Northwest **Power** and **Conservation** Council

July 6, 2016

MEMORANDUM

TO: **Fish and Wildlife Committee members**

FROM: **Tony Grover**

SUBJECT: **Report on Sea Lion predation**

BACKGROUND:

Presenter: Dr. Michelle Wargo-Rub, NOAA Fisheries, Pt. Adams Biological Field Station, Hammond, OR

Summary: Dr. Rub will update the committee on the latest available information from her research regarding sea lion predation on interior Columbia River adult Chinook salmon near the mouth of the Columbia River below Bonneville dam.

Relevance: Supports the 2014 Fish and Wildlife program emerging priority 3, expanded management of predators.

Background: Dr. Wargo-Rub and fellow researchers have been studying returning Chinook salmon near the mouth of the Columbia River for several years. Their research has identified increased Chinook salmon mortality coincident with peak sea lion presence near Astoria. 2016 was a record breaking year for the number of sea lions observed near Bonneville dam when 120 Steller and California sea lions were observed on May 4th. The previous record was 116 on April 22, 2015. In 2014 as much as 40% of the adult spring chinook returning fish run did not survive. Much of this loss may have been due to sea lion predation.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

More Info: May 4, 2016 presentation to NOAA's Columbia Basin Partnership by Dr. Wargo-Rub: *Adult spring/summer Chinook salmon estuarine and lower Columbia River survival and run timing*, attached.

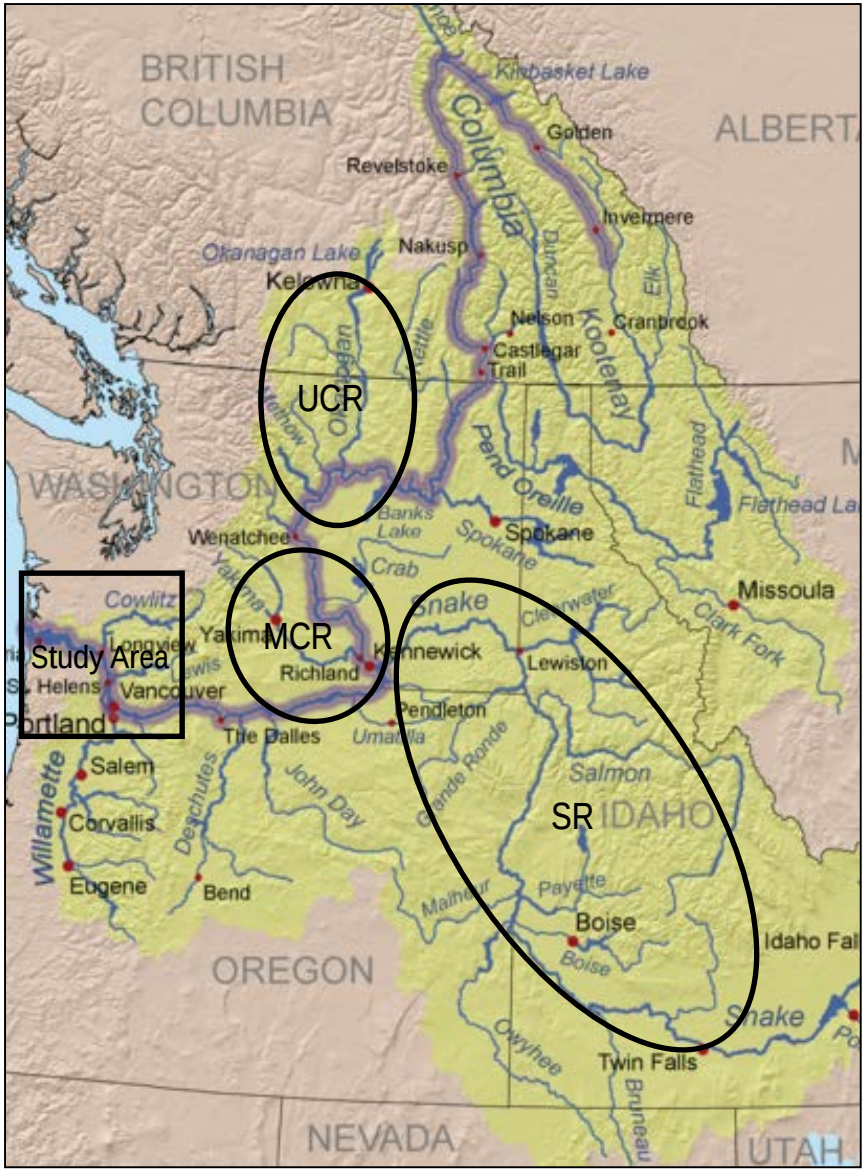
May 31, 2016, Corps of Engineers status report - *pinniped predation and deterrent activities at Bonneville Dam*, which is attached in this packet.

Adult spring/summer Chinook salmon estuarine and lower Columbia River survival and run timing

A. Michelle Wargo Rub, Lyle Gilbreath, David Teel, Benjamin Sandford, Donald Van Doornik, Kinsey Fricke, Brian Burke, Samual Rambo, Matthew Nesbit, Mark Sorel, David Huff, & Rich Zabel
NOAA Fisheries Northwest Fisheries Science Center, Seattle, WA 98112

The primary goal of this study is to provide estimates of survival and run timing for spring/summer Chinook salmon returning to the Middle & Upper Columbia & Snake Rivers

