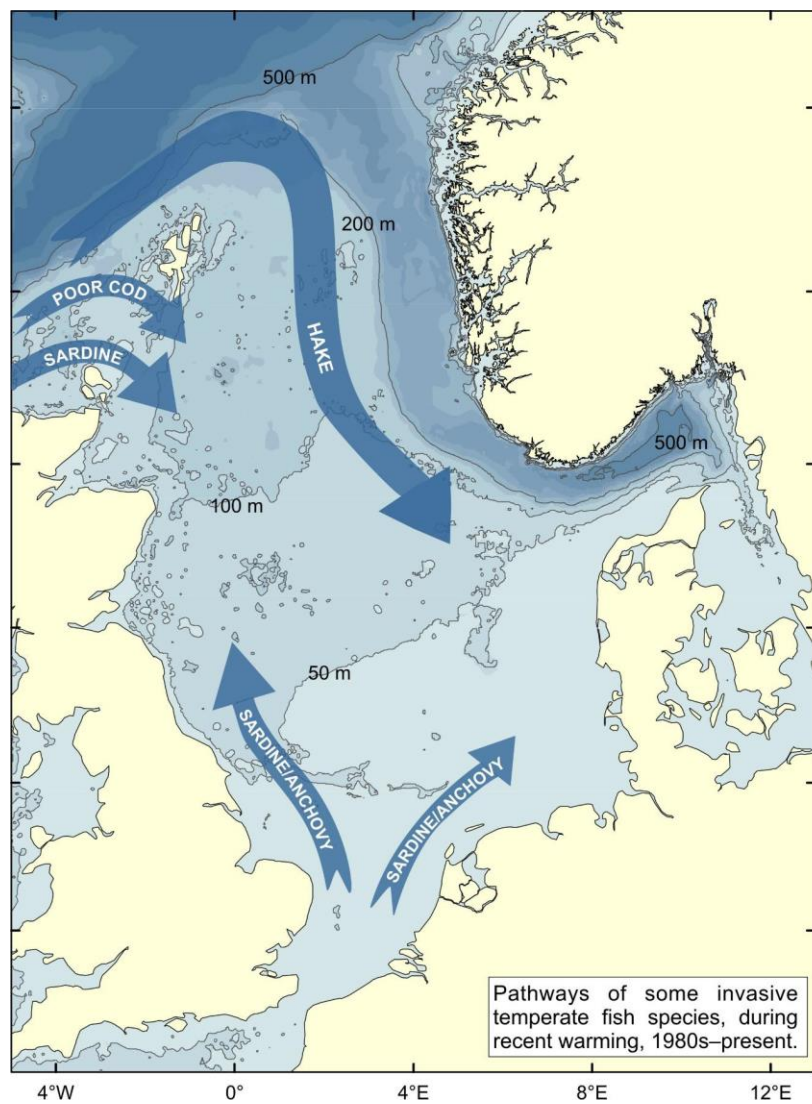
Anchovy has increased in the North Sea, Expansion from the southern part of the North Sea and northwards



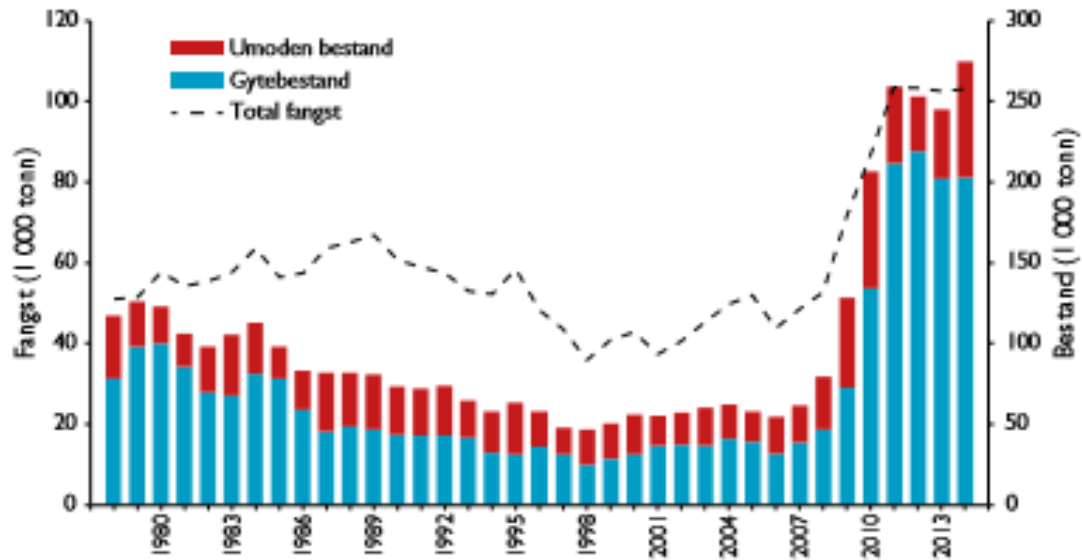
Catch rates of anchovy by period.

d

Poloczanska et al. (2013)

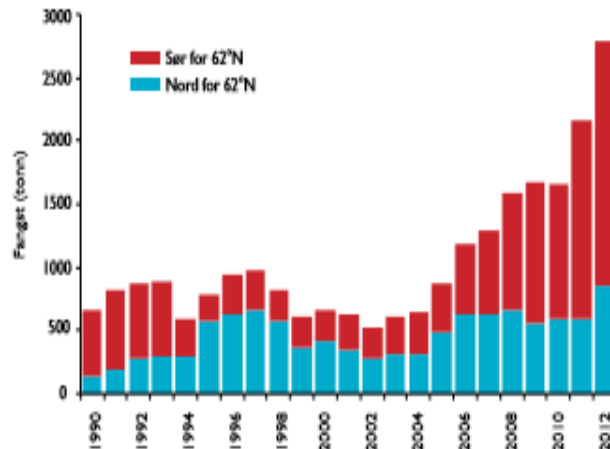


Nordlig lysing fra Biscaya til Norge



Bestand og fangst av "nordlig" lysing.

Stock size and total catch of "northern" hake.

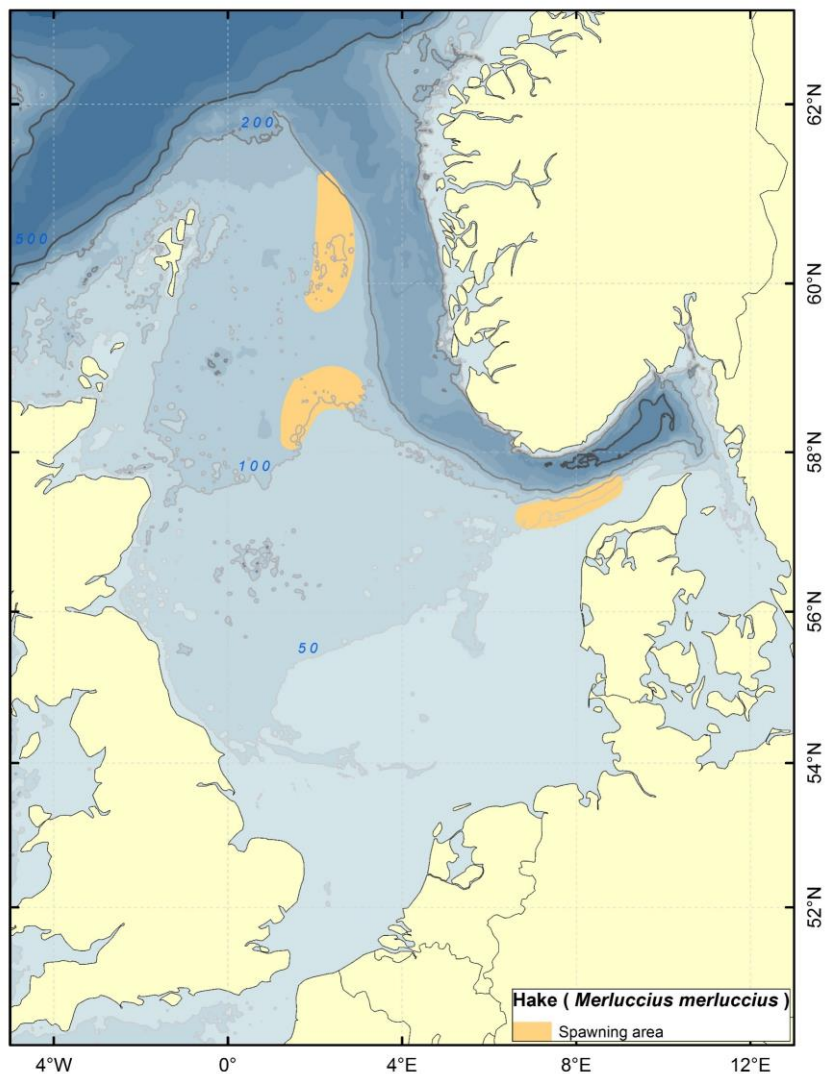


Norske lysing fangst (i tonn rundvekt).

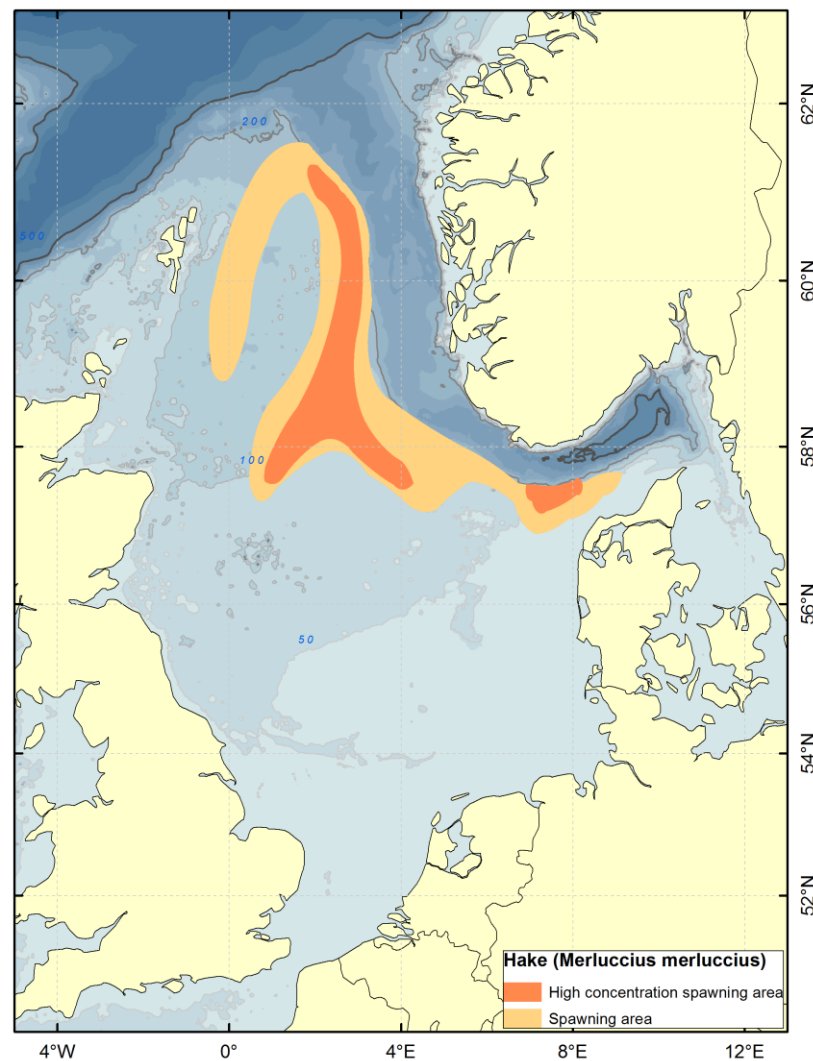
Norwegian catches (tonnes) of European hake.

