Breakout #1

10:45 – 11:20am

- In-depth example for habitat change
- Overview presentations on evidence bases and risk retirement for other three interactions
- Discussion and questions

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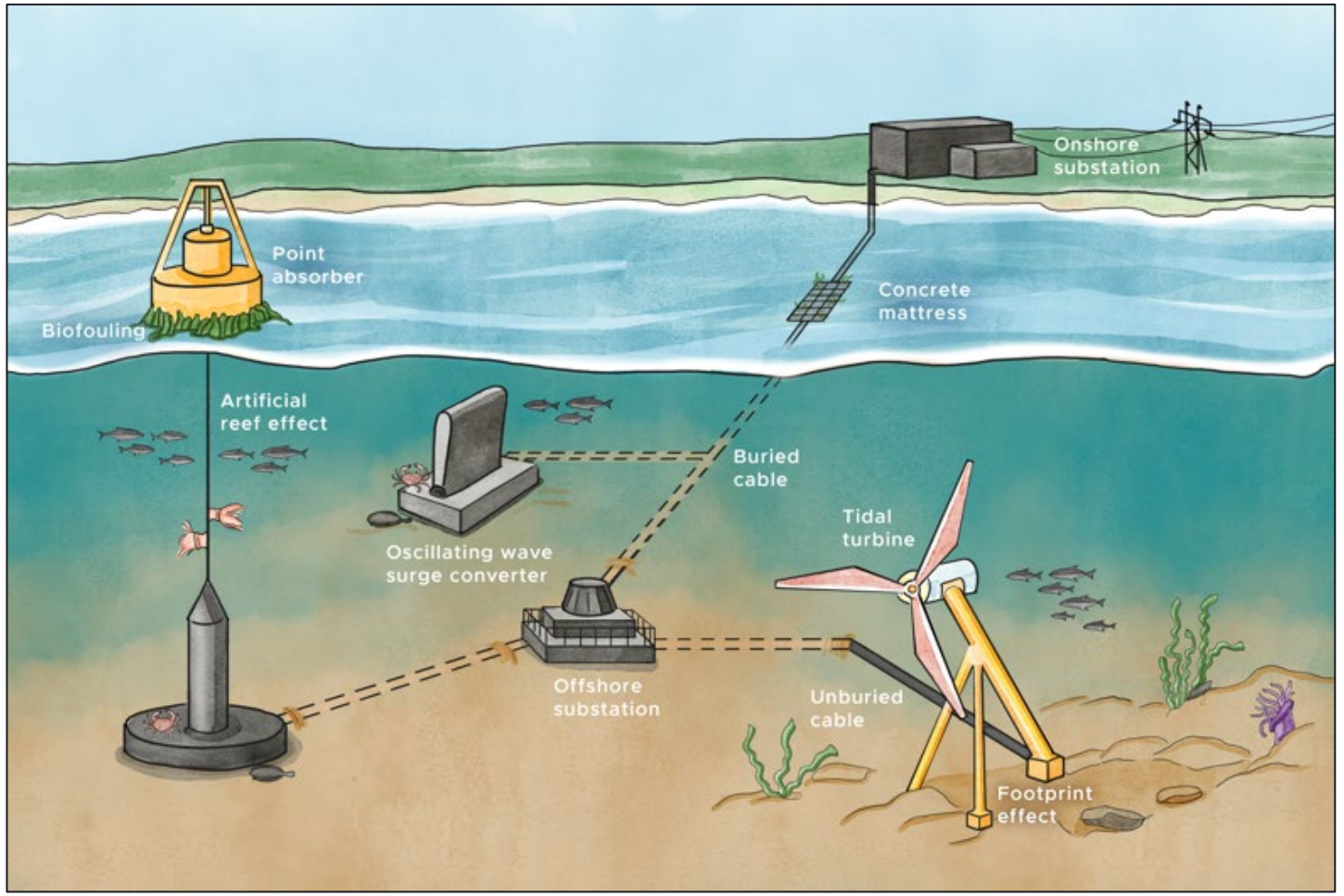
Risk Retirement:

