ProjectID: 35025
Optimization of FCRPS Impacts on Juvenile Salmonids: Restoration of Lower-Estuary and Plume Habitats
Sponsor: OH&SU
FY03 Request: $435,192
5YR Estimate: $1,206,325
Short Description: Restore Columbia River estuary and plume juvenile salmonid habitats and optimize FCRPS impacts on the plume through improved understanding of estuary and plume physical processes and definition of possible future management scenarios

Response Needed? Yes

Abstract

This project assembles a group of leading coastal scientists to tackle a complex, urgent problem, optimization of the interaction of the Federal Columbia River Power System (FCRPS) with the lower Columbia River estuary and plume in support of endangered salmonids. The timing and magnitude of flows released by the FCRPS strongly affect juvenile salmonids as they move through the estuary and plume. Restoration of the properties of the lower estuary and plume that constitute habitat for juvenile salmonids requires advances on several fronts. We seek to:

- *Objective 1: Define how the lower-estuary and plume interacted historically with coastal currents, how operation of the FCRPS has altered the lower-estuary and plume, and how climate change and the FCRPS will impact the system in coming decades.*
- *Objective 2: With Action Agencies, define needs and opportunities for science-based input to operational FCRPS management practices, given uncertain climate and coastal circulation forecasts.*
- *Objective 3: With FCRPS managers, define management scenarios: a) that are based on physical understanding, b) that can be evaluated in terms of habitat opportunity and other constraints on the system, and c) whose implementation can lead to a qualitative improvement in survival of juvenile salmonids.*

Innovative oceanographic methods, remote sensing, management science and analyses of numerical model results will be used to achieve the goals of the project, as it moves from research toward provision of definite strategies over the next 6 to 10 years. A Project Advisory Board (PAB) that includes Action Agency personnel, FCRPS managers and external scientists will be formed to help ensure productive application of the insights achieved. Tight cooperation with work carried out in the estuary and plume by the National Marine Fisheries Service (NMFS) will be facilitated by participation of PIs in this project as well as in two projects proposed by NMFS.

ISRP Preliminary Comments:

A response is requested. This proposal makes a very strong case for the integration of flow management with the needs of salmonids in the lower Columbia River, estuary, and plume environments. Dr. Jay has assembled a very strong research group and has obviously tried to more

clearly enunciate the value of this project to Columbia River salmonids and impacts of future climate scenarios. The BPA RME comments below strengthen our support for this work and the need for mutual consideration of flow and fish. The purpose of this program (section 9, page 24, Tasks and Methods) is "to optimize the interactions of the FCRPS with juvenile salmonids in the lower-estuary and plume."

The project emphasizes the need for understanding and dialogue but does not presume that the FCRPS would immediately be modified to meet only 'habitat opportunity' needs of the fish. The intent of the program is clearly to examine if fish needs can be incorporated into the water management planning cycle, and to explore how modifications of flow could benefit salmon while remaining within the limits imposed by other requirements. Further, if agreements could not be reached on how to respond to specific scenarios, then the models and sampling programs ISRP 2002-13 Mainstem and Systemwide Preliminary Review 26 developed provide an ideal opportunity to design a truly adaptive management approach to understanding the "integration of flow management with the needs of salmonids in the lower Columbia River, estuary, and plume environments."

The technical background in this proposal is thorough and reasonable but we must still acknowledge that the importance of the plume environment to salmon survival remains unquantified or tested. With the current developments in the micro-tags and extensive studies in the lower river, estuary, and plume, we may have answers to these questions in the near future. Consequently, and after further consideration of this proposal, the ISRP supports our recommendation presented June 7, 2002 (below).

However, we believe there is an obvious need to initiate dialogue with the FCRPS managers so that an understanding of the proposed research and process is begun. If FCRPS managers are not prepared to consider possible alterations in flow plans or how to respond to different climate conditions or random opportunities (annual deviations in weather), then there are a number of extensive programs that may not need to be funded at all. The costs and benefits of all recovery opportunities need to be considered, none should be excluded particularly given the investment made in science within the Columbia River basin.

We thank the ISRP for their support of the proposed work and agree that all options need to be "on the table". One unique aspect of future estuary and plume habitat management is that the scientific base for such management is now very weak. The environment above Bonneville Dam is comparatively better understood. We believe that there are considerable recovery opportunities available in the estuary and plume, but quantifying either costs or benefits would be a difficult exercise at this time.

The proposal still could benefit from a more detailed description of the use of management science to articulate management scenarios. How will managers' expectations and response to uncertainty be investigated? For example, the proposal includes some statements about different languages and time horizons among managers, researchers, and policymakers. This is a very general statement that will apply to varying degrees within the FCRPS. It would be helpful to be more explicit about its particular application within the FCRPS, how large a problem it is, and

potential remedies. The proposal describes the general problem as if it is a complete lack of understanding by one entity of all other entities.

Our proposed work will use management science to analyze the annual FCRPS decision cycle in critical high and low-flow years and use the concept of analog years (i.e., representing future management scenarios in terms of representative past years) to formulate management strategies, in consultation with FCRPS managers through a Project Advisory Board or PAB. Using this approach, we hope that our management scenarios will have real practical utility for improving juvenile salmonid survival in the estuary and plume. Effort expended in this area will reduce the time required to devise new management strategies for the FCRPS and make the strategies proposed more accessible to FCRPS managers. Dr. Pulwarty's previous research in the Columbia and Colorado River basins (below) has investigated how managers deal with uncertain forecasts and extreme years. Results from Pulwarty and Redmond (1997) resulted in changes the way NOAA provides hydrologic data and forecasts, to make them more responsive to the needs of FCRPS managers. We do not wish to over-state the differences between the FCRPS managerial and scientific cultures. Our project is distinctive, however, for its focus on making scientific information useful.

