

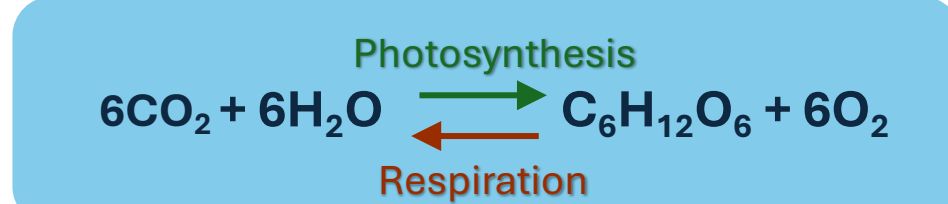
Drivers of Primary Production Variability in James Bay

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Primary Production in James Bay

- James Bay is a southern extension of the Hudson Bay System
- Primary production is the base of food web, supporting local fish, seal, beluga, and polar bear populations¹
- Primary producers require light and nutrients²
- Little is known about primary production in James Bay or the light and nutrients conditions required



Required nutrients for phytoplankton growth:
Nitrate, Nitrite, Phosphate, Silicate

Chlorophyll a (pigment) absorbs light energy

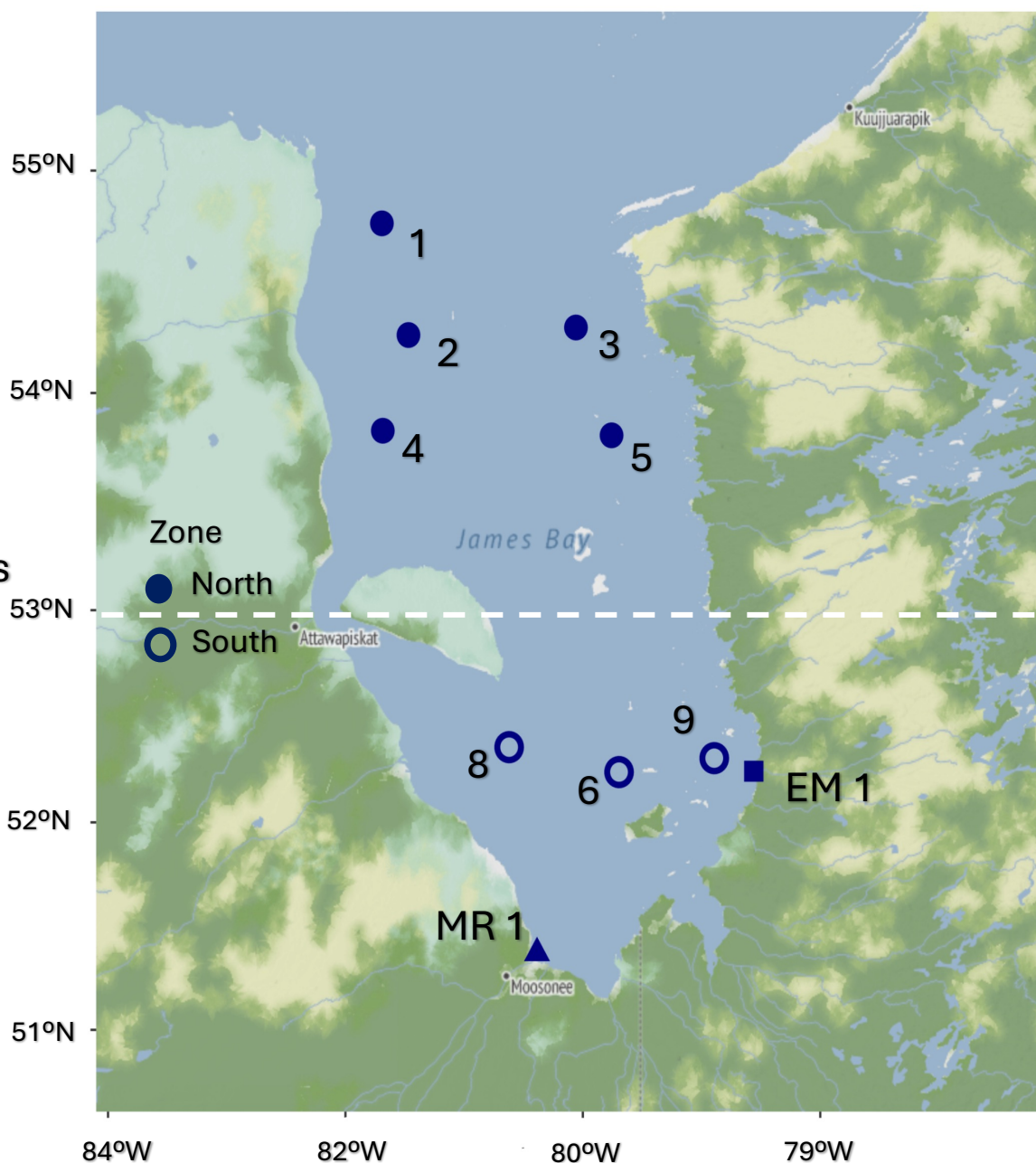


Figure 1: 8 water column stations, 2 river stations sampled in James Bay in August 2021.

Methods

- Water samples collected during August 2021 at various depths for nutrients, light and primary production at stations using a Rosette.
- Additional measurements for physical parameters such as **temperature, salinity, and stratification**.
- To better understand spatial variability of growth conditions and primary production rates



Figure 2: Images of Rosette and R/V William Kennedy (WK).

