

Gas Supersaturation Monitoring Report during Corner Collector Operation at Bonneville Dam in March, 2007

U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office
1211 S.E. Cardinal Court, Suite 100
Vancouver, WA 98683
November 30, 2007

Gas Supersaturation Monitoring Report during Corner Collector Operation at Bonneville Dam in March, 2007

Introduction

To aid the downstream survival of about 7.8 million tule fall Chinook (*Oncorhynchus tshawytscha*) juveniles scheduled for release from the Spring Creek National Fish Hatchery on March 5 and March 9, 2007, and to continue the passage study begun in 2004, the U.S. Fish and Wildlife Service (Service) requested a Bonneville Dam Power House 2 Corner Collector (B2CC) operation that included spillway flow. An agreement with the Action Agencies (Bonneville Power Administration (BPA), and U.S. Army Corps of Engineers (Corps)) for this provision was not reached. Sufficient depth for compensation from gas supersaturation, as measured by total dissolved gas (TDG) over listed chum salmon (*O. keta*) redds below the Bonneville Dam project, was requested. It was calculated by Service biologists that the anticipated level of flow and B2CC operation would produce a maximum TDG level not exceeding 120% in the tailrace of Bonneville Dam, and a maximum TDG level not exceeding 105%, when compensated by water depth, at the chum and fall Chinook salmon redds located below Bonneville Dam at the Ives Island complex and across the river along the Oregon shore, principally at the Multnomah Falls area (Figures 1 and 2).

Three years ago the Service requested a TDG waiver from the Oregon Department of Environmental Quality (ODEQ) and an adjusted dissolved gas standard from the Washington Department of Ecology (WDOE) for spill at Bonneville Dam for a ten day period in March, 2004. These requests were made to allow for TDG saturation up to 120% in the Bonneville Dam tailrace as measured at the Warrendale monitoring station (river mile 140), and 115% as measured at the Camas/Washougal monitoring station, required as a surrogate forebay station, at river mile 122, and on the Oregon and Washington shores, respectively. The Oregon Environmental Quality Commission approved this request at its February 6, 2004 meeting. The Oregon waiver was a multi-year waiver for spill through March 2007. The WDOE provided the adjusted TDG standard on February 27, 2004. The WDOE adjusted TDG standard expired on February 27, 2005. A new exemption was issued by WDOE in March 2005 to the Corps, which included actions at Bonneville Dam for the March release. This exemption extends through February 2008 and applies to Corps dams on the Columbia and Snake Rivers in Washington State.

This report summarizes the results of the 2007 March release and the monitoring for TDG during the B2CC operation.

Operations

The first release of 2006 brood of tule fall Chinook smolts (6.6 million) was on Monday March 5, 2007. The Bonneville Powerhouse 2 Corner Collector (B2CC) operation had already begun on March 1 to accommodate a month long Corps evaluation of steelhead

(*O. gairdneri*) kelt passage through the B2CC. A second group of about 1.2 million smolts was released on Friday March 9. The Service goal is to pass 95% of the Spring Creek tule smolts during a five day period after the smolts begin passing Bonneville Dam.

The Service monitored TDG levels from the mainstem Columbia River dissolved gas monitoring network gauges below Bonneville Dam (the tailwater gauge at Warrendale and the downstream gauge at Camas/Washougal) from March 6-16. To establish the critical tailwater elevations and TDG levels at the chum salmon redd locations, TDG levels and water depth at the redds were measured using a Hydro-Lab Datasonde4 probe (calibrated preseason).

Results

Biological Monitoring:

No biological monitoring of fish for gas bubble trauma (GBT) was conducted in 2007 as the TDG levels did not exceed the 110% limit. Passage timing of the tule smolts past Bonneville Dam was tracked with combined sub-yearling smolt data collected by the Smolt Monitoring Program at the Bonneville Dam Juvenile Fish Facility. Passage data from 2003-2007 is shown in Table 1 and listed in Figure 3. A post season evaluation using passage data into April, and correcting for non-tule Chinook sub-yearling passage, estimated that 95% of the tule fall Chinook smolts from the entire March release from Spring Creek Hatchery passed Bonneville Dam by March 12. This was six days after the first fish began passing the dam.

