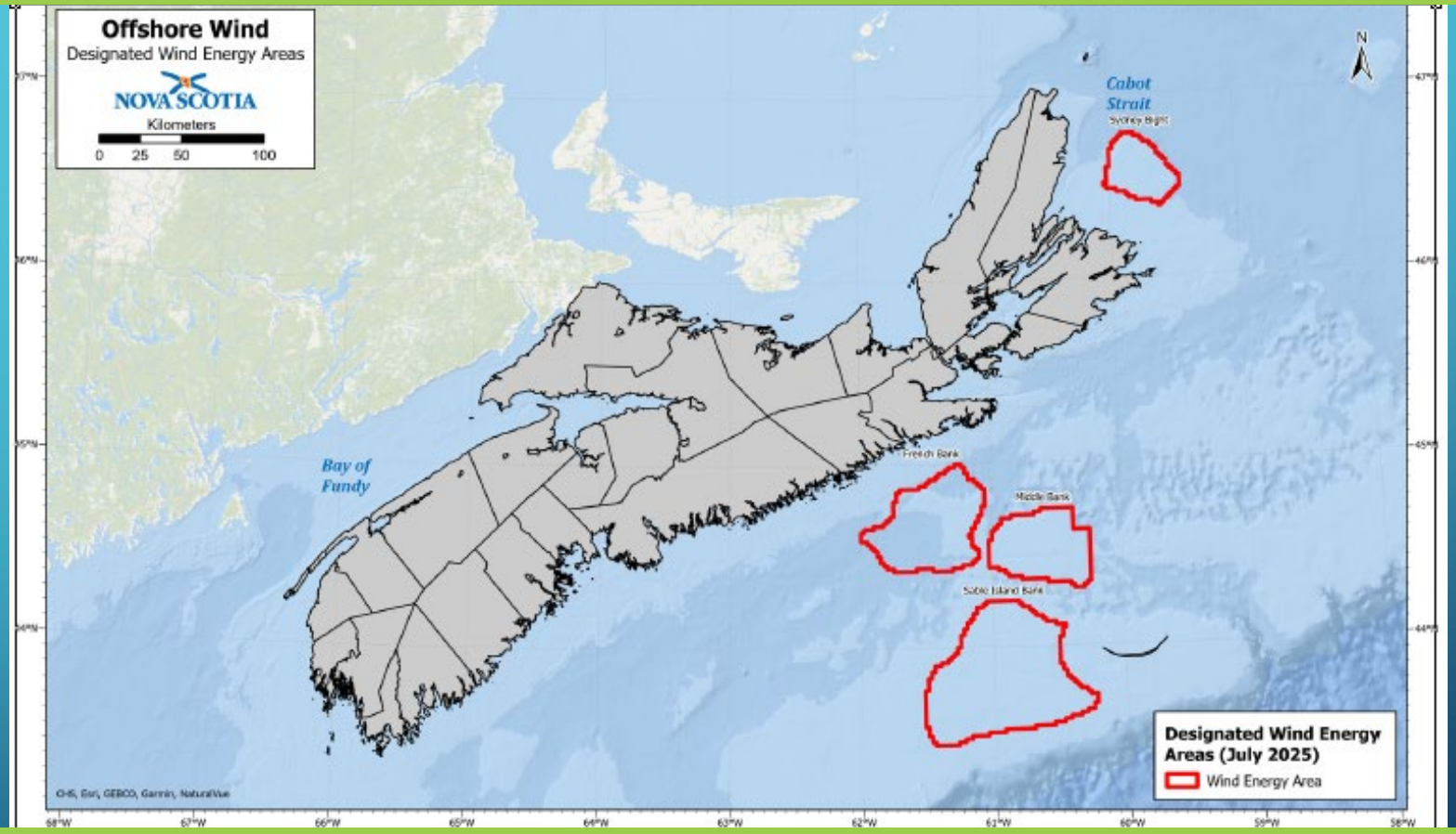
A Socio-Ecological Systems approach to Cumulative Effects Assessment for Nova Scotia's Offshore Wind Future



Dr. Ian Stewart
University of King's College
ian.stewart@ukings.ca
https://ukings.ca/people/ian-stewart

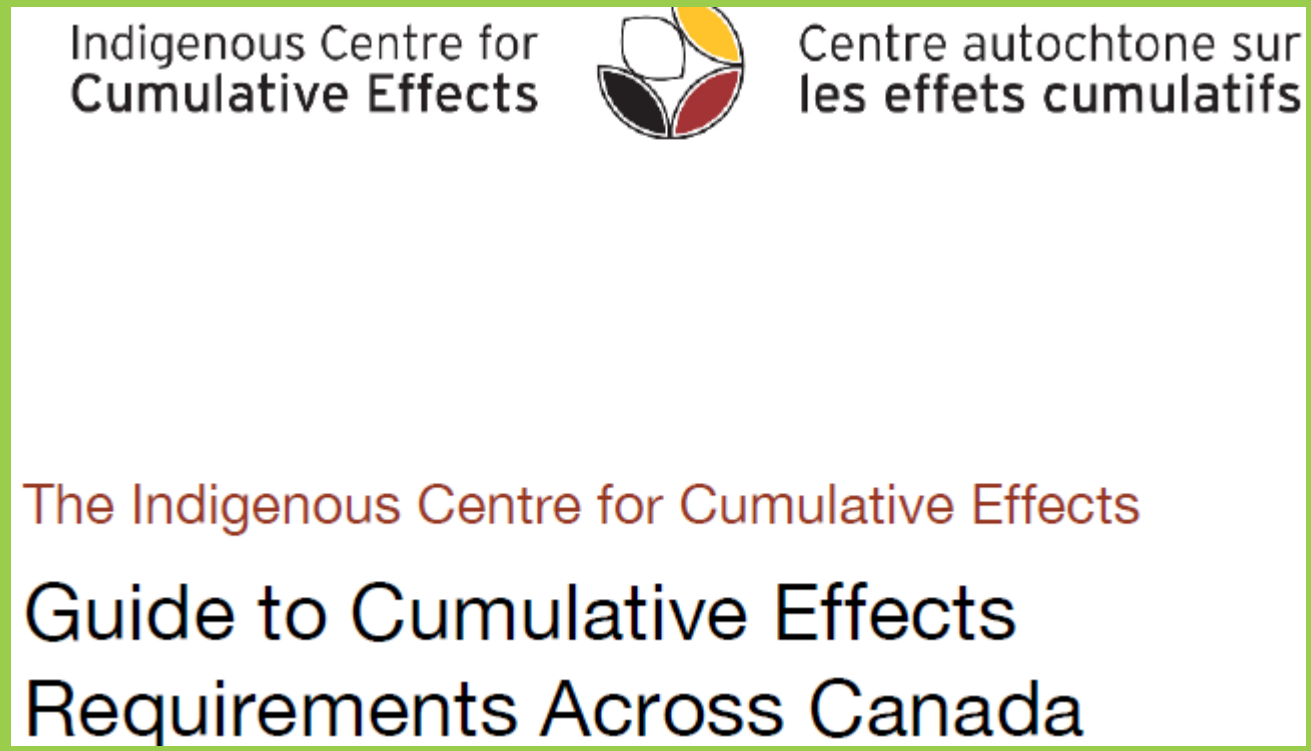
Dr. Elianny Domingues-Tejo
Program Developer, Ocean Biodiversity and Bioresources Research
Ocean Frontier Institute

Cumulative Effects Assessment (CEA)

"a change in the environment caused by multiple interactions among human activities and natural processes that accumulate across space and time"

(Canadian Council of Ministers of the Environment, CCME 2014).