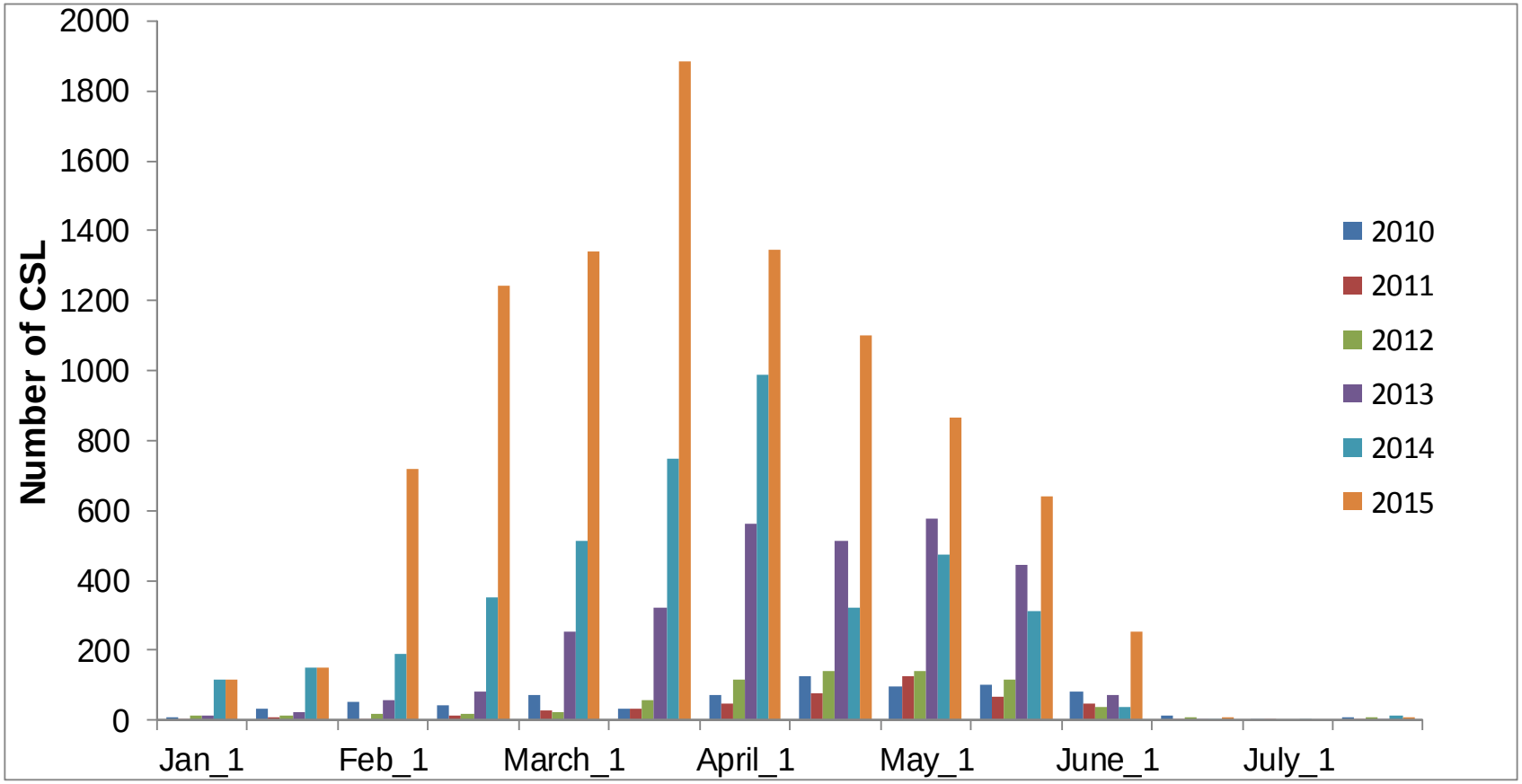

Photo by Darren Ogden, NOAA NWFSC



Natural mortality in the CR estuary and lower river may be significant

Due to success of the Marine Mammal Protection Act of 1972 by the late 1980's Harbor seal and Stellar sea lion presence within the CR had been reestablished and California sea lions had been introduced

Average biweekly number of sea lions hauled out at the East End Mooring Basin near Astoria, OR



Data provided by Matt Tennis, ODFW

Commercial tangle–net crew hauling in a Chinook salmon

Custom fabricated PVC tubes

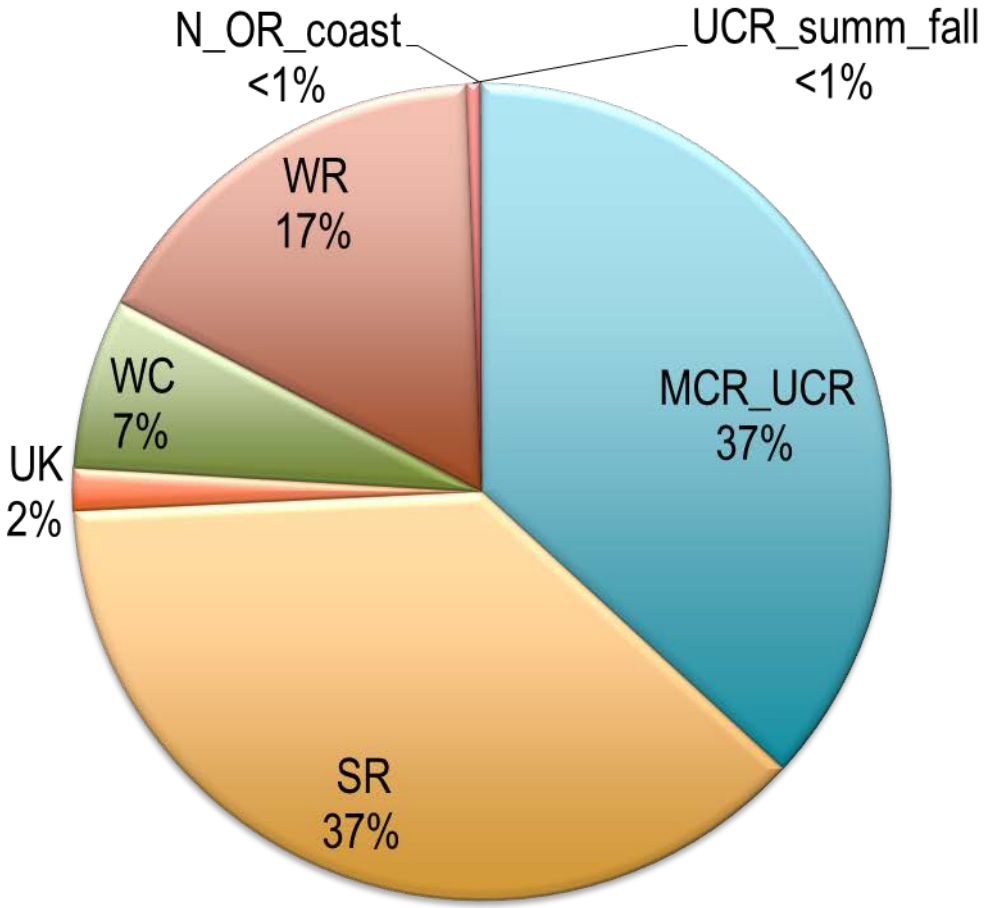
Facilitated safe handling, holding, and transfer of study fish

Adult Chinook salmon being transferred from the commercial fishing vessel to a research vessel using PVC tubes

