

6/16/08 Draft Program RM&E Language expanding on BPA's Amendment Recommendations

{This draft document expands on BPA's earlier recommendations by providing more detailed language on RME that could be amended into the program. BPA hopes to include its final version of this RM&E language in a complete redline program document that should be ready for release shortly.}

Research, Monitoring and Evaluation

This 2008 Program updates the RM&E section to capture common objectives, strategies, and terminologies developed since 2000 through ongoing RM&E planning and collaboration efforts under the Program, the FCRPS BiOp, ESA Recovery Planning, and resource manager agreements. The region now has a common RM&E structure, vocabulary, and strategies coordinated collaboratively through regional RM&E and data management forums including the Pacific Northwest Aquatic Monitoring Partnership, the Northwest Environmental Data Network, and the Executive Summit on Information Sharing. Building on these commonalities, this Program adopts the following six fundamental advancements as the backbone of the Council's RM&E and data management plan.

1. The Program's RM&E will be structured in a common regional framework to better communicate, plan, and implement regional RM&E strategies. This structure tracks the 2008 NOAA Fisheries Biological Opinion for the FCRPS. The framework includes standard terminology for the different types of monitoring and research, and several standard categories of RM&E for organizing strategies. The Program now includes standard terminology for concepts like status and trend monitoring, action effectiveness research, critical uncertainty research, project implementation and compliance monitoring.
2. Within this framework, RM&E will strategically target information needed to answer key management questions that are critical to effective Program planning, implementation, and adaptive management. The Program now defines strategic level management questions for individual RM&E strategies. This focus on management questions and information needs will guide more explicit statements of RM&E strategies, support more targeted RM&E solicitation, and facilitate project selection and prioritization processes.

3. The Program's RM&E will align with regional collaborative efforts for standard and compatible monitoring and data management approaches that support both Program and Pacific Northwest regional information sharing and networking. This will provide cost efficiencies, more information of higher quality, better connectivity among RM&E projects, and require cost sharing agreements and collaborative monitoring efforts across the region.
4. The Program will adopt strategies for fish population and habitat status and trend monitoring collaboratively developed with the region as part of a broader Pacific Northwest regional status monitoring effort that includes identification of appropriate levels of cost sharing. This monitoring information is a shared responsibility of other regional agencies and it is not the sole responsibility of BPA to fund, but it provides critical information for the effective management of the F&W Program and ESA BiOp and recovery efforts and should therefore be a high regional priority.
5. The Program will adopt a set of high-level indicators to better track and report on biological and programmatic level performance and more clearly align the Program's evaluation and reporting requirements with similar efforts in the region. These indicators will be coordinated with similar performance reporting needs of other regional agencies to facilitate consistent and compatible information sharing and reporting.
6. The Program adopts several RM&E strategic categories and associated strategies to provide information that supports effective planning, implementation, and adaptive management and that demonstrates accountability in effectively meeting Program biological objectives.

Key Management Questions

The Northwest Power Act directs the Council to develop a program to protect fish and wildlife affected by the region's hydroelectric system. The Program's RM&E strategies will serve that end but not seek to reach beyond it. The following high level management questions provide a basis for the needs and priorities of Pacific Northwest regional RM&E, of which the Program's needs related to hydrosystem operations, impacts, and mitigation efforts, are but a part. Regional coordination and cost sharing will be required for monitoring related to several of these management questions where they overlap with the management and information needs of other regional entities.

