

# Appendix J. 2015 Refugio Beach Oil Spill: Marine Mammal Exposure, Injury and Restoration

## Overview

Assessment of injury to marine mammals from the 19 May 2015 Refugio Beach Oil Spill (RBOS) included (1) a pre-assessment survey to identify the presence of cetacean and pinniped species within the spill zone in the weeks following the oil spill, and (2) analyses of post-spill stranding patterns as they relate to baseline conditions. This technical report includes a description of the data collected and methods used to assess injury to both pinnipeds and cetaceans.

### 1. Background

Most of the marine mammals known to occur off the California coast can be found in the Southern California Bight, and most of those are seen regularly in the Santa Barbara Channel (Barlow and Forney 2007, Barlow 2016, Carretta 2019).

Below is a brief overview of the cetaceans (whales, dolphins and porpoises) and pinnipeds (seals and sea lions) observed off the Santa Barbara and Ventura County coastlines shortly after the RBOS. The species presented are those that were sighted at-sea or observed stranded on the beach during the spill response period. A broader summary of each species can be found in National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS)'s Pacific Stock Assessment Report, which includes references to primary literature on the biology, abundance and distribution for each species (Carretta 2019).

The southern sea otter, an endangered species, is known to use the kelp beds of the Santa Barbara Channel and was a species of concern for effects from the RBOS spill. However, in an aerial survey conducted by the Incident Command on 21 May 2015, no sea otters were observed. There were also no reports of sea otters at other times during the oil spill response. Therefore, the Trustees did not consider sea otters further in the assessment.

#### a. Cetaceans observed following the Refugio Beach Oil Spill

**Coastal bottlenose dolphin (*Tursiops truncatus*):** The southern California coastal bottlenose dolphin population is less than 500 individuals and is typically found just outside of surf break less than 500 m from the beach and no farther than 1 km from shore (Carretta *et al.* 1998). These dolphins are nomadic, regularly traveling within a range that extends from Ensenada, Baja California, Mexico, in the south to Monterey Bay, California, in the north. This population has been studied since the early 1980s, and a 30-year photo-identification catalog is maintained by the NOAA NMFS, Southwest Fisheries Science Center (SWFSC) to document this population's movements and to estimate their abundance (Hwang *et al.* 2014, Weller *et al.* 2016).

**Eastern North Pacific long-beaked common dolphins (*Delphinus delphis bairdii*<sup>1</sup>):** This small dolphin species is a year-round resident of southern California's nearshore waters from within 1 km of shore to approximately 30 km offshore. Their range extends from approximately Monterey Bay to the southern tip of Baja California, Mexico, and the population off the California coast is estimated to be more than 100,000 (Carretta *et al.* 2011). Long-beaked common dolphins are routinely seen in the Santa Barbara Channel and are often sighted from Coal Oil Point (Smith 2017).

**Gray whale (*Eschrichtius robustus*):** Gray whales are seen off the southern California coast from approximately December through May, when most of the population of around 20,000 whales migrates between summer feeding grounds in the Arctic and winter breeding lagoons in Baja California, Mexico (Perryman and Lynn 2002, Weller *et al.* 2012). The migration has distinct phases for different sex and age classes. The last phase of the migration is made up of northbound adult females and their new calves. This last phase follows a near shore path just outside the surf zone off the California coast and typically concludes in late May (Poole 1984). As the migration ends, there are usually daily sightings of adult female and calf pairs passing by the Santa Barbara and Ventura County coastlines.

**Humpback whale (*Megaptera novaeangliae*):** Humpback whales feed off the California coast in the summer. Southern California is the southern limit of their summer feeding range, and these whales are most numerous here in the spring and summer (Campbell *et al.* 2014). Off Santa Barbara and Ventura Counties, humpback whales are often sighted feeding in the Santa Barbara Channel and around the northern Channel Islands (Campbell *et al.* 2014).

#### **b. Pinnipeds observed following the Refugio Beach Oil Spill**

**California sea lion (*Zalophus californianus*):** The Channel Islands contain the largest California sea lion rookeries in the United States, which serve as their primary breeding and pupping area. (Lowry *et al.* 2017). The primary breeding season is from May through July. Most pups are typically born in late June and weaned six to nine months later. California sea lions are found year-round in southern California, but all age and sex classes are only present at the same time during the breeding season; sub-adult and adult males migrate north, regularly as far north as British Columbia, Canada, during the non-breeding season. California sea lions are regularly sighted at-sea and hauled out on mainland beaches (Carretta 2019).

**Pacific Harbor seal (*Phoca vitulina richardii*):** This subspecies of harbor seal ranges from the Bering Sea to central Baja California. Harbor seals haul out to breed, pup, molt and rest. They have high site fidelity and are often known to use the same haul out site throughout their life (Lowry *et al.* 2008). Breeding and pupping occur during winter and spring; pupping dates vary latitudinally with later pupping dates occurring at rookeries farther north. There are haul outs in the Channel Islands and on mainland beaches in southern California, and there are several along the coast line of Santa Barbara and Ventura counties (Lowry *et al.* 2008).

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<sup>1</sup> The taxonomy of common dolphins is under review at the time of writing of this report. *Delphinus capensis* was the species name ascribed to the long-beaked common dolphin in 1994, and the current subspecies designation is a recent revision by the Taxonomy Committee, Society of Marine Mammals (<https://www.marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/>).

**Northern elephant seal (*Mirounga angustirostris*):** This species hauls out on Channel Islands and mainland beaches to breed, pup and molt (Caretta 2019). Breeding and pupping occur from December to March, and pups are weaned after 1 month. Molting takes place in spring (LeBeouf *et al.* 1994).

### **c. Potential routes of exposure and toxicological effects**

Both cetaceans and pinnipeds can be exposed to oil via inhalation, aspiration, ingestion of contaminated prey or water, and dermal exposure, especially through the eyes or other wounds and lesions. External oiling has been documented to cause lesions in harbor seals (Spraker *et al.* 1994). External oiling of fur (fur seals) or flippers (California sea lions or harbor seals) can also affect thermoregulation (Lipscomb *et al.* 1994; Odell 1974).

Exposure to oil can lead to damage to liver and kidneys and adrenal systems, suppression of the immune system and reproductive failure (Englehardt 1983). The *Exxon Valdez* oil spill affected killer whales (cetaceans), harbor seals and other pinnipeds, and sea otters, in some cases causing population level effects lasting decades (Loughlin 1992; Matkin *et al.* 2008). More recent studies, undertaken for the *Deepwater Horizon* oil spill natural resource damage assessment (NRDA), discussed in a special edition of *Endangered Species Research*, document post-spill effects such as lung disease, impaired stress response, immune system impairment, reproductive failure and reduced survivorship (Wallace *et al.* 2017 and associated papers).

## **2. Marine Mammal Studies and Data sources**

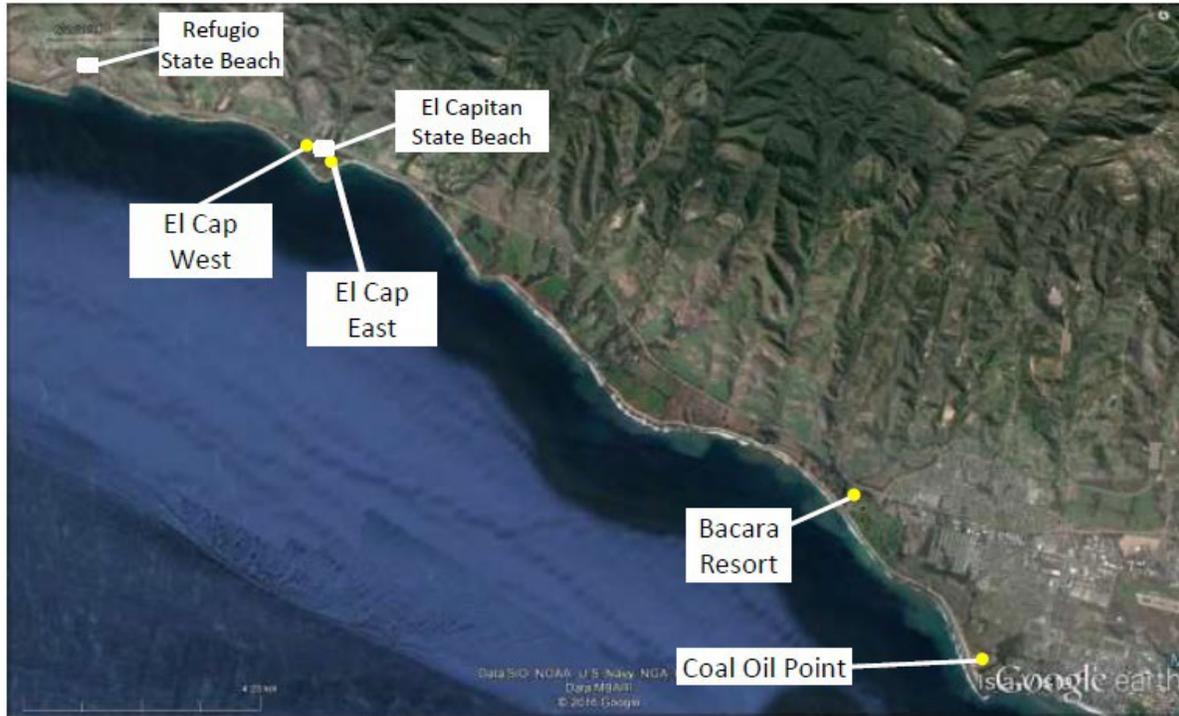
For the RBOS NRDA, the Trustees first documented exposure by reviewing Incident Command overflights and conducting NRDA boat surveys along the Gaviota coast for several weeks after the spill to determine what species were likely present during the spill.

The Trustees considered the magnitude and duration of the spill, presence of other environmental stressors and a documented increase in strandings during the weeks after the oil spill and focused their assessment on acute mortality as the basis for injury determination and quantification.

### **a. Pre-assessment marine mammal surveys**

The first phase of the marine mammal injury assessment consisted of surveys designed to (1) document the presence and count of cetacean and pinniped species following the oil spill and (2) conduct photo-id surveys in the response area for bottlenose dolphins. Scientists from NOAA NMFS's SWFSC conducted eleven days of land-based surveys at four locations around El Capitan State Beach from May 24, 2015, through June 7, 2015 (Figure 1).

Figure 1. Shore-based survey locations (Defran *et al.* 2017)



Sixty-six sightings of marine mammals were observed over the eleven shore-based survey days, including gray whales, bottlenose dolphins, long-beaked common dolphins, California sea lions, and harbor seals (Table 1).

