Task Force on Sustainable Tidal Energy Development in the Bay of Fundy

Interim Report

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Introduction: Setting the context for the Task Force

On June 20, 2023, the Honourable Joyce Murray, former Minister of Fisheries, Oceans, and the Canadian Coast Guard and the Honourable Jonathan Wilkinson, Canada's Minister of Natural Resources, announced the establishment of a Task Force on sustainable tidal energy. The intention is to explore issues and opportunities associated with the deployment of tidal energy projects in the Bay of Fundy.

The purpose of the Task Force is to:

- Build on work to date to clarify requirements for fish protection;
- Improve transparency and methodology of risk assessment and decision making on tidal turbine deployments, and,
- Reduce turnaround time for regulatory decisions for tidal energy projects in the Bay of Fundy.

The Task Force is co-chaired by Fisheries and Oceans Canada and Natural Resources Canada. It includes members from the Government of Nova Scotia, industry, and research organizations (see Annex 1). The Task Force facilitates greater collaboration between the federal government, the Province of Nova Scotia, members of the tidal industry and the tidal research community. Members of the Task Force are inviting the views of Indigenous groups. Engagement and consultation, as appropriate, will continue throughout the duration of the Task Force.

The purpose of this report is to provide an overview and update on the Task Force and its work to date.

Through a series of meetings and expert presentations, the Task Force has identified key regulatory issues and challenges raised by industry stakeholders involved in Nova Scotia's tidal energy industry development including:

- The administration of the *Fisheries Act* authorization process
- Environmental risk assessment and monitoring standards
- Consideration of international data and research on environmental impacts
- Consideration of climate change and economic benefits in decision making

This report summarizes these issues and challenges and outlines the Task Force's progress towards addressing these issues as well as future actions to take. The Task Force will produce a second report in December on its work, including progress achieved and areas to be considered for future action. . Moreover, the Government of Canada indicated in Budget 2023 that it would: "outline a concrete plan to improve the efficiency of the impact assessment and permitting processes for major projects, which will include clarifying and reducing timelines, mitigating inefficiencies, and improving engagement and partnerships," by the end of 2023.

Canada's Tidal Energy Sector: An Overview

To mitigate Canada's contribution to climate change, the Government of Canada has committed to achieving net-zero emissions in the electricity sector by 2035, while also rapidly expanding the use of clean electricity in Canada's electrical grid to meet the growing electricity demand required to support a net-zero emissions economy by 2050.

Tidal stream energy is a largely untapped potential source of clean and reliable energy to support this transition that provides both environmental and economic benefits. Though still an emerging technology, there has been continued investment in the sector internationally, including 94.5 megawatts (MW) contracted in the UK in 2022 and 2023, and 17 MW in France in 2023. The International Renewable Energy Agency (IRENA) estimates that 10 GW of tidal (and wave) energy projects could be installed by 2030, and the International Energy Agency (IEA) estimates that a total of 300 GW of tidal and wave energy could be installed by 2050. This could result in the creation of up to 680,000 jobs, approximately $42 billion in investment and 500 million tonnes of CO_2 removed from the atmosphere.

Currently, half of Nova Scotia's electricity is generated from coal and the province's largest Greenhouse Gas (GHG) emitting sector is electricity generation. There is exceptional tidal energy capacity in the Bay of Fundy due to its strong tidal currents, although other areas of Nova Scotia are being considered as well. Tidal is a clean, predictable source of energy. Development of the tidal resource could allow coastal communities to decarbonize their energy consumption or to enjoy a source that is less vulnerable to disruption than traditional models of electricity generation. In the long run, tidal can offer system-wide cost-savings: its predictability cuts down on the need for extra power plants, extra transmission lines, and extra battery and smart grid storage. Federal and provincial governments have invested approximately $200 million in the tidal industry, engaging over 500 companies and providing benefits to local communities. It is estimated that 60-80% of goods and services related to tidal can be supplied by local suppliers.

