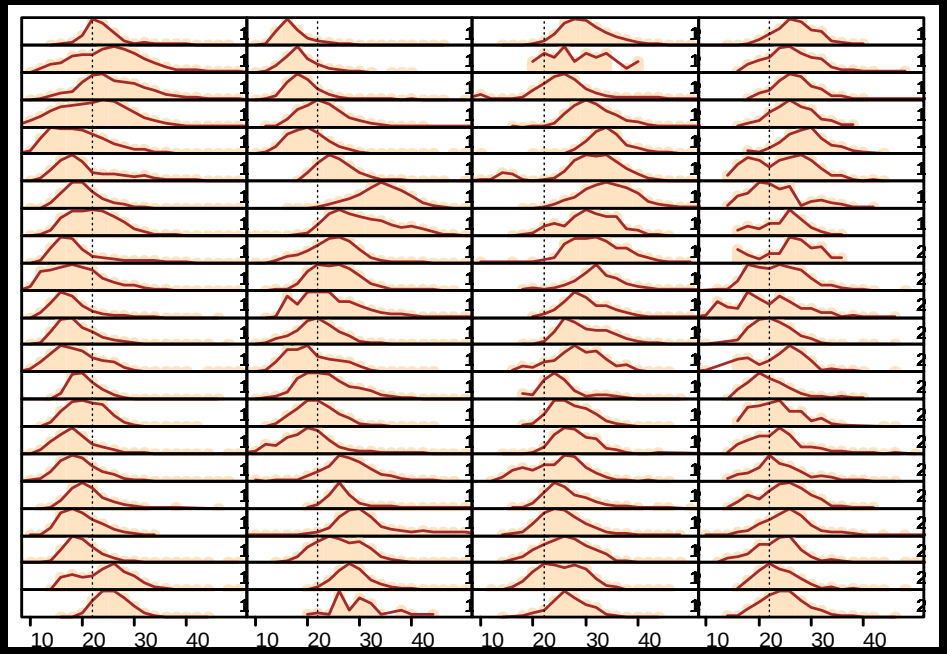
What the world's longest fish size time-series can tell us

about climate change, fishing, eutrophication and war:



North Sea plaice, 1902 – now

Georg Engelhard – John Pinnegar – Ewan Hunter

Cefas Seedcorn – *Trawling Through Time* – Sally Songer

Old data, new insights

- Long-term data are key for studying impact of climate change and other pressures on fish and fisheries
- For climatic variables, many long time-series exist, but…
- For fish, long-term data are sparser and tend to cover few decades only

Cefas' early home, and current home in Lowestoft

- Cefas has – ever since founded in 1902 – carried out numerous ship-based surveys in the North Sea
- Cefas has recently completed digitisation of extensive historical survey data

Trawling Through Time

- Cefas Seedcorn project to catalogue, digitise, and analyse our historical data
- Spirit – use long-term data to better understand past and…
- Use this for enhanced advice towards current and ongoing policy questions


