

DRAFT NATIONAL FRAMEWORK
FOR ASSESSING THE CUMULATIVE
EFFECTS OF MARINE SHIPPING

Appendix B

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1 Preface

In November 2016, the Government of Canada announced the \$1.5 billion Oceans Protection Plan (OPP) with the mandate of protecting coasts and waterways under Canadian jurisdiction. The main priorities of the OPP are to build a world-leading marine safety system, preserve and restore marine ecosystems, create stronger Indigenous partnerships and engage coastal communities, and build a stronger evidence base for decision-making. As Canada's lead department on policies and regulations related to the safety and security of marine transportation, Transport Canada (TC) has responsibilities to develop and administer various initiatives under the OPP.

1.1 WHAT IS THE CUMULATIVE EFFECTS OF MARINE SHIPPING INITIATIVE?

The Cumulative Effects of Marine Shipping (CEMS) initiative falls under the Restoring and Protecting the Marine Ecosystem pillar of the OPP. Concerns regarding the cumulative effects of marine shipping activities are frequently raised through project-level impact assessments (e.g. port development or resource extraction projects). The initiative grew out of concerns expressed about the effects of past, present and future shipping activity on coastal and marine environments and Indigenous ways of life. There have been few regional cumulative effects assessments conducted in Canada; however, they can help provide a more proactive approach to addressing the interactions between regional marine shipping activities and their effects. The purpose of the CEMS initiative is to establish a shared approach to better understand coastal ecosystems and the potential effects of regional marine shipping activities on the environment and the people surrounding it.

Regionally, Transport Canada is working alongside Indigenous partners and stakeholders in six pilot areas on all three coasts to inform the development of this National Framework. These pilot areas include:

- Northern Shelf Bioregion, British Columbia
- South Coast, British Columbia
- Cambridge Bay, Nunavut
- St. Lawrence, Quebec
- Bay of Fundy, New Brunswick and Nova Scotia
- Placentia Bay, Newfoundland

These areas provide a broad representation in terms of current and projected marine development as well as a variety of representative coastal environments. In these pilot areas, TC is working with Indigenous people, coastal communities and stakeholders to identify priority stressors from marine shipping and regionally specific environmental, social and cultural values, referred to, throughout this document as "Valued Components" (VCs; See Definitions, page 10). This input has and will continue to feed into a regional Cumulative Effects Assessments (CEAs), and ultimately, the recommendation of regional mitigation measures or management strategies.

Tangible outcomes from the CEMS initiative include:

- The development of a National Framework, which will be informed by national and regional work.
- Conducting regional cumulative effects assessments of marine shipping in the six pilot areas.
- The amalgamation of data and/or gathering of knowledge in each of the pilot areas to support the regional CEMS assessments.
- The development of regionally specific tools that can be applied to existing vessel movements or future project developments as well as system wide initiatives that can be applied nationally.

1.2 IMPORTANCE OF REGIONAL CUMULATIVE EFFECTS ASSESSMENTS

A CEA is a systematic process of identifying, analyzing, and evaluating changes in environmental, cultural, health, social and economic conditions, caused by multiple interactions among human activities and natural processes, which accumulate across time and space. CEAs at the regional scale are increasingly viewed by governments, Indigenous peoples, industry, and researchers as a viable means to proactively address large scale impacts, like ocean health and safety. Cumulative Effects (CE) in Canada have historically been addressed on a project-by-project basis. However, the cumulative effects of a project, such as those related to marine shipping activities, often exceed the temporal and regional scope of project-level impact assessments.

The CEMS initiative was created in response to heightened concerns expressed throughout recent project-based impact assessments about the effects of increased shipping activity on coastal and marine environments and Indigenous ways of life. A lack of research and gaps in data have historically prohibited our understanding of regional shipping impacts on marine environments. In response, a key deliverable of the CEMS initiative is the amalgamation of data and gathering of knowledge to support regional CE assessments of marine shipping. Another tangible outcome of the CEMS initiative is the development of national and regionally specific tools that can be applied to existing vessel movements or future project developments. In the context of impact assessments, these impacts are often addressed by conditions on proponents, despite many marine shipping activities generally not being within their control. The CEMS initiative provides an opportunity to address the regional cumulative effects of marine shipping at the strategic level through various avenues.

Potential opportunities for the CEMS initiative to inform project level impact assessments include:

- Understanding the values of Indigenous peoples and coastal communities within the pilot areas.
- Highlighting marine shipping issues relevant to the pilot areas.
- Identifying VCs and/or prioritizing areas of study
- Amalgamating available data and knowledge relevant to marine shipping and environments in pilot areas including the identification of data/knowledge gaps.
- Providing evidence to inform the identification of regional mitigation measures and developing management strategies that could be applied to future projects in the pilot areas, or more broadly.

Canada's *Impact Assessment Act, 2019* (IAA, 2019) has introduced new ways of addressing cumulative effects through Regional Assessments (RAs). As the CEMS initiative is an activity-based CE assessment that focuses only on marine shipping activities, the CEMS pilot work can feed into larger RAs by providing regionally and/or sub-regionally specific recommendations for managing marine shipping, as well as a data summary of the evidence that supports that decision making.

1.3 OPP, CEMS AND RECONCILIATION

The Government of Canada is committed to reconciliation through a renewed, nation-to-nation relationship with Indigenous peoples (i.e. First Nations, Inuit and Métis), founded on the recognition of rights, respect, co-operation and partnership. Indigenous peoples are key partners in the OPP as coastal environments are intrinsic to the identity and ways of life for coastal communities. Indigenous peoples along the coasts have valuable traditional and local knowledge, which can inform the marine safety system and ecosystems through OPP initiatives such as CEMS. Indigenous participation is especially important in Canada, where Indigenous peoples have constitutionally recognized rights, title and treaty rights with direct relevance to environmental decisions.

The CEMS initiative relies on regional partnerships, collaboration and engagement in each of the six identified pilot areas, as well as with national organizations where possible and appropriate. TC has developed various types of models for strengthened collaboration with Indigenous peoples, aimed at improving the quality and legitimacy of the CEMS assessments (See Appendix I for more information on these collaboration models).

1.3.1 Indigenous Knowledge

There is no universally accepted definition of Indigenous knowledge. The term itself is used to communicate a body of knowledge borne out of Indigenous ways of life and knowing. Among the definitions of Indigenous knowledge that are available, certain common traits exist. For example, Indigenous Knowledge (IK) is:

- rooted in Indigenous traditions, languages, cultures, and history;
- holistic in nature and closely linked to the environment;
- cumulative and dynamic, growing and expanding with the experiences of individuals and communities; and,
- integral to and inseparable from the livelihoods of Indigenous peoples.

In addition to the term Indigenous knowledge, other common terms include traditional knowledge, traditional ecological or environmental knowledge, Aboriginal traditional knowledge, Métis knowledge, Inuit Qaujimagatuqangit, Indigenous knowledge systems and community knowledge, among others.

Indigenous communities are the sole owners of their knowledge and are the only ones who can define it. IK is gathered over generations of experience and interactions within an environment and is inseparable from regionally specific Indigenous values and culture. IK and science represent different ways of understanding the environment. Both should be understood as complementary worldviews that, when appropriately brought together, create a more informed and holistic understanding of an ecosystem.

