

# **APPENDIX J**

## **FISH PASSAGE SUMMARY**



## FISH PASSAGE CENTER

2501 SW First Avenue, Suite 230, Portland, OR 97201-4752

Phone: (503) 230-4099 Fax: (503) 230-7559

<http://www.fpc.org>

e-mail us at [fpcestaff@fpc.org](mailto:fpcestaff@fpc.org)

December 2, 2002

Michael B. White, P.E.  
Director, Civil Works and Management  
U.S. Army Corps of Engineers  
Northwestern Division  
PO Box 2870  
Portland, OR 97208-2870

Dear Mr. White,

As per your request we are providing both you and Dr. Mark Schneider of NOAA Fisheries with a copy of our "Gas Bubble Trauma Monitoring and Data Reporting for 2002". This report summarizes data collected during the 2002 juvenile salmonid migration.

Please feel free to contact us if you require any additional information.

Sincerely,

Michele DeHart  
Fish Passage Center Manager

CC: David Ponganis, COE  
Dick Cassidy, COE  
Dr. Mark Schneider, NOAA

## **Gas Bubble Trauma Monitoring and Data Reporting for 2002**

### **Overview**

Monitoring of juvenile salmonids in 2002 for GBT was conducted at Bonneville Dam and McNary Dam on the Lower-Columbia River, and at Rock Island Dam on the Mid-Columbia River. The Snake River monitoring sites were Lower Monumental Dam, Little Goose Dam, and Lower Granite Dam. Sampling of fish began the first full week of April at all sites and continued through mid-June at the Snake River sites, when the numbers of steelhead and yearling chinook were too few to sample effectively. Subyearling chinook were not sampled in the Lower Snake River due to their endangered status and because the Biological Opinion does not call for the implementation of summer spill at the Snake River collector projects. Sampling of subyearling chinook did occur at Columbia River sites to the end of August.

Sampling occurred two days per week at the Lower Columbia sites and once a week at Lower Granite, Little Goose and Lower Monumental in the Snake River. In previous years fish were sampled every other day (3 to 4 days per week) at most facilities. The number of sampling days was reduced in 1999, in order to decrease the number of fish handled. It was determined that the reduced sampling effort would not significantly diminish the capability to detect the presence of GBT in the migrating population.

The goal was to sample 100 salmonids of the most prevalent species (limited to chinook and steelhead) during each day of sampling at each site, the proportion of each species dependent upon their prevalence at the time of sampling. Examinations of fish were done using variable magnification (6x to 40x) dissecting scopes. The eyes, and unpaired fins were examined for the presence of bubbles. The bubbles present in the fins were quantified using a ranking system based on the percent area of the fins covered with bubbles. A rank of 0 was recorded when no bubbles were present; rank 1 was recorded when up to 5% of a fin area was covered with bubbles; rank 2 was for 6% to 25%; rank 3 indicated 26% to 50% fin area was bubbled; and rank 4 indicated greater than 50% of a fin was covered with bubbles. The eyes of the fish were also examined and the eye with the highest amount of bubbles in it was ranked using the same criteria as was used for the fins. Additional information was recorded for each fish including, species, age, race, rearing disposition, fork length, fin clips, and tags. The examination procedures were

similar to those used in past years of the program (see the GBT Monitoring Protocol for details of exam procedures).

Sampling techniques varied somewhat based on the location. This year all sampling sites were at dams, where fish could be collected from the juvenile fish bypass system. At those dams where fish crossed separators the fish were collected as they entered the separator. At Bonneville Dam fish were collected at Powerhouse 1 (PH1), from the bypass trap that was sampled every 30 minutes from 4 pm to midnight. However, operations of Bonneville Dam prioritize Powerhouse 2 (PH2) turbine operation, so that when flows are low, few or no turbines are operated in Powerhouse 1. During those types of operations, fish collections at the PH1 are too low to achieve adequate numbers for GBT sampling. Then sampling switches to the juvenile collection facility below PH2. Rock Island Dam is the only site where fish were held in a tank (up to 24 hours) prior to examination.

## Results

A total of 13,477 juvenile salmonids were examined for GBT between April and August (Table 1). A total of 155 or 1.2% showed some signs of GBT in fins or eyes (Table 2).

