

***Environmental
Management Decisions in
the Face of Uncertainty***

A-South Jetty of the
Columbia River
B-Baker Bay
C-Youngs Bay
D-Formerly Mitigated
Wetland
E-Rice Island

**Prepared for Project Sponsor
Ports**

**Anne Fairbrother, DVM, PhD
Parametrix, Inc.
Corvallis, OR**

Adaptive Management

An iterative approach to managing ecosystems, where the methods of achieving the desired objectives are unknown or uncertain

– Holling 1978

Adaptive Management

A continuous process of action based on doing, learning, sharing, and improving

**– BC Ministry of Forestry
and
USDA Forest Service**



Plan & Set Directions



- **Determine Objectives**
 - **Environmental Action** → **Channel Deepening**
 - **Environmental Protection** → **Endangered Salmonids**

Plan & Set Directions

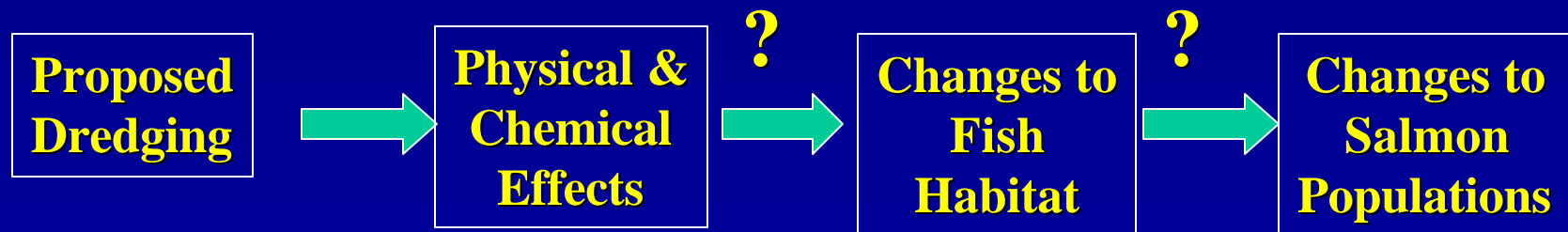


- **Determine Objectives**
 - **Environmental Action** → **Channel Deepening**
 - **Environmental Protection** → **Endangered Salmonids**
- **Conceptual Plans and Models**
 - **Channel Deepening** → **Proposed Dredging**
 - **Endangered Salmonids** → **Conceptual Model**

Plan & Set Directions



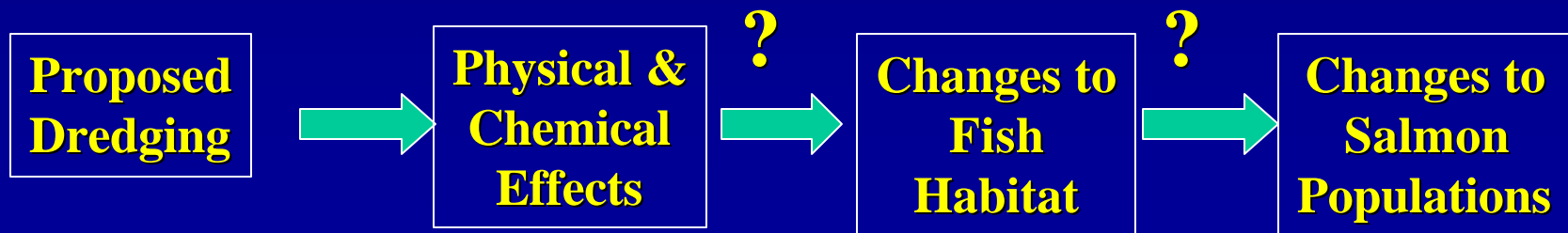
- **Conceptual Model for Salmonids**
 - Establishes hypotheses of connections between proposed Action and Receptors of Concern



