Environmental monitoring to support HAB events

[Redacted]

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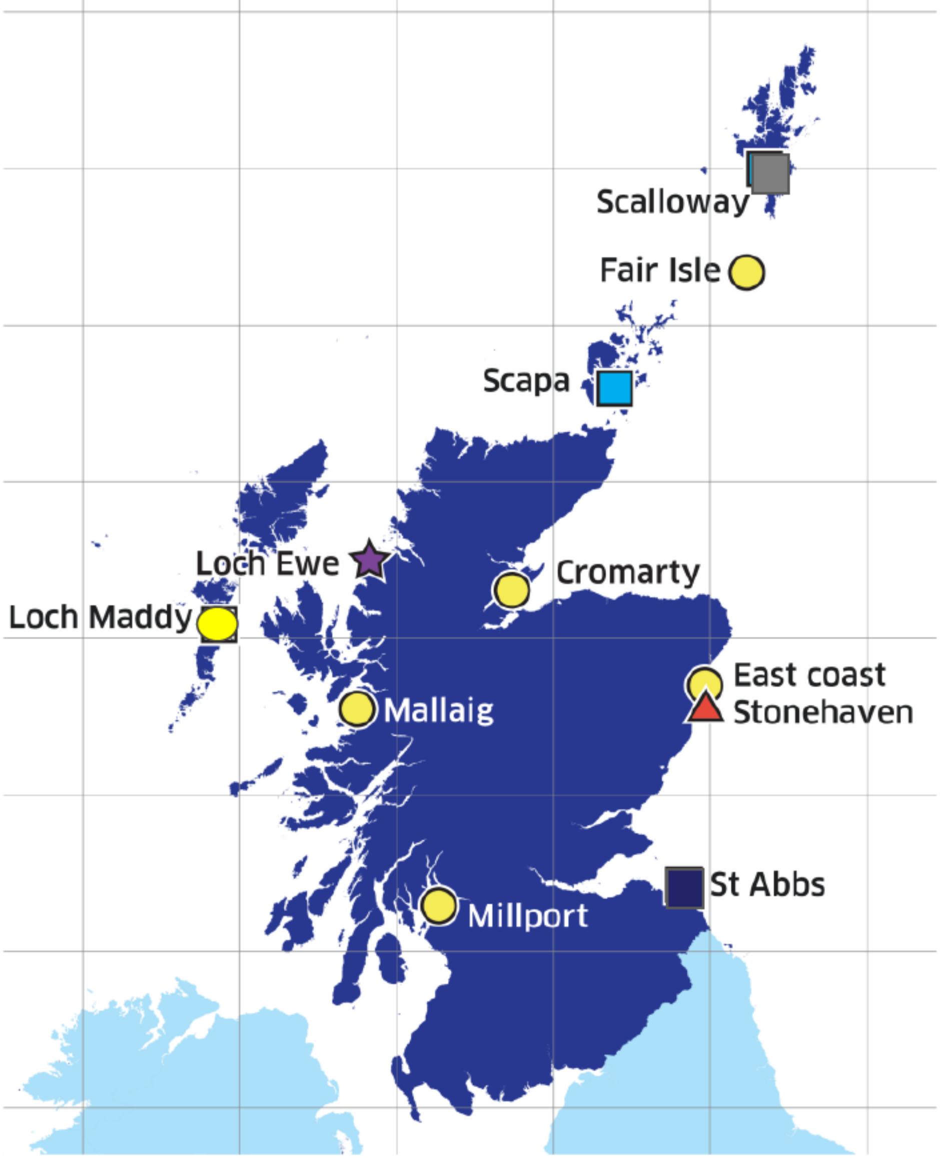

SCObs monitoring sites: parameters measured

▲ temperature, salinity, secchi, nutrients, ocean acidification, pigments, phytoplankton, zooplankton, fish larvae

★ temperature, salinity, secchi, nutrients, pigments, phytoplankton, zooplankton, OA (COMPASS)