There has also been ongoing research and development and environmental research to support tidal energy development in Nova Scotia, which commenced with a Strategic Environmental Assessment (SEA) in 2008. The Fundy Ocean Research Centre for Energy (FORCE) was established in 2009 by the Province of Nova Scotia to explore Minas Passage's 7,500 MW tidal energy resource. This includes onshore and offshore electrical infrastructure to deliver tidal-generated energy to the province's power grid, as well as a science program spanning 15 years, over 100 studies, and $20 million focused on physical and biological site characterization data. This investment includes work with many universities, ocean technology companies and other research partners to advance the science of data capture in high flows, conduct environmental monitoring (hydro acoustic, passive acoustic, and acoustic telemetry), and build a risk model to understand the probability of fish encountering a tidal device.

The Bay of Fundy is a diverse, complex and highly productive ecosystem, home to many species of marine mammals, fish, birds and invertebrates. Fish and invertebrate species in the area support a wide variety of Indigenous, commercial and recreational fisheries, and many of these species are socially and culturally significant to Indigenous communities. The commercial fisheries and aquaculture industries in the Bay of Fundy alone have an estimated value of over $1 billion. In addition, the Bay of Fundy provides habitat for a number of species at risk, such as Inner Bay of Fundy Atlantic Salmon and White Shark, which are listed under Canada's *Species at Risk Act* (SARA).

The Bay of Fundy's unique mudflats, combined with high flows and tidal turbulence, result in waters characterized by high amounts of fine sediment and low visibility, which complicate development and monitoring environmental effects.

These circumstances present challenges for tidal energy development under Canada's regulatory system for protecting and conserving aquatic ecosystems and aquatic species at risk. As a result, regulators and

the tidal energy sector need a better understanding of the potential for adverse interactions between marine wildlife and in stream tidal devices in the Bay of Fundy Therefore, it is important that federal and provincial regulators, Indigenous partners, industry stakeholders, academics, and others, work together to identify potential solutions to enable the sustainable growth of the industry.

Canada's Tidal Energy Sector: Identification of Regulatory Issues

The Task Force discussed four issues that impact timely and commercially viable tidal project development and deployment in the Bay of Fundy. The importance of robust government science and regulatory roles was recognized in all discussions. Each are described below.

Fisheries Act Authorization Process

DFO is responsible for the conservation and protection of fish and fish habitat, including species at risk, and must consider whether to issue a *Fisheries Act* authorization (and *Species at Risk Act* permit where warranted) when projects are likely to contravene the Act. Due to uncertainty regarding the impacts of tidal stream energy turbines on marine wildlife, DFO employs a Staged Approach to development that proposes to issue a *Fisheries Act* authorization for a single tidal turbine device to operate for a period of one year, provided all regulatory conditions are met, including an approved environmental effects monitoring and offsetting plans. This model is intended to support an incremental and adaptive approach to development that is informed by the results of environmental effects monitoring programs (EEMPs). Under this Staged Approach DFO may authorize additional deployments provided the proponent can monitor the first device effectively for adverse impacts to marine wildlife.

Tidal sector representatives explained that, though tidal projects are inherently modular, incremental, and reversible, they are not infinitely flexible in how they can be phased and scaled. Economies of scale, supply chains, and investment security dictate a minimum pace and size. The tidal sector needs a regulatory pathway for small arrays of multiple devices to demonstrate the viability of commercial tidal stream energy. DFO's Staged Approach to turbine deployment does not provide the required certainty. The Task Force is exploring options for a regulatory pathway that authorizes the operational lifecycle of the full project, subject to defined conditions for mitigation of risk to fish, monitoring compliance with the authorization, and, if necessary, curtailment. Such an approach would align with Nova Scotia's 2012 Marine Renewable Energy Strategy, which supported a staged and adaptive approach to the deployment of tidal devices with a view to moving towards commercial scale development.

Environmental risk assessment and monitoring standards

In support of DFO's regulatory review process under the *Fisheries Act* and SARA, DFO employs a nationally consistent risk management approach when reviewing projects for adverse impacts to fish and fish habitat, which aligns with the ISO 31000 standard. DFO identifies potential adverse impacts through the use of pathways of effects diagrams which connect an activity to a potential stressor and ultimate effect on fish and fish habitat. DFO identifies risks, considers whether avoidance or mitigation measures can be applied to fully address the stressor. If they cannot, the resulting potential residual effects are considered by DFO when determining whether to issue a *Fisheries Act* Authorization.