Norske fangster –
i Norge

Gytefelter for lysing



Datagrunnlag 1989-2013



Oppdatert til 2016

Climate Change and Distribution Shifts in Marine Fishes

Allison L. Perry,^{1*} Paula J. Low,^{2†} Jim

We show that the distributions of both exploited and non-exploited marine fishes have responded markedly to recent climate change, with nearly two-thirds of species shifting in mean latitude. For species with northerly or southerly distributions, half have shown boundary shifts with warming. Species with shifting distributions have smaller body sizes than nonshifting species. Further, there are profound impacts on commercial fisheries through changes in distribution and alterations in community interactions.

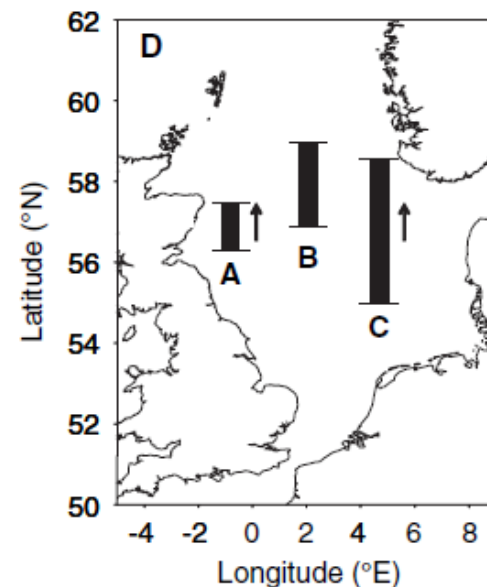
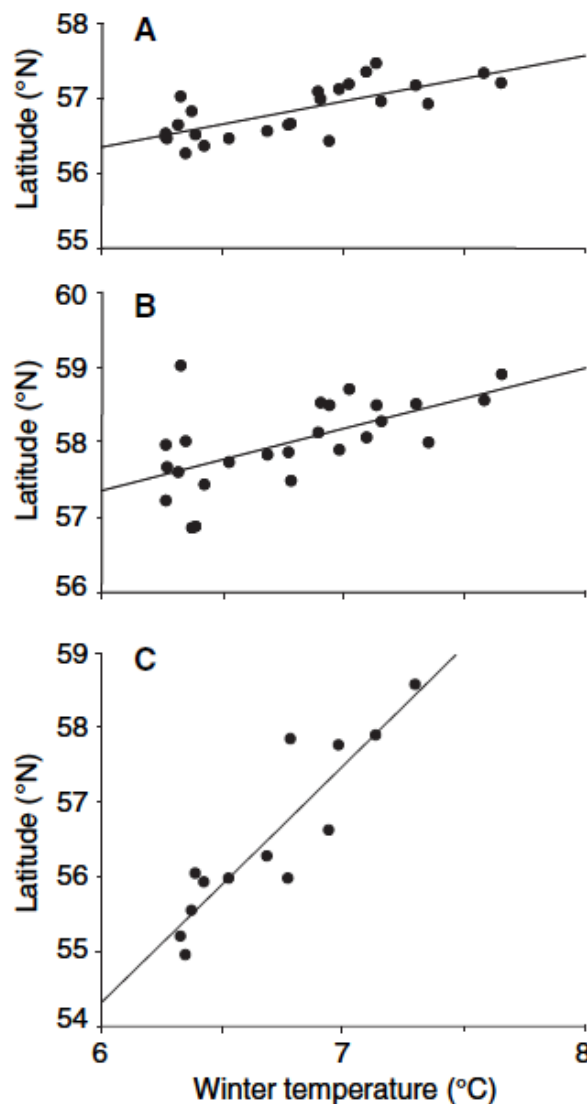


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Gyteperioder i Nordsjøen



Gyteperioder Gadidae

Cod - Viking Bank	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cod - Northwest	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cod - South	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Haddock	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Whiting - Northern North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Whiting - English Channel	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Saithe	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Norway pout	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pollack	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Blue whiting	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bib - Southern North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Silvery pout	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Poor cod	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Fourbearded rockling	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Tusk	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ling	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Blue ling	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Gyteperioder flatfisk

Sole	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Solenette - North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Solenette - English Channel-Ireland	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Witch	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Long rough dab	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dab - North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dab - Brittany/Southern England	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Lemon sole	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Flounder - Central North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Flounder - Southern North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Plaice - Northern	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Plaice - Southern	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

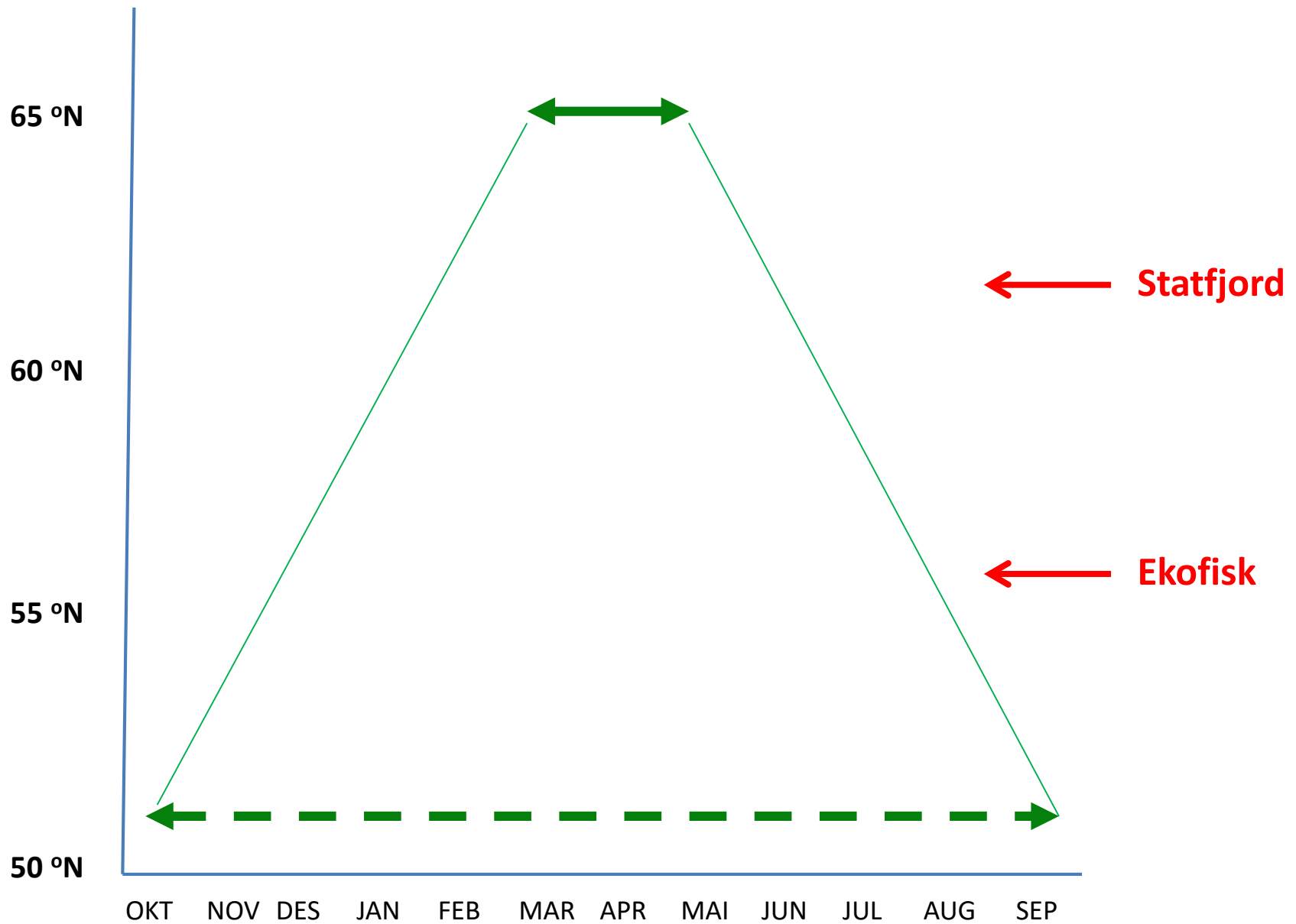
Gyteperioder diverse arter

Hake	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Sandeel	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Herring - Orkney-Shetland	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Herring - Buchan	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Herring -Banks	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Herring -Downs	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Sardine - southern North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Sardine - English Channel	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Sprat	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Anchovy - Zuidersee	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Anchovy -Southern region	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mackerel	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Horse mackerel - Southern North Sea	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Horse mackerel - Biscay-Ireland	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Gyteperioder diverse mesopelagisk-dypvannsarter

Greater argentine - Møre	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Greater argentine Skagerrak	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Greater argentine - Rockall	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Roundnose grenadier	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Anglerfish	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pearlside	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Breddegradsavhengig gyteforløp



