Guidance Documents for Risk Retirement

Background Document

Introduction

The novelty of marine renewable energy (MRE) devices, their placement in new areas of the oceans where stakeholders are engaged in other uses, and the ongoing natural and anthropogenic threats to marine animals and habitats all combine to create uncertainty around the potential effects of MRE. This uncertainty can lead to the use of precautionary approaches in consenting (or permitting) processes, which can result in cumbersome baseline data collection requirements, long timelines for monitoring, challenges for project developers, and intensive resource requirements for regulators and stakeholders.

There is a growing body of knowledge from research studies and monitoring of MRE developments that is yielding some indication of the level of risk associated with environmental, social, and economic effects of MRE. This evidence can reduce the uncertainty and aid in retiring certain environmental and other effects that may be low risk to marine animals, habitats, or communities from small-scale MRE developments[1], a process deemed "risk retirement"[2,3].

The risk retirement process helps determine which interactions of MRE devices and the marine environment are better understood and can be considered low risk, and therefore need not be fully investigated for every small-scale MRE project. Rather, MRE regulators, advisors, and developers may rely on what is known from already consented projects, from related research studies, or from findings from analogous offshore industries. Risk retirement is an international effort that brings together knowledge from the MRE community including research endeavors and observations from MRE projects across many nations. Risk retirement does not take the place of any existing regulatory processes, nor will it completely replace the need for environmental data collection and impact assessments before and after MRE device deployment. When larger arrays of MRE devices are planned, or when new information comes to light, these risks can be revisited and new decisions can be made about the level of risk that might allow for retirement.

To apply the risk retirement process during consenting procedures, OES-Environmental[4] has created a series of documents, called Guidance Documents for Risk Retirement. Included in the guidance documents are:

1. A background document, the current document, that provides:
    a. An overview of risk retirement and the guidance documents;

[1] For the purposes of risk retirement, small developments have been defined as one to four devices.

[2] Copping, A.; Freeman, M.; Gorton, A.; Hemery, L. (2020). Risk Retirement—Decreasing Uncertainty and Informing Consenting Processes for Marine Renewable Energy Development. *Journal of Marine Science and Engineering,* 8(3), 172. DOI: 10.3390/jmse8030172. https://tethys.pnnl.gov/publications/risk-retirement-decreasing-uncertainty-informing-consenting-processes-marine-renewable

[3] For more information on risk retirement, see the 2020 State of the Science Report, Chapter 13: Risk Retirement and Data Transferability for MRE

[4] Ocean Energy Systems (OES)-Environmental is an international initiative that mobilizes information and practitioners from OES nations to coordinate research on environmental effect of MRE and to progress the industry in an environmentally responsible manner.

   b. Descriptions of the four regulatory categories relevant for MRE consenting and licensing: species and populations at risk, habitat loss or alteration, effects on water quality, and effects on social and economic systems; and
   c. A depiction of the application of risk retirement to consenting processes as a framework.
2. Stressor-specific documents on underwater noise, electromagnetic fields (EMF), habitat change, changes in oceanographic systems, collision risk, entanglement, displacement, and social and economic effects, with links to existing datasets and information.
3. Country-specific documents providing the MRE regulatory context for each of the OES-Environmental countries.

This information is tailored for regulators, advisors, and developers, simplifying their search for data with which to assess potential effects and determine the feasibility to retire risks. The stressor-specific documents contain links to access data and information, such as key research papers and monitoring reports and available data from consented projects (e.g., OES-Environmental's evidence bases for risk retirement and the Monitoring Datasets Discoverability Matrix).

The guidance documents can be used internationally to organize and evaluate potential environmental, social, and economic effects within a general regulatory context. Moving forward, documents for each of the participating OES-Environmental countries will be added to provide information on applying risk retirement within country or region-specific regulatory contexts. Figure 1 provides an overview of the components in the guidance documents.

Having readily available information that can be applied across the MRE industry to inform risk retirement for future MRE projects can aid decision-making for regulators and advisors and support developers in preparing fit-for-purpose applications.

