BIOLOGICAL AND WATER QUALITY MONITORING IN THE RUSSIAN RIVER ESTUARY, 2000

FIFTH ANNUAL REPORT

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1.0 EXECUTIVE SUMMARY

The Russian River Estuary (Estuary) in Sonoma County, California, closes throughout the year as a result of a barrier beach (sandbar) forming at the mouth of the Estuary. The closure of the Estuary results in ponding of the Russian River behind the sandbar and an increase of the water level in the Estuary. The sandbar is artificially breached by the Sonoma County Water Agency (Agency) when the water level inside the Estuary exceeds 4.5 feet (as read at the Jenner gage located at the Jenner visitor's center). The sandbar is breached to alleviate potential flooding of low-lying shoreline properties near the town of Jenner. Artificial breaching of the Estuary is typically done using a bulldozer or by similar mechanical means to create a cut in the sandbar to a sufficient depth to allow the river flow to begin moving sand out of the mouth.

A management plan was adopted to evaluate potential impacts of artificial breaching activities on biological and hydrological conditions within the Estuary. This report provides the results of the fifth and final year of annual monitoring activities. A summary of the five years of biological and water quality monitoring is also included in this report.

The 2000 monitoring program consisted of water quality, fish and macroinvertebrate sampling, and pinniped monitoring. A total of four artificial breaching events were monitored in 2000. Following five years of monitoring artificial breaching of the sandbar at the Russian River Estuary, no significant impacts to the biota of the Estuary have been identified.

Results of the 2000 monitoring activities support the overall conclusions identified in the 1999 report (Merritt Smith Consulting 2000). During monitoring events I through IV in 2000, salinity stratification was evident during the pre-breaching monitoring and continued through the tidal survey, as shown by both the water quality profile and Minisonde data. Based on Station 3 Minisonde data and results from previous years, it appears that salinity stratification is usually present within the Estuary and that the freshwater lens fluctuates in depth based upon tides, river flows, and bar-open or bar-closed conditions. Deep water dissolved oxygen (DO) levels appear to be more closely connected with bar conditions, usually staying above 5.0 ppm when the bar was open, and dropping below 5.0 parts per million (ppm) when the sandbar is closed. Although low DO levels in the near-bottom layers of deep water stations, such as Stations 2, 3, and 4, are often associated with bar-closed conditions, anoxia also develops naturally when the bar is open during neap tides and/or low river flows. It takes more than one tidal cycle for the DO levels at upstream stations (Stations 2, 3, and 4) to recover following an artificial breaching event, as DO levels often remain near-anoxic at deep water locations during the first tidal survey.

Monitoring of water quality conditions in Willow Creek began in 1998 to investigate possible causes of a series of fish and macroinvertebrate mortalities at the mouth of the creek (Merritt Smith 1999 and 2000). No mortalities were observed following draining of Willow Creek in 2000. This is likely due to the fact that most of the artificial breaches were performed at approximately 7.0 feet on the Jenner visitor's center gage.

As discussed in the 1999 monitoring report (Merritt Smith Consulting 2000), the trend observed during the monitoring studies was that fish species diversity and abundance did not appear to be driven by sandbar conditions (bar-closed or bar-open) as much as by seasonal variability. Many

estuarine fish species are more abundant during spring and summer months when they enter the Estuary to spawn or rear. Fish species diversity and abundance declines during the fall months when fish move out of estuaries, probably due to unfavorable thermal conditions (Merritt Smith Consulting 2000). Otter trawl and beach seine results for 2000 support these conclusions.

In all five monitoring studies, the number of pinnipeds (primarily harbor seals) observed hauled out at the mouth of the Estuary declined when the sandbar was closed, and increased soon after artificially breaching the sandbar. Seals hauled out at the mouth of the Estuary appear to respond most negatively to human disturbances on the beach (typically beach visitors approaching the haulout).

Recommendations

Future artificial breaching of the sandbar at the mouth of the Russian River Estuary should be performed prior to water levels in the Estuary reaching 7.0 feet on the Jenner visitor's center gage to reduce the potential of fish and macroinvertebrate mortalities at the mouth of Willow Creek.

