



Developing a vector management approach to prevent introduction and spread of marine biofouling invasive species in Newfoundland, Canada

Kyle Matheson, Cynthia H. McKenzie, Terri Wells, Haley Lambert, Ashley Bungay, Nicole Hynes, Bobbi Rees, Melissa Abbott

19th International Conference on Aquatic Invasive Species

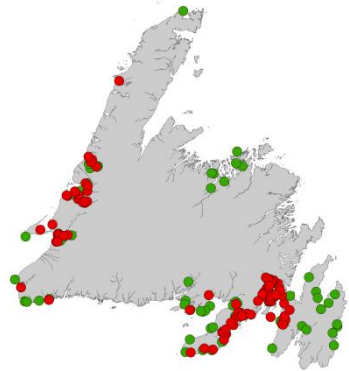
Winnipeg, MB – April 10 – 14, 2016



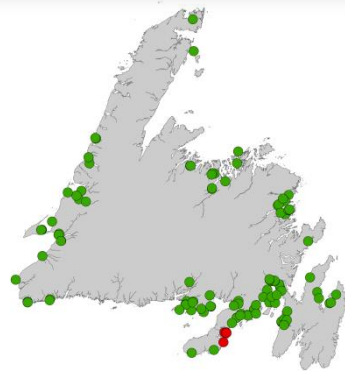


Aquatic Invasive Species in Newfoundland: Monitoring and Surveys

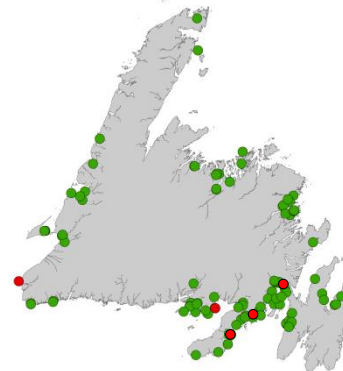
European Green Crab



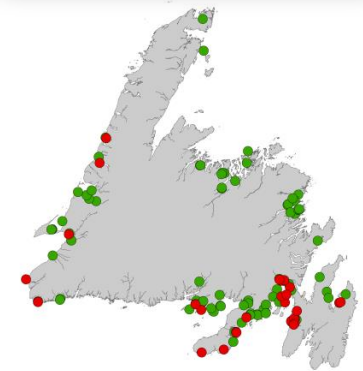
Vase Tunicate



Violet Tunicate



Golden Star Tunicate





Invasive Species Research

- Species specific research
- Early Detection
- Developing a rapid response framework



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Research Article

First record of vase tunicate, *Ciona intestinalis* (Linnaeus, 1767), in coastal Newfoundland waters

Philip S. Sargent^{1*}, Terri Wells¹, Kyle Matheson¹, Cynthia H. McKenzie¹ and Don Deibel²



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Research Article

Northward expansion of the invasive green algae *Codium fragile* spp. *fragile* (Suringar) Hariot, 1889 into coastal waters of Newfoundland, Canada

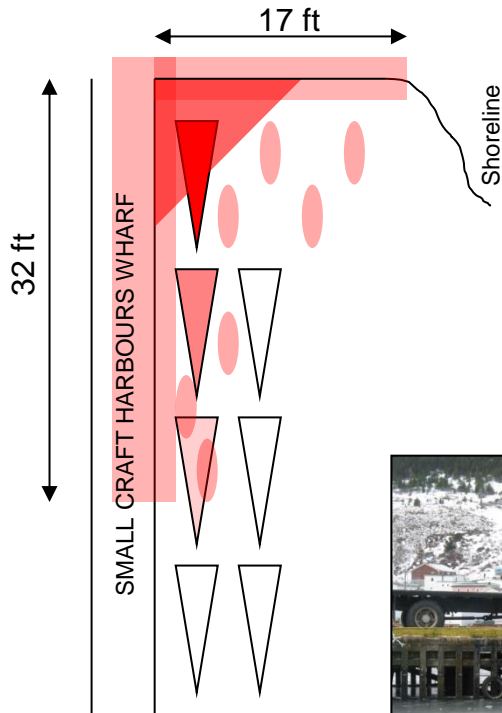
Kyle Matheson*, Cynthia H. McKenzie, Philip Sargent, Mike Hurley and Terri Wells





