2014 FIELD REPORT:

EVALUATION OF PINNIPED PREDATION ON ADULT SALMONIDS AND OTHER FISH IN THE BONNEVILLE DAM TAILRACE, 2014

Robert J. Stansell, Bjorn K. van der Leeuw, Karrie M. Gibbons, and William T. Nagy

U.S. Army Corps of Engineers
Portland District, Fisheries Field Unit
Bonneville Lock and Dam
Cascade Locks, OR 97014
(541) 374-8801

September 16, 2014

EXCECUTIVE SUMMARY

The adjusted estimate of consumption of salmonids by pinnipeds in the Bonneville Dam tailrace for the period January 1 through May 31, 2014 was 4,746, which is higher than the past three years, but lower than 2008-2010. The California sea lion portion of that estimate (2,855) was also higher than the past three years, but lower than any other year since 2003. However, the Steller sea lion component (1,891) continues the trend of increasing virtually every year since 2002. The adjusted white sturgeon consumption estimate (147), all except one by Steller sea lions in 2014, was the lowest we have observed since 2005. Whether this was due to a lack of sturgeon abundance or switching prey preference to salmonids is unknown. Predation on salmonids during October through December 2013 was higher than observed in 2011 or 2012 while predation on sturgeon was lower than previous years. Steller sea lions continue to dominate the predation events observed in the fall as few California sea lions were present.

The daily average abundance of California sea lions in 2014 (4.6 per day) was higher than the past two years, but lower than any other year since 2002. However, the daily average abundance of Steller sea lions in 2014 (9.9), while lower than the past four years, continued to be higher than that for California sea lions for the fifth consecutive year.

Sea lion exclusion devices (gates) continued to be effective at keeping sea lions out of the fishways. Non-lethal hazing with pyrotechnics from both the dam face and by boat continued to have short term impacts at driving or keeping some sea lions away from the fishways; however, some individual sea lions were not chased away at all and continued to hunt near the dam. The states removed 15 California sea lions from the Bonneville Dam population in 2014.

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INTRODUCTION

The U.S. Army Corps of Engineers (USACE) has used surface observations since 2002 to evaluate the seasonal abundance and predation activities of pinnipeds, including California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), and Pacific harbor seals (*Phoca vitulina*) in the Bonneville Dam tailrace (Stansell, 2004; Tackley, et al., 2008; Stansell, et al., 2010, 2011, 2012, 2013). This monitoring program is part of an ongoing effort to understand and manage pinniped predation on salmonids, particularly on Columbia River spring Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*) listed under the Endangered Species Act (ESA). The USACE and partnering agencies have used a variety of deterrents and barriers to prevent predation in and around fishways and to deter predation on salmonids and other fish in the tailrace.

This report is an annual summary of monitoring and deterrence efforts implemented by or coordinated with the USACE. Agency partners included the Oregon Department of Fish and Wildlife (ODFW), the Washington Department of Fish and Wildlife (WDFW), the Columbia River Inter-Tribal Fish Commission (CRITFC), the National Oceanic and Atmospheric Administration Fisheries (NOAA), and the U.S. Department of Agriculture (USDA). Although primarily covering 2014, data from 2002 to 2013 are also presented for comparison.

OBJECTIVES:

1. Estimate the number of adult salmonids (*Oncorhynchus* sp.), white sturgeon (*Acipenser transmontanus*), Pacific lamprey (*Entosphenus tridentatus*), and other fish consumed by pinnipeds in the Bonneville Dam tailrace and estimate the proportion of the adult salmonid run consumed.

2. Determine the seasonal timing and abundance of pinnipeds present at the Bonneville Dam tailrace, documenting individual California sea lion (CSL) and Steller sea lion (SSL) presence and predation activity when possible.

3. Evaluate the effectiveness of pinniped deterrents and barriers used at Bonneville Dam.

4. Evaluate the effect of the CSL removal program by ODFW and WDFW on the numbers of pinnipeds present and predation rates at Bonneville Dam.

METHODS

The methods used to collect data for developing pinniped predation estimates and pinniped abundance estimates have generally remained constant every year since 2002. Changes to procedures between years have involved the number of hours of observation made each year with a trend toward more detailed data collected on specific locations of predation events, and the species of predator and prey. Methods used for surface observations, predation and abundance estimates, and assumptions made are described in more detail in Stansell (2004), Tackley et al. (2008), and Stansell et al. (2010).

SURFACE OBSERVATIONS

While surface observations are a useful tool for assessing sea lion diet at Bonneville Dam, pinnipeds can consume smaller prey underwater, so all consumption estimates and associated impacts outlined in this report should be considered minimum estimates.

Observers were stationed at each of the three major tailrace areas of Bonneville Dam: the first powerhouse (PH1), the second powerhouse (PH2), and the spillway. They used binoculars to observe and record pinniped presence, identify and record fish catches, and identify individual CSL and SSL when possible. Prey species were identified when possible and size for white sturgeon was estimated. Individual pinnipeds were identified when possible by cataloging unique physical characteristics and/or unique brand numbers. Individual identification was used to generate abundance estimates and to track individual predation and other behavioral patterns both within and among years.

In 2014, regular observations began the hour of sunrise and ended the hour of sunset with one hour breaks in the morning and afternoon and with the break hours changing each day. No night observations were conducted in 2014 as there was not enough indication of nocturnal activity to warrant the additional observation times. The same 0.9% factor used in the past few years was used for the equation for determining adjusted estimates. Each tailrace was divided into seven zones (Figure 1) and the location of each predation event recorded by zone.

The primary study period was from early January to the end of May to focus on the spring Chinook salmon passage season at Bonneville Dam. In recent years it has been noted that SSL are arriving at Bonneville Dam as early as August. In light of this early arrival we began a pilot program of observations in the fall and early winter in 2011. In 2013, fall observations were made between September 16 and December 31 to collect additional information on SSL consumption of white sturgeon and other fish in the Bonneville Dam tailrace. In 2014, the primary study period for observations began January 9 and ended May 31 and covered Mondays through Fridays. Data were interpolated for days and hours not observed. Limited observations were conducted in early January and into June but not factored into predation estimates.

Figure 1. Primary study area and location of zones at Bonneville Dam, 2014.

PREDATION ESTIMATES

Expanded Consumption Estimates

Surface observations were used to estimate consumption of Chinook salmon, steelhead, Pacific lamprey and white sturgeon. Since observers were not present for all hours of daylight, we used interpolation at each of the tailrace areas (PH1, PH2, and spillway) to estimate adult salmonid, sturgeon, and lamprey consumption for those missing hours. Estimates for all three tailrace sub-areas were combined to calculate total daily estimated consumption for the Bonneville Dam tailrace. We used linear interpolation to fill in the data gaps for days on which no observations were made. All daily estimated consumption totals were added to get the total *expanded consumption estimate* for the year. The *minimum estimated impact* on salmonids passing during the observation period (expressed as percent of run) was calculated by dividing the expanded salmonid consumption estimate by the expanded salmonid consumption estimate plus the total salmonid passage count from Bonneville Dam for the January 1 through May 31 time period.

Adjusted Consumption Estimates

Expanded consumption estimates were adjusted to include unknown catches and nighttime predation. Observers were occasionally unable to identify a fish to species during a predation event. We can make more realistic estimates of salmonid and sturgeon consumption beyond the total *expanded consumption estimate* by attributing "unknown" prey to specific species based on the proportion of known prey observed consumed by each pinniped species (Stansell et al., 2010, Appendix B, Equation 2). The daily observed catch distributions included adult salmonids, sturgeon, American shad (*Alosa sapidissima*), northern pikeminnow (*Ptychocheilus oregonensis*), and bass (*Centrarchidae*). Lamprey and smolt (juvenile salmonids) were excluded from this proportional allocation, as we determined that their distinctive sizes and shapes made them extremely unlikely to be recorded as unidentified fish. The proportionally split consumption totals for "unknowns" for CSL and SSL were added to the expanded consumption estimates to calculate the adjusted consumption estimate for each day. We also estimated nighttime consumption by increasing the daily estimate by 0.9% based on our night work in 2011, 2012 and 2013. This is less than the 3.5% observed in 2009 and also used for 2010 adjusted estimates (Stansell, et al., 2009). Little or no nighttime predation was observed prior to large-scale daytime hazing efforts, which began in 2006, and we felt there was some shift to nighttime predation once large-scale daytime hazing began. This seems to have shifted in recent years as CSL numbers have declined; however, nighttime predation is very difficult to observe and therefore is still largely an unknown factor that we most likely are underestimating.

INDIVIDUAL IDENTIFICATION

Identification of individual CSL and SSL was used to determine the number of sea lions present (daily and seasonally) and to track individual presence and predation activity. We used video and photos from digital HD video recorders equipped with 30X optical zoom lenses, field sketches, and observer notes to identify unique marks for individual CSL and SSL and to confirm identities of individuals seen by multiple observers. Individual pinnipeds were identified by noting a combination of physical characteristics such as brands, cuts, scars, lumps, color patterns, size, maturity, and also behavior. Since harbor seal presence was relatively minor at the dam, we did not attempt to identify and track individual harbor seals.

A catalog of photos and sketches of all individuals is kept and updated annually. More detailed description of the methods used to determine daily and annual pinniped abundance estimates can be found in Stansell et al., 2010.

DETERRENTS AND MANAGEMENT ACTIVITIES

In 2014, physical barriers, called sea lion exclusion devices (SLEDs) and floating orifice gate barriers (FOGs) were re-deployed to keep pinnipeds from entering the fishways. SLEDs were installed at PH2 and Cascades Island entrances on February 13, at B-branch entrances on February 24, and PH1 entrances on February 25. All SLEDs were removed on June 2. All were effective, and no pinnipeds were observed entering the fishways during the 2014 season.

Personnel from ODFW and WDFW operated four floating sea lion traps (for a detailed description of the traps, see Brown et al., 2008) at Bonneville Dam at various locations across the season. Trapped animals were branded and specific CSL that qualified for removal under the States section 120 permit were removed from the population.

The USDA (dam-based) and CRITFC (boat-based) continued non-lethal harassment (hazing) techniques. Hazing involved a combination of acoustic, visual, and tactile non-lethal deterrents, including boat chasing, above-water pyrotechnics (cracker shells) and rubber buckshot from shotguns. Boat-based crews also used underwater percussive devices known as seal bombs. Dam-based and boat-based crews coordinated with USACE personnel, including our observers, to ensure safety and to increase the effectiveness of hazing efforts. Dam-based hazing by USDA began the first week in March and continued seven days per week through the end of May. Boat-based hazing in 2014 was conducted by personnel from CRITFC from the first week in March through mid-May. Boats operated primarily in the Bonneville Dam tailrace boat-restricted zone (BRZ). Boats could not operate within 30 m of dam structures or within 50 m of fishway entrances. To minimize the impact to fish, the use of seal bombs was prohibited within 100 m of fishways, collection channels, or fish outfalls for the PH2 corner collector and smolt monitoring facility, and the use of seal bombs ceased completely in the tailrace after adult salmonid passage exceeded 1,000 fish per day at Bonneville Dam. More detailed information on boat-based hazing activities is in Wright et al., 2007 and Brown et al., 2008, 2009, 2010, 2011, 2012 and 2013.

RESULTS AND DISCUSSION

PREDATION ACTIVITY

Between January 9 and May 31, 2014, observers completed over 2,947 hours of daytime observations. During this period, observers saw pinnipeds catch and consume 2,820 fish of several species. Adult salmonids were the primary prey item, comprising 86.9% (n=2,454) of observed catches (n=2824). White sturgeon, Pacific lamprey and American Shad were the second, third, and fourth most commonly identified prey types, comprising 2.8% (n=79), 1.5% (n=41) and 0.9% (n=25) of total observed catch respectively. Other fish (smolts, pikeminnow, other) made up about 1.0% (n=29) of observed catch. Observers were unable to identify 6.8% (n=192) of the fish caught and consumed by pinnipeds during this period.

Between September 16 and December 31, 2013 we completed over 536 daytime hours of observation. Adult salmonids were the primary prey item, comprising 53.9% (n=261) of observed catches (n=484). White sturgeon were the second most commonly observed prey type consumed, comprising 17.6% (n=85) of the catch. Observers were unable to identify 25.8% (n=125) of the fish caught and consumed by SSL. Identified salmonid species caught were 205 Chinook, 22 steelhead, and 34 coho (*Oncorhynchus kisutch*). All non-salmonid predation observed were by SSL. Adjusted estimates of fall/winter predation for 2011 through 2013 can be seen in Appendix D. At least three CSL were observed at Bonneville Dam in the fall of 2013 on four days, and a harbor seal was observed on one day. At least 27 individual SSL were observed from September through December 2013.