Monitoring of Physical Conditions:

The Service monitored tailwater depth and TDG data from the tailrace monitor (Warrendale) and TDG data from the downstream monitor (Camas/Washougal) during the 11 day period of peak passage past Bonneville Dam. These data were collected and transmitted automatically for display on the Corps website:

<http://www.nwd-wc.usace.army.mil/report/total.html>

Table 2 is a summary of Bonneville Dam spill, total flow, tailwater elevation, and percent TDG the entire month of March and during the 11 day period (March 6 - 16) encompassing the peak passage period of the smolts released from Spring Creek NFH on March 5 and March 9, 2007. The TDG levels ranged from 99.6% to 107.7% in the Bonneville forebay. Recorded TDG levels at the Warrendale monitoring station varied from 101.0% to 109.1% during this time period. The TDG levels recorded at the Camas/Washougal monitoring station varied from 100.4% to 108.0%.

The Bonneville Dam discharge, spill, and official project tailwater height can be retrieved from the Corps data query website: <http://www.nwd-wc.usace.army.mil/perl/dataquery.pl>

During this period the lowest tailwater elevation and the highest TDG readings remained below the 105% limit at the Ives Island complex and at the Multnomah Falls site, when

factored for depth compensation. Table 3 lists the measured TDG readings and water depth taken by the Service at the chum redd sites at the beginning of the passage period. There is approximately a 3% TDG compensation for every foot of water above the redds. The 2006 spawning chum salmon were held to spawning areas available at the 13 foot tailwater elevation.

Summary

The Service monitored water quality (TDG) from the mainstem Columbia River gauges below Bonneville Dam (Warrendale and Camas/Washougal) and at the critical chum salmon redd locations during the March 6- 16 smolt passage period.

Total dissolved gas levels recorded at the tailrace monitoring station (Warrendale) did not exceed the 120% waiver limit (106.0% actual). The TDG levels recorded at the Camas/Washougal monitoring station did not exceed the 115% waiver limit (106.9% actual). The TDG levels measured by the Service for shallow redds at the Ives Island and Multnomah Falls sites did not exceed the 105% TDG limit, when factored for depth compensation.



Figure 1. Location of chum salmon redds from 2006 spawning, and TDG sample sites (March 2007) in the Ives/Pierce area below Bonneville Dam.