Early Detection / Rapid Response

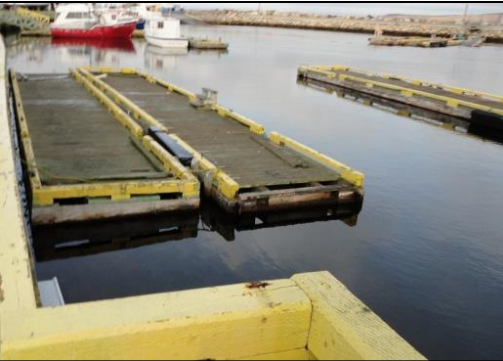
Violet Tunicate, Belleoram Hr 2008, 2009





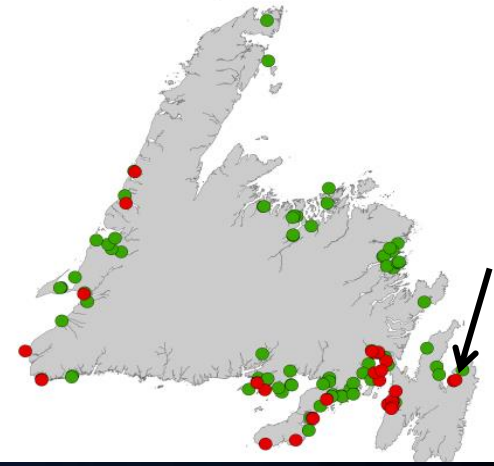
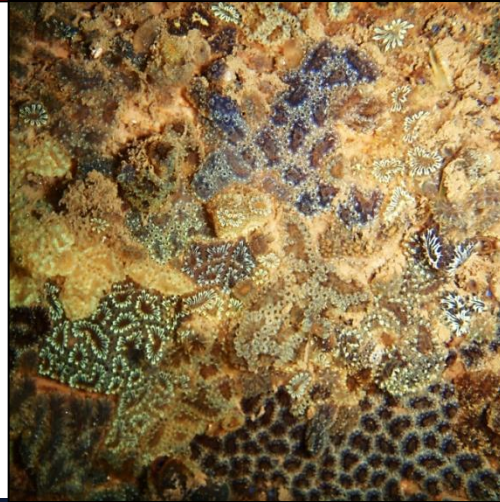
Early Detection / Rapid Response

Goldenstar Tunicate, Foxtrap Hr 2011



Timeline:

- Detection (late October)
- Confirmation and extent (early Nov)
- Mitigation planning (mid – late Nov)
- Docks Removed (Dec 5-6)
- Post Removal Dive (Dec 9)





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Proceedings of the 5th International Invasive Sea Squirt Conference (October 29-31, 2014, Woods Hole, USA)

Management in Practice

The development of a rapid response plan to control the spread of the solitary invasive tunicate, *Ciona intestinalis* (Linnaeus, 1767), in Newfoundland and Labrador, Canada

Cynthia H. McKenzie^{1*}, Kyle Matheson¹, Vanessa Reid², Terri Wells¹, Derek Moulund³, Darrell Green⁴, Brooks Pilgrim⁵ and Geoff Perry⁶

Rapid Response Vase Tunicate, Little Bay 2013

Key Phases:

- Communication
- Detection and Demarcation
- Containment and Risk Assessment
- Mitigation Implementation
- Evaluation





International Maritime Organization

Biofouling Guidelines

Terms of Reference – To investigate and evaluate methods/technologies to assess risks of, to minimize extent of, and to respond to vessel biofouling to inform national and/or international policies or guidelines.

The IMO Adopted the 2011 Guidelines for Control and Management of Ships Biofouling to Minimize the Transfer of Invasive Aquatic Species. (Annex 26 Resolution MEPC.207(62) Adopted 15 July 2011)

The IMO Approved the Guidance for Minimizing the Transfer of Invasive Aquatic Species as Biofouling (hull fouling) for Recreational Craft (IMO, 2012, Annex MEPC.1/Circ.792, 12 November 2012).