Habitat Changes



https://tethys.pnnl.gov/habitat-change-evidence-base

Habitat Changes
What We Know

Background

- Proper siting is key to avoid critical or rare habitats
- Impacts are spatially limited, and recovery is relatively rapid
- Can learn from surrogate industries

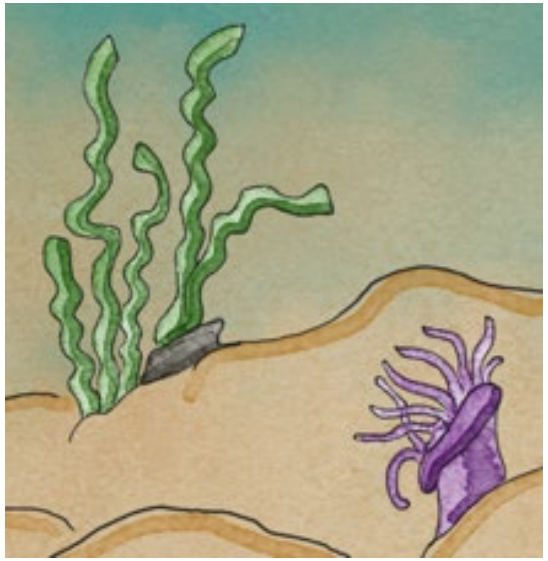
Categories of Habitat Change

- Effects of device installation/removal on benthos – net positive/neutral effect, negative effects minimal
- Changes in community composition – hard structures will become colonized, benthic communities in vicinity may change, but changes generally neutral
- Artificial reef effect – similar impact to other industries, likely to be neutral or potentially positive effect on species abundance
- Indirect effects possible, may include impacts to food webs or nutrients or reserve/spill-over effects

Habitat Changes
Online Workshop

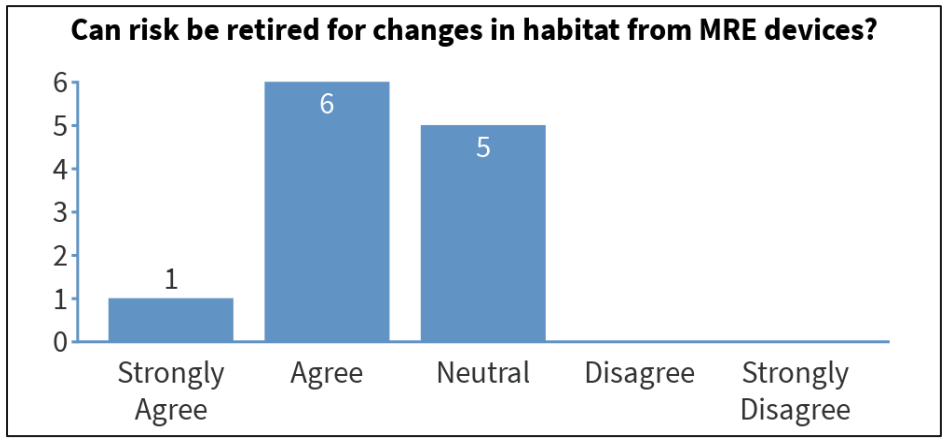
https://tethys.pnnl.gov/events/risk-retirement-habitat-change-workshop

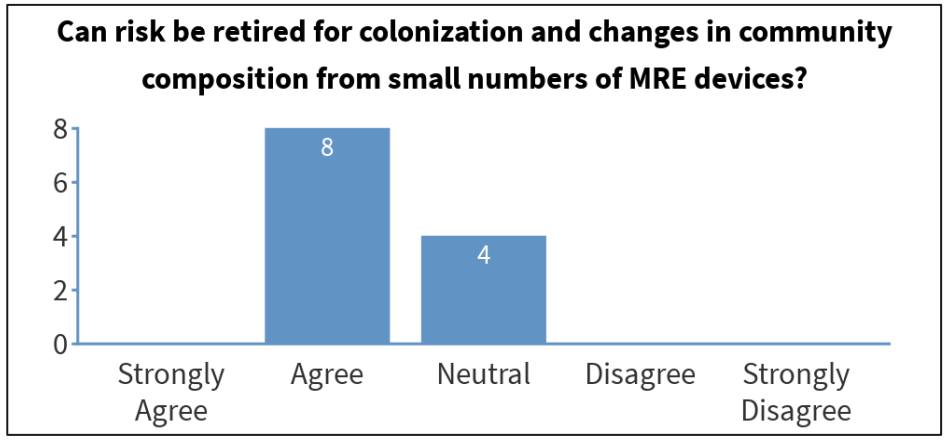
- 18 participants from 8 countries – developers, regulators, advisors, consultants, researchers
- Goals:
  - Identify data needs and requirements for permitting small projects
  - Assess risk retirement for habitat change
  - Identify additional research needs
- Structure:
  - Presentation of evidence base, case studies from Oregon and Scotland
  - Interactive polls throughout
  - Discussion groups