For a review of how CEA is approached across jurisdictions in Canada, see this 2022 study:



Key Challenges affecting the impact of CEAs in management of OSW

Meeting the information needs of decision-makers

- Lack of a clear and consistent definition of "cumulative impacts" and output expectations;
- Significant disparity in CEA approaches pose a challenge for consistency in decision making.

Data quality and knowledge gaps

- Data is sparse, fragmented or not easily accessible;
- Project-level CEA use a spatial and temporal scales that do not reflect regional changes;
- The lack of standardization leads to results not being comparable.

Uneven use is decision making

- Decades of CEA research has been focused on scientific challenges within disciplines, not working across disciplines and knowledge communities;
- The inherent complexity of cumulative effects across both societal and natural environments leads to complex assessments being simplified, siloed, or ignored.

Key Takeaways from International Experience

The international evidence shows that CEAs are used, but do not play a decisive role

- ✓ Lacking clear definitions, expectations and standardizing of CEA methods so results are comparable and credible.
- ✓ Applying CEA approaches at both project and strategic levels to serve different roles and produce fit-for-purpose deliverables to decision-makers.
- ✓ Closing data gaps through regional platforms for monitoring and data-sharing.
- ✓ Improving CEA guidelines to help managers and practitioners establish more direct links between CEA outputs and management triggers and decision frameworks.