Incorporating IK is a foundational piece to the CEMS initiative. However, Indigenous knowledge can be culturally sensitive and can include information the community may want to protect from public disclosure. Knowledge holders and/or their communities have control over their knowledge and may have requirements or conditions for working with it. It is important to TC to remain adaptable and respectful when approaching sensitive Indigenous knowledge. TC employees working with Indigenous knowledge must respect community protocols including any protocols concerning the handling, storage, access or integration of the knowledge. One way TC has championed this is by helping establish data sharing agreements between third party contractors and Indigenous peoples. Through this process, a third-party contractor may work directly with Indigenous peoples to access and incorporate IK in their work and then in turn provide TC with a high-level summary of that information, bypassing the need for TC to access the specific sensitive data/knowledge itself. It is important to note that this is just one approach to incorporating IK into a CEA, and that each approach should be regionally specific and directly informed by local Indigenous peoples.

1.3.2 Funding Agreements

Funding to support capacity for coastal communities and Indigenous peoples to participate in the CEMS initiative has been a key and ongoing priority throughout the initiative. Various types of funding agreements for coastal communities and Indigenous peoples to participate in OPP initiatives are and have been available through the Indigenous and Local Communities Engagement and Partnership Program (ILCEPP) and Community Participation Funding Program (CPFP). The ILCEPP encourages participation in long term, ongoing engagement activities, and builds capacity and relationships for ongoing participation in OPP initiatives, including CEMS. Similarly, the CPFP is

and has been used to provide short-term capacity funding to help Indigenous peoples and local communities participate in specific activities related to the national and regional pilot area work. Ensuring the availability of appropriate funding to support capacity been extremely important to the success of the CEMS initiative.

1.4 WHY IS MARINE SHIPPING IMPORTANT?

Canada's marine transportation sector is essential for trade growth and prosperity as it allows natural resources, agricultural products and manufactured goods to access domestic and international markets. According to the United Nations Conference on Trade and Development, marine shipping facilitates 90% of world trade (Transport Canada, 2019). Canada's ports and harbours are depended upon to import goods to Canadians and export Canadian products to international markets. As of December 2018, Canada had 557 port facilities, 883 fishing harbours and 127 recreational harbours, which support important marine activities including ferry services, commercial fishing and recreational boating (Transport Canada, 2019). In Canada's Arctic, marine transportation remains the most economical way to provide communities and their residents with an annual re-supply of goods and materials. It is important to identify the various environmental, social and cultural effects of marine shipping in order to protect Canada's people and environment, while sustaining the world's dependency on marine transportation. With an improved and heightened emphasis on efficiency, safety, security, and the development of environmental regulations that support international standards, Canada's marine transportation sector will continue to play a critical role in supporting economic prosperity.

The marine shipping industry has an important role to play in the CEMS initiative with respect to the development of regionally specific management tools that can be applied to existing vessel movements or future project developments. Collaboration between the Government of Canada, Indigenous and coastal communities, and stakeholders such as the marine industry, is key in developing these tools.

1.5 DEVELOPING THE FRAMEWORK

The following documents, resources and events are crucial pieces that make up the CEMS toolkit and have all contributed to shaping the CEMS Framework. Input received through engagement events, workshops, webinars, pilot area work and stakeholder engagement have been thoughtfully considered and adopted in the development of this National Framework, where appropriate.

1.5.1 Literature review of "Cumulative Effects Management Concepts and International Frameworks" (Lerner, 2018)

In the early stages of the CEMS initiative, a researcher from the University of British Columbia conducted a literature review of international cumulative effects management frameworks with a focus on marine shipping and coastal contexts. The purpose of this work was to inform the development of a Canadian CEMS Framework by identifying existing systems of policies, procedures, and tools that enable management of cumulative effects at a broader regional scale. Sources for the review included the author's professional experience, academic and grey literature, and on the recommendation of Transport Canada and Fisheries and Oceans Canada.

1.5.2 Evaluation of Cumulative Effects Assessment Methodologies for Marine Shipping (Pickard, et al., 2019)

In 2018, ESSA Technologies Ltd prepared a report for Transport Canada, reviewing existing national and international methodologies for the assessment of cumulative effects. The report informed various phases of the CEMS pilot areas by providing recommendations as to which categories of assessment methodologies (i.e. spatial,

analytical and modelling) are most applicable under different regional scenarios. Before finalizing the report, input was received from a national Indigenous and multi-stakeholder perspective, at a two-day workshop, which included participants with technical knowledge in the field of cumulative effects.

1.5.3 Cumulative Effects Assessment: Technical Workshop (Stratos Inc., 2019)

In February 2019, TC hosted a two-day workshop, which brought together over 60 practitioners with technical knowledge in the field of cumulative effects. Some key objectives of the workshop were to present the findings of the methodology assessment, gather input on evaluation research to inform a path forward for regional work, and to provide an opportunity to build and strengthen relationships and learning between federal governments and Indigenous peoples, territorial and provincial government departments, environmental non-government organizations, academia and marine industry stakeholders.

1.5.4 Follow-up webinars with Indigenous and academic cumulative effects practitioners

One of the recommendations coming out of the February 2019 workshop was to draft a straw dog of the Framework with input from CE practitioners. Two groups were then formed: an Indigenous CE practitioner group and a group of academics who were studying CEA Frameworks/methodologies. Input gathered from these Indigenous and academic CE practitioners provided insightful guidance and concepts which were incorporated into this Draft Framework. Some key themes of the input received include:

- Indigenous collaboration
- Incorporation of Indigenous Knowledge
- VC-based approach vs an ecosystem-based approach
- Adaptability (i.e. no one-all approach)
- Types of CEA methodologies

A summary of comments was provided to the Indigenous and academic CE practitioners along with an explanation of how each topic was approached and addressed in the development of this Draft Framework.

1.5.5 CSAS Science Advisory for Pathways of Effects for Marine Shipping in Canada (Department of Fisheries and Oceans Canada [DFO], 2020)

To support the CEMS initiative, TC requested science advice from DFO on the environmental effects of marine shipping in Canada. In response to this request, DFO developed, through the Canadian Science Advisory Secretariat (CSAS) process, *Science Advice for Pathways of Effects for Marine Shipping in Canada: Biological and Ecological Effects*. The report explores ways that the activities associated with commercial shipping can impact the marine environment, through the development of a suite of activity based Pathways of Effects (PoE) conceptual models.

1.5.6 Regional pilot area work

Due to varying regional realities, all CEMS pilot area work has progressed quite differently (e.g. through the development of regionally-specific collaboration models and engagement strategies, IK/data amalgamation, assessment methodologies, etc.). Lessons learned from the various regional contexts laid the foundation for many sections of this Framework.

1.5.7 Key stakeholder engagement

Industry has and will continue to have the opportunity to provide input into the CEMS process at certain stages, both regionally (i.e. through input and discussion on potential regional management levers) and nationally (i.e. input into the Framework). TC continues to bring interested industry representatives to the table to share information on mitigation as well as further explore what other measures could be implemented. Any mitigation options being proposed would be evaluated in the context of the potential impacts on the shipping industry and the economic and social benefits it provides. Academic researchers and non-government environmental organizations have helped to inform both the National Framework as well as regional pilot area work, especially through the sharing of their latest research on framework design, and the provision of data used to inform the regional cumulative effects assessments. Other federal/provincial/territorial government departments have also been instrumental in informing the development of the National Framework as well as carrying out the regional pilot area work.

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2 DEFINITIONS¹

These definitions have been adopted from various sources. It is important to note here that language can either increase accessibility and participation, or hinder its progress. Ensuring all participants have a clear understanding of the various terms being used is of utmost importance. Some terminology may vary from region to region.

Activity: An action that may impose one or more stressors on the ecosystem being assessed (O et al., 2015).

Collaboration: To work jointly on an activity, especially to produce or create something.

