Pacific Northwest NATIONAL LABORATORY

OES ENVIRONMENTAL the task formerly known as Annex IV

Risk Retirement for Marine Renewable Energy Development

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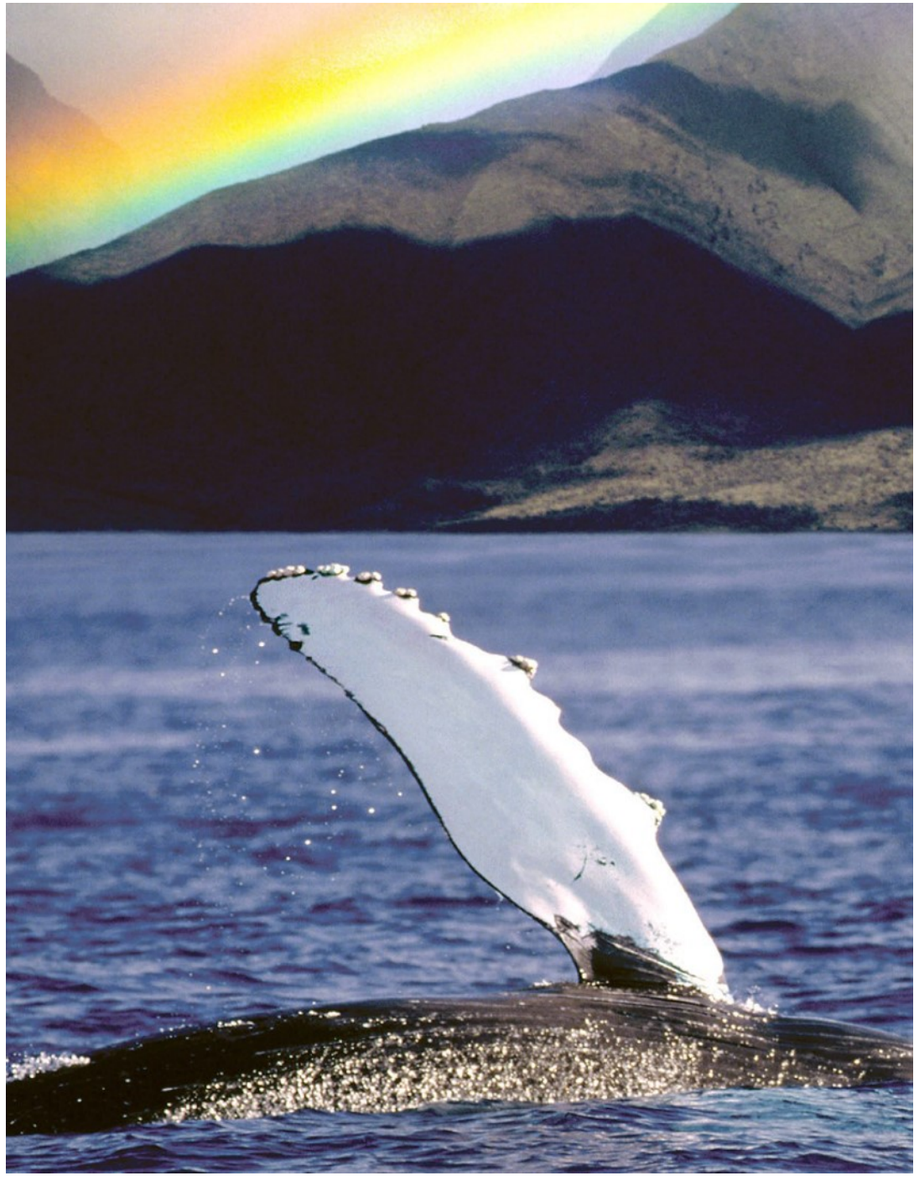
Today's workshop

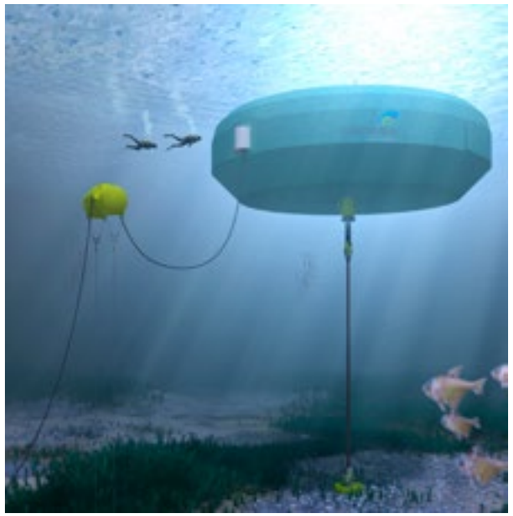
- Introductions
  - Purpose of the workshop
  - Review previous workshops
- Retiring Risk
  - Pathway for Retiring Risk
  - Data Transferability Process
  - Monitoring Dataset Discoverability Matrix
  - Best Management Practices
  - Data Collection Consistency
  - Case Studies
- Next Steps



