Russian River Estuary Management Project

Marine Mammal Protection Act Incidental Harassment Authorization
Report of Activities and Monitoring Results – January 1 to December 31, 2021

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

Sonoma Water

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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 (Sonoma Water) Russian River Estuary Water Level Management Activities (April 21, 2017, NMFS LOA).

Sonoma Water 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 Sonoma Water 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 2021 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. Sonoma Water'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. Sonoma Water 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 Sonoma Water'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 Sonoma Water 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 haulout 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. Sonoma Water 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 (SCWA and Stewards 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 Sonoma Water's water level management events (lagoon outlet channel implementation and artificial breaching). Estuary management monitoring occurred during the Sonoma Water'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 ten times during 2021, three of these closure events resulted in construction of a pilot channel to artificially breach the sand bar. The Russian River mouth was closed to the ocean for a total of 74 days (or 20%) in 2021.

Sonoma Water's biological and physical monitoring activities of the estuary are included in the NMFS LOA. Sonoma Water 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, Sonoma Water 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 2021 resulted in incidental harassment (Level B harassment) of 430 harbor seals, well under the total allowed by the NMFS LOA. The number of incidental harassment occurrences in 2021 was lower than the average number per year from 2010 -2020 (1,234 occurrences).

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 (Sonoma Water) Russian River Estuary Water Level Management Activities (April 21, 2017, NMFS LOA)

Sonoma Water 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 Sonoma Water 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 2021 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 Sonoma Water. Sonoma Water'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.

SPECIAL PROJECTS/RUSSIAN RIVER/7104-ESTUARY/EstuaryManage-PinnipedMonitoring.mxd December 9,2015

Figure 1. Russian River estuary management pinniped monitoring locations.

Biological Opinion and the Estuary

Sonoma Water 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 Sonoma Water'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 Sonoma Water 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). Sonoma Water 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 (SCWA and Stewards 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 (SCWA and Stewards 2016).

Sonoma Water biologists and Stewards of the Coast and Redwoods (Stewards) volunteers and staff monitored pinnipeds at the Jenner haul-out. The Stewards and Sonoma Water provide annual training for all volunteers; the most recent training occurred on April 29, 2021. Sonoma Water 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 Sonoma Water biologists and trained Stewards volunteers. Monitoring of water level management activities at the Jenner haul-out was also shared, but Sonoma Water biologists monitored artificial breaching activities on the day of the event. Pre- and post-breach monitoring was shared by the organizations depending on the availability of volunteers and Sonoma Water staff. Sonoma Water 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 one 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. If any potentially abandoned pup was observed during monitoring, Sonoma Water 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. Disturbances were recorded on a three-point scale adopted by NMFS 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 movement or flush responses.

Level	Type of response	Definition
1	Alert	Seal head orientation or brief movement in response to disturbance, which may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, changing from a lying to a sitting position, or brief movement of less than twice the animal's body length.
2	Movement	Movements in response to the source of disturbance, ranging from short withdrawals at least twice the animal's body length to longer retreats over the beach, or if already moving a change of direction of greater than 90 degrees.
3	Flush	All retreats (flushes) to the water.

Water Level Management Activities

Water level management activities were conducted three times in 2021, with the monitoring methods following a deliberate pattern. To begin, a one-day, pre-event survey was made within one to three 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. Sonoma Water monitors 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 seals as outlined in NMFS LOA. 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.

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. Sonoma Water 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 Sonoma Water 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. During barrier beach closures extra surveys to measure the lowest beach crest elevation may also be conducted to aid in planning of breaching activities. Pinniped monitoring occurs during these surveys as well.

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 baseline 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 Sonoma Water), 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 2021, including baseline, water level management events and estuary management investigations.

Baseline

In 2021 a total of 46 baseline, 11 beach topographic, two beach crest elevation, three pre-breaching (two of which were also baseline surveys), three breaching, and three post-breaching surveys (one of which replaced a baseline survey) were conducted (Appendix A).

Jenner Haul-out Use

Peak seal abundance, as measured by the single greatest count of harbor seals at the Jenner haul-out, was on July 6 (357 seals). Using the average number of seals hauled out by month, seal abundance at Jenner was greatest in July and lowest in October (Figure 2). Using counts during June and July to

represent the typical time of peak seal abundance on land, the average number of seals in 2021 during this period was similar to previous years, and slightly greater than the previous two years (Figure 3). Like previous years there were fewer seals present during closed mouth conditions compared to open conditions (Figure 4). There were more seals observed during perched conditions in 2021 compared to the ten-year average, but there are relatively few instances of perched river mouth conditions overall.