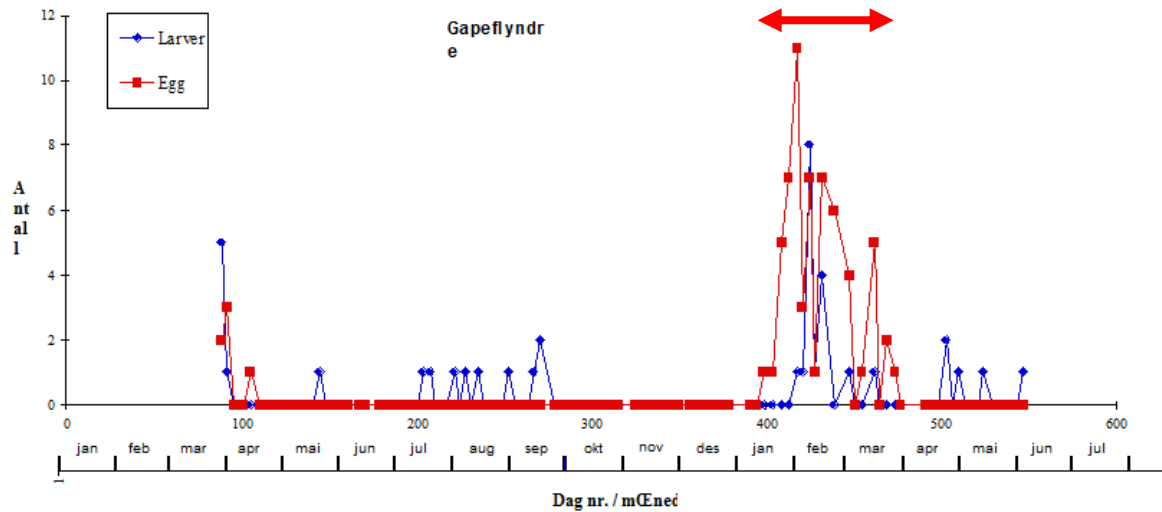


Fig. 7. Larver og egg av gapeflyndre. *Larvae and eggs of long rough dab.*

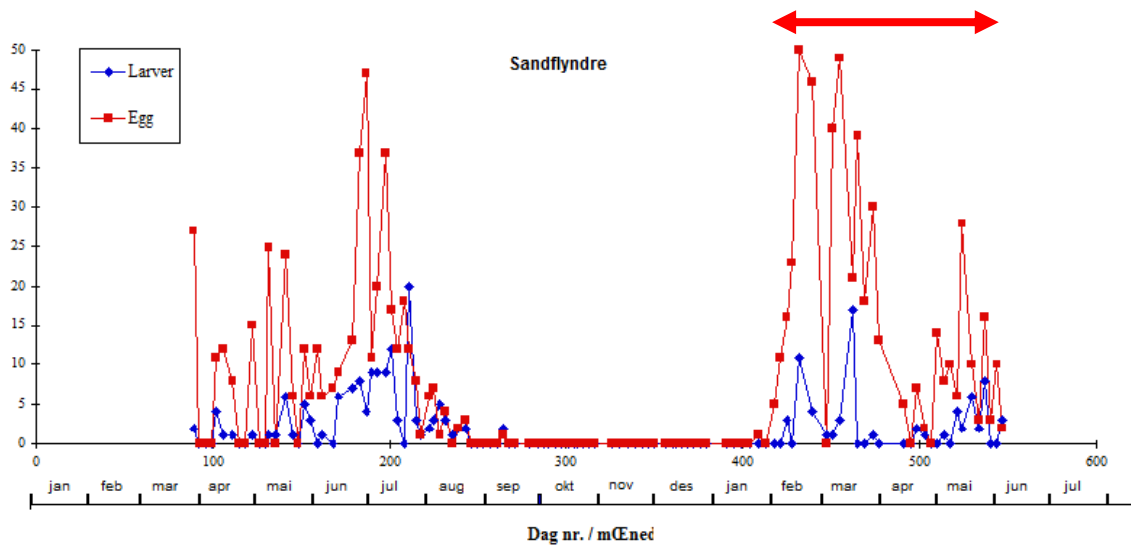
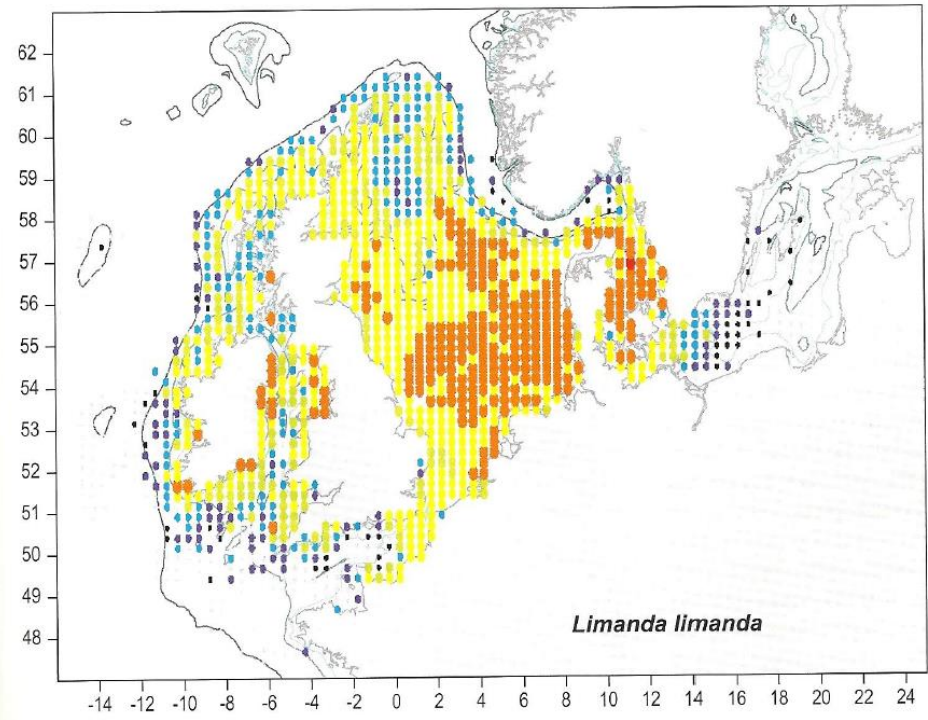
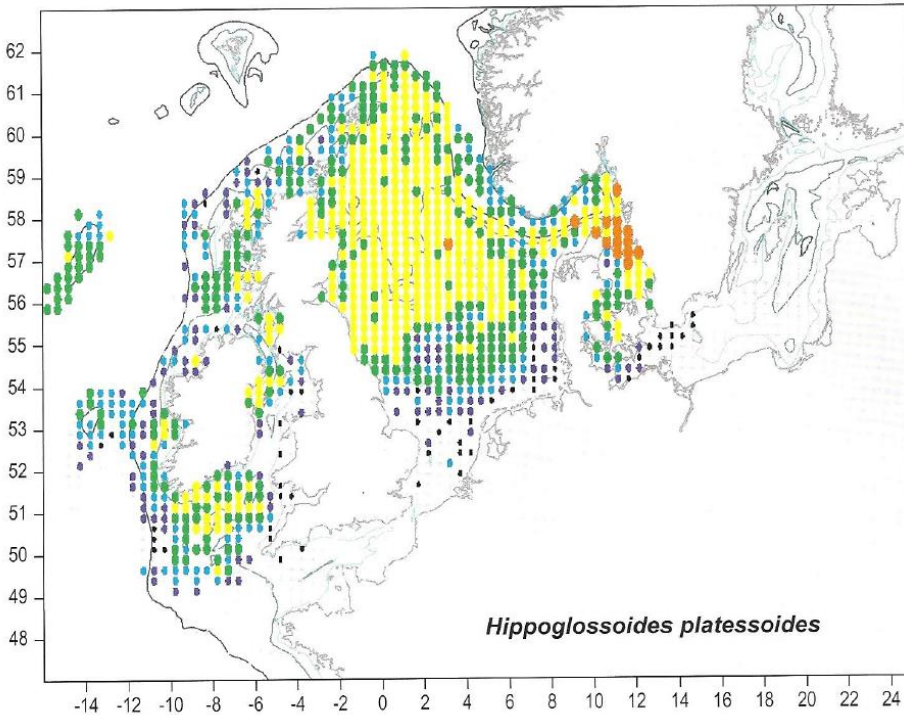


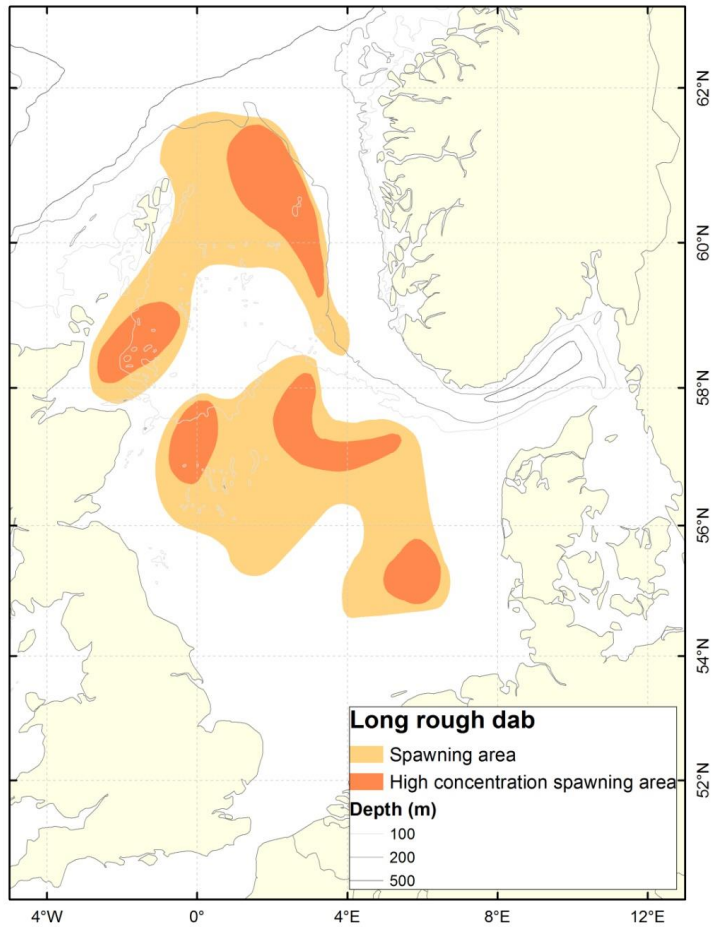
Fig. 8. Larver og egg av sandflyndre. *Larvae and eggs of dab.*

Som sørligere art
har sandflyndre
lengre
gyteperiode

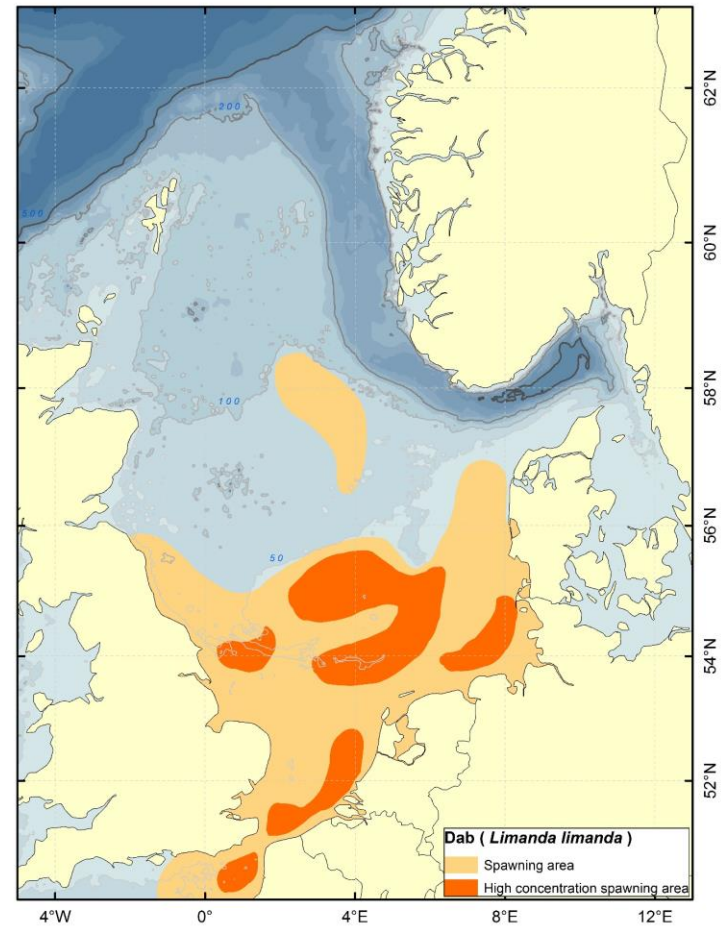
Gapeflyndre en mer nordlig art enn sandflyndre



Gapeflyndre



Sandflyndre

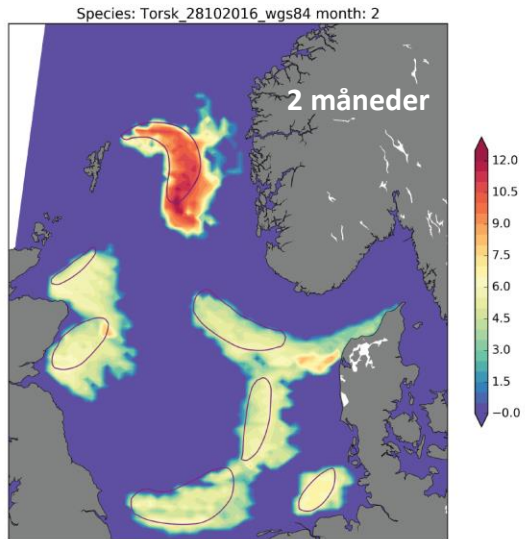


Gyteområder i Nordsjøen

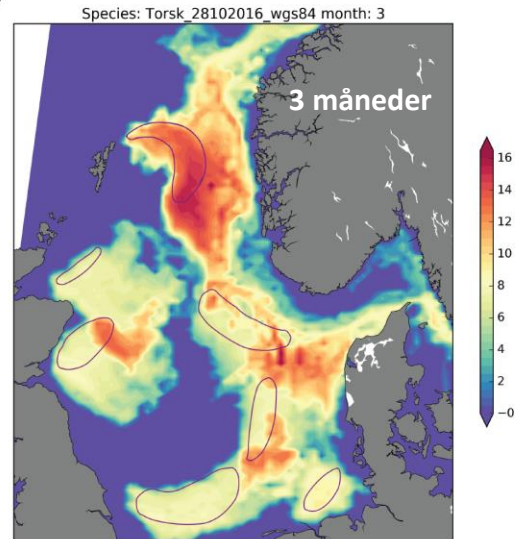


Spredning av avkom fra TORSK fra hovedgytefeltene

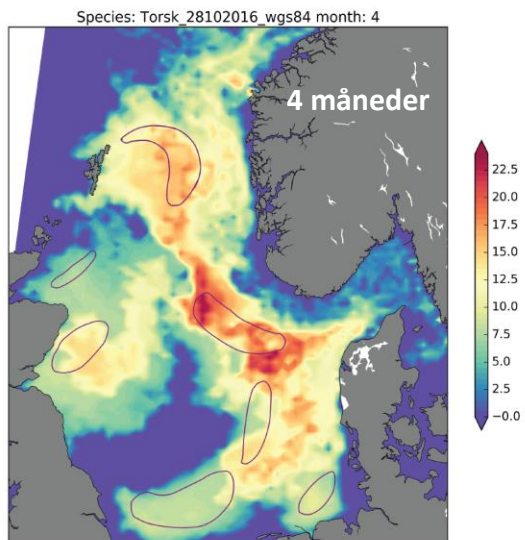
a)