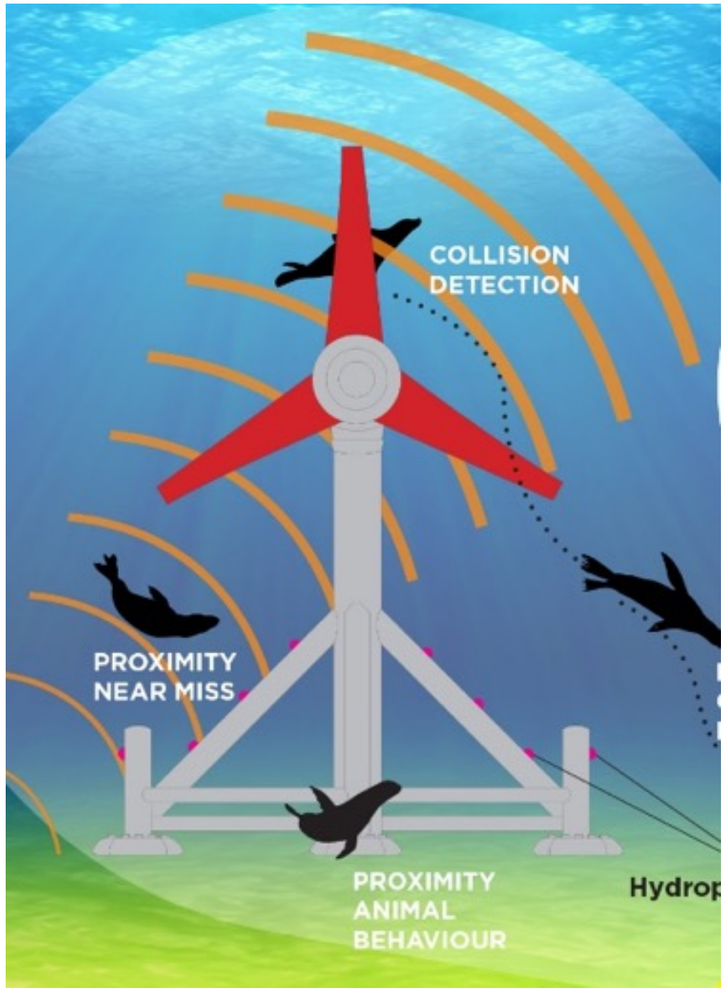
Barriers to Permitting

- MRE industry perceptions
- Our perceptions of the regulatory community

- OES-Environmental (formerly known as Annex IV) working to bridge these gaps



MRE Environmental Stressors



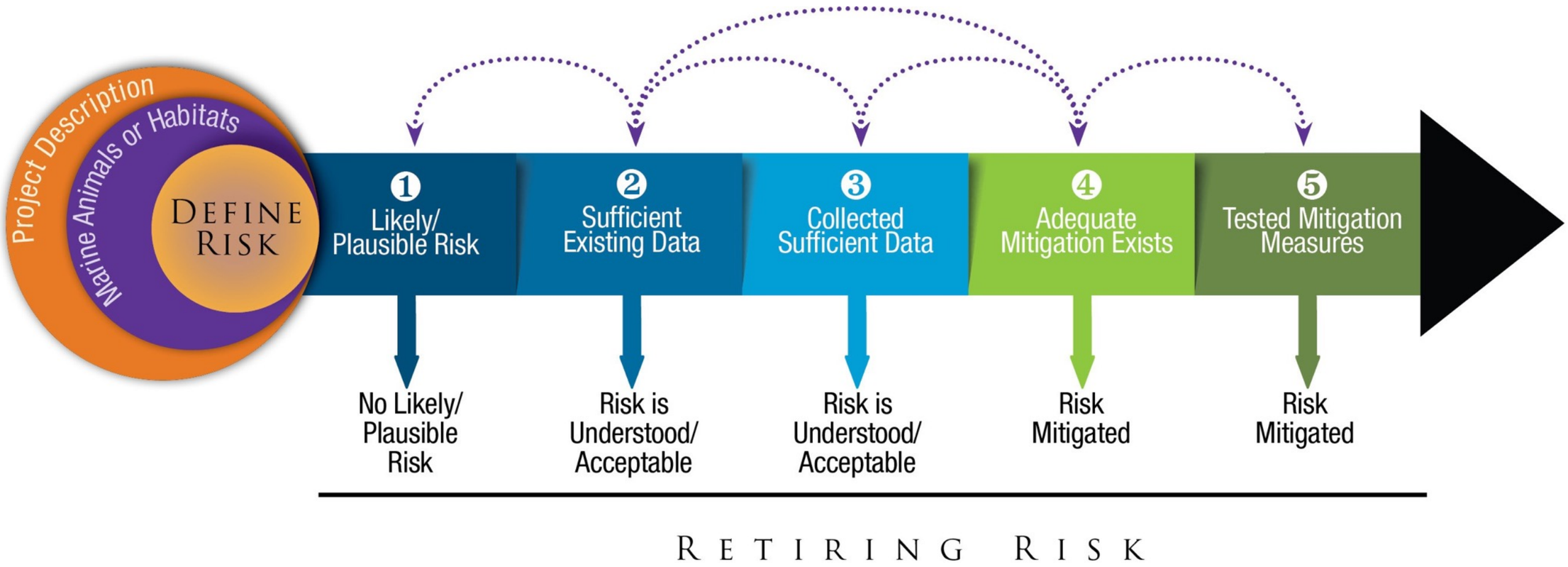
(ORE Catapult, 2016)

- Collision risk
- Underwater noise effects
- Electromagnetic fields (EMF) effects
- Habitat changes
- Changes to physical systems
- Displacement and barrier effects

Retiring Risk

- What is “retiring risk”?
  - For certain interactions, potential risks need not be fully investigated for every project for small developments (1-2 devices)
  - Rely on what is already known – already permitted projects, research, or analogous industries
  - A “retired risk” is not dead, and can be revived in the future as more information becomes available and with larger arrays

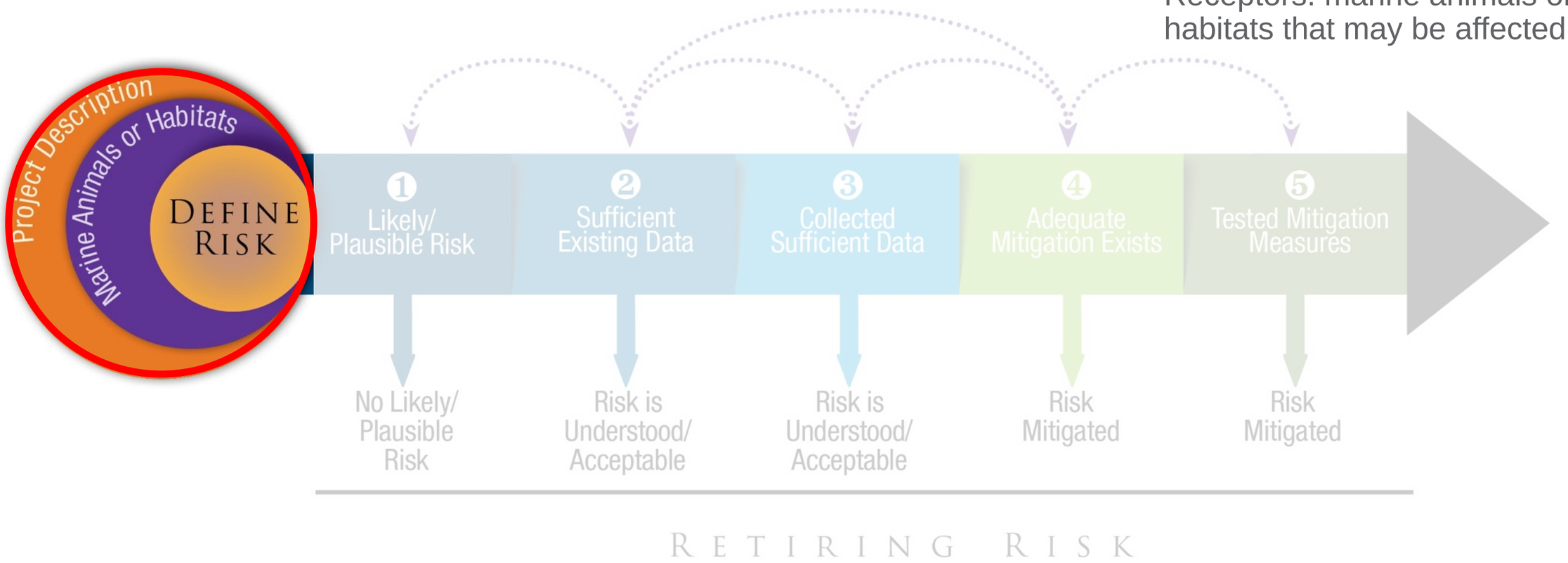
Pathway to Retiring Risk



Pathway to Retiring Risk

Define Risk

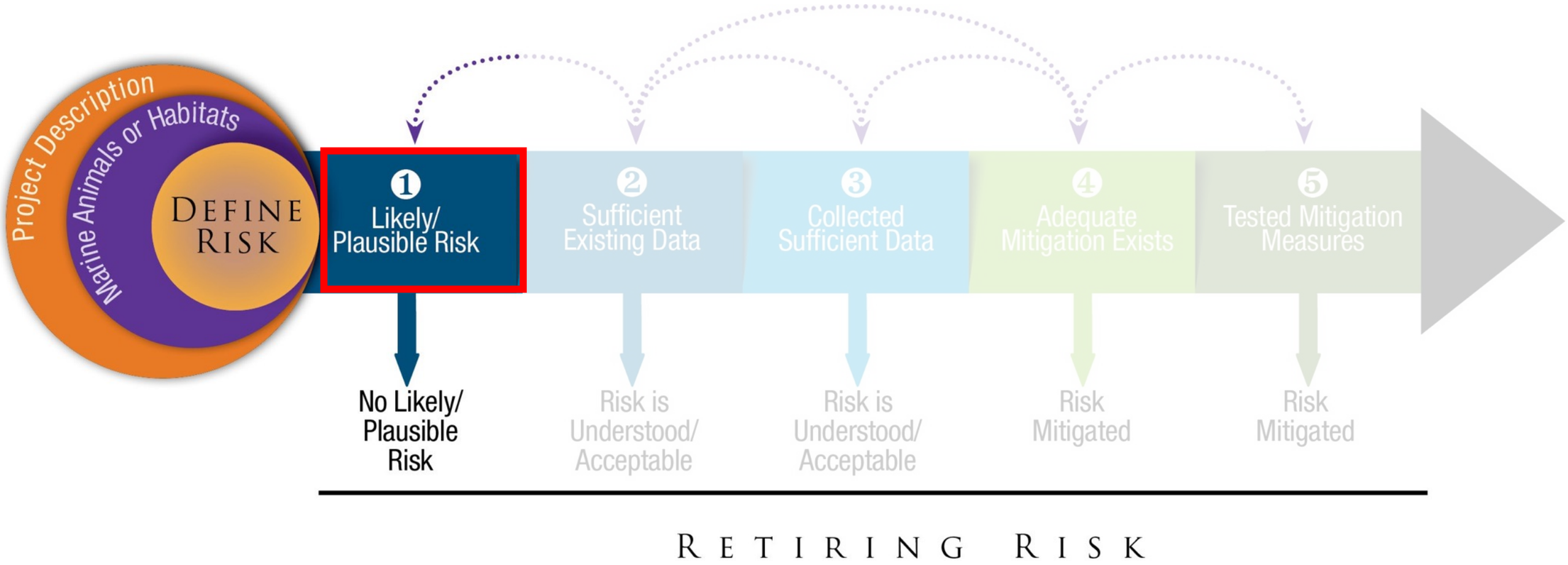
- Project Description
- Define interaction
  - Stressors
  - Receptors: marine animals or habitats that may be affected



