

# State, Federal and Tribal Fishery Agencies Joint Technical Staff Letter

*Columbia River Inter-Tribal Fish Commission  
Oregon Department of Fish and Wildlife  
Washington Department of Fish and Wildlife  
NOAA National Marine Fisheries Service*

February 28, 2007

Mr. Dennis Schwartz  
U.S. Army Corps of Engineers  
Fish Passage Team  
Robert Duncan Plaza  
333 SW First Avenue  
Portland, OR 97204

Subject: PNNL Proposed Ives Island Chum Redd Sampling ESA Take Permit Application

Dear Mr. Schwartz,

The System Configuration Team (SCT), Fish Passage Advisory Committee (FPAC) and the Technical Management Team (TMT) are considering studies of chum salmon incubation conditions in the Ives Island area, related to Total Dissolved Gas (TDG) issues and the effects of flow manipulation on egg and fry viability during and after spawning. The study plan proposed by the Pacific Northwest National Laboratory (PNNL) lists two objectives for “redd pumping”(i.e. partial evacuation) of chum redds in the Ives Island area. Objective 3 will “pump” five or more redds to determine TDG Gas Bubble Trauma (GBT) following an unspecified period of average to high spill. Objective 4 will “pump” five dewatered redds to determine if redd dewatering is causing mortality during post-hatch intragravel rearing. Objective 3 is part of a broader study to examine GBT of chum fry in relation to flow operations below Bonneville Dam (SCT study proposal SPE-P-06-1). Objective 4 is an add-on, at the request of the TMT as an attempt to determine if dewatering of redds constructed at higher elevations followed by intermittent rewatering is an effective flow management strategy.

## General Comment:

While laboratory work to determine total dissolved thresholds for chum provides good background information, it must be related to actual field like conditions. It is near impossible to simulate field/real life conditions and exposure in the laboratory. Case in point, prior laboratory research showed that smolts held in 110 to 120% TDG levels in the laboratory expressed signs of Gas Bubble Trauma, GBT, throughout a large portion of the test population. However, the field sampling and smolt monitoring program has never recorded levels similar to those reported by the laboratory work at the same gas levels. This is likely related to exposure time, depth compensation, and other factors that occur in the field that the laboratory did not replicate or was unable to replicate. One must always be careful making management decisions based solely on laboratory work without a monitoring/evaluation of field and real life conditions. Therefore we strongly recommend that field measurements and evaluations related to gas levels and GBT need to be completed and compared to the laboratory work to insure a more holistic understanding of how total dissolved gas affects the potential chum redds below Bonneville.

## Specific Comments:

The Joint Technical Staff (JTS) has reviewed the PNNL proposal and we have concerns regarding Objective 4:

- Viability criteria, sampling technique, and study design:
  - The proposed study plan does not provide any information on what constitutes viability of incubating eggs, alevins and fry. The TMT has not defined any criteria or objective for evaluating viability of dewatered redds versus non-dewatered redds. The researchers proposing to conduct the studies have not provided any background scientific information regarding egg, alevin and fry survival and mortality that could be used to develop criteria. Without such criteria or some information on what would normally be expected in healthy redds, it will be difficult to interpret findings from the proposed sampling.
  - The study does not include a control group of non-impacted (non-dewatered) redds for comparison with dewatered redds. A lack of a control group will make interpreting results difficult if not impossible. While redds “pumped” for Objective 3 could theoretically serve as controls if properly coordinated and sampled with Objective 4, the sampling periods for the two objectives are disparate and therefore not compatible. Adding the sampling of healthy redds to Objective 4 to serve as a control would require destruction of five additional redds, increasing the detrimental impacts of this objective on the chum population.
  - The technique of redd pumping may not provide useful data on effects of dewatering. When McMichael et al. (2003) used the redd pumping technique proposed in the Wanapum Dam tailrace, they stated that the “sampling efficiency was unknown and thought to be relatively low.” Given this unknown collection efficiency (which likely differs for live versus dead alevins/fry), along with the unknown number of fish in each redd, the redd pumping technique appears unlikely to produce meaningful data for assessing survival.
  - In addition to the problems associated with the redd pumping technique, measuring the effects of dewatering has proven extremely difficult in the field. McMichael et al. (2005)

used redd capping, which is thought to have higher collection efficiency than redd pumping, to assess effects of redd dewatering below Wanapum Dam. McMichael et al. (2005) was unable to demonstrate the effects of redd elevation or dewatering on redd production or fish survival, which was likely due to small sample size ( $n = 7$ ), low statistical power, unknown number of eggs within redds, high variability in fry production among sampled redds, and/or lack of a control group. They also found high variability in estimated survival rates (assuming the unknown number of eggs in each redd of seven redds was equal to 4,272) between selected redds. We expect that chum redds would have similarly high variability in alevin/fry production, making the likelihood of detecting dewatering effects unacceptably low. While not provided by the researchers, this study design likely has low statistical power to detect meaningful differences in survival associated with dewatering.

