

Marine Renewable Energy Regulator Survey: *Australia*



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Introduction

As the marine renewable energy (MRE) industry progresses around the world, understanding of the potential environmental effects of MRE has improved. Opportunities to investigate the environmental effects of operational MRE devices have increased in recent years with more projects in the water. Despite these advancements, some areas of uncertainty persist. Key concerns remain about how MRE devices and arrays interact with surrounding environments, and how marine animals behave around them. These uncertainties continue to pose challenges during permitting processes for MRE. Additionally, the development of larger-scale MRE devices and arrays presents new questions and uncertainty for MRE permitting processes, particularly in understanding how potential environmental effects of MRE scale up and interact with other ocean activities.

To better understand how regulators and advisors perceive and manage environmental risks during permitting processes for MRE projects, a survey was conducted across several OES-Environmental member countries beginning in 2025. Building on a previous regulator survey conducted by OES-Environmental for multiple countries from 2017-2021, this survey included updated questions to reflect changing information needs regarding the potential environmental effects of MRE. Its purpose was to understand regulators and advisors' familiarity with MRE technologies, perceptions of potential environmental risks associated with MRE technologies across varying scales, and views on best approaches to MRE development, including permitting and the applicability of data transferability. The survey also included questions to collect information on the use of Tethys. A list of questions and answer options are provided in Appendix A.

This report summarizes the results from the survey of regulators and advisors in **Australia**. Results are compared to the previous survey for Australia, conducted in 2021 and published in 2022¹.

Participants

Email invitations for the 2026 Survey on Regulatory Needs Regarding Environmental Effects of Marine Renewable Energy were sent to 41 individuals known to be involved in permitting MRE in Australia. Two full responses were received and retained for analysis.

Respondents were asked which levels of government their organizations represent, as well as what state they work in. Both respondents indicated that they work at a federal government level and work in Western Australia.

When asked about the number of planned, permitted, or operational MRE projects in their jurisdiction, both respondents reported between six and ten projects.

¹ Rose, D.; Freeman, M. (2022). MRE Regulator Survey Report: Australia. <https://tethys.pnnl.gov/publications/mre-regulator-survey-report-australia>

Respondents were also asked to indicate their organization’s focus for permitting MRE developments (Figure 1). Under ‘other’, one respondent added “Infrastructure integrity, Work Health and Safety”, noting that the relevance of the predefined environmental focus areas depends on project activity and environmental approval.

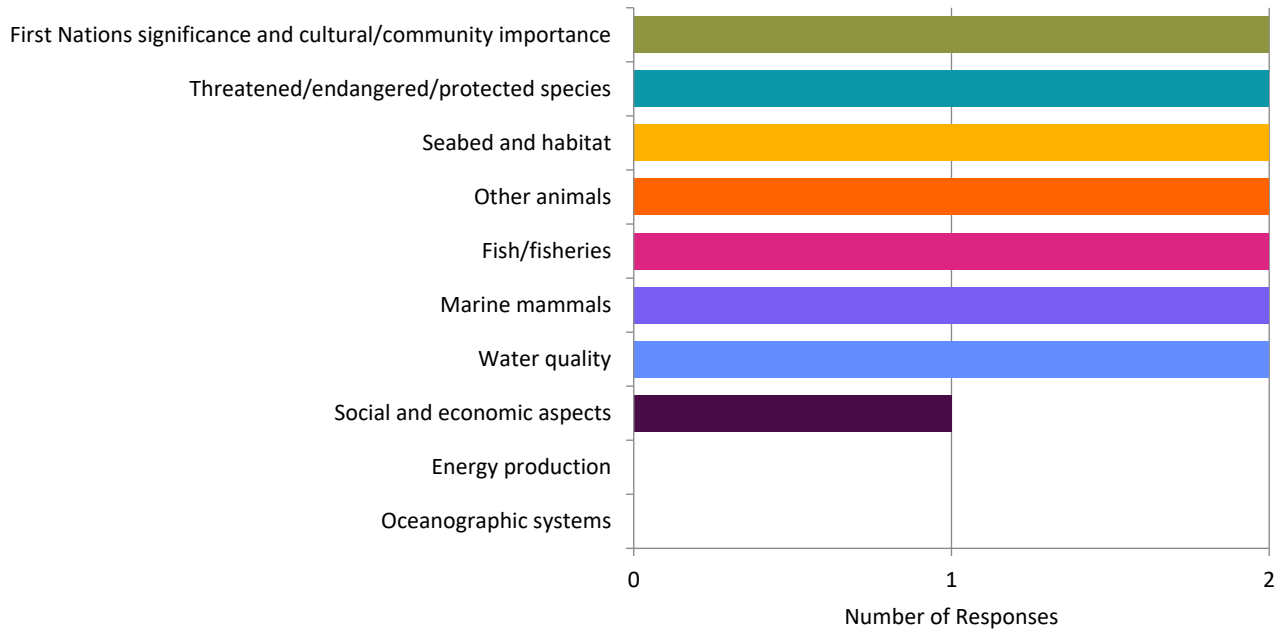


Figure 1. Organization focus in permitting marine renewable energy projects. (n = 2)

Figure 2 shows each respondent’s role in permitting MRE projects. Both respondents act as subject matter experts and manage licenses or permits during operational phases. One respondent also issues licenses or permits, while the other respondent also advises regulators, provides consultations and reviews, and advises on license or permit applications.