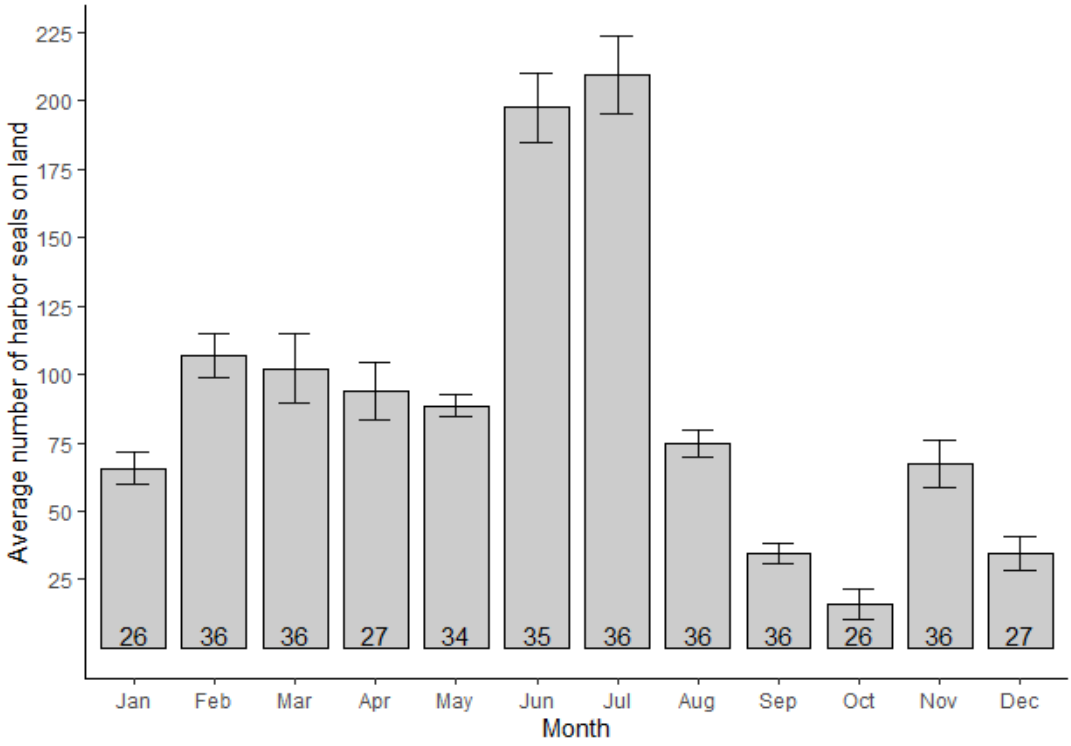

Figure 2. The average number of harbor seals hauled out at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) as counted during 2021 baseline surveys by month. Error bars represent ± 1 standard error and sample size for calculating the mean (n) is shown in the bottom of each bar.

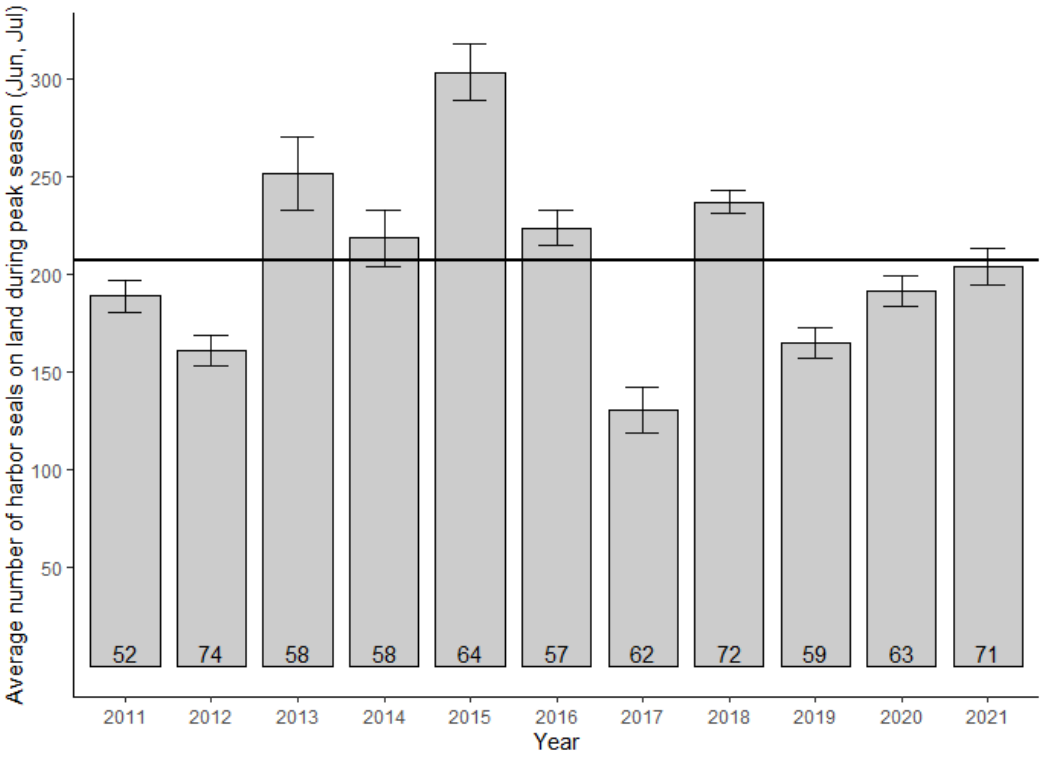

Figure 3. Average number of harbor seals hauled out during baseline surveys in June and July at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) by year. The ten-year (2011-2020) average of abundance during this period (207 seals) is represented by the horizontal line. Error bars represent ± 1 s.e. and sample size to calculate the mean (n) is shown in the bottom of each bar.