Table 1. Daily summary of marine mammal sightings during shore-based surveys in 2015

Species	5/24	5/25	5/27	5/30	5/31	6/1	6/3	6/4	6/5	6/6	6/7	Total
Dolphin, Coastal Bottlenose	1	1	2	0	1	3	0	1	0	2	1	12
Dolphin, Long-beaked Common	0	0	0	2	0	0	0	0	0	0	0	2
Dolphin, Common, unidentified to species	0	0	0	0	0	0	0	0	0	0	1	1
Dolphin, unidentified to species	0	0	0	0	0	0	0	0	0	1	0	1
Pinniped, California Sea Lion	1	2	2	7	7	3	0	0	5	1	3	31
Pinniped, Harbor Seal	0	0	3	1	1	2	2	0	0	1	0	10
Pinniped, unidentified to species	0	0	1	0	0	0	0	0	0	0	0	1
Whale, Gray	0	0	1	2	0	0	1	0	0	0	0	4
Whale, Humpback	0	0	0	1	0	0	0	0	0	1	0	2
Whale, unidentified to species	0	0	0	0	0	0	0	1	1	0	0	2

Scientists from NOAA NMFS’s SWFSC also conducted six days of boat-based surveys for the NRDA between June 2 and June 7, 2015, and reported 76 sighting events and over 1000 individual marine mammals (Table 2). Maps of tracklines and sightings are given in Appendix 1 of this technical report.

Table 2. Daily summary of marine mammal sightings (and average group size per sighting) during boat-based surveys in 2015

Species	6/2	6/3	6/4	6/5	6/6	6/7	Total sighting
Dolphin, Coastal Bottlenose	0	2 (5)	3 (3)	2 (6)	2 (7)	4 (4)	13
Dolphin, Long-beaked Common	1 (1050)	3 (42)	0	1 (70)	0	6 (205)	11
Dolphin, Common, unidentified to species	1 (41)	0	0	0	0	0	1
Pinniped, California Sea Lion	6 (7)	3 (7)	4 (1)	3 (1)	8 (1)	5 (7)	29
Pinniped, Harbor Seal	1 (1)	1 (1)	4 (1)	0	6 (1)	4 (2)	16
Whale, Gray	1 (2)	0	1 (2)	0	0	1 (2)	3
Whale, Humpback	0	1 (2)	0	2 (1)	0	1 (14)	4

These surveys provided documentation of marine mammal species and numbers in the area affected by the oil spill (Defran *et al.* 2017).

Analyses of the photo-identification data collected for bottlenose dolphins estimated that approximately 20% of the coastal bottlenose dolphin population was present during the survey period (Defran *et al.* 2017). However, no bottlenose dolphins stranded during the response period, and no further studies were initiated.

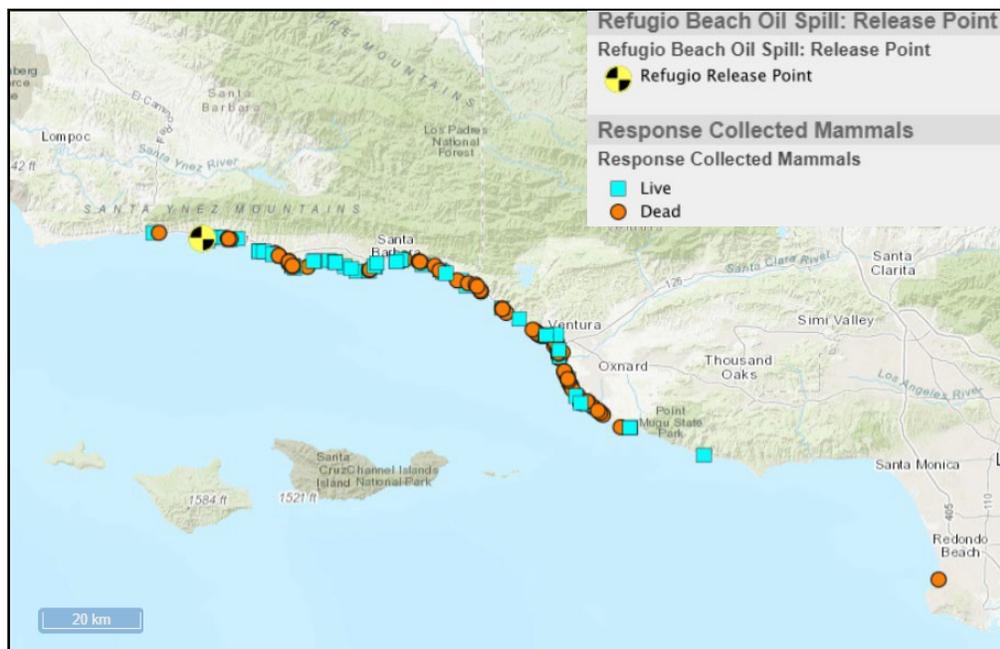
In summary, the Trustees observed over 100 sightings, comprising hundreds of individual pinnipeds (California sea lions and harbor seals), dolphins (coastal bottlenose dolphins and long-beaked common dolphins) and whales (humpback whales and gray whales) along the Gaviota Coast three weeks after the spill.

#### **b. Wildlife Intake Logs**

The Wildlife Branch of the Incident Command responded to live and dead marine mammal strandings following guidelines in Ziccardi *et al.* (2015). The Wildlife Branch was activated on May 19, 2015, and field activities ended on June 24, 2015. During the response, the Wildlife Branch screened stranding reports and primarily responded to those reports that noted animals with visible oiling. Reports of animals that were not visibly oiled were responded to by the California Marine Mammal Stranding Network (CAMMSN), discussed below. All activities were coordinated by the Wildlife Branch, which also maintained the intake logs (i.e., date and location of collection, species, sex, and age-stage class). Animals collected by the Wildlife Branch were transported to Sea World, San Diego, including both live animals for rehabilitation

and dead animals for necropsy. The Trustees used the intake data as the basis for documenting mortality of marine mammals following the spill. Strandings associated with this incident took place mainly in Santa Barbara and Ventura Counties (Figure 2).

Figure 2 Wildlife Branch stranded mammal collections, live and dead following the RBOS

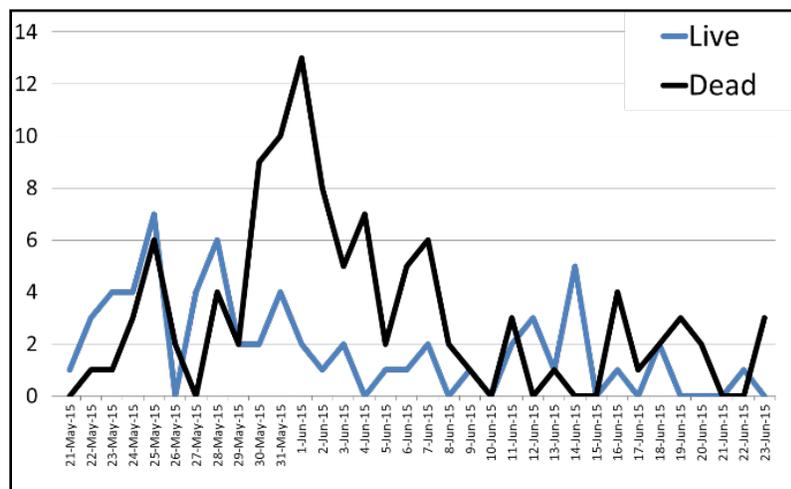


There were 106 dead and 62 live marine mammal strandings documented by the Wildlife Branch in the response area<sup>2</sup> (Figure 3, Appendix 1). Of the 62 collected alive, 24 were rehabilitated and released. Several were tagged to follow their movements. Subsequent stranding reports documented four of the released animals stranded dead in the months following their release. Of the 168 animals recorded there were 138 California sea lions, 15 long-beaked common dolphins, 9 northern elephant seals, and 2 harbor seals. The rest were unidentified species.

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<sup>2</sup>These numbers differ from those reported by OSPR (2016) reflecting data quality check of records that occurred after the OSPR report. OSPR (2016) reported 99 dead and 63 live marine mammals.

Figure 3. Daily intake of stranded marine mammals by the Wildlife Branch



### c. California Marine Mammal Stranding Network Reports

The California Marine Mammal Stranding Network (CAMMSN) has been well established in California for decades, and there is a long time series of data available to characterize spatiotemporal stranding patterns. General information on marine mammals strandings, rescue and rehabilitation, including data documentation, can be found in Geraci and Lounsbury (1993)

CAMMSN data were used in two ways: (1) to determine baseline strandings in Santa Barbara and Ventura Counties, and (2) to capture records of strandings in Santa Barbara and Ventura Counties in May – July 7, 2015, that were not recorded by the Wildlife Branch of the Incident Command, (for reasons described below), in order to have a complete stranding record for injury evaluation. Generally, the Trustees used CAMMSN data from 2000 through July 7, 2015, for baseline purposes. The year 2000 was selected because a Pacific Decadal Oscillation shift occurred about that time. This was a shift to a cool oceanographic regime (Chavez *et al.* 2003), which has been shown to influence strandings in the Southern California Bight (Danil *et al.* 2010). Although the RBOS Wildlife Branch ceased operation on June 24, 2015, the Trustees extended consideration of stranding data for another two weeks to July 7, 2015 because post oil spill strandings were elevated above the 2015 mean until the week of July 5, 2015.

However, for California sea lions the Trustees used only 2015 stranding data to determine baseline. A California sea lion Unusual Mortality Event (UME) was declared in January 2013 and was ongoing at the time of the RBOS. An early assessment of the UME revealed ecological factors, specifically limited prey availability, as the likely cause (McClatchie *et al.* 2016). In addition for 2015, there was an unprecedented number of pups stranding early in the year across the state (i.e., January through May). Peak strandings for pups are typically observed later in May and June coincident with weaning. Because of this anomaly, the Trustees believed that past years' stranding records would not serve as an appropriate baseline for comparison to 2015. For the purposes of NRDA, stranding patterns of California sea lion pups considered only the 2015 records to inform the likely expected stranding rates during the RBOS response period.

The 2015 CAMMSN records were also reviewed for strandings in Santa Barbara and Ventura Counties that occurred during the RBOS response period that were not handled by the Wildlife Branch. As noted in the previous section, during the response, the Wildlife Branch responded primarily to stranding reports that noted animals with visible oiling. Stranding reports of animals that were not visibly oiled were responded to by the CAMMSN. This protocol was necessary to ensure response to the large number of strandings that were occurring at this time. Furthermore, assembling all stranding records for this area was essential to compare stranding rates to baseline expectations.

The compiled data set of post-spill strandings was further reviewed to identify pre-spill strandings and other sources of mortality. The Trustees considered an advanced state of decomposition in the week to 10 days following the spill as evidence of a likely pre-spill stranding.

Table 3 provides the summary of all the strandings (live and dead) from May 19 through July 7, 2015, including both wildlife response and CAMMSN records.

Table 3. Total live and dead marine mammals strandings from May 19 through July 7, 2015 (Wildlife Branch and CAMMSN).

