Russian River Estuary Management Project

Marine Mammal Protection Act Incidental Harassment Authorization
Report of Activities and Monitoring Results – January 1 to December 31, 2012

Prepared for
Office of Protected Resources and
Southwest Regional Administrator
National Marine Fisheries Service
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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 (issued April 17, 2012, original authorization dated March 30, 2010, NMFS IHA).

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 an original IHA to the Water Agency on March 30, 2010 and subsequently on April 20, 2011. In January 2012 the Water Agency requested that NMFS issue a new IHA for similar activities and additional activities related to the Jetty Study Plan (ESA PWA 2011) and a subsequent IHA was issued on April 17, 2012. This report provides the results of all baseline monitoring and water level management activities for the 2012 calendar year, and additional summary information for all related activities.

The Estuary may close throughout the year as a result of a barrier beach forming across the mouth of the Russian River. Closures result in 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 primarily for steelhead. The historic method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the Estuary's water quality and freshwater depths.

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

The Biological Opinion's Reasonable and Prudent Alternative (RPA) 2 (NMFS 2008) requires the Water Agency to collaborate with NMFS and to modify estuary water level management in order to reduce marine influence (high salinity and tidal inflow) and promote a higher water surface elevation in the estuary (formation of a fresh or brackish lagoon) for purposes of enhancing the quality of rearing habitat for juvenile (age 0+ and 1+) steelhead from May 15 to October 15 (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.

The Biological Opinion also requires the Water Agency to study the potential influences of an existing jetty at the mouth of the Russian River on water surface elevations in the Estuary. In accordance with the Biological Opinion's RPA 2 the Water Agency commissioned a draft study plan to analyze the effects and role of the existing, remnant Goat Rock State Beach jetty on beach permeability, seasonal sand storage and transport, seasonal flood risk, and seasonal water surface elevations in the Russian River estuary (ESA PWA 2011). Implementation of this study plan was scheduled to begin in 2012, but was delayed. The study should begin implementation in 2013 and includes the installation and maintenance of monitoring wells and geophysical surveys.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known river haul-outs 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 haul-outs, 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 required by the Russian River Biological Opinion (NMFS 2008);
- artificially breaching the barrier beach to minimize the potential for flooding of low-lying properties along the Estuary; and
- biological and geophysical monitoring activities associated with the management actions described above
- construction and maintenance of monitoring wells on the barrier beach south of the jetty; and
- geophysical surveys conducted at the barrier beach south of the jetty.

Monitoring was performed in accordance with the requirements of NMFS IHA issued April 17, 2012, 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 haul-out and nearby coastal and river (peripheral) haul-outs, several other haul-outs on the coast and in the Russian River estuary were monitored. These haul-outs included North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Paddy'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 haul-out 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 haul-outs was completed concurrently with the monitoring of the Jenner haul-out. Pinniped use of the haul-outs was also monitored in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Each of the

peripheral haul-outs was monitored concurrently with baseline and monitoring of water level management activities in the vicinity of the Jenner haul-out.

In January 2012 the barrier beach was artificially breached after two days of breaching activity. There were also several periods over the course of the year where the barrier beach closed or became naturally perched and then subsequently breached naturally. In 2011 no water level 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. 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. 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 haul-out during the survey. Additionally, Water Agency field staff conducting biological and physical monitoring in the Estuary recorded any pinnipeds they encountered hauled out in the Estuary and any recorded disturbance to pinnipeds associated with their activities.

The Russian River Estuary Management and Monitoring Activities in 2012 resulted in incidental harassment (Level B harassment) of 208 harbor seals, well under the total 2,963 allowed by NMFS IHA. The Russian River Estuary Management activities in 2011 and 2010 resulted in incidental harassment (Level B harassment) of 42 and 290 marine mammals respectively. No other marine mammal species were harassed by Water Agency activities during the current or any previous years.

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 (issued April 17, 2012, original authorization dated March 30, 2010, NMFS IHA).

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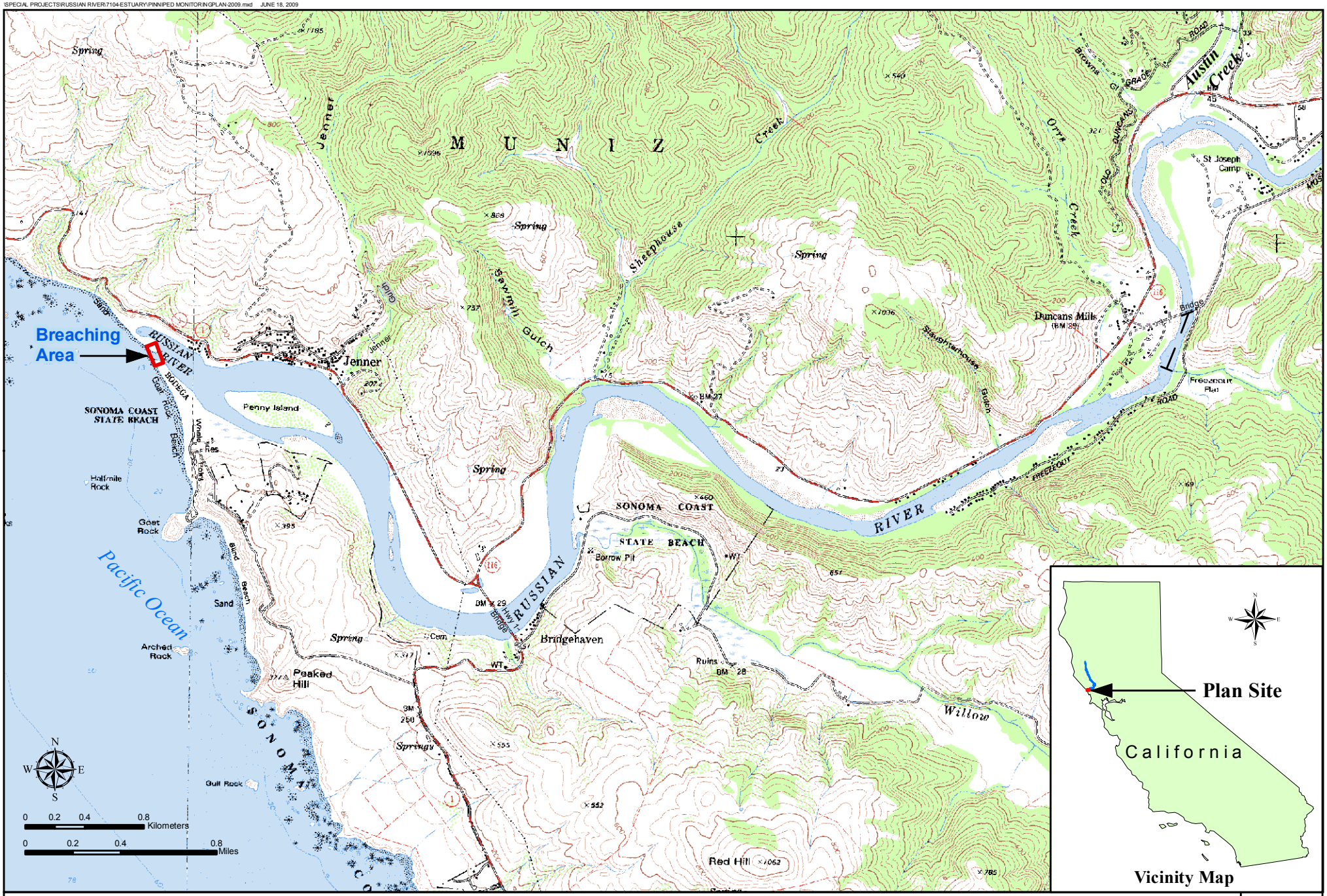
BACKGROUND

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.

\SPECIAL PROJECTS\RUSSIAN RIVER\7104-ESTUARY\PINNIPED MONITORING\PLAN-2009.mxd JUNE 18, 2009



Russian River Estuary

RRIFR
Russian River Instream Flow and Restoration

This Map is for general reference only.

Figure 1

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 primarily for steelhead. The historic method of artificial sandbar breaching, which is done in response to rising water levels behind the barrier beach, adversely affects the estuary's water quality and freshwater depths.

The 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.

In accordance with the Biological Opinion's RPA 2 the Water Agency commissioned a draftstudy plan to analyze the effects and role of the existing, remnant Goat Rock State Beach jetty on beach permeability, seasonal sand storage and transport, seasonal flood risk, and seasonalwater surface elevations in the Russian River estuary (ESA PWA 2011). Implementation of this study plan was scheduled to begin in 2012, but was delayed. The study should begin implementation in 2013 and includes the installation and maintenance of monitoring wells and geophysical surveys.

Harbor seals (*Phoca vitulina richardsi*) regularly haul out at the mouth of the Russian River (Jenner haul-out) (Figure 2). California sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed at the haul-out. There are also several known river haul-outs 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
- construction and maintenance of monitoring wells on the barrier beach south of the jetty; and
- geophysical surveys conducted at the barrier beach south of the jetty.

SPECIAL PROJECTS/RUSSIAN RIVER/7104-ESTUARY/HARBOR SEAL-2009-JENNER JUNE 18,2009

RRIFR
Russian River Instream Flow and Restoration

Pinniped Haulouts at the Russian River Estuary and Surrounds

Figure 2

METHODS

Monitoring was performed in accordance with the requirements of NMFS IHA issued April 17, 2012, and the Russian River Estuary Management Project Pinniped Monitoring Plan (Sonoma County Water Agency and Stewards of the Coast and Redwoods 2011).

Water Agency biologists and Stewards of the Coast and Redwoods (Stewards) volunteers and staff monitored pinnipeds at the Jenner and peripheral haul-outs. The Stewards provide annual training for all volunteers, trainings occurred on March 10, 2010, January 10, 2011 and February 14, 2012. 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, northern elephant seals, northern fur seals and Guadalupe fur seals;
- field identification of neonates (pups less than 1 week old);
- care and use of field equipment (e.g. cameras, spotting scopes, binoculars); and
- field visits to each haul-out monitoring location.