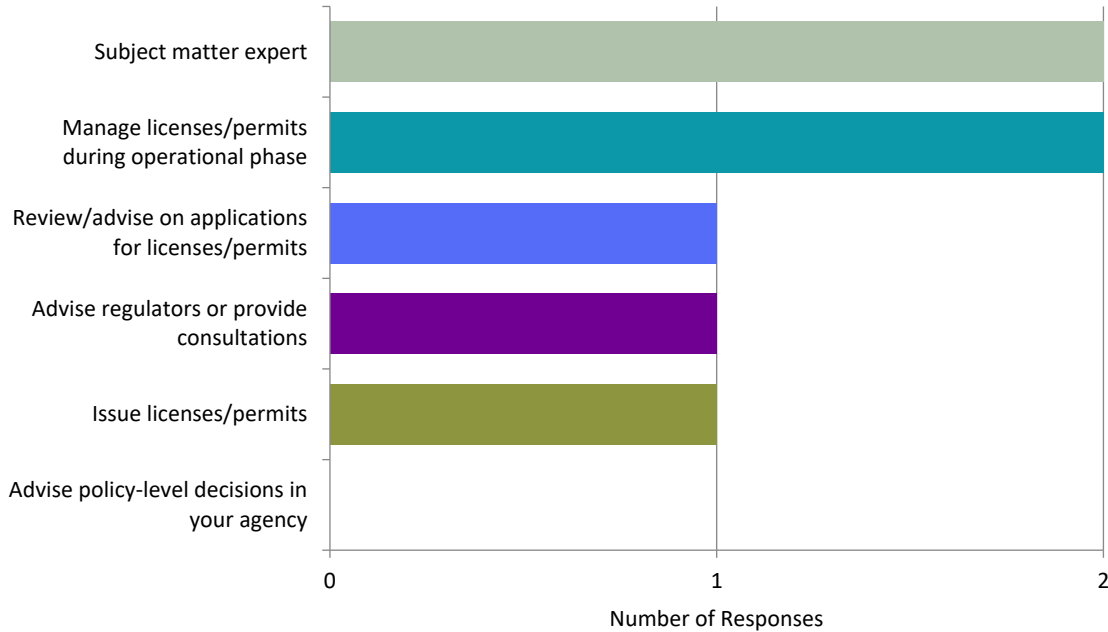


Figure 2. Respondent’s role in permitting marine renewable energy projects. (n = 2)

Figure 3 shows the length of time respondents have been in a position related to the permitting process for MRE projects. One respondent has been in such a position for 1-2 years and the other for 3-5 years.

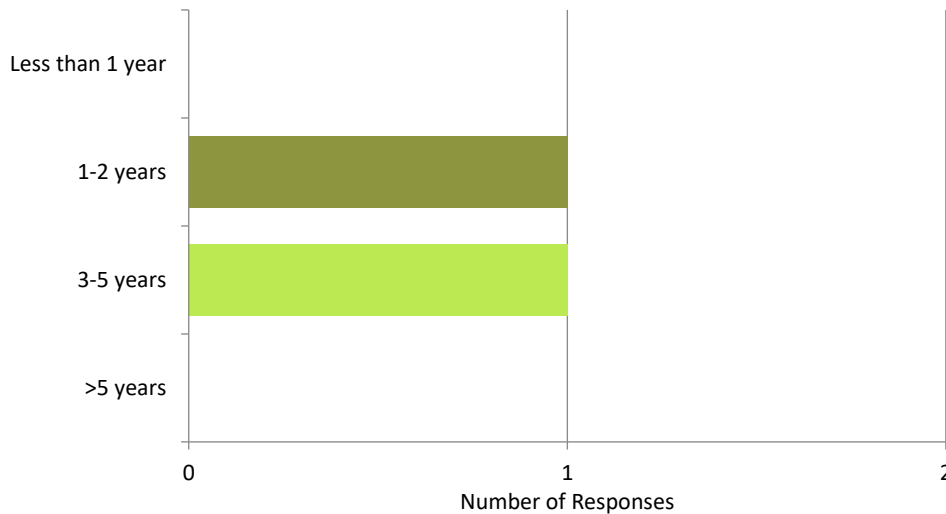


Figure 3. Length of time in a position related to the permitting process for marine renewable energy projects. (n = 2)

Respondents were asked if they had directly participated in the regulatory process for an MRE project. Both of the respondents indicated that they have been directly involved in an MRE project permitting process.

Familiarity with MRE Technologies

Respondents were asked to rate their familiarity with MRE technologies (e.g., ocean current energy, tidal energy, wave energy, ocean thermal energy conversion, salinity gradient, riverine energy) on a scale of 1 (not familiar) to 5 (very familiar). They were provided with explanations of all the terms presented from <https://openei.org/wiki/PRIMRE/Basics>. The results are presented in Figure 4. The respondents indicated a high level of familiarity with wave energy, slightly less familiarity with tidal and ocean current energy, and moderate familiarity with riverine energy. The least familiar technologies are salinity gradient and ocean thermal energy conversion. This aligns with the wave energy potential along the coasts of Australia.

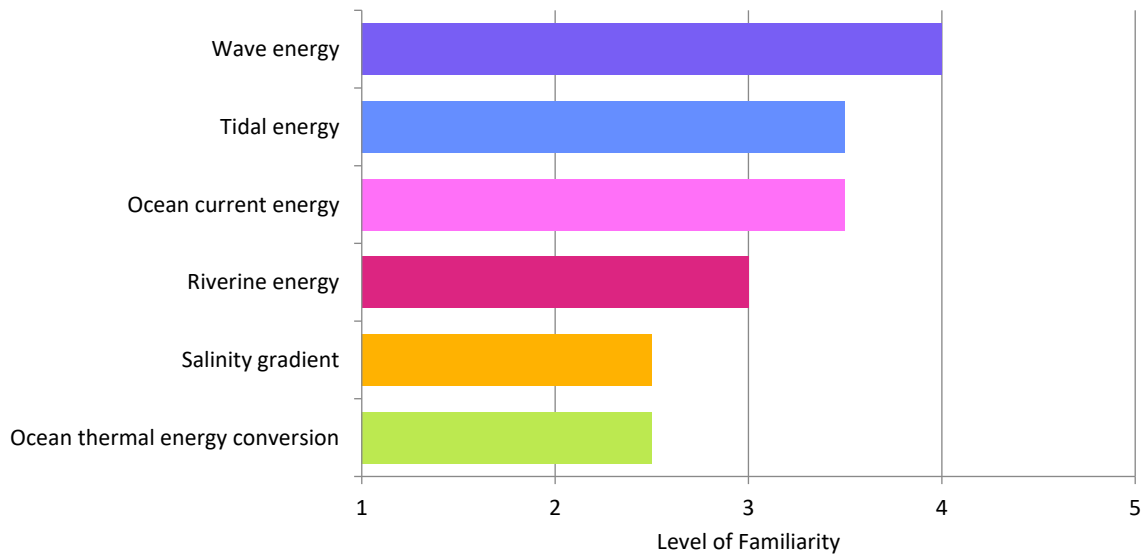


Figure 4. Average level of familiarity with marine renewable energy technologies from 1 (not familiar) to 5 (very familiar). (n = 2)

Top Challenges and Perceptions

The following questions differentiated between small arrays (one to six devices) and large arrays (more than six devices) of MRE devices to understand how perceptions of risk and information needs vary for different MRE project scales.

Small arrays

Respondents were asked to rank the following environmental effects by how challenging they are when permitting small arrays.