<b>Species</b>	<b>Total Recovered</b>	<b>Number of total reported oiled</b>
Dolphin, long-beaked common	22	3
Dolphin, bottlenose	1	0
Pinniped, California sea lion	221	79
Pinniped, northern elephant seal	9	7
Pinniped, harbor seal	2	2
Unidentified, marine mammals	9	1
<b>Total</b>	<b>264</b>	<b>93</b>

### **3. Assessment and Quantification**

The Trustees used both Wildlife Branch intake logs and CAMMSN data to evaluate marine mammal strandings from May 19 to July 7, 2015, as compared to baseline (expected number of strandings had the spill not occurred), after accounting for likely pre-spill mortality and mortality due to fishing interactions (or other non-spill-related causes). Finally, a correction factor was applied to account for mammals that died and were scavenged or otherwise did not strand on the beach (and so, were not recovered). This section discusses the steps undertaken by the Trustees to calculate baseline, remove pre-spill and fishery interaction or other non-spill related deaths, and apply a correction factor to achieve final injury numbers.

California sea lions:

CAMMSN stranding response data and wildlife intake logs for all of 2015 in Santa Barbara and Ventura counties were used to estimate the expected, or baseline, number of strandings during the RBOS response period.

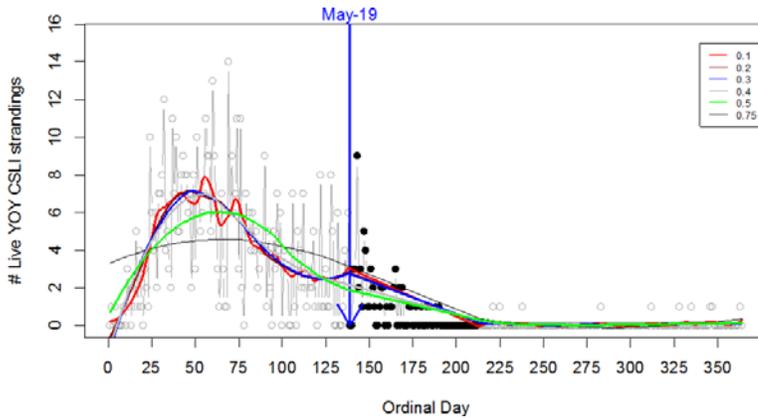
a. Calculate baseline

Baseline was estimated for live stranded sea lions using stranding records, because a more complete record of stranding data exists for live California sea lions in this area. For dead sea lions, the Trustees did not generate a separate, independent baseline. Rather, they assumed the proportion of expected live animals in the absence of a spill (baseline) compared to the number of observed live animals would be the same as the proportion of expected dead animals in the absence of a spill (baseline) compared to the number of observed dead animals. They calculated the ratio using the available data on live animal strandings and then applied that same ratio to dead animals. For example, if the estimated baseline number of live strandings was 3 and there were 12 observed, the ratio would be  $3/12=0.25$ . If there were 20 dead strandings, applying that same ratio would yield a dead animal stranding baseline of 5 ( $0.25 \times 20 = 5$ ). Therefore, out of 32 live and dead strandings, 8 would be considered baseline.

Three age class categories were considered for calculating baseline strandings for California sea lions. As noted above and described in detail below, due to unusual conditions in 2015, the Trustees considered only 2015 stranding data

- Young-of-the-Year (YOY): This category includes pups and yearlings. The Trustees estimated baseline (predicted strandings without a spill) by fitting a model to all 2015 data collected by the CAMMSN pre- and post-spill in 2015 (Figure 4). A nonparametric, locally weighted regression method was used to fit a smooth curve to the 2015 daily recovery data for live young-of-the-year (YOY) California sea lions in Santa Barbara and Ventura Counties using the LOESS function in the R statistical package.
- Adults: This category includes juveniles, sub-adults and adults (i.e., age 2+): Trustees calculated the average number of live California sea lions observed stranded weekly by the CAMMSN in 2015 to determine baseline.
- Unknown age class: The Trustees apportioned on the basis of observed YOY:Adult ratios.

Figure 4. Modeling to predict YOY baseline strandings. The open circles are recoveries made by members of the California Marine Mammal Stranding Network (CAMMSN), and the filled circles are recoveries made during the post-spill response period to July 7, 2015. All 2015 data were used to fit the model. Span settings influence the degree of smoothing and those ranging from 0.1 to 0.5 provided the best fit to the observed data and predicted strandings ranging from 59 to 63 for the post-spill period. Span = 0.75 is the default setting, and the legend shows the color coding for span settings.



b. Remove pre-spill strandings

According to the Marine Mammal Stranding Level A Report Examiners Manual, condition codes are recorded for each stranding as follows: Code 1 (alive); Code 2 (fresh dead); Code 3 (moderate decomposition); Code 4 (advanced decomposition), or Code 5 (mummified/skeletal) (NMFS 2020). For the purposes of the NRDA, all strandings were classified as pre-spill if they were Code 5. Code 4 animals found within ten days (before May 29, 2015) of the oil spill were also considered to be pre-spill. All identified pre-spill strandings were removed from the data set.

c. Remove mortalities attributable to other causes

All records were reviewed for other obvious, non-oil spill related causes of death. The most likely of these being fishery interactions. When field notes indicated stranding was likely attributable to fishery interactions, they were removed from consideration.

d. Calculate mortalities attributable to the RBOS

The Trustees estimated the number of strandings attributable to the spill by subtracting the calculated baseline strandings, pre-spill mortality, and strandings attributable to other causes, from the total number of live and dead California sea lions recovered. The results are summarized in Table 4.

Table 4. California sea lion strandings attributed to RBOS

Category	Number
Total recovered from 5/10 – 7/7/2015 (Live and dead)	221
Pre-spill	40
Fishery related	0
Baseline	87
Attributed to RBOS	94

Other species:

a. Calculate baseline

In the absence of a UME for other species at the time of the RBOS, and with lower numbers of strandings in general, the CAMMSN stranding data from 2000-2014 in Santa Barbara and Ventura Counties were used to estimate baseline post spill for long-beaked common dolphins, Northern elephant seals and Pacific harbor seals (Table 5).

Table 5. Baseline strandings for long-beaked common dolphins, northern elephant seals and harbor seals. The number of strandings expected during the 5 week response period (5/19-6/23/2015) was estimated from the average stranding rates previously observed during the same time period in prior years (i.e., 2000-2014.) Values are rounded to the nearest whole animal. Data sources: CAMMSN\_2000-2014.xlsx. [YOY = Young-of-the-year].

Species	Dead expected			Live expected		
	YOY	Adult	Total	YOY	Adult	Total
Long-beaked common dolphin	0	2	2	0	0	0
Northern elephant seal	2	0	2	0	3	3
Harbor seal	0	0	0	1	0	1

Strandings of all species except California sea lions are relatively rare in the response area but with high inter-annual variability. For example, the long-beaked common dolphin has had several years where UMEs led to a high baseline. Further, a high percentage of northern elephant seals and harbor seals were oiled (Table 3). Therefore, each stranding record was reviewed to determine whether to omit the record from consideration as a potentially ‘spill related’ stranding.

b. Remove pre-spill strandings

As with California sea lions, for the purposes of the NRDA, all strandings were classified as pre-spill if they were Code 5. Code 4 animals found within ten days (before May 29, 2015) of the oil spill were also considered to be pre-spill. All identified pre-spill strandings were removed from the data set.

c. Remove mortalities attributable to other causes

All records were reviewed for other obvious, non-oil spill related causes of death, the most likely of these being fishery interactions. When field notes indicated stranding was likely attributable to fishery interactions or other causes, they were removed from consideration.

d. Calculate mortalities attributable to the RBOS

Taking into account the baseline calculations and removals due to pre-spill mortality and other causes, the Trustees estimated the number of strandings attributable to the spill. The results are summarized in Table 6.

Table 6. Summary of strandings other than California sea lions after accounting for pre-spill and other causes of mortality

Species	Dead	Live	Total Recovered	Pre-spill	Fishery related	Baseline	Spill related
Dolphin, long-beaked common	22	0	<b>22</b>	2	2	0	<b>18</b>
Dolphin, bottlenose	1	0	<b>1</b>	0	0	0	<b>1</b>
Pinniped, northern elephant seal	1	8	<b>9</b>	1	0	0	<b>8</b>
Pinniped, harbor seal	0	2	<b>2</b>	0	0	0	<b>2</b>
Unidentified, marine mammals	9	0	<b>9</b>	9	0	0	<b>0</b>

Numbers injured—Correction Factor

To estimate the number of marine mammals injured, a ‘lost at-sea’ correction factor was applied to account for the low probability of dead marine mammals washing ashore. Beached marine mammal carcass recoveries only represent a percentage of total impacts on populations due to incomplete detection and recovery. Carcasses may not be recovered as a stranding due to the natural processes of scavenging, drifting, sinking, decomposing and removal from beaches by wave action prior to reporting. (DeGange *et al.* 1994, Cox *et al.* 1998, Eguchi 2002, Williams *et al.* 2011, Peltier *et al.* 2012, Carretta *et al.* 2016).

The Carretta *et al.* (2016) study provides a likely ‘best case scenario’ for carcass recovery for marine mammals inhabiting the nearshore waters of Santa Barbara and Ventura Counties, based on the study of coastal bottlenose dolphins. For the study, the population is estimated to be ~500 individuals when corrected for unmarked dolphins. Animals range from Ensenada, Mexico to San Francisco, CA with the core of their range in the Southern California Bight (18% south of US/Mexico) and greater than 99% of sightings occur less than 500m from shore. Ninety of 91 strandings occurred in California, and 80 of the 90 were in the Southern California Bight. That is, 89% of the data used in the carcass recovery study were collected in the Southern California Bight, therefore relevant to the location of the marine mammal strandings related to the RBOS oil spill.

For the purposes of the NRDA, the recovery rate applied to the dead cetaceans was 0.25-- the published estimate for the coastal ecotype of the common bottlenose dolphins (Carretta *et al.* 2016). This recovery rate translates to a “lost at sea” correction factor of four. That is, the total number of injured cetaceans was estimated by multiplying the stranding total by four (the “lost at sea” correction factor for cetaceans). Half of the dead cetacean “lost at sea” factor was applied to dead pinnipeds to reflect the lower probability that a pinniped dying nearshore would come ashore, but acknowledging that no published estimate is available. No correction factor was applied to live stranded pinnipeds reflecting the uncertainty in our understanding of whether a sick and dying animal is more or less likely to come ashore; there are no known publications addressing this aspect of behavior. Also, no correction factor was applied to account for injured animals that moved out of the area, potentially underestimating injury. The final injury numbers are given in Table 7.

Table 7. Final marine mammal injury numbers, after lost-at-sea factor applied

Species	Dead	Live	Total spill related strandings	Lost-at-sea factor	Est. number injured
Dolphin, long-beaked	18		18	4	72
Dolphin, bottlenose	1		1	4	4
Pinniped, California sea lion	52	42	94	2	146
Pinniped, northern elephant seal		8	8		8
Pinniped, harbor seal		2	2		2

#### 4. Other causes of mortality considered

##### Fishery bycatch

Stranded marine mammals with signs of fishery interaction are recognizable by experienced CAMMSN personnel. The typical signs are injuries associated with net or rope lacerations or missing appendages (see Byrd *et al.* 2014 and references therein). As noted, stranding records were reviewed, and any cases attributable to anthropogenic activities were removed from the post-spill stranding data set.

