

# Engaging the regulatory community to aid environmental consenting/permitting processes for marine renewable energy

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**Abstract**—Regulators involved in consenting/permitting marine renewable energy (MRE) have faced multiple challenges due to the relatively new, unfamiliar technologies used and uncertainty surrounding potential environmental effects. This has resulted in slow progress for the MRE industry, including long consenting timeframes and extensive and expensive monitoring requirements, which increase financial risk for investors. OES-Environmental has surveyed regulators internationally in order to support the development of the MRE industry through increased understanding of their key knowledge gaps and perspectives. From the results of these surveys, a data transferability process and a risk retirement pathway have been developed to assess consenting and monitoring requirements in proportion to risk. A tool for discovering existing data sets by using an online matrix has been developed, along with training materials, regulatory guidance documents, and a strategic outreach plan to engage regulators and advisers. This engagement and the application of these products should lead to a better understanding of the environmental effects of marine energy, and a more efficient consenting processes.

**Keywords**—consenting/permitting, data transferability, marine renewable energy, environmental effects, regulator engagement

## I. INTRODUCTION

THE emerging marine renewable energy (MRE) industry faces regulatory challenges due to the uncertainty surrounding potential environmental effects, and this uncertainty has often slowed the industry's advancement [1]–[3]. Uncertainty in environmental impact assessments for MRE stems from the lack of practical experience and data collected around deployments, as well as the difficulty associated with studying the marine

environment [4]. Risks that are poorly understood or unfamiliar are often considered of greater severity than those that are familiar, regardless of the true magnitude of risk [5]. Regulators and stakeholders express concerns about potential environmental effects based on these perceived levels of risk and the lack of available information on which to base decisions. This has often led to a cautious approach to consenting/permitting (hereafter consenting), that has limited development of the industry [6], [7]. Though the industry has been able to progress in some aspects, one of the key struggles for MRE is the high cost of baseline environmental assessments and post-installation monitoring, and the long timelines for obtaining consents, which lead to uncertainty and risk for financing development [8]. With increased MRE deployments and testing, understanding of environmental effects with the marine energy community is increasing. Recent research indicates there is a low risk to marine animals and habitats for small numbers of deployed MRE devices (1–4 devices) [9].

In 2017, the OES-Environmental initiative began to work with international regulators, to understand their perspectives, collaborate to decrease barriers for consenting MRE developments, and share knowledge about environmental effects, while ensuring the alignment of robust environmental protection with regulator priorities. The aim of this paper is to provide an overview of the survey methods used to engage international regulators, detail findings of the surveys, and discuss key results that have guided the development of products and processes that make existing information available to the regulatory community.

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## II. METHODS

The regulator survey was first developed in 2017 after the publication of the 2016 State of the Science report [10]. The purpose of the survey was to determine the most appropriate means of engaging regulators to learn about their perspectives, understanding, and challenges concerning MRE development, and to deliver up-to-date information on risks from MRE technologies. The online survey contained 18 questions, including multiple choice, ranked choice, and open-ended questions, focused on understanding regulators' environmental priorities, knowledge of various MRE technologies, appetite for risk, and familiarity with OES-Environmental tools and resources<sup>1</sup>.

The survey was first deployed online via SurveyMonkey to 200 United States (US) regulators and advisers<sup>2</sup> at different levels of government (mainly at the federal and state government level) who may be involved in consenting MRE projects. Thirty-six responses were received, representing an 18% response rate.

Following the US survey, additional surveys were developed for several of the 15 OES-Environmental countries. Each survey was developed in cooperation with experts representing their nations on OES-Environmental for their respective countries to include the most relevant terminology for each country's particular regulatory context. Both the French and Japanese surveys were translated into the countries' official languages, while the other surveys were administered in English. Each OES-Environmental country representative developed a list of key regulators who may be involved in consenting MRE projects for their country. In addition to the responses from the US, the regulator survey has been completed in the following countries:

- United Kingdom (UK, 2018)
- Sweden (2018)
- Spain (2018)
- France (2019)
- Ireland (2019)
- Japan (2019)
- Canada (2020).

