MRE REGULATOR SURVEY

Report on the PNNL study of MRE regulator perceptions on permitting MRE devices

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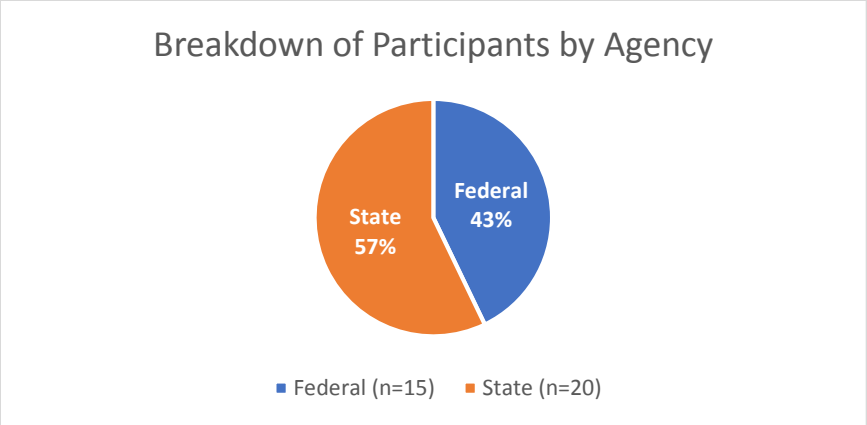
Introduction

As the marine renewable energy (MRE) industry moves forward around the world, there continues to be concerns about potential environmental effects of devices and systems on marine animals, habitats, and ecosystem processes. Much of this perceived risk may be due to the large uncertainties about how tidal and wave devices might interact with the environment, and how marine mammals and other species may behave around single devices or arrays of energy converters. This makes the regulatory and consenting process for permitting MRE developments challenging, especially as permitting processes are not well established for wave and tidal developments. Additionally, other marine uses also create concerns for marine species. This, coupled with insufficient knowledge of ocean environments in high energy areas, creates caution during permitting and consenting processes for MRE devices.

This cautious approach to permitting and consenting process may hinder the ability of the MRE industry to advance their technologies to the same degree as other, lower cost renewable energy sources. To better understand views on risks, conflicts, and challenges associated with potential environmental effects of MRE devices, United States regulators (both federal regulators and those from coastal states) who may be involved in permitting MRE devices were engaged. Following an online webinar on Environmental Effects of Permitting MRE Developments where the state of the science of environmental effects was discussed, an online survey was developed to further understand needs and challenges faced when permitting an MRE development. An invitation to participate in the survey was sent out to the regulators who were invited to the webinar. The survey aimed to understand the familiarity of regulators with MRE technologies, perceptions of environmental challenges, and thoughts on best approach to MRE development and data transferability. The survey also included some questions to gather *Tethys* user data.

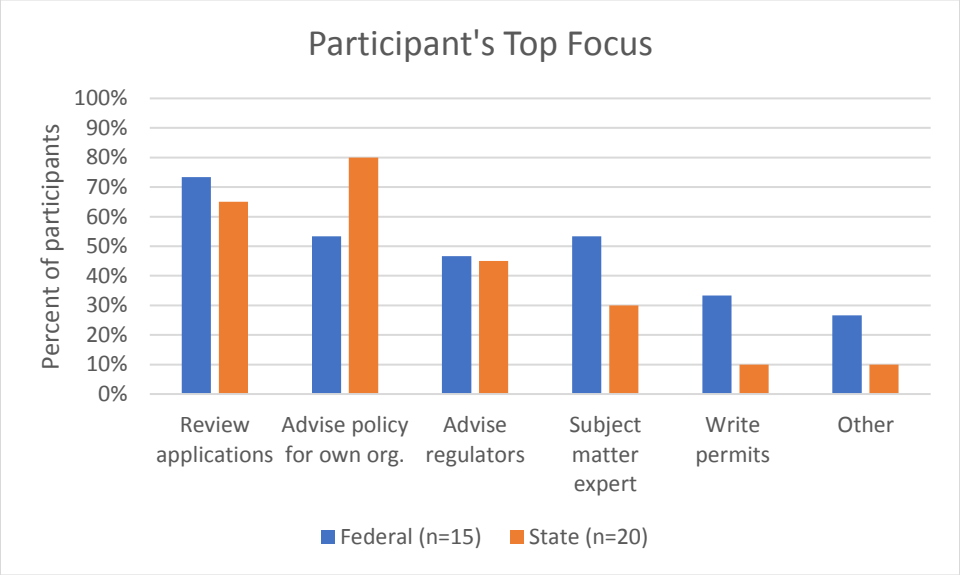
Participants

Email invitations to participate in the survey were sent to 200 individuals known to be working in the MRE regulation field. 36 participants completed the survey, an 18% response rate, however only 35 participants' responses were retained for analysis due to a significant portion of incomplete data in 1 response. Of these 35, 15 participants worked in federal agencies and 20 worked for state agencies. No participants indicated they worked at the county or local level. The majority of participants have directly participated in the environmental permitting of an MRE device (60% federal, 65% state).



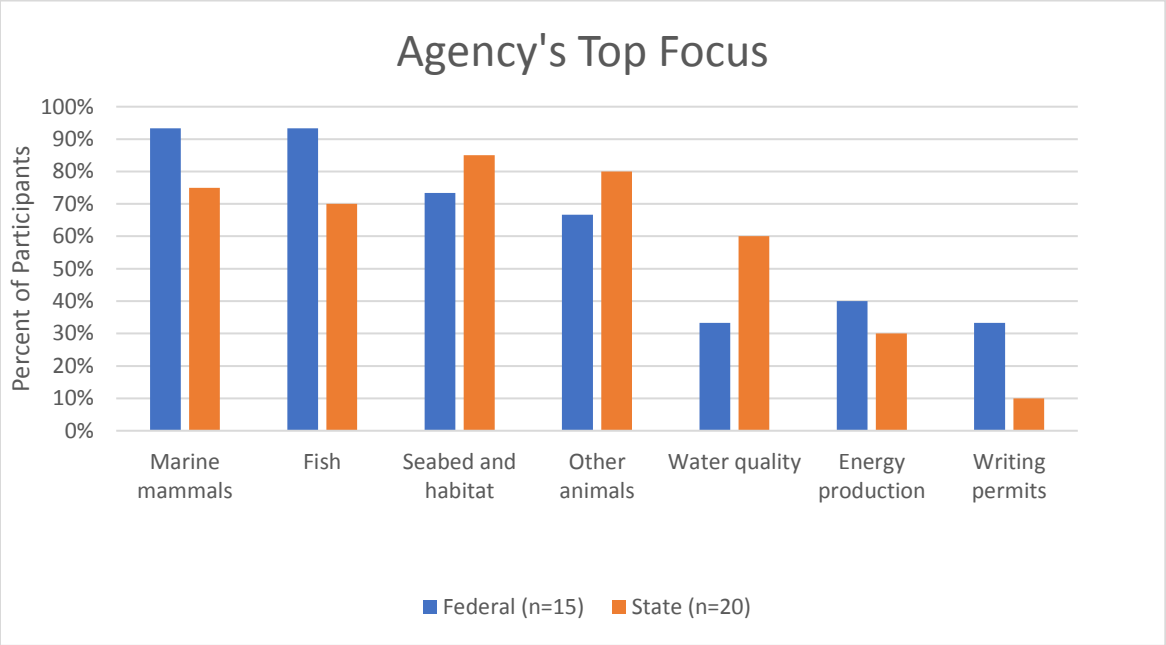
Top focus for participant and participant's agency

Participants were asked to indicate the top focus of their own role in permitting MRE developments among 6 choices: write permits, advise regulators, review applications, advise policy level decisions in your agency, subject matter expert, and other. Reviewing applications and advising policy in their organizations were the top two roles. Writing permits was the bottom focus for participants in both federal and state agencies, excepting the "other" category. Items listed in the other category for federal agencies were: conduct consultation on federal actions, manage ESA consultations for actions involving MRE, regulatory, and review permits after written. The items listed for state agencies were coastal consistency certifications issued and CZMA federal consistency.