##### Ocean conditions and food availability

From 2013 to 2017, sea lion pups stranded in high numbers in southern California. The high stranding numbers and other factors led NMFS to declare an Unusual Mortality Event (UME) for sea lions in 2013 (NMFS 2019). Although the investigation into the UME is not complete as of the writing of this report, pups were emaciated and underweight indicating a lack of food for nursing mothers (NMFS 2019). Warm ocean conditions overall in southern California in 2013,

the emergence of “the blob<sup>3</sup>” in 2014-15 and developing El Nino conditions in 2015 reduced plankton abundance nearshore, in turn contributing to the movement of sardines and other preferred prey fish offshore, thus reducing food availability for nursing mothers (Marine Mammal Center 2015). The year 2015 saw the greatest number of sea lion pup strandings of the 2013-2017 California sea lion UME. It was unusual for both the high number and early, (February-March) peak in strandings (NMFS 2019). Although these factors were considered during the injury assessment, the Trustees determined that the 2015 ocean conditions were sufficiently reflected in the baseline analysis for sea lions.

### *Domoic acid toxicosis*

Another source of marine mammal mortality considered during the assessment was domoic acid (DA) toxicosis. In 1998 and again in 2000, NOAA NMFS declared UMEs for California sea lions. These two UMEs were largely attributed to DA toxicosis. DA is a neurotoxin produced by the alga, *Psuedonitzschia* spp. which thrive in warmer waters. Later in 2002, DA was identified as the cause of a multi-species UME, which, in addition to sea lions, included long-beaked common dolphins. A 2006 review of multiple UMEs concluded that DA should no longer be considered an “unusual” cause of death in marine mammals (Gulland 2006). Beginning in 2007, DA outbreaks were no longer declared as UMEs, and DA is now frequently detected in stranded animals. Research on DA affecting California sea lions revealed that adult females are most susceptible and that the spatio-temporal patterns of DA outbreaks differ by year and species (Greig *et al.* 2005, Bejarano *et al.* 2008, Torres de la Riva *et al.* 2009, Bargu *et al.* 2010).

No publication characterizing DA in dolphins is currently available. However, the pre-2007 DA events affecting long-beaked common dolphins were dominated by adult males, suggesting they are the most susceptible age and sex class. In 2017, a significant DA event was evident in the southern California Bight, in which 94% of San Diego County strandings tested positive for DA, and 60% of those had acutely toxic levels of the neurotoxin present.

In summary, adults of all species are typically more susceptible to DA than juveniles, and adult female California sea lions are more likely to be affected than other age and sex classes. Behavioral symptoms, particularly seizures in live animals, are a key indicator of acute toxicity. DA can also be detected in urine and fecal samples; histology of the hippocampus will also reveal exposure (Buckmaster *et al.* 2014).

It is also well known that DA events typically follow El Nino events, and those environmental conditions in 2015 led to an unprecedented DA event that affected the United States coastline from central CA up to AK (McCabe *et al.* 2016). During 2015 in Santa Barbara County, water samples indicated high *Psuedonitzschia* counts at Stearns wharf (in Santa Barbara) in the spring and summer of 2015. And although fisheries were closed later in the summer, the Trustees are not aware of any obvious indicators of a DA outbreak among marine mammals recovered from the Gaviota Coast following the spill. Also the Trustees are not aware of any reports of DA toxicosis among the oiled and distressed animals in rehab from the spill. Samples from recovered dead and live marine mammals would likely have indicated whether the mammals were exposed

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<sup>3</sup>In 2013 and lasting until 2016, a large mass of warm water persisted along the U.S. West coast, dubbed “The Blob,” affecting ocean circulation and productivity. This is a separate phenomenon from El Nino weather patterns.

to DA, but unfortunately the Trustees were unable to obtain samples for analysis. Based on the forgoing, the Trustees did not subtract any animals from the injury estimate for potential DA toxicosis.

### Saxitoxin toxicosis

Known to affect fish and shellfish, among marine mammals, saxitoxin poisoning has been implicated in the deaths of sea otters and Mediterranean monk seals. However, testing of California marine mammals rarely detects saxitoxin (NMFS, SWFSC, unpublished data) and is not considered a primary risk factor, so it was not considered further in this assessment.

### Other disease or infections

Bacterial infections (e.g., *Leptospirosis*, *Clostridium* sp.) and other diseases have been identified among stranded California marine mammals (e.g., Greig *et al.* 2005, Danil *et al.* 2014). However, none of them are considered primary risk factors for dolphins, and no unusual cases were reported in 2015.

## **5. Restoration Equivalency**

The Trustees calculated a loss of 156 pinnipeds and 76 cetaceans (Table 7) as a result of the RBOS oil spill. The two projects selected for scaling are:

*Improving pinniped rehabilitation:* This project would assist and enhance the existing stranding network organizations that respond to live strandings in Santa Barbara and Ventura Counties. The project will supplement and improve stranding response capabilities, rehabilitation capacities, and veterinary facilities. If implemented, this increase in capacity is expected to result in an increased number of animals treated per year. The trustees estimate that at least 150 additional pinnipeds will be treated over the estimated three to seven year timeframe of the project.

*Cetacean Entanglement Response:* Nearly all entangled marine mammals die, and these deaths are often long and painful. This project would support the existing Entanglement Response Network, allowing them to respond to more entangled cetaceans. In addition to physically disentangling animals (directly reducing mortality), increased reporting and documentation will help support the adoption of other conservation management measures. NRDA funding would provide support for additional boat time, specialized gear, and hands-on training and is expected to increase the number of animals that the Entanglement Response Network can respond to and document. For example, in 2015, 49 reports of entangled cetaceans were investigated and confirmed, and, of those 49, only 11 cetaceans were successfully disentangled. The proposed budget funds response activities for seven years, potentially saving an estimated 77 additional cetaceans, while also providing valuable information on fishing interactions and how they can be prevented.

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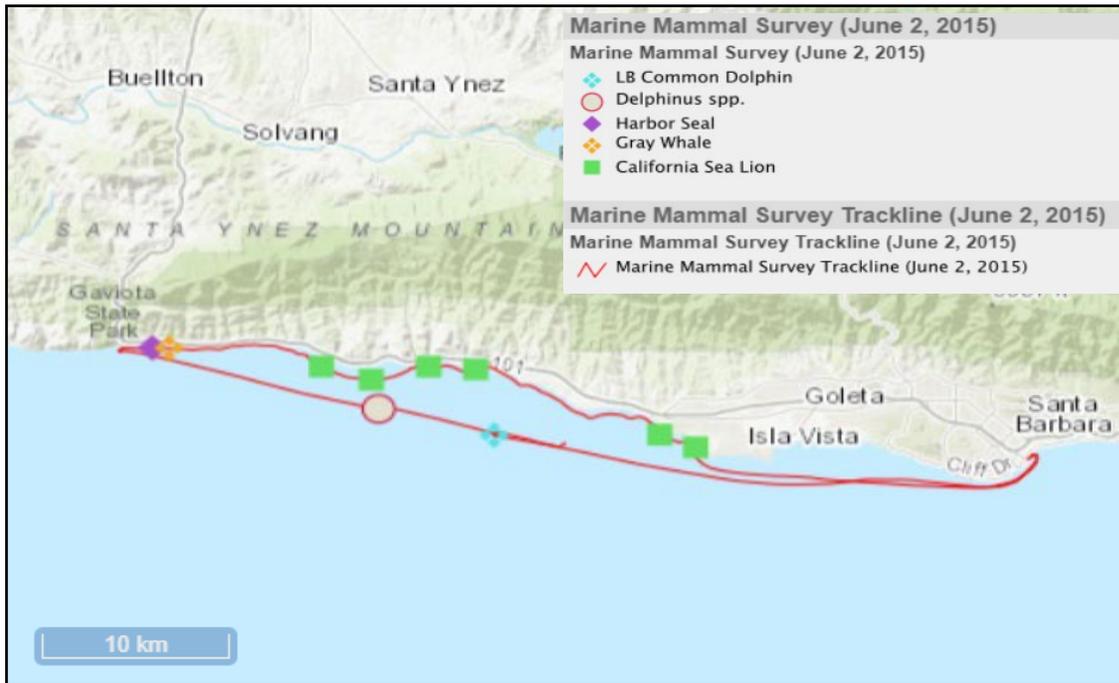
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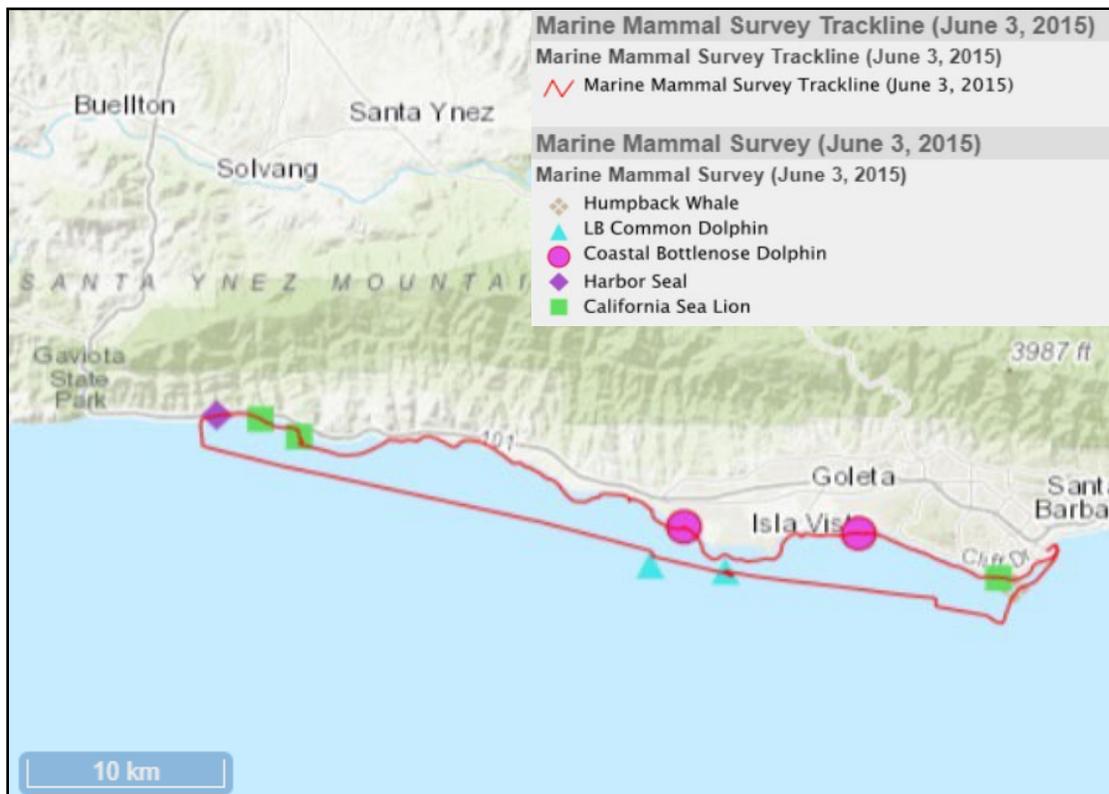
## Appendix 1

Tracklines and sightings of marine mammals from surveys conducted as part of the NRDA preassessment, June 2-7, 2015. Data are available in the RBOS Administrative Record or in ERMA.

