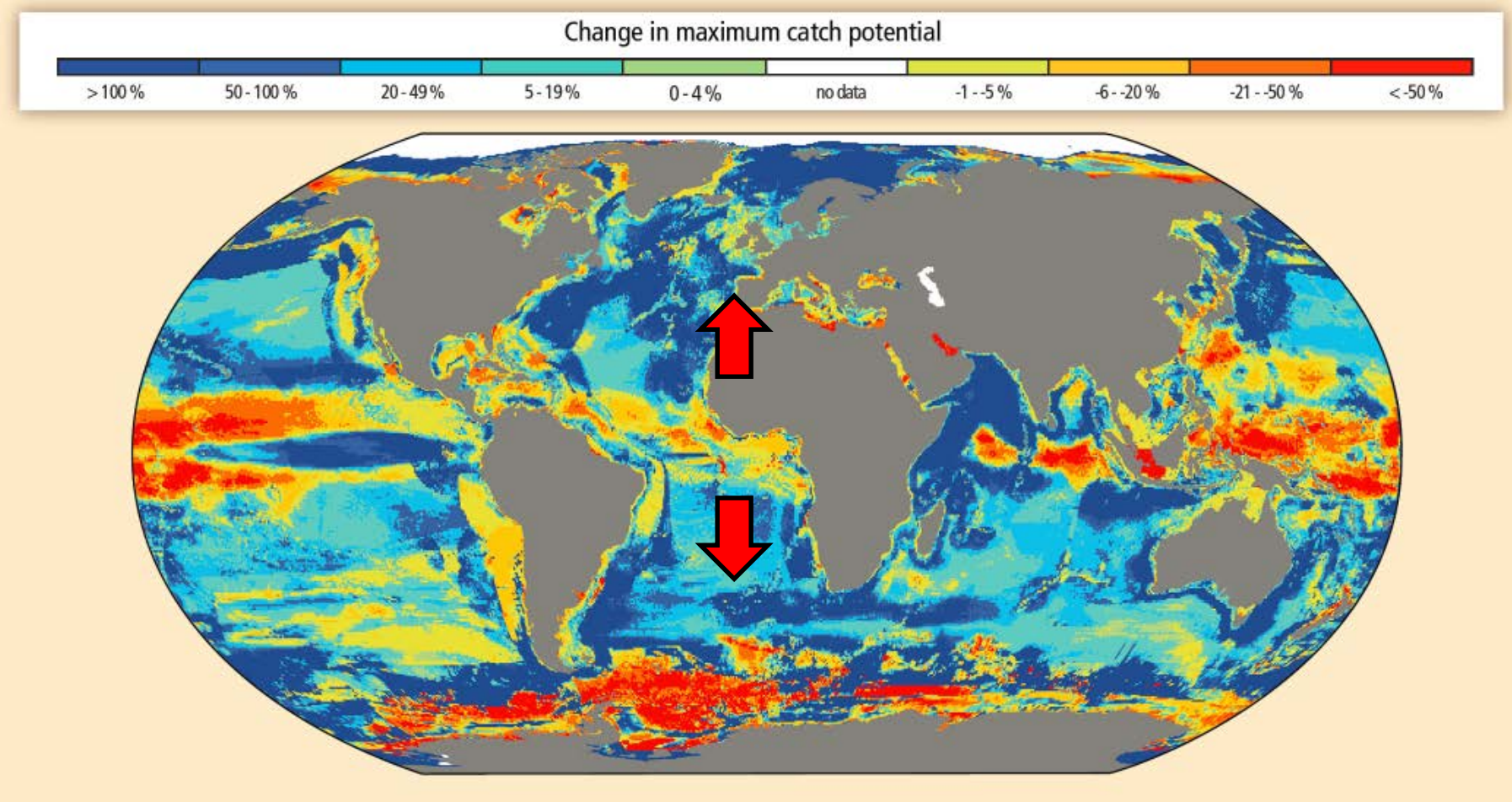
Klimaendringer: forflytning av stedegne arter og invasjon av nye arter i norske fiskeriområder

Svein Sundby

Klimamarin, Trondheim, 7. desember 2017

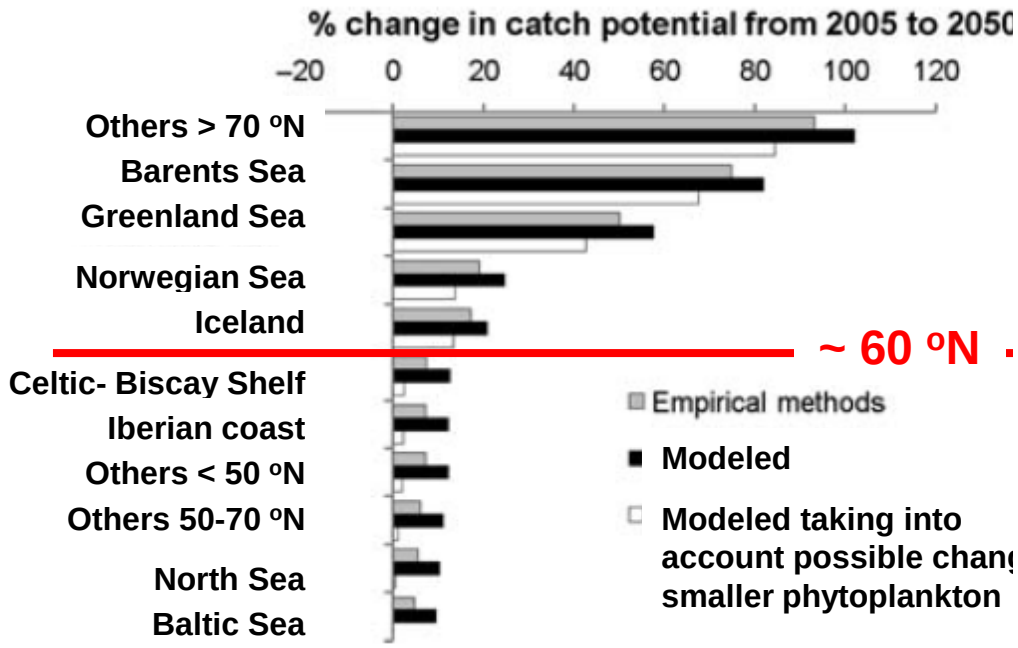
Globale klimaendringer gir omfordeling av artene i verdenshavene