Note: This was a "select all that apply" question, so percentages exceed 100%. Percentage was calculated per group, for example, the number of participants who reviewed applications was divided by 15 in the federal group and 20 in the state group. Similar calculations are used throughout this report.

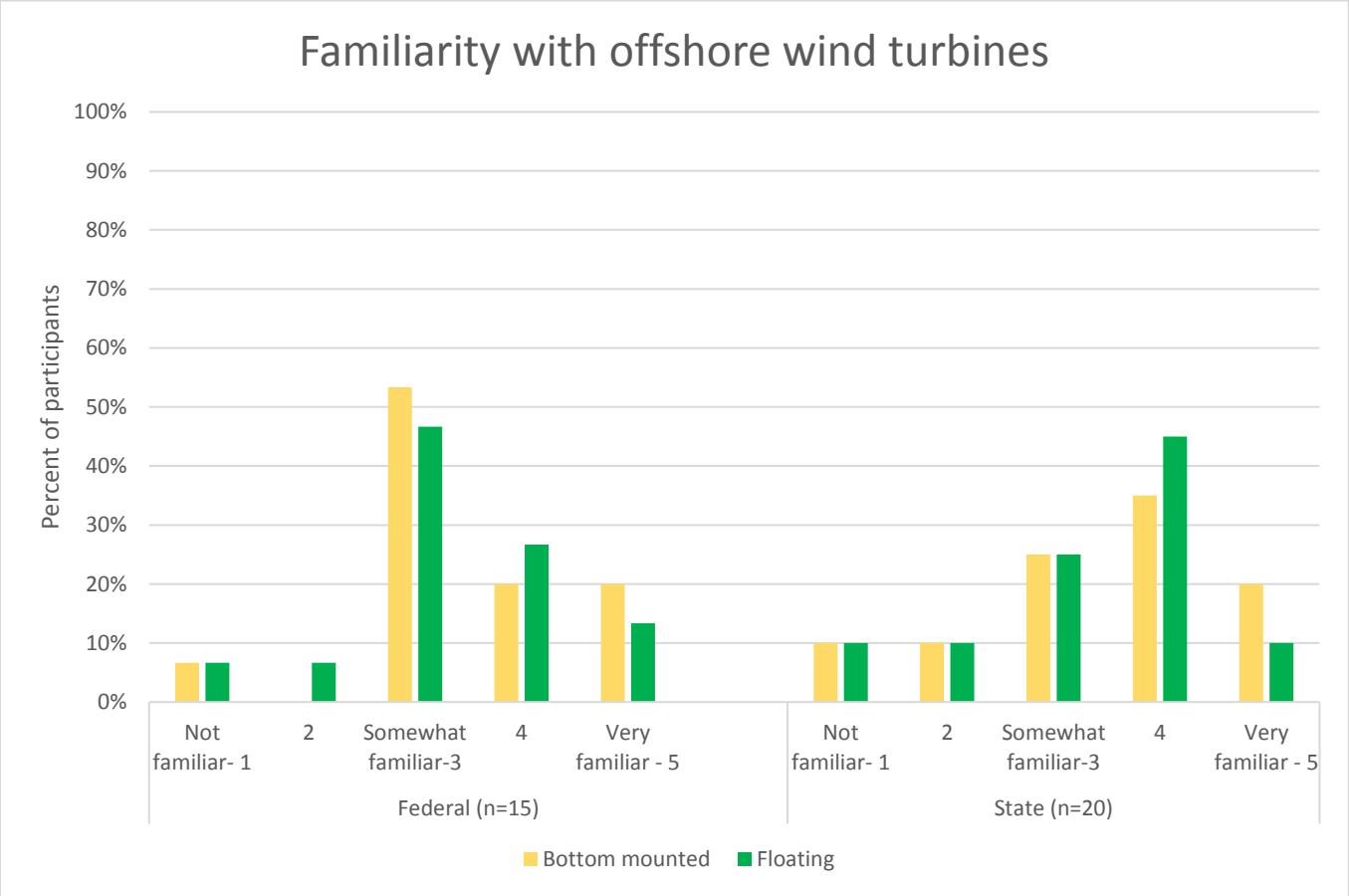
There were eight options for the top focus for agencies: water quality, marine mammals, fish, other animals, seabed and habitat, energy production, and other. The top focus for agency varied depending upon federal or state designation. For federal agencies, marine mammals and fish were the top focus when permitting MRE developments. For state agencies, seabed and habitat and other animals were the top focus. It is likely that the other animals that came to mind for these regulators were birds, sea turtles, and/or invertebrates. In the "other" category, one federal regulator wrote “turtles where applicable.”

