Coastal Index of Response to Climate Change by Economic Zone (CIREZ)

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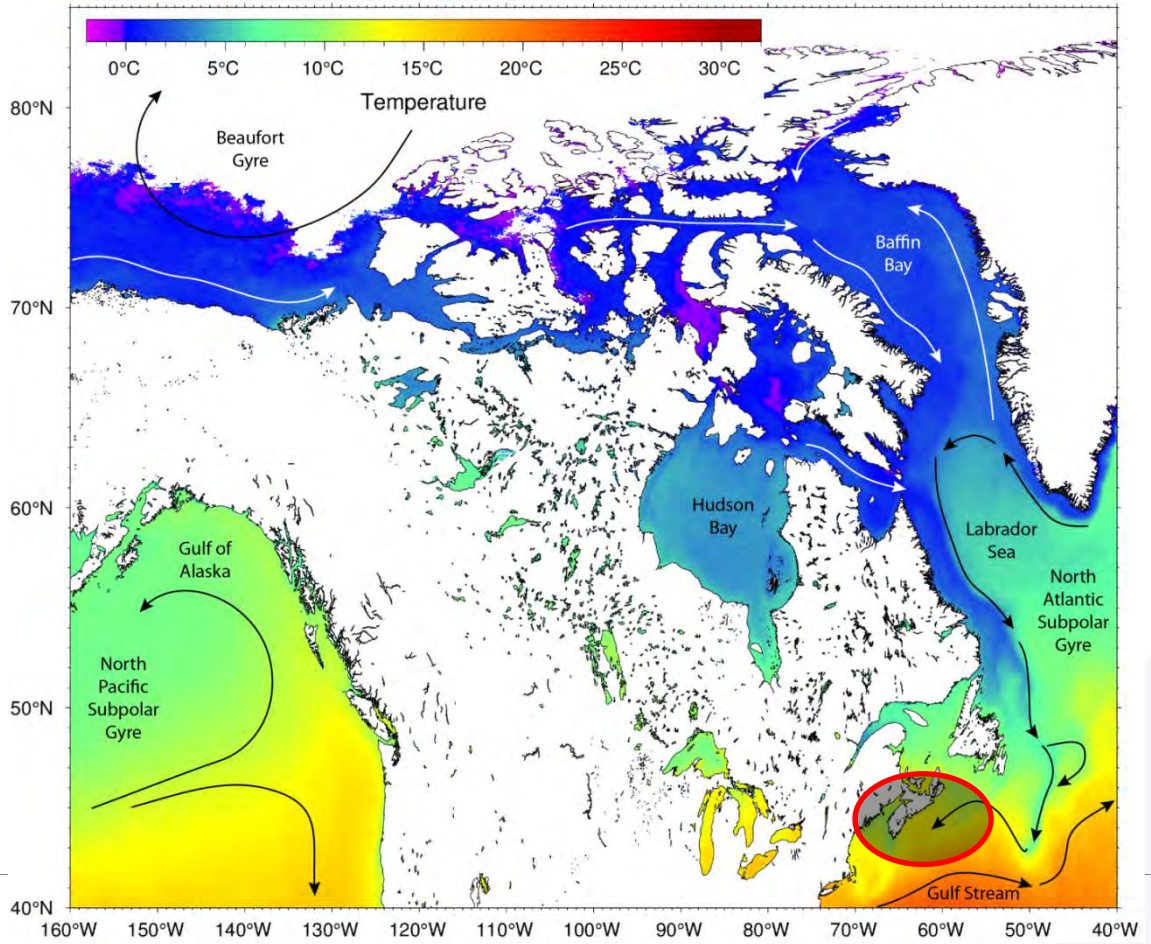
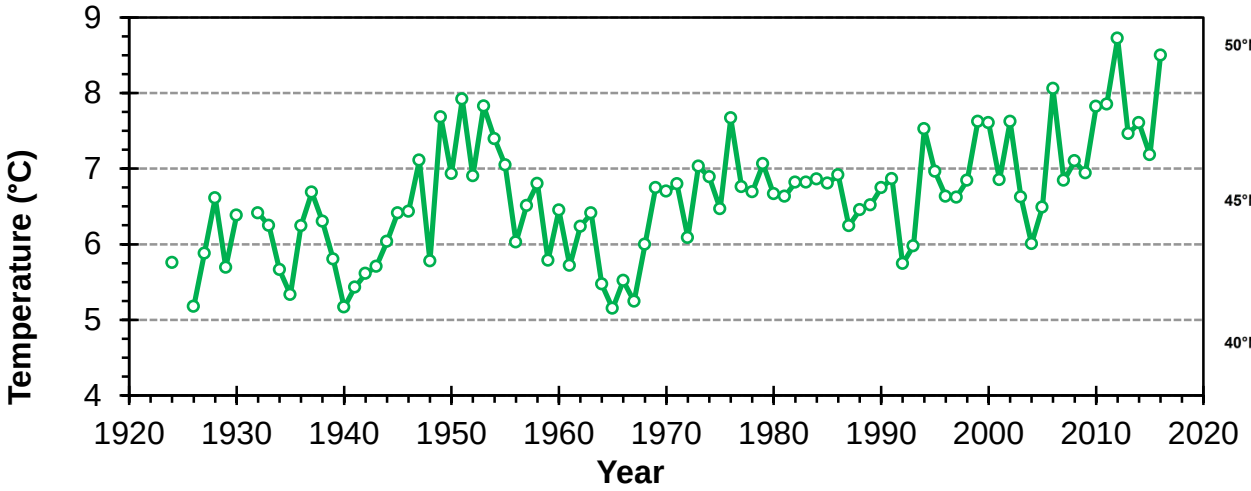
Outline