Merritt Smith Consulting (2000) provided recommendations for further monitoring studies. It was recommended that water quality sampling of breaching events be limited to maintaining Datasondes (or Minisondes) to monitor near-bottom temperature, salinity, and DO in and near the mouth of Willow Creek (such as Stations 3 and 3AA). A program of monthly biological samplings (otter trawls and beach seines) conducted year-round at Stations 1 through 4 was recommended to provide more basic and valuable information on seasonal use and general biological health of the Estuary. The recommendation included replicating samples one or more times at each station, where possible.

Posting signs and cordons on the sandbar 24 hours prior to breaching and removing them 24 hours following the breaching event should be continued. Placing the signs and cordons further south of the jetty would likely reduce the number of visitors bypassing the signs and approaching the haul out (seals hauled out at the sandbar are not as visible from south of the jetty). Agency staff should continue to keep crew members posted at the jetty during artificial breaching activities to prevent visitors from walking past the signs into the breaching area.

2.0 INTRODUCTION

2.1 BACKGROUND

The Russian River Estuary (Estuary) in Sonoma County, California, closes throughout the year as a result of a barrier beach (sandbar) forming at the mouth of the Estuary. The sandbar usually forms during late summer and fall months when river flows are low and ocean conditions result in the build up of sand in the mouth (although sandbars have historically closed the Estuary mouth occasionally during winter and spring). The closure of the Estuary results in ponding of the Russian River behind the sandbar and an increase of the water level in the Estuary. The sandbar is artificially breached by the Sonoma County Water Agency (Agency) when the water level inside the Estuary exceeds 4.5 feet (as read at the Jenner gage located at the Jenner visitor's center). The sandbar is breached to alleviate potential flooding of low-lying shoreline properties near the town of Jenner.

Artificial breaching of the Estuary is typically done with a bulldozer or by similar mechanical means. The bulldozer is used to create a cut in the sandbar to a sufficient depth to allow the river flow to begin moving sand out of the mouth. In the early 1990s, concerns were raised regarding the impacts of the artificial breaching activities on the health of the Estuary. In 1992 and 1993, a study was undertaken to evaluate the potential impacts of artificial breaching activities on the Estuary's biological and hydrological conditions and to develop a management and monitoring program for the Estuary. The study was performed under the direction of the Russian River Interagency Task Force for the County of Sonoma and the California Coastal Conservancy. A preferred Estuary management plan was included in the study's final report (Heckel 1994) and was subsequently adopted by the Sonoma County Board of Supervisors. The management plan outlines biological and water quality monitoring to be performed as part of the artificial breaching events in the Estuary.

Results of the 1996, 1997, 1998, and 1999 monitoring activities were presented in previous reports (Merritt Smith Consulting 1997, 1998, 1999, 2000). This report provides the results of the fifth and final year of annual monitoring activities. A summary of the five years of biological and water quality monitoring of artificial breaching activities in the Estuary is also included in this report.

2.2 MONITORING PROGRAM

The 2000 monitoring program consisted of water quality, fish and macroinvertebrate sampling, and pinniped monitoring. The monitoring activities performed in 2000 were similar to those performed in the previous four years. The most significant differences in the 2000 monitoring program from previous years are that plankton trawls were not performed (they were also not performed in 1999) and that the two sampling locations in the vicinity of Willow Creek, which were sampled in 1999, were also monitored in 2000. During a meeting on May 20, 1999, the Russian River Estuary Management Task Force concluded that the plankton sampling performed during previous monitoring years was not providing useful information regarding water quality in the vicinity of Willow Creek (Merritt Smith Consulting 1999). Therefore plankton monitoring was not continued during the 1999 and 2000 monitoring activities.

