UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
525 NE Oregon Street
PORTLAND, OREGON 97232-2737

F/NWR5

June 11, 2003

Ms. Susan Braley
Unit Supervisor, Water Quality
Washington Department of Ecology
Lacey, Washington

Dear Ms. Braley:

Thank you for the opportunity to provide the Washington Department of Ecology (WDOE) with additional information regarding the biological effects of total dissolved gas (TDG). The National Marine Fisheries Service (NOAA Fisheries) is grateful for the state's continued support for our efforts to improve salmonid survival through spill passage at Federal mainstem Columbia and Snake river hydroelectric dams. We are encouraged to learn that the recent state initiative to remove the "temporary" clause from the state rule has received support. In response to your request we offer the following information with the intention of aiding your efforts in this regard.

Your request identified three topics for which you are seeking additional input. Those topics are:

- resident fish tolerance of elevated TDG,
- the lethal TDG level equivalent to turbine passage lethality, and
- spill program action levels.

Resident Fish

Enclosed is a two-part list of resident fish references. The first section was extracted from the NOAA Fisheries 2000 Federal Columbia River Power System Biological Opinion (BiOp), Appendix E. If you have not already read the resident fish publications I have listed, you may find it beneficial to do so.

The second part of the list includes published reports from more recent scientific research. Please note that I have enclosed a copy of the "Gas Bubble Disease in Resident Fish below Grand Coulee Dam." This is a recently published report and may be difficult to obtain. As you review this report, you will note that it is comprised of several chapters. Each chapter has its own reference listing. You will find additional references pertinent to your resident fish efforts in those lists.

Another recent report is available on the BPA website. Technical difficulties prevented my printing a copy to send in this packet. However, the article describes five years of field monitoring of resident fish in the Clearwater river below Dworshak Dam. The BPA website is: www.efw.bpa.gov/cgi-bin/FW/publications.cgi. Once you are in the publications section of the website you can conduct a "Custom Query" under the author's name and access the referenced report.

The final two references in the enclosed list describe work conducted and reported by Dr. Don Weitkamp of Parametrix, located in Seattle, WA. As you can see from the reference, these reports are currently in press. Although I have not had the opportunity to read the articles, I have heard Dr. Weitkamp discuss his findings. His work on the Clark Fork River revealed that resident fish response to elevated TDG is, in many respects, similar to that of salmonids. This material should be directly applicable to your questions.

Turbine/Total Dissolved Gas Relative Lethalities

I am aware of only two documents pertinent to your concerns. I have enclosed a copy of one of these, i.e., "Spill and 1995 Risk Management" because this report was not formally published and is difficult to locate. If you have not previously had the opportunity to read this report you may find Section III C through E (pp 29-41) particularly useful. In summary, the 1995 risk assessment estimated turbine mortality and compared it with a TDG mortality curve. The report concluded that, at the point where projected dissolved gas mortality equaled the lethality of turbine passage, higher TDG levels due to additional spill beyond a certain point would be counter-productive. That point ranged between 120% and 125% TDG.

The second document pertinent to the issue of balancing spill for fish versus turbine passage related mortality is Appendix E of the BiOp. This evaluation was based on the results of five years of an annual biological monitoring program. The conclusions of the 1995 fishery managers risk assessment and Appendix E of the BiOp were essentially the same. The managed biological opinion spill program can result in gas up to 120% TDG but spill to this gas level is expected to provide a safer route of project passage than turbine passage.

Spill Program Action Levels

To my knowledge there has been no recent research that would stimulate a change to the action levels established by NOAA Fisheries in 1996. Researchers have never been able to make a clear, quantitative correlation with the incidence or severity of gas bubble disease signs and fish mortality. The conservative approach established by NOAA Fisheries in the early implementation of the Spill Program continues to be employed. At that time, research indicated that a significant mortality did not occur in test fish until a significant degree of GBT signs were apparent. The action levels were set conservatively at a fraction of that test level. With these

actions levels in place on those rare occasions when levels of GBT were observed they occurred in years of higher than normal runoff and significant amounts of involuntary spill, such as 1996 and 1997.

In closing, I would make one suggestion. If you have not already done so, as you complete Washington's water quality standards rule, we urge you to coordinate the Washington rule with the other state water quality agencies, particularly Oregon. From the NOAA Fisheries perspective as the federal agency responsible for ESA protection for salmon and steelhead in the mainstem Columbia and Snake rivers, it is also important that similar standards be developed and approved by the other states bordered by the rivers, e.g., Oregon and Idaho on the Snake River or Washington and Oregon on the lower Columbia River.