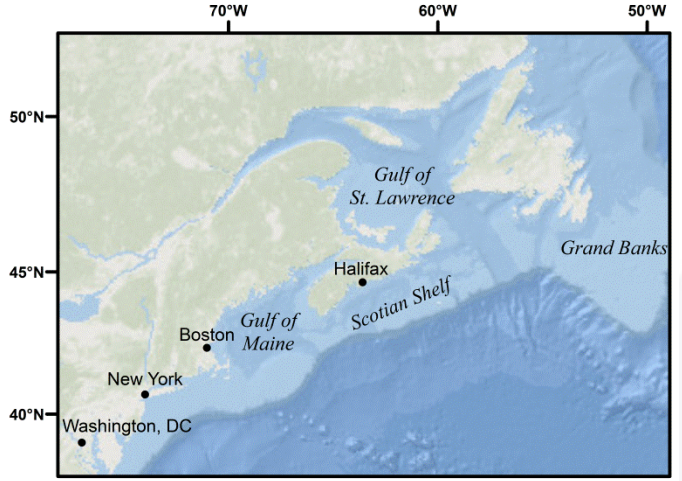
1. Climate Change Trends in Atlantic Canada
2. Coastal Infrastructure
3. Ecosystems & Fisheries
4. CIREZ – Combining Infrastructure, Fisheries and Socio-economic indicators

The Physical Setting



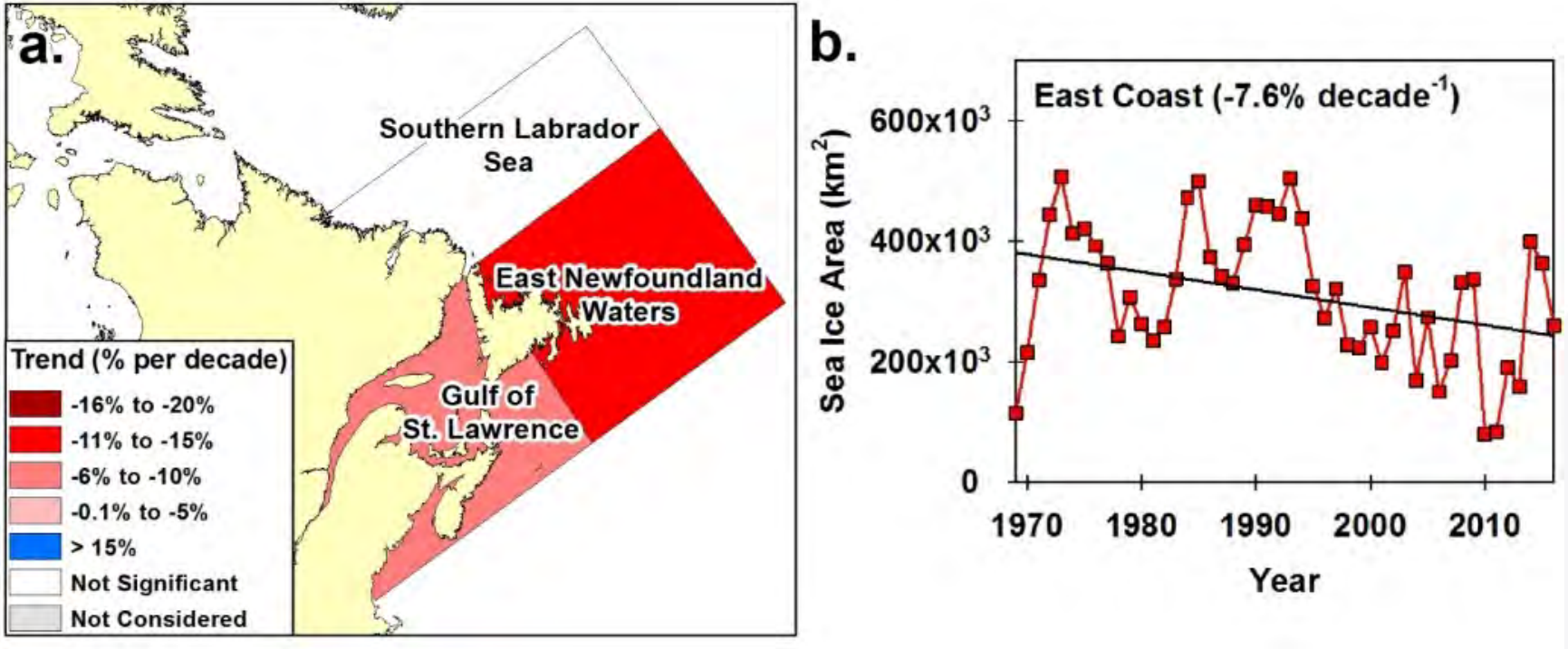
Temperature (Bay of Fundy – Prince 5 Station)



