This is a slide show given as an oral presentation on 14 May 2018
at the 4th World Conference on Marine Biodiversity
in Montreal, Quebec, Canada.

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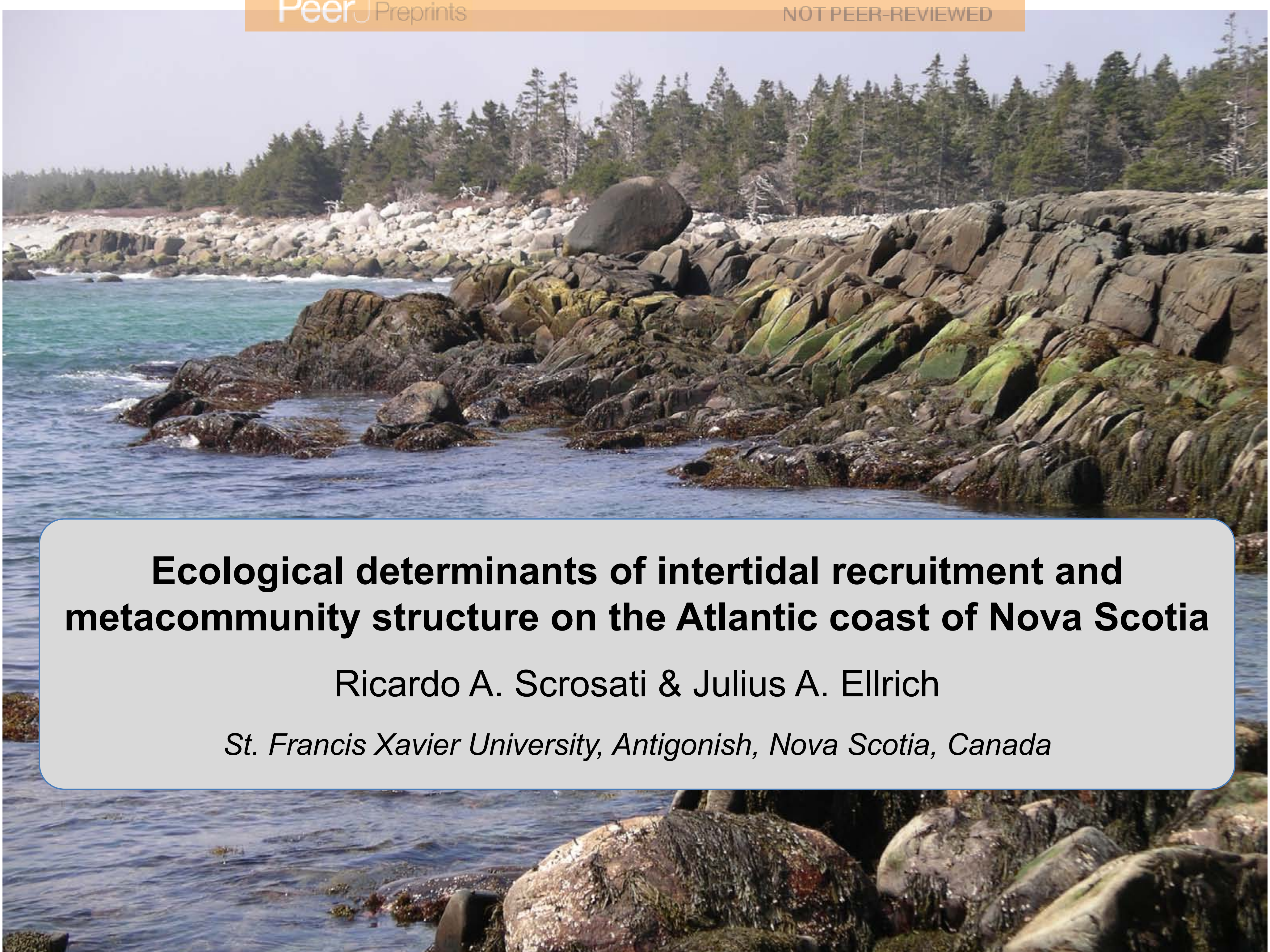

Ecological determinants of intertidal recruitment and metacommunity structure on the Atlantic coast of Nova Scotia

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Rocky intertidal biogeography

Rocky intertidal species are often distributed as metacommunities along marine coastlines, as rocky habitats are interspersed with sandy habitats.

Nearshore pelagic conditions often explain variation among local intertidal benthic communities, leading to benthic-pelagic coupling.

Ultimately, nearshore conditions can lead to bottom-up forcing, i.e., the effects of food/nutrient supply on basal trophic levels that propagate through consumption to higher trophic levels.

Most such studies have been done on eastern ocean boundary coasts where upwelling is prevalent (NE and SE Pacific, NE and SE Atlantic).

We investigated benthic-pelagic coupling and bottom-up forcing in Nova Scotia (NW Atlantic), a western ocean boundary coast.

Our main question is: What are the ecological determinants of intertidal recruitment and metacommunity structure along this coast?