Plan & Set Directions



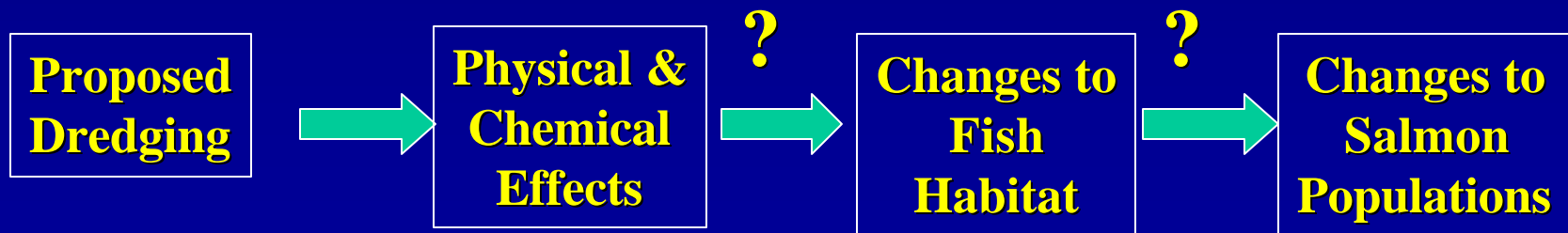
- **Conceptual Models...**
 - **clarity of assumptions**
 - **are a good communication tool for conveying those assumptions**
 - **provide a basis for organization and completion of the assessment.**



Plan & Set Directions



- **Assess risks of proposed dredging (= Biological Assessment)**
 - **predictive models of physical/chemical changes and their influence on fish habitat parameters**
 - **changes in fish population growth rate as a function of changing habitat parameters**



Plan & Set Directions



Risk is the **likelihood** and **magnitude** of the occurrence of unwanted effects

Plan & Set Directions



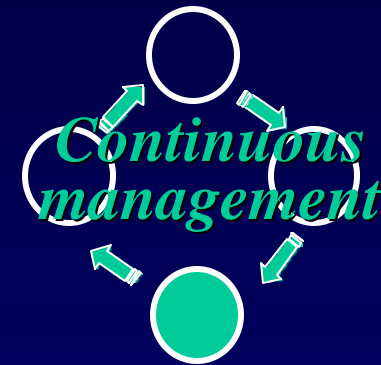
- **Make a determination on proposed dredging and, if necessary, appropriate mitigation plans (= Biological Opinion)**
- **Establish monitoring plans**
 - **include Management Decision Points**

Act

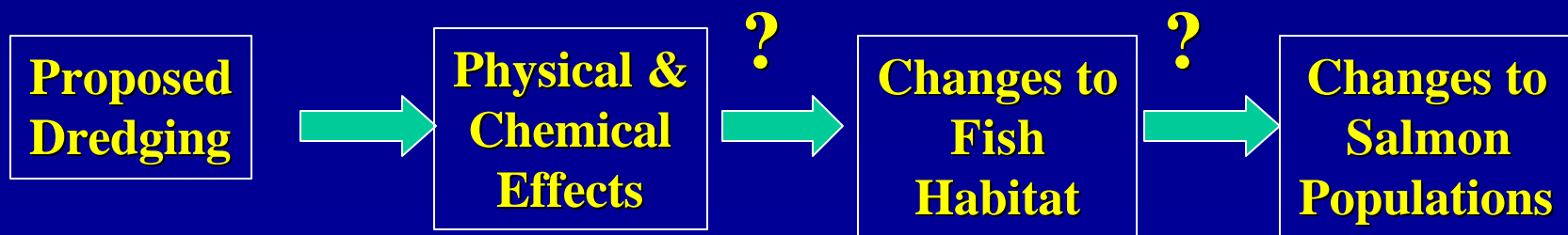
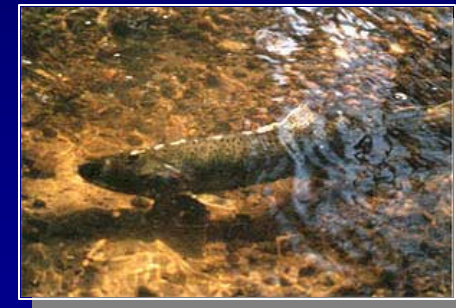


- **Conduct Channel Deepening project**
- **Continue with Channel Maintenance operations**
- **If necessary, institute agreed-upon mitigation efforts**