Predation on Adult Salmonids

In 2014, the expanded adult salmonid consumption estimate for the Bonneville Dam tailrace observation area was 4,314 or 1.9% of the adult salmonid run at Bonneville Dam from January 1 through May 31. Accounting for unidentified fish, the adjusted estimated consumption was 4,704 (or 2.1% of the run) (Table 1). A progressive series of tables, broken out for CSL and SSL, showing estimated salmonid consumption (interpolated for hours and days not observed), adjusted salmonid consumption (factoring in unidentified fish caught), and finally adding a nighttime consumption factor after hazing began (in 2006) is presented in Appendix A. The estimated percent of the run consumed declined from a high of 4.2% in 2007 through 2012 with a slight increase in 2013 and 2014 (Table 1). This decline is largely explained by an upward trend in the salmonid run size for 2007 through 2010 (Figure 2). In 2014 there was a small increase in the percent of the run consumed. CSL took more of the observed catch of salmonids in 2014 than did SSL, (60.5%, n=1,484 and 39.5%, n=970), respectively (Table 2). The expanded estimate of salmonid catch by SSL increased every year since 2007, where there were only 13 estimated, to 174 in 2008, 452 in 2009, 986 in 2010, 1,030 in 2011, 1,109 in 2012, 1,312 in 2013, and 1,699 in 2014 (Appendix A). The drop in CSL salmonid predation in 2011 and 2012 relative to previous years and the continuing rise in SSL salmonid predation each year can be seen in Figure 3.

Table 1. Consumption of salmonids by CSL, SSL, and harbor seals at Bonneville Dam tailrace, from surface observations conducted between 2002 and 2014. Total salmonid passage counts include all adult salmonids that passed Bonneville Dam from January 1 through May 31.

Year	Bonneville Dam Salmonid Passage (Jan. 1-May 31)	Expanded Salmonid Consumption Estimate		Adjusted Salmonid Consumption Estimate	
		Estimated consumption	% of run (Jan. 1 to May 31)	Estimated consumption	% of run (Jan. 1 to May 31)
2002	284,732	1,010	0.4 %	1,010	0.4 %
2003	217,934	2,329	1.1 %	2,329	1.1 %
2004	186,771	3,533	1.9 %	3,533	1.9 %
2005	81,252	2,920	3.6 %	2,920	3.4 %
2006	105,063	3,023	2.9 %	3,520	3.4 %
2007	88,474	3,859	4.4 %	4,507	5.1 %
2008	147,558	4,466	3.0 %	5,099	3.5 %
2009	186,056	4,489	2.4 %	5,134	2.8 %
2010	267,167	6,081	2.3 %	6,542	2.4 %
2011	223,380	3,557	1.6 %	4,007	1.8%
2012	171,665	2,107	1.2 %	2,382	1.4%
2013	120,619	2,714	2.3 %	2,954	2.4%
2014	219,929	4,314	2.0 %	4,746	2.2%

Table 2. CSL and SSL predation on adult salmonids at Bonneville Dam, from January 1 through May 31, 2014.

Predator		Expanded Salmonid Consumption Estimate		Adjusted Salmonid Consumption Estimate	
	Observed Salmonid Catch	Estimated consumption	% of Run (1/1 to 5/31)	Estimated consumption	% of Run (1/1 to 5/31)
CSL	1,484	2,615	1.2 %	2,855	1.3 %
SSL	970	1,699	0.7 %	1,891	0.9 %

Chinook salmon were the most commonly identified prey species, comprising 97.7% (n=2,398) of observed adult salmonid catch in 2014. The expanded Chinook salmon consumption estimate for the Bonneville Dam tailrace in 2014 was 4,209 or 1.6% of the Chinook salmon run (257,354 including jacks) from January 1 through June 15 (Table 3). Note that this time period includes the defined Columbia River spring Chinook salmon passage season at Bonneville Dam (through June 15), which extends beyond the period during which sea lions are normally present. Keefer et al. (2012) used radio-telemetry and our observational data between 2002 and 2010 to identify specific salmonid populations at risk due to predation on early-timed passage of upriver stocks. Those populations identified with the highest risk included endangered/threatened stocks from the Clearwater and Salmon rivers in Idaho, the Umatilla and Deschutes rivers in Oregon, and the Icicle River in Washington. The higher proportional impact to the early passing Chinook salmon stocks by CSL averaged over the past 12 years (Figure 4) was also evident for 2014 (Figure 5).

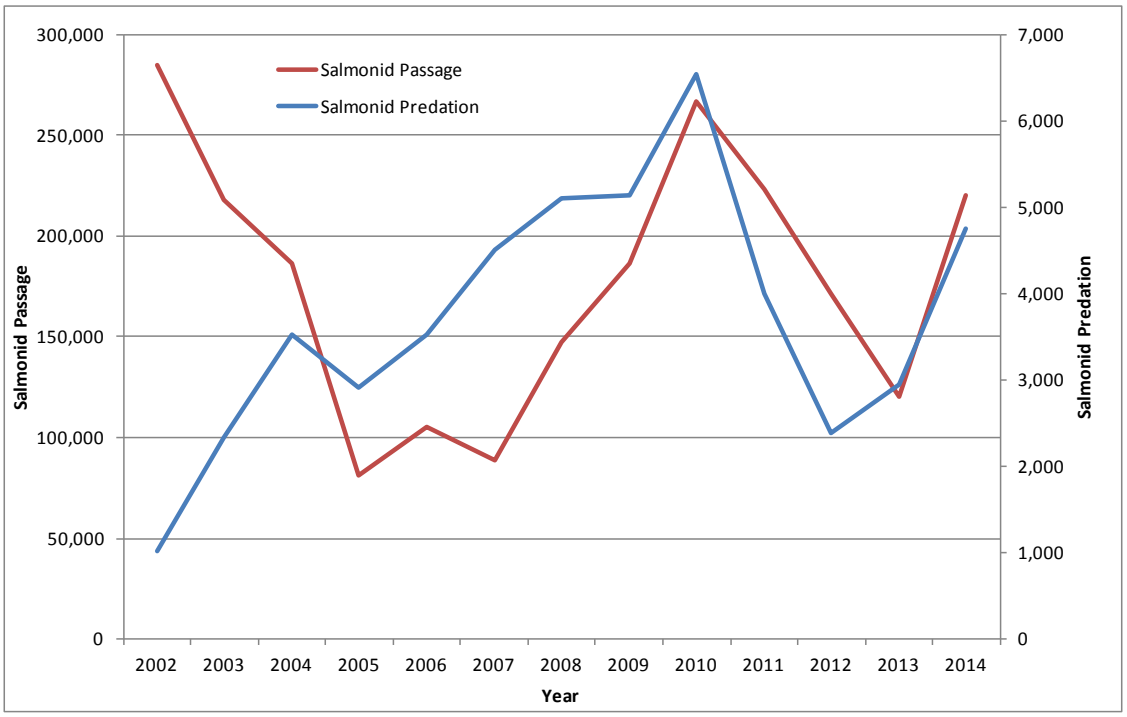

Figure 2. Annual adjusted estimate of salmonid consumption by pinnipeds and total salmonid passage through Bonneville Dam for the period January 1 through May 31.

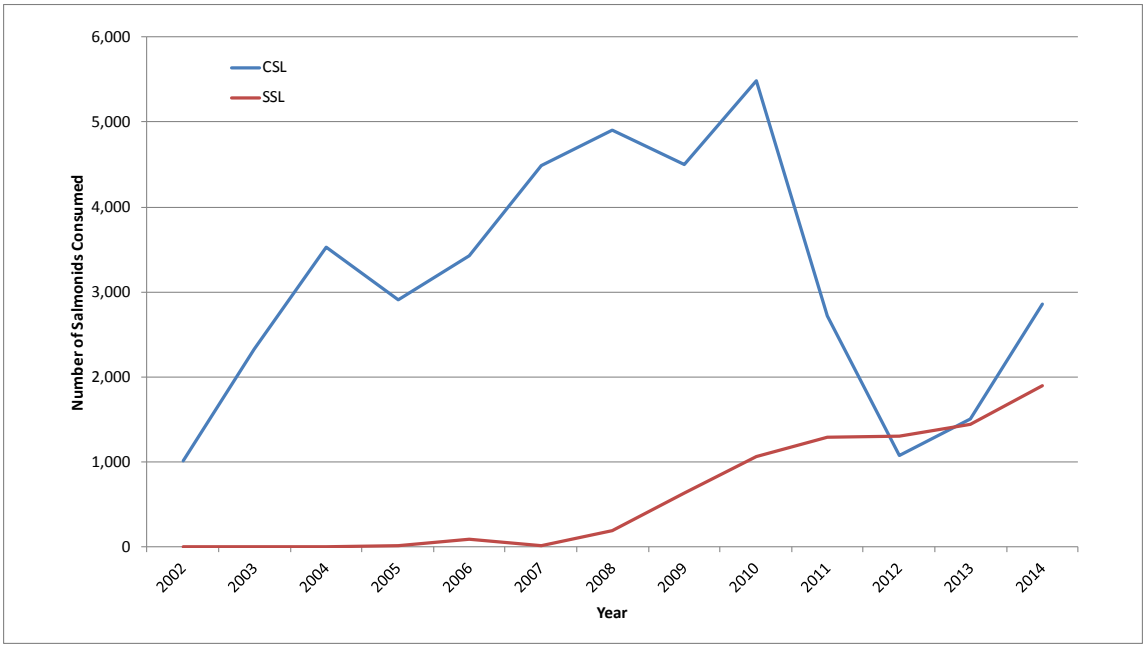

Figure 3. Salmonid consumption estimates adjusted for "unknown" and nighttime predation by CSL and SSL at Bonneville Dam, 2002-2014.

Table 3. Consumption of spring Chinook salmon by pinnipeds at Bonneville Dam between 2002 and 2014. (Note spring Chinook salmon passage dates are through June 15, not May 31.)

Year	Chinook salmon passage (Jan. 1 – June 15)	Expanded Chinook consumption estimate	Percent of Chinook run (Jan. 1 – June 15)
2002	316,468*	880‡	0.3 %
2003	247,059	2,313	0.9 %
2004	210,569	3,307	1.5 %
2005	102,741	2,742†	2.6 %
2006	130,014	2,580	1.9 %
2007	101,068	3,403	3.3 %
2008	174,247	4,115	2.3 %
2009	229,271	3,997	1.7 %
2010	293,662	5,757	2.0 %
2011	272,469	3,298	1.2%
2012	196,667	1,750	0.9%
2013	155,729	2,525	1.6%
2014	257,354	4,209	1.6%

* Fish counts did not start until March 15 in 2002. Chinook passage from January 1 through March 15 was minimal in all other years.

‡ From March 15 through April 25, we used fish passage count split between Chinook salmon and steelhead to estimate Chinook proportion of unidentified salmonid catch. After April 25, we used observed catch distribution to divide unidentified salmonid consumption.

† In 2005, regular observations did not start until March 18.

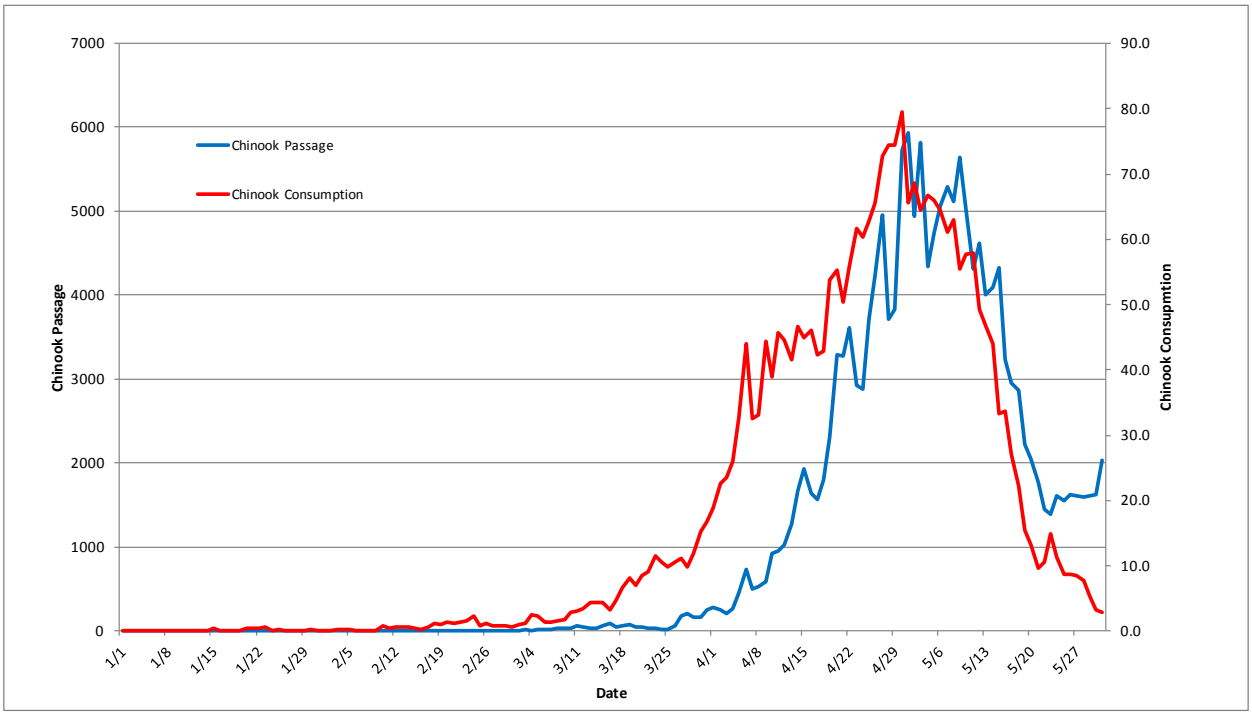

Figure 4. Mean daily Chinook consumption by CSL and mean daily Chinook passage at Bonneville Dam by date, 2002-2014.