1. *Are we meeting biological and programmatic performance objectives established within the Columbia Basin Fish and Wildlife Program, FCRPS BiOp and ESA Recovery Plans?*
2. *Where objectives are not being met, what factors are limiting our ability to achieve performance standards or objectives?*
3. *What is the effectiveness of different hydro and offsite mitigation actions in addressing factors limiting achievement of performance standards and objectives?*
4. *Is research and monitoring information accessible to the region and compatible with regional standards and protocols for monitoring, data collection and access?*
5. *Are actions being implemented and accomplished as proposed?*

High-level Indicators

The Council will provide an annual Program performance report that provides information on key indicators of Program success. These high-level indicators of performance will track the success of the Program at both a biological level and a program implementation level. Similar high-level indicators are being used by several federal, state and tribal programs across the Pacific Northwest for programmatic scale, high level reporting on the health of fish populations, the condition of watersheds, and the effectiveness and implementation of actions. To insure consistency and compatibility with regional high level indicators, and to encourage cost sharing of needed monitoring that supports these indicators, the Council will coordinate the development, adoption, updating, and reporting of high-level indicators with other entities in the region.

RM&E Strategic Categories and Strategies

Since the 2000 Program, resource managers have collaboratively identified several strategies to provide information needed to address these high level management questions as part of the Program. These strategies are accomplished primarily through the use of status monitoring, action effectiveness research, critical uncertainties research and project implementation and compliance monitoring. The following RM&E Strategic Categories include the pertinent management questions. This Program organizes these strategies following the structure in the 2008 FCRPS Biological Opinion and creates an ecosystem level approach to RM&E.

1. Fish Population Status Monitoring

2. Hydro RM&E
3. Tributary Habitat RM&E
4. Estuary and Ocean RM&E
5. Harvest RM&E
6. Hatchery RM&E
7. Predation and Invasive Species Management RM&E
8. Wildlife RM&E
9. Coordination and Data Management
10. Project Implementation and Compliance Monitoring

Strategic Category: Fish Population Status Monitoring

The following are the primary management questions with respect to the status of fish populations.

- What are the abundance, productivity, and spatial distribution of key fish populations affected by the FCRPS and other hydro projects?
- What is the proportion of spawners within ESA-listed salmonid populations that are of hatchery origin?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

***Strategy:** Monitor the status and trend of anadromous and resident fish populations relative to Program or Provincial level biological objectives.*

***Strategy:** Develop regional fish population monitoring approaches with common data collection and data management protocols as part of collaborative cost-sharing and coordination with other regional monitoring programs and non-hydro agency responsibilities.*

Anadromous and resident fish populations need to be monitored as appropriate to answer management questions regarding achievement of Programmatic and Provincial level biological objectives. The status of fish populations are a result of the combined effects of hydro and non-hydro conditions, and therefore this monitoring information and performance objectives are a shared responsibility with other regional federal and state entities. Regional cost sharing and collaborative monitoring are therefore a key component and requirement of this strategy. As such, the Council will seek and participate in a regional,

collaborative effort to define fish population monitoring needs and develop regional, strategic plans and cost sharing agreements for both anadromous and resident fish populations. Regional collaboration forums will be supported to facilitate this strategy.

Measures will be implemented under this Program to enable monitoring of hatchery-origin fish in natural spawning areas in support of the assessment of the status of wild populations and the effects of hatchery-origin fish upon those populations.

Strategic Category: Hydro RM&E

The following are the primary management questions with respect to FCRPS hydrosystem fish passage strategies.

- Are salmon and steelhead meeting juvenile and adult hydrosystem passage performance objectives?
- What are the most effective configurations and operations for achieving desired performance objectives in the FCRPS?
- What is the post-Bonneville mortality effect of changes in fish arrival timing and transportation to below Bonneville?
- Under what conditions does in-river passage provide greater smolt-to-adult return (SAR) rates than transport?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

Strategy: *Monitor and evaluate fish performance within the hydro electric corridor relative to biological objectives.*

Strategy: *Monitor and evaluate migration characteristics and river conditions relative to environmental and physical performance objectives.*

Strategy: *Monitor and evaluate the effects of changes in hydro system configurations and operations.*

Strategy: *Assess and investigate as appropriate critical uncertainties related to the scientific relationships that determine the survival and condition of fish passing thru or transported around the hydro system.*

These strategies provide information important to management questions regarding achievement of fish performance objectives, identification of limiting factors, and assessments of the effectiveness of actions within the hydro system of the Columbia Basin. These monitoring and research strategies are integral with the COE Anadromous Fish Evaluation Program and therefore require close coordination and collaboration with this program.