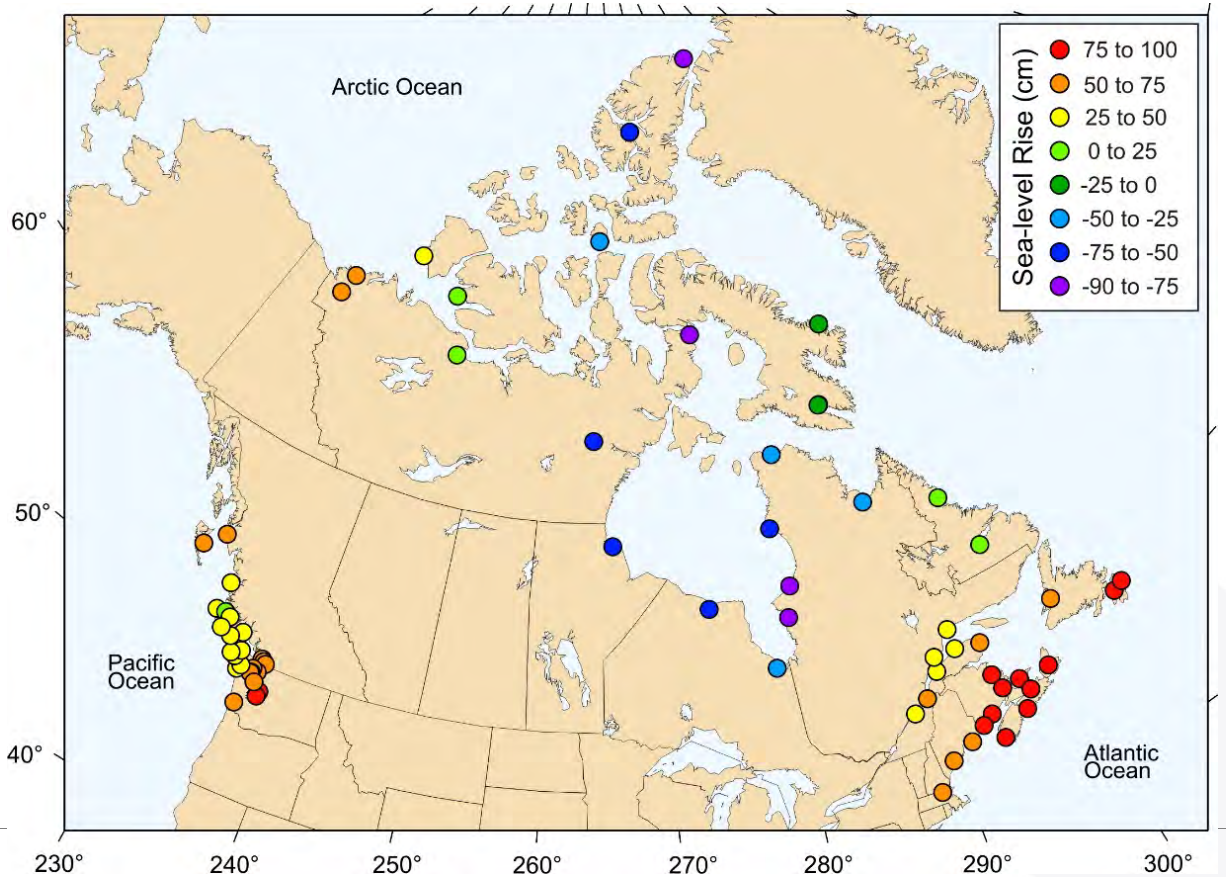


- Long-term warming rate of 1.6˚C/century.

Winter Sea Ice Trends



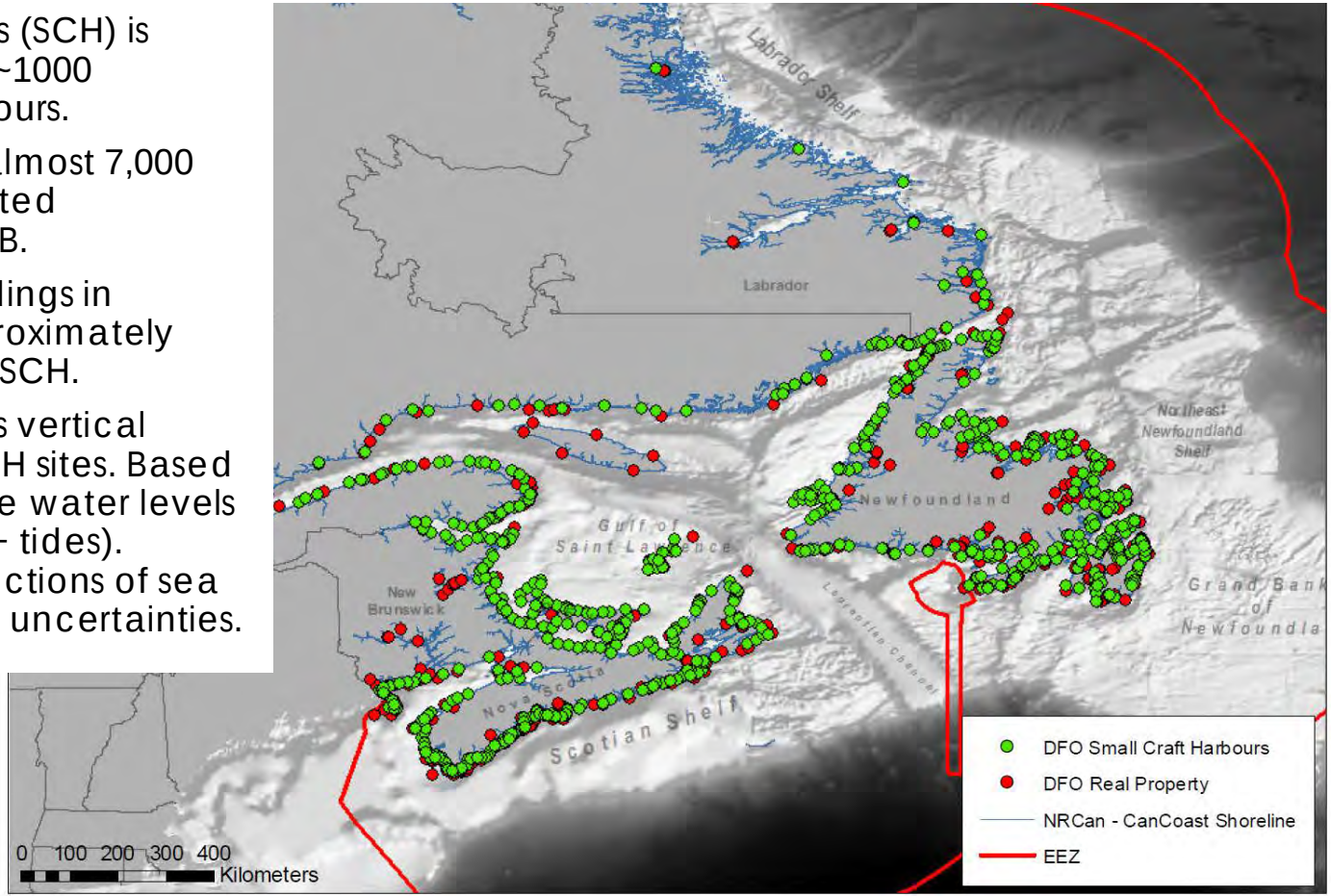
Sea Level Rise (RCP8.5 – End of 21st Century)