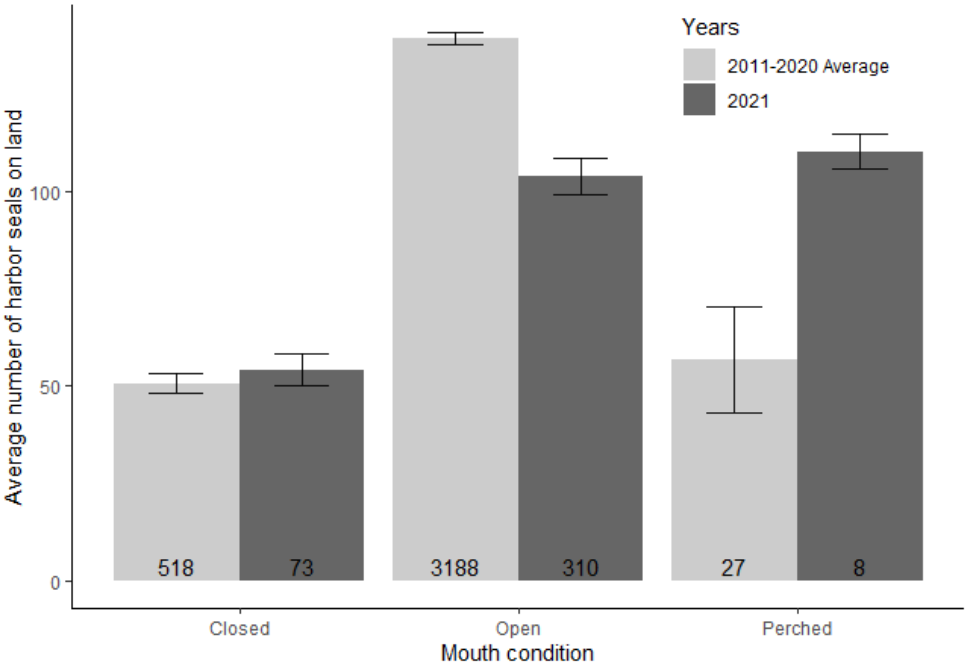

Figure 4. Comparison of the average number of harbor seals hauled out during baseline surveys in 2021 and the ten-year average (2011-2020) at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) by river mouth condition. Error bars represent ± 1 s.e. and sample size to calculate the mean (n) is shown in the bottom of each bar.

Pupping Season

In 2021 the first harbor seal pup was observed on April 6, with the latest observation of pups occurring on June 23 (the last neonate was observed on May 25). Once pups were weaned it became difficult to distinguish pups from sub-adult seals, as a result we did not attempt to classify pups during surveys beginning in July. The number of pups observed at the Jenner haul-out was similar to previous years with an average of 16 pups observed (when pups were present, April - June) and a single highest maximum count of 51 pups for the season (Figure 5).