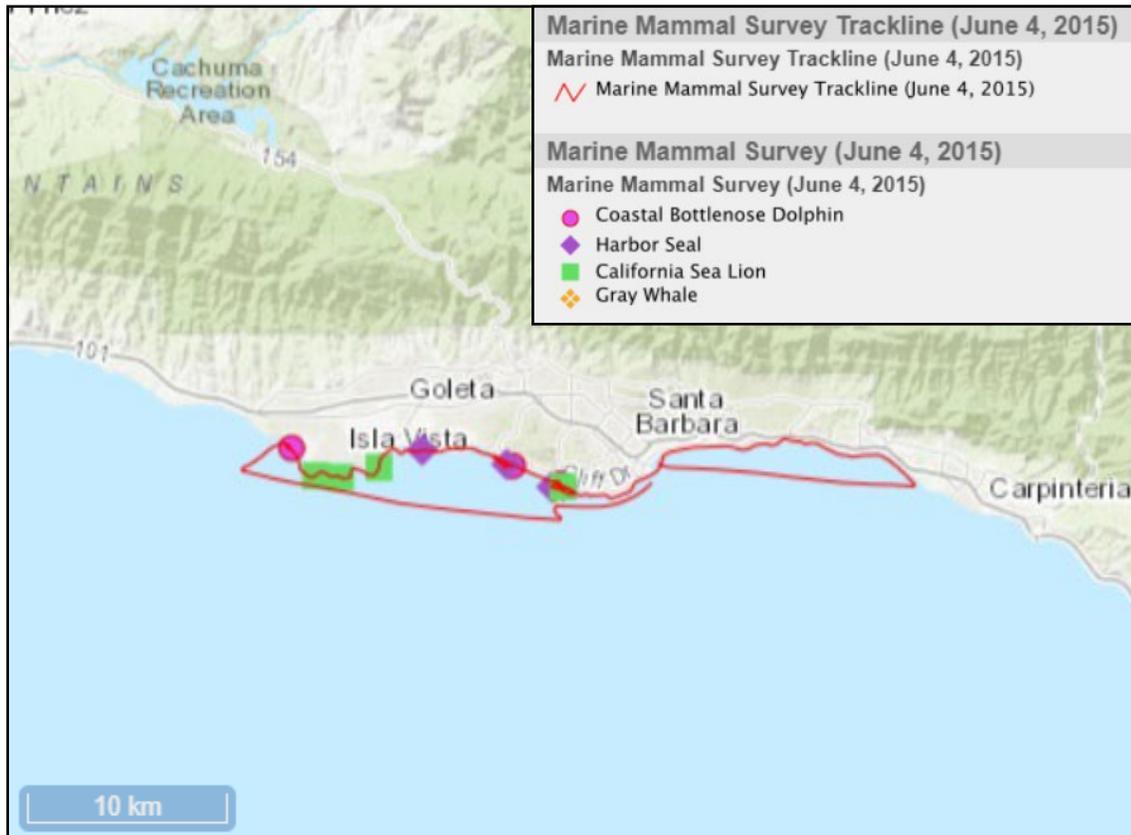
June 2, 2015



June 3, 2015



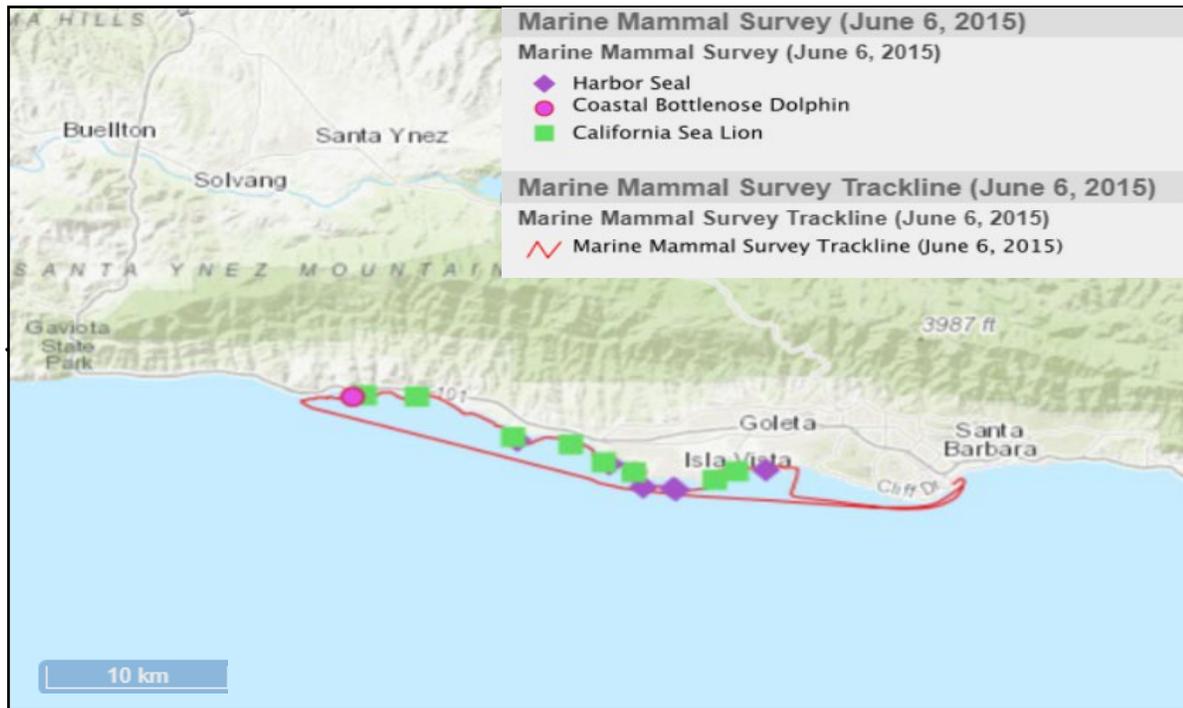
June 4, 2015



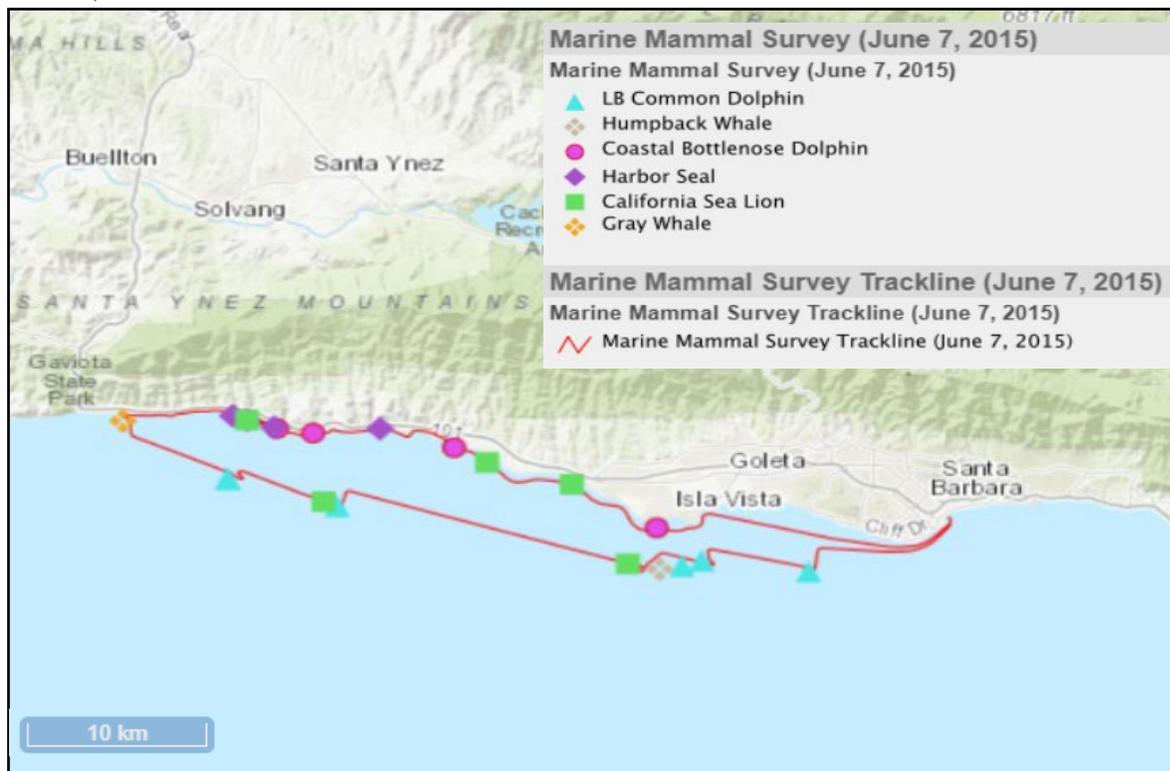
June 5, 2015



June 6, 2015



June 7, 2015



Appendix 2. Wildlife Branch intake logs for (a) dead and (b) live stranded marine mammals.