Huxley

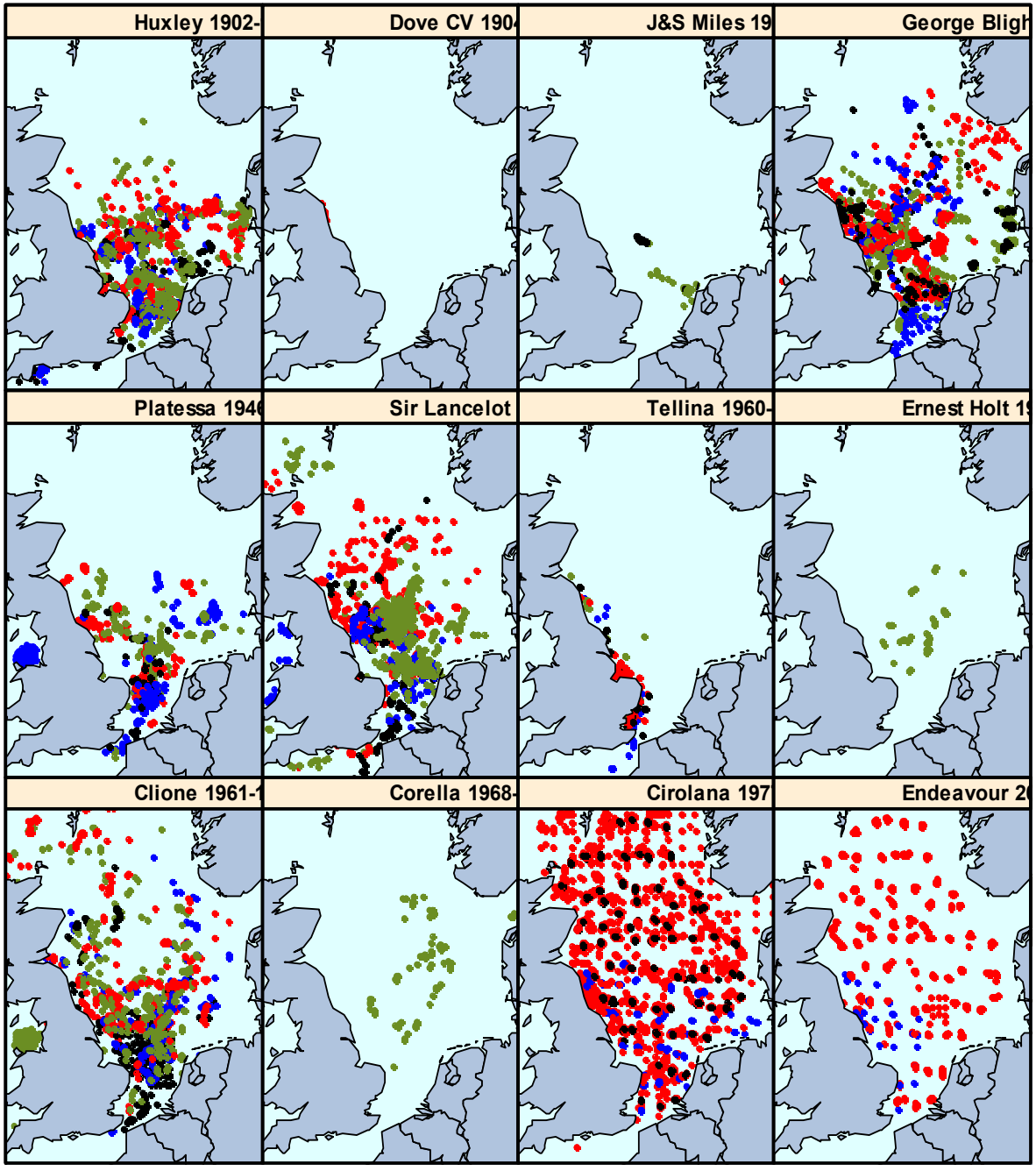

Platessa


Sir Lancelot


Ernest Holt


Corella


Corystes


Huxley 1902-
Dove CV 190
J&S Miles 19
George Bligh
Platessa 194
Sir Lancelot
Tellina 1960-
Ernest Holt 1
Clione 1961-1
Corella 1968-
Cirolana 197
Endeavour 2