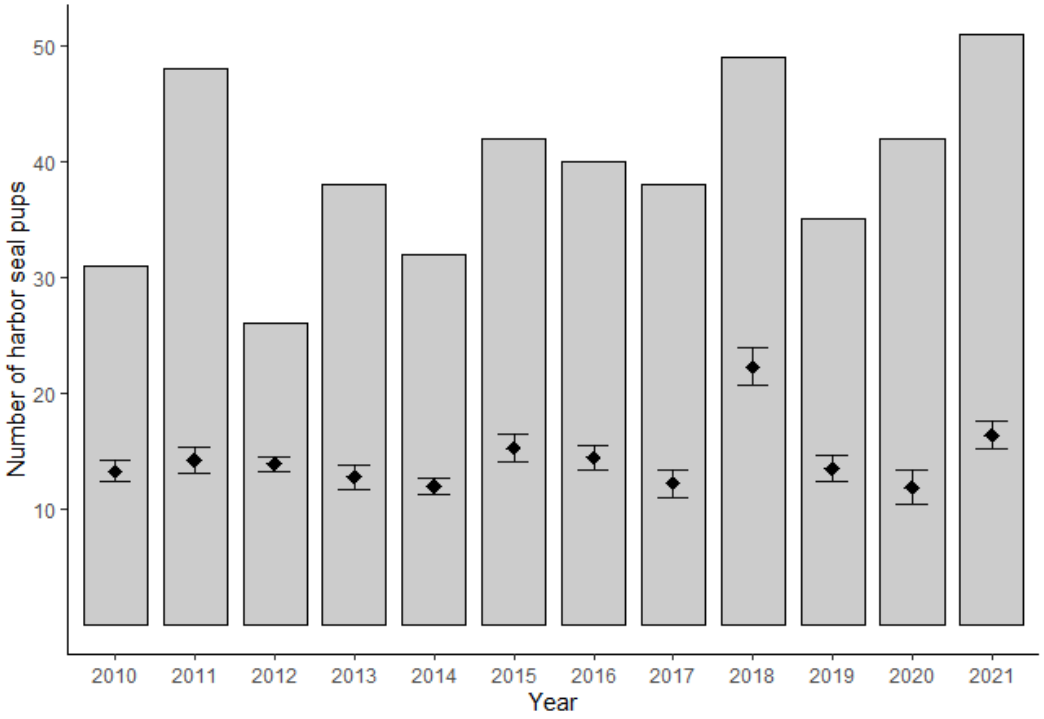

Figure 5. Number of harbor seal pups observed during all surveys at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) by year. Bar height indicates the maximum single day pup count, diamond indicates the average count of pups when pups were present from April-June each year with ± 1 s.e.

Disturbance of Seals

An effort was made to compare the level of disturbance between baseline surveys and surveys when Sonoma Water personnel are working in the vicinity of the Jenner haul-out. In 2021 there were eight disturbance sources recorded: aircraft, birds, dog, floating debris, kayak or other boat, people, unknown, and Sonoma Water. Seals were considered to be disturbed if they moved on or flushed from the haul-out (Table 1).

Harbor seals were most frequently disturbed by people on foot (33% of surveys), with fewer instances during Sonoma Water activities (19% of surveys) (Figure 6). Sonoma Water personnel disturbed seals on 80% of days with Sonoma Water activity on the beach (Figure 6). Birds were the next most frequent source of disturbance (13% of baseline surveys) (Figure 6). During 2021 baseline surveys, when people on foot were the source of a disturbance the distance between them and seals averaged 192 feet at the time the seals exhibited an alert response, 133 feet for a move response, and 70 feet for a flush response. The rate of disturbance and distances at which a response was elicited were very similar to those observed in previous years (SCWA 2021).

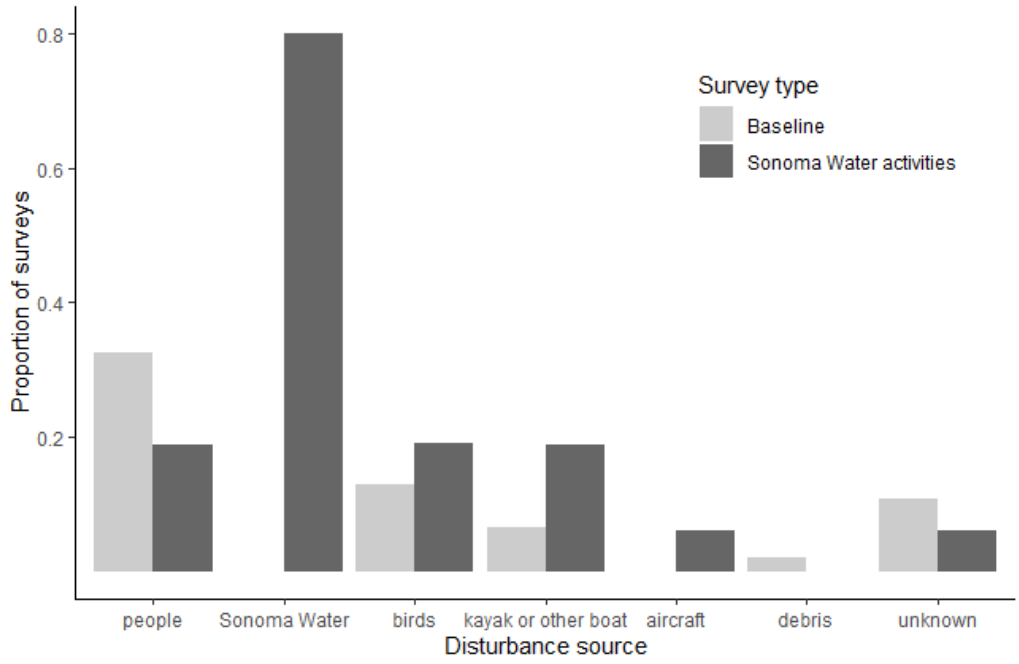

Figure 6. The proportion of surveys where harbor seals were disturbed (moved or flushed) at the Jenner haul-out, described for each disturbance source. Data includes all baseline surveys (n=46) and Sonoma Water activity surveys (i.e., breaching and topographic surveys) (n=16).