In an attempt to understand possible relationships between use of the Jenner haul-out and nearby coastal and river (peripheral) haul-outs, several other haul-outs on the coast and in the Russian River estuary were monitored (Figure 2). These haul-outs included North Jenner and Odin Cove to the north, Pocked Rock, Kabemali, and Rock Point to the south, and Penny Logs, Paddy's Rock, and Chalanchawi in the Russian River estuary. These are known harbor seal haul-outs 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 haul-out was shared by Water Agency biologists and Stewards volunteers (each group monitored once a month), with volunteers monitoring the peripheral haul-outs for all baseline monitoring. The water level management activity monitoring at the Jenner haul-out was also shared, but Water Agency biologists monitored artificial breaching activities on the day of the event (no lagoon outlet channel activities occurred). 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 haul-outs during the pre- and post-management monitoring events.

Baseline (Jenner Haul-out 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 haul-out 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 haul-outs was completed concurrently with the monitoring of the Jenner haul-out. 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 haul-outs 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 haul-out 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 haul-out. 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 haul-outs 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 haul-out using a high-powered spotting scope or binoculars.

In addition to the census data, disturbances of the haul-outs 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 haul-out, were recorded.

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

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

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 haul-outs was also monitored in relation to Water Agency water level management events (lagoon outlet channel implementation and artificial breaching). Each of the peripheral haul-outs was monitored concurrently with monitoring of water level management activities in the vicinity of the Jenner haul-out. 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 haul-outs. As the exact movements of individual seals are not tracked, the number of seals displaced from the Jenner haul-out to the peripheral haul-outs cannot be quantified; however, potential trends may be observed. The methods for monitoring water levels management activities are 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 haul-outs. Methods followed the census and disturbance monitoring protocols described in the "Baseline (Jenner Haul-out Use)" section above.

Biological and Physical Monitoring

The NMFS IHA also provides incidental take for Level B harassment of pinnipeds that may result from monitoring of biological resources and physical processes in the Estuary. Water Agency field staff record the presence of pinnipeds hauled out in the Estuary in the vicinity of their activities and record any resulting disturbances. The Russian River Biological Opinion also requires monthly topographic surveys of the sandbar at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haul-out and to observe pinniped response to the survey work in the vicinity of the Jenner haul-out. Once survey crews approached a seal haul-out 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

A training for Water Agency staff involved in water level management activities and biological and physical sampling on the beach or in the lower estuary was held on July 30, 2012. In addition, prior to each breaching activity and beach topographic survey, the biologist monitoring the survey participated in the onsite tailgate safety meeting to discuss the location(s) of pinnipeds at the Jenner haul-out that day and methods of avoiding and minimizing disturbances to the haul-out as outlined in NMFS IHA.

RESULTS

The NMFS IHA (April 17, 2012) requires the following information be provided in this report:

(a) the number of seals taken, by species and age class (if possible);
(b) behavior prior to and during water level management events;
(c) start and end time of activity;
(d) estimated distances between source and seals when disturbance occurs;
(e) weather conditions (e.g., temperature, wind, etc.);
(f) haul-out reoccupation time of any seals based on post activity monitoring;
(g) tide levels and estuary water surface elevation;
(h) seal census from bi-monthly and nearby haul-out 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 A includes the Estuary water surface elevations associated with pinniped monitoring in 2012, including both baseline and water level management events.

Baseline (Jenner Haul-out Use)

Baseline monitoring of the Jenner and peripheral haul-outs was performed two days out of each month with the intention of capturing a low and high tide each in the morning and afternoon (SCWA 2011, 2012). In 2012 a total of 25 baseline surveys, 11 monthly beach topographic surveys, 2 breaching surveys, 2 pre-breaching and 1 post-breaching surveys were conducted (Appendix A).

Peak seal abundance occurred during the summer molting period with a similar peak in abundance during the spring pupping season. Peak seal abundance, as determined by the single greatest count of harbor seals at the Jenner haul-out, was on July 2 (335 seals) and on April 4 (326 seals). In previous years the peak seal abundance occurred in July, however the April peak in seal abundance was only observed in the current year (SCWA 2012). Using the mean number of seals hauled out as a measure of average abundance, seal abundance at Jenner was greatest in April (mean = 169 ± 13.1 s.e.) and remained at a similar level through July (Figure 3.) In previous years average seal abundance was greatest in July. Similar to previous years, seal abundance did decline in the fall, however the 2012 average seal abundance was significantly higher in September and November compared to previous years (Multiple comparisons test = Unequal N HSD, $p < 0.001$; Figure 3). The same analysis concluded that the 2012 average seal abundance in March was lower than in previous years ($p < 0.001$). No other statistical differences were found in the monthly seal abundance between 2012 and all previous year combined.

Pups are born at the Jenner haul-out beginning in March (with the earliest observations during Baseline monitoring occurring on March 23, 2012) and continuing into May (with the latest observation of pups occurring on May 23, 2012, and the last neonate observed on May 2, 2012). 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 2012. Pup production at the Jenner haul-out was 13.8% of total seals as calculated from the peak pup count recoded on May 16 and the number of adult harbor seals present at the same time. Pup production was much lower compared to last year where 29.3% of seals were pups at the time of the peak pup count on May 4, 2011. However, the average of pups observed (when pups were present) during April and May were similar between years: 15.4 pups in 2012 and 14.9 pups in 2011. Appendix B presents a history of pup counts at Jenner.

The affect of tide cycle and time of day on the abundance of seals at the Jenner haul-out was explored in detail in the Water Agency's *Report of Activities and Monitoring Results July 2009 – December 2011* (SCWA 2012). Data collected in 2012 did not change the interpretation of these findings and will not be discussed further here.

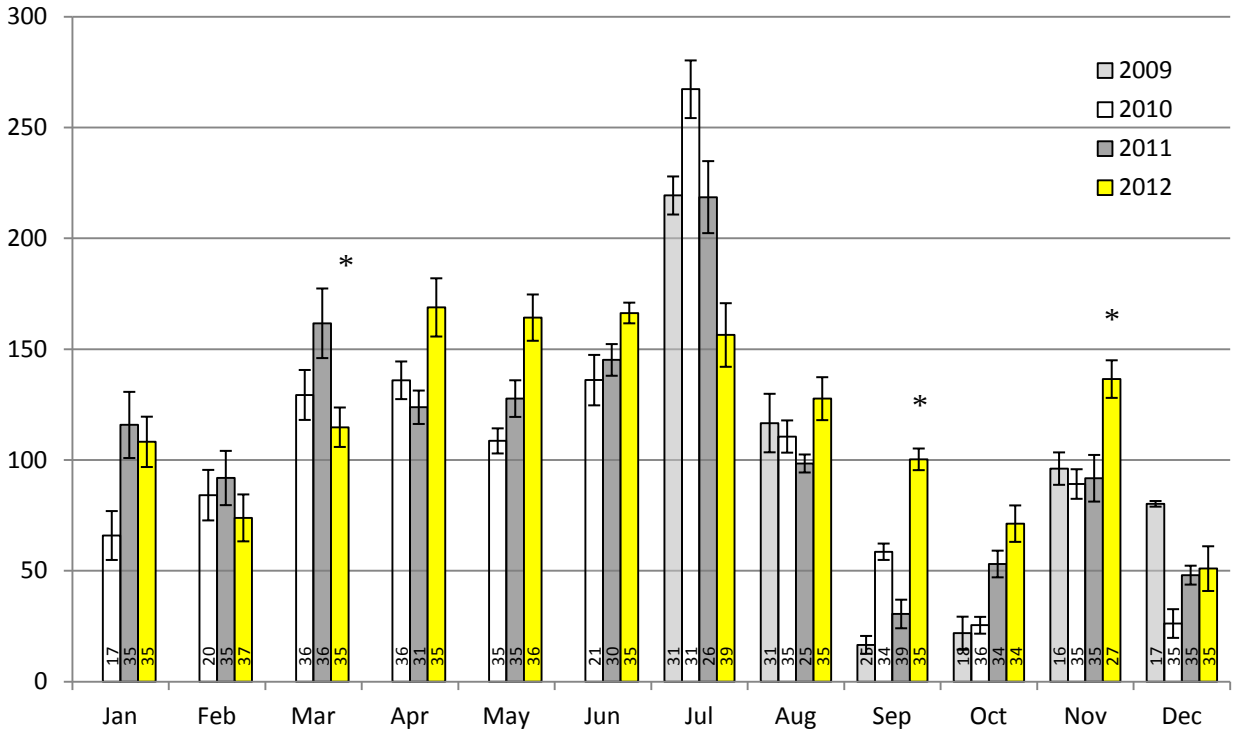


Figure 3. Mean number of harbor seals hauled out at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) as counted during baseline surveys for each year (July 2009 – December 2012) categorized by month. Error bars represent +/- standard error and sample size used to calculate means are presented inside the bars. Stars above bars indicate months where the average seal abundance in 2012 was significantly different from previous years' combined at the p < 0.001 level (Unequal N HSD multiple comparisons test).

Water Level Management Activities

In 2012 one breaching event occurred over 2 days in January following a closure of the barrier beach on January 3rd. 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). A detailed analysis of the affect of barrier beach closures and the abundance of harbor seals at the Jenner haul-out is described in the *Report of Activities and Monitoring Results – July 2009 to December 2011* (SCWA 2012). In this report we look more closely at the affect of open and closed barrier beach conditions on the number of people present and disturbances to seals.

Artificial Breaching January 9 and 11, 2012

The barrier beach was formed 5 times during 2012, but only one closure resulted in water level management activity from the Water Agency (Table 2). On January 3, 2012, the barrier beach formed during a period of high wave action that continued over several days making it difficult to safely access the beach. Breaching of the barrier beach was first attempted on January 9th, with an average river level at the Jenner gauge of 8.2 feet. During a pre-breaching survey conducted on January 8th, a maximum of 27 harbor seals were observed hauled out along the barrier beach. On January 9th observations began

at 07:37 with six harbor seals hauled out. At 09:30 three seals were on the beach as the safety crew advanced along the beach. At 09:45 these three seals flushed off the beach into the ocean when the crew came within 100 feet of the seals. At 09:56 breaching equipment entered the beach from the Goat Rock State Beach (GRSB) parking lot and at 10:13 the excavator began digging a channel through the barrier beach. Waves continued to wash over the barrier beach and at 11:02 the excavator stopped digging and moved along beach toward the parking lot. At 11:10 the equipment stopped on the beach at a high spot and at 12:19 breaching operations were canceled for the day. During breaching activities a total of 23 harbor seals were observed moving across the barrier beach. Heavy surf and waves washing over the barrier beach led to the cessation of breaching activity. During the final observation for the day at 12:30, 10 harbor seals were hauled out on the barrier beach and heavy surf conditions persisted.