3.0 METHODS

Biological and water quality monitoring (with the exception of pinniped monitoring) was performed at six stations (Figure 3-1). Station 1 is located between the western tip of Penny Island and the jetty at Goat Rock State Park. Station 2 is located downstream of the Highway 1 bridge spanning the Russian River. Station 3 is near the confluence of Willow Creek and the Russian River. Station 3A is within Willow Creek approximately 0.5 km upstream of the Willow Creek Road bridge. Station 3AA is located near the Willow Creek Road bridge. Station 4 is at the confluence of Sheephouse Creek and the Russian River.

Water quality profiles and fish and macroinvertebrate monitoring was performed for a total of four artificial breaching events in 2000. Monitoring consisted of "pre-breaching," "draining," and "tidal" surveys. Pre-breaching surveys were conducted after the Estuary mouth closed and the water level in the Estuary was between 5 and 7 feet as measured on the Jenner gage. Draining surveys were performed on the day following a successful artificial breaching event, while the Estuary was still in the process of being flushed. Tidal surveys were conducted two to four days after an artificial breaching event, so that data collected would be representative of typical bar-open, tidal circulation in the Estuary.

Pinniped monitoring was conducted at the Highway 1 overlook just north of the town of Jenner. The overlook is located immediately east of Haystack Rock and the mouth of the Estuary. The following sections provide detailed methodology information.

3.1 WATER QUALITY MONITORING

3.1.1 Water Quality Profiles

Water quality vertical profiles (observations at 1 meter vertical intervals) were conducted at each station during every biological sampling event. Portable YSI meters were used to obtain *in situ* data on temperature (degrees Celsius, °C), salinity (parts per thousand, ppt), conductivity (μmho), and dissolved oxygen (DO; parts per million, ppm). The profiles were performed in the deepest part of the channel at each station to determine if salinity stratification was present. Near each water quality monitoring station, a monument was established from which the water level at the time of sampling was measured. This enabled the water depths to be expressed relative to zero on the staff gage at the Jenner visitor's center. Water quality profiles for the 2000 data could therefore be plotted relative to this datum.

3.1.2 Minisondes

Hydrolab Model 4A Minisondes (Minisonde) were placed at Stations 3, 3A, and 3AA in the Estuary and Willow Creek (Figure 3-1). Minisondes use the same probes as the Hydrolob Datasondes used in the last four monitoring years, they are simply a smaller unit. The Minisondes recorded hourly temperature (°C), salinity (ppt), and DO (milligrams per liter, mg/l) a few centimeters above the river bottom. They were deployed continuously from June 1, 2000, through November 30, 2000. Minisondes were retrieved monthly to download collected data. After being cleaned and recalibrated, the Minisondes were redeployed at the same locations.

