

# Fishing and Environmental Effects on Size-based Indicators of Celtic Sea Fish Community Structure

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## Introduction

- Size-based metrics of fish communities are potentially useful ecosystem indicators.
- Reductions in the size structure and trophic level of exploited fish communities have been attributed to increases in fishing pressure.
- Links between changes in size structure and exploitation may be further complicated by climate-induced changes in fish communities.

### Objectives

- Do patterns in the size structure of the Celtic Sea fish community reflect temporal and spatial patterns in fishing intensity?
- Could these patterns also be linked to climate?

## Methods

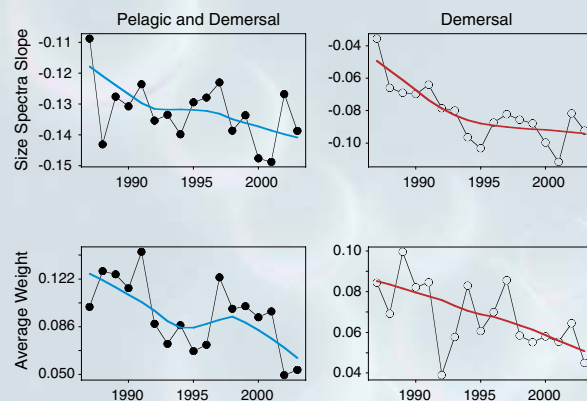
Celtic Sea survey data collected on an annual basis over 1987-2003 were used to calculate two size-based community metrics:

**Slopes of size spectra** were derived from linear fits of log (abundance) versus adjusted midpoints of 5 cm length classes.

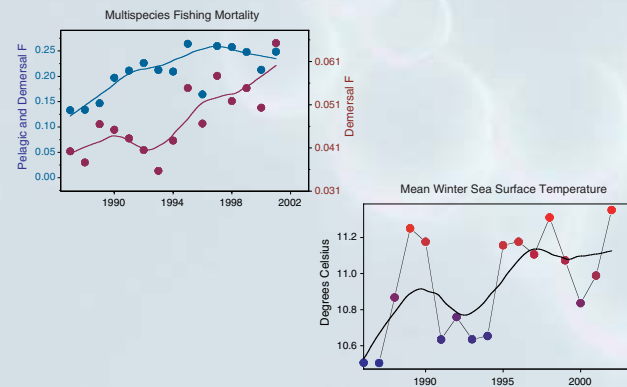
**Average weight** was calculated as  $\Sigma W/N$  where  $W$  is the body mass of an individual and  $N$  is the total number of individuals.

## Results

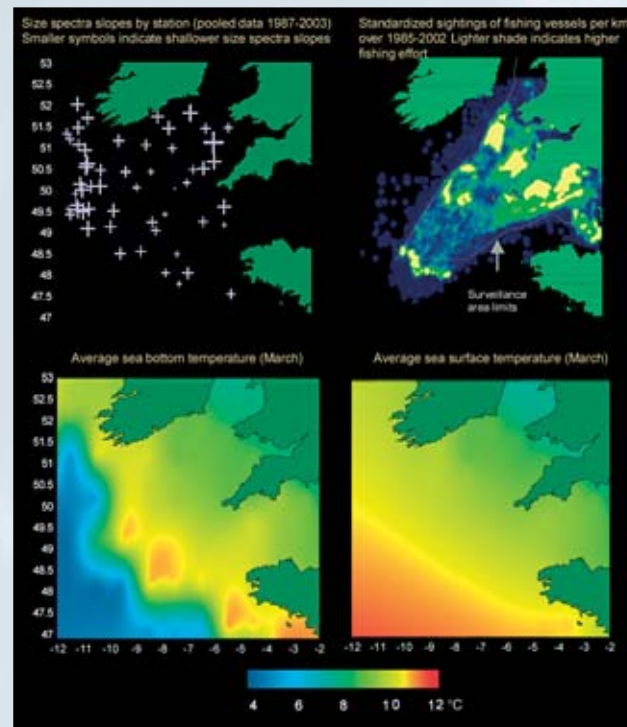
- There has been a decline in the size structure of Celtic Sea fish community over time.



- Trends in fishing pressure and sea surface temperature have increased in the Celtic Sea over 1987-2003.



- Size structure differs spatially and may be influenced by the combined spatial patterns of fishing intensity and environmental processes.



## Discussion

- These data were not appropriate for multiple regression analyses due to limited time series and hence low statistical power.
- Exploratory analyses revealed that temporal and spatial patterns in size structure were consistent with patterns of increased fishing effort and that environmental factors such as temperature also appeared to have an influence.
- Temporal trends indicated that a decrease in size structure over time was accompanied by increasing fishing mortality. Additionally a 'dip' in size structure during the early 1990s coincided with a 'dip' in the winter sea surface temperature signal (with a 2 year lag).
- Spatial areas with steepest size spectra slopes were associated with highest fishing intensity and in some areas high thermal stratification (i.e. shelf edge).



Onboard categorisation of fish according to size classes. Photograph by Nick Dulvy, Cefas.

## Conclusions

- In order to assess the potential utility of size-based indicators for ecosystem based fisheries management a greater understanding of the relative effects of fishing and environmental factors is required.
- Our next step is to explore whether environmental effects have acted primarily through recruitment and growth processes or distributional shifts in Celtic Sea fish species assemblages.

## Acknowledgements

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