

Marine Planning and Conservation Program

Marine Spatial Planning (MSP) decision support for offshore wind planning

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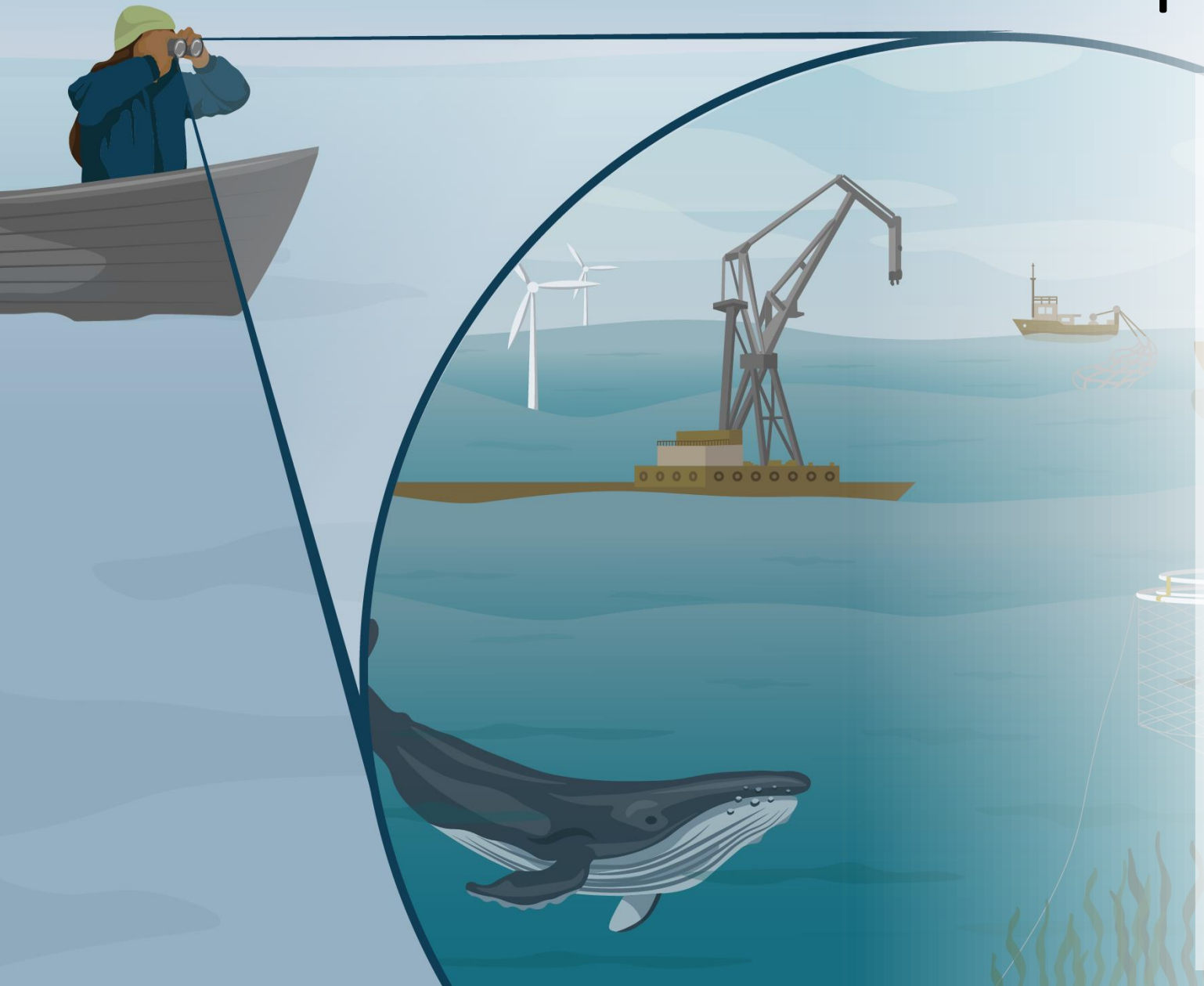
Nova Scotia Offshore Wind R&D Forum

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

What is Marine Spatial Planning (MSP)?



