DOM and nutrients from rivers to coast: observations and experimental results (and impacts on coastal ecosystems)

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Background: Coastal ecosystems and terrestrial inputs

Major anthropogenic drivers

Climate change

Land use change

Watershed biogeochem. change

Environmental factors

Increased DOM/DOC

Increased nutrients

Decreased light quality/quantity

Decreased pH (acidification)

Ecosystem effects

Alteration of carbon cycle

Change in community structure

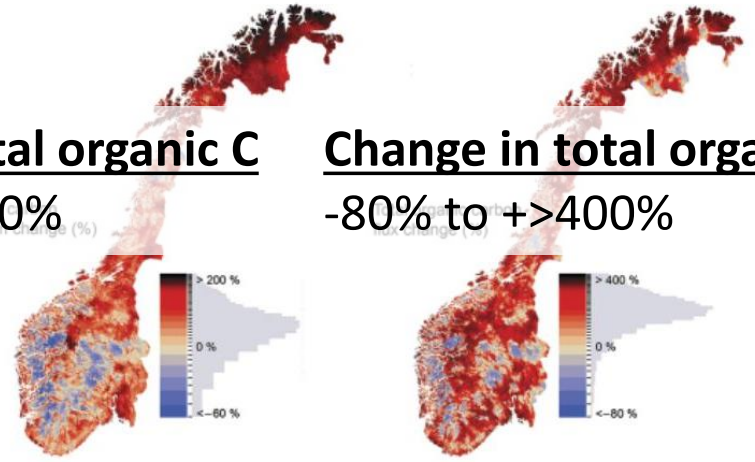
Change in food quality/quantity

Change in total organic C

-60% to +>200%

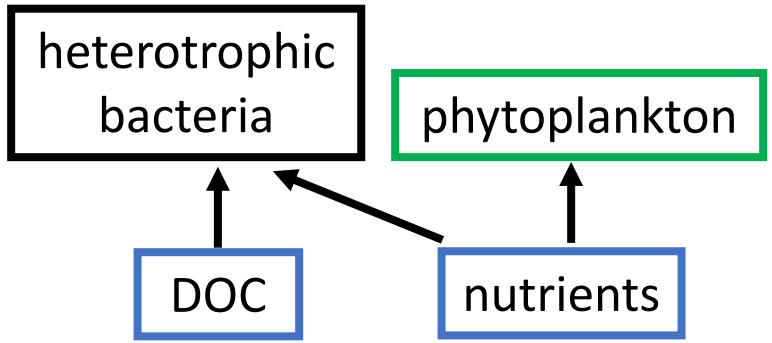
Change in total organic C flux

-80% to +>400%



From Monteith et al. (2007)