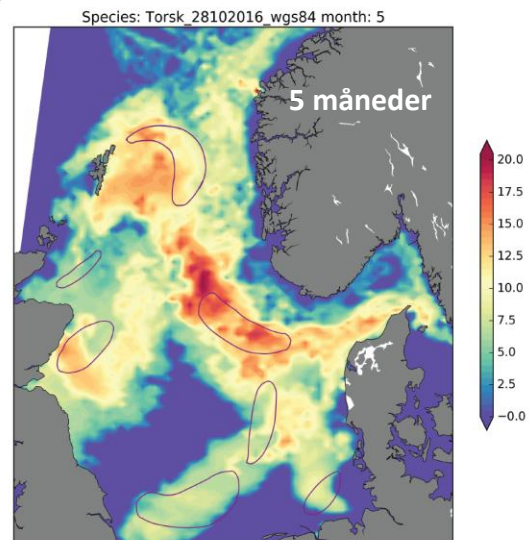
b)



c)

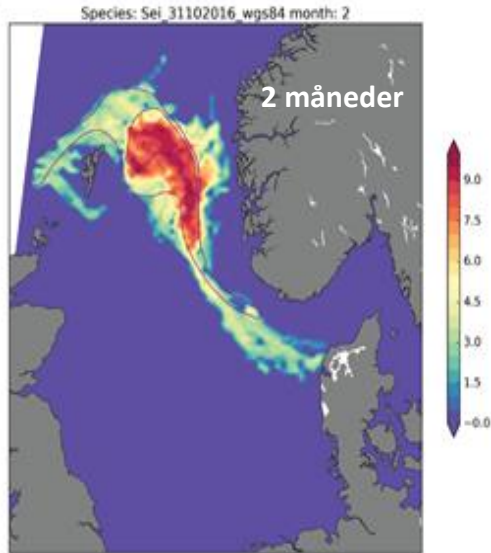


d)

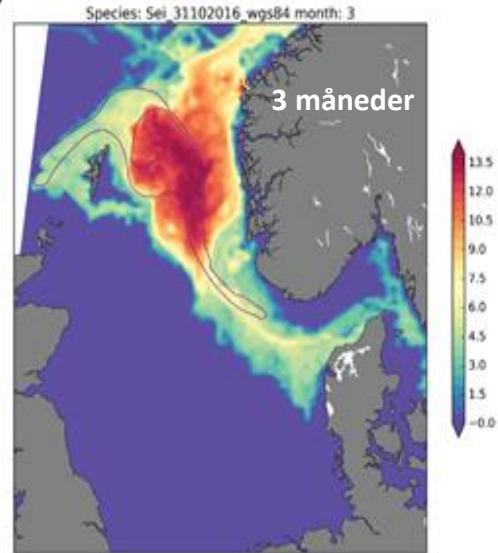


Spredning av avkom fra SEI fra hovedgytefeltene

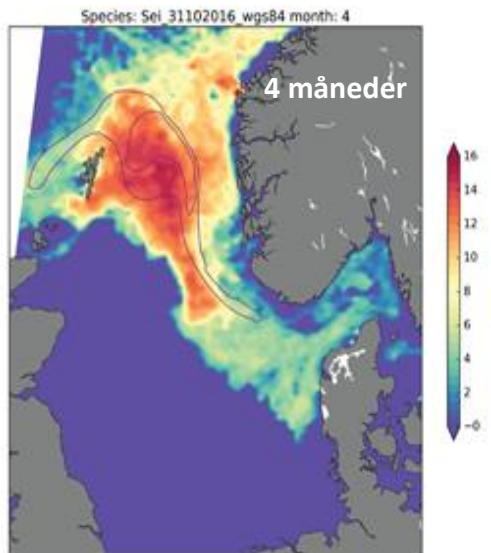
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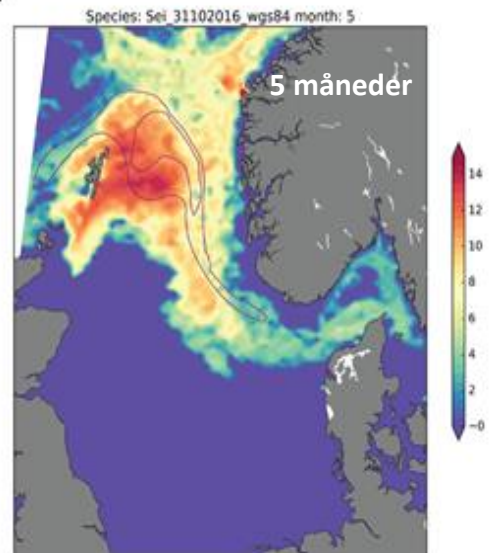
b)



c)

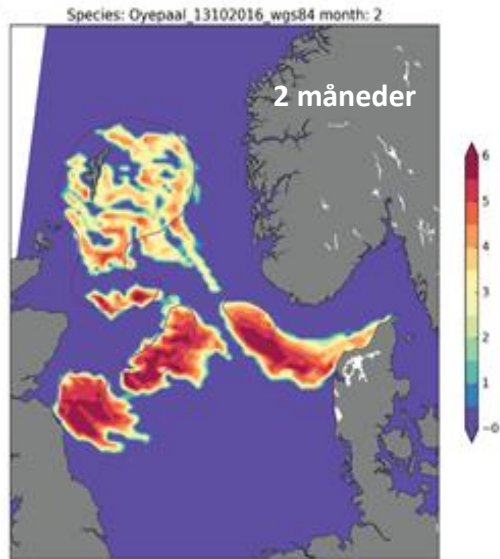


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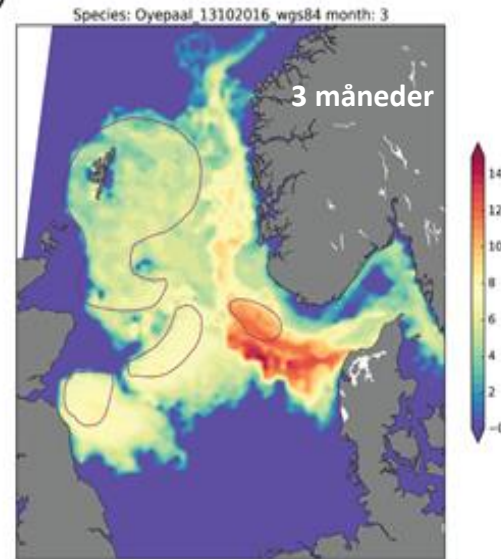