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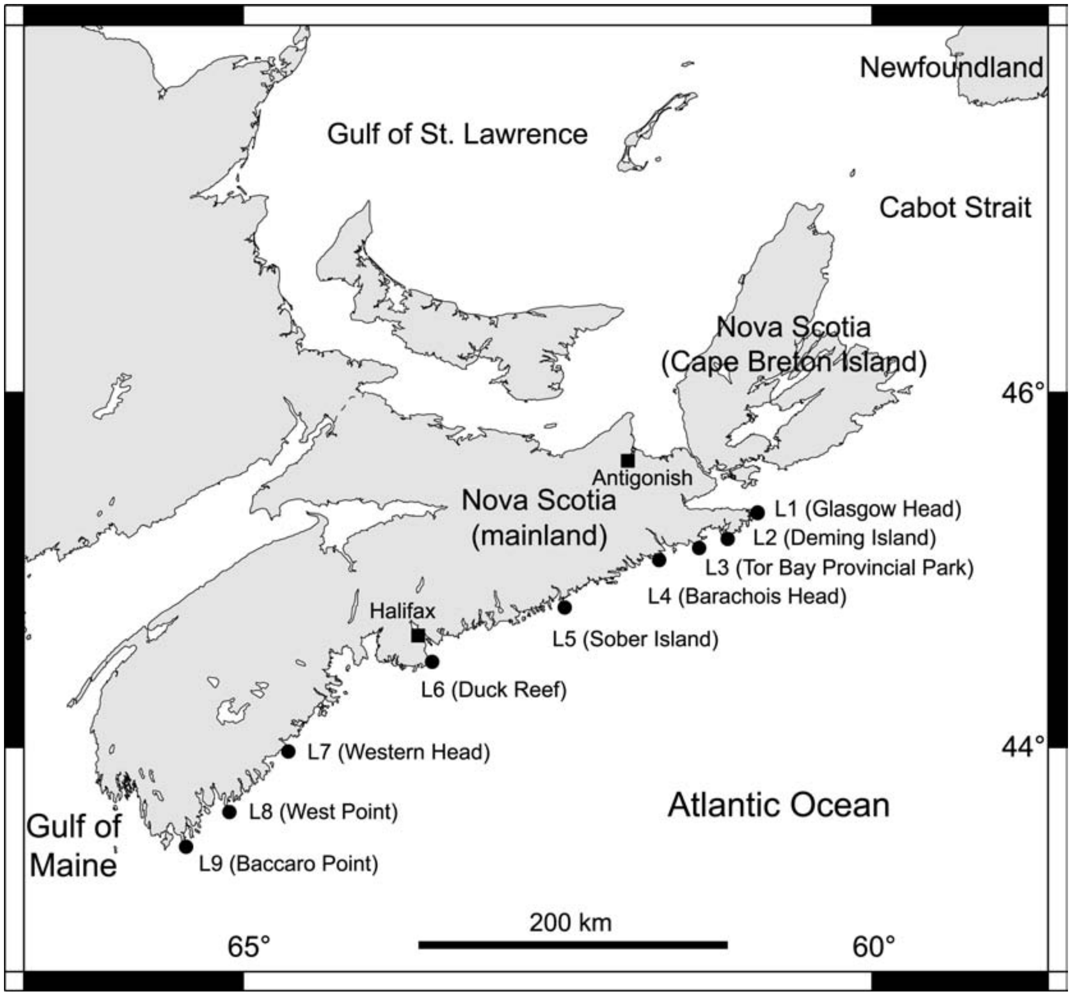
Initial project objectives

- To document benthic and pelagic ecological variation along the coast (2014)
- To seek evidence of benthic-pelagic links and bottom-up community regulation

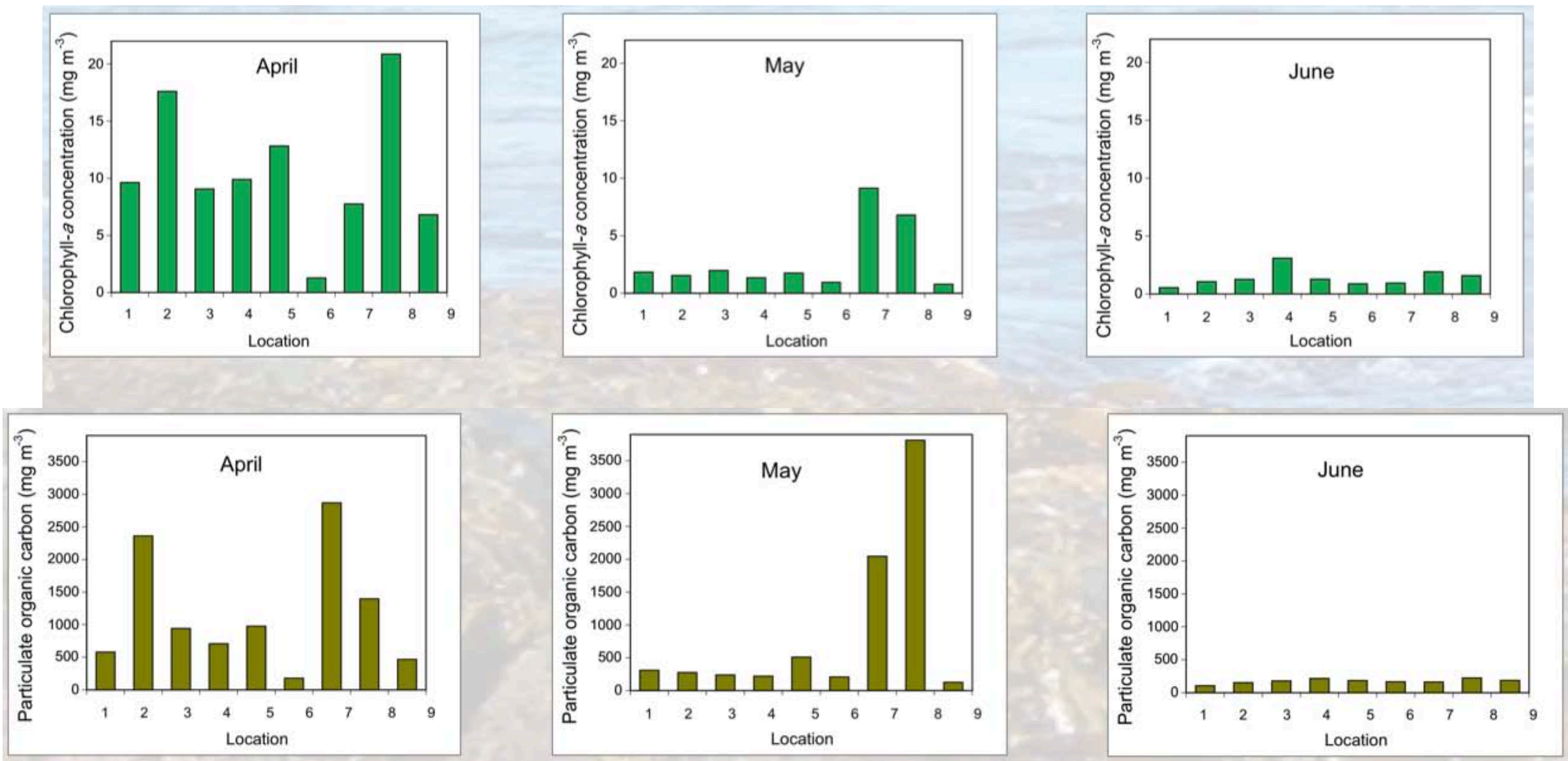


- Wave-exposed habitats
- Elevation = 2/3 of full intertidal range

Pelagic variables: Food supply

- Phytoplankton abundance (Chlorophyll-*a* concentration)
- Particulate organic carbon (POC)