(a)

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled	Lat	Long	Species	Notes
1	5/22/2015-1	5/22/2015	FP1-D-05/22/2015-1	D-0001	blank	blank	N	blank	blank	CODO	Santa Barbara Harbor
2	5/23/2015-1	5/23/2015	WRM1-D-05/23/2015-1	D-0002	blank	1	Y	34 19 05	119 23 14	CODO	Faria Beach
3	5/24/2015-1	5/24/2015	WRM1-D-05/24/2015-1	D-0004	Y	Y	Y	34.42669	-119.90932	CSLI	Bacara Beach
4	5/24/2015-2	5/24/2015	WRM1-D-5/24/2015-2	D-0005	Y	Y	Y	34.42776	-119.9108	CSLI	Bacara Beach
5	5/24/2015-3	5/24/2015	WRM3-D-5/24/2015-1	D-0006	N	blank	N	34.1936	-119.235	CSLI	Rincon Pt.
6	5/25/2015-1	5/25/2015	WRM3-D-5/25/2015-1	D-0003	N	blank	N	38.21286	-122.12558	CODO	near Oxnard Beach
7	5/25/2015-3	5/25/2015	WRM115-D-5/25/2015-2	D-0007	N	blank	N	34.42	-119.62	CSLI	Miramar Beach
8		5/25/2015	WRM12-D-5/25/2015-1	D-0010	U	Y	Y	34.41672	-119.58891	CSLI	Loon Pt
9		5/25/2015	WRM3-D-5/25/2015-2	D-0092	U	cbd	CBD	34.20507	-119.25331	CODO	Oxnard Power Plant
10	5/25/2015-2	5/25/2015	WRM-D-5/25/2015-1	D-0008	N	Y	Y	34.406	-119.844	CSLI	Campus Pt. Beach
11		5/25/2015	WRM5/4-D-5/25/2015-2	D-0009	N	Y	Y	34.43232	-119.91868	CSLI	Haskell's/Bacara Beach
12		5/26/2015	WRM1-D-05/26/2015-1	D-0011	N	N	N	34.28342	-119.3204	CODO	Emma Wood
13	5/26/2015-1	5/26/2015	WRM7-D-5/26/2015-1	D-0012	Y <2%	Y	Y	34.45819	-120.02433	CSLI	El Capitan
14	5/28/2015-1	5/28/2015	WRM1-D-5/28/2015-1	D-0013	Y	Y	Y	34.38	-119.5	CSLI	Bates Beach
15	5/28/2015-2	5/28/2015	WRM17-D-5/28/2015-1	D-0015	Y	Y	Y	34.23191	-119.26501	CSLI	Surfers Knoll
16	5/28/2015-3	5/28/2015	WRM3-D-5/28/2015-1	D-0016	N	BLANK	N	34.4151	-119.58395	CSLI	Loon Point
17	5/28/2015-4	5/28/2015	WRM3-D-5/28/2015-2	D-0017	Unk	blank	N	34.4071	-119.8778	CSLI	Coal Oil Point
18		5/29/2015	WRM2-L-05/29/2015-1	D-0024	Y	Y	Y	34.2556	-119.277	CSLI	Terminus of Nathan Lane
19	5/29/2015-1	5/29/2015	WRM4-L-05/29/2015-1	D-0032	N	blank	N	34.39783	-119.70286	CSLI	Leadbetter Beach; animal that went to CIMWI, died there and then went to SWSD for necropsy?
20	5/30/2015-2	5/30/2015	WRM9-D-5/30/2015-1	D-0020	Y	Y	Y	34.23443	-119.2655	CSLI	Ventura Beach S. of Harbor
21	5/30/2015-3	5/30/2015	WRM9-D-5/30/2015-2	D-0021	N	N	N	34.23443	-119.2655	CSLI	Ventura Beaches
22	5/30/2015-4	5/30/2015	WRM9-D-5/30/2015-3	D-0022	Y	Y	Y	34.23085	-119.26465	CSLI	Ventura Beaches
23	5/30/2015-5	5/30/2015	WRM9-D-5/30/2015-4	D-0023	N	N	N	34.14588	-119.21612	CSLI	Silver Strand

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled	Lat	Long	Species	Notes
24	5/30/2015-1	5/30/2015	WRM7-D-5/30/2015-1	D-0025	U	N	N	34.39943	-119.70232	CSLI	Leadbetter Beach
25		5/30/2015	WRM9-D-5/30/2015-7	D-0030	Y	N	N	34.13066	-119.17595	CSLI	Port Hueneme
26		5/30/2015	WRM9-D-5/30/2015-8	D-0031	U	Y	Y	34.13881	-119.18924	CSLI	Port Hueneme
27		5/30/2015	WRM9-D-5/30/2015-6	D-0028	N	Y	Y	34.13045	-119.17585	CSLI	Port Hueneme
28		5/30/2015	WRM9-D-5/30/2015-5	D-0029	N	Y	Y	34.13715	-119.18632	CSLI	Port Hueneme
29	5/31/2015-1	5/31/2015	WRM2-D-5/31/2015-2	D-0026	U	CBD	CBD	34.27357	-119.30402	CETA	Ventura County Fairground
30	5/31/2015-10	5/31/2015	WRM2-D-5/31/2015-1	D-0027		N	N	34.27417	-119.29954	CSLI	Surfers Point Park
31	5/31/2015-4	5/31/2015	WRM3-D-5/31/2015-1	D-0033	N	blank	N	34.12517	-119.16836	CSLI	Port Hueneme
32	5/31/2015-5	5/31/2015	WRM3-D-5/31/2015-2	D-0034	N	blank	N	34.12285	-119.16505	CSLI	Port Hueneme
33	5/31/2015-6	5/31/2015	WRM3-D-5/31/2015-3	D-0035	Y 2%	Y	Y	34.1286	-119.17304	CSLI	Port Hueneme
34	5/31/2015-7	5/31/2015	WRM3-D-5/31/2015-4	D-0036	N	blank	N	34.13009	-119.17532	CSLI	Port Hueneme
35	5/31/2015-8	5/31/2015	WRM3-D-5/31/2015-5	D-0039	N	blank	N	34.14522	-119.21674	CSLI	Silver Strand
36	5/31/2015-2	5/31/2015	WRM2-D-5/31/2015-4	D-0040	U	blank	CBD	34.27816	-119.31464	CODO	Emma Wood State Beach
37	5/31/2015-9	5/31/2015	WRM1-D-5/31/2015-1	D-0037	Y 2%	blank	Y	34.40821	-119.55162	CSLI	Padaro Beach
38	5/31/2015-3	5/31/2015	WRM2-D-5/31/2015-3	D-0038	U	Y	Y	34.2719	-119.28491	CSLI	San Buenaventura
39	6/1/2015-12	6/1/2015	WRM3-D-6/1/2015-4	D-0041	N	CBD	CBD	34.27653	-119.31202	CSLI	Surfers Point
40	6/1/2015-2	6/1/2015	WRM3-D-6/1/2015-2	D-0042	N	CBD	CBD	34.46021	-120.02773	CSLI	El Capitan
41	6/1/2015-4	6/1/2015	WRM9-D-6/1/2015-1	D-0043	U	CBD	CBD	34.17688	-119.23786	MAMA	Ocean Beach
42	6/1/2015-8	6/1/2015	WRM9-D-6/1/2015-5	D-0044	N	N	N	34.19975	-119.25009	CSLI	Mandalay Co. Park
43	6/1/2015-5	6/1/2015	WRM9-D-6/1/2015-2	D-0047	N	N	N	34.17709	-119.23809	CSLI	Ocean Beach
44	6/1/2015-11	6/1/2015	WRM4-D-6/1/2015-2	D-0050	U	N	N	34.25538	-119.27101	CSLI	San Buenaventura
45	6/1/2015-13	6/1/2015	WRM3-D-6/1/2015-5	D-0051	N	N	N	34.27474	-119.30867	NESE	Surfers Point
46	6/1/2015-3	6/1/2015	WRM3-D-6/1/2015-3	D-0052	N	N	N	34.37469	-119.4749	CSLI	Rincon
47	6/1/2015-6	6/1/2015	WRM9-D-6/1/2015-3	D-0057	N	N	N	34.18745	-119.24387	CODO	Mandalay Beach
48	6/1/2015-1	6/1/2015	WRM4-D-6/1/2015-1	D-0058	Y 2%	Y	Y	34.0991449	119.1240841	CODO	Point Mugu
49	6/1/2015-10	6/1/2015	WRM9-D-6/1/2015-7	D-0059	N	N	N	34.20519	-119.2534	CETA	Mandalay Power Plant
50	6/1/2015-7	6/1/2015	WRM9-D-6/1/2015-4	D-0053	N	Y	Y	34.19855	-119.24963	CSLI	Mandalay Co. Park
51	6/1/2015-9	6/1/2015	WRM9-D-6/1/2015-6	D-0060	N	Y	Y	34.20151	-119.2513	CSLI	Mandalay Bay
52	6/2/2015-5	6/2/2015	WRM2-D-6/2/2015-1	D-0045	U	N	N	34.27974	-119.31656	CSLI	Emma Woods

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled	Lat	Long	Species	Notes
53	6/2/2015-3	6/2/2015	WRM1-D-6/2/2015-2	D-0046	N	N	N	35.15982	-119.22227	CSLI	Kiddie Beach
54	6/2/2015-2	6/2/2015	WRM1-D-6/2/2015-1	D-0048	N	N	N	34.14624	-119.21631	CSLI	Silver Strand
55	6/2/2015-6	6/2/2015	WRM1-D-6/2/2015-3	D-0049	U	N	N	34.23754	-119.26647	MAMA	Spinnacer Point
56	6/2/2015-4	6/2/2015	WRM7-D-6/2/2015-1	D-0061	N	N	N	34.2795	-119.31644	CODO	Emma Woods
57	6/2/2015-8	6/2/2015	WRM4-D-6/2/2015-1	D-0063	N	N	N	34.41305	-119.88756	CSLI	Santa Barbara Harbor
58	6/2/2015-7	6/2/2015	WRM6-L-6/2/2015-1	D-0065	Y	Y	Y	34.307316	-119.87903	CSLI	Coal Oil Point
59	6/2/2015-1	6/2/2015	WRM3-D-6/2/2015-1	D-0056	N	Y	Y	34.27665	-119.31247	CODO	Surfers Point
60	6/3/2015-2	6/3/2015	WRM2-D-6/3/2015-2	D-0054	N	N	N	34.35934	-119.44569	MAMA	Mussel Shoals Beach
61	6/3/2015-1	6/3/2015	WRM2-D-6/3/2015-1	D-0062	N	CBD	CBD	34.35883	-119.44519	CSLI	Mussel Shoals Beach
62	6/3/2015-4	6/3/2015	WRM2-D-6/3/2015-3	D-0066	Y 2%	Y	Y	34.12691	-119.17101	CSLI	Ormond Beach
63	6/3/2015-5	6/3/2015	WRM2-D-6/3/2015-4	D-0067	N	N	N	34.17146	-119.23532	CODO	Hollywood Beach
64	6/3/2015-3	6/3/2015	WRM7-D-6/3/2015-1	D-0055	N	Y	Y	34.2572882	119.2713985	MAMA	San Buenaventura
65	6/4/2015-7	6/4/2015	WRM2-D-6/4/2015-3	D-0068	N	N	N	34.41624	-119.8869	CSLI	Deverony
66	6/4/2015-2	6/4/2015	WRM-8-6/4/2015-1	D-0070	CBD	N	N	34.1485	-119.20156	CSLI	Port Hueneme
67	6/4/2015-3	6/4/2015	WRM-8-6/4/2015-2	D-0071	CBD	N	N	34.1485	-119.20156	CSLI	Port Hueneme
68	6/4/2015-6	6/4/2015	WRM2-D-6/4/2015-2	D-0072	N	N	N	34.41622	-119.88669	CSLI	Deverony
69	6/4/2015-5	6/4/2015	WRM2-D-6/4/2015-1	D-0073	N	N	N	34.45917	-120.02106	CSLI	El Capitan
70	6/4/2015-4	6/4/2015	WRM-8-D-6/4/2015-2	D-0074	CBD	Y	Y	34.1485	-119.20156	CSLI	Port Hueneme
71	6/4/2015-1	6/4/2015	WRM5-D-6/4/2015-1	D-0076	N	Y	Y	34.41593	-119.5859	CSLI	Loon Pt Beach
72		6/4/2015	WRM7-D-06/04/2015-1	D-0094	N		N	34.40082	-119.70087	CSLI	Leadbetter Beach
73	6/5/2015-1	6/5/2015	WRM3-D-6/5/2015-1	D-0069	N	N	N	34.19516	-119.24764	CSLI	Mandalay State Beach
74	6/5/2015-2	6/5/2015	WRM4-D-6/5/2015-1	D-0075	CBD	N	N	34.325347	-119.395871	CSLI	Faria Beach site 82
75	6/6/2015-1	6/6/2015	WRM2-D-6/6/2015-1	D-0077	N	Y	Y	34.36101	-119.4472	CSLI	Mussel Shoals Beach
76	6/6/2015-2	6/6/2015	WRM2-D-6/6/2015-2	D-0080	N	N	N	34.36863	-119.45403	CSLI	Mussel Shoals Beach
77	6/6/2015-3	6/6/2015	WRM2-D-6/6/2015-3	D-0079	N	N	N	34.37199	-119.45758	CSLI	Mussel Shoals Beach
78	6/6/2015-4	6/6/2015	WRM3-D-6/6/2015-1	D-0078	CBD	N	N	34.471167	-120.185733	CSLI	East Gaviota Canyon
79	6/6/2015-5	6/6/2015	WRM2-D-6/6/2015-4	D-0083	CBD	N	N	34.28586	-119.32653	CSLI	Emma Wood
80		6/7/2015	WRM2-D-6/7/2015-1	D-0081	N	N	N	34.20647	-119.25383	CSLI	McGrath State Beach
81		6/7/2015	WRM3-D-6/7/2015-3	D-0082	N	N	N	34.24002	-119.26634	PINN	Surfers Knoll

