

Regulatory Models and Salish Sea Model Development

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EXHIBIT 2

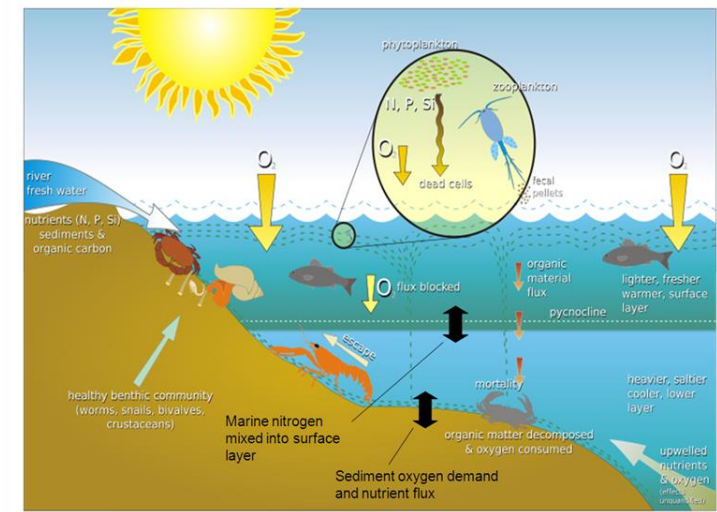
Topics

- Models in the regulatory process
- Salish Sea Model
 - Building and Testing
 - Documentation and Peer Review
 - Uncertainty
 - Acceptance
 - Application



Models and the Clean Water Act

- Models give us:
 - Scientific basis for regulatory decisions
 - Mathematical linkage between pollution and impacts
 - Identification of major and minor pollution sources
 - Estimated outcomes of different alternatives
 - Prediction of future changes (e.g., population growth)



Characteristics of a good regulatory model

- Model framework includes the important processes and capabilities
- Processes, equations, and assumptions are well documented
- Incorporates all available input data
- Thorough documentation of model development
- Transparency about limitations and uncertainty
- Peer review
- Public review



Salish Sea Model...Typical or Atypical?