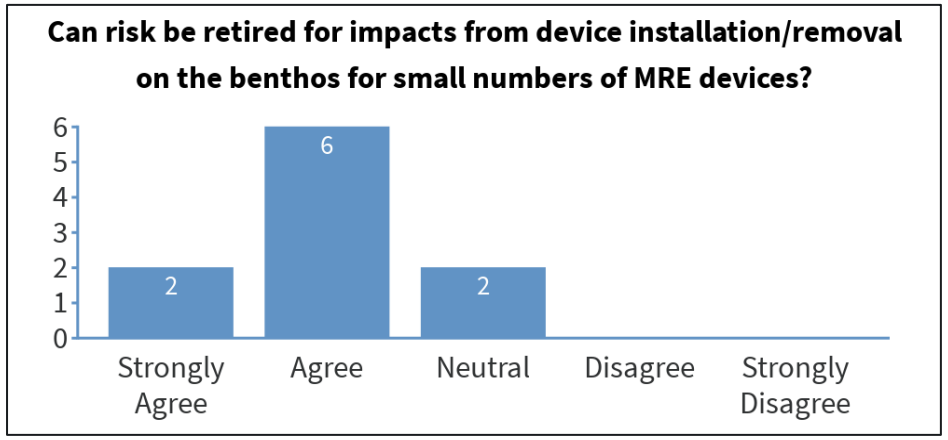


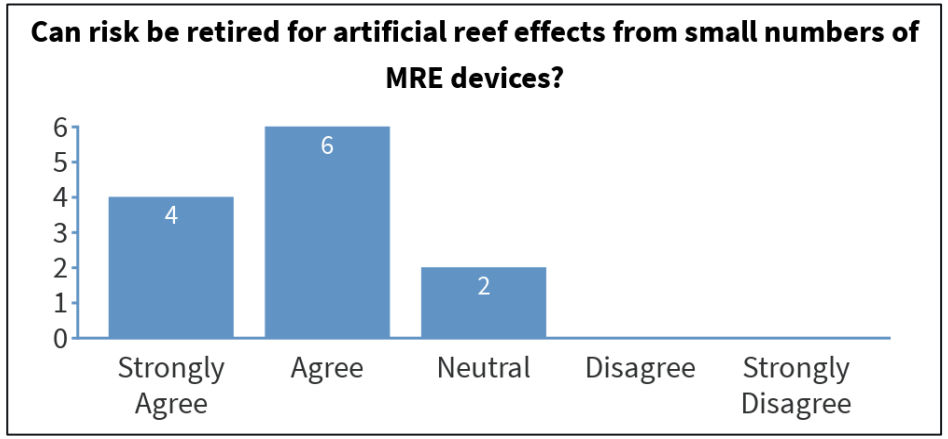
Habitat Changes
Online Workshop

- Overall strong support from experts for risk retirement of habitat change for small developments (1-4 devices)









Habitat Changes
Feedback & Conclusions

Consensus

- Most participants agreed that risks associated with changes in habitat could be retired for single devices or small arrays
- Concerns about effects should not prevent installation or further study
- Necessity for some site-specific surveys and monitoring