➡ Food for intertidal filter-feeders (barnacles and mussels) and their larvae



Source: MODIS-Aqua satellite data - NASA

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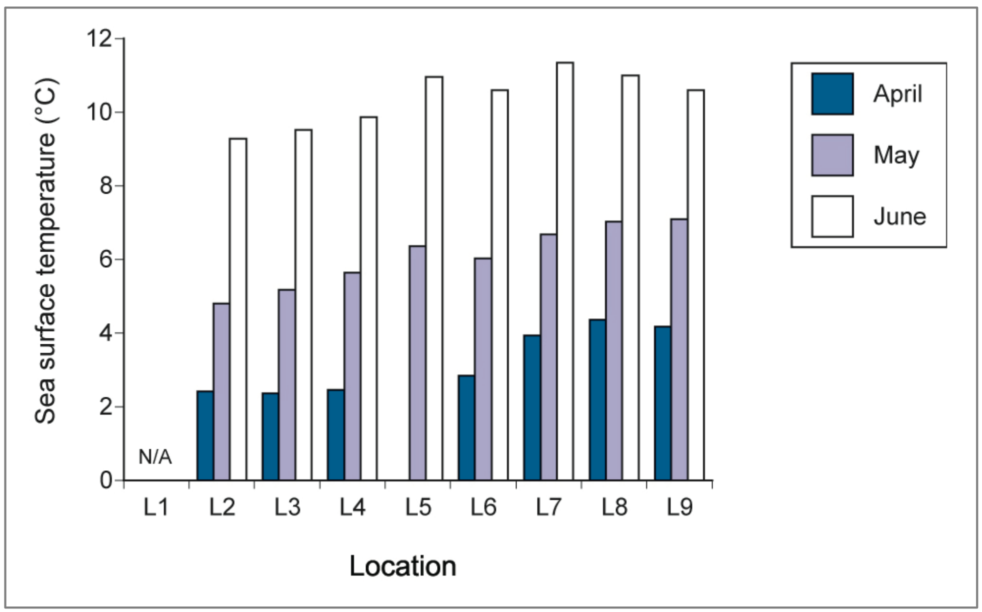
Pelagic variables: Sea surface temperature

→ SST affects the performance of pelagic larvae and benthic recruits

Submersible loggers on the intertidal substrate

Temperature measured every 30 min.

Daily SST extracted at the time of the highest tide



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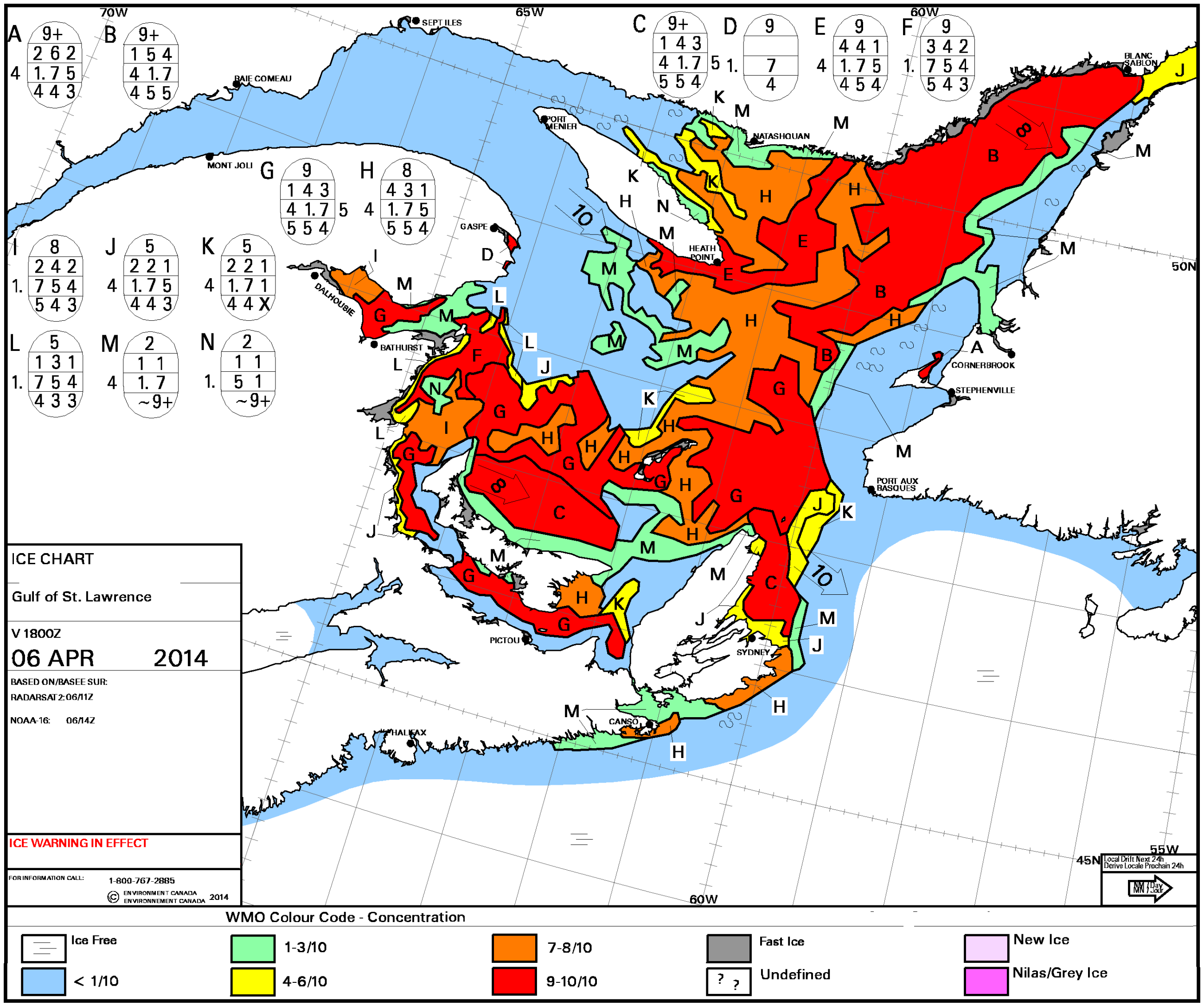
Pelagic variables: Drift sea ice



Source: Canadian Ice Service

Pelagic variables: Drift sea ice

Sea ice reaching Whitehead on 3 April 2014

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Benthic variables: Barnacle and mussel recruitment