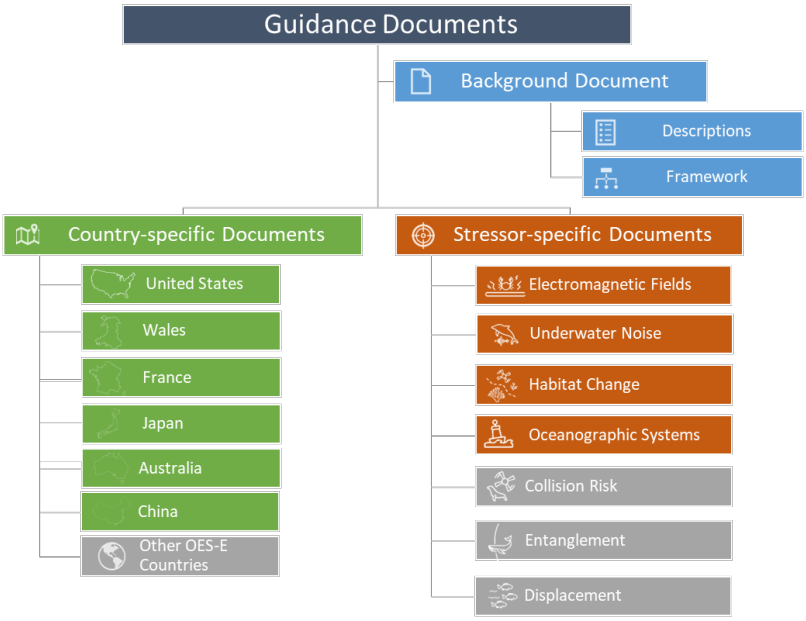


Figure 1. Overview of the components of the guidance documents, including the background document (this current document), country-specific documents, and stressor-specific documents. Those marked in color are currently being drafted while those marked in grey will be drafted in the next phase of development.

Descriptions

The guidance documents are organized to provide ready access to information that can be tailored for use in different consenting processes around the world. When considering environmental effects, there are generally four main categories of environmental regulations. To connect scientific understanding about environmental interactions and key stressors to the MRE regulatory context, these four main categories are used throughout the guidance documents: 1) species and/or populations at risk; 2) habitat alteration or loss; 3) effects on water quality and oceanographic systems; and 4) effects on social and economic systems (including cultural and historic uses). Each category is described below, with relevant types of information that may be needed for consenting. This includes baseline information from existing datasets, new research and data collection after consent and installation, and other knowledge that can help determine the level of risk associated with an MRE project. Such data can collectively be used to describe the potential for risk retirement of certain interactions, for small-scale MRE developments. It is important to note that use of existing data is encouraged where possible[5]; new data ought to be collected where significant gaps exist. The stressor-specific portion of the guidance documents will build on these four categories and the relevant information for consenting, as well as the potential for risk retirement in order to easily guide an assessment of potential environmental effects for an MRE project during consenting processes.

1. Species and/or populations at risk

It is important to consider potential risks to species, populations, and/or sub-populations that are protected under legislation/regulations as endangered, threatened, and/or vulnerable species (and other equivalent designations), as well as species that are commercially, recreationally, and/or culturally valuable. Endangered/threatened/vulnerable species include species that may be in danger of becoming extinct in the foreseeable future. Species that are commercially or recreationally valuable contribute to the economy through their significance as a resource. Culturally important species are important to First Nations/indigenous and local communities outside of economic value and are likely to have ties to cultural, historical, and/or subsistence practices. Regulations or definitions may vary by country and there may be a different impetus on understanding effects to a species based on its established commercial, recreational, or cultural value.

Relevant information for consenting processes:

- Baseline information includes available data or research that can be used to understand if species and/or populations at risk live in or migrate through an MRE development area and if they may be affected by the development itself. This information may include data on characteristics of species (such as species distribution, population size, dynamics and structure, life history, and behavior) as well as characteristics of the MRE project site (such as species diversity and abundance). Understanding such information can aid site selection within an area and development of management measures that minimize risk of potential impacts to species and/or populations at risk.

[5] OES-Environmental has developed a process for data transferability, for more information visit the *Tethys* page.