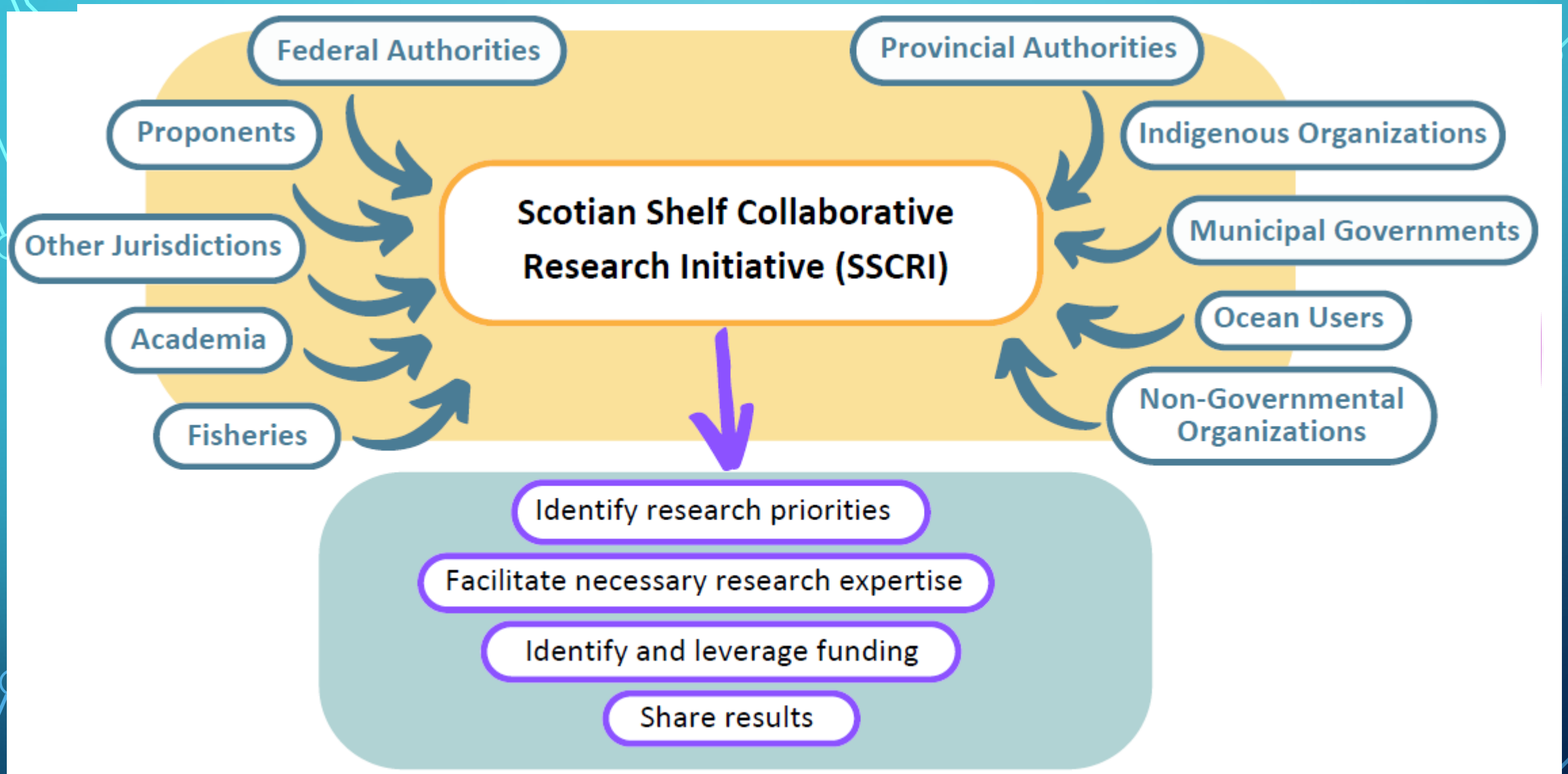


Figure 10.1 Recommended Strategy to Address OSW Environmental Issues

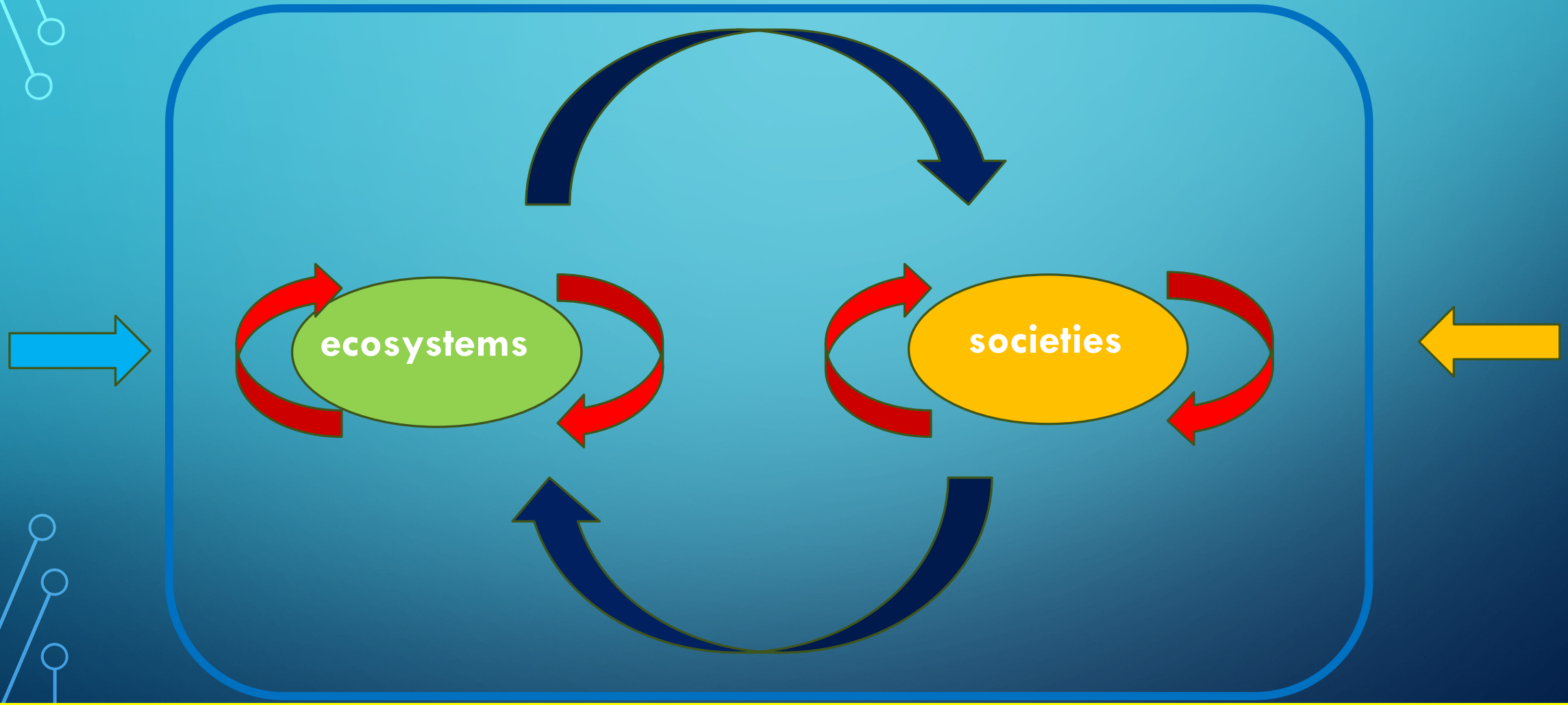
But what count as "effects" and "impacts"???

Under Canadian law (IAA, 2019):
"…. changes to the environment or to the health, social or economic conditions and the positive and negative consequences of those changes".

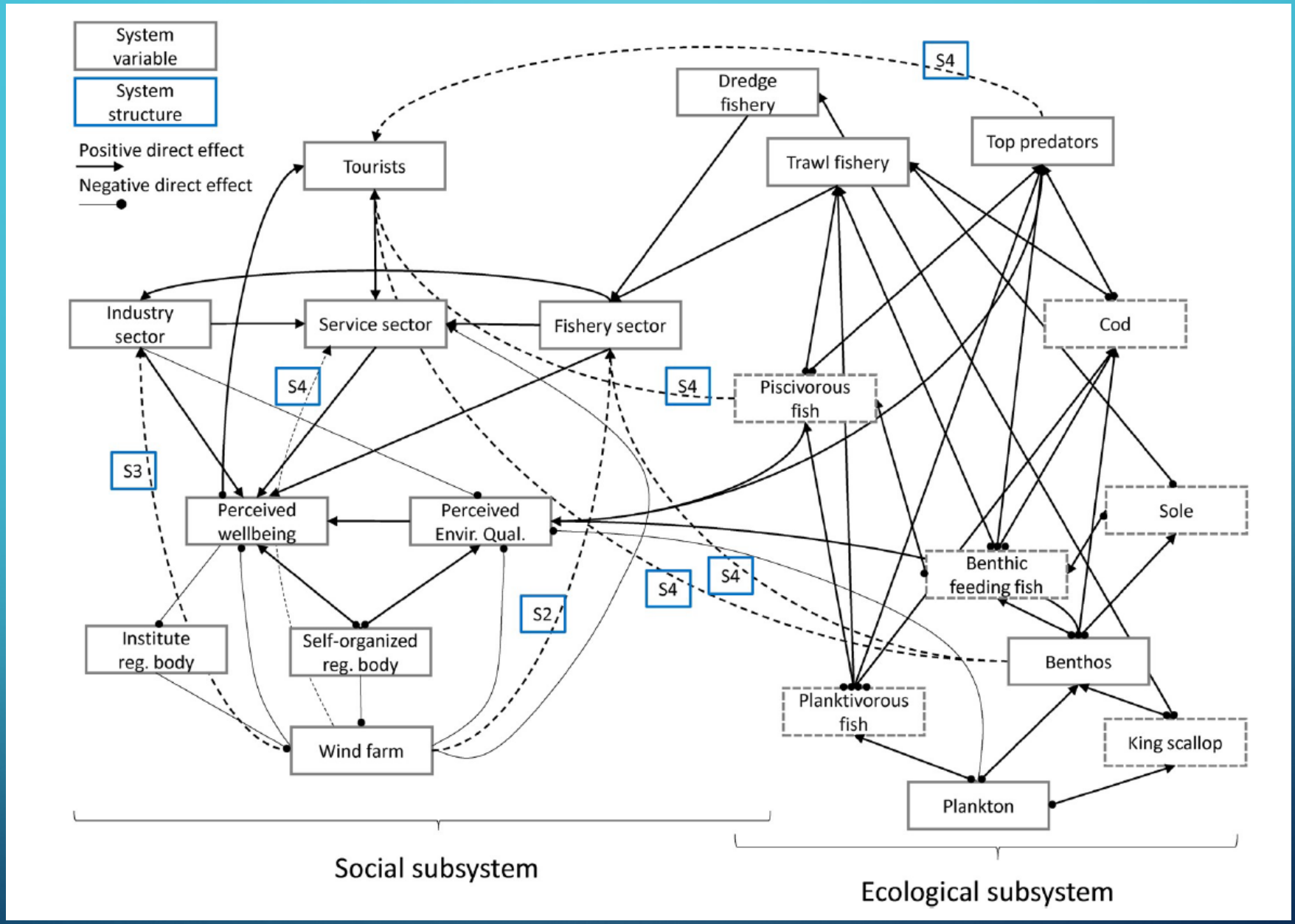
"*Dominated by a focus on environmental and biophysical values, current CEA practice results in an imbalance in the consideration and inclusion of health, social and economic valued components and an even lesser attention paid towards the effective management of cumulative effects on these values.*"

Ciera Group, 2021. *Improving the Consideration of Health, Social and Economic Values in Cumulative Effects Assessment in Canada.* Prepared for the Impact Assessment Agency Canada

