

INTERANNUAL VARIATION IN 'INDICATOR' CHAETOGNATHS OFF THE EAST AND WEST COASTS OF SCOTLAND

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Introduction

The important plankton predators, the chaetognath (Figure 1) species *Parasagitta setosa* and *P. elegans* are traditionally considered to be indicators of water masses and climate change in seas surrounding the UK (Russell 1935, 1939). *Parasagitta elegans* is a boreal species, indicative of colder oceanic water influence, whilst *P. setosa* is a temperate neritic species that indicates warmer shelf waters.



Figure 1: Live and preserved *Parasagitta* spp.

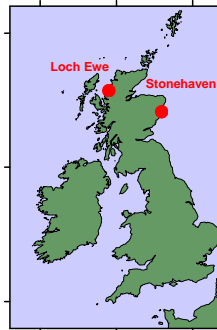


Figure 2: Location of Marine Scotland monitoring sites

Methods

- Zooplankton, temperature, salinity and chlorophyll concentration are sampled approximately weekly from 5 km off Stonehaven on the east coast of Scotland since 1999, and in Loch Ewe, on the west coast, since 2002 (Figure 2 and 3).
- A LOESS curve was fitted to transformed raw data to generate daily estimates of each parameter.



Figure 3: Sampling on RV Temora at Stonehaven



Results

Monitoring programme website:

www.scotland.gov.uk/Topics/marine/science/MSinteractive/coastal

Chaetognath community

- On the east coast (Stonehaven) the chaetognath community is dominated by *P. elegans* (Figure 4, 5A) with only small numbers of *P. setosa* present between September and March (Figure 5B).
- On the west coast (Loch Ewe) the chaetognath community is dominated by *P. setosa* (Figure 4, 5B) with *P. elegans* present all year round in low numbers (Figure 5A).
- Chaetognath community abundance peaks in late summer/ autumn on Scottish east and west coasts (Figure 5).
- There are no obvious trends in the abundance of *P. elegans* on either coast (Figure 6A).
- The abundance of *P. setosa* decreased dramatically after 2003 on the east coast.
- The abundance of *P. setosa* increased 2003-5 on the west coast (Figure 6B) but has decreased steadily since then.
- The average annual proportion of *P. setosa* on the east coast is negatively correlated with that on the west coast ($r = 0.65$).

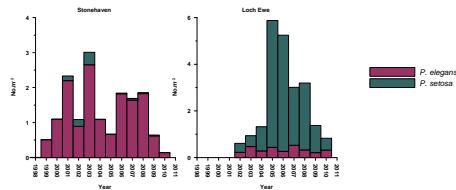


Figure 4: Annual average abundance of the chaetognath community on the east (Stonehaven) and west (Loch Ewe) of Scotland.

Explanatory variables

- Figure 7 shows the patterns in average annual values of temperature, salinity, the concentration of chlorophyll and the total abundance of copepods as an index of food.
- There was no significant relationship between the abundance of either chaetognath species and temperature, salinity or the total abundance of copepods using linear regression analysis.
- There was no significant relationship between the abundance of either chaetognath species and chlorophyll concentration on the west coast of Scotland (Loch Ewe).
- There was a significant positive relationship between the concentration of chlorophyll and the abundance of both *P. elegans* ($r^2 = 0.34$, $p < 0.05$) and *P. setosa* ($r^2 = 0.30$, $p < 0.05$) on the east coast of Scotland (Stonehaven).

Summary

The composition of the 'indicator' chaetognath community suggests that the Stonehaven monitoring site is more influenced by oceanic water than the Loch Ewe monitoring site.

The changes seen in the 'indicator' chaetognath communities imply that the hydrographic characteristics at both monitoring sites have changed since 2003, but that the change has been different on the east and west coasts of Scotland.

None of the variables associated with hydrographic characteristics (temperature, salinity) or food availability (total copepods) provide an explanation for the changes seen in the chaetognath community.

The abundance of the chaetognath community on the east coast increased as chlorophyll concentration increased but this was not seen on the west coast.

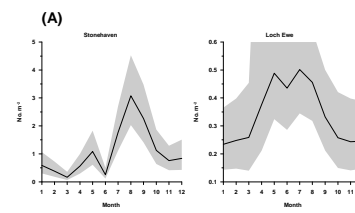


Figure 5: Average monthly abundance of (A) *P. elegans* and (B) *P. setosa* on the east (Stonehaven) and west (Loch Ewe) coasts of Scotland. Note the different scales on the y-axis.

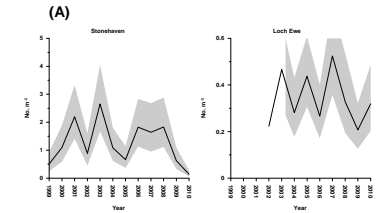


Figure 6: Average annual abundance of (A) *P. elegans* and (B) *P. setosa* on the east (Stonehaven) and west (Loch Ewe) coasts of Scotland. Note the different scales on the y-axis.

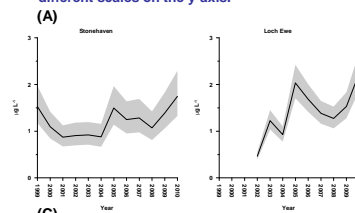


Figure 7: Average annual values of (A) chlorophyll concentration, (B) salinity, (C) temperature and (D) total abundance of copepods on the east (Stonehaven) and west (Loch Ewe) coasts of Scotland.

References

Russell F.S. (1935) On the value of certain plankton animals as indicators of water movements in the English Channel and North Sea. *Journal of the Marine Biological Association UK* 20 (2), 309-32
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