Evaluating Environmental Risks and Managing Data for Marine and Hydrokinetic Energy Development

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Pacific Northwest National Laboratory

DOE Environmental Webinar

"Marine and Hydrokinetic Environmental Data Management, Cumulative Impacts and Risk Assessment"

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Environmental Effects of MHK Development – What do we know? How can we move forward?

- New technologies, new use of ocean space, entry into areas with existing uses and stressors on marine animals and habitats
  - Few data available to determine potential effects
  - Limited appropriate data available from other industries, other countries
  - New scientific literature providing some insights
- Need to predict risks to marine receptors with incomplete data
- Need to organize existing data, plan for future data

Risk Assessment = Environmental Risk Evaluation System (**ERES**)

Knowledge Management System = ***Tethys***

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Purpose and Use of ERES & *Tethys*

- Purpose: to classify and evaluate environmental effects of MHK development, in support of siting and permitting
- Use of ERES: Determining highest risks:
  - Point of departure for discussions among developers, regulators
  - Optimization of siting to minimize risk
  - Guidance for technology & project developers to modify design/operation to minimize risk
  - Basis for designing cost-effective mitigation strategies
- Use of *Tethys*: Making data accessible
  - Serving as platform for ERES, other risk assessment
  - Portal for many uses to share, access data
  - Archive for range of supporting materials

