On sources and sinks of bioavailable nitrogen on the Scotian Shelf: Insights from nutrient distributions and nitrate isotope ratios

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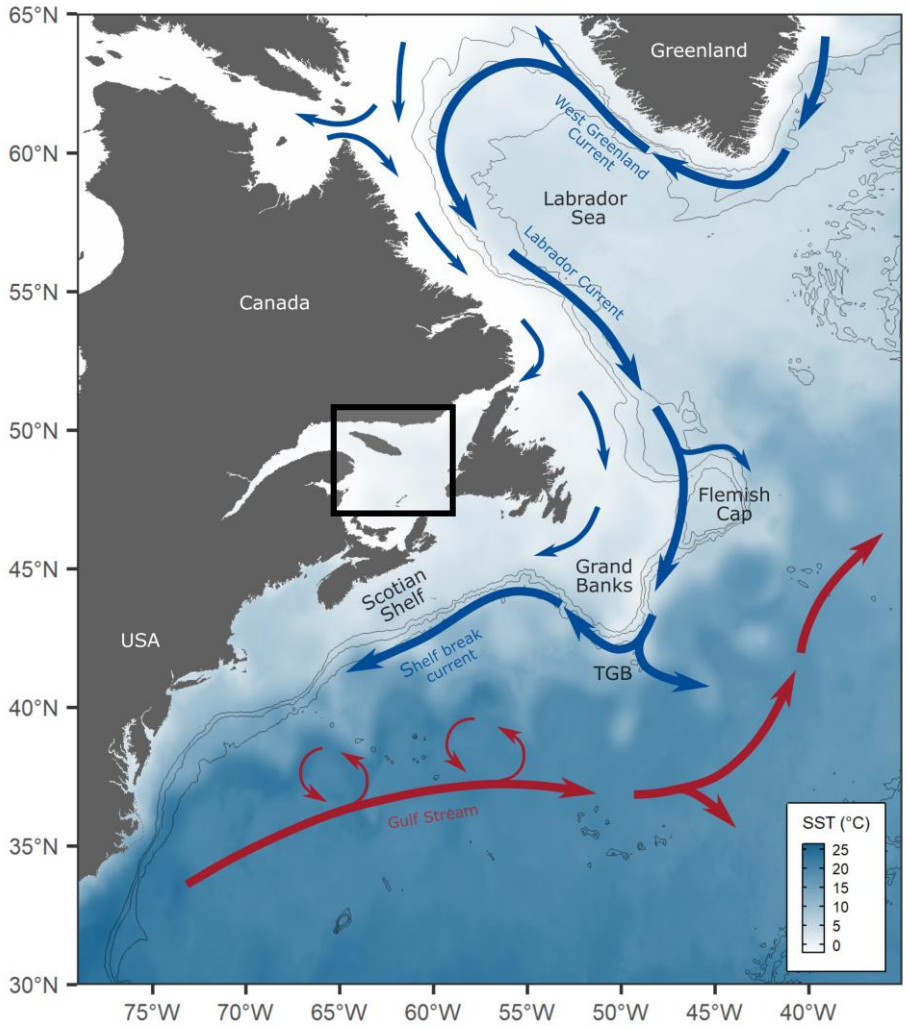
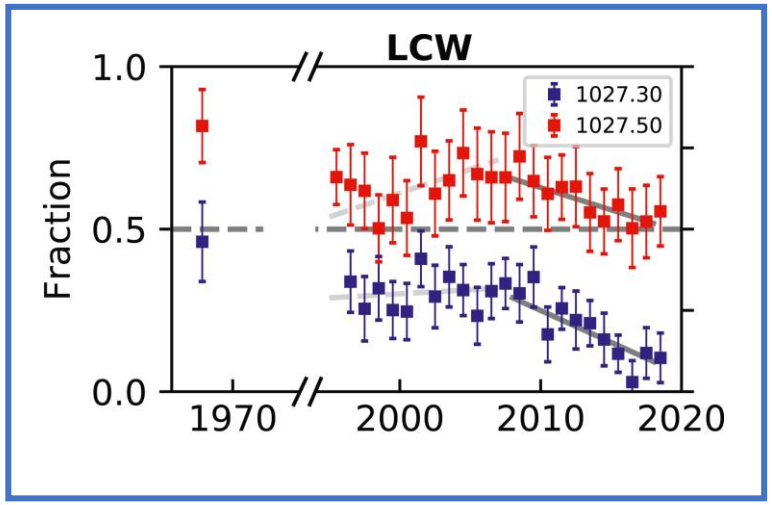
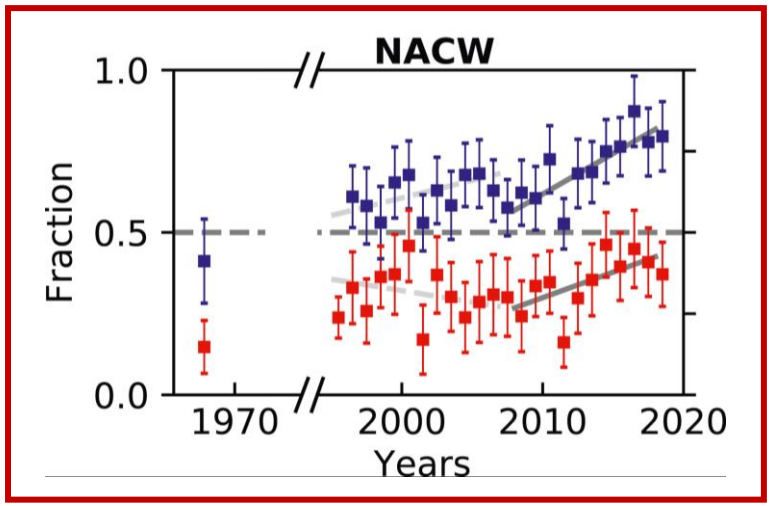