Spatial Variability at Surface Physical Parameters

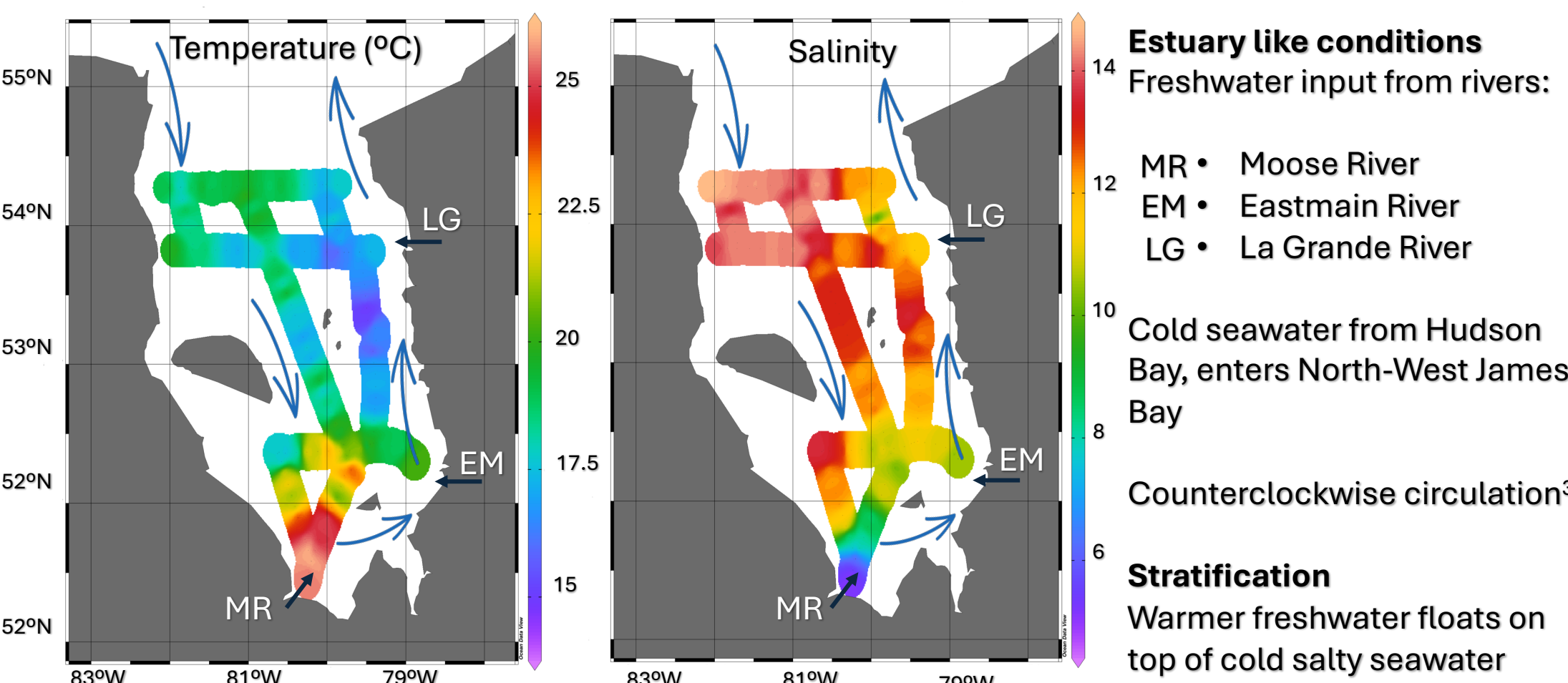