On January 11th a second attempt was made to breach the barrier beach. The average reading from the Jenner gauge that day was 8.9 feet. Observations began at 09:09 with 17 harbor seals and one California sea lion hauled out on the beach. At 10:47 a disturbance of unknown source disturbed a total of 21 seals, causing 8 of those seals to flee into the water. At the time a person (not from the Water Agency) was on top of the jetty concrete cap but did not appear to be the source of the disturbance. At 10:51 the excavator moved onto the beach from the GRSB parking lot, and remained until 11:37 when the equipment, led by two safety personnel, travelled north along the barrier beach. From 11:40 to 11:42 a total of 18 seals flushed off of the beach as the equipment approached. At 11:45 the single California sea lion lifted its head after the excavator passed. This is the only response observed from the sea lion during all of the breaching activities and he remained near the jetty wall throughout. At 12:00 the excavation of the barrier beach began and was completed at 14:10. At 14:34 equipment began to exit the barrier beach and by 14:45 all equipment was returned to the GRSB parking lot. At 14:38 one harbor seal was observed exiting the estuary through the new channel. During breaching activities a total of 18 seals were observed moving onto or across the barrier beach. During the final observation at 16:00 one California sea lion and no harbor seals were on the beach.

On the first day of breaching, January 9, the equipment left the area near the seal haul-out and remained parked on the beach from 11:10 to 12:26. During this time a single seal hauled out at 11:38 and by 12:00 the haul-out size had increased to 13 seals. After the equipment had left the beach and returned to GRSB parking lot at 12:30 there were 10 seals hauled out. The effective reoccupation time for harbor seals on this day was 28 minutes. On the second day of breaching activity, January 11, equipment was off the beach at 14:45 and two harbor seals were observed briefly hauling out in the ocean side of the beach and another two seals briefly hauled out from the estuary side north of the channel cut. As of the final census for the day at 16:00 there were no harbor seals and one California sea lion hauled out. Post-breaching monitoring was conducted on January 12th and during the first census at 07:03, 49 harbor seals were hauled out, making the reoccupation time approximately 16 hours, however due to the lack of observations overnight, this is likely an overestimate.

The estimated take by incidental harassment (Level B), as defined by the Marine Mammal Protection Act of harbor seals during the January 9-11, 2012, artificial breaching is 21 harbor seals (on January 9, 3 flushed and on January 11, 18 moved or flushed).

Natural Breaches

Beginning in June, there were several periods where the barrier beach formed and the condition of the barrier beach was naturally perched (Table 2). During these naturally perched conditions outflow from

the river was occurring through an area of the jetty structure where there are gaps in the rock pile (Figure 4). During these periods ocean inflow was restricted by the jetty structure and the barrier beach created conditions of reduced marine influence, similar to those desired by the Lagoon Outlet Channel Management Plan (REF). However, these conditions are very unstable and did not last more than 7 days before the barrier beach was naturally breached likely due to seepage induced sand mobilization.

Table 2. Summary of barrier beach closed or naturally perched conditions occurring in 2012 at the Russian River mouth (Goat Rock State Beach). Peak water level during the event was measured at the gauge located at the Sonoma Coast State Park Visitors Center in Jenner, Ca.

Date	Mouth condition	Peak Jenner gauge height (ft NGVD)	Date mouth opened
January 3-10	closed	9.26	January 11[a]
June 10 – 13	perched	4.61	June 14
June 16 - 18	perched	3.08	June 22
June 19 – 21	closed	4.94	
July 7 – 9	perched	3.34	July 10
July 13 – 19	perched	3.59	July 20
September 30 – October 1	perched	3.59	October 2
October 8 - 15	closed	5.37	October 15
November 5 - 6	closed	5.11	November 7
November 9 -11	closed	4.61	November 12

[a] *river mouth was artificially breached*

Figure 4. Photograph taken of jetty notch (Goat Rock State Beach, Jenner, CA) on June 11, 2012, illustrating naturally perched conditions.

Influence of Barrier Beach Condition on Seal Abundance

One main goal of the Pinniped Monitoring Plan (SCWA and Stewards 2011) is to describe how the maintenance of a seasonal lagoon with an outlet channel will affect the population of harbor seals at the Jenner haul-out. Since the Water Agency began implementing the lagoon outlet channel adaptive management plan a barrier beach has only formed during the lagoon management period eight times, the longest incidence lasting only eleven days, with an average duration of seven days.

Using all surveys conducted (including those for water level management activities) the average count of harbor seals during bar open conditions was 114.8 (n=1588, s.e. = 1.74) compared with bar closed conditions (including naturally perched) at an average of 28.6 seals (n=518, s.e. =3.04). This difference was significant at the $p < 0.0001$ level (Unequal N HSD). The affect was less apparent during certain times of the year. During June and July when the barrier beach was formed seals were present on the beach in numbers similar to those observed during bar open conditions (Figure 5). There is a positive trend with respect to time in the abundance of seals at the Jenner haul-out during both bar open and bar closed conditions (Figure 5).

In order to better determine what is behind the decrease in seal abundance during bar closed conditions the relationship between bar condition and the number of people on the beach was examined. Averaging the greatest single count of people on Goat Rock State Beach in the vicinity of the haul-out, per day, the number of people during bar open conditions was 1.9 (n=1547, s.e. =0.14), only slightly less than during bar closed conditions with a mean of 2.1 people (n=493, s.e. =0.26). This difference was not found to be statistically significant (Unequal N HSD p=0.538). There is a positive trend over time in the number of people found near the Jenner haul-out (Figure 6). The effect of this trend is larger during bar closed conditions.

While the number of people approaching the Jenner haul-out may not fluctuate based on barrier beach condition, their proximity to the seals may. An analysis of the distance of people to seals when disturbances were recorded show that during bar closed conditions most disturbances (36.8%) occurred when people were less than 50 feet from the seal haul-out (Figure 7).

Biological and Physical Monitoring

The NMFS IHA (2012) 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 2012 was calculated based on the number of animals that responded to disturbance by either moving on their haul out or flushing from their haul out. Alerts were also recorded by monitors, but are not included in the number of incidental takes reported. At haul-out sites within the estuary (excluding the barrier beach, Figure 2) disturbances were rare compared to the total number of monitoring events that occurred, with only one of 26 monitoring events in the upper estuary resulting in a seal disturbance (Table 3). Most often, when seals were present on the estuary haul-outs they either had no reaction or most often raised their heads in alert as the boat passed. The most seals hauled out in the middle reach of the estuary as observed by Water Agency field staff were seven at Chalanchawi. Other disturbances resulting from monitoring of the biological resources and physical processes in the estuary occurred at the river mouth haul-out. Only one of six fish seining events at the mouth resulted in a disturbance to harbor seals.

The Russian River Biological Opinion requires monthly topographic surveys of the barrier beach at the mouth of the Russian River. A Water Agency biologist was present during topographic surveys to provide guidance to the survey crews on minimizing disturbance of the haul-out and to observe pinniped response to the survey work in the vicinity of the Jenner haul-out. While having a monitor present greatly minimized the disturbance of seals during the topographic surveys some incidence of take occurred in response to seals responding to the presence of the survey crew. Of eleven topographic surveys in 2012, six surveys resulted in a total of 126 occurrences of incidental take of seals in the form of seals moving along the beach (51 seals) or flushing into the Estuary (75 seals) (Table 3). These numbers represent a wide range of the total amount of seals on the haul out (range = 9% - 100%) with an average of 36% of seals disturbed. In the case where 100% of the seals on the haul-out were disturbed, there were few seals on the beach (15) and they responded to the presence of the survey crew from a distance of 200 feet. It is often the case that a smaller group of seals will be more vigilant and sensitive to disturbance while on land.