- Effects of electromagnetic field emissions from underwater cables and other electrical infrastructure on marine animals
- Attraction, avoidance, or displacement of marine animals
- Changes to habitats
- Effects of underwater noise from devices on marine animals
- Risk of marine animals colliding with turbine blades
- Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.)
- Entanglement of large marine animals with mooring lines and underwater cables

Figure 5 shows respondents' perceptions of the level of challenge posed by environmental effects when permitting small arrays, when asked to rank from most challenging to least challenging. The top-ranked challenges were calculated by Survey Monkey, such that the answer choice with the largest average ranking, or value, is the top challenge. In Australia, the top challenges for respondents in permitting small arrays are underwater noise and attraction, avoidance, or displacement.

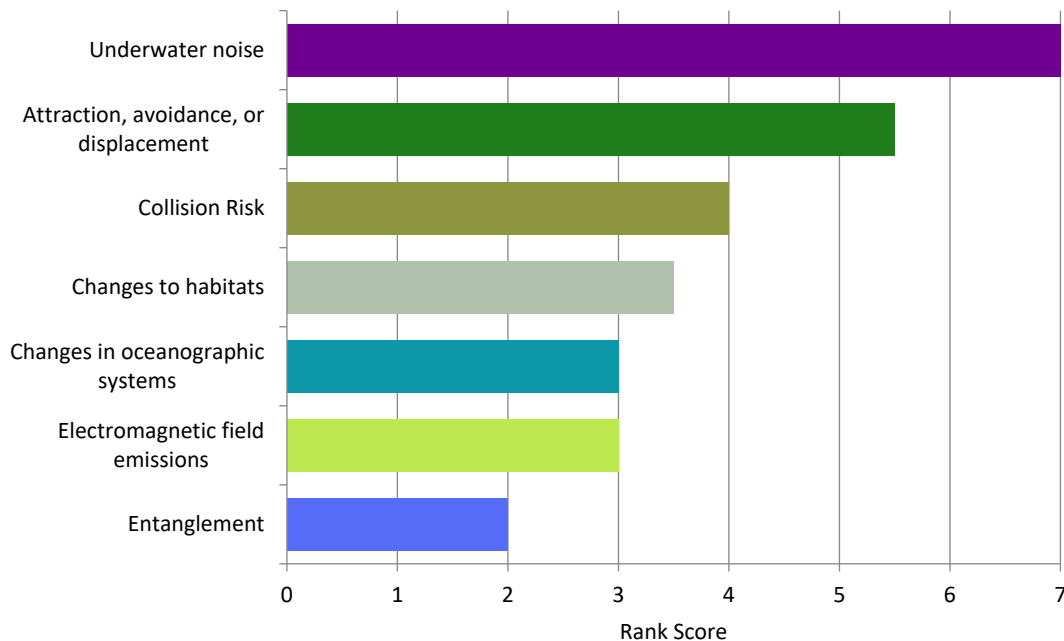


Figure 5. Ranking of challenges to permitting small arrays (one to six devices). (n = 2)

Respondents were also asked to rank their agreement with several statements regarding additional needs for permitting for small arrays, with respect to their top-ranked challenges for small arrays.

The results of this question are summarized in Table 1. Both respondents indicated agreement with the statement that regulators/advisors need to be knowledgeable and trained on MRE technologies. However, for all other statements the respondents were split, with one respondent selecting agree or strongly agree for the remaining statements and the other respondent selecting disagree or strongly disagree.

Table 1. Perceptions of small array statements. (n = 2)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Additional research/studies are needed to better understand the likely risk	0	1	0	1	0
Field data are needed to determine the risk and uncertainty of an MRE project	0	1	0	0	1
Validated numerical models are needed for environmental permitting	1	0	0	1	0
Organization/policy guidance is needed to interpret potential environmental risk and manage uncertainty	1	0	0	1	0
Regulators/advisors need to be knowledgeable and trained on MRE technologies, environmental interactions, etc.	0	0	0	2	0
Additional monitoring methods, instruments, etc. are needed to document environmental interactions	0	1	0	1	0

Large arrays

Respondents were asked to rank the following environmental effects by how challenging they are when permitting large arrays. Note that cumulative effects and ecosystem-wide effects were added for this question in contrast to small arrays.

- Effects of electromagnetic field emissions from underwater cables and other electrical infrastructure on marine animals
- Attraction, avoidance, or displacement of marine animals
- Changes to habitats
- Effects of underwater noise from devices on marine animals
- Risk of marine animals colliding with turbine blades
- Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.)
- Entanglement of large marine animals with mooring lines and underwater cables

- Cumulative effects with other anthropogenic activities/marine developments, including other MRE projects
- Ecosystem-wide effects

Figure 6 shows respondents' perceptions of the level of challenge posed by environmental effects when permitting large arrays, when asked to rank from most challenging to least challenging. The top-ranked challenges were calculated by Survey Monkey, such that the answer choice with the largest average ranking is the top challenge. In Australia, the top challenges for respondents in permitting large arrays are underwater noise; attraction, avoidance, or displacement; and cumulative effects.