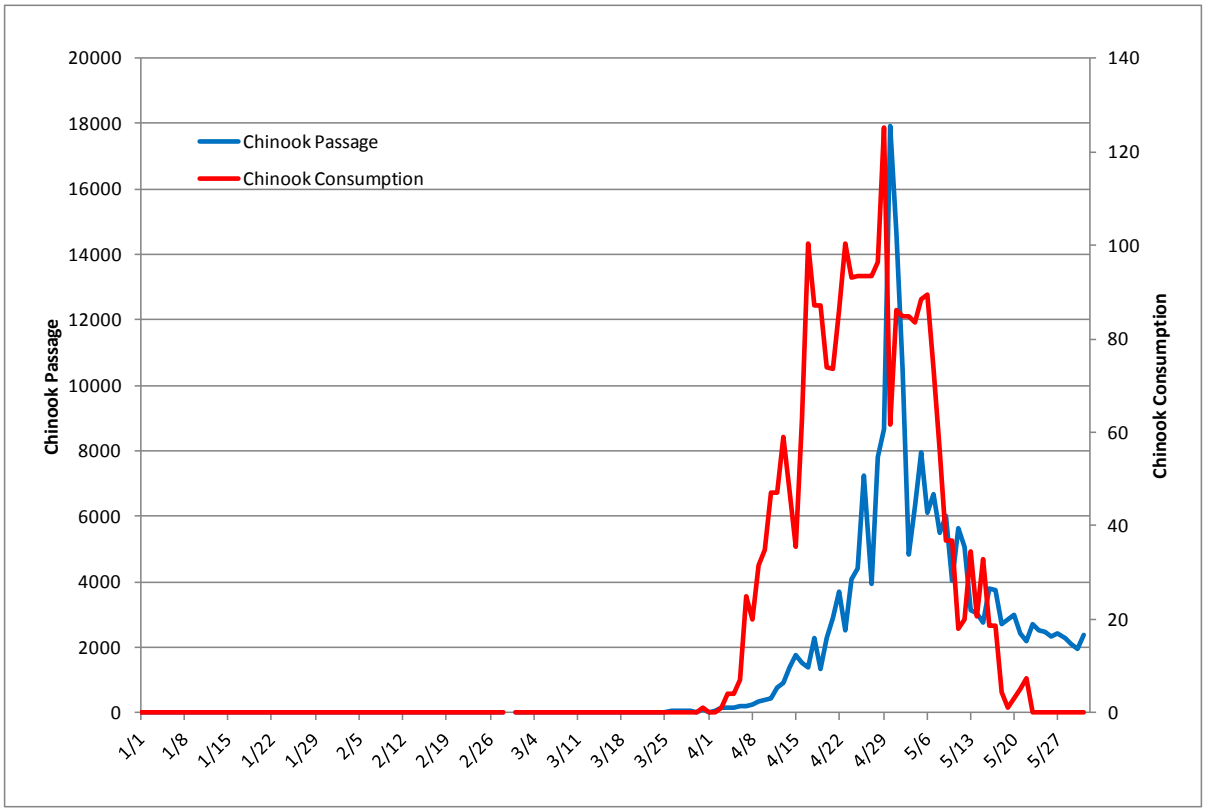

Figure 5. Mean daily Chinook consumption by CSL and mean daily Chinook passage at Bonneville Dam by date, 2014.

Steelhead comprised 2.3% (n=56) of observed adult salmonid catch in 2014. Steelhead, which are present in the Bonneville Dam tailrace throughout the winter and spring months, comprised the majority of salmonid catches prior to the onset of the spring Chinook salmon run. During the last few years, SSL were often observed swallowing steelhead whole, suggesting that they could consume steelhead and Chinook salmon jacks entirely below the surface. All consumption estimates provided are minimum estimates, but it should be noted that because the larger SSL can swallow steelhead whole, predation by SSL may be underestimated more than CSL predation by the current surface observation methods.

The adjusted estimate of salmonid predation during the fall of 2013 was 1,159 salmonids. Separated out by species, the adjusted estimates are 981 fall Chinook, 77 steelhead, and 101 coho (Appendix D). This is about 1.0% of the salmonids passing Bonneville during the same time period, which is slightly higher than the 0.6% seen in 2011 and 2012.

Predation on White Sturgeon

In 2014, the expanded white sturgeon consumption estimate for our study area was 127. This number is the lowest we have seen since sturgeon predation was first observed in the Bonneville Dam tailrace in 2005. In 2011 the expanded estimate was 2,178, in 2012 the estimate was 2,227, but in 2013 the estimate had dropped to 552 (Table 4). When unidentified catch was divided proportionally according to daily catch distributions and added to the expanded sturgeon

consumption estimate, the adjusted consumption estimate for 2014 was 147. White sturgeon were the second most commonly observed prey for SSL with over 10 times as many Chinook being taken than sturgeon. All except one of the observed sturgeon catches in 2014 were by SSL. Predation on sturgeon dropped off dramatically after the first week of April when spring Chinook salmon began to show up and became the preferred prey of both SSL and CSL by mid-April (Figure 6).

Table 4. Consumption of white sturgeon by pinnipeds at Bonneville Dam from 1 January through 31 May, 2005 to 2014.

Year	Total Hours Observed	Observed Sturgeon Catch	Expanded Sturgeon Consumption Estimate	Adjusted Sturgeon Consumption Estimate
2005	1,108	1	N/A	N/A
2006	3,647	265	315	413
2007	4,433	360	467	664
2008	5,131	606	792	1,139
2009	3,455	758	1,241	1,710
2010	3,609	1,100	1,879	2,172
2011	3,315	1,353	2,178	3,003
2012	3,404	1,342	2,227	2,498
2013	3,247	314	552	635
2014	2,947	79	127	147

An estimated 231 sturgeon were consumed by SSL in the Bonneville Dam tailrace between September 16 and December 31, 2013. Adjusting for unidentified prey, the estimated total sturgeon consumed in the fall/winter was 307. This was almost a third of the estimated sturgeon predation seen in 2011 (Appendix D). More sturgeon predation occurs well below the Bonneville Dam tailrace area, but no systematic observation program has been conducted.

When possible, observers estimated the lengths of sturgeon caught by pinnipeds in one foot increments. The estimated lengths of sturgeon caught between 2006 and 2014 ranged from less than 2 ft (0.6 m) to over 7 ft (2.7 m), but 80.3% of sturgeon lengths (n=4,422) were 4 ft (1.2 m) or shorter (Figure 7).

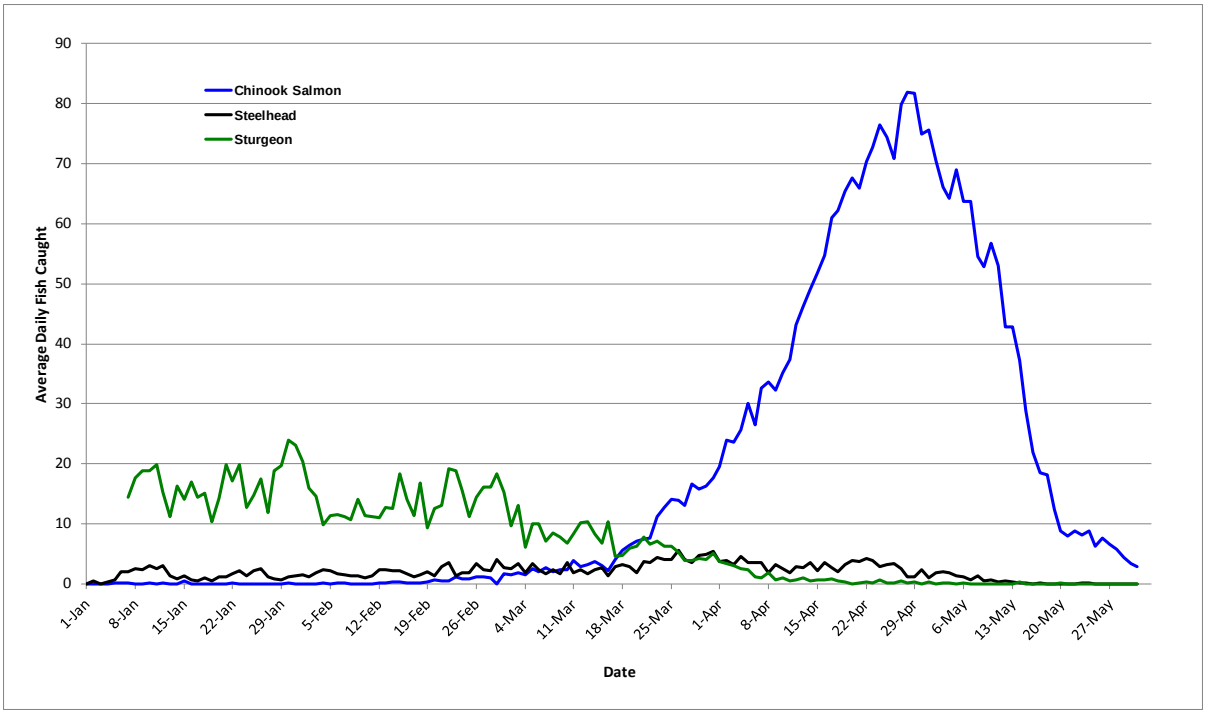

Figure 6. Daily average estimated Chinook salmon, steelhead, and white sturgeon consumption by both SSL and CSL at Bonneville Dam from January 1 through May 31, 2006 to 2014.

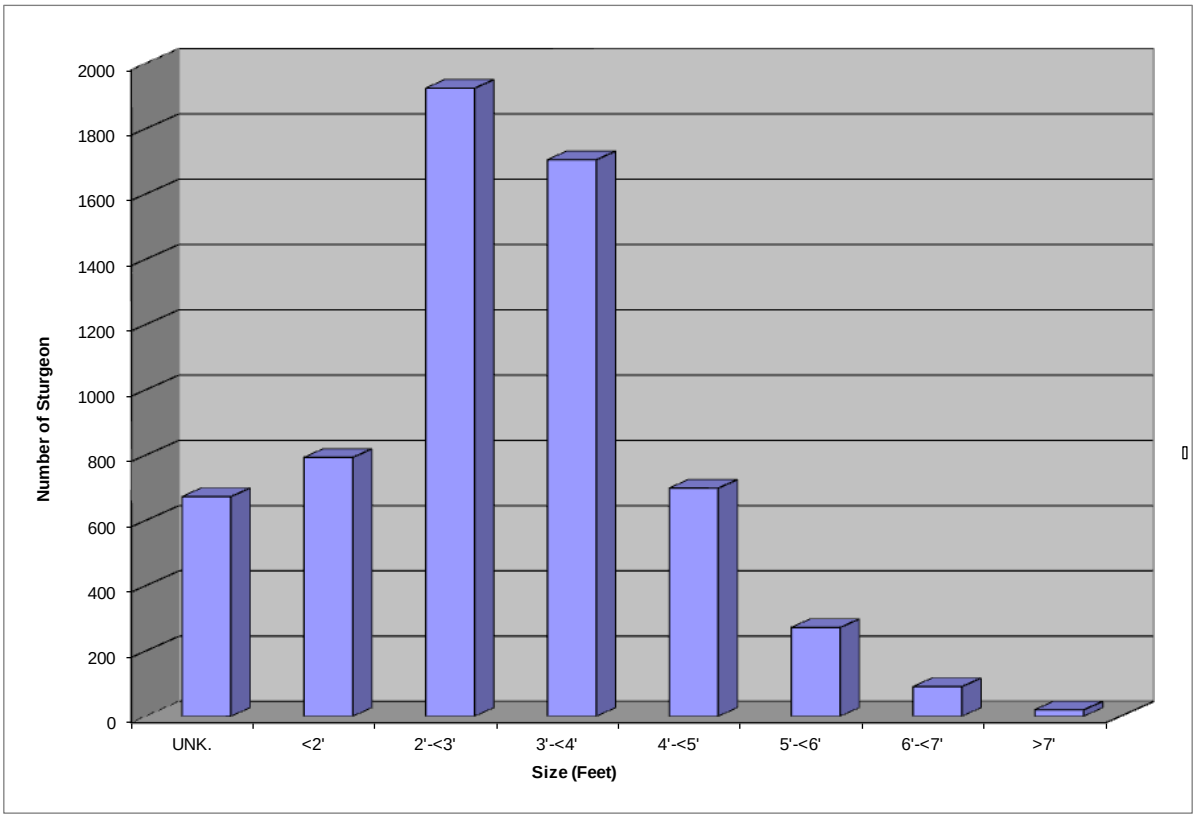

Figure 7. Estimated lengths of white sturgeon consumed by SSL and CSL at Bonneville Dam, from January 1 through May 31, 2006 to 2014.

