UNDERWATER LIGHT AVAILABILITY IN FJORDAL ECOSYSTEMS

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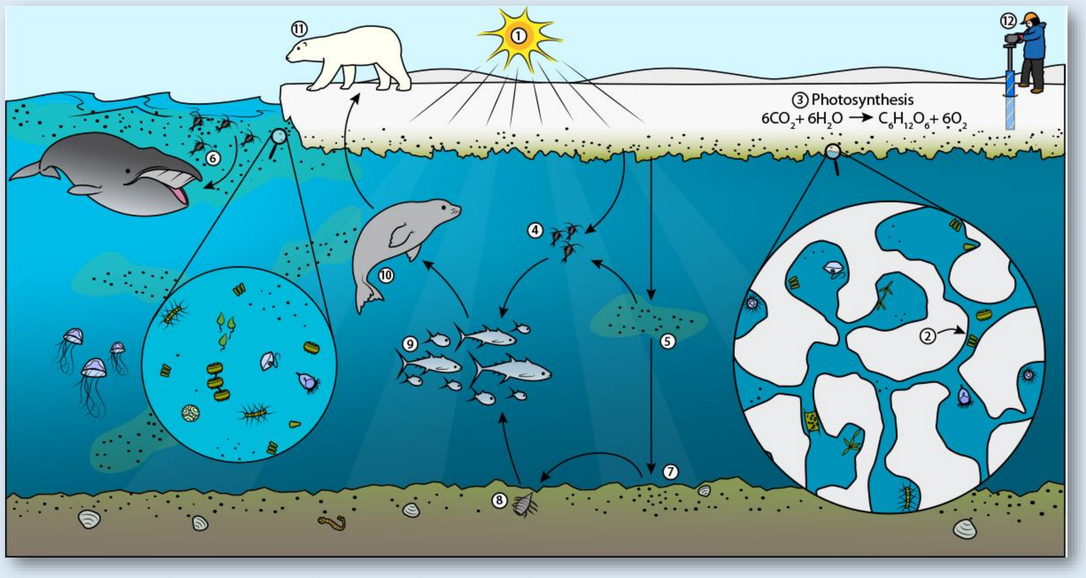

Figure 1: Schematic of Arctic food web (https://greenlandicecaps.weebly.com/the-arctic-food-web.html)

Role of light in aquatic ecosystems

- Light plays an essential role in aquatic food webs
- Under water, light is either absorbed or scattered by water constituents
- The optically active constituents (OACs) include phytoplankton, organic matter and sediments
- Abundance of OACs determine light availability underwater
- The constituents also determine color of water in aquatic ecosystems

Accelerated melting in the Arctic

- Greenland, 2nd largest Ice-Sheet in the world
- Its mass loss has quadrupled over last two decades
- Meltwater contributes to about ¼ th of the present sea level rise
- Melting glaciers also release sediments referred to as 'glacial flour'
- Released sediments affect light availability and alter ecosystem functioning

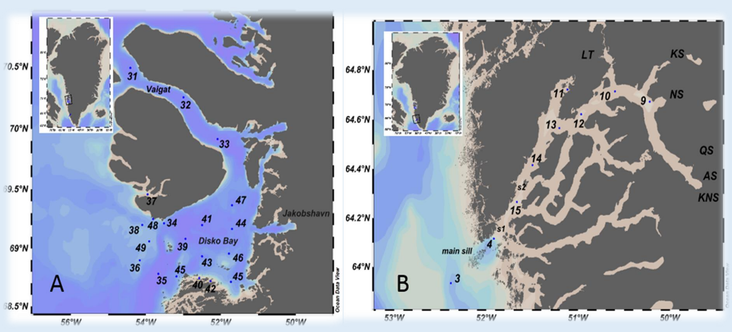

Figure 2A. Areas of study, (A) Vaigat-Disko Bay and (B) Godthabsfjord, along the coasts of West Greenland.