Tom James, Natural Resources Canada

CAN-EWLAT: Canadian Extreme Water Level Adaptation Tool

- DFO Small Craft Harbours (SCH) is currently responsible for ~1000 commercial fishing harbours.
- These harbours include almost 7,000 structures with an estimated replacement cost of ~$4B.
- Nearly 90% of all fish landings in Canada, valued at approximately $1.6B annually, occur at SCH.
- Adaptation tool provides vertical allowance advice for SCH sites. Based on past history of extreme water levels at SCH site (storm surge + tides). Incorporates future projections of sea level rise and associated uncertainties.



http://sealevelrise.ca/

SEA LEVEL RISE

ATLANTIC CANADA

Global Sea Level Rise = **the average amount water levels are rising in all of the oceans on the planet**

By **2100** global sea levels are expected to rise approximately **1 m** above current levels.

Sea-level rise predictions are presented by the Intergovernmental Panel on Climate Change (IPCC). The **IPCC ASSESSMENT REPORT 5**, published in 2013/2014, is a result of the collaborative efforts of **830 scientists** from over **80 countries** along with **1,000 contributing authors** and **2,000 expert reviewers**, assessing more than **30,000 scientific papers**. The AR5 is over **4,800 pages long** and is the **MOST COMPREHENSIVE** assessment of climate change ever undertaken.

2 Main reasons

sea levels are rising globally:

These are **both** caused by a **warming Earth**.

1 Thermal Expansion = The oceans increase in volume and take up more space as they heat up.

As a pot of water is heated, the water molecules move faster. The faster they move, the more space they take up, causing volume to expand.

The ocean is absorbing **90%** of **the heat** from global warming.

