Project ID 35041 – Monitoring the reproductive success of naturally spawning hatchery and natural spring chinook salmon in the Wenatchee, Tucannon, and Kalama Rivers

Response to ISRP Comments –

The reviewers question whether there is any redundancy between the proposed work and Moran and Waples ongoing work on steelhead.

Our study and Moran's study are aimed at essentially the same question -- the reproductive success of naturally spawning hatchery fish -- but we believe that there is no redundancy between the two studies. As we pointed out in our proposal, most of the ongoing and completed work on hatchery fish reproductive success has been conducted on three species: steelhead, coho salmon and Atlantic salmon. Because salmonid species differ substantially in their life-histories and perhaps in their genetic response to hatchery propagation, we believe it is essential to conduct reproductive success experiments on multiple species. Chinook salmon are particularly important to study in the Columbia River Basin, because they are such an important species economically, biologically and culturally. In addition, we are aware of only one ongoing study of the relative survival of naturally spawning chinook salmon (Reisenbichler and Rubin's BPA funded study on the Deschutes). That study, although very important, is examining only a small portion of the life-cycle, and in any case cannot be expected to be representative of all of the diverse chinook salmon hatchery programs and populations in the Columbia River Basin.

The reviewers note that this is a relatively costly proposal, mostly because the study will be conducted on three separate stream systems. They note that the Wenatchee River system is well suited for the necessary sampling, but the others (Tucannon and Kalama River) are less well suited. The reviewers also question whether the researchers can complete the required work on all three stream systems.

We agree that, logistically and to some degree biologically, the sites differ in their relative value, but believe that the study will be significantly weakened if any of the sites are excluded. RPA 182 specifically notes that it is necessary to conduct a large number of reproductive success studies (the RPA recommends two per ESU), and we have carefully selected our proposed study sites for their logistical suitability and biological relevance. We were unable to identify any other sites that met our criteria for logistical needs of the experimental design. There are relatively few areas in the Columbia Basin where barriers to migration exist below entire spawning distributions of sufficiently small and discrete chinook salmon populations. Barriers and associated traps are essential to achieve high sampling rates of the spawning population. We are unlikely to produce conclusions that will have application to the whole Columbia Basin unless we conduct studies on a variety of programs and locations. Studies that have examined reproductive success in single unreplicated locations are often plagued by the criticism, “that information does not apply to this population or drainage.” We address some specific issues associated with each site below:

Wenatchee: We agree with the ISRP that the Wenatchee is ideally suited for obtaining the samples necessary to conduct this study. The Wenatchee River also contains the largest, most diverse population within the Upper Columbia River spring chinook salmon ESU, and is therefore clearly of great biological importance. Because of its large size and the broad distribution of juvenile migration timing, however, the Wenatchee is also an expense place to work, requiring an annual budget greater than the other two sites combined. The Wenatchee is such an important and logistically suitable system, however, that we believe it is particularly critical to obtain accurate estimates of the reproductive success of hatchery fish there.

Tucannon: The Tucannon River population is a unique population in the Snake River spring/summer chinook salmon ESU, in that it has been relatively unaffected by large scale hatchery production and is located above fewer mainstem dams than any other population in the ESU. In its basic life-history, it is similar to the Wenatchee River population, and will therefore provide much needed replication across populations and ESUs. One advantage of working with the population is that we can readily take advantage of ongoing monitoring efforts. Logistically, we agree that the Tucannon is not as ideally suited as the Wenatchee, because the site of adult sampling in the Tucannon is not downstream of all natural spawning areas. This means that it will not be possible to sample the entire spawning population in the Tucannon, but it will be possible to sample 60-80% of the population. Three factors mitigate against this deficiency, however, leading us to believe that a study in the Tucannon will be highly productive. First, we have proposed installing a juvenile migrant trap near the site of adult collection. This means that for the juvenile samples collected in that trap, we will have sampled ~100% of the potential anadromous parents. Second, computer simulations indicate that our study is feasible even if only 60% of the potential parents have been sampled. Third, even though not as ideal as the Wenatchee, the Tucannon site is nonetheless one of the better suited sites in the Columbia River Basin for a reproductive success study on chinook salmon. Fourth, the costs associated with the Tucannon study are relatively low, and almost certainly much lower than would be necessary to build a logistically ideal weir in another system. Fifth, there may be a tendency for adults that spawn below the weir to produce offspring that also spawn below the weir, increasing the number of potential spawners sampled for adult-to-adult comparisons.

Kalama: The Kalama spring chinook population is in the Lower Columbia River chinook ESU, and is considered to be an independent population by the Willamette/Lower Columbia River Technical Recovery Team. It is one of a relatively small number of spring run populations in the ESU. Logistically, the Kalama site is similar to the Tucannon, in that the fish spawn above and below the trap. Approximately 100% of the potential natural spawners going above the trap can be sampled, however, and the proposed study will form part of a long-term, and highly successful, research and monitoring effort in this system. Additionally, the proposed Kalama project will provide an essential element of a proposed study to evaluate the effects of catch and release tangle net fisheries in the lower Kalama River (proposal #35018, Evaluate recreational and commercial mark-selective fisheries). Biologically, the Kalama spring chinook population is very different from the Wenatchee and Tucannon populations in several

ways: it has a high proportion of subyearling juvenile migrants, and it has been highly influenced by recent hatchery production. These attributes are shared by many populations in the Lower Columbia River ESU, making this an important and representative study population. Like the Tucannon project, the Kalama project is relatively inexpensive, and benefits from synergies with ongoing work.

Finally, we are completely confident that we can complete the required work on all three systems because we have the necessary infrastructure and experience. Our team includes biologists who have spent years conducting research in the proposed systems, and who are extremely well equipped to set up and obtain the samples necessary for this study. In addition, the two laboratory groups that will conduct the molecular work are also highly experienced, and both are involved in similar, ongoing, studies involving thousands of samples.

<u>The reviewers question whether precocial male chinook are "undesirable" and whether or not they reach the ocean</u>

We understand the ISRP's caution against concluding that the precocial trait is "undesirable." However, we are unaware of any resource manager who would consider an abnormally high production of precocials as a desirable outcome, all else being equal. Precocials do not provide a desirable fishery product, and potentially produce undesirable genetic and ecological impacts. As the reviewers note, precocials may indeed be an unavoidable byproduct of intensive culture, but even if that is the case it is essential that the biological costs associated with them be quantified as well as possible. We therefore agree completely with the reviewers that this is an important issue to study.

With regard to whether or not precocials reach the ocean, one of the most extensive evaluations of precocialism in spring chinook salmon is being conducted in the Yakima basin. There, we have documented a large number of age 1+ hatchery precocial spring chinook in the Yakima Basin that do not migrate to the ocean. In addition, Don Larsen (NMFS) has found that the proportion of downstream migrators that are precocially mature decreases with the distance from the release site in the Yakima River. However, we are aware that there is some evidence from otoliths that some precocials may migrate to the estuary before migrating back upstream to spawn. This phenomenon may be more prevalent at sites that are closer to the ocean.

RME group comments

We generally agree with and appreciate the RME group's positive comments. We would like to point out that our study addresses both RPA's 182 and 184. In fact, RPA 182 appears to us to be in essence a subset of RPA 184. One strength of our proposed study is that we will be measuring relative reproductive success of hatchery and natural both in the wild and in the hatcheries. This will allow direct estimation of the rate and degree of domestication selection in the hatcheries, which is clearly relevant to RPA 184.

We are eager to work with the RME group in any way to make the study fit in as best as possible with other monitoring plans in the Columbia River Basin.