



Oregon

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October 30, 2013

William W. Stelle, Jr.
Regional Administrator
West Coast Region
NOAA Fisheries
7600 Sand Point Way NE, Bldg 1
Seattle, WA 98115

Dear Mr. Stelle,

This letter summarizes activities conducted under the Marine Mammal Protection Act Section 120 lethal removal authority granted to the States of Oregon, Washington, and Idaho by the NOAA Fisheries on March 15, 2012 to reduce California sea lion (CSL) predation on threatened and endangered Columbia River salmonids. The following information comprises our annual report to NOAA Fisheries documenting compliance with the Terms and Conditions of the 2012 Letter of Authorization (LOA) for activities conducted during the 2013 field season.

Terms and Conditions Nos. 1 and 2

The States captured and removed four (4) predatory CSL between April 16 and April 30, 2013. Appendix 1 of the 2012 LOA provided a list of CSL that had previously met the criteria for permanent removal. Working with the U. S. Army Corps of Engineers (USACE) observation program, the States requested addition of 16 new CSL that had met the criteria for removal during the 2013 field season (May 15, 2013 letter from Brown to Stelle).

Terms and Conditions No. 3

By removing four predatory CSL, the States did not exceed the limit of taking no more the one percent of the current PBR (92 animals) in 2013.

Terms and Conditions No. 4

As required, the States consulted with our Institutional Animal Care and Use Committee (IACUC) prior to conducting work during the 2013 field season. Certain committee members monitored our activities throughout the season and some individual members of the committee participated in the capture, transfer, medical screening, and post-mortem examinations of sea lions taken under the LOA. We will again consult with the IACUC early in 2014 to discuss activities planned for the next field season.

Terms and Conditions No 5.

As stated above, the States captured four CSL in 2013 that had met the criteria for permanent removal. In early April the States were notified that one permanent holding facility (Queens Zoo, Bronx, NY) had received approval from NOAA Fisheries to obtain two (2) CSL. The States worked with NOAA Fisheries and Queens Zoo staff to make the necessary arrangements for transfer of the animals to a temporary holding facility (Point Defiance Zoo and Aquarium, Tacoma, WA). The temporary holding facility was inspected and approved for use by our IACUC. The two CSL were successfully transferred via the holding facility to Queens Zoo; the remaining two sea lions were chemically euthanized in accordance with protocols approved by the IACUC.

Terms and Conditions Nos. 6 and 7.

Firearms were not used to remove predatory CSL in 2012. Retrieval of carcasses from the water was not required.

Terms and Conditions No. 8

The States (Washington Fish and Wildlife Enforcement and Oregon State Police Fish and Wildlife Division) coordinated safety and security during removal activities among all agencies involved with the process in cooperation with the Columbia Basin Law Enforcement Council. This action included the establishment of an Incident Command Center (ICC) that coordinated security and safety with USACE, US Coast Guard, Columbia River Intertribal Fish Commission (CRITFC), Idaho Department of Fish and Game, and local law enforcement in Oregon and Washington during capture, removal and transportation operations.

Terms and Conditions No. 9

The States worked directly with USACE, Portland District and the Bonneville Lock and Dam Project Manager prior to and during capture and removal operations. The assistance provided by Bonneville Project staff was critical to our work and was very much appreciated. The ICC also worked directly with the Bonneville Project on safety, security and access issues during our removal operations.

Terms and Conditions No. 10

The carcasses, tissues, and parts of the CSL that were euthanized were disposed of according to applicable local, state and federal laws. A maximum effort was made to collect and retain multiple biological samples from euthanized animals for scientific and educational purposes.

Terms and Conditions No. 11

The States notified the Regional Administrator, NOAA Fisheries, Northwest Region, of all sea lion removal operations within the required three day period.

Terms and Conditions No. 12

In addition to conducting California sea lion capture, marking and removal operations, the States assisted with the USACE pinniped predation observation program, and the Columbia River Intertribal Fish Commission non-lethal boat-based pinniped hazing program. This work included efforts to document pinniped presence, abundance, foraging behaviors, salmonid consumption, identify individual animals, employ non-lethal hazing tools, and remove predatory California sea

lions. These efforts were directed at evaluating the impact of predation on salmonid passage at Bonneville Dam, determining the effectiveness of non-lethal hazing, identifying predatory sea lions, and ultimately evaluating the results achieved by removing predatory sea lions from the Bonneville Dam area. Detailed descriptions of the work completed in 2013 can be found in the respective annual field reports by USACE and the States/CRITFC (see attached for the latter).

