

Russian River Estuary Management Project

Marine Mammal Protection Act Incidental Harassment Authorization

Report of Activities and Monitoring Results – January 1 to December 31, 2017

Prepared for
Office of Protected Resources and
Southwest Regional Administrator
National Marine Fisheries Service

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EXECUTIVE SUMMARY

The purpose of this report of activities and monitoring results is to comply with the provisions of the Marine Mammal Protection Act (MMPA) and Regulations Governing Taking of Marine Mammals Incidental to Russian River Estuary Management Activities (50 CFR Part 217, Subpart A) under Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) to take small numbers of marine mammals incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (April 21, 2017, NMFS LOA).

The Water Agency applied in 2009 to the National Marine Fisheries Service (NMFS) Office of Protected Resources for an IHA under the Marine Mammal Protection Act (MMPA) for activities associated with water level management activities in the Russian River estuary. NMFS issued an original IHA to the Water Agency on March 30, 2010, and in each subsequent year until a Letter of Authorization (LOA) was issued on April 21, 2017. This report provides the results of all monitoring of baseline conditions and water level management activities for the 2017 calendar year, and additional summary information for all related activities.

The estuary may close throughout the year as a result of a barrier beach forming across the mouth of the Russian River. Closures result in the formation of a lagoon behind the barrier beach and, as water surface levels rise in the estuary, flooding may occur. The Water Agency's artificial breaching activities are conducted in accordance with the approach recommended in the Heckel (1994) study. The purpose of artificially breaching the barrier beach is to alleviate potential flooding of low-lying properties along the estuary. The Water Agency and the U.S. Army Corps of Engineers (Corps) consulted with NMFS under Section 7 of the Endangered Species Act (ESA) regarding the potential effects of their operations and maintenance activities, including the Water Agency's estuary management program, on federally-listed steelhead (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). As a result of this consultation, NMFS issued the Russian River Biological Opinion (NMFS 2008) finding that artificially elevated inflows to the Russian River estuary during the low flow season (May through October) and historic artificial breaching practices have significant adverse effects on the Russian River's estuarine rearing habitat for steelhead. The historic method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the estuary's water quality and freshwater depths.

The Biological Opinion (NMFS 2008) concludes that the combination of high inflows and breaching practices impact rearing habitat because they interfere with natural processes that cause a freshwater lagoon to form behind the barrier beach. Fresh or brackish water lagoons at the mouths of many streams in central and southern California often provide depths and water quality that are highly favorable to the survival of rearing salmon and steelhead.

The Biological Opinion's Reasonable and Prudent Alternative (RPA) 2 (NMFS 2008) requires the Water Agency to collaborate with NMFS and to modify estuary water level management in order to reduce marine influence (high salinity and tidal inflow) and promote a higher water surface elevation in the estuary (formation of a fresh or brackish lagoon) for purposes of enhancing the quality of rearing habitat for juvenile (age-0+ and -1+) steelhead from May 15 to October 15 (the lagoon management period). A program of potential, incremental steps are prescribed to accomplish this, including adaptive management of a lagoon outlet channel on the barrier beach.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known resting areas in the river at logs and rock piles. The Water Agency applied for an LOA under the MMPA for activities associated with Russian River estuary management activities, which occur in the vicinity of these haul-outs, including:

- excavation and maintenance of a lagoon outlet channel that would facilitate management of a summer lagoon to improve rearing habitat for listed steelhead as required by the Russian River Biological Opinion (NMFS 2008);
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the estuary;
- biological and geophysical monitoring activities associated with the management actions described above; and
- geophysical surveys conducted at the barrier beach.

Pinniped monitoring was performed in accordance with the requirements of the NMFS LOA issued April 21, 2017, and the Russian River Estuary Management Activities Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2016).

Baseline monitoring was performed to gather additional information about the population of harbor seals utilizing the Jenner haul-out including population trends, patterns in seasonal abundance and the influence of barrier beach condition on harbor seal abundance. Pinniped monitoring was also conducted in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Estuary management monitoring occurred during the Water Agency's monthly topographic surveys of the barrier beach and biological and physical monitoring of the estuary. The purpose of estuary management monitoring is to record any pinniped disturbances during the above activities.

A barrier beach was formed eight times during 2017, during four of these closure events the Water Agency conducted water level management activities at the sand bar. The Russian River mouth was closed to the ocean for a total of 85 days (or 23%) in 2017, mostly during the fall months. Pinniped monitoring occurred no more than 3 days before, the day of, and the day after each water level management activity.

The Water Agency's biological and physical monitoring activities of the estuary are included in the NMFS LOA. The Water Agency surveys the sandbar (or barrier beach) monthly to collect a topographic map of the beach, as required by the Russian River Biological Opinion. A monitor is present during these surveys to record any disturbances of the Jenner haul-out during the survey. Additionally, Water Agency field staff conducting biological and physical monitoring in the estuary recorded any pinnipeds they encountered hauled out and any disturbance to pinnipeds associated with their activities.

The Russian River estuary management and monitoring activities in 2017 resulted in incidental harassment (Level B harassment) of 1,290 harbor seals, well under the total allowed by NMFS LOA. The Russian River estuary management activities in 2016, 2015, 2014, 2013, 2012, 2011 and 2010 resulted in incidental harassment (Level B harassment) of 1,915, 2,383, 2,121, 1,351, 208, 42 and 290 harbor seals, respectively.

INTRODUCTION

The purpose of this report of activities and monitoring results is to comply with the provisions of the Marine Mammal Protection Act (MMPA) and Regulations Governing Taking of Marine Mammals Incidental to Russian River Estuary Management Activities (50 CFR Part 217, Subpart A) under Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) to take small numbers of marine mammals incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (April 21, 2017, NMFS LOA)

The Water Agency applied in 2009 to the National Marine Fisheries Service (NMFS) Office of Protected Resources for an IHA under the Marine Mammal Protection Act (MMPA) for activities associated with water level management activities in the Russian River estuary. NMFS issued an original IHA to the Water Agency on March 30, 2010, and in each subsequent year until a Letter of Authorization (LOA) was issued on April 21, 2017. This report provides the results of all baseline monitoring, water level management and associated activities for the 2017 calendar year, and additional summary information for all related activities.

BACKGROUND

The Russian River estuary is located about 97 kilometers (km; 60 miles) northwest of San Francisco in Jenner, Sonoma County, California (Figure 1). The Russian River watershed encompasses 3,847 square kilometers (km) (1,485 square miles) in Sonoma, Mendocino, and Lake Counties. The estuary extends from the mouth of the Russian River upstream approximately 10 to 11 km (6 to 7 miles) between Austin Creek and the community of Duncans Mills (Heckel 1994).

The estuary may close throughout the year as a result of a barrier beach forming across the mouth of the Russian River. The mouth is located at Goat Rock State Beach (California Department of Parks and Recreation). Closures result in formation of a lagoon behind the barrier beach and, as water surface levels rise in the estuary, flooding may occur. Natural breaching events occur when estuary water surface levels exceed the capability of the barrier beach to impound water, causing localized erosion of the barrier beach and creation of a tidal channel that reconnects the Russian River to the Pacific Ocean.

The barrier beach has also been artificially breached for decades; first by local citizens, then the County of Sonoma Public Works Department, and, since 1995, by the Water Agency. The Water Agency's artificial breaching activities are conducted in accordance with the Russian River Estuary Management Plan recommended in the Heckel (1994) study. The purpose of artificially breaching the barrier beach is to alleviate potential flooding of low-lying properties along the estuary.