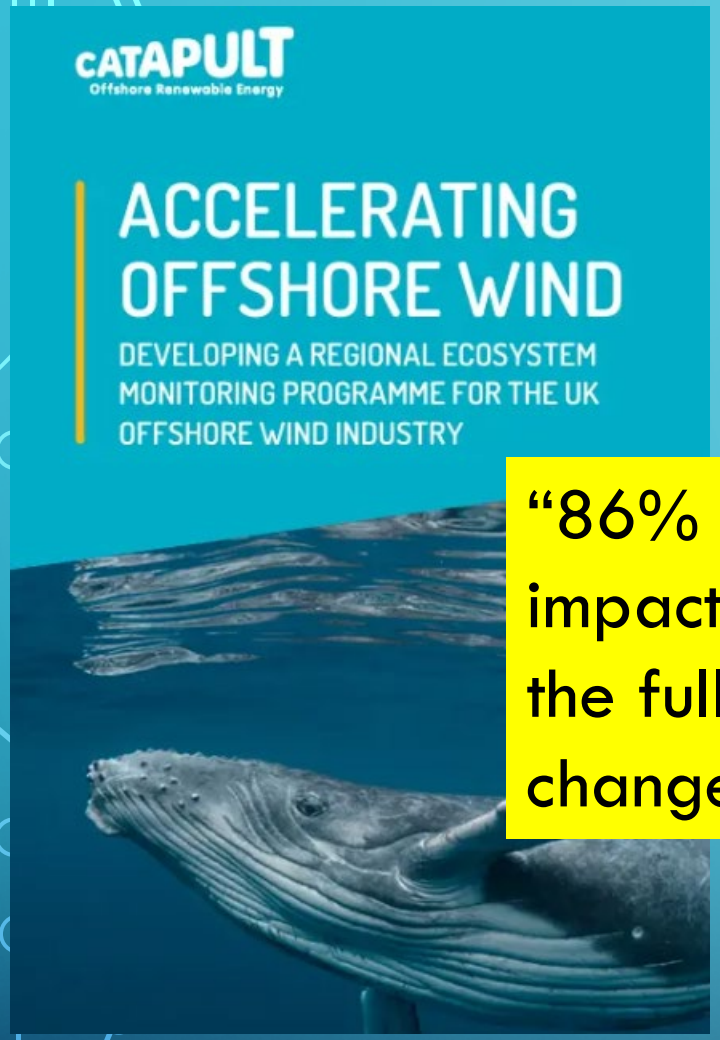
ecosystems and our societies form coupled systems,
Interacting at all scales (from local to global) and time frames (from short to long term) in the past and into the future



"human and ecological systems are deeply intertwined and must be studied together as complex adaptive systems"



Haraldsson, Matilda, et al. 2020. "How to Model Social-Ecological Systems? – A Case Study on the Effects of a Future Offshore Wind Farm on the Local Society and Ecosystem, and Whether Social Compensation Matters." *Marine Policy*

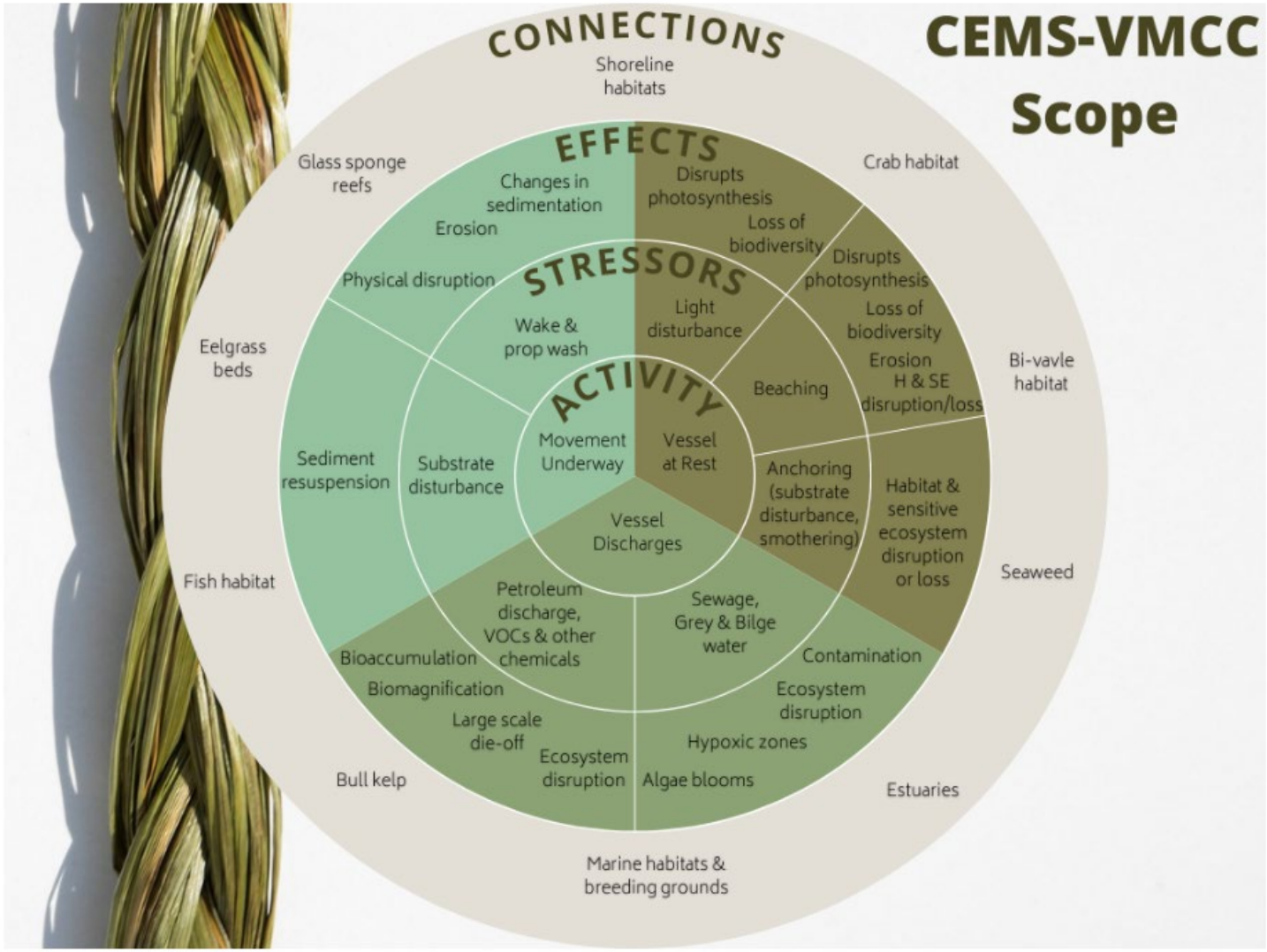


1. Bird and bat collision with wind turbines and onshore transmission lines
2. Seabed habitat loss, degradation and transformation
3. Hydrodynamic change
4. Habitat creation
5. Trophic cascades
6. Barrier effects or displacement effects due to the

"Ecosystem services"