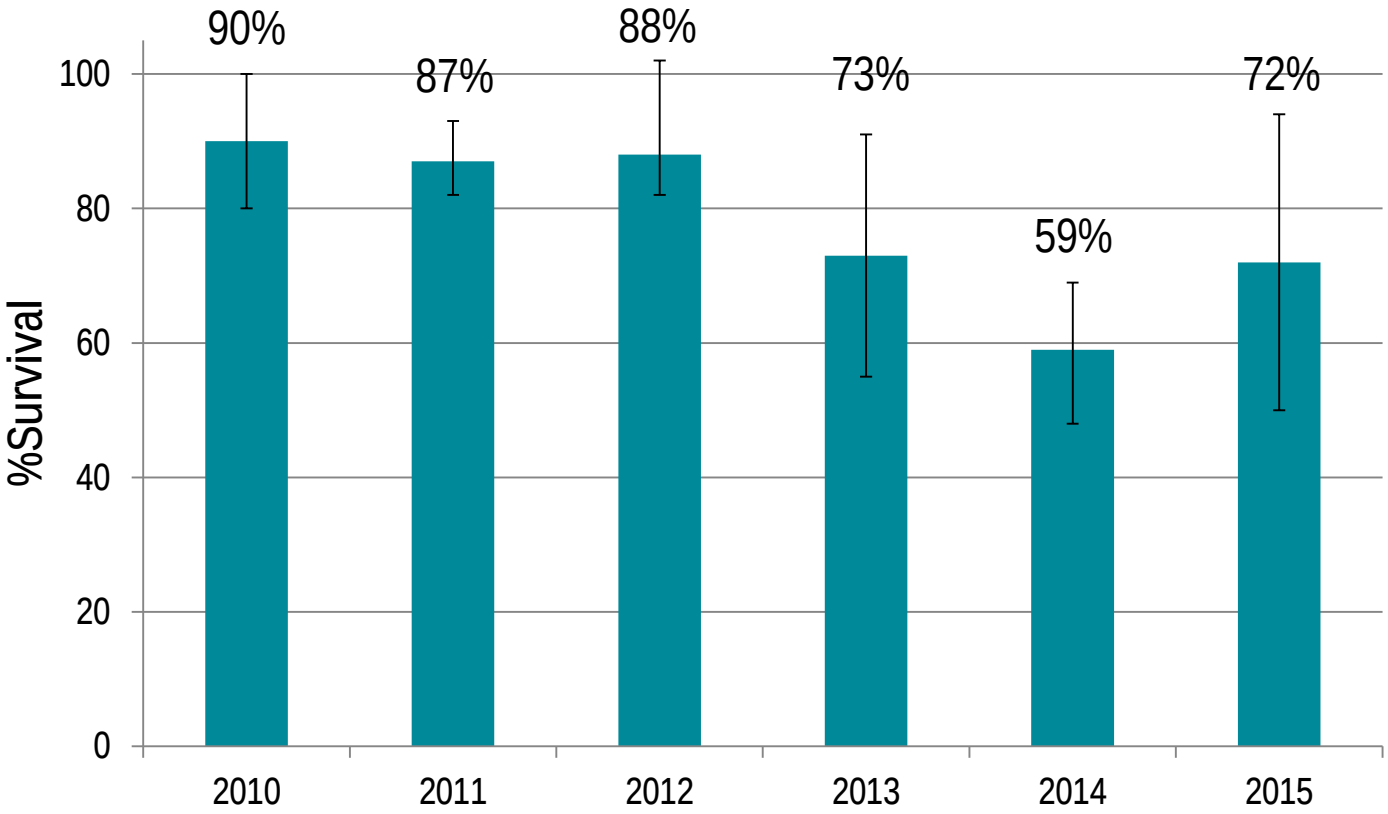
Study fish were physically restrained in dorsal recumbency for tissue collection and tagging

> 2200 returning spring/summer Chinook salmon have been tagged for this study since 2010

- Willamette River spring Chinook (17%)
- West Cascade tributary spring Chinook (7%)
- Middle and Upper Columbia River spring Chinook (37%)
- Snake River spring/summer Chinook (37%)
- Upper Columbia River summer/fall Chinook (<1%)
- North Oregon Coast Chinook (<1%)
- Unknown origin (2%)



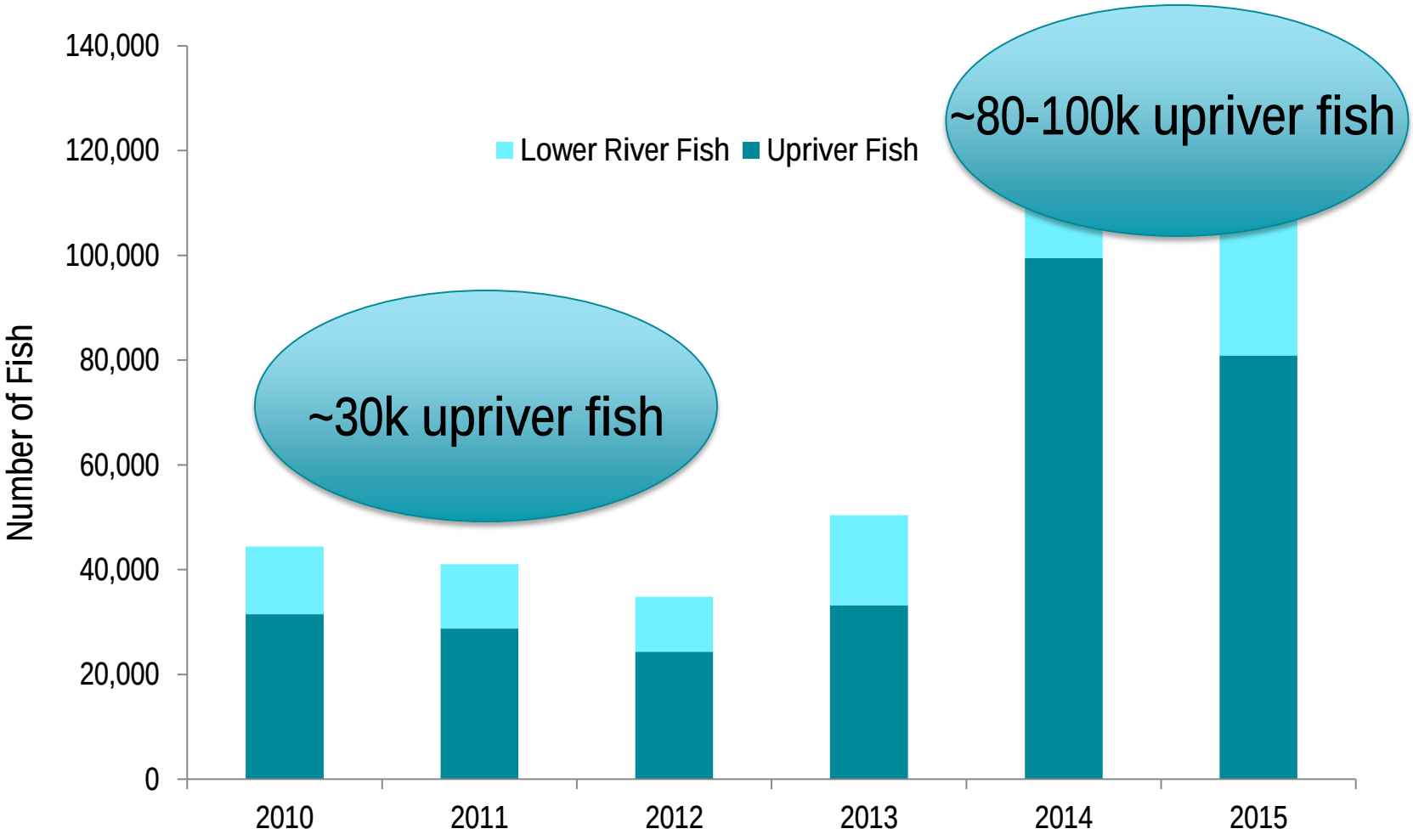
Weighted Mean Adjusted Survival
for Interior CR adults (FL ≥ 56 cm)