The presence of SARA-listed aquatic species, such as the Inner Bay of Fundy Atlantic salmon and white shark mean that proponents must meet requirements under both the *Fisheries Act* and the *Species at Risk*

Act. DFO can issue *Fisheries Act* authorizations that act as permits under the SARA. However, to do so the activity must meet three conditions:

1. All **reasonable alternatives** to the activity that would reduce the impact on the species have been considered and the best solution has been adopted; and
2. All **feasible measures will be taken to minimize the impact** of the activity on the species or its critical habitat or the residences of its individuals; and
3. The activity will not jeopardize the survival or recovery of the species.

According to DFO's Allowable Harm Assessment for Inner Bay of Fundy Atlantic Salmon, "any level of human induced harm could jeopardize the survival or recovery of this genetically distinct species".

DFO relies on monitoring data to determine the nature and extent to which impacts are occurring, being avoided, or mitigated. Predicting and monitoring how marine mammals, fish, and seabirds interact with an operating turbine is particularly challenging in high flow and turbid marine environments. Interactions are difficult to observe, both because of the turbulent waters and because of the limitations of monitoring instruments designed for use in marine environments with greater visibility.

The tidal sector indicated that DFO's approach to evaluating the risks of projects to marine wildlife should be clearer and monitoring requirements more proportionate to the scale of the proposed project. They also expressed that the regulatory criteria for authorizing tidal devices are unclear.

International data and research on environmental impacts

Sector representatives indicated that it is not clear whether and how DFO considers the body of external research, including international research, best practices, and standards when it assesses the risk of tidal energy devices to marine wildlife.

The sector wants greater clarity regarding the standards and criteria required by DFO in order to recognize and consider such sources. Research has been conducted internationally to assess the risk of tidal turbines to marine life, which could support decision making.

The Task Force heard presentations from DFO scientists on the Department's approach for generating and using scientific advice. DFO explained that the Canadian Science Advisory Secretariat (CSAS), which coordinates scientific peer review processes and provides science-based peer-reviewed advice for policy and management decisions, is a mechanism through which timely and responsive advice aligned with departmental priorities, can be provided. A series of CSAS documents have been produced in relation to tidal energy development. The most recent CSAS review related to tidal energy was completed in 2016 and was a review of the EEMP for the Fundy Tidal Energy Project

CSAS's science advisory processes can include expertise internal and external to government, includes the consideration of international research, and can be used to address urgent and unforeseen issues as well as provide updated information and/or data.

An international expert from the US Department of Energy's Pacific Northwest National Laboratory presented to the Task Force on the "International State of Science and Regulatory Approaches for Tidal". Key messages included:

- Collision risk is difficult to resolve because it entails proving a negative;

- Although no collisions between turbines and mammals, seabirds, or fish have been observed, there have been close calls with fish;
- There are seven factors that must each be present for injury or death of a fish to occur due to a turbine strike. (See Annex 2);
- While fish generally avoid rotating turbines in demonstrations to date, it is unclear whether fish can avoid turbines in fast moving currents with low visibility in the natural environment, such as those found in the Bay of Fundy. There is a need for more turbines in water and more monitoring to add to the knowledge base;
- Risk of collision between fish and turbines is difficult to monitor because technologies are not well developed, monitoring occurs in challenging environments, and there are large volumes of data that require processing;
- Numerical models of collision risk are improving but have not been validated;
- Perceptions of collision risk remain high due to uncertainties about probability of collisions and, because of negative consequences if collisions occur;
- There is a large and growing field of research internationally; and,
- FORCE has done considerable research on the movement patterns and presence of fish in the Bay of Fundy to determine the likelihood and frequency with which fish are proximate to sites that are optimal for tidal turbine deployment.

Consideration for climate change and economic benefits in regulatory decision making

Tidal sector representatives asked DFO to consider the potential benefits of tidal energy projects when making regulatory decisions. Tidal energy projects are aligned with the Government of Canada's climate change policy objectives and net zero mandate such as reduced GHGs and new economic opportunities. Sustainable development of the sector is critical to support this economic opportunity in a resource of global significance. Many in the marine renewable energy sector have expressed this view in their submissions to the Blue Economy Regulatory Review.