Strategic Category: Tributary Habitat RM&E

Management Questions: The following are the primary management questions with respect to tributary habitat offsite mitigation strategies.

- Are tributary habitat actions achieving the expected biological and environmental performance objectives?
- What are the tributary habitat limiting factors or threats preventing the achievement of desired tributary habitat performance objectives?
- What are the relationships between tributary habitat actions and fish survival or productivity increases, and what actions are most effective?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

***Strategy:** Monitor and evaluate tributary habitat conditions that may be limiting achievement of biological performance objectives.*

***Strategy:** Evaluate the effectiveness of tributary habitat actions relative to environmental, physical, or biological performance objectives.*

Effectively identifying habitat conditions that are limiting factors to fish productivity and evaluating the effectiveness of habitat actions that are being implemented as offsite mitigation for FCRPS effects are critical elements of both the F&W Program and FCRPS BiOp. This ongoing planning, adaptive management and performance evaluation of habitat actions will require a combination of broad, regionally coordinated and cost-shared status and trend monitoring with more localized, reach-level project effectiveness research, and intensively-monitored-watershed research. In addition, basic project implementation monitoring will be needed as part of these assessments. The collection and management of this information will need to be standardized

across the Pacific Northwest region for comprehensive assessments. Habitat based models will also need to be further advanced to facilitate these assessments.

Strategic Category: Estuary and Ocean RM&E

The following are the primary management questions with respect to Estuary Habitat mitigation strategies.

- Are aquatic, riparian, and upland estuary habitat actions achieving the expected environmental, physical or biological performance objectives?
- What are the limiting factors or threats in the estuary/ocean preventing the achievement of desired estuary habitat performance objectives?
- What are the relationships between estuary habitat actions and fish survival or productivity increases, and what actions are most effective?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

***Strategy:** Monitor and evaluate fish performance in the estuary and plume relative to environmental, physical, or biological performance objectives.*

***Strategy:** Monitor and evaluate estuary/ocean migration and habitat conditions that may be limiting achievement of biological performance objectives.*

***Strategy:** Evaluate the effectiveness of habitat actions in the estuary relative to environmental, physical, or biological performance objectives.*

***Strategy:** Assess and investigate as appropriate critical uncertainties related to the scientific relationships that determine the survival and condition of fish residing and/or migrating through the estuary and ocean.*

The estuary and ocean are where the majority of salmonid mortality takes place, yet it is the least understood life history stage. A broad range of estuary physical and biological metrics need to be monitored to improve our understanding of the relationships between different estuary habitat actions, the environment and the survival and productivity of salmonids. In addition, better understanding of salmonid early life history habitat conditions, timing, and distribution in the ocean is needed to address critical uncertainties for post-Bonneville survival of transported and non-transported fish.

Strategic Category: Harvest RM&E

The following are the primary management questions related to FCRPS-sponsored harvest management strategies.

- What is the effect of acquiring more accurate and precise in-river harvest estimates on the resultant estimates of straying and adult passage survival?
- Can selective fisheries targeting hatchery fish or healthy populations reduce impacts on ESA-listed populations?

The following strategy is focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

***Strategy:** Assess and investigate as appropriate critical uncertainties related to harvest estimates and harvest management practices.*

Uncertainties regarding harvest rates, incidental take, and illegal harvest need to be addressed to refine estimates of hydro upstream survival performance. In addition, critical uncertainties should be addressed regarding selective fishery methods and the feasibility of genetic stock identification monitoring techniques.

Strategic Category: Hatchery RM&E

The following are the primary management questions with respect to hatchery strategies.