*Preliminary estimate & assumes harvest of 7%

**Survival estimates have been adjusted for mortality due to handling & tagging, detection efficiency at Bonneville Dam, and harvest

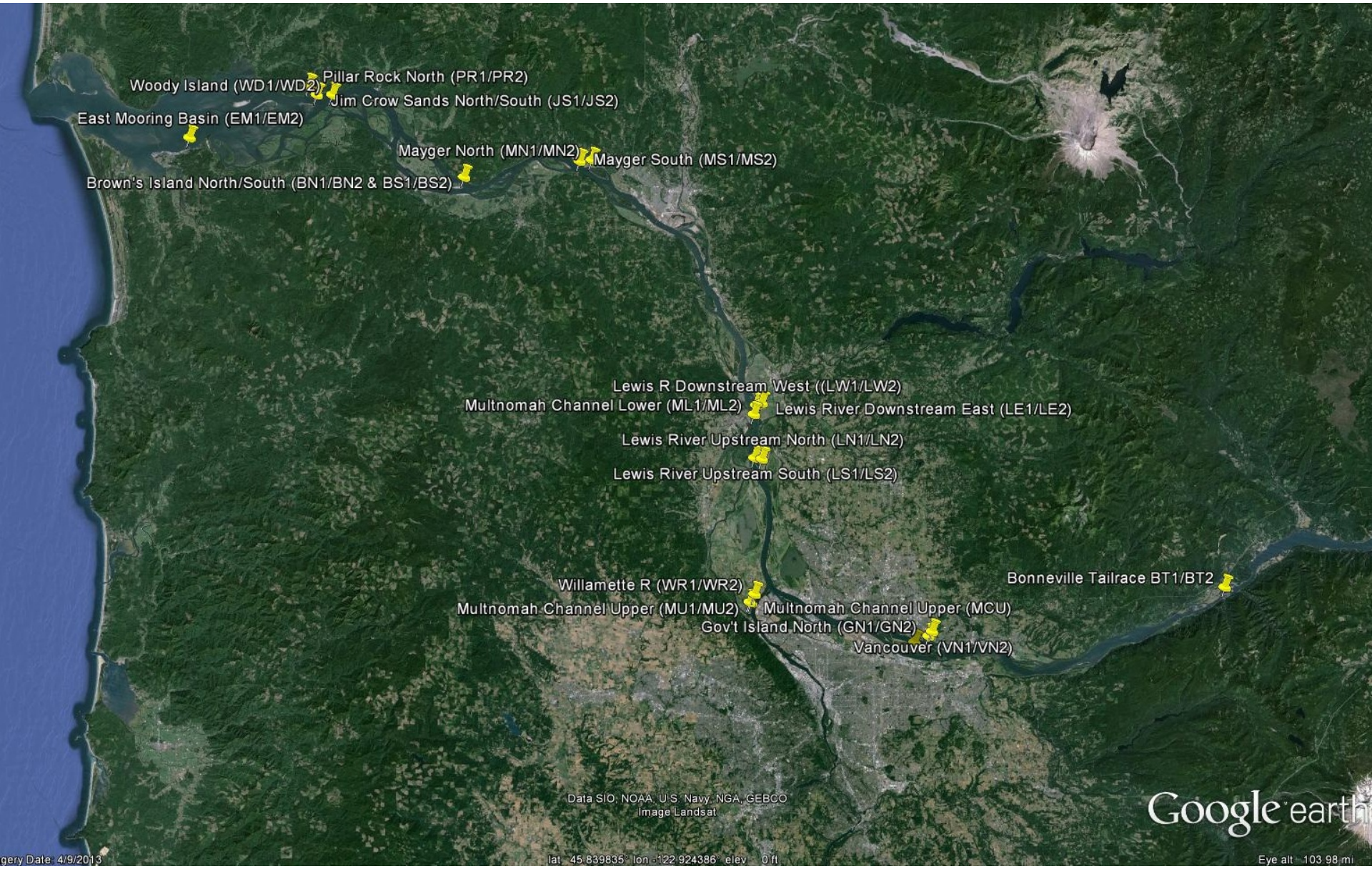
What do these estimates imply?



Estimates of Chinook salmon returns are from the 2016 WDFW Joint Staff Report and exclude Select Area spring/summer Chinook salmon returning to the CR estuary.

