

Russian River Estuary Management Project

Marine Mammal Protection Act Incidental Harassment Authorization (issued April 26, 2011)

Report of Activities and Monitoring Results – July 2009 to December 2011

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 requirements of the Incidental Harassment Authorization (IHA) issued pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C 1361 et seq.) to take small numbers of marine mammals, by Level B harassment, incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (renewed April 20, 2011, original authorization dated March 30, 2010, NMFS IHA No. 14426, Attachment A).

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 (Estuary). NMFS issued IHA No. 14426 to the Water Agency on March 30, 2010. In February 2011 the Water Agency requested that NMFS renew IHA No. 14426 and this request was granted on April 20, 2011. This report provides the results of all baseline monitoring and water level management activities since the beginning of pinniped monitoring activities in April 2009 to December 31, 2011, including the term of IHA No. 14426.

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 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 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. 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, the 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, coho salmon, and Chinook salmon. 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 (referred to hereafter as 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 richardii*) regularly haul out at the mouth of the Russian River (Jenner haulout). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haulout. There are also several known river haulouts at logs and rock piles in the Russian River estuary. The Water Agency applied for an IHA under the MMPA for activities associated with Russian River estuary management activities, which occur in the vicinity of these haulouts, including:

- excavation and maintenance of a lagoon outlet channel that would facilitate management of a barrier beach (closed sandbar) at the mouth of the Russian River and creation of a summer lagoon to improve rearing habitat for listed steelhead as mandated 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; and
- biological and geophysical monitoring activities associated with the management actions described above.

Monitoring was performed in accordance with the requirements of NMFS IHA No. 14426 and the Russian River Estuary Management Activities Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011).

In an attempt to understand possible relationships between use of the Jenner haulout and nearby coastal and river (peripheral) haulouts, several other haulouts on the coast and in the Russian River estuary were monitored. These haulouts included North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Patty's Rock, and Chalanchawi in the Russian River estuary.

Two types of monitoring were performed: baseline and water level management activities. Baseline monitoring was performed to gather additional information regarding a possible relationship between tides, time of day, and the highest pinniped counts at the Jenner haulout and to gain a better understanding about which specific conditions harbor seals may prefer for hauling out at the mouth. Baseline monitoring of the peripheral haulouts was completed concurrently with the monitoring of the Jenner haulout. Pinniped use of the haulouts was also monitored in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Each of the peripheral haulouts was monitored concurrently with baseline and monitoring of water level management activities in the vicinity of the Jenner haulout.

In 2011 no water level management activities occurred. There was a short-term closure on September 24, 2011, which was followed by a perched outlet channel forming on September 26, and no beach management activities occurred. In 2010 one lagoon management event and two artificial breaching events occurred (SCWA 2011). Pinniped monitoring occurred the day before, the day of, and the day after each water level management activity. The NMFS IHA No. 14426 allowed 4,200 occurrences of incidental harassment during the lagoon management period and 258 occurred in 2010. In 2009 eleven artificial breaching events occurred. Pinniped monitoring occurred during each breaching event.

The Water Agency's Estuary monitoring activities are included in the NMFS IHA No. 14426. 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 was present during these surveys to record

any disturbances of the Jenner haulout during the survey. Additionally, Water Agency field staff conducting biological and physical monitoring in the Estuary recorded any pinnipeds they encountered hauled out in the Estuary and any recorded disturbance to pinnipeds associated with their activities. The NMFS IHA No. 14426 allows 64 occurrences of incidental harassment and an estimated 32 occurred in 2010 and 42 occurred in 2011.

The Russian River Estuary Management and Monitoring Activities in 2011 resulted in incidental harassment (Level B harassment) of 42 marine mammals, well under the total allowed by NMFS IHA No. 14426. The Russian River Estuary Management activities in 2010 resulted in incidental harassment (Level B harassment) of 290 marine mammals.

INTRODUCTION

The purpose of this report of activities and monitoring results is to comply with the requirements of the Incidental Harassment Authorization (IHA) issued pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C 1361 et seq.) to take small numbers of marine mammals, by Level B harassment, incidental to the Sonoma County Water Agency's (Water Agency) Russian River Estuary Water Level Management Activities (renewed April 20, 2011, original authorization dated March 30, 2010, NMFS IHA No. 14426, Appendix A).

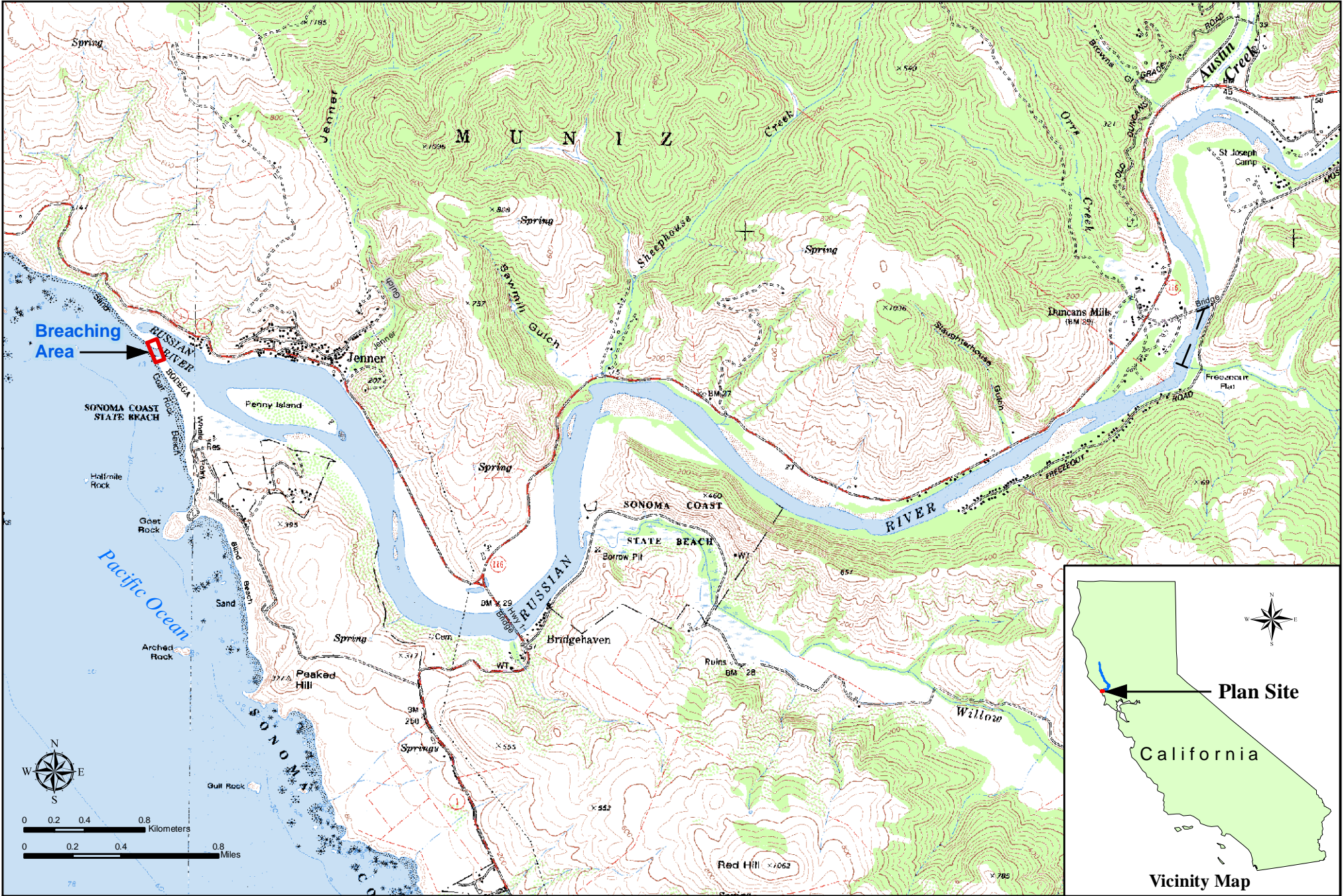
The Water Agency first applied in 2009 to the National Marine Fisheries Service (NMFS) Office of Protected Resources for an IHA under the Marine Mammal Protection Act (MMPA) for activities associated with water level management activities in the Russian River estuary (Estuary). NMFS issued IHA No. 14426 to the Water Agency on March 30, 2010. In February 2011 the Water Agency requested that NMFS renew IHA No. 14426 and this request was granted on April 20, 2011. This report provides the results of all baseline monitoring and water level management activities since the beginning of pinniped monitoring activities in April 2009 to December 31, 2011, including the term of IHA No. 14426.

BACKGROUND

The Russian River estuary (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, the 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, coho salmon, and Chinook salmon. 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 historic 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) 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 (referred to hereafter as 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 haulout) (Figure 2). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haulout. There are also several known river haulouts at logs and rock piles in the Russian River estuary (Figure 2). The Water Agency applied for an IHA 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 barrier beach (closed sandbar) at the mouth of the Russian River and creation of a summer lagoon to improve rearing habitat for listed steelhead as mandated 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; and
- biological and geophysical monitoring activities associated with the management actions described above.



METHODS

Monitoring was performed in accordance with the requirements of NMFS IHA No. 14426 and the Russian River Estuary Management Activities Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011, Appendix B).

Water Agency biologists and Stewards of the Coast and Redwoods (Stewards) volunteers and staff monitored pinnipeds at the Jenner and peripheral haulouts. The Stewards provide annual training for all volunteers, trainings occurred on March 10, 2010, and January 10, 2011. The training session was also attended by Water Agency biologists participating in the monitoring program. The training agenda covered:

- the Marine Mammal Protection Act;
- anticipated IHA 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, and northern elephant 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 each haulout monitoring location.

In an attempt to understand possible relationships between use of the Jenner haulout and nearby coastal and river (peripheral) haulouts, several other haulouts on the coast and in the Russian River estuary were monitored (Figure 2). These haulouts included North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Patty's Rock, and Chalanchawi in the Russian River estuary. These are known harbor seal haulouts that have been monitored by Joe Mortenson for the past 25 years.

Two types of monitoring were performed: baseline and water level management activities. Baseline monitoring of the Jenner haulout was shared by Water Agency biologists and Stewards volunteers (each group monitored once a month), with volunteers monitoring the peripheral haulouts for all baseline monitoring. The water level management activity monitoring at the Jenner haulout was also shared, but Water Agency biologists monitored lagoon outlet channel and artificial breaching activities on the day of the event. Pre- and post-management activity monitoring was shared by the organizations depending on the availability of volunteers and Water Agency staff. Stewards' volunteers monitored the peripheral haulouts during most of the pre- and post-management monitoring events.

Baseline (Jenner Haulout Use)

Baseline monitoring was performed to gather additional information regarding a possible relationship between tides, time of day, and the highest pinniped counts at the Jenner haulout and to gain a better understanding about which specific conditions harbor seals may prefer for hauling out at the mouth. Baseline monitoring of the peripheral haulouts was completed concurrently with the monitoring of the Jenner haulout. Baseline counts were scheduled for two days out of each month with the intention of capturing a low and high tide each in the morning and afternoon.

Pinnipeds at the Jenner and peripheral haulouts were counted twice monthly. This census began at local dawn and continued for 8 hours. All pinnipeds hauled out on the beach were counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the Jenner haulout using binoculars or a

high-powered spotting scope. Depending on how the sandbar is formed, harbor seals may haul out in multiple groups at the Jenner haulout. 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. Adults and pups were counted separately through June, after which it became difficult to differentiate between age classes. All neonates were also recorded and were identified by one or more of the following characteristics: less than 1 week old, less than 15 kg, thin for their body length, an umbilicus or natal pelage present, wrinkled skin, or awkward or “jerky” movement.