Biological Opinion and the Estuary

The Water Agency and the U.S. Army Corps of Engineers (Corps) consulted with the NMFS under Section 7 of the Endangered Species Act (ESA) regarding the potential effects of their operations and maintenance activities, including the Water Agency's Estuary Management Program, on federally-listed steelhead (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). As a result of this consultation, NMFS issued the Russian River Biological Opinion (NMFS 2008) finding that artificially elevated inflows to the Russian River estuary during the low flow season (May through October) and historical artificial breaching practices have significant adverse effects on the Russian River's estuarine rearing habitat primarily for steelhead. The historical method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the Estuary's water quality and freshwater depths.

The historical artificial breaching practices create a tidal marine environment with shallow freshwater depths and high salinity. Salinity stratification contributes to low dissolved oxygen at the bottom in some areas. The Biological Opinion (NMFS 2008) concluded that the combination of high inflows and breaching practices impacted rearing habitat by interfering with natural processes that form a freshwater lagoon behind the barrier beach. Fresh or brackish water lagoons at the mouths of many streams in central and southern California often provide depths and water quality that are highly favorable to the survival of rearing salmon and steelhead.

The Biological Opinion's Reasonable and Prudent Alternative (RPA) 2 (NMFS 2008) requires the Water Agency to collaborate with NMFS to modify estuary water level management to reduce marine influence on the estuary (tidal inflow and high salinity) and to promote a higher water surface elevation in the estuary to form a fresh or brackish lagoon to enhance rearing habitat for juvenile (age-0+ and -1+) steelhead from May 15 to October 15 (the lagoon management period). The Biological Opinion outlines a program of potential, incremental steps to accomplish this, including adaptive management of a lagoon outlet channel on the barrier beach.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out) (Figure 1). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known resting sites in the river at logs and rock piles in the estuary (Figure 1). The Water Agency applied for an LOA under the MMPA for activities associated with Russian River estuary management activities, including:

- excavation and maintenance of a lagoon outlet channel that would facilitate management of a summer lagoon to improve rearing habitat for listed steelhead as required by the Russian River Biological Opinion (NMFS 2008);
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the estuary;
- biological and geophysical monitoring activities associated with the management actions described above; and
- geophysical surveys conducted at the barrier beach.

The purpose of the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2016) is to detect the response of pinnipeds to estuary management activities at the Russian River estuary. Specifically, the following questions are of interest:

1. Under what conditions do pinnipeds haul out at the Russian River estuary mouth at Jenner?
2. How do seals at the Jenner haul-out respond to activities associated with the construction and maintenance of the lagoon outlet channel and artificial breaching activities?
3. Does the number of seals at the Jenner haul-out significantly differ from historic averages with formation of a summer (May 15th to October 15th) lagoon in the Russian River estuary?
4. Are seals at the Jenner haul-out displaced to nearby river and coastal haul-outs when the mouth remains closed in the summer?

METHODS

Monitoring was performed in accordance with the requirements of NMFS LOA issued April 21, 2017, and the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2016).

Water Agency biologists and Stewards of the Coast and Redwoods (Stewards) volunteers and staff monitored pinnipeds at the Jenner haul-out. The Stewards and Water Agency provide annual training for all volunteers; the most recent training occurred on February 27, 2017. Water Agency biologists participating in the monitoring program were also trained. The training agenda covered:

- the Marine Mammal Protection Act;
- anticipated LOA monitoring requirements;
- the Russian River Estuary Management Activities Pinniped Monitoring Plan and monitoring methods therein, including completion of data sheets;
- field identification of pinnipeds of the California coast, including harbor seals, California sea lions, Steller sea lions, northern elephant seals, northern fur seals and Guadalupe fur seals;
- field identification of neonates (pups less than 1 week old);
- care and use of field equipment (e.g. cameras, spotting scopes, binoculars); and
- field visits to the haul-out monitoring location.

Baseline monitoring of the Jenner haul-out was shared by Water Agency biologists and trained Stewards volunteers. Monitoring of water level management activities (lagoon outlet channel and artificial breaching) at the Jenner haul-out was also shared, but Water Agency biologists monitored artificial breaching and lagoon outlet channel implementation activities on the day of the event. Pre- and post-water level management activity monitoring was shared by the organizations depending on the availability of volunteers and Water Agency staff. Water Agency biologists also monitored pinnipeds during monthly topographic surveys of the beach, and biological and physical monitoring of the estuary.

Baseline

Baseline monitoring was performed to gather information about the population of harbor seals utilizing the Jenner haul-out including population trends, patterns in seasonal abundance and the influence of barrier beach condition on harbor seal abundance. Baseline counts were scheduled each month with the intention of capturing a low and high tide each in the morning and afternoon. Weather conditions were recorded at the beginning of each survey. These included temperature, visibility, ocean conditions (Beaufort scale) and wind speed. Tide levels and estuary water surface elevations were correlated to each monitoring day.

Jenner Haul-out Use

Pinnipeds at the Jenner haul-out were surveyed multiple times each month. Surveys were conducted between 0730 and 1630. All pinnipeds hauled out on the beach were counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the haul-out using binoculars or a high-powered spotting scope. Depending on time of year and how the sandbar is formed, harbor seals may haul out in multiple groups. At each 30-minute count, the observer would indicate where groups of seals are hauled out on the sandbar (e.g. Site A, Site B mapped on datasheet) and provide a total count for each group.

Pupping Season

Adults and pups were counted separately through June, after which it became difficult to differentiate between age classes. All neonates (less than 1 week old) were also recorded and were identified using one or more of the following characteristics: less than 15 kg, thin for their body length, an umbilicus or natal pelage present, wrinkled skin, awkward or “jerky” movement. In April and May surveys at Jenner were conducted approximately 1 week apart in order to provide a count the total number of neonates observed throughout the pupping season. If any potentially abandoned pup was observed during monitoring, the Water Agency would contact the NMFS stranding response network (Marine Mammal Center in Sausalito, CA) immediately and report the incident to NMFS’ Southwest Regional Office and NMFS Headquarters within 48 hours. Monitors were instructed not to approach or move the pup. Monitors used the following potential indications that a pup may be abandoned: no observed contacts with adult seals, no movement of the pup, and the pup’s attempts to nurse were rebuffed.

Disturbance of Seals

In addition to the count data, disturbances of seals on the haul-out were recorded. The methods for recording disturbances followed those in Mortenson (1996). Disturbances were recorded on a three-point scale that represents an increasing seal response to the disturbance (Table 1). The time, source, and duration of the disturbance, as well as an estimated distance between the source and seals, were recorded.

Table 1. Levels of pinniped response to disturbance used for Russian River Estuary Management Project pinniped monitoring. For permitting purposes a “take” or Level B harassment would include only moving or flight responses.

Level	Type of Response	Definition
1	Alert	Seal head orientation in response to disturbance. This may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, or changing from a lying to a sitting position.
2	Moving	Movements away from the source of disturbance, ranging from short withdrawals over short distances to hurried retreats many meters in length.
3	Flight	All retreats (flushes) to the water, another group of seals, or over the beach.
SOURCE: Mortenson, J. 1996. Human interference with harbor seals at Jenner, California, 1994-1995. Prepared for Stewards of Slavianka and Sonoma Coast State Beaches, Russian River/Mendocino Park District. July 11, 1996.		

Water Level Management Activities

Pinniped haul-outs were monitored during Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). The monitoring methods for water level management activities followed a deliberate pattern. To begin, a one-day, pre-event survey was made within 1 to 3 days prior to all water level management events. On the day of the management event, pinniped monitoring began at least one hour prior to the crew and equipment accessing the beach work area and continued during the duration of the event until at least one hour after the crew and equipment left the beach. Monitoring continued on the day following each water level management event to document the number of seals utilizing the haul-outs. Methods followed the count and disturbance monitoring protocols described in the “Baseline” section above.