Spredning av avkom fra ØYEPÅL fra hovedgrytefeltene

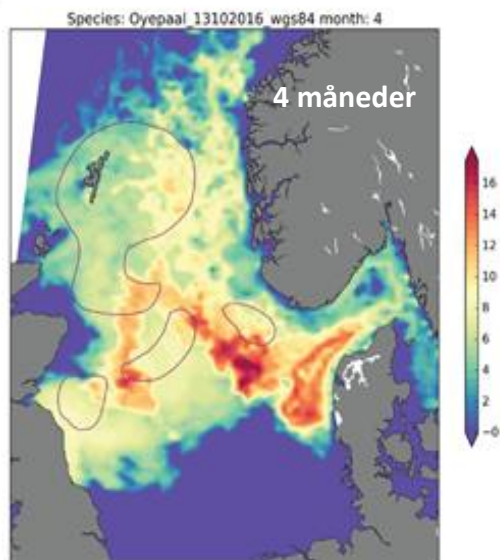
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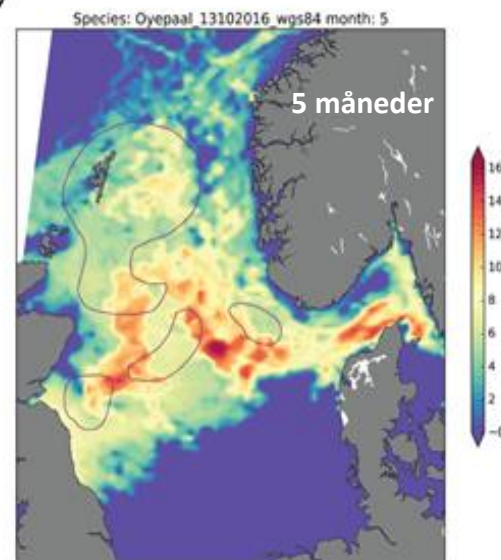
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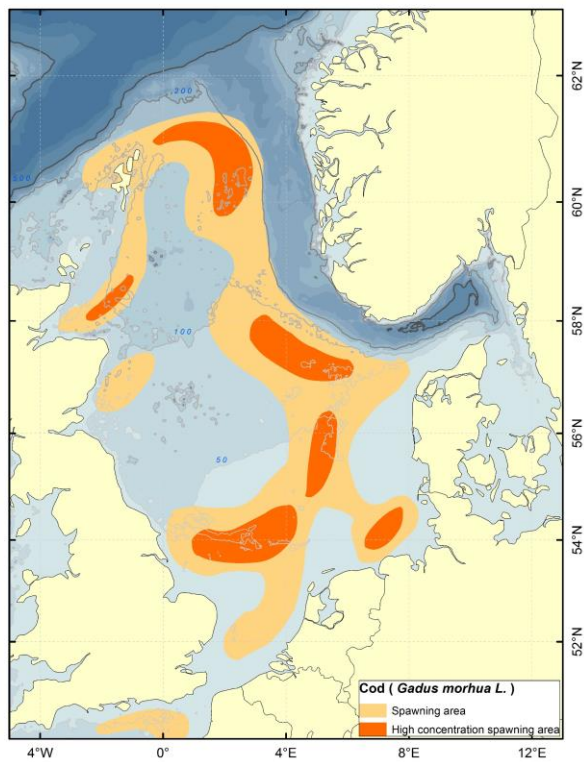
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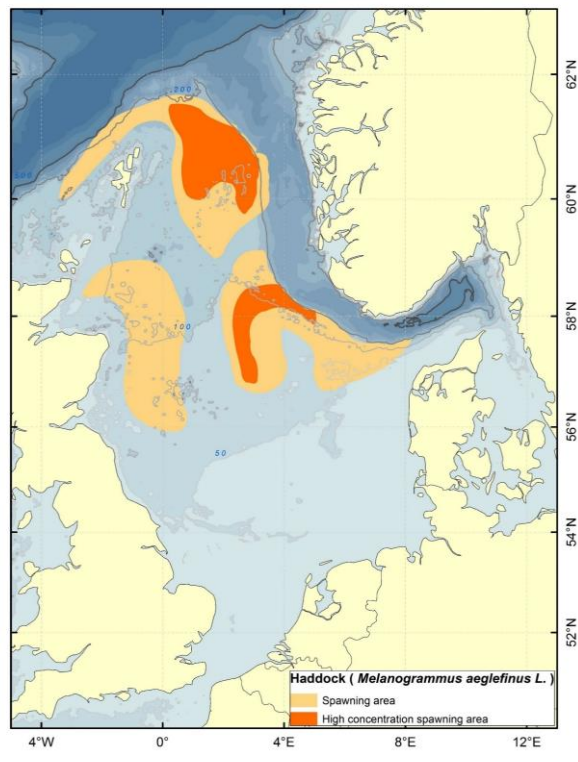
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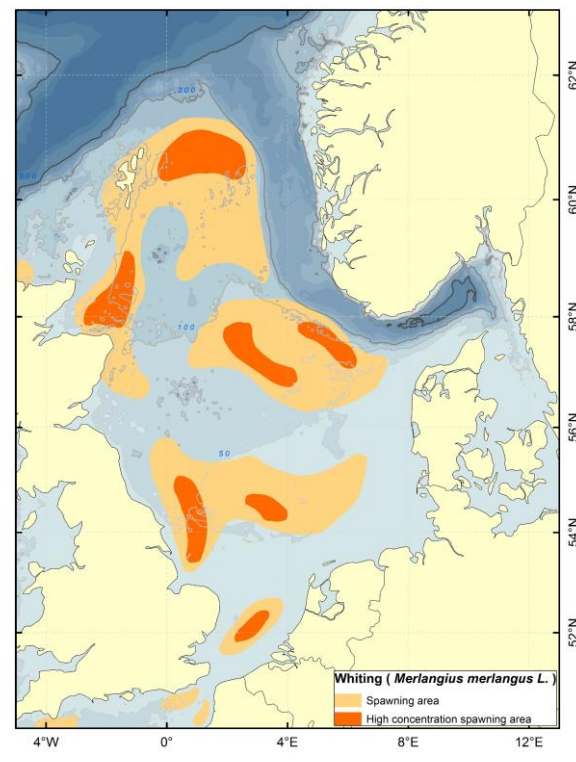
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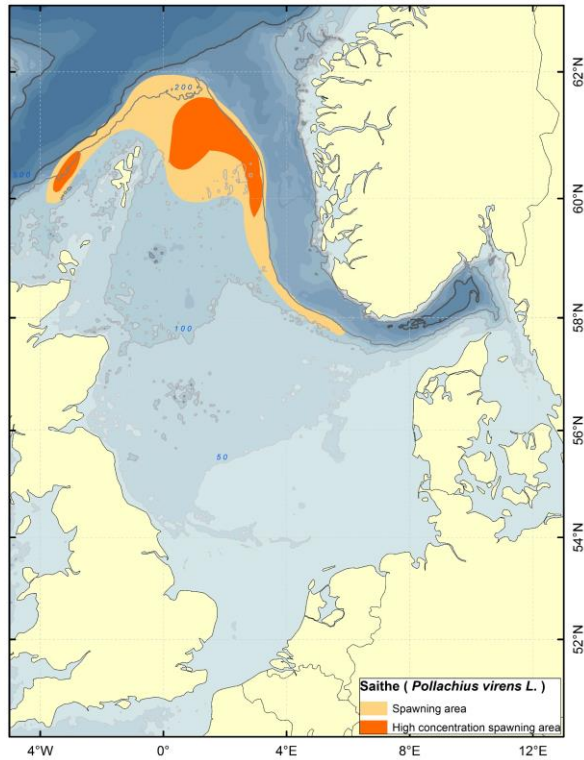
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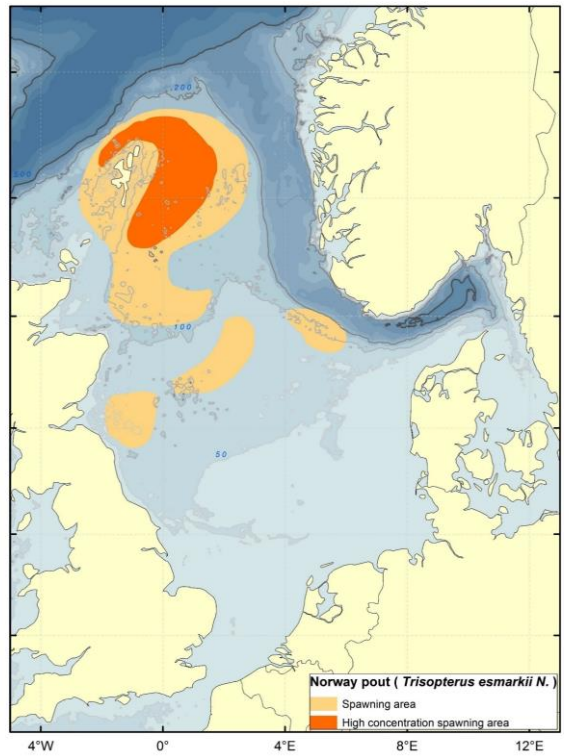
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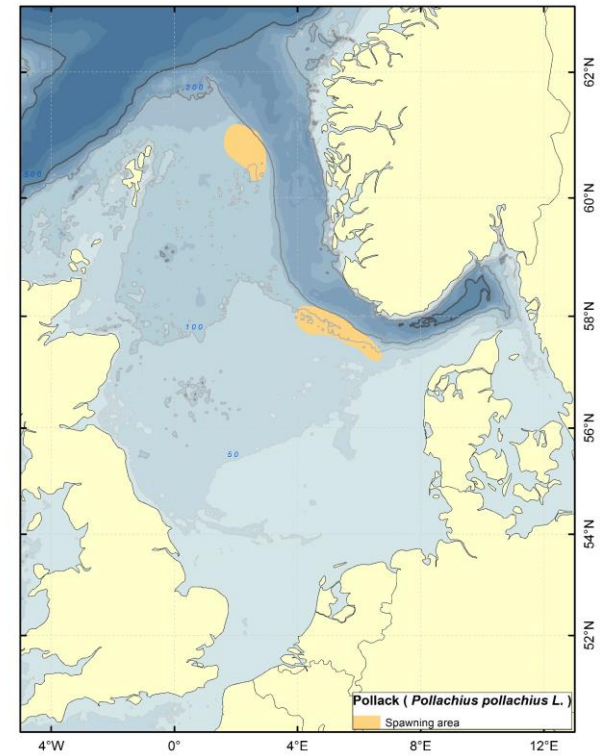
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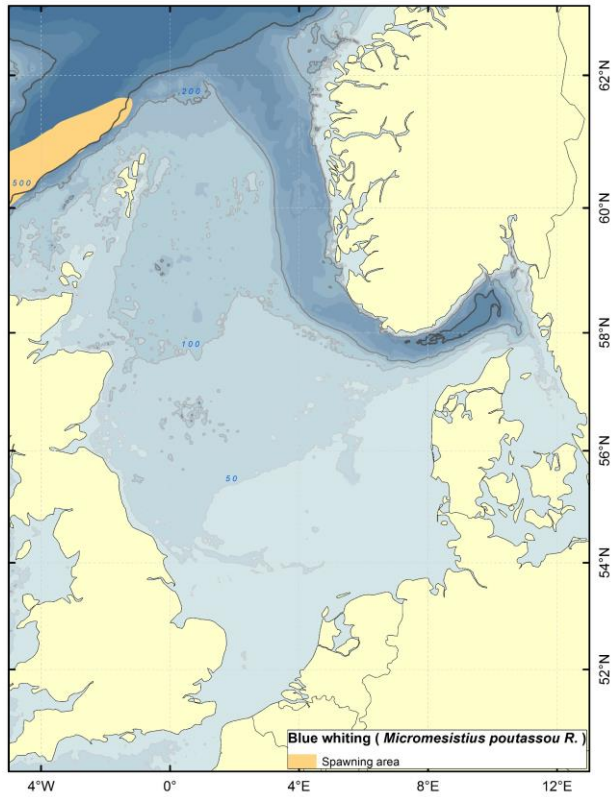
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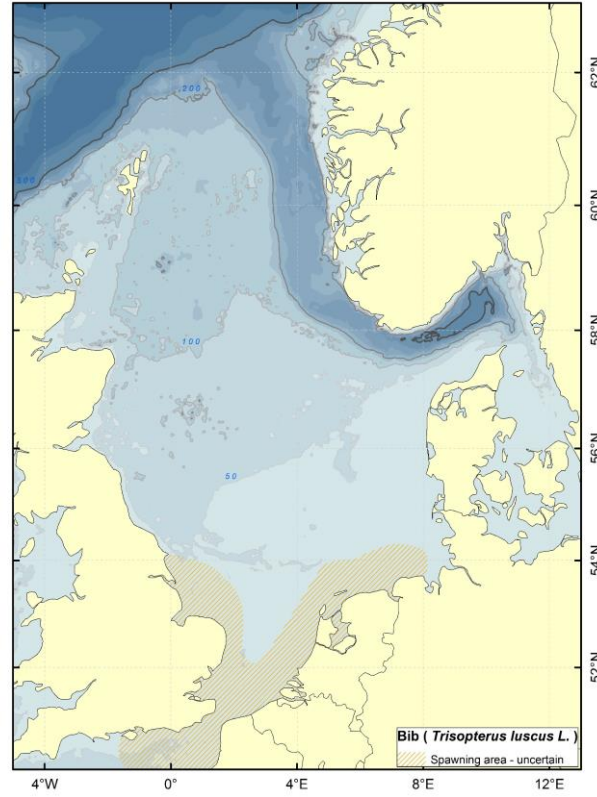
LYR