Pathway to Retiring Risk

Stage Gate 1

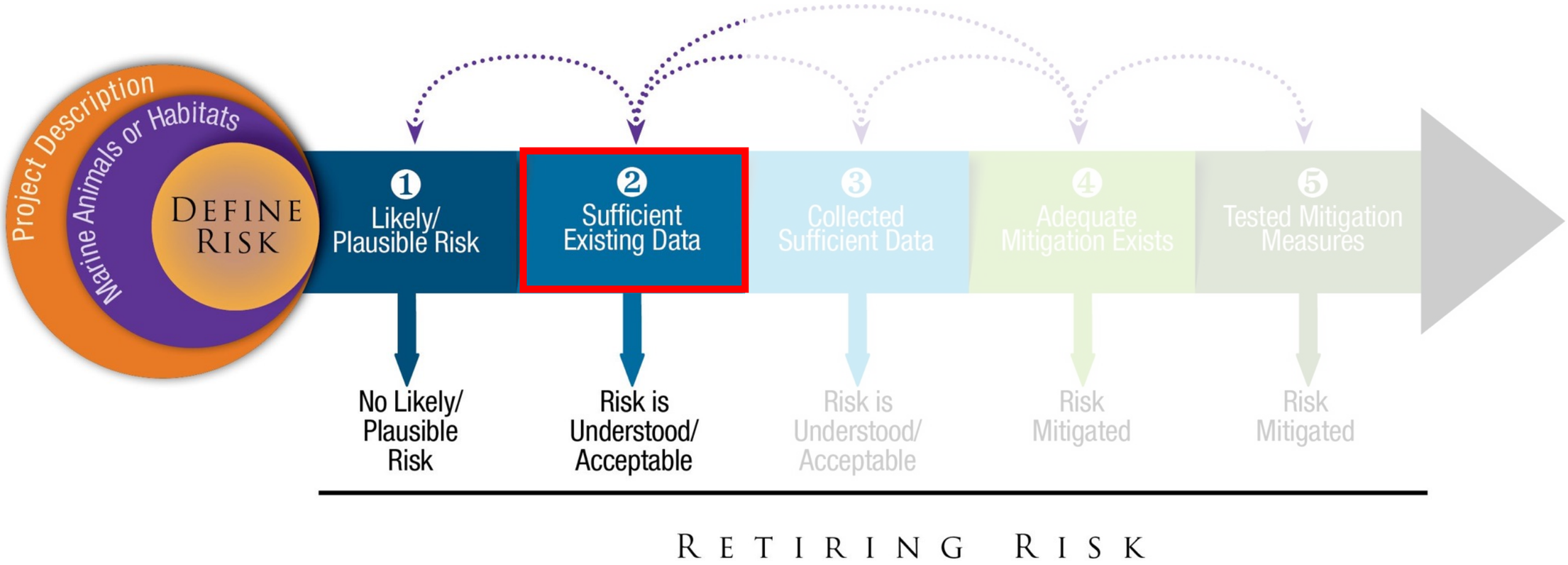
- Determine if significant risk exists
  - If not, risk can be retired



Pathway to Retiring Risk

Stage Gate 2

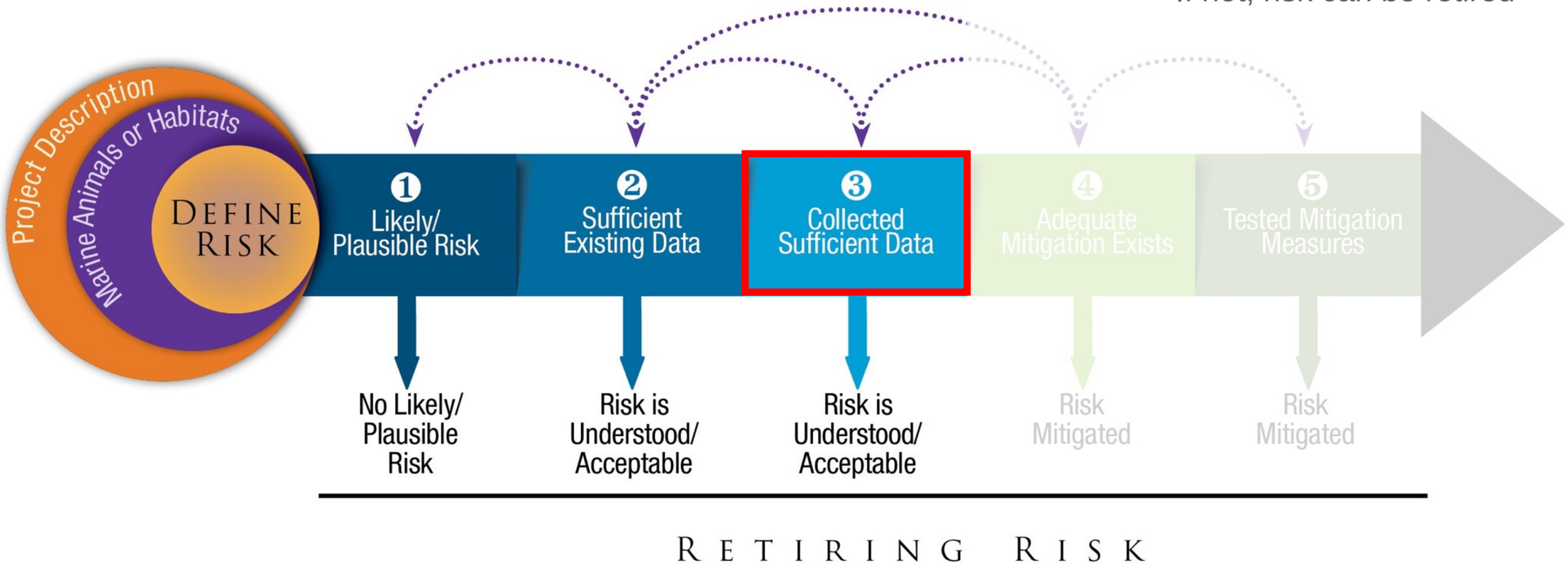
- Determine if sufficient data exists to demonstrate if risk is not significant
  - If not, risk can be retired



Pathway to Retiring Risk

Stage Gate 3

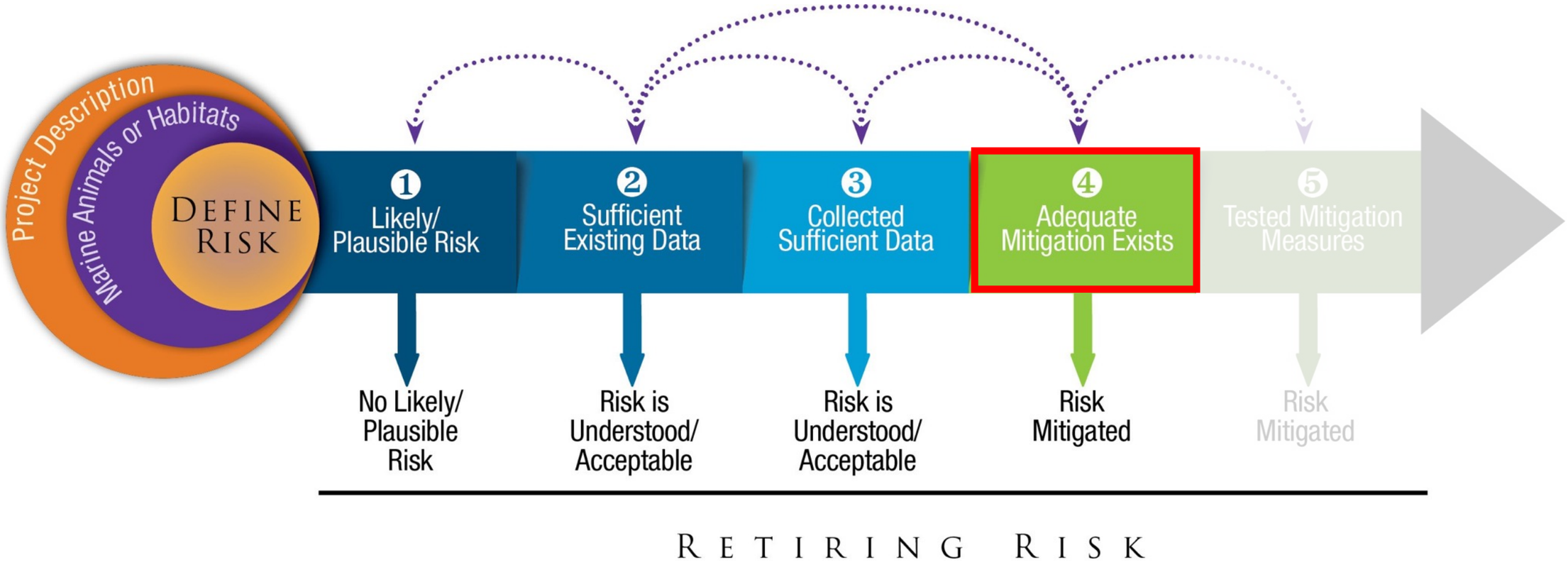
- Design and collect targeted project data
- Determine if risk is significant
  - If not, risk can be retired