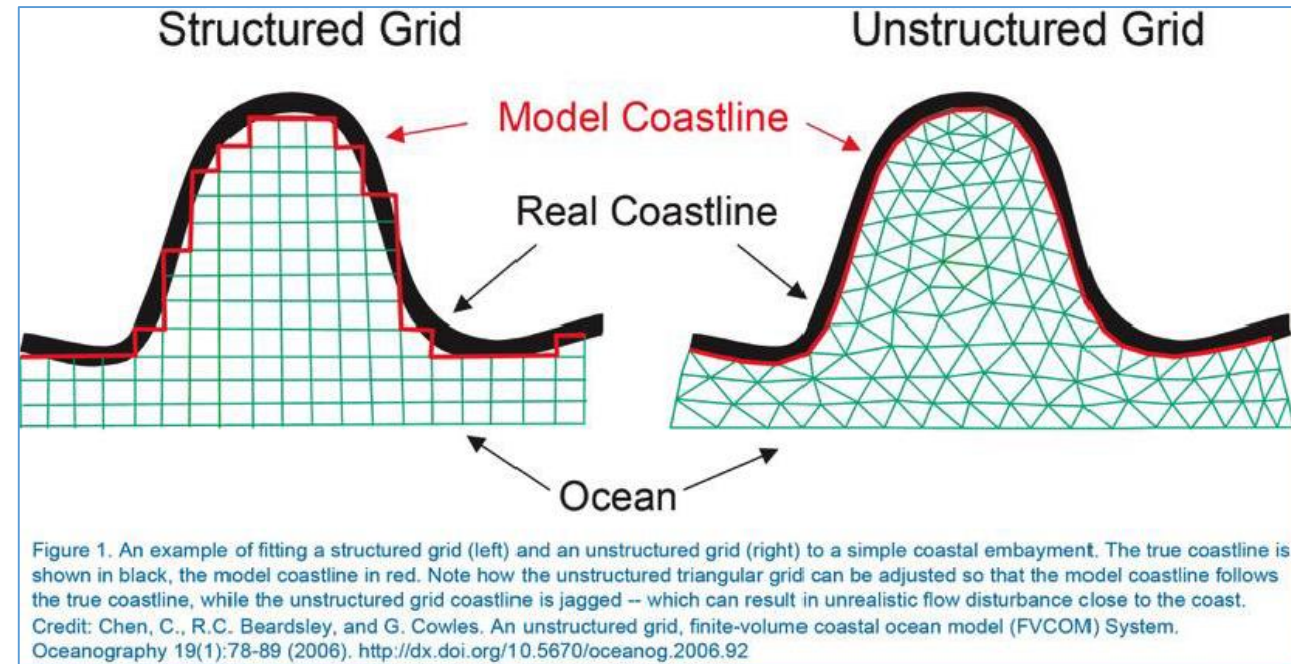
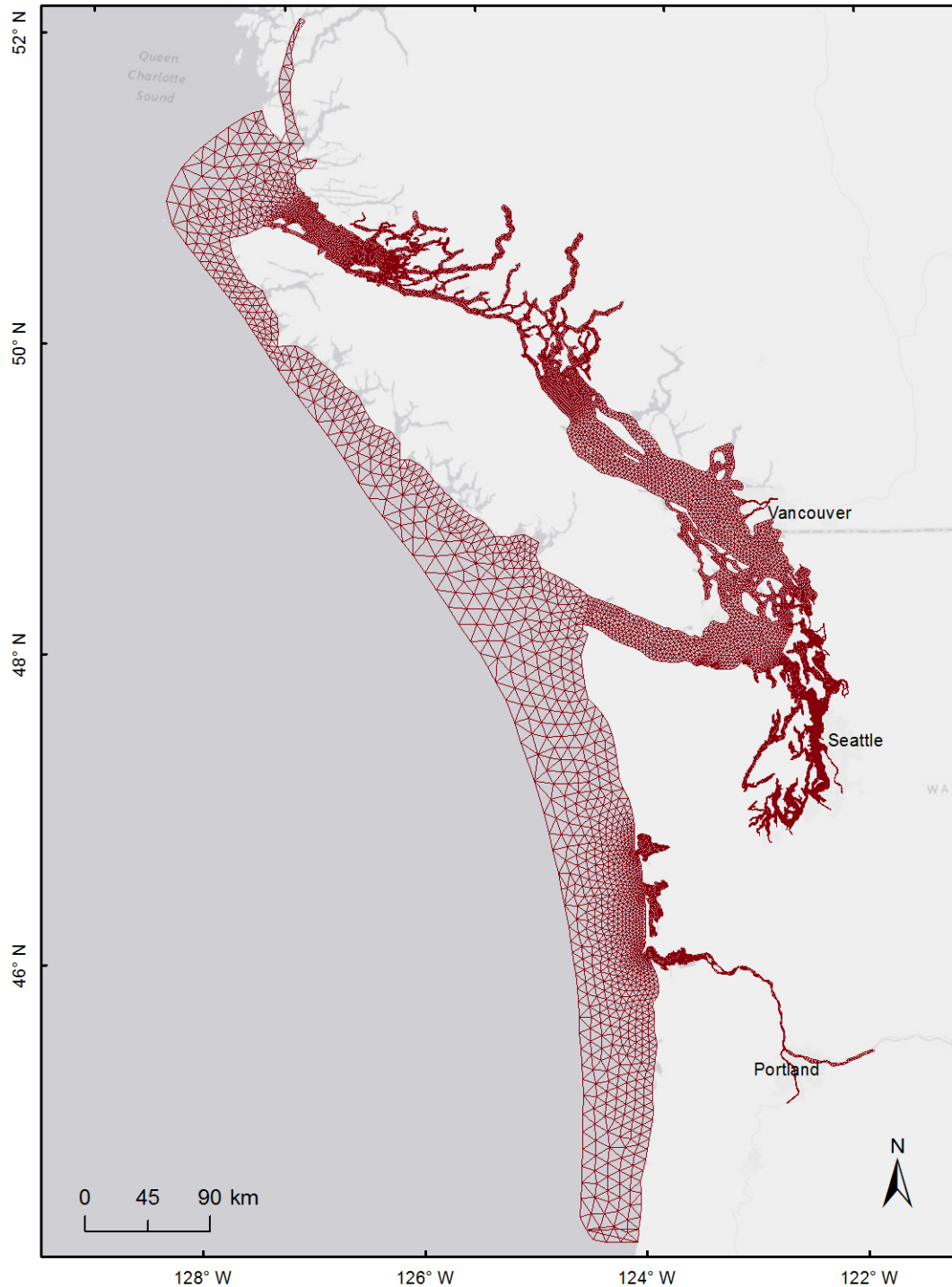
- Answer: Both
- Typical
 - Mathematical equations linking nutrients and DO/pH
 - Normal steps in model-building process
- Atypical
 - Large scale and complexity of Salish Sea (akin to Chesapeake Bay model)
 - Longer development time and higher cost
 - Limitations in estimates at smaller scales
 - More peer review and documentation than typical TMDL models