Terms and Conditions No. 13

This document (along with those referenced above under Terms and Conditions No. 12) represents the annual report to NOAA Fisheries that is required here. The States, in consultation with all other cooperating agencies, are currently planning for work to be conducted in 2014. We expect USACE to again lead the predation observation program at Bonneville Dam and to contract with USDA Wildlife Services to provide land-based non-lethal hazing operations. The States, along with CRITFC staff will assist USACE with predation observations and non-lethal hazing (boat-based).

Recently (September 27, 2013) the U.S. Court of Appeals for the Ninth Circuit upheld the March 15, 2012 LOA issued to the States by NOAA Fisheries for permanent removal of predatory CSL in the Columbia River. We expect to prepare traps for operation at Bonneville Dam in March as CSL begin to arrive with the spring Chinook run later that month.

As in previous years, our priority will be to fill requests from facilities authorized by NOAA Fisheries to receive and permanently house any of the captured CSL identified for removal. If no facilities are available, CSL listed for removal will be chemically euthanized and biological samples will be taken. Use of firearms as a removal tool will continue to be an option and may be used according to the conditions of the LOA in situations where trapping is ineffective.

We also intend to mark any unknown California sea lions that may be captured on the traps and release them in the same area. We may deploy telemetry instruments to some of these animals to further document their movements and foraging patterns in the Bonneville Dam area (e.g. night activities, proportion of time spent in and out of the BRZ and observation areas). We will continue to opportunistically collect fecal samples from all haul-out sites in the area to identify the variety of prey taken pinnipeds while in this area, including genetic identification of salmonid stocks consumed.

Terms and Conditions No 14.

As was done in 2013, the States will consult with the USACE predation observation program to identify any new CSL that have met the criteria for removal during 2014. Periodically during the field season we will request in writing that NOAA Fisheries add these newly qualifying CSL to the approved removal list.

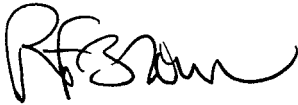
Terms and Conditions Nos. 15 and 16

We understand that the current LOA (valid through June 30, 2016) may be modified, suspended, or revoked by NOAA Fisheries at any time given 72 hours notice to the States. We will continue to consult with NOAA Fisheries and other partner agencies regarding the efficacy of this program as we proceed.

The States remain committed to pursuing all reasonable approaches to reduce pinniped predation on threatened and endangered Columbia River salmonids. As you know, existing non-lethal tools have proven highly ineffective and very few new options have been identified. While most would prefer to find and implement successful non-lethal methods of reducing predation, permanent removal of some number of repeat offending predatory sea lions may continue to be necessary for the foreseeable future.

We thank you for your assistance and support of our work to reduce sea lion predation on threatened and endangered salmonids below Bonneville Dam and look forward to working with you on this project in the years to come. Please let us know if we can provide further information related to our annual reporting obligations.

Sincerely,

A handwritten signature in black ink, appearing to read 'RFBrown', written in a cursive style.

Robin F. Brown
Marine Mammal Program Leader

Attached: FIELD REPORT: 2013 PINNIPED RESEARCH AND MANAGEMENT
ACTIVITIES AT BONNEVILLE DAM

FIELD REPORT:
2013 PINNIPED RESEARCH AND MANAGEMENT ACTIVITIES AT BONNEVILLE DAM

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October 30, 2013

¹ Oregon Department of Fish and Wildlife

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INTRODUCTION

Bonneville Dam, located approximately 146 miles upriver from the Pacific Ocean, is the lowermost hydroelectric project on the Columbia River. During the 1980s and 1990s, one to two California sea lions (*Zalophus californianus*) were reported annually at the dam during fishway inspections (Stansell 2004). In 2001, however, there were reports of up to six California sea lions observed at one time, and by 2002 the U.S. Army Corps of Engineers (USACE) estimated that 30 California sea lions were foraging at the dam for salmonids (*Onchorynchus* spp.), many of which are listed under the Endangered Species Act (ESA). Since then the minimum number of California sea lions has ranged from approximately 39 to 104 individuals per year. Salmonid predation at the dam by California sea lions increased from near zero before 2001, to an estimated high of 5,481 fish in 2010, declining to an estimated 1,077 fish in 2012 (Stansell et al. 2012).