■ temperature, salinity, nutrients phytoplankton

■ temperature, salinity, nutrients

■ temperature, salinity

● temperature

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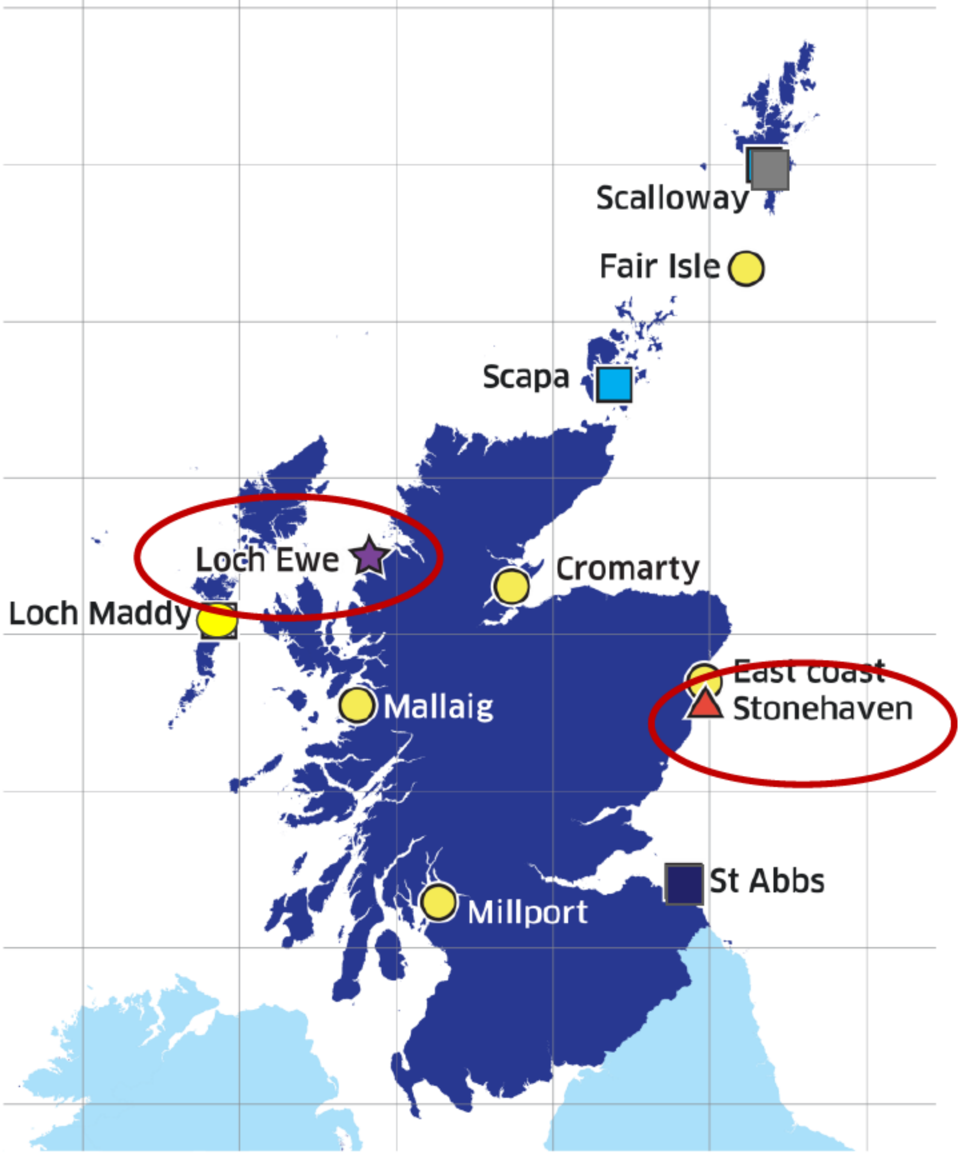

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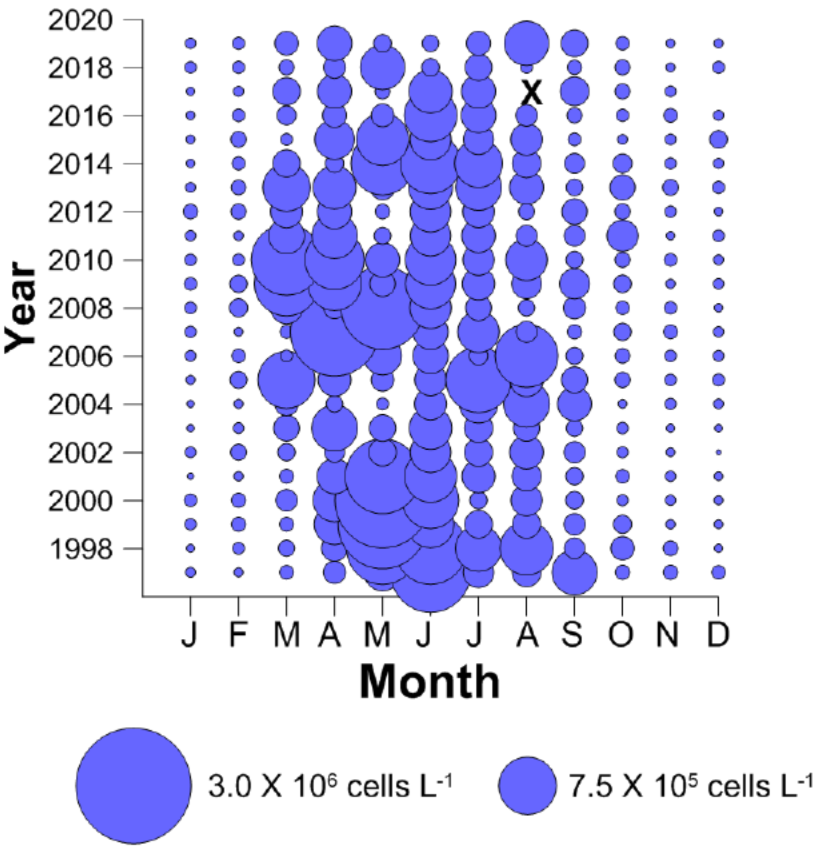
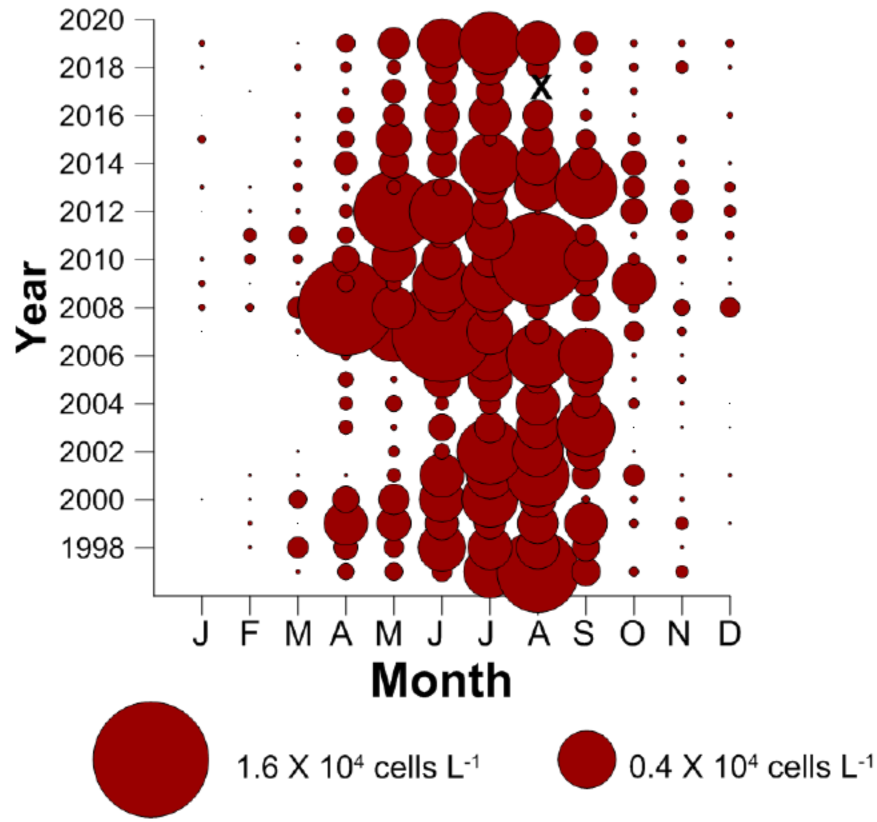
Stonehaven monthly averages