The peripheral haulouts were visited for 10 minute counts four times during each baseline monitoring day. All pinnipeds hauled out during the 10 minutes were counted from the same vantage points at each haulout using a high-powered spotting scope or binoculars.

In addition to the census data, disturbances of the haulouts 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 haulout, were recorded.

Table 1 Levels of pinniped response to disturbance used for Russian River Estuary Management Activities pinniped monitoring.

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.		

Weather conditions were recorded at the beginning of each census. These included temperature, visibility, ocean conditions and wind speed (Beaufort scale). Tide levels and Estuary water surface elevations were correlated to each monitoring day.

Water Level Management Activities

Pinniped use of the haulouts was also monitored in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Each of the peripheral haulouts were monitored concurrently with monitoring of water level management activities in the vicinity of the Jenner haulout. This provided an opportunity to investigate if there was any correlation to water level management activities and the number of seals using these nearby coastal haulouts. As the exact movements of individual seals are not tracked, the number of seals displaced from the Jenner haulout to the peripheral haulouts cannot be quantified; however, potential trends may be observed. As there were no water level management activities in 2011, only Baseline monitoring described in the “Baseline (Jenner Haulout Use)” section above were performed in 2011. The methods for monitoring water levels

management activities would have been as follows. 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 haulouts. Methods followed the census and disturbance monitoring protocols described in the “Baseline (Jenner Haulout Use)” section above.

Biological and Physical Monitoring

The NMFS IHA No. 14426 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. Although not specified in the NMFS IHA No. 14426, a Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haulout and to observe pinniped response to the survey work in the vicinity of the Jenner haulout. Once survey crews approached a seal haulout the Water Agency monitor would notify the survey crew as soon as the seals became alert to their presence via radio, in an effort to minimize any disturbance.

Monitoring During Pupping Season

If any pup which was potentially abandoned was observed during monitoring, the Water Agency contacted the NMFS stranding response network (Marine Mammal Center in Sausalito, CA) immediately and also reported 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.

Additional Training

As there were no water level management activities in 2011, a worker training was not held in 2011. However, prior to each beach topographic survey beginning, the biologist monitoring the survey participated in the onsite tailgate safety meeting to discuss the location(s) of pinnipeds at the Jenner haulout that day and methods of avoiding and minimizing disturbances to the haulout as outlined in NMFS IHA No. 14426.

RESULTS

The NMFS IHA No. 14426 (2011) 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) haulout reoccupation time of any seals based on post activity monitoring;

- (g) tide levels and estuary water surface elevation;
- (h) seal census from bi-monthly and nearby haulout monitoring; and
- (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 C includes the Estuary water surface elevations associated with pinniped monitoring in 2009 - 2011, including both baseline and water elevation management events

Baseline (Jenner Haulout Use)

Beginning in July 2009 baseline monitoring of the Jenner and peripheral haulouts was performed two days out of each month with the intention of capturing a low and high tide each in the morning and afternoon. In 2009 baseline surveys were only conducted once per month in October, November and December due to the additional number of days monitoring was required for the artificial breaching events in these months. In January 2010 only one baseline survey was conducted due to the additional monitoring required for an artificial breaching event that occurred on January 11, 2010. Appendix C lists all pinniped monitoring activity.

Pups are born at the Jenner haulout beginning in March (with the earliest observations during Baseline monitoring occurring on March 25, 2010, and March 17, 2011) and continuing into May (with the latest observation of neonates occurring on May 27, 2010 and May 23, 2011). Pups are counted during surveys through June, after which time it becomes difficult to distinguish pups from sub-adult seals. No distressed or abandoned pups were reported by Water Agency or Stewards monitors in 2011.

Peak seal abundance occurred during the summer molting period (Figure 3). Peak seal abundance, as determined by the single greatest count of harbor seals at the Jenner haulout, were on July 23, 2009 (292 seals), July 19, 2010 (416 seals) and June 29, 2011 (329 seals) (Appendix C). Abundance of seals on the Jenner haulout varies with month (ANOVA (11, 916) $F = 101.5$, $p < 0.000$) with declines in the fall and early winter months when seals may spend more time off their haulouts foraging or travelling (Figure 4).

Pinnipeds using the Jenner haulout are subjected to increased wave over wash and reductions in available haulout space with rising ocean tides. Harbor seals have been observed hauled out at the mouth of the Russian river throughout the tide cycle. However, they are less abundant during the highest of high tides (ANOVA: $F(5, 922) = 22.4$, $p < 0.000$)(Figure 5).

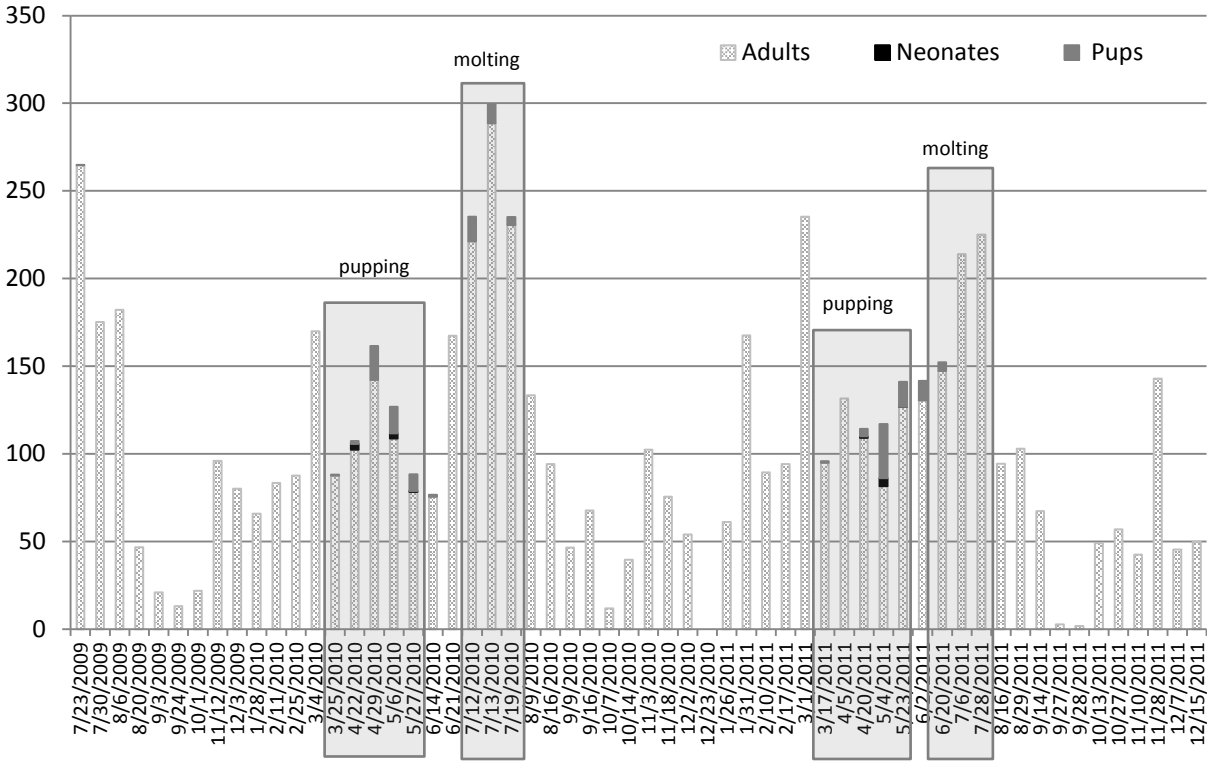


Figure 3. Mean number of harbor seals observed at the Jenner haulout (Russian River mouth at Goat Rock State Beach) during Russian River Estuary Management Project baseline pinniped monitoring from July 2009 to December 2011. Pups are counted separately through June, after which all seals are counted as adults as it becomes more difficult to accurately age.

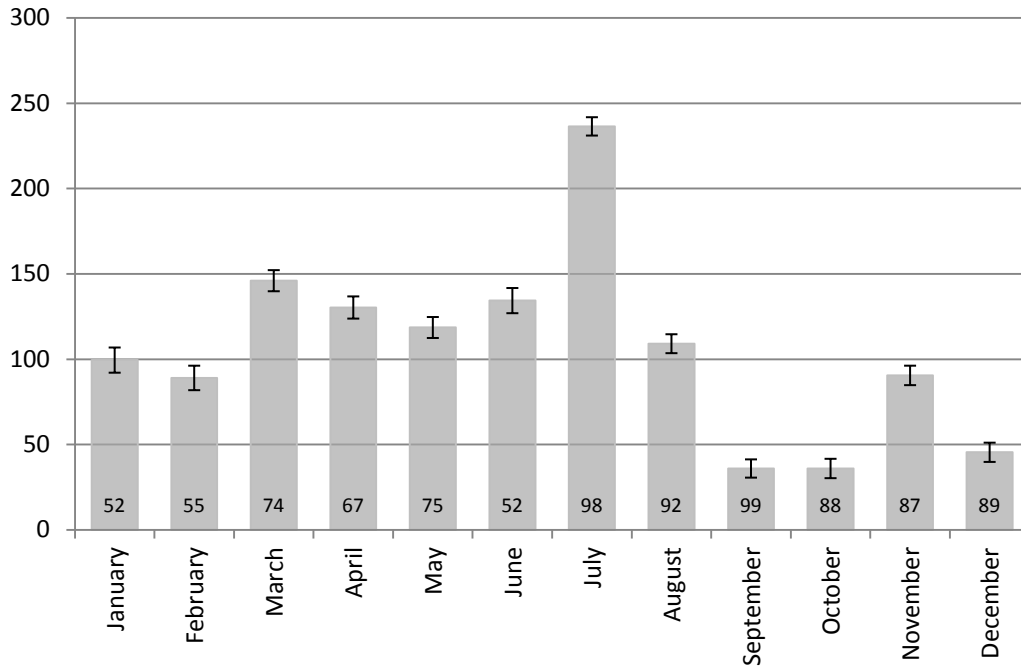


Figure 4. Mean number of harbor seals hauled out at the Jenner haulout (Russian river mouth at Goat Rock State Beach) as counted during baseline surveys from July 2009 – December 2011, categorized by month. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars.

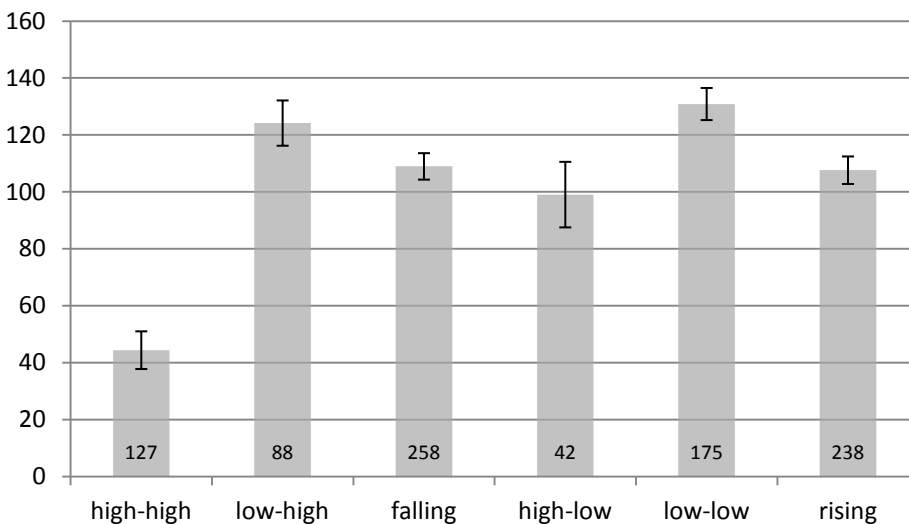


Figure 5. Mean number of harbor seals hauled out at the Jenner haulout (Russian river mouth (at Goat Rock State Beach) as counted during baseline surveys from July 2009 – December 2011, categorized by tidal state. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars.