Cumulative Effect (CE): The changes in the environment, health, social and economic conditions, caused by multiple interactions among human activities and natural processes, which accumulate across time and space (Adapted from Canadian Council of Ministers of the Environment [CCME], 2009).

Effects: Changes, either positive or negative, direct or indirect, short or long term, localized or large scale, to the environment or to health, social or economic conditions (Adapted from IAA, 2019).

Environment: components of the Earth, including:

- a) land, water and air, including all layers of the atmosphere;
- b) all organic and inorganic matter and living organisms; and
- c) the interacting natural systems that include components referred to in (a) and (b) (IAA, 2019).

Indicator: Any significant measure (e.g. density of cetacean species) relative or not, used to assess a state or change of state for the purpose of describing or evaluating it (e.g. environment, stressor or valued component).

Indigenous Knowledge: *There is no universally accepted definition of Indigenous knowledge. For the purpose of the CEMS initiative and this Framework, the following definition is appropriate.* A form of empirical information and is derived from a multitude of experiences and traditions that are passed down orally or by shared practical experiences of people who have lived within and as part of the natural environment for hundreds or thousands of years. Indigenous Knowledge includes the inextricably interconnected culture, spirituality, traditions, and ecology of a group of people and their landscape, as it is embedded within a larger socio-cultural context and traditional worldview (Pickard, et al., 2019).

Marine environment: All waterways including saltwater and freshwater ecosystems within Canadian jurisdiction.

Marine shipping: Includes commercial vessels, ferries, cruise, fishing and recreational vessels operating in waters within Canadian jurisdiction, if the data is available and accessible.

Management levers: Legislation, regulations, policies or voluntary tools that can be pulled or implemented in order to mitigate or manage the effects of marine shipping activities on environmental, social or cultural valued components.

Management measures: Legislation, regulations, policies, or voluntary tools currently in place which manage the effects of marine shipping activities under various levels of jurisdiction.

¹ Definitions may vary across regions to be inclusive of regional contexts, but to some degree, still encompass the concepts and factors defined in this report.

Management objective: A qualitative or quantitative statement or value representing the shared, long-term management goal for a valued component and/or ecosystem in a cumulative effects assessment.

Partnership: A relationship where two or more parties, having compatible goals, form an agreement to do something together.

Stressors: Any physical, chemical, or biological means that, at some given level of intensity, has the potential to change an ecosystem or one or more of its components (O, et al., 2015).

Threshold: Levels at which a particular stressor or VC exceeds a level of concern resulting in an alternative management regime. Thresholds are informed by a combination of technical understanding and a socially defined level of acceptable change (Pickard, et al., 2019).

Valued Components (VCs): Environmental features that may be affected by an activity and that have been identified to be of concern by the proponent, government agencies, Indigenous peoples, or the public. The value of a component not only relates to its role in the ecosystem, but also to the value people place on it. For example, it may have been identified as having scientific, social, cultural, economic, historical, archaeological, or aesthetic importance (Pickard, et al., 2019).

Valued Component is a term traditionally used and understood in the context of impact assessment, and as such is used throughout this document. However, assigning “value” to some aspects of the environment over others is counterintuitive to many Indigenous worldviews (reference). In some cases, alternate terms may be used and defined.

Pathway of Effects (PoE): The cause-effects relationships between activities associated to marine shipping and their effects, via stressors, on the Valued Components (VCs) of the environment [Adapted from Thornborough et al. 2018].

3 A NATIONAL FRAMEWORK FOR ASSESSING THE CUMULATIVE EFFECTS OF MARINE SHIPPING

3.1 VISION

The vision for the CEMS Initiative is that it will support evidence-based decision making that can preserve the marine ecosystem and Indigenous ways of life while facilitating economic growth in the marine transportation sector.

As reflected in the Framework, the CEMS initiative envisions nation-to-nation partnerships and collaboration between the federal government, Indigenous peoples, the marine industry, subject matter experts (e.g. academia and Non-Governmental Organizations), other levels of governments, and other stakeholders. Through the initiative, TC aims to enhance relationships and learning within the cumulative effects practicing community across the country and contribute to increased coordination of research. The CEMS initiative is an iterative and flexible process, which is responsive to collaborators, and changing environmental and social conditions. This National Framework is intended to keep evolving through time, practice and application.

3.2 GOAL

The goal of the Framework is to provide flexible guidance in a consistent way on how to assess the cumulative effects of marine shipping on a regional basis instead of project by project. It can also aid in the emerging practice of regional cumulative effects assessment.

The purpose of this Framework is to foster a shared understanding of our learning and approaches to regional CE assessments. It outlines the steps involved in conducting an assessment of the regional cumulative effects of marine shipping and provides further context and supporting information on the CEMS initiative as it has been rolled out in the pilot areas.

Going forward, this Framework could be a useful tool for regional CEAs in additional areas of Canada or a useful tool for other jurisdictions in furthering regional CEA understanding.

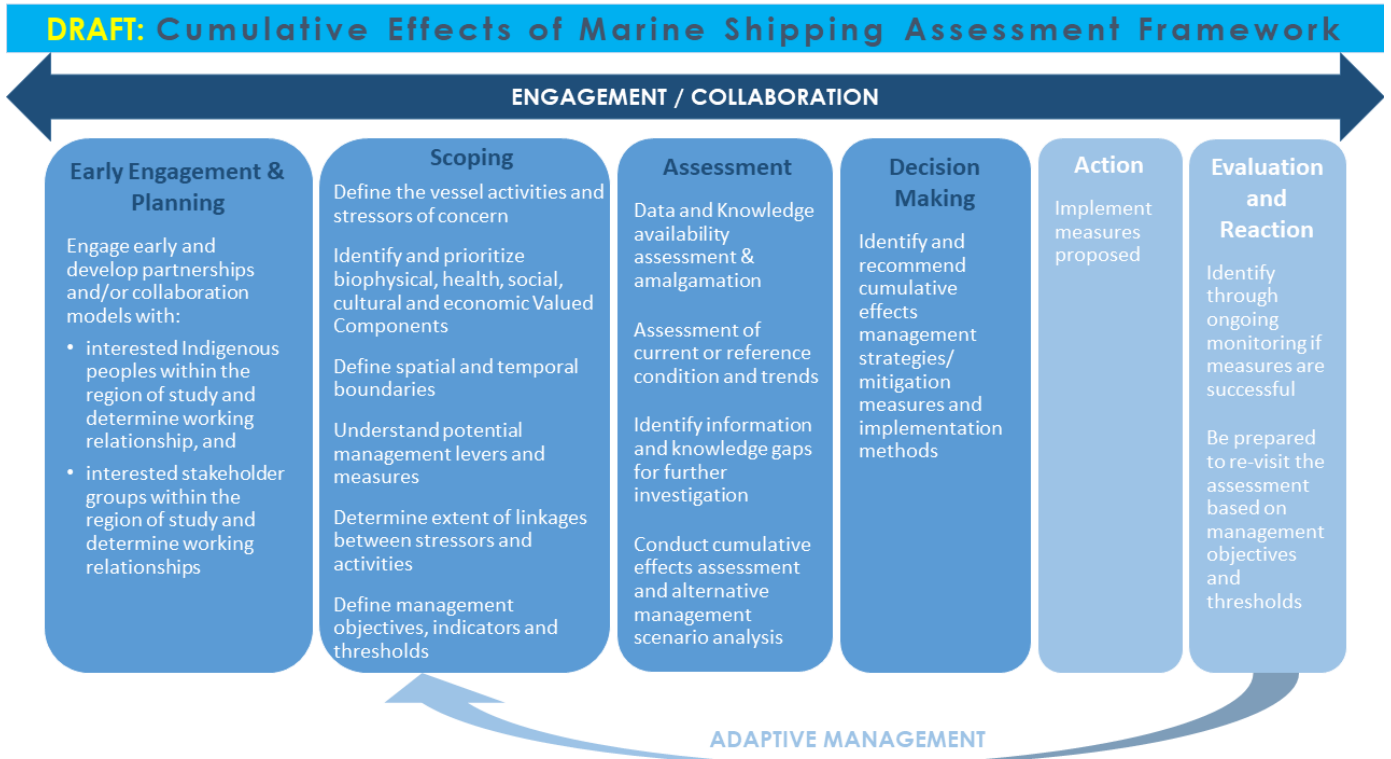


Figure 1: Transport Canada’s Cumulative Effects of Marine Shipping Assessment Framework under the Oceans Protection Plan.