Additional OES-Environmental countries that are currently making progress toward deploying the survey include Australia and Mexico.

## III. RESULTS

A total of 74 regulators responded to the survey – 36 from the US, 12 from France, 8 from Canada, 7 from the UK, 4 from Ireland, 4 from Japan, 2 from Spain, and 1 from Sweden. The number of responses from each country differed based on the size of regulatory bodies and number

of regulators in each country, the capacity of country representatives to identify and engage with regulators, and the overall status of each country's interest and investment in MRE.

The major findings from each substantive survey question are summarized by section here.

### A. Knowledge of the MRE Industry

While 59% of survey participants have been involved in consenting an MRE development, many were not familiar with specific MRE technologies (Fig. 1). Regulators in Sweden and Spain indicated that they were not familiar with any of the technologies for wave or tidal energy extraction. Across all countries surveyed, regulators were more familiar with tidal devices than wave energy converters. UK regulators were most familiar with different types of MRE energy devices. Irish regulators were also quite familiar with MRE devices.

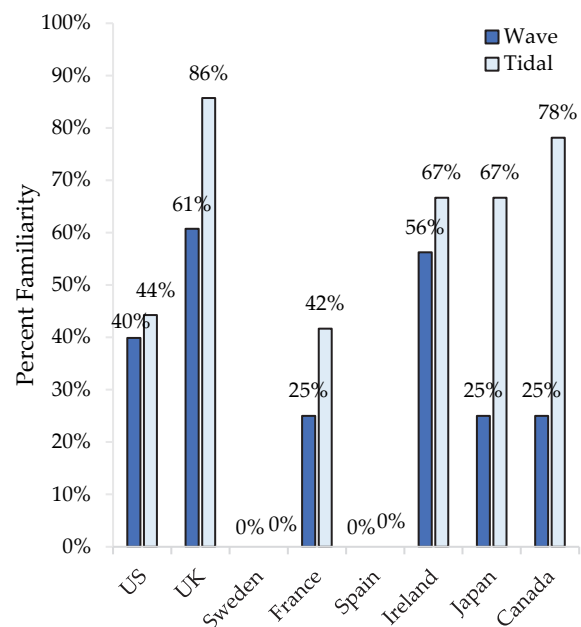


Fig. 1. The overall familiarity that regulators have with MRE technology types, when responding to the question "How familiar are you with the following technologies on a scale of 1 (not familiar) to 5 (very familiar)?" for wave and tidal devices.

### B. Consenting Challenges

When asked to rank the top challenges for consenting a MRE development, across all countries three challenges were noted as key concerns for both single devices and arrays: collision of marine animals with underwater devices; disturbances of benthic habitats; and avoidance, attraction, and/or displacement of marine animals in the presence of MRE devices (Fig. 2).

<sup>1</sup> A full list of questions for the US survey can be found at <https://tethys.pnnl.gov/regulator-surveys>.

<sup>2</sup> Regulators comprise those who are appointment by a government to oversee an area of activity, in this case environmental

impacts of MRE. Advisers are those who may provide scientific analysis, plans, or input to be used for decision-making within a government.

Regulators were then asked what is needed to move forward in the face of these top-ranked challenges. There was agreement that sufficient field data, numerical models, policy guidance, and training for regulators are all needed. The responses shifted slightly and deviated among countries when asked about arrays, suggesting greater support for the use of numerical models for consenting arrays in France and the UK, and a need for sufficient field data for consenting arrays in Canada, Spain, Japan, and Ireland. Overall, these results showed that regulators have a perception of increased risk as devices are scaled up to arrays, and a greater need for data when consenting arrays.