Pulwarty, R.,2002: Climate, adaptive management and social choices: Lessons from the Colorado and Columbia River Basins. American Fisheries Society Proceedings *(forthcoming)*

Pulwarty, R. and Melis, T., 2001: Climate extremes and adaptive management on the Colorado River. *J. Environmental Management* **63***(3) 307-324*

Pulwarty, R. and K., Redmond, 1997: Climate and salmon restoration in the Columbia River basin: the role and usability of seasonal forecasts. *Bull. Amer. Meteorol. Soc.* **78**, 381-397.

We have previously responded to the remaining comments including in the ISRP section.

This proposal also received two sets of comments from sub-groups. The first was from the Hydro RME subgroup:

This proposal establishes the need to link FCRPS river management to plume dynamics and productivity and ultimately salmon survival. Clearly there is a need to understand the contribution of early ocean conditions to salmon survival. The additional premise that the FCRPS might be managed to improve those conditions is less obvious. The river system is already being managed for multiple purposes; flood control, hydro power, irrigation, recreation and optimization of in-river smolt survival. To suggest that the system can be substantively altered further would require considerable reprioritization of existing river uses. This is not to diminish the importance of studying and understanding plume dynamics, but to be realistic with respect to expectations regarding the flexibility of the FCRPS.

The reviewers rightly emphasize the difficulty in managing the FCRPS system for yet another set of constraints, stemming from plume and estuary processes. It is typical of situation in which adaptive management is used and needed that the situation to be managed is over-constrained. We believe, however, that a better understanding of the effects of the FCRPS on the estuary and

plume and of the role of these waters in juvenile salmonid survival will provide opportunities as well as additional constraints. Some of the possibilities are outlined in the proposal on pp. 13 and 14. Recent research indicates, for example, that primary productivity during periods of upwelling off the Oregon and Washington coasts is partially limited by the availability of a micronutrient, iron. Dissolved and particulate iron is supplied in large amounts by the Columbia, but the iron discharge is likely now less than it was historically, and the seasonality of this iron discharge has changed. It may be that minor changes in the timing of winter reservoir draw-down could help increase the amount of particulate iron deposited on the shelf (as opposed to being carried off-shore to deep water). Once deposited on the shelf, the iron would mix into upwelling waters, reducing the tendency toward iron limitation during upwelling season. In some years, this could both increase productivity and shift the food web in a direction favorable for salmonids. Implementation of this approach on a regular basis might then provide an improved food supply for downstream migrant juveniles in some summers. Coordination of spring discharge with the spring-neap cycle may also bring benefits at a relatively low cost.

The second comment is in the Ocean and Estuary Sub-group section:

Action items addressed - 158, 194; 161, 187,196. Doesn't clearly address all the RPAs proposed by authors. Focus is on physical aspects of estuary and plume. Compliments projects 199801400 and 30001 (estuary province numbers), so the project will be linked to understanding biological aspects of the estuary. This project is complete enough for current funding.

The RPAs mentioned above are among those addressed as a group in the document: *Future Needs: Priorities for the Mainstem/ System-wide Fish and Wildlife Program Solicitation* http://www.cbfwa.org/ reviewforms/systemwide/FutureNeeds.pdf). This project (working with other proposed and on-going projects 30001 and 199801400) would contribute strongly to the following actions, each of which are given the rating: "needs immediate implementation" on p. 16-17:

- "(S)tudy the variability in atmospheric and oceanographic processes to understand the inter-annual and inter-decadal differences observed in salmonid survival and production".
- "(E)valuate whether bottom-up or top-down processes, or some combination of both, limit salmon production in estuarine and nearshore coastal environments".
- "(F)und programs and projects that result in a coordinated understanding of the factors affecting mortality of salmon through the estuary, plume and nearshore ocean environment".
- "Conduct research that advances the basic understanding of the ecology of the Lower Columbia River and estuary, plume, and ocean, and allows for the incorporation of that information into its current and future management".
- "Protect, conserve, and restore habitats that are important to supporting and enhancing life history strategies of salmonids and overall ecosystem of the Lower Columbia River and estuary, plume and ocean".
- "(A)dopt an ecologically-based framework for estuarine, plume, and ocean management and habitat restoration/conservation".

- "Conduct short and long-term monitoring of parameters important to salmonid life strategies and the overall ecosystem of the Lower Columbia River and estuary, plume, and ocean".
- "(E)valuate the impact of physical change (natural and anthropogenicallyinduced variability) on the availability of critical salmon habitat.".
- "Continue to evaluate the role of the Columbia River plume on growth and survival of juvenile salmon".
- "(C)ontinue to investigate the factors and processes associated with the plume environment that enable or alter salmonid survival potential".
- "(C)haracterize, over a 10-year period, the physical and biological features of the nearshore ocean environment with real-time and modeling projections of the Columbia River plume as it interacts with the coastal circulation regime, and to relate these features, both spatially and temporally, to variation in salmon health, cond ition, and survival".

Our proposed work is, moreover, vital to the success of projects 30001 and 199801400. It is arguable, moreover, that our work also addresses RPA 162 (the conceptual model of the role of the estuary and plume in salmonid survival).