Diatoms



Dinoflagellates



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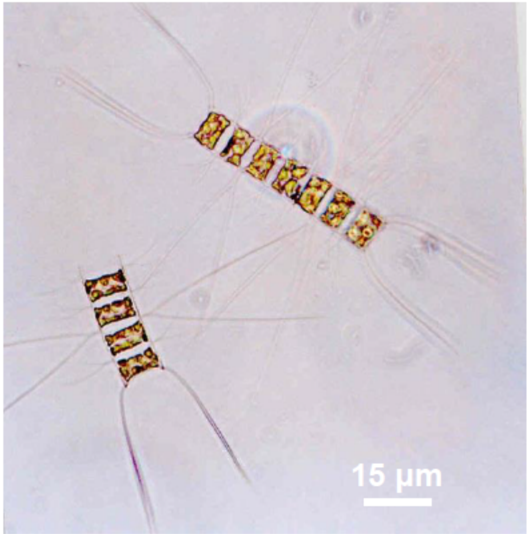
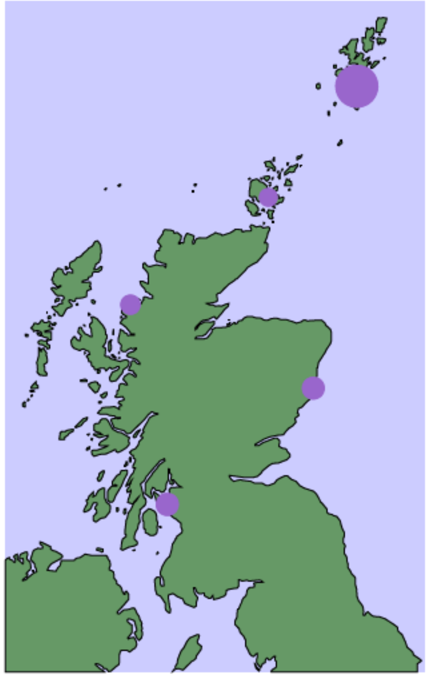
Chaetoceros spp.