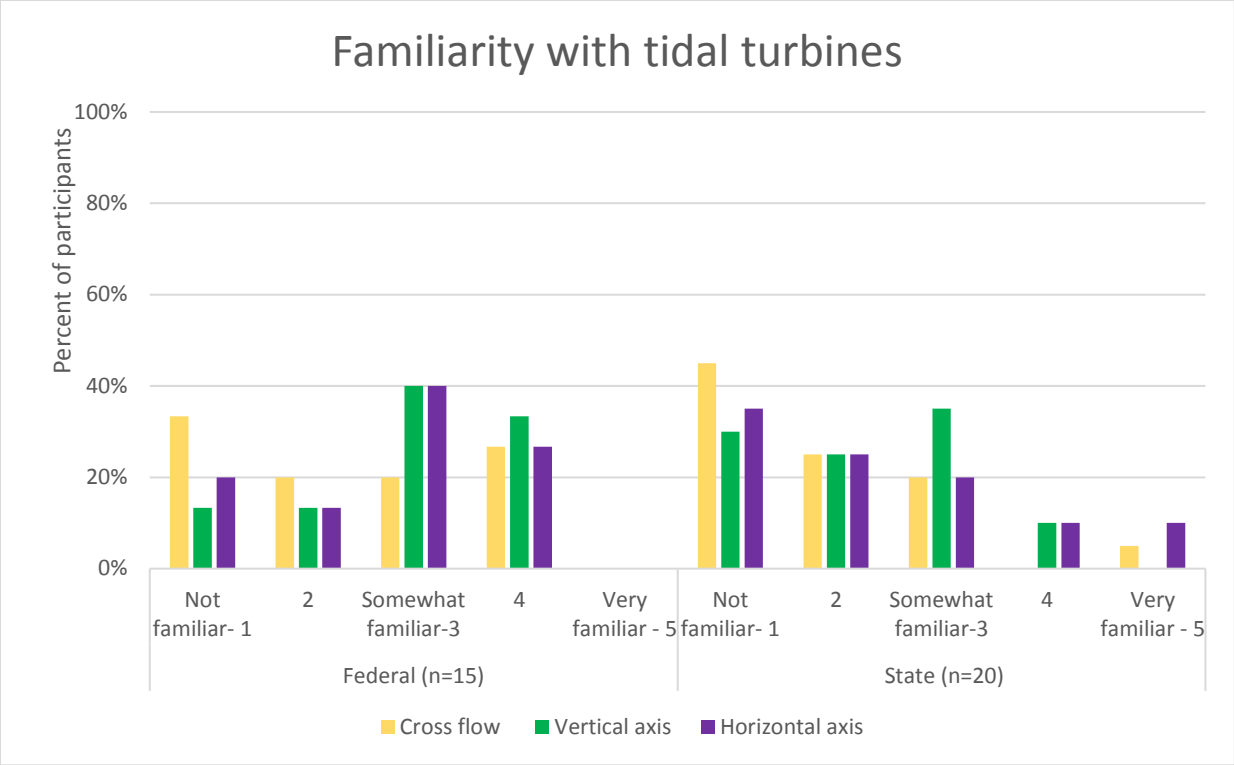


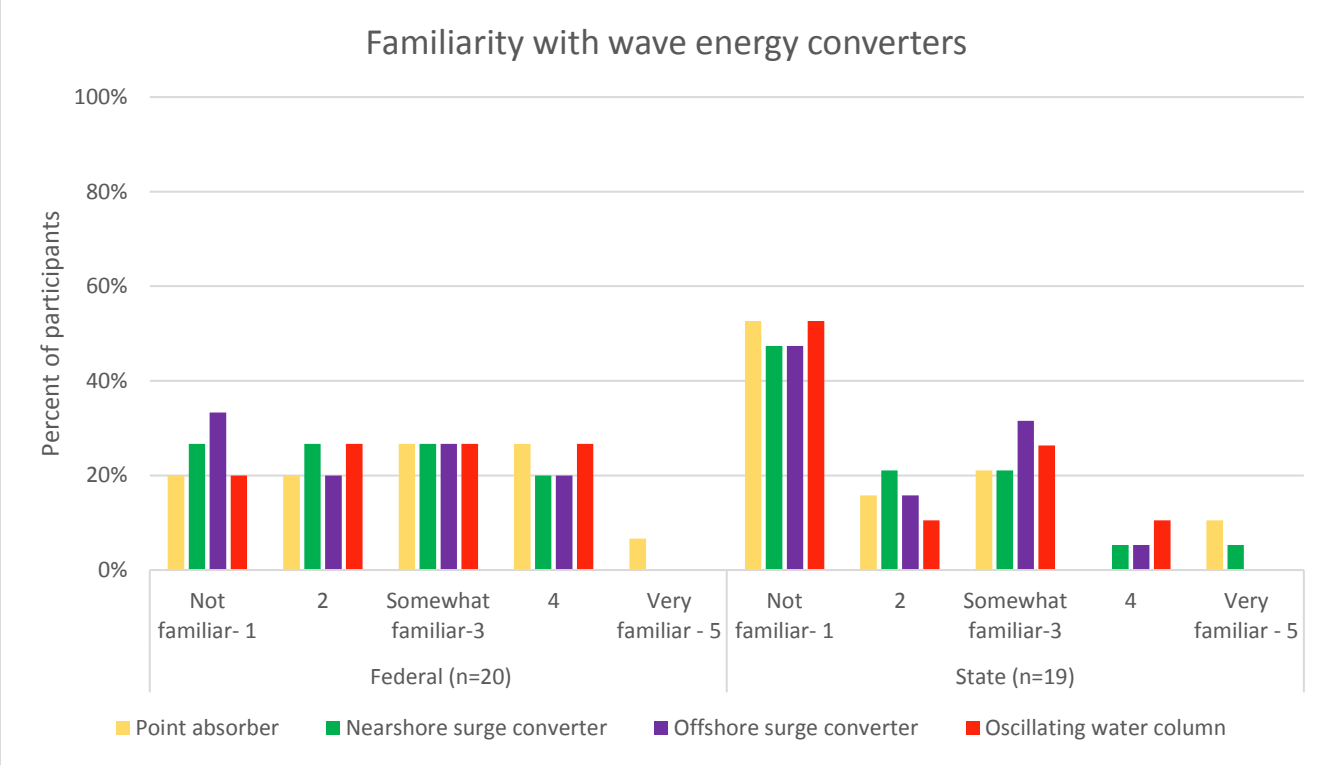
Note: This was a “select all that apply” question, so percentages exceed 100%.

Familiarity with MRE technologies

Overall, familiarity with specific technologies was low. However, offshore wind technologies were the most familiar to participants. It was expected that federal participants would be more familiar with these technologies and in general this seems to be true but it is less clear in the case of offshore turbines.




Familiarity with tidal turbines
Percent of participants
100%
80%
60%
40%
20%
0%
Not familiar- 1
2
Somewhat familiar-3
4
Very familiar - 5
Federal (n=15)
Not familiar- 1
2
Somewhat familiar-3
4
Very familiar - 5
State (n=20)
Cross flow
Vertical axis
Horizontal axis


Familiarity with wave energy converters
Percent of participants
100%
80%
60%
40%
20%
0%
Not familiar- 1
2
Somewhat familiar-3
4
Very familiar - 5
Federal (n=20)
Not familiar- 1
2
Somewhat familiar-3
4
Very familiar - 5
State (n=19)
Point absorber
Nearshore surge converter
Offshore surge converter
Oscillating water column