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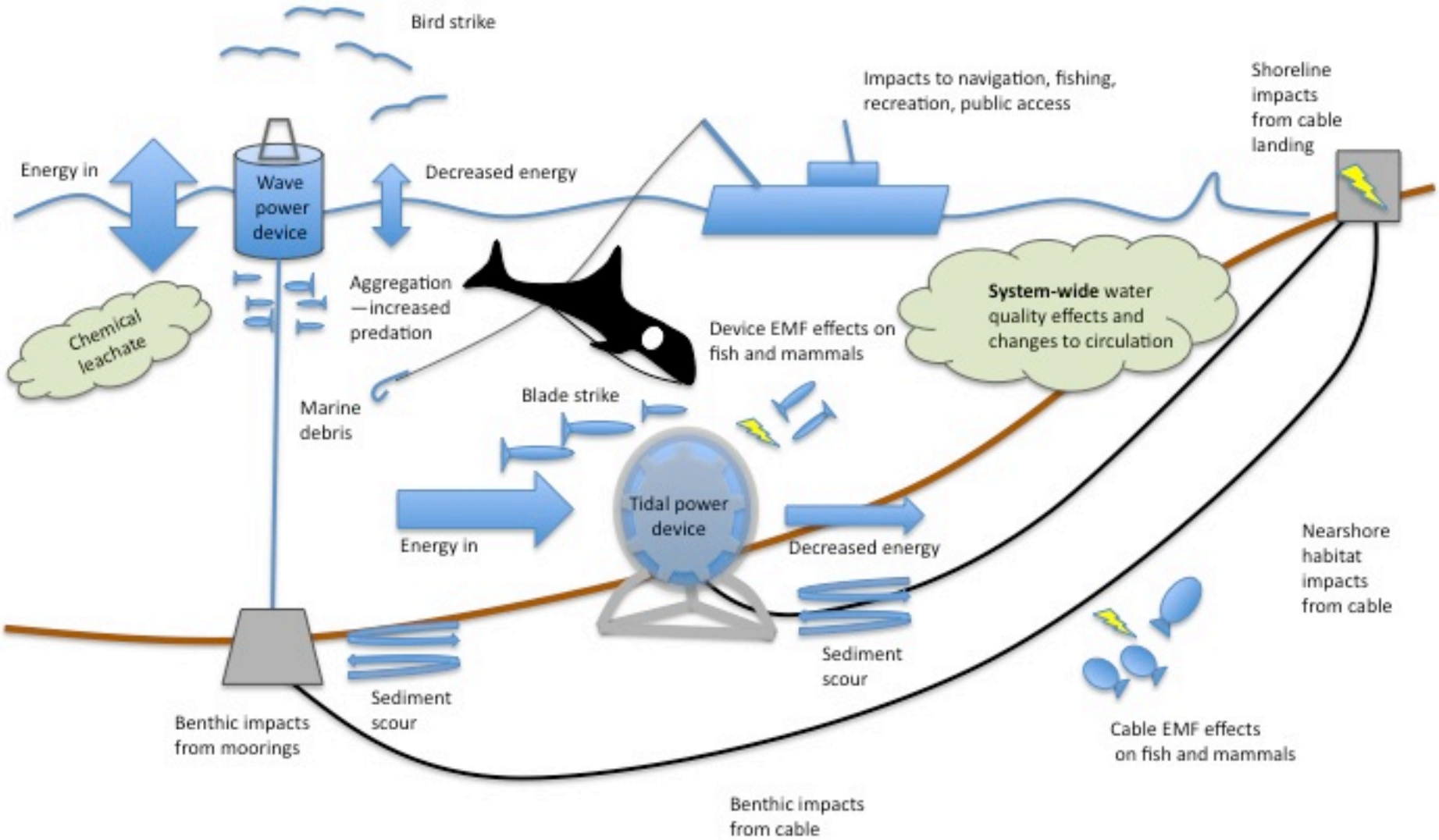
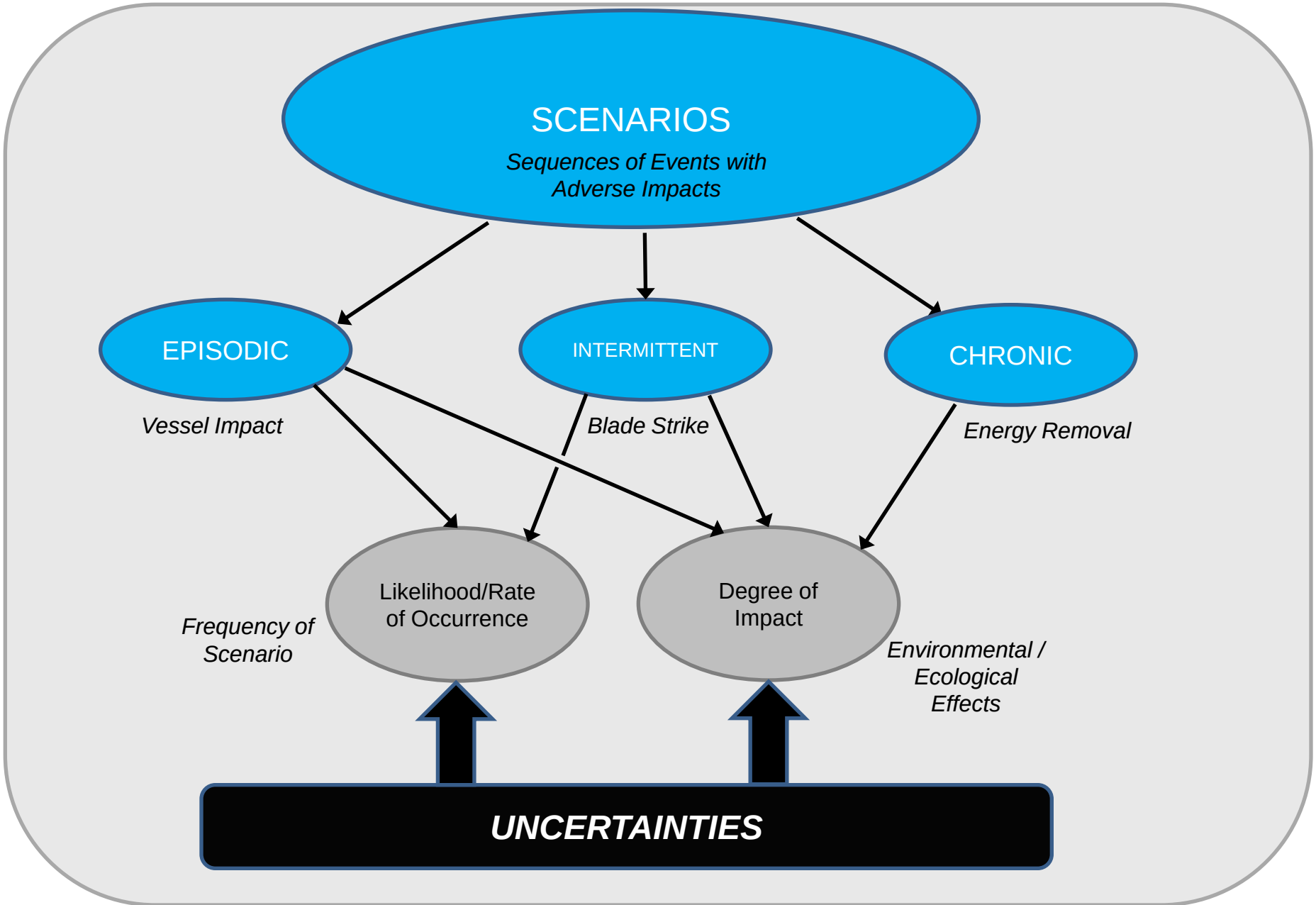
Potential Environmental Impacts of Marine and Hydrokinetic Energy Devices