Gulf of St. Lawrence

Jutras et al., 2020





LCW = Labrador Current Water

NACW = North Atlantic Central Water (Gulf Stream)

- Relative contributions of slope waters modulate oxygen and nutrient concentrations on the shelf
- Decadal trends in physical and chemical conditions: warming and deoxygenation of sub-surface waters

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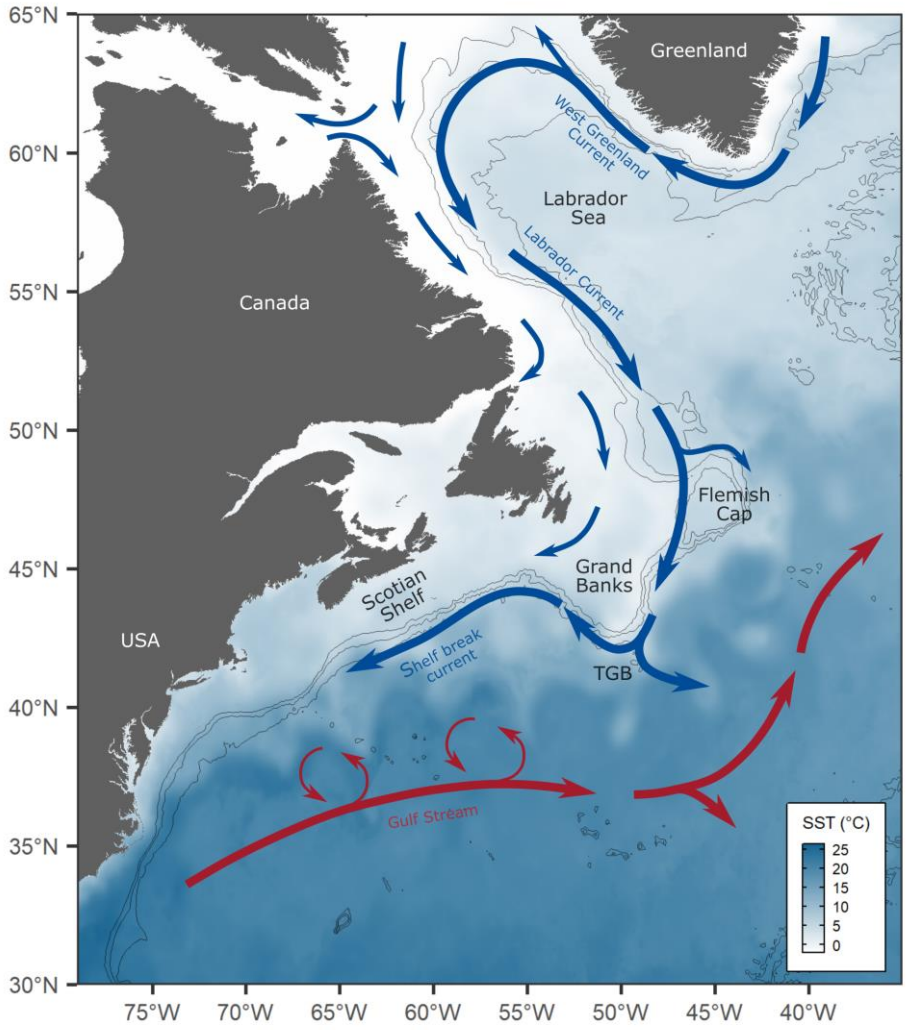
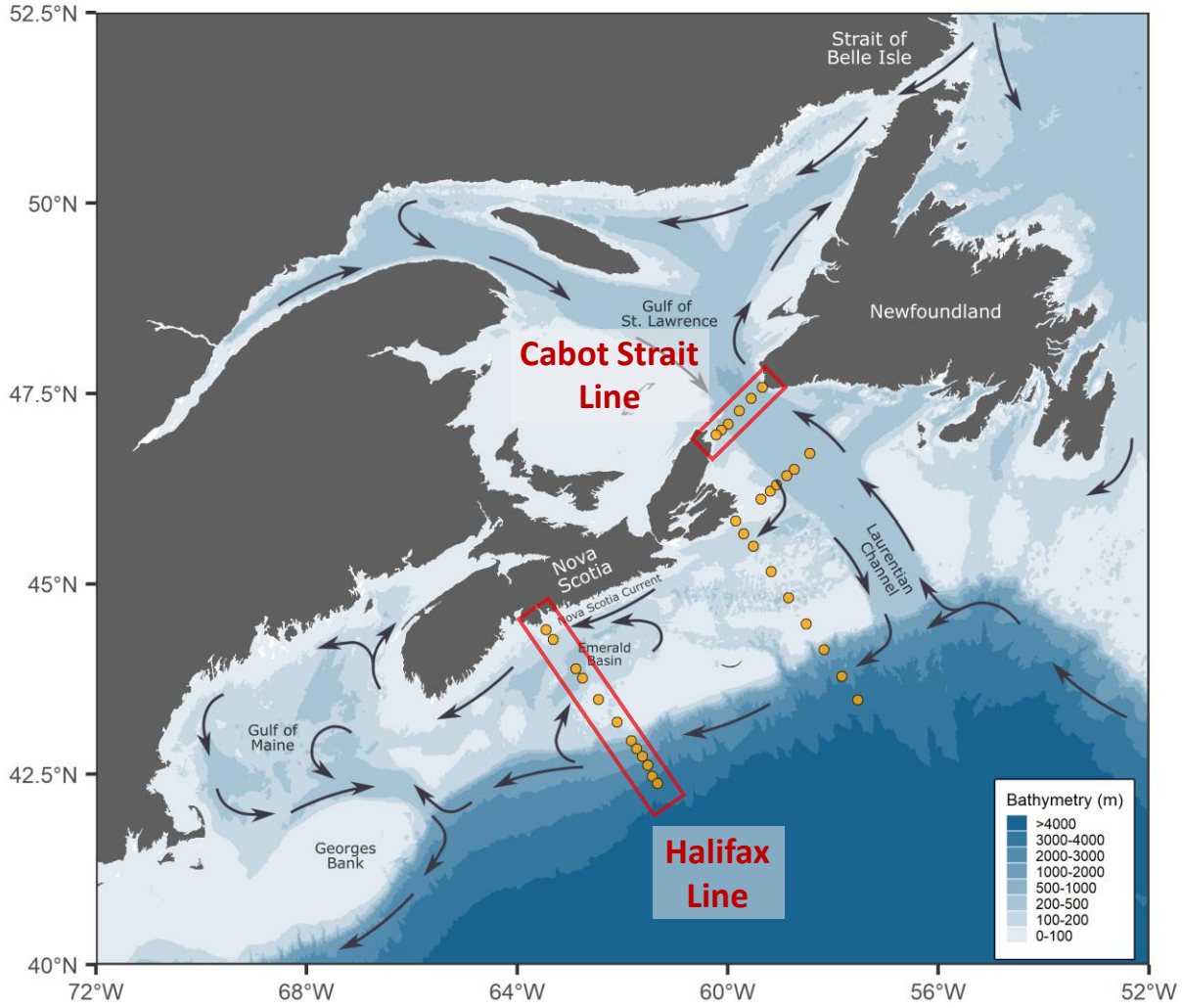