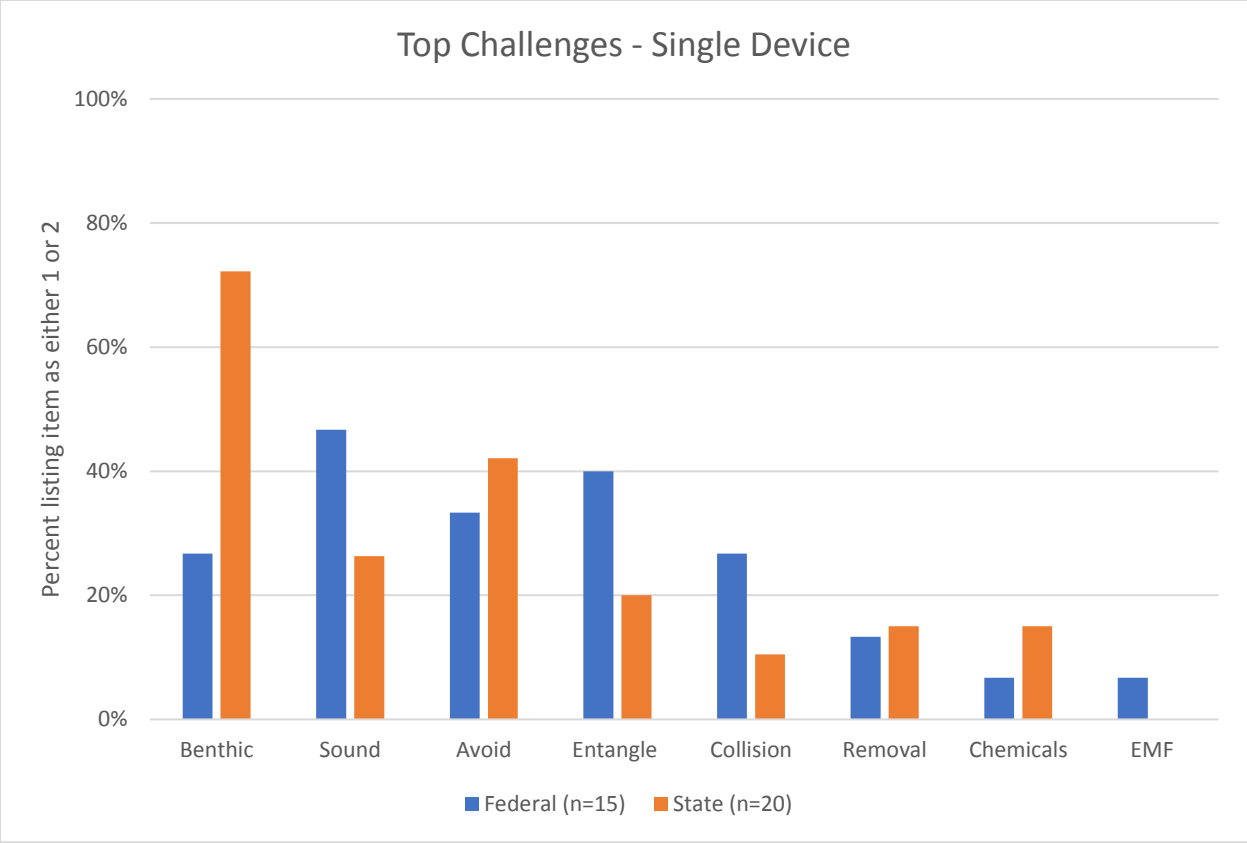
Top challenges

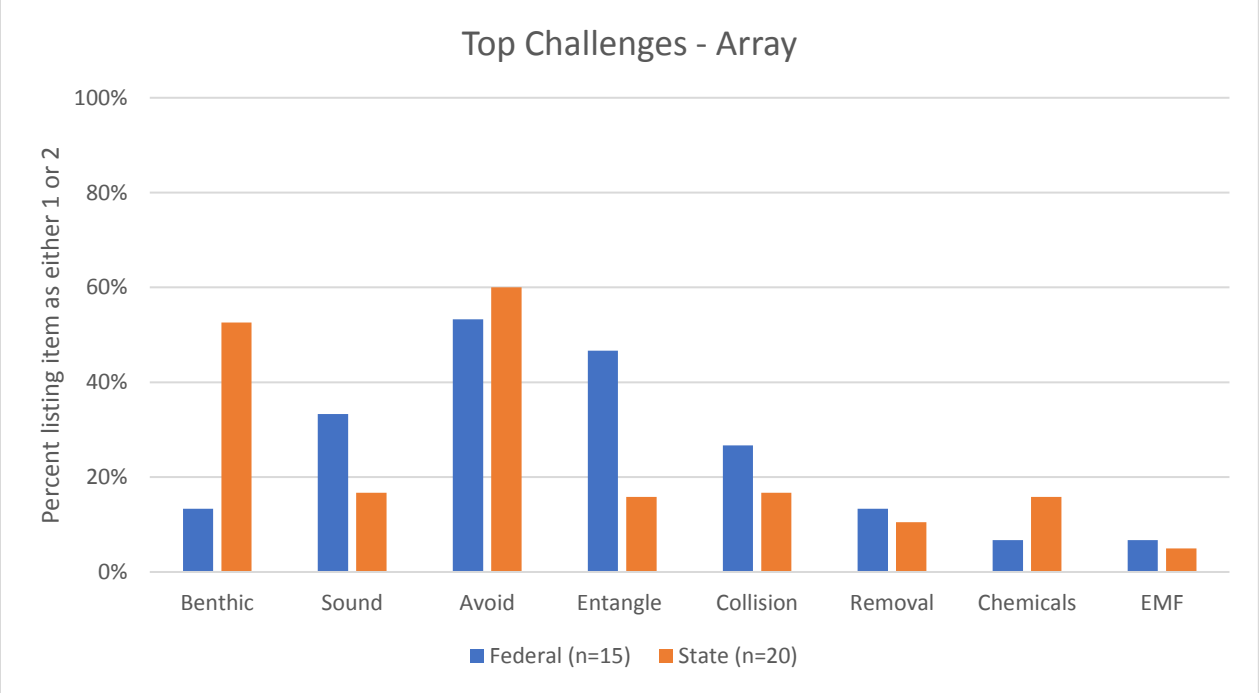
Participants were asked to rank the challenges for permitting a single device and then an array. They were given 8 challenges and asked to rank them from 1 (most important) to 8 (least important). The charts below show the percentage of participants that ranked each challenge as either a 1 or a 2 (most important or second most important). For ease of reading, the charts use the following shorthand on the X axis.

Shorthand abbreviations for challenges	
Benthic	Benthic/ habitat destruction
Sound	Effects of underwater sound emissions from devices on animals
Avoid	Avoidance, attraction, and/or displacement of animals
Entangle	Entanglement of animals with lines and cables
Collision	Risk of animals colliding with underwater devices
Removal	Energy removal and effects of changes in flow on the ecosystem
Chemicals	Chemical releases and water quality degradation
EMF	Electromagnetic field (EMF) effect on animals

Ratings vary both by federal or state agency and by device vs array. For federal agencies, "Effects of underwater sound emissions from devices on animals" was the most important challenge for a single device, whereas for an array "Avoidance, attraction, and/or displacement of animals" became the most important. For state agencies, the focus differed for a single device. "Benthic/habitat destruction" was the most important challenge for a single device whereas "Avoidance, attraction, and/or displacement of animals" was the most important for an array. No difference is noted for the most important challenge for an array between state and federal.

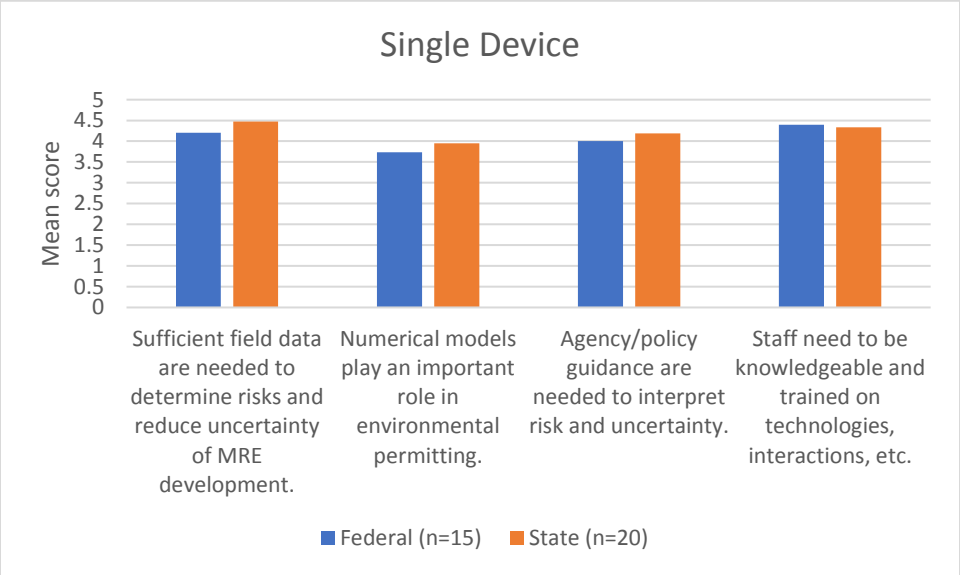
These tables only show what the two most important challenges were, and it is possible a different pattern might arise if looking at the rankings of all the challenges. Appendix A includes two matrices designed to show how all participants ranked all the challenges, split by federal and state regulators for both a single device and an array. The individual responses back up the pattern seen for the top challenges.