Salish Sea Model



Scientific Tool

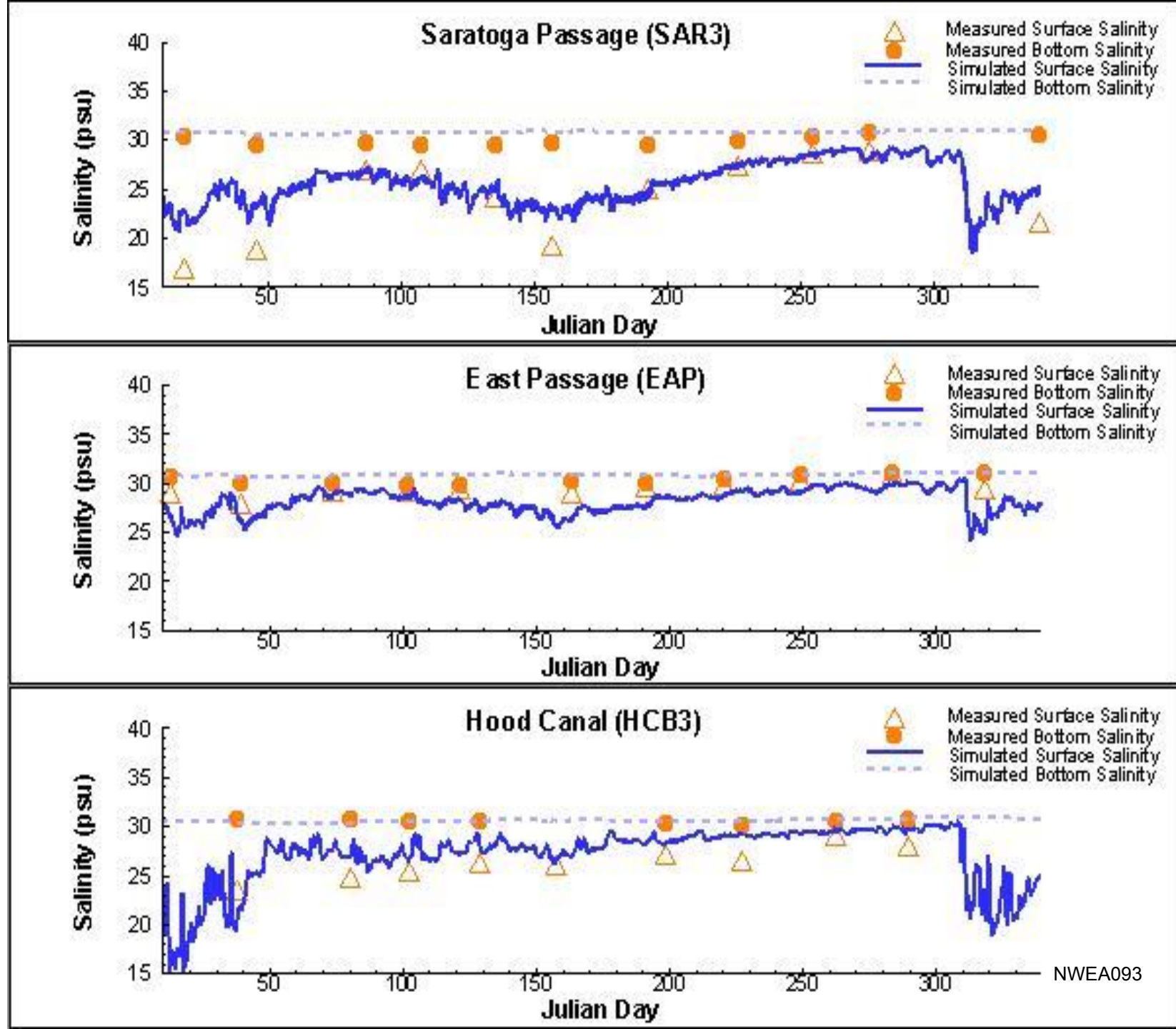
FVCOM + CE-QUAL-ICM
(Hydro) (WQ)