J & S Miles


George Bligh

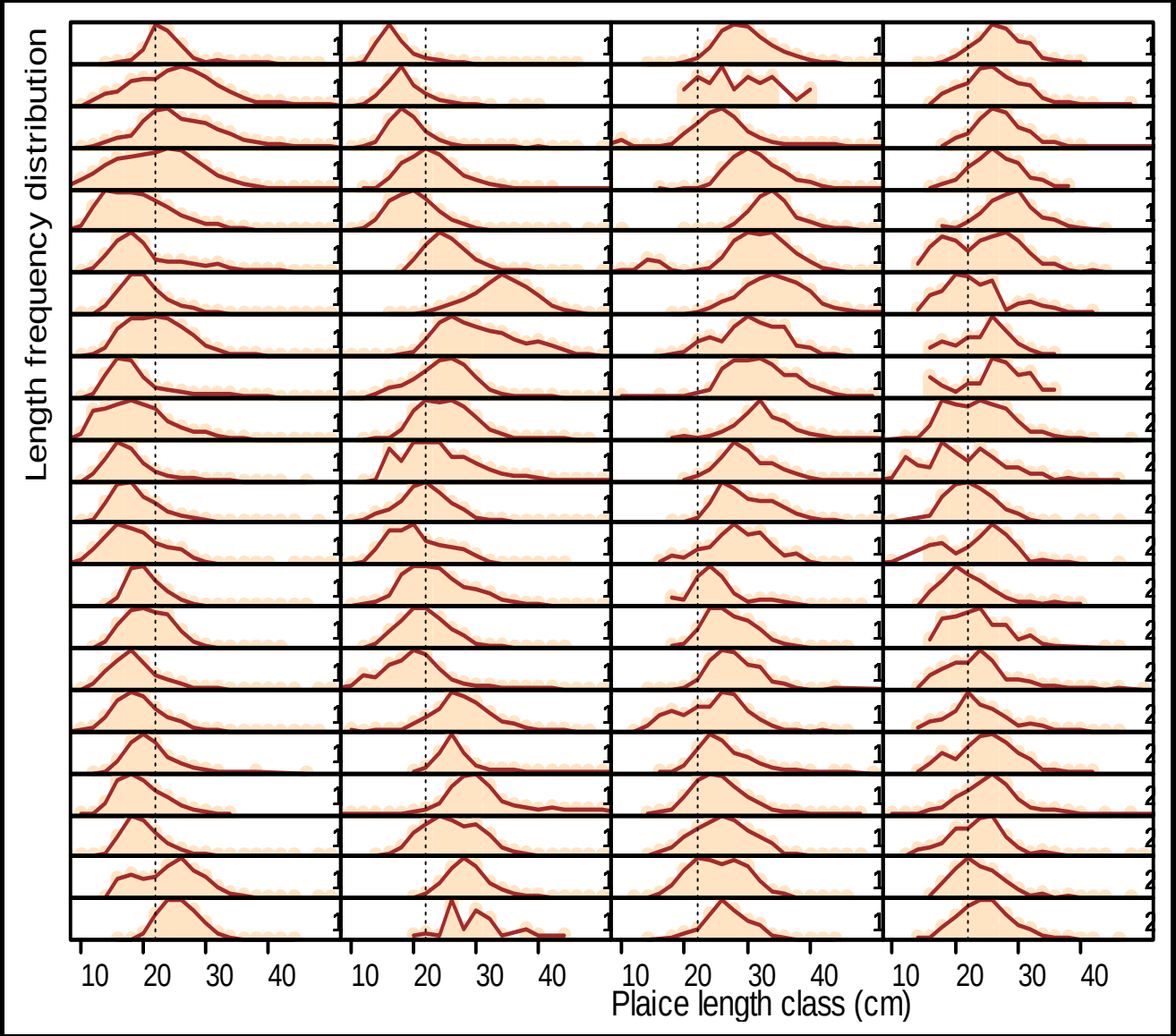

Tellina


Clione

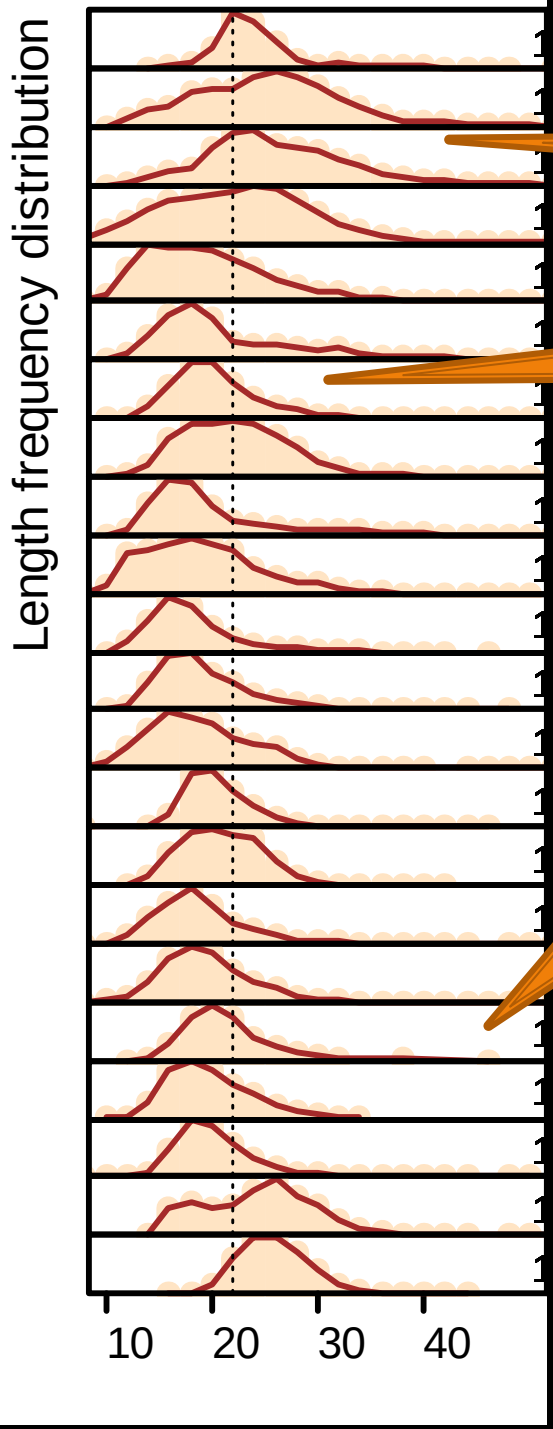

Cirolana


Cefas Endeavour

North Sea plaice length frequency distribution



- All data from Cefas surveys using otter trawls
- But vessels, gear specifics and sampling sites not fully consistent