Reduksjon i arter på lave bredder



IPCC (2014) AR5 WG2 Fig. 6.14

Eksempel på bioklimatisk modell i Nordøst-Atlanteren

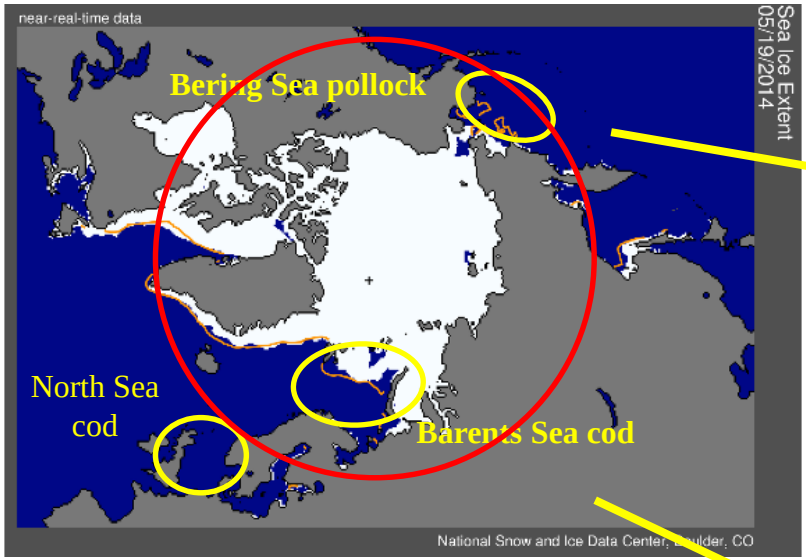


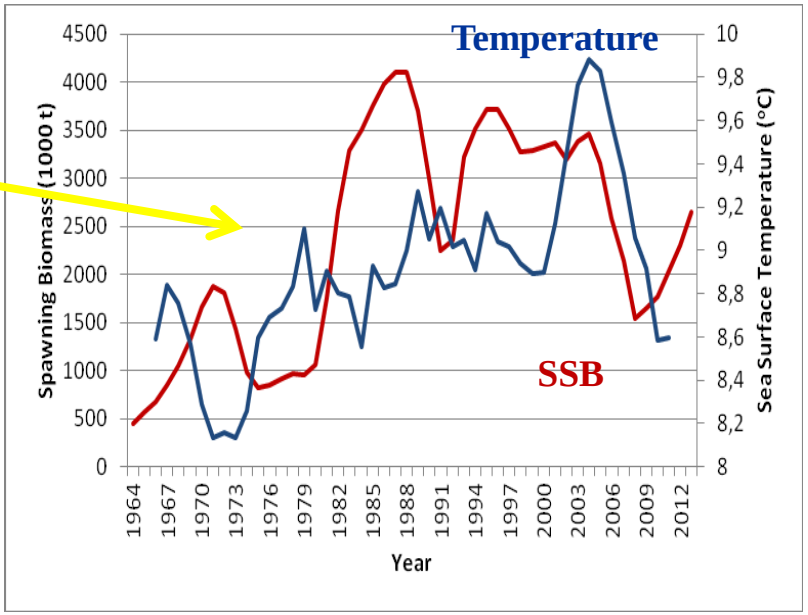
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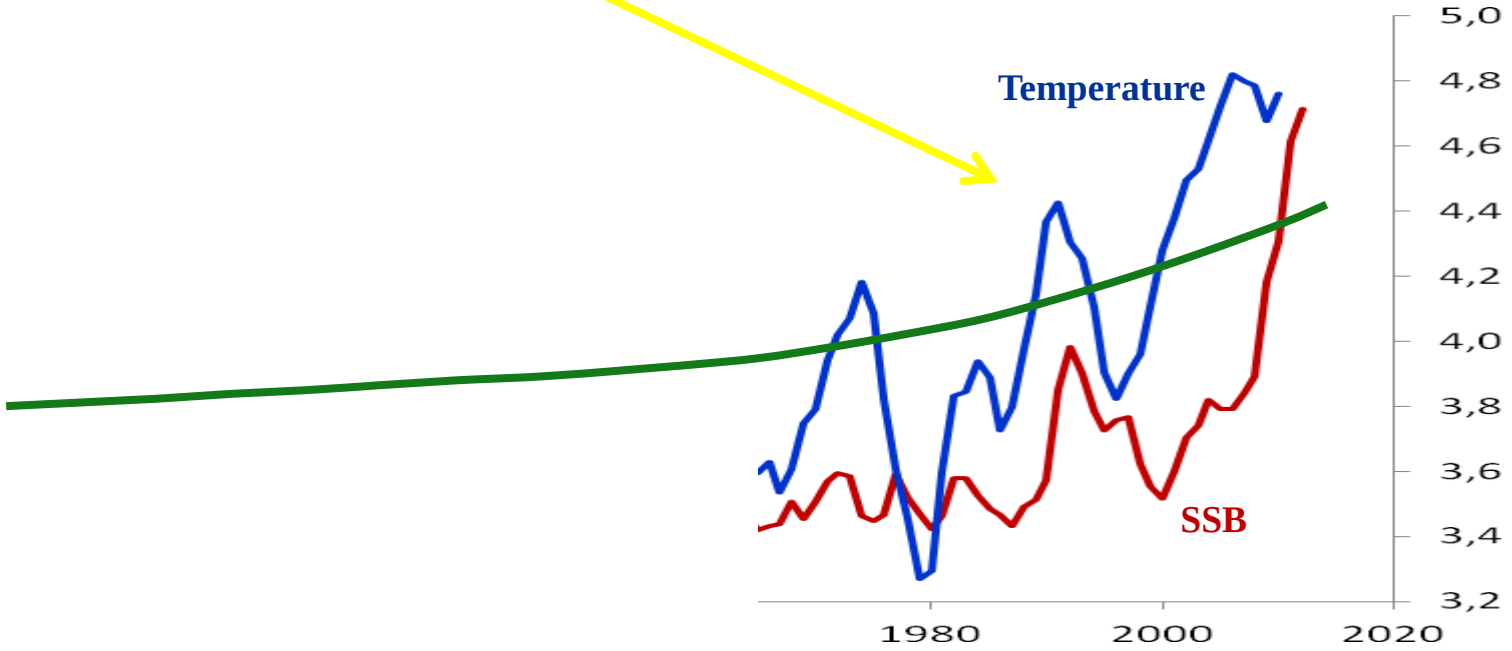
Cheung *et al*. (2011) ICES Journal of Marine Science