Predation on Pacific Lamprey

In 2014, the expanded Pacific lamprey consumption estimate was 85 (Table 5). CSL made 37 of the 41 observed lamprey catches in the Bonneville Dam observation area. The lamprey proportion of total observed catch was 1.5%, continuing the trend of low lamprey predation seen the past four years compared to 2003-2006. Due to the small body size and presumed vulnerability of lamprey to predation, our surface observation approach may significantly underestimate actual predation on lamprey. However, this underestimate should be similar among years. Lamprey passage numbers have decreased in general since 2006 at Bonneville Dam (Figure 8). The lamprey passage season is mid-May through October.

Table 5. Consumption of Pacific lamprey by pinnipeds at Bonneville Dam from January 1 through May 31, 2002 to 2014.

Year	Total Hours Observed	Observed Pacific Lamprey Catch	Expanded Pacific Lamprey Consumption Estimate	Percent of Total Observed Fish Catch
2002	662	34	47	5.6%
2003	1,356	283	317	11.3%
2004	553	120	816	12.8%
2005	1,108	613	810	25.1%
2006	3,647	374	424	9.8%
2007	4,433	119	143	2.6%
2008	5,131	111	145	2.0%
2009	3,455	64	102	1.4%
2010	3,609	39	77	0.7%
2011	3,115	16	33	0.4%
2012	3,404	40	79	1.4%
2013	3,247	38	66	1.7%
2014	2,947	41	85	1.5%

Location of Predation Events

In 2014, consumption of Chinook by CSL and SSL per zone was similar across the tailrace (Appendix Figures B-1 and B-2). The most obvious change between years was the decreased proportion of catch by CSL in the spillway tailrace in 2014 compared to 2013, but similar to previous years (Stansell et al., 2011, 2012, and 2013). Predation on sturgeon by SSL was high in zone 3 of PH2 and low in zone 7 of PH1, which was the highest zone of sturgeon predation in 2013 (Appendix Figure B-3). This change may simply be due to the very low overall sturgeon predation events observed in 2014. Whether or not the continued drop in sturgeon predation seen at the dam is due to low sturgeon numbers, some shift in prey selection, and/or sturgeon now aggregating at locations other than the Bonneville Dam tailrace is not known.

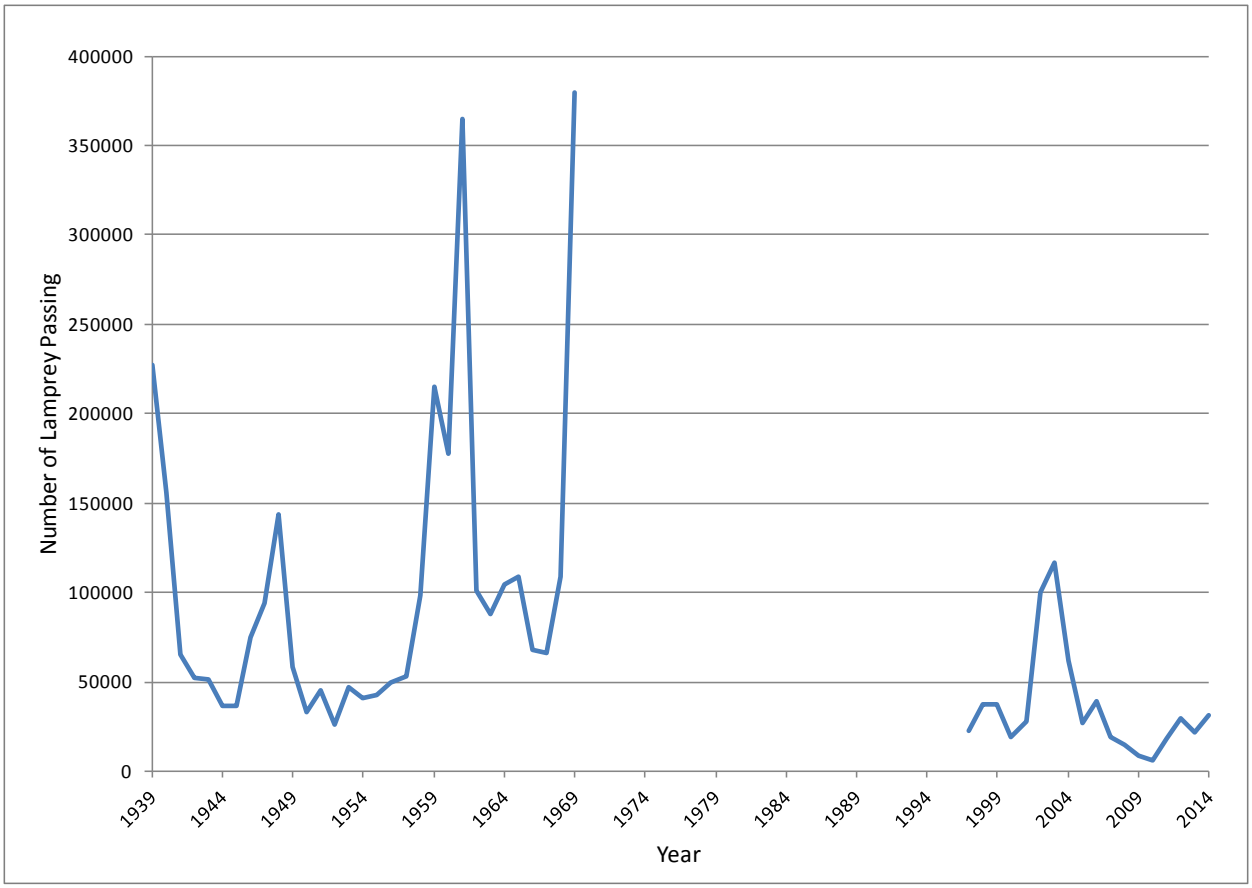

Figure 8. Annual lamprey total daytime passage estimates at Bonneville Dam from 1939 to 2014. Lamprey were not counted at Bonneville Dam from 1970 to 1996. Data for 2014 through September 8.

As always, the recorded zone is the location where the predator is first seen with the fish, and it is entirely possible the fish was caught farther upstream and dragged downstream underwater into other zones before being seen.

Predation on salmonids primarily occurred in the PH2 tailrace before 2006 but has alternately predominated between PH1 and PH2 from 2007 to 2010, and has lately been predominant at PH1 (Figure 9). This may be due to hazing activities, powerhouse flow, or access to haul out and rafting locations. It is not due to salmonid passage changing between powerhouses, as PH2 has consistently passed more salmonids (59-77%) each year. Sturgeon were primarily observed being consumed at the spillway from 2006-2008; more predation has been observed at PH2 since then , except for 2013, when the spillway was the predominant sturgeon predation location (Figure 10).

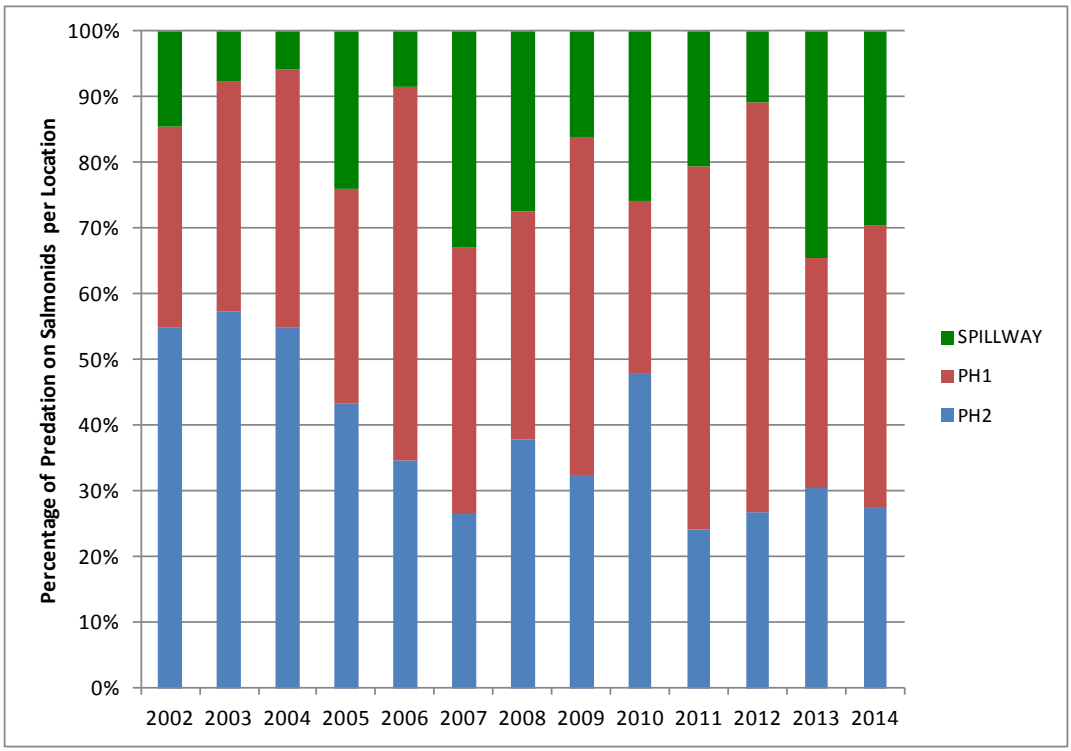

Figure 9. Annual percentage of predation on salmonids by pinnipeds by tailrace location.

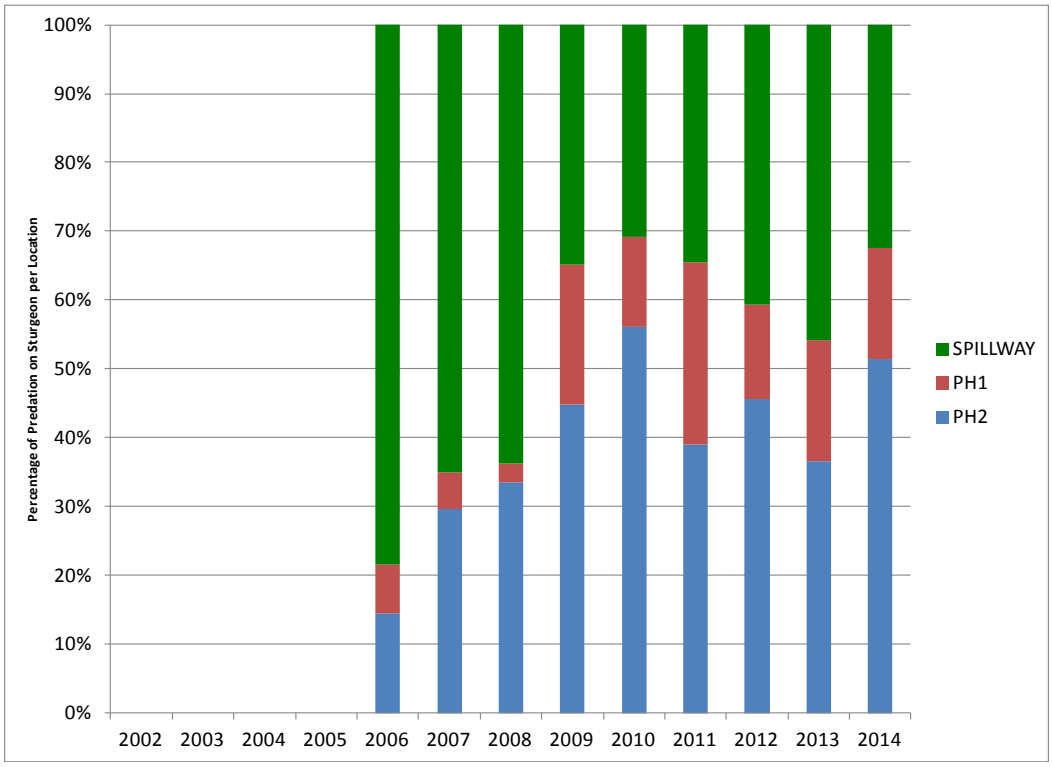

Figure 10. Annual percentage of predation on sturgeon by pinnipeds by tailrace location.