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4 FRAMEWORK COMPONENTS

The CEMS Framework includes key activities and outcomes through six phases:

- Early Engagement & Planning
- Scoping
- Assessment
- Decision Making
- Action
- Evaluation and Reaction

Through work on the CEMS initiative at both the national and regional levels, all six phases are important steps in a regional CEA process. The CEMS initiative is focused on completing work in the first four of these phases.

The following sections describe each phase in detail. It is important to note that this Framework is iterative, adaptable and has been and will continue to be informed by CEMS assessments undertaken to date. There is no one-size-fits-all approach when it comes to assessing regional cumulative effects of marine shipping across Canada. This Framework should guide future CEMS assessments in Canada, but ultimately, assessments should be informed by collaboration and regional realities.

While the goal of this Framework is to assess the cumulative effects of marine shipping, TC acknowledges that these Framework phases can be applied across various sectors.

4.1 EARLY ENGAGEMENT AND PLANNING

Steps:

- Engage early and develop partnerships and/or collaboration models with interested Indigenous peoples within the region of study and determine working relationships
- Engage early and develop partnerships and/or collaboration models with interested stakeholder groups within the region of study and determine working relationships

The objective of this phase is to build relationships between TC and regional partners centered on trust, respect and recognition of Indigenous rights and title. All interested Indigenous peoples and stakeholders within the region should be engaged in order to seek out opportunities to work in cooperation.

Collaboration models

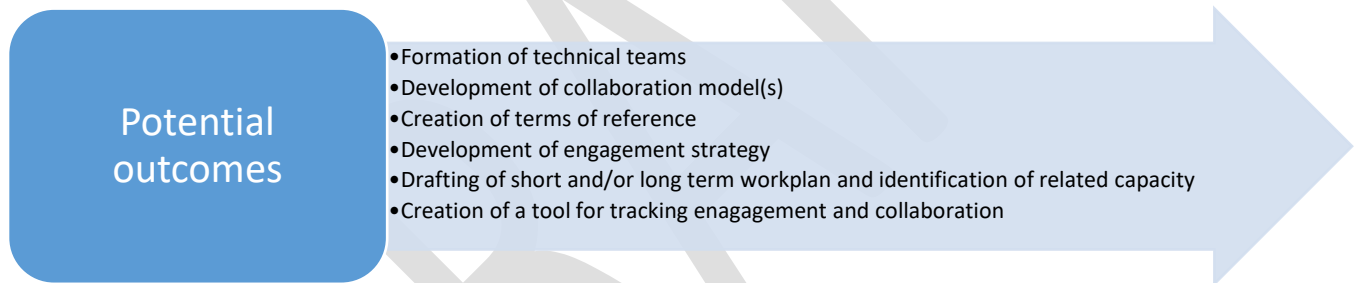
Indigenous peoples, collaborators and stakeholders should determine how and to what extent they would like to be engaged as a regional CEA proceeds. It is important that expectations, goals and objectives are clearly stated and documented in a collaborative governance structure. There are various types of collaboration models that can be used to engage with Indigenous peoples and stakeholders. Some questions that may guide the development of a collaboration model include:

1. What principles should ground the work?
2. What are the responsibilities for each group for the relationship to work?
3. What are the responsibilities for each group to complete the work?
4. How should the groups work together?

Through early discussions, TC found that the core principles to ground the engagement strategy for the CEMS initiative include collaboration, culture, cooperation, inclusivity, respect and vision (i.e. setting clear goals and objectives). Key methods for how to work together include establishing working groups, or operating through existing structures, and when possible, including elders and youth. Collaboration models should always be co-developed and may include information such as cultural context, key definitions, goals and objectives, governance structure, intended deliverables, linkages and dependencies, resourcing, etc. Some of this work planning may organically feed into the next phase of the Framework. For more on collaboration models developed for the CEMS pilots areas, see Appendix I.

When possible, TC has found that in-person discussions are the most effective for strong communication and relationship building. These events may also serve as an opportunity to provide education where necessary, such as on existing regulations or programs (e.g. bringing in experts on topics, such as emergency response). Other means of collaboration may be more appropriate when gathering input on a broader scale. For example, in the early days of the CEMS initiative, TC conducted cross country and online engagement on key factors to help guide the development of the National Framework, which included input on the early scoping of marine shipping issues and factors to consider when establishing spatial and temporal boundaries (Transport Canada, 2018).

In recognizing the shared stewardship of potential VCs and shared responsibilities for management of the cumulative effects of marine shipping at large, it is important to provide opportunities for collaboration and input from the marine industry, ENGOs and other stakeholders throughout a regional CEA process.



4.2 SCOPING

Steps:

- Define the vessel activities and stressors of concern
- Identify and prioritize biophysical, health, social, cultural and economic Valued Components
- Define spatial and temporal boundaries
- Understand potential management levers and measures
- Determine extent of linkages between stressors and activities
- Define management objectives, indicators and thresholds

Defining Valued Components:

The purpose of scoping is to define and justify all parameters of a regional CEA prior to the assessment phase. There are many possible methods for how to focus a regional CEA. In many cases, the CEMS initiative has adopted a VC-based approach, which is closely aligned with concepts common to ecosystem-based management. While it is important to understand the ecosystem context when conducting a regional CEA, assessing cumulative impacts on VCs can be a means to build an understanding of an ecosystem as a whole.

Conversation with some Indigenous communities has led to important discussions about compartmentalizing and assigning heightened “value” to certain aspects of the environment over others. An understanding of the interconnectedness of all aspects of the environment, including human wellbeing and belonging, is central to many Indigenous worldviews (Faculty of Native Studies, University of Alberta, 2020). Therefore, scoping parameters should initially be broadly defined to ensure all possible activities, stressors and VCs or priority study areas are considered. In the context of the CEMS initiative, this means identifying all shipping activities and stressors that may cause cumulative effects in the pilot areas, as well as all environmental, cultural and social components that may be impacted. From this point, a smaller, more manageable set of parameters may be chosen to focus the assessment.

Scoping should always be done in collaboration with regional partners and/or collaborators, and consider input from subject matter experts and other stakeholders. A collaboratively developed set of selection criteria will help to scope down regional issues and prioritize which stressors and VCs to focus efforts on. The process of refining a broader set of issues will help to document and justify the rationale behind the prioritized VCs.

Pathways of Effects diagrams:

A PoE diagram is a useful tool that may be developed for priority VCs. PoE conceptual models describe the linkages between activities, associated stressors, and their effects on VCs. They serve as visual representations of effects, and are supported by text describing each pathway linkage. Figure 2 shows a template of a PoE diagram. In the case of the CEMS initiative, the activity for any PoE is always marine shipping and the sub activity is always associated to an action resulting from marine shipping, such as movement underway or discharges. The numbers corresponding to each arrow in the diagram are accompanied by an associating text that describes and provides evidence for that linkage.