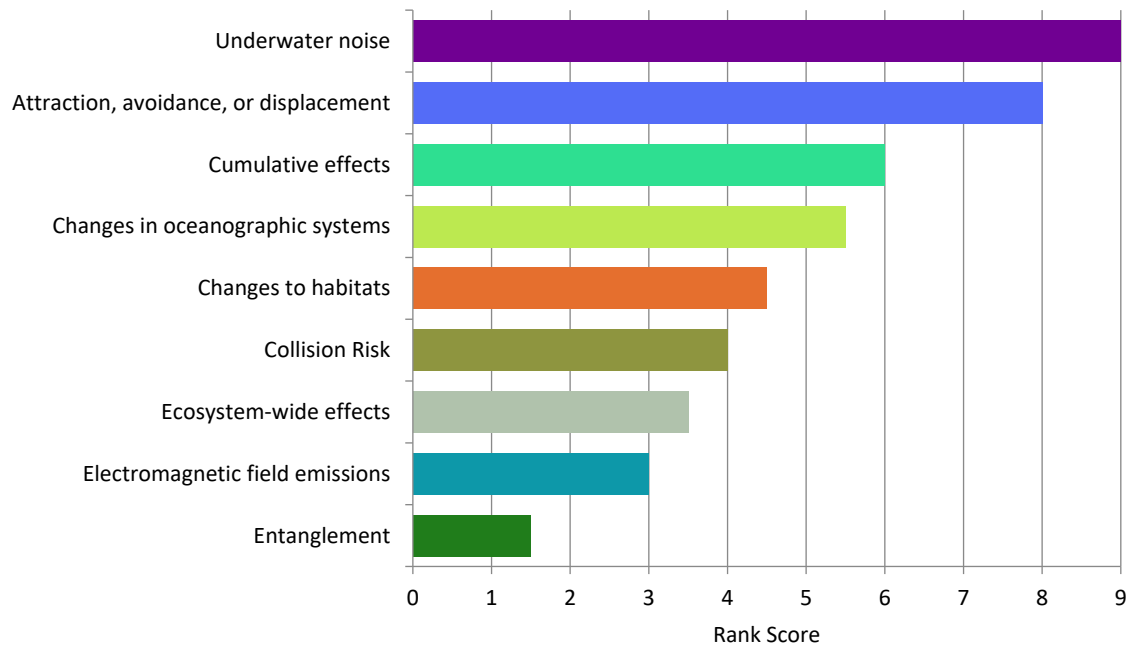


Figure 6. Ranking of challenges to permitting large arrays (more than 6 devices). (n = 2)

Respondents were also asked to rank their agreement with several statements regarding additional needs for permitting large arrays, with respect to their top-ranked challenges for large arrays. The results of this question are summarized in Table 2. One respondent agreed (agreed or strongly agree) with all of the statements. The other respondent agreed with most of the statements, except for the need for organization or policy guidance to interpret potential environmental risk and manage uncertainty, to which they were neutral.

Table 2. Regulator perceptions of large array statements. (n = 2)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Additional research/studies are needed to better understand the likely risk	0	0	0	1	1
Field data are needed to determine the risk and uncertainty of an MRE project	0	0	0	1	1
Validated numerical models are needed for environmental permitting	0	0	0	1	1
Organization/policy guidance is needed to interpret potential environmental risk and manage uncertainty	0	0	1	1	0
Regulators/advisors need to be knowledgeable and trained on MRE technologies, environmental interactions, etc.	0	0	0	1	1
Additional monitoring methods, instruments, etc. are needed to document environmental interactions	0	0	0	1	1

Barriers to Permitting

Respondents were asked to select statements that “Describe a barrier to permitting for you or your organization regarding environmental effects of MRE projects”. The predefined statements and associated responses are shown in Figure 7.

In Australia, the top barriers to permitting selected by both respondents are low social acceptance or public opposition to MRE projects and scientific uncertainty regarding environmental effects. In addition, one respondent also selected limited availability of research or environmental monitoring data and insufficient guidance for managing environmental risks. Based on the responses, the respondents do not find accessing information/data, lack of expertise and/or access to subject matter experts, or inadequate technical knowledge of devices as barriers.

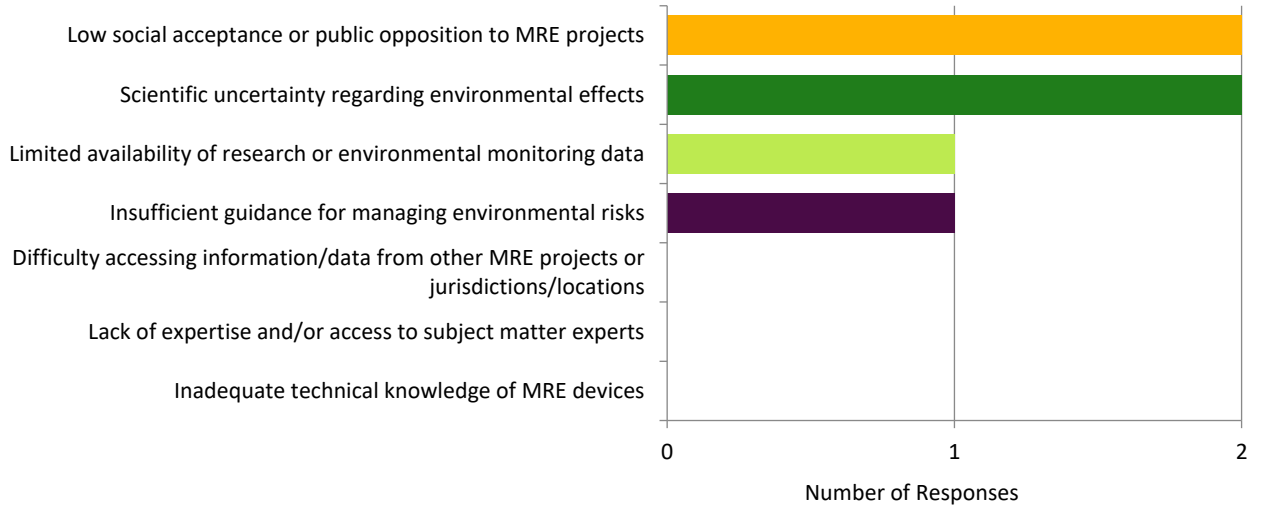


Figure 7. Barriers to permitting marine renewable energy projects. (n = 2)

Data Transferability and Risk Retirement

Risk retirement is a process to help simplify permitting processes for MRE devices by “retiring” risks of specific environmental interactions that are unlikely to cause harm to marine animals or habitats so that extensive investigations for every new MRE project are not required. Through data transferability, MRE developers, regulators, and advisors may rely on what is known from already permitted projects, from related research studies, or from findings from analogous offshore industries. Risk retirement does not take the place of any existing regulatory processes or replace the need for appropriate data collection before, during, and after MRE device deployment. To guide the application of risk retirement and data transferability by MRE developers, regulators, and advisors, OES-Environmental has created various tools and resources available on the Tethys [Risk Retirement page](#) and [Data Transferability page](#).

Respondents were provided with the following definition of risk retirement:

“Risk retirement is a process by which available data and information are examined to identify environmental effects that are unlikely to cause significant effects on marine habitats, animals, or ecosystem processes. These effects can therefore be retired and may not require extensive investigation for each new MRE project.”

Based on this definition, respondents were asked, “Can any of the following potential risks be retired for small arrays (one to six devices) in your jurisdiction?” Respondents ranked the ability to retire each of the following potential environmental risks as either strongly disagree, disagree, neutral, agree, or strongly agree.