Prior to each breaching or lagoon outlet channel implementation, the Water Agency monitor participated in the onsite tailgate safety meeting to discuss the location(s) of pinnipeds at the Jenner haul-out that day and methods of avoiding and minimizing disturbances to the haul-out as outlined in NMFS LOA.

Biological and Physical Monitoring

The NMFS LOA also provides incidental take for Level B harassment of pinnipeds that may result from monitoring of biological resources and physical processes in the estuary. Water Agency field staff record the presence of pinnipeds hauled out in the estuary in the vicinity of their activities and record any resulting disturbances. The Russian River Biological Opinion also requires monthly topographic surveys of the sandbar at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haul-out and to observe pinniped response to the survey work in the vicinity of the Jenner haul-out. Provided that no neonates or nursing pups were on the haul-out, the survey crew approached the haul-out slowly on foot and allowed for the seals to gradually vacate the beach before the survey proceeded. A pinniped monitor was present for all of these surveys and carefully documented the seals’ response and total number of animals disturbed.

RESULTS

The NMFS LOA (April 21, 2017) requires the following information be provided in this report:

- (a) the number of seals taken, by species and age class (if possible)
- (b) behavior prior to and during water level management events
- (c) start and end time of activity
- (d) estimated distances between source and seals when disturbance occurs
- (e) weather conditions (e.g., temperature, wind, etc.)
- (f) haul-out reoccupation time of any seals based on post activity monitoring
- (g) tide levels and estuary water surface elevation
- (h) seal census from bi-monthly monitoring
- (i) specific conclusions that may be drawn from the data in relation to the four questions of interest in SCWA’s Pinniped Monitoring Plan, if possible

Estuary water surface elevations are recorded at the Jenner gauge (operated by the Water Agency), located at the State Parks visitor center in the town of Jenner. Appendix A includes the estuary water surface elevations associated with pinniped monitoring in 2017, including baseline, water level management events and estuary management investigations.

Baseline

In 2017 a total of 44 baseline surveys, 15 beach topographic surveys, 2 breaching surveys, 2 pre-breaching, 2 post-breaching, 2 lagoon outlet implementation, 1 pre-lagoon outlet and 2 post-lagoon outlet surveys were conducted (Appendix A). One beach topographic survey was scheduled on the same day as a pre-lagoon outlet survey and one baseline survey also functioned as a pre-breaching survey.

Jenner Haul-out Use

Peak seal abundance, as measured by the single greatest count of harbor seals at the Jenner haul-out, was on February 16 (364 seals). Using the average number of seals hauled out by month, seal abundance at Jenner was greatest in February compared to all other months (mean = 292 ± 10.7 s.e., $n = 35$; Unequal N HSD multiple comparisons test, $p < 0.001$) (Figure 2). Seal abundance was lowest in September (mean = 27 ± 6.4 s.e., $n = 27$) (Figure 2).

Fewer seals were present during closed conditions (mean = 22 ± 3.5 s.e., $n = 68$) compared to open conditions (mean = 168 ± 5.7 s.e., $n = 295$; ANOVA $p < 0.001$). However, the overall trend was an increase in seal abundance compared to earlier years (Figure 3).

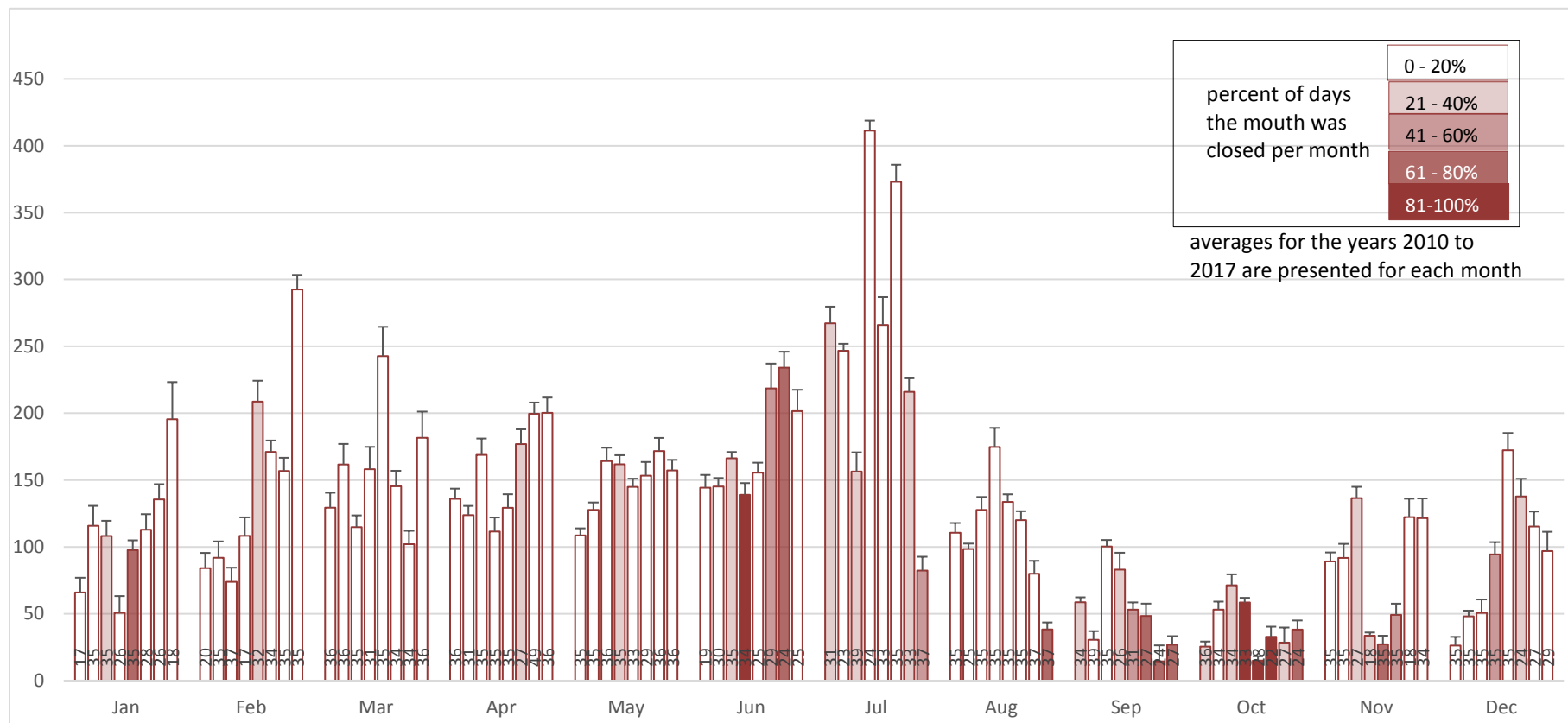


Figure 2. The average number of harbor seals hauled out at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) as counted during baseline surveys for each year (January 2010 – December 2017) categorized by month. Error bars represent standard error and sample size used to calculate means are presented inside the bars.