### C. Approaches for Advancing the MRE Industry

Regulators were asked about their preferred management approach for consenting MRE developments given the uncertainty about environmental effects. Management approaches used in the survey, and their definitions as provided in the survey are as follows:

- *Precautionary principle:* There is a high degree of uncertainty and potentially negative outcomes associated with MRE deployment and operation. Measures should be taken to avoid the negative outcomes by proceeding very cautiously or not pursuing projects at all.
- *Mitigation hierarchy:* Effects or risks should be systematically limited by taking actions to avoid, minimize, mitigate, and/or compensate for risks through siting and/or mitigation measures.
- *Phased approach:* Single devices should be deployed first, followed by slowly ramping up to array scale after potential risks are better understood and managed.
- *Adaptive Management:* A learning-based management approach should be applied that includes adapting monitoring and mitigation practices over time to understand risks, decrease uncertainty, and mitigate for effects.
- *Survey, deploy, monitor:* The area of a proposed project should be surveyed before deployment, and extensive monitoring should be conducted around the device after deployment to enable learning.
- *Just do it:* Risks to the marine environment are almost certainly low, so development should move forward with little concern.

No regulators selected the least cautious “Just do it” as the preferred approach. An adaptive management approach was favored by those in France, UK, US, and Japan, (38% total), whereas more cautious approaches were preferred in Ireland, Spain, and Canada (Fig. 3).

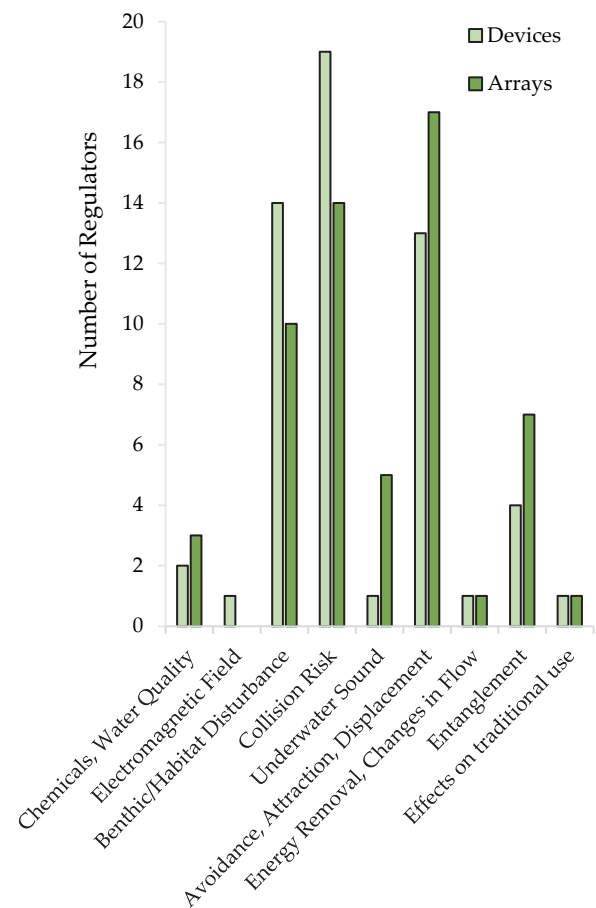


Fig. 2. Key regulator challenges related to environmental effects when consenting MRE development and deployment of single devices and arrays. Bars indicate the number of regulators that selected each effect as their top challenge for either small numbers of devices or arrays. The order of the bars is the order challenges were presented in the original survey.