Potential sources of mortality (or error)

- Pinniped depredation
- Permanent straying below Bonneville Dam for upriver fish
- Disease
- Under-estimation of sampling & handling mortality
- Under-estimation of harvest
- Artifact of learned behavior by predators


Woody Island (WD1/WD2)
Pillar Rock North (PR1/PR2)
Jim Crow Sands North/South (JS1/JS2)
East Mooring Basin (EM1/EM2)
Mayger North (MN1/MN2)
Mayger South (MS1/MS2)
Brown's Island North/South (BN1/BN2 & BS1/BS2)
Lewis R Downstream West ((LW1/LW2)
Multnomah Channel Lower (ML1/ML2)
Lewis River Downstream East (LE1/LE2)
Lewis River Upstream North (LN1/LN2)
Lewis River Upstream South (LS1/LS2)
Willamette R (WR1/WR2)
Bonneville Tailrace BT1/BT2
Multnomah Channel Upper (MU1/MU2)
Multnomah Channel Upper (MCU)
Gov't Island North (GN1/GN2)
Vancouver (VN1/VN2)
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Google earth
gery Date: 4/9/2013
lat 45.839835° lon -122.924386° elev 0 ft
Eye alt 103.98 mi

CSL Movement

30 CSL tagged in the EMB from 3/8-3/16 2016

- 50% (15 CSL) were only detected in the East Mooring Basin
- 17% (5 CSL) were detected as far upriver as Woody Island (rkm 28)
- 7% (2 CSL) were detected as far upriver as Brown's Island (rkm 75)
- 13% (4 CSL) were detected as far upriver as Mayger (rkm 87)
- 3% (1 CSL) was observed in Multnomah Channel (rkm 170)
- 7% (2 CSL) were detected as far upriver as Bonneville Dam

*20% (6 CSL) have been observed making trips upriver and returning to the EMB
**One CSL was observed in San Francisco Bay on 5/14
***One CSL was observed off the Olympic Penninsula on 5/19
****Several CSL were observed recently in the Channel Islands

What is driving survival?

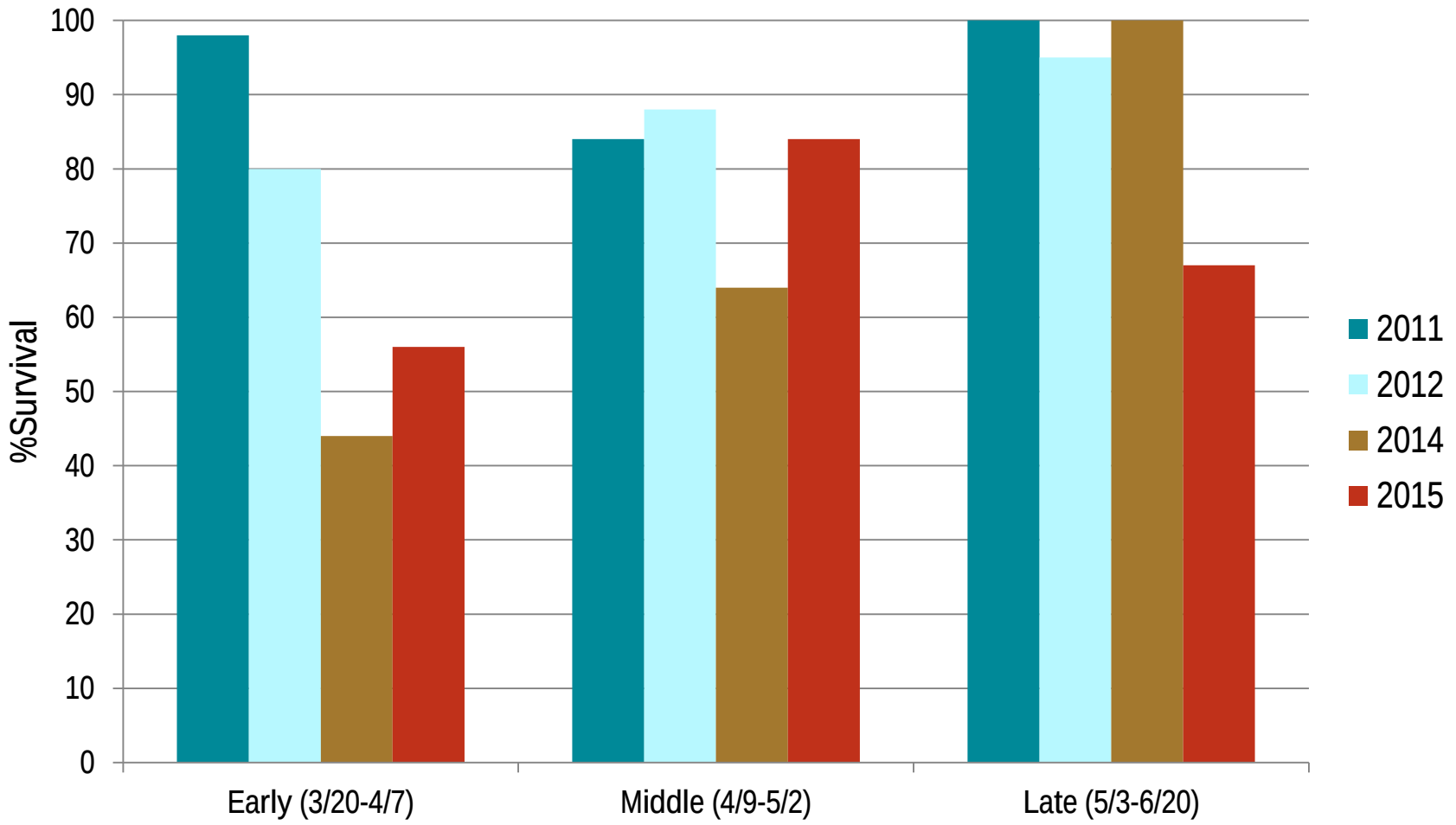
GLM Regression analysis indicates the following variables are significantly related to survival:

- CSL haul out counts at the EMB
- Clip Status
- Water temperature below Bonneville Dam (also highly correlated with date)
- Bonneville Spill

But when it comes to using the resulting model to predict survival, we are not doing very well. Predictors are describing only 8% of the variance leaving survival modelling efforts to date as being no better than a coin toss.