Knowledge Gaps

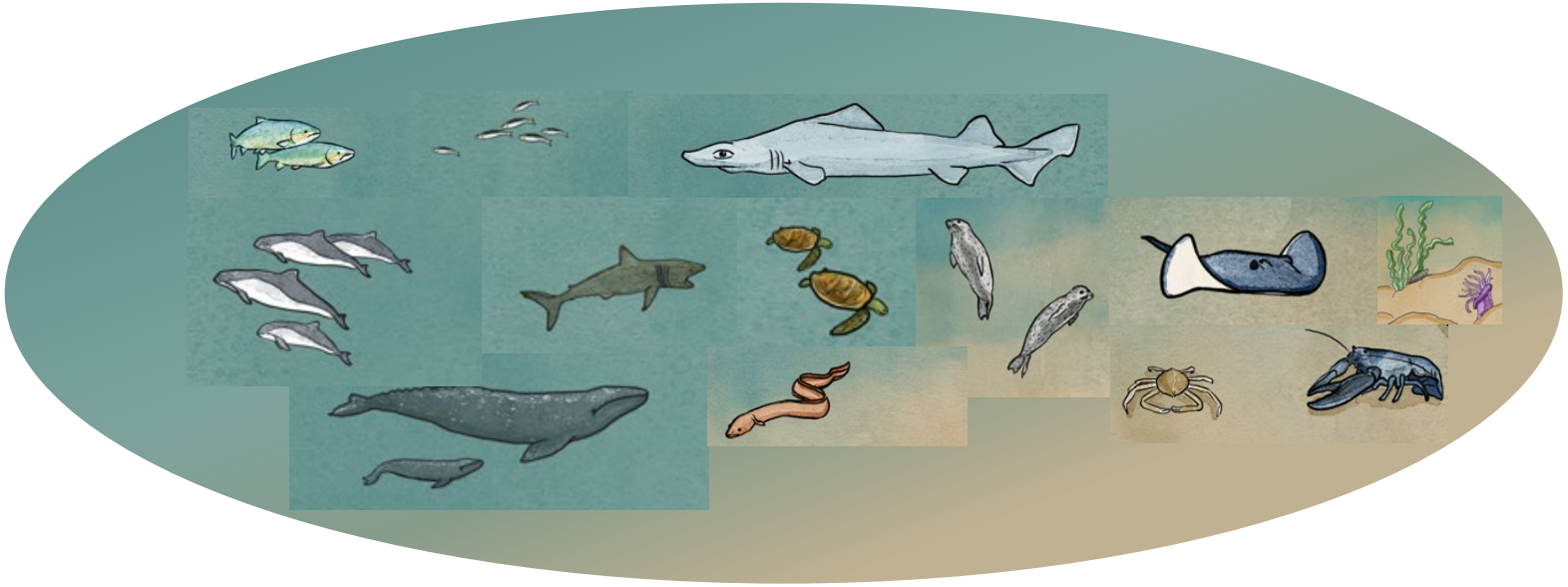
- Decommissioning and removal of devices
- Biofouling and non-native species
- Colonization patterns in high-energy tidal environments

Recommendations

- Continue monitoring programs to improve understanding
- Collect quality, long-term data to prepare for scaling up to arrays
- Establish guidelines, standard mitigation, and frameworks for monitoring
- Require identification of baseline conditions and species present

Habitat Changes
Conclusions

- Working with subject matter experts → Identify remaining uncertainties and knowledge gaps for habitat change
- Disseminate evidence base and knowledge gaps to broader MRE community → Ease concerns and progress toward risk retirement
- Future work → Connect regulators with this information for habitat change and other effects