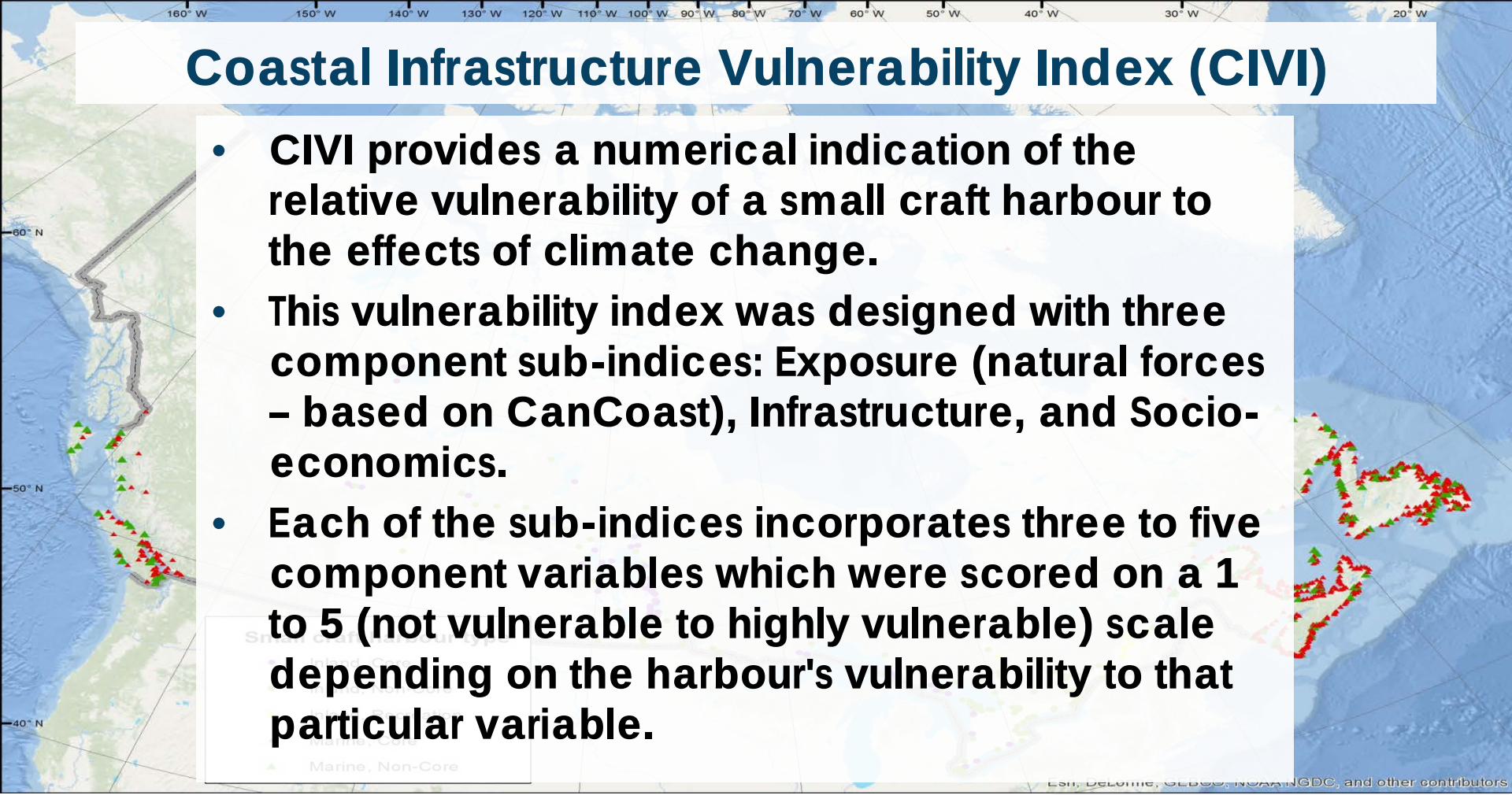
2 Melting Land Ice

(glaciers, ice caps, ice sheets)

As temperatures rise, land ice meltwater enters the ocean and causes sea levels to rise.

Coastal Infrastructure Vulnerability Index (CIVI)

- CIVI provides a numerical indication of the relative vulnerability of a small craft harbour to the effects of climate change.
- This vulnerability index was designed with three component sub-indices: Exposure (natural forces – based on CanCoast), Infrastructure, and Socio-economics.
- Each of the sub-indices incorporates three to five component variables which were scored on a 1 to 5 (not vulnerable to highly vulnerable) scale depending on the harbour's vulnerability to that particular variable.



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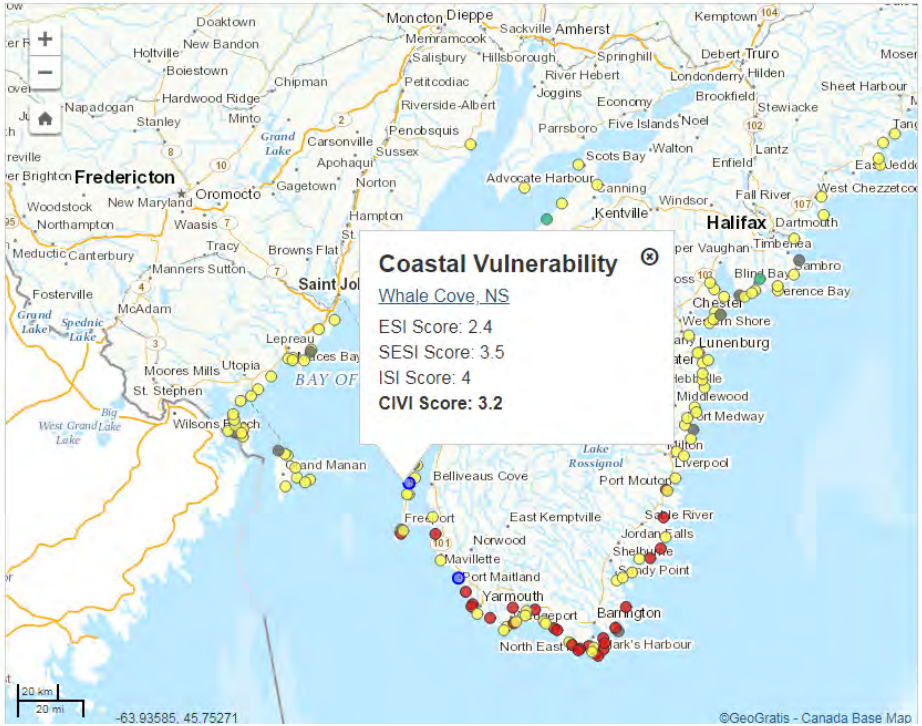
Coastal Infrastructure Vulnerability Index (CIVI)

Download Data

Coastal Vulnerability | High | Medium | Low | N/A | Submit

▶ Instructions: Map Navigation



Legend

Coastal Vulnerability

What about the fish?