Pathway to Retiring Risk

Stage Gate 4

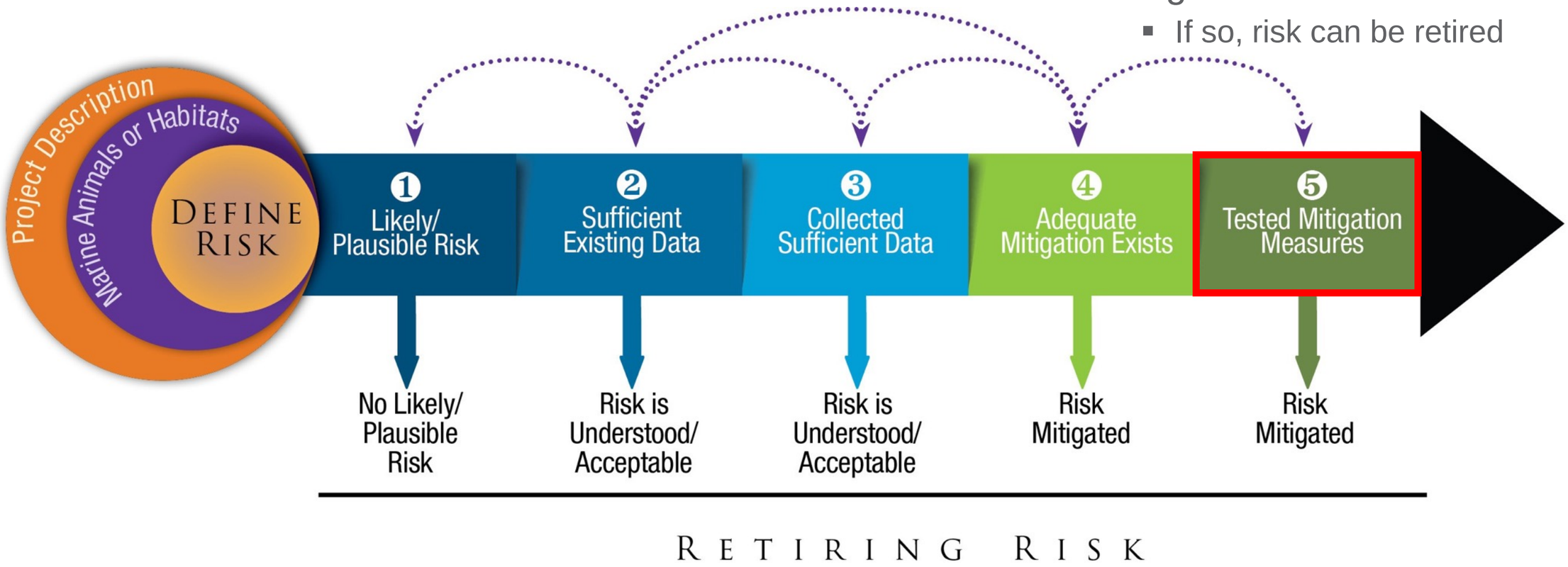
- Determine if proven mitigation measures exist to mitigate risk
  - If so, risk can be retired



Pathway to Retiring Risk

Stage Gate 5

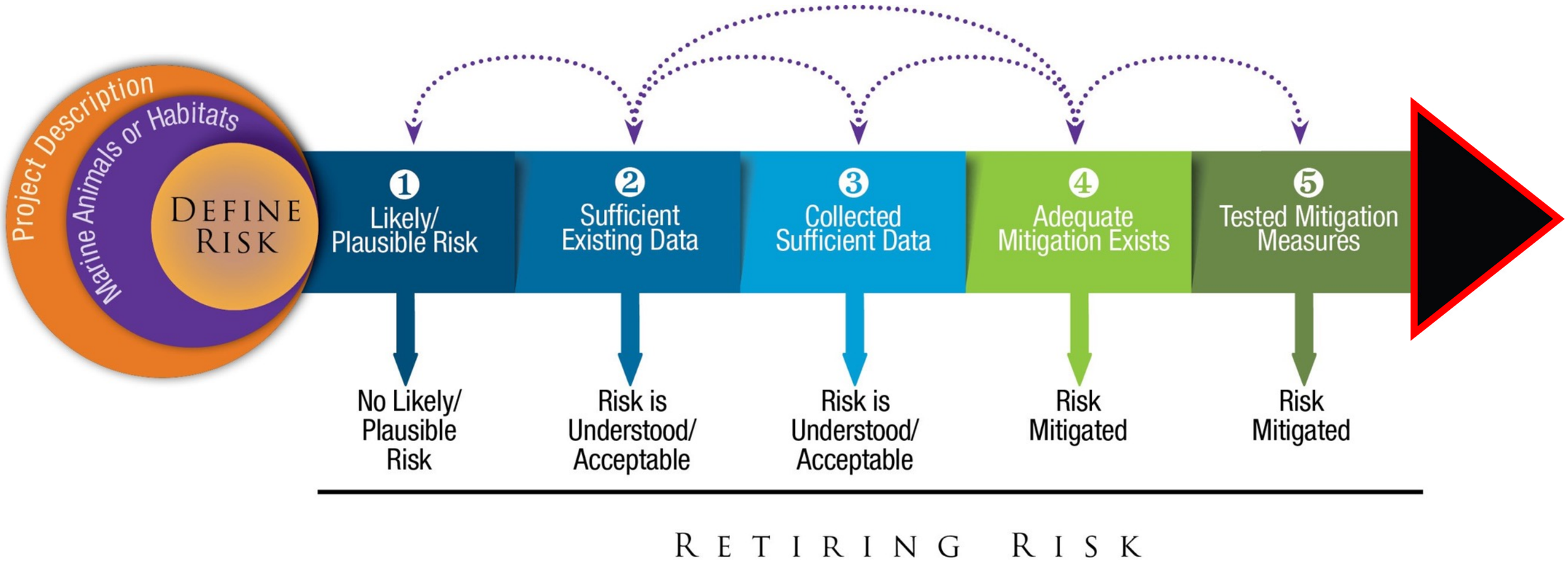
- Develop and test mitigation measures
- Determine if the risk can be mitigated
  - If so, risk can be retired



Pathway to Retiring Risk

End of Pathway

- If risk is not insignificant and cannot be mitigated
  - Need to redesign or perhaps abandon project

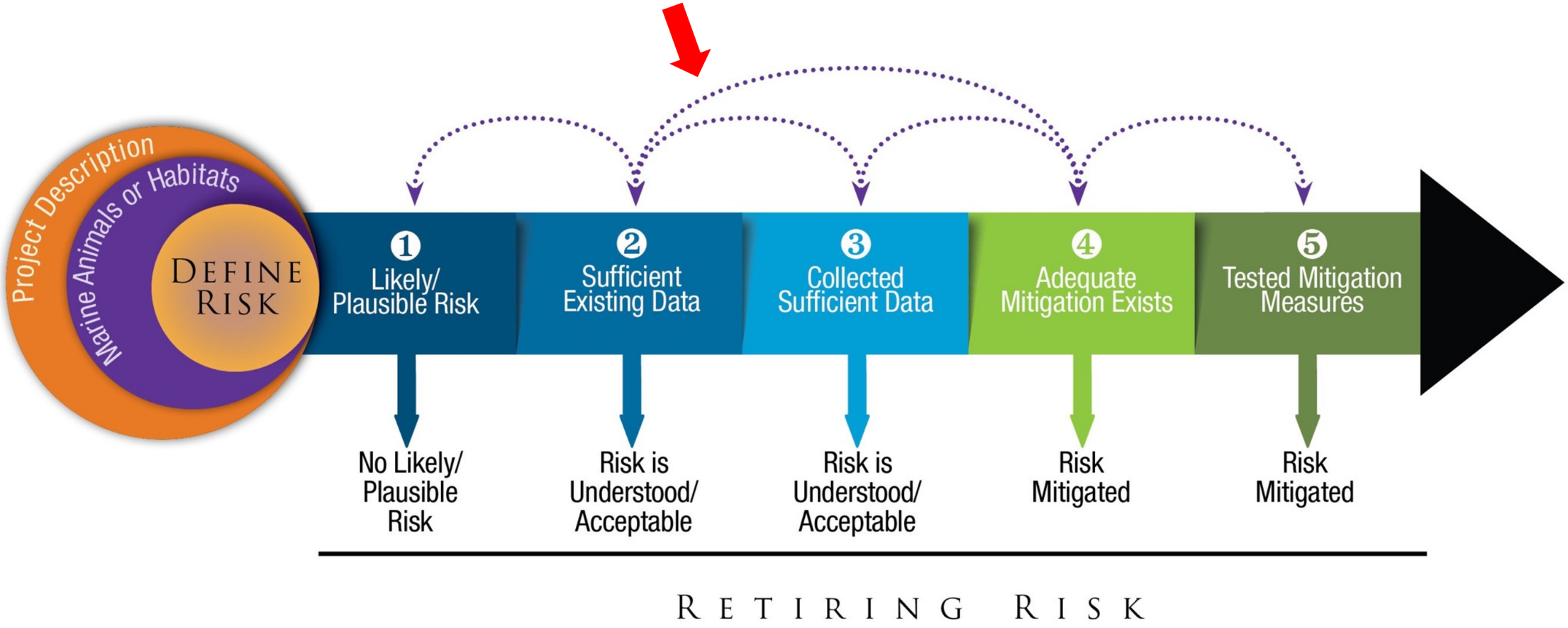


Discussion and Feedback

- What are your thoughts on the concept of “retiring risk”?
- Does the Pathway to Retiring Risk make sense?
- Could you make use of the Pathway to Retiring Risk?
- Can you suggest other groups of regulators who might be interested?