Steller sea lion (*Eumetopias jubatus*) abundance at the dam has also increased over the last decade, going from zero before 2003 to a high of 89 individuals in 2011 (Stansell et al. 2012). While Steller sea lions initially appeared to forage primarily on white sturgeon (*Acipenser transmontanus*), in recent years they have consumed increasing numbers of salmonids. In 2012 the number of sturgeon and salmonids consumed by Steller sea lions was estimated to be at least 2,498 and 1,305, respectively (Stansell et al. 2012).

In response to increasing pinniped predation at the dam, state, federal, and tribal partners have attempted to deter pinnipeds using a variety of non-lethal deterrents. Starting in 2005, these methods have included aerial and underwater pyrotechnics, acoustic harassment devices, vessel chase, rubber projectiles, and capture-relocation. In 2010 alone, for example, boat-based hazing crews used approximately 5,000 rounds of cracker shells, 750 seal bombs, and 100 rounds of rubber buckshot in attempts to deter sea lions from the Bonneville Dam tailraces (Brown et al. 2010). While thought to be potentially effective at deterring predation by new animals arriving at the dam for the first time, they have been ineffective at deterring predation by habituated individuals.

Increasing predation by California sea lions on ESA-listed salmonids and unsuccessful non-lethal deterrence efforts led the States of Washington, Oregon, and Idaho in November 2006 to apply under Section 120 of the Marine Mammal Protection Act (MMPA) for the authority to permanently remove California sea lions that were observed preying on salmonids near Bonneville Dam on the Columbia River (ESA-listed Steller sea lions are not subject to management under Section 120 of the MMPA). In March 2008, NOAA Fisheries (NMFS) partially approved the States' application and issued a Letter of Authority (LOA) for the lethal removal of certain California sea lions under specific conditions (NMFS 2008). Since then this authority has been repeatedly challenged in federal court and has resulted in only intermittent removal activity. Nonetheless, from 2008-2012, a total of 49 California sea lions were intentionally removed from the Columbia River (11 went to aquariums and 38 were euthanized). An additional five animals died due to accidental causes, bringing the total to 54 over the five year period.

This report summarizes pinniped research and management activities at Bonneville Dam in 2013. This work was led by the Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW), in association with the Columbia River Inter-Tribal Fish Commission (CRITFC). This work has been conducted in close coordination and cooperation with USACE and NMFS, as well as numerous other agencies.

METHODS

Boat-based deterrent activities

Boat-based hazers from CRITFC used a combination of deterrents (seal bombs, cracker shells, and vessel chase) in an attempt to deter pinnipeds from consuming threatened and endangered Columbia River salmon and steelhead as well as white sturgeon. Hazers primarily patrolled the tailrace Boat Restricted Zone (BRZ) at the dam in pursuit of foraging sea lions. The following was recorded for each discrete hazing event: species and number of pinnipeds encountered; starting location, time and direction of travel of pinniped(s); type and number of deterrent devices used; and ending location, time and direction of travel of pinniped(s). Predation observations and identifying marks of pinnipeds were also noted.

For personnel safety, and as recommended by the Fish Passage, Operations, and Management working group, boat access within the BRZ was limited to approximately 30 m from all Bonneville project structures and 50 m from main fishway entrances. No seal bombs were used within 100 m of fishways, floating orifices, the Powerhouse-2 corner collector flume or the smolt monitoring facility outfall. In addition, no seal bombs were used once salmon passage exceeded 1,000 fish per day. Hazing activities were coordinated daily with the USACE Control Room and Fisheries Field Unit (FFU) personnel, as well as with USDA Wildlife Services staff, who were conducting additional sea lion hazing activities from project ground facilities. VHF-radio contact was maintained with Control Room staff while boat hazing crews were active in the BRZ.

Trapping

Sea lions were captured by ODFW and WDFW using haul-out traps placed in dam tailraces. An additional sea lion trap was also operated year-round in Astoria and throughout late spring and early summer at The Dalles marina. Sea lions use these traps as haulout sites, entering and exiting traps via a vertically-sliding door which was pad-locked open prior to a scheduled capture attempt. Tailrace traps were monitored 24 hours a day by state, federal, and/or private security staff. A telephone contact list was provided to all staff involved with monitoring the traps to insure a quick response by trained staff should any trap be tampered with or close unexpectedly.