Forflytning mot nord er ikke luftig framtidsmusikk-

det har allerede skjedd, og det fortsetter…

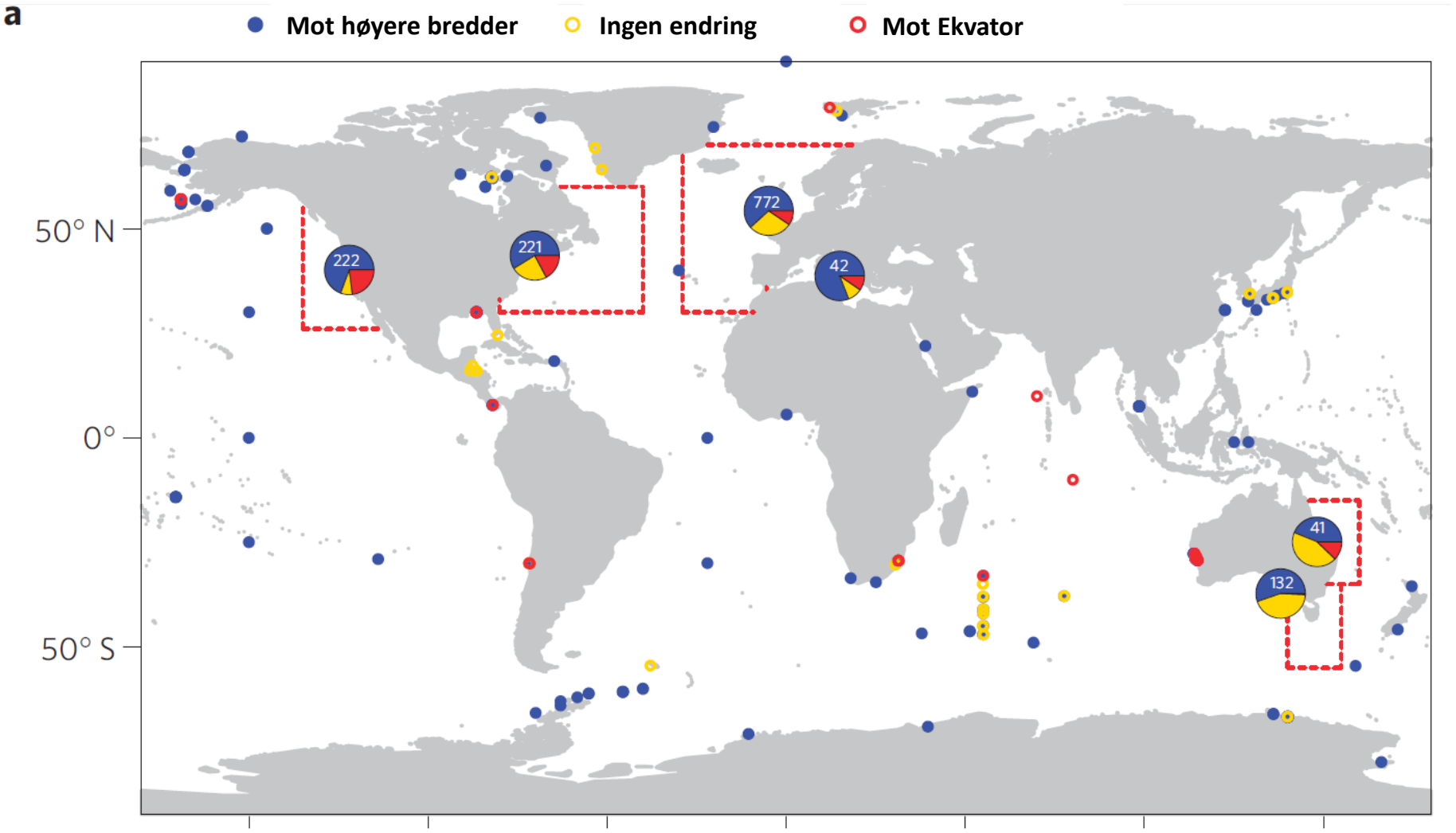






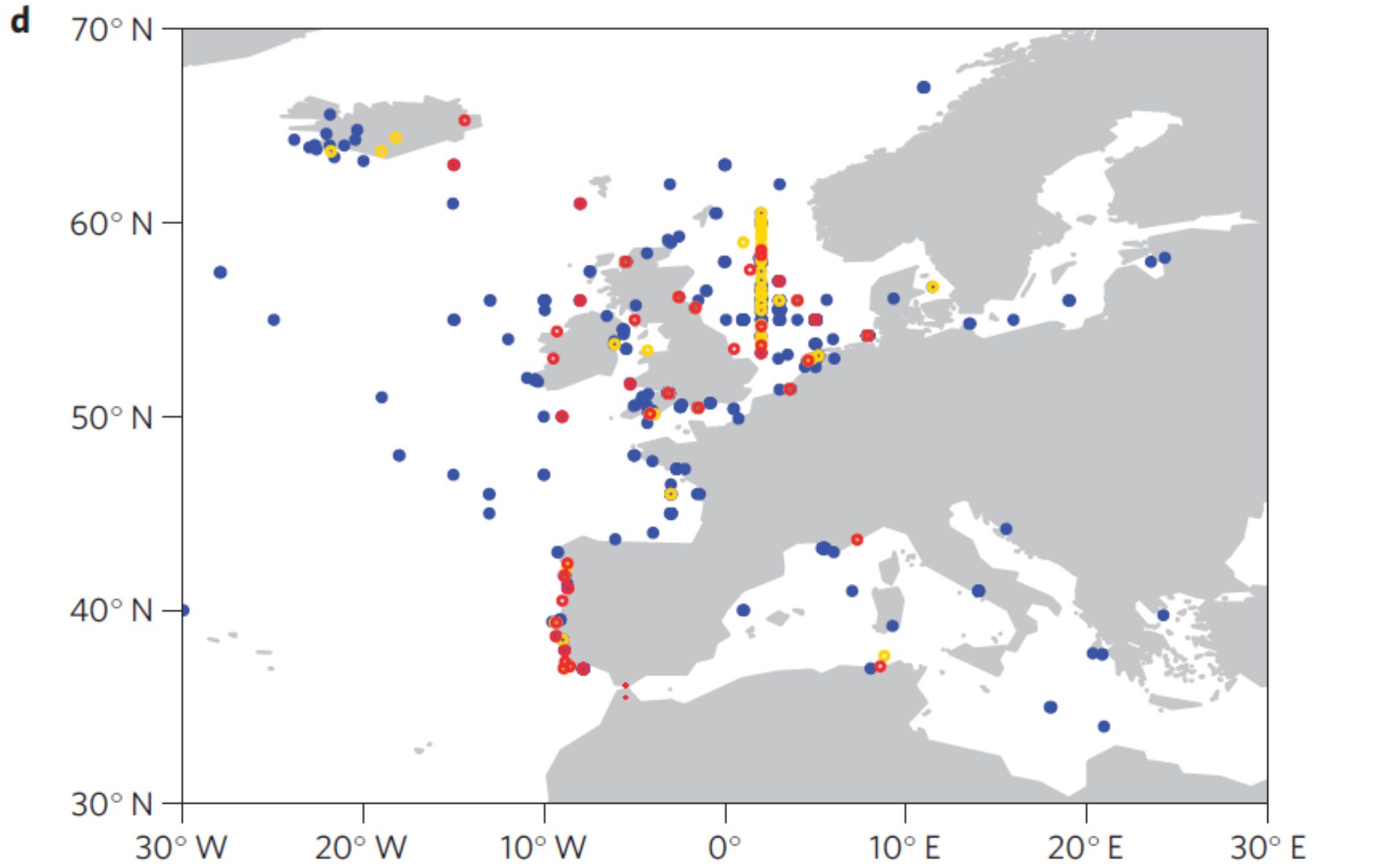
Hollowed and Sundby (2014)

Undersøkt vandringsretningen på over 1100 marine arter



Poloczanska et al. (2013)

I Nordsjøen har forflytningen gått i alle retninger

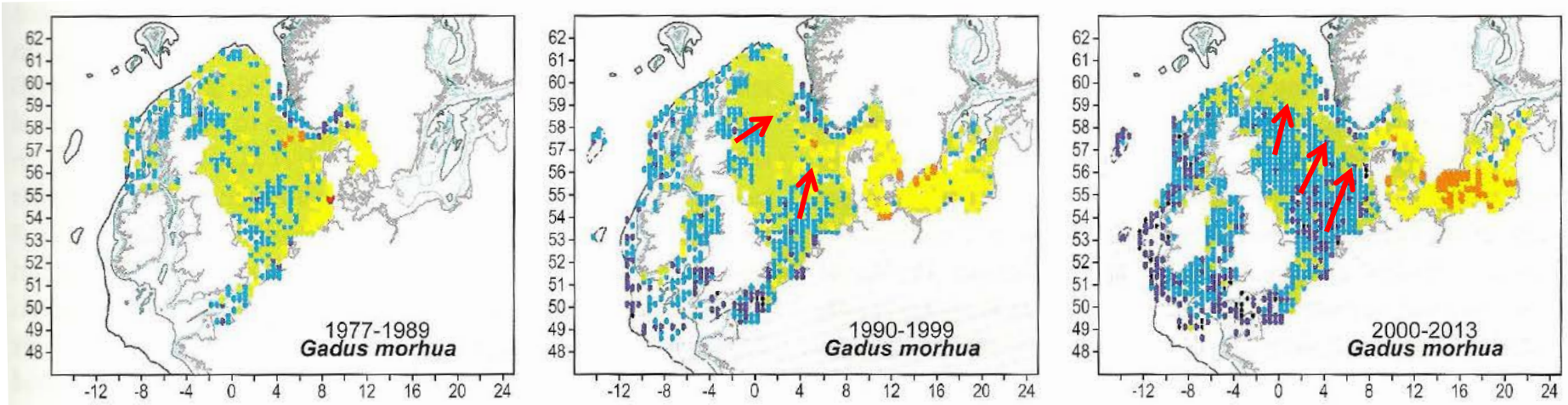


Poloczanska et al. (2013)

Eksempel på endemisk (stedegen) art

Forekomsten av torsk er redusert fra 1970-tallet

Fordelingen er «kollapset» mot nordøst, nær innstrømningen av Atlantisk vann



Catch rates of cod by period.

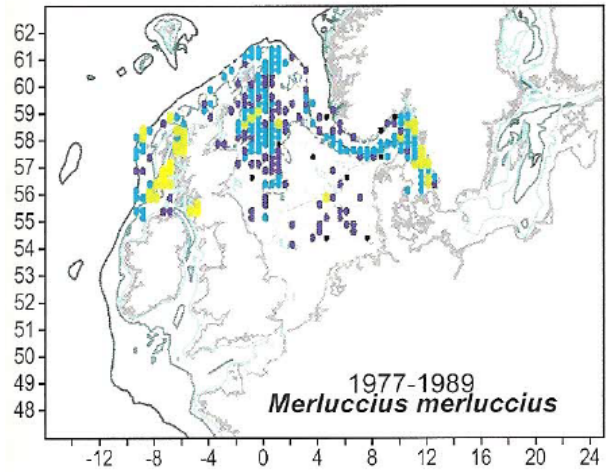
Sundby et al. (2017) KINO-rapporten

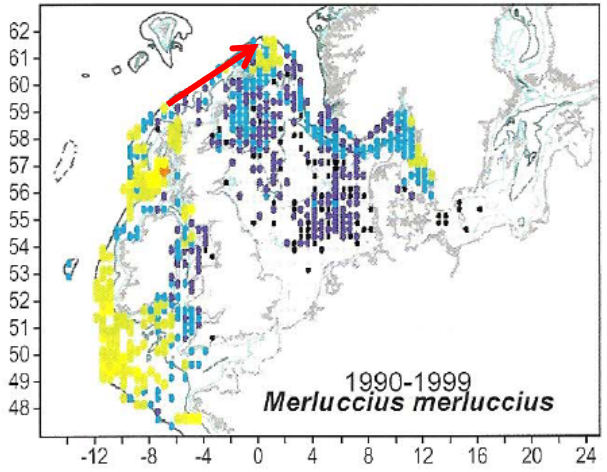
Maps from Heessen, Daan and Ellis (eds.) (2015)

