# Characterize abundance, richness and diversity of dinoflagellate communities in high risk ports of the Canadian Arctic

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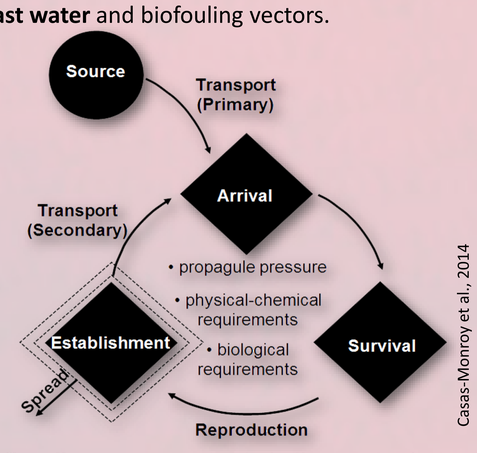
UQAR ISMER · NSERC CRSNG · Arctic Change 2017 · ArcticNet · Pêches et Océans Canada · Fisheries and Oceans Canada · Polar Knowledge Canada · Savoir polaire Canada

## 1. INTRODUCTION

Shipping activities in the Canadian Arctic are expected to increase due to global warming (sea ice reduction) and economic development. This increase is expected to enhance the risk for introduction of **nonindigenous** species via **ballast water** and biofouling vectors.




**INVASION PROCESS STAGES**
(Hallegraeff, 1998)

- Ballast uptake
- Survive transport conditions in ballast (low oxygen, lack of light, predation) — **ARRIVAL**
- De-ballasting
- Release In the new environnement — **SURVIVAL**
- Reproduce and establish
- Spread — **ESTABLISHMENT**

**Dinoflagellates** may survive in ballast tanks during voyages and reproduce after their release in destination ports. The capacity to produce resistant cysts (15% of dinoflagellates) increases their chances for survival, reproduction and invasion.

**Dinoflagellates** can be responsible for important ecological and economic impacts on the ecosystems once released in a new environment (Casas-Monroy et al. 2016):

- Cause hypoxia in surface waters;
- Produce harmful blooms;
- Produce toxins that could be accumulated in filtered feeders (e.g, bivalves) and fishes, transferred through food chain and be lethal to marine fauna or humans;
- Cause important income losses to the aquaculture industry.

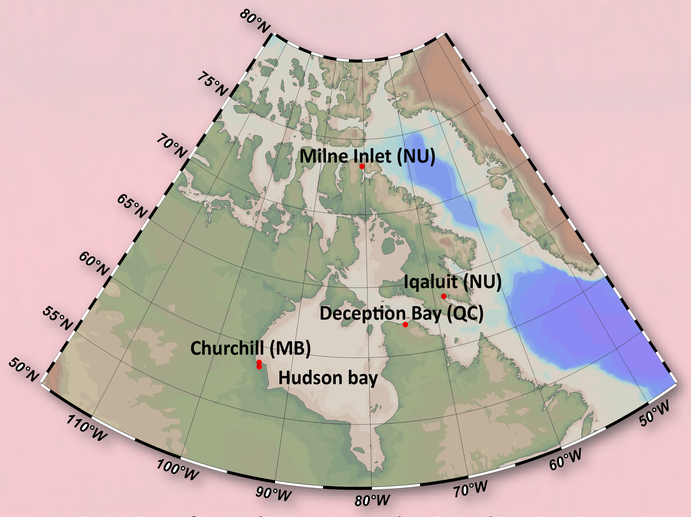
## 2. OBJECTIVES

- Characterize abundance, richness and diversity of dinoflagellate communities in high risk Canadian Arctic ports to provide baseline data and detect the presence of potential nonindigenous species
- Compare the communities of dinoflagellate sampled in 2007 and 2015 in Churchill

## 3. METHODS

**Study Area.** Samples were collected in the Canadian Arctic in August in the ports of Churchill (MB) in 2007 and 2015, Iqaluit (NU) in 2015, Deception Bay (QC) in 2016, and Milne Inlet (NU) in 2017.


