CSMEP Response to ISRP 2006 Proposal Review Comments
DRAFT
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1. Introduction

In their review of the 2007-2009 Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) the Independent Scientific Review Panel (ISRP) was generally very complimentary of both CSMEP's progress to date and our future proposed activities. The scientists and managers who have been working very hard over the last two and a half years were very pleased to receive such a positive review by the ISRP. We note that our website has been recently substantially improved, making it much easier to understand our activities and find work products. We look forward to ISRP reviews of our fy06 work products near the end of this year.

There were two sets of ISRP comments requiring a response: 1) several questions relating to the hatchery subgroup; and 2) a minor comment relating to non-focal species.

2. Hatchery Subgroup

The ISRP raised a number of meaningful questions regarding the progress and scientific basis for products that are currently under development by the Hatchery Subgroup. These concerns can be grouped into three categories:

1. failure to employ the regionally accepted definition of supplementation;
2. insufficient technical descriptions of the major questions/design goals associated with ongoing and proposed study design products; and
3. failure to achieve meaningful progress towards useful and applicable designs.

We believe that these concerns are valid; however, we also suspect that many of the concerns might arise from the fact that the content of the CSMEP proposal, particularly the hatchery components, suffered during the process of reducing multiple voluminous documents into a concise summary. In short, much of the subgroup's progress is not adequately described in the original proposal.

The Data Quality Objectives (DQO; EPA 2006) process employed by CSMEP is an iterative method that attempts to reduce policy level information needs into a tractable study design. A natural byproduct of such a process is the iterative refinement of questions from a more general conceptual state (provided by policy directives) to a more rigorous analytical and technical state (the basis for experimental design). In short, the technical rigor of the questions is expected to improve as analytical solutions are applied to the policy directives.

Over the course of the project, the hatchery subgroup has struggled to balance the obvious desire to optimize designs for the myriad questions associated with supplementation with the need to identify key uncertainties that are unlikely to be

addressed by existing and proposed Research Monitoring and Evaluation (RME) projects. A number of excellent hatchery RME designs have been proposed and implemented over the past several years. Despite the participation of several researchers with exceptional hatchery RME experience, much of the first year of CSMEP hatchery design work was necessarily expended in evaluating the state of hatchery RME science. In short, we had to review existing experimental designs and evaluate successes and failures in the implementation of those designs in order to identify and prioritize where CSMEP design efforts could best be focused. Following this review, the group concluded that many of the uncertainties that accompany supplementation at the scale of individual artificial propagation projects are likely to be sufficiently addressed by proposed and ongoing RME – if those initiatives are adequately funded. However, during this process the subgroup identified a number of large scale uncertainties that will not be addressed by existing or proposed projects, or that could potentially be addressed to greater benefit by optimizing the allocation of effort. Nonetheless, arriving at these conclusions required a great deal of effort, and necessarily limited initial progress towards the construction of new designs.

In the following sections, we describe how the regionally accepted definition of supplementation, while adequately descriptive, cannot be meaningfully employed at this time; why many of the questions defined by the Hatchery Subgroup appear vague; and how these deficiencies converge to lend the appearance of limited progress by the CSMEP Hatchery Subgroup.

2.1 Defining Supplementation

The regionally accepted definition of supplementation was forwarded by the Regional Assessment of Supplementation Projects (Vogel and Clune 1992), as:

> "*Supplementation is the use of artificial propagation in the attempt to maintain or increase natural production while maintaining the long term fitness of the target population, and keeping the ecological and genetic impacts on non-target populations within specified limits."*

The Hatchery Subgroup agrees that this definition concisely articulates the primary goals of supplementation. In fact, the Hatchery Subgroup concluded that sufficient design work has largely been completed to address the impacts of supplementation on target populations; measured as changes in fitness, abundance, and productivity – if ongoing and proposed RME projects are funded. However, the meaningful application of this definition requires that "specified limits" for ecological and genetic impacts on non-target populations can be identified by policy and that RME projects can adequately detect when such limits are exceeded. In this respect, we found that current policy guidance and existing and proposed RME projects are largely insufficient. During the first iteration of the DQO process, the Hatchery Subgroup found that policy guidance was insufficient at providing "specified limits" for these impacts, and that the region currently lacks the information to describe biologically meaningful thresholds for such impacts.

