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Maximising yield of fisheries while balancing ecosystem, economic and social concerns

WHAT IS MSY WHEN STOCK PRODUCTIVITY SHIFTS?

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MSY

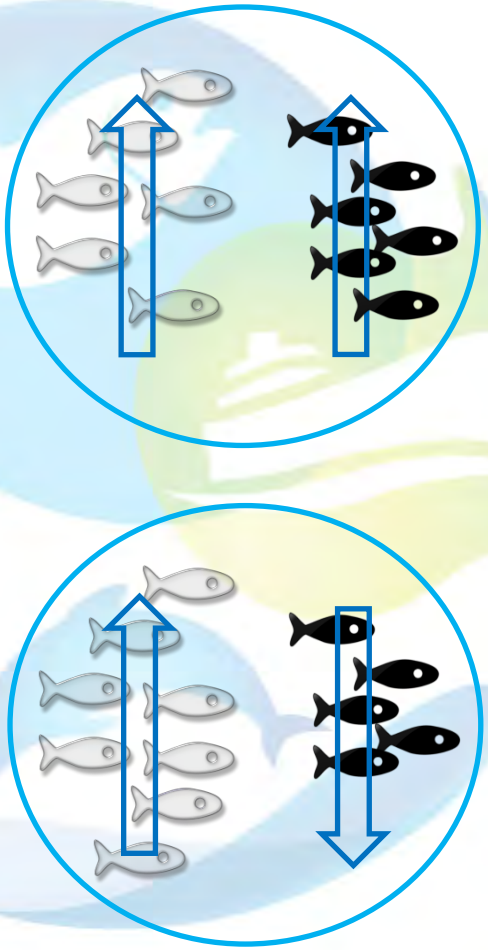
- DEFINITION: "*The highest theoretical equilibrium yield that can be continuously taken on average from a stock under existing average environmental conditions without significantly affecting the reproduction process*" CFP Regulation (EU) No 1380/2013
- ASSUMPTION: No species-interactions (e.g. competition is often ignored) and stable environmental forcing (i.e. no periodical fluctuations the long-term average primary and secondary productions)

The small pelagics

- Often a relative low number of different species, yet they often represents *THE* key link between system productivity and top predators.
- Often gigantic species biomasses.
- They feed mainly on zooplankton (the secondary producers).
- The secondary producers constitute a heterogeneous community in terms of nutritional quality, size, geographic distribution, and seasonality.

MSY and small pelagics

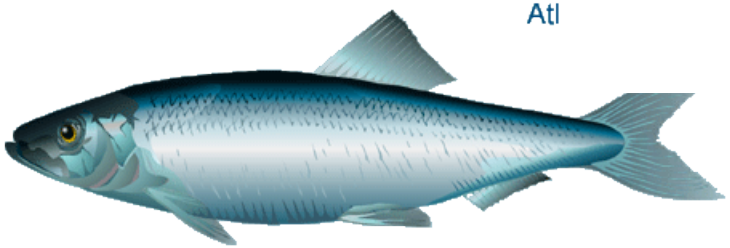
- Do we see any indications that system productivity has changed during the past decades?
- Does small pelagic species change productivity in the same way (synchronicity) or do they 'cover-up'
- What is the consequence for FMSY, if the system is not stable, but undergo periods of low and high productivity?