International Maritime Organization

Biofouling Guidelines

Terms of Reference – To investigate and evaluate methods/technologies to assess risks of, to minimize extent of, and to respond to vessel biofouling to inform national and/or international policies or guidelines.

Research needs (12.1) (Annex 26 Resolution MEPC.207 (62))

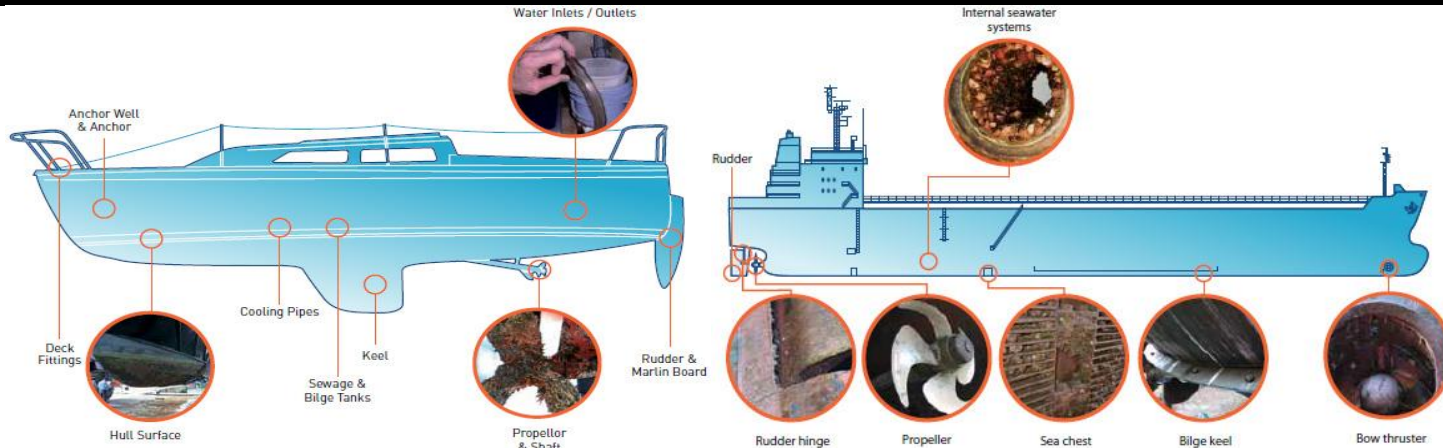
1. Minimizing and/or managing both macrofouling and microfouling particularly in niche areas;
2. In-water cleaning that ensures effective management of the antifouling system, biofouling and other contaminants, including effective capture of biological material;
3. Comprehensive methods for assessing the risks associated with in-water cleaning;
4. Shipboard monitoring and detection of biofouling;
5. Reducing the macrofouling risk posed by the dry-docking support strips;
6. The geographic distribution of biofouling invasive aquatic species;
7. The rapid response to invasive aquatic species incursions, including diagnostic tools and eradication methods.



International Maritime Organization Biofouling Guidelines

Terms of Reference – To investigate and evaluate methods/technologies to assess risks of, to minimize extent of, and to respond to vessel biofouling to inform national and/or international policies or guidelines.

Investigating and Breaking the vector!