 chum spawning site  TDG sample site

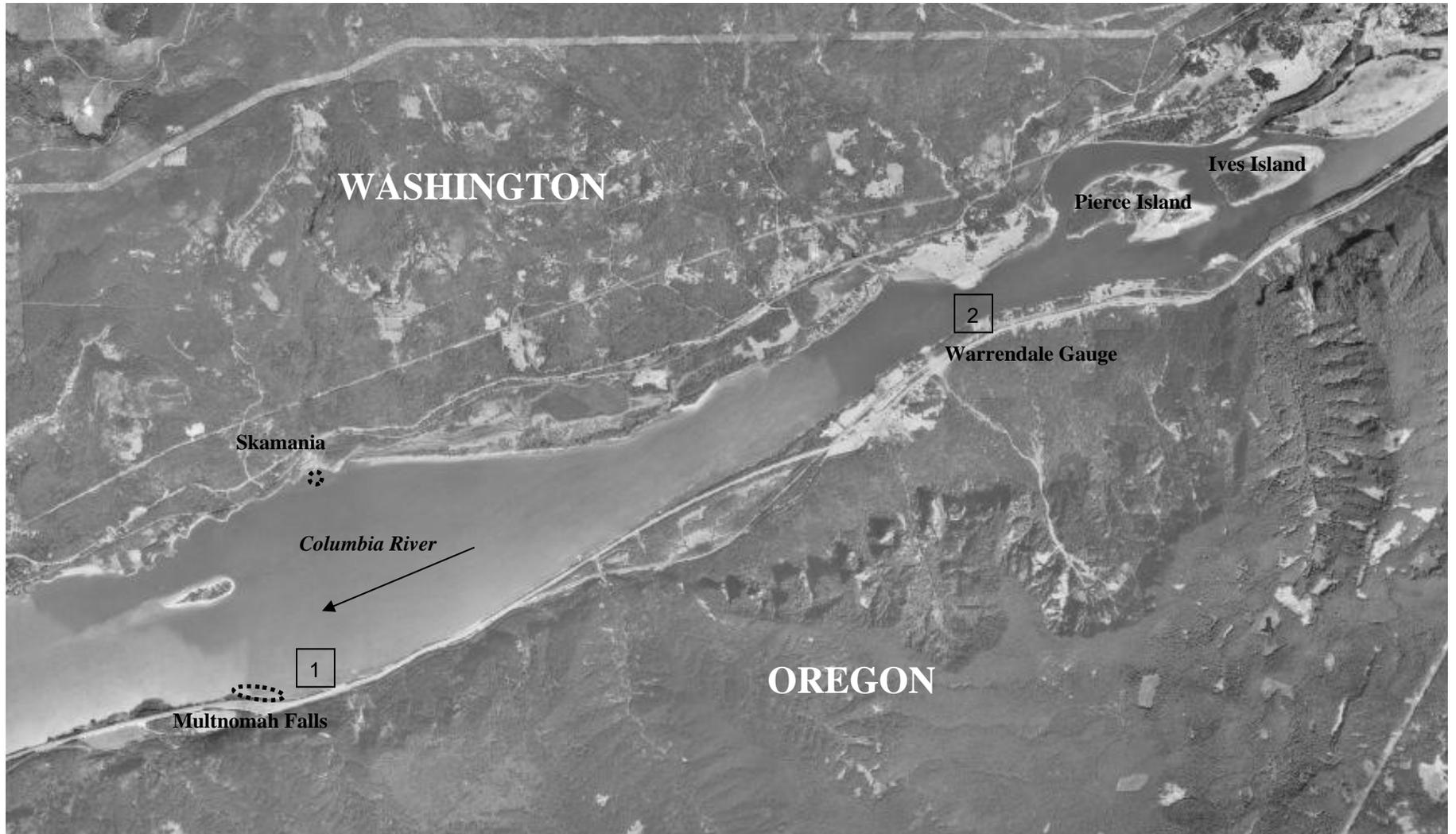


Figure 2. Location of salmon chum redds from 2006 spawning, and TDG sample sites (March 2007) from Multnomah Falls to Warrendale below the Ives Island Complex.

••••• chum spawning site

1 TDG sample site

Table 1. Sub-yearling Chinook passage index counts at Bonneville Dam Power House 2 during the March release from Spring Creek NFH (2003-2007).

Number of days into spill start1	Spring Creek Release2		Spring Creek Release		Spring Creek Release		Spring Creek Release "B"		Spring Creek Release "A"		Spring Creek Release	
	03/5&9/07	B2CC1	3/2/2006 0:00	B2CC	3/2/2005 0:00	B2CC	3/10/2004 0:00	B2CC	3/1/2004 0:00	Spill	3/1/2003 0:00	Spill
	Index Count *	Date	Index Count *	Date	Index Count *	Date	Index Count *	Date	Index Count *	Date	Index Count *	Date
-1	8	3/5/07	57	3/2/06	35	3/2/05	-----	3/10/04	-----	3/1/04	-----	3/9/03
1	0	3/6/07	55	3/3/06	33	3/3/05	-----	3/11/04	-----	3/2/04	-----	3/10/03
2	106,076	3/7/07	51,611	3/4/06	8,924	3/4/05	50,260	3/12/04	20,825	3/3/04	256,056	3/11/03
3	429,248	3/8/07	387,150	3/5/06	387,479	3/5/05	242,411	3/13/04	173,388	3/4/04	62,621	3/12/03
4	298,932	3/9/07	219,703	3/6/06	264,004	3/6/05	52,319	3/14/04	123,449	3/5/04	16,830	3/13/03
5	37,238	3/10/07	54,658	3/7/06	89,485	3/7/05	18,647	3/15/04	26,718	3/6/04	5,861	3/14/03
6	80,973	3/11/07	24,241	3/8/06	29,584	3/8/05	7,230	3/16/04	4,464	3/7/04	940	3/15/03
7	71,001	3/12/07	6,284	3/9/06	13,558	3/9/05	7,322	3/17/04	6,740	3/8/04	1,148	3/16/03
8	32,204	3/13/07	2,314	3/10/06	6,037	3/10/05	4,644	3/18/04	3,678	3/9/04	708	3/17/03
9	7,633	3/14/07	1,548	3/11/06	6,785	3/11/05	3,829	3/19/04	2,331	3/10/04	576	3/18/03
10	1,855	3/15/07	1,095	3/12/06	2,846	3/12/05	6,186	3/20/04	2,310	3/11/04	745	3/19/03
11	2,041	3/16/07	1,006	3/13/06	2,898	3/13/05	5,976	3/21/04			386	3/20/03
12 Day Total	1,067,209		749,722		811,668		398,824		363,903		345,871	
5 Day Passage	952,467		737,363		779,476		363,637		344,380		341,368	
5 Day %	89.2%		98.4%		96.0%		91.2%		94.6%		98.7%	