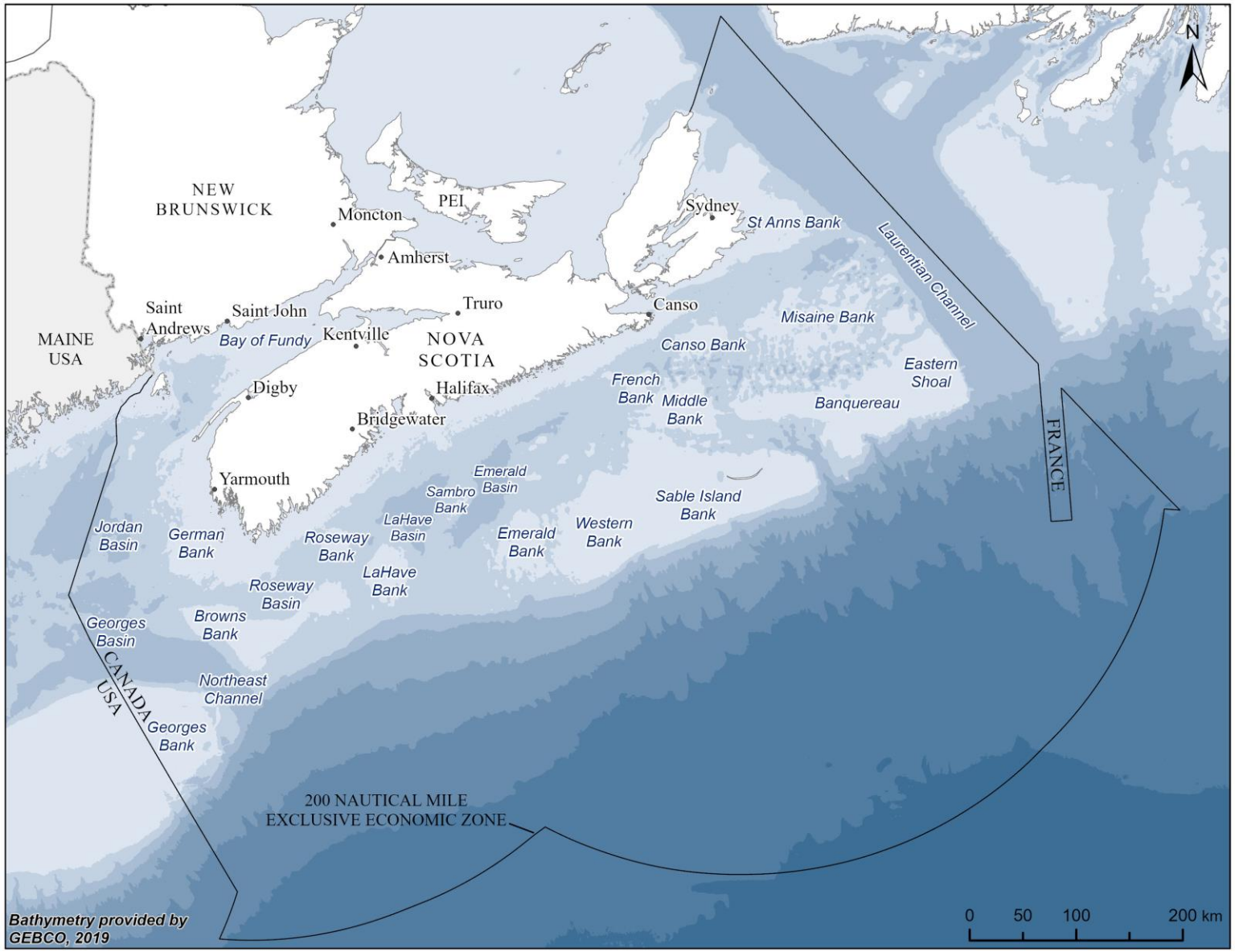
A **process** for supporting the management of ocean spaces that considers a range of ecological, economic, cultural and social objectives

Drivers for MSP include an increasingly crowded marine environment with multiple activities vying for space

Benefits of MSP include:

- supporting economic opportunities
- reducing conflicts between activities during siting
- improving awareness and understanding of ocean issues
- including diverse perspectives and knowledge systems
- planning at local to regional scales

DFO Maritimes Region



Boundaries align with the **Scotian Shelf and Bay of Fundy** planning area



First-generation Marine Spatial Plan:
Scotian Shelf and Bay of Fundy

Vision: Healthy marine and coastal ecosystems and sustainable communities are supported through effective participation, management, and decision-making processes

Goals*:* Improved planning and improved decision-making

Objectives include:

- Balancing social, cultural, economic, and environmental considerations
- Setting priorities and being adaptable
- Provide timely and accessible information
- Developing knowledge products and **decision support tools**