Barnacles: *Semibalanus balanoides*

Mussels: *Mytilus trossulus* (mostly)
and *Mytilus edulis*

Barnacle recruitment: May-June

Mussel recruitment: April-May

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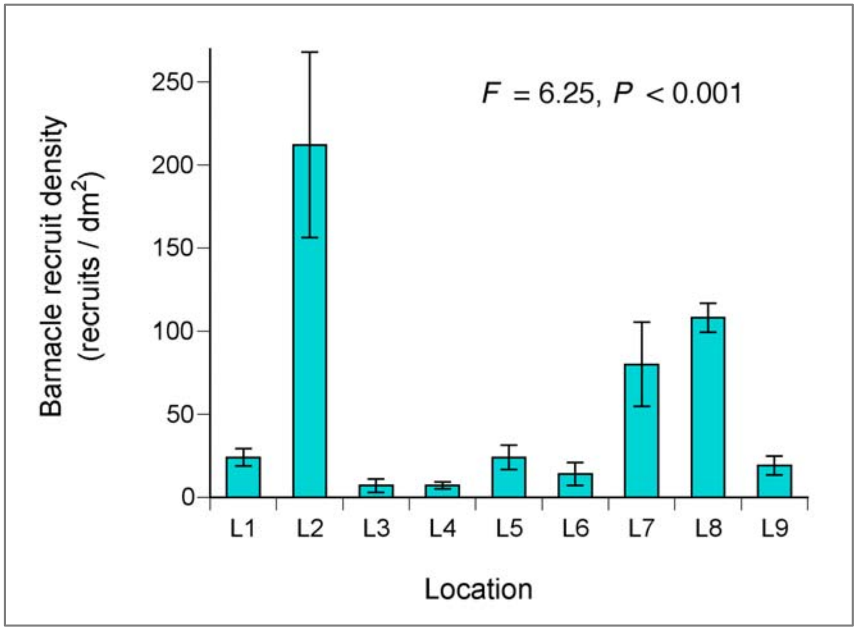
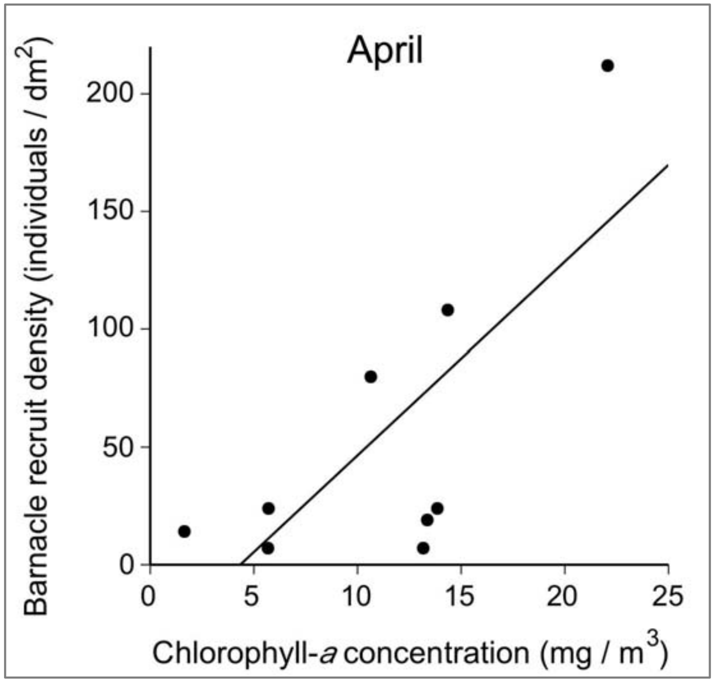
Barnacle recruitment

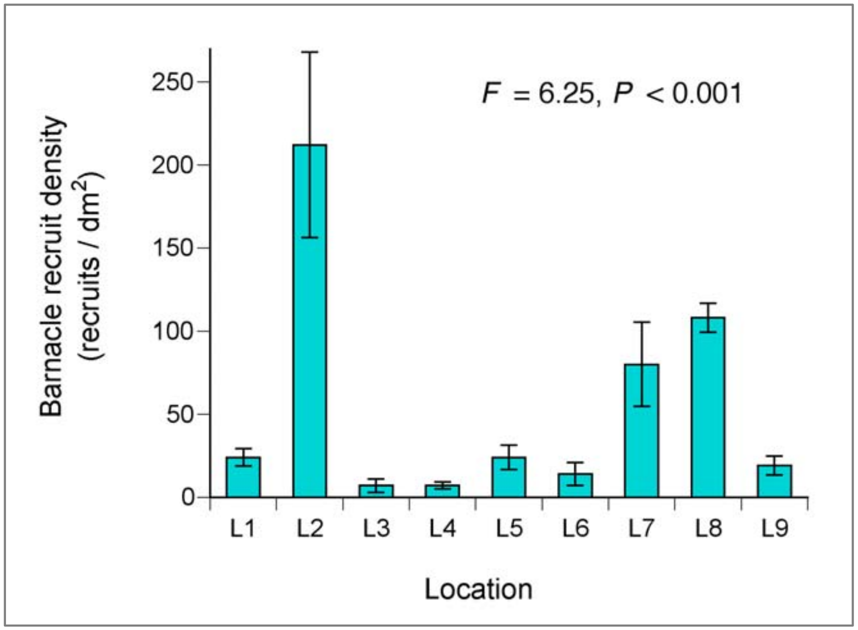


Relationship with Chl-*a*

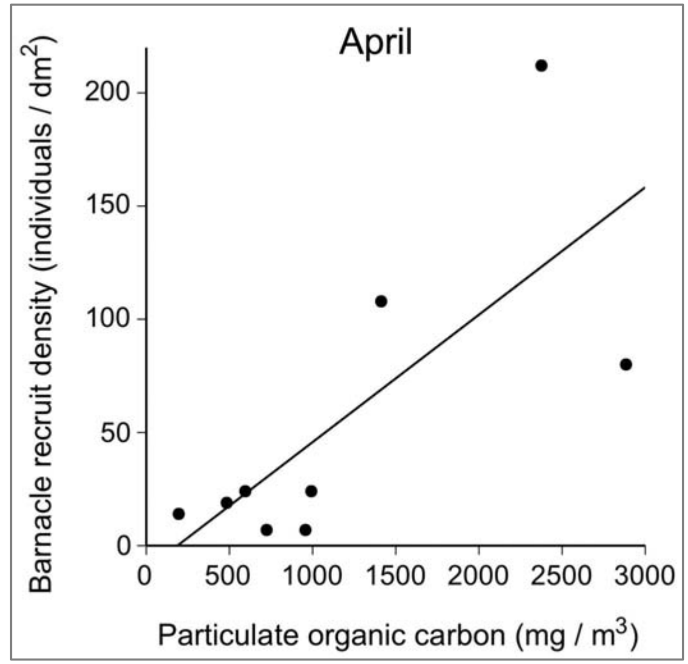
Intercept	April Chl-*a*	May Chl-*a*	June Chl-*a*	AICc	Adjusted R^2
-35.707	8.22	0	0	104.55	0.465
55	0	0	0	106.58	0
34.433	0	4.716		110.74	-0.065
76.195	0	0	-8.6	110.58	-0.046
-45.623	7.982	3.183	0	111.14	0.416
-13.969	9.279	0	-13.566	106.65	0.646
57.745	0	4.42	-8.175	117.17	-0.141
-22.314	9.066	2.497	-13.212	118	0.605