Monitor



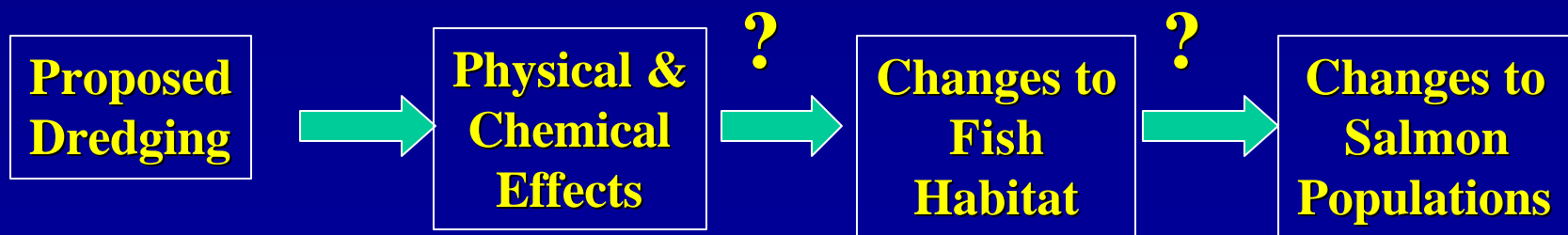
- **Gather information to evaluate and refine the accuracy of predictions**
 - **conceptual model**
 - **risk assessment results**



Monitor



- **Gather information to evaluate accuracy of predictions**
 - **requires establishment of clearly stated goals, specific metrics, Management Decision Points**



Evaluate



- **Determine whether management goals are being met**
 - **re-evaluate uncertainty in predictions**
- **Adjust actions to move closer to agreed-upon goals**
- **Establish new management goals, Decision Management Points, monitoring plans, and actions**

Adaptive Management will...

- Recognize that there are ***multiple explanations*** about biological processes
- Recognize that there is ***uncertainty*** in all proposed explanations
- Incorporate this uncertainty into ***decision-making*** processes
- Reduce uncertainty and improve environmental management through ***monitoring***

Cornerstones

- A ***continuous process*** of action and management
- ***Partners*** and ***collaboration*** are needed to get things done
- An ***ecosystem approach*** is most effective, recognizing a multiplicity of scales
- ***Sustainable development*** recognizes that people are part of the ecosystem

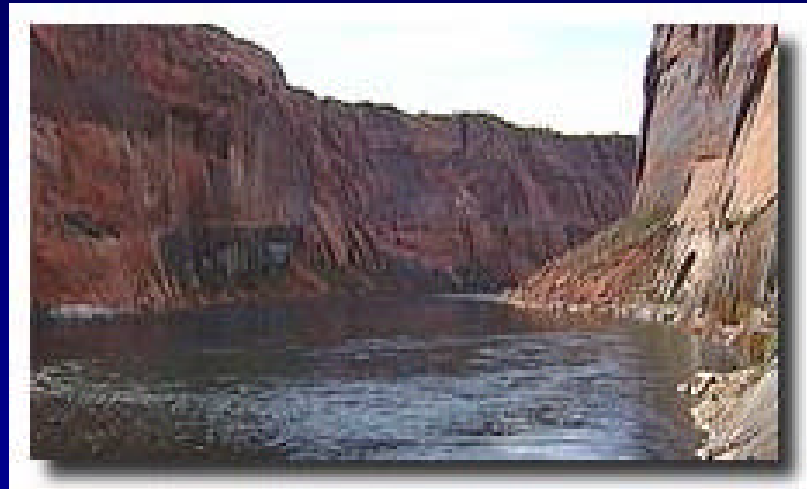
Glen Canyon Dam

The **Adaptive Management Working Group** was established “...to provide an organization and process for cooperative integration of dam operations, downstream resource protection, and management, monitoring and research information...”



Glen Canyon Dam

Significant resources include water, sediment, fish, vegetation, wildlife and habitat, listed species, cultural resources, air quality, recreation, and hydropower.



Additional Reading

- **Holling, C.S. (editor). 1978. Adaptive Environmental Assessment and Management. John Wiley and Sons, New York.**
- **Lee, K.N. 1999. Appraising adaptive management. Conservation Ecology 3(2):3**

www.consecol.org/vol3/iss3/art3