- Are hatchery improvement programs and actions achieving the expected biological performance objectives?
- What is the proportion and origin of hatchery fish within naturally spawning salmon and steelhead populations?
- What deleterious effects does artificial production have on natural populations of anadromous fish?
- How can hatchery reforms reduce the deleterious effects of artificial production on listed populations?
- Can properly designed intervention programs using artificial production make a net positive contribution to recovery of listed populations?
- What is the reproductive success of hatchery fish spawning in the wild relative to the reproductive success of wild fish?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

***Strategy:** Evaluate the effectiveness of hatchery safety-net/conservation programs and the effectiveness of hatchery reform actions on the achievement of biological performance objectives.*

***Strategy:** Assess and investigate as appropriate critical uncertainties regarding the effects of artificial propagation on the viability of wild fish populations.*

Hydro impact mitigation currently includes major hatchery fish production, supplementation, and conservation programs supporting both harvest and population viability objectives. Evaluations of the effects of these hatchery programs and associated reform actions on wild fish populations are critical to future management of the Program and FCRPS BiOp actions.

Strategic Category: Predation and Invasive Species Management RM&E

The following are the primary management questions with respect to predation and invasive species management.

- What are the distributions, population sizes, and productivity for the major predators within the Columbia River Basin? Are there aquatic

invasive species present within the habitat of Columbia Basin fish populations?

- What are the impacts and consumption rates of major piscivorous, avian, and marine mammal predators on juvenile salmonids within the Columbia River Basin?
- Are predation management programs and actions achieving the expected biological performance objectives, including consideration of inter- and intra-specific compensation?
- Are there alternative management alternatives/actions to those currently being implemented to reduce the impact of predation? What are the most effective management alternatives/actions?

The following strategies are focused on providing information needed to answer these questions in support of planning, implementation, and adaptive management.

Strategy: Monitor the status of the Caspian Tern and the Double-Crested Cormorant populations in the Columbia River Estuary, their impacts on juvenile salmonids and the effectiveness of management strategies that may be implemented.

Strategy: Monitor the status of Inland Avian Predator populations in the Mid-Columbia River, their impacts on juvenile salmonids and the effectiveness of management strategies that may be implemented.

Strategy: Monitor the population status of marine mammals (e.g., Sea Lions and seals) below Bonneville Dam, their fish predation rates, and the effectiveness of deterrent actions.

Strategy: Evaluate the effects of the northern pike minnow removal program and investigate strategies to reduce non-indigenous piscivorous (e.g., walleye, bass) predation on salmonids.

Strategy: Develop guidelines and procedures for monitoring for presence and prevalence of aquatic invasive species.

Piscivorous, avian and marine mammal predation is a significant impact on fish populations in the Columbia Basin and predator monitoring and control actions are being used as an effective hydro offsite mitigation action under the Program and the FCRPS BiOp. RM&E to track the status of predation and the effectiveness of predator control actions is critical to the ongoing adaptive management of these complex and dynamic management actions.

Strategic Category: Wildlife RM&E

The primary management questions with respect to wildlife mitigation programs are:

- Are wildlife mitigation programs and actions achieving expected habitat unit or acreage objectives?
- What are the most effective actions for achieving wildlife habitat unit or acreage objectives?

***Strategy:** Evaluate the effectiveness of the wildlife mitigation program actions in meeting objectives.*

Tracking the response of wildlife habitat to the various management actions employed across the Program will allow for adaptive management the wildlife mitigation program. In some cases, the response of target wildlife species may also be monitoring to determine their response to management actions. The Council should arrange for any necessary wildlife species monitoring through existing monitoring programs that are being conducted by entities like the U.S. Fish and Wildlife Service, the states (e.g. the state Conservation Strategies), and others.

Strategic Category: Coordination and Data Management

The following is the primary management question with regard to RM&E coordination and data management.

- Is research and monitoring information accessible to the region and compatible with regional standards and protocols for monitoring, data collection and data access?

The following strategies are focused on addressing this question.

