

# "RAW - RETREAT AND WITHER"

## What is the influence of glaciers recession from tidewater to land-based on the marine biological production and biogeochemistry in the Arctic?

### Abstract

The **productivity of marine ecosystems** is an important factor in conditioning elements and organic matter cycling on Earth. It also influences the composition of the atmosphere and thus shapes our climate. The world's oceans are a great source of O<sub>2</sub> and sink for atmospheric CO<sub>2</sub>. They absorb more than 20% of anthropogenic CO<sub>2</sub> emissions and therefore **limit global warming**. The Arctic Ocean, due to its relatively **high productivity** and low water temperatures **enhances CO<sub>2</sub> solubility**, is responsible for one-tenth of the global CO<sub>2</sub> uptake by marine regions. This makes the **Arctic marine ecosystems** important components in the **global carbon cycle**. Recent findings show that **Arctic fjords** are especially **effective in absorbing atmospheric CO<sub>2</sub>**. The biogeochemistry of the fjord systems is very complex and not yet fully understood. The great unknowns that remain include the effect of glacial retreat on the CO<sub>2</sub> budget of coastal waters.

Climate change is disproportionately strong in the **Arctic**, which is **the most rapidly warming region on Earth**. One of the observable consequences of the transformation of the Arctic environment is the **rapidly receding glaciers**. Due to glaciers' calving, submarine melting, and drainage of meltwater through glacial outflows, **glaciers are recognized as the main source of freshwater supply** into the fjords, mineral, organic matter, and **nutrients**. These **nutrients affect marine primary productivity** in the areas where there are tidewater glaciers. However, there is a growing body of evidence suggesting that **deepwater upwelling** at the terminus of tidewater glaciers **causes the most important increases in primary production**.

Furthermore, sustained **glacier recession will change the glacial regime** from predominate tidewater to land-based. The current oceanographical, sedimentological, and biogeochemical conditions will, therefore, adopt more characteristics of land-based glaciers and non-glacial inputs. This, in turn, may **alter the total nutrient flux supplied to the euphotic zone**.

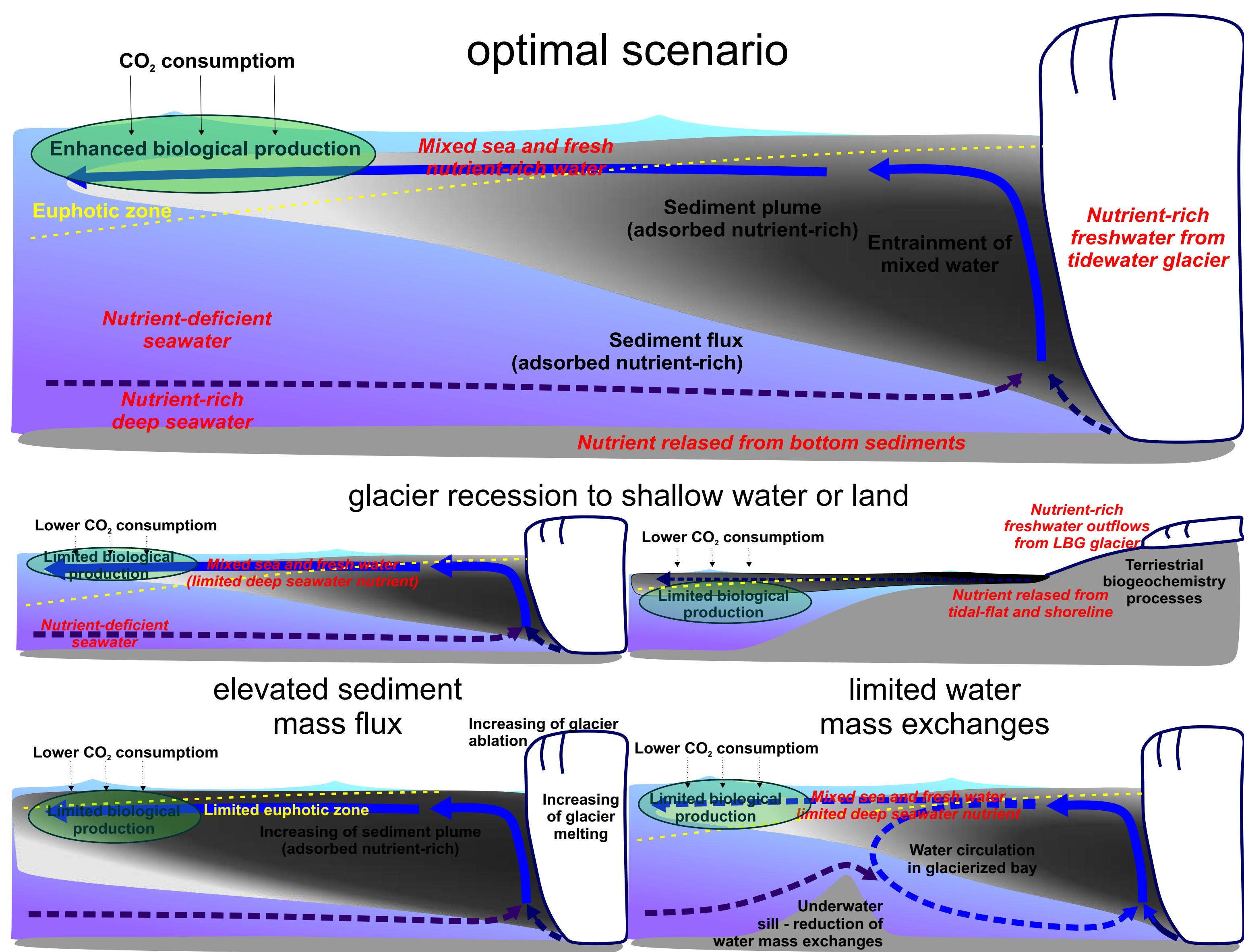
Therefore, it remains uncertain how the marine ecosystem productivity will respond to future changes in the Arctic.