Chaetoceros **spp.**



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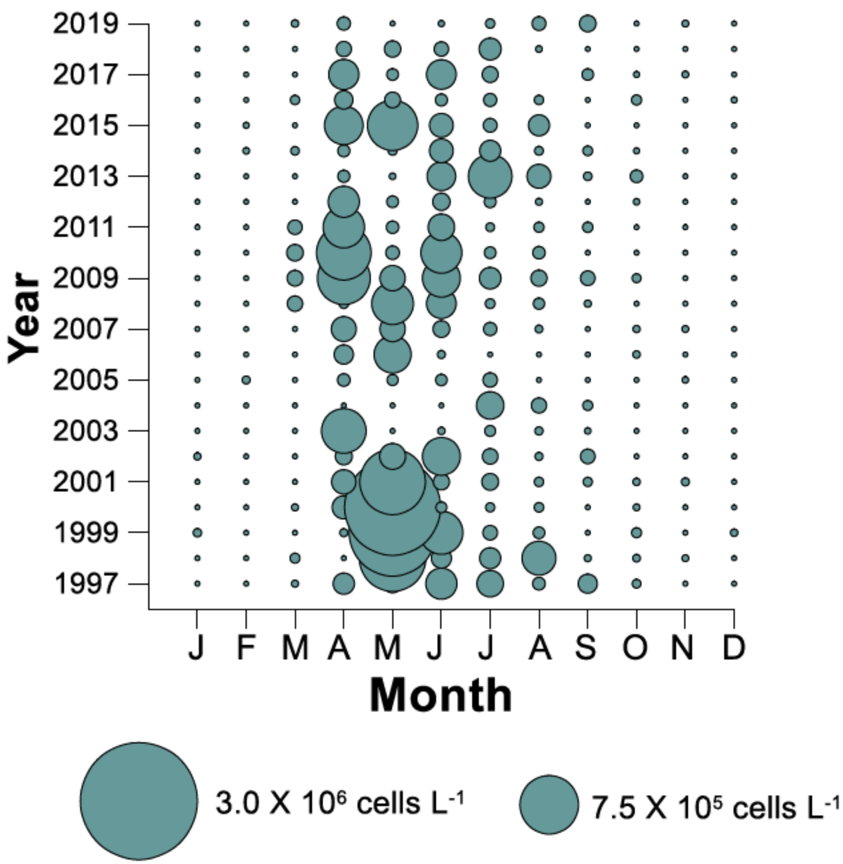
Chaetoceros spp. Stonehaven



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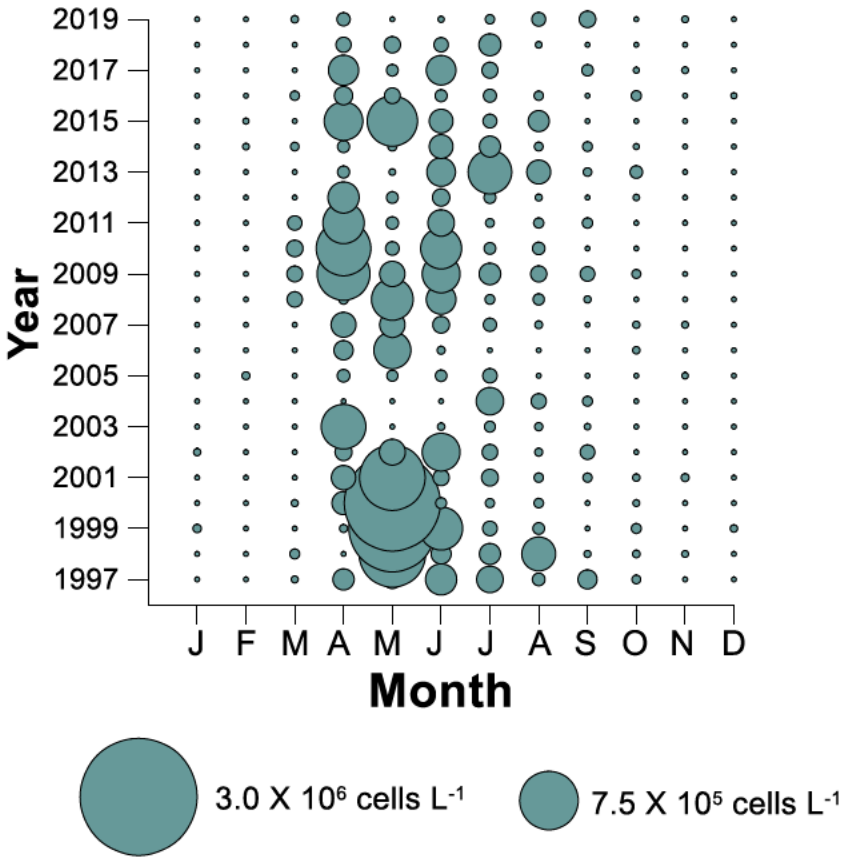
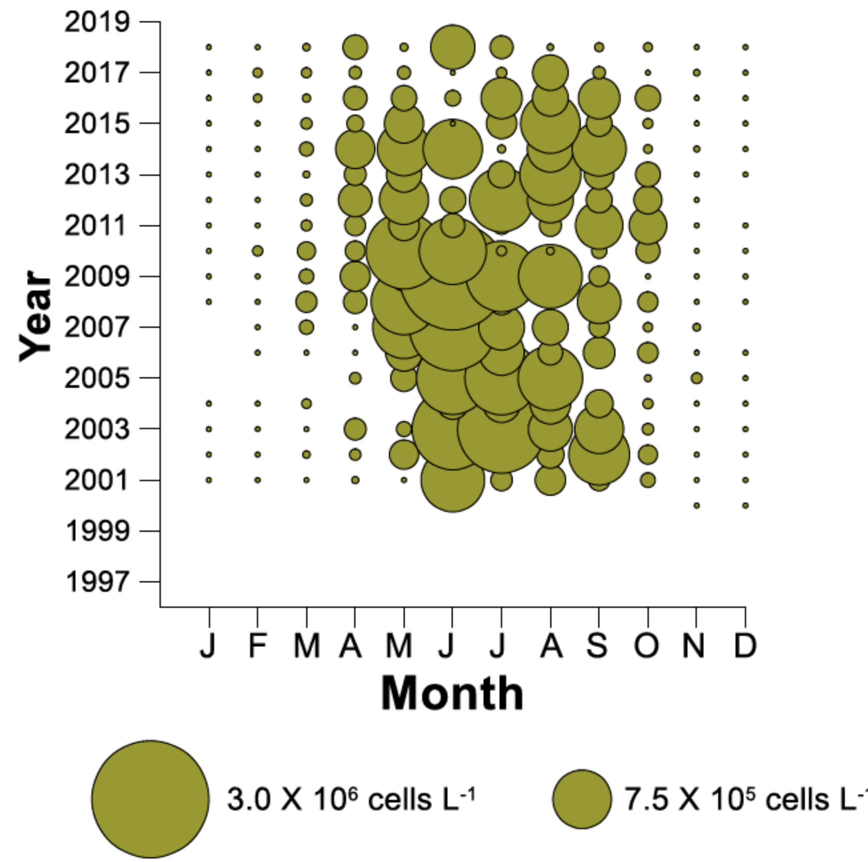
Chaetoceros spp. Stonehaven