Barnacle recruitment

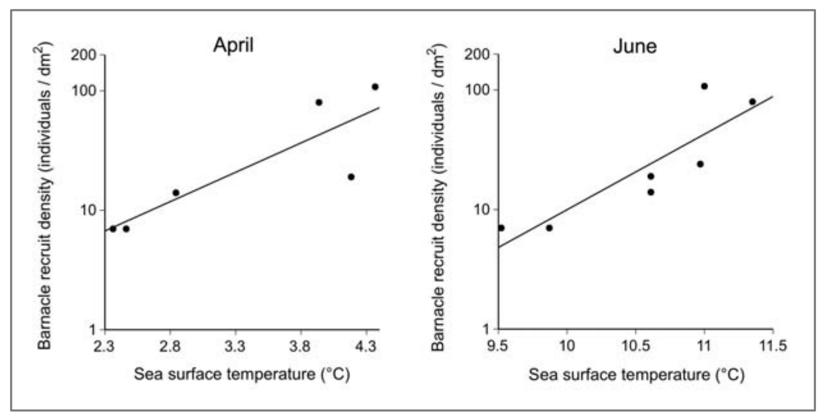


Relationship with POC

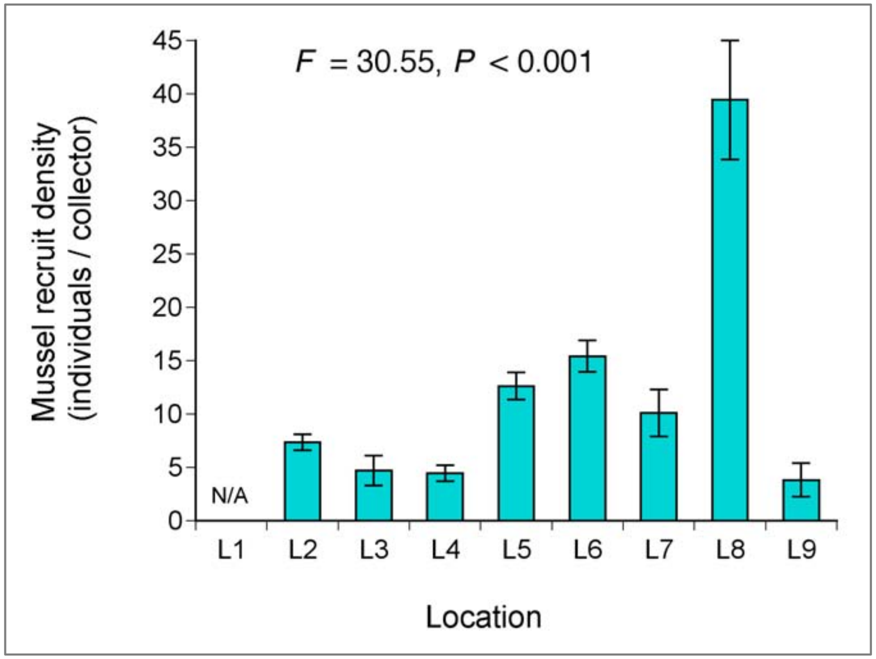


Relationship with SST

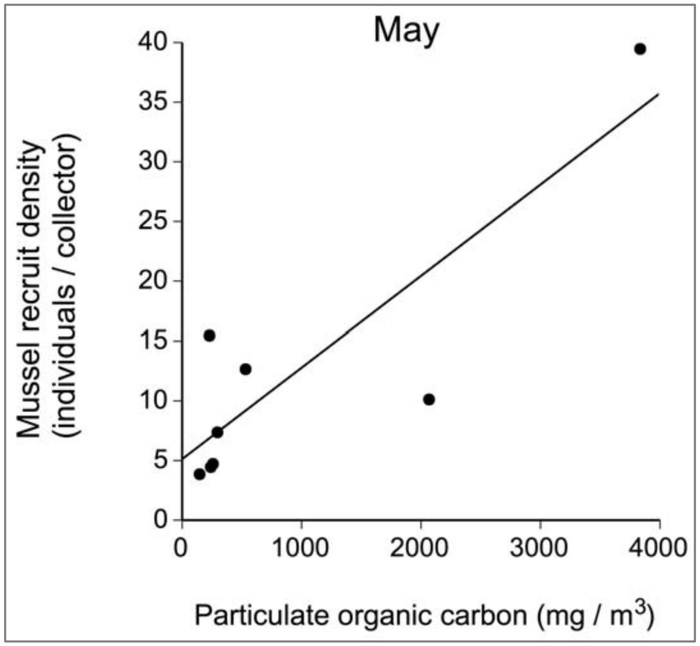
Intercept	April SST	May SST	June SST	AICc	Adj. R^2
-0.304	0.492	0	0	17.824	0.679
1.342	0	0	0	15.984	0
-1.931	0	0.522	0	20.044	0.536
-5.758	0	0	0.677	15.944	0.765
1.919	1.037	-0.646	0	46.606	0.651
-4.058	0.21	0	0.448	44.404	0.758
-5.451	0	0.082	0.599	45.797	0.695
-1.677	0.946	-0.952	0.555	48.756	0.877



Mussel recruitment



Relationship with POC



No relationships with Chl-*a* and SST

Evidence of benthic-pelagic coupling

Role of:

Pelagic food supply ➡ strong

Seawater temperature ➡ weak

Coefficient of variation:

Pelagic food supply ➡ high (55-77 %)

Seawater temperature ➡ low (7-14 %)