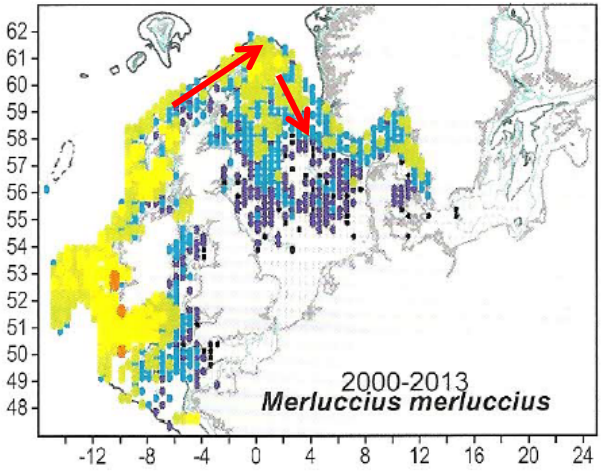
Eksempel på invaderende art

Lysing har økt i Nordsjøen

Invasjon fra vest om De britiske øyer
til den nordøstlige delen av Nordsjøen langs den atlantiske innstrømningen





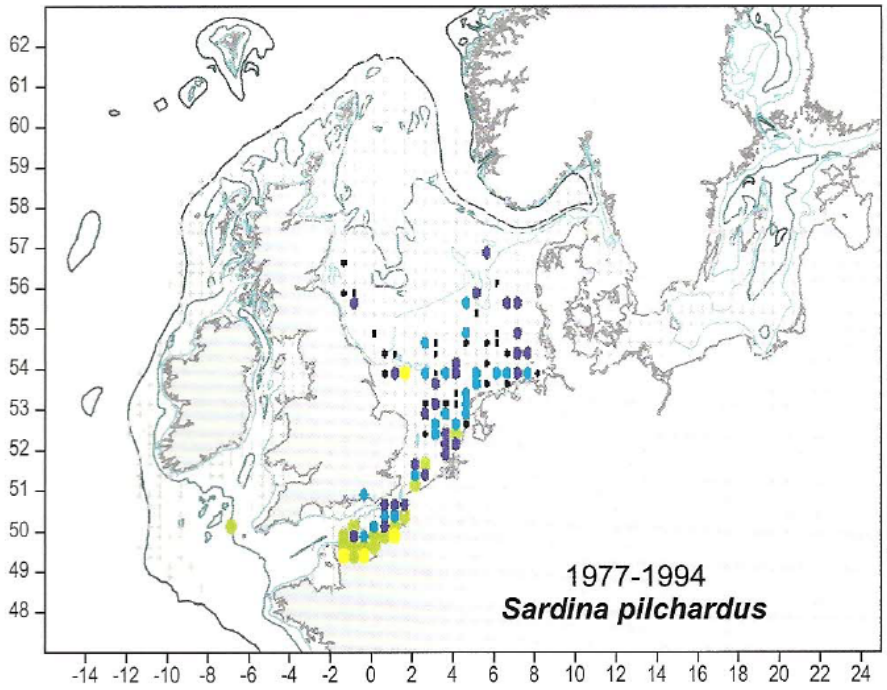


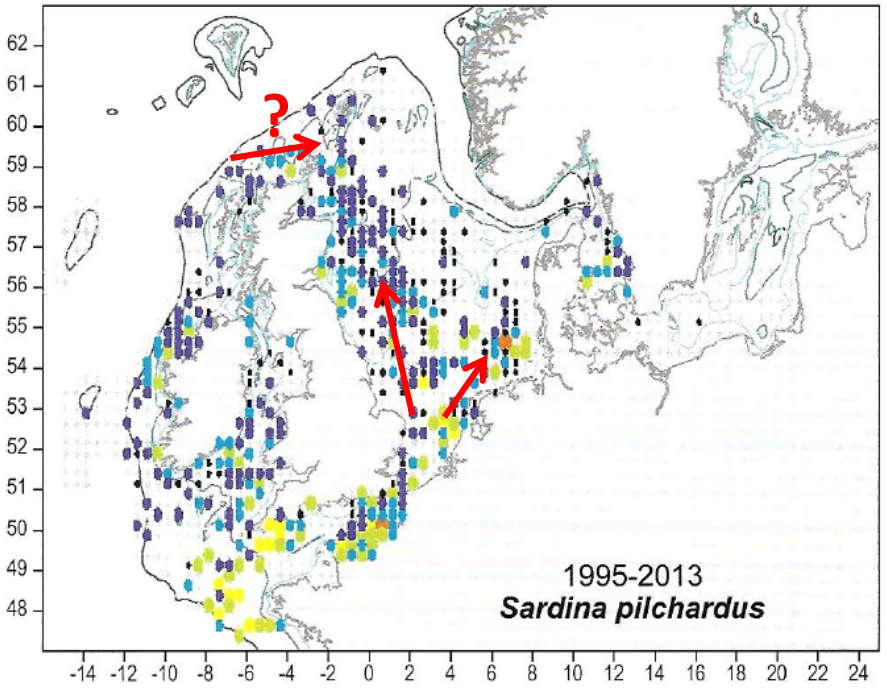
Sundby et al. (2017) KINO-rapporten

Maps from Heessen, Daan and Ellis (eds.) (2015)

Eksempel på invaderende art

Sardin har økt i Nordsjøen,
Invasjon gjennom Den engelske kanalen





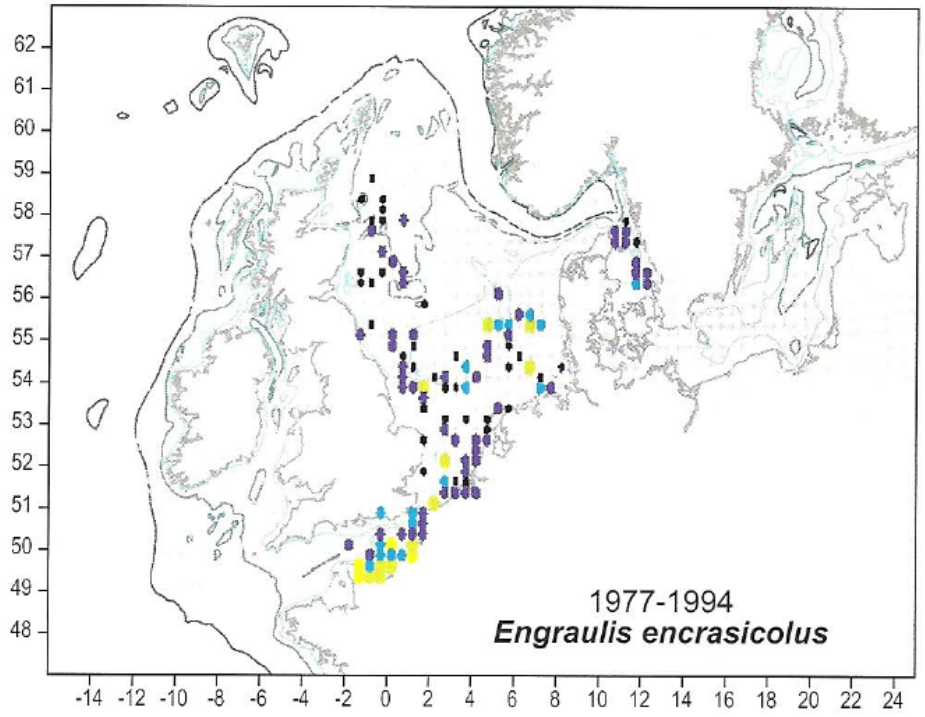
Catch rates of pilchard by period.