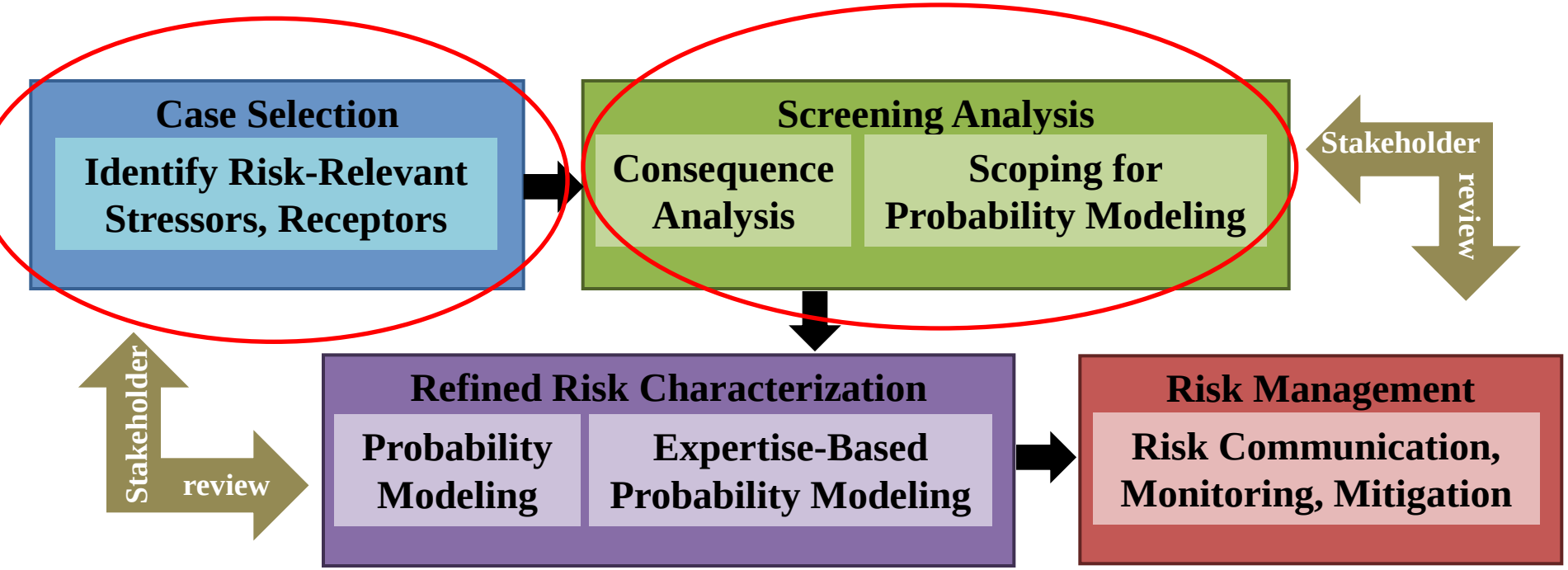
Description of Risk



Environmental Risk Evaluation System

- Consider interactions of Stressors and Receptors
  - Stressors: parts of MHK device, moorings, anchors, cables
  - Receptors: marine animals, habitats, ecosystems
- Case Study Approach
  - MHK projects as cases: proposed or under development
  - With enough cases "span the analytical space"
  - Three initial cases: one tidal, one wave, one river
- Rank S/R interactions using biophysical risk factors
- Assumptions:
  - Outcome of ERES actionable, determine highest risks
  - High biophysical risks due to: 1) high uncertainty; 2) real risk
  - Biophysical risk factors can provide scientific ranking of risks for a receptor group, but cannot rank risks across receptor groups
  - Risk across receptor groups ranked using regulatory risk factors