Top Challenges - Single Device
100%
80%
60%
40%
20%
0%
Percent listing item as either 1 or 2
Benthic
Sound
Avoid
Entangle
Collision
Removal
Chemicals
EMF
Federal (n=15)
State (n=20)

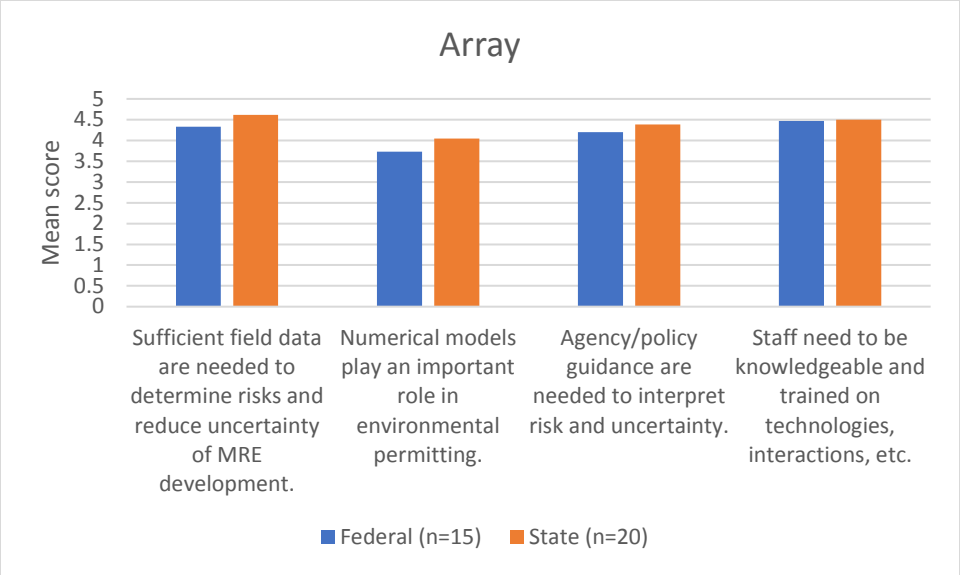

Top Challenges - Array
100%
80%
60%
40%
20%
0%
Percent listing item as either 1 or 2
Benthic
Sound
Avoid
Entangle
Collision
Removal
Chemicals
EMF
Federal (n=15)
State (n=20)

Perceptions of challenges for permitting single device and array

Participants were asked how strongly they agreed or disagreed[1] with 4 different statements concerning their top challenge (indicated in the previous question) for permitting a single device as well as an array. No notable differences existed between state and federal or single device or an array. There was a high level of agreement across all statements, but especially that "sufficient field data are needed to determine risks and reduce uncertainty of MRE development" and "staff need to be knowledgeable and trained on technologies, interactions, etc."

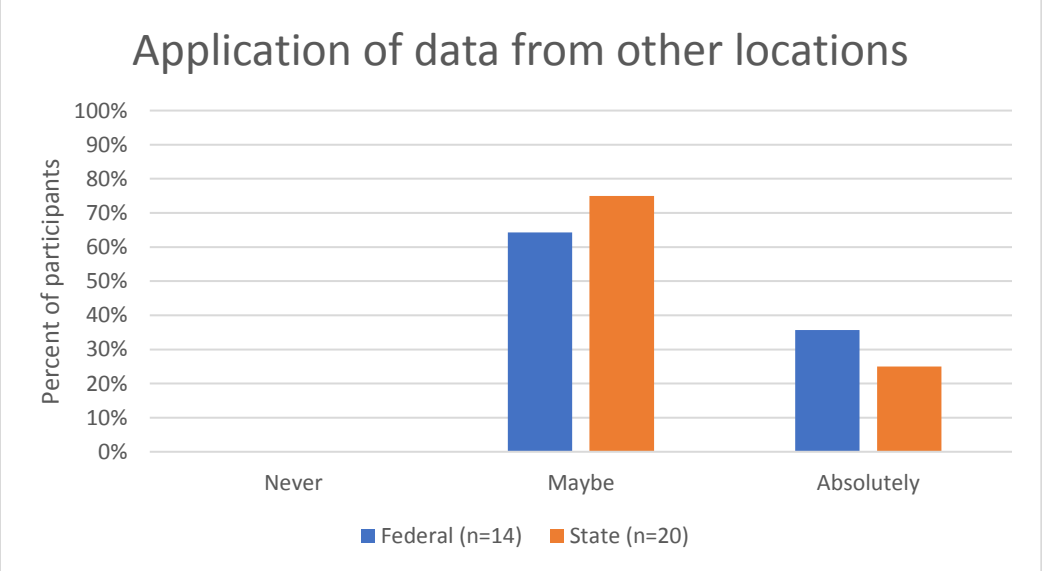


[1] 5 = strongly agree



Application of data from other locations

Survey participants were asked “can data collected from other locations be applied towards environmental permitting within your jurisdiction?” They were given the option of “never” “maybe” and “absolutely.” None of the participants chose the never category. Interestingly, whereas more state regulators thought “maybe,” slightly more federal regulators thought “absolutely.”

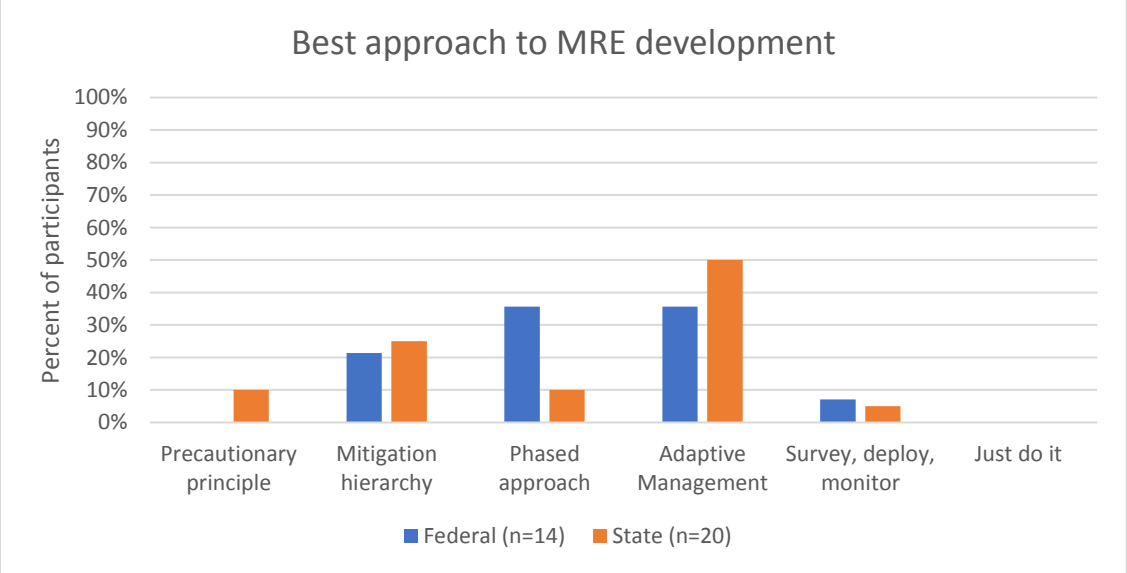


Best approach to MRE development

Participants were asked, “which of the following approaches best describes your vision of how the MRE industry should develop? (Choose one).” The options were:

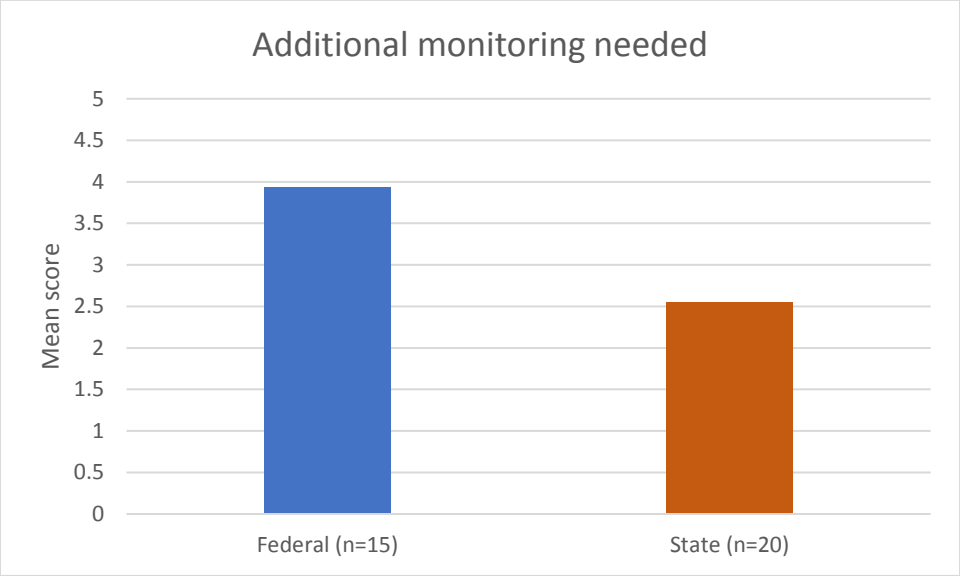
a. **Precautionary principle.** There is a high degree of uncertainty and potentially negative outcomes associated with MRE deployment and operation. Measures should be taken to avoid the negative outcome by proceeding very cautiously or not pursuing projects at all.
b. **Mitigation hierarchy.** Impacts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

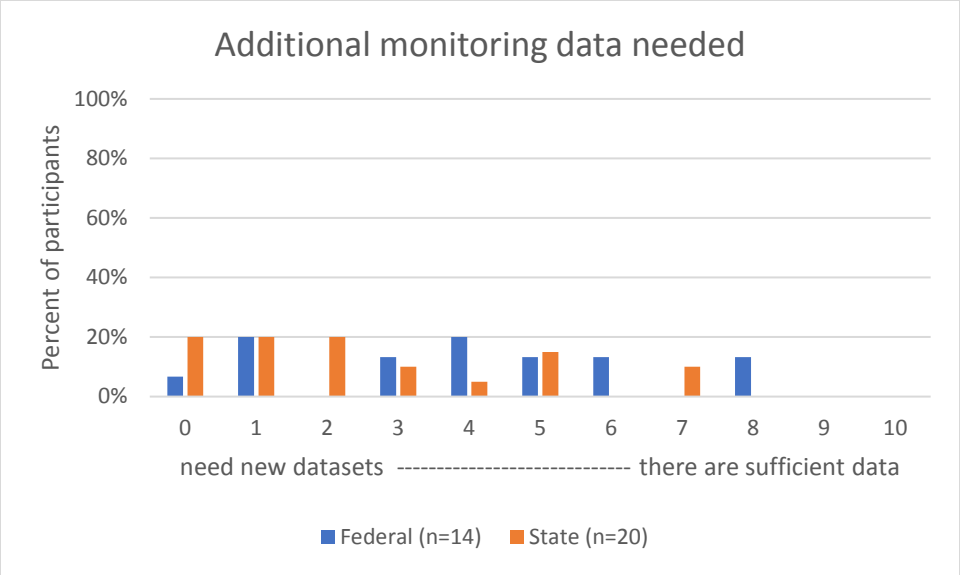
For federal regulators, phased approach and adaptive management were equally preferred. For state regulators, adaptive management was the preferred approach.



Participants were then asked, “How strongly do you feel additional monitoring data are needed (to decrease scientific uncertainty)?” They were prompted to respond based on their answers for the single device question. They responded on a sliding cursor, with labels assigned at the left hand side of the scale “need new datasets (high level of uncertainty)” (0) and the right hand of the scale “There are sufficient data (very low uncertainty)” (10).

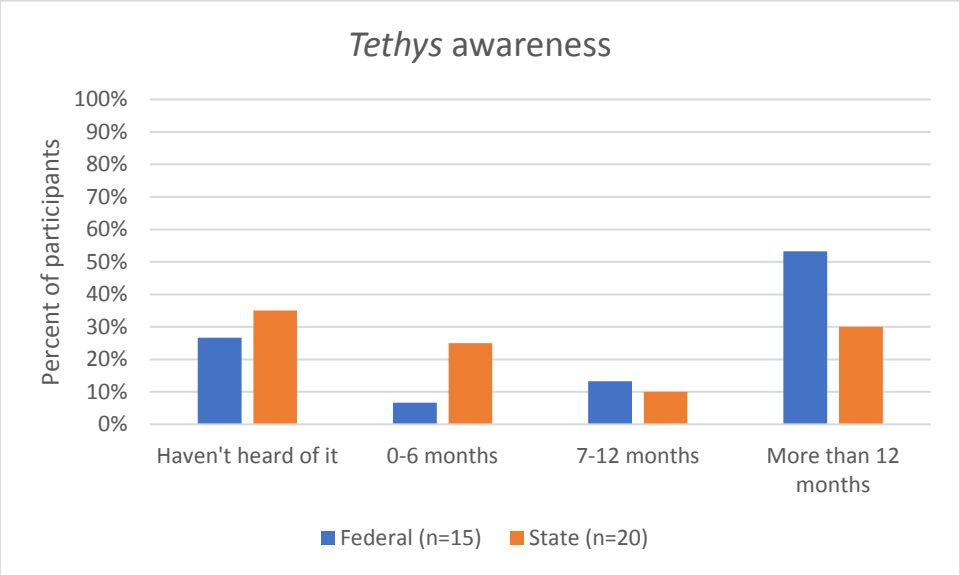
Mean scores varied with federal regulators feeling less strongly that additional monitoring was necessary (federal 3.93(2.49) and state 2.55(2.26) respectively). No regulator, federal or state, believed that we currently had sufficient data. Given the large standard deviation for these mean scores, this finding should be interpreted with caution. Median score for federal regulators was 4, for state regulators it was 2. Also included is a chart that shows the distribution across the values of the sliding scale from 1 (need new datasets) to 10 (there are sufficient data).