DFO’s roles in offshore wind

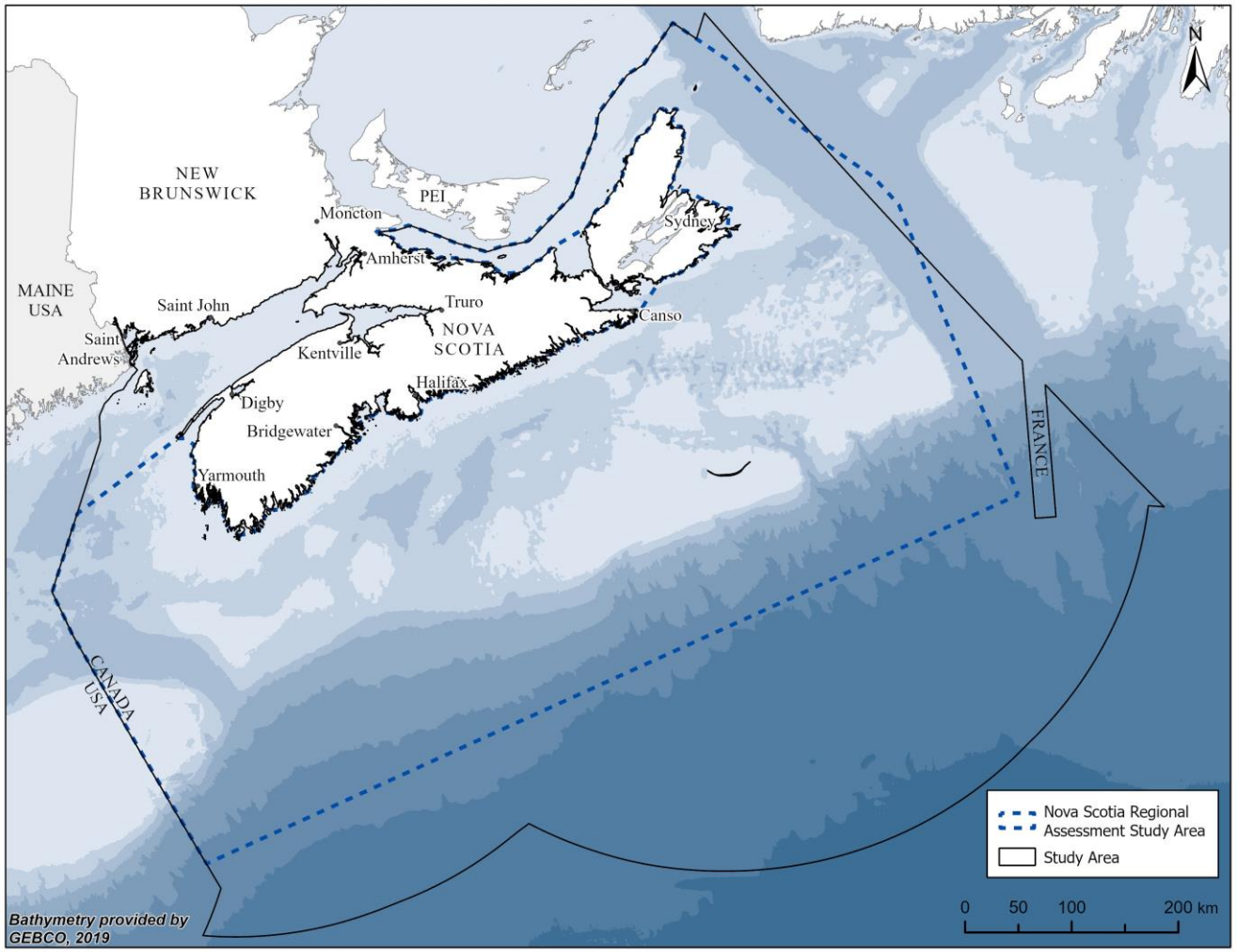
Current and past

- Support the ongoing Nova Scotia Regional Assessment through the provision of specialist information related to DFO’s mandate
- Develop departmental scientific knowledge of OSW
  - ➢ Identify science needs and develop capacity to fill knowledge gaps
- Provide input into the regulatory regime
- Apply Marine Spatial Planning tools to inform future planning and siting processes (e.g., Marxan with Zones spatial analysis)

In future

- Support future project-specific environmental/ impact assessment processes
- Conduct regulatory reviews of proposed offshore wind projects, per DFO’s responsibilities under the *Fisheries Act, Species at Risk Act, Oceans Act* and *Aquatic Invasive Species Regulations*

Applying MSP: Marxan with Zones spatial analysis[1]



- Decision-support tool developed by DFO's Marine Planning and Conservation Program
- Purpose was to inform NS Regional Assessment
- **Study area** includes the NS Regional Assessment study area (includes a portion of DFO Gulf Region)
- **Objectives:**
  - Identify potentially suitable areas for offshore wind energy, which **avoid** human uses and ecological features
  - Develop a decision-support tool for marine spatial planning and demonstrate the capabilities of Marxan with Zones

[1] Nagel, E.J., Pardy, G., Gordon, K., and Long, M.-A. 2024. Application of Marxan with Zones as a marine spatial planning decision-support tool: a case study for offshore wind planning in Nova Scotia. Can Tech. Rep. Fish Aquat. Sci. 3601: xi + 91 p.

Project timeline

2022

- Graduate project developed to test Marxan methods (Gordon, 2022)[2]
- Began federal/ provincial engagement

2023

- Federal / provincial engagement on data and methods, including across DFO sectors and Regions
- Engaged with commercial fishing industry on data and methods
- Preliminary results
- Methods refined following DFO & external feedback

2024

- Report completed and reviewed
- Results provided to Nova Scotia Regional Assessment Committee (February 2024)
- Report published (August 2024)

[2] Gordon, K. 2022. Identifying potential spatial use conflicts between the commercial fishing industry and offshore wind development in the Scotian Shelf-Bay of Fundy planning area [graduate project]. Halifax, NS: Dalhousie University. https://dalspace.library.dal.ca/handle/10222/82609