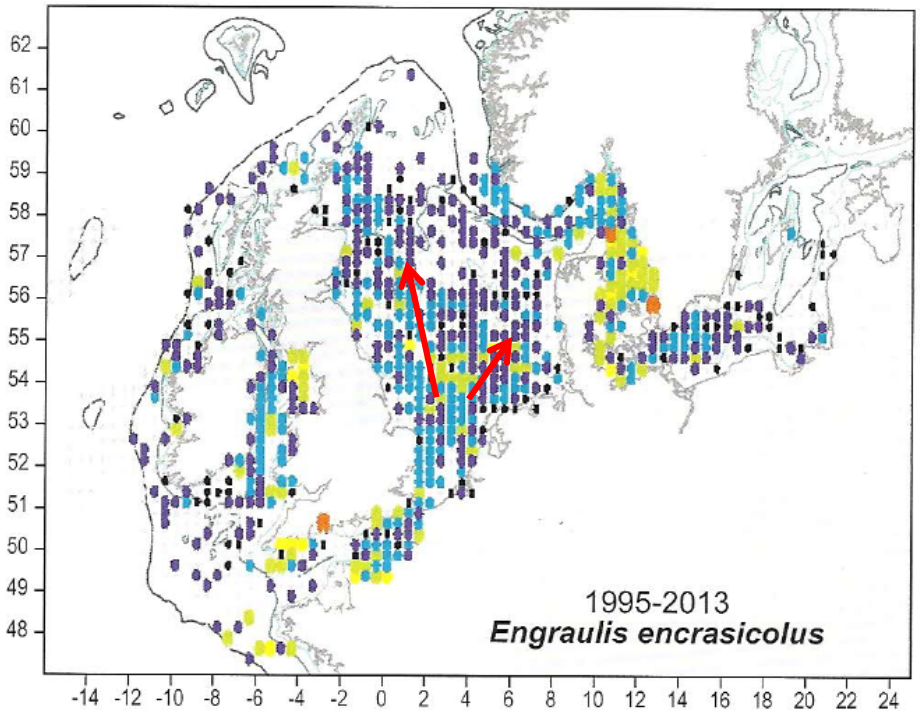
Sundby et al. (2017) KINO-rapporten

Maps from Heessen, Daan and Ellis (eds.) (2015)

Eksempel på invaderende art

Ansjos har økt i Nordsjøen,
Ekspansjon fra den sørlige Nordsjøen



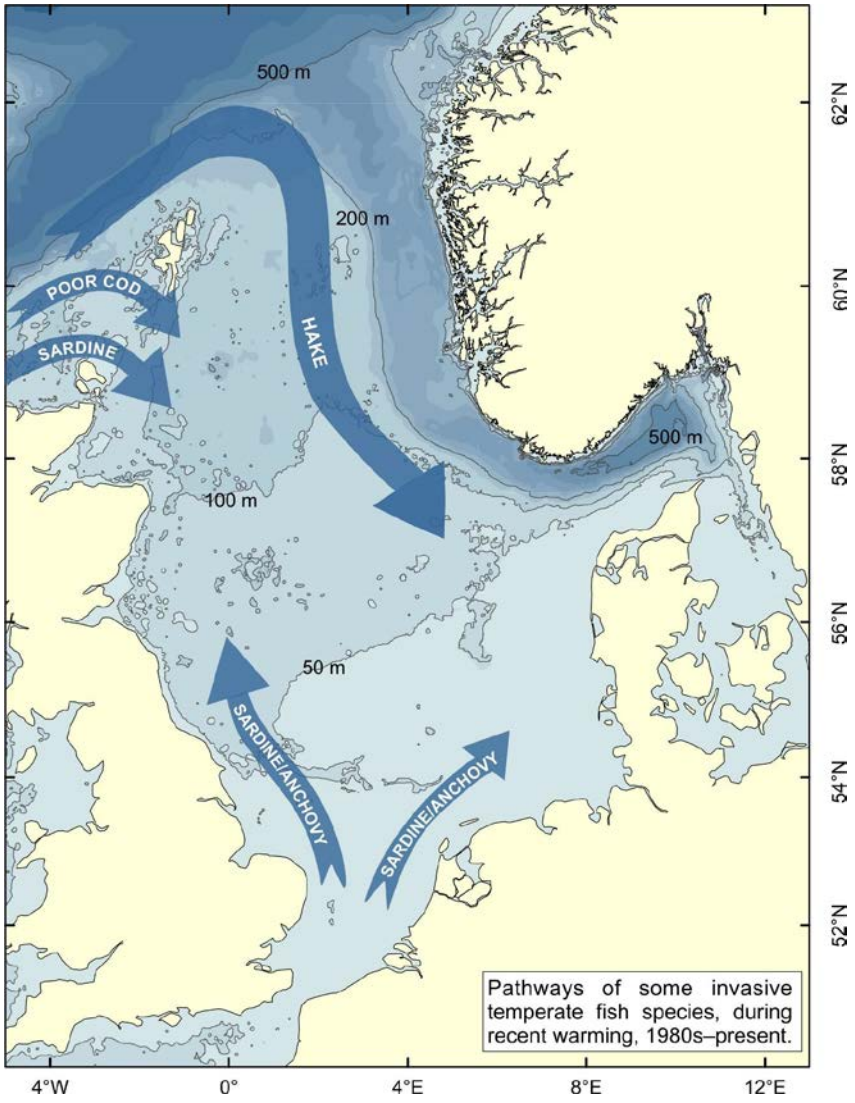


Catch rates of anchovy by period.

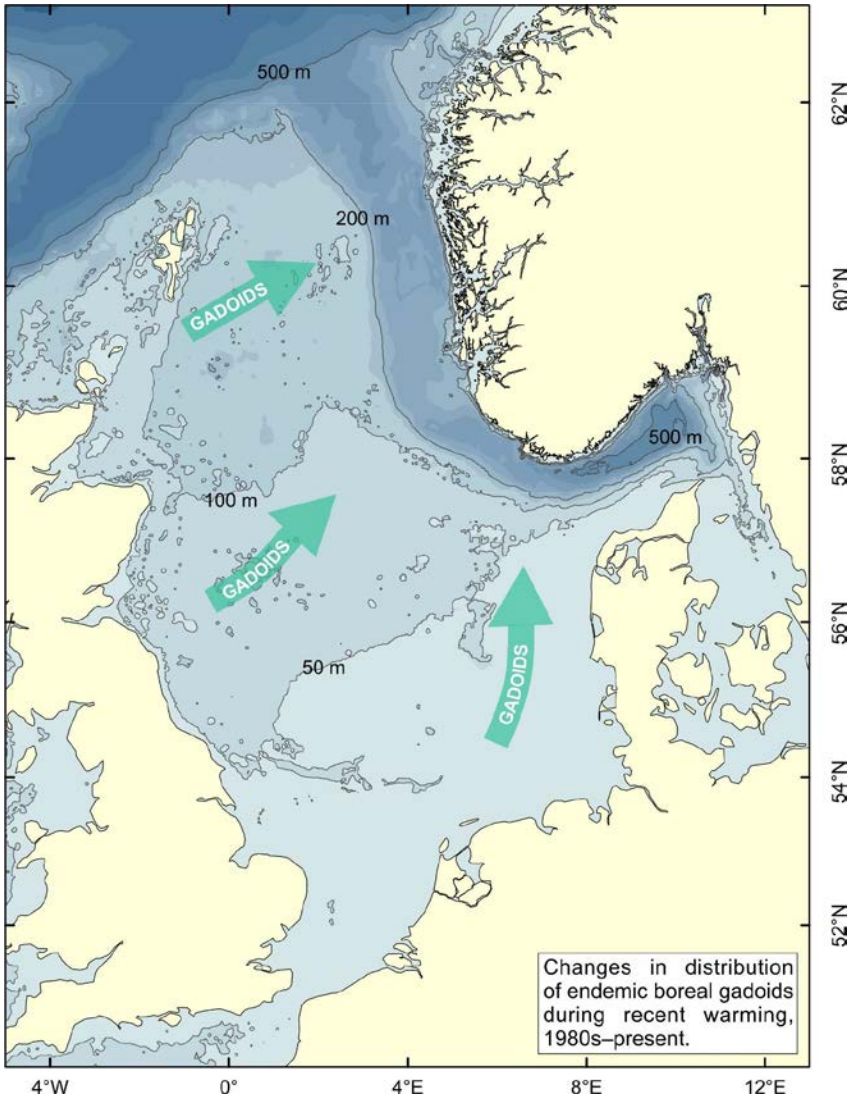
Sundby et al. (2017) KINO-rapporten

Maps from Heessen, Daan and Ellis (eds.) (2015)