Atlantic Zone Monitoring Program



- Key parameters: T, S, O_2, dissolved nutrients (nitrate, phosphate, silicate), $\delta^{15}N_{NO3}$

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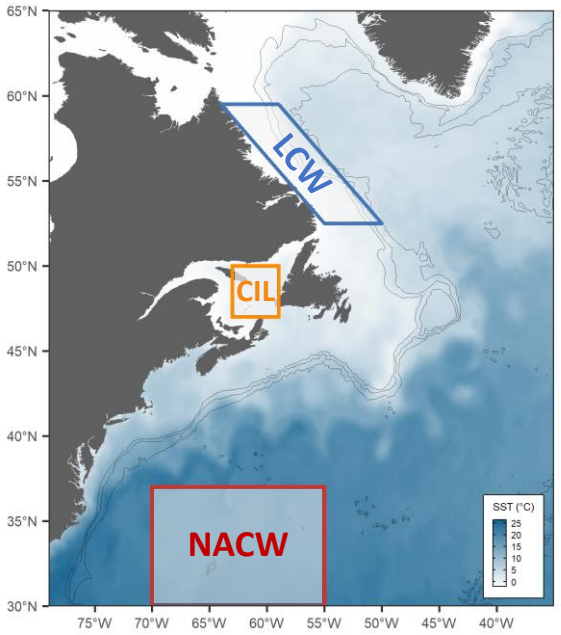
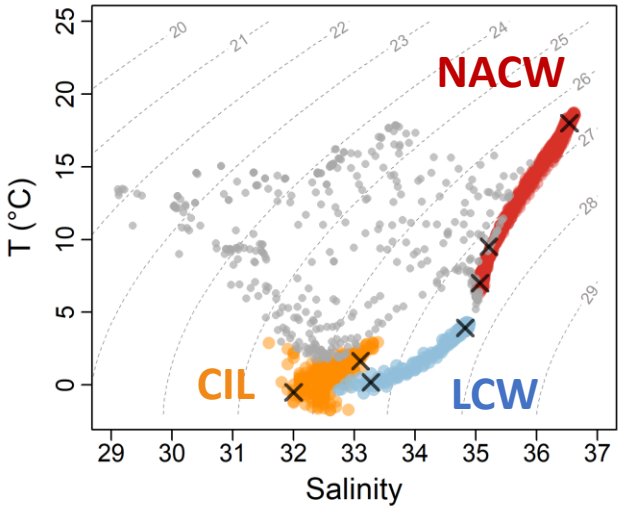
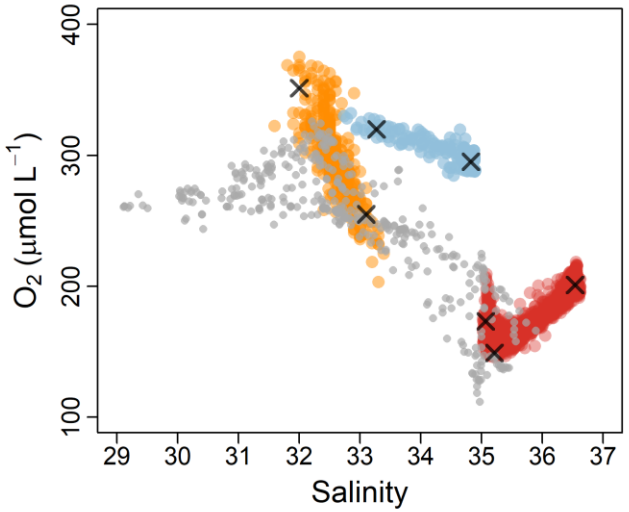
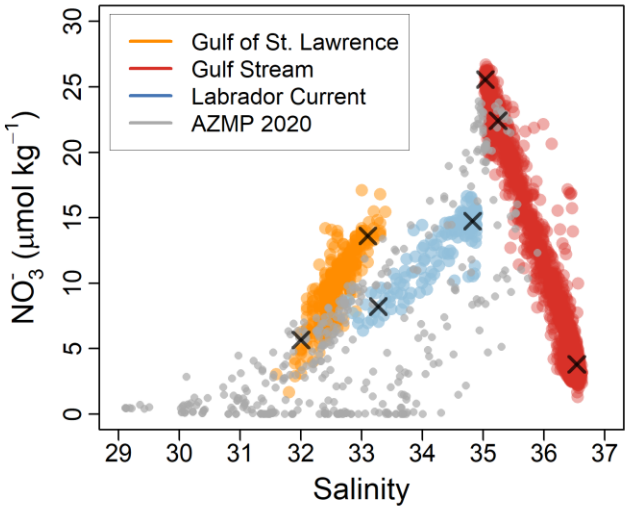
EXTENDED OPTIMUM MULTIPARAMETER ANALYSIS

CIL = Cold Intermediate Layer









- Distinguish between physical forcing (on-shelf transport) and biogeochemical processes (remineralization)
- Regional water masses difficult to distinguish based on T and S alone

$$f_1\theta_1 + \cdots + f_n\theta_n + 0 = \theta_{obs} + R_\theta$$
$$f_1S_1 + \cdots + f_nS_n + 0 = S_{obs} + R_S$$
$$f_1O_{2,1} + \cdots + f_nO_{2,n} + r_{O/P}\Delta O_2 = O_{2,obs} + R_{O_2}$$
$$f_1Si(OH)_{4,1} + \cdots + f_nSi(OH)_{4,n} + r_{Si/P}\Delta O_2 = Si(OH)_{4,obs} + R_{Si(OH)_4}$$
$$f_1NO_{3,1}^- + \cdots + f_nNO_{3,n}^- + r_{N/P}\Delta O_2 = NO_{3,obs}^- + R_{NO_3}$$
$$f_1SRP_1 + \cdots + f_nSRP_n + \Delta O_2 = SRP_{obs} + R_{SRP}$$
$$f_1 + \cdots + f_n = 1 + R_f$$
$$f_i > 0$$