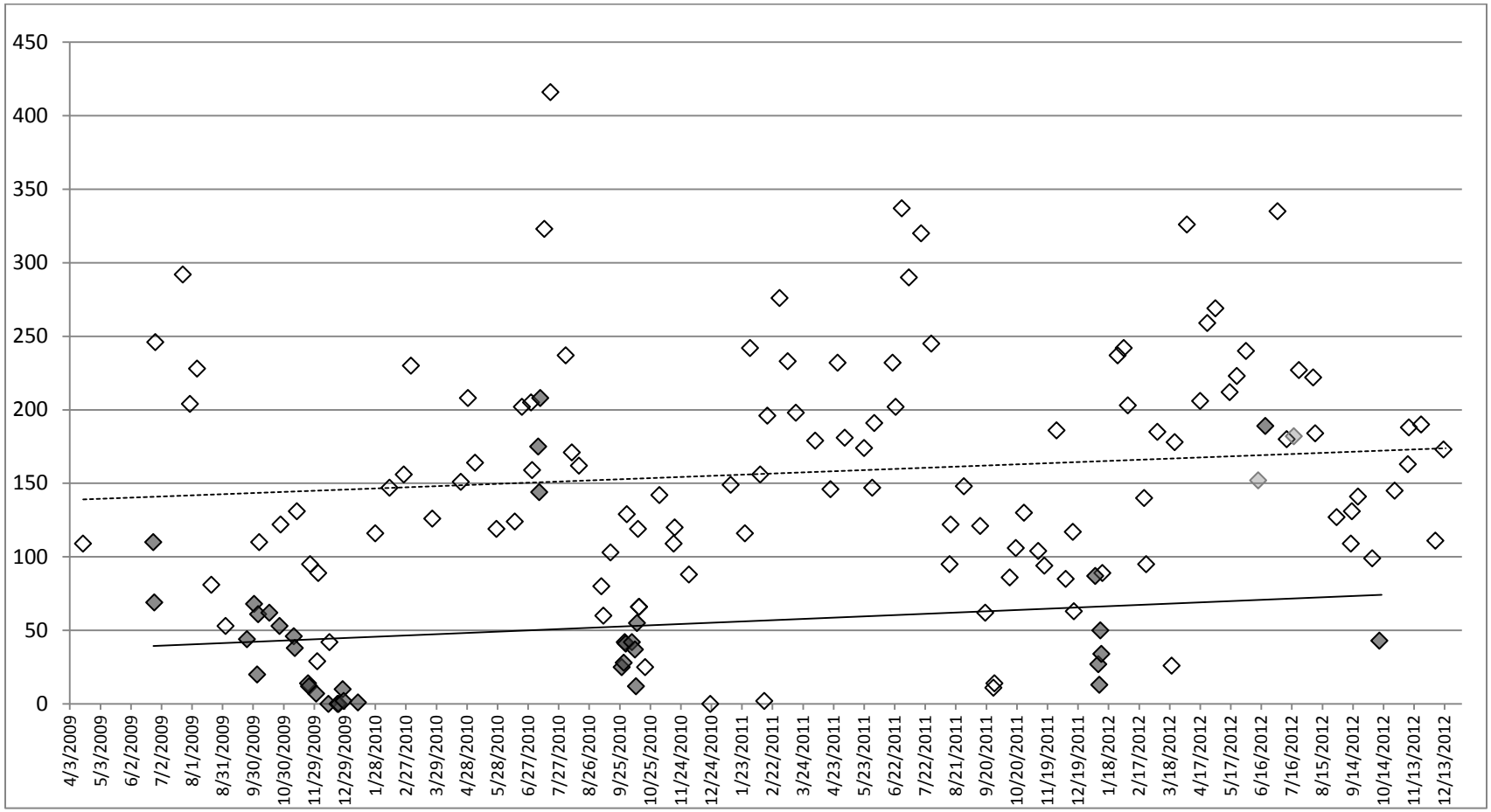


Figure 5. Maximum number of harbor seals counted during all pinniped surveys at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) since surveys began in 2009. Open diamonds represent counts in bar open conditions, dark grey filled diamonds represent counts during bar closed conditions and pale grey diamonds represent counts during naturally perched conditions. Dashed line represents linear trend for harbor seal counts in bar open conditions and solid line represents linear trend for harbor seal counts in bar closed conditions.

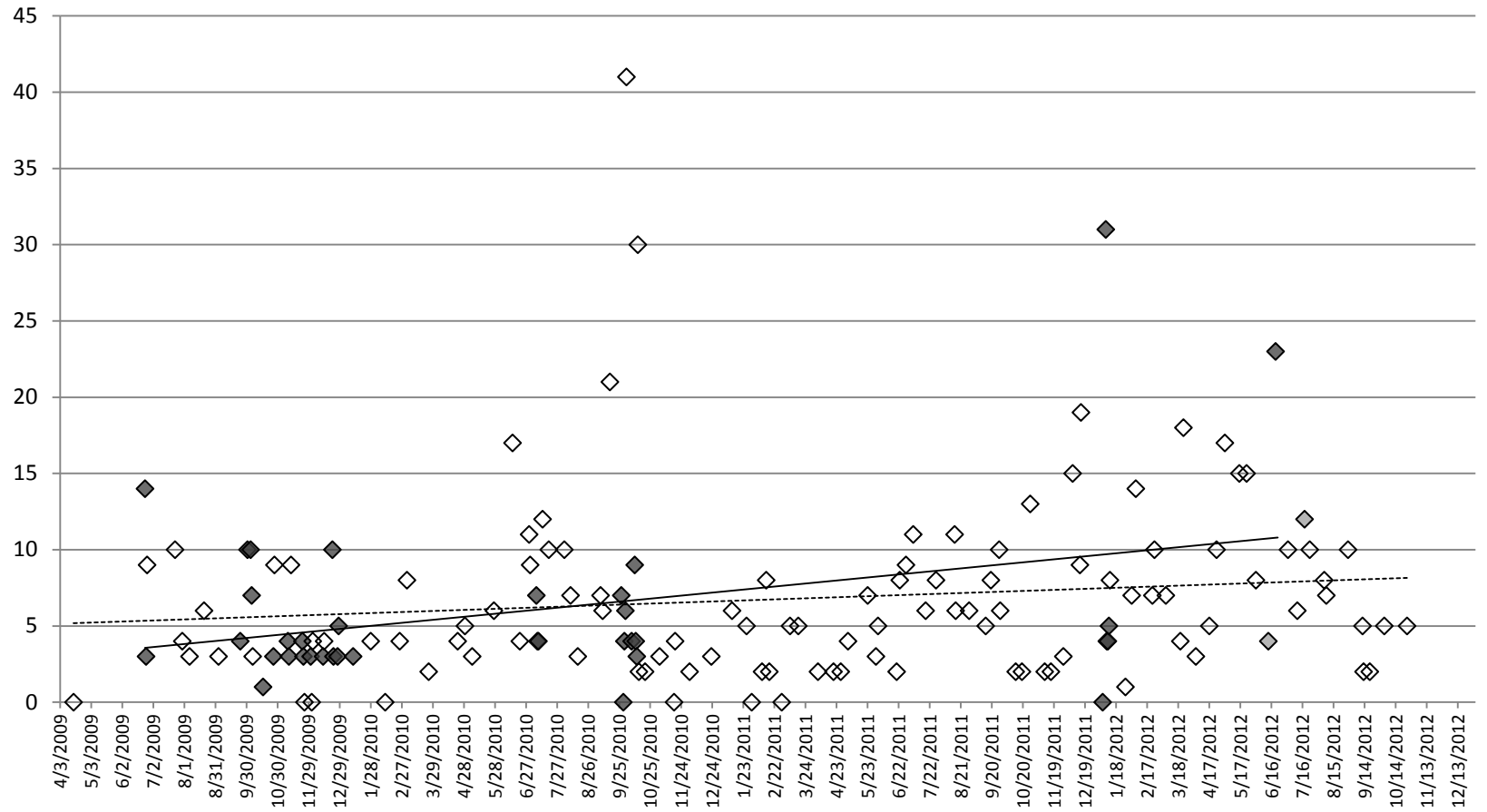


Figure 6. Maximum number of people counted during all pinniped surveys at the Jenner haul-out (Russian River mouth at Goat Rock State Beach) since surveys began in 2009. Open diamonds represent counts in bar open conditions, dark grey filled diamonds represent counts during bar closed conditions and pale grey diamonds represent counts during naturally perched conditions. Dashed line represents linear trend for people during bar open conditions and the solid line represents linear trend for people during bar closed conditions. In order to better illustrate trends, there were 6 survey days removed from analysis where the maximum single count of people exceeded 50.

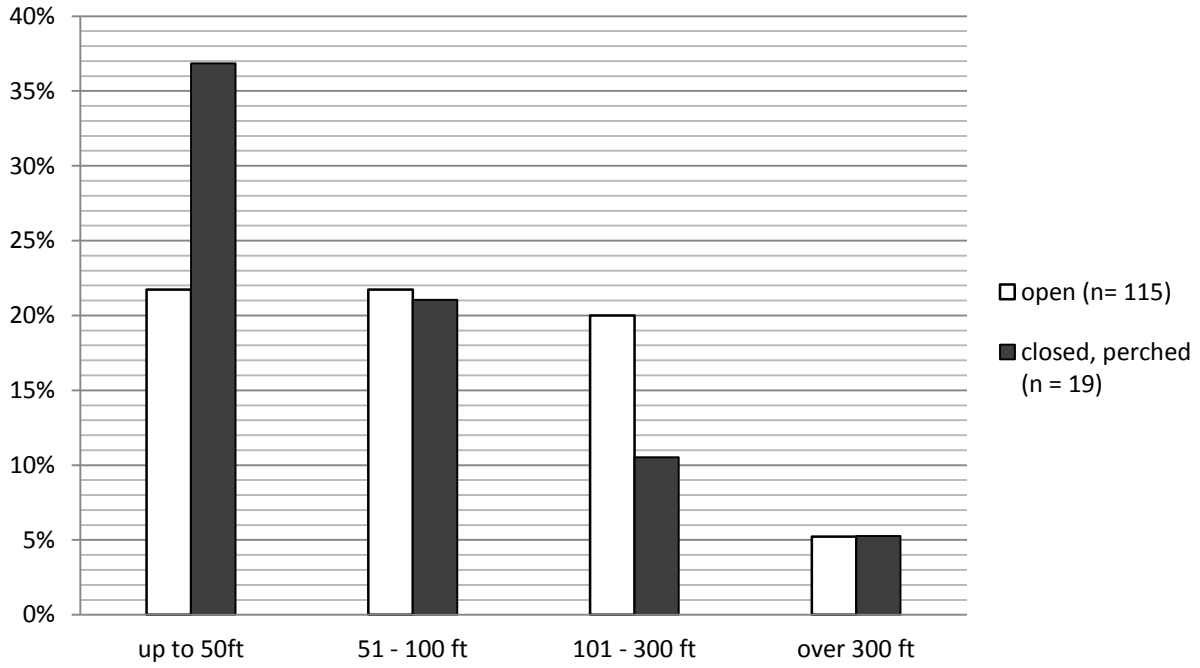


Figure 7. Frequency of human caused disturbances observed at the Jenner haul-out (Russian river mouth, Goat Rock State Beach) grouped by distance of people to seals when the disturbance occurred during bar open and bar closed conditions for monitoring surveys (excluding water level management activities) from June 2009 – December 2012.

Table 3. Number of disturbances of pinnipeds during Russian River Estuary Management and Monitoring Activities for 2012 that resulted in incidental take by harassment. Disturbances reported here are pinnipeds moving on or flushing from their haul-out, number and % of disturbed seals that flushed from their haul-out is denoted by (#).