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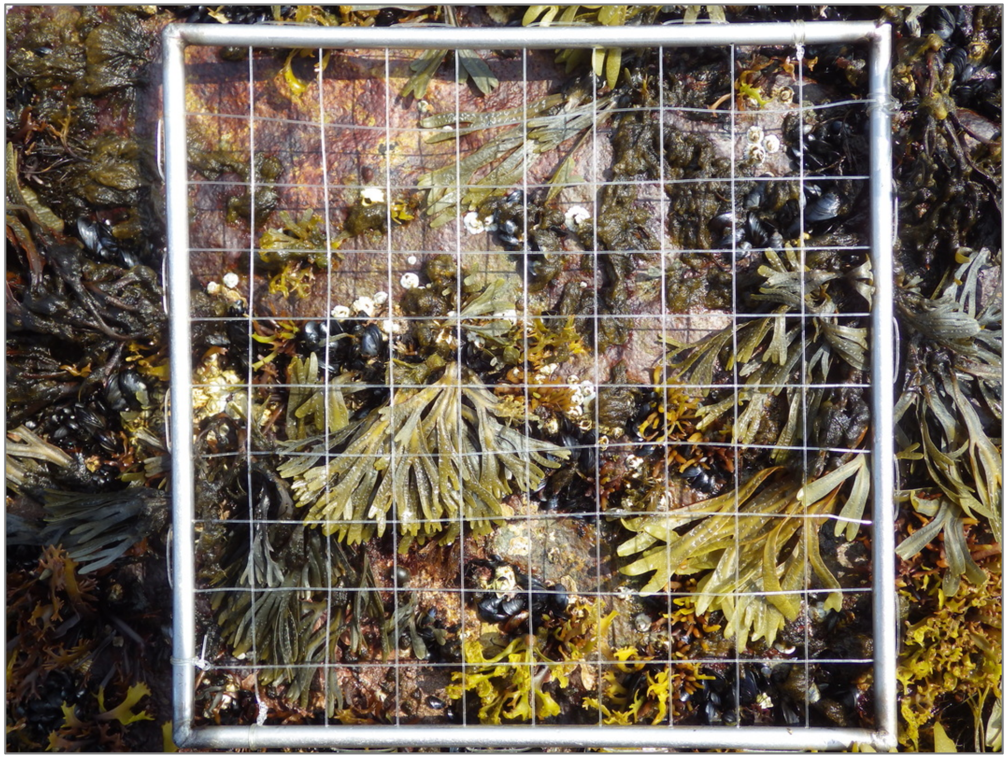
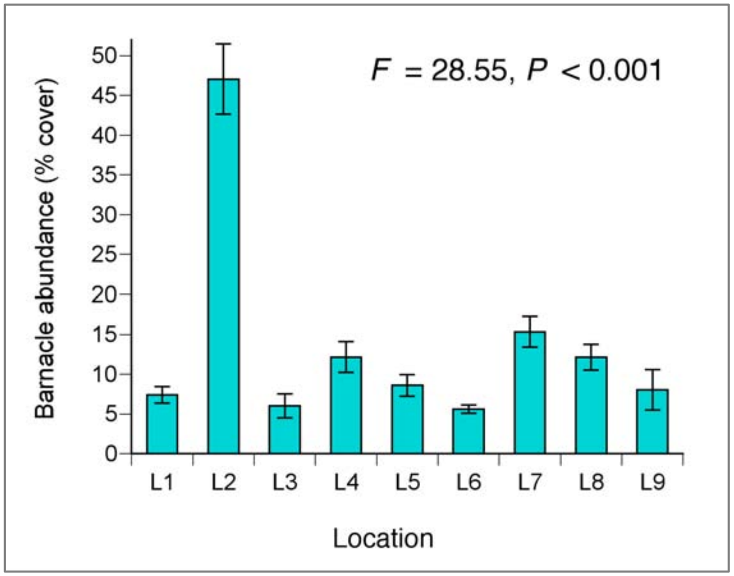
Relationships with adult abundance and predator abundance

Species abundance measured in natural communities in August

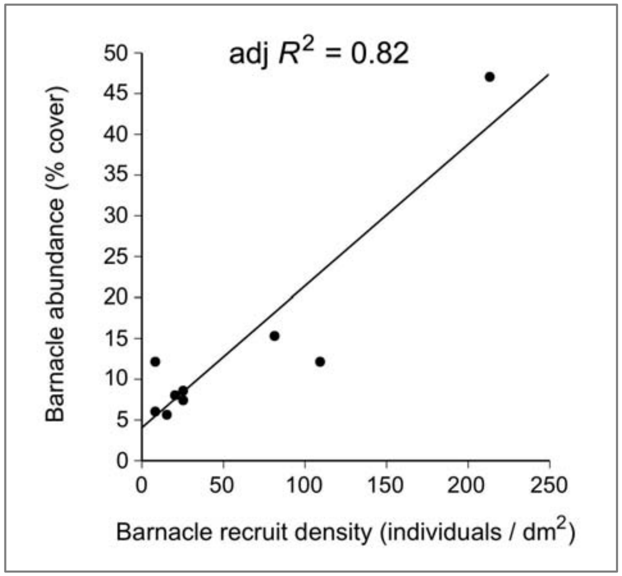


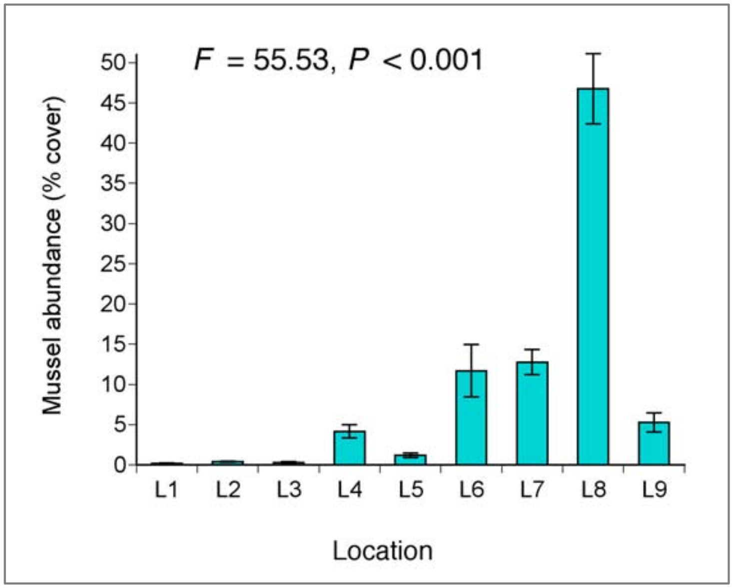
30 quadrats (20 cm x 20 cm) per location