Time of day did effect the abundance of seals at the Jenner haulout (ANOVA: $F(10,917) = 4.6, p < 0.000$). Seals were more abundant in the afternoon hours compared to the morning hours. A few counts were conducted in the early morning hours (from 06:00 to 06:59) and the late afternoon hours (16:00-16:59) when seal abundance was relatively high (Figure 6). The early morning counts were conducted mostly in July and August around the time of peak seal abundance. The late afternoon counts were mostly

conducted in the winter months when seals may haul out in greater abundance after the ambient temperatures increase. In both cases too few counts were conducted at these hours for these results to reach statistical significance.

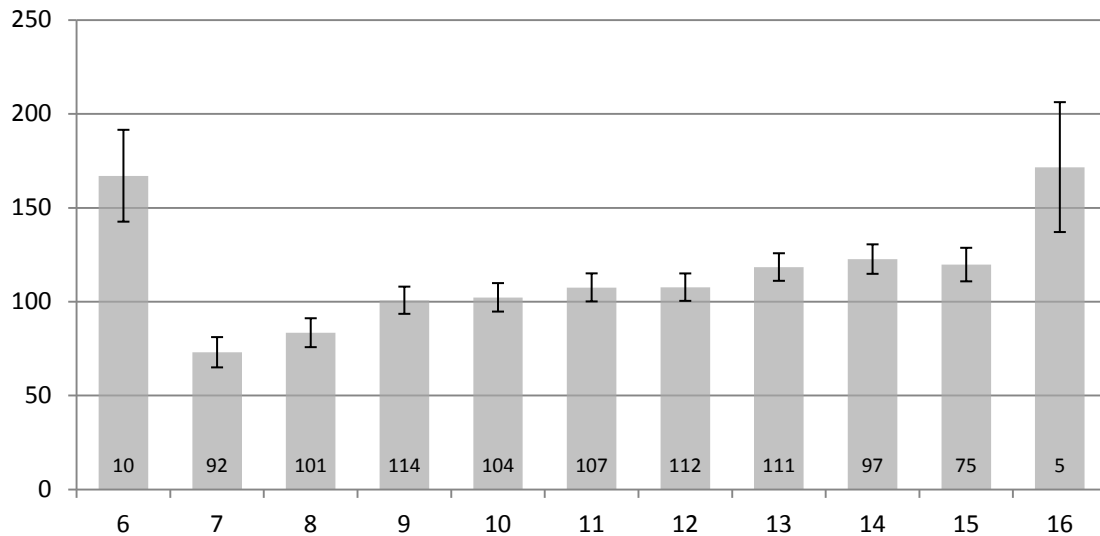


Figure 6. Mean number of harbor seals hauled out at the Jenner haulout (Russian river mouth at Goat Rock State Beach) as counted during baseline surveys from July 2009 – December 2011, categorized by hour. Monitoring times range from 0600 to 1600. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars.

Water Level Management Activities

No water level management activities were conducted in 2011. There were 6 barrier beach formations (sandbar closures) at the mouth of the Russian River in 2010 (SCWA 2011). The February 2011 Report of Activities and Monitoring Results – April 1 to December 31, 2010 provides a detailed description of each of the water level management activities conducted in 2010 (SCWA 2011). For the breaching events in 2009 and 2010 harbor seals were less abundant at the Jenner haulout both before and during breaching activities, with abundance increasing the day following a breaching event (ANOVA: $F(2, 406) = 217.1, p < 0.000$) (Figure 7). During the single lagoon outlet implementation on July 8, 2010 harbor seals were more abundant both before and after the day of lagoon outlet implementation (ANOVA: $F(2, 42) = 15.5, p < 0.000$) (Figure 8).

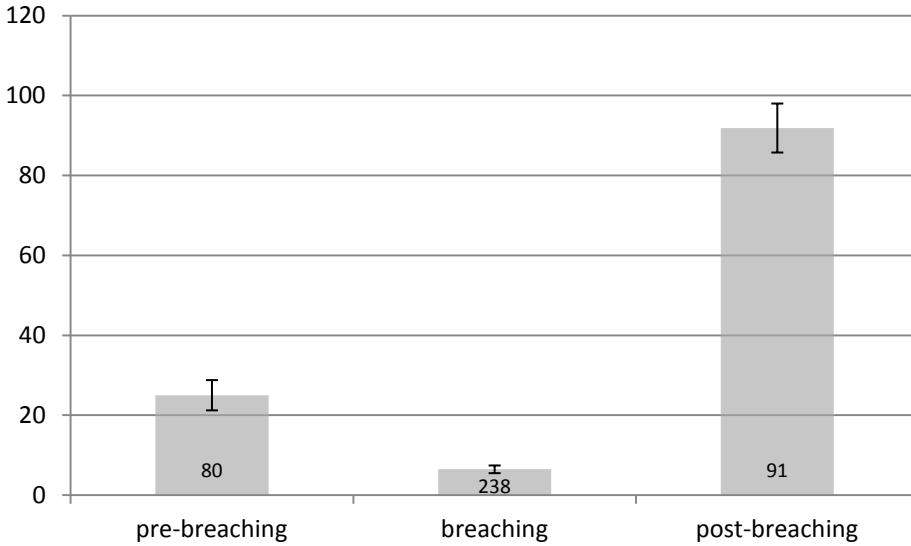


Figure 7. Mean number of harbor seals hauled out at the Jenner haulout (Russian river mouth at Goat Rock State Beach) as counted during monitoring before, during and after artificial breaching activity conducted by the Water Agency in 2009 and 2010. No water level management activities occurred in 2011. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars.

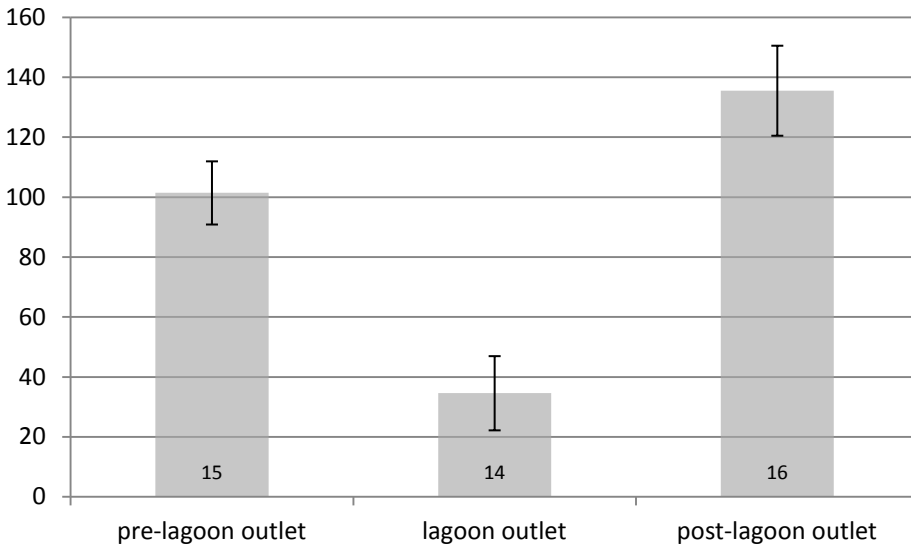


Figure 8. Mean number of harbor seals hauled out at the Jenner haulout (Russian river mouth at Goat Rock State Beach) as counted on July 7-9, 2010, during monitoring before, during and after lagoon outlet implementation conducted by the Water Agency. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars.

Biological and Physical Monitoring

The NMFS IHA No. 14426 also 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 2011 was calculated based on the number of animals that responded to disturbance by either moving or flushing. Alerts were also recorded by monitors, but are not included in the number of incidental takes reported. All disturbances recorded were a result of field staff driving boats past the Estuary haulout at Chalanchawi (Figure 2). When seals were present at the haulout they either had no reaction or most often raised their heads in alert as the boat passed. On one occasion in May of 2011 three seals flushed from the haulout as the boat passed, clearing the haulout. The most seals hauled out in the middle reach of the Estuary as observed by Water Agency field staff were nine at Chalanchawi.

The Russian River Biological Opinion requires monthly topographic surveys of the sandbar at the mouth of the Russian River. Although not specified in the NMFS IHA No. 14426, a Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haulout and to observe pinniped response to the survey work in the vicinity of the Jenner haulout. While having a monitor present greatly minimized the disturbance of seals during the topographic surveys some incidence of take occurred in response to seals alerting at the presence of the survey crew. Of thirteen topographic surveys in 2011, seven surveys resulted in a total of 38 occurrences of incidental take of seals in the form of seals moving along the beach (22 seals) or flushing into the Estuary (16 seals).

The estimated Level B Harassment (incidental take) of pinnipeds under the NMFS IHA No. 14426 during Russian River Estuary biological and physical monitoring activities is summarized in Table 2. The IHA allows 64 occurrences of incidental harassment monitoring activities and an estimated 42 occurred. In 2010 an estimated 32 occurrences of incidental take were reported from the Russian River Estuary biological and physical monitoring activities and monthly topographic surveys combined (SCWA 2011).

Table 2. Estimated number of disturbances of pinnipeds during Russian Estuary Management Activities from 2009 to 2011. Disturbances recorded here are pinnipeds moving and flushing from the haulout.

Date	Event Type	Estimated Disturbance ^a		
		Species	Age Class	Number
24-Jun-09	pre-breach	harbor seal	adult	43(13)
25-Jun-09	artificial breaching	harbor seal	adult	54(40)
5-Oct-09	artificial breaching	harbor seal	adult	0
16-Oct-09	artificial breaching	harbor seal	adult	55(55)
26-Oct-09	artificial breaching	harbor seal	adult	88(53)
9-Nov-09	artificial breaching	harbor seal	adult	59(55)
10-Nov-09	artificial breaching	harbor seal	adult	38(38)
23-Nov-09	artificial breaching	harbor seal	adult	19(2)
24-Nov-09	artificial breaching	harbor seal	adult	14(14)
2-Dec-09	artificial breaching	harbor seal	adult	0
	2009 total	harbor seal	adult	370(270)
8-Jul-10	lagoon outlet implementation	harbor seal	adult	170(148)
30-Sep-10	artificial breaching	harbor seal	adult	42(42)
1-Oct-10	artificial breaching	harbor seal	adult	38(38)
11-Oct-10	artificial breaching	harbor seal	adult	5(5)
12-Oct-10	artificial breaching	harbor seal	adult	3(2)
14-Jun-10	Biological and physical monitoring in the Estuary	harbor seal	adult	5
30-Jun-10	beach topographic survey	harbor seal	adult	5
17-Nov-10	beach topographic survey	harbor seal	adult	22
	2010 total	harbor seal	adult	290(235)
12-Jan-11	beach topographic survey	harbor seal	adult	4
9-Mar-11	beach topographic survey	harbor seal	adult	12(1)
27-Apr-11	beach topographic survey	harbor seal	adult	1
18-May-11	Biological and physical monitoring in the Estuary	harbor seal	adult	4
18-Jul-11	beach topographic survey	harbor seal	adult	3(3)
19-Sep-11	beach topographic survey	harbor seal	adult	6(6)
16-Nov-11	beach topographic survey	harbor seal	adult	6(6)
14-Dec-11	beach topographic survey	harbor seal	adult	6
	2011 total	harbor seal	adult	42(16)

^a Number of disturbances that resulted in seals flushing from haulout is given inside the parentheses ().