- Includes only offshore C, S North Sea (excludes inshore nursery areas)
- WWI, WWII, some years 1970s lacking
- Reference: current minimum landing size

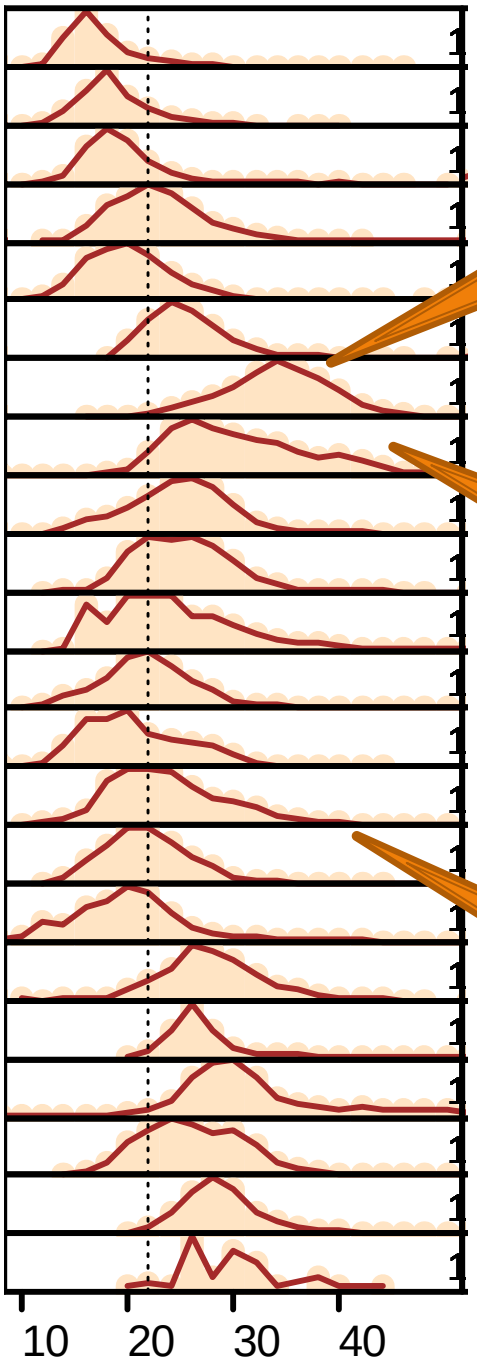


Large plaice still common in early 1900s when intensive trawling commenced…

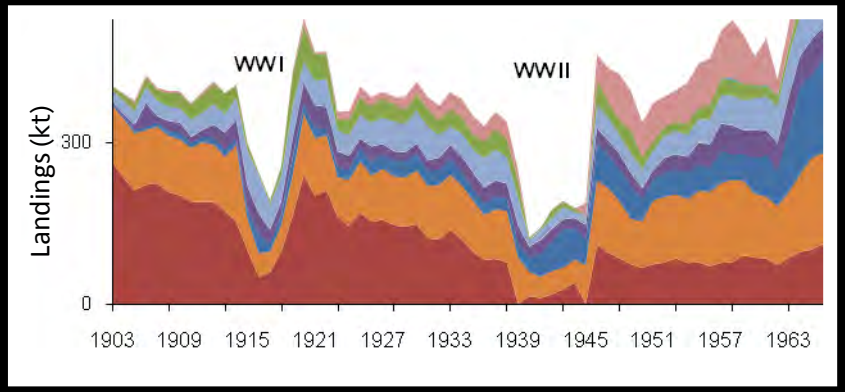
But already before WWI, numbers drop!