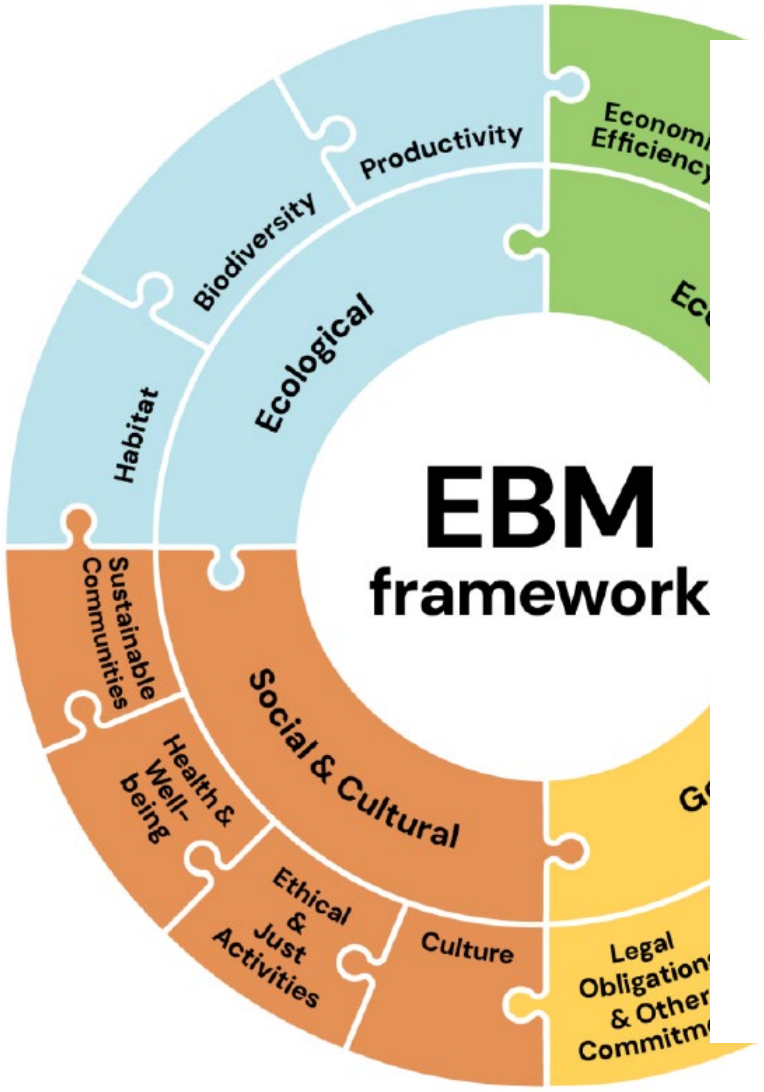
"86% of possible offshore wind farm impacts on ES are still unknown, suggesting that the full extent and consequences of ecological change are not being considered."

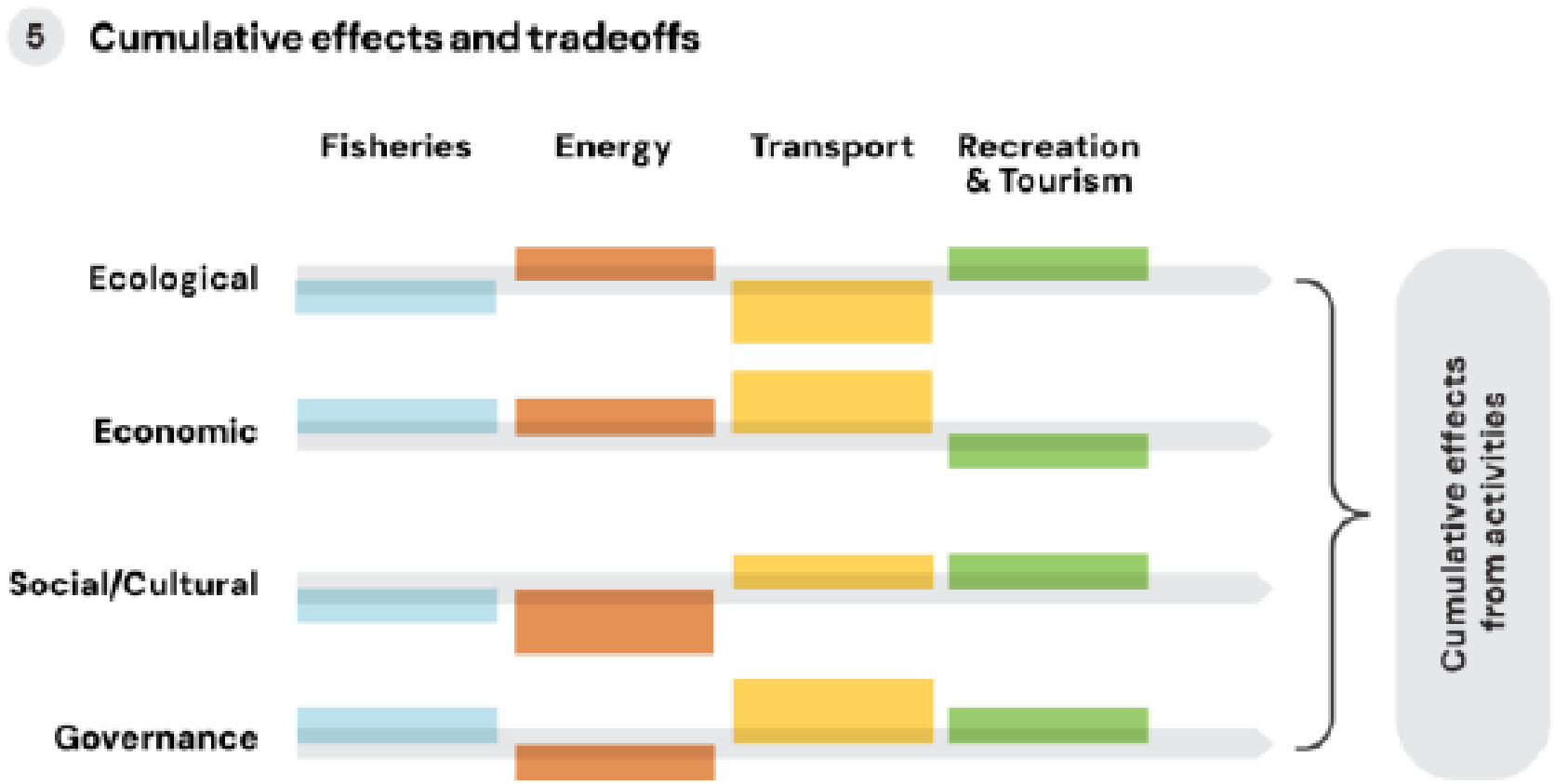
10. Behavioural effects associated with electromagnetic fields of submarine cables
11. Pollution (e.g., dust, light, solid/liquid waste)
12. Indirect impacts offsite due to increased economic activity and displaced activities, such as fishing
13. Associated ecosystem service impacts
14. Introduction of invasive alien species



Scoping wheel or pathway of effect diagram developed to document the inventory of marine shipping stressors, effects and connections in South Coast.

Fisheries and Oceans Canada's Maritimes Region Ecosystem-Based Management Framework for Sustainable Management
Bundy et al. 2025, *Canadian Technical Report of Fisheries and Aquatic Sciences* 3716 https://doi.org/10.60825/vwv9-2728





The EBM Framework includes the four pillars of sustainability, Governance, Ecological, Economic, and Social and Cultural. Each pillar has been unpacked into a series of candidate objectives that are based on DFO policies, Government of Canada policies and Canadian International commitments.