Transportveier for invaderende arter

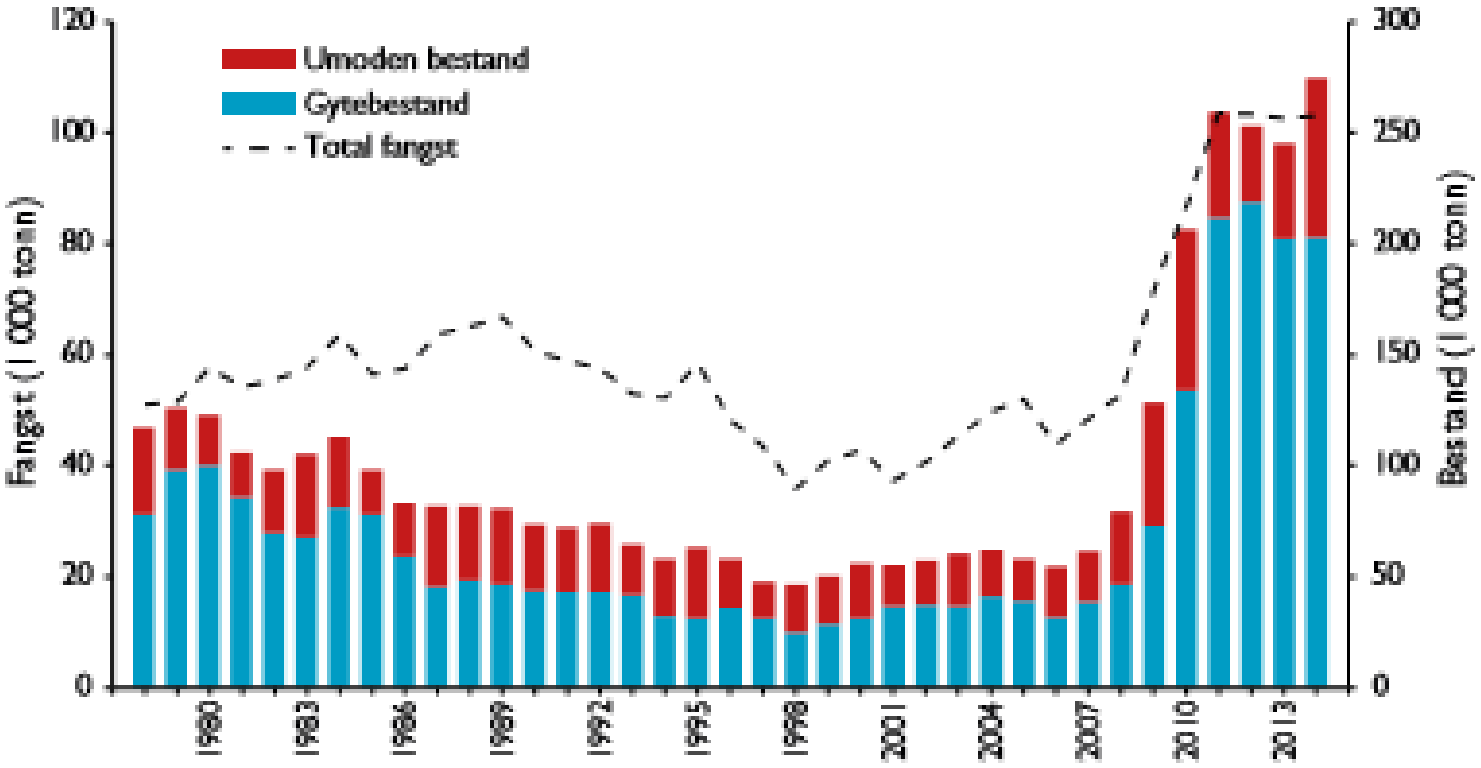


Endringer i stedegne arter av torskefisk



Sundby et al. (2017)

Nordlig lysing fra Biscaya til Norge

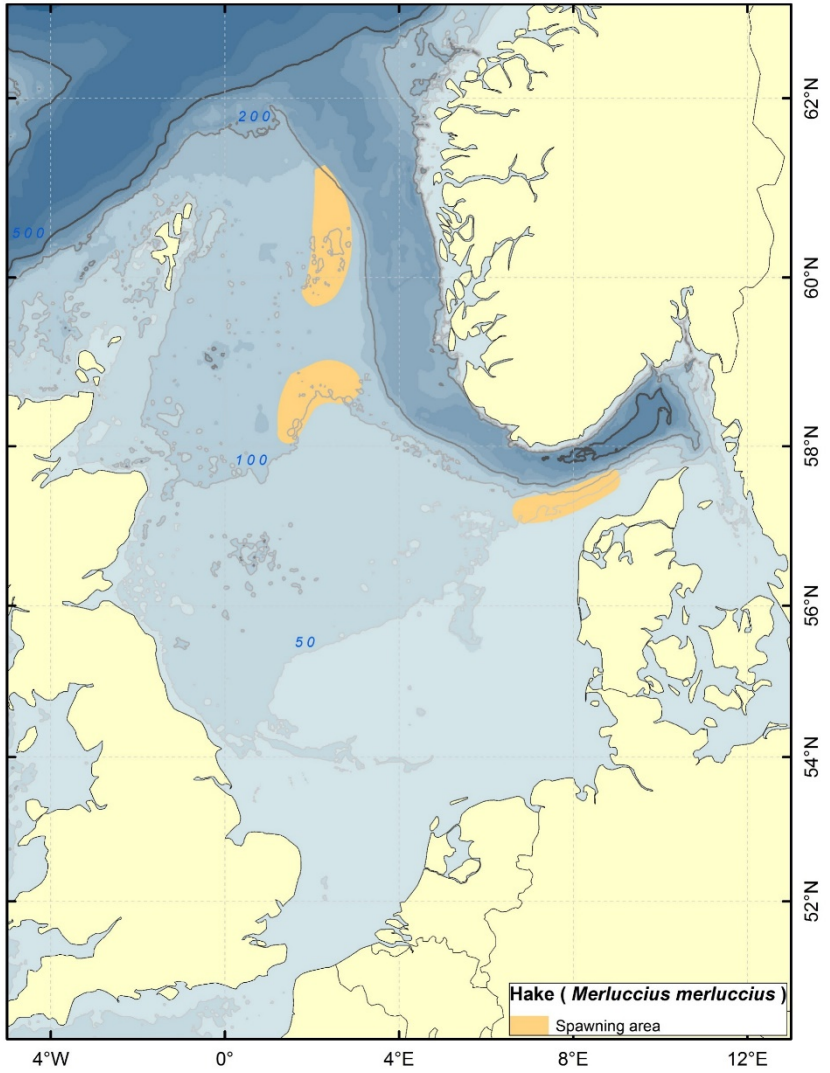


Bestand og fangst av "nordlig" lysing.