1920s – 1930s: intensive fishing; lack of large plaice causes substantial concern of overfishing…

…as expressed by Michael Graham, later Cefas director from 1945-58, and a strong advocate of ship-based surveys

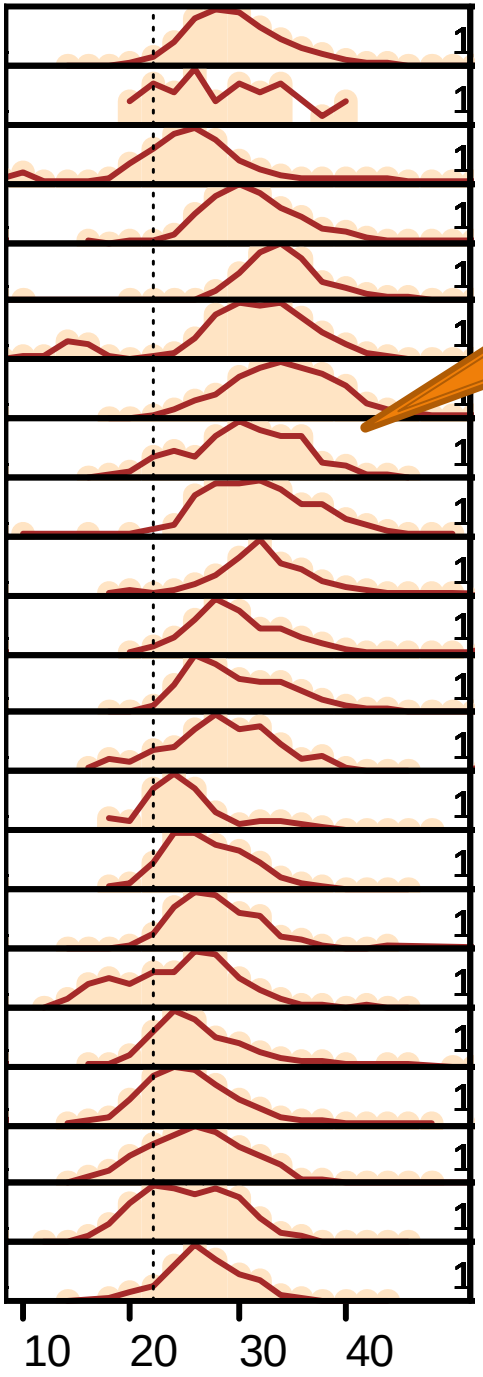


During WWII, fishing in the North Sea came to a near stand-still…



… allowing plaice to recover and grow fully, so that at the close of the war many very large, mature plaice were present!

But intensive fishing recommenced, and the size distribution became soon truncated again…