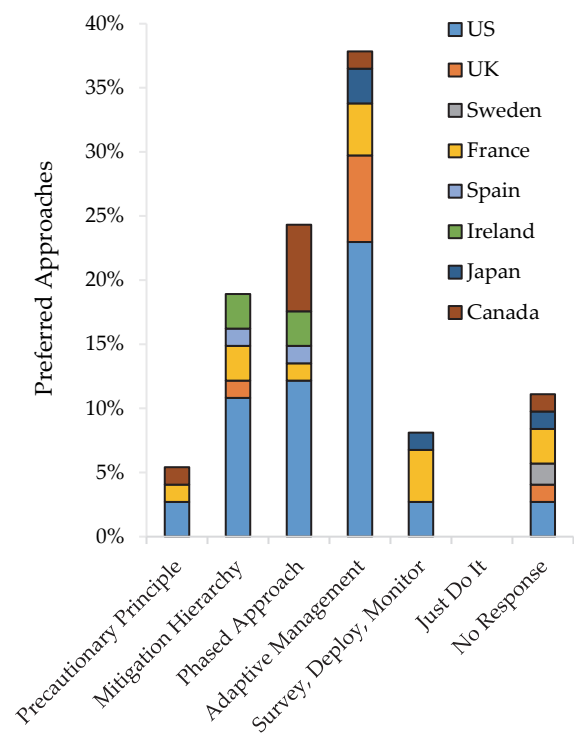


Fig. 3. Regulators' preferred approaches for advancing the MRE industry.

#### D. Need for MRE Data Transfer

One way to reduce consenting timelines and high costs of environmental monitoring requirements is the ability to use data that have been collected at one location or MRE project to inform consenting at another location or project. The concept of data transferability originated in the field of land use management [12] [13] and refers to this application of existing learning, analyses, and monitoring data sets across projects, jurisdictions, or technologies when appropriate [9]. To understand regulatory perspectives on this concept of data transferability, regulators were asked if data and information collected from other locations could be applied towards consenting MRE developments within their jurisdiction. Most regulators responded that data transfer is possible (20% responded “absolutely” and 76% responded “maybe”). Additional comments from regulators noted that data transfer is dependent on site and project characteristics (species present, local context, environmental factors, technology type, etc.) and may not be applicable in every scenario. When used properly, data transferability can help developers comply with regulatory requirements, amplify understanding of the environmental effects of MRE devices, and lead to standardized processes for data collection and analysis.

### IV. DISCUSSION

The results gathered from the regulator surveys since 2017 have been used to guide OES-Environmental’s outreach efforts and content development. The associated products and processes are geared towards providing assistance to regulators while also informing the MRE industry and researchers about what will be expected around project deployments. Results highlight that as scientific understanding of environmental effects from MRE progresses, synthesizing and communicating this information to regulators can reduce unnecessary data collection burdens placed on developers, while protecting the marine environment.

#### A. Findings from the Surveys

The familiarity of regulators with wave and tidal devices in the UK is likely due to the larger number of deployed MRE devices and knowledge acquired from offshore wind energy consenting in that context. While Canadian regulators were not very familiar with wave energy devices, they were the second most familiar with tidal devices, likely due to the significant tidal resource and testing programs in the Bay of Fundy. The UK and Canada support large high-energy MRE test centers, EMEC<sup>1</sup> and FORCE<sup>2</sup> respectively, that may lead to

increased awareness. Overall, the need for increased engagement and outreach about wave and tidal technologies is shown by the level of awareness of many country regulators, despite their participation in consenting processes.

The lack of familiarity may also influence perception of risk, especially as single devices scale to arrays. Understanding challenges and preferred approaches allows developers seeking consent for an MRE project to align their proposals with regulator preferences. In this regard, adaptive management or “learning by doing” [11] appears to be the best approach to satisfy regulatory requirements, though it should be noted that there is significant variation in preferred approaches both within countries and among countries on this topic.

#### B. Data Transferability Process and Monitoring Datasets Discoverability Matrix

Based on the initial US regulator survey results and the willingness of US regulators to transfer data, OES-Environmental developed a data transferability process, with input and engagement from US regulators, to guide the transfer of data and information between and among MRE developments. This data transferability process includes a framework, best management practices, and an online tool for regulators and project developers to easily find and access data and information for transfer<sup>3</sup> [9]. The importance of developing this process was strengthened by the responses from regulators in OES-Environmental countries indicating that data transfer was both possible and useful for consenting.

