Summary of the Faroe Islands BioGeoSCAPES for the International BioGeoSCAPES community.

The Faroe Islands have only very recently (July 2023) become involved in BioGeoScapes international community through the ambassadorship of Dr. Ian Salter. It was not possible to find a date for a national meeting prior to the international workshop. However, in an attempt to solicit some preliminary input from the national community a briefing letter was sent to the main department leaders of academic centers involved in marine research in the Faroe Islands.

Q1: Thoughts on preliminary BioGeoSCAPES Mission statement this? How could this be improved?
"To improve our understanding of the functioning and regulation of ocean metabolism and its interaction with nutrient cycling within the context of a hierarchical seascape perspective".

We felt that the term **hierarchical seascape perspective** was perhaps a bit difficult to understand for a general audience. The term could be changed to just **seascapes** for the mission statement

Nutrient cycling is perhaps a bit too specific, could perhaps be changed to **biogeochemical cycling**

Ocean metabolism – Perhaps would be interpreted in its traditional understanding of the respiratory balance, and not encompass the full range of ocean metabolism.

Alternative suggestion: *Develop a mechanistic understanding of how microbial activity regulates ocean metabolic pathways and shapes biogeochemical seascapes.*

Q2: How would your nation best contribute to BioGeoSCAPES efforts? – e.g. fieldwork, laboratory work, modelling, intercalibration efforts, project coordination, data management, bioinformatics

The Faroe Islands could best contribute to BioGeoSCAPES efforts by building capacity through existing national efforts and initiatives that are currently in place.

a) *Fieldwork* – The Faroe Marine Research Institute has recently acquired a new state-of-the-art research vessel that it operates year round February-November. There are a number of standard programs that have sustained funding for monitoring purposes that could provide a useful platform for BioGeoSCAPES observation programs, building on existing observations

b) *Large-Scale Oceanography* – The NE Atlantic encompasses the confluence of contrasting subarctic water masses from the subpolar gyre and Atlantic waters carried by the North Atlantic Current, and advected north from the Bay of Biscay. Consequently the nutrient dynamics within this region are highly sensitive to the strength and size of the subpolar gyre and lateral shifts of the Subarctic front (SAF) – the large-scale nutrient front. However, in order to fertilize the poleward flowing Atlantic waters, subarctic waters of the subpolar gyre must be transported across the SAF. The nutrient concentrations off the south Iceland and European continental slopes are therefore regulated by the SAF dynamics and the winter convection – both associated with the dynamics of the SPG – as well as the summer mixed layer dynamics.

The ocean climate of the southern Norwegian Sea - the Norwegian Basin - is largely set by the relative amount of Atlantic Water in the eastern and Arctic Water transported from the Iceland and Greenland Seas. Both nitrate and silicate winter (pre-bloom) concentrations are significantly higher in the Arctic Water compared to Atlantic Water, and there is a reduction in nutrients from the 'Arctic periods' compared to Atlantic periods. Since these nutrients can be interpreted as the potential for new production, changes in the influx of western Arctic waters are expected to have a bottom-up effect on the Norwegian Sea. The amount of Arctic waters and their concentration of nutrients and zooplankton are more important for the Norwegian Basin ecosystem functioning rather than the temperature of the Atlantic waters.

The upper layer water masses that flow northeastwards through the North Atlantic and through the Iceland-Faroe gap immerse the Faroe shelf. The Faroe Shelf system therefore represents a good observational framework to examine impacts of onwelling on all major shelf ecosystem components –

from nutrient-driven plankton dynamics to upper trophic levels. This system may thus serve as a useful model for understanding oceanic influence on boreal shelf systems in general.

c) *Modelling*
Modelling capabilities in the Faroes are limited to regional high-resolution models covering the Faroe plateau. FarCoast800 is run by the Aquaculture Research Station, in collaboration with the Marine Research Institute in Norway. It is a Regional Ocean Model System (ROMS) model setup for the Faroe shelf with a horizontal resolution of 800m x 800m and 35 vertical layers.
The Faroe Islands do not yet have super-computing facilities, able to run large-scale demanding models.

d) *FAMEOS* – In 2018 we established an –omics (ocean biomolecular observing network) observing program as part of the newly established program FAMEOS (Faroese Marine Ecosystem Observing Study). FAMEOS currently has two nodes, a weekly time-series on the Faroese Shelf and a bi-annual spatial study (20 stations) in a demersal fishing ground. Consequently we have an archive of eDNA that can used for microbial community dynamics and linked to nutrient biogeochemistry in addition to potential to add more advanced –omics approaches to our monitoring. We are seeking to extend the spatial and temporal resolution of our biomolecular observing network to cover key hydrographic and biogeochemical regimes.

d) Historical Time-Series – The Faroese Marine Research Institute has a long history of monitoring oceanographic parameters from repeated transects North, South East and West of the Faroe Islands that cover key Atlantic and Sub-Arctic water masses relevant for Atlantic-Arctic basin scale connectivity. These time-series have generated long-term and valuable datasets of temperature, salinity, fluorescence, dissolved oxygen, nutrient profiles, and discrete samples phytoplankton and zooplankton data.

Q3 - What science questions are most important to your nation within the broad scope of BioGeoSCAPES on a 10-year timeframe?

How do large-scale changes in nutrient biogeochemistry and ocean metabolism influence productivity and prevailing phytoplankton traits of the Faroese Shelf ecosystem

How do changes (natural and anthropogenic) in pelagic and demersal fish stocks influence the cycling of carbon and nutrients through ocean metabolic pathways.

How does microbial metabolism influence the cycling of nucleic acids through particulate and dissolved phases in seawater.

Q4 Are there any impediments that the international community could seek to mitigate via training or collaboration?

We are quite a small nation and thus despite our enormous potential, lack expertise in a key areas that could help us to significantly contribute towards the BioGeoSCAPES overall objectives. Training and collaborative efforts that would be particularly valuable are:

a) Sampling and analysis of transcriptomic, proteomic and metabolomics techniques

b) Standardizing approaches for rate measurements to align with the BioGeoSCAPES communit

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