**Field work**




Location of sampling ports in the Canadian Arctic. MB = Manitoba, QC = Québec and NU= Nunavut.

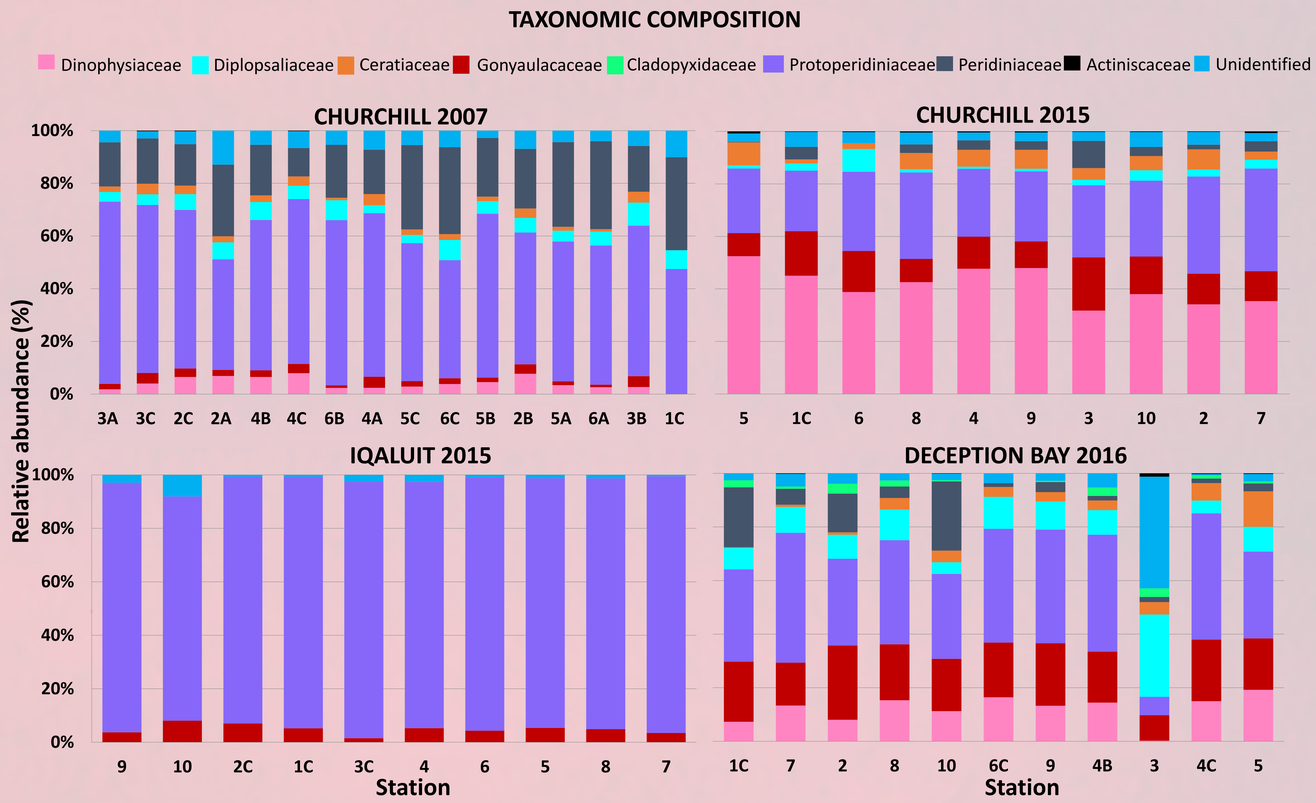
- Vertical profile of temperature and salinity using a CTD;
- Photic zone depth determined using a Secchi disk;
- Vertical plankton net (Nitex® 20 µm) from the bottom to the surface to collect dinoflagellate samples;
- Concentrated samples preserved with formaldehyde solution (4%).

**Laboratory**

- Samples analyzed based on the Utermöhl method (Utermöhl, 1958) using a NIKON Eclipse TE-2000 inverted microscope at 200 X magnification;
- Sub samples of 300-500 cells enumerated and identified.