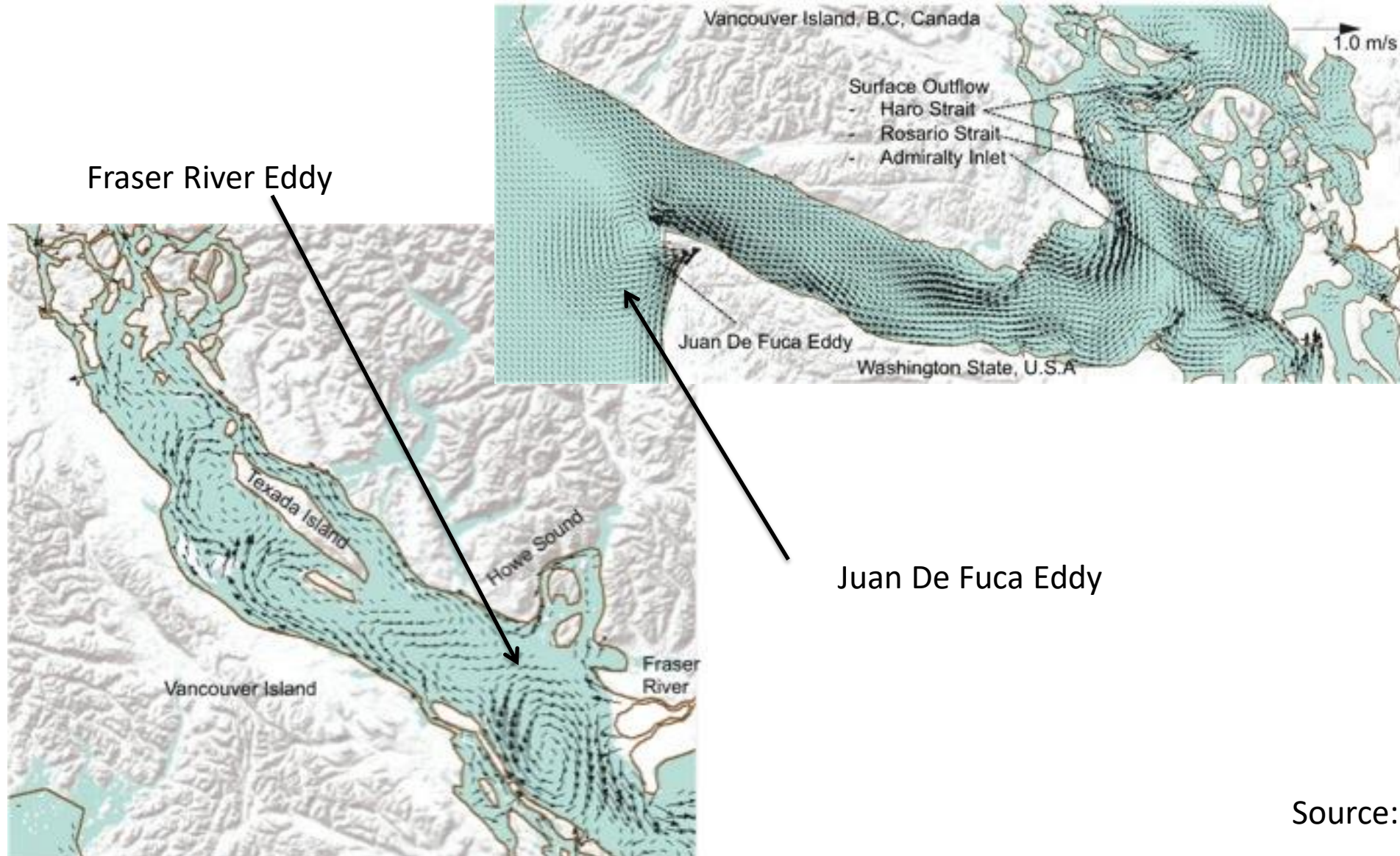
Source: PNNL
NWEA092

Matching patterns is a test of:

- Freshwater input volume
- Vertical mixing
- Interbasin mixing

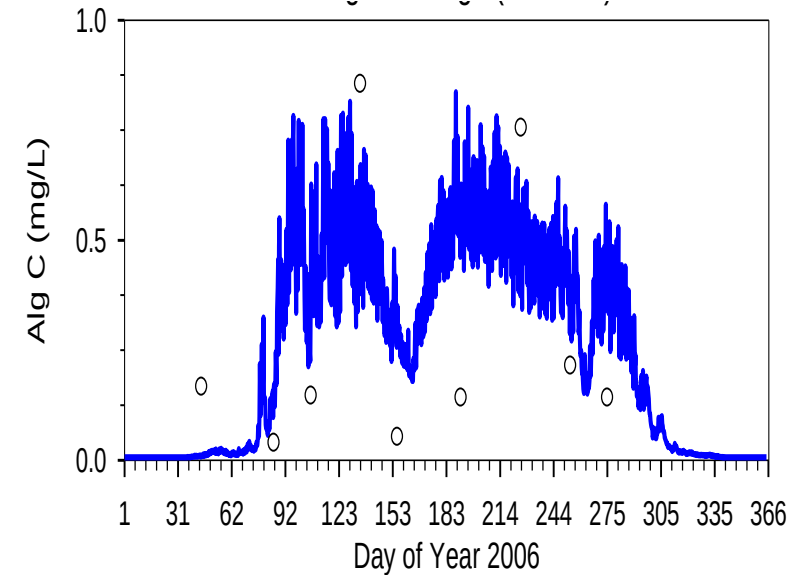


Surface Currents

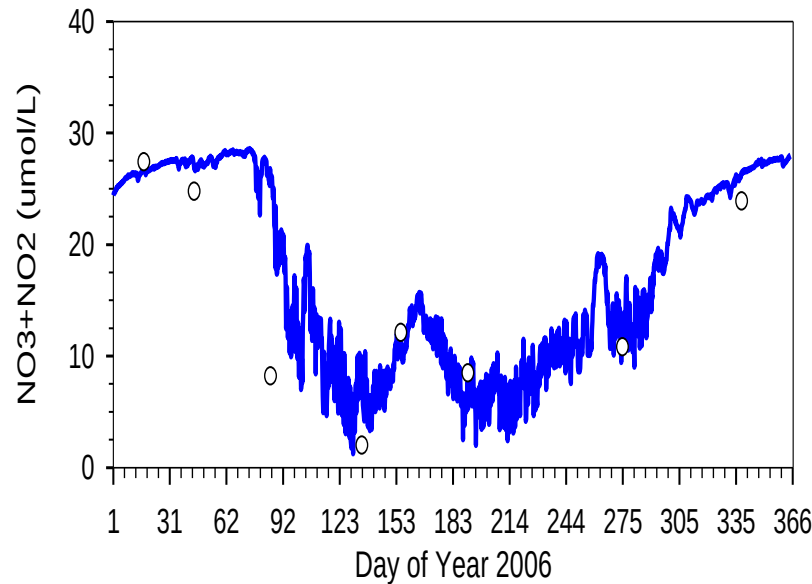


Saratoga Passage, Year 2006, Surface Layer