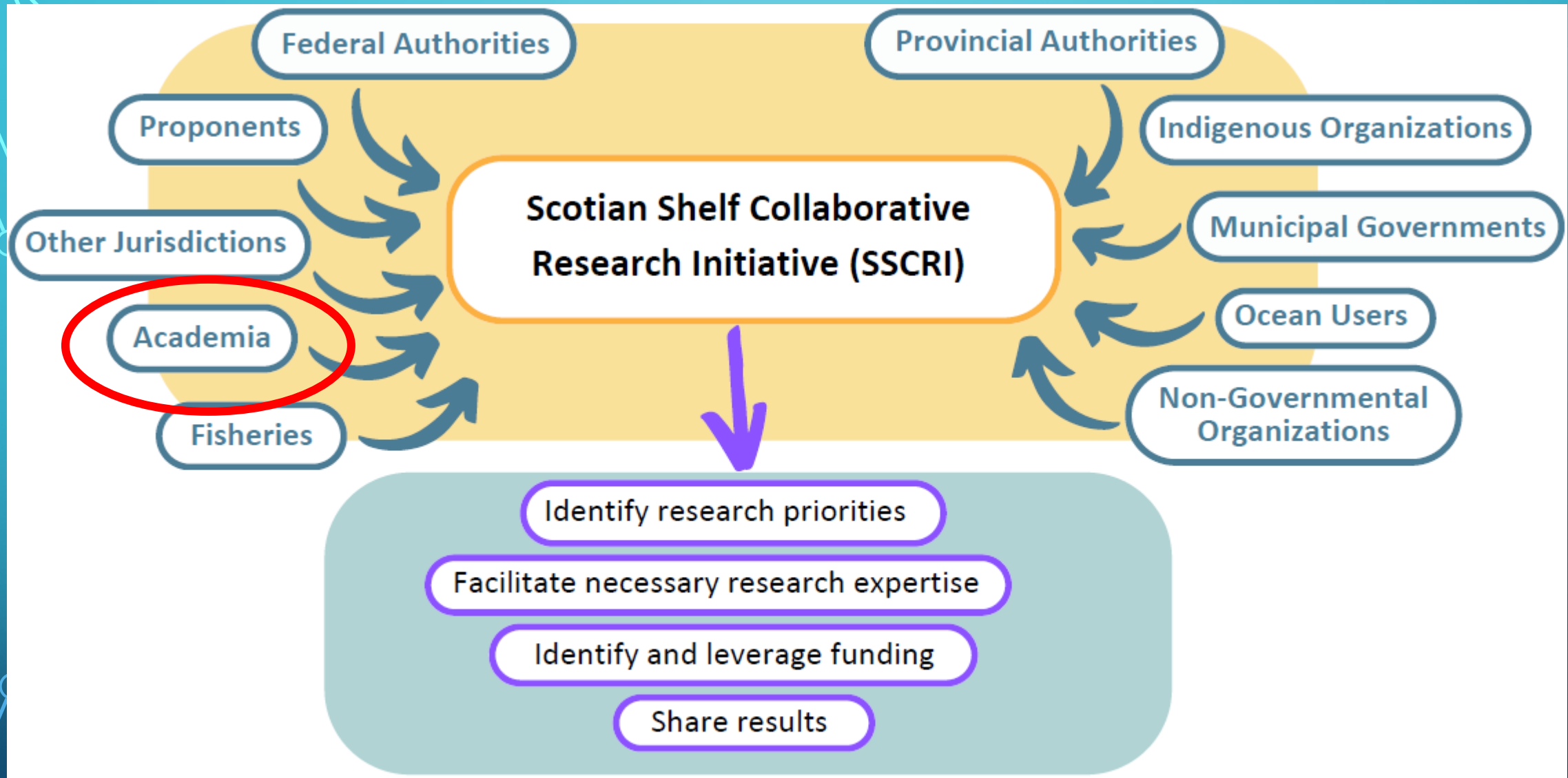
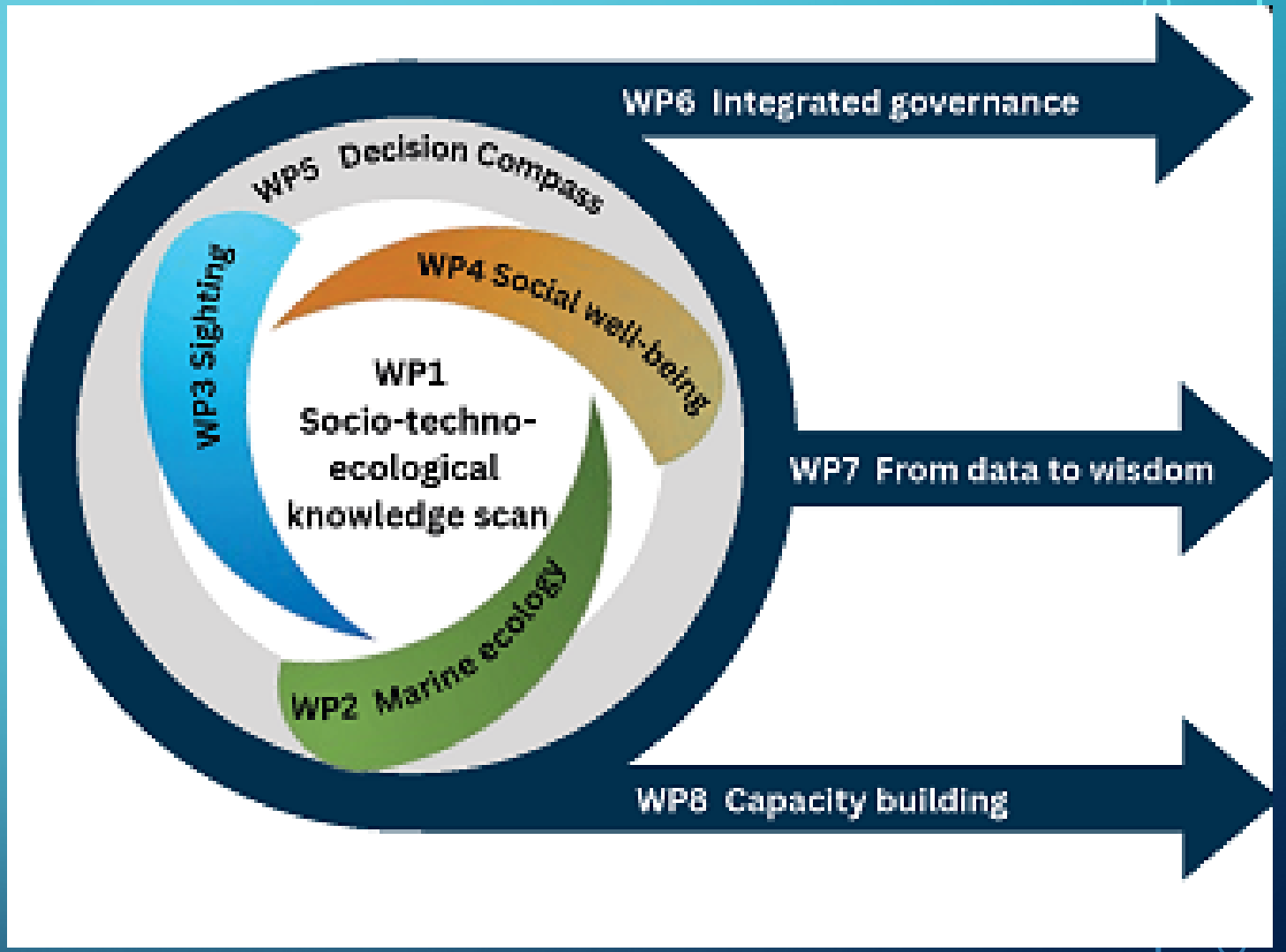