***Strategy:** Actively support the coordination and standardization of regional and Program monitoring efforts with other federal, state, and tribal monitoring programs including the development and adoption of standard requirements for metrics, sample designs, data collection protocols, data dictionary, meta-data, and data access.*

Strategy: *Work with regional federal, state and tribal agencies, and non-governmental entities to establish a coordinated, standardized, web-based distributed information network and a regional information management strategy for water, fish, and habitat data. Establish necessary administrative agreements to collaboratively implement and maintain the network and strategy.*

Adaptive management associated with all of the RM&E strategies of the Program is highly dependent on accessible and well documented information that follows regionally accepted and understood standards and protocols. Regional collaboration, partnerships, and agreements on these standards and protocols as part of a regional strategy for sharing and distributing information is critical to the success of the Program and the FCRPS BiOp.

Strategic Category: Project Implementation and Compliance Monitoring

The following is the primary management question with regard to project implementation and compliance monitoring.

- Are actions being implemented, accomplished, and functionally maintained as proposed?

The following strategies are focused on addressing this question.

Strategy: *Maintain a comprehensive project implementation tracking system with standard performance metrics that are coordinated with other regional federal, state, and tribal project tracking systems.*

Strategy: *Develop a project compliance monitoring program for independent post-project auditing of project performance to assess ongoing performance of habitat based mitigation projects in support of adaptive management planning.*

Project level monitoring is a key component adaptive management. This monitoring is needed to insure projects are implemented and functioning as proposed and that they continue to function as expected over the long term. This information is important to assess achievement of programmatic level objectives, but is also essential to designing action effectiveness studies and relating actions to expected action effects. This information collection will require project level implementation monitoring as well as independent post project auditing of the ongoing functionality of certain types of habitat projects (i.e., compliance monitoring).

Standard Definitions of the Types of RM&E Projects

1. Fish/Wildlife Population and/or Environmental Status and Trend Monitoring – census or statistically designed monitoring of fish or wildlife population and/or environmental conditions (i.e. watershed conditions) to assess the current status or change (trend) over time. This is sometimes referred to as an observational study (ISRP, 2005). These monitoring data may also be used to correlate fish performance with environmental conditions.
 - Ecosystem/Landscape level, broad-scale, periodic monitoring
 - Geographically localized, frequent monitoring
2. Action Effectiveness Research – research to determine the effects of an action or suite of actions on fish survival, productivity and/or habitat conditions. This is a manipulative experiment that statistically assesses the effect of a treatment (action) condition relative to a control or reference condition. Action effectiveness research can be performed for a localized effect (project or stream reach level effect) or for a watershed level effect (intensively monitored effect). Localized (project level) effects most commonly identify changes in habitat conditions associated with the action, while fish or biological responses may require a watershed level (intensively monitored approach) to capture a broader area in which a biological response is expressed.
3. Uncertainties Research – research to resolve scientific uncertainties regarding the relationships between fish or wildlife health, population performance (abundance, survival, productivity, distribution, diversity), habitat conditions, life history and/or genetic conditions (e.g., the existence and causes of delayed mortality, hatchery spawner reproductive success relative to wild populations, etc.). This is a manipulative experiment where variables are manipulated to infer or demonstrate cause and affect relationships using statistical-designed hypothesis testing. Uncertainties research does not include experimental research and monitoring specifically targeting the effect of a mitigation or restoration action (this is Action Effectiveness Research).
4. Project Implementation and Compliance Monitoring – monitoring the execution and outcomes of projects. This type of monitoring does not

require environmental response data directly linking restoration actions to physical, chemical, or biological responses.

- *Project Implementation* monitoring determines whether projects were carried out as planned, through documentation of the type and location of management action, and whether the action was implemented properly or complies with established standards. This is generally carried out as an administrative review and does not require any parameter measurements beyond those specified by the project design requirements. It is usually a low-cost monitoring activity that should be included for all mitigation activities.
- *Project Compliance* monitoring determines whether specified project criteria are being met, through a post-project auditing of project performance. This type of monitoring would typically not be carried out by the project sponsor, and may require the development of independent, compliance monitoring projects. A limited, statistical-designed sample of projects could be monitored annually for compliance.

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