Blue carbon refers to carbon dioxide that is absorbed from the atmosphere and stored in the world's ocean and coastal ecosystems (biotic tissues and sediments). The temporal persistence of the storage can differ from hours to tens of years. The carbon fixed in phytoplankton and benthic algae biomass remains there for a short period (hours to months), the carbon stored in benthic animal biomass persists for a longer duration (months to years). The fraction of carbon that is buried in anoxic sediments (preventing aerobic respiration and thereby decreasing the remineralization rate) is regarded as **sequestered carbon** because it is **removed from the carbon cycle for at least 100 years** and evidently provides the **most efficient mechanism for rising greenhouse gasses effects mitigation**.

Climate warming will reshape the patterns of geographical distribution of macroalgae in the ocean. In contrast to the global trends of dramatic declines in macrophyte habitats areal coverage and the loss of kelp forests at their low latitude distribution limits, polar kelp beds are predicted to expand in terms of aerial coverage, stocks and productivity. Expanding kelp bed habitats are likely to define the functioning and biodiversity of the future polar ecosystems as well as to reshape the spatial distribution of blue carbon efficiency across the global oceans with the growing importance of the polar regions in mitigating effects of rising greenhouse gas emissions.

The kelp importance to carbon-storage extends well beyond the vegetated rocky bottom habitat boundaries and is defined by kelp forests role as carbon donors to other systems. The pathways and the magnitude of this carbon transfer as well as the sequestration efficiency of the receiver sites remain undescribed for the present and future Arctic and Antarctic coastal habitats. Fiordic deep basins are characterized by sediment accumulation and organic carbon burial rates a hundred times higher than the global ocean average and are natural receiver sites to dense kelp beds commonly growing on the fiordic shallow banks, therefore can be very effective in capture and long-term storage of kelp derived carbon.

In this study we will apply sediment eDNA, drop camera seabed imagining, mixing modelling of stable isotope data and radionuclide dating of sediment cores to understand the potential of Arctic and Antarctic fiordic basins to act as hot spots of Blue Carbon sequestration at the regional and global scale. In particular we aim to explore:

1. How is kelp derived detritus distributed on the bottom in the central basins of the polar fiords in relation to the location of the donor algal beds? Are kelp detritus distribution patterns reflected in the spatial distribution of kelp derived organic carbon stocks in surface sediments?

2. If the eDNA footprint of algal species in deeper basins reflect the taxonomic composition of the fiordic shallow water kelp communities?

3. What is the magnitude of the kelp derived organic carbon sequestration in deeper sediment layers in Arctic and Antarctic fiordic basins? Is it comparable to values reported from lower latitude sedimentary habitats?

We **hypothesize** that **Arctic and Antarctic fiordic basins can act as hot-spots of macroalgal detritus sequestration**. The research will be conducted in west Spitsbergen and King George Island coastal waters, particularly in fjords, where the intensive macroalgal production is coupled with the high rates of sediment accumulation rates dictated by the high loads of minerals transported by the glaciers and restrictive nature of fiordic basins compared to more open coastal environments. Quantification of the sequestration capacity of these habitats will provide the basis for evaluation of their current and future role in greenhouse gasses emissions effects mitigation and promoting conservation of both kelp detritus donor and receiver habitats in polar regions as already advocated for such systems in temperate waters.