Chaetoceros spp. Shetland



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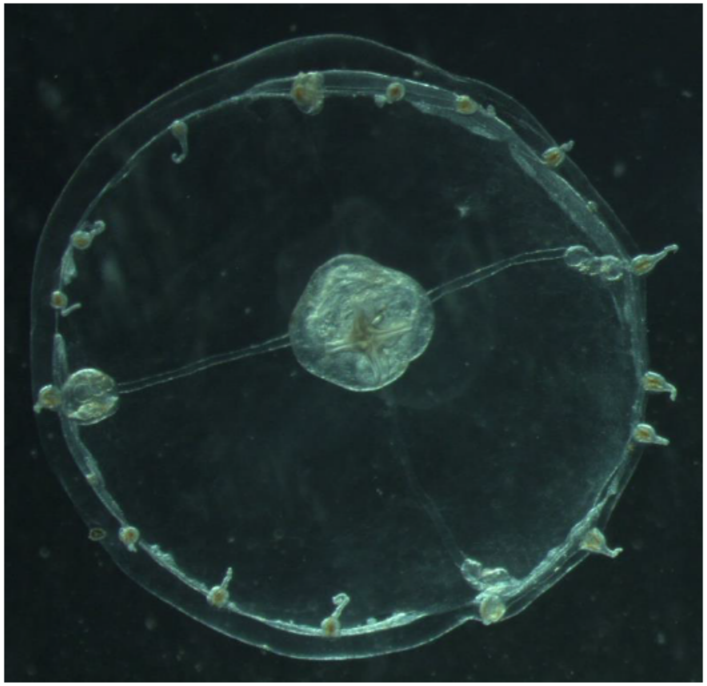
Hydrozoans

Clytia hemisphaerica



Aglantha digitale

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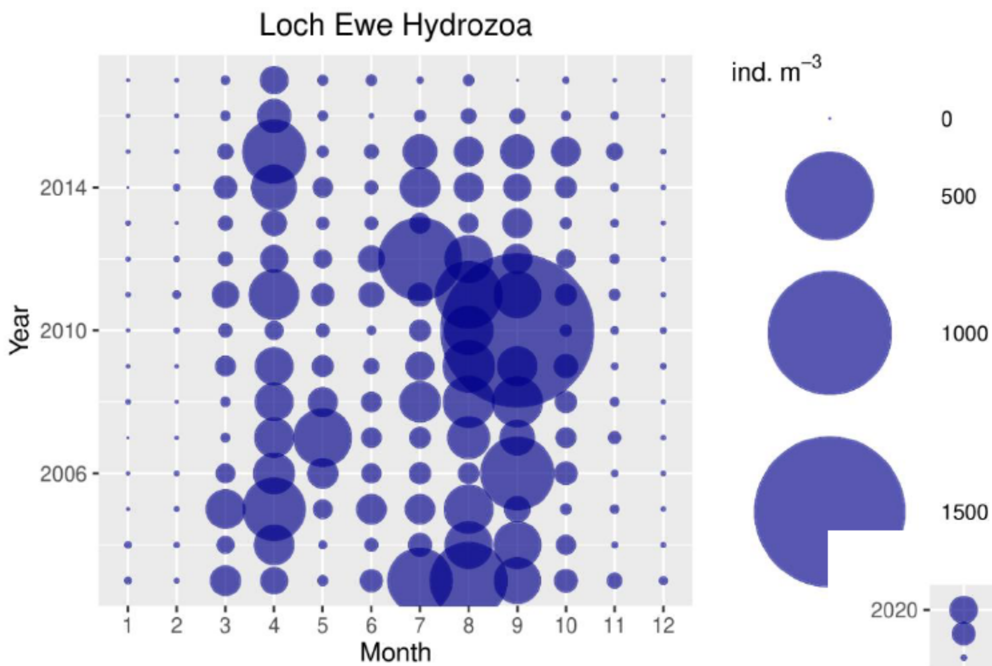