Task Force Progress and Action Plan

Based on the issues and gaps identified in discussions and described above, the Task Force has started to address the most pressing issues. This section highlights the key actions already taken by the Task Force, as well as the work plan to continue addressing and ultimately closing these gaps.

Fisheries Act authorization process for tidal projects

The tidal sector requires a clear and predictable regulatory path that encompasses the operational lifecycle of a project and includes adaptive management measures that ensure compliance with the authorization that consider the degree of risk.

The Task Force has discussed DFO's Staged Approach for the development of tidal stream energy in the Bay of Fundy in the context of the sector's concerns. In particular, the Task Force is exploring approaches to authorizing tidal stream projects for their entire lifecycle, subject to conditions such as environmental effects monitoring, with timelines that support a more stable investment environment and supply chain.

DFO is developing guidance on its current approach to risk assessment with respect to the review of tidal energy projects and is undertaking an analysis of available flexibilities within its suite of regulatory tools

that could support enhanced alignment with the sector's context. These efforts help advance a shared understanding on the part of the Task Force of decision points for both the regulator and industry.

Risk assessment and monitoring

Current approaches to monitoring have not yet been proven to provide reliable information related to interactions between tidal turbines and marine wildlife and approaches to data processing and analytics continue to evolve. To advance the regulatory approach outlined above, it is critical that the Task Force foster a common understanding of the risks tidal devices pose to marine wildlife in the Bay of Fundy. This may require more advanced technologies, data processing and analytics and modeling to quantify the probability and consequence of fish encounter, collision, injury and/or avoidance of turbines.

Working Group on Risk Assessment and Monitoring

To leverage the best available Canadian and international research, the Task Force has formed the Risk Assessment and Monitoring Working Group to help validate environmental monitoring technologies and approaches and explore considerations of the risk tidal turbines present to aquatic species. Co-chaired by Acadia University and FORCE, the Working Group seeks to:

- Identify approaches to improve the transparency and methodology of risk assessment and decision-making.
- Identify and address specific data, information requirements, and risk criteria for fish and fish habitat to inform the scientific process for evaluating tidal projects, and to support timely assessments, including potential environmental effects.
- Develop recommendations related to fish protection, risk assessment, and regulatory decision-making.
- Identify and prioritize immediate, necessary, and achievable scientific priorities related to risk assessment and monitoring over the short- and long-term.

More specifically, the Working Group will build a work plan to monitor and evaluate the collision risk of marine wildlife with individual tidal stream energy devices (surface and bottom mounted) and oversee this work as it unfolds.

Proponents of tidal projects appreciate the need to abide by conditions on their operations, such as effective monitoring of their projects to determine if they are having adverse effects on marine life, and potential timing shutdowns during migration seasons. However, it is difficult for the regulator to prescribe conditions on the operation of tidal turbines because understanding of collision risk is low. Similarly, it is difficult for proponents to monitor the impacts of the projects on marine life due to limitations on technology and data analytic techniques. The Working Group will seek to advance common understanding on these issues.

International perspectives

The Task Force has actively sought to bring in international perspectives on risk assessment and monitoring standards and regulations to understand and potentially leverage international best practices and the state of play on the science related to the environmental effects of tidal energy.

The Task Force has agreed to explore ways in which the CSAS process can be leveraged to update the state of science around tidal energy and review the critical questions that remain un-answered as related to tidal energy sector needs.

Considering climate change in regulatory decision making

The tidal energy sector articulated that tidal energy can help to reduce carbon emissions and ultimately support Canada's net zero goals and commitments and that these environmental benefits are not considered when evaluating the environmental impact of tidal energy projects.

There is an established process for stakeholders to suggest legislative change to the Government of Canada. To ensure that the *Fisheries Act* remains relevant a new section requiring that a Parliamentary Committee review of the provisions and operations of the Act every five years was introduced. As required by the Act, the review will be initiated by Parliament and not led by Fisheries and Oceans Canada. Should Parliament initiate the review, the scope will be determined at that time, and it is expected that the reviewing committee will invite provinces and territories, Indigenous partners and stakeholders to submit written briefs and to provide testimony and recommendations for amendments to the Act.

Following the conclusion of the Parliamentary Committee's review, it is expected that a report and recommendations (informed by witness testimony and written briefs) will be presented in Parliament, and that Fisheries and Oceans Canada will be requested to submit a Government Response to the recommendations in the report.