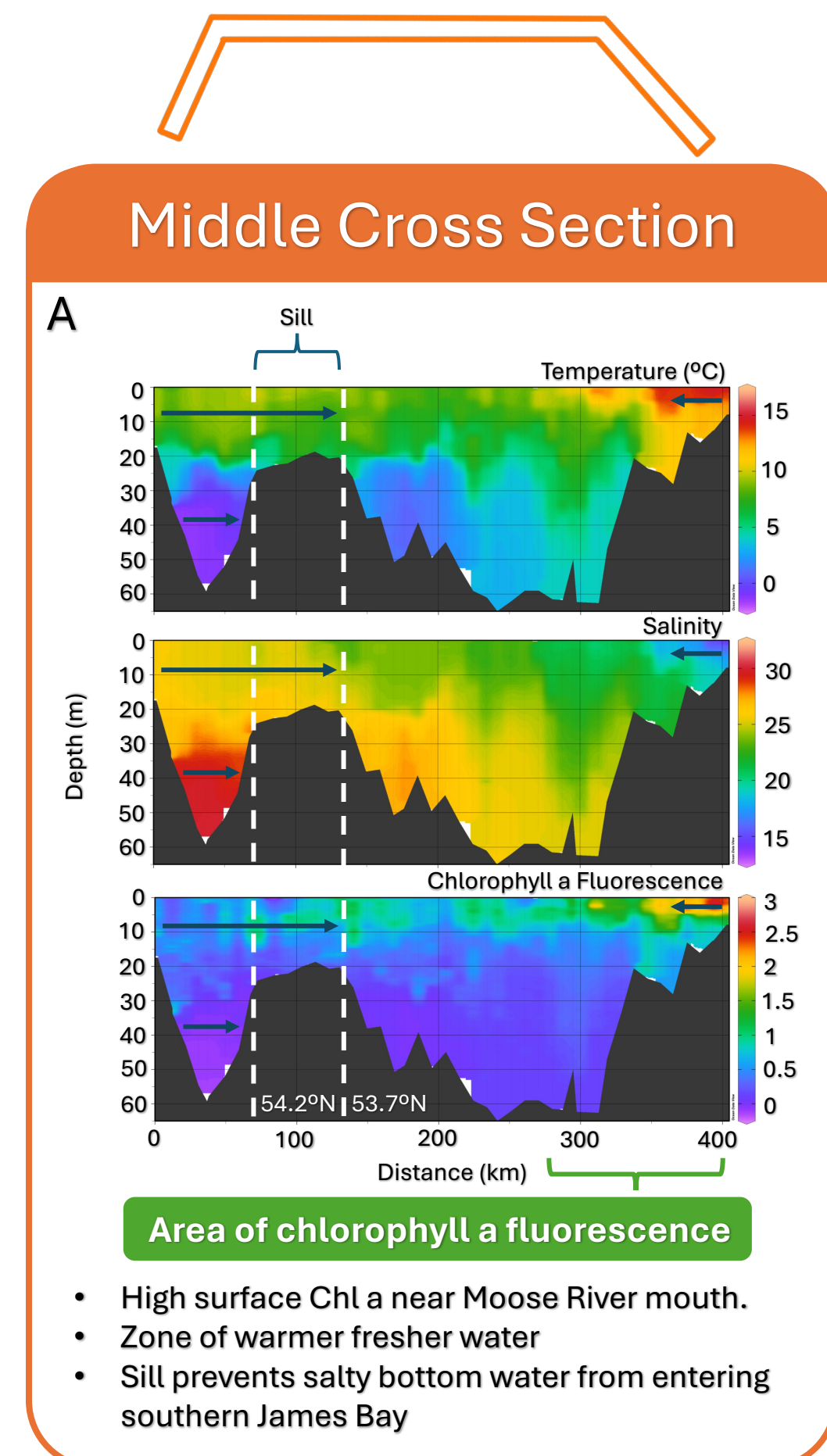


Figure 3: Surface Temperature and Salinity from 2021 CTD casts.