Tailrace trap doors were closed using a remote-controlled magnetic release mechanism. Once sea lions were captured they were herded into holding cages on a barge built specifically to handle and process sea lions. If an animal was an approved candidate for permanent removal it was transferred to an on-site holding facility for further evaluation. If a NMFS-approved zoo or aquarium facility was available to receive candidate sea lions for permanent holding, then captured animals would be given a health screening by field staff and veterinarians, including

members of the States' Institutional Animal Care and Use Committee (IACUC). If an animal passed the health screening it would be transferred to an approved temporary housing facility prior to shipment to a zoo or aquarium. If an animal failed the health exam, or if there were no approved facilities prepared to accept an animal, then it was chemically euthanized. Euthanized animals were necropsied and tissues were collected for a variety of biological analyses.

Instrumentation

Instruments were placed on two Steller sea lions and four California sea lions in order to study sea lion foraging behavior near the dam. Steller sea lions received National Geographic Crittercams and California sea lions received either GPS-phone tags or satellite-linked telemetry tags. The Crittercams and satellite tags were attached with remote release devices (RRDs) which allow the instruments to be recovered without having to recapture the animal.

Pinniped surveys

River surveys were conducted periodically by CRITFC in order to document and enumerate sea lion abundance and predation activity in the river below Bonneville Dam. Surveys were either conducted by two independent boats in order to estimate sea lion detectability or with a single boat. Each boat was crewed by a captain and at least one observer. Sea lion species, predation events and GPS location data was recorded for all sightings. In addition, counts of sea lions hauled out at the East Mooring Basin and at Phoca Rock were conducted throughout the season.

Effect of removals

The effect of the California sea lion removal program from 2008-2013 was estimated by predicting the number of salmon that would have been required by the sea lions had they not been removed. Predictions are based on the bioenergetics model described in Brown et al. (2010, 2011).

RESULTS

Boat-based deterrent activities

The boat-based hazing crew from CRITFC hazed sea lions for a total of 34 days from 3/4/2013 to 5/10/2013 (Table 1). Hazing resulted in 299 hazing events on 114 and 359 California sea lions and Steller sea lions, respectively. A total of 740 cracker shells and 392 seal bombs were used during deterrent activities. The final direction of sea lions at the end of these encounters resulted in 70.2% of sea lions moving down stream of the hazing boat.

Trapping

Bonneville tailrace traps were opened in late March, with successful trapping events occurring between 4/16/2013 and 5/14/2013 (Tables 2 and 3). A total of three Steller sea lions (Table 2) and 11 California sea lions (Table 3) were branded. Additional animals of each species were captured and released without handling, sometimes multiple times, because they were already

marked or were too large to handle. As allowed under the States' MMPA Section 120 Letter of Authorization, a total of four California sea lions were permanently removed. Two were ultimately sent to the Queens Zoo in New York and the remaining two were chemically euthanized.

Instrumentation

Two Steller sea lions were instrumented with Crittercams attached to RRDs. Unfortunately, both animals departed the dam for the mouth of the Columbia River shortly after tagging and only one of the two Crittercams has been recovered to date. Video from this camera contained footage of the animal swimming downriver and intraspecific interactions with other Steller sea lions but no obvious foraging behavior.

Of the four California sea lions instrumented at Bonneville Dam, two received satellite tags attached to RRDs and two received GPS-phone tags. One satellite tag was recovered during a recapture of the sea lion (C028) at Bonneville Dam and the other tag was tracked to the animal's (U264) breeding grounds in the Channel Islands, CA. Of the two GPS-phone tagged sea lions, one animal (C025) traveled from Bonneville Dam to the East Mooring Basin in Astoria, back upriver to Willamette Falls on the Willamette River, and then back to Astoria before the tag stopped transmitting. The GPS-phone tag on the other animal (C026) only transmitted from Bonneville Dam for approximately two weeks. Both GPS-phone tags were recycled from the previous year and had limited battery life remaining.

Pinniped surveys

Summary and analysis of river survey data is still pending. Preliminary results indicate, however, very large concentrations of sea lions in the lower river during the spring. One river survey, for example, conducted on March 19 documented 63 Steller sea lions, 227 California sea lions, and 36 harbor seals in the river between Bonneville Dam and Astoria. In addition, record high numbers of California sea lions were hauled out at the East Mooring Basin during most of April and May, with a high of 739 animals counted on April 12 (about four times greater than what is typical for that time of the year). The maximum number of Steller sea lions hauled out at Phoca Rock at one time was 19 animals observed on both March 7th and 8th.