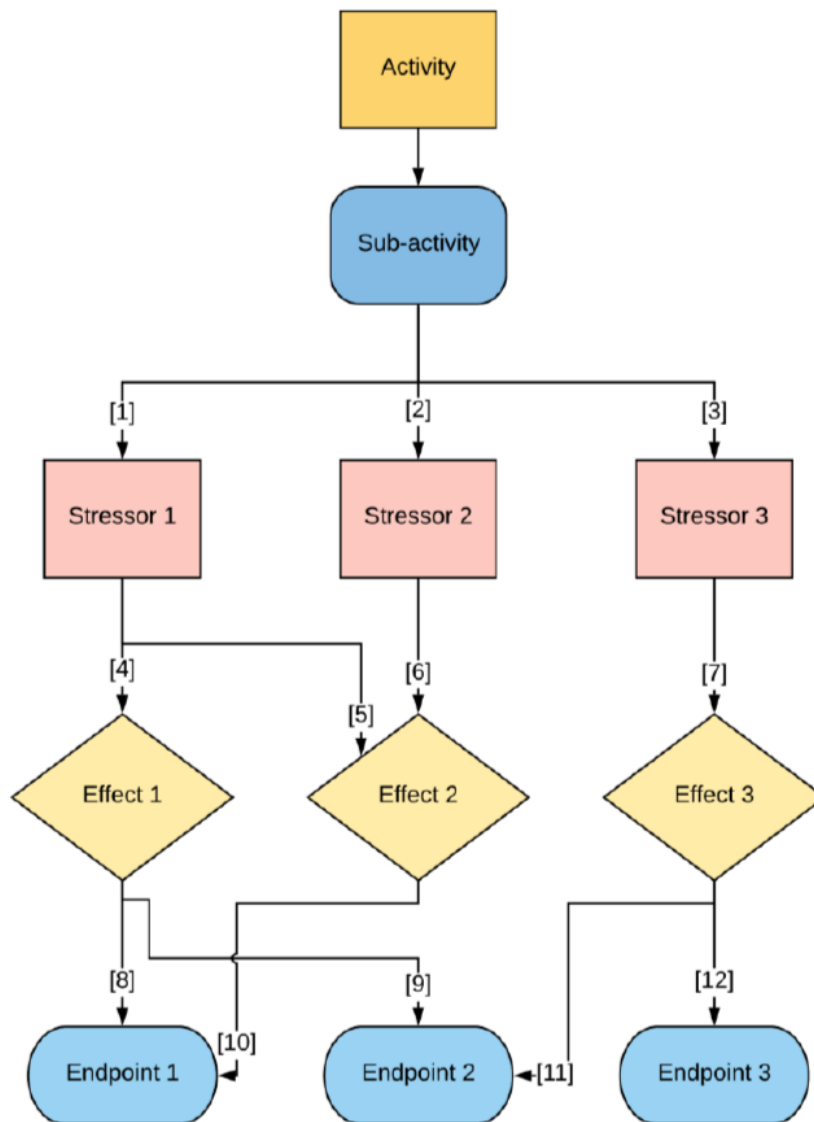


Figure 2: Template structure for a Pathway of Effect model diagram from the PoE CSAS report. Arrows indicate the linkages between components, number links to supporting text/evidence.

Spatial and temporal boundaries:

Defining spatial and temporal boundaries is an important step in scoping out a regional CEA. Through early engagement, TC found that there are many factors that may contribute to spatial and temporal boundaries. For the CEMS pilot areas, the geographic scales may be defined by the extent of the marine shipping activities on chosen VCs, the scale that management levers can be implemented, or already established boundaries such as Indigenous territories or bioregional boundaries. The spatial boundaries for the assessments of pathways in a study area should be informed by the best available data for an indicator. Regional CEAs may also be divided into sub-regional CEAs. This tiered approach allows for sub-regionally specific issues, values and mitigation measures to be identified, ultimately leading to a more fulsome regional CEA. Considerations for temporal boundaries will be discussed further in section 4.3.

Management objectives, indicators and thresholds:

Collaboratively drafting clear management objectives for each prioritized value helps set the stage for the following steps and phases of a regional CEA. A management objective defines the desired future condition of a value and should typically include a measurable result in order to help identify appropriate indicators, thresholds, potential mitigation measures and monitoring strategies (Wilson, 2020).

Indicators are metrics used to assess the potential effect of an activity on a VC. They serve as a proxy for VCs and stressors and help to measure the condition of a VC based on its management objective. Indicator selection should consider criteria such as relevance, responsiveness and feasibility (Pickard, et al., 2019). Through the CEMS initiative, TC has found that in certain cases, indicators for VCs may be chosen prior to defining management objectives. This step, much like many other steps in a regional CEA, is iterative and may vary on a case-by-case basis.

Thresholds are qualitative or quantitative levels of an indicator, which if surpassed, initiate changes in management. Those who have a strong relationship or understanding of a resource, or VC, will have a deeper understanding of its acceptable thresholds. Thresholds may vary from region to region and community to community, and may not be appropriate for some stressor-VC relationships. They should always consider the regional context of where the CEA is taking place, and be directly informed by science and local community and Indigenous knowledge. Suitable indicators and thresholds should have sufficient data available to understand the regional context and support the assessment. An analysis and amalgamation of existing data is crucial to identifying a suitable indicator, but this may only reach completion in the following phases of the regional CEA process. In some cases, there may not be data available to assess the impacts on an indicator. However, identifying where gaps in data and knowledge exist is still an important outcome for focusing future efforts. These are clear examples of the importance of maintaining an iterative framework process.

Management levers and management measures:

As defined above, management levers include legislation, regulations, policies or voluntary tools that can be implemented in order to mitigate or manage the effects of marine shipping activities on environmental, social or cultural valued components. Management measures are existing legislation, regulations, policies, or voluntary tools currently in place which manage the effects of marine shipping activities under various levels of jurisdiction. It is important to understand the management context and what the possible outcomes may be in order to help focus efforts during the scoping phase. However, depending on factors including capacity, this exercise may be carried out in tandem with the assessment phase. Key pieces to identify during this step include the type of lever, who has jurisdiction over the lever, and the process for implementing it. A list of possible management levers and management measures with respect to Transport Canada's marine shipping mandate can be found in Appendix II.

Potential outcomes

- Development of selection criteria, including rationale, for prioritizing interests and values
- Development of conceptual diagrams
- Identification of spatial and temporal boundaries for prioritized values
- Identification of management levers, measures and objectives for all prioritized values

4.3 ASSESSMENT

Steps:

- Data and knowledge availability assessment & amalgamation
- Assessment of current or reference condition and trends
- Identify information and knowledge gaps for further investigation
- Conduct cumulative effects assessment and alternative management scenario analysis

Data and knowledge amalgamation

Data and knowledge availability assessment and amalgamation is an important first step of a CEA, which typically involves considering a variety of potential input datasets and data gaps. This exercise begins with compiling and evaluating the quality and spatial/temporal extent of the best available data in relation stressors, VCs, and their indicators. Indigenous knowledge should be included in this amalgamation. As discussed in section 1.2.1, there may be sensitivities with respect to how sensitive cultural Indigenous knowledge is gathered, utilized and accessed.