Methods

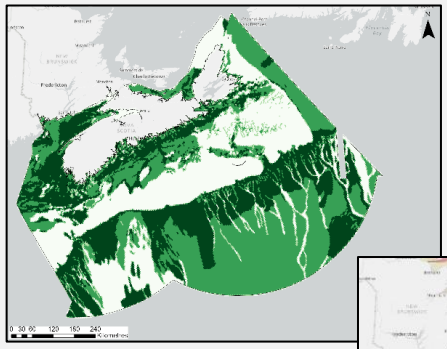
- Specific targets set (economic, social, ecological) within Marxan software
  - Multi-sector analysis included offshore wind, commercial fishing, transportation, conservation, oil & gas, and aquaculture

- Priorities for this version of the tool:
  - Address commercial fishing and ecological data gaps noted by Kilpatrick et al. (2023)
  - Work collaboratively across federal departments
  - Focus on conflict-avoidance

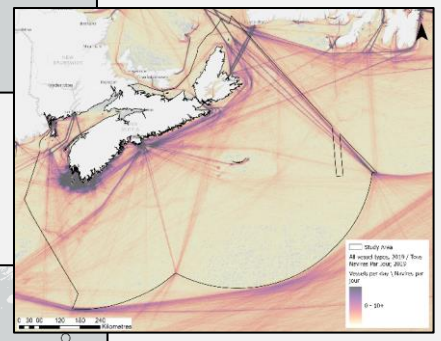
Project included 100+ features

Example feature data:

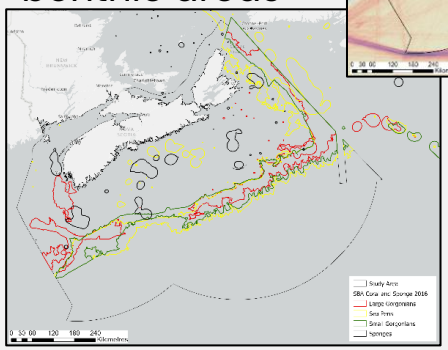
Surficial geology



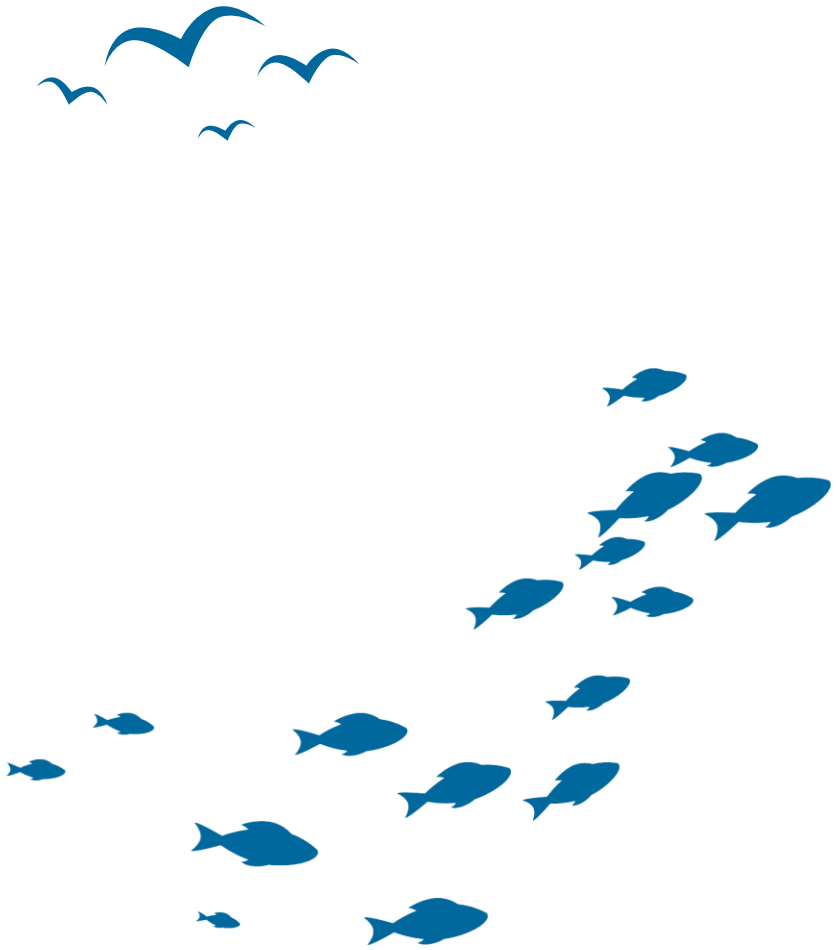
AIS vessel traffic



Significant benthic areas



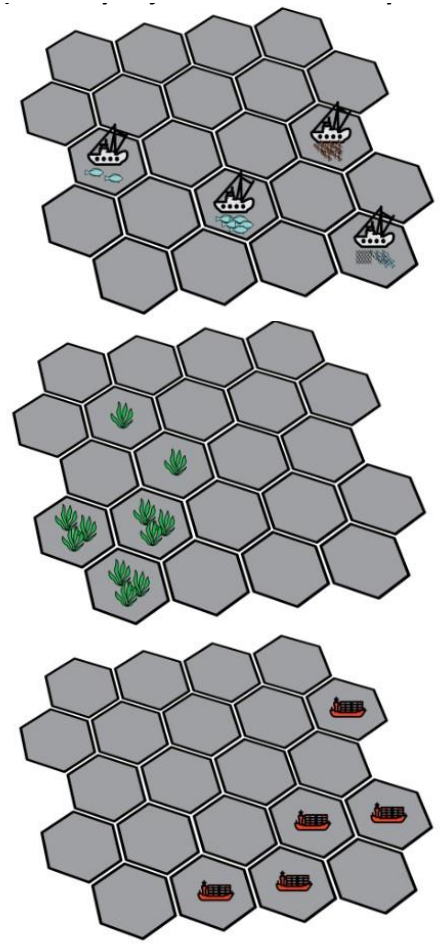
Data



Ecological (26)	**DFO:** MPAs, OECMs, draft Marine Conservation Network (Maritimes Region), EBSAs (Gulf Region), Critical habitat and important habitat for Species at Risk, Significant Benthic Areas **ECCC:** Marine bird predictive foraging areas, sea duck key habitat, important marine habitat for Species at Risk, sightings
Physical (5)	**NRCan:** Surficial geology**,** distance to shore **ECCC:** Sea ice **GEBCO**: Depth **Global Wind Atlas**: Wind speed
Human Use (85)	**DFO:** Commercial fishing (landings, VMS, inshore lobster, Indigenous communal commercial fishing), AIS vessel traffic **TC:** Vessel traffic routes **CNSOPB:** Oil & gas leases **Province of NS:** Aquaculture leases
Economic (1)	**Aegir Insights via Province of NS:** Levelized Cost of Energy (LCoE; depth, wind speed, distance to port, distance to grid)

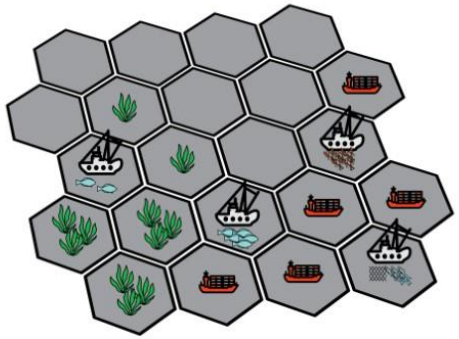
Marxan with Zones: general process

1) Gather data and set objectives



3 example features:

- Fishing
- Ecological areas
- Marine transportation



Objectives:

- Offshore wind zone: select 5 units for offshore wind while avoiding features

- Existing use zone: select areas with higher feature values

2) Develop solutions

3) Combine solutions into summed solutions

Marxan with Zones: general process

1) Gather data and set objectives

Individual solutions:

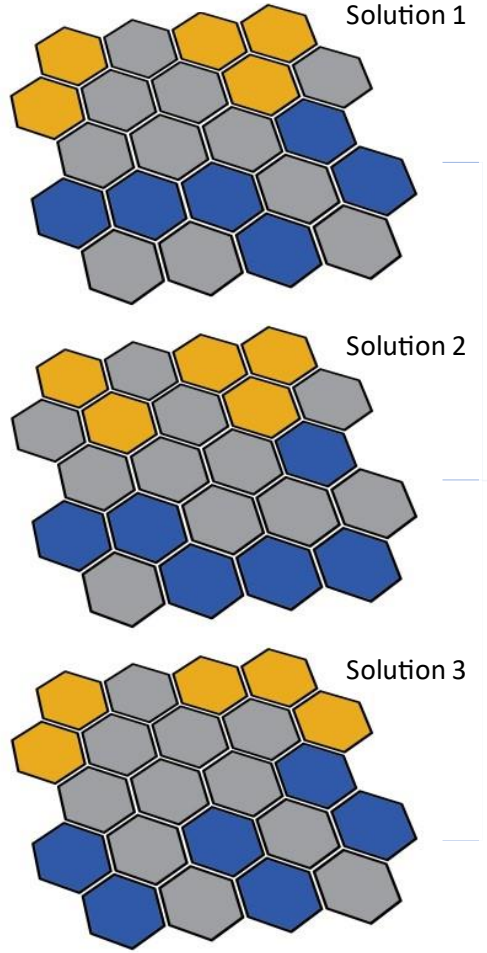
Wind zone (yellow)

- Area targets reflected a range of planning densities for 5 GW of offshore wind energy

Existing-use zone (blue)

- Specific targets set to capture areas with high feature values
  - *E.g.: capture 90% of important habitat for Species at Risk*

2) Develop solutions



3) Combine solutions into summed solutions

Summed Solution

Selection Frequency

Offshore Wind Zone

Low High

Existing Use Zone

Marxan with Zones: general process

1) Gather data and set objectives

3 example features:
- Ecological areas
- Marine transportation
- Fishing

Objectives:
- Existing use zone: select areas with higher feature values
- Offshore wind zone: select 5 units for offshore wind while avoiding features