Water Level Management Activities

A barrier beach formed ten times during 2021 (Table 2). During three closure events a pilot channel was constructed to reduce the water level in the estuary and in the other events the barrier beach self-breached. The Russian River mouth was closed to the ocean for a total of 74 days (or 20%) in 2021, with 35% of these occurring during the lagoon management period.

On January 12 Sonoma Water constructed a pilot channel just north of the jetty structure at Goat Rock State Beach beginning at 11:36. The pilot channel was completed after 50 minutes of digging and all equipment and crew were off the beach at 12:40. Prior to the arrival of the excavation crew there were 36 harbor seals hauled out north of the jetty structure. Seals alerted to the sound of the excavator traveling on the beach at 11:24 at approximately 700 feet distant. Crews walking in advance of the excavator flushed one group of the seals hauled out at 100 feet distant with the remaining seals flushing into the estuary at 30 feet distant. Seals were observed at the new channel opening within an hour of its completion, alternately hauling up on the beach and swimming in the newly formed channel. During the post-breach survey the following day a maximum count of 108 harbor seals was recorded at the Jenner haul-out.

On January 19 Sonoma Water constructed a pilot channel approximately 100 feet north of the jetty structure at Goat Rock State Beach beginning at 9:26. The pilot channel was completed at 11:46, and all equipment and crew were off the beach at 12:40. Prior to the arrival of the excavation crew there were 19 harbor seals hauled out north of the jetty structure. Crews walking in advance of the excavator flushed most of the seals hauled out at 450 feet distant with the remaining seals flushing into the estuary at 60 feet distant. A few seals were observed hauling out just south of the excavation activity before it was completed, with a maximum of 13 seals observed hauled out at the new opening at 14:00.

During the post-breach survey the following day a maximum count of 118 harbor seals was recorded at the Jenner haul-out.

On March 10 Sonoma Water constructed a pilot channel north of the jetty structure at Goat Rock State Beach beginning at 11:55. The pilot channel was completed at 12:55, and all equipment and crew were off the beach at 13:20. Prior to the arrival of the excavation crew there were 50 harbor seals hauled out north of the jetty structure. Crews walking in advance of the excavator flushed a few seals at 400 feet distant with most seals flushing into the estuary at 150 feet distant. At the time digging started there were 4 seals remaining on the beach approximately 70 feet north of the excavator. These remaining seals flushed into the estuary after four minutes of digging activity. Five seals were observed hauled at the new opening at 13:47. During the post-breach survey the following day a maximum count of 193 harbor seals was recorded at the Jenner haul-out.

Table 2. Summary of river mouth closures in 2021 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
January 2	10.4	January 7	none
January 9	9.2	January 12	artificial breach
January 15	8.8	January 19	artificial breach
January 26	10.4	January 28	none
March 5	8.8	March 10	artificial breach
April 21	6.2	May 6	none
May 10	4.9	May 18	none
September 28	11.2	October 24	none
November 26	5.3	November 28	none
November 30	7.4	December 4	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 2021 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 (Table 1). 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 Sonoma Water biologist was present during topographic surveys to monitor the seal response to the survey crew. Between 3% 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 2021, 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]
1/12/2021	Artificial breaching	harbor seal	adult	72(36)	100%
1/19/2021	Artificial breaching	harbor seal	adult	25(25)	100%
1/21/2021	Monthly beach topo survey	harbor seal	adult	38(37)	84%
2/24/2021	Monthly beach topo survey	harbor seal	adult	34(33)	100%
3/10/2021	Artificial breaching	harbor seal	adult	50(50)	100%
3/18/2021	Monthly beach topo survey	harbor seal	adult	20(13)	100%
4/22/2021	Monthly beach topo survey	harbor seal	adult	54(40)	60%
			pup	18(16)	100%
6/1/2021	Estuary seining	harbor seal	adult	4(4)	80%
6/23/2021	Monthly beach topo survey	harbor seal	adult	13(8)	16%
7/15/2021	Monthly beach topo survey	harbor seal	adult	10(10)	3%
8/12/2021	Monthly beach topo survey	harbor seal	adult	10(10)	12%
10/7/2021	Monthly beach topo survey	harbor seal	adult	28(28)	100%
10/19/2021	Extra beach survey	harbor seal	adult	54(29)	100%
2021 total		**harbor seal**	**adult**	**412(323)**	
			pup	**18(16)**	

[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 Sonoma Water resulted in incidental harassment (Level B harassment) of 430 harbor seals in 2021, well under the total allowed by NMFS LOA.

The purpose of the Russian River Estuary Management Project Pinniped Monitoring Plan (SCWA and Stewards 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, 2021). Harbor seals were most abundant on the Jenner haul-out in July during their annual molt in most years (SCWA 2012, 2013, 2014, 2016, 2021). 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). 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 with seals most abundant during open mouth conditions (SCWA 2021).