Source:
Commonwealth of
Australia, 2009



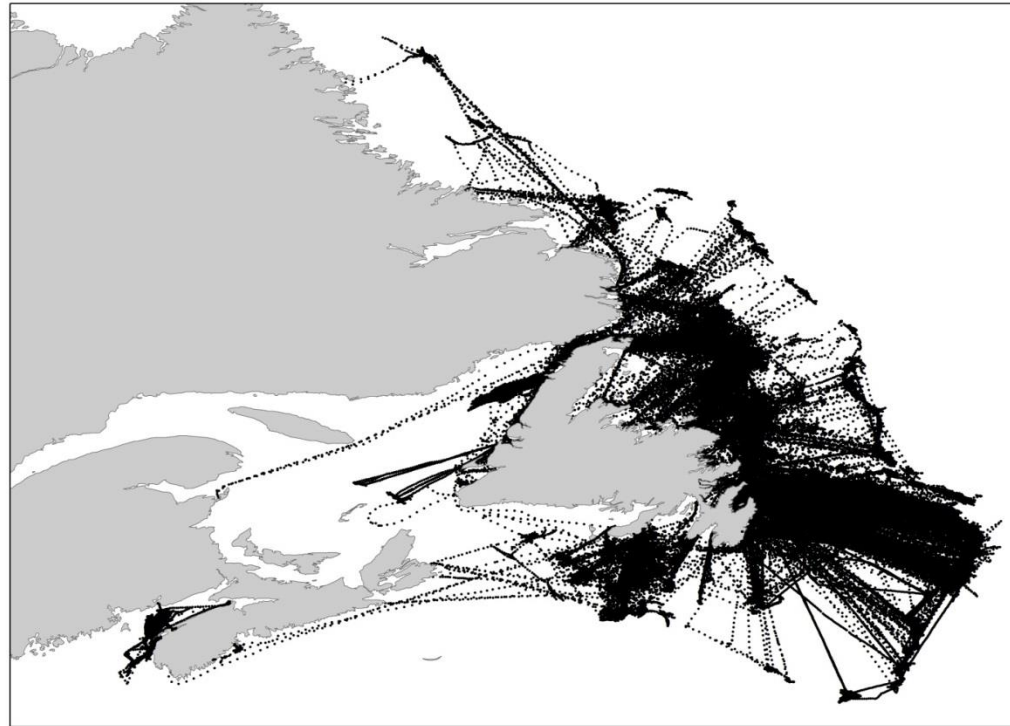


Best Management Practices Identifying Vectors & Pathways

Vectors in Newfoundland:

- Biofouling (vessels < 20 m)
- Ballast water (vessels > 20 m)
- Gear (e.g. traps, nets, cages, holding containers)
- Bilge/wasterwater
- Infrastructure (permanent and semi-permanent)

In NL, it's voluntary, but recommended to remove biofouling from boat, dispose in garbage, rinse and dry boat and gear between locations, drain waste water on land, use antifouling paint.



Movement patterns (n=170) for fishing boats less than 20 m equipped with a VMS, with last port of call listed as Newfoundland. Data obtained from DFO VUE database (2016).



Best Management Practices

Communication / Education / Outreach

Aquatic invasive species have been identified as a priority between provincial and federal departments

Our objective is to provide a review of preventative and mitigative strategies to provide guidelines to stakeholders, based on the best information available to prevent the spread and introduction of aquatic invasive species in Newfoundland and Labrador

Communication has already led to many unique preventative opportunities (e.g. surveying barges and docks before movement, removing docks temporarily, shared knowledge from harbour authorities.





Best Management Practices Communication / Education

What is done elsewhere?

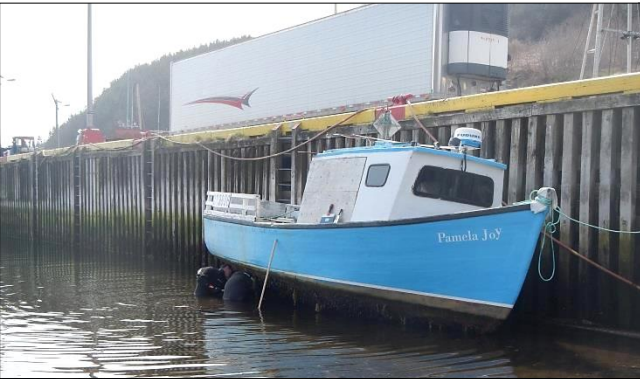
State/Province (Country)	M/V	Purpose	Action Taken				
			What to do?	How Often/When	Checking/Responsibility		
Alberta (CA)	M	Prevent the spread of AIS	Clean and inspect gear and vessel, soak gear in 2% bleach solution, rinse, scrub, or pressure wash; Drain on land; Dry craft and equipment before re-entering a water body	Each time you leave a water body	Must stop at all watercraft inspection stations		
British Columbia (CA)	V	Reduce the spread of AIS	Clean all equipment and vessel; drain onto land; dry fully	As soon boat is removed from the water	Always check before entering or leaving a water body	Air Dry completely before launching into another body of water	Invasive Species Council of British Columbia, 2014
Manitoba (CA)	M ^a V ^b	Help protect Manitoba's waters and resources	Clean, rinse, remove, inspect; Drain all water from motor, live well, bilge, ballast tanks, and bait buckets; dry; dispose in proper areas	Before launching, and after removing, any watercraft or water-related equipment into any Manitoba water body	Report all sightings of invasive species	8 consecutive days in spring or fall; >5 days if heated water is applied first	Government of Manitoba, 2016