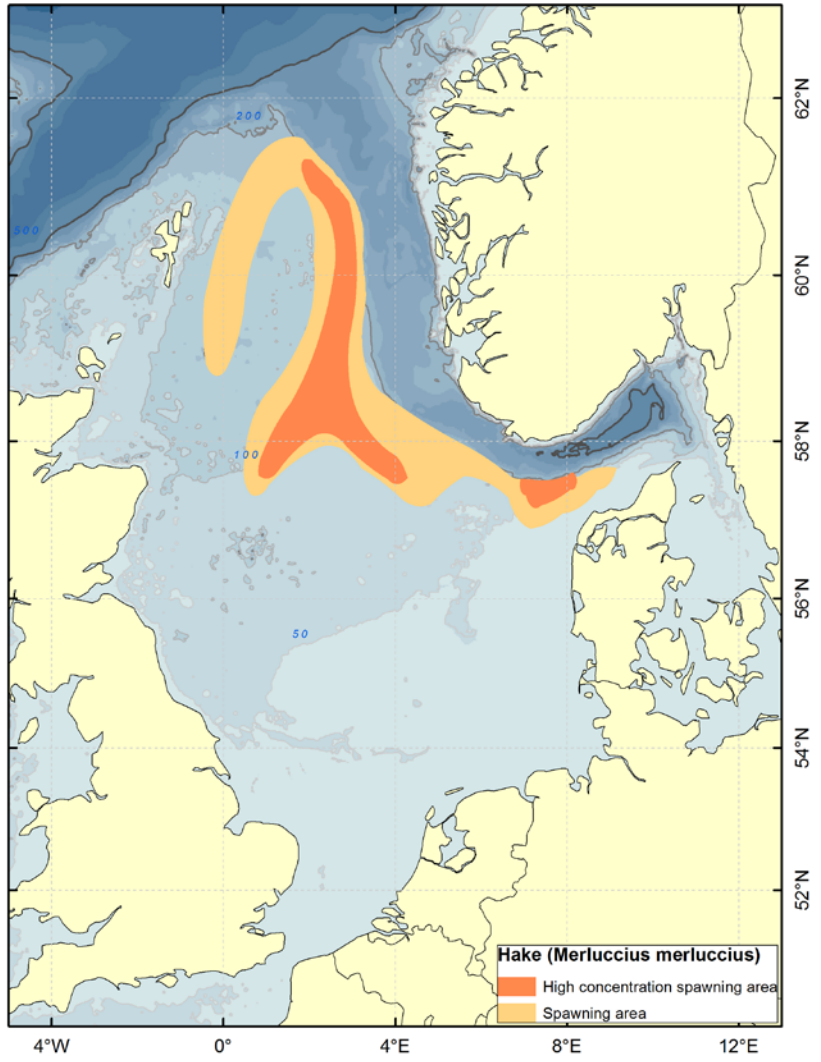
Stock size and total catch of "northern" hake.

Havforskningsrapporten (2016)

Gytefelter for lysing



Datagrunnlag 1989-2013

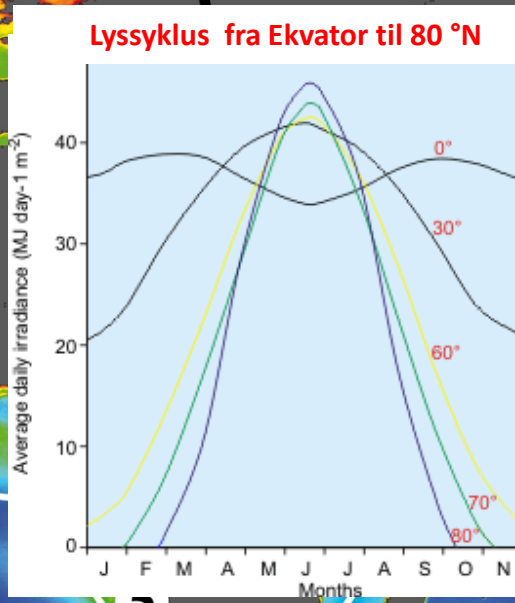


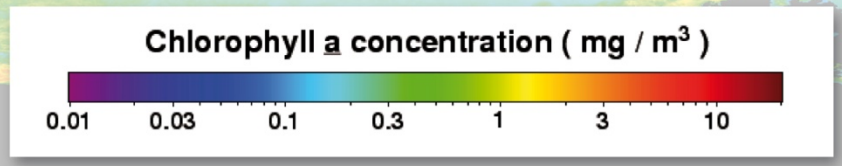
Oppdatert til 2016

Sundby et al. (2017)

En grense for forflytning av nye arter mot nord

Vårоppblomstringssystem – gyting begrenset til mars-april





Sundby et al. (2016) Frontiers Mar. Sci.

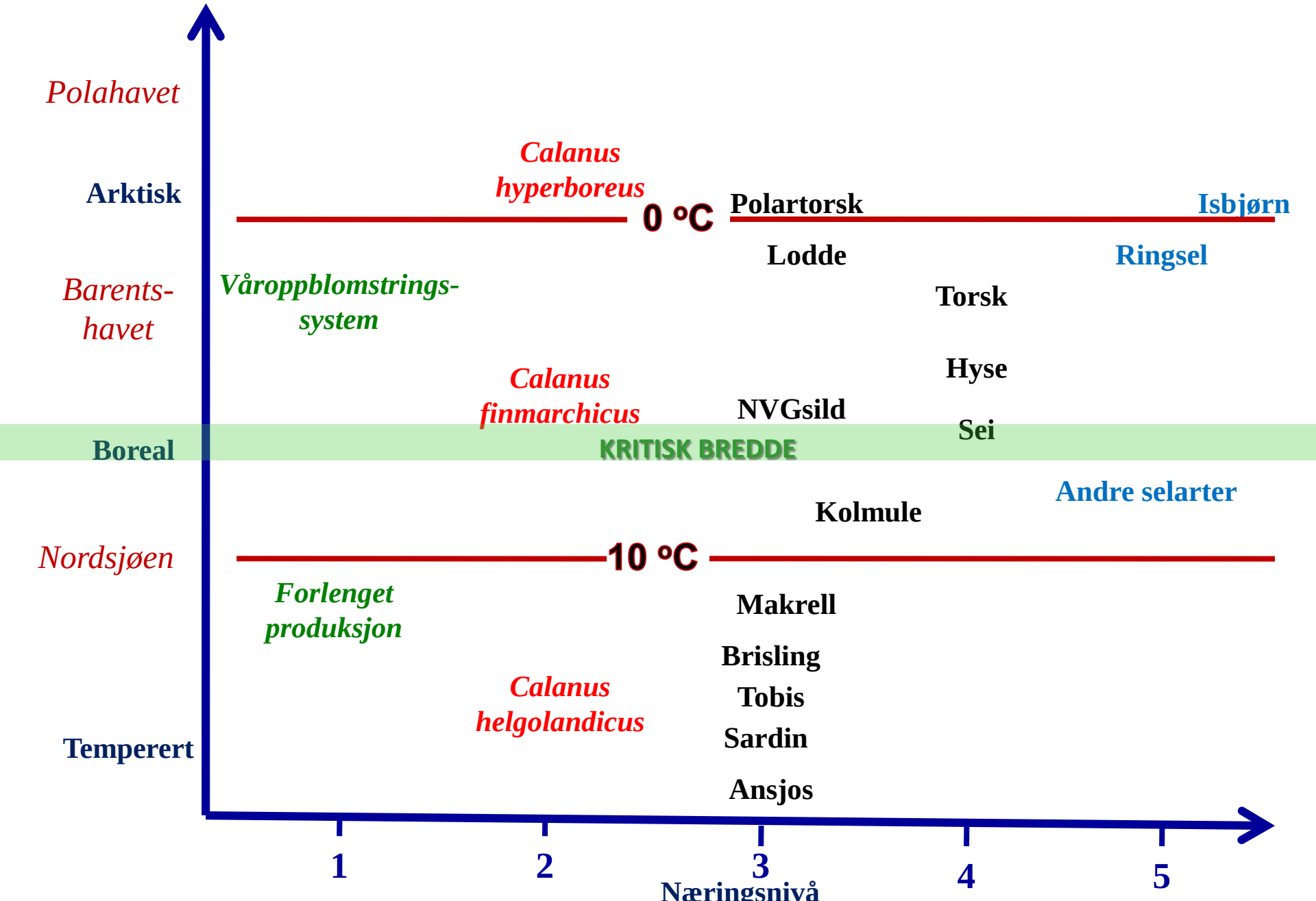
Raudåta – spesialist på våroppblomstring