These conclusions were not immediately apparent. The Hatchery Subgroup spent a great deal of time reviewing information regarding the optimization of statistical designs to detect ecological and genetic impacts of hatchery programs at the scale of *individual projects*. While necessary and meaningful, this work did little to address the efficacy of artificial propagation as a *regional class of actions* aimed at maintaining, restoring, or recovering salmonid populations and harvest. The deficiencies of this approach became apparent only after the group had sufficient time to review available RME efforts. During this review it became apparent that the majority of hatchery projects employed the RASP definition of supplementation, but few identified the "specified limits" for impacts to non-target populations. Those that attempted to define "specified limits" primarily utilized seemingly arbitrary requirements for statistical measures of precision, such as coefficient of variation of the mean, more in an attempt to calculate necessary sampling effort than to identify biologically meaningful thresholds. For example, many programs attempted to identify acceptable levels of straying, often employing language suggesting that no greater than 5% of total hatchery origin adults could return to non-target locations or specifying that strays from a given program could compose no greater than 5% of the escapement in non-target populations. In general, these thresholds were derived from two sources:

1. NOAA Tech Memo NMFS-NWFSC-30 Genetic Effects of Straying of Non-Native Hatchery Fish into Natural Populations (Grant 1997) and
2. NOAA Technical Memo NMFS-NWFSC-42 Viable Salmonid Populations (McElhany et al. 2000).

While we do not dispute the technical value of these documents, the application of these criteria is immensely challenging when viewed from the scale of an individual hatchery RME project. How can an individual hatchery RME project calculate the total number of fish that stray into non-target locations? Likewise, aren't we really interested in ensuring that less that 5% of the total escapement into non-target populations is composed of hatchery strays rather than simply the strays from a single hatchery?

In 2006, the Hatchery Subgroup finally completed the first iteration of the DQO process, at which time it was apparent that our focus was at the wrong spatial scale. In short, we recognized that uncertainties exist at the scale of individual artificial propagation projects, but the ongoing and proposed projects that we reviewed were likely to address these uncertainties – if adequately funded. On the other hand, the questions relating to impacts on non-target populations would remain largely unaddressed or at best could be evaluated only via weak inference from the extrapolation of results obtained at the scale of individual programs. We noted that the distribution of monitoring effort was likely insufficient to representatively address many uncertainties, limiting the broad application of the results. Hence, we endeavored to reduce some of the large scale uncertainties to a set of tractable study designs with the goal of evaluating hatcheries as a regional class of actions (top-down approach) rather than by simply trying to accumulate results from individual projects to address large scale questions (bottom-up approach). This is also more consistent with CSMEP's vision as a systemwide collaborative effort to improve monitoring and evaluation.

2.2 Identification of Large Scale Uncertainties and Design Opportunities

At the conceptual level, the impacts of artificial propagation on non-target populations are simply a function of the direct and indirect interactions of hatchery and natural origin fish, in shared environments and their net impacts on shared resources. There are obvious problems when one moves from this conceptual level into the design of a tractable study design that can be implemented. The available data enable limited inference when viewing these issues at the scale of hatcheries as a regional class of actions, largely as a result of two issues:

1. sampling effort is allocated on the basis of individual projects that may or may not be readily combined to address uncertainties that manifest at larger spatial scales and result from the cumulative impact of all artificial propagation programs and
2. largely as a function of the first deficiency, we have little information to evaluate the impacts of hatcheries on non-target populations, and thus very limited ability to identify biologically relevant impact thresholds.

Data relevant to the uncertainties of artificial propagation are currently generated primarily by RME projects tailored to evaluate individual programs. Information is gathered opportunistically where infrastructure enables appropriate sampling (e.g. studies of relative reproductive success), individuals are motivated to produce high quality proposals that are subsequently funded, and innovative hatchery practices are being employed. This information, while useful, is not likely to represent the range of hatchery practices, the spatial scale of the Columbia Basin, or the diversity of species influenced by artificial propagation. Likewise, it is extremely rare for this effort to be leveraged towards non-target populations. Similarly, evaluations of stray rates, and the proportion of target and non-target populations composed of strays, are typically limited to locations where sampling infrastructure exists, thus raising obvious questions about whether the generated data are representative.

Given the limitations of current data for understanding straying, non-target population composition, and relative reproductive success *on a regional scale*, the hatchery subgroup endeavored to evaluate whether these questions were amenable to a large scale study design. In short, we proposed to evaluate these questions by viewing all hatchery programs as a regional class of actions with common questions. Viewing hatcheries from the "top-down" perspective enables the application of stratified sampling designs that may be capable of addressing these information needs for all hatcheries simultaneously while sampling activities can be restricted to a subset of the projects. As a simplistic example, one could envision allocating genetically based parentage analysis effort by employing the following strata:

1. proportion of broodstock composed of natural origin adults;
2. proportion of target population escapement composed of hatchery origin adults; and
3. duration of the program.