Data Transferability Process

- Need to ensure datasets from permitted projects are readily available and able to be compared



Data Transferability and Collection Consistency

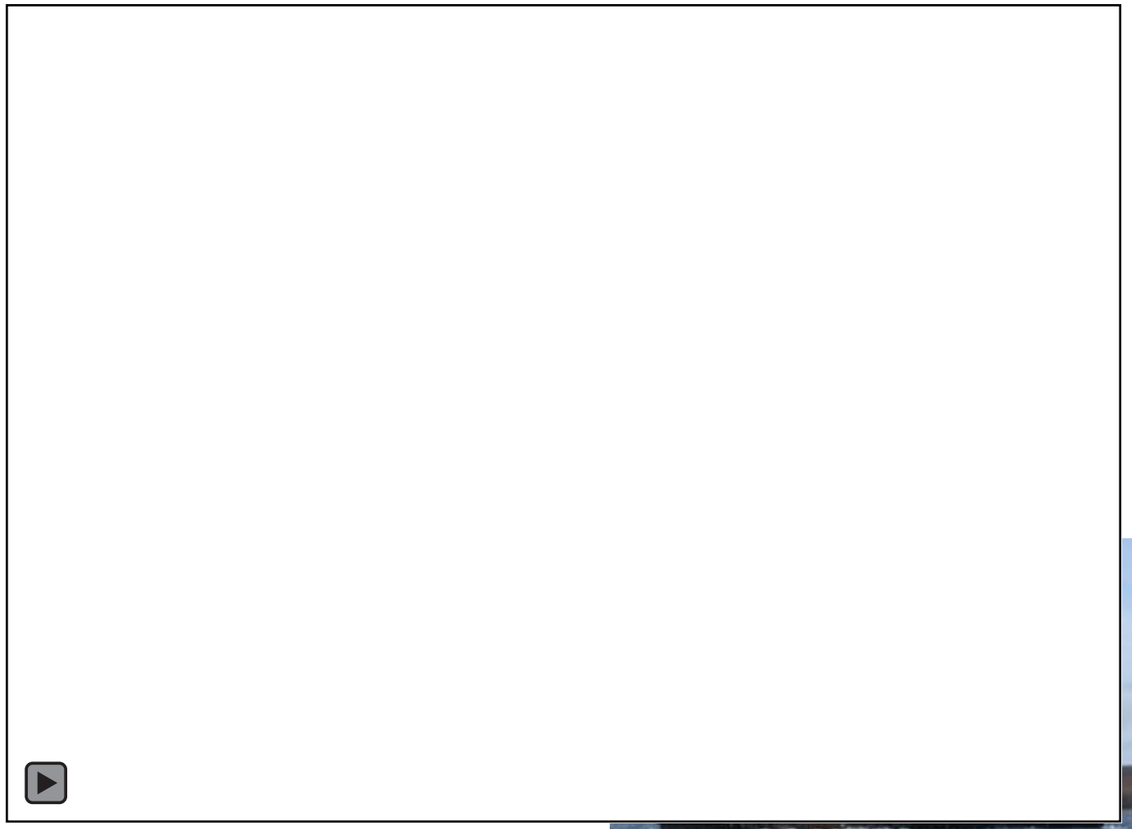
- **Data Transferability**
  - Using data from already permitted MRE project or analogous industry to be “transferred” to inform potential environmental effects and permitting for a future MRE project
  - Data that might be “transferred” need to be collected consistently for comparison

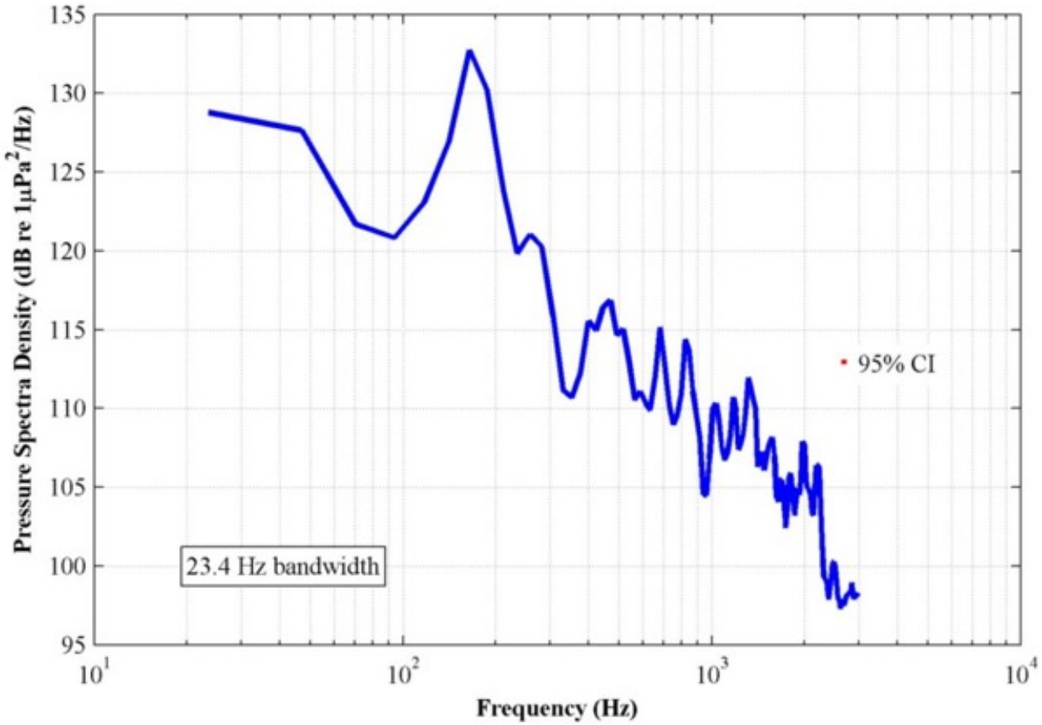
- By “**data**”, we mean
  - Data and information

    Could be raw or quality controlled data, but *more likely* analyzed data and information, synthesized data to reach some conclusion, reports, etc.

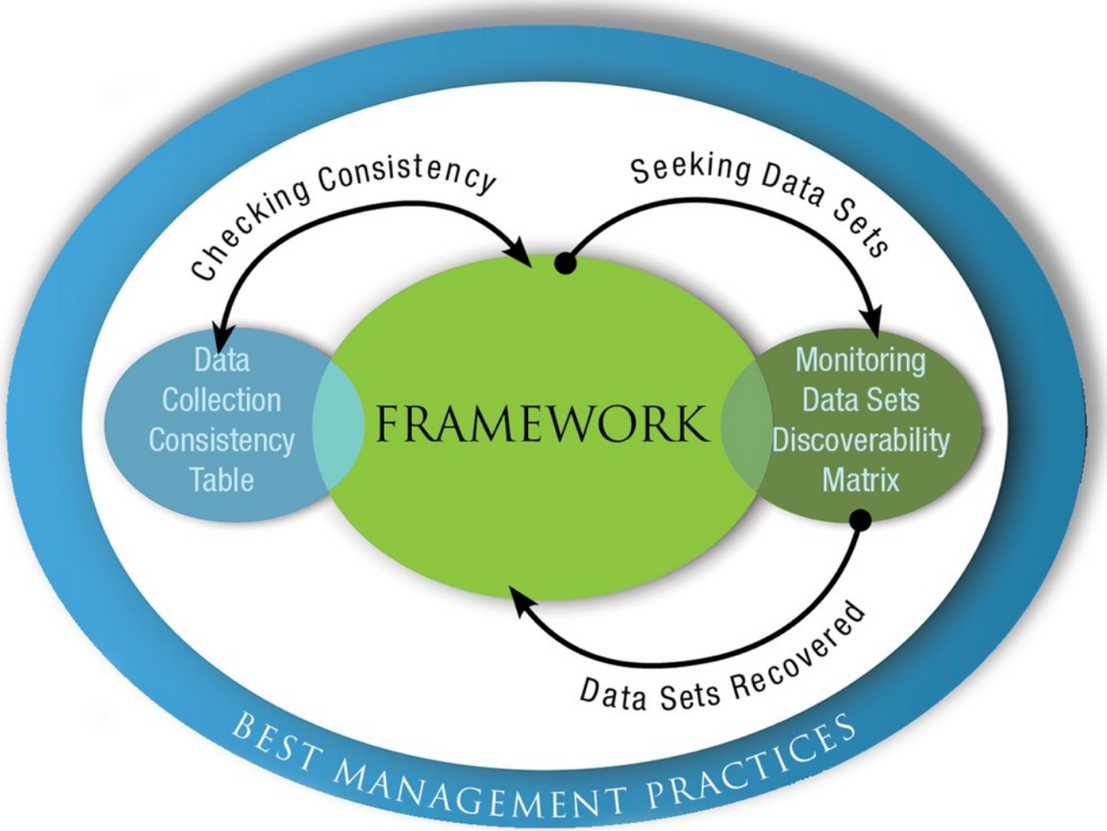
Example data/information

- Tidal turbines at EMEC (Scotland)