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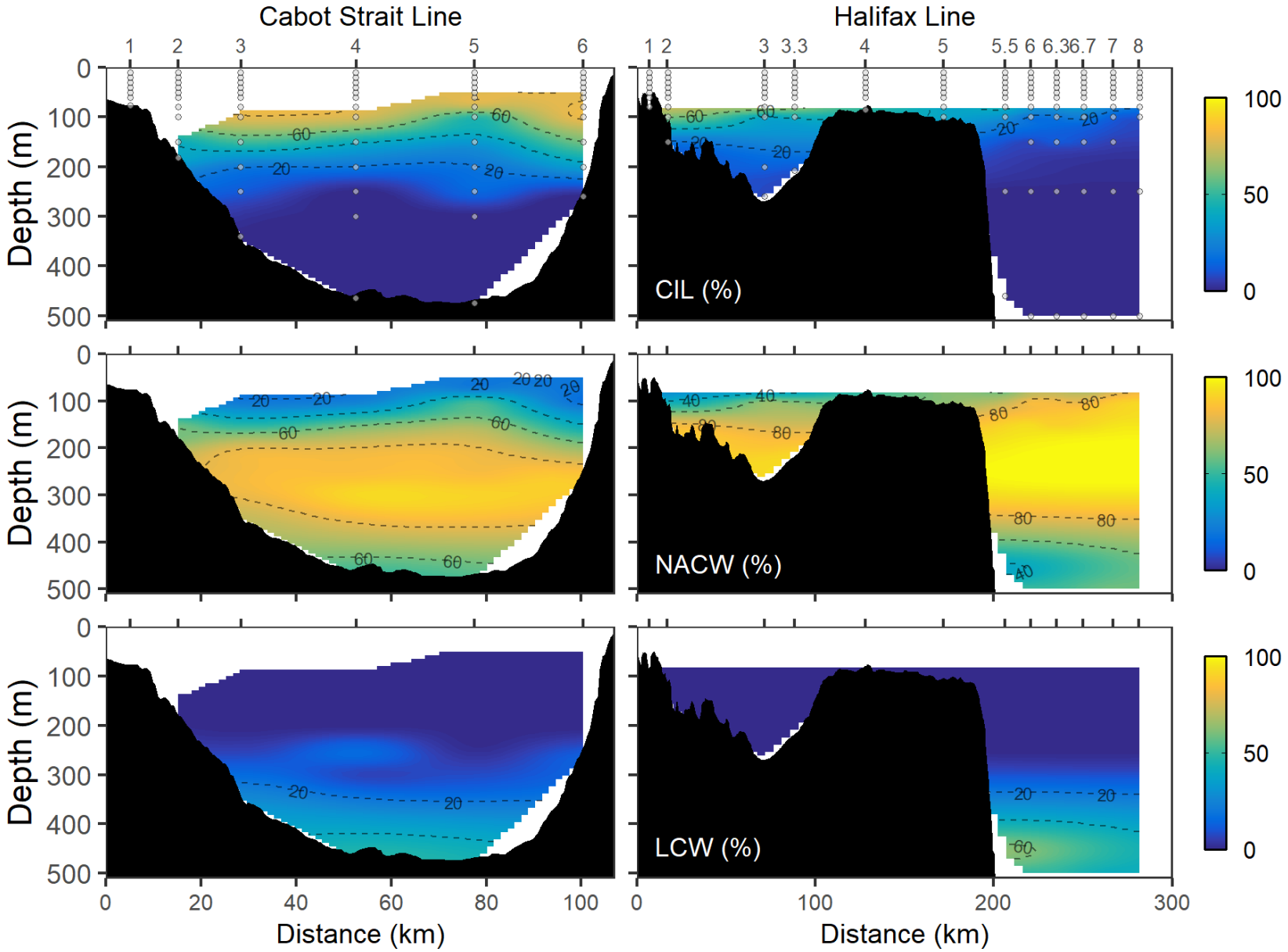

- Distinct 3-layered water column
- Gulf Stream dominant slope water source to both Cabot Strait and central Scotian Shelf
- Absence of Labrador Current Water in deep basins on Scotian Shelf