Peripheral Haulout Use

In addition to monitoring harbor seal abundance at the Jenner haulout, eight additional coastal and estuary haulouts were monitored. Most of these peripheral haulouts had very low seal abundance with three sites averaging less than one seal as observed during baseline surveys (Penny Logs = 0.5, Paddy's Rock = 0.4 and North Jenner = 0.3) and four sites averaging less than 3 seals as observed during baseline surveys (Chalanchawi = 1.4, Odin Cove = 1.9, Pocked Rock = 1.4 and Kabemali = 2.6). The southernmost rocky haulout included in our monitoring surveys, Rock Point, had the highest abundance of seals with a baseline average of 5.2. Seasonal variation was observed at a few of the peripheral haulouts with the monthly abundance patterns similar to those observed at the Jenner haulout, with higher abundance during the spring and summer months coinciding with pupping and molting respectively (Table 3). Seasonal variations among peripheral haulout use may become more evident as additional monitoring data are gathered over several years.

Table 3. Mean number of harbor seals by month hauled out at peripheral sites as observed during monitoring surveys conducted in 2009-2011.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
North Jenner	0.0	0.0	0.0	0.1	0.8	0.1	1.5	0.7	0.2	0.4	0.0	0.0
Odin Cove	0.9	1.2	0.0	2.8	1.7	0.1	6.4	1.1	1.6	3.1	0.9	0.8
Penny Logs	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.7	1.3	0.4	0.7
Paddy's Rock	1.1	0.2	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8
Chalanchawi	2.0	1.1	0.9	1.3	2.0	3.7	1.8	1.7	1.7	0.9	1.2	0.6
Pocked Rock	1.5	0.3	2.7	2.0	4.8	4.8	2.1	1.1	1.6	0.4	0.6	0.7
Kabemali	3.3	5.0	2.5	0.5	4.5	1.6	1.1	4.2	0.8	3.0	2.7	1.7
Rock Point	0.9	1.4	0.0	0.9	4.9	6.3	18.8	10.3	4.2	5.2	3.0	3.1

Mostly, the average number of seals observed during breaching activities at the peripheral sites was not different from the average number of seals observed during baseline surveys. This was true for Paddy's Rock, North Jenner, Odin Cove, Pocked Rock and Kabamali. Slightly more seals were observed at Penny Logs during breaching events (Figure 9) where at Chalanchawi and Rock Point fewer seals were observed during breaching events (Figures 10 and 11). The haulout at Chalanchawi does become submerged as river levels rise during closed mouth conditions, explaining the decrease in seal abundance for that site.

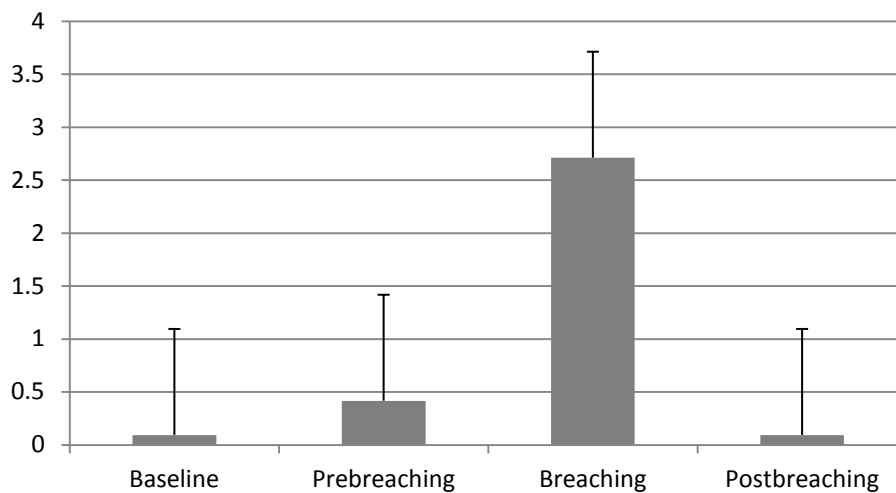


Figure 9. Mean number of harbor seals observed at Penny Logs as observed during baseline, pre-breaching, breaching and post-breaching monitoring in years 2009-2011. Error bars represent standard error.

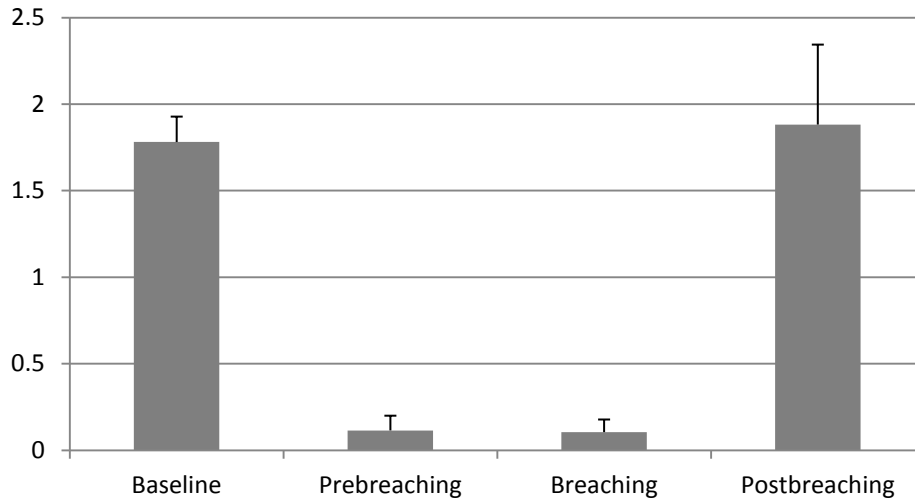


Figure 10. Mean number of harbor seals observed at Chalanchawi as observed during baseline, pre-breaching, breaching and post-breaching monitoring in years 2009-2011. Error bars represent standard error.

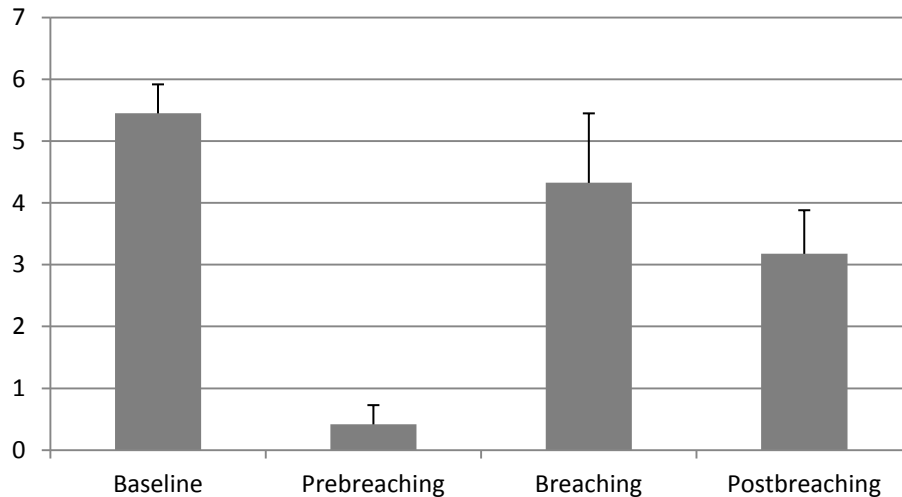


Figure 11. Mean number of harbor seals observed at Rock Point as observed during baseline, pre-breaching, breaching and post-breaching monitoring in years 2009-2011. Error bars represent standard error.

During the single lagoon outlet implementation in July 2010 high seal abundance was recorded at Rock Point (Figure 12) and Odin Cove (Figure 13). Seal abundance was little changed at Rock Point on the day after the lagoon outlet implementation, but decreased at Odin Cove. It is difficult to interpret these results as related to the formation of a seasonal lagoon in the Estuary since this event also coincided with the molting period where harbor seal haulout abundance is high. It is also unknown if these increases in seal abundance at the peripheral sites are a result of seals moving from the Jenner haulout during mouth closures or beach management activities since we are unable to track the movements of individual seals. However, looking at the combined pattern of seal abundance at Odin Cove and Jenner during and after lagoon outlet implementation does suggest that it is possible seals moved from the Jenner haulout when lagoon outlet implementation occurred and then returned the day after. Since the river mouth was closed again on the day after lagoon outlet implementation, this would not be merely a result of the mouth returning to an open condition, but more a response of seals to disturbance on their

haulout. This pattern was not observed at Rock Point, which is approximately 8 km south of the Jenner haulout and less likely to be a site of temporary refuge for seals during a disturbance event.

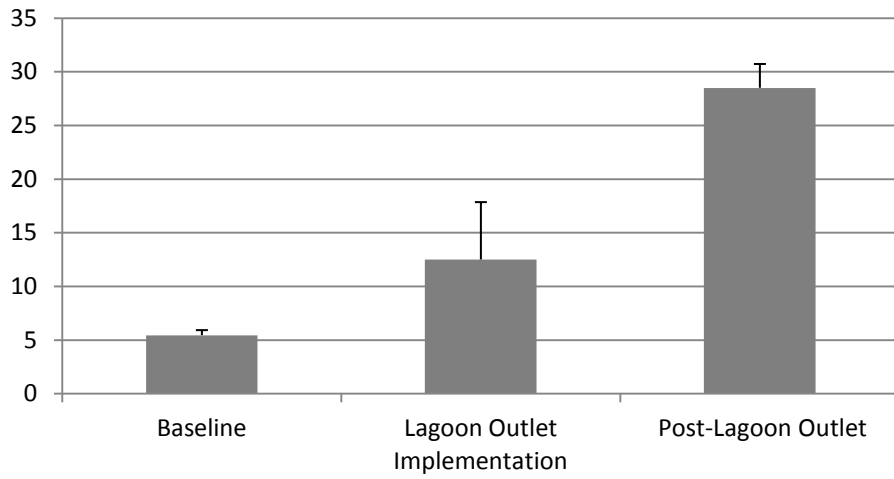


Figure 12. Mean number of harbor seals observed at Rock Point as observed during baseline, lagoon outlet implementation and post-lagoon outlet implementation monitoring. Error bars represent standard error.

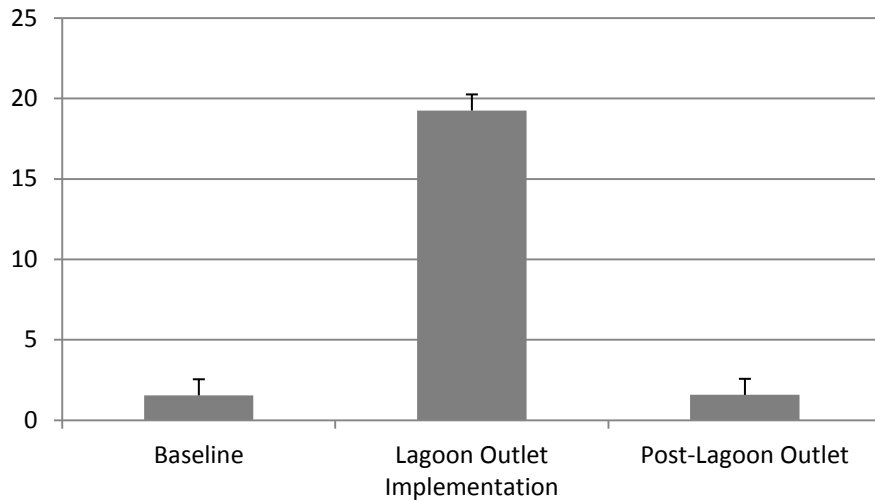


Figure 13. Mean number of harbor seals observed at Odin Cove as observed during baseline, lagoon outlet implementation and post-lagoon outlet implementation monitoring. Error bars represent standard error.