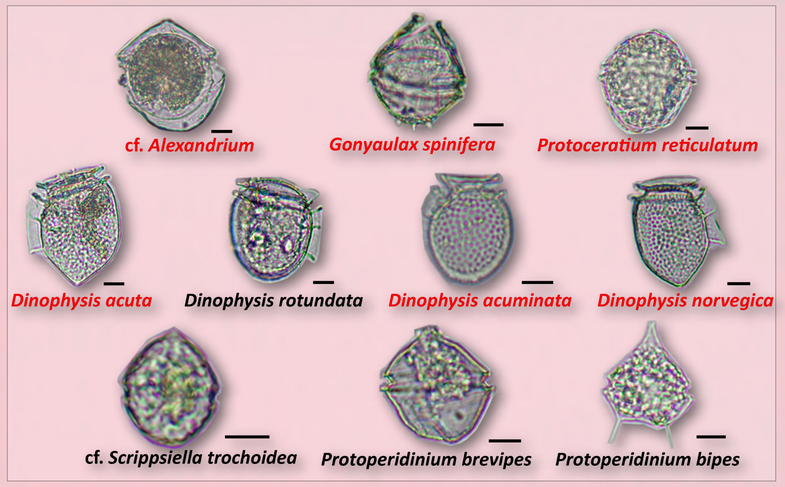
## 4. PRELIMINARY RESULTS

**TAXONOMIC COMPOSITION**




| Port | Family (#) | Taxa (#) | Abundance | Dominant Family | Dominant Species | Toxin Producers Taxa | Harmful taxa (%) |
|---|---|---|---|---|---|---|---|
| Churchill 2007 | 8 | 36 | 181 cells/l | Protoperidiniaceae | cf. Scrippsiella trochoidea (Peridiniaceae) | Dinophysis acuminata, D. acuta, D. norvegica, cf. Alexandrium sp., Gonyaulax spinifera and Protoceratium reticulatum | 14% |
| Churchill 2015 | 8 | 40 | 155 cells/l | Dinophysiaceae | D. acuminata (Dinophysiaceae) | D. acuminata, D. acuta, D. norvegica, cf. Alexandrium sp., G. spinifera and P. reticulatum | 49% |
| Iqaluit | 2 | 7 | 46 cells/l | Protoperidiniaceae | Protoperidinium bipes (Protoperidiniaceae) | P. reticulatum | 5% |
| Deception Bay | 8 | 47 | 127 cells/l | Protoperidiniaceae | Protoperidinium brevipes (Protoperidiniaceae) | D. acuminata, D. acuta, D. norvegica, cf. Alexandrium sp., G. spinifera and P. reticulatum | 30% |

Milne Inlet port 2007: ongoing analysis




Micrographs of selected taxa identified in all samples. The text in red indicates the six toxin producer taxa present in the samples. Scale bar = 10µm.

**DIVERSITY INDEX**

| | J' (Evenness) | H'(Shannon Wiener) |
|---|---|---|
| Deception Bay | 0.859 | 2.9629 |
| Churchill 2015 | 0.794 | 2.579 |
| Churchill 2007 | 0.782 | 2.380 |
| Iqaluit | 0.427 | 0.643 |

- DB diversity index > Churchill > Iqaluit.

## 5. CONCLUSION

The preliminary results indicate that dinoflagellate communities are different in each port. Statistical tests are underway for validation. We will also investigate the influence of environmental factors on species composition among ports and examine correspondence between dinoflagellate communities found in ballast water with the results of the present work.

**ACKNOWLEDGEMENTS** We want to thank Baffinland and Raglan mines and ship crews for their support. We are grateful to local community members. DFO and university collaborators who participated to sampling collections. This project is funded by Polar Knowledge Canada, Natural Sciences and Engineering Research Council of Canada, Nunavik Marine Region Wildlife Board, Nunavut Wildlife Management Board, DFO AIS Monitoring Program and Polar Continental Shelf Program.

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