Night Observations

No night time observations were conducted in 2014. Although data for some earlier years (Stansell, et al., 2009) suggested an additional 3.5% of predation events could occur after dark, we found nighttime predation accounted for only an additional 0.9% in 2011 (Stansell, et al., 2011), and this is the factor we used for 2012 and 2013 as it seemed more realistic than the near 0% we saw in 2012 and 2013 with our small sample size. Pinnipeds were present, but very little predation was observed. We also applied this 0.9% factor to 2014 as anecdotal evidence suggested there still was some pinniped presence at night, but not even as much as the previous three years. Actual predation at night could have been more, but there was no indication this was the case. Glare from dam lighting, power tower lighting, highway lights, and poor weather conditions all combined to make viewing at night difficult in previous years. Predation by SSL tends to be fast, quiet, and typically farther downstream than CSL predation, so we could be missing more nighttime predation than in the past, when predominately CSL were present. Predation estimates for salmonids adjusted to include nighttime predation estimates are given in Appendix A.

Additional Observations

One CSL (B325) was documented to have passed through the navigation lock upstream into the forebay on April 15, 2011. He has been identified numerous times at The Dalles Dam and on a private dock at The Dalles marina since then and is still upstream of Bonneville Dam as of this report (about 3 ½ years). In 2012, we were able to document the CSLs C014, U95, and a small unbranded CSL (not B325) also upstream of Bonneville Dam and have had numerous confirmations of C014 and B325 still being in the Bonneville Pool as of this report. One unbranded SSL (S127) briefly appeared in the Bonneville Dam forebay in 2013 but he was observed back downstream the following week. No additional reports of sea lions entering the forebay were noted in 2014.

Bonneville Dam has a policy to keep the downstream navigation lock gates closed at all times except for the few minutes it takes for a barge to enter or exit the locks. This seems to be helping, although it is not 100% effective. The states deployed two traps in the Bonneville Pool after the 2013 spring season in an attempt to catch the sea lions, however, as of yet, they have not been seen to use the traps to haul out on.

PINNIPED ABUNDANCE, RESIDENCE TIMES, AND RECURRENCE

The estimated number of individual pinnipeds observed at Bonneville Dam in 2014 was 137, similar in total to last year but only the third highest since observations began in 2002 (Table 6). SSL numbers decreased in 2014 to 65 individuals. This may be in part due to the apparent lack of sturgeon in the Bonneville Dam tailrace. A maximum of 41 SSL observed on two separate days in 2014 was exactly the same as last year and higher than the previous two years but not as high as the 53 SSL seen in 2010. CSL numbers increased in 2014 for the second year in a row to

71 (excluding at least two upstream of Bonneville Dam). The maximum number of CSL seen on any one day was 27. This year was similar to 2010 and 2013 in that record numbers of CSL (over 1,400) were seen at the East Mooring Basin in Astoria (Matt Tennis, personal comm.). the 2014 observation season at Bonneville was similar to 2010 and 2013 in that many younger CSL showed up at Bonneville which were not repeats. One harbor seal was observed this year at Bonneville on at least two separate days as was the case for our fall 2013 observations. As in previous years, hazing activity typically resulted in changes in behavior (e.g. more time below the water surface, less time with backs and unique markings exposed, etc.) which made identification of individuals challenging. These abundance figures should be considered minimum estimates.

Table 6. Minimum estimated number of individual pinnipeds observed at Bonneville Dam from 2002 to 2014.

	CSL	SSL	Harbor seals	Total pinnipeds
2002	30	0	1	31
2003	104	3	2	109
2004	99	3	2	104
2005*	81	4	1	86
2006	72	11	3	86
2007	71	9	2	82
2008	82	39	2	123
2009	54	26	2	82
2010	89	75	2	166
2011	54	89	1	144
2012	39	73	0	112
2013	56	80	0	136
2014	71	65	1	137

* Regular observations did not begin until March 18 in 2005.

Daily pinniped abundance peaked in late April 2014 (Figure 11), primarily due to SSL numbers. The highest number of pinnipeds counted on any one day in 2014 was 59 (April 23), which was higher than the past three years (Figure 12). Mean daily number of pinnipeds present was 14.4 in 2014, the lowest we have seen since 2005 (Figure 12). The CSL component (4.6 per day), although higher than the past two years, continues to show a downward trend (Figure 13). SSL were present in lower numbers this year (9.9 per day) and reversed the trend of increasing presence of SSL at Bonneville Dam seen over the past four years (Figure 13).

The most number of days an individual CSL was observed at Bonneville Dam was 20 days in 2014, higher than last year but otherwise the lowest since 2002 (Figure 14). This is also true of the mean number of days CSL were observed at Bonneville Dam (5.4 days per individual CSL).

The first CSL was observed on February 25 in 2014; however, there were only a few sporadic sightings of CSL until mid-April when CSL began showing up in larger numbers and staying. Most of the individuals returning multiple years have been removed by the states over the previous six years, and this may account for the trend of most individuals now arriving later in the season and spending less time at Bonneville Dam.

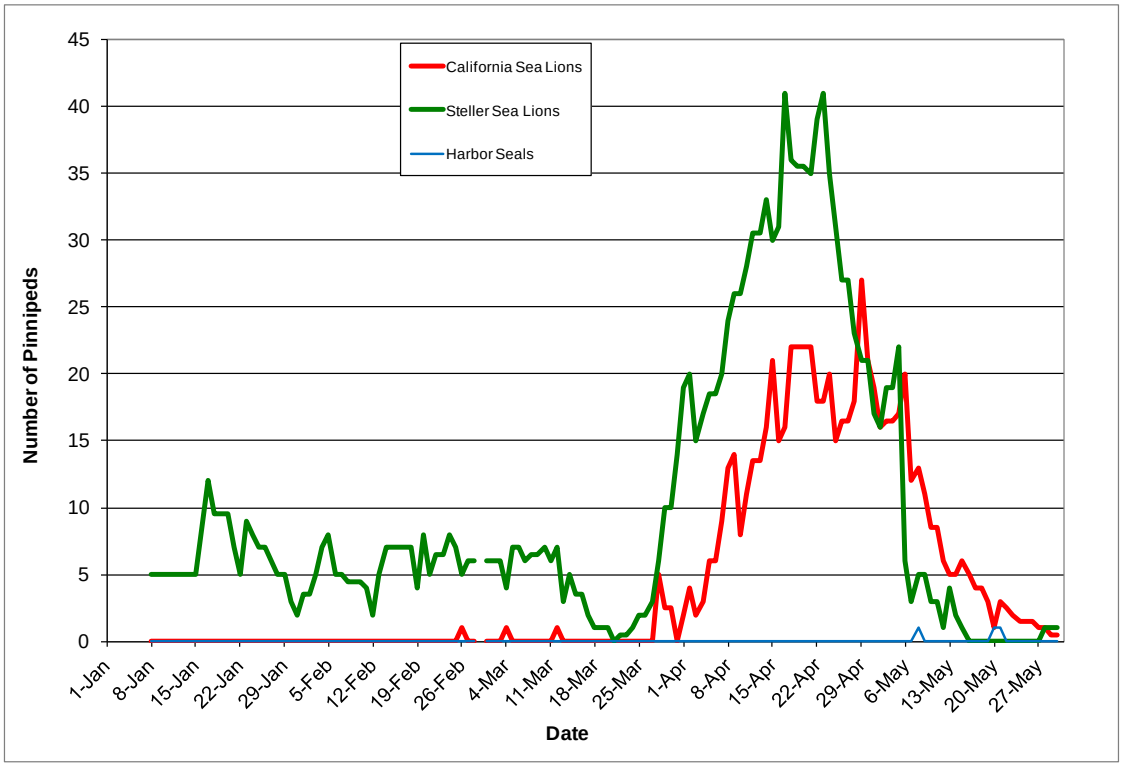

Figure 11. Daily abundance estimates for CSL, SSL, and harbor seals at Bonneville Dam from January 1 through May 31, 2014.

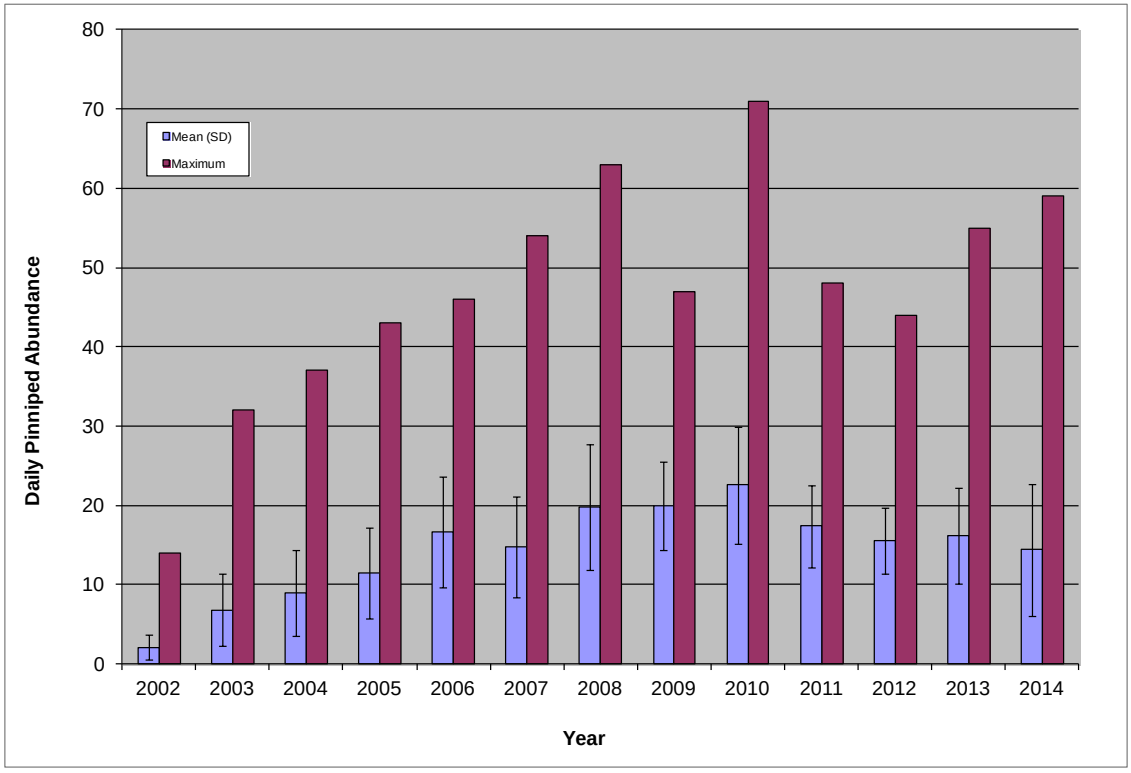

Figure 12. Mean, standard deviation, and maximum daily estimated number of pinnipeds present at Bonneville Dam between January 1 and May 31, 2002 to 2014.