We are currently looking for data sets describing additional variables such as run composition and availability of alternative prey

Survival varied by tagging date



*2015 results are preliminary

Summary:

- >2200 fish tagged since 2010
- Average annual survival ranged from 55-90%
- Average annual survival decreased as the number of sea lions hauled out near Astoria, OR increased through 2014 but not beyond
- Higher seasonal mortality also coincides with peak sea lion presence
- Radio-telemetry has been incorporated into the study this spring to identify reach level behavior and survival and to obtain direct predation evidence
- Preliminary results from RT fish tagging in 2016 indicate that tagging and handling methods are robust and fish are dropping out of the study system-wide
- Preliminary results of RT CSL tagging indicate ~50% of animals at the EMB likely do not venture into the upper estuary, 7% forage directly below Bonneville Dam, 3% may venture into the Willamette River, and 20% likely forage regularly within the upper estuary/lower river
- Additional information from RT such as fish survival and CSL residence time is pending

Acknowledgements:

Susan Hinton, George McCabe, and Bob Emmett of NOAA Fisheries Pt. Adams Research Station, Jim Simonson and crew of NOAA Fisheries Pasco Research Station, Laurie Weitkamp of NOAA Fisheries NWFSC, Newport Research Station, David Kuligowski of NOAA Fisheries NWFSC, Manchester Research Station, John Hess, Doug Hatch & Ryan Brandstetter of CRITFC, Jason Romine and Mike Parsley of USGS, Chris Kern and Geoffrey Whisler of ODFW, Matt Campbell of IDF&G, Brian, Frank, & Stephanie Tarabochia, and Dan Marvin of Astoria, OR, Sean Hayes of NOAA Fisheries SWFSC, Kane Cunningham & Colleen Reichmuth of the Institute of Marine Sciences, Long Marine Laboratory, UCSC, NOAA Near Term Priority (2010 & 2011) and NOAA Fisheries Cooperative Research (2012, 2013, & 2014), Albert Little, Wyatt Wullger, Ben Rudolph, & Cody May of Ocean Associates, Dave Caton & Lila Charlton of PSMFC

www.nwfsc.noaa.gov/research/divisions/fe/estuarine/adult-est-survival.cfm

STATUS REPORT – PINNIPED PREDATION AND DETERRENT ACTIVITIES AT BONNEVILLE DAM, 2016

Patricia L Madson & Bjorn van der Leeuw

Fisheries Field Unit
U.S. Army Corps of Engineers
Bonneville Lock and Dam
Cascade Locks, OR 97014

MAY 31, 2016

This is the sixth and final status report for the 2016 pinniped monitoring season and summarizes the observed predation and deterrent activities at Bonneville Dam from January 1 through May 31, 2016. Observations were conducted during daylight hours Monday through Friday. This report can be found at: http://www.nwd-wc.usace.army.mil/tmt/documents/fish

PLEASE NOTE - All data presented here are preliminary as of the status report date. Predation figures are unexpanded (unless otherwise noted) and sea lion abundance estimates will likely change as the season progresses and data are proofed and analyzed. Final predation estimate data will be expanded to adjust for the number of daylight hours and days not observed as well as "unknown" prey species consumed for the final report. The final report summarizing the results of the 2016 Pinniped Monitoring Program will be available in the fall of this year.

PINNIPED ABUNDANCE

During the past two weeks we have seen a large decline in the numbers of both California (*Zalophus californianus*) and Steller (*Eumetopias jubatus)* sea lions (Figure 1). California sea lion (CSL) abundance decreased from 37 in mid-May to 1 by the end of May. The first CSL was observed on February 26. The daily average of CSL was 4 in March, 22 in April, and 31 in May. The maximum number of CSL observed on a single day at the dam was 66 on May 4. We have documented approximately 131 uniquely branded individual CSL through May 31. Of these, 89 have been seen in multiple years and 42 were newly identified.

Steller sea lions (SSL) were present when observations began January 4, increasing in number through April before departing by the end of May (Figure 1). The daily average of SSL was 13 in January, 5 in February, 14 in March, 40 in April, and 21 in May. The maximum number of SSL observed on a single day at the dam was 54 on May 4. We have documented approximately 39 unique individual SSL this season. Of these, 36 were observed in previous years and three were newly identified.

The maximum number of pinnipeds (CSL and SSL combined) on a single day was 120 on May 4 which surpassed the previous record of 116 on April 22, 2015.

Point counts are taken at powerhouse 1, spillway, powerhouse 2, Tower Island, and Tanner Creek throughout the day to monitor the number of pinnipeds present at Bonneville Dam.

Pinniped abundance (CSL and SSL combined) for 2016 through May 31 in comparison with the 10 year average is shown in figure 2 below.

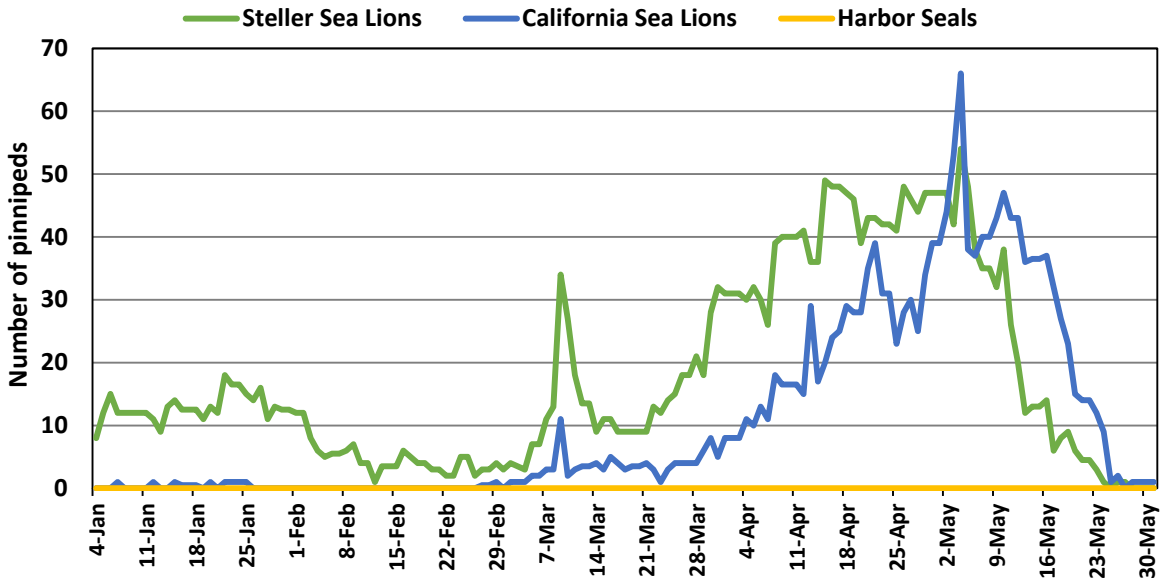


Figure 1. Maximum daily count of pinnipeds by species (interpolated for weekends) through May 31, 2016 at Bonneville Dam.