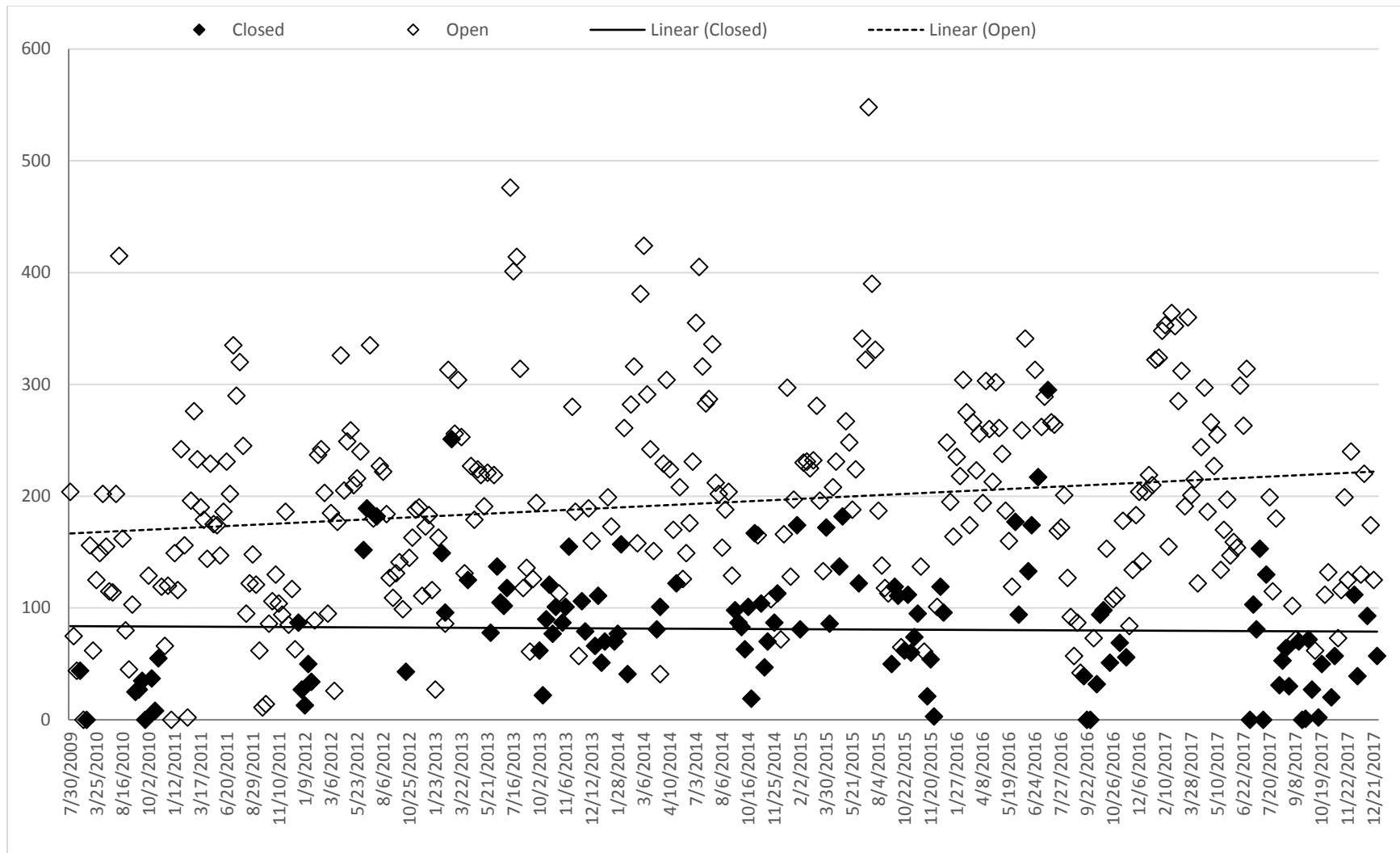


Figure 3. Maximum number of harbor seals counted during all pinniped surveys at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) since 2009. Open diamonds represent counts in mouth open conditions and black filled diamonds represent counts during mouth closed.

Pupping Season

Pups have been observed at the Jenner haul-out as early as March (SCWA 2012, 2013). In 2017 the first harbor seal pups were observed on April 7, with the latest observation of pups occurring on June 20 (the last neonate was observed on May 10). Pups are counted during surveys through June, after which time it becomes difficult to distinguish pups from sub-adult seals. On March 16, 2017, a deceased harbor seal pup was observed on Goat Rock State Beach and reported to the local stranding network (The Marine Mammal Center, Sausalito, CA) and to the regional stranding coordinator and NMFS Office of Protected Resources. The pup carcass had characteristics of premature birth (lanugo) and could possibly have been still born.

The number of pups observed at the Jenner haul-out was similar to previous years with an average of 16.5 pups observed (when pups were present) and a single highest maximum count of 48 pups for the season (Figure 4). Using the sum of the maximum number of pups observed on a single day during weekly counts in April and May, we estimate a minimum of 48 harbor seal pups born at Goat Rock State Beach in 2017. Counting neonates on the beach every 7 days and using the cumulative total of neonates to estimate the minimum number of pups born yielded a total of 22 pups, which would have underestimated the number of pups. The variability between the two methods was largely due to an observer not recoding pups of any age during one survey in May. It is unlikely there were no pups present on the beach that day, given that pups were observed the week prior and the week after.

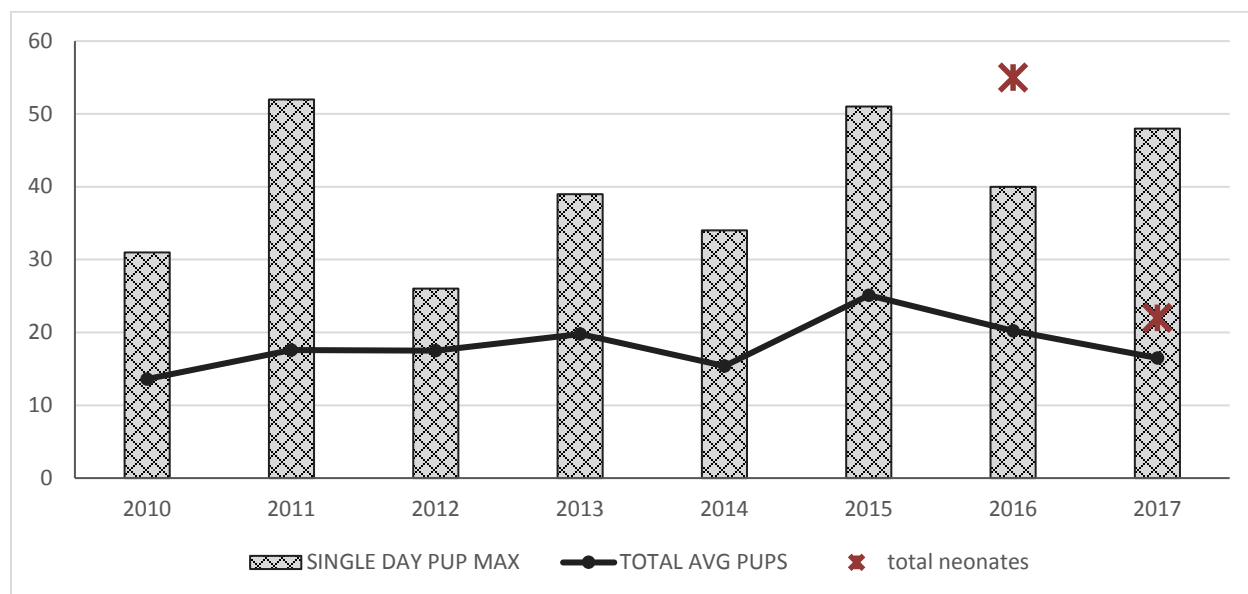


Figure 4. Number of harbor seal pups observed at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) by year. Bar height indicates the maximum single day pup count, line indicates the average of pups counted throughout the season and the red stars indicate the total number of neonates counted during weekly surveys throughout the season for each year.