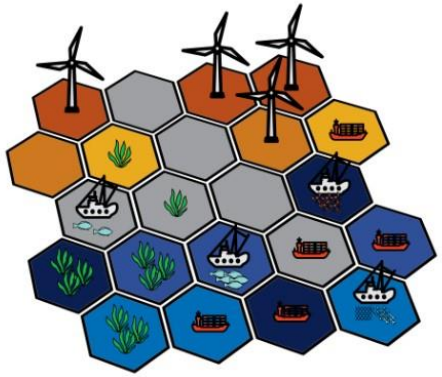
2) Develop solutions

Solution 1

Solution 2

Solution 3

3) Combine solutions into summed solutions



Summed Solution

Selection Frequency

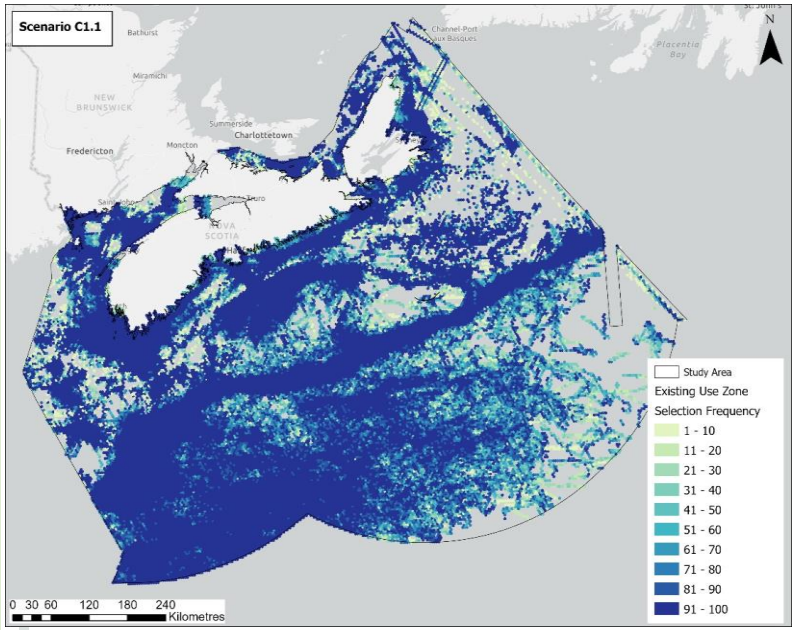
Offshore Wind Zone

Low High

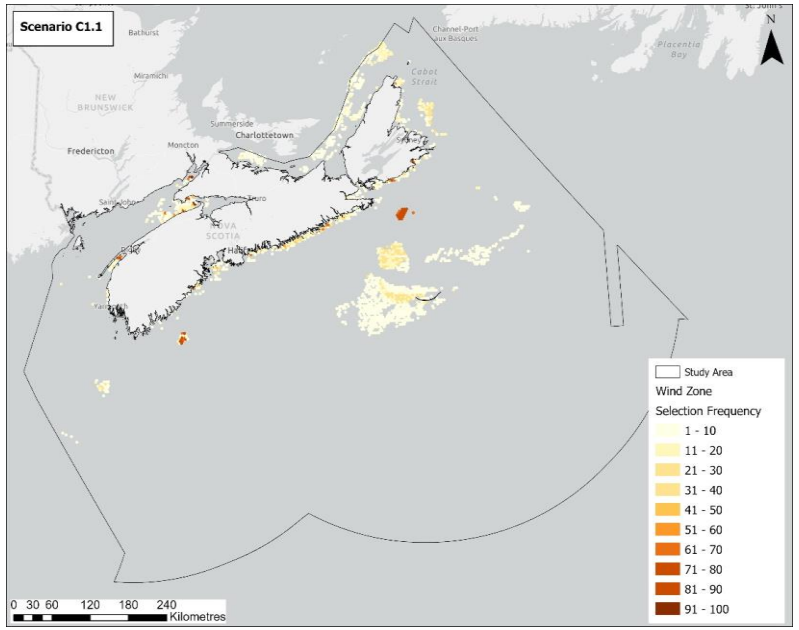
Existing Use Zone

Example project results

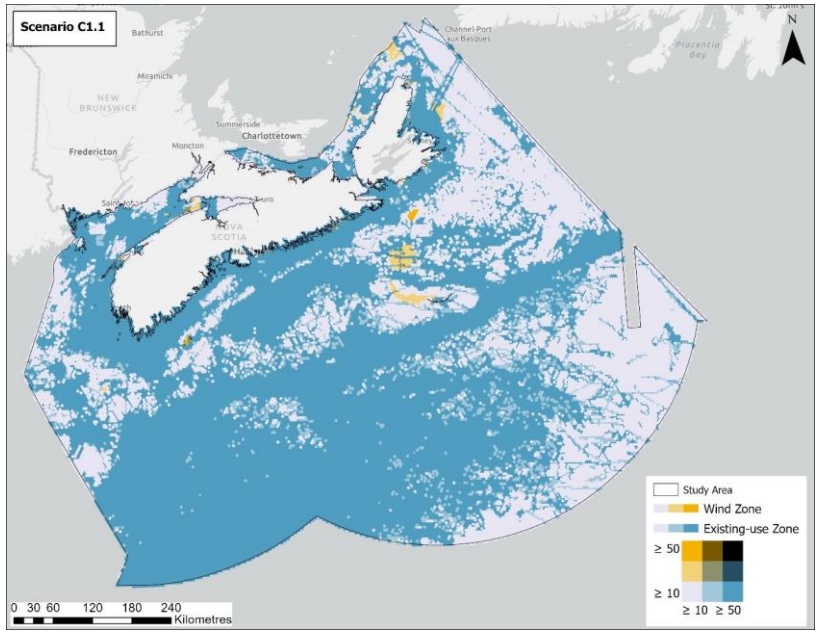
- 18 scenarios were developed with different combinations of data, targets to achieve, and exclusion areas
- **Scenario C1.1: Fixed-foundation baseline scenario**