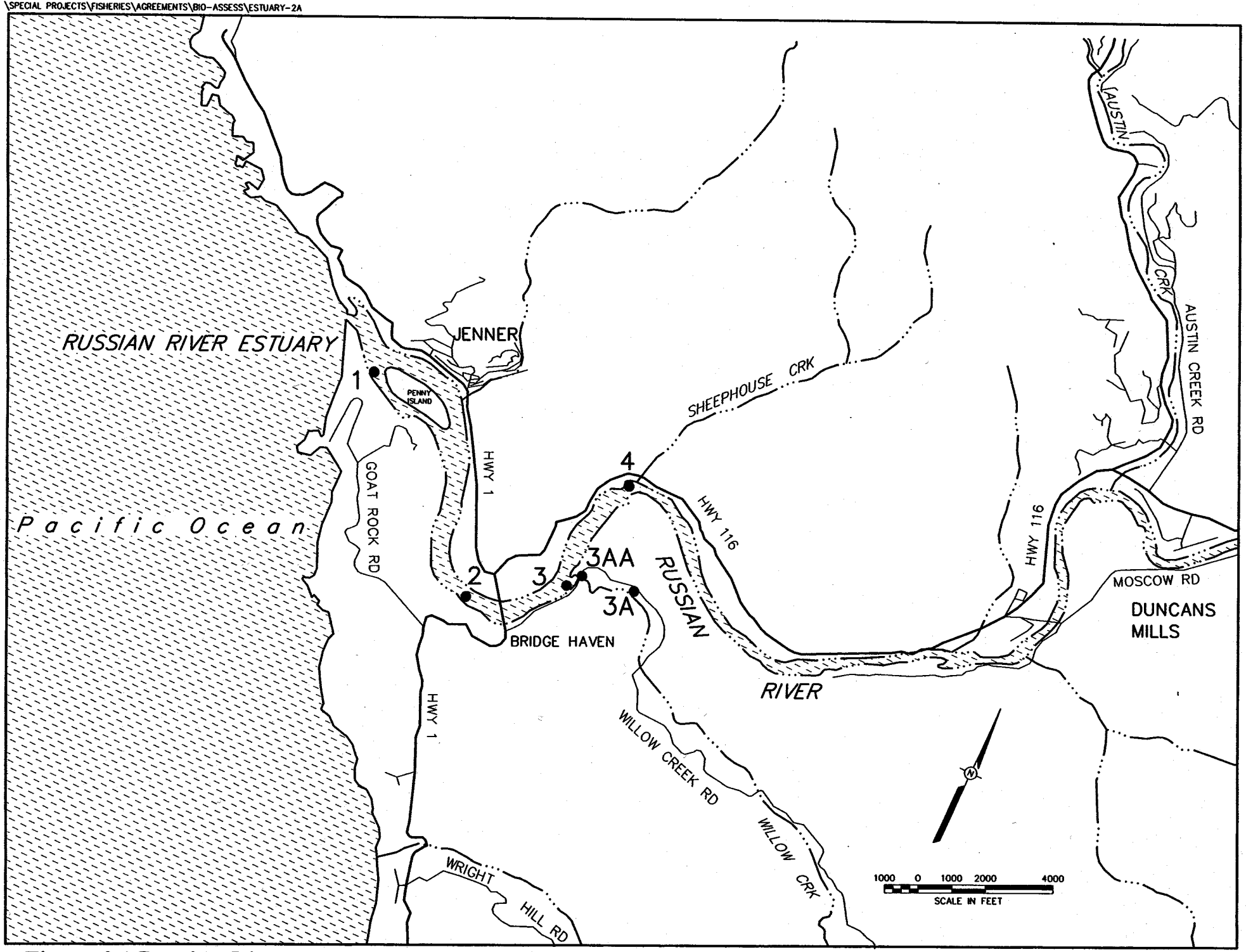


Figure 3-1 Russian River Estuary Monitoring Stations for the 2000 Monitoring Program

3.2 FISH AND MACROINVERTEBRATE MONITORING

3.2.1 Otter Trawls

Otter trawl sampling was conducted in the deep channel at Stations 1, 2, 3, and 4 to collect slow-moving benthic fishes and macroinvertebrates (e.g. crabs, shrimp, and mysids). Otter trawls are nets that are dragged along the bottom of a water body behind a boat. The trawl used in this study is 8 feet wide at the mouth with 1/8-inch (square) mesh throughout. Single tows of four-minute duration were conducted at each station. The trawl was towed at 3 to 5 miles per hour behind a 16-foot aluminum skiff powered by a 15-horsepower outboard motor. After each successful trawl was completed, the contents of the net were brought aboard and emptied into a large plastic tray filled with water for sorting, counting, and species identification. Nearly all specimens were released alive and unharmed. A small number of invertebrates and non-salmonid juvenile or larval fish were preserved for closer examination in the laboratory. Fish were identified to the species level, except for a few juvenile rockfish, which were identified only to the genus *Sebastes*. Most invertebrates were identified to species; in a few cases identifications were only to the genus or family level.

3.2.2 Beach Seines

Beach seine sampling was used to capture more agile fish (especially salmonids) that cannot be caught by otter trawl, as well as mid-water fish. Beach seines collect fish throughout the water column near shore. The beach seine used in this study is 100 feet long, 8 feet deep, with an 8 foot by 8 foot by 8 foot bag in the center. The seine is composed of 3/8-inch mesh knotless nylon netting. The seine was deployed using the boat to pull one end offshore and then around in a half-circle while another person held the other end onshore. Both team members then pulled the net ashore by hand. Captured fish and invertebrates were placed in a water-filled tray for sorting, identifying, and counting prior to release. Captured salmonid juveniles were also measured and examined closely for general condition and wild *versus* hatchery origin prior to release.