Effect of removals

The median estimated daily individual salmonid biomass requirement for California sea lions based on the bioenergetics model was 14.2 kg (95% confidence interval was 7.8 to 27.1 kg/day), which translated into a median of 3 Chinook/day (95% confidence interval was 2 to 6 Chinook/day). The median estimated seasonal salmonid requirement for each sea lion was 57 salmonids (95% confidence interval was 6 to 216 salmonids/season). The predicted number of salmonids that would have been required from 2008 to 2013 by the 58 California sea lions that have been removed ranged from 5,106 to 18,623 fish (Table 5).

DISCUSSION

Boat-based deterrent activities

As in previous years, the purpose of non-lethal, boat-based deterrent activities was two-fold. First, it attempts to disrupt sea lion foraging behavior and reduce sea lion abundance immediately below Bonneville Dam, thereby increasing salmonid survival. Second, hazing may discourage naïve animals from becoming habituated to foraging below the dam, thus limiting the number of animals that may become eligible for permanent removal. Boat-based and/or structure based hazing also fulfills the LOA requirement that predatory California sea lions be exposed to hazing prior to subjecting them to permanent removal efforts. Results from this year were similar to that seen in past years. There was no apparent reduction in overall sea lion abundance or predation near the dam in response to hazing but there does appear to be an immediate effect on the animals while hazing is occurring. This is similar to other studies that have demonstrated that pinnipeds habituate quickly to acoustic and other deterrents that may be initially effective (see reviews by Franker and Mate 1999 and Scordino 2010).

Trapping

Haul-out traps were used without incident to mark and tag Steller sea lions and California sea lions, as well as remove California sea lions. Trapping California sea lions upstream of the dam in 2013 has so far been unsuccessful.

Instrumentation

Instrumentation of sea lions allowed us to increase and refine our understanding of sea lion foraging behavior in the Columbia River. While Crittercam deployments were only partially successful they showed promise in their ability to potentially capture underwater predation events. If Crittercams are redeployed in 2014 then using them earlier in the season on known animals would likely increase the chance of obtaining footage of foraging behavior in the tailraces.

Pinniped surveys

While analysis of survey data is still pending, it is likely that above average numbers of California sea lions and Steller sea lions seen this spring in lower Columbia River were due to the biggest run of eulachon (*Thaleichthys pacificus*) in the lower river in a decade. Recently listed as 'threatened' under the Endangered Species Act, these fish were once likely an important prey item of pinnipeds in the lower river each spring when large numbers of the smelt migrated into the lower river to spawn in its tributaries. The decline of the smelt runs in the early 1990s may have been one contributing factor to the start of sea lion predation on salmonids at Bonneville Dam in the early 2000s.

Effect of removals

For every California sea lion removed, escapement above Bonneville Dam by salmonids increases by an estimated 57 fish per season. Since habituated sea lions have shown high fidelity to Bonneville Dam, these savings accrue over multiple years. In addition, removal of habituated animals is believed to reduce opportunities for new, naive animals to be recruited into the Bonneville Dam "population", since at least some naive animals are thought to follow habituated animals upriver from the Columbia River mouth haul-outs. Indeed, indications suggest that continued removal of the most habituated individuals has led to a reduction in annual California sea lion abundance at the dam and their associated predation on salmonids.

It is important to note that bioenergetic models produce estimates of food requirements, not food consumption. Nevertheless, the results from this model were consistent with data from captive California sea lions (Kastelein et al. 2000) that showed adult (age 10) males consumed approximately 10.9 kg/day on a diet of mackerel, herring, sprat, and squid. They were also consistent with direct observations by the USACE which documented individual sea lions consuming up to 198 salmonids per season (Stansell et al. 2012). Results from bioenergetic calculations may also be applied in other parts of the river, albeit perhaps with some modifications to reflect local conditions. Refinements to the current model may need to be made in the near future in order to account for recent declines in apparent residency times at the dam and to account for limits to the number of years an animal's removal accrues savings in lost fish.

Recommendations for 2014

Recommendations for work in 2014 include continuing normal field operations at the dam (i.e., hazing, trapping, marking, surveys, etc.) and trying to trap the 3-4 sea lions that are above the dam. While declining budgets continue to constrain the amount of work that is possible, a recent ruling by the Ninth Circuit Court of Appeals has at least ended years of litigation that has hampered full implementation of the Section 120 removal authority. We anticipate that the removal program will now continue unimpeded by litigation through 2016 when the efficacy of the program will be assessed and a decision made as to whether it needs to continue.