- Risks specific to species and/or populations include stressor-receptor interactions[6] such as collision risk (to marine mammals, fish, diving birds, or sea turtles); underwater noise impacts (to marine mammals, fish, sea turtles, or invertebrates); habitat change (to all marine organisms); and EMF impacts (to sensitive species such as fish, elasmobranchs, sea turtles or possibly invertebrates). Additional risks include entanglement of marine mammals, large sharks, or sea turtles with water-column cables and mooring lines, and displacement from areas with large arrays.

2. Habitat alteration or loss

Regulations for habitats generally include those for essential (e.g., Essential Fish Habitats in the U.S. or Special Areas of Conservation in the European Union), critical, rare, or vulnerable (also known as vulnerable marine ecosystems) habitats, as well as for wider protected ecosystems. Specific habitats may be deemed important due to their scarcity, uniqueness, or support functions for a species and/or population at risk, including a specific life stage of one of those populations. Methods to define essential, critical, or vulnerable habitats can vary internationally.

Relevant information for consenting processes:

- Baseline information on habitat quality and quantity includes data or research used to understand where essential, critical, rare, or vulnerable habitats are and what makes them essential or critical. This information is needed to consider and, where possible, avoid such habitats during project design and site selection processes and to understand baseline conditions prior to development. Overall, this understanding will aid in site selection and development of management measures that reduce or avoid habitat alteration or loss of essential, critical, rare, or vulnerable habitats.
- Risks specific to habitat loss or alteration include habitat changes (such as effects of device presence and installation/removal on benthos, changes in community composition on and near a device, and artificial reef effects). In some countries regulations concerning changes in habitats may refer to oceanographic systems, such as changes in water circulation, wave heights, current speeds, and sediment transport processes.

3. Effects on water quality

Water quality (e.g., water pH, oxygen and nutrient content) has the potential to be affected by changes in oceanographic systems (such as changes in water circulation, wave heights, and current speeds) due to the operation of MRE devices, or by the addition of contaminants through device installation, operation, and maintenance. Oceanographic processes define the movement of water, which, among other critical ocean features, maintains water quality that support healthy ecosystems. Relevant regulations are related to these water quality concerns and how they may impact marine animals and the environments around devices and may vary by country.

Relevant information for consenting processes:

[6] Interactions between MRE systems and the marine environment are noted in terms of stressors and receptors. Stressors are those parts of an MRE system that may have an impact on a marine organism, a habitat, oceanographic processes, or ecosystem processes. Receptors can include marine organisms, habitats, or oceanographic processes, and may also include humans. It is the intersection of stressors and receptors that define the interactions that can be examined through observations, laboratory and field experiments, and modeling studies.

- Baseline information on water quality will require available data or research to understand pre-development water quality, and may include data on concentration of nutrients, toxins, and contaminants; eutrophication and dissolved oxygen levels; basic oceanographic data (e.g., tidal currents and ranges, wave heights); flushing rates and vertical mixing; and suspended sediment levels.
- Risks specific to water quality and oceanographic systems include changes in circulation and sediment transport, turbidity, wave height, concentrations of contaminants, and dissolved oxygen levels and eutrophication, and may impact both species and habitats.

4. Effects on social and economic systems

MRE developments have the potential to impact social and economic systems within communities, regions, and nations. Impacts can include benefits or adverse effects on people, health and well-being, jobs and wages, infrastructure, and revenues. To fully understand such consequences, social and economic effects, dynamics, and values within a community must be considered. Often required as part of consent applications within environmental impact assessments (or environmental impact statements), effects on social and economic systems are evaluated through cost-benefit analyses or social and economic impact analyses. Social and economic issues are often lumped together, but it is important to distinguish the differences. Examples of economic effects include changes to gross value added (or the contribution of a sector), employment opportunities, export of products/services, businesses, and existing industries. Examples of social effects include changes to services, health and well-being, infrastructure, and communities (including First Nations/indigenous, remote, and/or marginalized communities) as well as impacts to existing ocean/maritime uses. Relevant regulations vary greatly by country and region.