Thank you for the opportunity to provide input. I hope this was helpful. If there is more that I can do to assist the state efforts, please contact me at 503-231-2306 or by electronic mail at mark.schneider@noaa.gov.

Sincerely,

Mark Schneider

Mark J. Schneider
Water Quality Advisor, FCRPS Branch
NOAA Fisheries

Enclosures

cc: Mike Herold, WDOE
Russell Harding, ODEQ
Don Essig, IDEQ
Jim Adams, Corps
Dave Zimmer, USBR
Helen Rueda, EPA - Portland
Jannine Jennings, EPA - Seattle

Resident Fish Literature References

2000 FCRPS Biological Opinion

Toner, M. A., B. A. Ryan, and E. M. Dawley. 1995. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates downstream from Bonneville, Ice Harbor, and Priest Rapids Dams, 1994. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, to U.S. Army Corps of Engineers.

Ryan, B. A,. and E. M. Dawley. 1998. Effects of dissolved gas supersaturation on fish residing in the Snake and Columbia Rivers, 1997. National Marine Fisheries Service, Fish Ecology Division, Northwest Fisheries Science Center, Seattle, Washington, to Bonneville Power Administration (Project 96-022-00).

Ryan, B. A., E. M. Dawley, and R. A. Nelson. 2000. Modeling the effects of dissolved gas supersaturation on resident aquatic biota in the mainstem Snake and Columbia rivers. North American Journal of Fish Management 20:180-192.

Schrank, B. P., E. M. Dawley, and B. Ryan. 1997. Evaluation of the effects of dissolved gas supersaturation on fish and invertebrates in Priest Rapids Reservoir, and downstream from Bonneville and Ice Harbor Dams, 1995. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, to U.S. Army Corps of Engineers, North Pacific Division, Poretland, Oregon.

Schrank, B. P., B. A. Ryan, and E. M. Dawley. 1996. Effects of dissolved gas supersaturation on fish residing in the Snake and Columbia rivers, 1996. Annual Report 1996 of National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, to U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon (Project 96-022).

Schrank, B. P., B.A. Ryan, and E. M. Dawley. 1998. Effects of dissolved gas supersaturation on fish residing in the Snake and Columbia Rivers, 1996. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington, to U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.

Toner, M. A. 1993. Evaluation of effects of dissolved gas supersaturation on fish and invertebrates downstream of Bonneville Dam, 1993. National Marine Fisheries Service, Coastal Zone and Estuarine Studies Division, Northwest Fisheries Science Center, Seattle, Washington, to U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.

Weitkamp, D. E. 1977. Gas Bubble Disease of Resident Fish and Juvenile Salmonids in the Columbia River System. Doctoral Thesis. University of Washington.

Recent Research Results

Beeman, J.W., D.A.Venditti, R.G, Morris, D.M. Gadomski, B.J. Adams, S.P. Vanderkool, T.C.

Robinson and A.G. Maule. 2003. Gas Bubble Disease in Resident Fish Below Gand Coulee Dam. 2003 Draft Final Report of Research. U.S. Department of the Interior. U.S. Geological Survey. 159 pages.

Chapter III of the above publication has been accepted for publication by Northwest Science

Chapter V of the above publication has been published as:

Morris , R.G, J Beeman ,SP VanderKooi , and AG Maule. 2003. Lateral line pore diameters correlate with the development of gas bubble trauma signs in several Columbia River fishes. Comparative Biochemistry and Physiology Part A 135: 309-320.

Cochnauer, T. 1999. Summarization of Gas Bubble Trauma Monitoring in the Clearwater River, Idaho. Final Report 1999. DOE/BP-31259-3. Contract 97BI31259.

Weitkamp, D.E., R. P. Sullivan, T. Swant, and J. DosSantos. 2003. Behavior of Resident Fish Relative to TDG Supersaturation in the Lower Clark Fork River. Transactions of the American Fisheries (in press)

Weitkamp, D.E., R. P. Sullivan, T. Swant, and J. DosSantos. 2003. Gas Bubble Disease in Resident Fish of the Lower Clark Fork River. Transactions of the American Fisheries Society (in press).

Prepared by : Mark Schneider
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