ACKNOWLEDGEMENTS

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- CRITFC: John Whitaker, Bobby Begay, Aaron Quaempts, Percy Brigham, and Sara Thompson.
- NMFS: Robert DeLong, Pat Gearin, Garth Griffin, Brent Norberg, Tom Gelatt, and Brian Fadley.
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- PSMFC: Dave Colpo, Dan Heiner, and Matt Tennis.

- USACE: Project Manager Jerry Carol, Tony Kirk, Edward Carroll and the Bonneville Rigging Crew, Ben Haussmann, Andrew Taylor, Glen Smith, Robert Stansell, Karrie Gibbons, and Bjorn van der Leeuw.
- USDA Wildlife Services staff.
- WDFW: Josh Oliver, Mike Brown, Dyanna Lambourn, and Guy Norman.
- PSU: Mandy Cook, Debbie Duffield, and their students.
- Safety and Security: Jeff Samuels and Chris Allori, Oregon State Police; Murray Schlenker, Washington Department of Fish and Wildlife; and Ronald McDonald and Greg Webb, USACE.

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Table 1. Summary of boat-based hazing activities at Bonneville Dam, 2013.

Week of	Days	Take*		Munitions	
		CSL	SSL	Cracker shells	Seal bombs
3/3/2013	3	1	14	34	27
3/10/2013	4	0	37	93	65
3/17/2013	2	7	20	49	40
3/24/2013	4	0	42	74	52
2/31/2013	4	22	48	132	90
4/7/2013	2	3	32	32	28
4/14/2013	4	15	82	110	20
4/21/2013	4	22	58	87	33
4/28/2013	4	31	20	90	30
5/5/2013	3	13	6	39	7
Total	34	114	359	740	392

* Take refers to numbers of animal-harassment events (note: one animal may be harassed multiple times); CSL=California sea lion, SSL=Steller sea lion.

Table 2. Summary of Steller sea lion captures at Bonneville Dam, 2013.

Date	Capture-Release*	Recapture-release	Capture-brand-release	Weight (lbs)	Instrument
4/16/13	X				
	X				
	X				
	X				
		O24			
		O28			
4/17/13	X				
	X				
		O12			
		O13			
		O27			
		O29			
		O33			
4/23/13	X				
		O002			
		O007			
		O28			
4/24/13	X				
		O001			
		O12			
		O18			
		O24			
4/30/13	X				
	X				
	X				
		O20			
		O27			
		O28			
		O35			
			O37	342	
			O38	755	Crittercam
			O39	725	Crittercam
5/7/13		O20			
		O27			
Total	11	20	3		

*Animals released without branding (e.g., too large to handle).

Table 3. Summary of California sea lion captures at Bonneville Dam, 2013.

Date	Recapture-release	Capture-brand-release	Capture-remove	Weight (lbs)	Instrument	Comment
4/16/13			C022			Euthanized
4/23/13		C025		635	GPS 12346	Recycled tag
		C026		340	GPS 12347	Recycled tag
4/24/13	C026					
4/30/13	C026					
	U169					
	U254					
	U264				WC 91978	
		C027				
		C028			WC 91979	
		C029				
		C030				
		C031				
		C032				
			C018			Euthanized
			C023			Queens Zoo, NY
			C08			Queens Zoo, NY
5/7/13	C028					WC tag recovered
	C029					
	C032					
	U254					
	U262					
	U264					WC tag not recovered
	U84					
		C033				
		C034				
		C035				
5/8/13	U262					
	U84					
5/14/13	C026					
Total	15	11	4			

Table 4. Predicted numbers of salmonids that would have been required by California sea lions had they not been removed from the lower Columbia River, 2008-2013.

Year	Number of CSLs removed*	Salmonids required						
		2008	2009	2010	2011	2012	2013	Total
2008	11	184-654	258-968	242-1,038	242-1,018	254-1,010	243-1,015	1,423-5,703
2009	15		251-821	417-1,230	380-1,240	413-1,271	392-1,258	1,853-5,820
2010	14			212-766	318-1,181	348-1,210	381-1,195	1,259-4,352
2011	1				1-142	0-205	0-207	1-554
2012	13					222-729	314-1143	536-1,872
2013	4						34-322	34-322
Total	58	184-654	509-1,789	871-3,034	941-3,581	1,237-4,425	1,364-5,140	5,106-18,623

* Note: includes all animals removed during trapping activities, including accidental mortalities in 2008. Fall removals are not included in same-year predation calculations.