Depending on the nature and scope of assessment, data-related considerations for both science and Indigenous knowledge could involve building awareness and understanding of themes such as:

- Qualitative vs quantitative data & analysis
- Current vs historic conditions
- Spatial & temporal factors
- Scale & context
- Availability & cost (open data, shared/donated, purchased, collected, derived, etc)

Geographic Information Systems (GIS)

Collaborative decision making could involve discussion of some or all of the above topics among the participants and stakeholders of the initiative. There are many tools that can facilitate these discussions through shared exploration and visualization of data. Considering the goals and requirements of these discussions will help in selecting appropriate collaboration tools.

For the CEMS pilot assessments, an online platform with a broad range of GIS capabilities was selected on a trial basis to help users view, explore, share and discuss data. The platform allows for the creation of as many private collaborative spaces as needed. For CEMS, it has also been important to consider potential linkages with other initiatives that cover related interests or subject matter. Finding overlaps and opportunities to collaborate helps to maximize efficiency and minimize duplication of effort.

Assessment methodologies

As categorized by Pickard, et al. (2019), regional CEA methodologies can be grouped into core themes including spatial, analytical and modeling methods. The selection of an assessment methodology must be regionally-specific as it depends on the relevance (i.e. priority valued components, shipping issues of concern), rigor (i.e. data availability), and feasibility (i.e. capacity) within each study area. Selecting a methodology depends on the outputs from other components within the Framework and may change as scope is refined, more data becomes available, or the regional context shifts. Throughout CEMS engagement, adaptability was identified as an essential element of a regional CEA Framework, since it is widely acknowledged that processes and methodologies should

be informed by the regional context of each pilot area. The regional context considers both the ecological environment, the local and Indigenous context and input from stakeholders.

Assessing the pathways of effects includes an understanding of the shape of the functional relationship between stressors and priority VCs (e.g. linear, exponential, optimum range), and the magnitude of each effect (Pickard, et al., 2019). This understanding helps identify which pathways have the most significant influence on the overall health of an ecosystem (i.e. the relative drivers of the system) which, in principle, supports decision making (Pickard, et al. 2019).

Assessment: understanding baseline conditions

The purpose of this step is to use the best available data to understand the significance of historical stressors on priority VCs when determining baseline conditions. At the basic level of a regional CEA, the baseline condition of indicators are assessed in relation to their threshold to determine whether a change in management (i.e. implementation of management lever) is required.

Good CEAs begin with understanding how priority VC conditions have changed over time and whether those changes are significant considering the threshold identified (Nobel, 2015). If the current condition of an ecosystem is taken as the baseline for which future effects are compared against (i.e. the baseline does not consider past effects), the assessment would greatly underestimate the cumulative effects that have already occurred in the study area and would lead to the ineffective management of priority VCs, particularly those that are already nearing a critical sustainable tipping point (Nobel, 2015). Looking at historical data to understand the effects that have already occurred in a study area is essential to assessing how an ecosystem may react to future changes and can help to inform the development of thresholds. However, there are several considerations to be made when defining the temporal scope of the baseline conditions. Historical data can be culturally sensitive, difficult to find, and may require a considerable amount of time and resources to collect.

This step can be done in tandem with the data and knowledge amalgamation step described above. Information gaps are often identified at this stage.

Assessment: predicting future effects

Once the retrospective analysis is conducted on the priority VCs, a good regional CEA predicts what future effects may look like based on various proposed or projected development scenarios (Nobel, 2015). According to the core themes of assessment methodologies categorized by Pickard, et al. (2019), this type of future scenario assessment would require the use of a modelling tool. In the case of the CEMS initiative, the focus of this work is to analyze the condition of priority VCs given various predicted future shipping scenarios, as well as gain an understanding of how priority VCs interact and respond to regional cumulative disturbance. The predicted change in the conditions of priority VCs, compared to their thresholds, may alter the management outcome or a pulling of a management lever to mitigate any potential regional cumulative effects.

Potential outcomes

- Agreement on assessment methodologies
- Amalgamation of data and/or knowledge
- Increased understanding of indicators, trends and thresholds
- Understanding of assessment conclusions
- Refining list of relevant potential mitigation measures and management levers

4.4 DECISION MAKING

Steps:

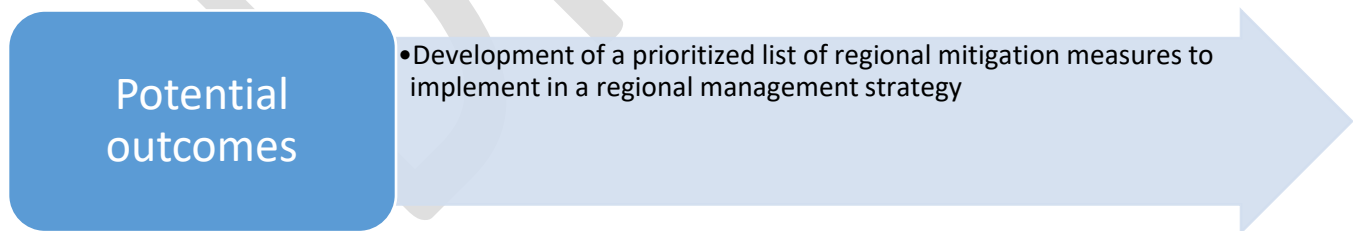
- Identify and recommend cumulative effects management strategies/mitigation measures and implementation methods

The key outcome of the decision making phase of a regional CEA is to identify a suite of prioritized measures to be recommended through the regional mitigation strategy. These mitigation measures should be derived from the list of potential management levers and measures identified in the scoping phase of the assessment (See Appendix II) and refined as necessary with the outcomes of the regional CEA. However, other measures may be identified throughout and after the assessment phase as more information becomes available and more collaboration occurs.

The objective of mitigation measures is to reduce or eliminate the adverse cumulative effects of an activity on the ecosystem as a whole through priority VCs. In the cases where, through the regional CEA, a priority VC has been identified to have reached or surpassed its sustainable threshold, the only acceptable management action may be to restore, and hopefully enhance, the VC condition (Nobel, 2015).

In addition to implementing concrete mitigation measures (e.g. those listed in Appendix II), a regional CEA may also inform strategic level outcomes (e.g. marine use planning), as well as federal project impact assessments under the IAA, or any other project reviews subject to a provincial or territorial impact assessment process. A regional mitigation strategy may also include recommendations for knowledge building and coordination such as further data collection where data gaps have been identified. It is important that the results of a regional CEA be available to and widely shared with all relevant stakeholders and authorities to ensure all possible mitigation and management actions are considered.

Due to the nature of regional CEAs, management decisions typically fall under the jurisdiction of multiple relevant authorities. These relevant authorities may include various federal government departments, other levels of government, the marine shipping industry, and Indigenous communities. The results of a regional CEA support decision makers by providing information and evidence on the current and projected future state of priority VCs. The stronger the evidence base for adverse cumulative effects, the higher the likelihood of decision makers to implement recommended mitigation measures.