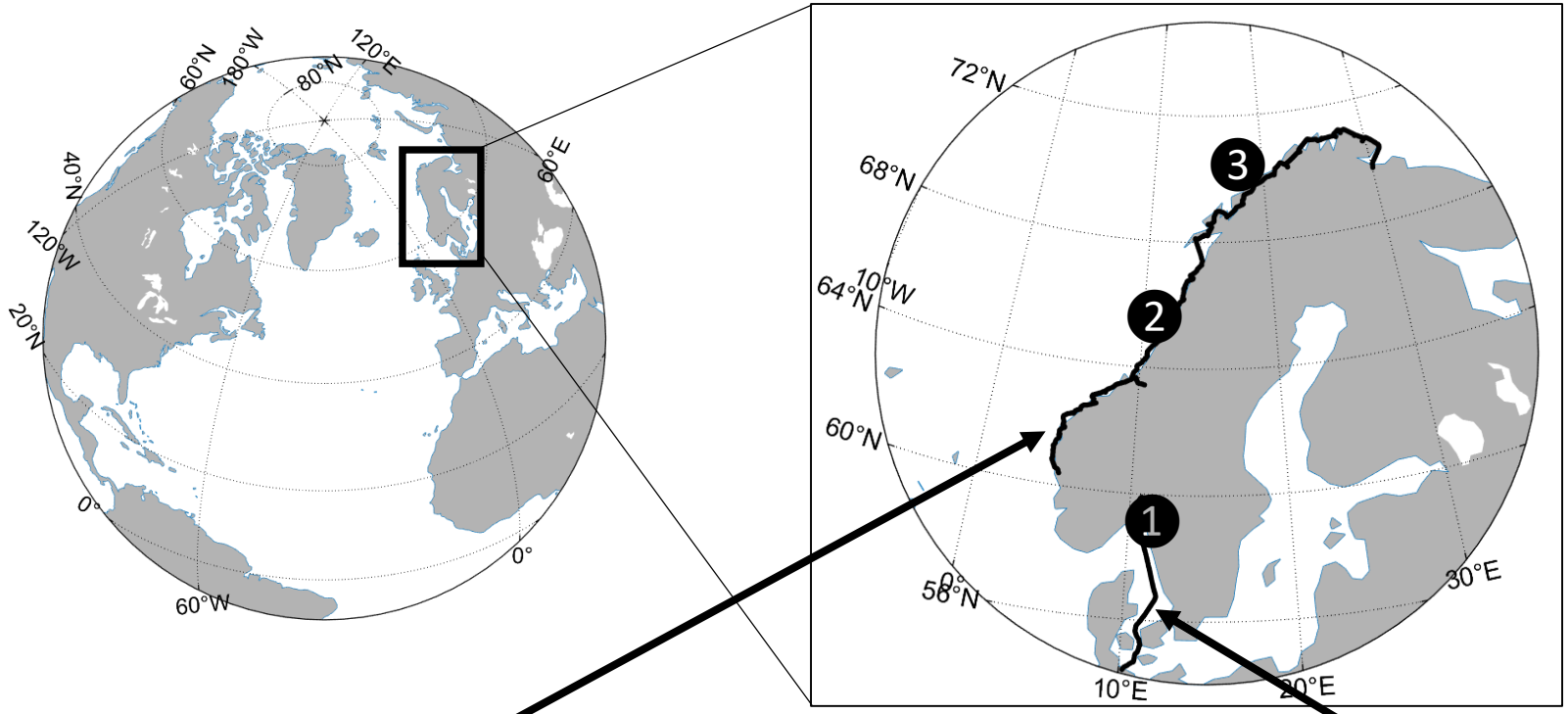
Autotrophy:heterotrophy balance



Simplified from Thingstad et al. (2007)

Methods

- River sampling and sensors
- NorSOOP FerryBox Ships of Opportunity
- Research cruises
- Mesocosm experiment