- Timing of Sampling:
  - Sampling of dewatered redds in the spring may be too late to obtain meaningful information. The proposal does not specify when samples of dewatered redds would occur, other than to say “posthatch”. Addition of this Objective to the PNNL study was suggested with the notion that dewatered redds should be sampled using standard techniques by researchers experienced in their application and in conjunction with other similar sampling (eg. Objective 3). Presumably then, Objective 4 would probably be conducted in the Spring during periods of average or high spill, in conjunction with Obj. 3.
  - However, sampling of chum redds after April 10<sup>th</sup>, when spill is scheduled to begin in the lower Columbia, may be well after the majority of chum fry have emerged. Sampling of chum fry by seining in the Ives Island area since 1999 has shown that 76% to 92% of chum fry have emerged by April 10<sup>th</sup> (Figure 1). In only one year, 2001, were more than half of the chum fry still in the gravel. Dewatered redds in the Ives Island area were constructed during high tailwater conditions in November, and thus were some of the first redds constructed. It is likely that these redds, if viable will be the first for fry to emerge. Sampling of redds after emergence could potentially lead to an erroneous conclusion of non-viability of the redd.
  - Sampling late in the incubation period may result in loss of dead eggs and fry due to decomposition and predation over the extended incubation period, potentially leading to an erroneous conclusion of non-viability of the redd.
  - Mobility of post-hatch fry in dewatered/intermittently watered redds may allow the fry to migrate through the gravel to more favorable conditions at lower depths. If fry do migrate deeper in the gravel (or laterally), sampling excavation may find no redds present, potentially leading to an erroneous conclusion of non-viability of the redd.
- Impacts to the chum population:
  - Lower Columbia River chum populations are severely depressed and listed as threatened under the Endangered Species Act (ESA).
  - Recent population levels have been quite low, less than 700 spawning adults, except for 2002.
  - Observed redds (217) in the Ives Island area in 2006 are the second lowest since 1998 when redd surveys began.

- A high proportion (81%) of Ives Island 2006 chum redds are at elevations that put them at risk of being dewatered late in the incubation period due to insufficient water in the Columbia system and conflicts with power generation and spring migration flow augmentation needs.
- Sampling of redds by pumping effectively destroys the redds and the eggs/fry they contain, resulting in an adverse impact to the chum population.
- Adequate sampling of dewatered redds, which may be lost anyway, requires additional sampling of a comparable number of healthy redds, adding to the adverse impact to the overall chum population.