### Project hypothesis

The warming-driven glacier recession causes a reduction in marine biological production in polar coastal regions and seas due to:

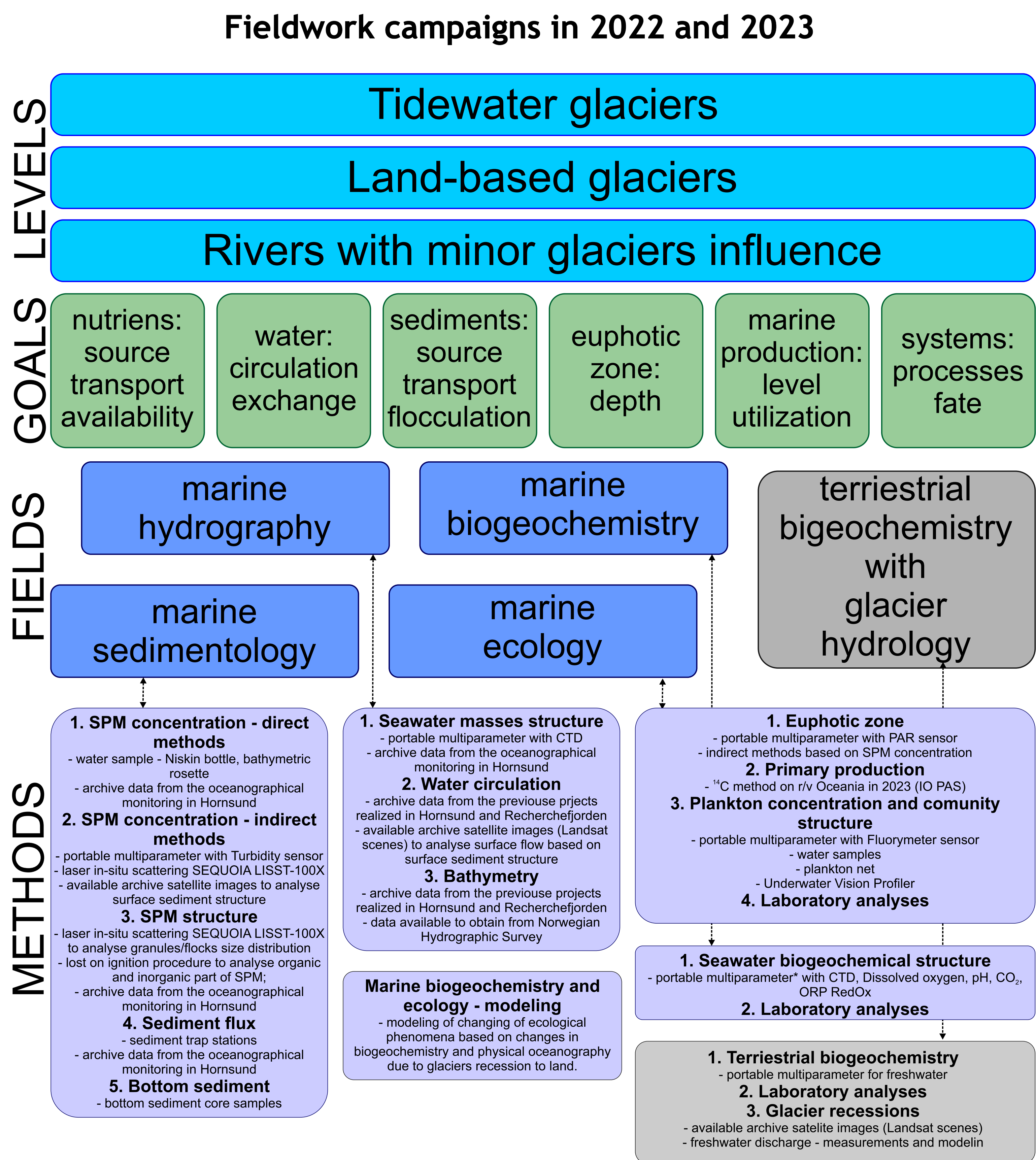
- **unfavorable nutrient balance caused by a reduction in nutrient-rich deep water upwelling from buoyant meltwaters plumes;**
- **shallowing the euphotic zone caused by increased surface suspended sediments concentration;**
- **reduction of water mass exchanges and sediment-bound nutrients transfer between the fjord/open sea and newly formed bay due to hydrography and formation of natural sediment traps.**

### Conceptual model of the project hypothesis



### Preliminary project results on other conference posters:

- Korhonen M. Comparison of sedimentation processes in coastal waters influenced by marine-terminating and land-based glaciers
- Szeligowska M. An integrated approach to blue carbon estimates in Hornsund, an expanding Arctic fjord affected by dark plumes of glacial meltwater
- Szeligowska M. Polar fjords will not wither after the retreat of marine-terminating glaciers?
- Trudnowska E. Watched in a flake - interplay between ocean biogeochemistry and plankton in varying states of glacier melt reflected by morphology and distribution of marine aggregates



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Project webpage: [www.raw-grieg.igf.edu.pl](http://www.raw-grieg.igf.edu.pl)