- Effects of electromagnetic field emissions from underwater cables or other electrical infrastructure on marine animals

- Changes to habitats
- Attraction, avoidance, and displacement of marine animals
- Effects of underwater noise from devices on marine animals
- Risk of marine animals colliding with turbine blades
- Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.)
- Entanglement of large marine animals with mooring lines and underwater cables

Figure 8 shows respondents’ perceptions on retiring risks for small arrays. Both respondents agreed with retiring entanglement (one strongly agreed), were neutral on retiring electromagnetic field emissions, and disagreed with retiring underwater noise and attraction, avoidance, and displacement. However, the respondents held diverging perspectives regarding the retirement of the remaining risks. While one respondent strongly agreed with retiring changes in oceanographic systems and changes in habitats, the other respondent disagreed with retiring either. For the environmental effects that cannot be retired, one respondent noted: “Too much uncertainty on the effect on animals even at individual level and stringent requirements applied via EPBC [Environment Protection and Biodiversity Conservation Act] recovery plans. Precautionary principle given the status of endangered / migratory species.”

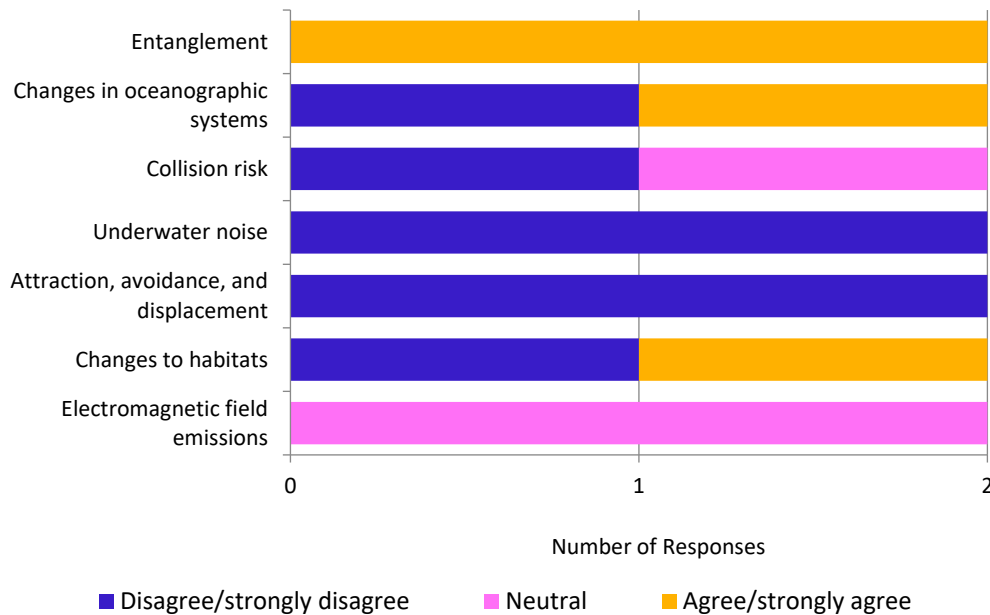


Figure 8. Ability to retire risks for small arrays (one to six devices). (n = 2)

Respondents were also asked to respond to the question: “Can data collected at other locations be used to inform permitting processes for proposed MRE developments within your jurisdiction?” Respondents were given the options of ‘Never’, ‘Maybe’, and ‘Absolutely’. No respondents selected ‘Never’.

One respondent selected ‘Absolutely’ and provided the comment included below.

- “Relevant studies can always be applied so long as the rationale and application are appropriate and support their use.”

One respondent selected ‘Maybe’ and provided the comment included below.

- “It can inform risk assessment and management methods; however uncertainty remains regarding local conditions and species. A simple example is bird strike predictions for offshore wind that have not been tested for Australian conditions for Australian sea and migratory birds.”

Best Approach to MRE Development

Respondents were asked, “Which of the following approaches best describes your strategy for managing environmental risks and uncertainties during the permitting process when moving from small arrays (one to six devices) to large arrays (greater than six devices) (Choose one)”.

The options, as provided to respondents in the survey, are listed below:

- *Precautionary principle.* Potential environmental risks should be avoided through preventative measures and consideration of alternatives to avoid unacceptable impact, particularly when there is scientific uncertainty. Project proponents are responsible for proving that a risk will not cause irreversible environmental harm.
- *Mitigation hierarchy.* Potential environmental risks should be systematically limited by taking actions to avoid, minimize, mitigate and/or compensate for risks through siting and/or mitigation measures.
- *Adaptive management.* Potential environmental risks and scientific uncertainty can be managed through a flexible, learning-based approach that includes adapting monitoring and mitigation over time to understand risks, decrease uncertainty, and mitigate impacts.
- *Survey, deploy, monitor.* Potential environmental risk level should be identified through surveys or available data at a proposed project site. If low risk, permitting may be fast-tracked. If high risk, the project may require additional surveys. Surveys and post-deployment monitoring should be based on a risk-based approach and proportionate to the project scale.

Respondents provided additional responses, which are shown in Table 3 next to the management strategy selected. When managing environmental risks and uncertainties during permitting processes for MRE projects scaling from small to large arrays, one respondent selected adaptive management while the other respondent selected mitigation hierarchy. Respondents had diverging perspectives on managing environmental risks. The respondent who selected adaptive management preferred a learning-based approach that adapts monitoring and mitigation over time. The respondent who selected mitigation hierarchy preferred a systems approach using siting and/or mitigation measures.

Table 3. Selected strategies for managing environmental risks and uncertainties during the permitting process when moving from small arrays (one to six devices) to large arrays (more than six devices). (n = 2)

Management strategy selected	Additional Comment
<i>Adaptive management</i>	“Potential environmental risks and scientific uncertainty can be managed through a flexible, learning-based approach that includes adapting monitoring and mitigation over time to understand risks, decrease uncertainty, and mitigate impacts.”
<i>Mitigation Hierarchy</i>	“Potential environmental risks should be systematically limited by taking actions to avoid, minimize, mitigate and/or compensate for risks through siting and/or mitigation measures.”

Off-grid MRE

Respondents were asked:

“MRE devices are being designed for uses other than supplying electricity to the national grid. These systems are likely to consist of fewer and/or smaller-scale devices, to provide power to remote, coastal, or island communities or at-sea applications such as aquaculture, ocean observations, and navigation. Would the permitting process for these smaller MRE projects differ from national grid-scale projects in your jurisdiction?”

Responses were collected via an open comment box and categorized by level of certainty (e.g., no difference, potential difference, known difference). Both respondents indicated a potential but likely minor difference between permitting processes for national grid-scale projects and smaller-scale MRE projects.