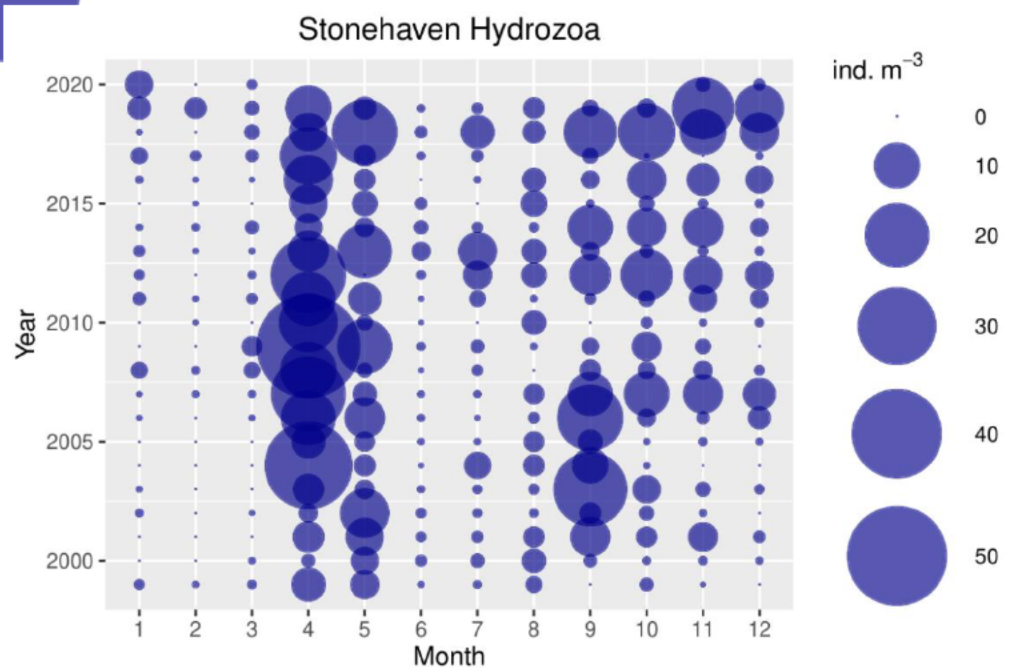

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- Heat in the water
- Proxy for water column stability

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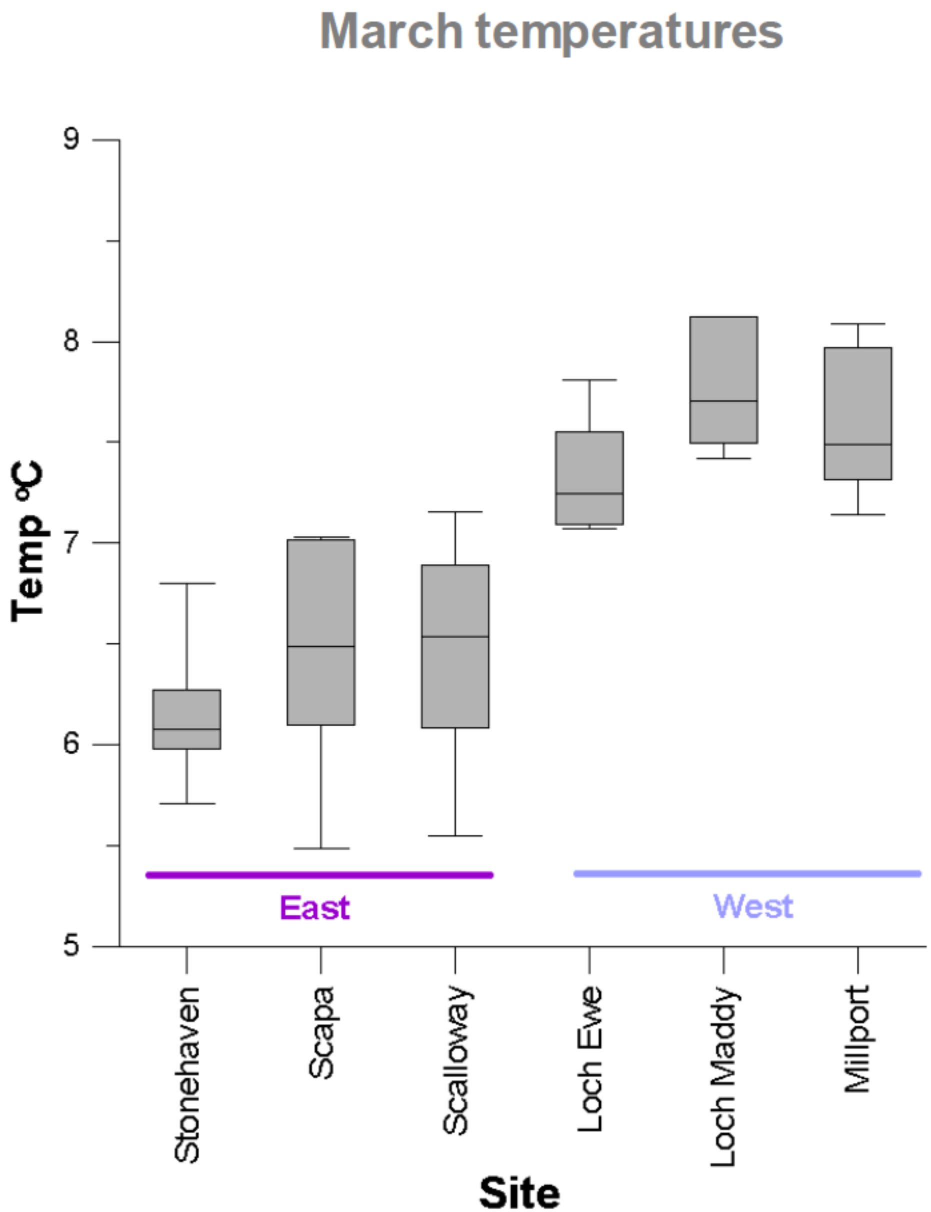