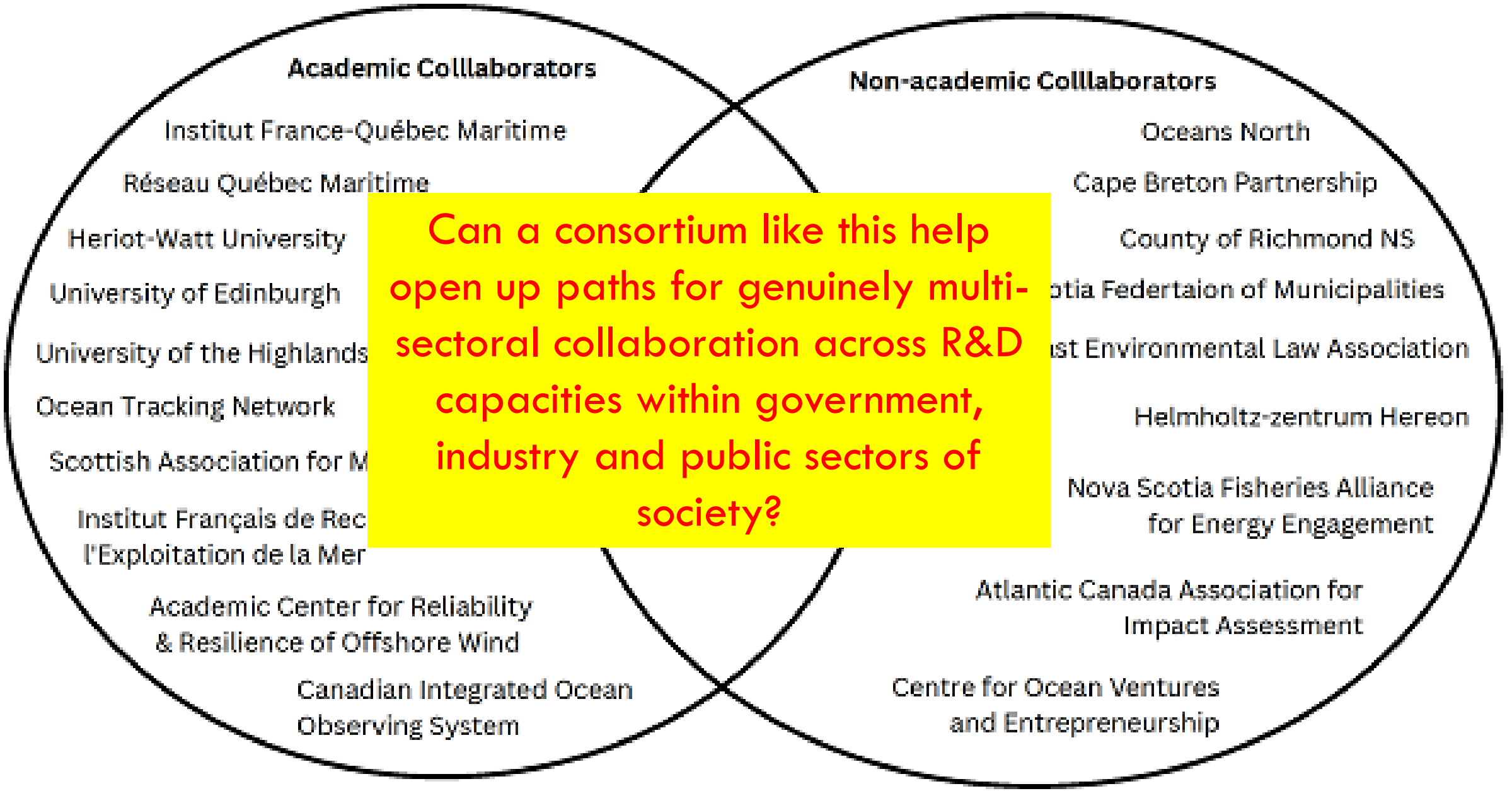
Figure 10.1 Recommended Strategy to Address OSW Environmental Issues

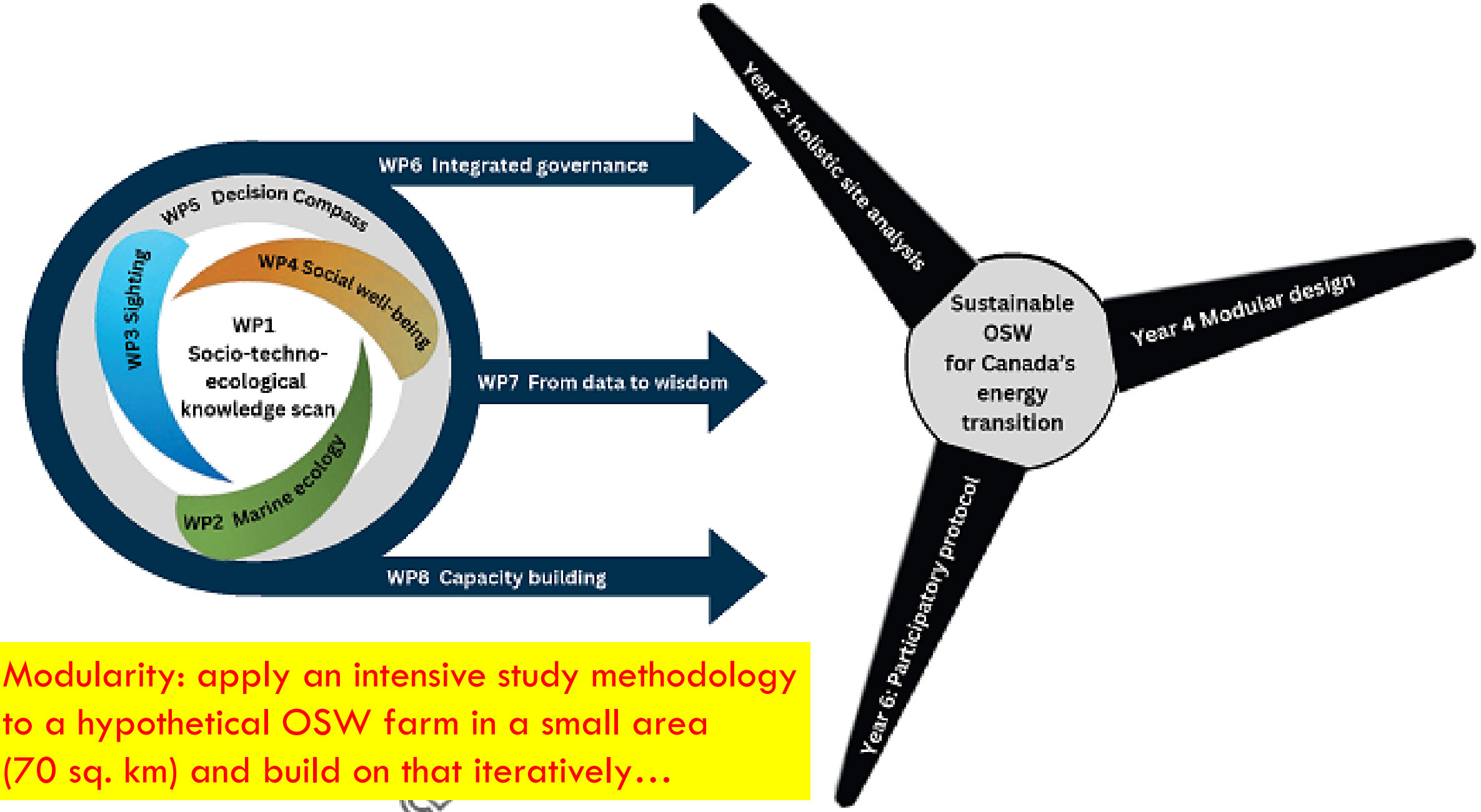
Multi institutional collaborative research initiative powered by