Province/State (Country)	Method	Dry Time	Cleaner/Disinfectant/Soap	Reference
(Australia)	In-water hull cleaning system; on land filtration station with UV; scraper			Government of Western Australia, 2013
	Re-sleeve substandard wooden piles with concrete or epoxy resins			Currie et al. 1998
Europe	Dry dock Removal, Mechanically; fouling biota should be removed and destroyed; Flushing of water in docks during peak settlements		Antifouling Paints	Minchin 2009a
	Mechanical cleaning, Scrapping		Copper Salts, Brine Dips	Minchin 2009b
(United Kingdom)	Jet Washing with freshwater on land, dispose of debris properly,			Cook et al. 2016
	encapsulation of the infected areas		Biobullet	
	enclose with Plastic film bags; can add accelerant		sodium hypochlorite, acetic acid, chlorine, or freshwater	
	Apply antifouling paint			



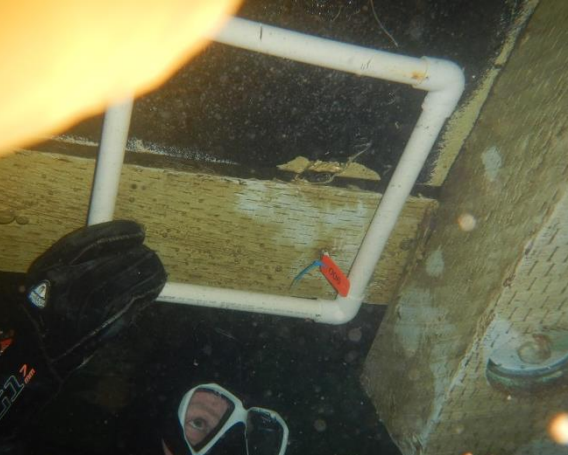


Best Management Practices AIS Regulations





Antifouling Coatings (i.e. Paint)

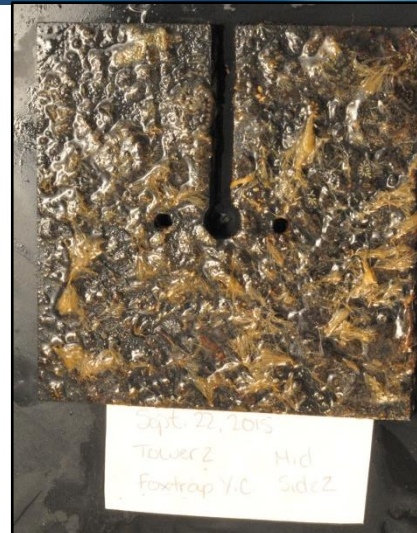




Antifouling Sonication

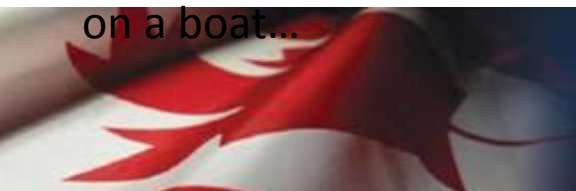
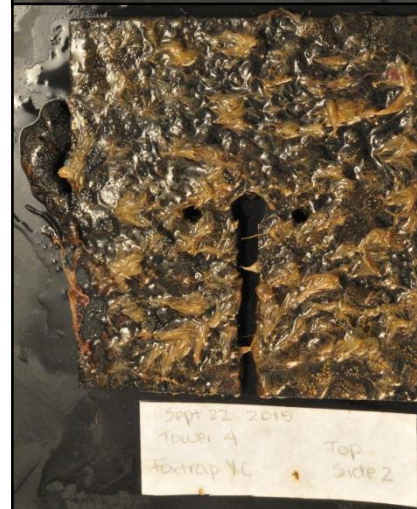


Sonication



- Did not see a large difference between sonication and control plates
 - Too much fouling? Season? Substrate? Species?
- Future ideas include testing different materials, trying sonication on a boat...