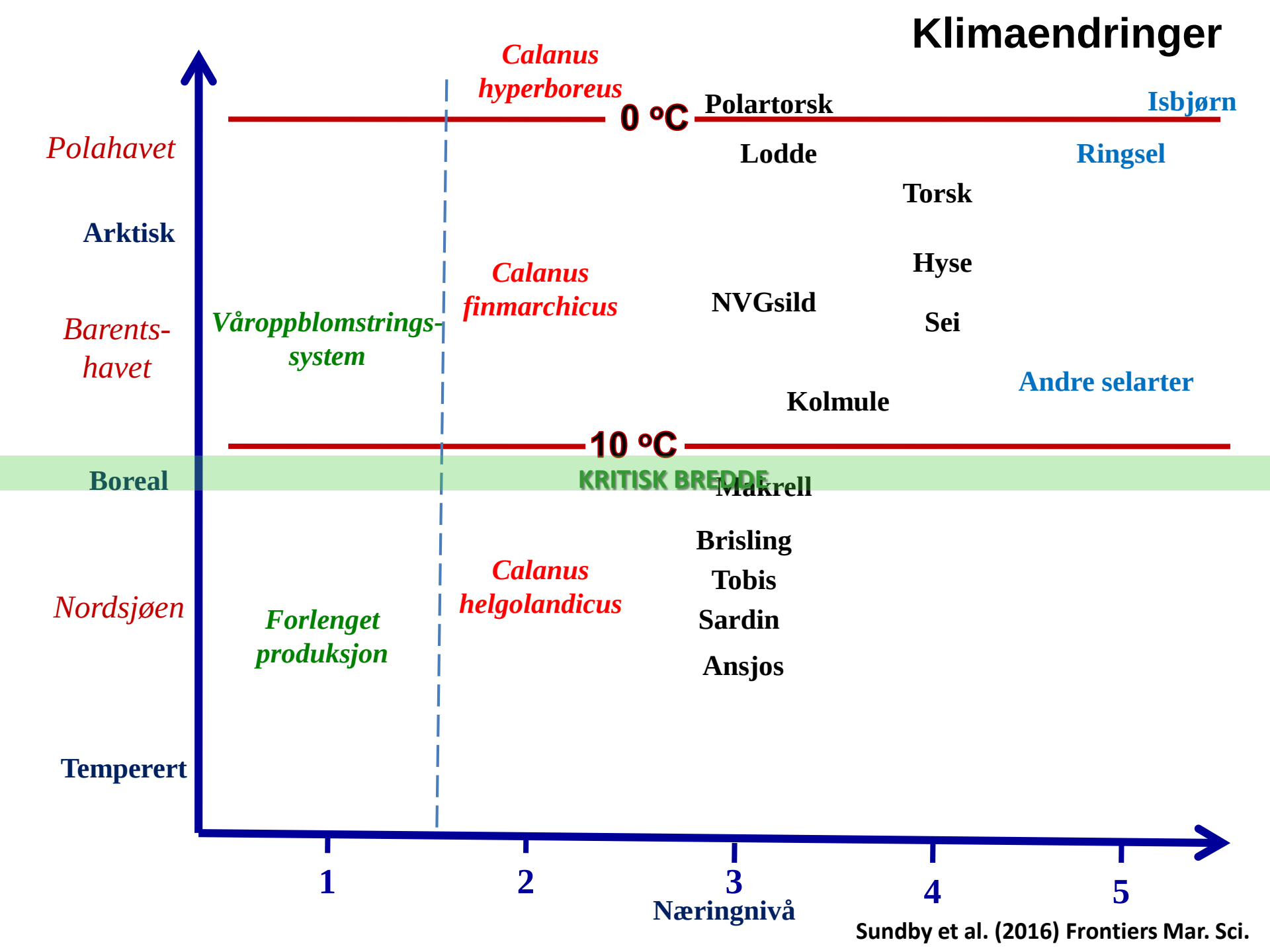
Calanus finmarchic

Opp fra havdypet om våren fremdeles med fettreserver i bel

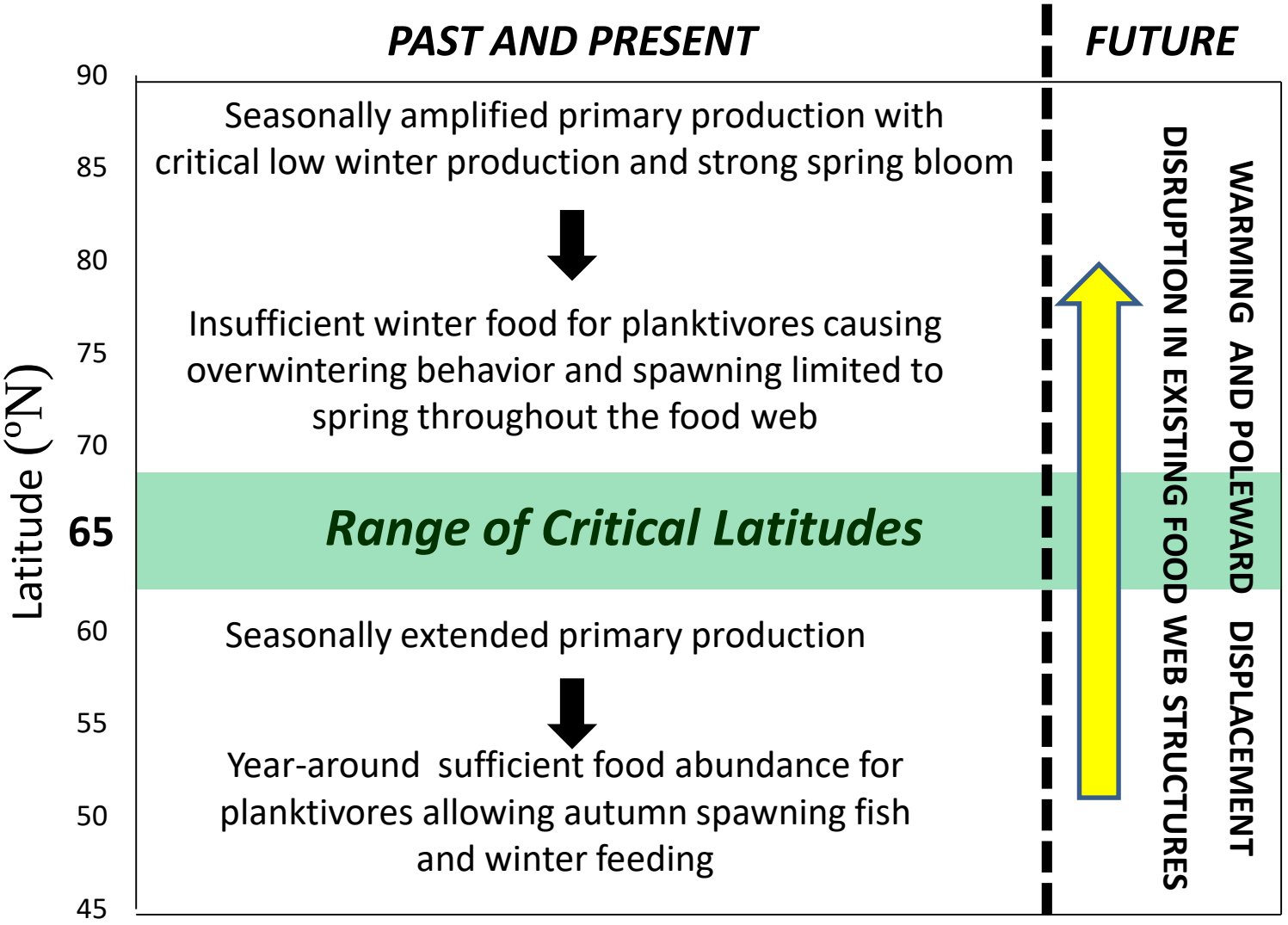
Photo: Calanus.no



Sundby et al. (2016) Frontiers Mar. Sci.


Klimaendringer
Calanus hyperboreus
0 °C
Polartorsk
Isbjørn
Polahavet
Lodde
Ringsel
Torsk
Arktisk
Hyse
Calanus finmarchicus
NVGsild
Barents-havet
Våroppblomstrings-system
Sei
Andre selarter
Kolmule
10 °C
Boreal
KRITISK BREDDE
Makrell
Brisling
Calanus helgolandicus
Tobis
Nordsjøen
Forlenget produksjon
Sardin
Ansjos
Temperert
1
2
3
4
5
Næringnivå
Sundby et al. (2016) Frontiers Mar. Sci.

Økosystem-struktur i Nordøst-Atlanteren



Sundby et al. (2016) Frontiers Mar. Sci.