A comparison of the food web structure of intertidal mud flat ecosystems in the Minas Basin, Nova Scotia

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INTRODUCTION

Mud flats are the unvegetated, lowest-most intertidal areas of salt marshes in low energy shorelines, and in the Bay of Fundy, are vast due to macrotides and high sedimentation rates. Biodiverse mud flats here feed both bordering salt marshes and the Avon River estuary of the Minas Basin as well as serve as a migratory bird stopover and support a bloodworm (*Glycera dibranchiata*) fishery[3]. The salt marsh at Windsor Causeway (Fig. 1, red circle) is nearly 50 years old, and is far more mature than the newly formed site outside Avonport (green circle). Blue Beach (blue circle) is different from the other two sites in that it does not have an adjacent salt marsh but instead a rocky beach. A full-scale ecological assessment of the Minas Basin was done 15 years ago[2]. The potential scope of change to the community composition since that time is currently unknown, making this research important to further our understanding of this essential mud flat region[4]. The goal of the study was to see how the different habitats affect the food webs, community composition, and the abundance of bloodworms.

METHODS

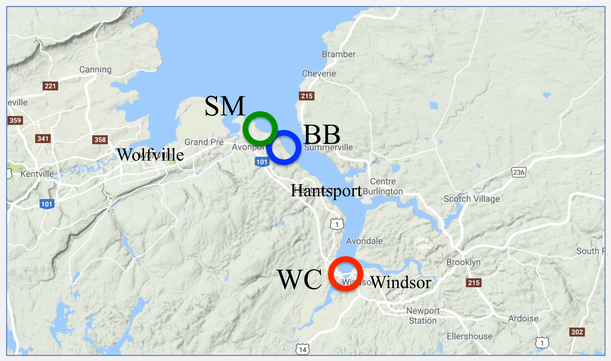

Figure 1: Map of 3 study sites (WC = Windsor Causeway, BB= Blue beach, SM = new salt marsh), in the Minas Basin, Nova Scotia (taken from Google Maps)

10 replicate core samples (~0.017m^3) from each location

Organism identification (>500µm) and abundance counts

Create food webs for each site and use non-parametric statistics (PERMANOVA, SIMPER) to compare communities across sites[1]

RESULTS

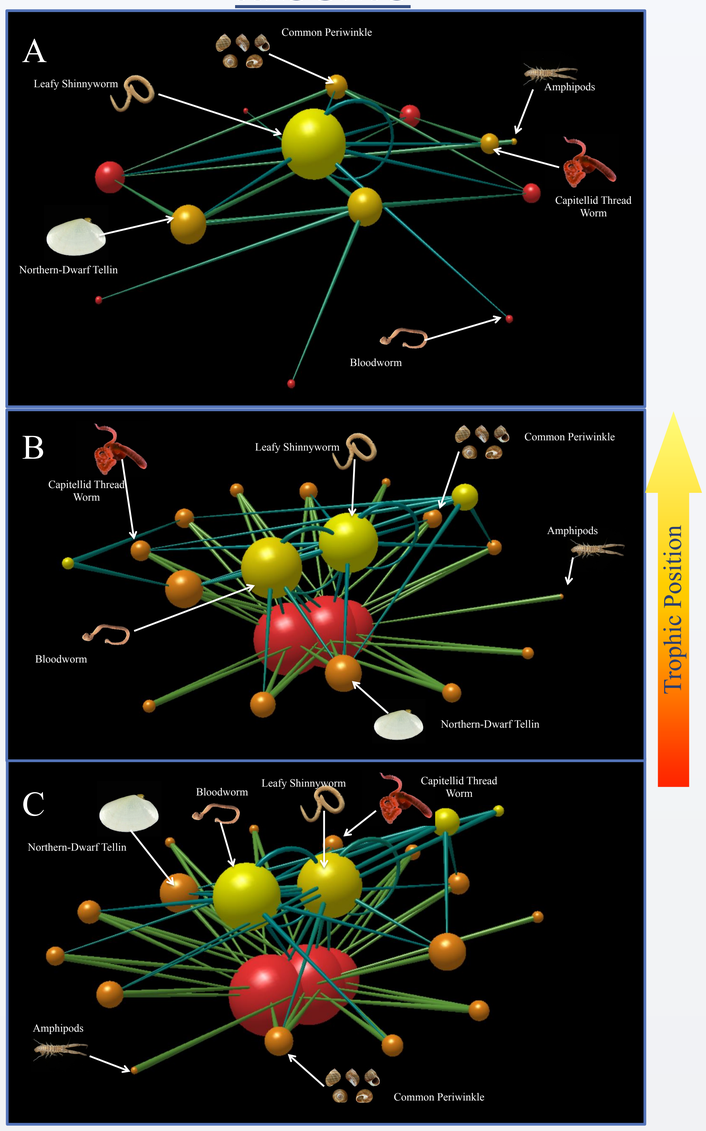

Figure 2: Food webs for (A) Windsor Causeway, (B) new salt marsh, and (C) Blue Beach showing feeding links, trophic levels (basal red through upper-consumer yellow), labeled SIMPER species, as well as *Glycera dibranchiata*.