The North Sea case

Sandeel

Sprat

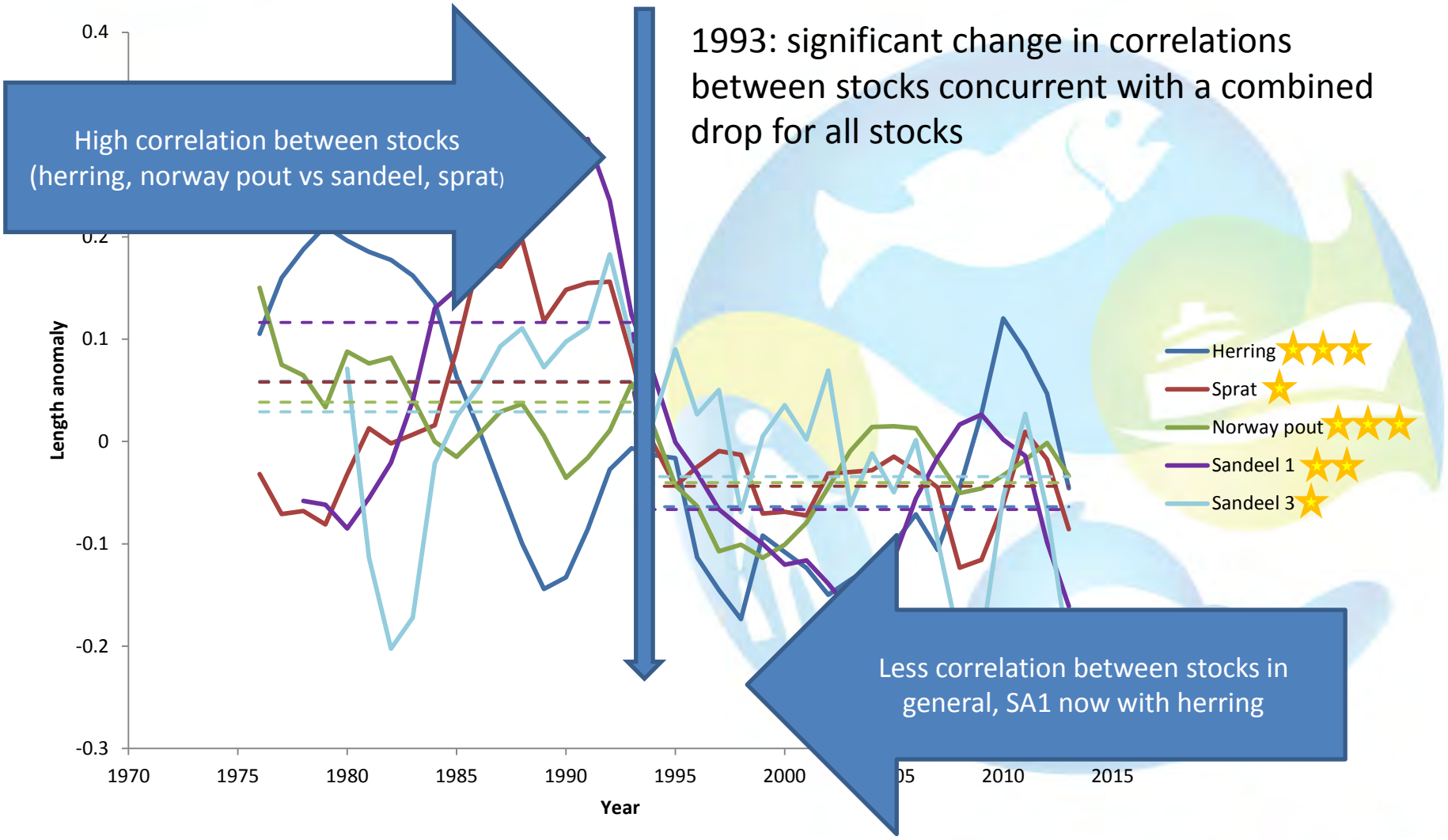


Herring

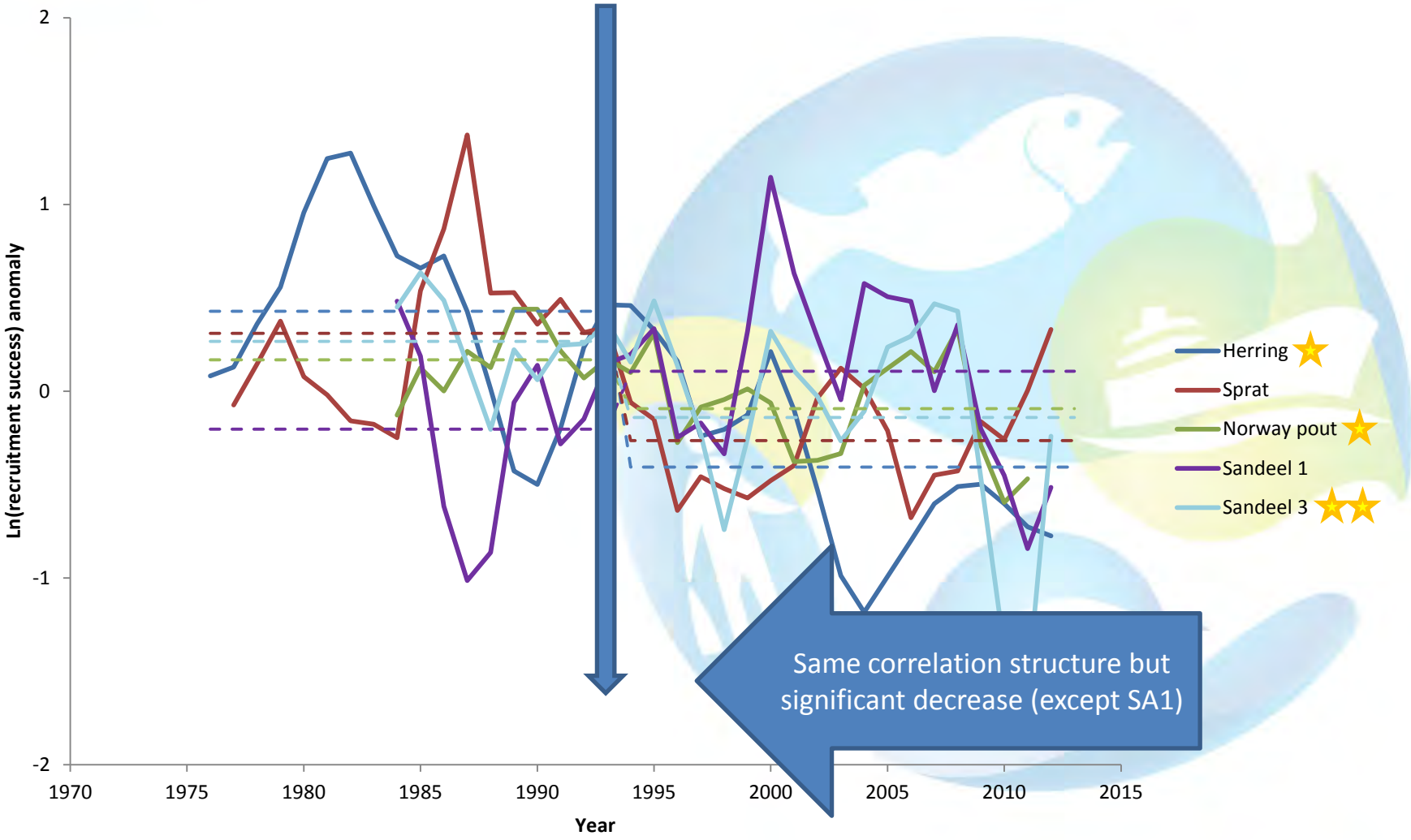
Norway pout

- All important 'translators' of zooplankton into biomass; particulate feeders with a calanus craving
- We looked at the temporal dynamics of recruitment and mean length of adults to gauge the production of the pelagic community in the North Sea