Responses are listed below:

- “In our jurisdiction - not significantly. Other than recognition of the nature and scale of the project within the existing regulations and processes.”
- “Not really differ. The objective based environmental approvals allow for adjustment to specific circumstances/nature and scale of project and [environmental] impacts and risks.”

Use of Tethys

In addition to questions about permitting MRE projects, respondents were asked how they find information on the environmental effects of MRE and their awareness and use of the [Tethys online database](#). The results are provided in the subsections below.

Finding Information

Respondents were asked, “What resources or methods do you use to find information on the environmental effects of MRE and support permitting? (check all that apply)”.

Figure 9 shows that both respondents obtain information on the environmental effects of MRE from Tethys, government organization reports, scientific journals, conferences or workshops, and other regulators or colleagues. One respondent indicated that they also obtain information from newsletters.

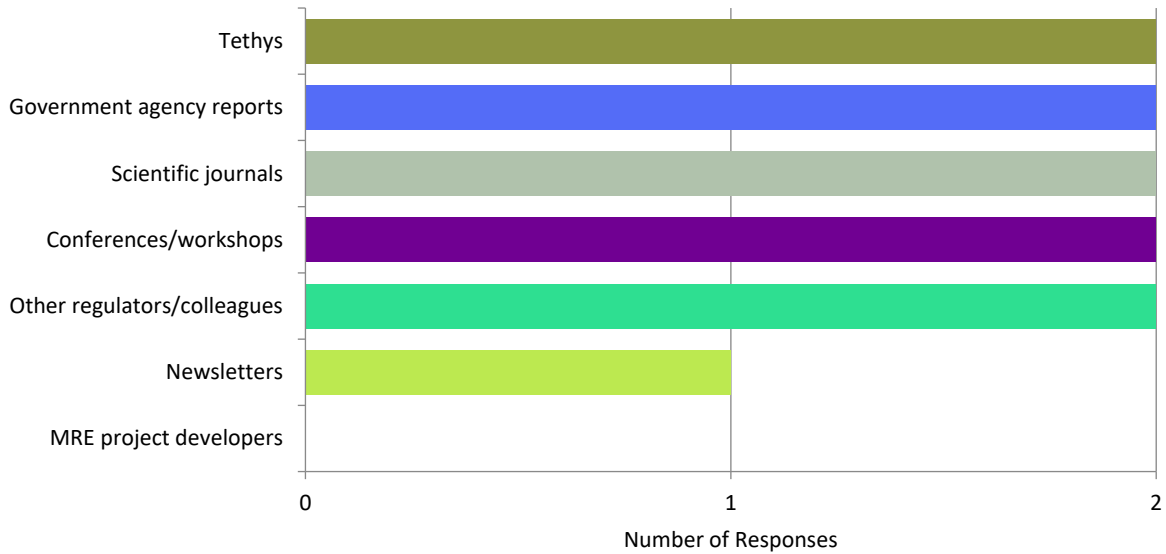


Figure 9. Resources and methods used to find information on environmental effects of marine renewable energy and support permitting. (n = 2)

Awareness, Purpose, and Usefulness

When asked if they had heard of Tethys, both respondents selected “Yes”. The respondents were asked to indicate how they use Tethys by indicating all uses that apply from the following list:

- To find papers and reports on the environmental effects of MRE
- To view live or archives webinars and expert forums
- To receive Tethys Blast newsletter
- To find project information (e.g., OES-Environmental metadata)
- To use tools and resources (e.g., data discoverability matrix, management measures tool, etc.)

Shown in Figure 10, both respondents use Tethys to receive the Tethys Blast Newsletter and find papers and reports on environmental effects of MRE. One respondent indicated that they also use Tethys to use tools and resources as well as to find project information.

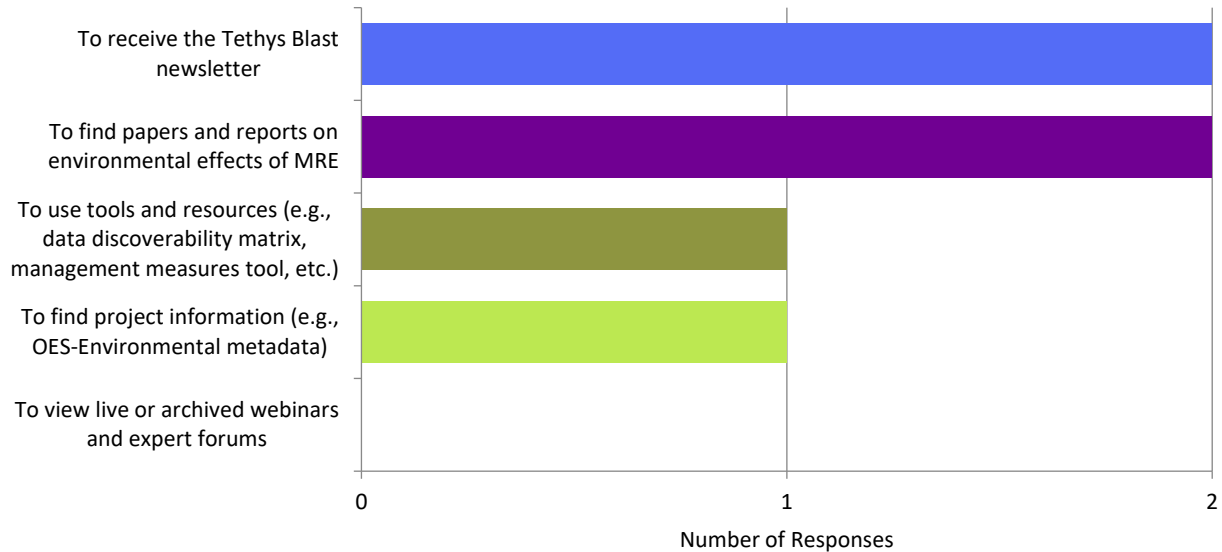


Figure 10. How do you use Tethys? (n = 2)

The respondents were also asked how useful they find Tethys (not useful, somewhat useful, very useful). Both respondents indicated that they find Tethys very useful.

Conclusion

Both survey respondents in Australia reported having experience with permitting processes for MRE projects, with high familiarity with wave energy technologies and moderate familiarity with tidal, ocean current, and riverine energy technologies. Familiarity was more limited for salinity gradient and ocean thermal energy conversion technologies. Both respondents work for organizations focused on First Nations significance and cultural/community importance, threatened/endangered/protected species, seabed and habitat, marine mammals, fish/fisheries, other animals, and water quality. One respondent works for an organization that also focuses on social and economic effects.

