The Aquatic PEP Panel

Table 1 Field of expertise and institution of Aquatic Protocol Evaluation Panel Members

Name	Field of Expertise	Institution
Paul Anders	Fish ecology, Population genetics	Department of Fish and Wildlife Resources, University of Idaho
Mike Bradford (chair)	Fish ecology, Population dynamics	Fisheries and Oceans Canada and Simon Fraser University, Vancouver, B.C.
Paul Higgins	Fish ecology Monitoring design	B.C. Hydro Vancouver, B.C.
Keith H. Nislow	Aquatic ecology, Experimental design	USFS and Univ. Mass. Amherst, Mass.
Charles Rabeni	Aquatic Ecology Fisheries Ecology	USGS, and Univ. Missouri
Cathy Tate	Aquatic ecology, Fisheries ecology Water Quality	USGS, Denver

The Panel's Charge:

"To determine if the research and monitoring programs for Colorado River aquatic biological resources were adequate to evaluate the status of aquatic resources in relation to the interim qualitative management goals."

We saw 2 issues that were somewhat distinct:

1. Monitoring to evaluate long-term change in the GCE
2. Monitoring to evaluate effects of adaptive management experiments on GCE biota.

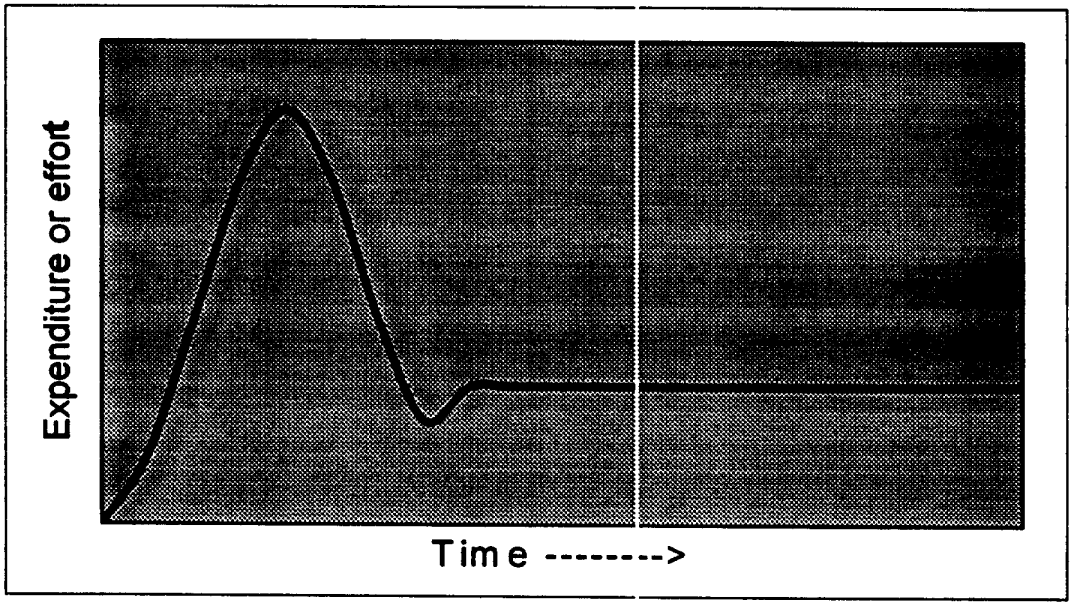
We considered direct metrics and a weight-of-evidence approach.

The Ontogeny of Monitoring Programs

- There is an initial period of investigation including a:
  - Description of the ecosystem
  - Identification of key processes
  - Development of sampling methods

- Then there might be a 'hiatus' to develop the monitoring plan

- Afterwards, monitoring begins, and expenditures are reduced.



We divided the aquatic program into its major components and evaluated them relative to this curve.

Our report is divided into 6 main chapters:

1. Water quality
2. Food base
3. Humpback Chub
4. Other native fish
5. Non-native fishes
6. Management and Institutional issues

1. Water quality

- provides a useful check on changes to the GCE for "weight of evidence" inference

- routine program should be established at physical sampling sites

- include drift sampling to measure organic flux

- improve resolution of nutrient analysis

- existing data from GCE and other systems provides experience on sampling intensity, techniques, replicates etc.

2. Food base

- lower trophic level information can be used to
  - evaluate changes in ecosystem function through biodiversity indices, or,
  - evaluate the potential flux of energy to (native) fish

- the Panel was concerned about our understanding of #2 to justify the current approach as a monitoring tool.

- Need to explicitly consider how variables being collected relate to food for native fish, and whether other measures might be more appropriate (particularly those from the fish themselves).

- If the current food base program is to continue, there should be an explicit elucidation of how the data will be used, the detection limits for the monitoring program, and an evaluation of existing data to determine sampling effort and design.

3. Humpback Chub

- The Panel recommends the development of a conceptual 'metapopulation' model for HBC to provide a context for long-term monitoring program design

- Definition of viable population

- Both demographic and genetic concerns may be important

- Clearly define how monitoring results will be used to evaluate progress towards goals.

- We support the continued development of the stock-synthesis model as a devise to assemble all existing data, but anticipate limited utility in detecting recruitment variation.

- We also support re-analyses of other data (lower LCR juvenile, backwater sampling) for integration into the model, or for utility as monitoring tools

- Is there an HBC program that will be able to detect effects of GCD operation changes?

4. Other native fishes

- There is no plan for monitoring these species yet they are no less intrinsically deserving than HBC

- Panel recommends continued assembly of existing data for flannelmouth suckers for modelling purposes, and any available information for the other species.

- Review monitoring possibilities given existing data and experience with sampling techniques

- Consider use of wiers and other technology on tributary streams

- Explicitly consider how proposed monitoring activities will be linked to management objectives.

5. Non-native fishes

- we considered non-native fish relative to their impacts on native species.

- the most likely interaction is through predation, although competition may be important in restricted environments such as the LCR

- predation risk is a function of:
  - the number of predators
  - the overlap in space and time with native species
  - the probability of being captured

- we recommend a review of existing information to:
  - rank the non-native species with respect to risk
  - consider alternatives for monitoring programs to detect changes in distribution, life history traits or relative abundance of key non-native species.

6. Management and institutional issues

- The Center should have more in-house capability for program design, data analysis and synthesis

- The Center should take greater control of the contracting process for monitoring programs
  - More detailed RFP's
  - Longer contracts
  - More rigorous data management and reporting cycle requirements.