M/S Trollfjord

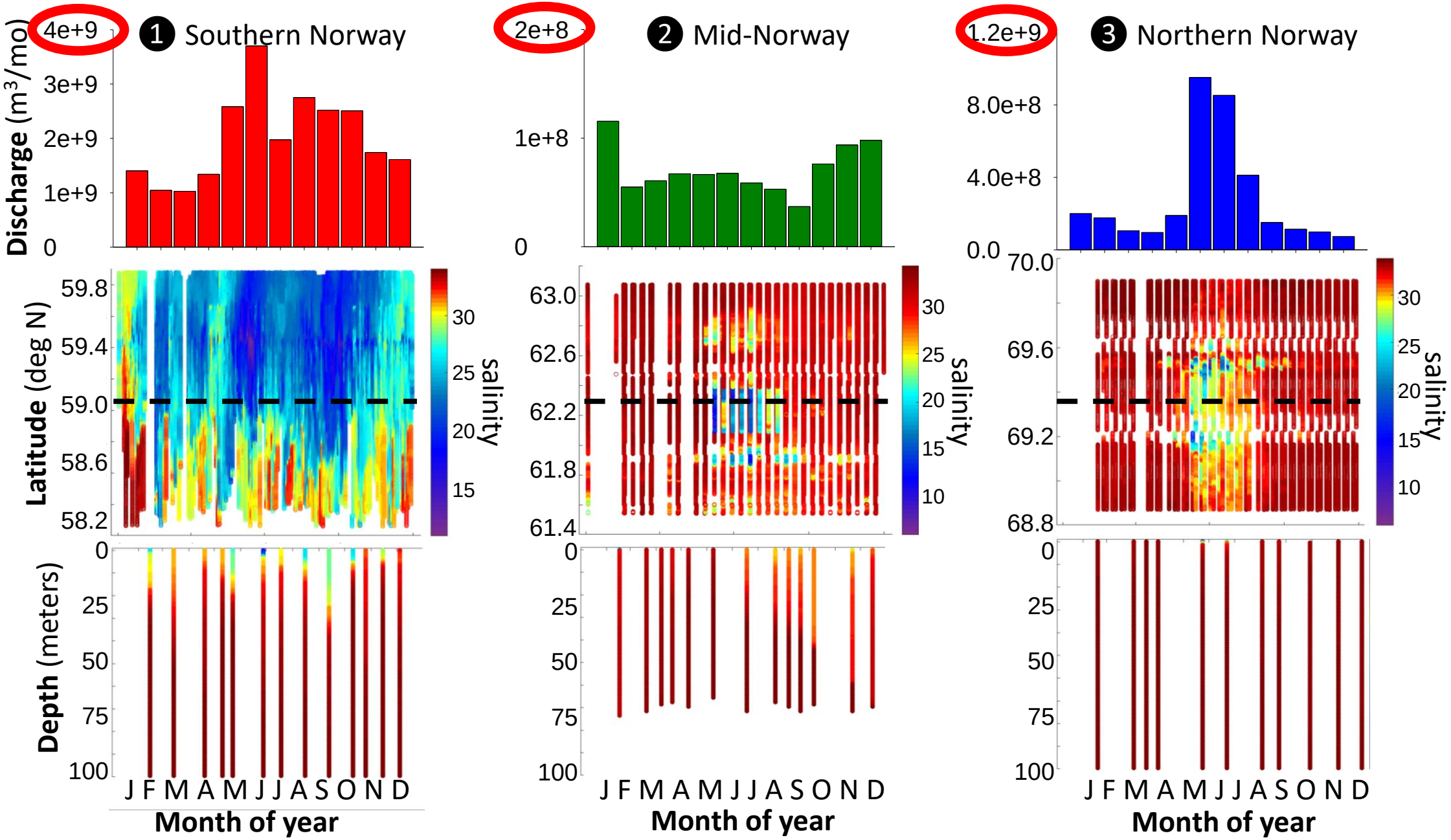
M/S Color Fantasy

Impacts of freshwater input

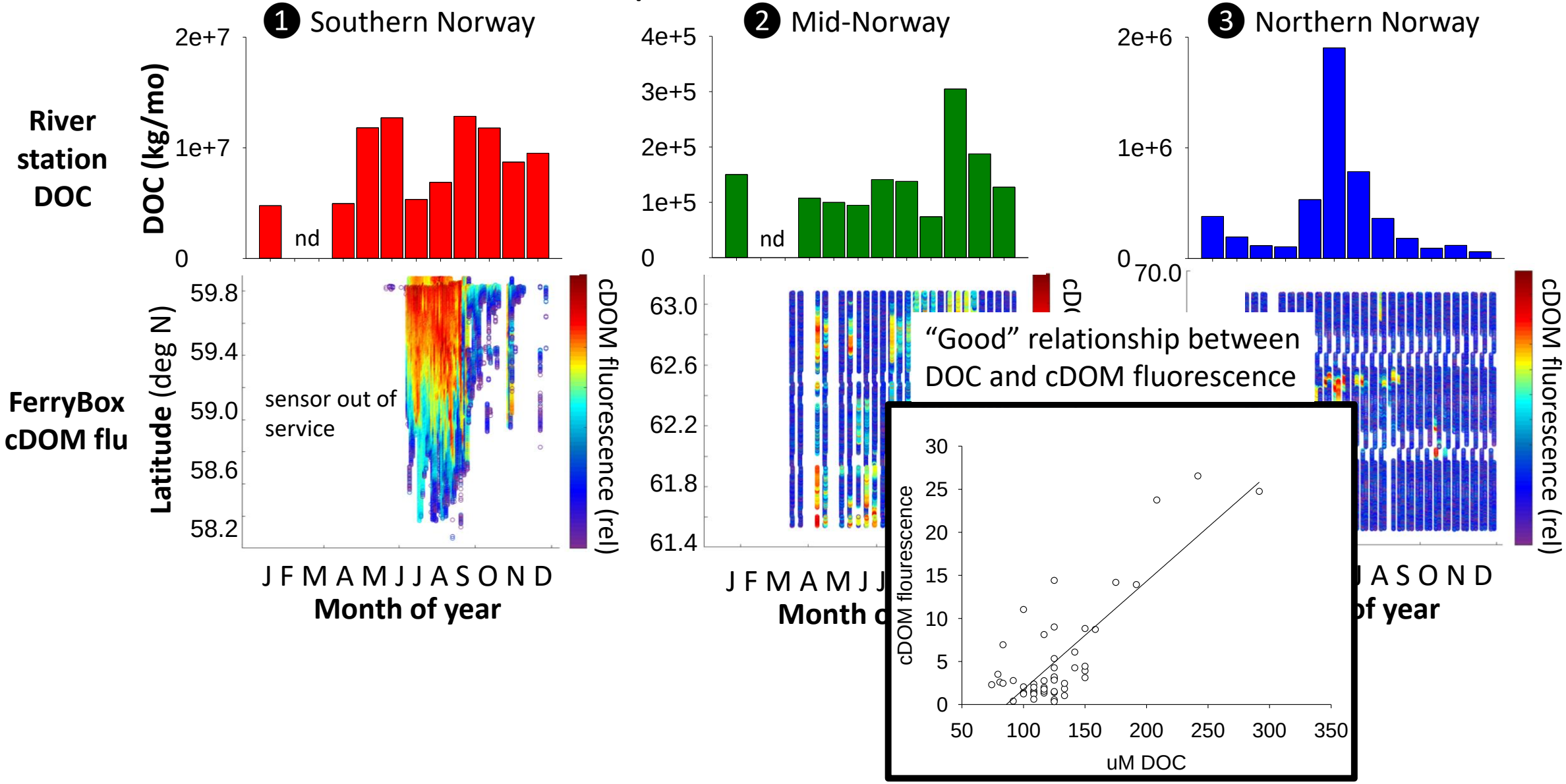
River station discharge