Control





Environment Parameters Matching / Hotspots

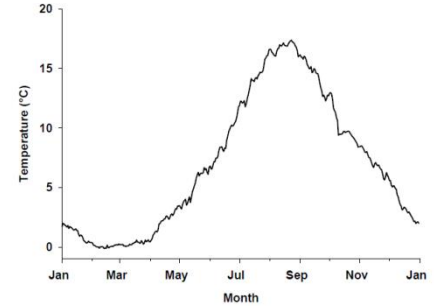
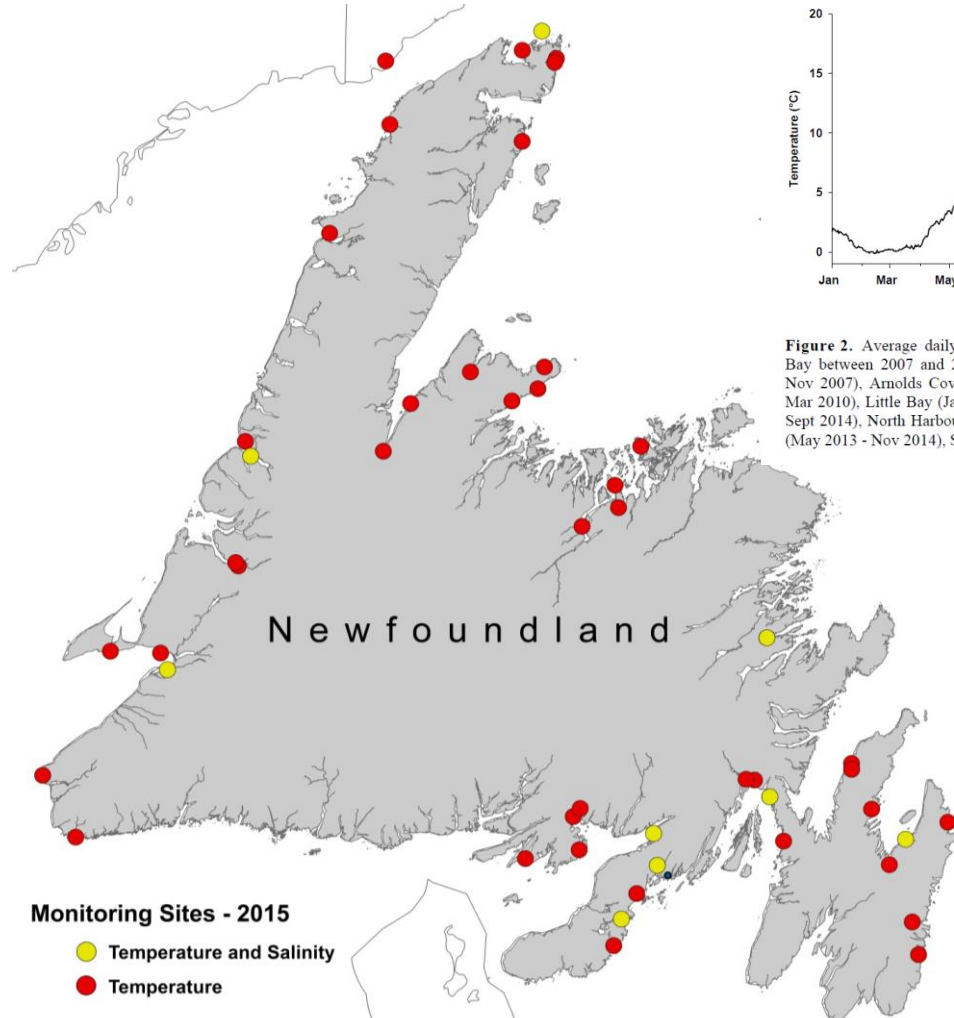