Risk-Informed Analytical Process – Step 1: Case Selection



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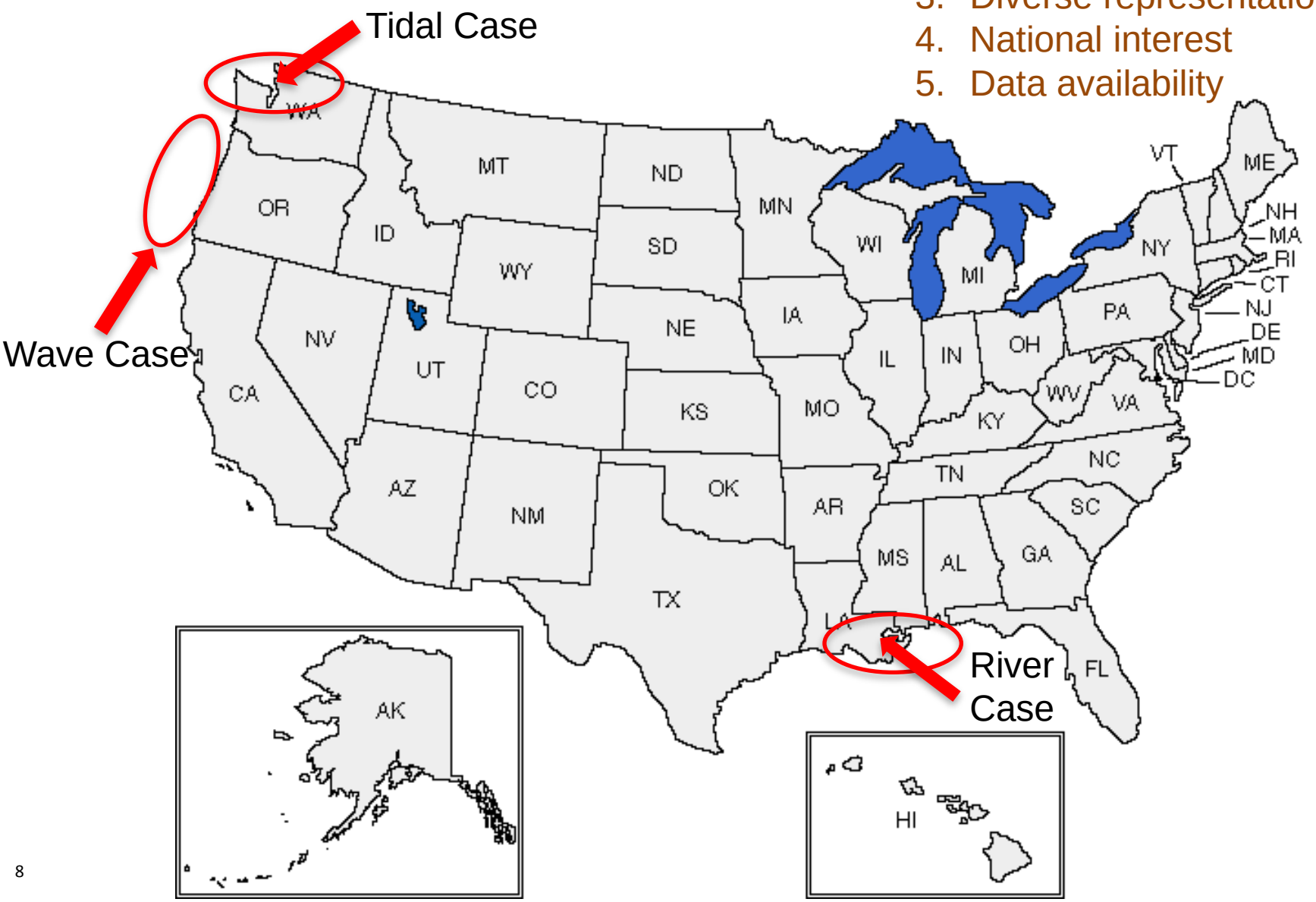
Case Selection

Criteria:
1. Real/readiness
2. Developer willingness
3. Diverse representation
4. National interest
5. Data availability