Fjords along coasts of Norway & Greenland

- Fjords are estuaries formed by glacial activity
- Fjords form transition zones between Ice-sheets and the ocean
- Profiles of spectral light measured using radiometers
- Water samples collected at descrete depths to determine concentrations of optically active constituents

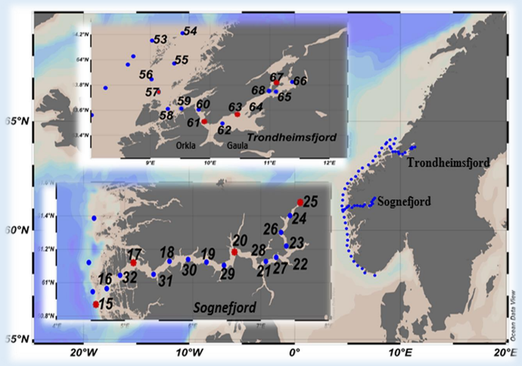

Figure 2B. Areas of study, Sognefjord and Trondheimsfjord along west coast of Norway.

Key findings & Take away

- Three spectral types of one percent irradiance curves identified along fjord transects in Norway and Greenland

  • Type 1: V-shaped, with ~ 500 nm traveling deepest
  • Type 2: U-shaped, with ~ 500 – 560 nm traveling deepest
  • Type 3: V-shaped, with ~ 560 nm traveling deepest

- Spectral types not specific to fjord sections but strongly influenced by concentrations of optically active constituents in the sections

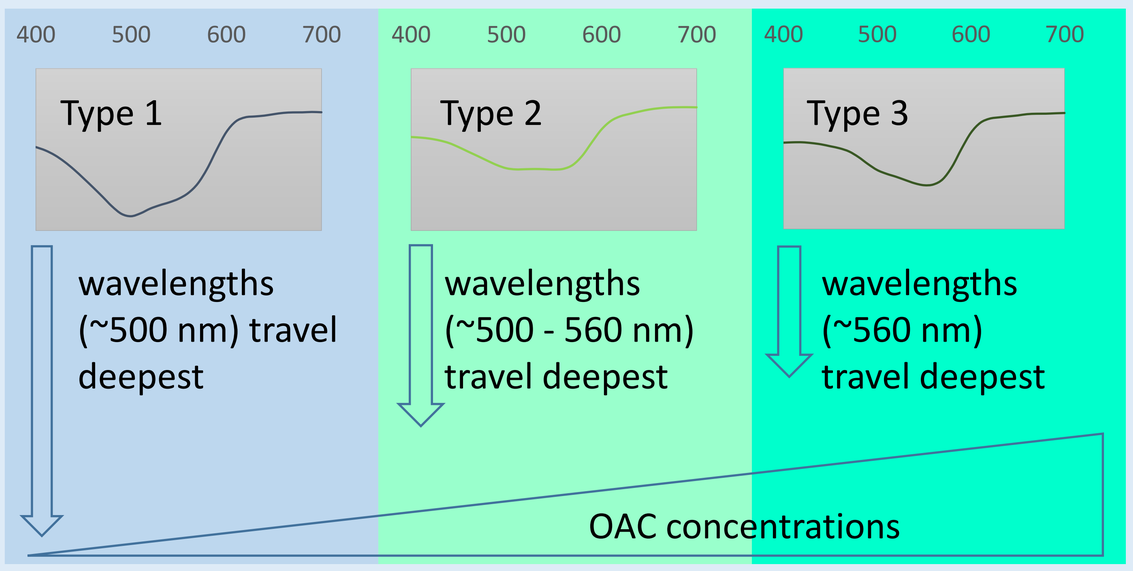

Figure 3. Schematic of one percent irradiance spectral types identified along fjord transects (OAC: Optically Active Constituent)

Acknowledgements and References

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- Schlitzer, R., Ocean Data View, odv.awi.de, 2018.
- Straneo, F., and Cenedese, C., The dynamics of Greenland's glacial fjords and their role in climate, Anu. Rev. Mar. Sci. 2015.
- Mascarenhas, V., Voß, D., Wollschlaeger, J., and Zielinski, O. (2017). Fjord light regime: Bio-optical variability, absorption budget, and hyperspectral light availability in Sognefjord and Trondheimsfjord, Norway. *Journal of Geophysical Research: Oceans* 122(5), 3828-3847

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