KOLMULE

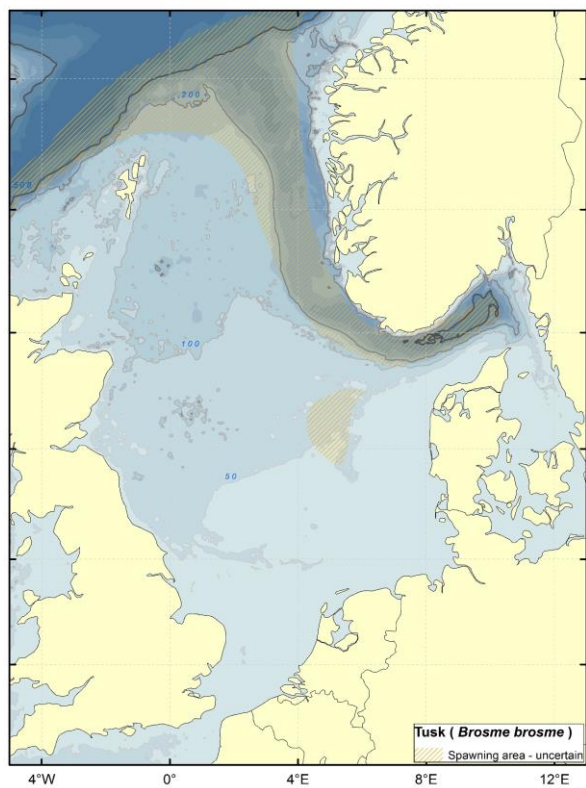


SKJEGGTORSK

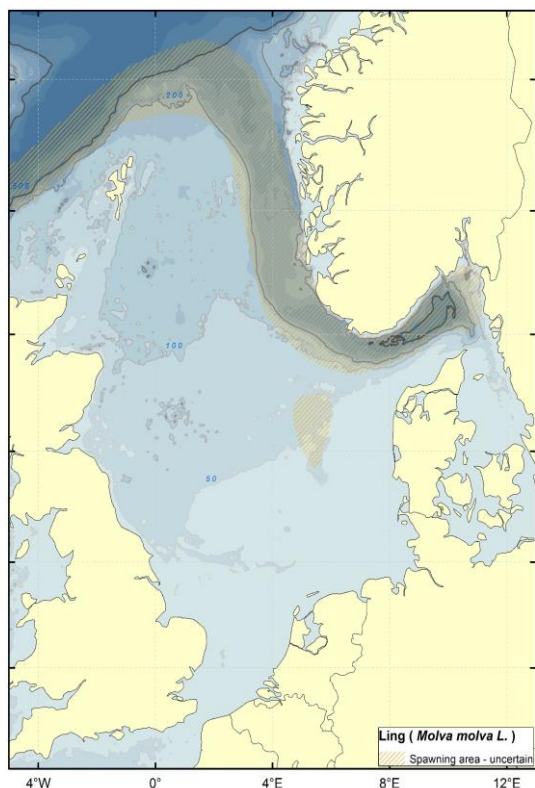


Gadoide dypvannsararter

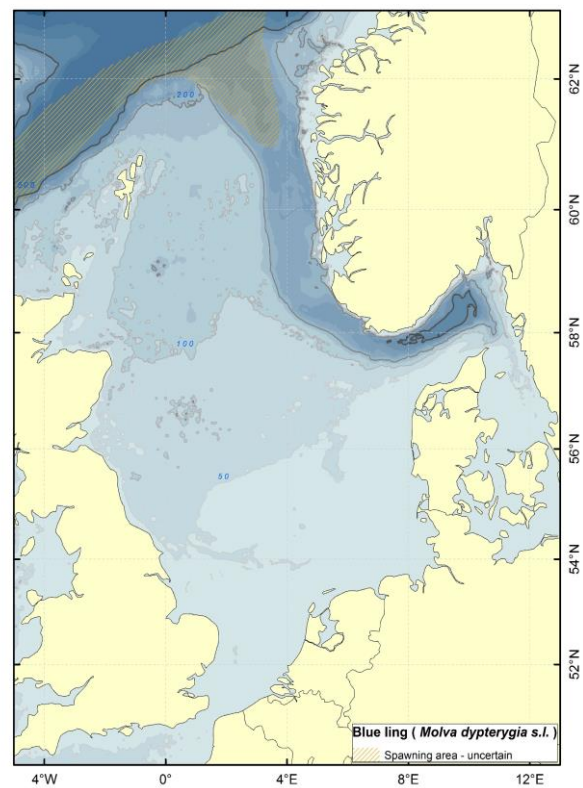
BROSME



LANGE

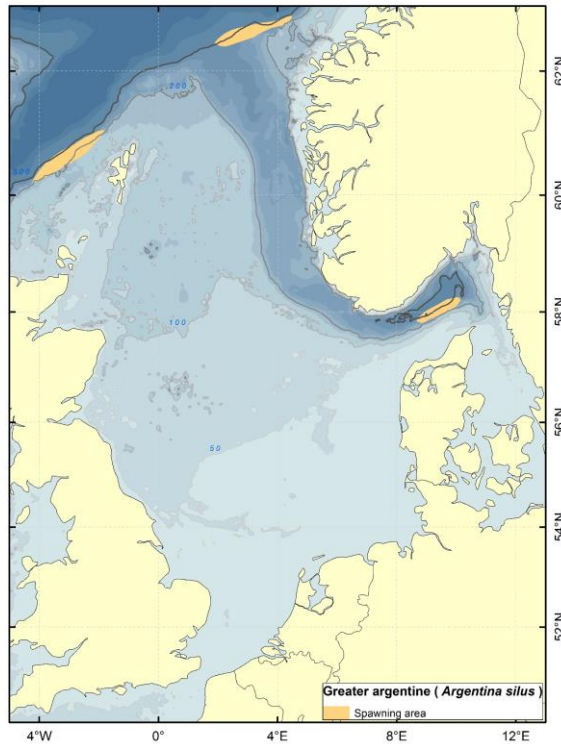


BLÅLANGE

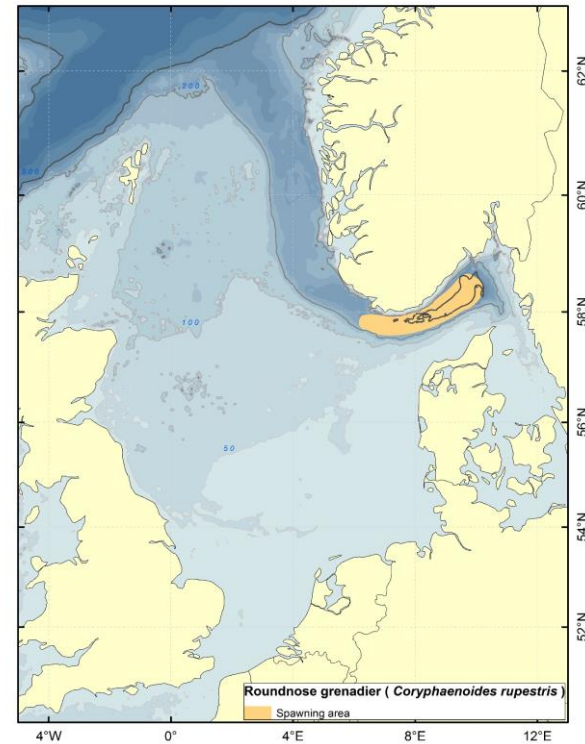


Andre dypvannsararter

VASSILD

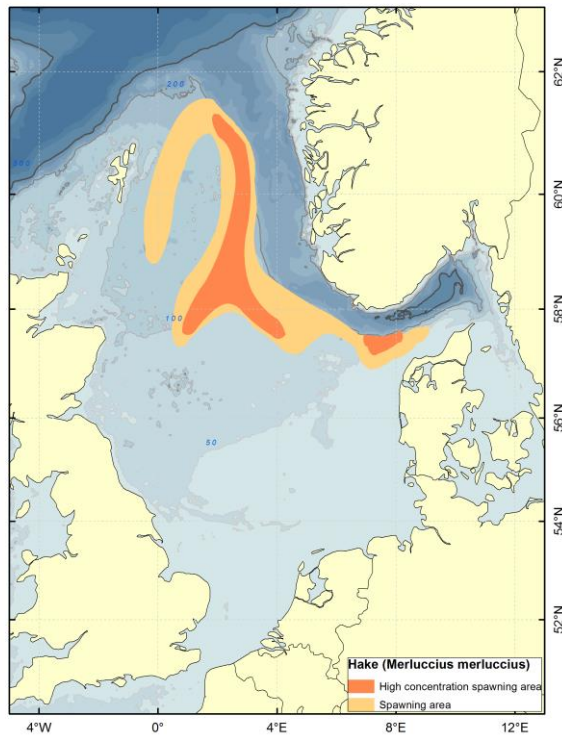


SKOLEST

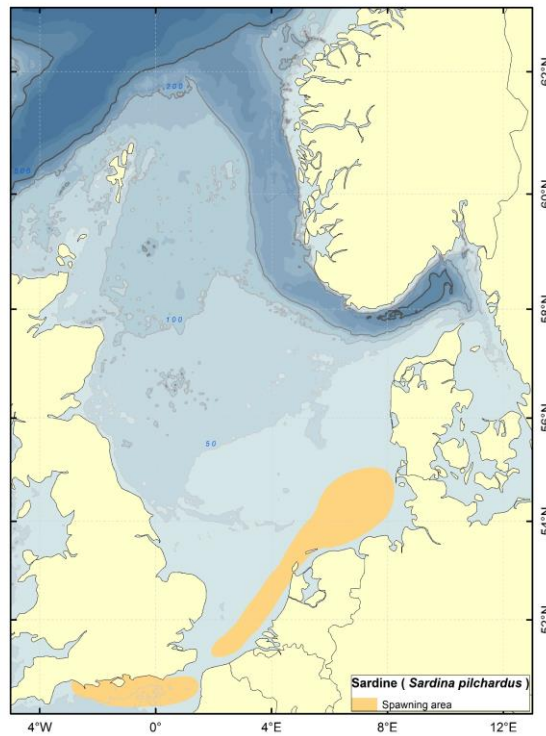


Invaderende arter – virkninger av klimaendringer

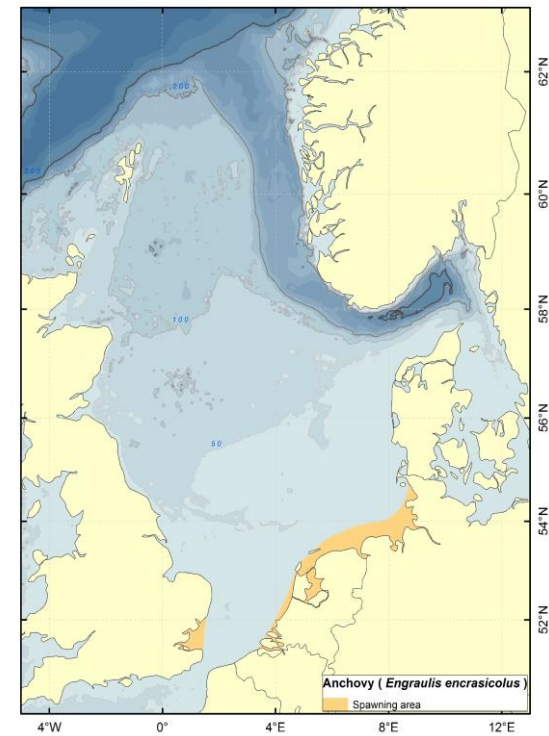
LYSING



SARDIN

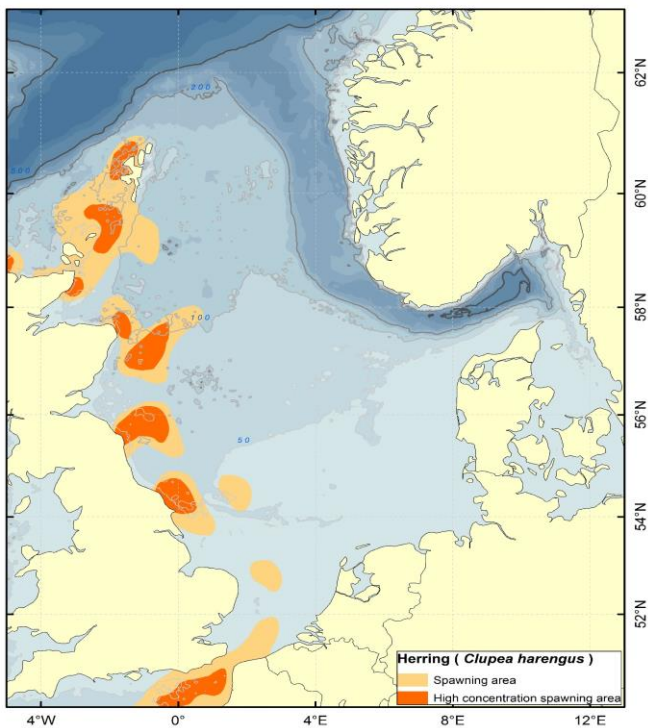


ANSJOS

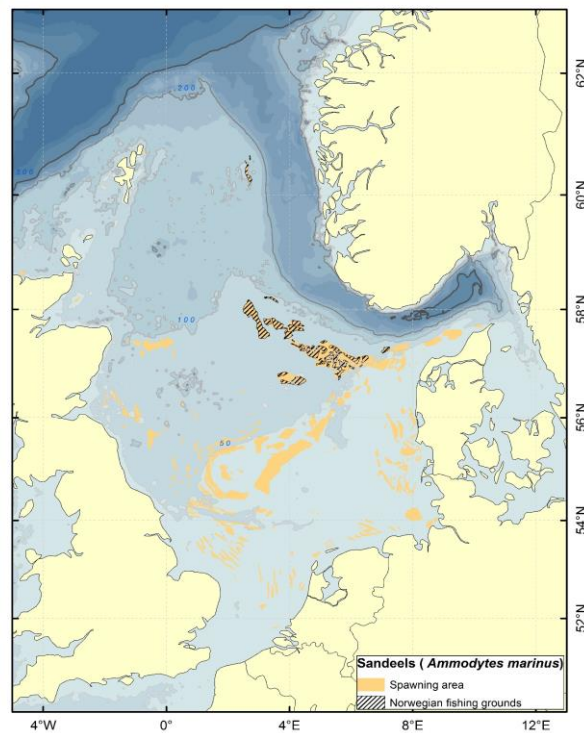