Date	Event Type	Estimated Disturbance			
		Species	Age Class	Number	% total seals disturbed
8-Jan-12	pre-breaching[a]	harbor seal	adult	6(6)	100% (100%)
9-Jan-12	artificial breaching	harbor seal	adult	3(3)	100% (100%)
11-Jan-12	artificial breaching	harbor seal	adult	18(18)	100% (100%)
2-Feb-12	beach topographic survey	harbor seal	adult	20(0)	11% (0%)
20-Mar-12	beach topographic survey	harbor seal	adult	15(15)	100% (100%)
16-May-12	beach topographic survey	harbor seal	adult	4(0)	9% (0%)
17-May-12	fisheries seining	harbor seal	adult	4(0)	21% (0%)
12-Jun-12	photographic survey of perched barrier beach	harbor seal	adult	50(20)	100% (40%)
13-Jun-12	beach topographic survey	harbor seal	adult	17(0)	12% (0%)
8-Aug-12	beach topographic survey	harbor seal	adult	58(48)	62% (52%)
12-Sep-12	beach topographic survey	harbor seal	adult	12(12)	24% (24%)
19-Sep-12	water quality sampling	harbor seal	adult	1(1)	33% (33%)
	2012 total	**harbor seal**	**adult**	**208(123)**	

[a] *Disturbance was caused by Water Agency personnel posting warning signs on beach, prior to breaching activities.*

Disturbance of Seals at Russian River Mouth

In addition to the recording of disturbances to seals that occur during Water Agency water level management and biological and physical monitoring activities, other sources of disturbance are recorded during monitoring surveys. In an effort to compare the impact of Water Agency caused disturbances to those seals encounter from other sources at and around Goat Rock State Beach a summary of disturbance observations is reported here. Disturbance sources were separated into 9 categories: aircraft, bird, dog, people, SCWA (Water Agency personnel), kayak, other boat, vehicle and unknown. For the purpose of comparison, monitoring surveys that occurred during a breaching or lagoon outlet channel implementation were excluded since these do not represent typical activity that seals would encounter, and the seals are usually vacant from the haul out once water level management activities have begun. Monthly beach topographic surveys of Goat Rock State Beach, conducted by Water Agency personnel are included. Also, only seal movement or flushing responses were considered a disturbance since that is the criterion for a take under our permit. Given that there is some evidence that seal abundance on the haul-out may be depressed during bar closed (including naturally perched) conditions we also compare the frequency of disturbances by barrier beach condition.

Harbor seals were most frequently disturbed by people on foot (50% of surveys), with a small increase in frequency of disturbances during mouth closed conditions (Figure 8). People in kayaks were the next most frequent source of disturbance overall (23.1%) with an increase during mouth closed conditions (31.6%). Water Agency personnel and birds were the next most frequent source of disturbance with 14.9% and 14.2% respectively. For any disturbance event it is often only a fraction of the total haul-out that is disturbed. Figure 8 illustrates the average proportion of seals disturbed by a given source. Some sources of disturbance, though rare, have a larger disturbing effect when they occur. For example, disturbances from dogs or occur in less than 5% of the surveys, however, on average dogs disturbed over half of the seals hauled out (58.4%). Although Water Agency personnel was the third most frequent source of disturbance, on average less than one third of the haul-out was disturbed (29.9%).

In order to compare the relative level of disturbance seals at the Jenner haul-out (Goat Rock State Beach) experience compared to other local haul-outs, Table 4 provides a summary of total number and percent of disturbances observed. For this table we include head alerts since that is the method for data recording presented in the National Park Service report. Based on this summary it is clear that seals are most often disturbed by people on foot (67.7%) and kayakers (15.4%). The National Park Service at Point Reyes National Seashore (NPS) reports 31.9% of disturbances as caused by humans on foot and 9.2% for non-motor boat at all Marin County haul-out locations (Codde et. al. 2012). Since the NPS seal surveys are conducted March through July we compared the disturbance rate per hour at the Jenner haul-out during March through July 2011 with the disturbance rate per hour during the same period for Tomales Bay, the NPS haul-out with the most observed disturbances. The disturbance rate at Jenner was 1.1 per hour, much greater than the 0.59 disturbances per hour reported for Tomales Bay (Codde et. al. 2012).

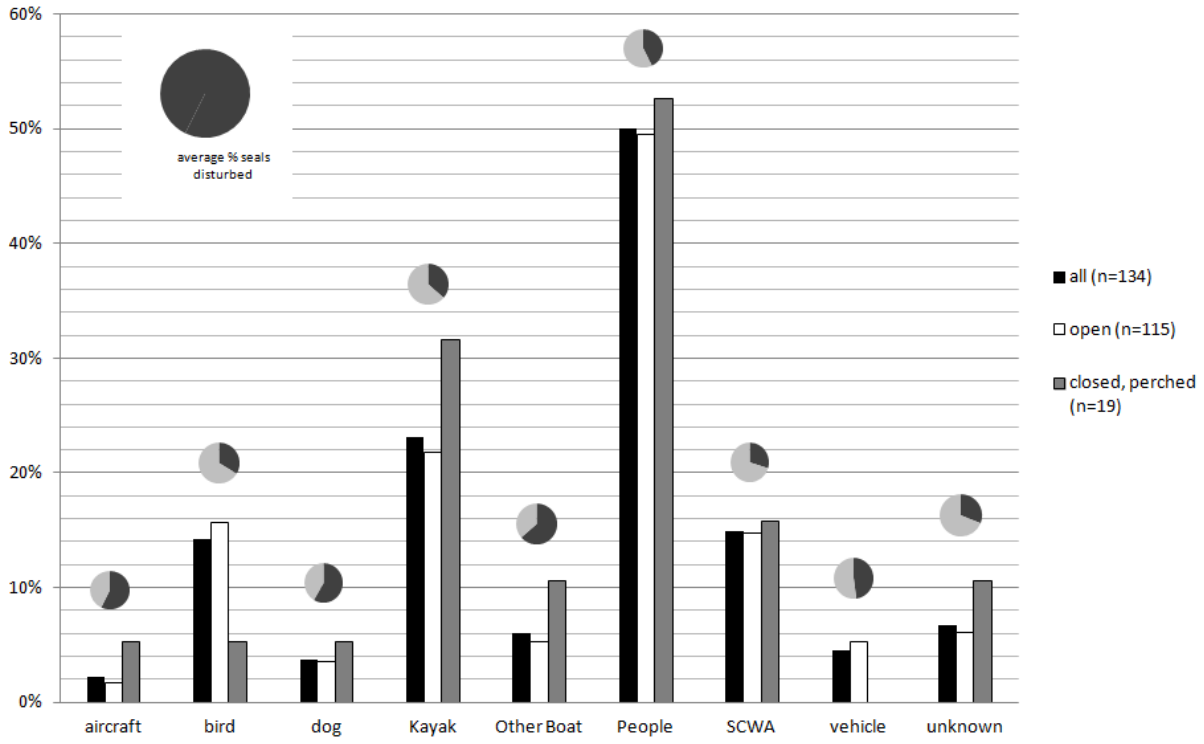


Figure 8. Percent of all pinniped surveys (excluding water level management activities) where disturbances occurred by disturbance source. Pie charts above bars represent the average % of seals from the haul-out that was disturbed. For this figure disturbances were defined as only movement or flushes, not head alerts.

Table 4. Total number and percent of disturbance events observed at the Jenner harbor seal haul-out (Russian river mouth, Goat Rock State Beach) during pinniped surveys in 2012, excluding those during water level management activities. Disturbance is classified as head alert, movement or flight. In this table disturbance from SCWA is included in the total for "people" in order to calculate a similar metric to facilitate comparisons with other local harbor seal monitoring efforts.

	aircraft		bird		dog		kayak		other boat		people (includes SCWA)		vehicle		unknown		total
Year	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
2010	3	1.6	4	2.2	5	2.8	29	15.9	7	3.8	130	71.4	2	1.1	2	1.1	182
2011	2	1.2	12	7.0	4	2.3	21	12.2	5	2.9	115	66.9	9	5.2	3	1.7	172
2012	1	0.5	18	8.6	2	0.9	38	18.1	3	1.4	136	64.8	2	0.9	10	4.8	210
average	**2**	**1.1**	**11**	**5.9**	**4**	**2.0**	**29**	**15.4**	**5**	**2.7**	127	67.7	**4**	**2.4**	**5**	**2.5**	**188**

Peripheral Haul-out Use

In addition to monitoring harbor seal abundance at the Jenner haul-out, eight additional coastal and estuary haul-outs were monitored. Similar to previous years, most of these peripheral haul-outs had very low seal abundance with two sites averaging less than one seal as observed during baseline surveys (Penny Logs = 0.0, Paddy's Rock = 0.0) and four sites averaging less than 3 seals as observed during baseline surveys (North Jenner = 2.2, Odin Cove = 2.6, Chalanchawi = 1.3 and Pocked Rock = 1.9) The two southernmost rocky haul-outs included in our monitoring surveys, Kabemali and Rock Point, had the highest abundance of seals with a baseline average of 3.8 and 6.9 respectively. Seasonal variation was observed at a few of the peripheral haul-outs with the monthly abundance patterns similar to those observed at the Jenner haul-out, with higher abundance during the spring and summer months coinciding with pupping and molting respectively (Table 5).

Table 5. Mean number of harbor seals by month hauled out at peripheral sites as observed during all monitoring surveys conducted in 2012. Shaded areas represent time of pupping (Mar-May) and molting (Jul-Aug).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Jenner	0.3	0.0	0.0	3.8	0.0	0.0	**10.4**	**7.0**	2.1	0.6	0.0	0.0
Odin Cove	0.8	2.4	1.8	0	1.9	0.1	**11.6**	1.8	3.1	1.0	1.3	0.5
Penny Logs	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paddy's Rock	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Chalanchawi	0.7	1.0	**3.6**	1.3	1.0	0.4	0.6	2.3	1.0	0.5	0.4	0.3
Pocked Rock	0.8	1.9	0.8	2.5	**3.4**	3.0	0.9	**2.9**	**3.1**	0.0	0.5	0.4
Kabemali	2.5	3.8	**7.0**	3.8	3.9	1.0	1.8	3.9	3.6	1.9	1.5	0.5
Rock Point	7.4	4.3	0.9	2.1	4.4	6.5	**19.0**	**13.9**	**14.9**	2.8	1.0	1.9

CONCLUSIONS

The water level management activities and biological monitoring activities conducted by the Water Agency in 2012 resulted in incidental harassment (Level B harassment) of 208 marine mammals, well under the total allowed by NMFS IHA (2012).