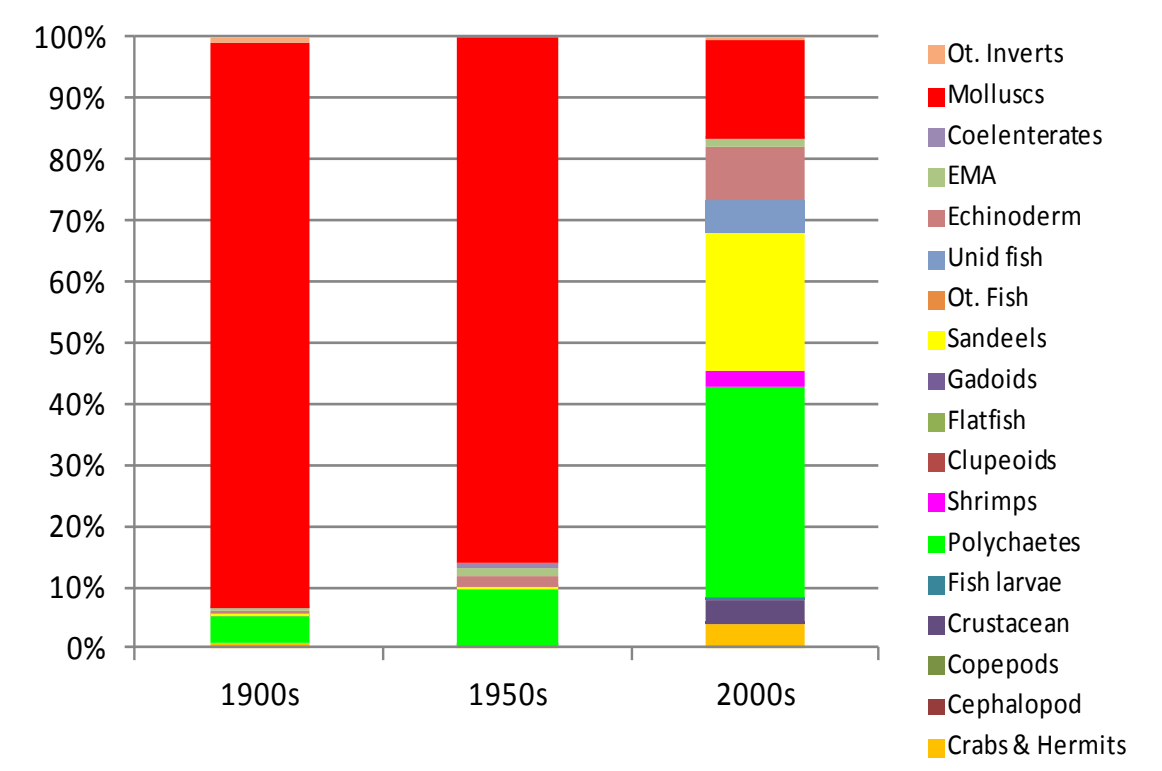
Late 1960s – 1970s: ***unexpected*** prevalence of large plaice, ***in spite*** of intensive fishing and introduction of modern, mechanised beam trawling!

- *Re-working seabed through trawling, and eutrophication through agricultural run-off*
- *Favouring polychaetes, impacting slow-growing bivalves*
- *Improved feeding for plaice*