OES-Environmental continued to engage US regulators by presenting survey results and hosting a series of regional focus groups to discuss the application of data from MRE studies and deployments in other nations to consenting processes within their jurisdictions. Focus group feedback highlighted the need for data and information to be readily accessible. As part of the data transferability process, OES-Environmental created an online tool—the Monitoring Datasets Discoverability Matrix<sup>4</sup>—to easily sort available environmental effects data and information by stressors, receptors, and other key identifiers for application at other project locations. The matrix was presented to US and UK regulators to gather feedback about the use of the tool, and to ensure that regulators were engaged throughout the development of the tool.

The data transferability process also supports the larger concept of risk retirement. Risk retirement is the idea that each potential risk need not be fully investigated for every project for environmental effects that can be considered low risk [9]. Rather, MRE developers and regulators can

<sup>1</sup> European Marine Energy Centre (<http://www.emec.org.uk/>)

<sup>2</sup> Fundy Ocean Research Centre for Energy (<https://fundyforce.ca/>)

<sup>3</sup> The data transferability process is available at <https://tethys.pnnl.gov/data-transferability>.

<sup>4</sup> The monitoring datasets discoverability matrix is available at <https://tethys.pnnl.gov/monitoring-datasets-discoverability-matrix>.

rely on what is known from already consented projects, from related research studies, or from findings from analogous offshore industries to inform the level of risk for a new project. If a specific environmental risk is considered low for small numbers of devices (1–4 devices), the risk can be considered “retired”, or no longer in need of active investigation for each individual MRE project. However, this decision will always be made at the discretion of the regulatory body, and risk retirement is not intended to replace regulatory processes or eliminate the requirement for appropriate baseline data collection. When larger arrays of MRE devices are planned, or when new information comes to light, these risks can be revisited and new decisions about the level of risk can be made. The intent of the process is to provide assistance to regulators in their decision-making and to inform the MRE community on what is likely to be required for consenting single device deployments, demonstration projects, and small arrays, as well as to help distinguish between perceived and actual risks to the marine environment.

Results from the regulator survey showed that several environmental effects were considered lower priority concerns for regulators—effects from electromagnetic fields, underwater noise, and changes in oceanographic systems (energy removal, etc.). While habitat change may be more of a concern for regulators, this impact can be minimized by properly siting MRE projects away from unique and important habitats [14]. Based on these findings, OES-Environmental explored the potential to retire these four stressors. Evidence bases were compiled from recent research and MRE deployments and were discussed with experts, including regulators, advisers, developers, consultants, and researchers to understand the ability to retire these risks<sup>1</sup> [15]. There was general consensus that each of these potential risks can be considered low risk, and therefore retired for small numbers of devices, though some caveats and additional understanding may be needed, especially as the industry scales up to arrays. On the other hand, some environmental effects need more information gathering and increased understanding to be able to move towards risk retirement. For example, uncertainty remains regarding collision risk, which was noted as a high-priority concern for regulators (Fig. 2), requiring more data collection, analysis, and modelling before considering this risk for retirement [16].

#### C. Bridging the Gap from Science to Regulation

OES-Environmental is in the process of developing guidance documents to provide linkage between research findings and the information needed for consenting. These documents are based on the wealth of knowledge about MRE environmental effects and will be available to enable

regulators to align consenting requirements with science-based, priority environmental concerns. The scientific evidence related to risks from MRE device stressors is roughly divided into four types of statutes and regulations that are broadly applicable across all nations, and pertain to protecting: (1) marine species and populations; (2) habitats and areal extents of marine lands; (3) water quality; and (4) social and economic aspects of ocean use. The guidance documents provide high-level information that can be applied internationally to connect between what is known scientifically and what must be used to ensure that the ocean and its inhabitants are protected. The scientific evidence is organized to boost understanding of environmental effects, to encourage a standardized assessment of the potential to retire certain risks, and to apply this knowledge to consenting processes. The guidance is available online.<sup>2</sup>