Spatial Variability in Water Column Temperature, Salinity and Chlorophyll a Fluorescence in selected cross sections



- Blooms of chlorophyll fluorescence at river mouths
- Stratification where fresh water is being introduced
- Bottom water in southern James Bay is distinct from northern bottom water
 - Sill and mixing may act as barriers to the exchange of bottom waters between North and South

Figure 5: CTD profiles of both Middle (A) and East (B) cross sections selected from Figure 4.

Preliminary Summary

- Zones with high concentrated chlorophyll a fluorescence near rivers
- Rivers don't have high N and P concentrations compared to bottom waters
- Nutrients are relatively depleted in the surface waters at all stations, but not zero
- Northern stations had higher nutrient concentrations and salinity in bottom waters relative to the southern stations
- All stations were nitrate depleted according to Redfield ratios
- River stations showed Ratios closer to Redfield but in lower concentrations than bottom waters
- Physical barriers, changes in bathymetry, seem to promote the mixing of the water column and prevent exchange of bottom waters between North and South James Bay

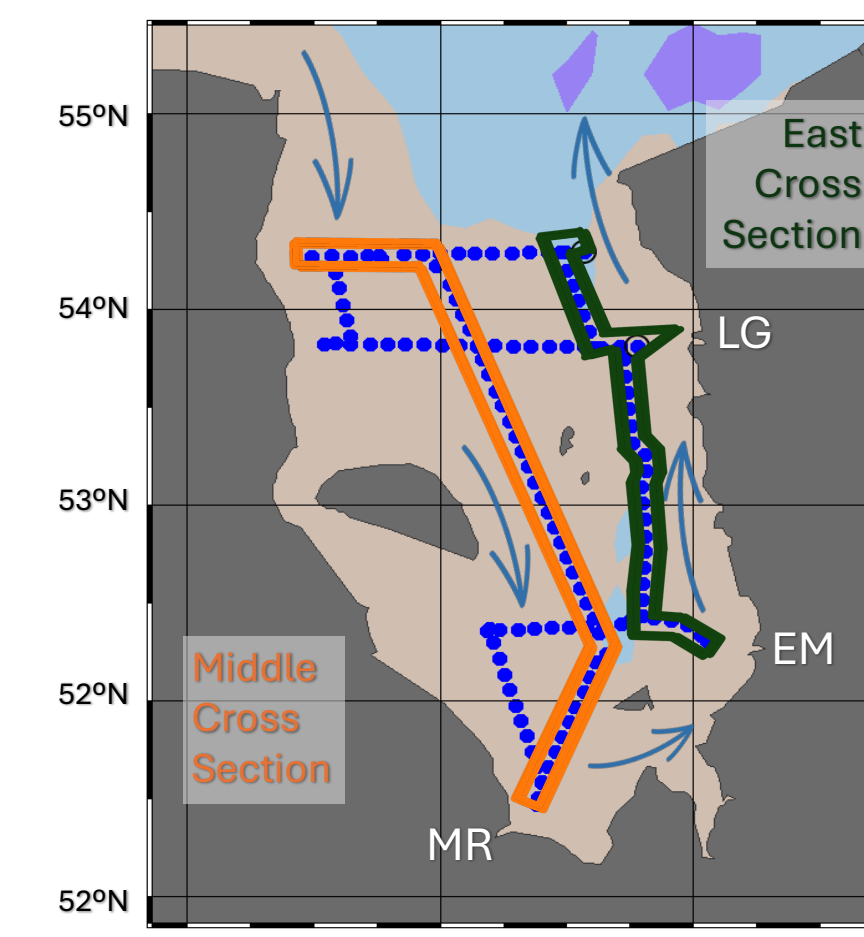
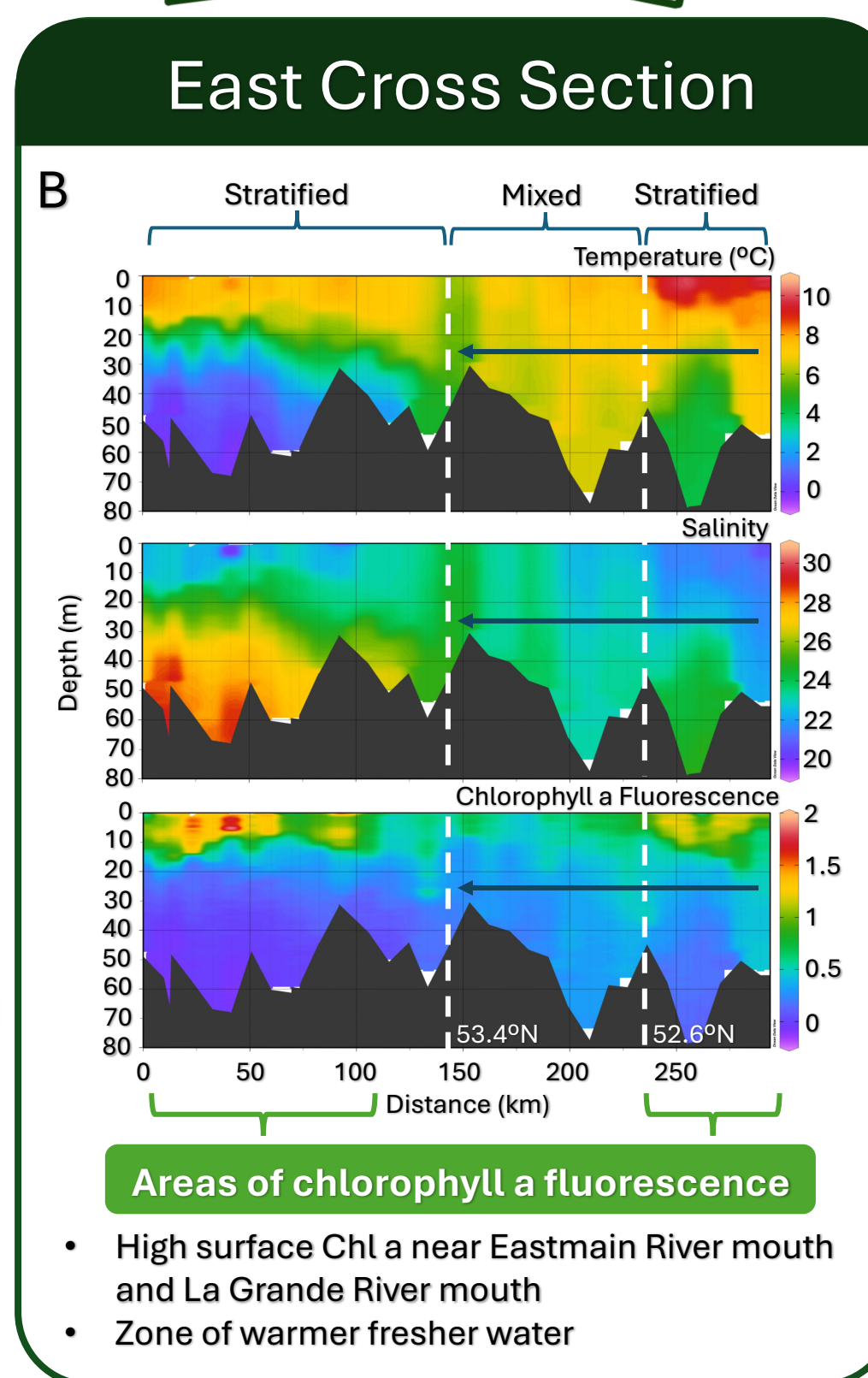


Figure 4: Cross sections selected from CTD casts on the 2021 WK cruise.