Beach seines were used at Stations 1, 3, and 4. No beach seining was performed at Station 2 because the beach slope is too steep for seine deployment during pre-breaching surveys (high water levels); and seining was not possible during draining and tidal surveys (low water level) due to the large number of snags that have accumulated there since the 1997 field season.

3.3 PINNIPED MONITORING

Pinniped monitoring was performed during pre-breaching (day before artificial breaching activities), breaching (day of event), and post-breaching (day after successful breaching) events. Monitoring consisted of seal counts every half-hour and recording of disturbances to seals throughout the day. Half-hour counts of all seals hauled out on the beach began at dawn and continued for approximately five hours. Disturbances to pinnipeds hauled out on the beach were recorded as they occurred. The source and duration of the disturbance and behavioral response of the pinnipeds was noted. Monitoring occasionally lasted longer than five hours when artificial breaching activities occurred in late morning or early afternoon.

4.0 RESULTS

The sandbar at the mouth of the Estuary was artificially breached on 11 occasions in 2000 (Table 4-1). Four artificial breaching events were monitored in 2000: September 5 (Event I), October 11 and 27 (Events II and III), and November 7 (Event 4, see Table 4-1). The first closure of the year occurred in May, which was earlier than in 1999. The sandbar closed again in mid-June and, after breaching, then stayed open until late August. Sandbar closures occurred more frequently in the fall and early winter months (two in October, three in November, and two in December), although river flows were fairly consistent from June through November [typically between 200 and 250 cubic feet per second (cfs)]. Figures 4-1 through 4-6 provide predicted tidal height, water levels at the Jenner gage (located at the visitor's center), and river flow at the Hacienda Bridge. Gaps in the graphs are a result of data missing due to gage malfunction at the Jenner visitor's center and at the Hacienda Bridge.

Table 4-1. Summary of 2000 Russian River Estuary Sandbar Closures and Artificial Breachings

Date Closed[1]	No. Days Closed	Breach Date	Height[2]	No. Days Open	Monitoring Event
May 7	2	May 9	8.46	37	not monitored
June 16	5	June 21	6.90	67	not monitored
August 28	8	September 5	7.62	31	Event I
October 7	4	October 11	6.54	12	Event II
October 24	3	October 27	6.87	7	Event III
November 4	3	November 7	6.93	2	Event IV
November 10	3	November 13	6.74	7	not monitored
November 21	3	November 24	7.34	2	not monitored
November 27	3	November 30	7.73	2	not monitored
December 3	3	December 6	7.69	20	not monitored
December 27	2	December 29	7.10	4	not monitored

1 Assumed that sandbar has closed once water level within Estuary reaches 4.5 feet at the Jenner gage and continues to rise.
2 Water level in feet at Jenner gage at time of breaching.

4.1 WATER QUALITY MONITORING

4.1.1 Water Quality Profiles

Unlike previous years, water quality profiles were not conducted during typical tidally influenced conditions prior to the first monitored artificial breaching event of 2000. Therefore, there are no data available for 2000 to compare sandbar-closed and sandbar-open water quality conditions prior to September. However, it is possible to compare breaching data from the 2000 monitoring events with those of the previous four years of study. This comparison will be provided in the Discussion section.

Table 4-2 summarizes the water quality profile survey dates in 2000. Appendices A-1 through A-16 provide the water quality profile data collected during the surveys.