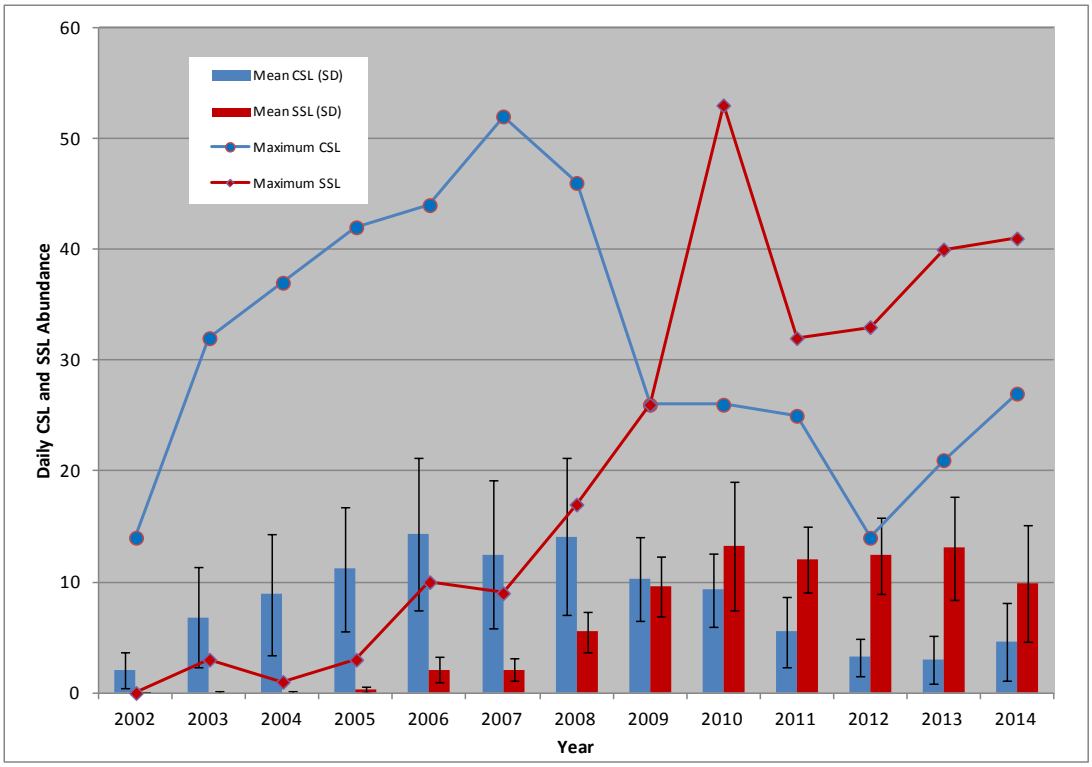

Figure 13. Mean, standard deviation, and maximum daily estimated number of CSL and SSL present at Bonneville Dam between January 1 and May 31, 2002 to 2014.

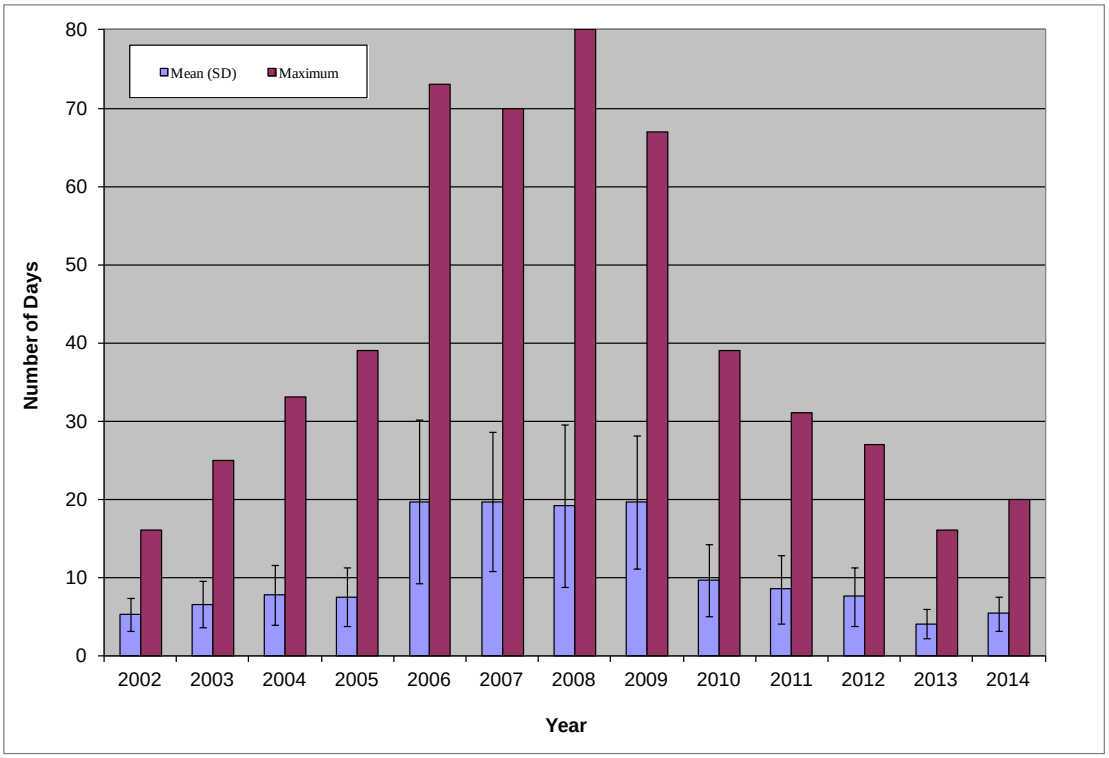

Figure 14. Mean, standard deviation, and maximum number of days individually identified CSL were observed at Bonneville Dam between January 1 and May 31, 2002 to 2014.

Many CSL not previously identified showed up this year. Of the 63 highly identifiable CSL observed in 2014, 60.3% were new additions to that category (including 8 branded and 18 more given brands while at Bonneville). The percentage of highly identifiable CSL returning each year was at least 19.2%, 51.2%, 77.1%, 65.7%, 65.6%, 69.2%, 68.5%, 35.4%, 62.0%, 67.6%, 30.0% and 39.7% for 2003 through 2014, respectively. This year was similar to 2010 and 2013 in which more new CSL were identified than returning individuals (discussed in Stansell et al., 2011). We have observed at least 188 individual CSL that have returned for one or more years to Bonneville Dam (Table 7).

Table 7. Number of years that individually identified CSL and SSL were observed at Bonneville Dam between 2002 and 2014 and the number that have been removed. Individuals present for less than one year (<1) were new animals identified in 2014. "Known dead" are those branded CSL that have been identified from carcass recoveries along the west coast.

Number of years observed	All identified CSL	All identified SSL	Listed for Removal CSL	Removed or Known Dead CSL
8	6	1	6	4
7	4	5	4	2
6	1	5	1	0
5	21	4	21	8
4	25	11	21	8
3	46	26	29	17
2	85	36	53	22
1	317	172	28	6
<1	50	29	13	3

DETERRENTS AND MANAGEMENT ACTIVITIES

Physical Barriers

There were no sea lions observed inside the fishways, nor did any observers note any sea lions attempting to get through the SLEDs or FOG barriers in 2014 despite significant predation activity near dam structures. As in the previous four years, no pinnipeds hauled out on the PH2 tailrace concrete apron along Cascades Island in 2014, preferring instead to rest in pods near the shoreline of Tower Island or near the traps. Concrete blocks set on the concrete apron to impede haul out at Cascades Island and encourage haul out on the traps seems to have had the effect to move the sea lions' resting area to Tower Island.

Non-Lethal Harassment

No acoustic deterrent devices were deployed in 2014 as they have proved ineffective during testing from 2006 to 2010 under the environmental conditions that are present near fishway entrances.

Boat crews from CRITFC hazed up to five days a week most weeks between early March and mid-May, and their results will be presented in a separate report. USDA agents hazed from the

dam on 92 days between March 1 and May 31. Table 8 shows the actual near dam hazing level for boat and dam-based hazing. Data excludes weekends and boat hazing downstream of the BRZ as our observers were not present to record this information.

Table 8. Total hours of hazing activity in the Bonneville Dam tailrace observation area in 2014. Data excludes weekends when observers were not present.

	Number of Times Hazers were Present at Least Once in an Hour		Total Time (Hours) Hazers were Present	
	Boat hazing	*Dam hazing*	*Boat hazing*	*Dam hazing*
Location				
Powerhouse 1	78	199	20.3	64.3
Powerhouse 2	43	184	15.8	57.7
Spillway	20	64	4.2	17.2
Total	*141*	*447*	*40.2*	*139.2*

As in past years, hazing activity temporarily moved some sea lions out of tailrace areas, but the animals typically returned and resumed foraging shortly after hazers left the area. Overall, actual active hazing was slightly less than last year.

Trapping and Removal

In 2014, personnel from ODFW and WDFW operated four traps in the Bonneville Dam tailrace area as they have for the past several years. These traps were used to capture sea lions for branding and permanent removal of specific CSL from the population. Additional trapping occurs at Astoria, primarily for branding purposes. Fifteen CSL that were on the list for removal were captured at Bonneville in 2014. Other captured CSL were given brands and released at Bonneville. Successful trapping events are summarized in Appendix C.

In 2014, a total of 36 different CSL were captured at Bonneville (excluding those captured that had already been branded and were not on the list for removal). Of those, 21 were given brands and fifteen were euthanized. SSL that were captured on the traps were released as soon as possible back into the tailrace.

Impact of the Removal of Selected California Sea Lions

Although higher than last year, CSL salmonid predation was still lower than any other year since 2003 (figures 2 and 4, tables 9 and 10). Mean daily CSL abundance in 2014 was again lower than any year since 2002 and continues the downward trend that began after 2008 (Figure 12), although maximum daily CSL and individual CSL identified increased somewhat since last year. These results provide some evidence that the impact of the CSL removal program conducted since 2008 may be at least partially responsible for reducing the CSL abundance and predation on salmonids by CSL at Bonneville Dam. However, the unusual event of the influx of large numbers of new CSL males showing up at Bonneville Dam tailrace in 2010 and 2013, coupled with the virtual halting of removal actions in 2011, make further analysis of this program more difficult. It is also likely that the reduction in predation on the early Chinook salmon runs

(Figure 6) is due to the removal of many of the returning CSL that would arrive earlier each year waiting for the arrival of Chinook salmon. The increasing presence and salmon predation by SSL at Bonneville Dam could also continue to complicate the issue of the effectiveness of the CSL removal program if current trends persist. Overall, there was similar clepto-parasitism (stealing prey by one individual from another) observed in 2014 as was seen in 2013 and 2012, all three being much less than the preceding four years (Table 11). Perhaps it was because there were fewer opportunities for that behavior as there were fewer CSL present and less CSL predation overall.

Table 9. Adjusted consumption estimates on adult salmonids by CSL and SSL at Bonneville Dam from January 1 through May 31, 2002 to 2014.

Year	California sea lions			Steller sea lions		
	Adjusted salmonid consumption estimates	Salmonid consumption per capita	% of run (Jan 1 – May 31)	Adjusted salmonid consumption estimates	Salmonid consumption per capita	% of run (Jan 1 – May 31)
2002	1,010	33.7	0.4%	0	0.0	0.0 %
2003	2,329	22.4	1.1%	0	0.0	0.0 %
2004	3,516	35.1	1.9%	13	4.3	0.0 %
2005	2,904	35.9	3.5%	16	4.0	0.0 %
2006	3,428	47.6	3.2%	88	8.0	0.1 %
2007	4,492	63.3	4.8%	15	1.7	0.0 %
2008	4,901	59.9	3.2%	198	5.1	0.1 %
2009	4,505	83.4	2.4%	628	24.2	0.3 %
2010	5,481	61.6	2.0%	1,061	14.1	0.4 %
2011	2,713	50.2	1.2%	1,294	14.5	0.6%
2012	1,077	27.6	0.6%	1,305	17.9	0.8%
2013	1,510	27.0	1.2%	1,444	18.1	1.2%
2014	2,855	40.2	1.3%	1,891	29.1	0.8%

Table 10. Maximum number of salmonids observed consumed by identified CSL at Bonneville Dam from January 1 through May 31, 2002 to 2014.

Year	Maximum number of salmonids caught by an individual CSL	Percentage of salmonid catches attributed to individual CSLs
2002	51	85.6%
2003	52	67.7%
2004	35	54.3%
2005*	11*	8.9%*
2006	79	43.0%
2007	64	28.1%
2008	107	42.6%
2009	157	62.1%
2010	198	51.9%
2011	125	41.7%
2012	41	53.0%
2013	59	42.1%
2014	59	26.3%

* Began observation season late and did not have the opportunity to train observers on individual CSL identification.

Table 11. Summary of estimates of clepto-parasitism events observed at Bonneville Dam , 2002 to 2014. Most involve salmonids (e.g. we observed 490 Chinook, 20 steelhead, 4 sturgeon, and 16 unidentified prey stolen in 2010, all sturgeon being SSL from SSL events).