4.5 ACTION

Steps:

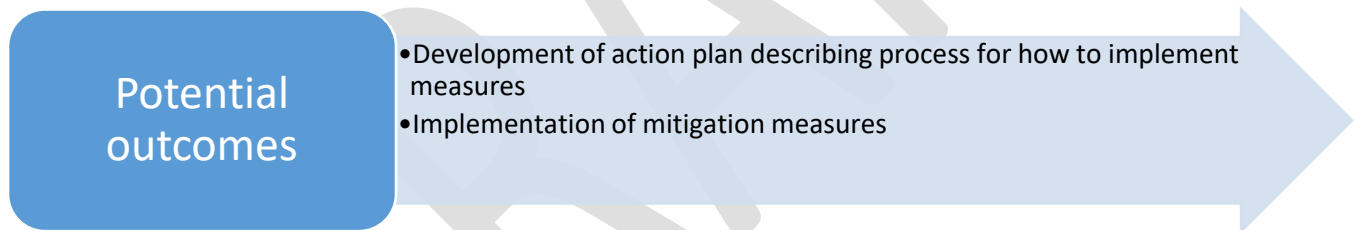
- Implement measures proposed

The objective of this phase is to implement recommended mitigation measures agreed upon in decision-making and, where appropriate, begin drafting a follow up program to design how the measures will be monitored. As

discussed above, implementation may fall under the jurisdiction of many relevant authorities, depending on the nature of the recommended mitigation measures. There are many factors that may contribute to the successful implementation of marine management measures. Elliott (2013) describes these factors as the 10-tenets for integrated, successful and sustainable marine management. According to Elliott (2013), measures to manage the marine environment must be:

- Ecologically sustainable
- Technologically feasible
- Economically viable
- Socially desirable/tolerable
- Legally permissible
- Administratively achievable
- Politically expedient
- Ethically defensible (morally correct)
- Culturally inclusive
- Effectively communicable

The process and plan for implementing mitigation measures is dependent on the type of lever selected. For example, creating new or revising existing legislation is a lengthier process than enacting new regulations. Similarly, the process of creating new legislation or enacting new regulation looks much different than trialing a voluntary measure with industry stakeholders. In all cases, it's important that an action plan allows for engagement and input from interested implicated parties.



4.6 EVALUATION AND REACTION

Steps:

- Identify through ongoing monitoring if measures are successful
- Be prepared to re-visit the assessment based on management objectives and thresholds

Follow-up and monitoring

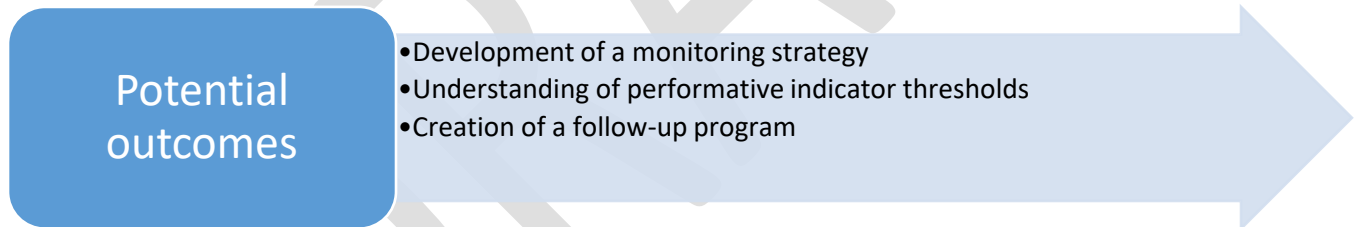
A well designed follow-up program is a critical component for the success of a CEA. Regional CEAs are often designed with a considerable amount of uncertainty and are often sensitive to unpredictable socio-economic changes. Monitoring is integral to a follow-up program as it allows for practitioners to reevaluate regional study areas after the implementation of mitigation measures to determine if scoping or management changes need to be made. This is the foundation of adaptive management.

The overall objective of a follow-up program is to understand the outcomes of decision making, which can inform ongoing refinement of the CEA and associated management actions. More specifically, a follow-up program may have many purposes, such as:

- verify predictions of environmental effects identified in the regional CEA;
- determine the effectiveness of mitigation measures in order to modify or implement new measures where required;
- support the implementation of adaptive management measures to address previously unanticipated adverse effects;
- provide information on effects and mitigation that can be used to improve and/or support future impact assessments including CEAs;
- support environmental management systems used to manage the environmental effects of projects (adapted from CEAA, 2011).

Indicator monitoring involves periodic collection of data to confirm the condition and trend estimates of the indicators, which helps to inform the effectiveness monitoring of the overall regional CEA (Wilson, 2020). If the measure of an indicator surpasses the management threshold established in the scoping phase (section 4.2), then a change in management should be triggered. This often involves implementing a more rigorous mitigation measure. Effectiveness monitoring is broader in scope and aims to evaluate the success of the overall CEA. Determination of success is achieved by periodically evaluating the current state of the study area with the stated management objectives of each VC and the overall stated goal of the CEA. When the regional reality, as determined through monitoring outcomes, does not align with stated management objects and goals, then the cumulative effects projected in the CEA are not being adequately addressed, and adaptive management would be needed.

A follow-up program should be designed with input from local knowledge holders and must allow the opportunity for input by relevant authorities. Opportunities should be available for Indigenous and local communities to be involved in monitoring studies.



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Draft National Framework Cumulative Effects of Marine Shipping

APPENDIX I: PILOT AREAS²

CAMBRIDGE BAY, NU

NORTHERN SHELF BIOREGION, BC

SOUTH COAST, BC

ST. LAWRENCE, QC

BAY OF FUNDY, NS/NB

PLACENTIA BAY, NL

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² In a future version of this National Framework, this Appendix will include a summary of the application of the Framework in our six pilot areas (see map below), including how each of the Framework phases has been applied: Early Planning, Scoping, Assessment and Decision Making.

APPENDIX II: POTENTIAL MANAGEMENT LEVELS

*Shaded boxes reflect existing **management measures** and non-shaded boxes reflect **management levers**. For definitions, please refer to section 2 of this Draft Framework.

Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
Transport Canada	Canadian Shipping Act, 2001	Section 10.1: Powers of the Minister – Interim Order	An Interim order by the Minister of Transport may be issued if he or she believes that immediate action is required to deal with a direct or indirect risk to marine safety or to the marine environment. The order will last up to one year with potential for cabinet to extend up to two years or make the order into regulation.
		Section 35.1: Powers of GIC – Regulations	The Governor in Council (GIC) may make regulations respecting the protection of the marine environment from vessel activities such as compulsory or recommended routes, restrictions on operation, navigation, anchorage, mooring, and berthing.
		Section 120(1): Powers of GIC – Regulations	The GIC may create regulations respecting vessel safety for the purpose of protecting shorelines or environmentally sensitive areas.
		Section 136(1)(f): Powers of GIC – Regulations	The GIC may create regulations or restrictions to navigation, anchoring, mooring or berthing of vessels for the purpose of protecting the public interest or the environment.
		Section 175.1(1) and 189: Powers of the Minister or Pollution Response Officer	A pollution response officer or the Minister may direct any vessel carrying, discharging or at risk of discharging a pollutant to follow specific routes.

Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
		Navigation Safety Regulations 2020 ³	Part 3, Division 1: It is prohibited for a vessel to anchor within the waters described in Schedule 5.
		Ballast Water Control and Management Regulations	Prevents the introduction of non-native species to waters under Canadian jurisdiction.
		Collision Regulations	Section 7: Every vessel shall comply with any instructions and directions contained in Notices to Mariners or Notices to Shipping ⁴ that are issued as a result of threats to marine safety or to the marine environment.
			Rule 10: Vessels must follow routing measures, such as Areas to be Avoided (ATBA), precautionary areas and traffic separation schemes. These management measures can be imposed for various purposes, including the protection of off-shore infrastructure, the environment or wildlife.
		Marine Machinery Regulations	Standards for construction and installation of machinery on certain vessels.
		Small Vessel Regulations	Small vessels safety construction standards. They can also address elements such as noise for pleasure craft and other small vessels.
		Vessel Operation Restriction Regulations	Modify Schedules 1-3 in order to restrict certain vessel access in certain waters.