Disturbance of Seals

An effort was made to compare the level of disturbance between baseline surveys and surveys when Water Agency personnel are working in the vicinity of the Jenner haul-out. Disturbance sources were separated into ten categories: aircraft, bird, dog, kayak, multiple, other boat, people, unknown, vehicle, and Water Agency. Seals were considered to be disturbed if they moved on or flushed from the haul-out.

Figure 5 illustrates the proportion of surveys when harbor seals were disturbed at the Jenner haul-out, categorized by disturbance source. Harbor seals were most frequently disturbed by people on foot (47% of surveys), with a similar frequency during Water Agency activities (43% of surveys). Water Agency personnel disturbed seals on 73% of days with Water Agency activity on the beach. People in kayaks were the next most frequent source of disturbance (22% of baseline surveys) (Figure 5). When people on foot were the source of a disturbance the distance between them and seals averaged 147 feet at the time the seals exhibited an alert response, 114 feet for a move response, and 102 feet for a flush response.

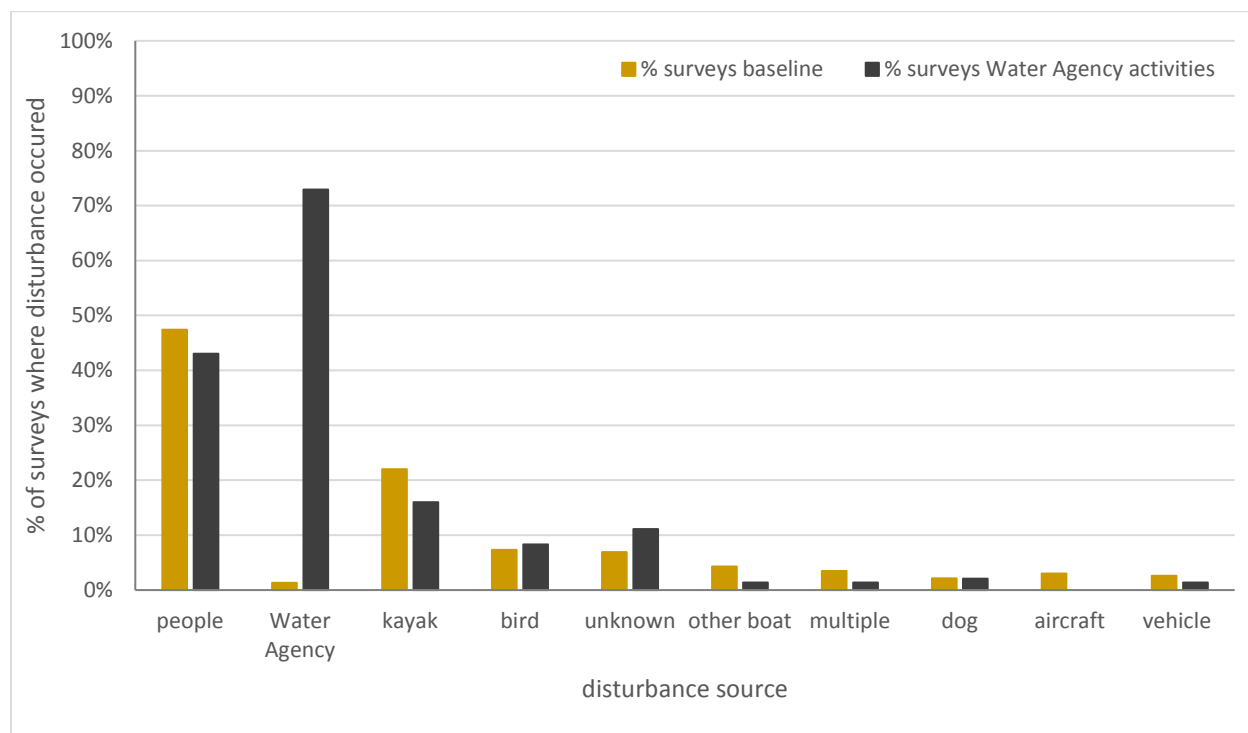


Figure 5. The proportion of surveys where harbor seals were disturbed (moved or flushed) at the Jenner haul-out, described for each disturbance source. Data includes all baseline surveys since surveys began in 2009 (n=232) and Water Agency activity surveys (i.e., breaching, lagoon outlet implementation, topographic surveys, and jetty study) (n=144).

Water Level Management Activities

A barrier beach formed eight times during 2017 (Table 2). Four of these closures occurred during the lagoon management season and the Water Agency implemented a lagoon outlet channel during two of these closures. The Water Agency artificially breached the barrier beach during two of the closures outside the lagoon management season. The Russian River outlet was closed to the ocean for a total of 85 days (or 23%) in 2017, with 65 (or 76%) of these days occurring during the lagoon management period.

On July 4, 2017, the river mouth closed and on July 17 the Water Agency excavated a lagoon outlet channel. However, the outlet channel scoured open by the following day, reconnecting tidal conditions in the lagoon. The peak water level in the lagoon was 7.8 ft NGVD as read from the Jenner gauge at 13:00 on July 17. Construction of the outlet channel occurred from 10:20 to 12:50. There were no

pinnipeds on the beach during the day of the lagoon outlet implementation. During the pre-lagoon outlet survey there were 153 harbor seals hauled out (July 14) and the day after the lagoon outlet channel was constructed there were 130 harbor seals hauled out.

The river mouth closed again on September 12 and the Water Agency excavated a lagoon outlet channel on September 28. The bed elevation of the outlet channel was constructed above the lagoon water level in an attempt to allow water levels to rise and slowly flow into the outlet. Heavy fog impaired viewing conditions on the morning of the activity, but an estimated 100 harbor seals were hauled out on the ocean side of the barrier beach before activities began. Excavation activities began at 09:40 and were complete at 10:55. Viewing conditions improved slightly and 72 seals were observed flushing into the ocean when the Water Agency crew walked within 100 feet of the haul-out. No seals were observed on the beach for the remainder of the survey. The morning after the lagoon outlet channel was implemented 27 harbor seals were observed on the beach. The river mouth remained closed after the outlet channel was constructed and water levels in the estuary continued to rise until it reached 8.6 feet on October 3. On October 3, an unknown party dug a pilot channel within the footprint of the outlet channel, allowing the barrier beach to self-breach.

The river mouth closed on October 7 and water levels reached a peak height of 7.9 ft NGVD until the Water Agency excavated a pilot channel on October 19. Excavation activities lasted from 12:44 to 13:51. Prior to breaching activities there were 49 seals on the estuary side of the beach. Seals began to flush from their haul-out as crew and equipment approached within 250 ft of the seals. At the end of the monitoring there were no seals hauled out. Continued high ocean swell conditions contributed to a subsequent barrier beach closure on October 25. On November 2 the Water Agency cancelled a scheduled breaching event as the barrier beach self-breached early that morning, with water levels at 7.9 ft NGVD.

On November 29, during heavy surf, the river mouth closed and the Water Agency scheduled an artificial breach event for December 1. Due to heavy surf, State Parks determined it was unsafe for any activities on the beach and the breaching was postponed until the following day. Water levels in the estuary reached a high of 10.1 ft NGVD on December 2 before the pilot channel was excavated. There were 39 harbor seals on the beach prior to the start of breaching activities. Excavation of the pilot channel in the barrier beach occurred to the south of the seal haul-out and only a few seals (4) were disturbed by the Water Agency crew walking on the beach. Excavation of the pilot channel lasted from 14:04 to 15:18. At the end of the survey 6 seals were hauled out on the beach; other seals had been disturbed by people walking on the beach.