Year	CSL from CSL	CSL from SSL	SSL from SSL	SSL from CSL	Other	Total
2002	0	0	0	0	0	0
2003	14	0	0	0	0	14
2004	366	22	0	0	0	388
2005	22	0	0	22	6	50
2006	12	0	0	5	0	17
2007	33	0	0	4	0	37
2008	161	0	4	135	5	305
2009	152	4	7	324	6	492
2010	58	2	37	801	0	898
2011	2	0	12	279	0	293
2012	2	0	55	35	0	92
2013	1	0	19	67	0	87
2014	0	0	4	58	0	62

It is interesting to note that the highest predation estimates attributed to SSL that we have ever seen at Bonneville Dam occurred this year. That fact, coupled with a fairly good sized drop in SSL individuals present resulted in the highest per capita salmonid consumption seen by SSL. Although it is still not quite to the level seen for CSL, this does suggest that the SSL present during 2014 were are targeting salmonids more than they have in the past. This does not include the salmonids stolen from CSL by SSL, nor any salmonids consumed underwater and therefore unseen by our observers. If this trend continues, SSL consumption of salmonids at the dam could exceed that of CSL, particularly if sturgeon and other prey are not as available.

It is possible that the increasing presence of SSL is a contributing factor in the decline of CSL abundance and predation over the past few years, although it is unclear whether SSL numbers are increasing due to the decline of CSL numbers, or if the increase in SSL abundance are responsible for "driving out" some of the CSL. Some evidence for this can be found in Wright et al. (2014) which has documented several CSL first seen and branded at Bonneville Dam being subsequently observed at the Willamette Falls Locks tailrace. Environmental factors, including river flows, turbidity and temperatures, annual fluctuations in the size of the Columbia River smelt (Thaleichthys pacificus) run or even timing of the spring Chinook run may also be contributing factors to the decline of CSL abundance and predation. However, a simple look at the correlation of temperature and flow data with CSL abundance and predation do not seem to indicate a strong relationship, and it should be pointed out that SSL abundance and predation trends have tended to be in the opposite direction than that for CSL.

RECOMMENDATIONS

1. In light of increasing SSL abundance and white sturgeon and salmonid consumption, the earlier and more protracted presence of SSL from October through May, and concurrent decrease in CSL presence and predation, we strongly suggest a continuation of this monitoring program at this level for two more years. The states have received a permit to remove specific CSL from the Bonneville population that is valid through 2016. The full impact of removal of specific individual CSL cannot be fully measured until the subsequent year's monitoring is completed. However, long term monitoring efforts need to be discussed among the action agencies to determine the usefulness, resolution, and costs of the information obtained.
2. The Corps should continue to coordinate with agency partners (such as ODFW, Portland State University and CRITFC) performing observations in the area downstream of our study area.
3. SLEDs and FOG barriers have proved effective and should continue to be used to prevent sea lions from entering the fishways of Bonneville Dam. If presence of sea lions in the fall becomes a regular occurrence, the Corps and regional fish passage agencies should consider installing these barriers in the fall, or leaving them in place for the entire fish passage season.
4. The Corps should continue to assist in the pursuit and evaluation of potential non-lethal deterrent technologies as part of a long-term strategy to reduce pinniped predation on adult salmonids, sturgeon, and lamprey in the Bonneville Dam tailrace.
5. ODFW/WDFW should strongly consider adding additional traps and/or additional methods for removal of more individual CSL each season (e.g. 30, not 10-15).
6. Use of an optical camera (e.g. Critter-Cam©) affixed to multi-year CSL and SSL early in the season would allow biologists to get a better understanding of how and where the sea lions are taking prey, and possibly if there is significant underwater consumption going on undetected by surface observations.

ACKNOWLEDGEMENTS

We would like to thank all who continue to help us provide the most accurate information on pinniped predation at Bonneville Lock and Dam. The Columbia River Inter-Tribal Fish Commission conducted the vast majority of the boat-based hazing program, while the USDA Wildlife Services continued to conduct the dam-based hazing program. Special thanks to Robin Brown (ODFW), Steve Jeffries (WDFW), Matt Tennis (PSMFC), and Bryan Wright (ODFW) for their advice, input, and cooperation. Bernard Klatte (USACE) helped with study objectives, funding, and program support. The Bonneville Lock and Dam rigging crew should be commended for successfully deploying and removing SLEDs.

A very big thank you goes to all the observers who collected valuable data for us this year. Interns from the Student Conservation Association (SCA) did a great job with observations and assisting with data management. Kate Abbott, Kody Bankston, Dina Grinstead, Jessica Mejia, Greg Robertson, and Claire Satterwhite endured the extreme cold, snow, and rainy weather conditions this past winter and spring and performed admirably. Patricia Madson and Nathan Zorich of the Fisheries Field Unit helped with observations in the fall of 2013 in addition to their other duties and their efforts helped increase the sample size for our fall work.

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Appendix A. Table of progressive estimates of pinniped predation on salmonids (also broken out by pinniped species) at Bonneville Dam, 2002-2014, adjusted for unidentified fish prey caught, and nighttime predation.

ADJUSTED FOR DAYLIGHT HOURS AND DAYS NOT OBSERVED

			ALL PINNIPEDS		CALIFORNIA SEA LIONS		STELLER SEA LIONS	
	TOTAL HOURS OBSERVED	TOTAL SALMONID PASSAGE	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN
2002	662	284,732	1,010	0.35%	1,010	0.35%	0	0.00%
2003	1,356	217,934	2,329	1.06%	2,329	1.06%	0	0.00%
2004	516	186,771	3,533	1.86%	3,516	1.85%	7	0.00%
2005	1,109	81,252	2,920	3.47%	2,904	3.45%	16	0.02%
2006	3,650	105,063	3,023	2.80%	2,944	2.72%	76	0.07%
2007	4,433	88,474	3,859	4.18%	3,846	4.17%	13	0.01%
2008	5,131	147,558	4,466	2.94%	4,292	2.82%	174	0.11%
2009	3,455	186,056	4,489	2.36%	4,037	2.12%	452	0.24%
2010	3,609	267,167	6,081	2.23%	5,095	1.86%	986	0.36%
2011	3,315	223,380	3,557	1.57%	2,527	1.11%	1,030	0.45%
2012	3,404	171,665	2,107	1.21%	998	0.57%	1,109	0.64%
2013	3,247	120,619	2,714	2.20%	1,402	1.14%	1,312	1.06%
2014	2,947	219,929	4,313	1.92%	2,615	1.17%	1,699	0.76%

ADJUSTED FOR UNIDENTIFIED FISH

			ALL PINNIPEDS		CALIFORNIA SEA LIONS		STELLER SEA LIONS	
	TOTAL HOURS OBSERVED	TOTAL SALMONID PASSAGE	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN
2002	662	284,732	1,010	0.35%	1,010	0.35%	0	0.00%
2003	1,356	217,934	2,329	1.06%	2,329	1.06%	0	0.00%
2004	516	186,771	3,533	1.86%	3,516	1.85%	7	0.00%
2005	1,109	81,252	2,920	3.47%	2,904	3.45%	16	0.02%
2006	3,650	105,063	3,401	3.14%	3,312	3.05%	85	0.08%
2007	4,433	88,474	4,355	4.69%	4,340	4.68%	15	0.02%
2008	5,131	147,558	4,927	3.23%	4,735	3.11%	192	0.13%
2009	3,455	186,056	4,960	2.60%	4,353	2.28%	607	0.32%
2010	3,609	267,167	6,321	2.31%	5,296	1.94%	1,025	0.37%
2011	3,315	223,380	3,971	1.75%	2,689	1.18%	1,282	0.56%
2012	3,404	171,665	2,360	1.36%	1,067	0.61%	1,293	0.74%
2013	3,247	120,619	2,928	2.37%	1,497	1.21%	1,431	1.16%
2014	2,947	219,929	4,704	2.09%	2,830	1.27%	1,874	0.84%

ADJUSTED FOR NIGHT HOURS NOT OBSERVED (AN ADDITIONAL 3.5% ADDED 2006-2010, 0.9% 2011-2014)

			ALL PINNIPEDS		CALIFORNIA SEA LIONS		STELLER SEA LIONS	
	TOTAL HOURS OBSERVED	TOTAL SALMONID PASSAGE	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN	ESTIMATED SALMONID CATCH	% RUN TAKEN
2002	662	284,732	1,010	0.35%	1,010	0.35%	0	0.00%
2003	1,356	217,934	2,329	1.06%	2,329	1.06%	0	0.00%
2004	516	186,771	3,533	1.86%	3,516	1.85%	7	0.00%
2005	1,109	81,252	2,920	3.47%	2,904	3.45%	16	0.02%
2006	3,650	105,063	3,520	3.24%	3,428	3.16%	88	0.08%
2007	4,433	88,474	4,507	4.85%	4,492	4.83%	15	0.02%
2008	5,131	147,558	5,099	3.34%	4,901	3.21%	198	0.13%
2009	3,455	186,056	5,134	2.69%	4,505	2.36%	628	0.33%
2010	3,609	267,167	6,542	2.39%	5,481	2.00%	1,061	0.39%
2011	3,315	223,380	4,007	1.76%	2,713	1.19%	1,294	0.57%
2012	3,404	171,665	2,382	1.37%	1,077	0.62%	1,305	0.75%
2013	3,247	120,619	2,954	2.39%	1,510	1.22%	1,444	1.17%
2014	2,947	219,929	4,746	2.11%	2,855	1.28%	1,891	0.85%

Appendix B. Maps (Figures B1-B3) of Bonneville Lock and Dam and vicinity, with predations zones shown.

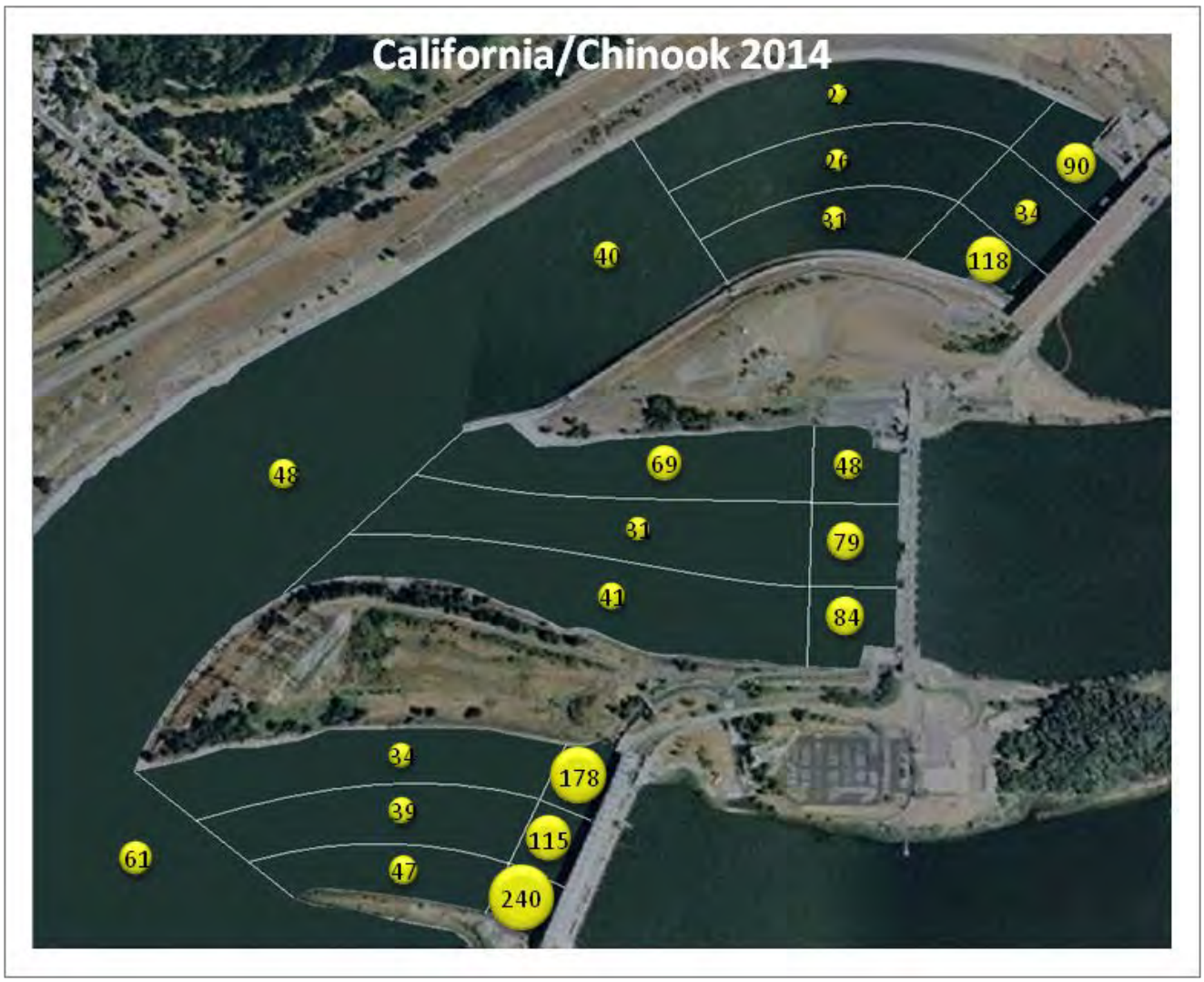

Figure B1. Frequency distribution by location of Chinook salmon caught by CSL at Bonneville Dam, 2014.