<u>Next Step</u>: Add Biological Response Assessment to Website

Ecosystem Change

Knowledge of Impacts of Environmental Drivers varies, and can be INDIRECT

Acidification

Warming

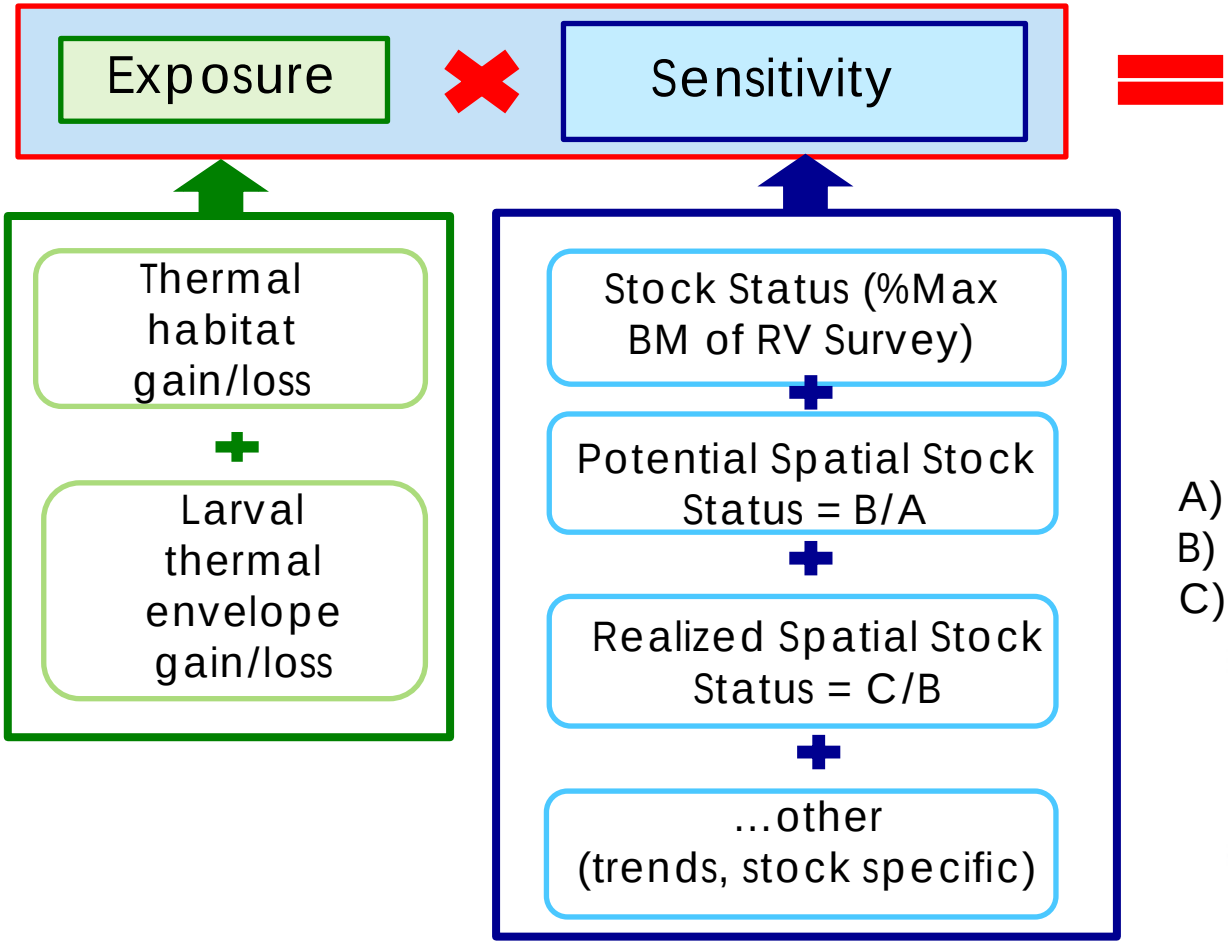
Altered boundary current

Stratification

Lower dissolved oxygen