#### Recommendations

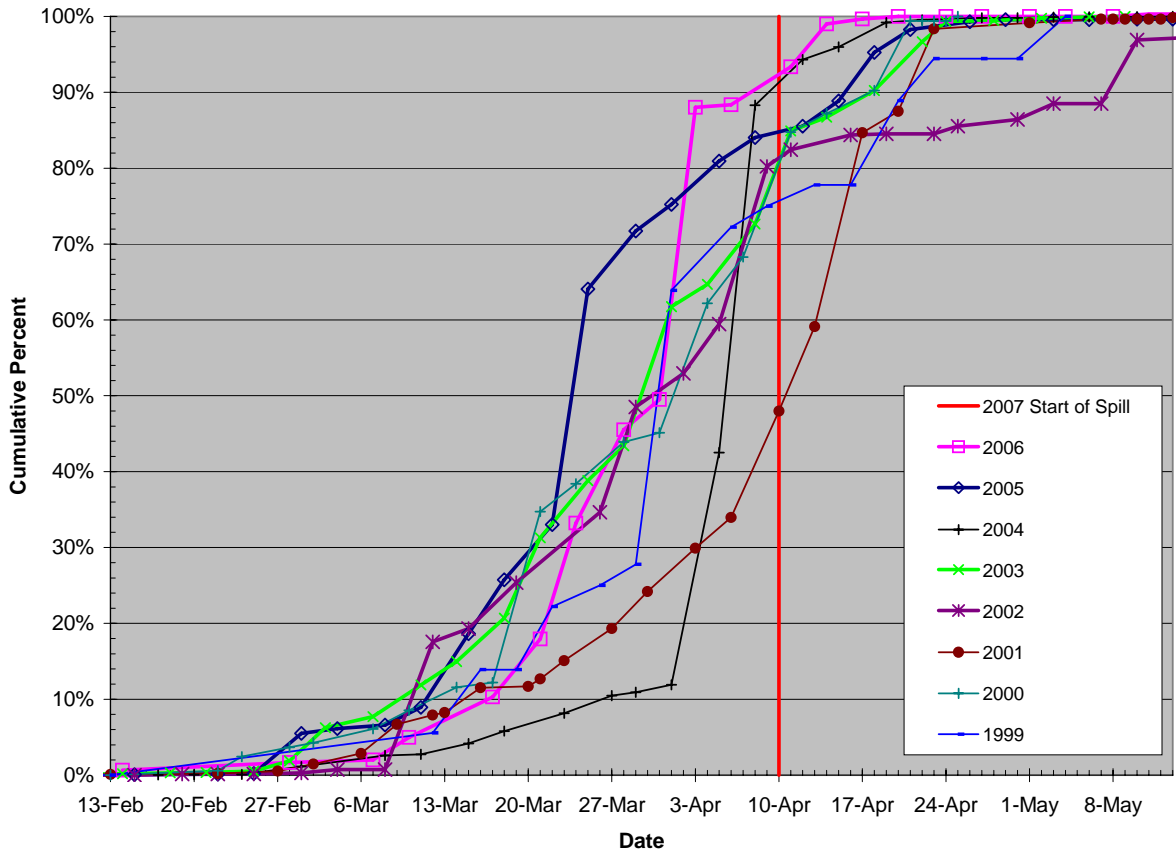
- To properly evaluate the effects of TDG on chum fry survival, an evaluation with adequate controls would be necessary. One possible means to evaluate this issue would be to place known numbers of hatchery-reared yolk sack fry in containment vessels buried in the gravel and evaluate them for sign of GBT at staged intervals. It would be very important to ensure that the containment vessels experienced conditions similar to natural redds, in terms of their location, depth, shape, upwelling, and substrate composition. This approach would provide a more controlled evaluation and avoid the ambiguity of not knowing whether fish were even present in the redd being evaluated. Further, because this approach would utilize hatchery-reared chum, it would not impact the listed wild chum population below Bonneville Dam.
- We recommend that criteria for evaluating viability of dewatered redds be developed prior to sampling, using available information on viability within un-impacted redds.
- We recommend that researchers proposing to conduct this type of sampling in the future provide information from the scientific literature, both published and unpublished, that describes the proportion of live and dead eggs, alevins and fry that could be expected in a healthy redd and the known effects of dewatering on salmon redds.
- If this sampling proceeds, we recommend that it be conducted earlier during the emergence period to avoid problems associated with decomposition and predation on dead eggs, alevins and fry and to avoid problems that may result from mobility of posthatch fry and early emergence.
- If the above technical issues cannot be resolved, we recommend that Objective 4 of the proposed PNNL study not be conducted due to the high probability of producing non-meaningful and confounded information.
- Given observed high variability in survival rates among redds, sampling enough redds to obtain precise information, including the addition of a control group, will impose losses to the chum spawning population that should be carefully considered in light of the tenuous status of the chum population.

References:

McMichael, Geist, D.R., Hanrahan, T.P. and others. 2003. Chinook salmon in the Priest Rapids Project. Project Report PNWD-3243 to Public Utility District No. 2, Grant County, WA.

McMichael, G.A., C.L. Rakowski, B.B. James, and J.A. Lukas. 2005. Estimated fall Chinook salmon survival to emergence in dewatered redds in a shallow side channel of the Columbia River. North American Journal of Fisheries Management 25(3):876-884.

Figure 1. Timing of chum salmon fry capture in beach seines in the Ives Island area, 1999 - 2006.



Sincerely,

**Thomas Lorz**  
Columbia River Inter-Tribal Fish Commission

**Paul Wagner**  
NOAA Fisheries

**Richard Kruger**  
Oregon Department of Fish and Wildlife

**Cindy LeFleur**  
Washington Department of Fish and Wildlife