

FISHERIES FIELD UNIT
CENWP-OD-SRF
BONNEVILLE LOCK AND DAM
CASCADE LOCKS, OR. 97014
(541) 374-8801

December 19, 2006

To: David Clugston, USACE
From: Robert Stansell, USACE

Re: Summary of Pinniped Observations at Bonneville Dam in 2006; Letter Report.

The following is a summary of our monitoring of pinniped predation on fish in the Bonneville Dam tailrace for 2006. The purpose of the monitoring was to determine the effect hazing, acoustic deterrents, and sea lion exclusion devices (SLED's) had on pinniped abundance and predation activity at the dam.

Background

Pinniped activity at Bonneville Dam became a serious and very visible issue in the spring of 2005 as first one, and then several sea lions began entering the fishways, some all the way up to the count stations. Some hazing was conducted to chase sea lions out of the fishways and physical barriers (SLED's) were constructed and installed to keep them out of the fishways. Some hazing from boats was also conducted. However, because of the small size of the spring Chinook (*Oncorhynchus tshawytscha*) run in 2005, and the continued trend of more pinnipeds at the dam each year, pinnipeds were estimated to have taken about 3.4% of the run.

In 2006, we evaluated the effectiveness of several deterrence measures at keeping pinnipeds out of the fishways and reducing predation on salmon (*Oncorhynchus* spp.) at the dam. These deterrents included SLED's at all main fishway entrances, acoustics at all main fishway entrances, and an active hazing program for pinnipeds near fishway entrances or hauled out at the dam. Later, this included hazing from boats manned by NMFS, ODFW, WDFW, OSP, and CRITFC personnel.

Objectives

The objectives were basically the same in 2006 as in previous years except for #4:

1. Determine seasonal timing and abundance of pinnipeds present at Bonneville Dam.
2. Estimate pinniped consumption of adult salmonids at Bonneville Dam.
3. Identify individual California Sea Lions at Bonneville Dam, determine whether they return in subsequent years, and where they haul out at the dam.
4. Conduct non-lethal hazing/harassment of pinnipeds near fishways to keep them out. Install acoustic deterrents at all fishway entrances and determine if pinnipeds avoid and do not pass these locations. Deploy sea lion exclusion devices (SLED)

at all main fishway entrances and determine whether they kept sea lions out of the fishways.

Methods

Methods of surface observations and data collection were the same as those used in 2002-2005 (Stansell, 2004; Letter Report: Stansell, 2005). Limited observations began in January, when Steller's sea lions (*Eumetopias jubatus*) were frequently feeding on large white sturgeon (*Acipenser transmontanus*) below the dam. Full time observations began on February 10. Methods of calculating estimates of fish taken were the same as described in Stansell (2005).

SLED's were installed between February 12 and March 4 at all main fishway entrances. Acoustics were in place at or near all fishway entrances before the end of February. The acoustic projectors emitted a 205 decibel sound in the 15 kHz range. Acoustic deterrents and land based hazing and harassment (by Wildlife Service personnel) of sea lions near fishway entrances and hauled out began on March 5 and continued through the season according to a randomized block schedule where acoustics were on and hazing conducted for two days, or acoustics were off and no hazing occurred for two days within each block of four days. Above water pyrotechnics (cracker shells) and rubber bullets were used for harassment most of the time, with some use of rockets to scare animals from great distances. To test whether sea lions could be chased away from the tailrace, additional hazing/harassment was conducted by NMFS, WDFW, ODFW, and CRITFC personnel beginning on April 2 in the tailrace of Bonneville Dam and downstream several miles. These personnel used above water pyrotechnics, rubber bullets, and underwater pyrotechnics. Boat-based hazing was conducted in an alternating four-day block schedule (four days of hazing, four days off) to overlap the hazing from the dam study. Additional observations were made of the presence of sea lions and take that occurred within 100 ft of fishway entrances. These figures, along with project take and daily maximum sea lion abundance, were used to compare during hazing and non-hazing periods.