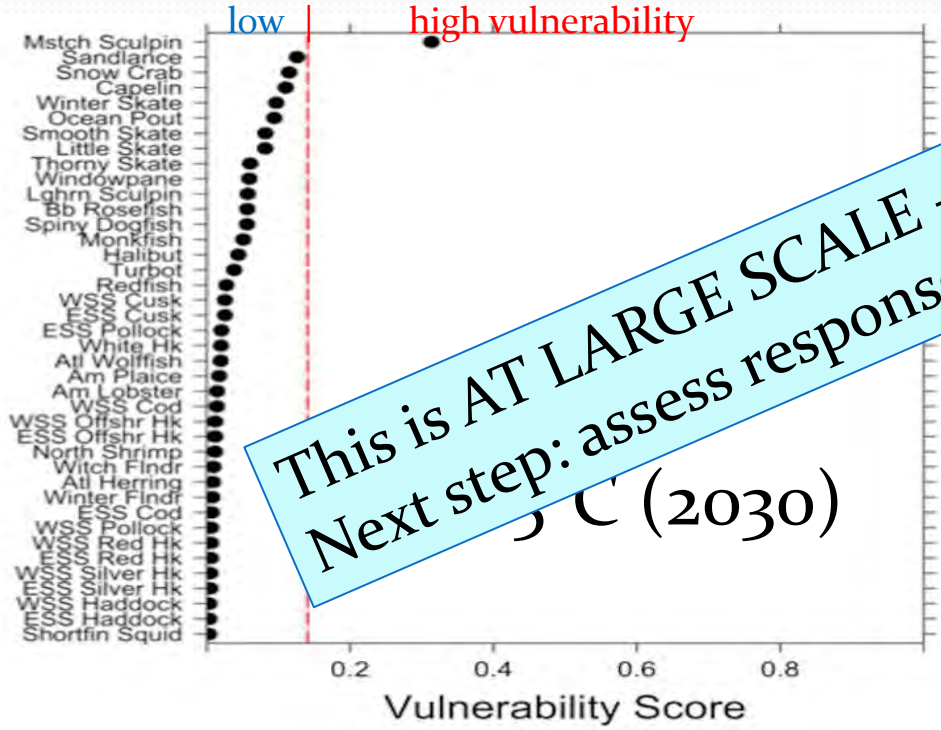
Less ice

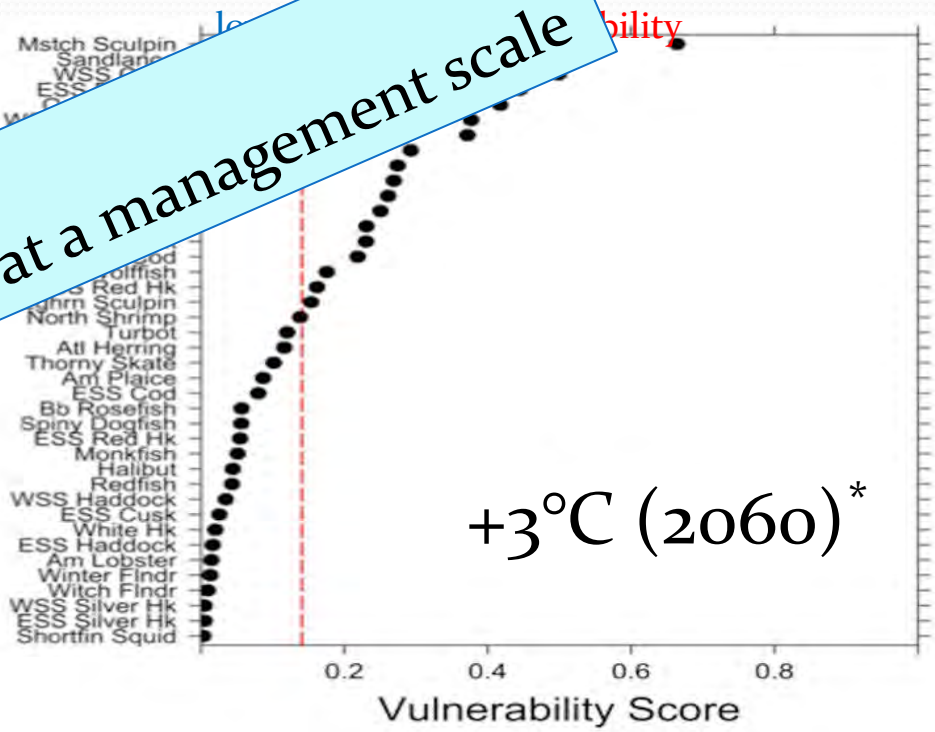
Freshening



Response in Economic Zone

A) Management (area)
B) Suitable Habitat (area)
C) Occupied Suitable Habitat (area)





This is AT LARGE SCALE –
Next step: assess response at a management scale

°C (2030)