Relevant information for consenting processes:

- Baseline information on effects to social and economic systems includes available data or research to understand current job opportunities, businesses, extent of the supply chain, wages, exports, existing industries, infrastructure and facilities, services, cost of living, health and well-being, cultures and values, and communities. It is important in any assessment to include the effects on First Nations/indigenous, remote, and/or marginalized communities as they may be affected differently than other communities. Understanding current marine uses/users in an area is also important, including industries such as commercial fishing, shipping, offshore oil and gas, aquaculture, and mining; cultural, historic, or First Nations/indigenous uses; and recreational uses such as fishing, boating, scuba diving, surfing, and tourism. Additional information includes policy perspectives at the local, regional, and national levels as well as implications and/or benefits regarding climate policies and community resilience.
- Risks to social and economic systems arise from new MRE projects that may create adverse effects such as sea use conflicts or areas of exclusion, navigational hazards, or visual impacts. MRE projects also have the potential to create benefits such as increased job opportunities, economic development, local services, energy security, and opportunities for tourism.

Risk Retirement

For each of the four categories, it is important to assess if data and information exist to support risk retirement for small numbers of devices (one to four devices). Risk retirement signals that with every

new MRE development a potential interaction need not be fully investigated for consenting purposes; instead, regulators and other stakeholders may rely on existing data and information to inform if a risk may be low or considered acceptable (e.g., under regulatory thresholds). While there may always be a need to collect some project-specific data for consenting processes, data from MRE developments, research studies, and analogous industries with similar attributes can be used to help determine the level of risk associated with an MRE project. Such data and information can be used when considering potential impacts at a project-level and can aid in decision-making. Experts in the MRE community agree that risk retirement is possible for certain environmental interactions for small numbers of devices because sufficient data and information exists to support the consenting process with regards to these issues[7]. It is important to note that while certain risks can be retired, further consideration will likely be required as the industry scales up to large-scale MRE developments.

Species and/or populations at risk: Based on general acknowledgement from stakeholders considering single or small numbers of devices, sufficient data exist for underwater noise, EMF, and entanglement to be able to retire these risks. More information is necessary to understand collision risk from MRE devices before risk retirement can be considered. Displacement will become more relevant as the industry scales up to large-scale MRE developments.

Habitat alteration or loss: For small numbers of devices, most experts agree that sufficient data exist to retire the risks related to habitat changes from device presence and operation. The literature and modeling studies suggest that habitat effects from changes in oceanographic systems can also be retired for single or small numbers of devices.

Effects on water quality: Sufficient understanding exists to retire the risk from changes in oceanographic systems for small numbers of devices. While understanding is limited to modeling studies and empirical data is needed to validate models and to better understand impacts from large-scale arrays, there is general agreement that small numbers of devices will have no effects within the natural variability of the system.

Social and economic impacts: Uncertainties remain about social and economic benefits and adverse effects from MRE. Improved and increased social and economic data collection is necessary to understand the full range of effects, especially as they may greatly vary with the project location. Because of this, social and economic effects are not suitable for risk retirement in the manner of environmental interactions. Providing standard methods to assess impacts can create a better understanding of how an MRE development may affect a community, region, or nation.

Caveats and remaining research needs: While many of these risks can be considered retired for small-scale MRE projects as there is sufficient information for consenting purposes, there are still remaining research questions, even for smaller projects, that should be addressed through strategic, collaborative research programs, complementing work undertaken by project developers to increase overall

[7] OES-Environmental has held multiple workshops and webinars and engaged with subject matter experts to understand the ability to retire certain risks for small numbers of MRE devices. The information noted here comes from feedback received from the MRE community and the subject matter experts. For more information on risk retirement, visit the risk retirement page on *Tethys*, read the risk retirement and data transferability chapter in the 2020 State of the Science report, watch the recording of a risk retirement webinar held in September 2020, or read the risk retirement journal article.

understanding[8]. For underwater noise, understanding behavioral changes for animals around devices, validating noise propagation models, and assessing cumulative effects are still needed. For EMF, more field measurements are needed to improve and validate models, as well as understand the relationship between emissions, cable configuration, and power variability. For entanglement, models need to incorporate species-specific diving or swimming behavior and be validated with data from MRE deployments, especially as the industry moves toward arrays. For habitat change, additional research is needed to better understand impacts from decommissioning, changes in high-energy tidal environments, and biofouling from non-native species in additional locations.