CONCLUSIONS

The biological and geophysical monitoring activities conducted by the Water Agency in 2011 resulted in incidental harassment (Level B harassment) of 42 marine mammals. There were no closures (formation of the barrier beach) at Goat Rock State Beach that resulted in any Russian River Estuary Management Activities during 2011. The Russian River Estuary Management Activities from April to December 2010 resulted in incidental harassment (Level B harassment) of 290 marine mammals, well under the total allowed by NMFS IHA No. 14426.

The purpose of the Russian River Estuary Management Activities Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011) 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 haulout 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 haulout 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 haulout displaced to nearby river and coastal haulouts when the mouth remains closed in the summer?

The baseline data collected since 2009 shows the highest number of pinnipeds observed at the Jenner haulout occurs in July, during the molting season (Table 3). The baseline effort focused on understanding if time of year, tides, and time of day affected the timing of the use of the Jenner haulout by harbor seals. Harbor seals are found at the Jenner haulout throughout the year. Seasonal variation in the abundance of harbor seals at their haulout 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 then followed by a decline in seal abundance which is likely a result of individual seals decreasing the amount of time on the haulout post-molt to spend more time foraging and also coincides with the time that young of the year pups may disperse from their natal haulout. Overall, seals utilize the Jenner haulout throughout the tidal cycle. Their abundance is significantly lower during the highest of tides when the haulout is subjected to an increase in wave over wash. Time of day did have some affect on seal abundance at the Jenner haulout. Seal abundance was greater in the afternoon hours compared to the morning hours. More analysis exploring the relationship of ambient temperature, incidence of disturbance and season on time of day effects would help to explain why these variations in seal abundance occur. It is likely a combination of multiple factors (e.g. season, tides, wave heights, level of beach disturbance) that influence when the haulout is most utilized.

The Water Agency implemented the lagoon outlet channel in a single event on July 8, 2010. The response of harbor seals at the Jenner haulout to the outlet channel implementation activities (Question 2 above) was similar to the responses observed during artificial breaching events in 2010 and in previous years of monitoring the Jenner haulout during breaching events (Merritt Smith Consulting 1997, 1998,

1999, 2000; Sonoma County Water Agency and Merritt Smith Consulting 2001). The harbor seals alerted to the sound of equipment on the beach and left the haulout as the crew and equipment approached closer on the beach. Harbor seals hauled out on the beach while equipment was operating, left the beach when equipment and staff were leaving the beach, and began to return to the haulout within 30 minutes to 3 hours of the work ending. Because the barrier beach reformed soon after outlet channel implementation and subsequently breached on its own, maintenance of the outlet channel was not necessary and the response of pinnipeds at the Jenner haulout to maintenance of the outlet channel and management of the lagoon for the duration of the lagoon management period was not possible in 2010. For the same reason, Question 3 above cannot be definitively answered as the duration of closure associated with the lagoon outlet channel implementation was not dissimilar from the duration of closure that have been previously observed at the Estuary.

Responding to Question 4 is also difficult due to the lack of extended lagoon conditions in 2010. However, initial comparisons of peripheral (river and coastal) haulout baseline and water level management activity count data to the Jenner haulout counts suggest that further information from subsequent Estuary management activities are needed. For example, during the single lagoon outlet implementation in July of 2010 low seal abundance was recorded at Jenner and high seal abundance was recorded at Odin Cove. On the day after the lagoon outlet implementation seal abundance rose at Jenner and decreased at Odin Cove. This pattern is consistent with the idea that seals disturbed from the Jenner haulout would temporarily relocate to a nearby haulout. However, these results are inconclusive since we are not able to track the movements of individual seals.

ACKNOWLEDGEMENTS

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 haulouts in and around the Russian River estuary. M. Luna, J. Mortenson, D. Dekelaita and A. Cresswell provided the training and support that made the monitoring effort possible. Special thanks to the volunteers that provided their time and keen observations to monitoring pinnipeds: B. Bambrick, D. Barth, J. Cross, C. Duncan, C. Else, C. Farnes, L. Fisher, K. Ludwig, T. Macaluso, B. Madrone, R. Muszyniski, K. O'Conner, T. Pohlmann, A. Southwick, T. Watts, J. Wilson and T. York.

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Appendix A. Incidental Harassment Authorization No. 14426



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

APR 20 2011

Jessica Martini-Lamb
Sonoma County Water Agency
404 Aviation Blvd
Santa Rosa, California 95403

Dear Ms. Martini-Lamb,

Enclosed is an Incidental Harassment Authorization (IHA), issued pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act, to take small numbers of marine mammals, by Level B harassment, incidental to the Sonoma County Water Agency's Russian River estuary management activities.

You are required to comply with the conditions contained in the IHA, including all mitigation, monitoring and reporting requirements. In addition, you must cooperate with any federal, state, or local agency monitoring the impacts of your activities. Along with mitigation measures to be incorporated, the IHA requires monitoring for the presence and behavior of marine mammals prior to, during, and after all management events.

If you have any questions concerning the IHA or its requirements, please contact Ben Laws, Office of Protected Resources (NMFS), at 301-713-2289.

Sincerely,

James H. Lecky,
Director, Office of Protected Resources,
National Marine Fisheries Service.

Enclosure





UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Department Of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

INCIDENTAL HARASSMENT AUTHORIZATION

The Sonoma County Water Agency (SCWA), 404 Aviation Blvd, Santa Rosa, California 95403, is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107, to harass marine mammals incidental to conducting estuary management activities in the Russian River, Sonoma County, California.

1. This Incidental Harassment Authorization (IHA) is valid from April 21, 2011 through April 20, 2012.
2. This IHA is valid only for activities associated with estuary management activities (See items 2(a)-(c)) in the Russian River, Sonoma County, California.
 - (a) Lagoon outlet channel management;
 - (b) artificial breaching of barrier beach; and
 - (c) physical and biological monitoring of the beach and estuary as required.
3. General Conditions
 - (a) A copy of this IHA must be in the possession of the SCWA, its designees, and work crew personnel operating under the authority of this IHA.
 - (b) The species authorized for taking are the harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and the northern elephant seal (*Mirounga angustirostris*).
 - (c) The taking, by Level B harassment only, is limited to the species listed in condition 3(b) (See Table 1 for take numbers, attached).
 - (d) The taking by Level A harassment, serious injury or death of any of the species listed in item 3(b) of the Authorization or the taking by harassment, injury or death of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA.
 - (e) In the unanticipated event that any cases of pinniped injury, serious injury, or mortality are judged to result from these activities, the holder of this Authorization must immediately cease operations and report the incident, within 48 hours, to the Assistant Regional Administrator (ARA) for Protected Resources, Southwest Region, National Marine Fisheries Service (NMFS), phone (562) 980-



4000 and to the Chief, Permits, Conservation, and Education Division, Office of Protected Resources, NMFS, phone (301) 713-2289.

- (i) In such case, SCWA shall postpone operations until NMFS is able to review the incident and determine whether steps can be taken to avoid further injury or mortality or until such taking can be authorized under regulations promulgated under section 101(a)(5)(A) of the MMPA.
- (f) If SCWA observes a pup that may be abandoned, it shall contact the NMFS stranding response network immediately and also report the incident to NMFS' Southwest Regional Office and NMFS Headquarters within 48 hours. Observers shall not approach or move the pup.

4. Cooperation

The holder of this Authorization is required to cooperate with NMFS and any other federal, state, or local agency authorized to monitor the impacts of the activity on marine mammals.

5. Mitigation Measures

In order to ensure the least practicable impact on the species listed in condition 3(b), the holder of this Authorization is required to implement the following mitigation measures:

- (a) SCWA crews shall cautiously approach the haul-out ahead of heavy equipment to minimize the potential for sudden flushes, which may result in a stampede – a particular concern during pupping season.
- (b) SCWA staff shall avoid walking or driving equipment through the seal haul-out.
- (c) Crews on foot shall make an effort to be seen by seals from a distance, if possible, rather than appearing suddenly at the top of the sandbar, again preventing sudden flushes.
- (d) During breaching events, all monitoring shall be conducted from the overlook on the bluff along Highway 1 adjacent to the haul-out in order to minimize potential for harassment.
- (e) A water level management event may not occur for more than two consecutive days unless flooding threats cannot be controlled.
- (f) Equipment shall be driven slowly on the beach and care will be taken to minimize the number of shut-downs and start-ups when the equipment is on the beach.
- (g) All work shall be completed as efficiently as possible, with the smallest amount of heavy equipment possible, to minimize disturbance of seals at the haul-out.
- (h) Boats operating near river haul-outs during monitoring shall be kept within posted speed limits and driven as far from the haul-outs as safely possible to minimize flushing seals.

In addition, SCWA shall implement the following mitigation measures during pupping season (March 15-June 30):

- (i) SCWA shall maintain a one week no-work period between water level management events (unless flooding is an immediate threat) to allow for an adequate disturbance recovery period. During the no-work period, equipment must be removed from the beach.
- (j) If a pup less than one week old is on the beach where heavy machinery will be used or on the path used to access the work location, the management action shall be delayed until the pup has left the site or the latest day possible to prevent flooding while still maintaining suitable fish rearing habitat. In the event that a pup remains present on the beach in the presence of flood risk, SCWA shall consult with NMFS and CDFG to determine the appropriate course of action. SCWA shall coordinate with the locally established seal monitoring program (Stewards' Seal Watch) to determine if pups less than one week old are on the beach prior to a breaching event.
- (k) Physical and biological monitoring shall not be conducted if a pup less than one week old is present at the monitoring site or on a path to the site.

6. Monitoring

The holder of this Authorization is required to conduct baseline monitoring and shall conduct additional monitoring as required during estuary management activities:

- (a) Baseline monitoring shall be conducted twice-monthly for the term of the IHA. These censuses shall begin at dawn and continue for eight hours, weather permitting; the census days shall be chosen to ensure that monitoring encompasses a low and high tide each in the morning and afternoon. All seals hauled out on the beach shall be counted every thirty minutes from the overlook on the bluff along Highway 1 adjacent to the haul-out using high powered spotting scopes. Observers shall indicate where groups of seals are hauled out on the sandbar and provide a total count for each group. If possible, adults and pups shall be counted separately.
- (b) In addition, peripheral haul-outs shall be visited for ten minute counts twice during each baseline monitoring day.
- (c) During estuary management events, monitoring shall occur on all days that activity is occurring using the same protocols as described for baseline monitoring, with the difference that monitoring shall begin at least one hour prior to the crew and equipment accessing the beach work area and continue through the duration of the event, until at least one hour after the crew and equipment leave the beach. In addition, a one-day pre-event survey of the area shall be made within one to three days of the event and a one-day post-event survey shall be made after the event, weather permitting.
- (d) Monitoring of peripheral haul-outs shall occur concurrently with event monitoring, when possible.