Spatial Variability Water Column Nitrate and Phosphate

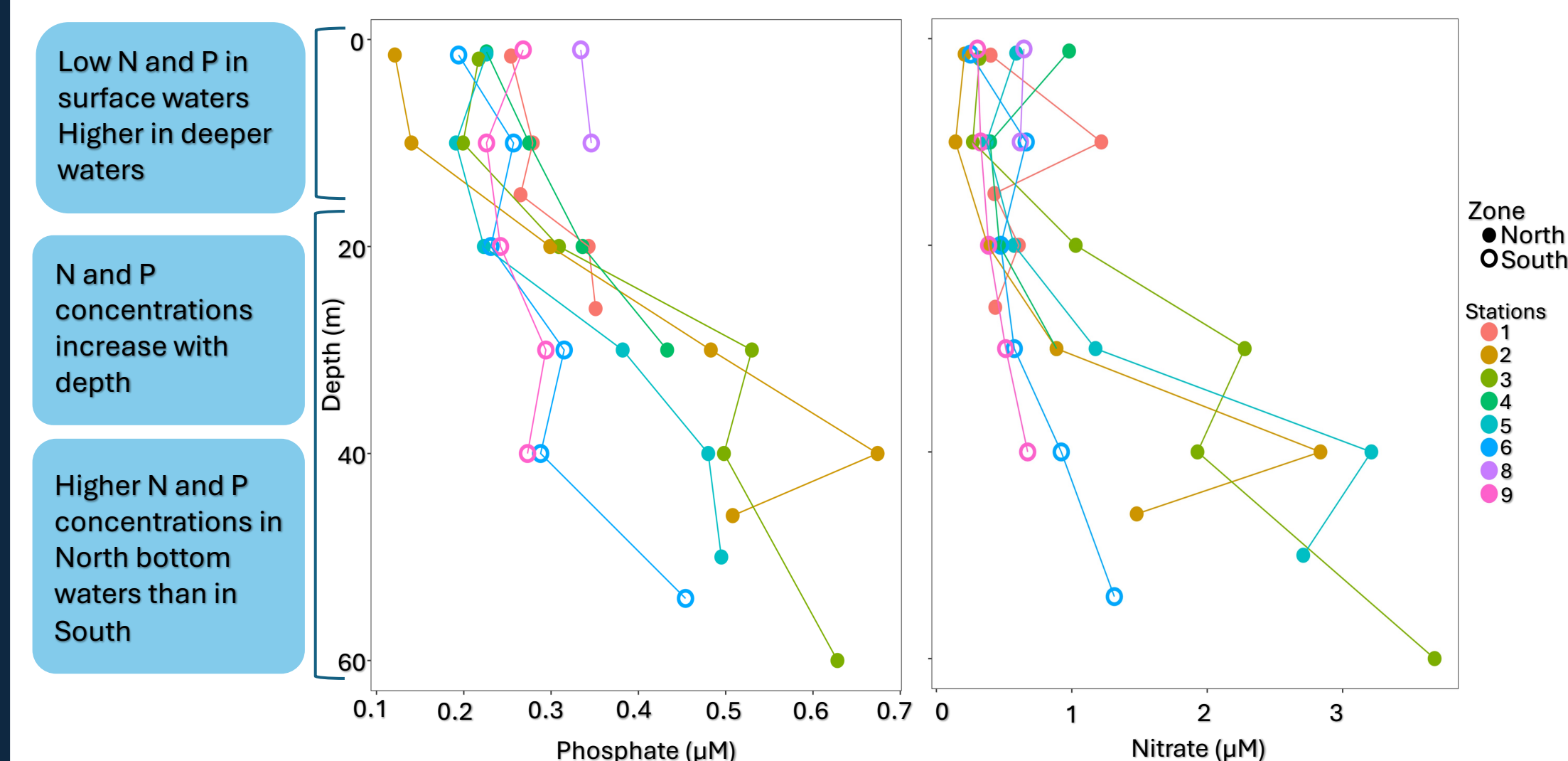


Figure 6: Nutrient concentrations profiles for the 2021 stations. Station numbers correspond to the stations in Figure 1.