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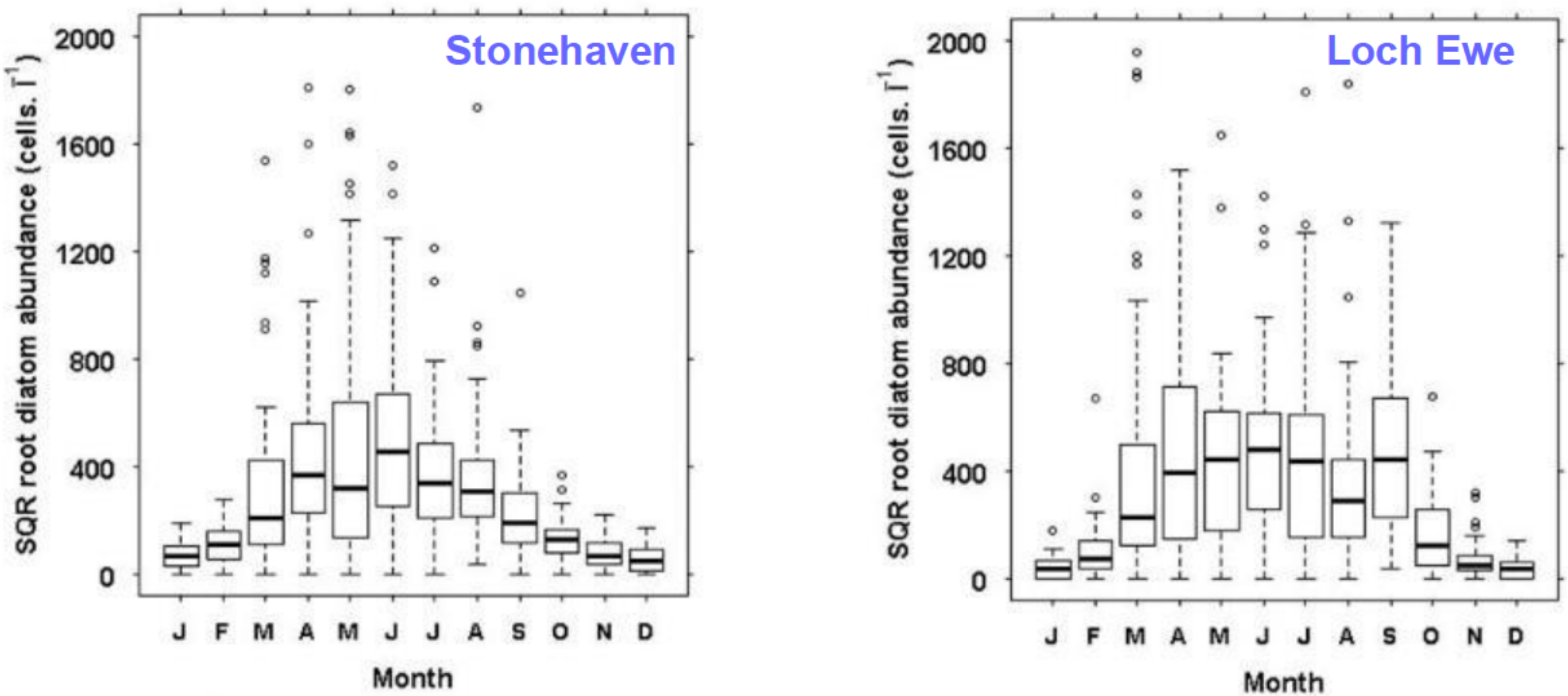
Diatom seasonal cycle