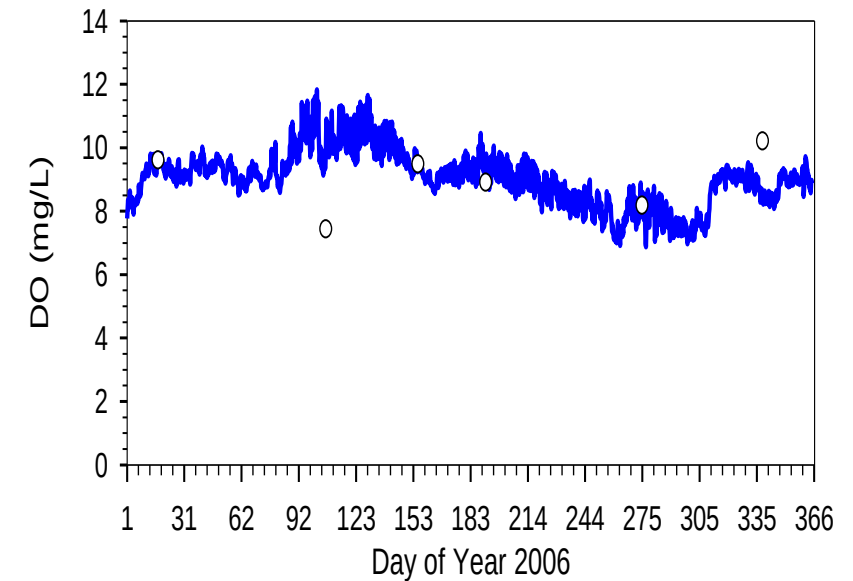
Algae



Nitrate/Nitrite



Dissolved Oxygen



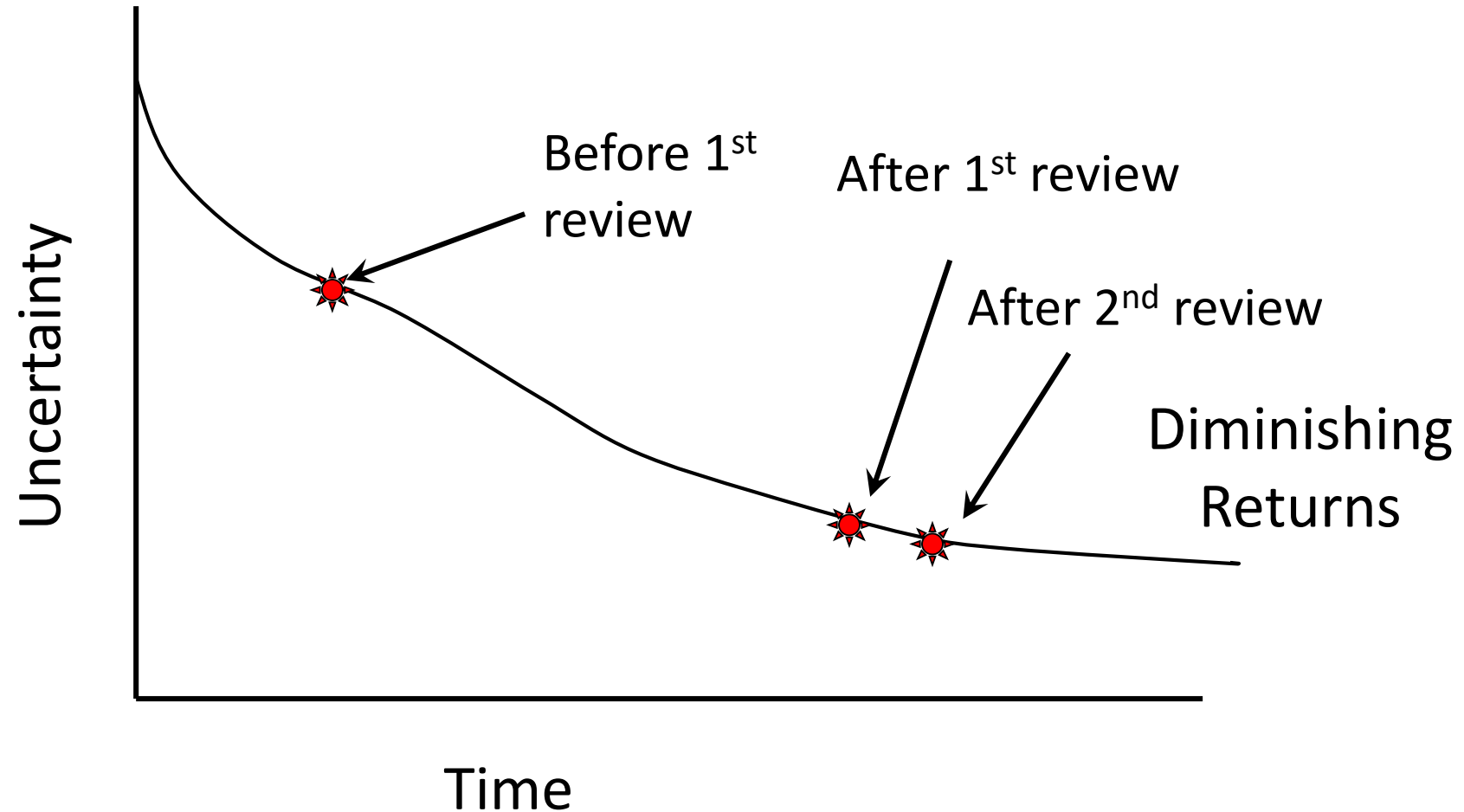
- Patterns are test of:
 - Nutrient supply
 - Nutrient/Biomass/DO linkage
 - Seasonal variation