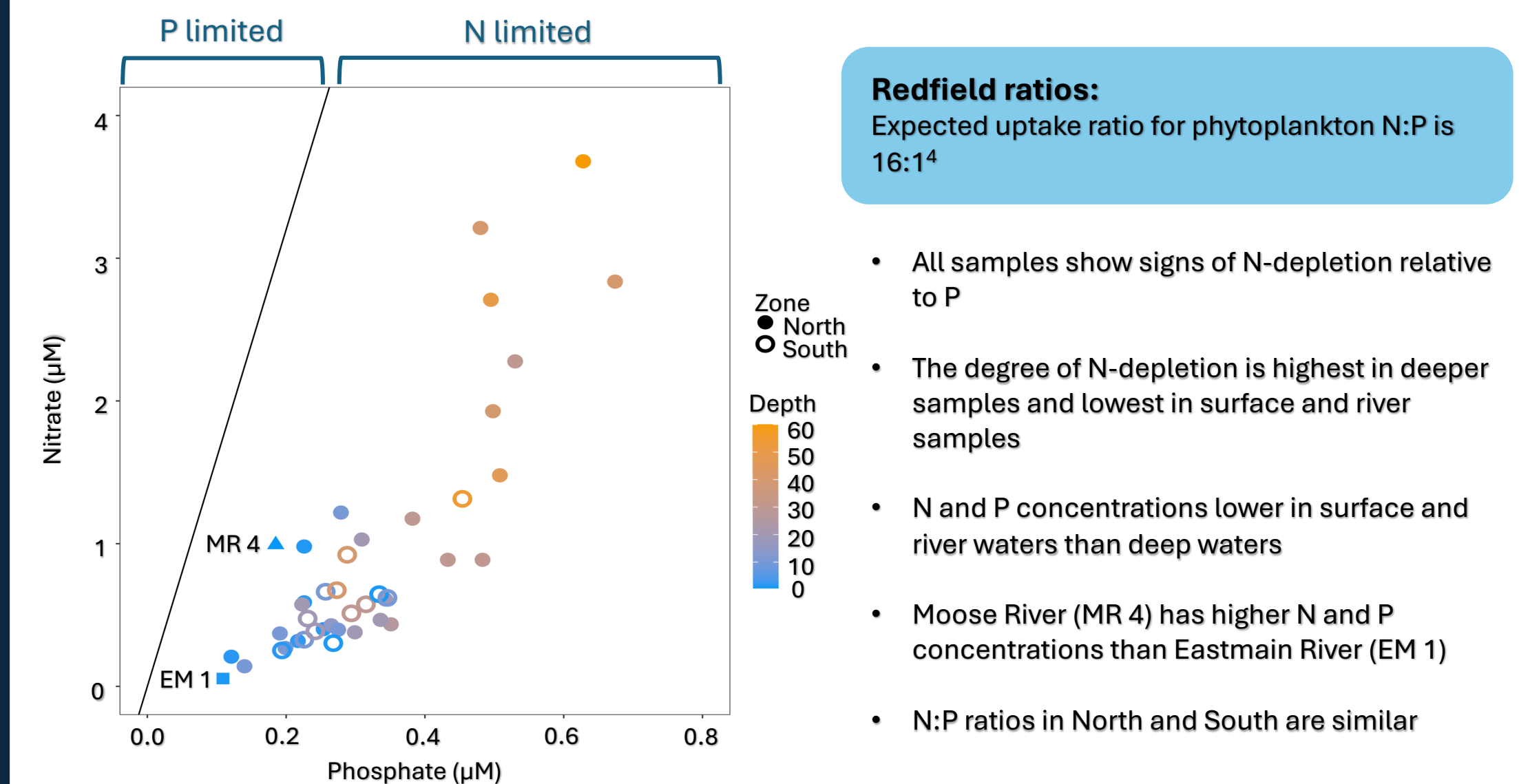


Figure 7: 2021 Water column stations and the freshest River stations. Moose River (MR 4) and the Eastmain River (EM 1) were sampled at the surface. The line represents the 16:1 Redfield ratio: what we would expect if N and P were not limited for phytoplankton growth

References

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Next Steps:

- Processing primary production estimates
 - Stable Isotope incubation and Light Dark incubations
- Determining the euphotic zone and mixed layer
- Comparing Chl a fluorescence to in situ Chl a samples
- Comparing 2021 cruise data to that of 2022
 - Spatial and temporal variations in James Bay