Table 4-2. Water Quality Profiles, Fish and Macroinvertebrate Monitoring in 2000

Monitoring Event	Pre-breaching	Draining	Tidal
Event I	September 1 (I-p)[1]	September 6 (I-d)	September 8 (I-t)
Event II	October 9 (II-p)	October 12 (II-d)	October 16 (II-t)
Event III	October 26 (III-p)	October 28 (III-d)	October 31 (III-t)
Event IV	November 7 (IV-p)	November 8 (IV-d)	November 16 (IV-t)

1 Event code abbreviations: p – pre-breaching survey; d – draining survey; t – tidal survey.

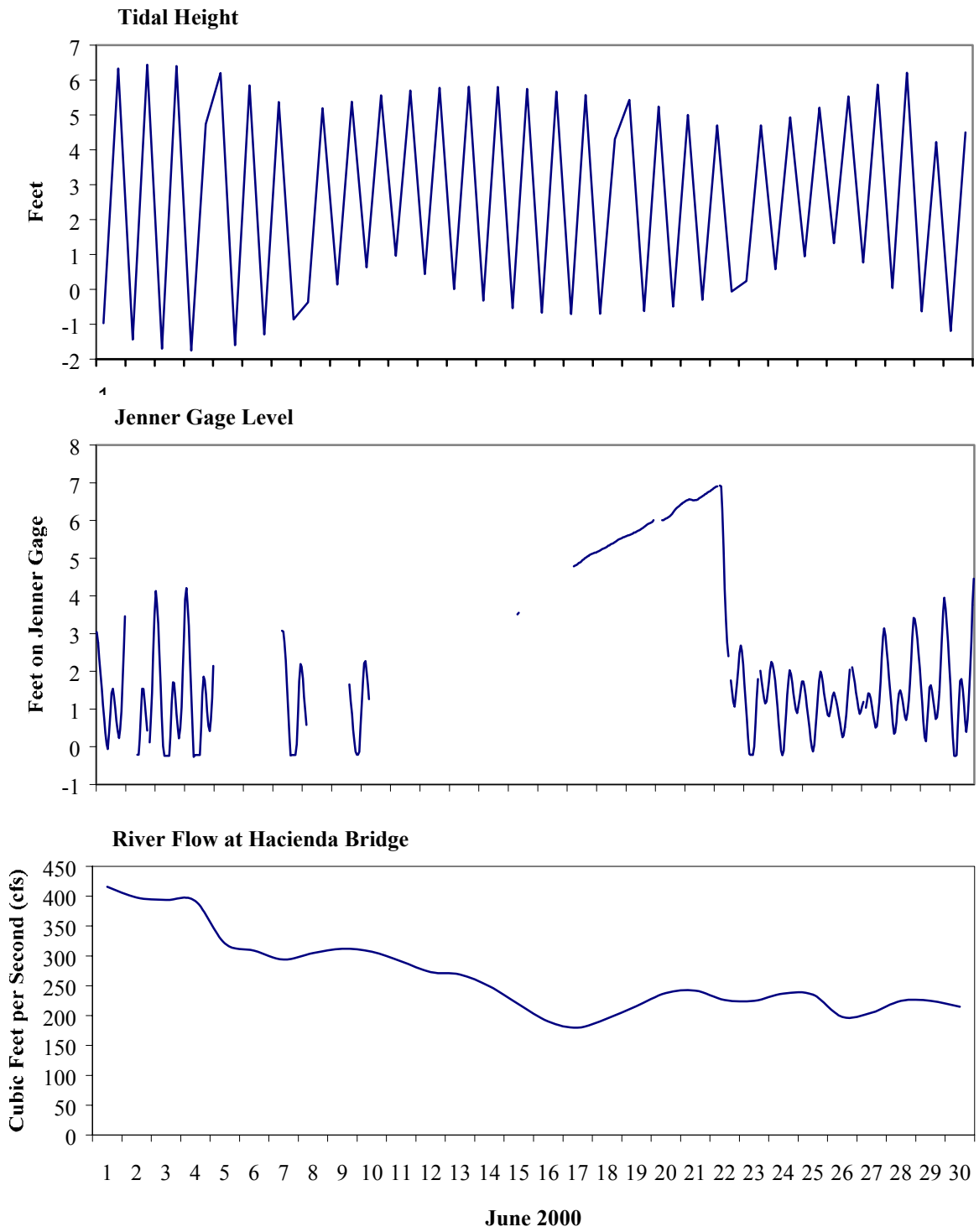


Figure 4-1. Tidal Heights, Jenner Gage Levels, and River Flows for June 2000.