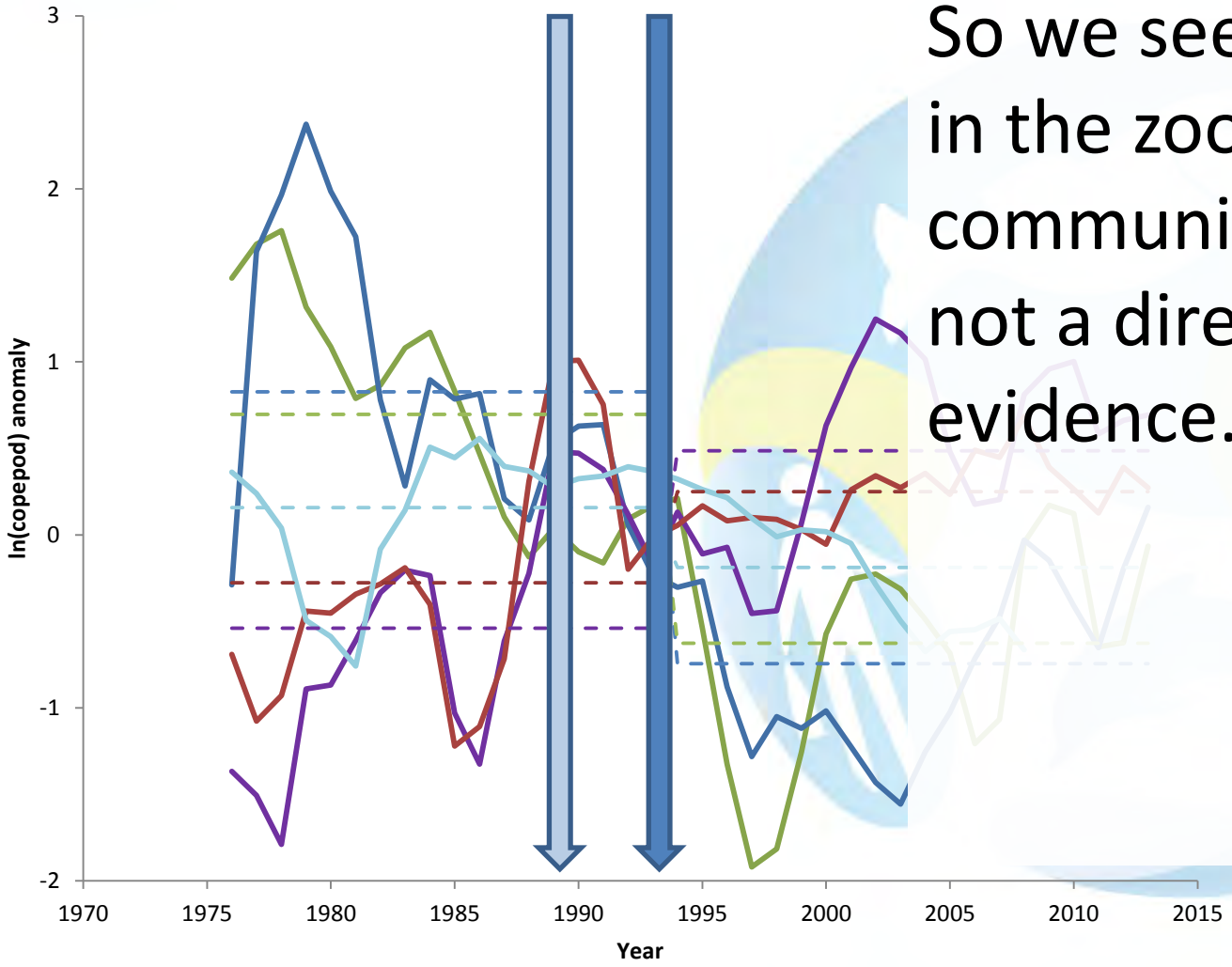
Changes in mean lengths (2+ fish)



Changes in recruitment



Changes in the zooplankton



So we see changes in the zooplankton community – but not a direct causal evidence.

Does it matter?

We observed a change in the productivity for the pelagic community with a breakpoint around 1993 – this could have an effect on FMSY as the Fpa would be hit at lower yields

Stock	Spawning stock change	Change in yield	FMSY
Sandeel stock 1	-18%	-49%	-50%
Sandeel stock 2	-31%	-66%	-64%
Sprat	-10%	-34%	-48%
Herring	-35%	-33%	-26%
Norway pout	-10%	-45%	-41%
Total	-27%	-43%	-49%

Conclusions

- There are strong indications that system productivity dropped in the years around 1993
- Not really support for the stable total biomass with alternating good-bad stocks
- Support for a ‘bottom-up’ environmental factor or at least a common environmental factor regulating total production of small pelagic fish
- MSY reference points changed substantially between the high and low productivity period in the North Sea
- Ecosystem effect less than effects on fishery due to regulation
- Substantial effects on fishery yield (reduction in TAC on average of 40% - largest change 66%)

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Thank you for your attention!

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