

Vita

Candidate's name: Eke Ikechi Kalu

Universities
Attended: University of New Brunswick (2020)
Bachelors of Science

University of New Brunswick (2025)
Masters of Science
Biology

Publications / Conference Presentations:

Kalu EI, Reyes-Prieto A & Barbeau MA (2023). Community dynamics of microbial eukaryotes in intertidal mudflats in the hypertidal Bay of Fundy. *ISME Communications*. 3:21. <https://doi.org/10.1038/s43705-023-00226-8>

IX European Congress of Protistology & Annual Congress of the International Society of Protistologists (Joint Meeting). 2023, 9–14 July. Vienna, Austria. Insights into protist activity, spatio-seasonal dynamics and multi-trophic linkages in a Canadian hypertidal mudflat. Kalu EI, Barbeau MA & Reyes-Prieto A (oral presentation).

Atlantic Canada Coastal & Estuarine Science Society (20th Annual Conference). 2023, May 23-26. Shippigan, NB, Canada. Differential bottom-up and top-down controls on benthic fauna and microbiota in a hypertidal mudflat. Kalu EI, Vanbaelinghem L, Reyes-Prieto A, Hamilton DJ & Barbeau MA (oral presentation).

Atlantic Canada Coastal & Estuarine Science Society - Bay of Fundy Ecosystem Partnership (Joint Meeting). 2022, May 18-21. Truro, NS, Canada. Effects of nutrient enrichment and foraging by invertebrates and shorebirds on microbial communities in a hypertidal mudflat. Kalu EI, Reyes-Prieto A, Hamilton DJ & Barbeau MA (oral presentation).

Taxon-Specific Ecological Drivers Of Diatom-Dominated Microphytobenthos: Experimental And Spatio-Temporal Insights From A Temperate Hypertidal Mudflat

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Eke I. Kalu

in the Department of Biology

U.N.B., Fredericton, N.B.

**Wednesday, October 29th, 2025
9:30 a.m.**

Bailey Hall, Room B27

Examining Committee

Dr. Myriam Barbeau
Dr. Adrian Reyes-Prieto
Dr. Gavin Douglas
Dr. Audrey Limoges
Dr. Shawn MacLellan

co-Supervisor
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Internal Examiner
External Examiner
Chair of Oral Examination

Abstract

Photosynthetic microorganisms form the productive base of many coastal ecosystems. Yet, the relative importance of the ecological drivers underlying variability in their abundance, diversity, and species composition remains poorly resolved. To address this, I examined the variability in microalgal assemblages in relation to infaunal and epifaunal grazers, heterotrophic microbial eukaryotes, nitrogen- and sulfur-cycling bacteria, and sediment physico-chemical properties in a Bay of Fundy intertidal mudflat. I quantified these biotic and environmental variables using environmental DNA metabarcoding, chlorophyll *a* fluorescence, microscopy, and field measurements. I used data from a field experiment manipulating epifaunal grazer abundance using shorebird and mud snail exclosures, and nutrient availability using NPK fertilizers. Diatoms constituted the dominant component of microalgal assemblages in surface sediments across three summers, comprising 77% of sequence reads and 60% of the amplicon sequence variant richness. Biotic interactions were taxon-dependent and accounted for 26–88% of the summer variability in microalgal assemblages, while nutrient enrichment increased microalgal biomass by 42% over 2 months, driving assemblage-wide

responses. Raphid pennate diatoms were positively correlated with shorebirds and mud snails but negatively with protistan parasites, while polar centric diatoms showed the reverse pattern. These microalgal lineages displayed contrasting depth distributions and seasonal dynamics, and were top contributors to the interannual variability in species composition. Sediment temperature (16–24°C) was positively correlated with microalgal diversity, accounting for 44% of the variation in a separate analysis. Cyanobacteria were rare in the sequence data, suggesting negligible contribution to primary production relative to microalgae and chemosynthetic bacteria. My findings suggest differing sensitivities of the biomass and species composition of diatom-dominated microphytobenthos to ecological drivers, with variations in species composition more closely linked to biotic interactions, and biomass varying under resource-driven control within the broader environmental context. My thesis contributes to ongoing efforts to clarify the ecological controls on the productive, carbon-sequestering base of coastal ecosystems.