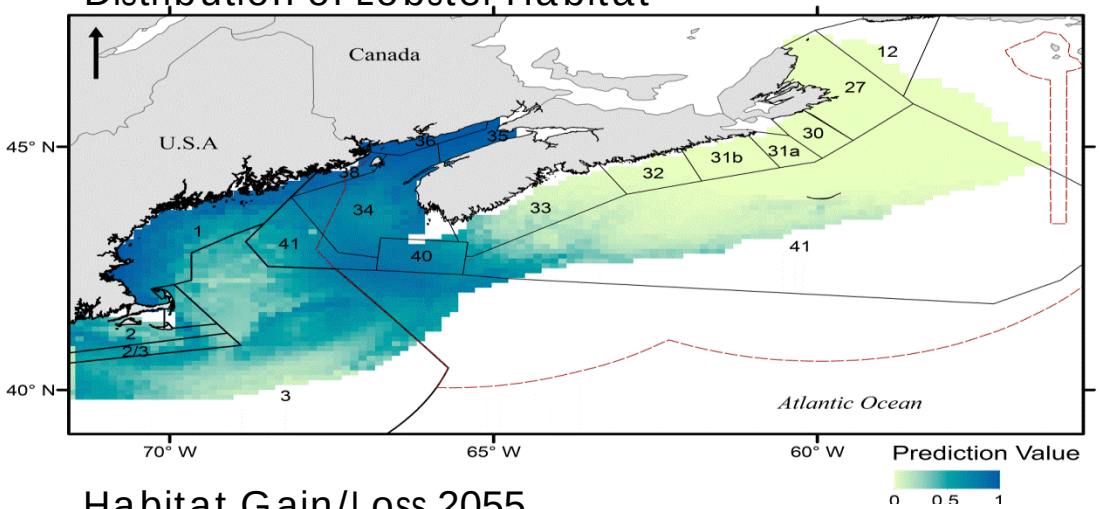
+3°C (2060)*

Stortini et al. 2015 ICES J Mar Sci
Shackell et al. 2014 PLoS

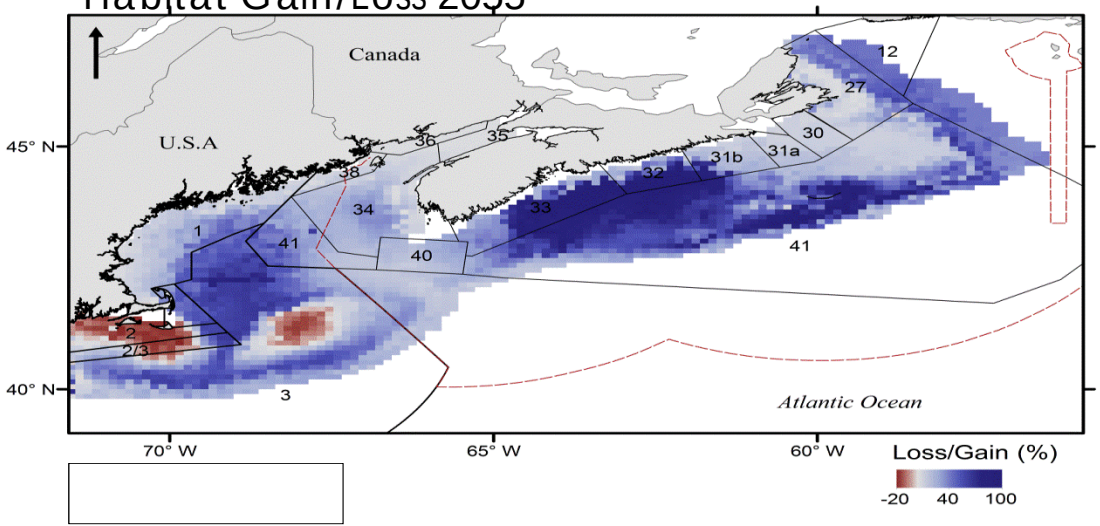
* Heat pulse to this degree occurred in 2012

Canada

Distribution of Lobster Habitat



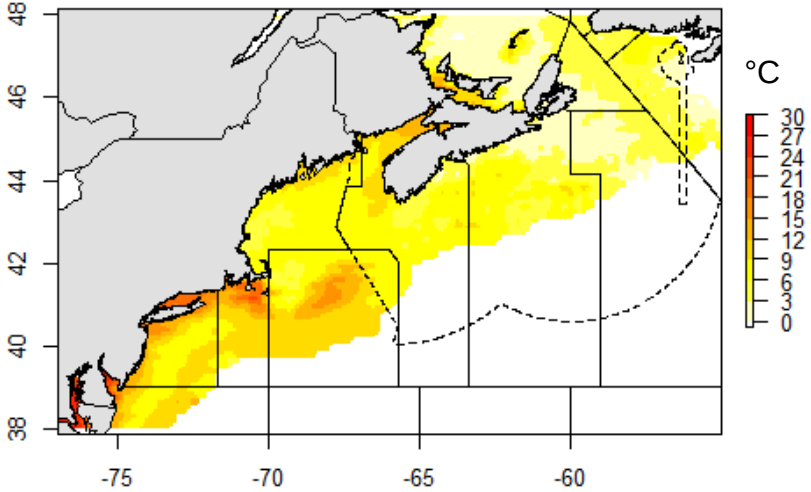
Habitat Gain/Loss 2055



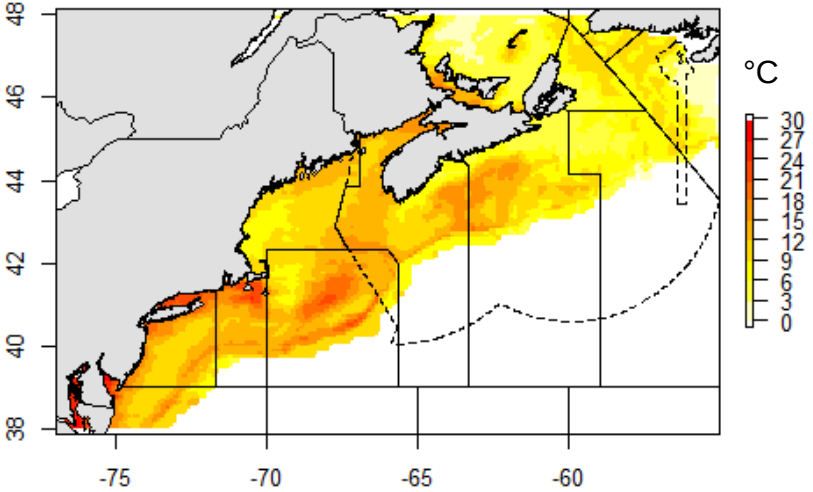
Using RCP8.5 projection with NEMO model (Brickman)

Warming Trends

Climatology (August 1950-2010)



Projection: CO_2 Doubled



- Saba et al, (2016) forecasted the rate of ocean temperature change on the Northwest Atlantic Shelf to exceed the global average by nearly 3X.
- Largest change is projected to be in more southern regions
- Could this impact the spatial footprint of habitat suitability for various commercial species and elicit a positive or negative response?

Summary

- A climate change adaptation tool for coastal infrastructure has been developed to address the issue of sea level rise
- Projected changes in ocean temperature in Atlantic Canada will impact some commercial fish species
- CIREZ will leverage the existing tool for coastal infrastructure to include fish response and provide this at a scale suitable for fisheries management decision-makers.