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled	Lat	Long	Species	Notes
82		6/7/2015	WRM3-D-6/7/2015-2	D-0084	Y 2%	Y	Y	34 24 273	119 26 716	CSLI	Surfers Knoll
83		6/7/2015		D-0085		N	N	34.24.251	119.25.775	PINN	Surfers Knoll
84		6/7/2015	WRM2-D-6/7/2015-2	D-0086	N	N	N	34.24122	-119.26749	CODO	Surfers Knoll
85		6/7/2015	WRM1-D-6/7/2015-3	D-0090	N	N	N	34.399154	-119.54042	CODO	Sand Point, Carpinteria
86		6/8/2015	WRM1-D-6/8/2015-1	D-0088	Y 2%	Y	Y	34.1877	-119.2379	CSLI	Mandalay State Beach
87		6/8/2015	WRM1-D-6/8/2015-2	D-0089	N	N	N	34.19151	-119.24577	CSLI	Mandalay State Beach
88		6/8/2015	WRM2-D-6/8/2015-1	D-0091	N		N	34.42754	-119.91028	PINN	Haskell Beach
89		6/11/2015	WRM6-D-6/11/2015-3	D-0093	Y <2%	y ,2%	Y	34.41617	-119.88666	CSLI	Elwood Beach
90		6/11/2015	WRM6-D-6/11/2015-1	D-0096	N	n	N	34.26123	-119.27424	CSLI	Pierpoint Beach
91		6/11/2015	WRM6-D-6/11/2015-2	D-0097	N	n	N	34.41626	-119.88677	CSLI	Elwood Beach
92		6/12/2015	WRM2-D-6/14/2015-1	D-0099	N	n	N	none	none	CSLI	Milpas St., Santa Barbara; admitted to CIMWI, died
93		6/13/2015	WRM4-D-06/13/2015-1	D-0095	Y 2-25%	Y 2-25%	Y	34.45954	-120.02574	CSLI	El Capitan State Beach
94		6/13/2015	WRM3-D-6/13/2015-1	D-0098	N	n	N	34.27483	-119.2971	CSLI	Surfers Point; left at beach
95		6/15/2015	WRM3-D-6/16/2015-1	D-0101		cbd	CBD	34.40822	-119.87891	csli	Coal Oil Point; yellow flipper tag 71V; Brand 195V; animal left in garbage bag by unknown person on unknown date
96		6/16/2015	WRM1-D-6/16/2015-1	D-0100		y <2%	Y	34.13105	-119.17661	CSLI	Port Hueneme
97		6/16/2015	WRM1-D-6/16/2015-2	none	N		N	34.13898	-119.1889	CSLI	Port Hueneme; no carcass recovered, only photos
98		6/16/2015	WRM1-D-6/16/2015-3	none	N		N	34.13792	-119.18733	CSLI	Port Hueneme; no carcass recovered, only photos
99		6/18/2015	WRM1-D-6/18/2015-1	none	N		N	34.23991	-119.26718	CSLI	Surfer's Knoll; left in place, photos only, no samples
100		6/18/2015	WRM2-D-6/18/2015-1	none	N		N	34.14125	-119.19447	CETA	Left in place, photos only, no samples
101		6/19/2015	WRM2-D-6/19/2015-1	D-102	Y <2%	n	Y	34.26117	-119.27426	CSLI	San Buenaventura
102		6/19/2015	WRM4-D-6/19/2015-1	none	N		N	34.41944	-119.6276	CSLI	Miramar Beach; Left in place, photos only, no samples
103		6/19/2015	WRM2-D-6/19/2015-3	none	CBD		CBD	34.14758	-119.21684	CSLI	Silver Strand; Left in place, photos only, no samples
104		6/20/2015	WRM4-D-6/20/2015-2	D-103	Y 2-25%	n	N	34.33139	-119.4014	CSLI	Rincon Beach
105		6/20/2015	WRM4-D-6/20/2015-2	none	N		N	34.1881	-119.24397	CSLI	Mandalay State Beach; Left in place, photos only, no samples
106		6/23/2015	WRM2-D-6/23/2015-1	D-104	Y <2%	y <2%	Y	34.46894	-120.11484	CSLI	Arroyo Quemado

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Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled Final	Lat	Long	Species	Notes	Disposition (D=Died, E=Euthanized, R=Released)	Notes 2	Necropsy Date	Gross Necropsy Findings of Note
24	28-May-15-1	5/28/2015	WRM15-L-5/28/2015-1	D-0014	Y <2%	Y <2	Y	34.41805	-119.79437	CSLI	Hope Ranch, died at FS	D	Died 5/28/15		
28	28-May-15-5	5/28/2015	SBMMC-15-508	D-0018	Y <2%	Y <2	Y			CSLI	Carpinteria - originally stranded on 5/23 or 5/24	D	Died 5/28/15		
29	28-May-15-6	5/28/2015	SBMMC-15-508P	D-0019	N	N	N			CSLI	born in rehab	D	Died 5/28/15		
41	3-Jun-15-1	6/3/2015	WRM7-L-6/3/2015-1	D-0064	Y 2%	Y	Y	34.143001	119.1988465	CSLI	Point Hueneme Beach; recovered alive and DOA at MASH	D	Died 6/3/2015		
46	7-Jun-15-2	6/7/2015	WRM1-L-6/7/15-2	D-0087	N	N	N	34.414798	-119.779792	CSLI	Hope Ranch Beach	D	Died at CIMWI		
1	21-May-15-1	21-May	none	L-0001		Y	Y	34.460543	-120.079599	CSLI	1/2 mi N Refugio	D	Died 5/23	5/24/2015	Emaciation, aspiration (of gastric content), icterus
2	22-May-15-3	22-May	FP1-L-05/22/15-2	L-0002	Y	Y	Y	34.2536329	119.2696329	CSLI	Ventura State Beach Marina	D	Died 6/1	6/1/2015	Gastric perforation and peritonitis; cerebral cyst
3	22-May-15-1	5/22/2015	FP1-L-05/22/15-1	L-0003	Y	2	Y	34.408367	-119.880149	CSLI	Coal Oil Point	R	Released 8/15/15		
4	22-May-15-2	5/22/2015	FP2-L-05/22/2015-1	L-0004	Y	2	Y	34.435884	-119.956307	NESE	Naples Point	R	Released 8/15/15		
5	23-May-15-1	5/23/2015	WRM2-L-5/23/2015-1	L-0005	Y	3	Y	34.46292	-120.0447	CSLI	El Capitan State Beach	R	Released 9/18/15		
6	23-May-15-2	5/23/2015	WRM3-L-5/23/2015-1	L-0006	Y	2	Y	34.435837	-119.956373	NESE	Naples Point	D	Died 6/4	6/4/2015	Nasal mites, generalized icterus, arterial nematodes (presumptive Otostrongylus sp).
7	23-May-15-3	5/23/2015	MMFS1-L-5/23/2015-1	L-0007	Y	2	Y	34.38	-119.49	CSLI	Carpinteria State Beach	R	Released 9/18/15		
8	23-May-15-4	5/23/2015		L-0008		blank	N	34.3270165	119.3975374	CSLI	Feria Beach, Space 66; not on FS notes, not in daily count	R	released 7/30/15		
10	24-May-15-2	5/24/2015	WRM1-L-5/24/2015-1	L-0009	N	N	N	34.41585	-119.63892	CSLI	1323 Playa Pacifica Rd	D	Died 5/25	5/25/2015	Emaciation, gastric nematodiasis, external oil
11	24-May-15-3	5/24/2015	MMFS1-L-5/24/2015-1	L-0010	Y	3	Y	34.45809	-120.02202	CSLI	El Capitan State Beach	R	Released 8/15/15		