(e) For all monitoring, the following information shall be recorded in thirty minute intervals:

- i. pinniped counts, by species;
- ii. behavior;
- iii. time, source and duration of any disturbance, with takes incidental to SCWA actions recorded only for responses involving movement away from the disturbance or responses of greater intensity (e.g., not for alerts);
- iv. estimated distances between source of disturbance and pinnipeds;
- v. weather conditions (e.g., temperature, percent cloud cover, and wind speed); and
- vi. tide levels and estuary water surface elevation.

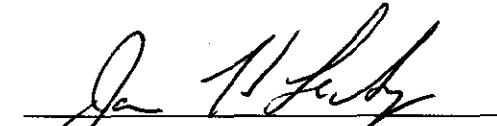
(f) All monitoring during pupping season shall include records of any neonate pup observations. SCWA shall coordinate with the Seal Watch monitoring program to determine if pups less than one week old are on the beach prior to a water level management event.

7. Reporting

The holder of this Authorization is required to:

- (a) Submit a report on all activities and marine mammal monitoring results to the Office of Protected Resources, NMFS, and the Southwest Regional Administrator, NMFS, 90 days prior to the expiration of the IHA if a renewal is sought, or within 90 days of the expiration of the permit otherwise. This report must contain the following information:
 - (i) the number of seals taken, by species and age class (if possible);
 - (ii) behavior prior to and during water level management events;
 - (iii) start and end time of activity;
 - (iv) estimated distances between source and seals when disturbance occurs;
 - (v) weather conditions (e.g., temperature, wind, etc.);
 - (vi) haul-out reoccupation time of any seals based on post activity monitoring;
 - (vii) tide levels and estuary water surface elevation;
 - (viii) seal census from bi-monthly and nearby haul-out monitoring; and
 - (ix) 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.

8. Validity of this Authorization is contingent upon compliance with all applicable statutes and permits, including NMFS' 2008 Biological Opinion for water management in the Russian River watershed. This Authorization may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if the authorized taking is having a more than a negligible impact on the species or stock of affected marine mammals.



James H. Lecky,
Director, Office of Protected Resources,
National Marine Fisheries Service.

APR 20 2011

Date

Table 1. Authorized Take Numbers for Each Species

Species	Authorized Take
Harbor seal (<i>Phoca vitulina</i>)	2,735
California sea lion (<i>Zalophus californianus</i>)	19
Northern elephant seal (<i>Mirounga angustirostris</i>)	15

**Appendix B. Russian River Estuary Management Activities Pinniped
Monitoring Plan**



Russian River Estuary Management Project

Pinniped Monitoring Plan



February 2011

Reference as:

Sonoma County Water Agency and Stewards of the Coast and Redwoods. 2011.
Russian River Estuary Management Project Pinniped Monitoring Plan. February 2011.

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Introduction

The Russian River estuary (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 km² (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).

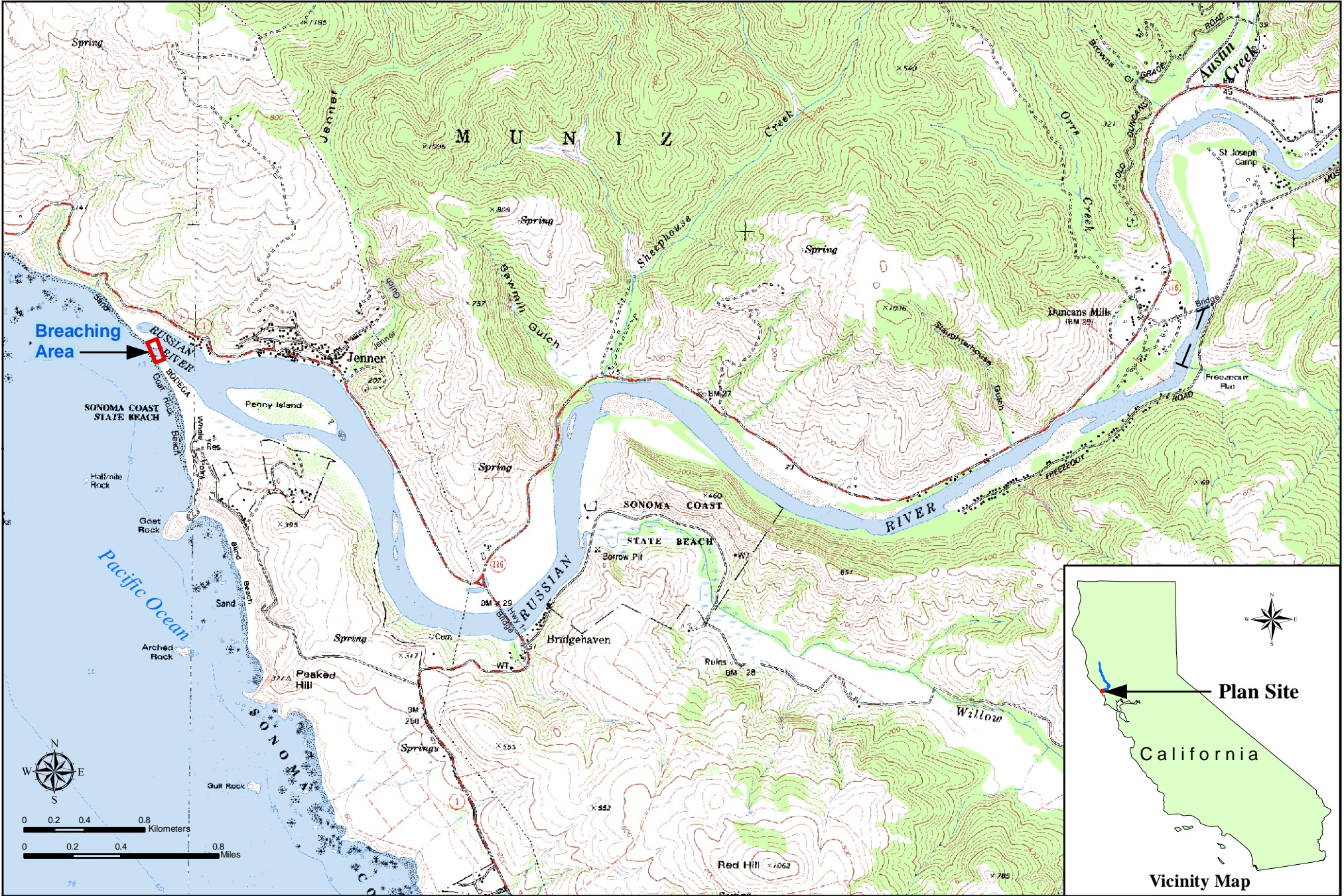
Harbor seals (*Phoca vitulina richardii*) regularly haul out at the mouth of the Russian River (Jenner haulout) (Figure 2). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the mouth. There are also several known river haulouts at logs and rock piles in the Russian River estuary. This monitoring plan has been prepared as part of the Sonoma County Water Agency's (Water Agency) application for incidental harassment authorization (IHA) under the Marine Mammal Protection Act (MMPA) for activities associated with the Russian River Estuary Management Project. These activities include:

- construction and maintenance of a lagoon outlet channel that would facilitate management of a closed barrier beach at the mouth of the Russian River and create a summer lagoon to improve rearing habitat for listed steelhead as mandated by the Russian River Biological Opinion (NMFS 2008); and
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the Estuary.

The monitoring plan is a collaborative effort between the Water Agency and the Stewards of the Coast and Redwoods (Stewards).

Background

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). Although closures may occur at anytime of the year, the mouth usually closes during the spring, summer, and fall (Heckel 1994; Merritt Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt Smith Consulting 2001). Closures result in ponding of the Russian River behind the barrier beach and, as water surface levels rise in the



Russian River Estuary

Figure 1

This Map is for general reference only.



SPECIAL PROJECTS/RUSSIAN RIVER/7104-ESTUARY/HARBOR SEAL-2009-JENNER FEBRUARY 10, 2011

Pinniped Haulouts at the Russian River Estuary and Surrounds



Figure 2

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 Sonoma County Water Agency (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.

Biological Opinion and the Estuary

The Water Agency and the U.S. Army Corps of Engineers (Corps) consulted with the National Marine Fisheries Service (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, the 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, coho salmon, and Chinook salmon. The historic method of artificial breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the estuary's water quality and depth of freshwater. The California Department of Fish and Game (CDFG) issued a consistency determination on November 9, 2009, finding that the Russian River Biological Opinion was consistent with the requirements of the California Endangered Species Act (CESA) and adopted the measures identified in the Russian River Biological Opinion.

The historic breaching practices create a tidal marine environment with shallow depths and high salinity. Salinity stratification contributes to low dissolved oxygen at the bottom in some areas. 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 CDFG 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 (*i.e.*, 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 15th to October 15th (lagoon management period). A program of potential, incremental steps are prescribed to accomplish this, including adaptive management of a lagoon outlet channel.

The Water Agency anticipates that lagoon outlet channel management activities would occur in accordance with the Russian River Biological Opinion between May 15 and October 15. Artificial breaching activities would occur in accordance with the Russian River Biological Opinion primarily from October 16 to May 14. However, if Estuary water surface elevations rise above 7.0 feet (at the Jenner gage) and threaten to flood low-lying properties during the lagoon management period, the Water Agency may consult with NMFS and CDFG regarding artificially breaching the barrier beach to alleviate potential flooding, as discussed in the Biological Opinion. The Biological Opinion incidental take statement estimates that the Water Agency may need to artificially breach the the barrier beach "twice per year between May 15 and October 15 during the first three years covered by this opinion, and once per year between May 15 and October 15 during years 4-15 covered by this opinion" (NMFS 2008).

Previous Monitoring Efforts

The Jenner haulout has been extensively monitored. The Stewards' Seal Watch Public Education Program began in 1985, when Dian Hardy and other local activists from Jenner discovered that the harbor seals at Goat Rock State Beach were in greater danger from beach visitors and unleashed dogs than from the pollution of a recent sewage spill into the Russian River. In response to these concerns, they organized and set up four-hour shifts on the beach at the river mouth where they asked visitors to abide by the Marine Mammal Protection Act and stay at least 50 yards from the harbor seals. Today, State Parks Volunteer Docents assist the public in safeguarding this local harbor seal habitat, the largest on the Sonoma Coast. Docents are available at Goat Rock State Beach on weekends during the pupping and molting season (March through Labor Day weekend) when the seals are most vulnerable to public interactions. In addition to public outreach, the volunteers record the numbers of visitors and seals on the beach, other marine mammals observed, and the number of boats and kayaks present.