Model Uncertainty and Acceptance

- Uncertainty
 - Fact of life in water quality modeling
 - Ideal : perfect match with observations
 - Reality: irreducible model error
- Model Acceptance
 - No fixed numeric guidelines for “acceptable” model error
 - Judgment call...by the water quality agency



Getting to Acceptance

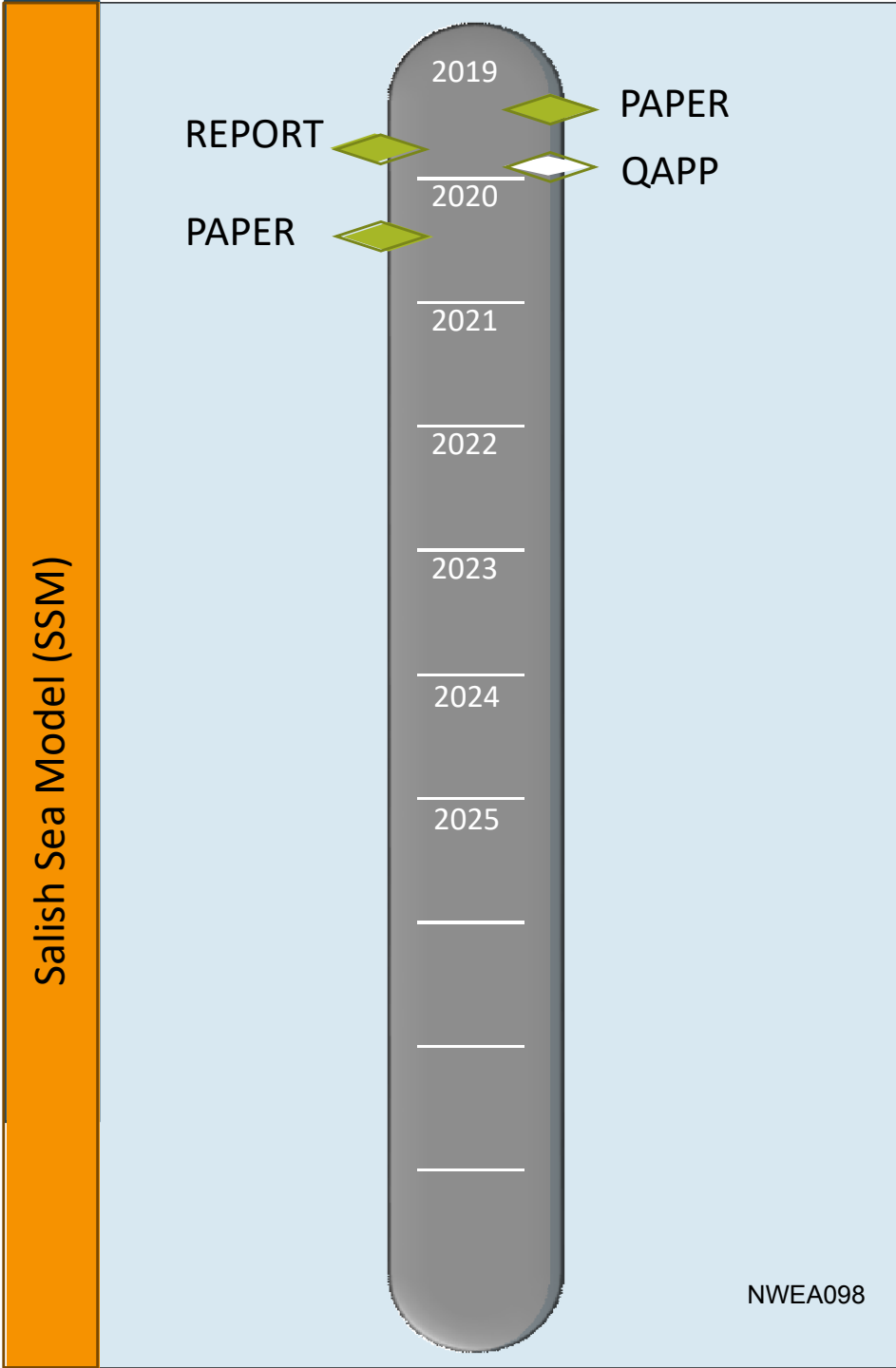
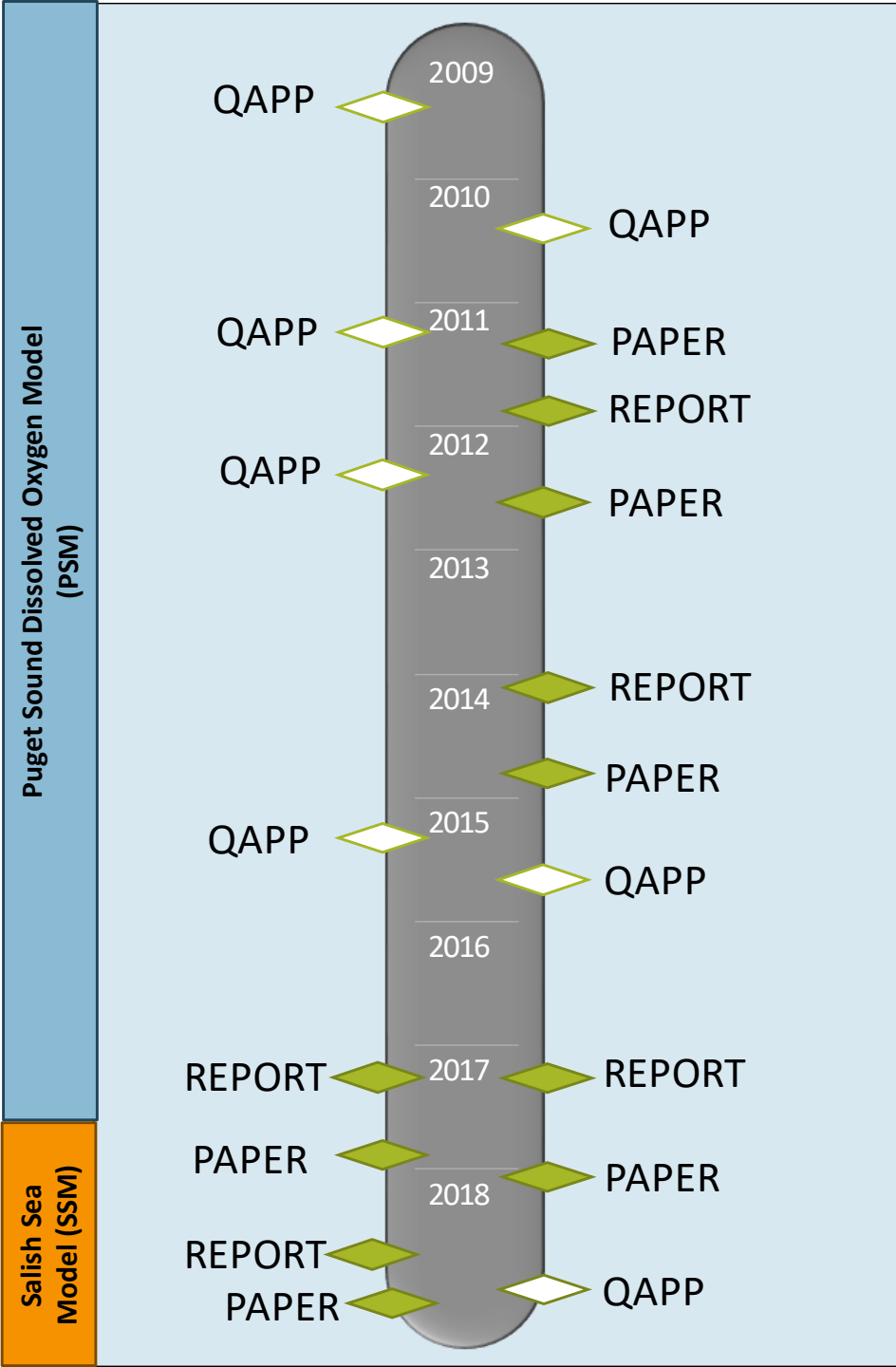