Existing use zone: Key areas for existing uses and ecological features

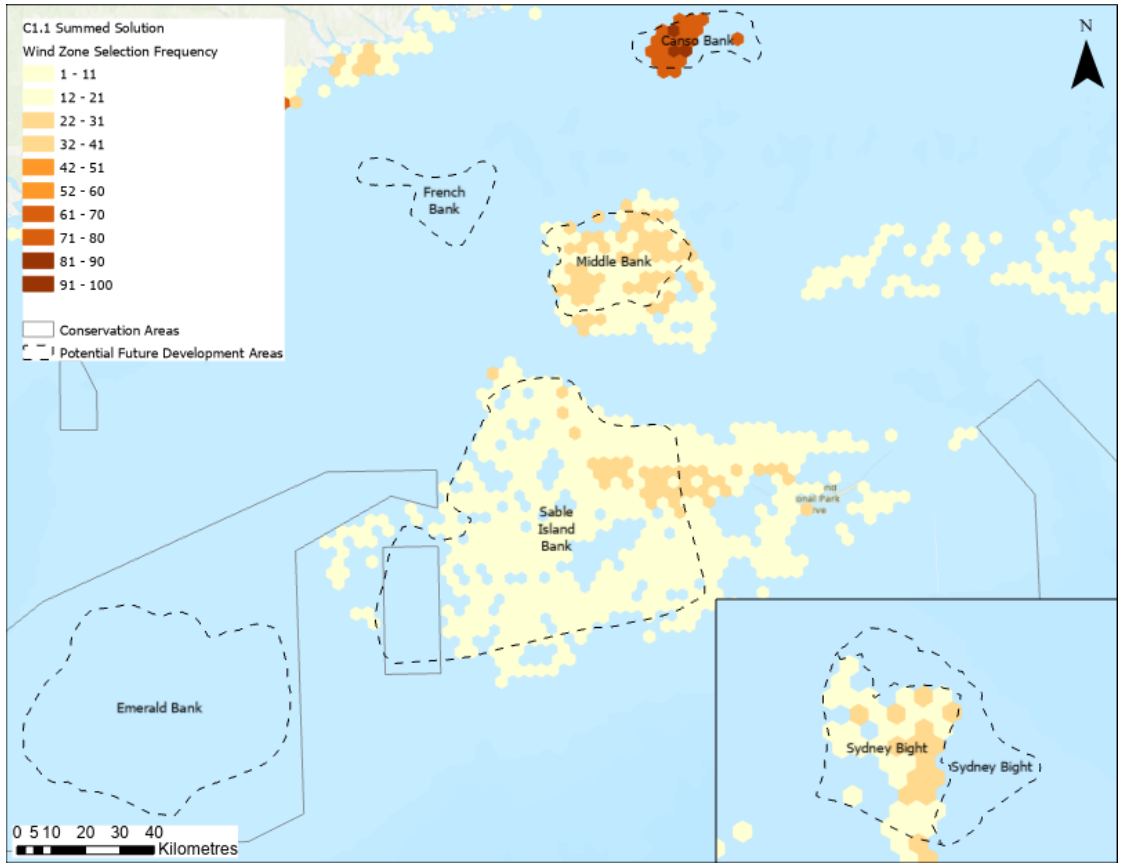


Wind zone: Potentially suitable areas for offshore wind which avoid conflict

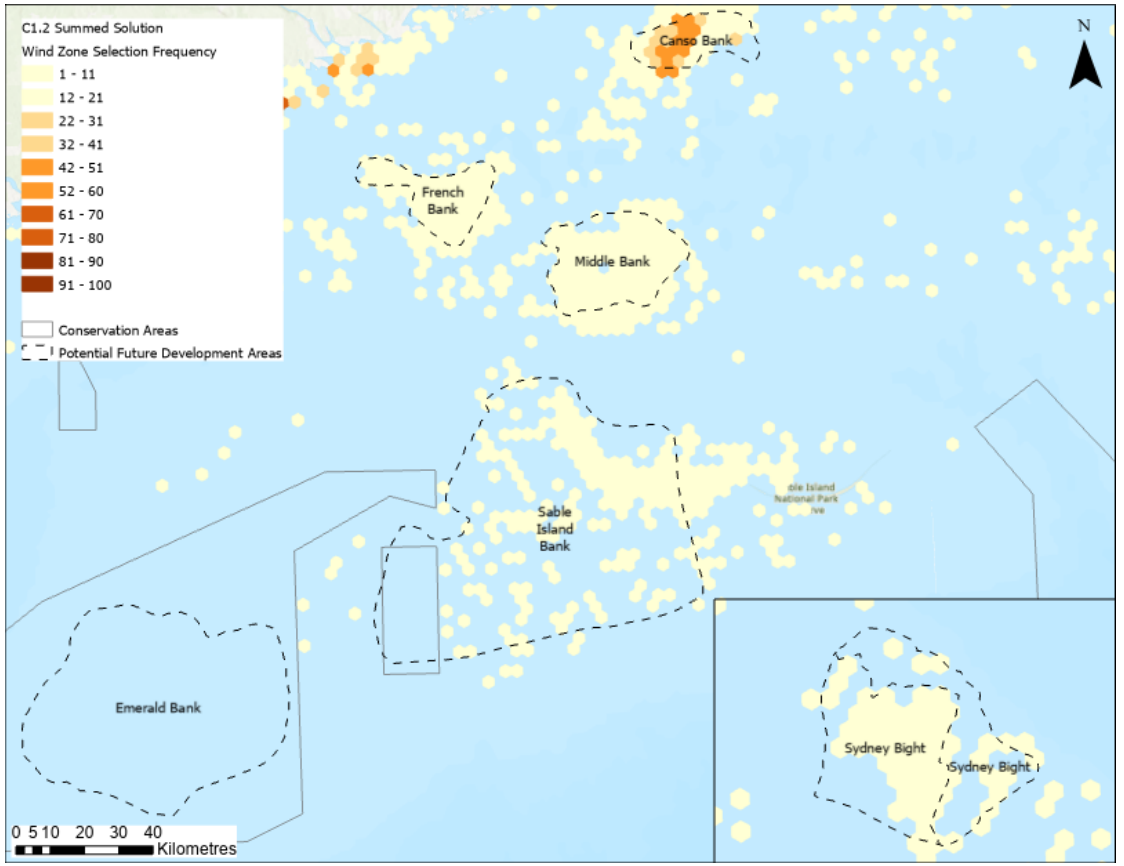


Both zones combined: Areas of potential higher conflict (dark blue/black) and lower conflict (bright yellow)

Regional Assessment PFDAs vs. baseline scenarios



Scenario C1.1 wind zone summed solution and PFDAs. Baseline multi-use scenario, **fixed-base** offshore wind only limited to 70m depth



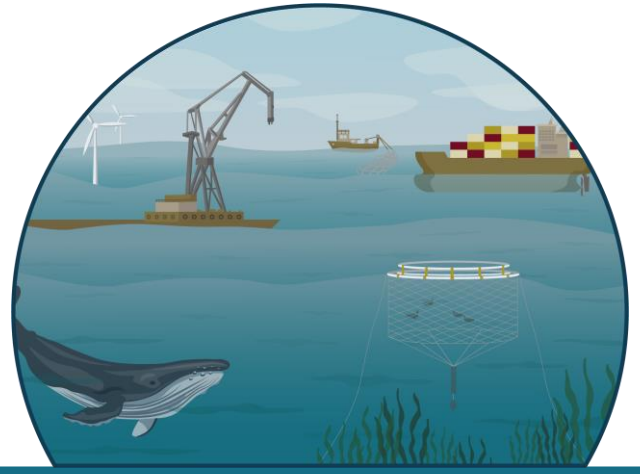
Scenario C1.2 wind zone summed solution and PFDAs. Baseline multi-use scenario**, fixed and floating** offshore wind, not depth limited

Summary: Marxan with Zones spatial analysis

This MSP decision-support tool can:

- Combine multiple complex datasets to summarize information for planners
- Facilitate development of multiple scenarios to explore options/ objectives
- Quantify potential overlap between offshore wind energy, other ocean activities, and ecological features
- Support conflict avoidance at early planning stages

- Tool is data-driven, flexible, scalable for future applications
  - E.g., could include different planning objectives such as co-location of activities



Key messages

- The current approach to MSP is not regulatory, it is focused on supporting improved planning and decision-making
  - The first-generation Marine Spatial Plan (Fall 2024) describes the approach for MSP based on recent engagement and years of integrated management

- The *Marxan with Zones* offshore wind analysis is a real-world example of taking an MSP approach to planning
  - Results are intended to inform decision-making, not to prescribe a single scenario or answer

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Nagel, E.J., Pardy, G., Gordon, K., and Long, M.-A. 2024.
Application of Marxan with Zones as a marine spatial planning decision-support tool: a case study for offshore wind planning in Nova Scotia. Can Tech. Rep. Fish Aquat. Sci. 3601: xi + 91 p.