While the seasonal abundance of harbor seal at the Jenner haul-out has not always follow the seasonal pattern described above (SCWA 2018, 2019, 2020) we have observed peak seal abundance in the summer months during the past two years (SCWA 2021). Additionally, seal abundance during June and July 2021 was not different (within the standard error) from the ten-year average (Figure 3).

Harbor seals responded to breaching activities in 2021 in the same manner that they have responded to water level management activities in previous years (SCWA 2021). Seals initially alert to the noise of the excavator approaching on the beach or the presence of staff walking in advance of the equipment. As staff and equipment continue to approach seals flush into the estuary.

No summer lagoon was formed during 2021 and the river mouth was closed only briefly (3 and 9 days) during the lagoon outlet management period. The question about how seals would respond to the maintenance of a summer lagoon in the Russian River estuary remains unanswered because Sonoma Water has not constructed and maintained a summer lagoon for more than a few days (< 1 to 5 days) on only five occasions since 2009 (SCWA 2011, 2017, 2018).

Sonoma Water applied for a second Letter of Authorization in September 2021 for continued water level management activities in the Russian River Estuary. We expect to be operating under a new LOA by the time our current one expires in April 2022. As part of the request for a new LOA Sonoma Water updated the Pinniped Monitoring Plan (SCWA and Stewards 2021). The updated monitoring plan considers data collected on harbor seal use of the Jenner haul out for an eleven-year period (2010-2020) and the monitoring goals were updated accordingly. Going forward the objective of pinniped monitoring will be to detect and report on the response of pinnipeds to estuary management activities and to continue to report on annual abundance (including pups) and trends in harbor seal population size at the Jenner haul-out.

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Much appreciation is extended to the Stewards of the Coast and Redwoods staff and volunteers for their hard work and commitment to gathering data on the pinnipeds and haul-outs in and around the Russian River estuary. Stewards staff provided the training and support that made the monitoring effort possible. Special thanks to all the volunteers that provided their time and keen observations to monitoring pinnipeds.

REFERENCES

Allen, S. G., H. R. Huber, C. A. Ribic and D. G. Ainley. 1989. Population dynamics of harbor seals in the Gulf of the Farallones, California. California Fish and Game 75(4): 224-232.

Gemmer, A. 2002. Ecology of harbor seals, *Phoca vitulina*, in northern California. M.A. Thesis, Humboldt State University: 128pp.

Heckel, M. 1994. Russian River Estuary Study 1992-1993. Prepared for Sonoma County Department of Planning and California State Coastal Conservancy. 186 pp.

NMFS (National Marine Fisheries Service). 2008. Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River watershed. September 24, 2008.

Small, R. J., L. F. Lowry, J. M. Ver Hoef, K. J. Frost, R. A. DeLong and M. J. Rehberg. 2005. Differential movements by harbor seal pups in contrasting Alaska environments. Marine Mammal Science 21(4):671-694

Sonoma County Water Agency. 2021. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Summary Report for April 2017 LOA. Prepared for

Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, May 2021.

Sonoma County Water Agency. 2020. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2019. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, March 2020.

Sonoma County Water Agency. 2019. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2018. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, February 2019.

Sonoma County Water Agency. 2018. 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, March 2018.

Sonoma County Water Agency. 2017. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2016. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, February 2017.

Sonoma County Water Agency. 2016. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2015. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, January 2016.

Sonoma County Water Agency. 2014. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2013. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, January 2014.

Sonoma County Water Agency. 2013. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results – January 1 to December 31, 2012. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, January 2013.

Sonoma County Water Agency. 2012. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization, Report of Activities and Monitoring Results - April 2009 to December 31, 2011. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, January 2012.

Sonoma County Water Agency. 2011. Russian River Estuary Management Project, Marine Mammal Protection Act Incidental Harassment Authorization (No. 14426), Report of Activities and Monitoring Results - April 1 to December 2010. Prepared for Office of Protected Resources and Southwest Regional Administrator, National Marine Fisheries Service, February 2011.

Sonoma County Water Agency and Stewards of the Coast and Redwoods. 2021. Russian River Estuary Management Project, Pinniped Monitoring Plan, Revised. August 2021.

Sonoma County Water Agency and Stewards of the Coast and Redwoods. 2016. Russian River Estuary Management Activities Pinniped Monitoring Plan, Revised. January 2016.

Stewart, B. S. and P. K. Yochem. 1994. Ecology of harbor seals in the southern California bight. pp. 123-134 *in* The fourth California islands symposium: update on the status of resources, W. L. Halvorson and G. J. Maender (eds.), Santa Barbara Museum of Natural History, Santa Barbara, California.