Listed below are the key findings from the 2026 Australia Regulator Survey:

- The respondents perceived underwater noise as the most challenging, and attraction, avoidance, or displacement as the second most challenging environmental effect when permitting MRE projects, regardless of project size. Additionally, cumulative effects was the third most challenging stressor for large arrays.
- The respondents perceived changes to oceanographic systems and changes to habitats as less challenging when permitting small arrays (one to six devices) and slightly more challenging when permitting large arrays (more than six devices). Given that respondents also perceived cumulative effects as a challenge when permitting large arrays (ranked third), this suggests that regulators in Australia may have heightened

awareness or concern regarding potential additive or multiplicative effects of potential changes to oceanographic systems or habitats as additional devices are deployed within an array.

- The respondents indicated higher levels of agreement with all statements regarding information and data needs when addressing the environmental challenges of large arrays, as compared to small arrays. The largest increases in agreement with statements for large arrays were the need for validated numerical models for environmental permitting, additional monitoring methods and instruments to document environmental interactions, additional research and studies to better understand likely environmental risk, and field data to determine the risk and uncertainty of a project. This suggests that regulators in Australia may view the potential environmental risk associated with large arrays to still largely be unknown, and a need to collect and analyze more data on environmental effects as MRE projects scale up. As projects in other parts of the world deploy larger arrays, transferring data to inform Australia MRE permitting and development will be useful, especially as both respondents indicated that data transferability could be applicable.
- The respondents agreed on risk retirement for entanglement, with one respondent strongly agreeing. The respondents were neutral on risk retirement for electromagnetic field emissions and disagreed on risk retirement for underwater noise and attraction, avoidance, and displacement. The respondents were mixed on the remaining environmental stressors, with one respondent noting that there is still uncertainty around individual effects on animals and stringent regulatory requirements.
- These regulators and advisors are supportive of data transferability but did note that local context should be considered. Survey participants' preference for the best approach to MRE development were mixed, with one participant preferring adaptive management while the other preferred mitigation hierarchy.
- The respondents were split on all statements regarding needs for small arrays, except for the need for regulators and advisors to be knowledgeable and trained on MRE technologies, environmental interactions, and other aspects of MRE projects. This suggests that targeted engagement and outreach efforts to share relevant resources, tools, and educational materials with Australian regulators and advisors could meaningfully support the environmental permitting process.

Similarities and differences were identified between the 2026 Australia Regulator Survey and the previous Australia Regulator Survey conducted by OES-Environmental in 2021 and published in 2022². The 2026 Australia Regulator Survey received two complete responses,

² Rose, D.; Freeman, M. (2022). MRE Regulator Survey Report: Australia. <https://tethys.pnnl.gov/publications/mre-regulator-survey-report-australia>

while the previous iteration received four complete responses. The participants in this survey were generally familiar with MRE technology including wave energy, tidal energy, and ocean current energy, while less familiar with riverine energy, salinity gradients, and ocean thermal energy conversion. Compared to the 2022 survey, Australian regulators and advisors may be more familiar with a broader range of MRE technology. The two Australian regulators and advisors represented in this survey are primarily concerned about effects of underwater noise and attraction, avoidance, and displacement from MRE on marine animals. This is consistent with the 2022 survey, highlighting there is still a strong need for more information sharing and research on these interactions. From the 2022 survey to the 2026 survey, concerns about changes to habitat decreased and concerns about collision risk increased. OES-Environmental has suggested that habitat change could be retired for small arrays, which could account for the decreased concern in changes to habitat. More information is needed to fully assess the interactions component of collision risk, and that knowledge gap could account for the increased concern in collision risk. Due to the low number of respondents, broader conclusions about changes in perceptions over time cannot be drawn. Both participants were familiar with Tethys, use Tethys to find papers and reports on environmental effects of MRE, and receive the Tethys Blast Newsletter. From the 2022 survey, none of the participants surveyed had ever heard of Tethys. This suggests that the work of OES-Environmental and Tethys to expand outreach on available tools and products has been successful in providing support to Australian regulators and advisors.

Therefore, a recommendation arising from this survey is to continue to engage with Australian regulators and advisors to share Tethys and OES-Environmental resources. Understanding regulators and advisors' needs and challenges over time helps address key barriers to the advancement of the MRE industry. By identifying these evolving needs, information and tools can be developed that are relevant in various contexts.

Appendix A

#	Question	Potential Choices
1	What level of government does your organization represent?	<ul style="list-style-type: none"> - Federal - State - Local - Other (please specify)
2	What country do you work in?	<ul style="list-style-type: none"> - Text box
3	How many MRE (wave, tidal, current, thermal or salinity gradient) projects are currently planned, permitted or operational in your jurisdiction?	<ul style="list-style-type: none"> - 0 - 1-5 - 6-10 - >10
4	Please indicate your agency's focus for permitting MRE projects. Check all that apply.	<ul style="list-style-type: none"> - Water quality - Marine mammals - Fish/fisheries - Other animals - Seabed and habitat - Oceanographic systems - Threatened/endangered/protected species - Energy production - First Nations significance and cultural/community importance - Social and economic aspects - Other (please specify)
5	Please indicate your role in permitting MRE projects. Check all that apply.	<ul style="list-style-type: none"> - Issue licenses/permits - Manage licenses/permits during operational phase - Advise regulators or provide consultations - Review/advise on applications for licenses/permits - Advise policy-level decisions in your agency - Subject matter expert - Other (please specify)
6	How long have you held a position related to the permitting process for MRE projects?	<ul style="list-style-type: none"> - Less than 1 year - 1-2 years - 3-5 years - >5 years
7	Have you directly participated in the regulatory process for an MRE project?	<ul style="list-style-type: none"> - Permitting - Management of an operational project - Decommissioning - No