Bunngytende arter

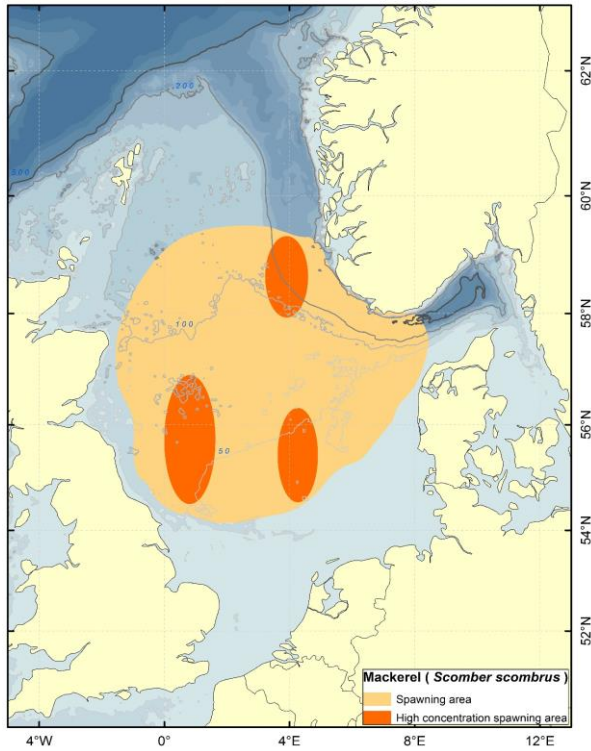
SILD



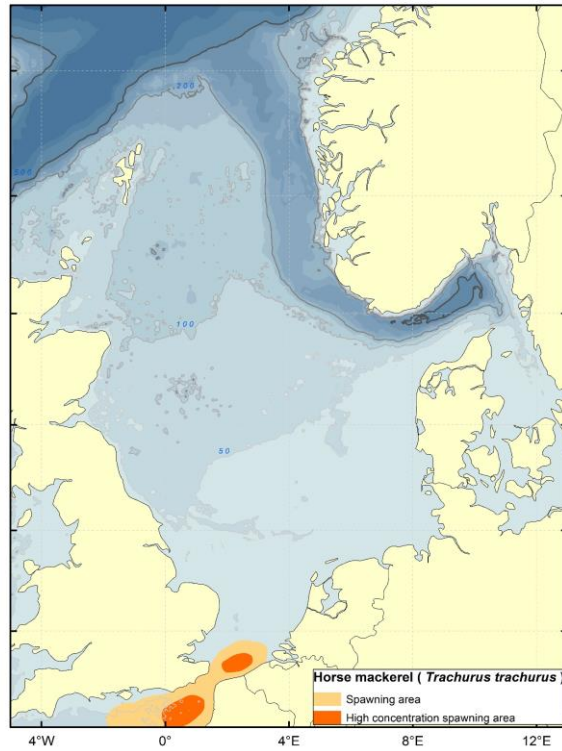
TOBIS



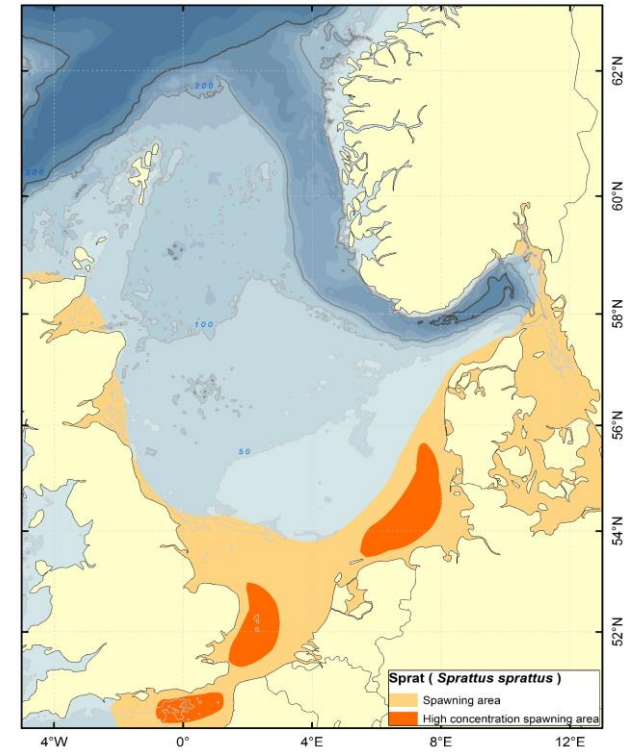
MAKRELL



HESTMAKRELL

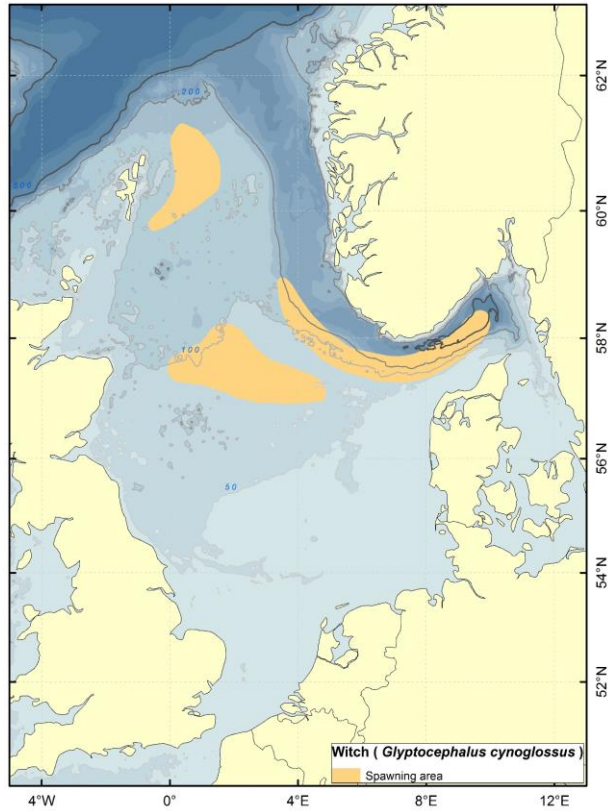


BRISLING

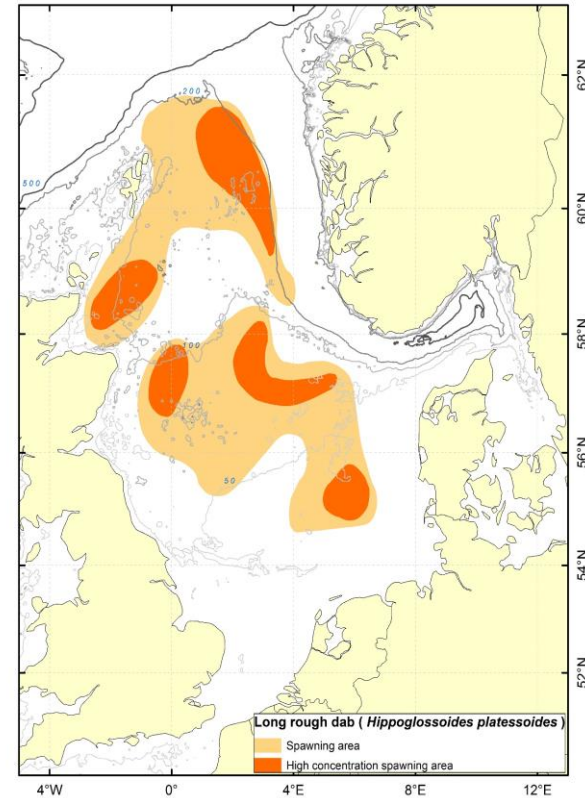


Nordlige flatfiskarter

SMØRFLYNDRE

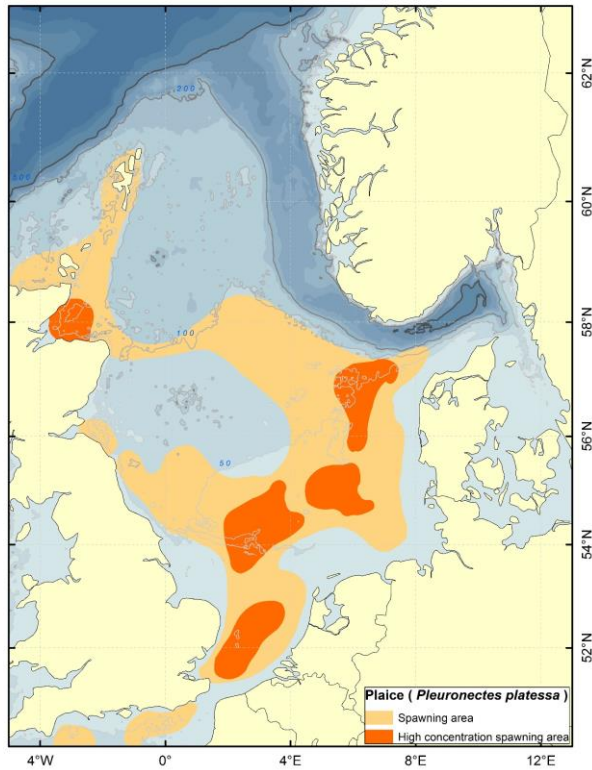


GAPEFLYNDRE

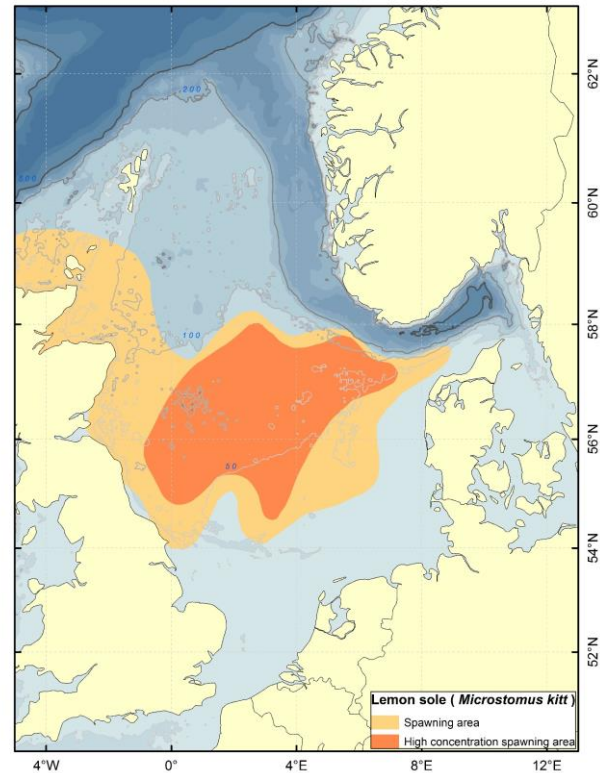


Sentrale flatfiskarter

RØDSPETTE

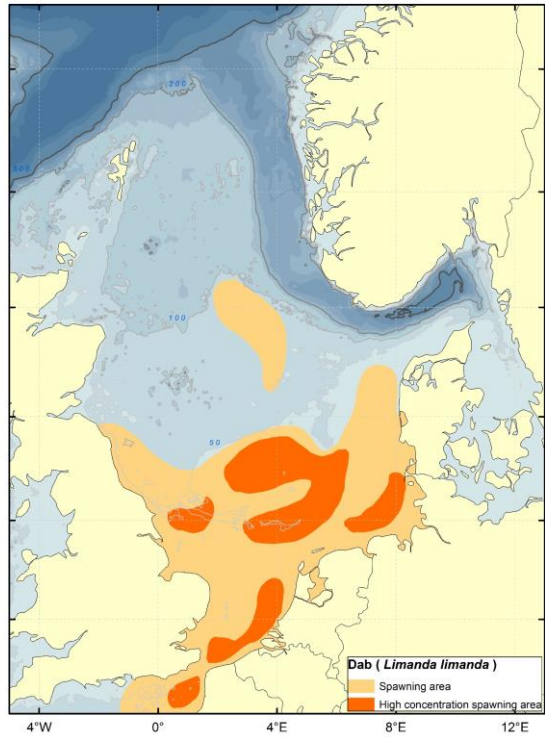


LOMRE

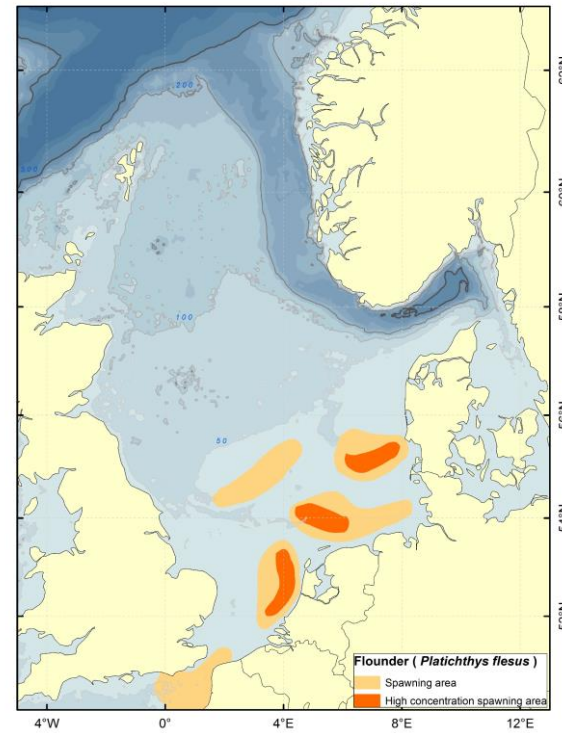


Sørlige flatfiskarter

SANDFLYNDRE

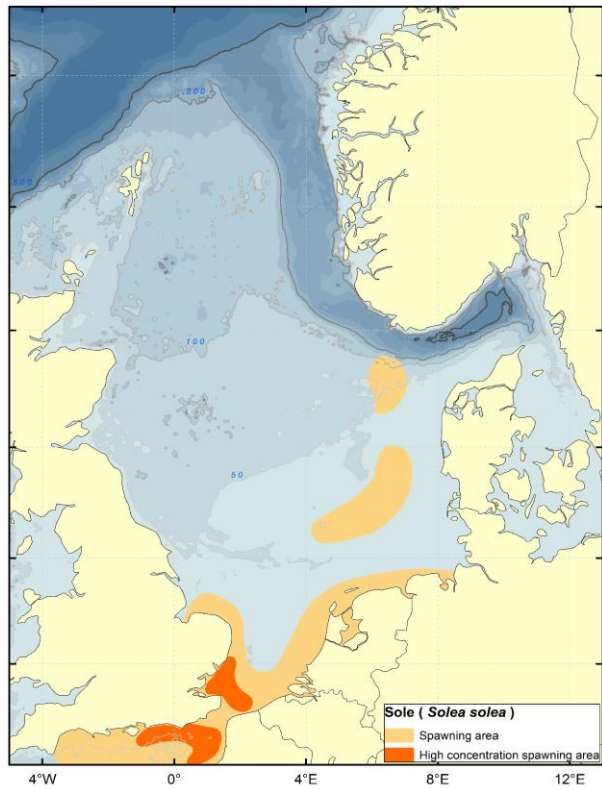