Thompson, P. M., K. M. Kovacs and B. J. McConnell. 1994. Natal dispersal of harbor seals (Phoca vitulina) from breeding sites in Orkney, Scotland. Journal of Zoology, London 234:668-673.

Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by Sonoma Water and Stewards of the Coast and Redwoods from January to December 2021 for the Russian River Estuary Management Project, including summary of pinniped abundance and estuary water surface elevation.

				HASE adult			HASE pups			HASE neonate					
date	activity	mouth condition	estuary water level	max	mean	s.e.	max	mean	s.e.	max	mean	s.e.	n	CASL present	NES present
1/5/2021	Baseline	Closed	7.33	111	104.1	2.81	0	0.0	0.00	0	0.0	0.00	9		
1/11/2021	Baseline/pre-breaching	Closed	8.38	50	42.8	1.92	0	0.0	0.00	0	0.0	0.00	9		
1/12/2021	Breaching	Closed	8.39	39	13.0	4.75	0	0.0	0.00	0	0.0	0.00	11		
1/13/2021	Post-Breaching	Open	4.72	107	56.0	14.52	0	0.0	0.00	0	0.0	0.00	8	Y	
1/18/2021	Pre-Breaching	Closed	8.10	98	81.9	2.26	0	0.0	0.00	0	0.0	0.00	9		
1/19/2021	Breaching	Closed	8.82	19	6.9	2.07	0	0.0	0.00	0	0.0	0.00	12		
1/20/2021	Baseline	Open	1.39	122	90.3	8.23	0	0.0	0.00	0	0.0	0.00	9		
1/21/2021	Monthly beach topo survey	Open	2.44	91	46.0	14.53	0	0.0	0.00	0	0.0	0.00	6		
1/28/2021	Baseline	Open	7.27	119	60.7	11.72	0	0.0	0.00	0	0.0	0.00	9		
2/2/2021	Baseline	Open	4.41	186	155.7	6.61	0	0.0	0.00	0	0.0	0.00	9		
2/9/2021	Baseline	Open	1.40	136	131.3	1.88	0	0.0	0.00	0	0.0	0.00	9		
2/17/2021	Baseline	Open	4.27	110	100.4	3.74	0	0.0	0.00	0	0.0	0.00	9		
2/23/2021	Baseline	Open	2.91	91	40.2	11.27	0	0.0	0.00	0	0.0	0.00	9		
2/24/2021	Monthly beach topo survey	Perched	3.32	49	24.9	6.27	0	0.0	0.00	0	0.0	0.00	7		
3/4/2021	Baseline	Open	4.04	36	28.2	2.39	0	0.0	0.00	0	0.0	0.00	9		
3/8/2021	Monthly beach topo survey	Closed	7.07	88	79.7	3.01	0	0.0	0.00	0	0.0	0.00	9		
3/9/2021	Pre-Breaching	Closed	7.85	100	94.1	1.79	0	0.0	0.00	0	0.0	0.00	9		
3/10/2021	Breaching	Closed	8.68	96	42.2	12.41	0	0.0	0.00	0	0.0	0.00	11		
3/11/2021	Post-Breaching	Open	2.34	193	186.9	1.64	0	0.0	0.00	0	0.0	0.00	9	Y	
3/16/2021	Baseline	Open	1.65	233	211.6	4.30	0	0.0	0.00	0	0.0	0.00	9		
3/18/2021	Monthly beach topo survey	Open	1.01	31	11.7	2.96	0	0.0	0.00	0	0.0	0.00	11		
3/24/2021	Baseline	Open	2.12	167	74.8	21.18	0	0.0	0.00	0	0.0	0.00	9		
4/6/2021	Baseline	Open	0.90	163	148.8	4.93	7	4.7	0.50	5	3.7	0.41	9		
4/13/2021	Baseline	Open	1.07	107	84.1	7.33	0	0.0	0.00	12	9.6	0.44	9		
4/20/2021	Baseline	Open	2.06	125	110.4	2.89	29	24.3	1.29	0	0.0	0.00	8		
4/22/2021	Monthly beach topo survey	Closed	3.00	55	28.0	5.88	19	12.7	1.83	3	2.7	0.24	9		