Harbor seal response to excavation activities was similar for all breaching and lagoon outlet channel implementation events, and similar to those observed in previous years. Seals that were hauled out first alerted to the sound of the excavator being off-loaded in the Goat Rock State Beach parking lot (greater than 1,500 feet south of the haul-out). Seals then moved on the beach or flushed into the water as the Water Agency safety crew approached on foot. People on foot typically came within 167 feet of the haul-out on average before seals were disturbed (all years combined). Once on the beach, the noise and motion of the excavator disturbed seals at greater distances, creating a disturbance at an average of 867 feet. Seals remained on the beach in small numbers if the excavation activity was far enough away from their initial haul-out location. The estimated take by incidental harassment (Level B), as defined by the Marine Mammal Protection Act, of harbor seals during lagoon outlet implementation and artificial

breaching activities in 2017 was 168 harbor seals (116 flushed and 52 moved). Disturbance information for each event is provided in Table 4.

Table 2. Summary of river mouth closures in 2017 at the Russian River mouth (Goat Rock State Beach). Peak water level during the event was measured at the gauge located at the Sonoma Coast State Park Visitor's Center in Jenner, CA.

Date mouth closed	Peak height (ft NGVD)	Date mouth opened	Management Activity
July 4	7.8	July 17	lagoon outlet
August 5	8.3	August 27	none
September 12	8.6	October 3	none
* lagoon outlet implemented on September 28, mouth remained closed through October 3			lagoon outlet
October 7	7.9	October 19	breach
October 25	7.9	November 2	none
November 26	6.2	November 27	none
November 29	10.1	December 2	breach
December 13	7.5	December 18	none

Biological and Physical Monitoring

The NMFS LOA (2017) provides incidental take for Level B harassment of pinnipeds that may result from monitoring of biological resources and physical processes in the Russian River estuary. The number of incidental takes in 2017 was calculated based on the number of animals that responded to activities by either moving on their haul-out or flushing from their haul-out. Alerts were also recorded by monitors, but are not included in the number of incidental takes reported. Most often at haul-out sites within the estuary (excluding the Jenner haul-out on Goat Rock State Beach, Figure 1) harbor seals either had no reaction or raised their heads in alert as a boat passed.

The Russian River Biological Opinion requires monthly topographic surveys of the barrier beach at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to monitor the seal response to the survey crew. With the exception of the harbor seal pupping season, when survey personnel will avoid the haul-out when neonates are present, between 6% and 100% of seals were flushed from their haul-out during the monthly mapping activities (Table 3).

Table 3. Number of pinnipeds disturbed as a result of Russian River Estuary Management Project beach management and monitoring activities for 2017, resulting in incidental take by harassment. Disturbances reported are pinnipeds moving on or flushing from their haul-out; number of disturbed seals that flushed from their haul-out is denoted by (#).

Date	Event Type	Estimated Disturbance			
		Species	Age Class	Number	Max % total seals flushed ^a
2/15/2017	Monthly beach topo survey	harbor seal	adult	166(166)	100%
3/16/2017	Monthly beach topo survey	harbor seal	adult	222(207)	93%
5/18/2017	Monthly beach topo survey	harbor seal	adult	7(7)	6%
			pup	6(6)	43%
5/24/2017	Monthly beach topo survey	harbor seal	adult	137(137)	100%
			pup	11(11)	100%
6/22/2017	Monthly beach topo survey	harbor seal	adult	35(15)	8%
7/11/2017	Monthly beach topo survey	harbor seal	adult	143(82)	100%
8/3/2017	Monthly beach topo survey	harbor seal	adult	130(127)	43%
8/10/2017	Monthly beach topo survey	harbor seal	adult	35(30)	100%
9/26/2017	Monthly beach topo survey	harbor seal	adult	1(1)	100%
9/28/2017	Lagoon Outlet Implementation	harbor seal	adult	122(72)	100%
10/19/2017	Artificial breaching	harbor seal	adult	42(40)	100%
10/26/2017	Monthly beach topo survey	harbor seal	adult	13(11)	80%
11/22/2017	Monthly beach topo survey	harbor seal	adult	89(89)	99%
12/2/2017	Artificial breaching	harbor seal	adult	4(4)	13%
12/21/2017	Monthly beach topo survey	harbor seal	adult	127(127)	100%
2017 total		harbor seal	adult	1,273(1,115)	
			pup	17(17)	

^a Due to the fact that multiple disturbance episodes are represented by the total number of seals disturbed for a given day, the number reported for the percent of seals on the haul-out that were flushed is the maximum value recorded for that day.

CONCLUSIONS

The water level management activities and biological and physical monitoring activities conducted by the Water Agency resulted in incidental harassment (Level B harassment) of 1,290 harbor seals in 2017, well under the total allowed by NMFS LOA.

The purpose of the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2016) is to detect the response of pinnipeds to estuary management activities at the Russian River estuary. Specifically, the following questions are of interest:

1. Under what conditions do pinnipeds haul out at the Russian River estuary mouth at Jenner?
2. How do seals at the Jenner haul-out respond to activities associated with the construction and maintenance of the lagoon outlet channel and artificial breaching activities?
3. Does the number of seals at the Jenner haul-out significantly differ from historic averages with formation of a summer (May 15th to October 15th) lagoon in the Russian River estuary?
4. Are seals at the Jenner haul-out displaced to nearby river and coastal haul-outs when the mouth remains closed in the summer?

Harbor seals are found at the mouth of the Russian River (Jenner haul-out) throughout the year. They are observed on the beach throughout the tidal cycle and at any time of day. Our baseline pinniped monitoring concluded that tidal state and time of day influenced harbor seal abundance at the Jenner haul-out, with seals less abundant in the early morning and at high tide (SCWA 2012). Harbor seals were most abundant on the Jenner haul-out in July during their annual molt (SCWA 2012), with these same trends being observed in most subsequent years (SCWA 2013, 2014, 2016). Seasonal variation in the abundance of harbor seals at their haul-out locations is commonly observed throughout their range (Allen et al. 1989, Stewart and Yochem 1994, Gemmer 2002). The variation in their abundance can mostly be explained by changes in their biological and physiological requirements throughout the year. Peak seal abundance occurring in July during their molting season is likely a result of seals spending more time on land in order to help facilitate the molting process. This annual peak is typically followed by a decline in seal abundance, which is likely a result of individual seals decreasing the amount of time on the haul-out post-molt to spend more time foraging and also coincides with the time that young seals may temporarily disperse from their natal haul-out (Stewart and Yochem 1994, Thompson et al. 1994, Small et al. 2005).

During 2017 the seasonal abundance patterns of harbor seals at the Jenner haul-out did not follow the trend observed in most previous years. The peak in haul-out abundance, as measured by the single greatest count of seals on land and the highest daily average count, was observed in February. During July, when seal abundance is usually at its maximum, there were fewer seals on land compared to the same month in all previous years. Additionally, there were two monitoring days in July where no harbor seals were observed on the beach. This has not been observed before since monitoring began in 2009. Even if one only compared the number of seals observed when seals were present the single daily maximum count during July for previous years ranges from 295 to 548; in 2017 the most recorded at one time was 199. The river mouth was closed (or perched) for a total of 16 days in July 2017. When one compares previous July surveys when the river mouth was closed to surveys in 2017, the average daily maximum count is 201 seals (2010-2016, n=5) to 78 seals (2017, n=6). The abundance of seals

during the pupping season (March – June) and the number of pups observed during a season has remained relatively stable since these monitoring efforts began, so the population size of harbor seals using the Jenner haul-out as a rookery does not appear to have declined (Figure 4). Seal abundance was higher in January and February compared to previous years and compared to the 2009-2016 average (Figure 6). The abundance of seals on the haul-out has been declining in the July – September period over the past 2 years (Figure 2).