In addition, a number of non-target populations would be evaluated based on the average composition of hatchery strays (e.g., composed of less than 5% hatchery strays, 5%-15% hatchery strays, and greater than 15% hatchery strays on average). A stratified effort of this type would cover a large range in hatchery programs, thus programs that are not directly evaluated could use the results to bracket their expectations. By stratifying such efforts *a priori* statistical inference can potentially be greatly enhanced relative to the *status quo*.

In short, we believe that a number of the uncertainties relating to artificial propagation can be addressed most efficiently at a larger spatial scale using stratified designs. We have initiated significant design effort on two of these questions: 1) relative reproductive success; and 2) hatchery stray rates and the proportion of non-target populations composed of hatchery strays. However, these designs are far from complete, as evidenced by the lack of detailed description in the 2007-2009 proposal. We have recently been working with the EPA to utilize EMAP based sampling to provide spatial sampling components and have begun to develop cost estimates and quantitative methods to evaluate the tradeoffs among alternative designs and differing levels of sampling effort.

2.3 Apparent Lack of Progress

A number of factors have converged to lend the appearance that the hatchery subgroup has achieved little progress, including:

1. policy constraints;
2. personnel availability; and
3. development of novel approaches.

Hatcheries operate to fulfill legal mandates, fulfill conservation and restoration goals, and to sustain harvest opportunities. As such, decisions regarding the operation of hatcheries, and thus their acceptable impacts, are not purely scientific. The strictly quantitative approach employed by the DQO is likely perceived as threatening by some policy makers; however, without adequate policy guidance the DQO process cannot proceed. We have made significant progress towards improving communication with policy makers, but that progress has come at the expense of slowing the development of study designs. Buy-in at a policy and management level is critical to progress in improving monitoring and evaluation, across all of CSMEP's five subgroups (status and trend, harvest, habitat, hydro and hatcheries).

The CSMEP Hatchery Subgroup has suffered from a marked decrease in participation in 2006. Many of our most experienced and productive members have been unable to participate as a result of the demands of the 2007-2009 BPA proposal process, the NOAA Biological Opinion Remand process, Technical Review Team meetings and the workloads imposed by their agencies. Because of the complexity of many of the hatchery issues, effective participation requires that individuals have a detailed knowledge of hatchery RME, hatchery operations, and hatchery policy. Few individuals meet these

criteria, and those that do have significant responsibilities in addition to CSMEP. Thus, the pace of CSMEP progress is largely set by the availability of key individuals.

Finally, the CSMEP Hatchery Subgroup is attempting to view hatcheries from a completely novel perspective; requiring the interaction of hatchery RME experts with biometricians and the accumulation of substantial amounts of information at regional scales. Given the range of principles underlying hatchery operations, the development of widely applicable design features has been a challenging task. While we agree that progress towards unifying study designs has been slow, we also submit that efforts to expedite this progress would come at the expense of collaboration, which in turn would ultimately limit their value.

3. Non-Focal Species

The ISRP review of CSMEP had the following comment:

> "There is likely to be indirect long-term benefit to focal species through links with other projects. The project investigators should consider the effects on non-focal species because this project provides a rare opportunity to update the status of some of these species at a broad scale."

We weren't entirely sure what the ISRP meant here by 'non-focal' species, and would appreciate a clarification so that we can respond appropriately.

CSMEP's species focus has been on salmon, steelhead, bull trout and other resident fish species of concern, as described in our fy07-09 proposal. Within each subbasin subject to inventory efforts, the metadata that we collect, display[1] and evaluate include both listed and non-listed populations of these groups of species (e.g. we have assembled data, mostly from Canada, on Okanagan sockeye). Our design efforts attempt to build on the strengths and overcome the weaknesses identified in these inventory and assessment efforts, across **all** fish species evaluated. As we move beyond the Snake Basin into other regions (e.g. the Mid and Upper Columbia) we expect to encounter many unlisted populations (e.g. Hanford Reach fall Chinook), and will include them in our inventory efforts, building around past inventory efforts by both StreamNet, state and tribal fish agencies, and other recent initiatives such as the State of Salmon metadata inventory[2].

Literature Cited

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[1] https://nrimp.dfw.state.or.us/csmep/
[2] http://stateofthesalmon.org/

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