Abundance of barnacles and mussels

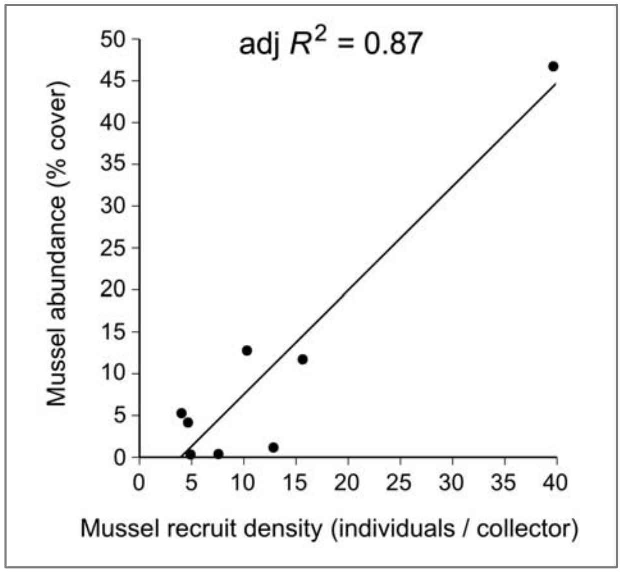


Barnacles





Mussels



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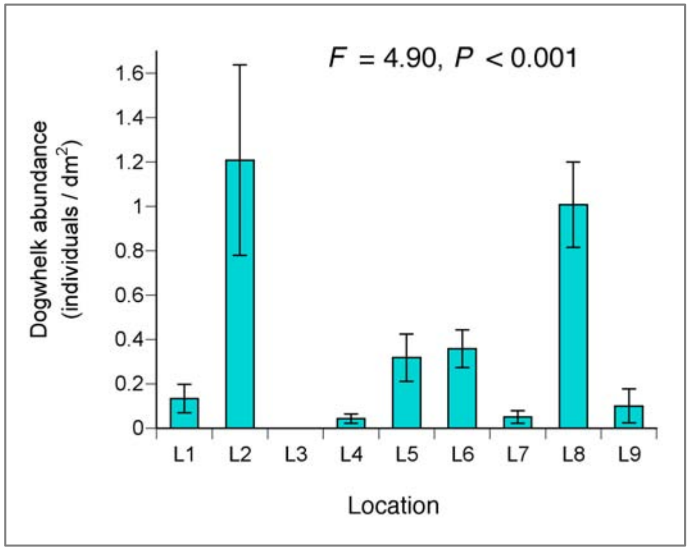
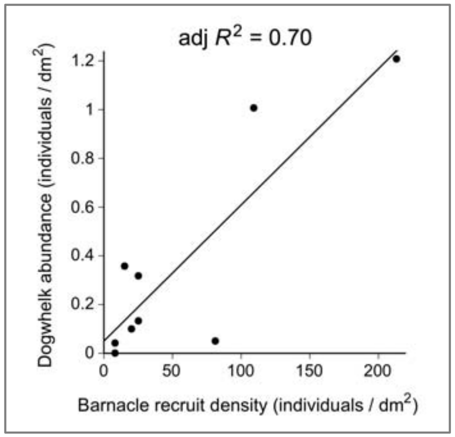
Abundance of predators (dogwhelks)