----- no counts taken, no data available

bolded dates are first and last days of spill or Corner Collector operations

* Index counts are based on a 24 hour Smolt Monitoring Program sample collection counted about 8 AM on the listed date.

1 B2CC opened March 1 and closed August 31, 2007.

2 Split release March 5 and March 9.

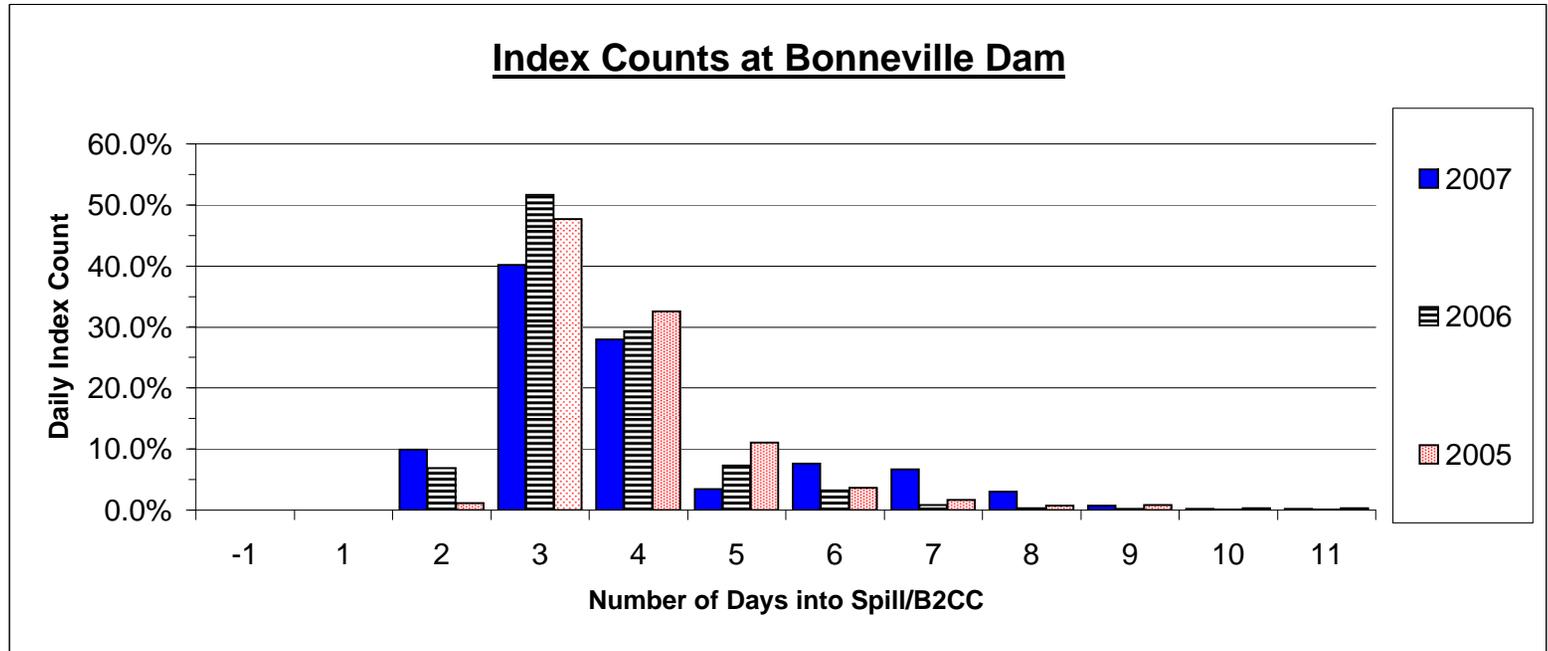


Figure 3. Sub-yearling Chinook passage index counts at Bonneville Dam expressed as a percentage of a 12 day period before and during the March release from Spring Creek NFH, from 2003-2007.