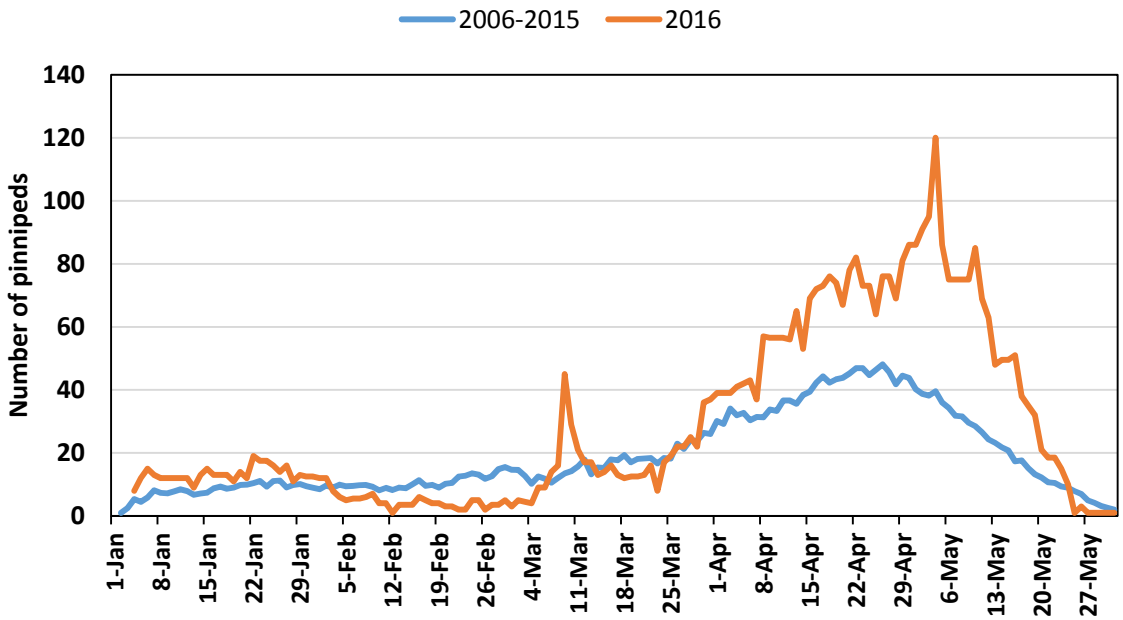


Figure 2. California and Steller sea lion combined maximum daily count (interpolated for weekends) at Bonneville Dam January 1 through May 31.

PREDATION DATA

During the last two weeks of May the total number of observed catches declined considerably as the pinnipeds were departing. In total, observed adult salmonid catch by pinnipeds was 4,196 through May 31. Of these, 4,094 were Chinook *(Oncorhynchus tshawytscha*) and 102 were steelhead (*Oncorhynchus mykiss*). There have been 231 lamprey catches, 191 of those by CSL and 40 by SSL (Table 1). The majority of lamprey take has occurred at powerhouse 2, followed by powerhouse 1, and then spillway (Figure 3).

Table 1. Observed fish catches by pinnipeds at Bonneville Dam through May 31, 2016.

Prey	Steller Sea Lion	California Sea Lion	Total
Chinook	1,150	2,944	4,094
Steelhead	43	59	102
Sturgeon	26	3	29
Unknown	111	145	256
Smolt	5	10	15
Shad	8	41	49
Lamprey	40	191	231
Other	23	14	37
Pikeminnow	1	1	2
Total	1,407	3,408	4,608

Note: these are raw numbers

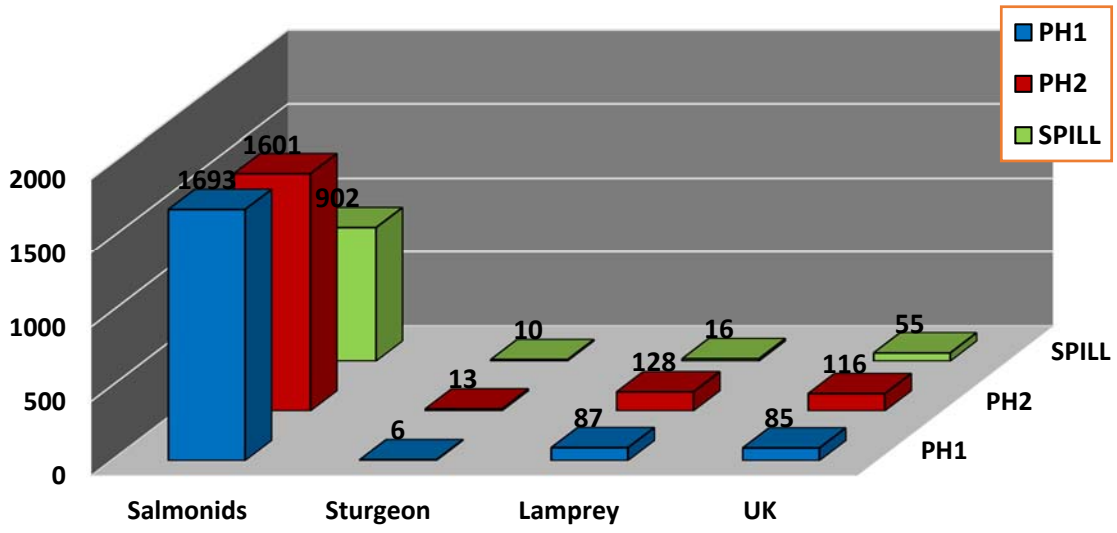


Figure 3. Observed pinniped catches of salmon, sturgeon, lamprey, and unknown fish species by location at Bonneville Dam, 2016.

The estimated consumption of adult salmonids (Chinook salmon and Steelhead combined) by CSL and SSL was more than twice that of the ten year average (Figure 4). Estimated consumption of adult salmonids through May 31, expanded for daylight hours not sampled, is 8,986 (Table 2). California sea lions took 71% of the estimated salmonid catch while SSL took 29%. Preliminary data suggests that pinnipeds consumed an estimated 5.5% of the migrating adult salmonids in the Bonneville Dam tailrace during the January 1 to May 31 timeframe. Estimated consumption of Chinook salmon by CSL and SSL is 6,267 and 2,459 respectively.