³ Regulation expected to be published October 2020

⁴ Navigational Warnings (NAVWARNs) replace Notices to Shipping (NOTSHIPS) and shall be construed as Notices to Shipping

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Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
			<p>Modify Schedule 6 in order to set speed restrictions for power-driven vessels and vessels driven by electric propulsion in certain waters.</p>
			<p>Section 6(1): The Minister may authorize in writing any person or class of persons to place a sign in an area for the purpose of indicating that a restriction on the operation of vessels has been imposed by any of subsections 2(1) to (6) and 11(2).</p>
		<p>Vessel Pollution and Dangerous Chemicals Regulations</p>	<p>Aims to mitigate environmental impacts by preventing pollution (eg. oil, noxious liquid substances, sewage, grey water, garbage, air emissions, and antifouling systems) from vessels in waters under Canadian jurisdiction through inspections, certification and operational requirements.</p>
		<p>Vessel Traffic Services Zones Regulations (VTS Regulations), the Eastern Canada Vessel Services Zone Regulations (ECAREG), the Northern Canada Vessel Traffic Services Zone Regulations (NORDREG)</p>	<p>Vessel Traffic Services (VTS) refers to the collection, dissemination, and exchange of marine traffic information (e.g. vessel certificates vessel destinations, estimated times of arrival (ETA) to certain points, pertinent weather or navigational information, etc.) to maintain awareness on the water, and to ensure that mariners have the information they need to transit safely. Mariners are required, based on their type of vessel and geographical area, to provide certain information pertaining to their vessel and voyage to the Canadian Coast Guard MCTS officers, such as the type of cargo on board and the vessels intended route, that is then used to grant clearances and facilitate the safe and efficient movement of vessel traffic.</p>
<p>Pilotage Act, 1985</p>	<p>Section 52(f): Powers of GIC – Regulations</p>	<p>The GIC may make regulations establishing compulsory pilotage areas.</p>	

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Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
	Canada Marine Act, 1998	Section 56(1): Powers of port authorities – Procedures	A port authority may establish procedures or traffic control zones for the purpose of promoting safe and efficient navigation or environmental protection in the waters of the port, with respect to ships or classes of ships.
		Section 62(1), 74(1) and 98(1): Powers of GIC – Regulations	The GIC may make regulations respecting the use, management and environmental protection of a port, public port, or the St. Lawrence Seaway including the regulation or prohibition of equipment, structures, works and operation.
	Arctic Waters Pollution Prevention Act, 1985	Arctic Shipping Safety and Pollution Prevention Regulations	Implements the IMO’s Polar Code, as well as additional requirement for vessel safety. Sets additional pollution prevention measures from various sources such as sewage, garbage and oil from vessels in polar waters (eg. Arctic). Applies to Canadian vessels navigating in polar waters and foreign vessels navigating in a shipping safety control zone.
		Arctic Waters Pollution Prevention Regulations	Standards for depositing and reporting the deposit of domestic of industrial waste in Arctic waters, including limits of liability.
Multiple		Guidelines for Passenger Vessels Operating in the Canadian Arctic	General guidelines, including references to requirements and certifications, to aide passenger vessel operators and Designated Vessel Representatives on voyages through the Canadian Arctic.
Transport Canada and Fisheries and Oceans Canada	Canadian Shipping Act, 2001	Part 8 and 9	Supported by enabling regulations, the framework sets requirements for vessels, oil handling facilities and TC certified oil spill response organizations. Prevents and mitigates the impacts of a ship source oil spill in the marine environment

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Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
Fisheries and Oceans Canada	Oceans Act, 1996 (with Bill C55 Amendments)	Section 35 and 36(1): Powers of GIC – MPAs	The GIC may make an interim marine protected areas in emergency situations, where the Minister is of the opinion that a marine resource or habitat is or is likely to be at risk to the extent that such orders are not inconsistent with a land claims agreement.
		Section 32(d): Powers of the Minister – Quality measures	The Minister may establish marine environmental quality (MEQ) measure(s) for the purpose of an integrated management plan.
		Non-regulatory	Marine Spatial Planning (integrated management planning).
		Non-regulatory	Conservation agreements.
	Fisheries Act, 1985	Marine Mammal Regulations (<i>currently does not apply to vessels in transit</i>)	Procedure for reporting accidental contact with marine mammals.
	Canadian Coast Guard Programs		Notice to Mariners.
Environment and Climate Change Canada	Canadian Environmental Protection Act, 1999	Disposal at Sea Permit Application Regulations	Must consider sensitive areas for disposal permit; prohibition on permits.
	Canadian Wildlife Act, 1985	Section 4.1(1): Powers of GIC – MPAs	The Governor in Council may establish protected marine areas in any area of the sea that forms part of the internal waters of Canada, the territorial sea of Canada or the exclusive economic zone of Canada Marine protected area.
	Species at Risk Act, 2002	Section 11(1) & 12(1): Powers of the Minister	A Minister may enter into a conservation agreement with any government in Canada, organization or person to benefit a species at risk or non-species at risk or enhance its survival in the wild.

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Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
		Section 28(1): Powers of any person with knowledge of species – Imminent threat assessment	Any person who considers that there is an imminent threat to the survival of a wildlife species may apply to COSEWIC for an assessment of the threat for the purpose of having the species listed on an emergency basis under subsection 29(1) as an endangered species.
		Section 71(1): Powers of GIC – Regulations	The Governor in Council may, on the recommendation of the competent minister, make any regulations with respect to aquatic species that the Governor in Council considers appropriate for the purpose of implementing the measures included in the management plan of a species of special concern.
		Section 80: Powers of GIC – Emergency protection order	The Governor in Council may, on the recommendation of the minister, make an emergency order to provide for the protection of a listed wildlife species. The emergency order may identify habitat that is necessary for the survival or recovery of the species and include provisions prohibiting certain activities.
Parks Canada	Saguenay-St. Lawrence Marine Park Act, 1997	Marine Activities in the Saguenay-St. Lawrence Marine Park Regulations	Section 14.1: The Minister shall establish a temporary exclusion area if it is necessary for the protection of ecosystems or any elements of ecosystems, in the park (s. 14.1(b)), the protection of the cultural resources submerged in the park (s. 14.2(c)), or the protection, health or safety of the public in the park (s. 14.1(d)). The decision will be communicated in a Notice to Shipping or a Notice to Mariners.

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Jurisdiction	Legislation, Regulations and Programs		Management levers and measures
International Maritime Organization (IMO)	Convention on the Safety of Life at Sea V (SOLAS V)	Regulation V.10(g): Adhering to IMO measures concerning ship routing	Under the IMO, governments can impose voluntary measures to vessel routing, such as designation of Areas to be Avoided (ATBA), precautionary areas and traffic separation schemes. These management measures can be imposed for various purposes, including the protection of off-shore infrastructure, the environment or wildlife.
	Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life (MEPC.1/Circ.833)	Non-regulatory	

Other potential measures ⁵
Vessel speed reductions
Additional communications and reporting procedures
Changes in timing of traffic
Changes in shipping practices
Changes in ship design and retrofits to existing ships

⁵ It may be advantageous to conduct a risk assessment to assess and potentially mitigate the risk to the safety of navigation that some of the following potential measures represent.

Other potential measures ⁵
Redirection of traffic
Changes in maintenance procedures (e.g. hull cleaning)
Operational responses to observed presence of marine mammals
Grouping vessels (e.g. convoy)
Escort tugs
Creating periods of quiescence
Develop a Waterway Safety Committee

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