The Task Force notes that there are several processes intended to expedite Canada's environmental assessment and permitting regime, which may nor may not directly address the tidal sector's concerns. DFO and NRCan are participating in these efforts, which will support the Government of Canada's clean growth agenda.

At the same time, the Government of Canada is committed to marine conservation and protecting biodiversity which is seen as one component to support nature-based resiliency to the impacts of climate change.

Next Steps

The Task Force has identified immediate next steps to support its efforts to advance sustainable tidal energy development in the Bay of Fundy, in advance of releasing its final report in December:

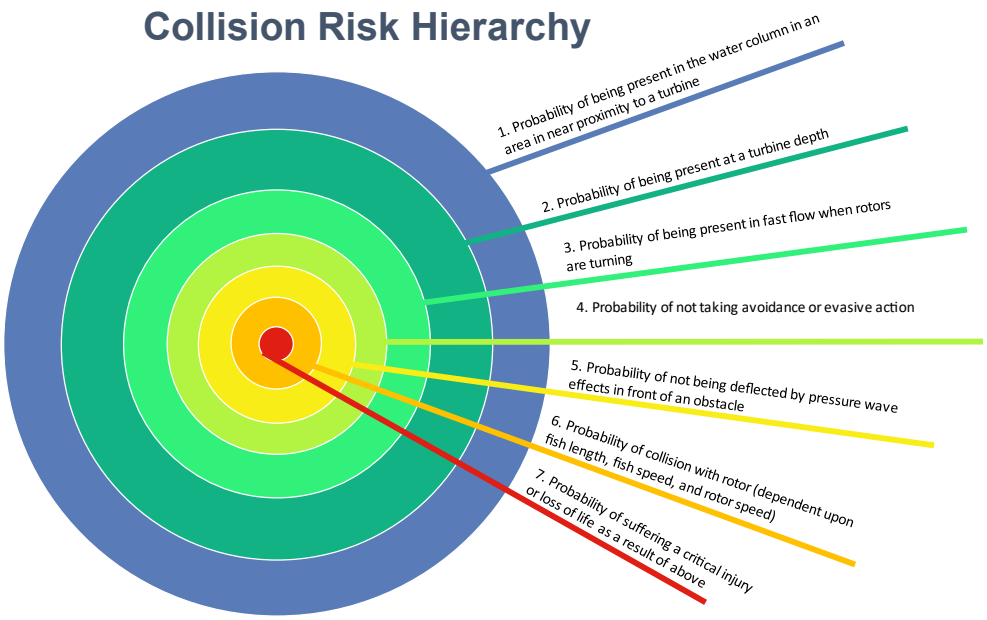
- Exploring flexibilities within DFO's Staged Approach including:
    - Facilitate a case study exercise reviewing hypothetical tidal energy projects through DFO's regulatory review process to better understand how DFO's risk assessment process is applied and how a single authorization could cover the operational lifecycle of a project; and,
    - Continue to explore options on a regulatory pathway that more closely aligns with the lifecycle of a tidal energy project
- Continue the work of the Risk Assessment and Monitoring Working Group to better understand collision risk and to advance development of promising monitoring technologies and methodologies.

- Continue discussions on science in the context of outstanding questions facing the tidal sector, including exploring ways to leverage DFO's CSAS process; and,
- Continue and expand engagement with implicated partners and stakeholders.

Annex 1 – Task Force Membership

- **Co-chairs** Fisheries and Oceans Canada: Regional Director General, Maritimes Region and Senior Assistant Deputy Minister, Programs Sector
- **Co-chair** Natural Resources Canada: Assistant Deputy Minister, Energy Efficiency and Technology Sector, NRCan
- Director, Marine Renewable Energy and Clean Innovation, Ministry of Natural Resources and Renewables, Nova Scotia
- Acting Executive Director, Policy, Nova Scotia Department of Environment and Climate Change
- Executive Director, Marine Renewables Canada
- Executive Director, Fundy Ocean Research Centre for Energy
- Chair of Fundy Ocean Research Centre for Energy

Annex 2 – Collision Risk Hierarchy



Copping et al. (in prep.)