A comparative analysis of coastal environmental conditions in the eastern Norwegian Sea and southern Barents Sea by means of *Arctica islandica* growth records

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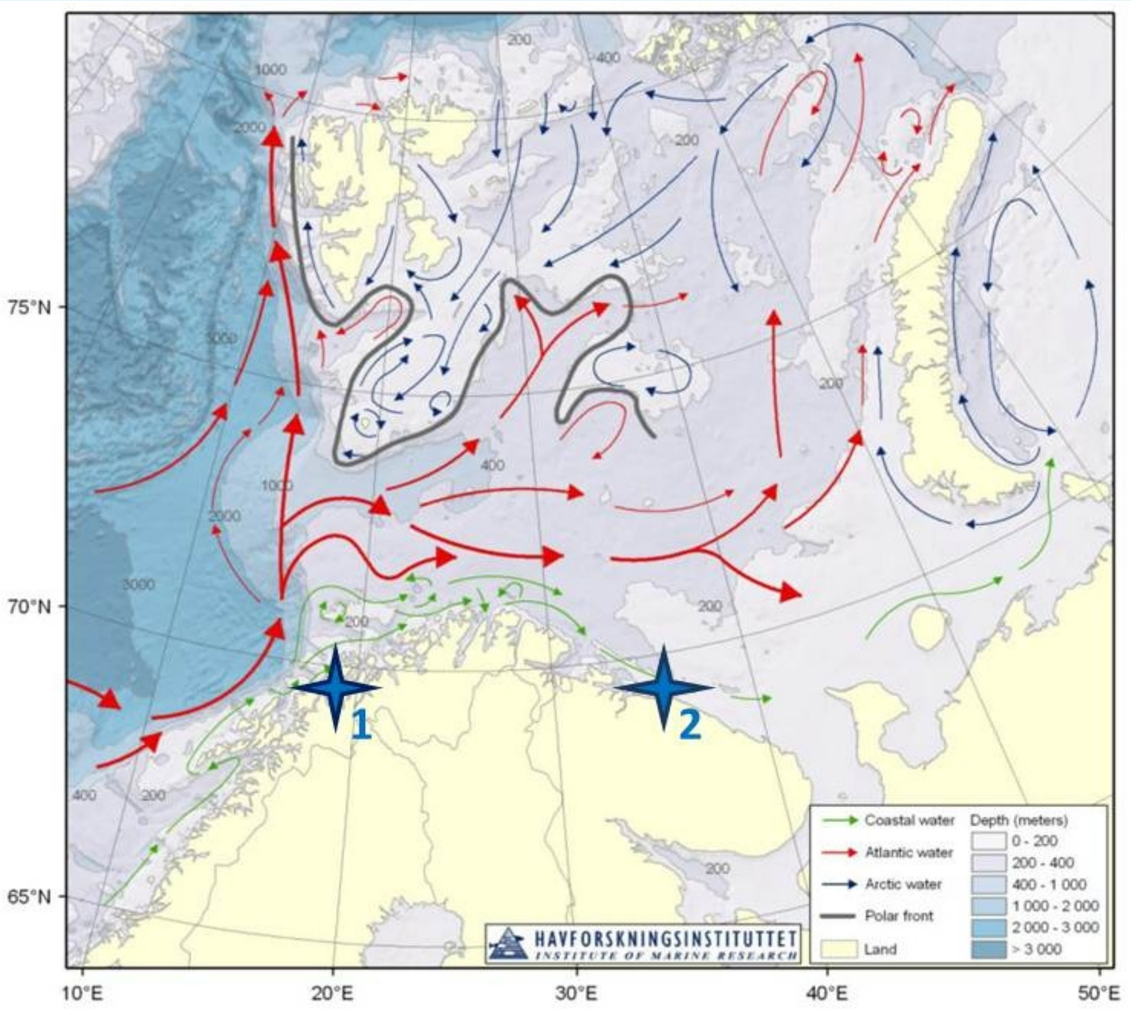

Figure 1 The map of the study area showing the main ocean circulations (arrows). Blue stars showing the two locations of the sampling points, 1: Norwegian coast, 2: Barents Sea coast. Arrows show the distribution of the currents, in red: Atlantic current, blue: Arctic current, green: Coastal current (Norwegian, Murman) (Map from Stiansen et al., 2005).