The purpose of the Russian River Estuary Management Project 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 haul-out respond to activities associated with the construction and maintenance of the lagoon outlet channel and artificial breaching activities?

3. Does the number of seals at the Jenner haul-out significantly differ from historic averages with formation of a summer (May 15th to October 15th) lagoon in the Russian River estuary?

4. Are seals at the Jenner haul-out displaced to nearby river and coastal haul-outs when the mouth remains closed in the summer?

A summary of baseline pinniped monitoring concluded that time of year, tidal state and time of day influenced harbor seal abundance at the Jenner haul-out (SCWA 2012). Harbor seals were most abundant on the haul-out in July during their annual molt. For 2012 this seasonal pattern was not as evident as seals were equally abundant from April through July. Seasonal variation in the abundance of harbor seals at their haul-out locations is commonly observed throughout their range (Allen et al. 1989, Stewart and Yochem 1994, Gemmer 2002). The variation in their abundance can mostly be explained by changes in their biological and physiological requirements throughout the year. Peak seal abundance occurring in July during their molting season is likely a result of seals spending more time on land in order to help facilitate the molting process. This annual peak is typically followed by a decline in seal abundance which is likely a result of individual seals decreasing the amount of time on the haul-out post-molt to spend more time foraging and also coincides with the time that young seals may temporarily disperse from their natal haul-out (Stewart and Yochem, 1994, Thompson et al. 1994, Small et al. 2005). Compared to previous years the abundance of harbor seals during the fall of 2012 was greater, especially during September and November. While many factors work to influence the relative abundance of harbor seals at Jenner at any given time, a few potential factors are worth discussion. For 2009 and 2010 the barrier beach was closed during the month of September, and in 2011 while the barrier beach did not close fully, there was a period when the channel was extremely narrow and potentially in naturally perched conditions. These closed or perched barrier beach conditions did not exist in September 2012 and may have contributed to depressed seal abundance in previous years. Decreased seal abundance during bar closed conditions may be a result of the lack of direct aquatic access from the estuary. Harbor seals prefer haul-outs with easy aquatic egress as they move more slowly and awkwardly on land, compared to other pinnipeds like California sea lions. This effect may also be related to the closer proximity of people to the Jenner haul-out during bar closed conditions. When the barrier beach is open the river mouth channel provides a natural barrier between visitors accessing Goat Rock State Beach from the main parking area to the south. The increase in disturbances due to kayakers during bar closed conditions may also be due to the lack of river flow out to the ocean, allowing for kayakers to paddle much closer to the seal haul-out.

The response of harbor seals at the Jenner haul-out to water level management activities in 2012 (Question 2 above) was similar to the responses observed in previous years of monitoring (Merritt Smith Consulting 1997, 1998, 1999, 2000; Sonoma County Water Agency and Merritt Smith Consulting 2001, SCWA 2011 and 2012). The harbor seals alerted to the sound of equipment on the beach and left the haul-out as the crew and equipment approached closer on the beach. 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 haul-out within 30 minutes of the work ending.

Since the beginning of the modified estuary water level management procedures as a result of the NMFS 2008 Biological Opinion a summer lagoon has only been implemented once (July 2010). However, since the Water Agency began implementing the lagoon outlet channel adaptive management plan a barrier beach has only formed during the lagoon management period eight times, the longest incidence lasting only eleven days, with an average duration of seven days. Given the short lived and infrequent formations of a summer lagoon it is not prudent to make overall comparisons between seal abundance during the lagoon management period compared to historic data (Question 3 above). However, it is possible to examine some of the short term effects of bar closed conditions on seal abundance. The overall decline in seal abundance during bar closed conditions was not observed during June and July. This suggests that when seals are more motivated to spend time on land, i.e. during their annual molt, barrier beach closures will not deter them from using the Jenner haul-out. However, when seals are less

biologically constrained to spend time on land, they may be more sensitive to the formation of a barrier beach. These lower seal numbers during bar closed conditions could indicate that seals are choosing alternate haul outs or they are simply not spending as much time on land, hauling out in briefer bouts, effectively lowering the onshore count of seals. In order to determine which of these is true we would need to be able to track individual seals.

Responding to Question 4 is also difficult due to the lack of extended lagoon conditions. Initial comparisons of peripheral (river and coastal) haul-out baseline and water level management activity count data to the Jenner haul-out counts were inconclusive. Observations from 2012 did not enhance our ability to draw conclusions about the potential displacement of seals from the Jenner haul-out during lagoon conditions, as these conditions did not persist. Overall, very few seals utilize the nearby rocky and estuarine haul-outs included in our study. What patterns we were able to detect from our count data suggests that their abundance at these sites is related to the biologically seasonal events of pupping and molting.

Harbor seals are generalists in many ways: including diet, resting locations and activity patterns. They are able to find refuge on sandy beaches, tidal mud flats and rocky shores (Allen et al. 1989, Gemmer 2002, Small et el. 2005). Seals exploit a wide range of locally abundant prey (Gemmer 2002, Hanson 1993, Tollit et al. 1997): they may forage during the day and come ashore at night, or forage nocturnally and rest ashore at day, or even spend multiple days at sea (Small et al. 2005, Suryan and Harvey 1998, Yochem et al. 1987). With this plasticity in behaviors evident in harbor seals our ability to understand short or long term temporal changes in seal behavior and population abundance is limited by the use of periodic count data. In order to better understand the underling behaviors that influence the population trends for harbor seals located at Jenner, we propose to conduct a photo-identification study as a means to observe individual seals over time. In the coming year we will be implementing a pilot study to determine if our current observation locations allow us to capture detailed images of seals that can be used to identify individuals based on spot patterns.

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Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from January – December 2012 for the Russian River Estuary Management Project, including summary of pinniped abundance and Estuary water level.

			HASE adults			HASE neonates			HASE pups					
Date	**Activity**	**Estuary water level[a,b] (ft)**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**n**	**CASL present[c]**	**NES present**
1/5/2012	baseline	--	87	61.1	7.24							17		
1/8/2012	pre-breaching	7.5*	27	4.7	1.61							21		
1/9/2012	breaching (1st attempt)	8.2*	13	4.7	1.13							13		
1/10/2012	pre-breaching	8.7	50	39.5	2.63							10		
1/11/2012	breaching (successful)	9.2	34	10.3	3.41							15	Y	
1/12/2012	post-breaching	--	89	69.9	2.58							17		
1/27/2012	baseline	--	237	152.7	14.65							18		
2/2/2012	topo survey	1.2	242	190.4	16.92							11		
2/6/2012	baseline	1.5	203	95.6	17.45							19		
2/22/2012	topo survey	2.0	140	127.4	6.34							5		
2/24/2012	baseline	4.8	95	50.9	9.35							18		
3/6/2012	baseline	1.5	185	122.6	13.44							17		
3/20/2012	topo survey	1.1	26	5.8	3.08							10		
3/23/2012	baseline	1.1	177	107.1	11.69	1	0.3	0.11	0	0.0	0.00	18		
4/4/2012	baseline	1.4	326	140.5	22.44	0	0.0	0.00	0	0.0	0.00	17		
4/17/2012	topo survey	1.9	196	110.8	19.64	5	4.2	0.25	5	3.2	0.36	10		
4/24/2012	baseline	1.4	236	181.9	6.53	2	0.4	0.20	21	13.2	1.05	18		
5/2/2012	baseline	1.5	247	146.9	17.90	2	0.6	0.18	20	10.9	1.22	18		
5/16/2012	topo survey	1.3	186	150.9	9.12	0	0.0	0.00	26	21.9	1.03	8		
5/23/2012	baseline	--	200	153.6	7.00	0	0.0	0.00	23	16.5	0.77	18		
6/1/2012	baseline	2.0	240	182.3	5.63	0	0.0	0.00	0	0.0	0.00	18		
6/13/2012	topo survey	4.3*	152	134.9	5.34							9		
6/20/2012	baseline	4.5*	189	149.5	4.99							17		
7/2/2012	baseline	2.5	335	218.4	10.24							16		

Appendix A. Summary of pinniped monitoring activities at the Jenner haul-out (Goat Rock State Beach, Sonoma County) conducted by the Sonoma County Water Agency and Stewards of the Coast and Redwoods from January – December 2012 for the Russian River Estuary Management Project, including summary of pinniped abundance and Estuary water level.

			HASE adults			HASE neonates			HASE pups					
Date	**Activity**	**Estuary water level[a,b] (ft)**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**max**	**mean**	**s.e.**	**n**	**CASL present[c]**	**NES present**
7/11/2012	topo survey	2.6	180	156.8	16.71							6		
7/18/2012	baseline	3.4	182	76.2	20.72							16		
7/23/2012	baseline	2.1	227	197.3	6.24							7		
8/6/2012	baseline	1.4	222	175.9	6.18							18		
8/8/2012	topo survey	0.9	184	158.4	15.92							11		
8/29/2012	baseline	1.6	127	76.6	7.15							17		
9/12/2012	topo survey	1.2	109	78.1	5.28							9		
9/13/2012	baseline	1.1	131	114.3	3.26							18		
9/19/2012	baseline	0.9	141	85.5	8.11							17		
10/3/2012	baseline	2.9	99	67.3	8.55							18		
10/10/2012	topo survey	3.5	43	23.4	4.75							8		
10/25/2012	baseline	1.2	145	75.8	14.85							16		
11/7/2012	topo survey	4.7*	163	141.7	5.08							10		
11/8/2012	baseline	3.0*	188	153.5	4.75							17		
11/20/2012	baseline	3.4	190	107.6	18.58							10		
12/4/2012	baseline	1.6*	111	35.6	11.09							18		
12/12/2012	baseline	--	173	66.5	16.62							17		

[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] Only counts for sea lions on land, does not include sea lions observed in the water

** some estuary water level values from the day are missing*

-- missing data

History of Harbor Seal Pups at Jenner

By

Joe Mortenson

Stewards of the Coast and Redwoods

January 2013

Harbor seal pups were first formally noted at Jenner in 1982 in the initial year of the California Department of Fish and Game seal census. The census entailed aerial surveys as well as ground surveys at some sites. At Jenner 114 adults and 5 pups were counted by ground personnel. From the air it was impossible to distinguish pups from other seals. In subsequent years of this census, California Fish and Game abandoned the pupping season count but continued with a molt count until 1995.