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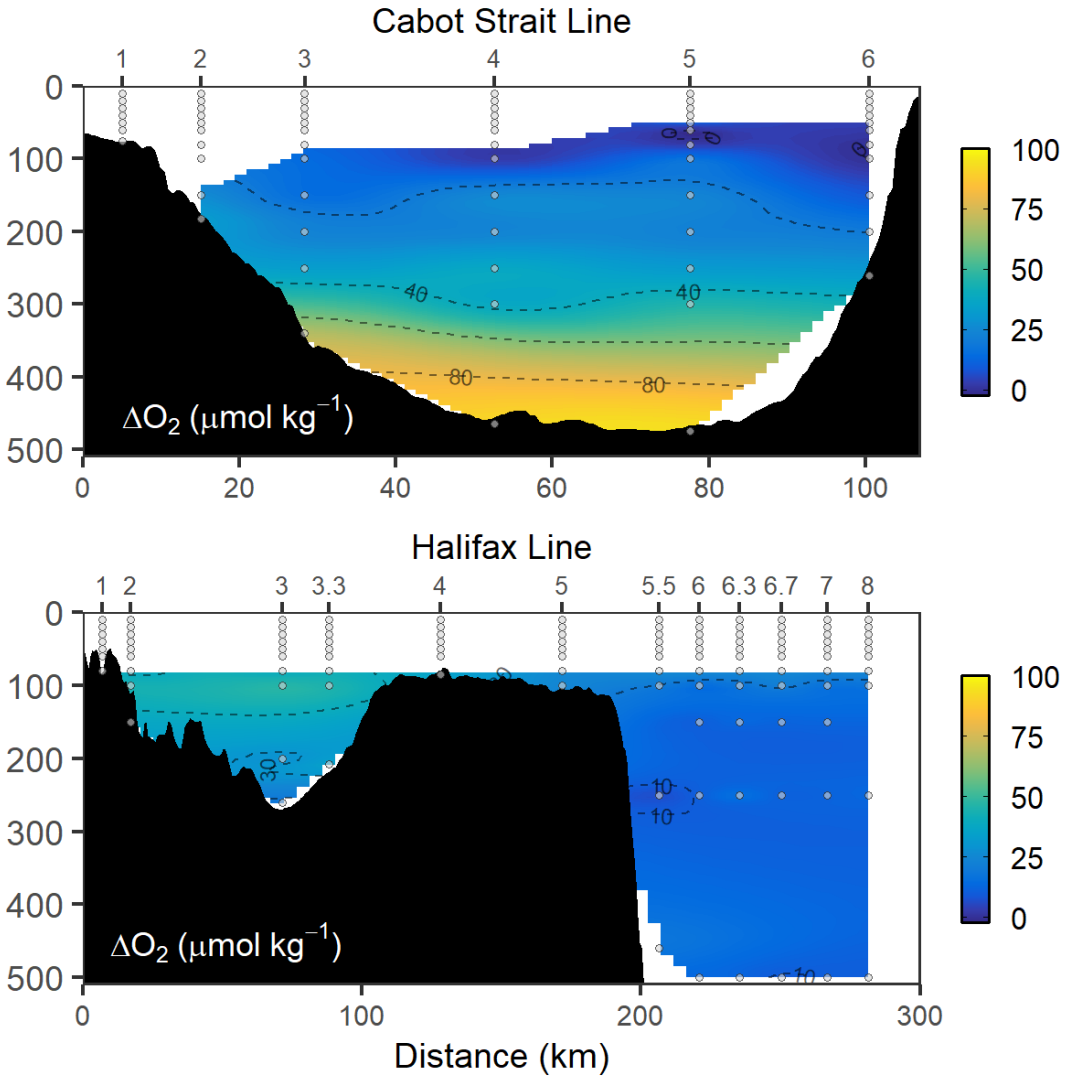