Objectives

- To analyse the growth variability in shells of *Arctica islandica* and to compare the results of the Norwegian and the Russian populations.
- To determine the external factors controlling the annual shell growth variability in *A. islandica*.
- To check for decadal oscillations within the growth patterns of *A. islandica.*
- To use stable oxygen isotopes ($\delta^{18}O$) to reconstruct seasonalities and water temperatures on a sub-annual level.

Study area

We examined the shells from two sampling sites the northern Norwegian coast (69°39'N 18°57'E) and the Kola Peninsula coast (69°11'N 36°05'E) (Fig.1). Both localities are in the realm of the Norwegian Coastal Current (after crossing the border to Russia it is called the Murman Coastal Current). It is expected that similarities in the oceanographic conditions are reflected in the shell, possibly occurring with certain time lag.

Figure 2 Left valve of *Arctica islandica* (sampled on the Norwegian coast). Red line indicate LSG (line of strongest growth).

Materials and methods

The shell material for this study comprises 30 and 32 shells of *A. islandica* from the Norwegian Sea and Russian coast of the Barents Sea respectively. All shells were collected alive and soft part were removed immediately after collection.

For the investigation of the annual and inter-annual growth variability all collected shells were cut parallel to the line of strongest growth (LSG) (Fig.2) and 3-mm thick-sections were attached to a glass slide. After grinding and polishing, the cross-sections were stained in Mutvei´s solution. Annual growth bands were identified and measured. To obtain the environmental influence we will use the so-called standardized growth index (SGI) (e.g. Wanamaker Jr. et al., 2009).

After the cutting the second part of the shell was used for stable oxygen isotope ($\delta^{18}O$) analysis (the result is not presented here).

SGI time series were analysed for significant spectral components using software package *kSpectra* (procedure described in Brey et al. 2011).

Preliminary results

The maximum onthogenetic ages are 118 years for the shells from the Barents Sea and 82 years for the Norwegian shells.

The *A. islandica* growth time series comprise 1999 single increment measurements for the shells from the Norwegian coast and 1893 measurements from the Barents Sea coast. Hereby, they cover a 77 year period (1927-2004) and a 113 year period (1897-2010) respectively (Fig. 3).

Spectral analysis (Fig.4) of the SGI records indicate a similarity for both localities in the 2-3 year periodicity. Noticeable cyclic variability in water temperature with the same periodicities have been found in that area (Bochkov, 2005). The signals with frequencies 0.08 yr^{-1} (period 12 yr), 0,18 yr^{-1} (5,5 yr) and 0,22 yr^{-1} (4,5 yr) were detected only in the Barents Sea SGI record.