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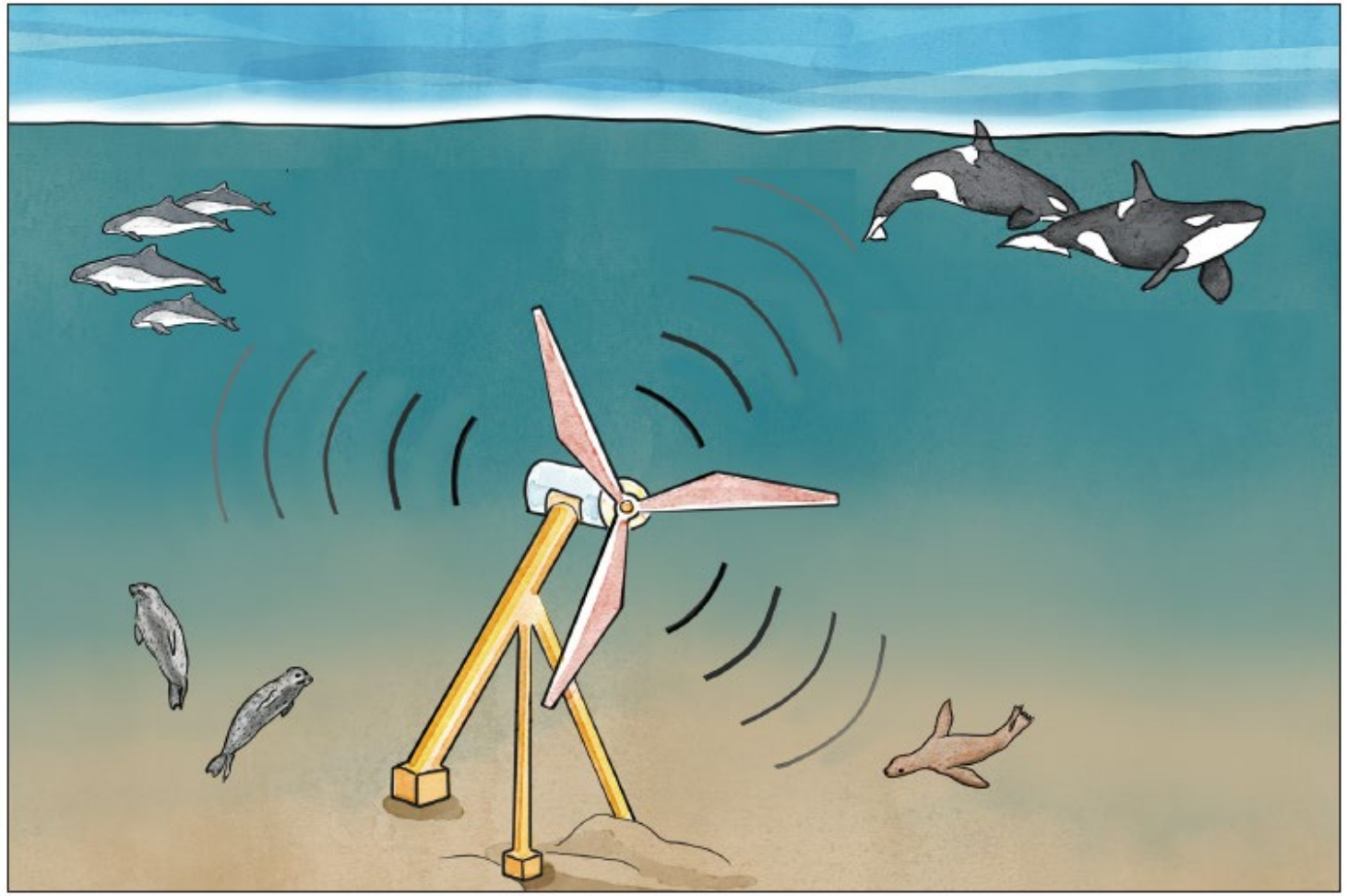
Risk Retirement:

Underwater Noise



https://tethys.pnnl.gov/underwater-noise-evidence-base

Underwater Noise
What We Know

Background

- Underwater noise from operational devices fall below levels expected to cause serious harm/injury
- Likely below some marine mammals and fish hearing threshold
- Noise from MRE not as loud as other anthropogenic sources

U.S. Thresholds

- Marine Mammals: NOAA Technical Guidance (2018)
- Fish: NOAA Fisheries and BOEM Underwater Acoustic Modeling Report (2013)

International Specifications

- IEC TC 114 Technical Specification 62600-40:2019 provides methods and instrumentation to characterize sound near MRE devices

Underwater Noise
Feedback & Conclusions

Consensus

- Operational noise unlikely to cause harm/injury to marine animals
- Expert reviewers agreed that the risk could be retired for single devices or small arrays

Knowledge Gaps

- Understand how marine animals use the habitat surrounding a device and how they might behave in response to underwater noise from the device
- Validate noise propagation models for large arrays
- Assess cumulative effects

Recommendations

- Need a library of standardized noise measurements produced by MRE
- Test centers could play key role in measuring underwater noise under operation