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled Final	Lat	Long	Species	Notes	Disposition (D=Died, E=Euthanized, R=Released)	Notes 2	Necropsy Date	Gross Necropsy Findings of Note
17	25-May-15-5	5/25/2015	WRM11-L-5/25/2015-1	L-0011	N	1	Y	34.41954	-119.6285	CSLI	Miramar Beach	R	Released 8/7/15; found dead 9/1/15 on Camp Pendleton;		
16	25-May-15-4	5/25/2015	WRM8-L-5/25/2015-1	L-0012	Y <2%	1	Y	34.37	-119.479	NESE	Rincon Point		Still in Rehab as of 10/16		
14	25-May-15-2	5/25/2015	WRM12-L-5/25/2015-1	L-0013	N	1	Y	34.405934	-119.688143	CSLI	Santa Barbara breakwater	R	Released 9/16/15		
15	25-May-15-3	5/25/2015	n/a	L-0014	Y 15%	blank	Y	34.045308	-119.932887	CSLI	live CSLI juv - Malibu -oiled	E	Euthanized 5/28	5/29/2015	Pulmonary nematodiasis, gastric ulcerations
9	24-May-15-1	5/24/2015	WRM2-L-5/24/2015-1	L-0015	Y	1	Y	34.47088	-120.19861	NESE	Mariposa Reina Rd	E	Euthanized 8/15/15		
12	24-May-15-4	5/24/2015	MMFS1-L-5/24/2015-2	L-0016	Y	1	Y	34.46232	-120.06538	NESE	Refugio	D	Died 6/3	6/3/2015	Icterus, pulmonary edema and hemorrhage, thoracic effusion, vascular nematodes (presumptive lungworms) noted
13	25-May-15-1	5/25/2015	WRM9-L-5/25/2015-1	L-0017	Y 30%	blank	Y	34.4563	-120.0735	CSLI	Refugio Point; SWSD intake log says collected on 5/24	D	Died 5/28	5/29/2015	Neoplasia (presumptive urogenital carcinoma)
19	25-May-15-7	5/25/2015	WRM1-L-5/25/2015-1	L-0018	N	1	Y	34.4042	-119.8735	CSLI	Coal Oil Point	R	Released 7/24/15		
18	25-May-15-6	5/25/2015	WRM5-L-5/25/2015-2	L-0019	Y	blank	Y	34.39757	-119.732222	NESE	Hendry's Beach	D	Died 5/29	5/29/2015	Icterus, cardiac enlargement (presumptive lung worm)
23	27-May-15-4	5/27/2015	WRM2-L-5/27/2015-1	L-0020	Y 2%	1	Y	34.43534	-119.944501	CSLI	Los Paradiso	D	Died 6/11	6/11/2015	Emaciated, flipper swelling, lymph node enlargement /abscess
20	27-May-15-1	5/27/2015	WRM1-L-5/27/2015-1	L-0021	Y 30%	4	Y	34.4	-119.54	CSLI	Sand Point	R	Released 9/18/15	-	-
22	27-May-15-3	5/27/2015	WRM10-L-5/27/2015-1	L-0022	Y 3%	3	Y	Unk	Unk	CSLI	Elwood Pier	R	Released 9/16/15		
21	27-May-15-2	5/27/2015	WRM1-L-5/27/2015-2	L-0023	Y 15%	4	Y	34.41	-119.58	CSLI	Loon Point	D	Died 6/1	6/1/2015	Emaciation, ascites/peritonitis, duodenal perforation
27	28-May-15-4	5/28/2015	WRM3-L-5/28/2015-1	L-0024	Y 2%	1	Y	34.242	-119.5241	CSLI	Coal Oil Point	D	Died 6/21/15	6/21/2015	Pulmonary edema, gastric nematodes
26	28-May-15-3	5/28/2015	WRM5-L-5/28/2015-1	L-0025	Y <2%	0	N	34.45987	-120.00529	CSLI	El Capitan Ranch	R	Released 9/16/15		
25	28-May-15-2	5/28/2015	WRM11-L-5/28/2015-1	L-0026	Y <2%	1	Y	34.43	-119.925	CSLI	Ellwood	R	Released 7/17/15		

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled Final	Lat	Long	Species	Notes	Disposition (D=Died, E=Euthanized, R=Released)	Notes 2	Necropsy Date	Gross Necropsy Findings of Note
30	29-May-15-1	5/29/2015	WRM5-L-5/29/2015-1	L-0027	Y <2%	1	Y	unk	unk	CSLI	El Capitan Beach Ranch	R	Released 7/17/15		
31	29-May-15-2	5/29/2015	WRM10-L-5/29/2015-1	L-0028	Y	2	Y	unk	unk	CSLI	Santa Barbara Harbor Patrol	D	Died 6/5	6/5/2015	Emaciation, multiple skin abrasions, nasal, pulmonary, gastric and enteric parasites
32	30-May-15-1	5/30/2015	WRM7-L-5/30/2015-2	L-0029	Y	2	Y	34.098	-119.1033	CSLI	Family Beach (Pt. Mugu)	D	Died 6/14	6/14/2015	Emaciated, mild ascites, skin abrasions
33	30-May-15-2	5/30/2015	WRM10-L-5/30/2015-1	L-0030	Y 8%	2	Y	34.27521	-119.29765	CSLI	Ventura Pier	D	Died 6/3	6/3/2015	Thin, nasal ascaris, lymph node enlargement, cutaneous ulcer/wound at the left mandible
34	31-May-15-1	5/31/2015	WRM9-L-5/31/2015-3	L-0031	Y	1	Y	34.39599	-119.53393	CSLI	Sandyland Beach	R	Released 7/17/15		
35	31-May-15-2	5/31/2015	WRM9-L-5/31/2015-2	L-0032	Y	1	Y	34.4073	-119.87899	CSLI	Coal Oil Point	E	Euthanized 6/3	6/3/2015	Emaciated, skin ulcerations, purulent ascites
36	31-May-15-3	5/31/2015	WRM5-L-5/31/2015-1	L-0033	Y <2%	1	Y	34.1905	-119.2437	CSLI	1073 Mandalay Beach	D	Died 6/4	6/4/2015	Emaciated, thoracic and pericardial effusion, icterus, hydrocephalus
37	31-May-15-4	5/31/2015	WRM9-L-5/31/2015-1	L-0034	Y	2	Y	34.46199	-120.04829	CSLI	Venadito Beach/Canyon	R	Released 8/15/15; Recovered Dead in LA County 10/1/15		
38	1-Jun-15-1	6/1/2015	WRM3-L-6/1/2015-1	L-0035	N	1	Y	34.40707	-119.7588	CSLI	Hendry's Beach	D	Died 6/4	6/4/2015	Gastric perforation and peritonitis
39	1-Jun-15-2	6/1/2015	WRM7-L-6/1/2015-1	L-0036	Y <2%	1	Y	34.098216	-119.10353	CSLI	Point Mugu (Navy Base)	D	Died 6/15	6/15/2015	Emaciated, lungworms
40	2-Jun-15-1	6/2/2015	WRM1-L-6/2/2015-1	L-0037	Y 2-5%	1	Y	34.23454	-119.26536	CSLI	Spinnaker Estuary	R	Released 8/7/15		
42	3-Jun-15-2	6/3/2015	WRM1-L-6/3/2015-1	L-0038	Y <2%	2	Y	34.417145	-119.827264	CSLI	Goleta Beach	D	Died 6/13	6/13/2015	Cardiac fibrosis/cardiomyopathy, endocardiosis, lymph node enlargement
43	5-Jun-15-1	6/5/2015	WRM2-L-6/5/2015-1	L-0039	Y <2%	blank	Y	34.27564	-119.28963	CSLI	Ventura Pier	R	Released 9/16/15		
44	6-Jun-15-1	6/6/2015	WRM5-L-6/6/2015-1	L-0040	Y 2-25%	2	Y	34.41534	-119.7819	HASE	Hope Ranch	D	Died 6/7/15	6/7/2015	Complex mandibular fracture, flipper wound
45	7-Jun-15-1	6/7/2015	WRM1-L-6/7/15-1	L-0041	N		N	34.403058	-119.743971	CSLI	Hendry's Beach	R	Released 9/16/15; initially thought potential fracture hind end		

Cumulative Total	Daily Report #	Date	Field ID	Intake ID	Oiled Field	Oiled Intake	Oiled Final	Lat	Long	Species	Notes	Disposition (D=Died, E=Euthanized, R=Released)	Notes 2	Necropsy Date	Gross Necropsy Findings of Note
47	9-Jun-15-1	6/9/2015	CIMWI15-30022-297	L-0042	N	0	N	34.05.879	-119.06.200	CSLI	Family Beach	D	Died at CIMWI	6/11/2015	Emaciated, skin abrasions
48	11-Jun-15-1	6/11/2015	WRM3-L-6/11/15-1	L-0043	Y	1	Y	34.40732	-119.69083	CSLI	Santa Barbara Harbor	E	Euthanized at Field Stabilization 6/11	6/13/2015	HI- bullet recovered
49	11-Jun-15-2	6/11/2015	WRM4-L-6/11/15-1	L-0044	N		N			CSLI	Channel Islands Harbor	D	Died at CIMWI	6/13/2015	Emaciated
50	12-Jun-15-1	6/12/2015	WRM2-L-6/12/15-1	L-0045	Y		Y	34.2763	-119.2713	CSLI	Hanover St.	R	Released 7/24/15		
51	13-Jun-15-1	6/13/2015	WRM1-L-6/13/15-1	L-0046	Y <2%	1	Y	34.2753	-119.2957	CSLI	San Buenaventura	R	Released 7/24/15		
52	14-Jun-15-1	6/14/2015	WRM3-L-6/14/15-1	L-0047	Y <2%		Y	34.2472	-119.2661	CSLI	Ventura West Marina	D	Died 6/14/15 en route	6/15/2015	No significant gross findings
53	13-Jun-15-2	6/13/2015	WRM2-L-6/13/15-1	L-0048	N		N	34.159131	-119.22731	CSLI	Hollywood Beach at San Clemente	D	Died 6/14/15 at CIMWI	6/15/2015	Emaciated, gastric ulcers
54	14-Jun-15-2	6/14/2015	WRM1-L-6/14/15-1	L-0049	Y <2%		Y	34.41341	-119.68456	CSLI	East Beach	E	Euthanized 6/18/15	6/19/2015	Tracheal occluding foreign body
55	14-Jun-15-3	6/14/2015	WRM1-L-6/14/15-2	L-0050	Y <2%		Y	34.4166	-119.8311	CSLI	Goleta Beach	R	Released 8/24/15		
56	14-Jun-15-4	6/14/2015	WRM2-L-6/14/2015-1	L-0051	Y <2%	1	Y	34.416	119.6401	CSLI	Coral Casino	R	Released 8/24/15		
57	14-Jun-15-5	6/14/2015	WRM2-L-6/14/2015-2	L-0052	CBD	1	Y	34.3064984	-119.3575098	CSLI	Rincon Parkway	E	Euthanized 6/16/15	6/17/2015	Clinical seizures, gastrointestinal metazoan parasites
58	15-Jun-15-1	6/16/2015	WRM3-L-6/16/2015-1	L-0053		1	Y	34.46298	-1120.06896	CSLI	Refugio State Beach	D	Died 6/17/15	6/17/2015	Myocardial pallor/cardiomyopathy, gastrointestinal parasitism, unilateral renal atrophy
59	15-Jun-15-2	6/16/2015	WRM2-L-6/16/15-2	L-0054		0	Y			CSLI	Ormond Beach	D	Died 6/19/15	6/20/2015	No significant gross findings beyond the oil noted
60	18-Jun-15-1	6/18/2015	WRM3-L-6/18/15-2	L-0055		0	Y	34.39354	-119.52585	CSLI	Carpinteria at unden	D	Died 6/19/15	6/20/2015	Mottled lungs
61	22-Jun-15-1	6/22/2015	WRM2-L-6/22/2015	L-0056		1	Y	34.1454	-119.21645	CSLI	Silver Strand	D	Died 6/23/15	6/23/2015	Myositis left front limb, thoracic effusion (pyothorax), necrotizing hepatitis
62		6/6/2015		L-1001		4	Y			HASE	LA County	D			