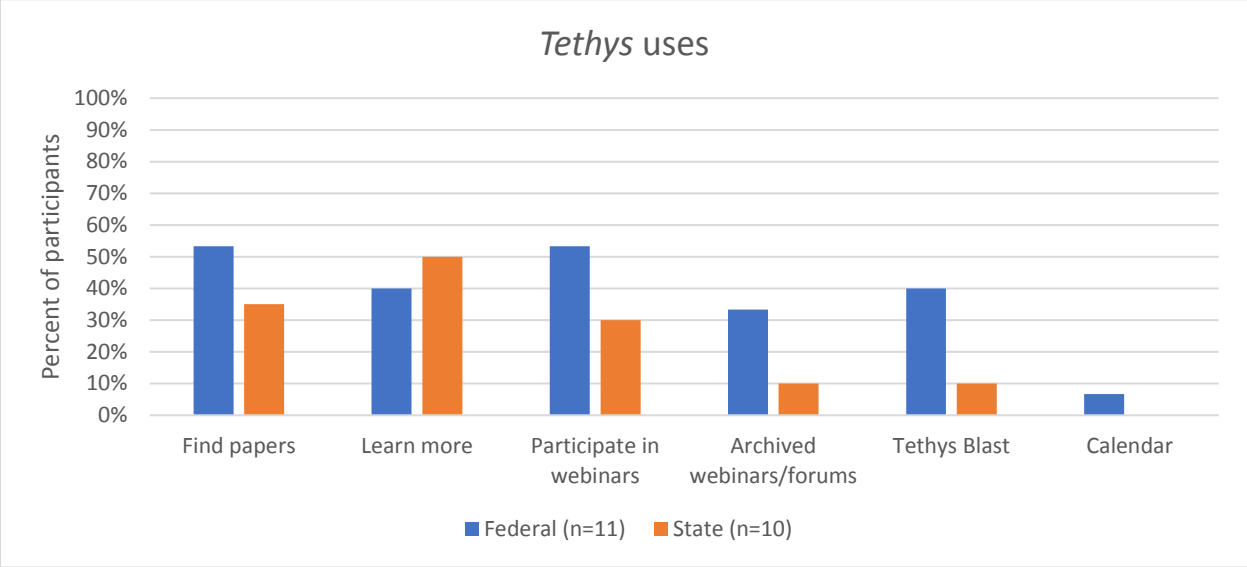


The use of *Tethys*

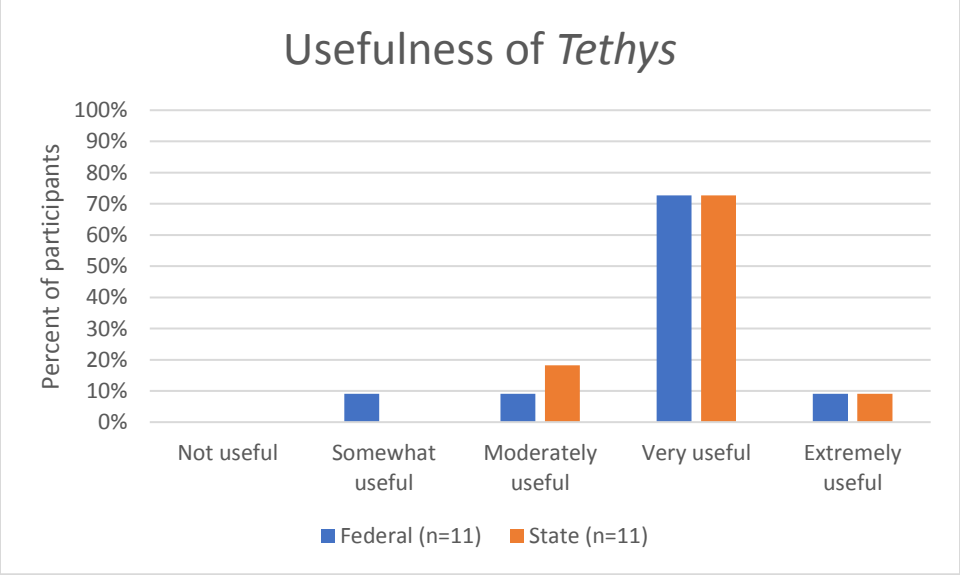
Participants were asked how long they had been aware of *Tethys*, if at all. Participants varied in the length of time they had known of *Tethys*, with the majority of federal regulators knowing about it for more than 12 months. State regulators were equally split at 33.3% between never hearing of it to more than 12 months, with an even smaller percent ranging from 0-6 and 7-12 months.



Participants who had heard of *Tethys* were asked how they used *Tethys*. They could select as many uses that were applicable. Overall, more federal regulators indicated use of *Tethys* than their state counterparts. One exception is that state regulators were more likely to use *Tethys* to learn more about the environmental effects of the MRE industry.

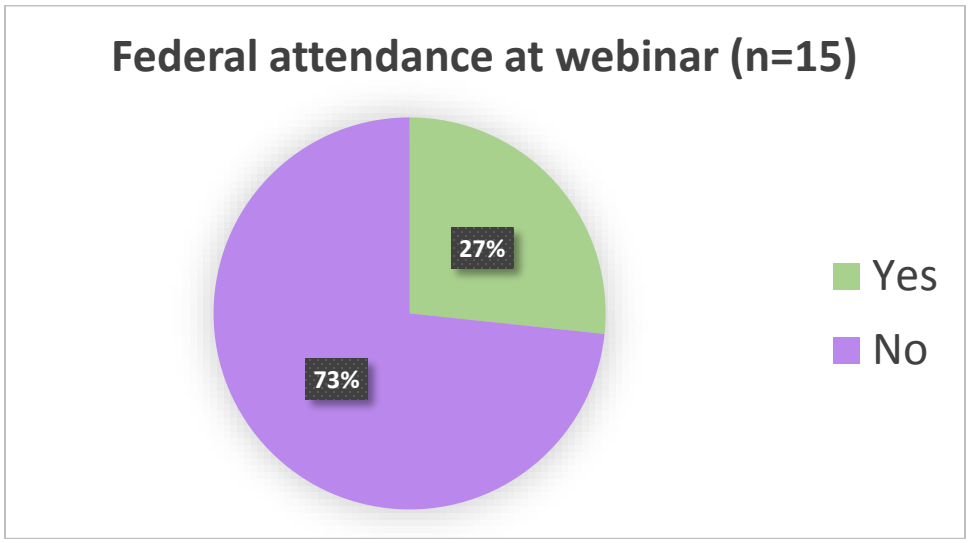


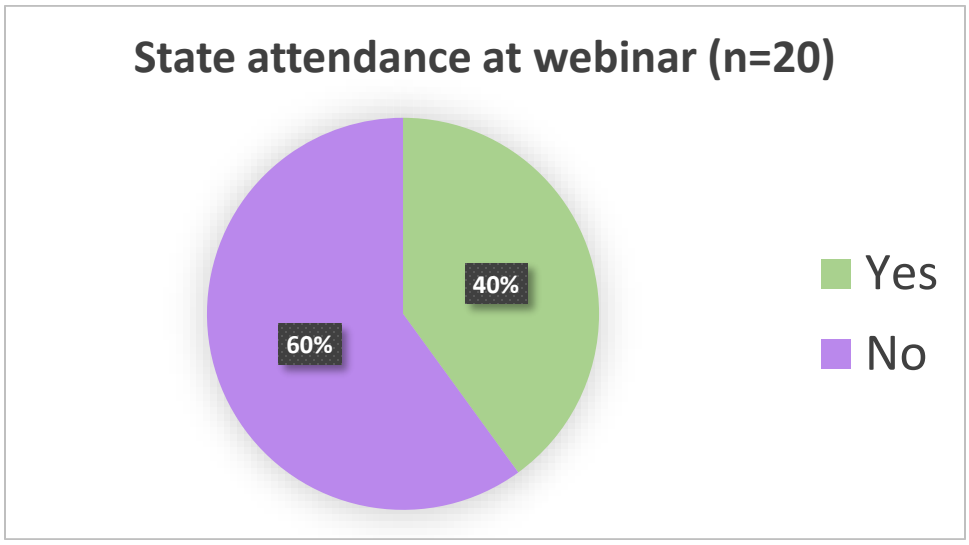
In general, participants who had heard of *Tethys* found *Tethys* to be very useful. Federal and state regulators had similar scores, except for one federal participant indicating that *Tethys* was somewhat useful.



Attendance at webinar

The Environmental Effects of Permitting MRE Deployments Webinar was held on March 29th, 2017. Participants were asked if they either attended or viewed the webinar on line. 27% of federal regulators and 38% of state regulators attended or viewed the webinar.





Discussion

This findings in this report indicate how familiar state and federal regulators are with various types of MRE and what the top challenges are. It makes sense that the top challenges differed for state and federal regulators, as the responsibilities of these agencies differ. The state has jurisdiction over submerged waters and commonly researches benthic habitats. Therefore, it is no surprise that benthic and habitat destruction emerges as a top challenge for a single device for the state.