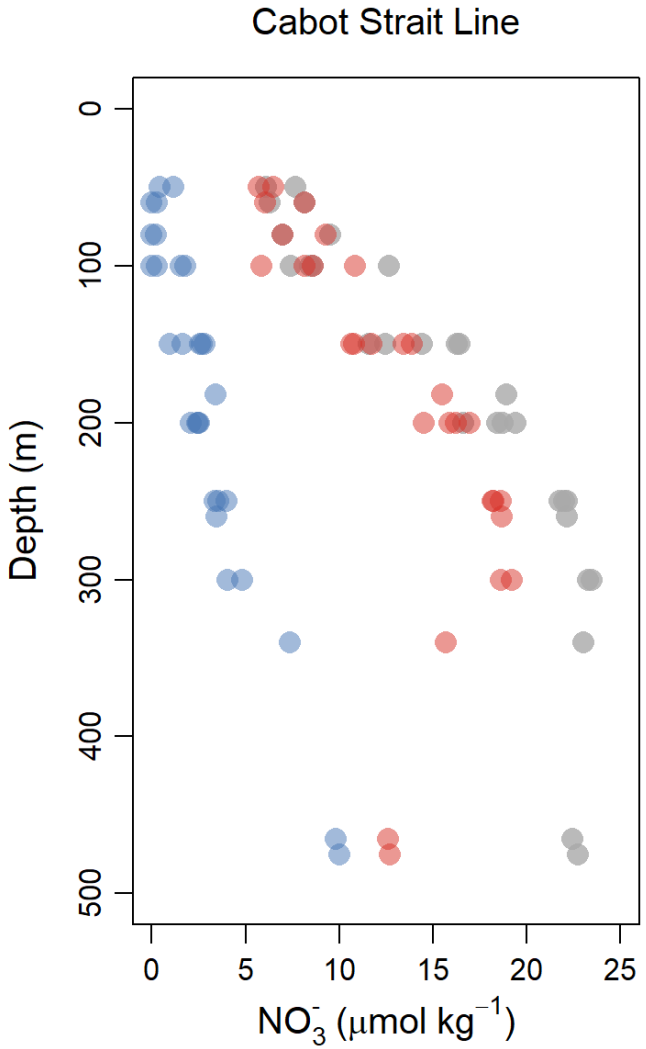

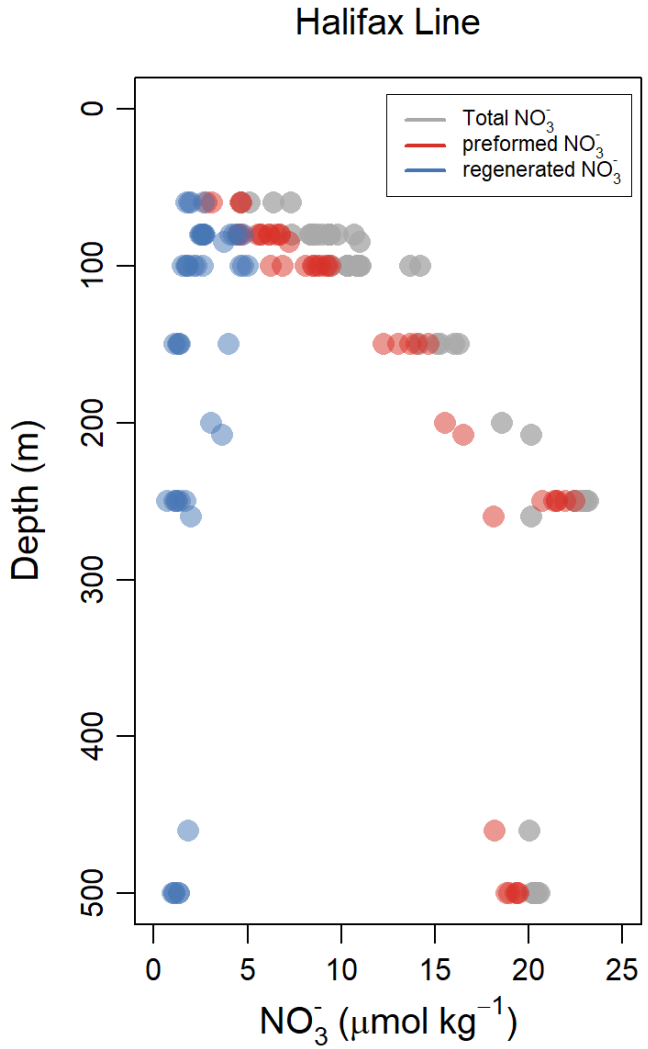

- Enhanced biogeochemical N inputs throughout deeper Cabot Strait
- Limited contribution from remineralization along Halifax Line