FerryBox salinity

CTD cast salinity

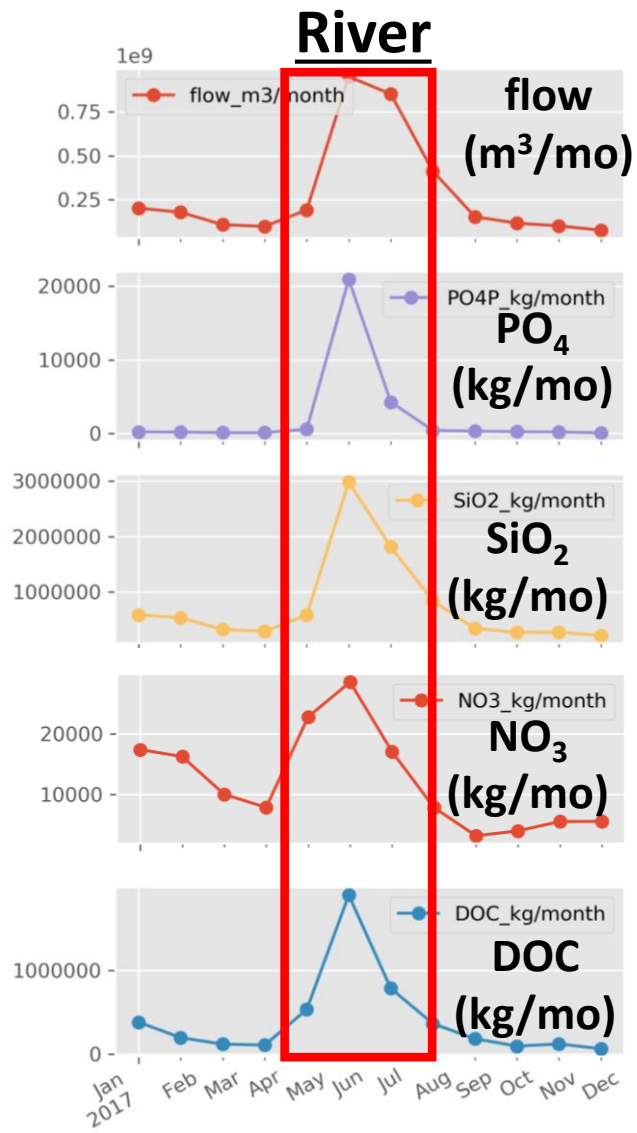


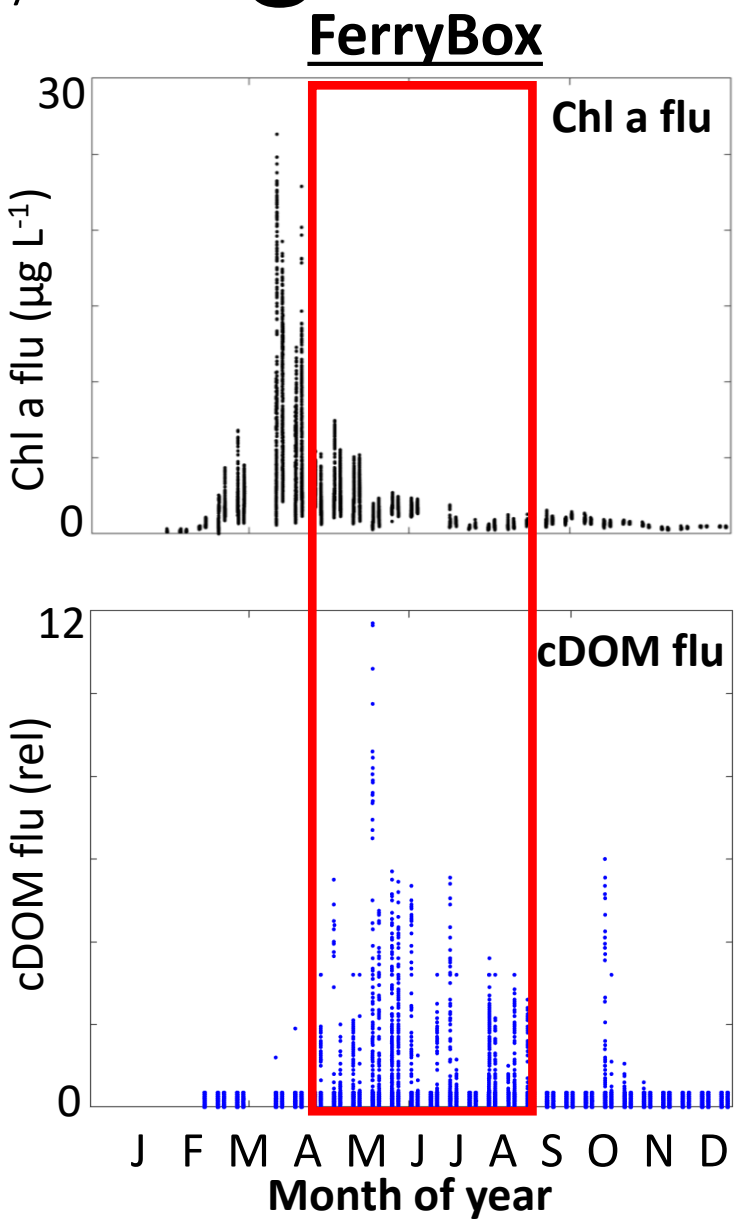
cDOM fluorescence and DOC input into coastal waters