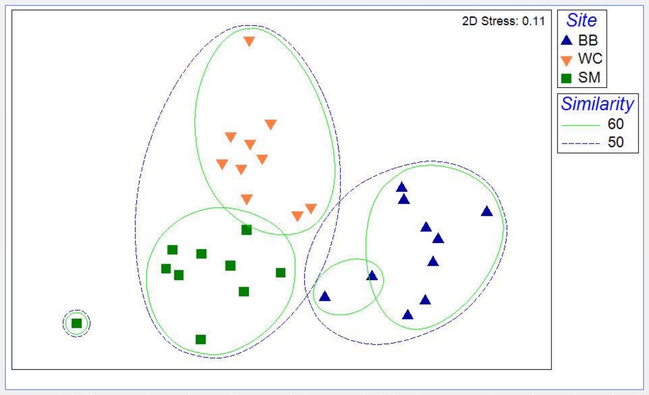

Figure 3: Multidimensional scaling with overlaid clusters showing the similarity (%) between samples (each symbol) and sites. Significant differences were detected between all 3 sites (pseudo-F = $19.9_{2,27}$, p = 0.001).

Table 1: PERMANOVA and post hoc analyses for community metrics and SIMPER species with significant results in bold. Factor DF = 2 , error DF = 27.

	Pseudo-F	p	p (WC, SM)	p (WC, BB)	p (BB, SM)
Total Abundance	37.9	**0.001**	**0.001**	**0.001**	**0.001**
Species richness	25.6	**0.001**	0.86	**0.001**	**0.002**
Shannon Diversity (H')	0.67	0.54	0.24	0.47	0.72
Pielou's Evenness (J)	21.5	**0.001**	**0.01**	**0.002**	**0.001**
Amphipods	17.8	**0.001**	**0.001**	**0.002**	**0.001**
Capitellid Thread Worm	20.2	**0.001**	0.81	**0.001**	**0.001**
Leafy Shinnyworm	36.8	**0.001**	**0.001**	**0.002**	**0.002**
Common Periwinkle	8.75	**0.001**	**0.002**	**0.006**	0.75

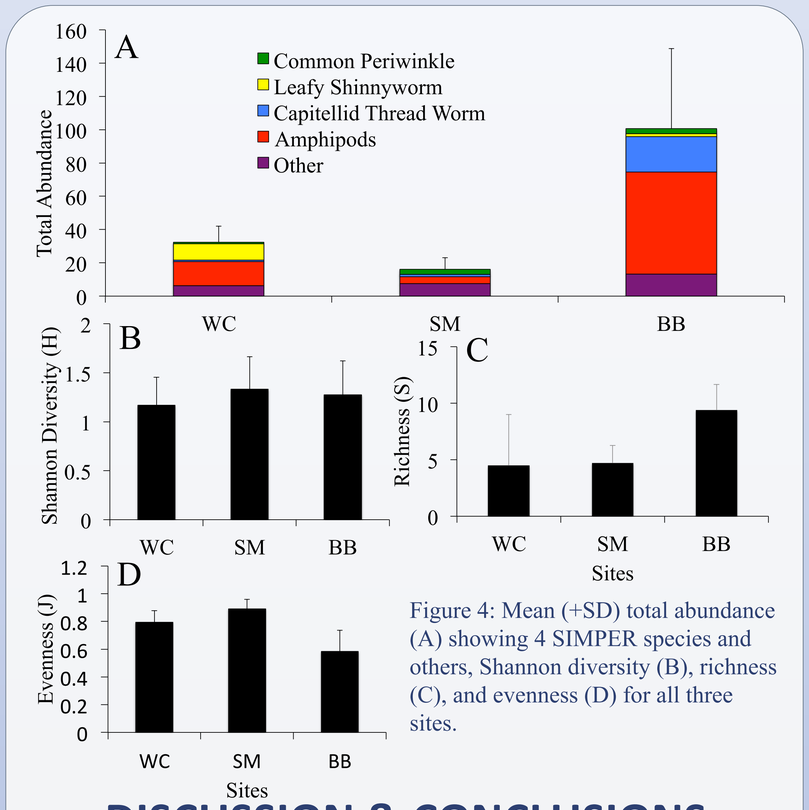

Figure 4: Mean (+SD) total abundance (A) showing 4 SIMPER species and others, Shannon diversity (B), richness (C), and evenness (D) for all three sites.

DISCUSSION & CONCLUSIONS

- The food webs give insight into developing community structure and function; the newly formed salt marsh and Blue Beach food webs look more similar to each other than to the web at Windsor Causeway.
- In contrast, salt marsh mud flat community composition are more similar to each other than to the rocky mud flat seen at Blue Beach.
- Shannon diversity was not different between the two salt marsh locations, but both were different compared to Blue Beach whereas all other metrics and species showed differences across all sites.
- The presence or absence of flora, rather than abiotic factors, may have a larger impact on the food web[3].
- Windsor Causeway had a high number of Shinnyworms, a predatory ragworm, which could account for the lack of certain species.
- Low faunal abundance at the new salt marsh may be due to immaturity, and should be examined over time to monitor community changes.

REFERENCES & ACKNOWLEDGEMENTS

[1]**Coll M et al**. 2011. Food-web structure of seagrass communities across different spatial scales and human impacts. PLoS ONE 6(7): e22591.

[2]**Daborn GR et al**. 2003. Ecological studies of the Windsor Causeway and Pesaquid Lake, 2002. Wolfville (NS): Nova Scotia Department of Transportation and Public Works. Contract # 02-00026.

[3]**Parker M et al**. 2007. Ecosystem overview report for the Minas basin, Nova Scotia. Fish Ocean Canada. Dartmouth (NS): Fisheries and Oceans Canada. Oceans and Habitat Report 2007-05.

[4]**Vinagre C et al**. 2017. Effect of spatial scale on the network properties of estuarine food webs. Ecol Compl 29: 87-92

I'd like to thank my supervisors, Dr. Schmidt and Dr. Frail-Gauthier for their continued patience and enthusiasm, as well as Tom Duffett for the use of the sieving room, and Jordan Henry for being my transportation and sample collection partner.