**Table 1. Number of juvenile salmonids examined for signs of GBT at dams on the Lower Snake River and on the Columbia River from April to August 2002 as part of the GBT Monitoring Program.**

Species	Site						
	BON	MCN	LMN	LGS	LGR	RIS	Total
Chinook Subyearlings	1,852	2,202	0	0	0	1,659	5,713
Chinook Yearlings	941	1,123	418	398	306	1,047	4,233
Steelhead	213	393	692	640	808	785	3,531
Total	3,006	3,718	1,110	1,038	1,114	3,491	13,477

Fin signs were found in 150 or 1.1% of the fish sampled at all sites. Two fish were found with severe fin signs (rank 3 or higher) while, 8 fish had fin rank 2, with the remainder (140 having rank 1 signs). The prevalence of GBT signs at Rock Island Dam was higher than any other Columbia River site during the 2002 monitoring season as is typically the case each season. Because the Rock Island data may obscure other interannual trends in the occurrence of GBT signs among sites, it will be treated separately in the remainder of this report.

**Table 2. Number of juvenile salmonids found with fin GBT at dams on the Lower Snake River and on the Columbia River from April to August 2002 as part of the GBT Monitoring Program.**

Species	Site						
	BON	MCN	LMN	LGS	LGR	RIS	Total
Chinook Subyearlings						41	41
Chinook Yearlings			3			24	27
Steelhead		7	57	4	2	12	82
Total		7	60	4	2	77	150

At the Lower Columbia River and Snake River sites (i.e. excluding Rock Island) a total of 9,986 fish were examined with 74 (0.7%) exhibiting signs of GBT, compared to 0.1% in 2001, 0.2% in 2000, 1.4% in 1999, 1.6% in 1998, 4.3% in 1997, 4.2% in 1996 and 1.3% in 1995. Seventy-three fish were found with fin signs in 2002, comparable to 1998 when 1% were found with fin signs. The percent signs over the past several years has been 0.001% in 2001, 0.2% in 2000, 0.3% in 1999, 1.0% in 1998, 3.2% in 1997 and 3.3% in 1996. One fish was found with severe fin GBT in Lower Snake and Lower Columbia sampling. This is similar to 2001, 2000 and 1995 when no severe fin GBT was found. Other years showed higher incidence of severe fin GBT; in 1998 four (0.01%) fish displayed severe fin signs, 1997 when 117 fish (0.27%) had severe fin signs (again excluding Rock Island) and 47 fish (0.12%) in 1996 while in 1999 no severe signs were found.

The Biological Opinion Spill Program was managed using the data collected for total dissolved gas levels. However, signs of GBT in fins of juvenile fish, examined as part of the biological monitoring, were used to compliment the physical monitoring program. The NMFS set the action criteria for the biological monitoring program at 15% prevalence of fish having fin signs **or** 5% with severe signs (rank 3 or greater) in fins. The NMFS action criteria were exceeded twice at Lower Monumental Dam on June 17 and June 24 (based on dates when at least 30 fish were sampled). There were no exceedences of the NMFS action criteria in 2001, 2000, 1999 or 1998, but 23 dates when GBT levels surpassed the action criteria in 1997, 20 in 1996, and there were no exceedences in 1995.

The prevalence and severity of fin signs in juvenile salmonids sampled in the Lower Snake and Lower Columbia rivers from 1995 to 2002 reflected changes in TDGS conditions in the river from year to year. In 1995 no fish had severe fin GBT and 1995 had the lowest number

of days with high TDGS (Table 3). Also the occurrence of severe signs in 1996 and 1997, and the increase in exceedences of the NMFS action criteria, reflected a significant increase in the number of days when TDGS rose above 125% in the forebays of these dams (see Tables 3 and 4). While in 1998 only 4 fish were found with severe fin GBT and 1 fish in 1999, reflecting the more moderate conditions found in the river.

**Table 3. The number of days when TDSG levels were above 120% and 125% at representative forebay monitors in the Lower Snake and Lower Columbia Rivers from April 1 to August 31.**

TDGS Monitor	2002		2001		2000		1999		1998		1997		1996	
	days >120	days >125												
Lower Granite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Goose	1	0	0	0	0	0	5	0	8	3	23	8	29	6
Lower Monumental	5	0	0	0	0	0	7	2	14	8	61	31	64	33
Ice Harbor	0	0	0	0	1	0	5	1	14	4	52	19	41	11
McNary (Oregon) <sup>a</sup>	0	0	0	0	0	0	3	0	0	0	46	0	30	4
John Day	0	0	0	0	0	0	0	0	7	0	47	15	33	11
Bonneville	0	0	0	0	0	0	0	0	3	0	65	27	45	6
Total	6	0	0	0	1	0	20	3	46	16	294	100	242	60

<sup>a</sup> 2002 data used Washington monitor at McNary due to missing data from Oregon monitor during July and August.

