



# FISH PASSAGE CENTER

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## MEMORANDUM

TO: Tracy Hauser, BPA  
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FROM: Michele DeHart, FPC

DATE: October 10, 2011

RE: Smolt Monitoring Program, Gas Bubble Trauma Monitoring 2011

On September 19, 2011 the Fish Passage Center became aware, via email, of concerns that had been raised by research contractors on the sites from Kintama Corporation and Pacific Northwest laboratories, regarding the Smolt Monitoring Program and the Gas Bubble Trauma Monitoring Programs at John Day and Bonneville Dam in May of 2011. These concerns were raised verbally to the BPA COTR for the Smolt Monitoring Program Project at the American Fisheries Society meeting held in Seattle Washington on September ??, 2011. The email we received on September 19, stated:

*“Problem with Fish Passage Center Contract”*

*“Two independent sources (one from Kintama, one from the COE) suggest FPC (Fish Passage Center) technicians responsible for detecting gas bubble disease at two dams (John Day, Bonneville) were not performing their duties according to protocol (eyeballing fish, not using microscopes). Consequently, significant mortality was occurring for weeks prior to their announcement that this was a problem. The data were overwhelming convincing. If you look at wording from the contract, it appears they are not fulfilling the terms;*

Upon notification that these issues had been raised we began to investigate these concerns. Details were requested in writing from PNNL researchers and from BPA staff involved in these conversations. BPA pursued details and provided them to the FPC. The PNNL researcher

declined to respond to our written inquiries. The Corps of Engineers provided detailed study plans of the research being implemented. Smolt Monitoring Program personnel provided details of sampling, dates that the research was being conducted and sampling on those days. The results of our review, our recommendations and detailed discussion of each point follow.

#### **Conclusions:**

- **There were no problems with the SMP or GBT monitoring at these projects however, our review illuminated significant issues and concerns with the research conducted at these sites during the spring of 2011.**
- **The researchers (Kintama and PNNL) conducting acoustic tag studies in the spring of 2011, apparently did not account for or address the effects of holding fish in shallow tanks in high dissolved gas conditions.**
- **The acoustic tag data collected in the spring of 2011, should be considered with caution since these fish were held for long periods of time in shallow tanks.**
- **The GBT Monitoring Program showed its highest incidence of GBT symptoms on the same day that the Kintama, shallow tank fish experienced high mortality. The high mortality of the Kintama shallow tank fish could be predicted based upon available research.**
- **Smolt Monitoring Program (SMP) personnel at John Day and Bonneville were following the SMP and Gas Bubble Trauma Monitoring protocols exactly as written.**
- **The PNNL researcher, who reported the “eyeballing” at John Day, rather than use of a microscope, was uninformed regarding the gas bubble trauma monitoring program. John Day Dam is not a GBT monitoring site. What the researcher observed at John Day Dam was the examination process for fish condition monitoring, which does not involve microscopes.**

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During the spring migration period in 2011 river flows were high and spill was largely uncontrolled. As a result, during some time periods and some locations dissolved gas levels in the river were higher than the states' water quality standards. It appears that researchers conducting acoustic tag studies in the lower Columbia River did not address or account for the spring migration conditions. The applicability of these research results should be carefully considered in light of the migration conditions, and the research fish holding conditions. Particularly, in light of higher than normal dissolved gas levels for long periods of time, coupled with researchers holding fish in shallow holding tanks which would precipitate gas bubble trauma. Although this was apparent in the incidences when research fish died in sample tanks,

sub-lethal effects that might not be obvious, could affect research results and would not necessarily represent the run-at-large. Therefore, the research results from 2011 may have limited applicability, because results may primarily reflect fish holding and handling.

**The researchers (Kintama and PNNL) conducting acoustic tag studies in the spring of 2011, apparently did not account for or address the effects of holding fish in shallow tanks in high dissolved gas conditions.**

Research shows that water depth affects the incidence of gas bubble trauma in fish. Total dissolved gas (TDG) supersaturation is described relative to surface (ambient atmospheric) pressure. As depth increases the total pressure causes the amount of atmospheric gases the water will hold in an equilibrium state to increase relative to the water's surface pressure. The compensation rate is about 10% of saturation or 74 mm Hg per meter of depth. In the natural environment, fish commonly spend much, and in many cases all of their time at depths greater than 1 m. Laboratory experiments (Mesa et al., 1997) showed that fish confined in water 28 cm deep at a TDG level of 130% juvenile Chinook began to die after 5 h exposure, reaching about 50% mortality at 9 h. And, at 120% TDG in the shallow water the mortality rate followed a sigmoid curve reaching about 43% at 58 h.

**The GBT Monitoring Program showed its highest incidence of GBT symptoms on the same day that the Kintama, shallow tank fish experienced high mortality. The high mortality of the Kintama shallow tank fish could be predicted based upon available research.**

Researchers for Kintama and PNNL have inferred that the Smolt Monitoring Program Gas Bubble Trauma Monitoring Program did not indicate correctly the incidence of gas bubble trauma in juvenile migrating salmon and steelhead, based on the incidence of mortality in their research fish groups. On the contrary, the highest incidence of gas bubble trauma at Bonneville Dam (3.17%) occurred on May 28, 2011, concurrent with the high incidence of mortality for the research fish. The high mortality in research fish was apparently caused by extended periods of holding in a shallow tank. Based upon extensive research results, the researchers could have anticipated the effects of shallow tank holding on fish exposed to high dissolved gas levels. The incidence of gas bubble trauma in the research fish held in shallow tanks does not indicate that the GBT Monitoring Program is inaccurately indicating the extent of dissolved gas trauma in the run-at-large. **However, it does indicate that the applicability of research results in 2011 from these studies might be limited.**

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**was the examination process for fish condition monitoring, which does not involve microscopes.**

PNNL researchers raised a concern that SMP personnel at John Day Dam were not following monitoring protocol. We reviewed the activities of the SMP personnel at John Day Dam and reviewed the data, and data reporting. We have concluded that all SMP personnel at John Day were following the established protocol.

The GBT monitoring program is designed towards the objective of giving an early indication that gas bubble trauma monitoring is occurring in the run-at-large. In addition the program is designed to limit the handling impact on fish. The regionally agreed upon gas bubble trauma monitoring program does not include the John Day site. However, fish condition monitoring does occur at the John Day project. Fish condition monitoring does not include or require microscopic examination of fish.

Mesa, M. G., J. J. Warren, K. M. Hans and A. G. Maule. 1997. Progression and severity of gas bubble trauma in juvenile Chinook salmon and development of non-lethal methods for trauma assessment. Pages 55-90 in Maule, A. G., J. Beeman, K. M. Hans, M. G. Mesa, P. Haner, and J. J. Warren. 1997. Gas bubble disease monitoring and research of juvenile salmonids. Annual Report 1996 (Project 96-021), Bonneville Power Administration, Portland, Oregon.