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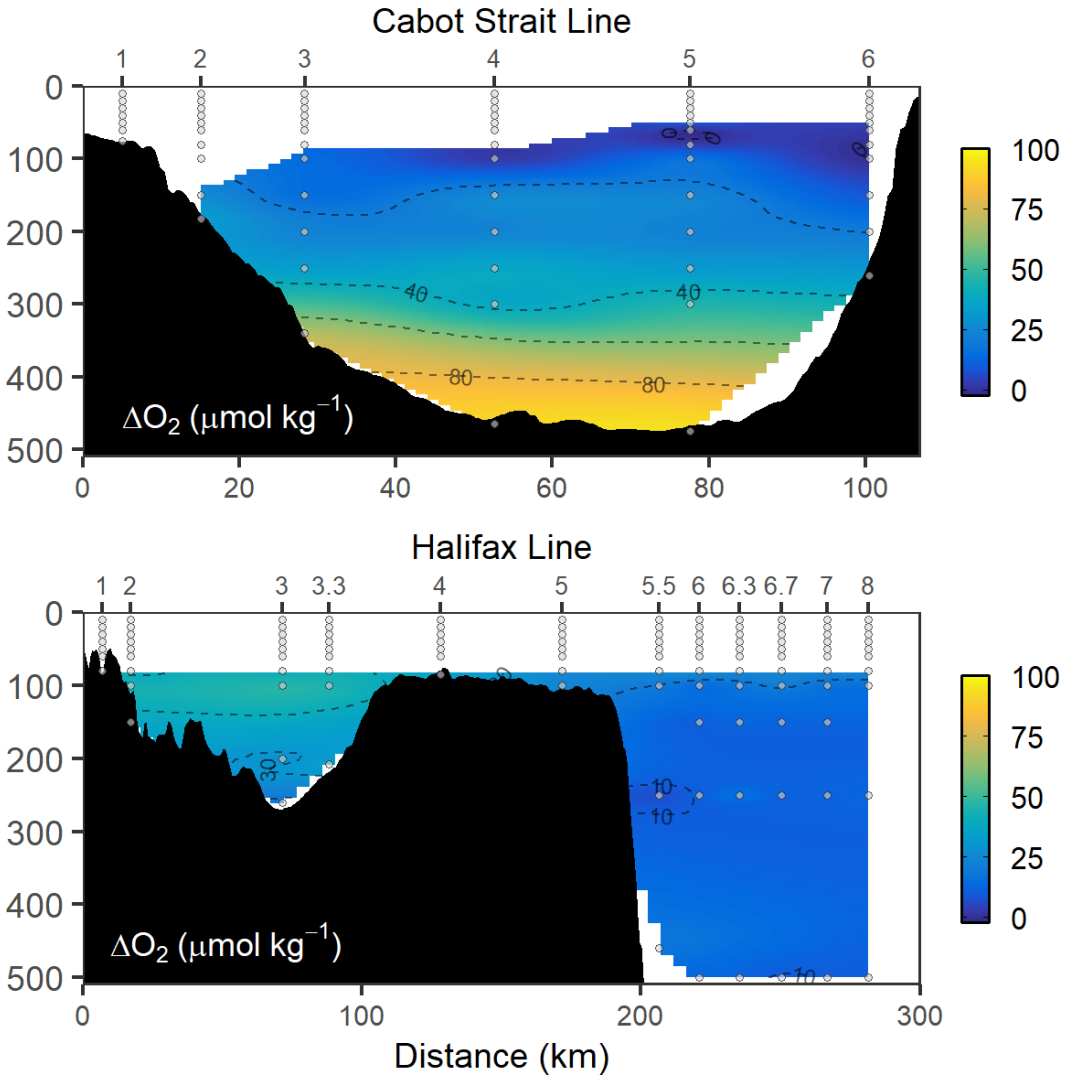
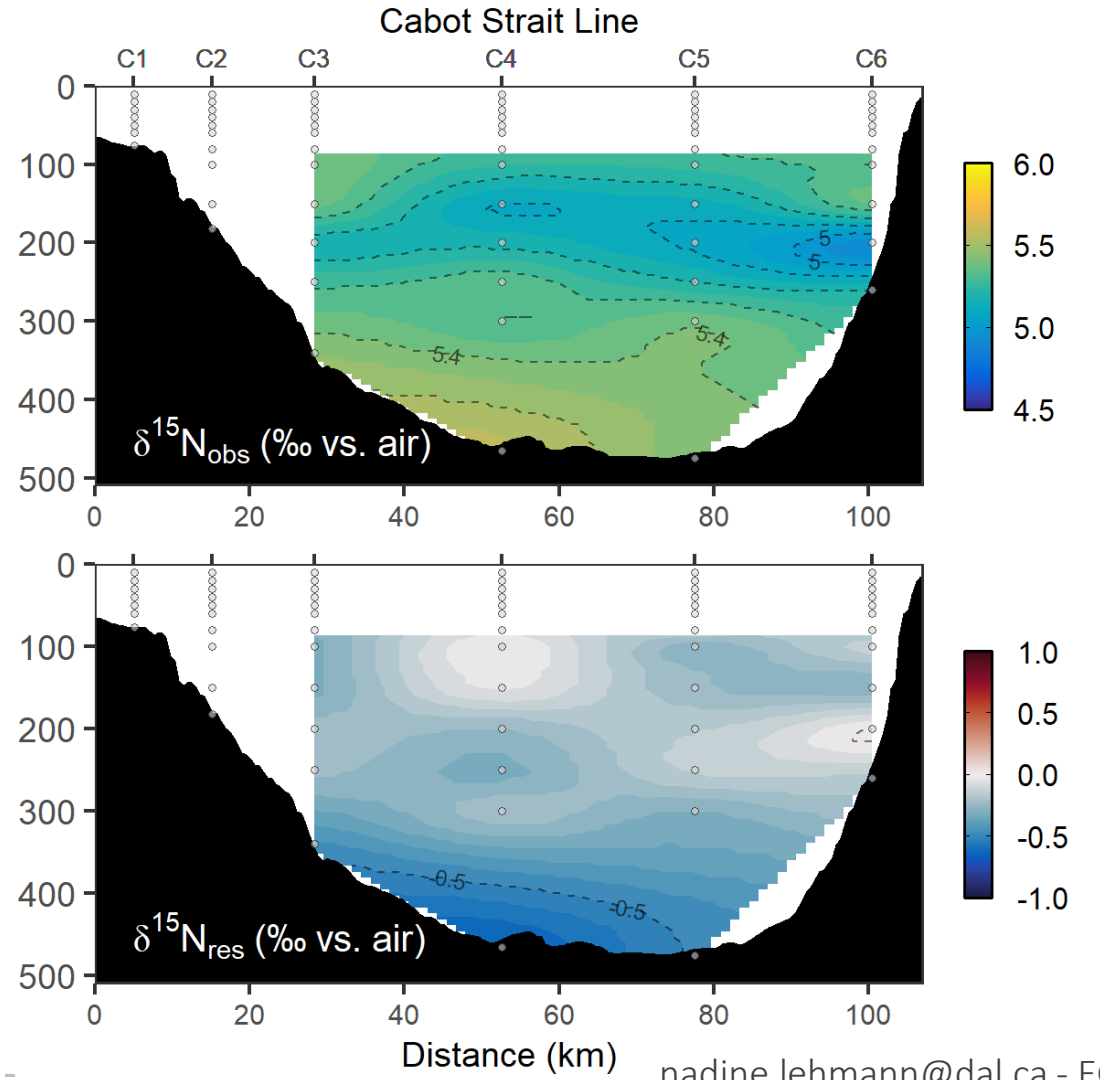


- Link model output to regional patterns in $\delta^{15}N_{NO3}$

ONGOING WORK

- Residual $\delta^{15}N_{NO3}$ = modeled $\delta^{15}N_{NO3}$ - observed $\delta^{15}N_{NO3}$



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