8	<p>How familiar are you with the following MRE technologies on a scale of 1 (not familiar) to 5 (very familiar)? For more information on these technologies, see https://openei.org/wiki/PRIMRE/Basics.</p>	<ul style="list-style-type: none"> - Ocean current energy - Tidal energy - Wave energy - Ocean thermal gradient conversion (OTEC) - Salinity gradient - Riverine energy
9	<p>How challenging are the following MRE environmental effects when permitting small arrays (1-6 devices)? Rank the below options from 1 (most challenging) to 7 (least challenging).</p>	<ul style="list-style-type: none"> - Effects of electromagnetic field emissions from underwater cables and other electrical infrastructure on marine animals - Attraction, avoidance, or displacement of marine animals - Changes to habitats - Effects of underwater noise from devices on marine animals - Risk of marine animals colliding with turbine blades - Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.) - Entanglement of large marine animals with mooring lines and underwater cables
10	<p>Based on your top-ranked response from Question 9, how strongly do you agree or disagree with the following statements for small arrays (1-6 devices)?</p>	<ul style="list-style-type: none"> - Additional research/studies are needed to better understand the likely risk - Field data are needed to determine the risk and uncertainty of an MRE project - Validated numerical models are needed for environmental permitting - Agency/policy guidance is needed to interpret potential environmental risk and manage uncertainty - Regulators/advisors need to be knowledgeable and trained on MRE technologies, environmental interactions, etc. - Additional monitoring methods, instruments, etc. are needed to document environmental interactions
11	<p>How challenging are the following MRE environmental effects when permitting large arrays (greater than 6 devices)? Rank the below options from 1 (most challenging) to 9 (least challenging).</p>	<ul style="list-style-type: none"> - Effects of electromagnetic field emissions from underwater cables and other electrical infrastructure on marine animals - Attraction, avoidance, or displacement of marine animals - Changes to habitats - Effects of underwater noise from devices on marine animals - Risk of marine animals colliding with turbine blades - Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.) - Entanglement of large marine animals with mooring lines and underwater cables - Cumulative effects with other anthropogenic activities/marine developments, including other MRE projects - Ecosystem-wide effects
12	<p>Based on your top-ranked response from Question 11, how strongly do you agree or disagree with the following statements for large arrays (greater than 6 devices)?</p>	<ul style="list-style-type: none"> - Additional research/studies are needed to better understand the likely risk - Field data are needed to determine the risk and uncertainty of an MRE project - Validated numerical models are needed for environmental permitting

		<ul style="list-style-type: none"> - Agency/policy guidance is needed to interpret potential environmental risk and manage uncertainty - Regulators/advisors need to be knowledgeable and trained on technologies, environmental interactions, etc. - Additional monitoring methods, instruments, etc. are needed to document environmental interactions
13	Do any of the following statements describe a barrier to permitting for you or your organization regarding environmental effects of MRE projects? Select all that apply.	<ul style="list-style-type: none"> - Insufficient guidance for managing environmental risks - Limited availability of research or environmental monitoring data - Inadequate technical knowledge of MRE devices - Lack of expertise and/or access to subject matter experts - Difficulty accessing information/data from other MRE projects or jurisdictions/locations - Scientific uncertainty regarding environmental effect - Low social acceptance or public opposition to MRE projects
14	Can environmental data collected at other locations be used to inform permitting processes for proposed MRE developments within your jurisdiction?	<ul style="list-style-type: none"> - Never - Maybe - Absolutely - Comment box: Please explain your answer.
15	Risk retirement is a process by which available data and information are examined to identify environmental effects that are unlikely to cause significant effects on marine habitats, animals, or ecosystem processes. These effects can therefore be retired and may not require extensive investigation for each new MRE project. Can any of the following potential risks be retired for small arrays (1-6 devices) in your jurisdiction? (Strongly disagree, disagree, neutral, agree, strongly agree)	<ul style="list-style-type: none"> - Effects of electromagnetic field emissions from underwater cables or other electrical infrastructure on marine animals - Changes to habitats - Attraction, avoidance, and displacement of marine animals - Effects of underwater noise from devices on marine animals - Risk of marine animals colliding with turbine blades - Changes in oceanographic systems (e.g., energy removal, sediment transport, etc.) - Entanglement of large marine animals with mooring lines and underwater cables - Comment box: For environmental effects that cannot be retired, please explain
16	Which of the following approaches best describes your strategy for managing environmental risks and uncertainties during the permitting process when moving from small arrays (1-6 devices) to large arrays (greater than 6 devices)? (Choose one)	<ul style="list-style-type: none"> - Precautionary principle. Potential environmental risks should be avoided through preventative measures and consideration of alternatives to avoid unacceptable impact, particularly when there is scientific uncertainty. Project proponents are responsible for proving that a risk will not cause irreversible environmental harm. - Mitigation hierarchy. Potential environmental risks should be systematically limited by taking actions to avoid, minimize, mitigate and/or compensate for risks through siting and/or mitigation measures. - Adaptive management. Potential environmental risks and scientific uncertainty can be managed through a flexible, learning-based approach that includes adapting monitoring and mitigation over time to understand risks, decrease uncertainty, and mitigate impacts. - Survey, deploy, monitor. Potential environmental risk level should be identified through surveys or available data at a proposed project site. If low risk, permitting may be fast-tracked. If high risk, the project may require additional surveys. Surveys and post-deployment monitoring

		<p>should be based on a risk-based approach and proportionate to the project scale.</p> <ul style="list-style-type: none"> - Comment box: Please explain your answer or note a different approach used.
17	<p>MRE devices are being designed for uses other than supplying electricity to the national grid. These systems are likely to consist of fewer and/or smaller-scale devices, to provide power to remote, coastal, or island communities or at-sea applications such as aquaculture, ocean observations, and navigation. Would the permitting process for these smaller MRE projects differ from national grid scale projects in your jurisdiction?</p>	<ul style="list-style-type: none"> - Open comment box
18	<p>Tethys (https://tethys.pnnl.gov/) is an online knowledge hub with information and resources on the environmental effects of MRE. Have you heard of Tethys?</p>	<ul style="list-style-type: none"> - Yes - No
19	<p>After learning about Tethys, is it likely that you will explore it further?</p>	<ul style="list-style-type: none"> - Yes - No - Maybe
20	<p>Do you find Tethys useful?</p>	<ul style="list-style-type: none"> - Not useful - Somewhat useful - Very useful
21	<p>How do you use Tethys? Indicate all that apply.</p>	<ul style="list-style-type: none"> - To find papers and reports on environmental effects of MRE - To view live or archived webinars and expert forums - To receive the Tethys Blast newsletter - To find project information (e.g., OES-Environmental metadata) - To use tools and resources (e.g., data discoverability matrix, management measures tool, etc.) - Other (please specify)
22	<p>What resources or methods do you use to find information on the environmental effects of MRE and support permitting? (check all that apply)</p>	<ul style="list-style-type: none"> - Other regulators/colleagues - MRE project developers - Conferences/workshops - Newsletters - Scientific journals - Government agency reports - Tethys - Other (please specify)