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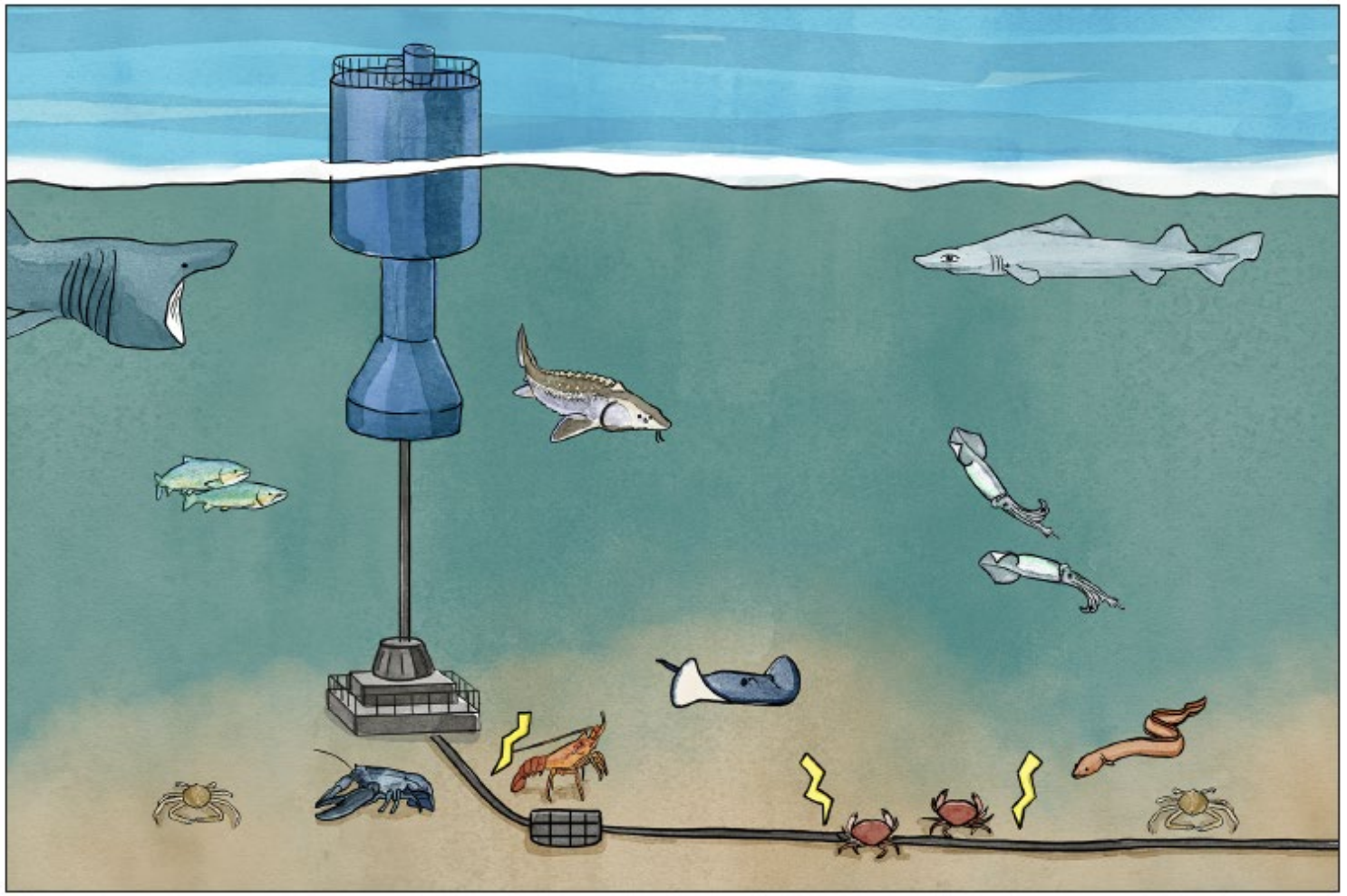
Risk Retirement:

Electromagnetic Fields (EMF)



https://tethys.pnnl.gov/emf-evidence-base

Electromagnetic Effects
What We Know

Background

- Only few EMF-sensitive marine species
- Power level much lower than offshore wind farms or other sources
- Cable burial effective at separating sensitive animals from EMF