#### D. Regulator Engagement and Training

Survey results show that progress can also be made through engagement and outreach. Specifically, by providing information about MRE technologies and environmental effects to regulators, addressing key uncertainties or gaps for top regulatory challenges, and increasing regulatory engagement. With the awareness that regulator knowledge of MRE technologies appears to be low, providing information could greatly improve overall understanding of MRE technologies and current MRE developments around the world. OES-Environmental is currently developing a suite of regulator training materials, portions of which are geared towards improved understanding of these technologies and potential effects. The main content focuses on sharing knowledge of environmental effects, both providing a basic understanding of these effects for regulators and others who are new to the MRE industry, as well as providing a more in-depth understanding of the environmental effects research and how to apply risk retirement and data transferability to consenting processes.

Engagement with regulators is key for each of these processes to develop education and training materials. Throughout the development of the risk retirement pathway, data transferability process, and training material/guidance documents, regulators have been kept informed and their feedback has been sought to ensure that the products are useful, practical, and can be applied to consenting processes. Regulators have been engaged through webinars to share knowledge, expert forums and workshops to share feedback on the materials, and an iterative process of outreach and engagement to gain insights from those who will use and apply these products.

<sup>1</sup> The evidence bases are available at <https://tethys.pnnl.gov/risk-retirement-evidence-bases>.

<sup>2</sup> The guidance documents are available at

<https://tethys.pnnl.gov/guidance-documents>.

OES-Environmental has also developed a brochure<sup>1</sup> that provides an overview of MRE technologies, environmental effects by stressor with examples from current and past projects, as well as summarizing the risk retirement and data transferability processes. Together, the brochure and the guidance documents provide key information for regulators and other stakeholders that was generally not available at the time that OES-Environmental undertook the regulator surveys. With a better understanding of technologies and environmental effects, uncertainties or gaps in knowledge can begin to be addressed by collaboration between regulators, developers, and the research community. In particular, this enhanced understanding can address priority needs for monitoring around MRE projects.

#### E. Challenges and Recommendations

While outreach efforts with regulators and advisers to complete the survey were widespread, some challenges for participation remained. Several countries only had a single or few regulator(s) participate in the survey, making it difficult to generalize understanding of MRE technologies and appetite for risk in the country more broadly. These lower response rates may have been due to i) a lack of interest in MRE in the country at present, ii) smaller numbers of key regulators involved in this type of project consenting, iii) unclear regulatory processes and responsibilities due to the state of the industry, iv) capacity of the country representative to identify and support regulators in completing the survey, or v) inability of regulators to participate in the survey at the time due to workload constraints.

### V. CONCLUSION AND NEXT STEPS

The regulator surveys deployed by OES-Environmental identified key environmental challenges and information needs for regulators in multiple countries. The results informed the process of data transferability and risk retirement. They also continue to guide the outreach efforts of OES-Environmental analysis, targeting regulator needs to address barriers for consenting MRE. Next steps for OES-Environmental include deploying the survey in the remaining OES-Environmental countries as well as continuing to advance risk retirement and data transferability to aid consenting processes. Each of the challenges reported in the surveys will be examined by the individual countries to identify crosscutting issues and improve survey design for future iterations of regulator engagement. As new projects are developed and consented, it will be important to continue connecting with regulators to understand the current state of knowledge and uncertainty. To stay current with regulator

understanding, needs, concerns, and perspectives, it is recommended that a form of the regulator survey be repeated periodically, on the order of every five years or as new relevant legislation or initiatives are released.

Understanding the needs of regulators and working collaboratively to improve understanding of environmental effects and technologies will support expansion and establishment of a sustainable MRE industry. Consented projects are needed to further our understanding of environmental effects at scale, predict long-term population effects on key species, inform effects from scaling up to arrays, parameterize numerical models, and understand cumulative effects of MRE development with other anthropogenic activities in the face of climate change. Without strategic outreach and regulatory engagement, the MRE industry will continue to lag behind other offshore energy sources.

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<sup>1</sup> The MRE brochure is available at <https://tethys.pnnl.gov/mre-brochure>.

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