Wave (OPT) Stressor	Wave (OPT) Receptor
First Tier	
Accident/disaster (oil spill, lost gear)	T&E pinniped (Steller sea lion)
Accident/disaster (oil spill, lost gear)	T&E bird (marbled murrelet)
Physical presence	T&E bird (marbled murrelet)
Accident/disaster (oil spills, lost gear)	T&E reptile (green sea turtle)
Second Tier	
Accident/disaster (oil spill, lost gear)	T&E cetacean (humpback whale)
Leaching of toxic chemicals	T&E bird (marbled murrelet)
Physical presence	T&E reptile (green sea turtle)
Third Tier	
Noise	T&E cetacean (humpback whale)
Noise	T&E pinniped (Steller sea lion)
Physical presence	T&E cetacean (humpback whale)
Physical presence	T&E pinniped (Steller sea lion)
EMF	T&E bird (marbled murrelet)
Noise	T&E bird (marbled murrelet)
EMF	T&E reptile (green sea turtle)
Fourth Tier	
EMF	T&E cetacean (humpback whale)
EMF	T&E pinniped (Steller sea lion)
Leaching of toxic chemicals	T&E cetacean (humpback whale)
Leaching of toxic chemicals	T&E pinniped (Steller sea lion)
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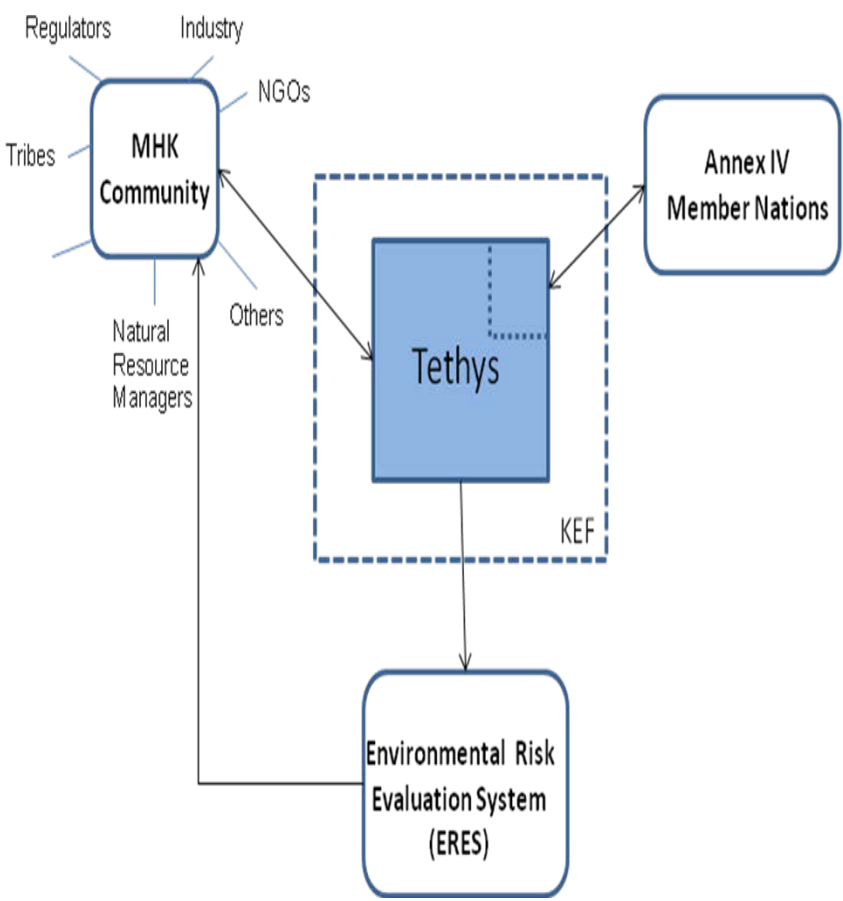
MHK Knowledge Management System, aka *Tethys*