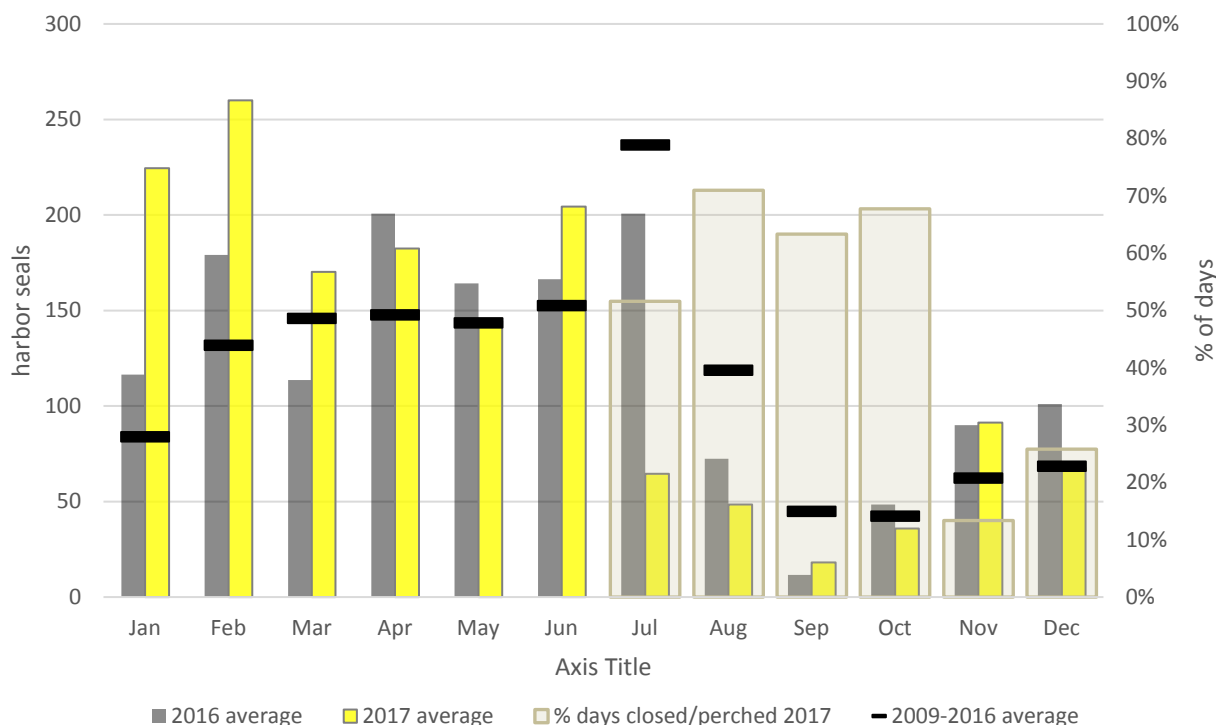


Figure 6. Comparison of the average number of harbor seals hauled out at the Jenner haul-out by month for 2016, 2017 and the 2009-2016 average, including the percent of days the river mouth was closed or perched for each month in 2017.

The Jenner haul-out is a harbor seal rookery and we have attempted to standardize a measure of pup counts so that comparisons can be made across years. However, our ability to accurately measure natality (*i.e.*, proportion of births to the number of mature females) is limited by the fact that harbor seals are not sexually dimorphic so the number of adult females on the beach cannot be easily determined. To obtain a minimum estimate of the number of pups born at Jenner, this year we used the single highest count of pups, rather than the total of neonates, since it was the larger number. While we were able to conduct surveys every week during the pupping season, the estimate of pups born using the total of neonates observed was half as much as the single day maximum of pups observed. This result was likely caused by difficulty some volunteers had correctly identifying and aging pups. Improving reliability of pup counts will be a focus of our upcoming training.

Harbor seals will use the beach when there is an open channel or when a barrier beach has formed, however, the number of seals at Jenner was influenced by river mouth condition. Daily average seal abundance was lower during closed conditions compared to open conditions. The fact that river mouth was closed for a portion of July may have contributed to the low number of seals observed at that time for 2017, but this result was not consistent with results in previous years under similar conditions.

The response of harbor seals at the Jenner haul-out to water level management activities in 2017 was similar to the responses observed in previous years of monitoring (Merritt Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt Smith Consulting 2001; SCWA 2011, 2012, 2013, 2014, 2015 and 2016). Harbor seals alerted to the sound of equipment on the beach and left the haul-out as the crew and equipment approached closer on the beach. When breaching activities were conducted south of the haul-out, or when seals were hauled out on the ocean side of the beach, seals often remained on the beach during all or some of the breaching activity. This indicates that seals are less disturbed by activities when equipment and crew do not pass directly past their haul-out.

Two attempts were made to implement a lagoon outlet channel in 2017. The first attempt ended when the lagoon outlet channel failed to an open river mouth and estuary water levels dropped within 24 hours of implementation. During this period the river mouth was closed for 13 days in July. While the length of the July closure was similar to previous years, fewer harbor seals were observed during lagoon conditions in July 2017 when compared to previous years when the river mouth was closed in the same month. The second attempt resulted in lagoon conditions lasting a total of 21 days (during September, October), until the barrier beach breached 5 days after an outlet channel was excavated. During these lagoon conditions, when estuary water levels were high and there was no outlet to the ocean, harbor seals were observed using the haul-out. The number of seals observed under lagoon conditions in the fall was similar to observations in previous years.

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Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from January to December 2017 for the Russian River Estuary Management Project, including summary of pinniped abundance and Estuary water surface elevation.

date	Activity	Mouth	Estuary water level	HASE adult			HASE pups			HASE neonates			n	CASL present	NES present
				max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
1/13/2017	Baseline	Open	5.82	210	91.8	22.71	0	0.0	0.00	0	0.0	0.00	9		
1/24/2017	Baseline	Open	5.77	322	299.3	7.75	0	0.0	0.00	0	0.0	0.00	9		
1/26/2017	Topo survey	Open	5.52	324	299.0	10.09	0	0.0	0.00	0	0.0	0.00	7		
2/3/2017	Baseline	Open	4.85	348	300.7	13.58	0	0.0	0.00	0	0.0	0.00	9		
2/10/2017	Baseline	Open	7.75	353	335.4	7.46	0	0.0	0.00	0	0.0	0.00	8		
2/15/2017	Topo survey	Open	3.58	155	69.7	28.75	0	0.0	0.00	0	0.0	0.00	6		
2/16/2017	Baseline	Open	4.34	364	259.8	28.35	0	0.0	0.00	0	0.0	0.00	9		
2/22/2017	Baseline	Open	6.03	352	279.2	23.30	0	0.0	0.00	0	0.0	0.00	9		
3/2/2017	Baseline	Open	3.12	285	162.3	32.13	0	0.0	0.00	0	0.0	0.00	9		
3/8/2017	Baseline	Open	3.50	312	167.3	37.58	0	0.0	0.00	0	0.0	0.00	9		
3/16/2017	Topo survey	Open	3.20	191	118.8	21.32	1	0.1	0.13	0	0.0	0.00	8		
3/21/2017	Baseline	Open	3.41	360	314.4	14.79	0	0.0	0.00	0	0.0	0.00	9		
3/28/2017	Baseline	Open	3.75	201	82.6	22.97	0	0.0	0.00	0	0.0	0.00	9		
4/7/2017	Baseline	Open	5.23	215	135.6	17.38	1	0.3	0.17	1	0.6	0.18	9		
4/10/2017	Topo survey	Open	4.09	115	70.2	16.49	0	0.0	0.00	7	4.8	1.05	6		
4/13/2017	Baseline	Open	4.09	234	156.4	17.40	9	5.9	0.56	3	1.8	0.22	9		
4/19/2017	Baseline	Open	3.71	275	254.0	6.67	20	19.3	0.29	4	3.2	0.15	9		
4/25/2017	Topo survey	Open	4.13	154	153.0	1.00	21	21.0	0.00	11	10.0	1.00	2		
4/26/2017	Baseline	Open	4.55	228	190.8	12.24	35	26.2	1.57	13	7.1	1.84	9		
5/3/2017	Baseline	Open	3.03	227	163.0	15.27	0	0.0	0.00	0	0.0	0.00	9		
5/10/2017	Baseline	Open	4.05	243	177.0	19.81	13	10.7	0.78	1	1.0	0.00	9		
5/16/2017	Baseline	Open	3.20	134	110.2	4.05	3	1.7	0.33	0	0.0	0.00	9		