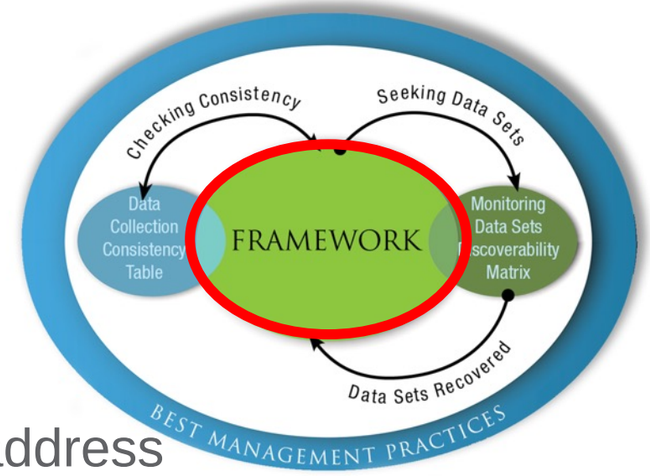




Data Transferability Process

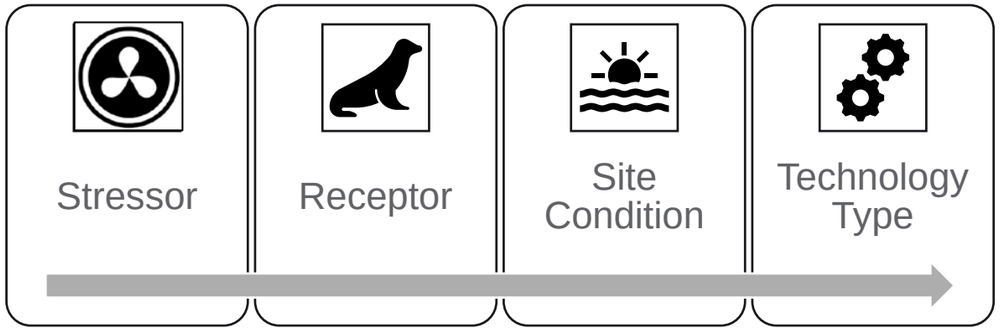


Framework for Data Transferability

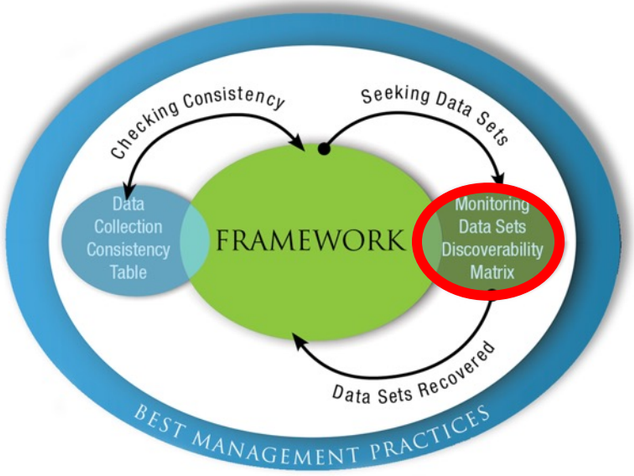


- Develops common understanding of data types and parameters to address potential effects of MRE development
- Brings together datasets from already permitted projects in an organized fashion
- Compares the applicability of each dataset for transfer
- Guides the process for data transfer

- Uses stressors to categorize framework and four variables to define an interaction



Monitoring Datasets Discoverability Matrix

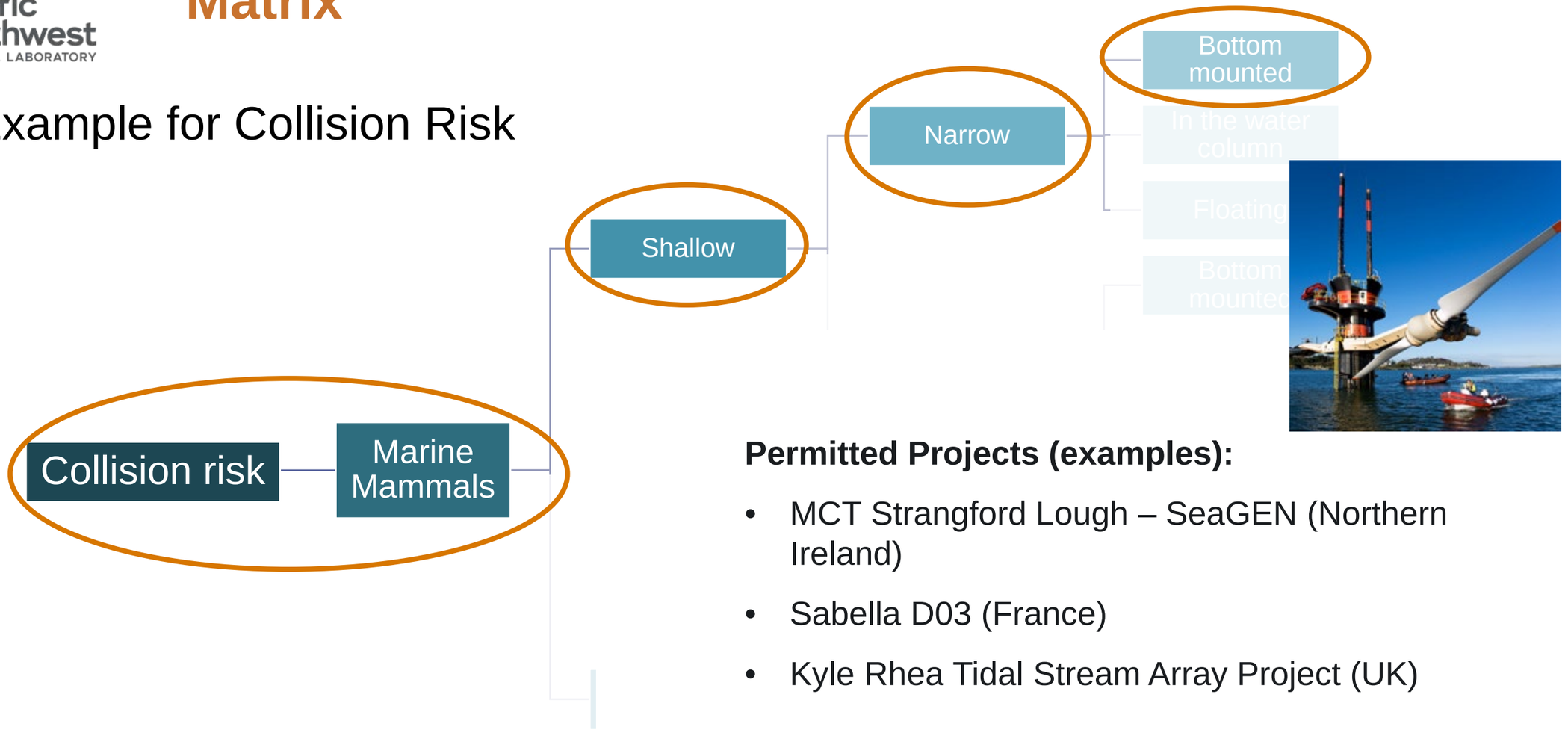


- Classify existing monitoring datasets by:
  - stressor, receptor, site conditions, technology, and project size (single/array)

- Used to discover already permitted datasets and transfer data to permit future projects
- Under development; will be a web-based tool on *Tethys* (https://tethys.pnnl.gov/)