Nucella lapillus

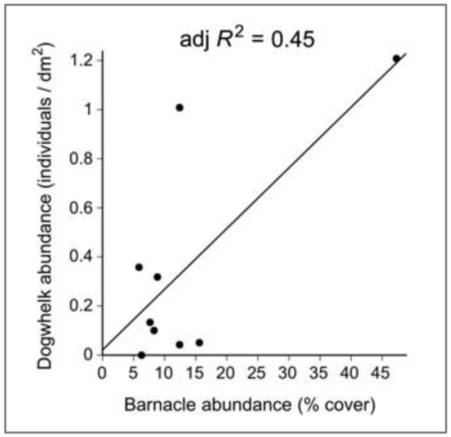


Evidence of bottom-up forcing

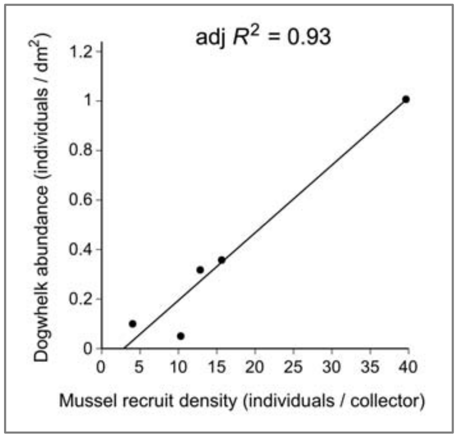
Correlation with barnacle recruitment



Correlation with barnacle abundance

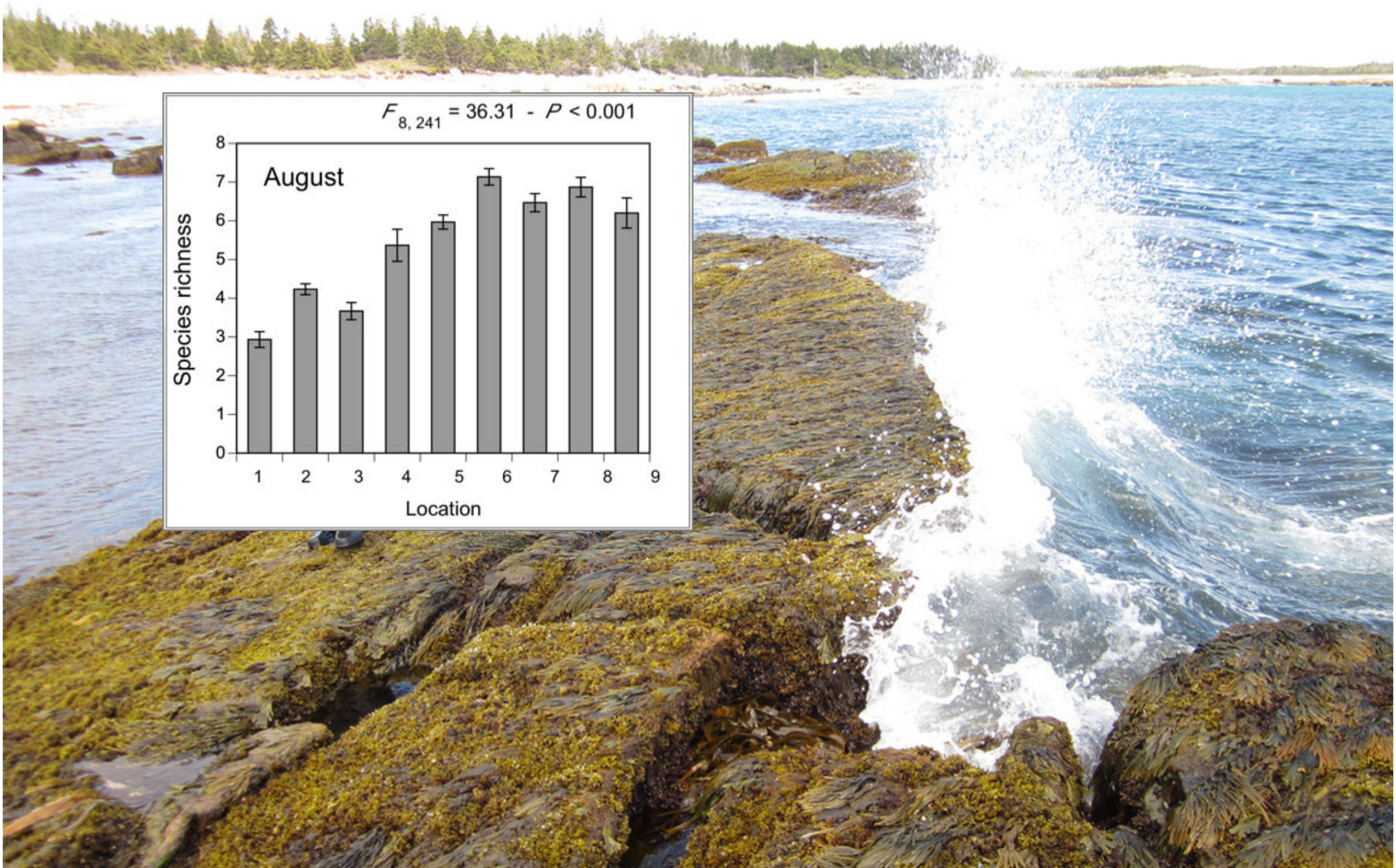


Correlation with mussel recruitment



without L1-L4 (ice scour)

Species richness



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Overall conclusions and future research

Evidence of benthic-pelagic coupling and bottom-up forcing

Seawater temperature less important than pelagic food supply

Ice scour determines north vs. central/south differences in communities

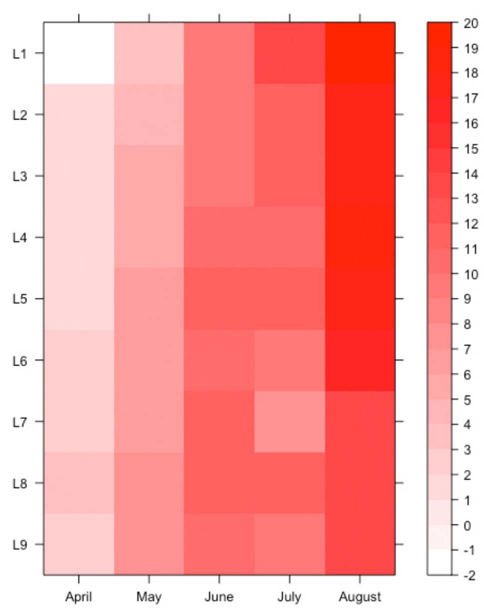
Pelagic food supply probably responsible for biogeographic patchiness

What drives coastal productivity (Chl-*a* and POC)?

Upwelling?

(Menge & Menge 2013, Ecological Monographs)

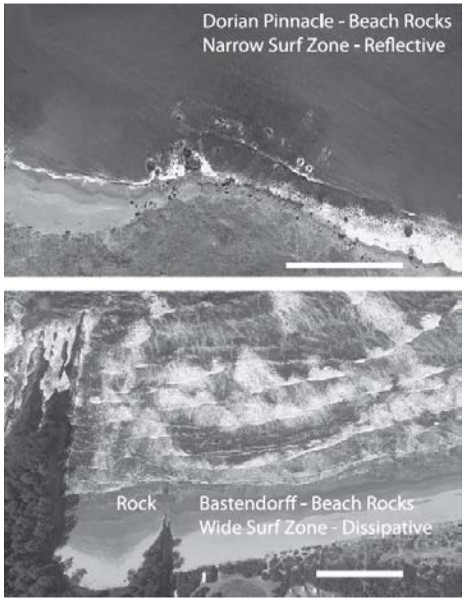
monthly SST



Surf zone hydrodynamics?

(Shanks & Morgan 2018, Ecological Monographs)

reflective vs. dissipative



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Benthic–pelagic coupling and bottom-up forcing in rocky intertidal communities along the Atlantic Canadian coast

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Citation: Scrosati, R. A., and J. A. Ellrich. 2018. Benthic–pelagic coupling and bottom-up forcing in rocky intertidal communities along the Atlantic Canadian coast. Ecosphere 9(5):e02229. 10.1002/ecs2.2229

Abstract. Benthic species from rocky intertidal systems are irregularly distributed along marine coastlines. Nearshore pelagic conditions often help to explain such variation, but most such studies have been done on eastern ocean boundary coasts. We investigated possible benthic–pelagic coupling along the Atlantic coast of Nova Scotia, a western ocean boundary coast. In 2014, we surveyed high-intertidal habitats from nine wave-exposed bedrock locations spanning 415 km of coastline. At each location in the spring, we measured the recruitment of barnacles and mussels, the two main filter-feeders. Recruitment varied irregularly along the coast. Satellite data on coastal phytoplankton and particulate organic carbon (food for intertidal filter-feeders and their pelagic larvae) and in-situ data on sea surface temperature explained, to varying degrees, the geographic structure of recruitment. In turn, the summer abundance of barnacles and mussels was positively related to their spring recruitment. Ultimately, intertidal predator (dogwhelk) abundance was positively related to the recruitment and/or abundance of barnacles and mussels (the main prey of dogwhelks). Sea ice may also have influenced this predator–prey interaction. Drift ice leaving the Gulf of St. Lawrence in late winter strongly disturbed the northern surveyed locations, making barnacles (through high spring recruitment) the only food source for dogwhelks (which survived ice scour in crevices) in such places. Overall, this study supports the occurrence of benthic–pelagic coupling and bottom-up forcing on this coast. Investigating the oceanographic drivers of pelagic food supply and seawater temperature should help to further understand how this large metacommunity is organized.

Thank you

StFX University

NSERC

Canada Foundation for Innovation

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