There is indication that all participants perceive a difference in impact between a single device and an array as different challenges come into focus. Avoidance, attraction, and displacement of animals was the top challenge for both and state regulators at the level of an array. This highlights the importance of scale and the necessity to specify whether one is asking about the challenges/impacts of one device, a small array of 10 or so, or a much larger commercial scale array. Scale matters.

It may also be assumed that perceived risk increases with scale, however we do not have the data to test that hypothesis here. However, the preferred approach for management may serve as a proxy for participants risk tolerance/aversion. The more risk tolerant one is, the more likely they would favor survey, deploy, monitor where as a risk averse regulator may favor the precautionary principle. More research is needed to test perceived risk and risk tolerance.

The idea of transferability is worth further exploring. No participants indicated that data collected from other locations could “never” be applied towards environmental permitting within their jurisdiction. Furthermore, 25% of state and 36% of federal regulators indicated that it could “absolutely” be applied. Data transferability could reduce challenges and timely and expensive monitoring in regard to permitting.

This study does have a few limitations. In asking about the challenges, we did not separate out tidal, wave, or offshore wind. It may be that offshore wind is driving the responses due to the familiarity with wind. It is advisable that future studies separate these out, and perhaps not include wind at all, if tidal and/or wave energy is the main interest.

Another limitation is potentially the way in which the question, “How strongly do you feel additional monitoring data are needed (to decrease scientific uncertainty)” was asked. Results from this question were hard to interpret and should be taken with caution. Future research should pilot better ways to understand whether participants believe more monitoring data is needed to reduce uncertainty.

Next Steps for Outreach

Results from this study and from multiple PNNL meetings discussing this topic highlight a few areas for outreach efforts to be concentrated.

1. Continued outreach focused on familiarity with wave and tidal technologies. Particularly state regulators indicated less familiarity with wave and tidal technologies. In order for regulators to be able to successfully permit MRE developments they need to fully understand the technologies that they are regulating and permitting. By educating regulators, and specifically state regulators, we hope to improve their understanding of wave and tidal technologies, which can help better understand environmental effects and perceived risks versus actual risks.

2. Education outreach focused on highly rated challenges. The highest rated challenges were effects of underwater noise and benthic/habitat destruction for single devices and avoidance, attraction and/or displacement of animals for arrays. Gaining an understanding of why regulators feel these are the biggest challenges can help focus education outreach. Also conducting education outreach where concern does not match actual risks would be beneficial.

3. Better information regarding the thresholds for certainty. This includes understanding how much uncertainty is acceptable as well as how this compares to other energy industries. For instance, is the MRE industry being held to greater demand of certainty than other energy industries? One example of this is the industry being asked to provide data that there is no collision risk for tidal devices, however the cost of monitoring is high and the chance of getting data on a collision event is unlikely. Some see it as trying to prove the negative). Having a good understanding of how much certainty is enough (or how much uncertainty is acceptable) to retire a risk will aid in developing monitoring plans for MRE developments and future research needs.

4. Opportunities to discuss data transferability and collection consistency. No regulators felt that data collected from other locations can never be applied towards environmental permitting within their jurisdiction. This is a good starting point to begin discussing data transferability, especially as 25% of state and 35% of federal regulators said they would absolutely use data from other locations. Collecting monitoring data for MRE developments can be timely and costly, and improving the potential to transfer data from one location to another can help decrease barriers to MRE developments.

Appendix

This appendix includes three tables. The first is the shorthand abbreviations for the challenges that the respondents ranked for both a single turbine and an array. The second and third tables are color coated matrices designed to better understand patterns in the top challenges by showing how all participants ranked their challenges, split by federal and state regulators. Top challenges are ranked as “1” and are represented by the boldest red color whereas the lowest challenges are ranked as “8” and are represented by the lightest color. Empty grey cells indicate no response on that rating by the participant. The second table contains all the rankings from each respondent for each challenge for a single turbine. The third table is the same as the second, except it corresponds to challenges for an array.

Shorthand abbreviations for challenges	
Benthic	Benthic/ habitat destruction
Sound	Effects of underwater sound emissions from devices on animals
Avoid	Avoidance, attraction, and/or displacement of animals
Entangle	Entanglement of animals with lines and cables
Collision	Risk of animals colliding with underwater devices
Removal	Energy removal and effects of changes in flow on the ecosystem
Chemicals	Chemical releases and water quality degradation
EMF	Electromagnetic field (EMF) effect on animals

Single Turbine Challenges Ranked by Respondent								
	Sound	Avoid	Benthic	Cable	Collision	Energy	EMF	Chemicals
Federal	3	2	5	1	8	6	4	7
	2	7	4	1	3	5	6	8
	2	1	4	3	7	5	8	6
	1	3	6	4	5	2	7	8
	5	3	1	4	2	8	7	6
	3	5	4	1	7	6	2	8
	3	6	4	5	1	2	8	7
	3	5	1	2	6	7	4	8
	7	5	2	4	3	6	8	1
	1	3	2	8	4	5	7	6
	2	3	6	5	1	8	7	4
	2	1	3	5	7	8	6	4
	1	4	6	2	7	8	3	5
	3	2	6	4	1	7	5	8
	4	1	5	2	3	7	8	6
State	7	4	1	5	8	6	3	2
	5	2	1	6	3	8	4	7
	5	6	8	3	4	2	7	1
	3	1	2	4	8	6	5	7
	7	1	3	5	4	2	8	6
	5	1	2	4	7	8	3	6
	2	3	1	5	4	8	7	6
	1	3	5	2	6	7	4	8
	2	6	1	5	4	8	3	7
	3	1	2	4	8	6	7	5
	3	4	1	2	5	6	8	7
	4	1	6	3	2	8	5	7
	3	1	2	6	4	7	5	8
	7	3	1	4	6	8	5	2
		8		6	7	2		3
	5	3	2	4	1	6	7	8
	2	1	3	4	7	6	5	8
	5	4	1	2	3	7	6	8
	6	5	1	2	3	8	7	4
	2			3		4	6	5

Array Challenges Ranked by Respondent								
	Sound	Avoid	Benthic	Cable	Collision	Energy	EMF	Chemicals
Federal	3	2	6	1	8	4	5	7
	3	7	4	1	5	2	6	8
	2	1	5	4	6	3	8	7
	1	3	5	6	4	2	7	8
	6	2	1	3	4	8	5	7
	2	7	5	1	6	4	3	8
	3	1	4	5	2	6	8	7
	7	3	1	5	2	4	6	8
	8	4	5	2	3	7	6	1
	4	1	6	2	3	5	8	7
	6	3	4	1	2	7	8	5
	2	1	3	5	7	8	6	4
	1	5	6	3	4	8	2	7
	4	2	6	3	1	7	5	8
	4	2	5	1	3	7	8	6
State	7	4	1	5	8	6	3	2
	5	1	2	7	3	6	4	8
	5	6	8	3	4	2	7	1
	3	1	4	7	8	6	2	5
	7	2	3	5	4	1	8	6
	5	1	2	3	7	8	4	6
	5	1	2	3	4	8	6	7
	1	2	6	4	7	3	5	8
	4	6	3	1	2	8	5	7
	3	1	2	4	5	8	7	6
	4	3	1	2	6	7	5	8
	4	1	6	3	2	5	8	7
	1	2	6	7	4	5	3	8
	3	4	1	5	6	8	7	2
		7		5			6	3
	4	3	2	5	1	6	7	8
	2	1	3	6	4	7	5	8
	6	2	1	4	3	5	7	8
	6	1	3	2	5	8	7	4
		3	2			4	7	