Joe Mortenson began his ongoing monthly seal counts at the Jenner haulout and Bodega Rock in January 1987, with nearby haulouts added to the counts thereafter. Elinor Twohy began daily counts of seals and people at the Jenner haulout, including photographing the haulout, on November 1, 1989. Her daily counts were taken at different times on successive days to determine if there were diurnal patterns in use of the haulout (Mortenson and Twohy 1994). She also photographed and noted whether the mouth at the Jenner haulout was opened or closed each day. The information that has emerged from these data sets is that the Jenner haulout is atypical in terms of the time of year that the peak numbers of harbor seals are present. The numbers of seals at the Jenner haulout peaks in the late winter (February and March); at other harbor seal haulouts, peaks are typically observed during the pupping and molting season (spring and summer; Mortenson and Twohy 1993). The Jenner haulout is also atypical in terms of the time of day seal count peaks are observed. At other harbor seal haulouts, daily peaks are typically observed at midafternoon low tides regardless of the season. Although daily harbor seal numbers at the Jenner haulout do peak at midday during the winter (November 16th to March 30th) and in the pupping and molting seasons

(April/May and June/July/August, respectively), a midday peak is not observed during the fall (Mortenson and Twohy 1994).¹

The Water Agency monitored biological and water quality conditions before, during, and after artificial breaching events from 1996 to 2000. Harbor seals regularly hauled out at the mouth of the Russian River, with the greatest numbers observed in late winter and mid-summer. California sea lions and elephant seals were occasionally observed at the river mouth. In all five years of monitoring, the number of pinnipeds hauled out at the mouth of the Estuary declined when the barrier beach was closed and increased soon after it was breached (Sonoma County Water Agency and Merritt Smith Consulting 2001). Seals at the haulout responded most negatively to human disturbances on the beach (typically beach visitors approaching the haulout). When approaching the breaching location, Water Agency crews walked ahead of the bulldozer to ensure that no pinnipeds were harmed on the beach. Most pinnipeds usually abandoned the haulout prior to the bulldozer reaching the breaching location due to disturbance from visitors prior to crews arriving onsite. The remaining pinnipeds flushed as the crew approached the breaching location ahead of the heavy equipment. Once breaching was completed, equipment and crews left the beach and pinnipeds returned to the haulout within a day.

¹ The winter, pupping, and molting seasons were defined in Mortenson and Twohy (1994).

Goals and Objectives

The purpose of this monitoring plan is to detect the response of pinnipeds to estuary management activities at the Russian River estuary. Specifically, the following questions are of interest:

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

Monitoring Components

Pinnipeds will be monitored to meet the plan's goals and objectives. The results would provide information on the effects of estuary management activities on the pinnipeds, primarily Pacific harbor seals, that haul out at the mouth of the Russian River estuary. Methods may be revised as data are collected and evaluated in the field. Any significant changes in methodology would be documented and included in the annual report (see below).

Schedule

The term of the monitoring plan would correspond with the MMPA IHA issued by NMFS. Baseline data on conditions associated with seal presence at the Jenner haulout would be collected for the term of the IHA. Generally, monitoring associated with implementation and maintenance of the lagoon outlet channel would occur between May 15 and October 15. Monitoring of artificial breaching activities would occur with each event, generally from October 16 to May 14. Should the mouth remain open during the lagoon management period, biweekly monitoring of the Jenner and river and coastal haulouts would continue as described below.

Methodology

Baseline (Jenner Haulout Use)

Based on previous monitoring efforts, it is known that harbor seals haul out at the mouth of the Russian River at various times of day, with the highest counts in the afternoon, except in the fall (Mortenson and Twohy 1993, Mortenson 1996). Additional information is needed for the Jenner haulout regarding a possible relationship between tides, time of day, and the highest seal counts. Other studies have found that the optimum time to census seals is afternoon low tides (Allen 1987, Pauli and Terhune 1987). It is important to gain a better understanding about what specific conditions seals may prefer for hauling out at the mouth. This baseline information could be a foundation for planning future estuary management activities to minimize disturbances at the Jenner haulout.

Seals at the Jenner haulout would be counted twice monthly for the term of the IHA. Counts would be scheduled for two days out of each month with the intention of capturing a low and high tide each in the morning and afternoon. This may require differing durations of time between baseline monitoring each month to capture the target tides (e.g. 2 weeks between surveys in some months, 1 week between in other months). This census would begin at local dawn and continue for 8 hours. All seals hauled out on the beach would be counted every 30 minutes from the overlook on the bluff along Highway 1 adjacent to the haulout using high powered spotting scopes (Figure 2). Monitoring may conclude for the day if weather conditions affect visibility (e.g. heavy fog in the afternoon). Depending on how the sandbar is formed, seals may haul out in multiple groups at the mouth. 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. If possible, adults and pups should be counted separately.

In addition to the census data, disturbances of the haulout would be recorded. The methods for recording disturbances would follow those in Mortenson (1996). Disturbances would be 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 haulout, would be recorded.

Table 1. Seal response to disturbance.

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.

Weather conditions would be recorded at the beginning of each census. These include temperature, percent cloud cover, and wind speed (Beaufort scale). Tide levels and Estuary water surface elevations can be correlated to the monitoring start and end times in the office at the end of each day.

In an attempt to understand possible relationships between use of the Jenner haulout and nearby coastal and river haulouts, several other haulouts on the coast and in the Russian River estuary would be monitored (Figure 2). These peripheral haulouts include North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Patty's Rock, and Chalanchawi in the Russian River estuary. These are known harbor seal haulouts that have been monitored by Joe Mortenson, researcher with the Stewards from 1994 to 1995, with Merritt-Smith on breaching studies from 1996 through 1999, and with the Gulf of the Farallones Marine Sanctuary Association for 7 years.

The peripheral haulouts would be monitored concurrently with the Jenner haulout baseline monitoring. This monitoring would begin at local dawn and continue for 8 hours. Each peripheral haulout would be visited four times during the monitoring event (twice in the morning, twice in the afternoon). All seals at the peripheral haulout would be counted for 10 minutes from the same vantage point (or points for the haulouts that require more than one vantage point) using binoculars or high powered spotting scopes. Monitoring may conclude for the day if weather

conditions affect visibility (e.g. heavy fog). Disturbances and weather conditions would be recorded as described above for the Jenner haulout.

Lagoon Outlet Channel Monitoring

Should the mouth close during the lagoon management period, the Water Agency would construct a lagoon outlet channel as required by the Russian River Biological Opinion and described in the MMPA IHA. Activities associated with the initial construction of the outlet channel, as well as the maintenance of the channel that may be required, would be monitored for disturbances to the seals at the Jenner haulout.

A one-day pre-outlet channel survey would be made within 1 to 3 days prior to constructing the outlet channel. The haulout would be monitored on the day the outlet channel is constructed and daily for up to 2 days during channel excavation activities. Monitoring would also occur on each day that the outlet channel is maintained using heavy equipment for the duration of the lagoon management period. Monitoring of outlet channel maintenance would correspond with the monitoring described under the "Jenner Haulout Use" section above. Methods would follow the census and disturbance monitoring protocols described in the "Jenner Haulout Use" section.

Displacement. In an attempt to understand if seals from the Jenner haulout are displaced to coastal and river haulouts nearby when the mouth remains closed in the summer, several other haulouts, on the coast and in the Russian River estuary, would be monitored (Figure 2). These haulouts include North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny logs, Patty's Rock, and Chalanchawi in the Russian River estuary. Each of these coastal and river haulouts would be monitored concurrent with monitoring of outlet channel construction and maintenance activities. This would provide an opportunity to qualitatively assess if these haulouts are being used by seals displaced from the Jenner haulout during lagoon outlet channel excavation and maintenance. This monitoring would not provide definitive results that individuals from the Jenner haulout are displaced to the coastal and river haulouts as individual seals would not be marked; however, it would be useful to track general trends in haulout use during lagoon outlet channel excavation and maintenance.

As volunteers would be required to monitor these haulouts (please see "Staffing" below), haulout locations may need to be prioritized if there are not enough volunteers available. In that case, priority would be assigned to the North Jenner and Odin Cove haulouts, followed by the Russian River estuary haulouts, and finally the Pocked Rock, Kabemali, and Rock Point haulouts.

To obtain more definitive data on displacement of harbor seals from the Jenner haulout and use of the coastal and river haulouts, a mark/tagging program should be considered for future studies. Such a program would be valuable for long-term management of the Jenner haulout and would be an effective method of identifying seasonal activity patterns and seal response to estuary management activities. A similar program implemented at the Point Reyes National Seashore for the Drakes

Estero harbor seal population would be an example that could be reviewed in development of a mark/tagging program (Allen et al. 1987a, 1987b).

Artificial Breaching Events

Pinniped responses to the Water Agency's artificial breaching activities were extensively monitored from 1996 to 2000 (Merritt-Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt-Smith Consulting 2001). In accordance with the Russian River Biological Opinion (NMFS 2008), the Water Agency would artificially breach the barrier beach outside of the summer lagoon management period (from October 16 to May 14), unless Estuary water surface elevations from May 15 to October 15 rise above 7 feet at the Jenner gage. In that case, the National Marine Fisheries Service and California Department of Fish and Game could be consulted regarding potentially scheduling an artificial breaching event to open the barrier beach and reduce flooding risk.

Pinniped response to artificial breaching would be monitored at each such event during the term of the MMPA IHA. Methods would follow the census and disturbance monitoring protocols described in the "Jenner Haulout Use" section, which were also used for the 1996 to 2000 monitoring events (Merritt-Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt-Smith Consulting 2001). Half-hour counts of all seals hauled out on the beach would begin at least one hour before artificial breaching is scheduled to begin and conclude at least 2 hours after crews and equipment have left the beach, with a minimum of 6 hours of monitoring. If breaching is scheduled in the morning, monitoring could be begin as early as local dawn. For breaching events scheduled in the afternoon, monitoring would conclude at least 2 hours after crews and equipment have left the beach or at dusk..

Monitoring During Pupping Season

The pupping season is March 15 to June 30. Baseline, lagoon outlet channel, and artificial breaching monitoring during the pupping season will include recording observations of neonates (pups less than 1 week old). Characteristics of a neonate pup include: body weight is less than 15 kg; thin for their body length; an umbilicus or natal pelage present; wrinkled skin; and awkward or "jerky" movements on land. The Water Agency shall coordinate with the Stewards SealWatch monitoring program to determine if pups less than one week old are on the beach (e.g., a pup was sighted being born) prior to a water level management event.

If, during monitoring, observers sight any pup which may be abandoned, the Water Agency would contact the NMFS stranding response network [Marine Mammal Center, 415-289-7350] immediately and also report the incident to NMFS' Southwest Regional Office and NMFS Headquarters within 48 hours. Observers are not to approach or move the pup. Potential indications that a pup may be abandoned include: no observed contacts with adult seals, no movement of the pup, pup's attempts to nurse are rebuffed.

Staffing

Monitoring would be conducted by qualified individuals with prior approval by NMFS. Generally, these individuals would include professional biologists employed by NMFS or the Water Agency or volunteers trained by the Stewards. All volunteer monitors would be required to attend a classroom-style training and field site visits to the haulouts. Training would cover the MMPA and any conditions of a MMPA permit issued by NMFS, this Pinniped Monitoring Program, pinniped species identification, age class identification (including a specific discussion regarding neonates), recording of count and disturbance observations (including completion of datasheets), and use of equipment. Pinniped identification would include harbor seal, California sea lion, and northern elephant seal, as well as other pinniped species with potential to occur in the area.

Generally, Water Agency staff and volunteers would collect baseline data on Jenner haulout use during the twice monthly monitoring events. A schedule for this monitoring would be established with Stewards of the Coasts and Redwoods once volunteers are available for the monitoring effort. Water Agency staff would monitor lagoon outlet channel excavation and maintenance activities and artificial breaching events at the Jenner haulout, with assistance from Seal Watch volunteers as available. Seal Watch volunteers would monitor the coastal and river haulout locations during lagoon outlet channel excavation and maintenance activities.

Reporting

An annual report would be prepared and distributed to the NMFS, California State Parks, and Stewards of the Coasts and Redwoods. The report would also be available to the public on the Water Agency's website.

The annual report would include an executive summary, monitoring methodology, tabulation of estuary management events, summary of monitoring results, and discussion of problems noted and proposed remedial measures.

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Appendix C. Summary of pinniped monitoring activities conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from April 2009 – December 2011, including summary of pinniped abundance and Estuary water level.