Salish Sea Model

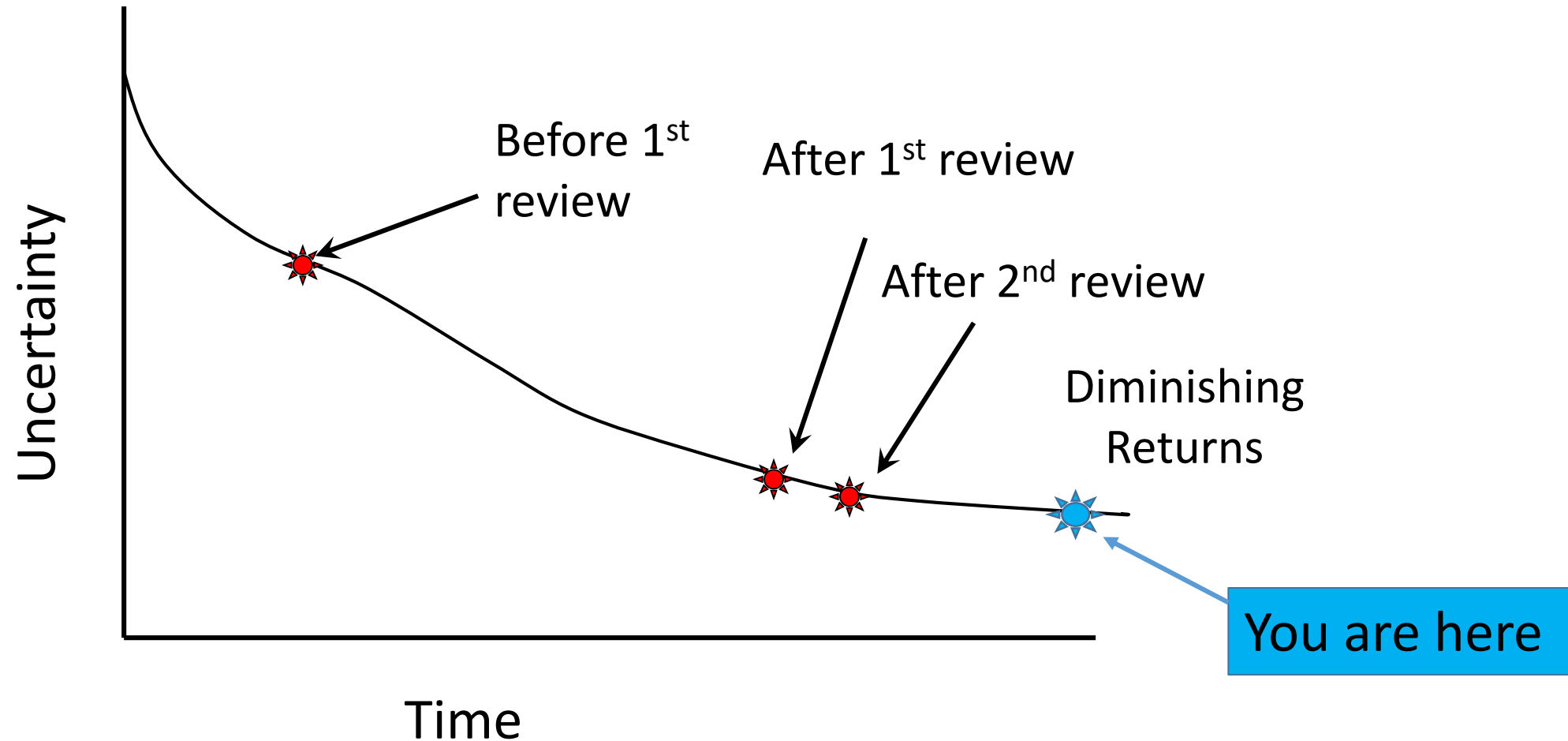
Long term
development and
improvement

Documentation

Peer review



Getting to Acceptance

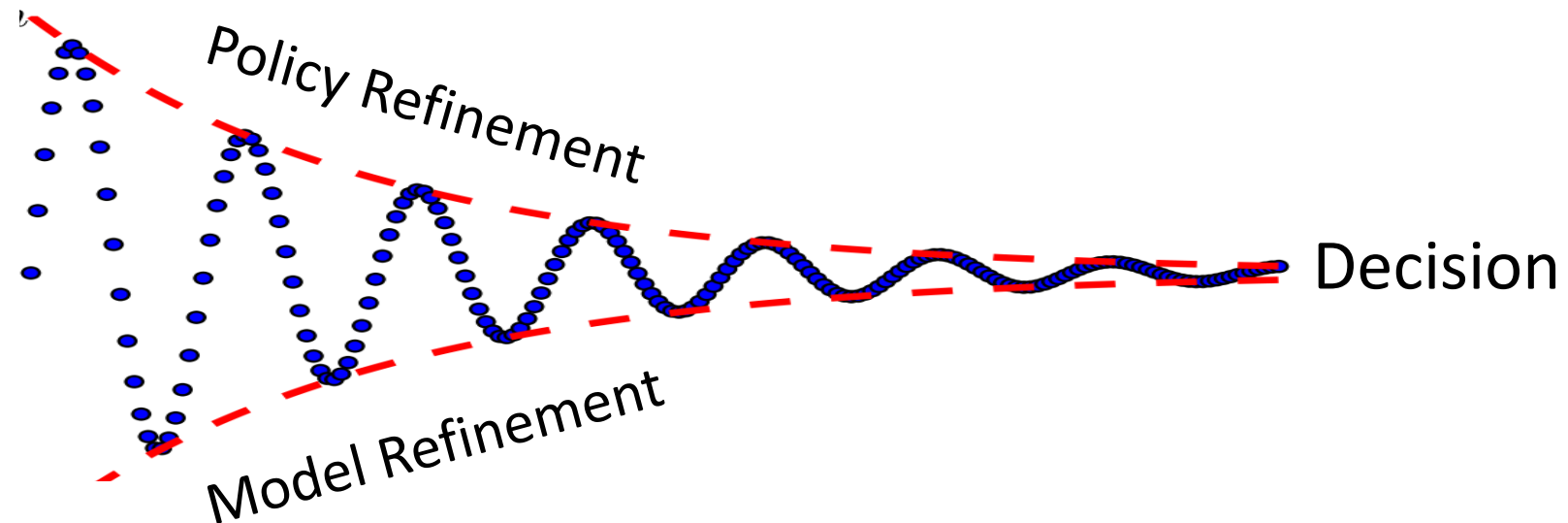


Where we are

- Ecology has accepted the model for use in the nutrient project
 - Calibrated model or “core model”
 - Final reports on model development – input data, assumptions, calibration (plots and error stats), etc.
- Scenario Phase
 - “What if” scenarios
 - Isolating source impacts – “Best Estimates”
 - Many model runs with specified source input changes
 - Guided by policy goals and practical considerations
- New questions about the core model?
 - Re-opened and modified only for discovery of new information or substantial error

Models and Policy are refined together

- Build the best model you can
- Ask scientists and stakeholders for ideas/info to improve it
- Accept model and start applying scenarios
- Model Scenarios and Policy Approaches are refined until final decision





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