Using the Monitoring Dataset Discoverability Matrix

Example for Collision Risk

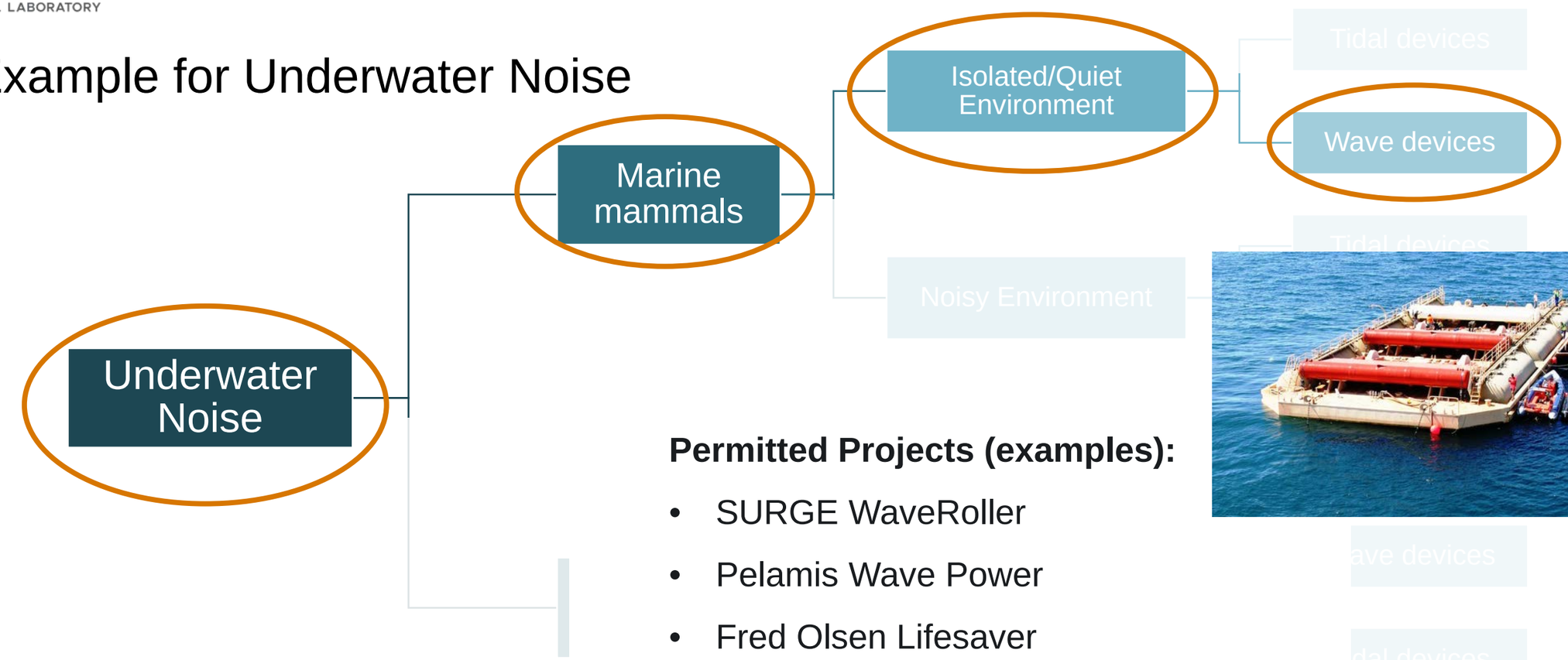


Permitted Projects (examples):

- MCT Strangford Lough – SeaGEN (Northern Ireland)
- Sabella D03 (France)
- Kyle Rhea Tidal Stream Array Project (UK)

Using the Monitoring Dataset Discoverability Matrix

Example for Underwater Noise

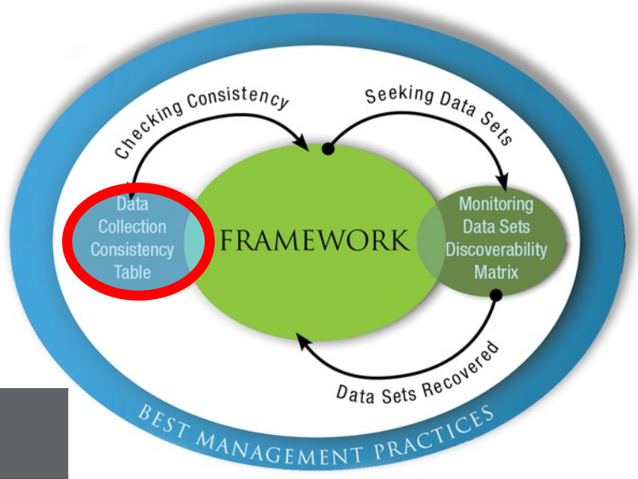


Permitted Projects (examples):

- SURGE WaveRoller
- Pelamis Wave Power
- Fred Olsen Lifesaver
- Wello Oy Penguin EMEC

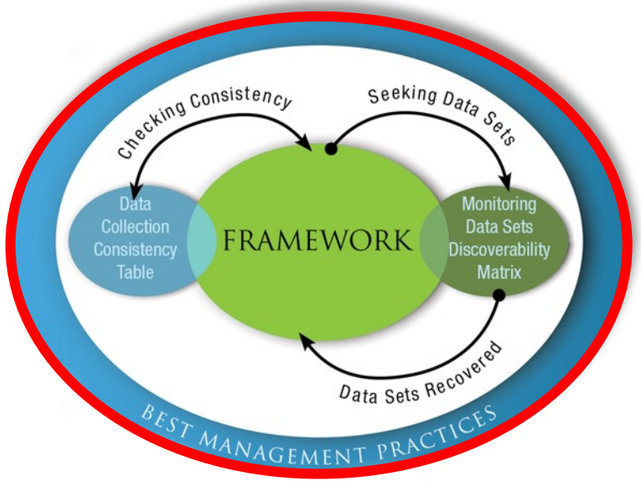
*Isolated/Quite Environment = < 80db
Noisy Environment = > 80 db

Data Collection Consistency



Stressor	Process or Measurement Tool	Reporting Unit	Analysis or Interpretation
Collision Risk	Sensors include: acoustic only, acoustic + video, Other	Number of visible targets in field of view, number of collisions	Number of collisions and/or close interactions of animals with turbines used to validate collision risk models.
Underwater Noise	Fixed or floating hydrophones	• Amplitude dB re 1 µPa at 1 m • Frequency: broadband or specific frequencies	Sound outputs from MRE devices compared against regulatory action levels. Generally reported as broadband noise unless guidance exists for specific frequency ranges.
EMF	Source: Cable, other, shielded or unshielded	AC or DC, voltage, amplitude	Measured EMF levels used to validate existing EMF models around cables and other energized sources.
Habitat Change	• Underwater mapping with: sonar, video • Habitat characterization from: mapping, existing maps	Area of habitat altered, specific for each habitat type	Compare potential changes in habitat to maps of rare and important habitats to determine if they are likely to be harmed.
Changes in Physical Systems	Numerical modeling, with or without field data validation	No units. Indication of data sets used for validation, if any	Data collected around arrays should be used to validate models.
Displacement/ Barrier Effect	Population estimates by: human observers, passive or active acoustic monitoring, video	Population estimates for species under special protection	Validation of population models, estimates of jeopardy, loss of species for vulnerable populations.

Best Management Practices



BMP 1

- Meet necessary minimum requirements to be considered for transfer from an already permitted project to a future project

BMP 2

- Determine likely datasets that meet data consistency needs and quality assurance requirements

BMP 3

- Use models in conjunction with and/or in place of datasets

BMP 4

- Provide context and perspectives for datasets to be transferred

Data Transferability Case Studies

- To evaluate the effectiveness of the Data Transferability Process
  - Use case studies from already permitted projects to test the process
  - Assess how the process might be used in practice
- Working on development and analysis of case studies
- Case Studies examples
  - Collision Risk
  - EMF
  - Noise

Case Study
SeaGen – Collision Risk

- Marine Current Turbines SeaGen deployment (2009 – 2016)
  - Strangford Narrows, Northern Ireland
- 3 years of post-installation monitoring through Environmental Monitoring Programme
- Behavior of seals and harbor porpoise in tidal streams

- Monitoring methods:
  - Active acoustic monitoring
  - Passive acoustic monitoring
  - Marine mammal observations
  - Telemetry studies
  - Aerial surveys
  - Land based visual observations

Case Study
SeaGen – Collision Risk

- No major impacts of SeaGen turbine detected on marine mammals
  - No mortalities as a consequence of physical interaction with turbine
  - No detectable changes in relative abundance or annual counts of seals
  - Seals and porpoises regularly move past operating turbine
  - Seals moved at a higher rate during periods slack tide, indicating avoidance

- Links to data transferability
  - Findings can be used to provide better understanding of marine mammal behavior:
    - In high energy environments
    - Nearfield behavior around turbine
    - Potential risk of collision

Collision Risk | Marine Mammals | Shallow | Narrow | Bottom mounted

Case Study
Pelamis Wave Power – Underwater Noise

- Pelamis Wave Power P2 demonstration (2010 – 2014)
  - European Marine Energy Centre (EMEC) – Stromness, Scotland
- Operational noise on protected species

- Acoustic measurements
  - Determine underwater sound profile
  - Produce noise propagation model

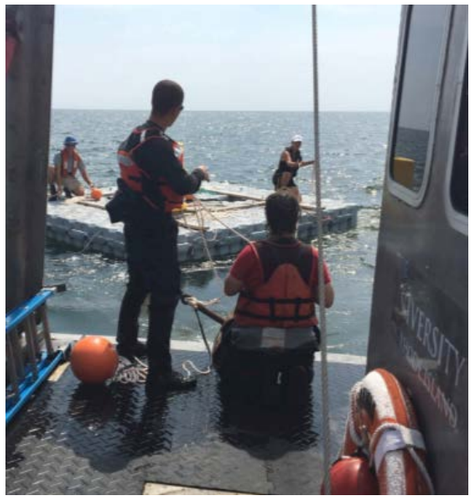
Case Study
Pelamis Wave Power – Underwater Noise