Linda Hanson (1993) recorded harbor seals and pups in the course of her foraging ecology study at the mouth of the Russian River. In her report she commented that 6 pups were noted in the peak of pupping in 1990 and 16 in 1991. The percentage of pups present in May 1990 was 5 % of the haul-out and was 8 % in May 1991.

The next sampling of adult and pup attendance at Jenner was made by Mortenson (1995) during a study of human disturbance at the harbor seal haul-out. Counts from February 1994 to July 1995 were reported (Figure 1). In order to compare counts between Jenner studies, the average number of pups and adults for April and May were calculated (Figure 2). In this region a few pups may appear in March, counts increase in April and May, and then drop off. At the end of pupping it may be difficult to distinguish growing pups from newly molted small older seals. Thus comparisons between years in this report are drawn from April-May averages. In the disturbance study pup numbers grew from April to May. The percent of seals that were pups also increased from April to May each year, and the percentages were higher in 1995.

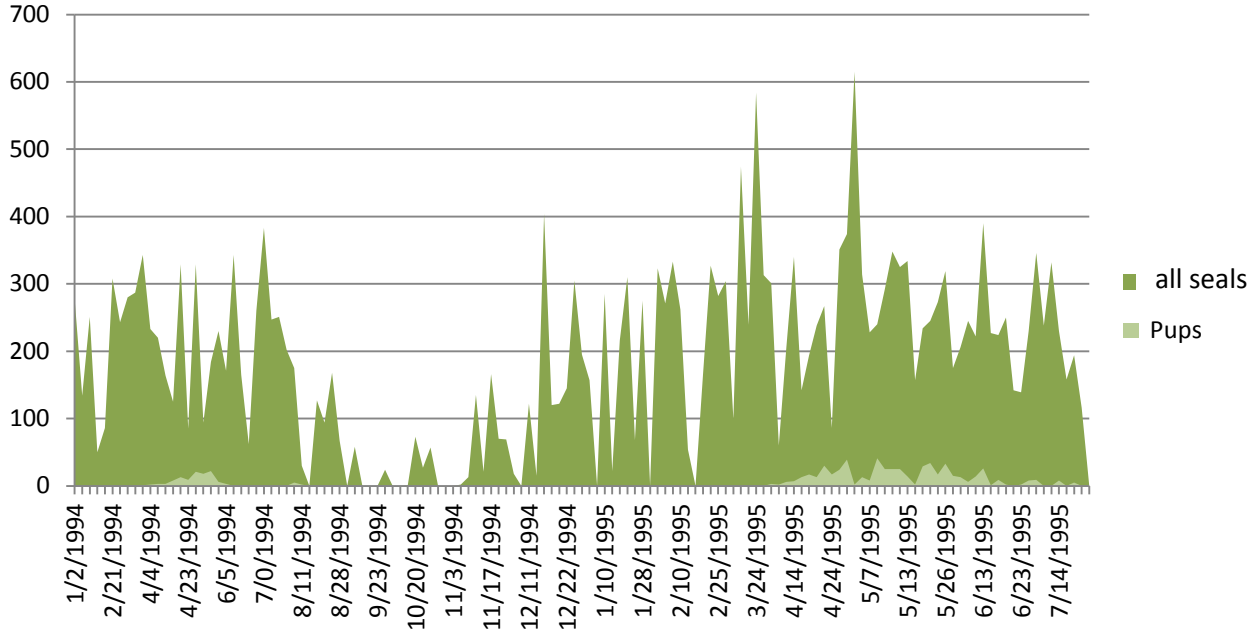

Figure 1. Pup and total seal attendance at Jenner in 1994 and 1995 (Mortenson, 1995)

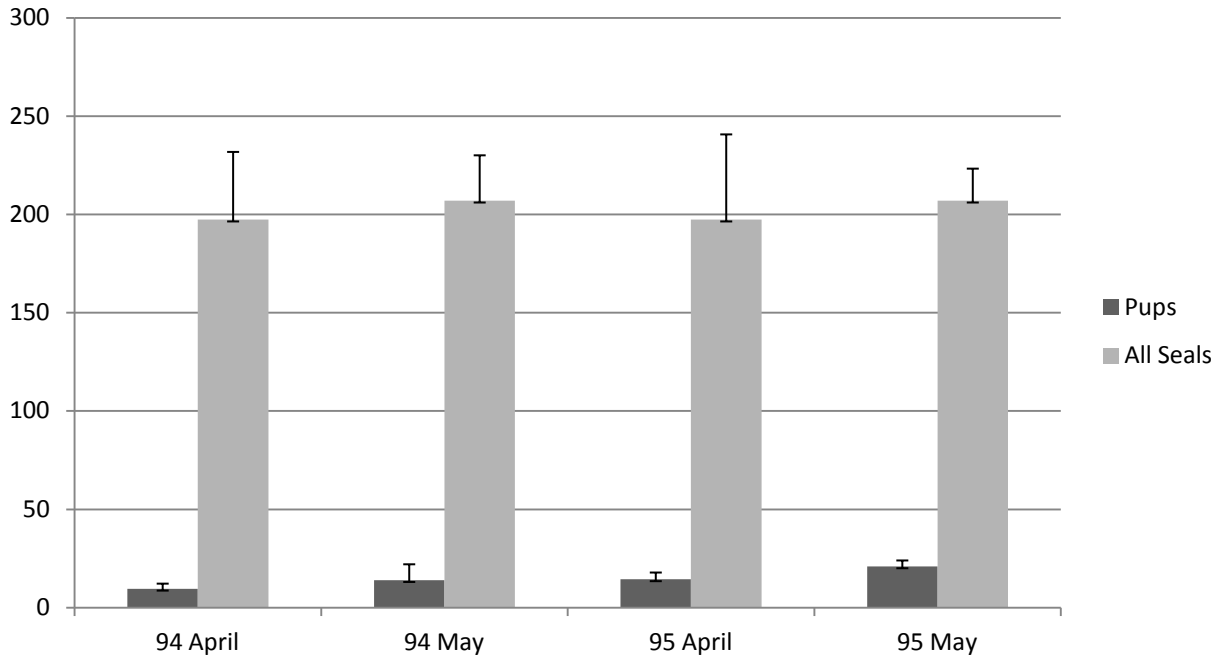

Figure 2. Mean pup and mean total seal counts for the 1994 and 1995 pupping seasons. Bars indicate standard error.

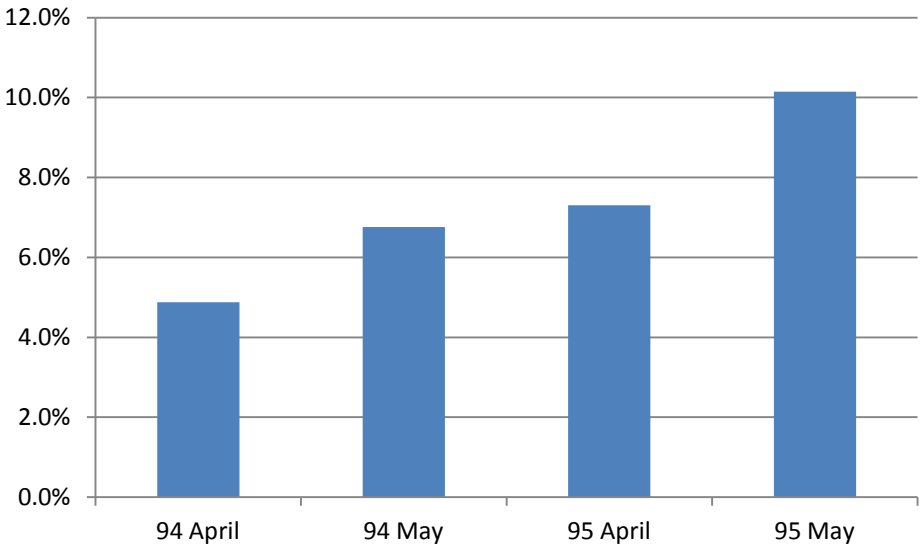

Figure 3. Percent of pups present in the 1994 and 1995 pupping seasons.

The next series of pup counts at Jenner was made as part of the central California regional harbor seal census (Codde et. al. 2011). This census began in 1998 and included data from the Gulf of the Farallones, Point Reyes National Seashore, two regional counts in Sonoma County, as well as data from short term studies. The census has been taken more frequently since its inception. Here we consider the data collected at Jenner. For purposes of comparison the pupping season averages for May and June are given in Figure 4 along with the averages for 1994 and 1995. As may be seen pup counts varied over the years. The low count in 1998 presumably reflected the exceptional 1997/1998 El Niño-Southern Oscillation (ENSO). The low count in 2007 resulted from the presence of R-1, a rogue elephant seal that arrived in 2001 during the winter haul-out. Numbers at the winter haul-out in fell. In 2007 R-1 extended his stay into the pupping period. R-1 killed many seals at Jenner, particularly on his last visit. The final drop in pup and older seal numbers might be partially due to deaths rather than to flight to the periphery or beyond. Figure 5 combines the disturbance and census counts and indicates the effect of R-1 on pups. The pupping percentage also dropped to a low level in 1998, which may reflect the extreme 1997/1998 ENSO event.