**Table 4. The number of days when NMFS GBT criteria of 15% prevalence or 5% severe signs were exceeded at sites in the Lower Snake and Lower Columbia rivers from April 1 to August 31.<sup>ab</sup>**

Site	2002	2001	2000	1999	1998	1997	1996
Lower Granite	0	0	0	0	0	0	0
Little Goose	0	0	0	0	0	1	1
Lower Monumental	2	0	0	0	0	7	9
Ice Harbor	0	0	0	0	0	3	2
McNary	0	0	0	0	0	2	1
John Day	0	0	0	0	0	1	4
Bonneville	0	0	0	0	0	11	4
Total	2	0	0	0	0	25	21

<sup>a</sup> Based on dates when at least 30 fish of the species exhibiting signs were captured.

<sup>b</sup> More than 5% of fish showed severe signs on only 1 date in each year 1996 & 1997 and on those same dates the prevalence of fin signs was greater than 15%.

## **Discussion**

This year, as in previous years, the proportion of fish showing fin signs appears to be proportional to the levels of TDGS experienced by fish. Lower Monumental Dam was the only location in the Lower Snake and Lower Columbia where signs of GBT exceeded NMFS action criteria. It is also the location with the greatest number of days when TDGS exceeded 120% at the forebay monitor (Table 4), but only by a small amount. There are several factors that may have affected the response of fish to these total dissolved gas levels. First, the fish with signs of GBT were detected late in June, which is well after most of the migrating steelhead have passed the project and our ability to collect an adequate sample decreases. Steelhead that migrate late in the season often revert to parr and do not continue to migrate in that year, spending a longer than normal time in the hydrosystem. Second, there was no voluntary spill program at Lower Monumental Dam this year. Limited spill (flow in excess of hydraulic capacity) only occurred for a short time period (one week) well before these fish with signs were detected. Spill has been shown to decrease the amount of time fish spend in the forebay. Consequently, because of the lack of spill and because of the physiological state, these fish may have spent longer periods of time in the forebay. The fish characteristics described and the project operations may have contributed to the occurrence of signs at the gas levels observed this year.

Also, Rock Island Dam continues to have the highest proportion of fish with signs of GBT versus TDGS levels in the reach of river above the dam. With such low spill volume there were few times when total dissolved rose above 120% as measured at forebay monitors (See Table 3). The low percentage of fin signs reflect these conditions, with only 0.7% fish in the Lower Columbia or Snake showing a fin bubble.



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

F/NWR5

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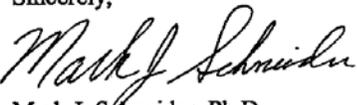
Michael B. White, P.E.  
 Director, Civil Works and Management  
 U.S. Army Corps of Engineers  
 Northwest Division  
 P.O. Box 2870  
 Portland, OR 97208-2870

Dear. Mr. White:

The National Marine Fisheries Service (NOAA Fisheries) has reviewed a copy of the Fish Passage Center (FPC) report, "Gas Bubble Trauma Monitoring and Data Reporting for 2002" (GBT). The purpose of our review is to provide technical assistance to the Corps of Engineers as described in the Water Quality Strategy section of the NMFS 2000 Biological Opinion. Representatives of our two agencies had agreed that a NMFS review of the GBT report would be helpful during the annual discussions with state water quality agencies associated with implementation of the spill program.

The 2002 GBT report prepared by the FPC was consistent with past reports in format and data interpretation. In addition, the report continues to document the biological response observed in previous years, i.e., juvenile and adult salmonids display few GBT signs below 120% total dissolved gas. The single error noted in the 2002 FPC report was typographical. The error is found in the legend for Table 3. The legend now reads, "The number of days when TDSG levels..." The acronym refers to total dissolved gas supersaturation and should therefore be changed to "TDGS".

Thank you for the opportunity to review the report. If I can be of further service to the Corps effort regarding the spill program for 2003 please contact me at, 503-231-2306, or via electronic mail at, [mark.schneider@noaa.gov](mailto:mark.schneider@noaa.gov).

Sincerely,  


Mark J. Schneider, Ph.D.  
 Water Quality Advisor  
 FCRPS Branch, Hydro Division  
 NOAA Fisheries