- Researchers across biophysical, engineering, social and human sciences disciplines based at Universities and Community Colleges in Atlantic Canada
- Net Zero Atlantic
- Confederation of Mainland Mi'kmaw
- Research consortia in UK, Europe, USA
- Government and NGO researchers

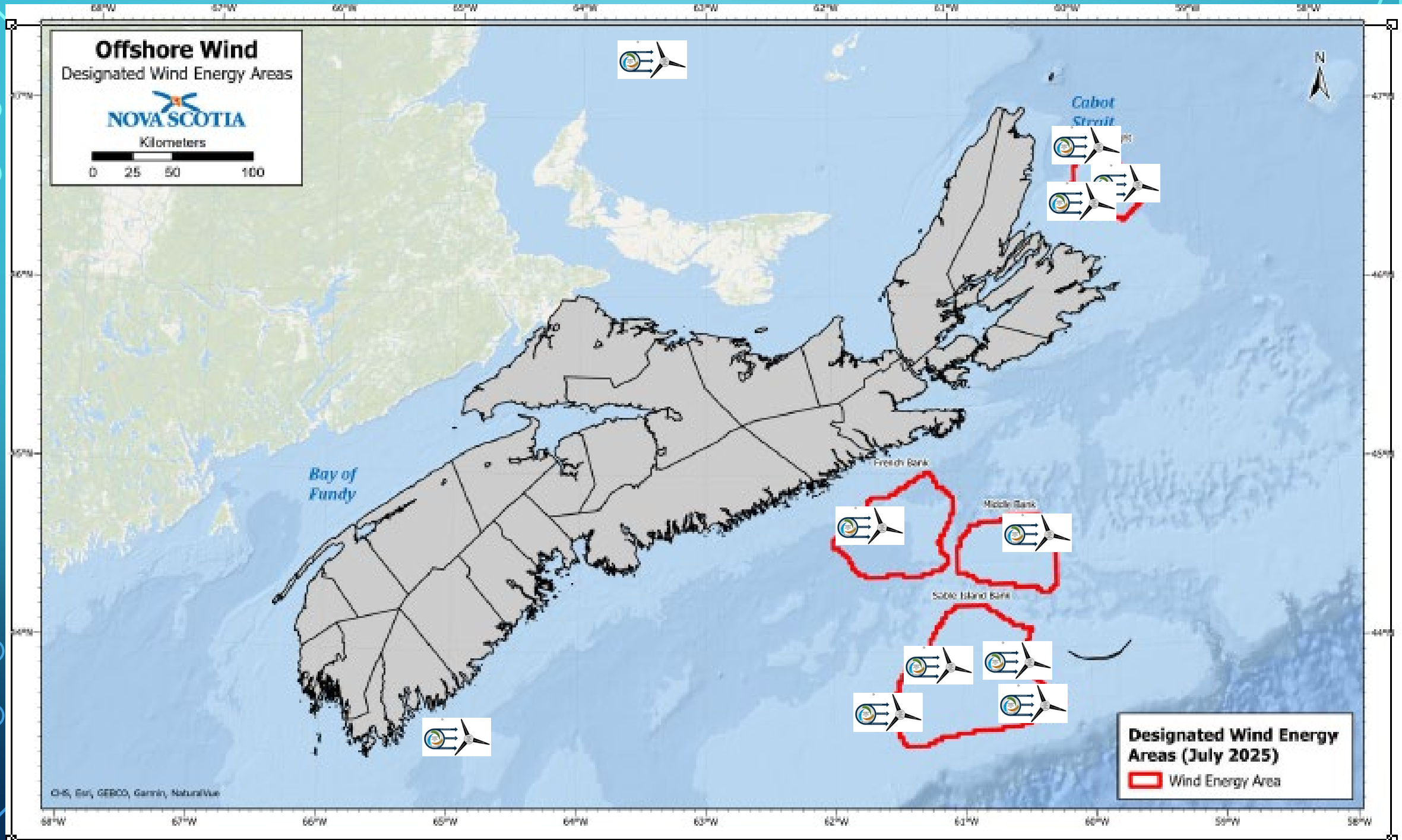


For a pending national research application (NFRF) we called this project "Minding (more than) the Gaps"


Academic Colllaborators
Institut France-Québec Maritime
Réseau Québec Maritime
Heriot-Watt University
University of Edinburgh
University of the Highlands
Ocean Tracking Network
Scottish Association for M
Institut Français de Rec
l'Exploitation de la Mer
Academic Center for Reliability
& Resilience of Offshore Wind
Canadian Integrated Ocean
Observing System
Non-academic Colllaborators
Oceans North
Cape Breton Partnership
County of Richmond NS
otia Federtaion of Municipalities
ıst Environmental Law Association
Helmholtz-zentrum Hereon
Nova Scotia Fisheries Alliance
for Energy Engagement
Atlantic Canada Association for
Impact Assessment
Centre for Ocean Ventures
and Entrepreneurship
Can a consortium like this help open up paths for genuinely multi-sectoral collaboration across R&D capacities within government, industry and public sectors of society?



Modularity: apply an intensive study methodology to a hypothetical OSW farm in a small area (70 sq. km) and build on that iteratively…


Offshore Wind
Designated Wind Energy Areas
NOVA SCOTIA
Kilometers
0 25 50 100
N
Cabot Strait
Bay of Fundy
French Bank
Middle Bank
Sable Island Bank
Designated Wind Energy Areas (July 2025)
Wind Energy Area
68°W
67°W
66°W
65°W
64°W
63°W
62°W
61°W
60°W
59°W
58°W
47°N
46°N
45°N
44°N

A Socio-Ecological Systems approach to Cumulative Effects Assessment for Nova Scotia's Offshore Wind Future

Thank you for attending!

If you want to follow up…

ian.stewart@ukings.ca