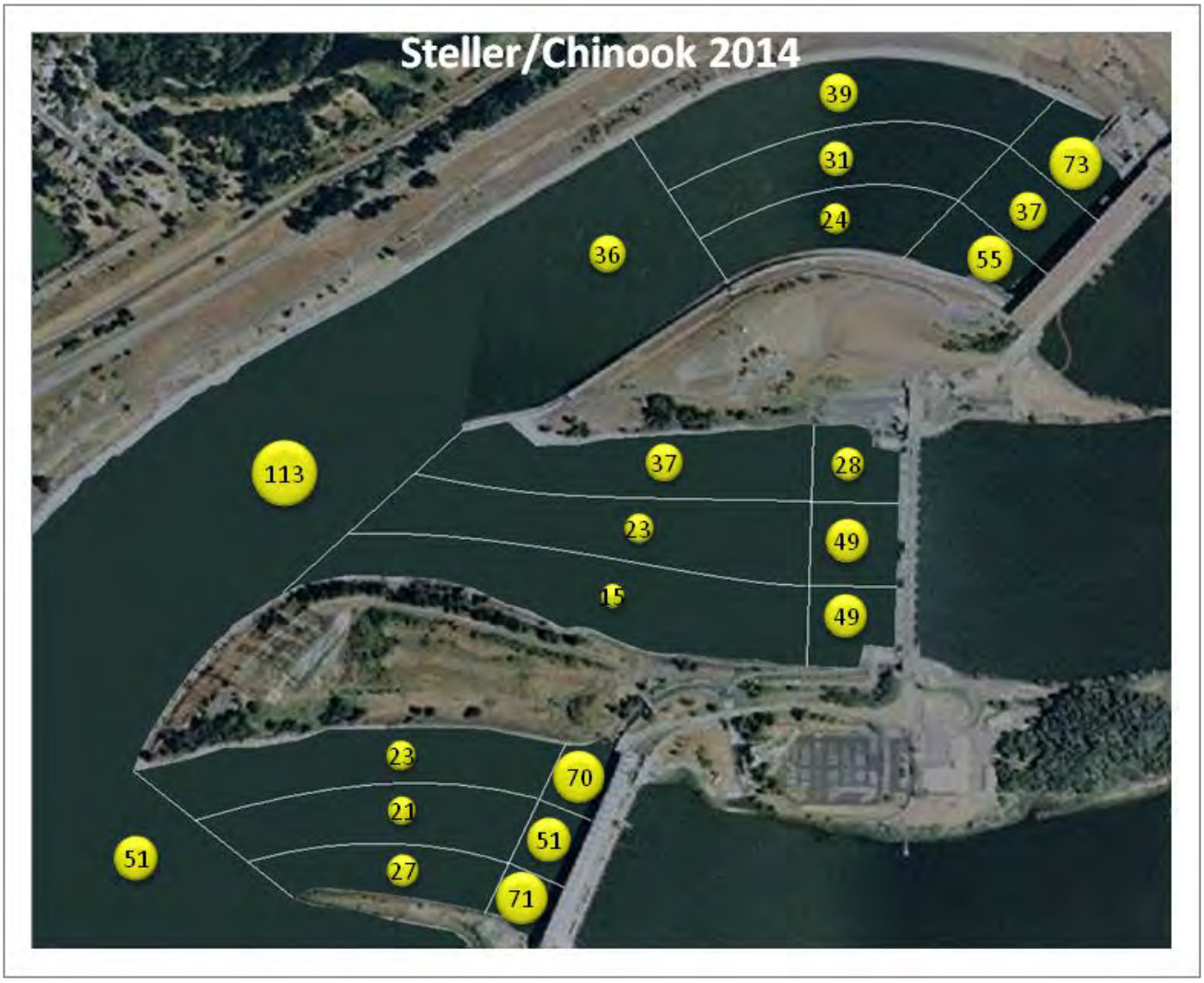

Figure B2. Frequency distribution by location of Chinook salmon caught by SSL at Bonneville Dam, 2014.

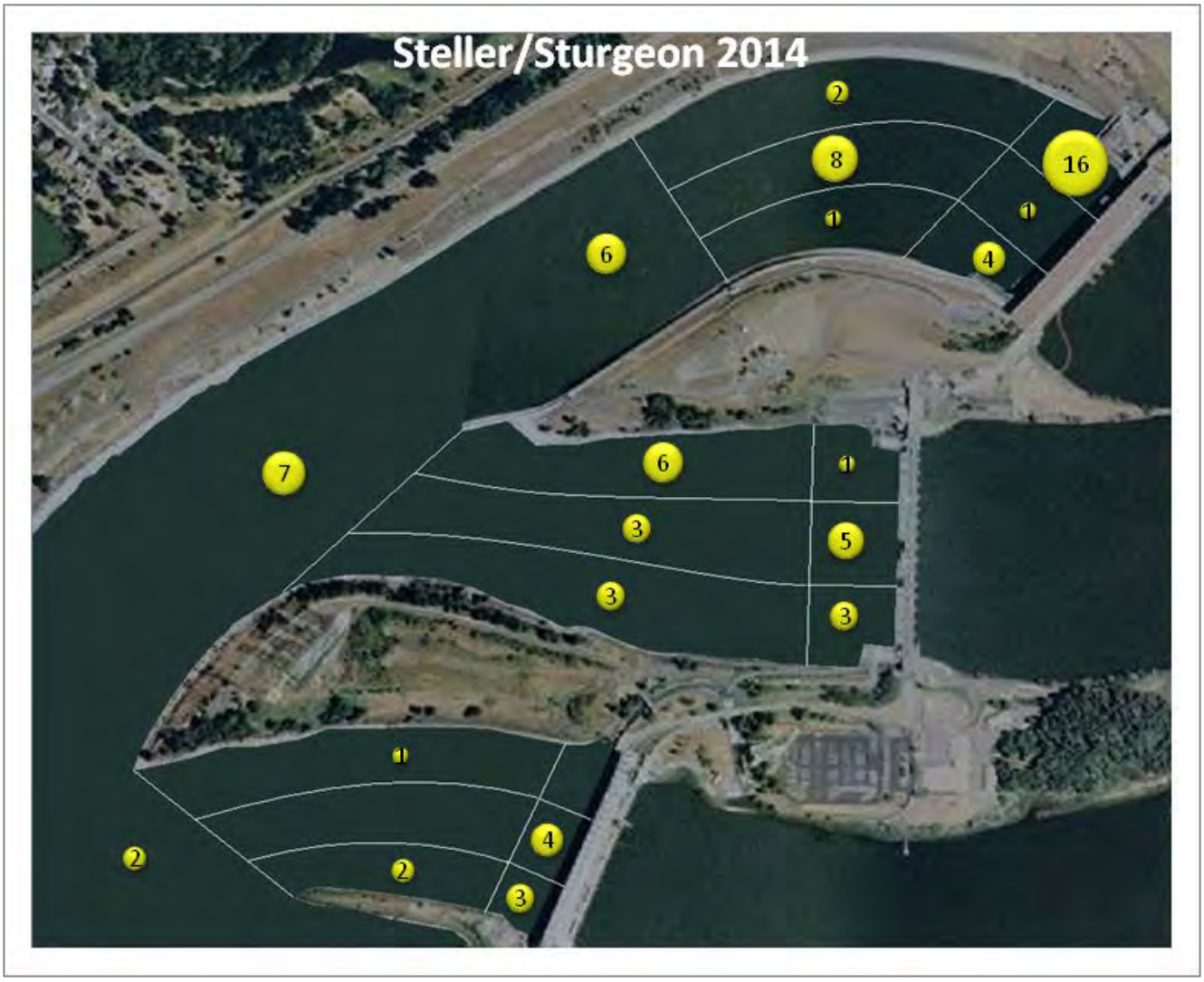

Figure B3. Frequency distribution by location of white sturgeon caught by SSL at Bonneville Dam, 2014.

Appendix C. List of CSL trapped at Bonneville Dam in 2014. (Yellow highlight denotes animal removed from population known to visit Bonneville Dam)

Species	*Sea lion ID*	*Capture date*	*On removal list?*	*Action*	*Additional information*
CSL	C036/B407	4/9/2014	No	Released	Branded and released
CSL	C027	4/15/2014	Yes	Euthanized	
CSL	C028/B379	4/15/2014	Yes	Euthanized	
CSL	C035/B371	4/15/2014	Yes	Euthanized	
CSL	U84	4/15/2014	Yes	Euthanized	
CSL	U254	4/15/2014	Yes	Euthanized	
CSL	U262	4/15/2014	Yes	Euthanized	
CSL	C037/B408	4/16/2014	No	Released	Branded and released
CSL	C038/B391	4/16/2014	No	Released	Branded and released
CSL	C039	4/16/2014	No	Released	Branded and released
CSL	C040	4/16/2014	No	Released	Branded and released
CSL	C041	4/16/2014	No	Released	Branded and released
CSL	C930	4/22/2014	Yes	Euthanized	
CSL	C020/B339	4/22/2014	Yes	Euthanized	
CSL	C029/B380	4/22/2014	Yes	Euthanized	
CSL	C042	4/22/2014	No	Released	Branded and released
CSL	C043	4/22/2014	No	Released	Branded and released
CSL	C044	4/22/2014	No	Released	Branded and released
CSL	C045/B384	4/22/2014	Yes	Released	ODFW crew could not ID, so Branded and released
CSL	C046/414	4/23/2014	No	Released	Branded and released
CSL	C047	4/24/2014	No	Released	Branded and released
CSL	C048/B410	4/24/2014	No	Released	Branded and released
CSL	C049	4/24/2014	No	Released	Branded and released
CSL	C050	4/24/2014	No	Released	Branded and released
CSL	C051/B415	4/29/2014	No	Released	Branded and released
CSL	C052	4/29/2014	No	Released	Branded and released
CSL	C053/B396	4/29/2014	No	Released	Branded and released
CSL	C033/B390	4/29/2014	Yes	Euthanized	
CSL	U267	4/29/2014	Yes	Euthanized	
CSL	U312	4/29/2014	Yes	Euthanized	
CSL	C054	5/1/2014	No	Released	Branded and released
CSL	C055/B412	5/1/2014	No	Released	Branded and released
CSL	C031/B382	5/1/2014	Yes	Euthanized	
CSL	U264	5/1/2014	Yes	Euthanized	
CSL	B409	5/1/2014	Yes	Euthanized	
CSL	C056/B413	5/6/2014	No	Released	Branded and released

Note – Some animals have both a “C” or “U” brand and a “B” code as these individuals were originally identified through documentation of natural physical features and were subsequently branded either at Bonneville Dam or Astoria. Additional animals were trapped and released without any handling.

Appendix D. Adjusted estimate of prey taken by SSL and CSL between October 1 and December 31 at Bonneville Dam tailrace, 2011, 2012, and between September 16 and December 31, 2013.

	FALL-WINTER STELLER PREDATION				FALL-WINTER CALIFORNIA PREDATION		
	2011	2012	2013		2011	2012	2013
Chinook	317	95	976	Chinook	0	10	5
Steelhead	187	165	77	Steelhead	0	19	0
Coho	20	85	101	Coho	0	9	0
Chum	4	6	0	Chum	0	0	0
Total Salmonids	527	351	1154	Total Salmonids	0	38	5
Sturgeon	828	456	307	Sturgeon	0	0	0
Lamprey	8	17	2	Lamprey	0	0	0
Shad	19	12	7	Shad	0	0	0
Smolt	3	0	0	Smolt	0	0	0
Carp	10	8	10	Carp	0	0	0
Sucker	0	2	4	Sucker	0	0	0
Bass	0	2	3	Bass	0	0	0
Pikeminnow	0	2	0	Pikeminnow	0	0	0
Other	4	19	10	Other	0	0	0