- Initial findings showed noise from P2 device not at levels which may cause injury to sensitive species
- Based on data, did not need to undertake 2 year offshore bird surveys
  - Significant time and money savings
- Links to data transferability
  - Results of monitoring can inform future data collection for similar device or device with similar noise outputs and similar environment

Underwater Noise	Marine Mammals	Isolated/Quiet Environment	Wave device
Underwater Noise	Birds	Isolated/Quiet Environment	Wave device

Case Study
BOEM/URI studies – EMF

- BOEM and University of Rhode Island research
  - Long Island Sound, Connecticut (Cross Sound Cable)
  - Raritan Sound, New Jersey (Neptune Cable)
  - Block Island, Rhode Island (sea2shore Cable)
- EMF effect on lobster and skates
- Methodology
  - Literature review
  - Computer simulation/model
  - Field studies
    - Surveys of cables
    - Enclosure experiment

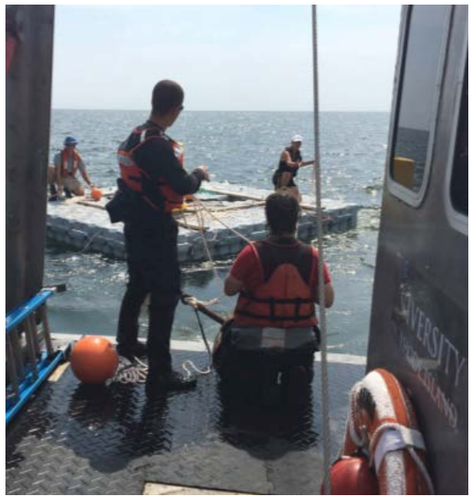


Case Study
BOEM/URI studies – EMF

- Model was an effective tool to model/simulate EMF for DC
- Provides a standard method for EMF survey
  - Swedish ElectroMagnetic Low-noise Apparatus (SEMLA) towed on a sled
- Not a barrier to movement
  - But statistically significant behavior responses
- Links to data transferability
  - Model could be used in place of expensive monitoring
  - Data collection consistency: standardized protocol for EMF surveys – SEMLA
  - Data further understanding of EMF effects
    - Can be used for future MRE developments

EMF | Invertebrates | Buried cable

EMF | Elasmobranchs | Buried cable



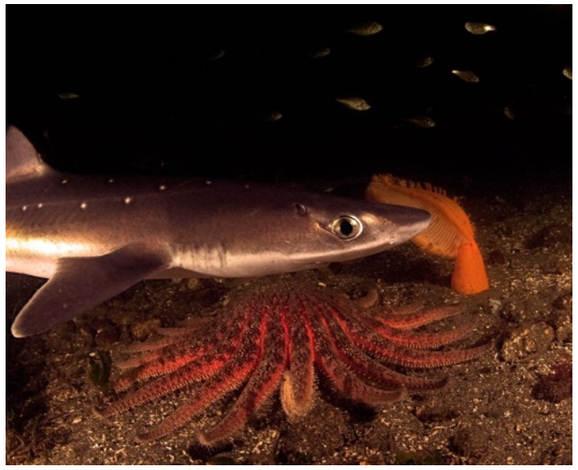
Discussion and Feedback

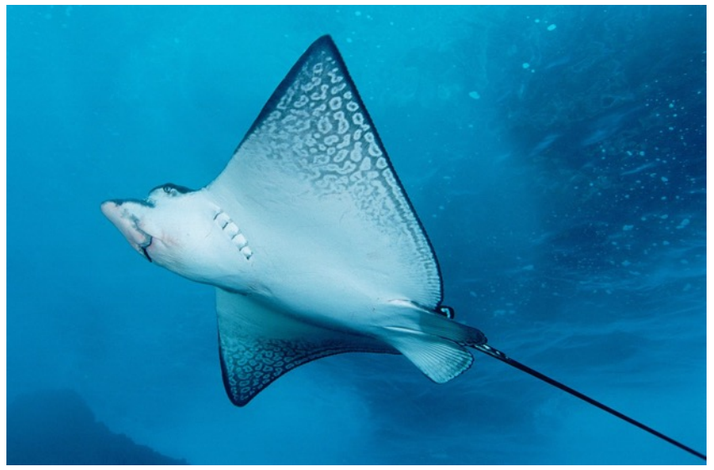
- Does the Data Transferability Process make sense?
- Would you make use of the Monitoring Datasets Discoverability Matrix?
- Are the BMPs useful to aid in the transfer of data?
- Will the Data Collection Consistency Table be useful to you?
- Any feedback on the Case Studies?

Testing Pathway to Retiring Risk

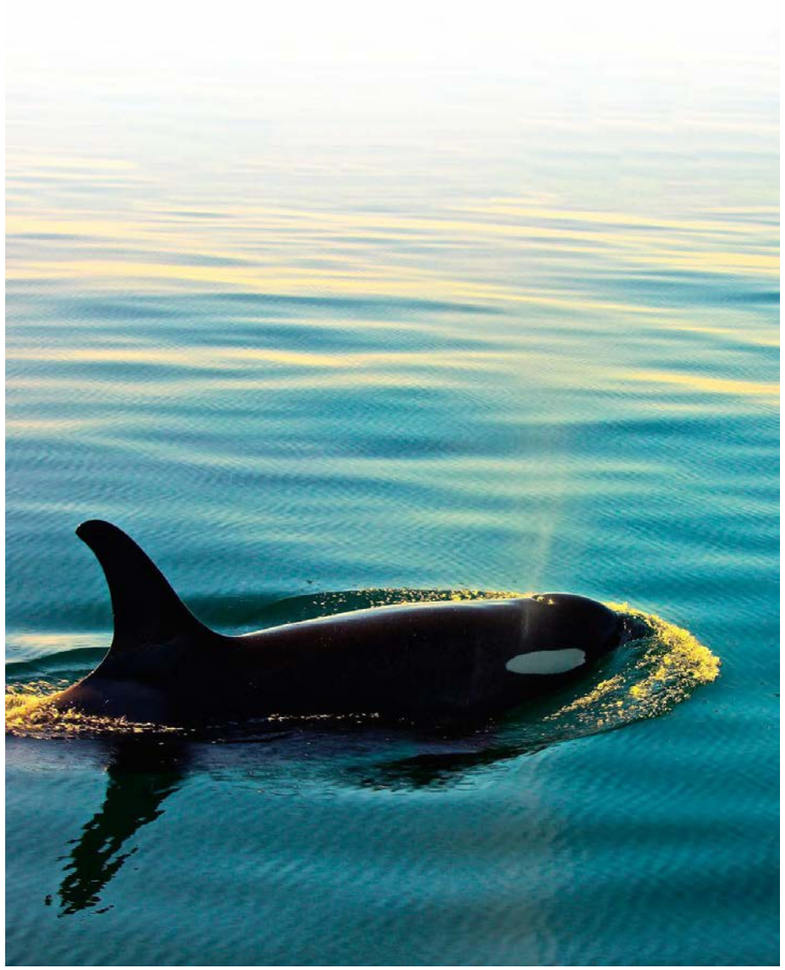
- Underwater noise and EMF may be ripe to retire for small numbers of devices
  - Develop these as examples for how a risk might be retired

- International workshop around the European Wave and Tidal Energy Conference (EWTEC)
  - Sept 5, 2019 in Naples, Italy
  - Gather international MRE regulators, developers, consultants, and researchers
  - Continue to receive feedback on the Pathway to Retiring Risk
  - Work through examples and the potential to retire risks





Getting to Success with Risk Retirement



- Regulators
  - Willing to accept premise of risk retirement and data transferability
  - Apply the principles of data transferability and collection consistency to evaluate permitting applications
- Device and project developers
  - Recognize the value of risk retirement and data transferability
  - Commit to collecting/providing data that will best fit the data transferability framework and guidelines for collection consistency, quality assurance, and trustworthiness
- Researchers and consultancies
  - Inform themselves of data collection consistency and potential use of data collected around MRE devices to ensure that research data can be transferred and used to retire risks

Next Steps

- Incorporate feedback from US regulator workshops
- Continue to develop Pathway to Retiring Risk and Data Transferability Process
  - Monitoring Dataset Discoverability Matrix
  - Data Transferability Case Studies
  - Risk Retirement examples
- Continue to seek input from US and other OES-Environmental country regulators
- Present process via web-based tool on *Tethys*

Links on *Tethys*

- *Tethys*
  https://tethys.pnnl.gov/

- Data Transferability Process
  - Previous regulator workshop recordings
  - Data Transferability Report
  - Workshop documents and report
  - *Will host today's presentation and recording*

  https://tethys.pnnl.gov/data-transferability

- Retiring Risk
  - To be developed – check back for more information

  https://tethys.pnnl.gov/riskretirement

Thank you!

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