Effects on species

- Some studies show small behavioral changes, range from:
  - No evidence of positive/negative effect
  - Species swimming more slowly
  - An increase in exploratory activity near energized cable
- Overall, most studies show no evidence of barrier effect

Electromagnetic Fields
Feedback & Conclusions

Consensus

- Evidence base showed limited impacts from MRE EMF emissions
- Level of power carried in MRE cables is very small compared to other anthropogenic sources
- Expert reviewers agreed that the risk could be retired for single devices or small arrays

Knowledge Gaps

- Field measurements of EMFs needed to improve and validate models
- Increased understanding of how EMF emissions vary with cable configuration and power variability
- Risks associated with offshore substations and vertical and draped cables

Recommendations

- Work with MRE industry to help regulators understand that risk will be minimal
- Larger deployments may still require measurements to be taken

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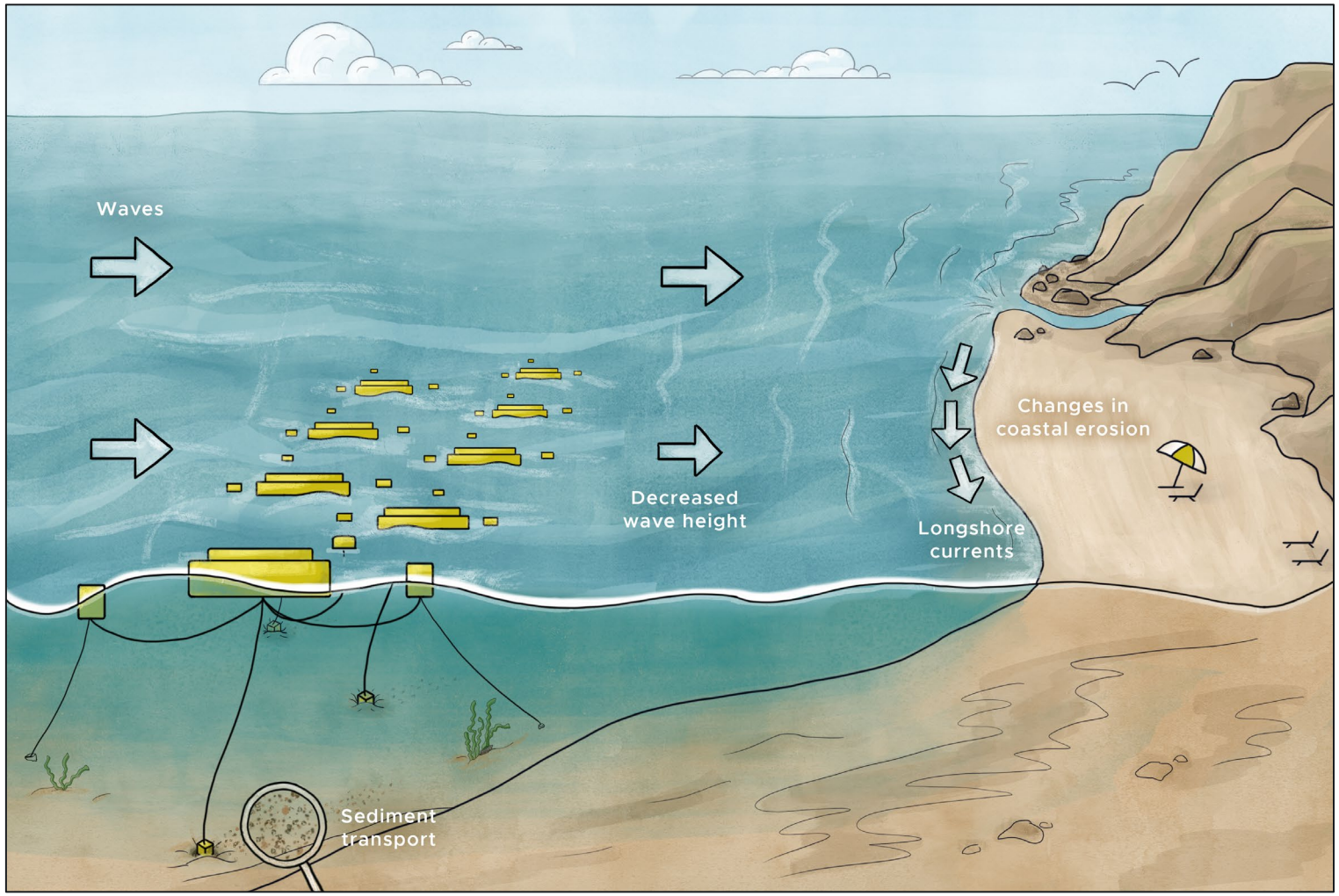
Risk Retirement:

Changes in Oceanographic Systems

https://tethys.pnnl.gov/oceanographic-changes-evidence-base



Changes in Oceanographic Systems
What We Know

Background

- Changes in oceanographic systems from small wave and tidal deployments are small and likely not detectable within natural variability
- What we know is primarily informed by numerical models that lack validation
  - Models do not use the numbers of devices expected in early deployment scenarios

Nearfield Effects

- Observed in and around the device footprint (e.g., changes to flow, turbulence)
- Localized and have little impact on the greater environment

Farfield Effects

- Observed further from the device (e.g., changes to wave climate, tidal range, circulation)
- As larger arrays are deployed, secondary effects on biological and sedimentary processes may occur (e.g., changes in nutrient concentrations, coastal erosion)

Changes in Oceanographic Systems
Feedback & Conclusions

Consensus

- Evidence base suggests that changes in oceanographic systems from small wave and tidal deployments are not detectable within natural variability
- Risk from changes to oceanographic systems from small deployments can be retired

Knowledge Gaps (array-scale)

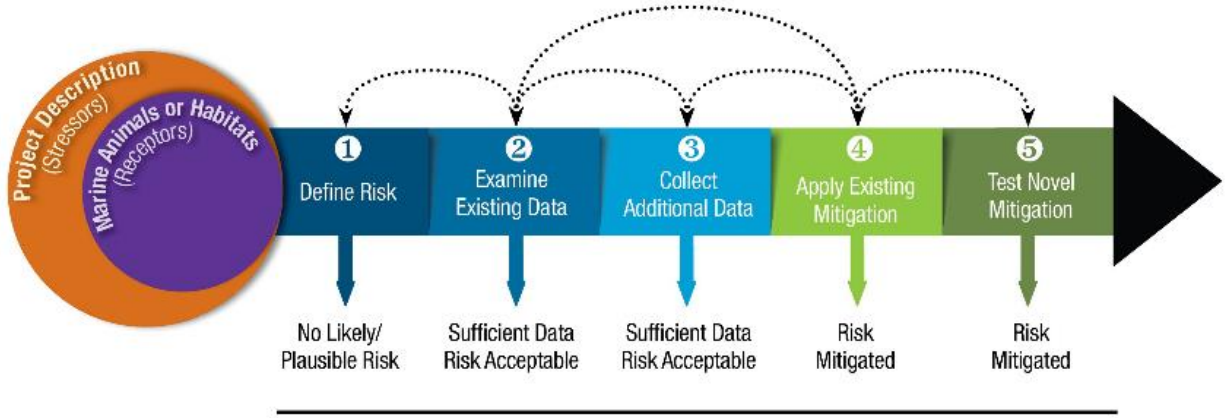
- Improve model validation with more field measurements around deployed devices
- Assess cumulative effects in relation to natural variability and anthropogenic activities
- Understand how changes translate to specific habitats and marine species

Recommendations

- Work with MRE industry to help regulators understand that risk will be negligible for small numbers of devices
- As move to larger arrays, field data collection may be needed

Summary

- Risk retirement, and data transferability, make information available to support regulators in decision-making, distinguish between perceived/actual risk, and access available data
- Based on feedback:
  - Risk from underwater noise, EMF, habitat changes, and changes in oceanographic systems can be retired for single devices or small arrays
  - Additional information can help increase understanding, especially with large-scale arrays
- More data and information needed to consider risk retirement for other stressor-receptor interactions, especially collision risk



https://tethys.pnnl.gov/risk-retirement

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Discussion