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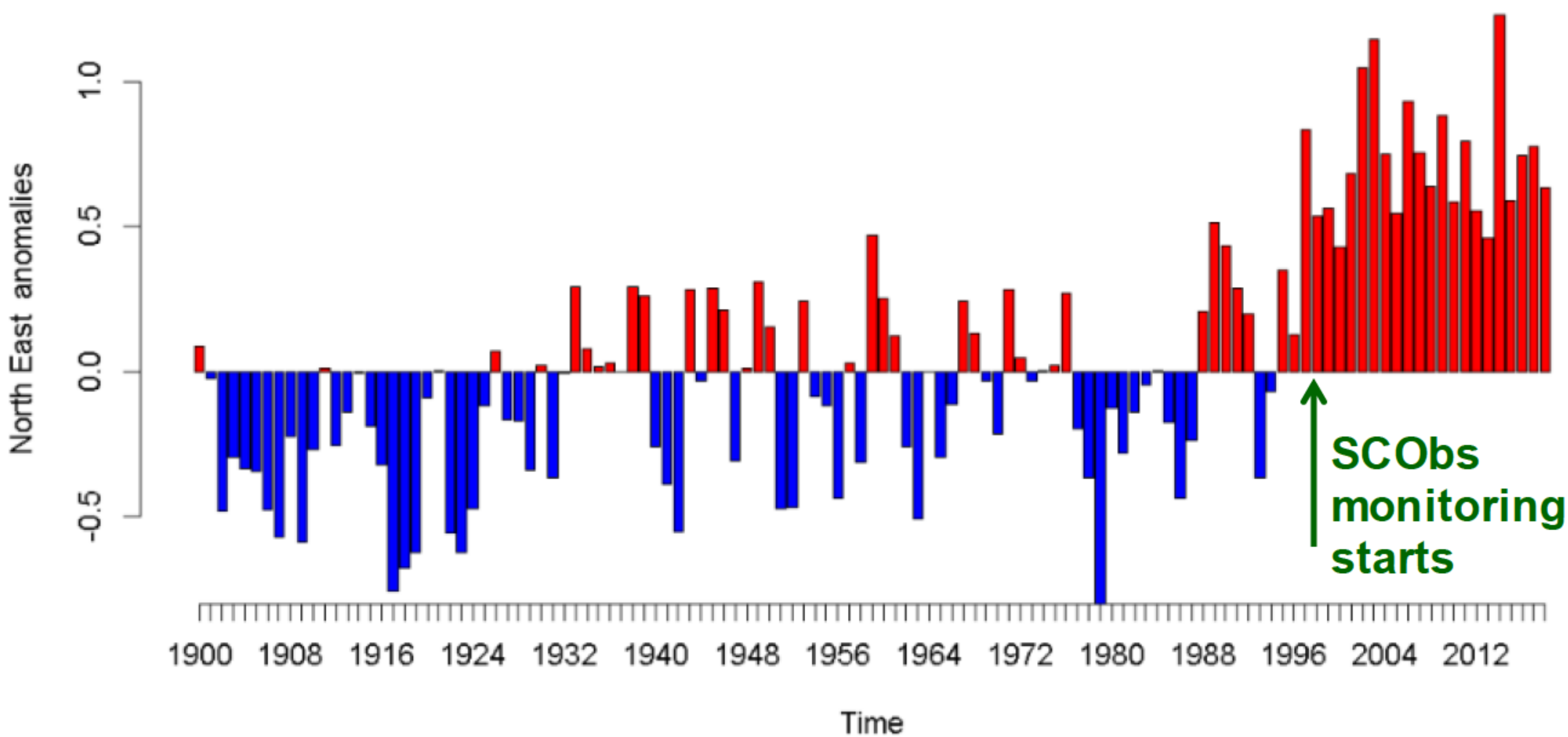
Annual temperature anomalies
North East of Scotland Scottish Marine Region



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Case for coastal temperature data

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ELSEVIER

Modelling temperature and fish biomass data to predict annual Scottish farmed salmon, *Salmo salar* L., losses: Development of an early warning tool

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Model performance
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ABSTRACT

Losses due to mortality are a serious economic drain on Scottish salmon aquaculture and are a limitation to its sustainable growth. Understanding the changes in losses, and associated drivers, are required to identify risks to sustainable aquaculture. Data on losses were obtained from two open source data sets: monthly losses of biomass 2003 – 2018 and losses of salmon over production cycles (numbers input minus output harvest) 2002-2016. Monthly loss rates increased, accelerating after 2010, while losses per production cycle displayed no trend. Two modelling frameworks were investigated to produce an early warning tool for managers about potential increases in losses. Both linear regression and beta regression showed that monthly losses related to biomass and minimum winter air temperatures with high precision and low bias. These relationships apply at both the national and regional levels where the beta regression best fit model explain 82 % and 69 % of variation in mortality, some regional differences apply, particularly for the Northern Isles. The lack of trend in losses per production cycle may have been due to shorter production cycles as more salmon were harvested earlier, and possibly increasing losses of larger salmon (which affects biomass but not numbers lost). In the long-term, the models predict that milder winters and increased biomass will be associated with increased mortality, which will need to be managed. In the short-term, given relatively little year-to-year variation in biomass, minimum winter temperature is a powerful early warning of the likely extent of losses in the Scottish salmon farming industry.

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Salinity at Loch Ewe