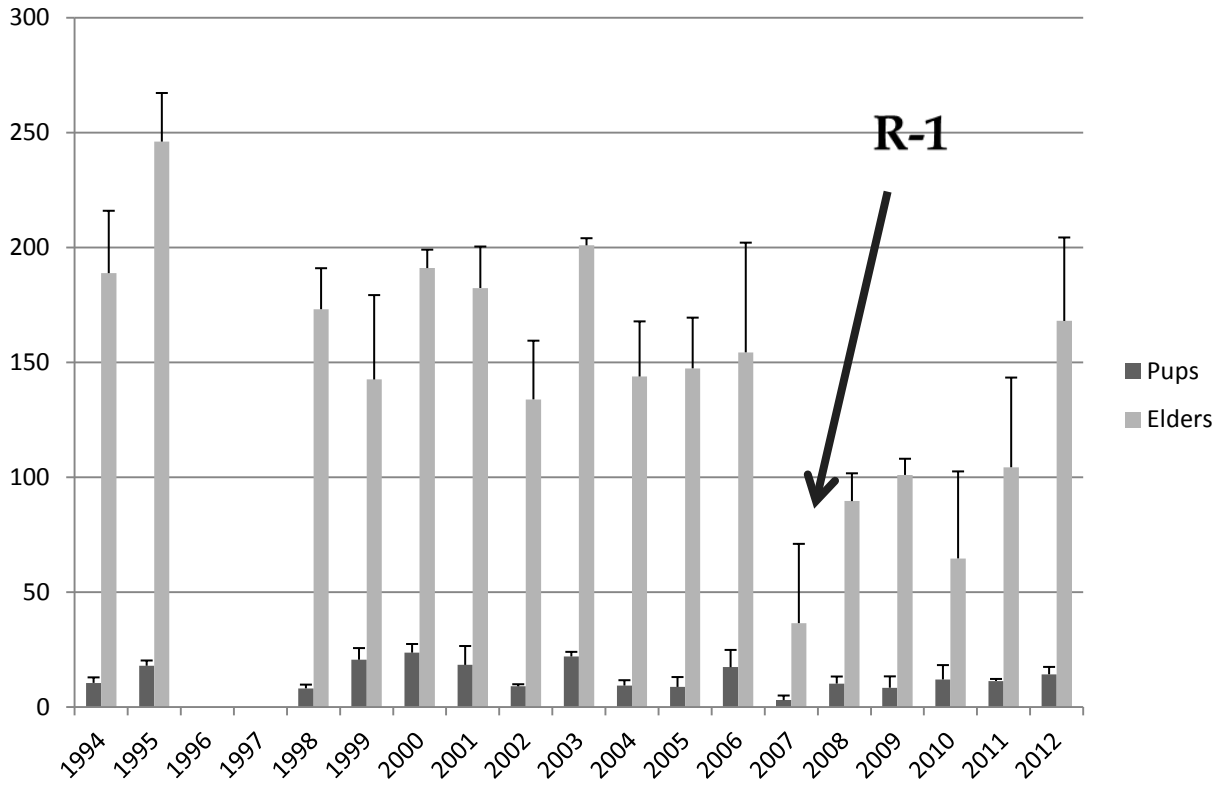

Figure 4. Yearly averages for May and June at Jenner from the disturbance study and the central California census. Bars indicate standard error.

Beginning in 2006, Seal Watch, the long running interpretative and protective program of the Stewards of the Coast and Redwoods, began counting adults and pups at the start of their shifts at 10:00 and 14:00. Their average pupping season counts from 2006 to 2012 reveal the impact of R-1's extended stay in 2007. R-1's departure was followed by gradual increase in the number of pups over the years since (Figure 5). The percent pups fell after 2006 (Figure 6), which reflects the drop in numbers of adult seals when R-1 was present. In 2007 the number of pups fell during R-1's presence in pupping season, which lowered the percentage.

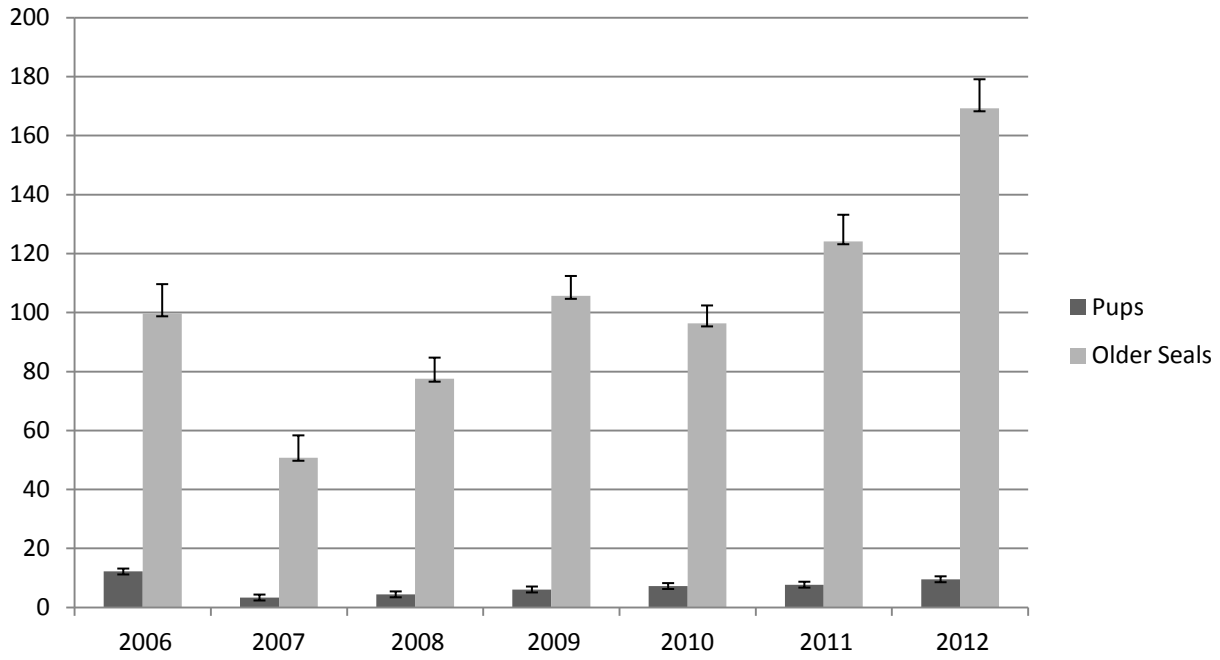

Figure 5. Yearly average counts for April and May of pups and older seals from the Seal Watch database. Bars indicate standard error.

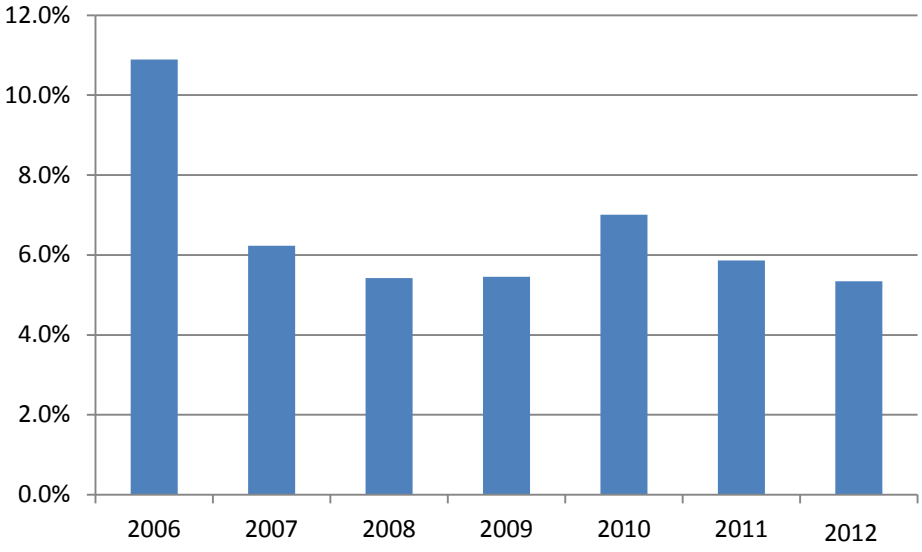

Figure 6. Percent of total seals that were pups in April and May from the Seal Watch database.

The latest study monitoring harbor seals at Jenner began in July 2009. Volunteer monitors from the Stewards of the Coast and Redwoods and staff from the Sonoma County Water Agency record all pinnipeds present at the river mouth. Baseline counts for the annual pupping seasons are shown in Figure 7. Counts are collected on weekdays and are made at half hour intervals from approximately local dawn until midafternoon. Pup averages varied across and within years. The pattern may vary from the trends seen in the Seal Watch data since the number of visitors would be expected to be higher on weekends than on weekdays. Kayakers may especially affect the harbor seals on weekends despite Seal Watch.

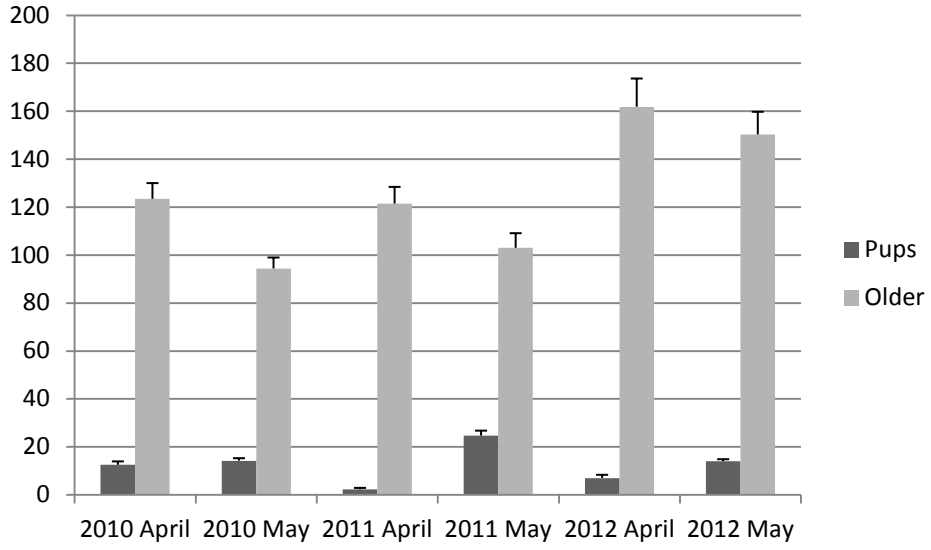

Figure 7. April and May pups and older seal averages for baseline counts from the Water Agency and Stewards of the Coast and Redwoods pinniped monitoring surveys. Bars indicate standard error.

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