cDOM , nutrients, and phytoplankton bloom

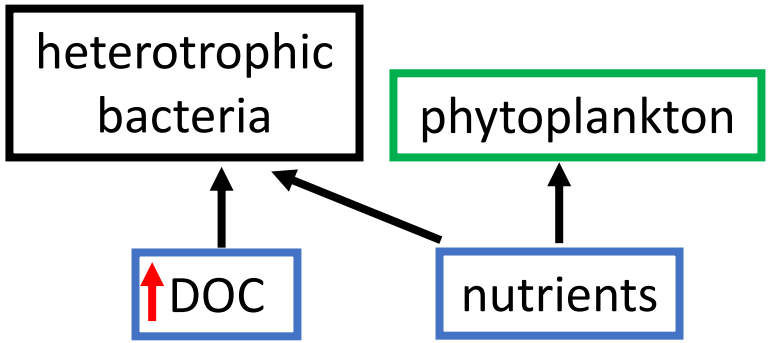
Example of northern Norway station ❸





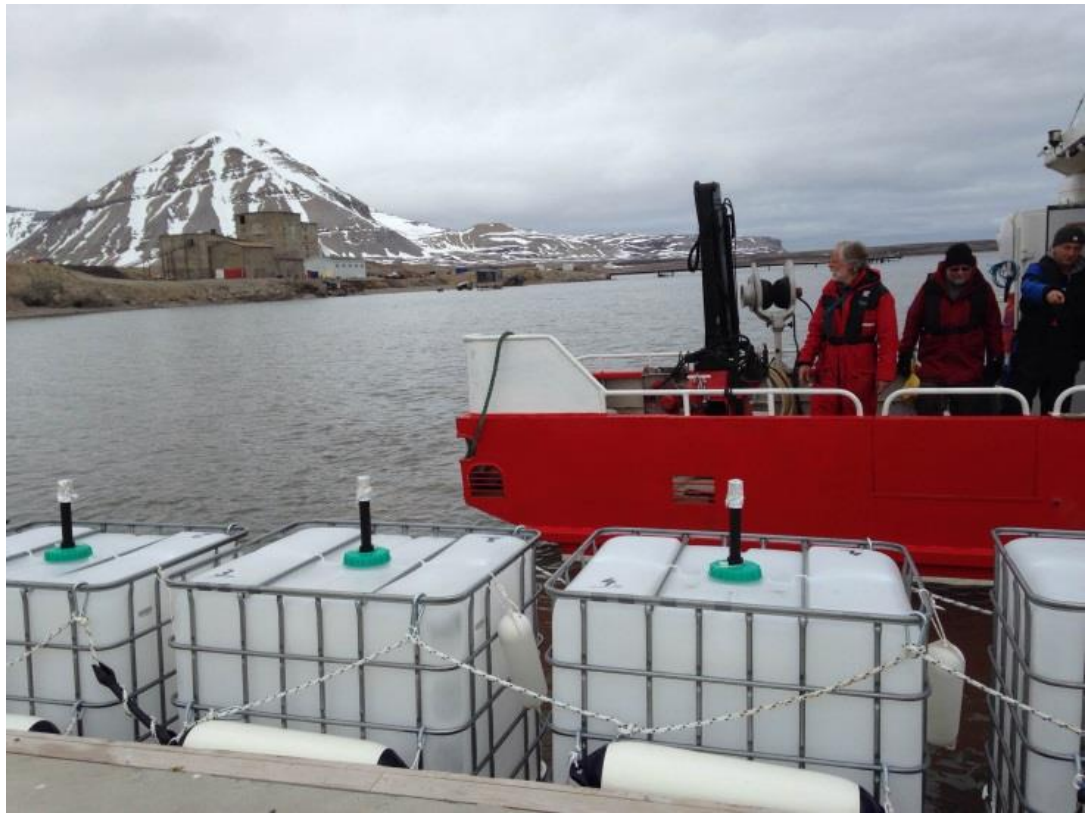
- Phytoplankton bloom began in Feb/March fueled by light and winter nutrient reserves
- Despite mid-year nutrient input, phytoplankton bloom subsided; possibly linked to light or minimum foodweb model?