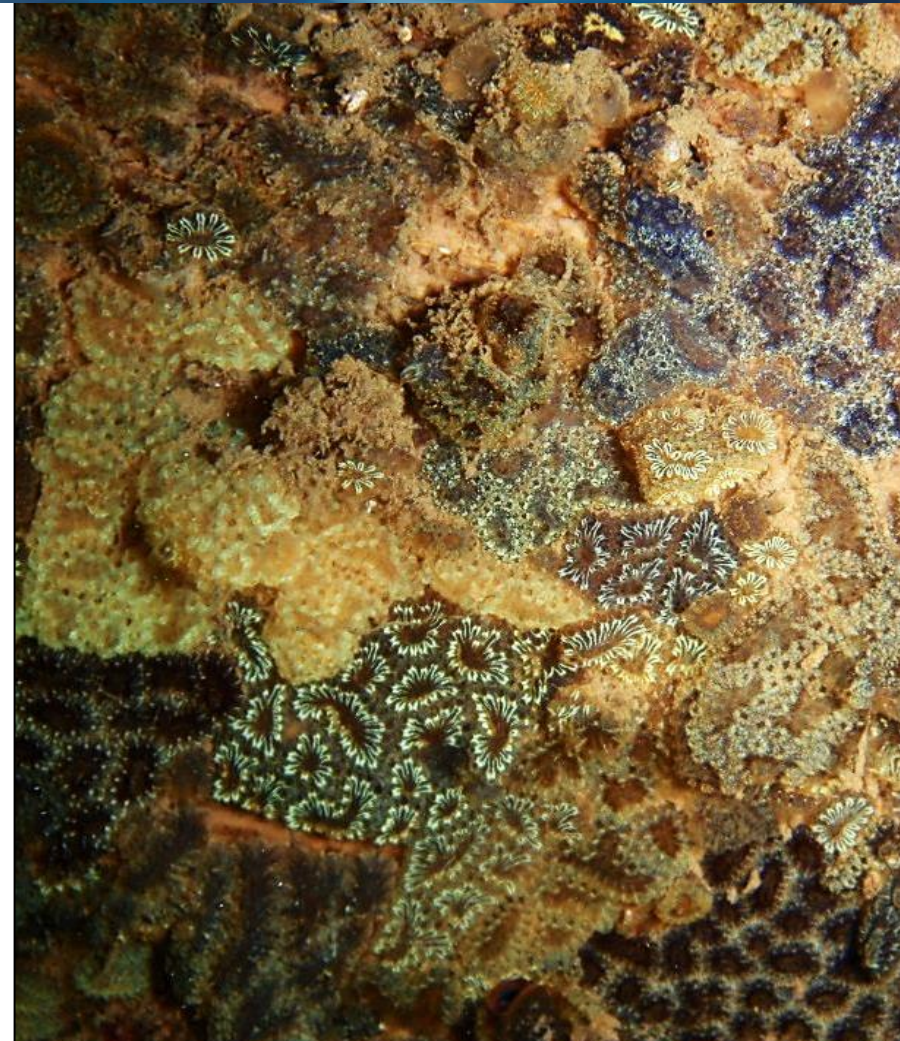
Figure 2. Average daily seawater temperatures from Placentia Bay between 2007 and 2014. Data from Argientia (Dec 2006 - Nov 2007), Arnolds Cove (Sept 2007 - Aug 2008; July 2009 - Mar 2010), Little Bay (Jan 2013 - Oct 2014), Marystown (May - Sept 2014), North Harbour (Oct 2008 - July 2012), Placentia NE (May 2013 - Nov 2014), Swift Current (July - Nov 2014).
(McKenzie et al. 2016)



Summary

Moving forward

- Continue antifouling research (MSc candidate, Ashley Bungay)
- Continue to distribute and collect temperature/salinity loggers
- Continue to experiment with application of sonication as an antifouling technique
- Increase signage with AIS prevention advice
- Continue to expand our relationship with harbour authorities and resource users





Questions?



Acknowledgements:

- Fisheries and Oceans Canada
 - AIS Science Program, Science Branch, Oceans, Policy & Economics, FAM, Small Craft Harbours
- Memorial University of Newfoundland
- Provincial Department of Fisheries and Aquaculture
- Harbour Authorities and Towns
- Industry Partners (Aquaculture, Fisheries Union)
- First Nations
- Canadian Centre for Fisheries Innovation CCFI
- Environmental Organizations (ACAP- Humber Valley)
- Parks Canada