Appendix C. Summary of pinniped monitoring activities conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from April 2009 – December 2011, including summary of pinniped abundance and Estuary water level.

date	activity	estuary water level ^{a,b} (ft)	HASE adults			HASE neonates			HASE pups			n	CASL present ^c	NES present
			max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
4/16/2009	pre-breach (bar naturally breached)	5.8	104	68.0	12.78	0	0.0		5	4.0	0.27	8		
6/24/2009	pre-breach	6.2	110	91.0	3.87	0	0.0		0	0.0		9		
6/25/2009	breach	6.4	60	6.4	2.16	0	0.0		9	0.5	0.37	27		Y
6/26/2009	post-breach	1.7	246	237.4	2.28	0	0.0		0	0.0		8		
7/23/2009	baseline	1.0	289	264.7	3.64	0	0.0		3	0.2	0.20	15		
7/30/2009	baseline	-	204	175.2	4.29	0	0.0		0	0.0		17		
8/6/2009	baseline	-	228	182.1	7.48							16	Y	
8/20/2009	baseline	1.2	81	46.7	5.28							17		
9/3/2009	baseline	-	53	21.1	5.79							15		
9/24/2009	baseline	6.3*	44	13.3	5.15							12	Y ^c	
10/1/2009	baseline	7.0*	68	21.9	7.43							18		
10/4/2009	pre-breach	7.2	20	13.2	1.29	0	0.0		0	0.0		13	Y ^c	
10/5/2009	breach	7.3	61	13.2	5.76	0	0.0		0	0.0		18	Y ^c	
10/6/2009	post-breach	1.9	110	95.5	3.95	0	0.0		0	0.0		13		
10/16/2009	breach	7.7	54	35.0	8.84	0	0.0		8	4.8	1.54	6		
10/26/2009	breach	6.8	53	10.8	4.59	0	0.0		0	0.0		19		
10/27/2009	post-breach	2.1	122	108.5	2.88	0	0.0		0	0.0		16		
11/9/2009	breach	7.6	46	8.5	3.87	0	0.0		0	0.0		17		
11/10/2009	breach	8.1	26	6.5	3.12	0	0.0		12	2.1	1.19	11		
11/12/2009	baseline	1.3	131	96.1	7.32							16		
11/23/2009	breach	6.9	12	1.8	0.98	0	0.0		2	0.3	0.18	12		
11/24/2009	breach	7.5	12	1.8	1.18							10		
11/25/2009	post-breach	1.9*	95	86.2	2.32							11		
12/1/2009	breach	7.3	7	0.4	0.37							19		
12/2/2009	post-breach	7.5	29	22.3	1.38							11		

Appendix C. Summary of pinniped monitoring activities conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from April 2009 – December 2011, including summary of pinniped abundance and Estuary water level.

date	activity	estuary water level ^{a,b} (ft)	HASE adults			HASE neonates			HASE pups			n	CASL present ^c	NES present
			max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
12/3/2009	baseline	1.9	89	80.2	1.27							17		
12/13/2009	breach	9.0	0	0.0								6		
12/14/2009	post-breach	2.8*	42	35.1	1.06							11		
12/22/2009	pre-breach	6.7	0	0.0								11		
12/23/2009	breach	8.2	0	0.0								7		
12/27/2009	pre-breach	7.8	10	1.2	0.92							11		
12/28/2009	breach	9.1	2	0.2	0.17							12		
1/11/2010	breach	7.5	1	0.2	0.15	0	0.0		0	0.0		9		
1/28/2010	baseline	1.7*	116	65.9	11.03	0	0.0		0	0.0		17		
2/11/2010	baseline	-	147	83.5	11.60	0	0.0		0	0.0		17		
2/25/2011	baseline	3.2	156	87.7	46.06	0	0.0		0	0.0		3		
3/4/2010	baseline	3.1*	230	170.0	14.19	0	0.0		0	0.0		20		
3/25/2010	baseline	2.5*	125	87.6	9.43	0	0.0		1	0.7	0.11	18		
4/22/2010	baseline	1.6	142	102.4	8.43	5	3.4	0.19	4	1.6	0.28	17		
4/29/2010	baseline	2.3	177	142.3	7.74	0	0.0		31	19.3	1.35	19		
5/6/2010	baseline	0.7	136	108.7	5.33	5	3.1	0.38	23	15.1	0.95	18		
5/27/2010	baseline	2.8*	102	78.3	5.31	1	0.5	0.12	16	9.5	0.89	18		
6/14/2010	baseline	1.8	117	75.6	14.42	0	0.0		7	1.2	0.59	12		
6/21/2010	baseline	1.7	202	167.5	12.56	0	0.0		0	0.0		11		
6/30/2010	topo survey	4.1	203	179.7	5.75	0	0.0		2	1.3	0.21	6		
7/1/2010	topo survey	3.8	159	140.4	7.70	0	0.0		0	0.0		5		
7/7/2010	pre-lagoon outlet channel	5.1	175	101.4	10.54	0	0.0		0	0.0		15		
7/8/2010	lagoon outlet channel	5.6	135	33.4	12.03	0	0.0		8	1.5	0.68	14		
7/9/2010	post-lagoon outlet channel	4.8	208	135.5	15.02	0	0.0		0	0.0		16		
7/12/2010	baseline	2.5*	270	221.3	24.87	0	0.0		15	14.0	1.00	4		
7/13/2010	baseline	-	323	288.6	5.28	0	0.0		12	11.0	0.58	21		

Appendix C. Summary of pinniped monitoring activities conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from April 2009 – December 2011, including summary of pinniped abundance and Estuary water level.

date	activity	estuary water level ^{a,b} (ft)	HASE adults			HASE neonates			HASE pups			n	CASL present ^c	NES present
			max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
7/19/2010	baseline	0.9	410	230.6	22.85	0	0.0		6	4.5	0.40	15		
8/3/2010	topo survey	1.0	237	210.5	4.33	0	0.0		0	0.0		15		
8/9/2010	baseline	1.2	171	133.4	6.74							17		
8/16/2010	baseline	0.8	162	94.3	10.44							17		
9/7/2010	topo survey	1.9	80	74.1	1.48							8		
9/9/2010	baseline	0.4*	60	46.6	1.29							16		
9/16/2010	baseline	0.9	103	67.8	5.99							17		
9/27/2010	pre-breach	5.9	25	19.3	3.22							4		
9/28/2010	pre-breach	6.4	28	27.5	0.29							4		
9/30/2010	breach	7.1	10	6.6	1.72							5		
10/1/2010	breach	7.7	41	9.6	4.05							17		
10/2/2010	post-breach	2.2	129	111.6	8.63							11		
10/7/2010	baseline	5.1*	42	11.8	3.60							17		
10/10/2010	pre-breach	6.1	37	11.7	3.35							20		
10/11/2010	breach	6.6	11	4.1	1.66	1	0.5	0.50	0	0.0		9		
10/12/2010	breach	6.9	55	5.0	4.55							12		
10/13/2010	post-breach	1.3	119	67.6	15.13							10		
10/14/2010	baseline	1.2	116	39.7	6.73							18		
10/20/2010	topo survey	2.0	25	6.6	3.18							8		
11/3/2010	baseline	3.2	142	102.4	9.86							17		
11/17/2010	topo survey	2.4*	109	59.6	13.30							7		
11/18/2010	baseline	2.6	120	75.7	8.04							18		
12/2/2010	baseline	2.0	88	54.0	9.47							17		
12/23/2010	baseline	2.1	0	0.0								18		
1/12/2011	topo survey	1.2	149	115.2	8.98	0	0.0		0	0.0		9		
1/26/2011	baseline	2.6*	116	61.1	11.66	0	0.0		0	0.0		17	Y	

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date	activity	estuary water level ^{a,b} (ft)	HASE adults			HASE neonates			HASE pups			n	CASL present ^c	NES present
			max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
1/31/2011	baseline	3.0*	242	167.5	20.54	0	0.0		0	0.0		18		
2/10/2011	baseline	-	156	89.5	14.57	0	0.0		0	0.0		17		
2/14/2011	topo survey	-	2	1.0	1.00	0	0.0		0	0.0		2		
2/17/2011	baseline	-	196	94.2	19.83	0	0.0		0	0.0		18		
3/1/2011	baseline	1.1	276	235.4	13.34	0	0.0		0	0.0		17		
3/9/2011	topo survey	0.9	233	196.4	11.77	0	0.0		0	0.0		10		
3/17/2011	baseline	-	190	94.9	14.75	0	0.0		8	0.9	0.51	19		
4/5/2011	baseline	1.0	179	131.6	10.30	0	0.0		0	0.0		17		
4/20/2011	baseline	1.6	137	109.1	8.21	2	1.0	0.18	7	4.2	0.59	14		
4/27/2011	topo survey	-	204	167.5	9.28	4	2.3	0.41	24	18.1	0.94	11		
5/4/2011	baseline	-	134	81.7	6.96	10	4.4	0.54	43	31.0	1.90	20		
5/23/2011	baseline	0.6	155	126.8	4.88	1	0.1	0.05	19	14.3	0.81	19		
5/31/2011	topo survey	0.1	147	132.0	4.04	0	0.0		0	0.0		10		
6/2/2011	baseline	0.8	173	130.5	4.66	0	0.0		18	11.2	0.91	18		
6/20/2011	baseline	1.0	223	147.4	15.18	0	0.0		9	4.8	0.89	11		
6/23/2011	topo survey	0.5*	194	139.8	14.44	0	0.0		8	2.7	0.89	11		
6/29/2011	topo survey	0.8	322	227.4	35.12	0	0.0		7	4.2	0.83	11		
7/6/2011	baseline	0.8	290	213.9	28.35	0	0.0		0	0.0		15		
7/18/2011	topo survey	0.6	320	260.9	12.62	0	0.0		0	0.0		10		
7/28/2011	baseline	0.8	245	225.1	4.29	0	0.0		0	0.0		11		
8/15/2011	topo survey	-	95	76.8	3.46	0	0.0		0	0.0		11		
8/16/2011	baseline	-	122	94.3	3.70							13		
8/29/2011	baseline	-	148	102.9	7.43							12		
9/14/2011	baseline	1.4	121	67.4	8.65							17		
9/19/2011	topo survey	1.2	62	45.5	4.27							8		
9/27/2011	baseline	4.4*	11	2.8	2.75							4		

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date	activity	estuary water level ^{a,b} (ft)	HASE adults			HASE neonates			HASE pups			n	CASL present ^c	NES present
			max	mean	s.e.	max	mean	s.e.	max	mean	s.e.			
9/28/2011	baseline	4.6*	14	1.9	1.07						18			
10/13/2011	baseline	5.2	86	49.1	6.10						17			
10/19/2011	topo survey	1.4	106	97.9	2.30						7			
10/27/2011	baseline	1.4*	130	56.9	9.91						18			
11/10/2011	baseline	1.8	104	42.5	9.09						19			
11/16/2011	topo survey	1.1	94	85.5	1.86						8			
11/28/2011	baseline	1.8	186	142.9	8.02						17			
12/7/2011	baseline	0.9*	85	45.4	7.96						18	Y		
12/14/2011	topo survey	2.6	117	99.7	5.57						9			
12/15/2011	baseline	2.6	63	49.9	2.96						19			

^a For breaching events Estuary water level from time of breaching

^b For all other events Estuary water level is average height for the day

^c California sea lions observed on Paddy's Rock haulout in Estuary

* some estuary water level values from the day are missing

-- missing data