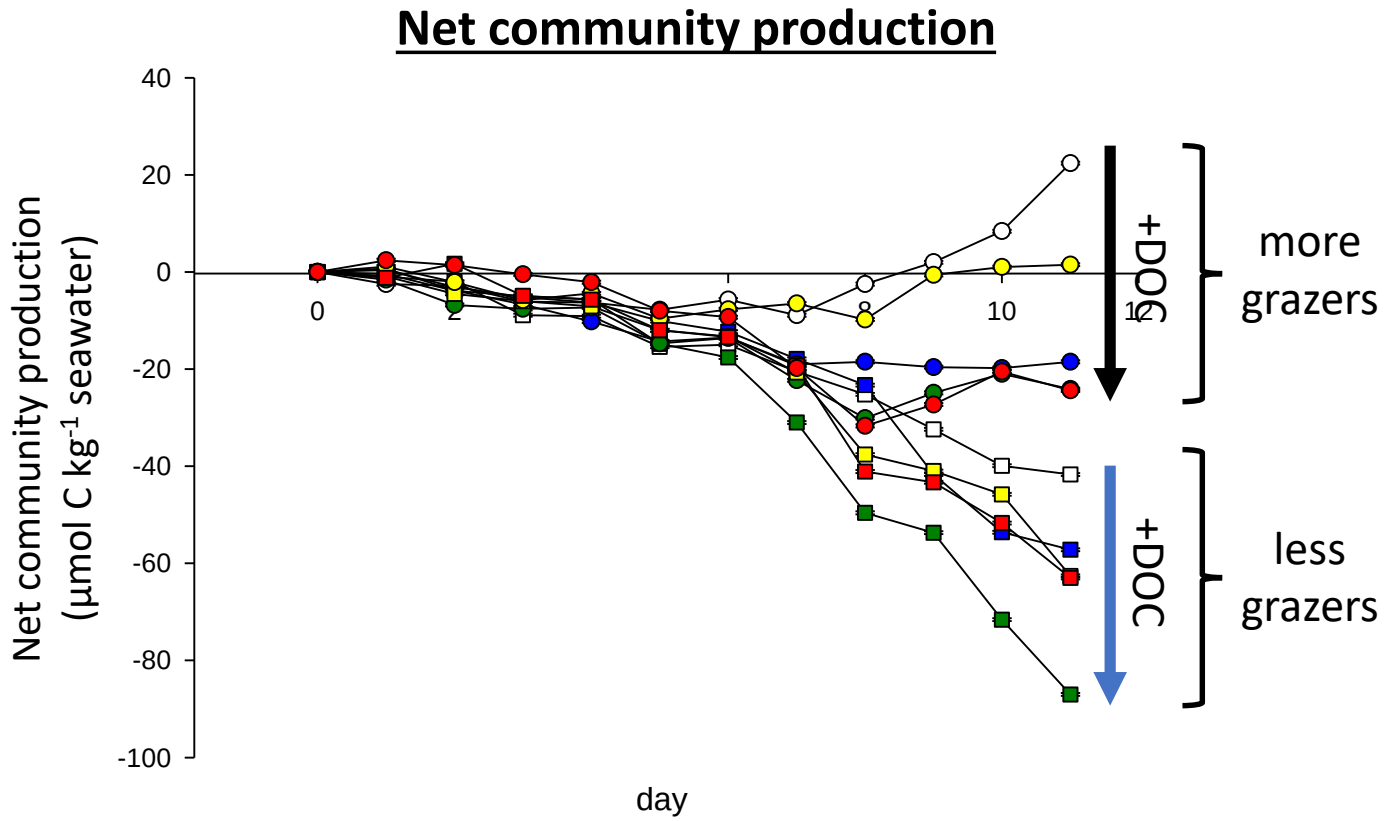
Autotrophy:heterotrophy balance



DOC and autotrophic:heterotrophic C balance

Mesocosm experiment in the Arctic





- DOC addition favored heterotrophic bacteria; resulted in ~-0.2 pH and ~+200 ppm pCO_2
- Grazer addition favored autotrophic phytoplankton

Tsagaraki et al. (2018), Bellerby et al. (in prep.)

Summary & conclusions

- Seasonal variability in DOM/DOC inputs into different systems
- Observations indicate that phytoplankton do not take advantage of nutrient input during summer months (Grazer-limited? Light-limited?)
- Experimental findings support that +DOC -> net heterotrophy & exacerbates coastal acidification
- 2018+ data to work up; experiments planned to characterize DOM/DOC reactivity and bioavailability