Table 2. Summary of Bonneville Dam spill, total flow, tailwater elevation (TW), and percent TDG the month of entire month of March and the 11 day period (March 6 - 16) encompassing the peak passage period of the smolts released from Spring Creek NFH on March 5 and March 9, 2007.

March 1 - March 31, 2007			TDG % Saturation			
	SPILL (KCFS)	TOTAL FLOW (KCFS)	Project TW (ft)	Bonneville		
				Forebay (BON)	Warrendale (WRNO)	Camas (CWMW)
Average	14.9	209.6	17.6	103.1	104.3	104.2
Minimum	0.0	80.6	12.4	99.6	101.0	100.4
Maximum	105.2	322.9	23.4	107.7	109.1	108.0

March 6- March 16, 2007			TDG % Saturation			
	SPILL (KCFS)	TOTAL FLOW (KCFS)	Project TW (ft)	Bonneville		
				Forebay (BON)	Warrendale (WRNO)	Camas (CWMW)
Average	1.1	179.0	15.7	102.3	103.9	104.0
Minimum	0.0	128.0	13.0	101.2	101.7	101.7
Maximum	2.5	242.5	19.4	104.2	106.0	106.9

Table 3. USFWS TDG field measurements below Bonneville Dam during the 2007 Spring Creek release.

Sample Site	Date	Time Probe1 into Water	Time of Sample	Total Depth (feet)	Probe1 Depth (feet)	Probe1 Temp (°C)	Probe1 TDG Pressure (mmHG)	Baro Pres Warrendale WRNO (mmHG)	%TDG	%TDG Warrendale (WRNO)	Time of Sample
1 Multnomah Falls redds ²	6-Mar	10:50	11:11	3+ ft	2 ft	5.3	787	768	102.5	101.9%	11:00 AM
1 Multnomah Falls redds ²	6-Mar	10:50	11:15	3+ ft	2 ft	5.3	789	768	102.7	101.9%	11:00 AM
1 Multnomah Falls redds ²	6-Mar	10:50	11:18	3+ ft	2 ft	5.3	790	768	102.9	101.9%	11:00 AM
2 Warrendale Gauge Dock ²	6-Mar	11:35	11:55	3+ ft	2 ft	5.3	793	767	103.4	102.2%	12:00 PM
2 Warrendale Gauge Dock ²	6-Mar	11:35	12:00	3+ ft	2 ft	5.4	794	767	103.5	102.2%	12:00 PM
2 Warrendale Gauge Dock ²	6-Mar	11:35	12:05	3+ ft	2 ft	5.3	796	767	103.8	102.2%	12:00 PM
3 Ives Island	6-Mar	12:21	12:26	2 ft	1.5 ft	8.7	835	767	108.9	102.2%	12:00 PM
3 Ives Island	6-Mar	12:21	12:34	2 ft	1.5 ft	8.1	838	767	109.3	102.2%	12:00 PM
3 Ives Island ²	6-Mar	12:21	12:40	2 ft	1.5 ft	8.5	840	767	109.5	102.2%	12:00 PM
4 Fish Wheel Pilings ^{*2}	6-Mar	12:51	13:14	3+ ft	2 ft	5.7	794	767	103.5	102.3%	1:00 PM
4 Fish Wheel Pilings ^{*2}	6-Mar	12:51	13:19	3+ ft	2 ft	5.7	794	767	103.5	102.3%	1:00 PM

1 Hydro-Lab Datasonde4 probe was used. Pre-season calibration.

2 Probe stabilized for at least 20 minutes.

* Downstream from the mouth of Hamilton Creek.