Appendix A. continued

				HASE adult			HASE pups			HASE neonate					
date	**activity**	**mouth condition**	**estuary water level**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**n**	**CASL present**	**NES present**
4/27/2021	Baseline	Closed	4.60	40	23.0	4.39	13	7.6	1.29	1	0.2	0.15	9		
5/4/2021	Baseline	Closed	5.91	80	59.4	5.18	34	21.8	2.52	2	0.2	0.22	9		
5/11/2021	Baseline	Closed	2.74	70	57.3	3.03	21	14.8	1.19	3	0.6	0.38	8		
5/18/2021	Baseline	Closed	4.85	74	57.3	7.60	19	12.3	1.86	0	0.0	0.00	9		
5/25/2021	Baseline	Open	1.12	127	110.9	3.40	11	7.7	1.24	1	0.1	0.11	9		
6/3/2021	Baseline	Open	0.61	148	138.3	2.35	24	18.4	1.16	0	0.0	0.00	9		
6/9/2021	Baseline	Perched	3.20	127	109.0	4.12	0	0.0	0.00	0	0.0	0.00	9		
6/16/2021	Baseline	Open	0.47	182	163.6	6.09	51	45.7	1.19	0	0.0	0.00	9		
6/22/2021	Baseline	Open	1.15	316	304.3	2.49	0	0.0	0.00	0	0.0	0.00	9		
6/23/2021	Monthly beach topo survey	Open	1.29	325	312.0	3.23	7	0.9	0.77	0	0.0	0.00	9		
7/6/2021	Baseline	Open	1.24	357	334.9	4.59	0	0.0	0.00	0	0.0	0.00	9		
7/14/2021	Baseline	Open	0.66	244	224.6	6.13	5	3.7	0.24	0	0.0	0.00	9		
7/15/2021	Monthly beach topo survey	Open	0.58	237	210.9	6.01	2	2.0	0.00	0	0.0	0.00	7		
7/21/2021	Baseline	Open	1.15	178	139.9	11.87	0	0.0	0.00	0	0.0	0.00	9		
7/29/2021	Baseline	Open	0.56	157	135.2	5.70	0	0.0	0.00	0	0.0	0.00	9		Y
8/4/2021	Baseline	Open	1.13	127	120.8	1.30	0	0.0	0.00	0	0.0	0.00	9		
8/11/2021	Baseline	Open	0.54	69	61.7	1.89	0	0.0	0.00	0	0.0	0.00	9		
8/12/2021	Monthly beach topo survey	Open	0.52	68	51.9	5.16	0	0.0	0.00	0	0.0	0.00	8		
8/20/2021	Baseline	Open	1.76	70	53.0	5.50	0	0.0	0.00	0	0.0	0.00	9		
8/23/2021	Baseline	Open	0.65	68	63.3	0.88	0	0.0	0.00	0	0.0	0.00	9		
9/2/2021	Baseline	Open	1.41	40	27.9	3.53	0	0.0	0.00	0	0.0	0.00	9		
9/8/2021	Monthly beach topo survey	Open	0.69	15	4.8	2.37	0	0.0	0.00	0	0.0	0.00	8		
9/9/2021	Baseline	Open	0.60	58	31.9	8.11	0	0.0	0.00	0	0.0	0.00	9		
9/15/2021	Baseline	Open	1.33	20	14.4	1.63	0	0.0	0.00	0	0.0	0.00	9		
9/23/2021	Baseline	Open	1.09	70	64.8	1.29	0	0.0	0.00	0	0.0	0.00	9		
10/5/2021	Baseline	Closed	3.57	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	4		
10/5/2021	Extra Survey	Closed	3.56	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	5		
10/7/2021	Monthly beach topo survey	Closed	3.72	28	11.2	4.46	0	0.0	0.00	0	0.0	0.00	9		

Appendix A. continued

				HASE adult			HASE pups			HASE neonate					
date	**activity**	**mouth condition**	**estuary water level**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**n**	**CASL present**	**NES present**
10/14/2021	Baseline	Closed	4.22	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	9		
10/19/2021	Extra Survey	Closed	4.64	31	10.0	6.33	0	0.0	0.00	0	0.0	0.00	6		
10/22/2021	Baseline	Open	6.23	1	0.3	0.25	0	0.0	0.00	0	0.0	0.00	4		
10/28/2021	Baseline	Open	2.24	80	45.4	10.13	0	0.0	0.00	0	0.0	0.00	9		
11/3/2021	Baseline	Open	1.94	123	109.6	3.62	0	0.0	0.00	0	0.0	0.00	9		
11/9/2021	Baseline	Open	2.99	156	100.3	17.37	0	0.0	0.00	0	0.0	0.00	9		
11/18/2021	Monthly beach topo survey	Open	3.14	37	11.8	4.71	0	0.0	0.00	0	0.0	0.00	10		
11/22/2021	Baseline	Open	2.91	0	0.0	0.00	0	0.0	0.00	0	0.0	0.00	9		
11/30/2021	Baseline	Closed	2.71	90	60.0	8.36	0	0.0	0.00	0	0.0	0.00	9		
12/6/2021	Baseline	Open	3.53	84	74.0	2.69	0	0.0	0.00	0	0.0	0.00	9		
12/15/2021	Baseline	Open	4.25	53	24.2	6.73	0	0.0	0.00	0	0.0	0.00	9		
12/16/2021	Monthly beach topo survey	Open	5.53	157	96.3	15.98	0	0.0	0.00	0	0.0	0.00	6		
12/28/2021	Baseline	Open	2.52	16	5.4	2.22	0	0.0	0.00	0	0.0	0.00	9		