Results and Discussion

California sea lions (*Zalophus californianus*) were noted at Bonneville Dam from February 9 through June 5. These arrival and departure dates are similar to 2005 dates, which were a little earlier and about a week later, respectively, than previous years. Steller's sea lions and some harbor seals (*Phoca vitulina*) were observed several days during December and January.

Pinniped Abundance Estimates

At least 70 individual California sea lions, 10 Steller's sea lions, and 3 harbor seals were observed. This compares to the estimated 30 California sea lions in 2002, 110 in 2003, 102 in 2004, and about 80 in 2005.

About 57% of the highly identifiable California sea lions seen in 2005 were seen again in 2006. This is similar to the proportion we saw returning in the previous two years.

Predation Estimates

Although the estimated number of salmonids taken was slightly more than last year (see Table 1), the percentage of the run taken (January 1 through May 31) was lower at 2.8%. This is probably because fewer salmonids passed Bonneville Dam in 2005 than 2006 or in the previous three years. Unlike last year, the sea lions were not taking very many salmonids early in the season, yet they remained at the dam. A very late spring Chinook run began in late April, early May (peak on May 6), and this may have had some predator swamping affect as the higher daily average number of sea lions present did not correspond to a higher catch. In 2003 and 2004, sea lions were taking relatively large numbers of salmonids before the peak of the salmon passage. This may indicate that sea lions do not take more fish when more fish are present and fewer fish when fewer fish are present in proportion to the run size, but that they are consuming fish at a relatively steady rate, regardless of run size. Alternatively, if huge numbers of fish were present below Bonneville, the pinnipeds would likely catch a higher total number of fish, but only to some point of saturation, and the percentage of the run taken would be much less.

All these estimates and figures are for observed take in the immediate vicinity below Bonneville Dam, and predation is reportedly occurring all the way down to the mouth of the Columbia River at an unknown level. Hundreds of sport and commercial fisherman as well as Oregon and Washington State Biologists conducting sturgeon sampling have reported seeing predation activity throughout the lower Columbia River. It is likely that Bonneville Dam presents a “choke point” for fish passage and that these roughly 70-100 sea lions have learned to capitalize on this situation. However, it is not known whether these sea lions would increase their efforts elsewhere if they were effectively excluded from the immediate vicinity below Bonneville Dam. The California sea lions are predominately males, fattening up for their trip to southern California breeding grounds. Large breeding males will not feed for a month or two during the breeding season, so energetic demands are high during the months preceding their annual migration. If hazing at Bonneville Dam is successful, they may go after easier prey such as lamprey or shad, or target more heavily the sport anglers who have already hooked a salmon. Might sea lions actually take more salmon as they use up energy having to work harder to find and chase their prey? Without further studies, we will never know beyond speculation.

Fewer lampreys were taken this year than last year, but take was similar to 2003 and 2004 levels (Table 1). Shad take in 2006 was similar to previous years (Table 1). Since lamprey and shad are smaller prey and can be eaten quickly or swallowed whole, actual predation numbers are likely underestimated. For the last two to three weeks in May, the sea lions were feeding almost exclusively on lamprey and shad even though over a thousand salmon a day were passing the project.

Steller’s sea lions were observed as early as December and numbered up to 10 at Bonneville this year, targeting almost exclusively sturgeon (*Accipenser transmontanus*) (263 of the 264 sturgeon taken). Size of sturgeon taken was normally distributed, with few taken over six feet. Once boat hazing and spill began in early April, very few

Steller's were observed the rest of the season, and no more sturgeon were seen taken at the dam.

Hazing Activities

C404 was first seen in a fishway on February 26, having through the bars of the SLED's. He was only seen in the Washington Shore fishway after March 3 where he was likely entering through the floating orifice gates (FOG's). Temporary bars were installed on all the FOG's and C404 was at the project but not seen in any fishways between April 12 and May 8, when he left the project. No other sea lions were ever seen in the fishways.