SKRUBBE

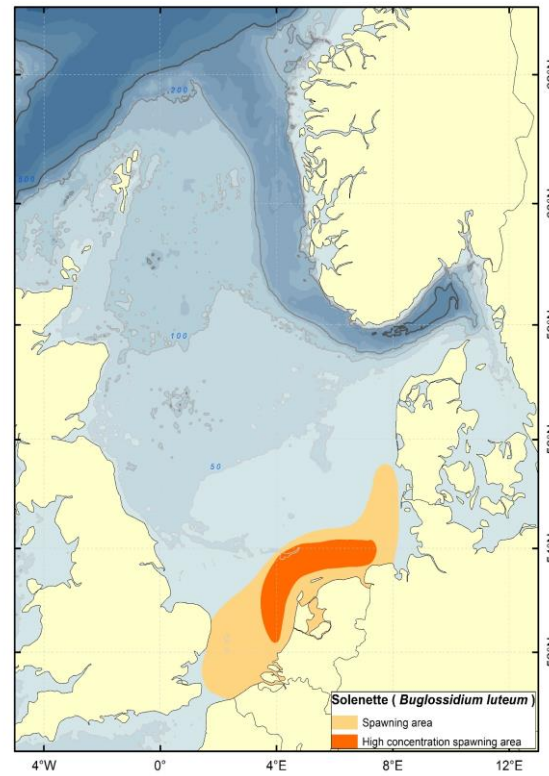


Sørlige flatfiskarter

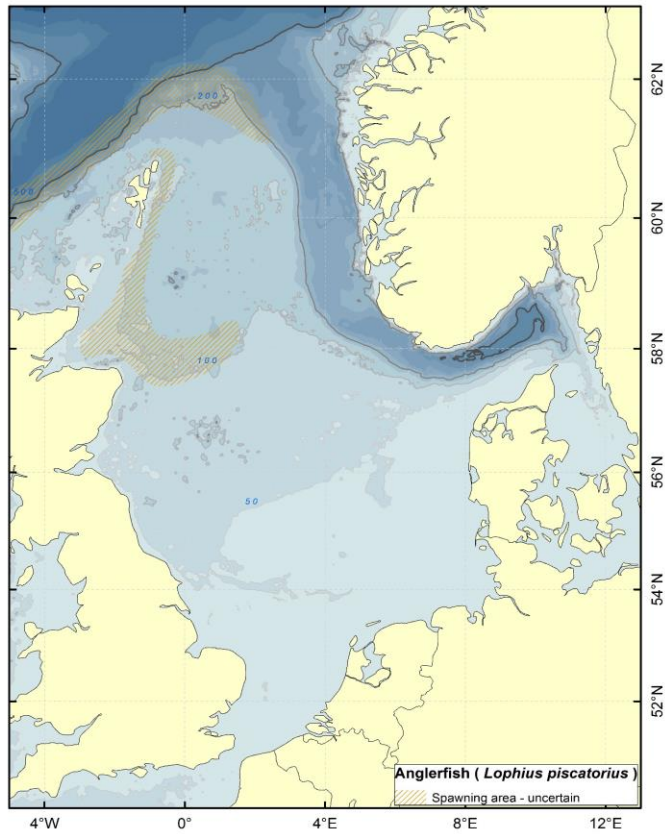
TUNGE



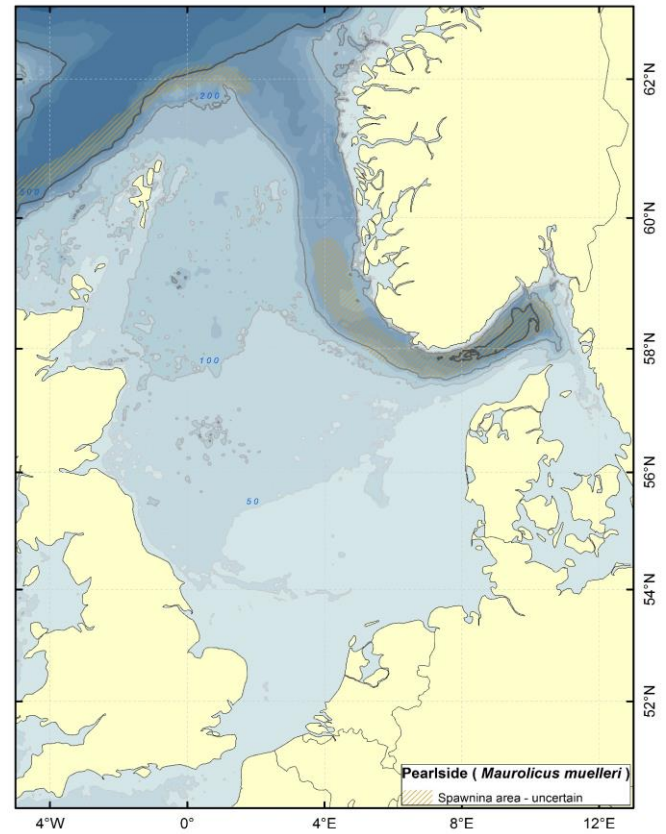
GLASSTUNGE



BREIFLABB



LAKSESILD



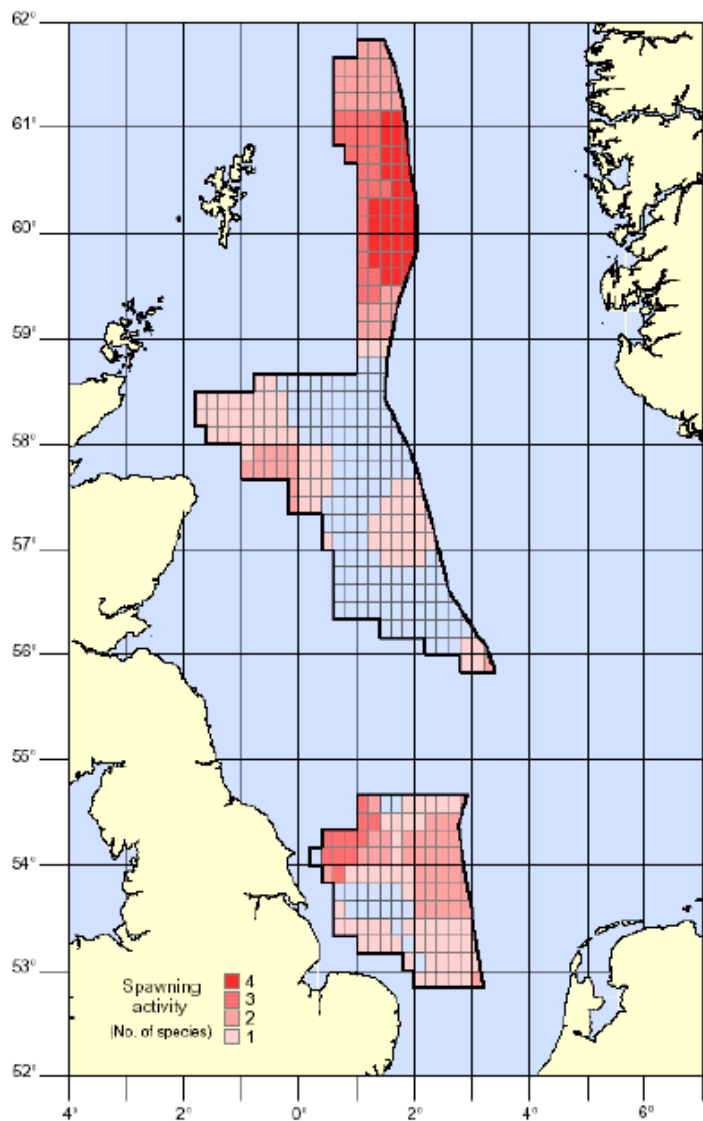


Figure 3.3.3 Different spawning intensities of fin fish (cod, haddock, whiting, saithe, Norway pout, plaice, sole, and mackerel) by licence block, during February to June.

Rogers and Stocks (2001):

Samlet gyteintensitet fra:
Torsk, hyse, hvitting, sei, øyepål,
rødspette, tunge og makrell i
perioden februar-juni.

Fordelt i britiske lisensblokker