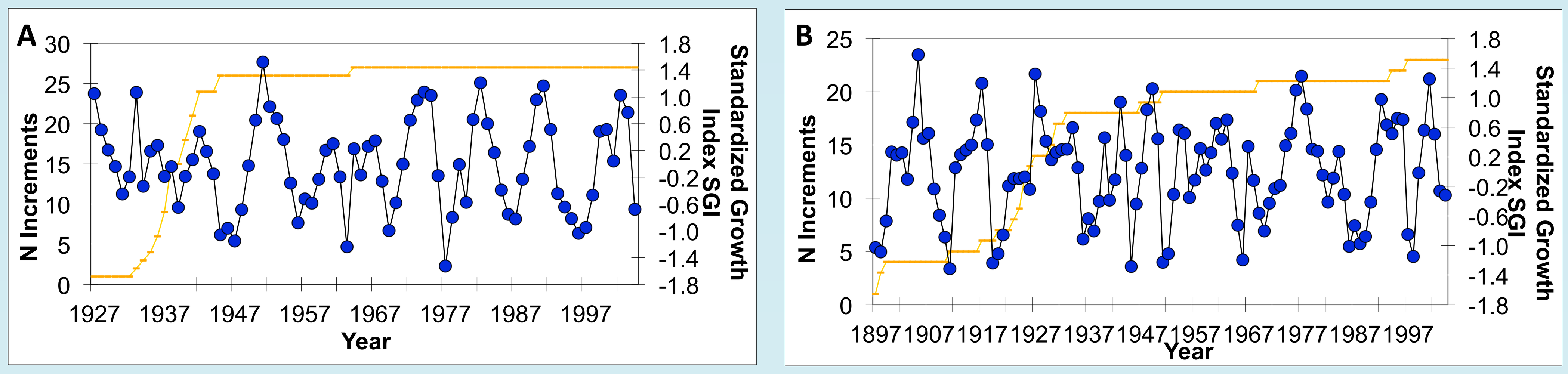

Figure 3 Time series of *A. islandica* growth, using standardized annual growth index (SGI), A – from the Norwegian coast (based on 1999 increment measurements in 30 Individuals), B- from Barents Sea coast (based on 1893 increment measurements in 23 individuals). Yellow line shows the number of measured increments in a relation to the calendar years.

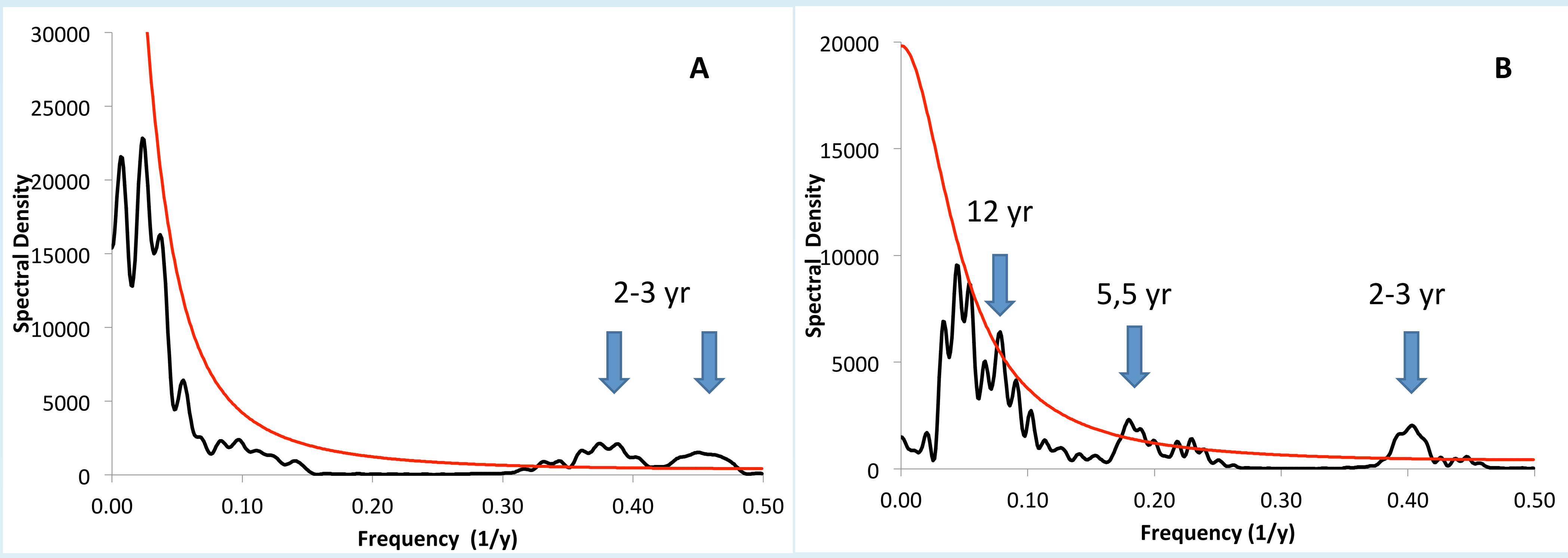

Figure 4 Power spectra of the *A.islandica* SGI time series (A-Barents sea, B-Norwegian coast), produced by Multi Taper Method (MTM). Red lines indicate red noise 95% confidence level.

Future work questions

- Is there a significant difference in the growth of *A. islandica* from the Barents Sea and Norwegian Sea?
- Which factors control the shell growth in both populations?
- Do we get seasonal signals from *A. islandica* shells measuring stable oxygen isotopes ($\delta^{18}O_{shell}$)?
- Can we reconstruct water temperatures using $\delta^{18}O$?

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