The results of the acoustics and hazing deterrent tests, both land based and by boat, can be seen in Table 2. Overall, the tests showed no dramatic drop in the number of salmon taken or the number of pinnipeds present at the project. More salmon were observed taken on days with hazing and acoustics, but fewer pinnipeds were present near the entrances on those days. Fewer salmon were taken on days of boat hazing, but more pinnipeds were present near the entrances. This may be because the boats had limited access and could not get too close to the dam, having the occasional effect of chasing some pinnipeds closer to the dam.

Table 1. Summary of data for 2006 compared to the previous four years of observation. Data are for January 1 through May 31. 2005 data collection began in mid-March.

	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>
Total Salmonid Run	284,733	217,185	186,804	82,006	105,063
Total Estimated Salmon Take	1,010	2,329	3,533	2,920+	3,023
Percentage of Salmonid Run Taken	0.4%	1.1%	1.9%	3.4%+	2.8%
Estimated Numbers of Pinnipeds at Bonn.	31	111	105	87+	83
Mean Daily Number of Pinnipeds Present	4.4	13.3	13.7	21.4	27.0
Max. Daily Number of Pinnipeds Present	14	32	37	43	46
Number of Days Pinnipeds Present	58	71	97	101+	112+
Mean Number of Days Individuals Present	4.7	6.4	7.5	8.4	N/A
Max. Number of Days a Pinn. was Present	14	25	31	39	72
Percentage of Salmonids Caught – Escaped	11.9%	9.5%	1.8%	0.8%	2.6%
Percentage of Lamprey in Diet	5.4%	11.3%	12.2%	25.1%	9.9%
Percentage of Shad in Diet	0.0%	3.5%	2.0%	2.8%	2.6%

Additional Prey Observed Taken (all years combined):

Smolts – 21, Northern Pikeminnow – 10, Small mouth bass – 3, Sturgeon – 265, Sucker – 1

Percentage of Individual Pinnipeds Returning From Each Year

2002	81%	75%	56%	38%
2003		59%	42%	26%
2004			61%	38%
2005				57%

	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>
1 ST Day California Sea Lion Observed	3/20	3/14	2/24	2/10	2/9
Last Day California Sea Lion Observed	5/17	5/24	5/26	6/10	6/5
Average Number of Sea Lions Present/day	5.2	10.5	14.0	19.5	23.9
Average Number of Salmon Caught/day	6.7	15.4	22.1	19.3	17.4

Table 2. 2006 Hazing Results:

21 blocks of land based hazing and acoustics:

USDA Hazing/Acoustics	<u>Active (On)</u>	<u>Inactive (Off)</u>	<u>Paired t</u>
Total project salmonid take:	1,488	1,177	0.02
Average daily project pinniped presence:	26.8	27.1	0.40
Salmonid take w/in 100' of entrances:	202	232	0.22
Total pinniped activity w/in 100' of entrances:	9,098	12,819	0.002

7 blocks of boat hazing:

NMFS/ODFW/WDFW/Tribal Boat Hazing	<u>Active (On)</u>	<u>Inactive (Off)</u>	<u>Paired t</u>
Total project salmonid take:	1,147	1,241	0.33
Average daily project pinniped presence:	29.3	27.3	0.24
Salmonid take w/in 100' of entrances:	183	186	0.47
Total pinniped activity w/in 100' of entrances:	8,870	7,623	0.17

Table 3. Other observational catch data.

Sturgeon Catch at Bonneville 2006:

<u><2'</u>	<u>2-2.9'</u>	<u>3-3.9'</u>	<u>4-4.9'</u>	<u>5-5.9'</u>	<u>6-6.9'</u>	<u>>7'</u>
14	44	52	58	28	8	3

Plus 57 of undetermined length for a total of 264 sturgeon. All but 1 caught by Steller's.

Unexpanded #'s	<u>Caught</u>	<u>Lost (additional)</u>
Salmonid sp.:	713	22
Chinook:	1707	46
Chinook jack:	1	0
Steelhead:	297	15
Smolt:	3	0
Lamprey:	374	1
Shad:	32	1
N. Pikeminnow:	7	0
Bass sp.	1	1
Sturgeon:	264	6
Unknown:	396	42