Acknowledgements

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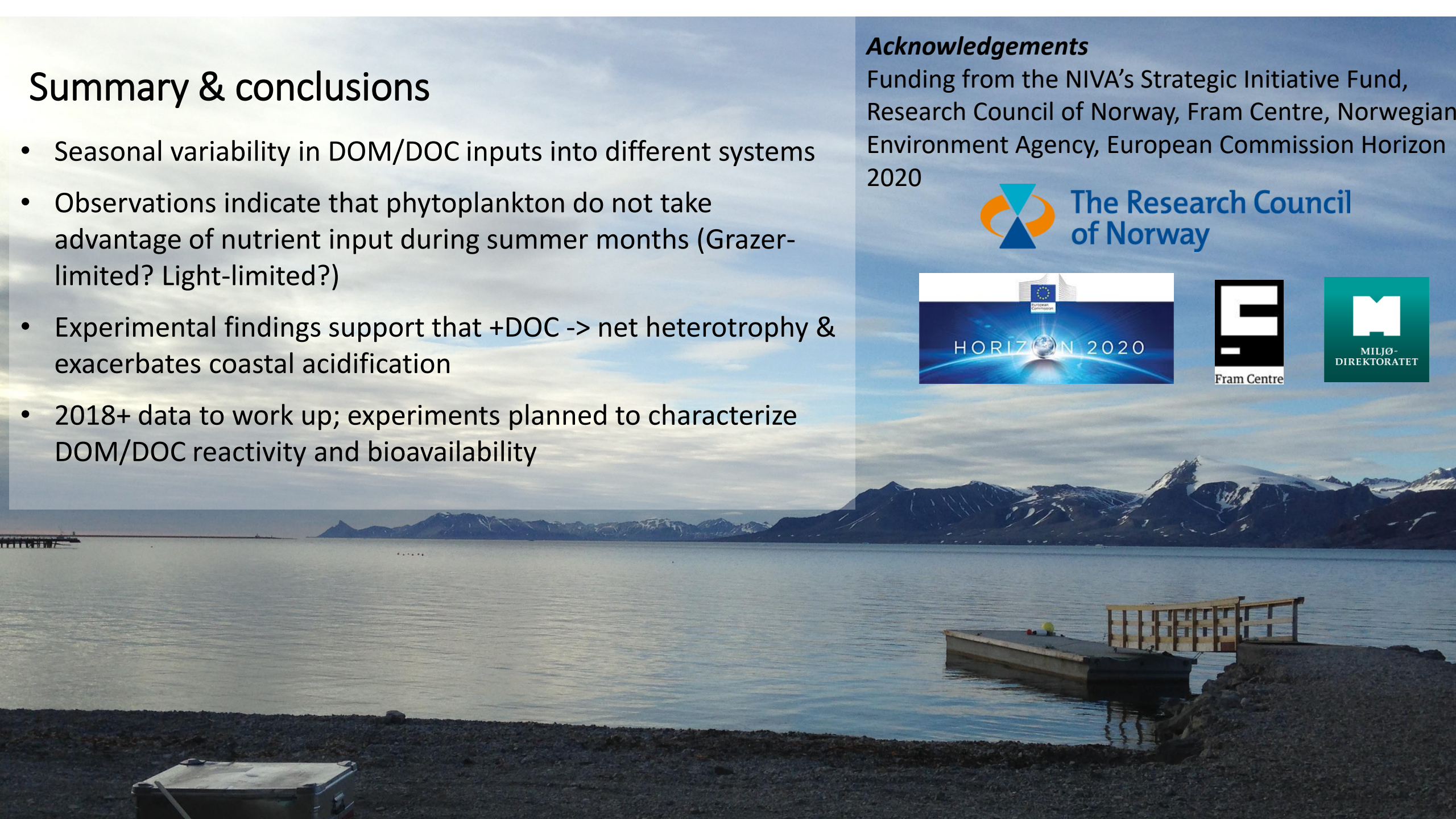
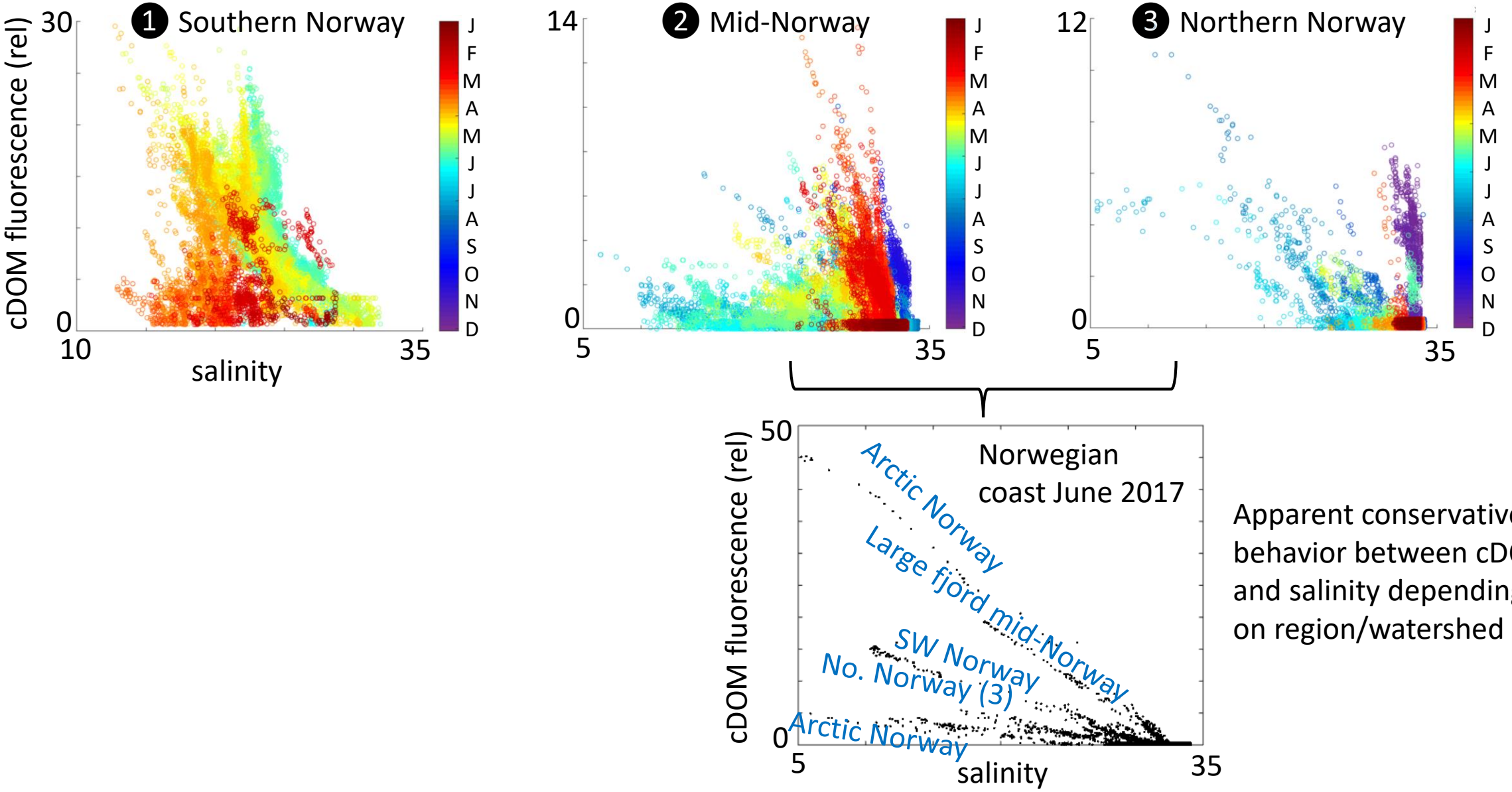


Salinity and cDOM relationship



Apparent conservative behavior between cDOM and salinity depending on region/watershed