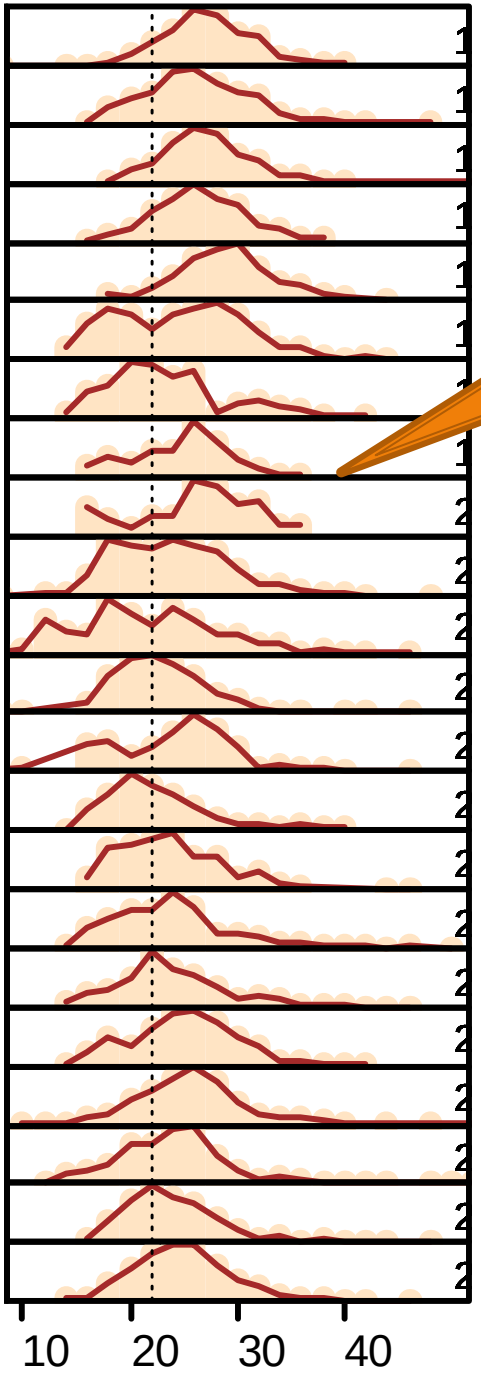
→ ***Faster growth rates***

Plaice diet

1900s – 1950s – 2000s



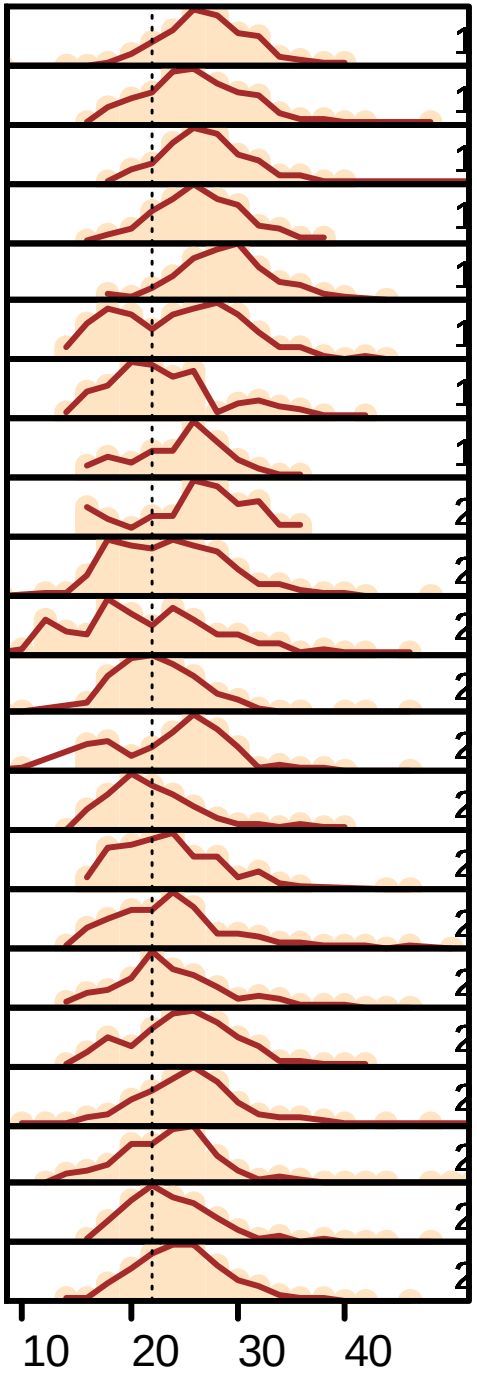
- **Stomach contents analysis confirms a long-term dietary shift**
  - from bivalves to polychaete worms
- **Reflects major reorganisation in North Sea benthos**
  - originally dominated by slow-growing, vulnerable bivalves
  - currently by fast-reproducing, resilient polychaetes, echinoderms, crustaceans