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				max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
5/18/2017	Topo survey	Open	2.32	160	140.3	10.44	14	11.0	1.29	0	0.0	0.00	4		
5/23/2017	Baseline	Open	3.92	186	155.0	5.26	14	10.4	0.73	0	0.0	0.00	9		
5/24/2017	Topo survey	Open	4.72	136	79.8	20.69	11	3.3	1.37	0	0.0	0.00	8		
6/6/2017	Baseline	Open	3.41	159	155.3	2.03	0	0.0	0.00	0	0.0	0.00	3		
6/13/2017	Baseline	Open	2.82	154	124.1	11.47	0	0.0	0.00	0	0.0	0.00	9		
6/20/2017	Baseline	Open	3.37	295	214.4	20.71	6	3.8	0.66	0	0.0	0.00	5		
6/22/2017	Topo survey	Open	3.79	263	213.1	19.31	0	0.0	0.00	0	0.0	0.00	8		
6/27/2017	Baseline	Open	3.92	314	295.8	5.48	0	0.0	0.00	0	0.0	0.00	8		
7/7/2017	Baseline	Closed	5.77	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	9		
7/11/2017	Topo survey	Closed	6.87	103	46.8	18.37	0	0.0	0.00	0	0.0	0.00	6		
7/12/2017	Baseline	Closed	7.12	81	67.4	5.35	0	0.0	0.00	0	0.0	0.00	8		
7/14/2017	Pre-Lagoon Outlet	Closed	7.75	153	82.0	20.07	0	0.0	0.00	0	0.0	0.00	9		
7/17/2017	Lagoon Outlet	Closed	7.75	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	12		
7/18/2017	Post-Lagoon Outlet	Perched	5.10	130	130.0	n/a	0	0.0	n/a	0	0.0	n/a	1		
7/20/2017	Baseline	Open	2.91	199	153.7	19.69	0	0.0	0.00	0	0.0	0.00	9		
7/26/2017	Baseline	Open	3.03	114	101.2	1.83	1	1.0	0.00	0	0.0	0.00	11		
8/3/2017	Topo survey	Open	2.99	180	132.4	14.89	0	0.0	0.00	0	0.0	0.00	8		
8/10/2017	Topo survey	Closed	5.60	31	15.3	4.87	0	0.0	0.00	0	0.0	0.00	9		
8/11/2017	Baseline	Closed	5.82	53	39.6	5.35	0	0.0	0.00	0	0.0	0.00	9		
8/17/2017	Baseline	Closed	7.08	64	39.0	7.68	0	0.0	0.00	0	0.0	0.00	11		
8/23/2017	Baseline	Closed	8.09	30	3.3	3.33	0	0.0	0.00	0	0.0	0.00	9		
8/29/2017	Baseline	Open	2.99	102	75.1	9.84	0	0.0	0.00	0	0.0	0.00	8	Y	
9/8/2017	Baseline	Open	2.99	72	65.1	2.36	0	0.0	0.00	0	0.0	0.00	9		
9/14/2017	Baseline	Closed	4.59	70	15.4	10.22	0	0.0	0.00	0	0.0	0.00	9		
9/19/2017	Baseline	Closed	6.32	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	9		
9/26/2017	Topo survey	Closed	7.84	1	0.3	0.15	0	0.0	0.00	0	0.0	0.00	10		

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date	Activity	Mouth	Estuary water level	HASE adult			HASE pups			HASE neonates			n	CASL present	NES present
				max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
9/28/2017	Lagoon Outlet	Closed	8.05	72	12.0	12.00	0	0.0	0.00	0	0.0	0.00	6		
9/29/2017	Post-Lagoon Outlet	Closed	8.18	27	15.7	4.52	0	0.0	0.00	0	0.0	0.00	9		
10/4/2017	Baseline	Open	5.98	62	48.7	4.79	0	0.0	0.00	0	0.0	0.00	9		
10/17/2017	Baseline	Closed	7.50	2	0.5	0.50	0	0.0	0.00	0	0.0	0.00	4		
10/19/2017	Breaching	Closed	7.88	50	25.9	6.71	0	0.0	0.00	0	0.0	0.00	12		
10/20/2017	Post-Breaching	Open	4.26	112	78.0	17.11	0	0.0	0.00	0	0.0	0.00	9		
10/24/2017	Baseline	Open	3.41	132	43.3	12.44	0	0.0	0.00	0	0.0	0.00	11		
10/26/2017	Topo survey	Closed	4.97	20	4.5	1.90	0	0.0	0.00	0	0.0	0.00	10		
11/1/2017	Pre-Breaching	Closed	7.88	57	44.0	2.85	0	0.0	0.00	0	0.0	0.00	8		
11/3/2017	Baseline	Open	3.54	73	30.1	9.89	0	0.0	0.00	0	0.0	0.00	9		
11/7/2017	Baseline	Open	4.05	116	63.2	10.71	0	0.0	0.00	0	0.0	0.00	9		
11/14/2017	Baseline	Open	3.29	199	183.6	3.28	0	0.0	0.00	0	0.0	0.00	7		
11/22/2017	Topo survey	Open	3.58	125	44.9	12.34	0	0.0	0.00	0	0.0	0.00	14		
11/28/2017	Baseline	Open	6.15	240	223.1	4.11	0	0.0	0.00	0	0.0	0.00	9		
12/1/2017	Pre-Breaching	Closed	9.40	112	67.3	13.68	0	0.0	0.00	0	0.0	0.00	9		
12/2/2017	Breaching	Closed	10.07	39	20.7	3.94	0	0.0	0.00	0	0.0	0.00	9		
12/4/2017	Post-Breaching	Open	4.38	130	32.8	16.63	0	0.0	0.00	0	0.0	0.00	8		
12/6/2017	Baseline	Open	4.09	220	185.4	9.78	0	0.0	0.00	0	0.0	0.00	9		
12/14/2017	Baseline	Perched	4.64	93	21.3	10.94	0	0.0	0.00	0	0.0	0.00	9		
12/20/2017	Baseline	Open	3.29	174	93.0	19.72	0	0.0	0.00	0	0.0	0.00	9		
12/21/2017	Topo survey	Open	2.74	125	44.0	21.38	0	0.0	0.00	0	0.0	0.00	6		
12/28/2017	Baseline	Perched	3.24	57	56.5	0.50	0	0.0	0.00	0	0.0	0.00	2		