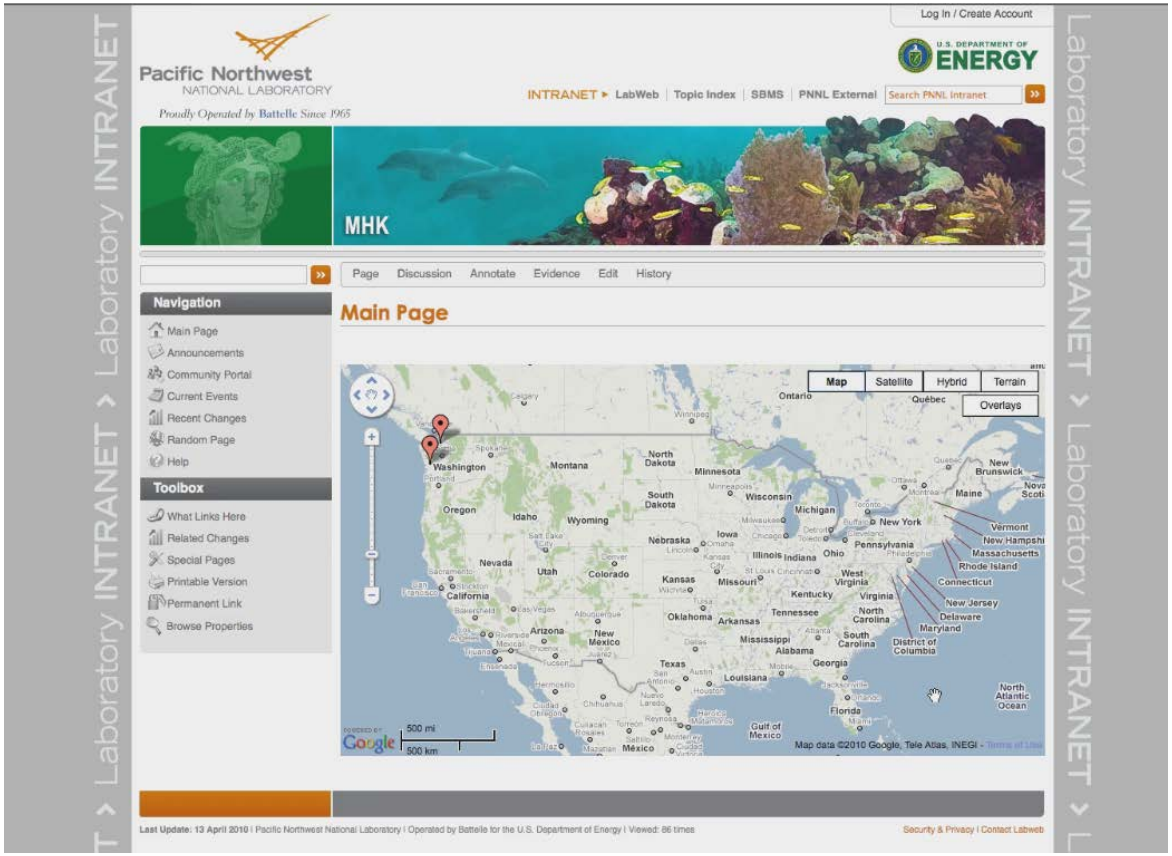
- Named for Greek Titan goddess
- Primary function of the system is as a knowledge base to support the risk framework (ERES)
  - Evidence collection and marshalling
  - Data navigation and management of risk model results
- Other functions expected to be important
  - Knowledge portal for various stakeholders
  - Portal to other knowledge sources (e.g., Annex IV database under construction)
  - Collaborative environment for MHK research community
- Functionality created through interviews with users



Key Needs Identified by Stakeholders

User Needs	Example of Functionality
High degree of geospatial resolution	Ability to put data into geospatial context, including 3D
Transparency into ERES process and the underlying data	Access to all available data
Ability to associate data with specific sites, MHK technologies, and environmental impacts	Tools that associate each data item with another; clear and consistent tagging of data
Multiple presentation formats for searching, navigating, and presenting data and documents	Features such as: project timeline, map-based displays, model/scenario-centric visualizations

Tethys Live Demo



http://mhk.pnl.gov/wiki/index.php/Tethys_Home

Annex IV

- International Energy Agency – Ocean Energy Systems, Implementing Agreement
  - 28 member nations
  - "Annex" is an agreement to carry out collaborative tasks
- OES-IA Annex IV
  - Gather environmental effects data from member nations, evaluate effects, monitoring methods, mitigation strategies
  - Eight member nations, U.S. is lead, DOE is operating agent
- PNNL will lead for U.S.
  - Create portion of *Tethys* for Annex IV data
  - Wave Energy Center/University of Plymouth Marine Institute (UK) assisting with data collection, analysis
  - Held experts' workshop last week in Dublin to help get direction, organized by Irish Marine Institute
  - Collecting data for analysis now

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Delivery of ERES & *Tethys*

- **ERES**:
  - First three cases for consequence: February 2011
  - First two probability analyses: July 2011
  - Two additional cases (tidal, wave) for consequence: September 2011
  - Two new cases in FY12 (OTEC, wave)
  - Expert elicitation to further probability analysis

- ***Tethys:***
  - Published requirements document 2011
  - Prototype launched in spring 2011 for stakeholder feedback
  - Collaborating with BOEMRE on geospatial data handling (via MMC)
  - Full deployment scheduled for late September 2011
  - Building Annex IV portion of KMS, collecting metadata
  - Currently adding documents related to offshore wind as well as MHK technologies; full site will include views to each

Thank you for your attention!

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