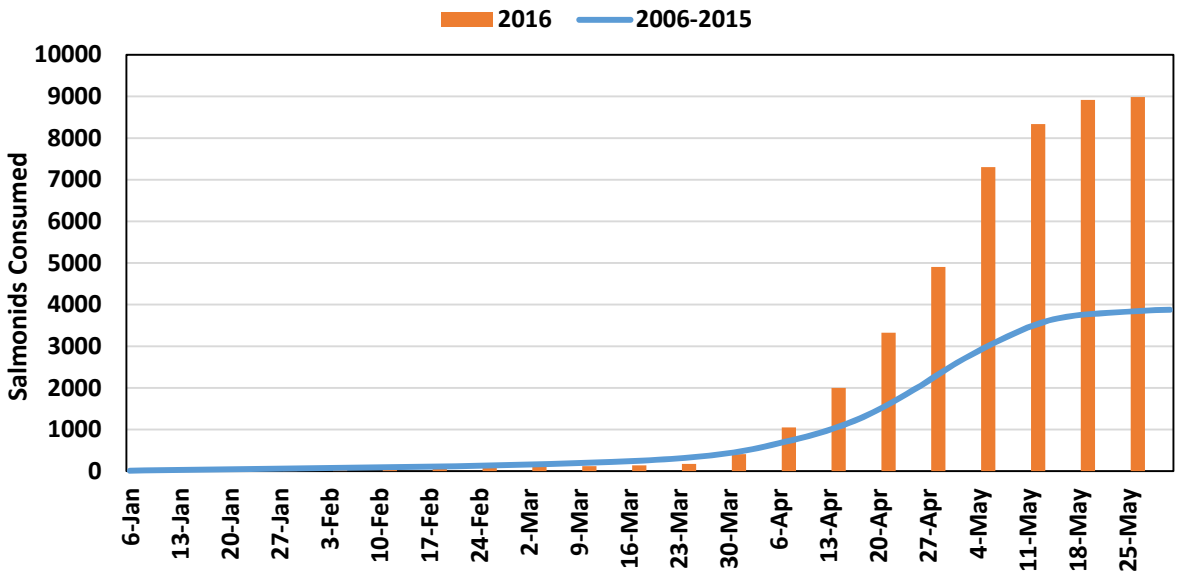


Figure 4. Pinniped cumulative consumption estimate of adult salmonids at Bonneville Dam from January 1 through May 31 not adjusted for unknown catches. The ten year average is the blue line.

Table 2. Estimated consumption of adult salmonids by pinnipeds at Bonneville Dam through May 31, 2016.

Prey	Steller Sea Lion	California Sea Lion	Total
Chinook	2,459	6,267	8,726
Steelhead	130	130	260
Total	2,589	6,397	8,986

Pinniped predation of white sturgeon (*Acipenser transmontanus*) has dropped greatly from the ten year average (Figure 5). Similar to 2015, few sturgeon catches were observed this year. No sturgeon catches were observed over the past two weeks. The 2016 estimated consumption of sturgeon through May 31, expanded for daylight hours not sampled, is 86.

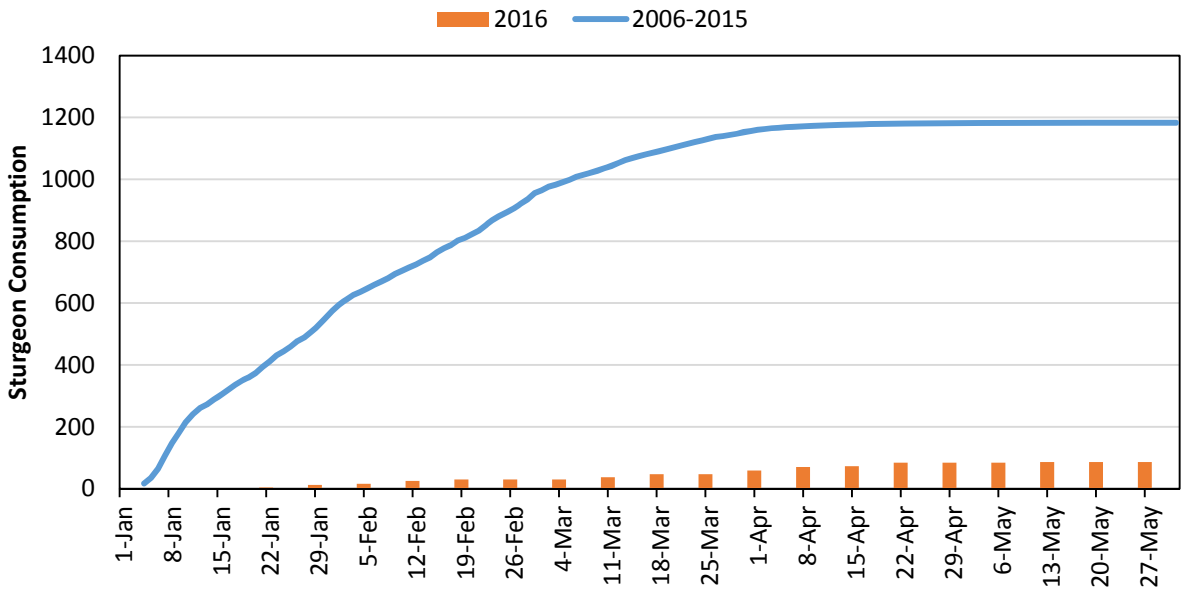


Figure 5. Pinniped cumulative consumption estimate of white sturgeon from January 1 through May 31, at Bonneville Dam. The ten year average is the blue line.

OTHER ITEMS

Up to three sea lions were observed at The Dalles Dam tailrace feeding on salmonids this year. One branded CSL has been observed in the Bonneville pool for multiple years. Another branded CSL was last seen on May 4 by fisheries personnel at The Dalles Dam and was subsequently sighted by one of our observers on May 13 in the Bonneville Dam tailrace indicating that it moved back downstream voluntarily.

DETERRENTS & TRAPPING

Sea lion exclusion devices (SLEDs) were deployed at powerhouse 2 on October 26, 2015 and the remaining SLEDS were installed by March 5, 2016. Specifically, the SLEDS at powerhouse 1 were installed on March 1, 2016.

After several SSL were observed climbing over the floating orifice gates (FOGs) at powerhouse 2 and entering the fishway, wood panels were placed on top of the FOGs to prevent this behavior from recurring. To date there have been no additional reports of sea lions accessing the fishway channel via the FOGs.

Boat-based hazing by Columbia River Inter-Tribal Fish Commission (CRITFC) began on March 7 and finished for the year on May 16th. Dam-based hazing of pinnipeds by USDA began on March 8 and ran through May 31.

Pinniped management activities by the states of Oregon and Washington have concluded at Bonneville Dam for 2016. The last day of trapping was May 24. There were 59 CSL removed this year under the section 120 permit. Fifty CSL were branded at Bonneville Dam in 2016. Additional information about these activities can be found at Oregon Department of Fish & Wildlife's California sea lion management website:

http://www.dfw.state.or.us/fish/SeaLion