From 1990s on: size distribution again shifted more towards smaller sizes

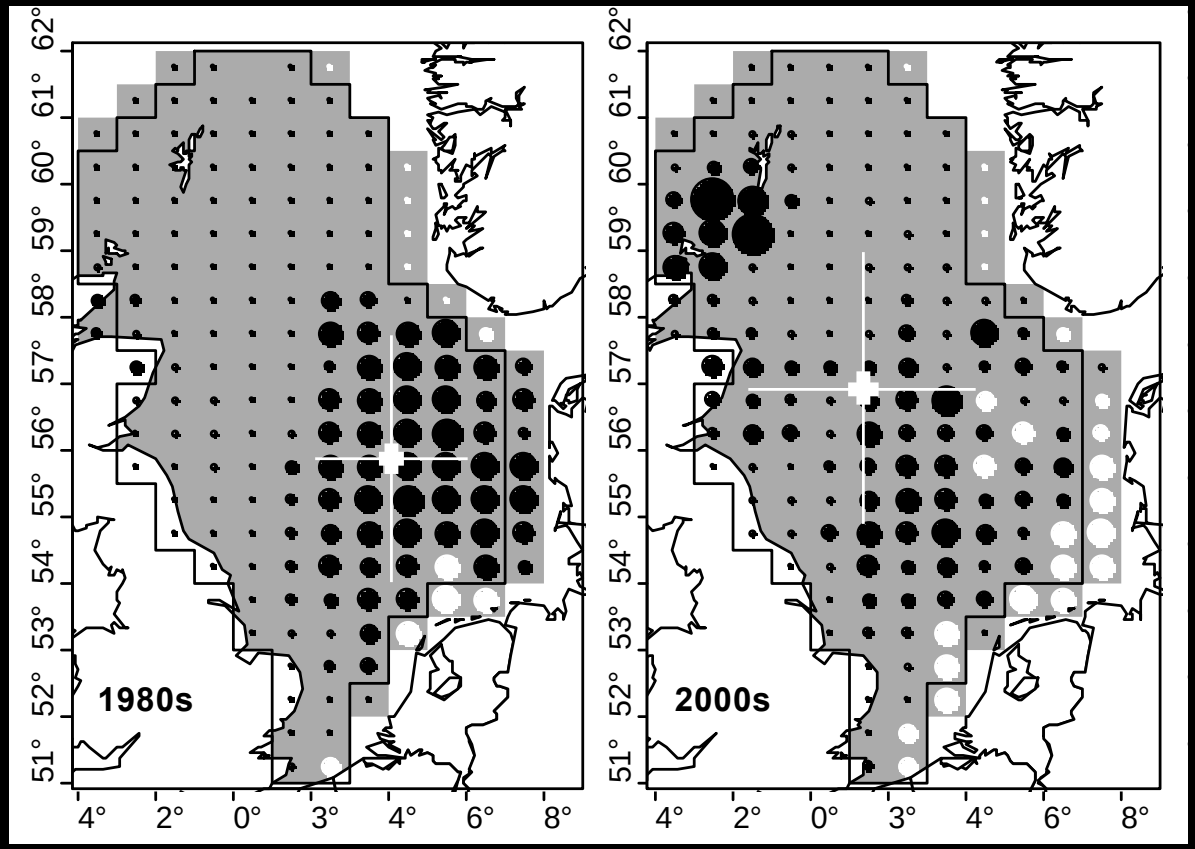
May reflect :

- *Reduced eutrophication and beam trawl ing – possibly affecting prey availability and plaice growth*
- *Fishing – increasing until 2000, then strongly decreasing; stock currently in good shape*
- **Climate change** *and distribution shift – juvenile plaice have* **shifted** *their distribution further* **offshore**!



Shifting plaice distribution

Engelhard et al. (2011) Nine decades of North Sea sole and plaice distribution. *ICES J. Mar. Sci.* 68: 1090-1104.



→ ***More small plaice in offshore population?***

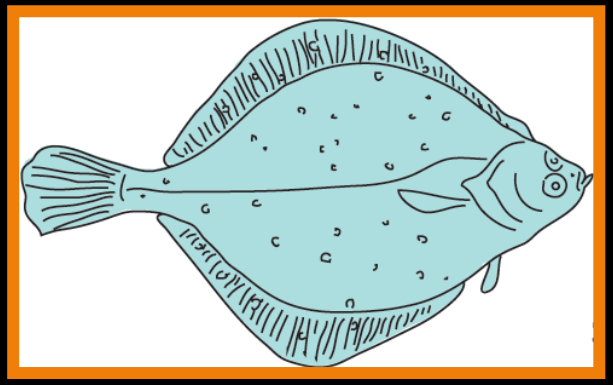
112 years North Sea plaice:

Cumulative effects of alternating pressures

Fishing

War
Conflict

Marine
climate
change

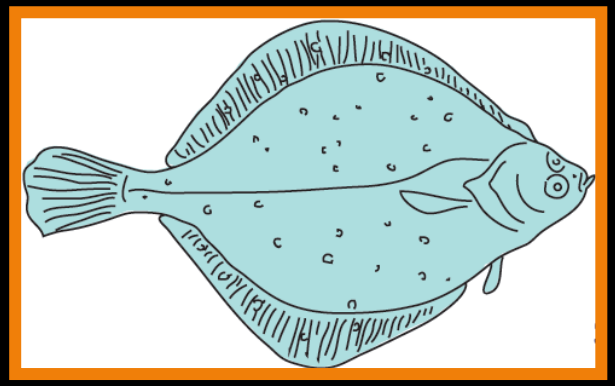


Eutrophication
River runoff

Prey
sources

Habitat
modification

And in the future?



Fishing

War
Conflict

Marine
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Eutrophication
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Trawling Through Time: **Glossy**

- Celebrating Cefas' extensive historical data
- Showing how ***old*** data are used for science in ***current*** policy context
- ***Pick one up!***

(or leave me your name and address for a copy sent to you)