Cumulative Effects

Cumulative effects are changes caused by the combined impacts from multiple human activities on natural processes that may compound to impact the marine environment and organisms. Many anthropogenic activities occur in the marine environment that may have impacts greater than the sum of their parts. There remains a need to further develop fit-for-purpose and proportionate methodologies for cumulative impact assessments for small numbers of MRE devices to assess interactions with other marine uses. In certain countries, cumulative effects may be included as part of marine spatial planning approaches (such as in Spain and Sweden) or as part of environmental impact assessments (such as in the European Union). In addition to cumulative effects, some countries like the US require an assessment of interrelated and interdependent effects – those secondary effects that would not occur if it were not for the development of an MRE project – to determine the overall effect on a species or habitat. Assessing cumulative effects on the environment and socio-economics is necessary to understand anthropogenic uses of the marine environmental and how they interact, and will become increasingly important as MRE developments move to array-scales and as additional uses of the marine environment increase.

Framework

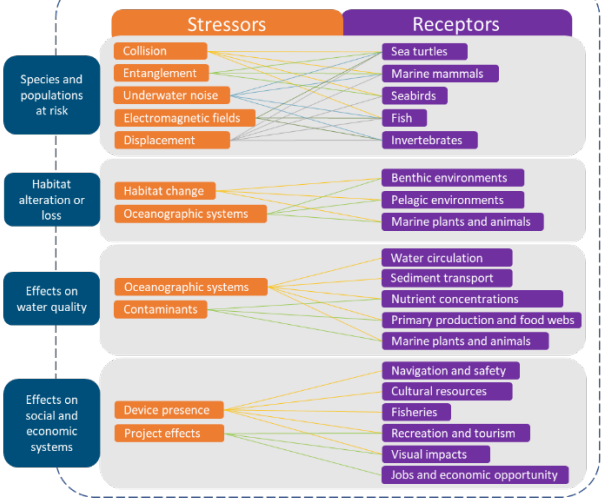
The below framework aims to show how risk retirement and data transferability can be used throughout the consenting process, as well as when OES-Environmental resources can be used to gather relevant data and information.

[8] For more information on research needs, see the 2020 State of the Science report (Copping and Hemery 2020) and the ORJIP Forward Look and associated documents.

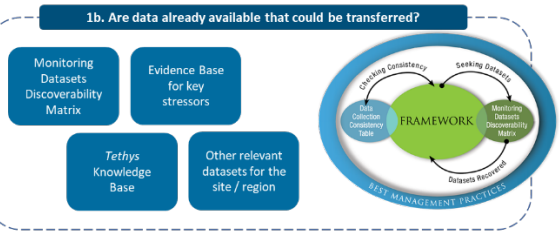
Environmental Consenting for Small Numbers of Marine Renewable Energy (MRE) Devices

1. Project scoping completed by developer, potential for consultation with regulator/advisor

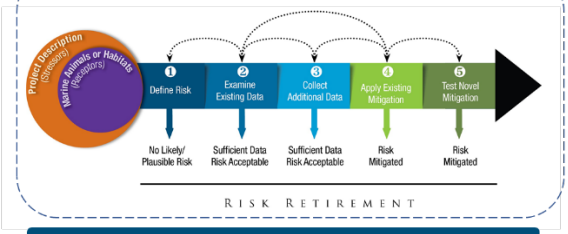
1a. Identify potential environmental concerns at the proposed site



1b. Are data already available that could be transferred?



1c. Can any risks be retired or managed?



1d. Have all relevant impact mechanisms, stressors, and receptors been identified?

2. Application submitted by developer

3. Regulator and advisors evaluate information for environmental assessment

- Are there sufficient data to understand the risks?
- Are the risks acceptable?
- Can the remaining risks be managed?

4. Regulator and advisors may request additional data collection

- Baseline data collection
- Prior to consent
- Post-installation monitoring

Developer collects additional data and/or develops monitoring plans

- Project consented
- Project modified to receive consent
- Project abandoned

ENVIRONMENTAL