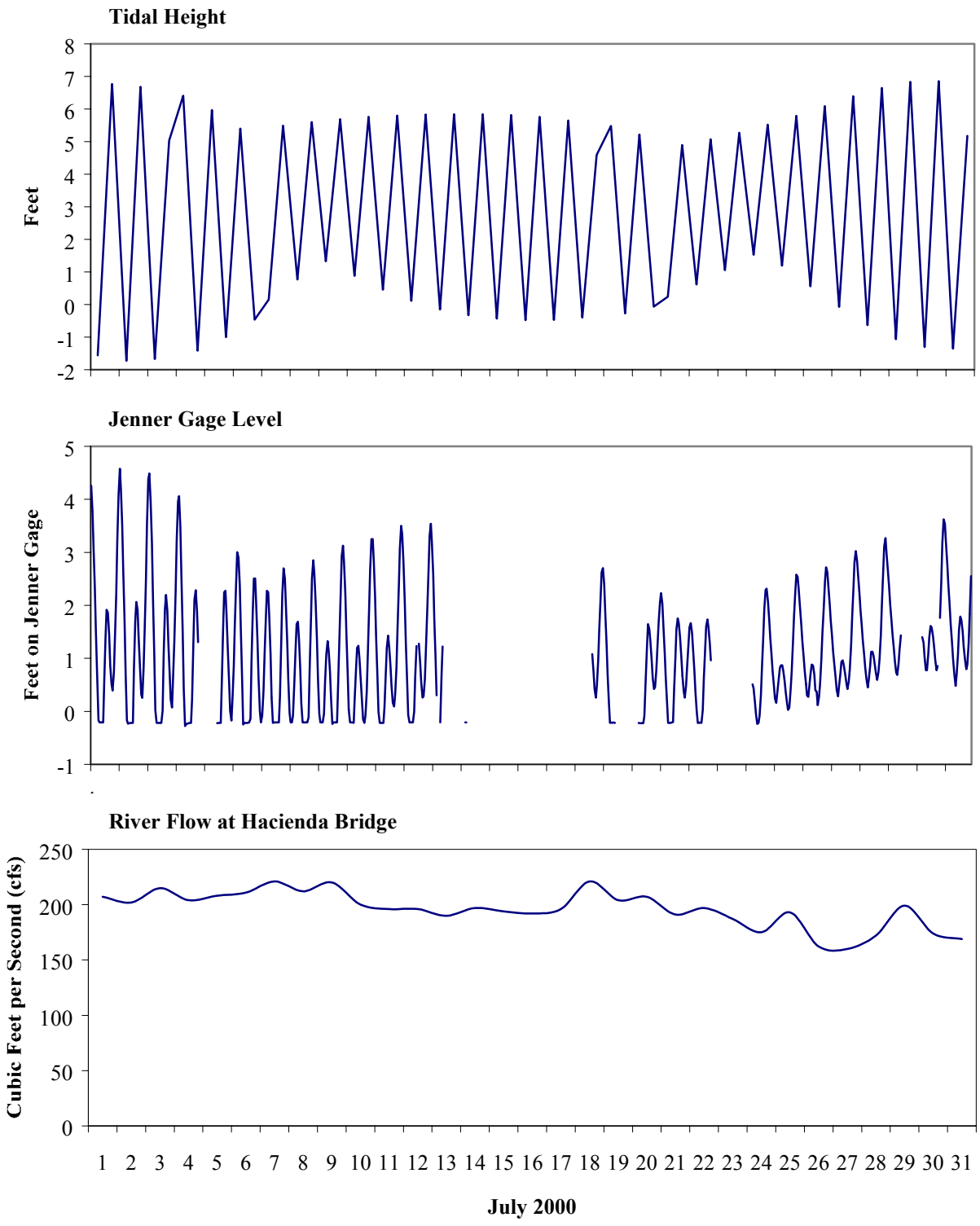


Figure 4-2. Tidal Heights, Jenner Gage Levels, and River Flows for July 2000.

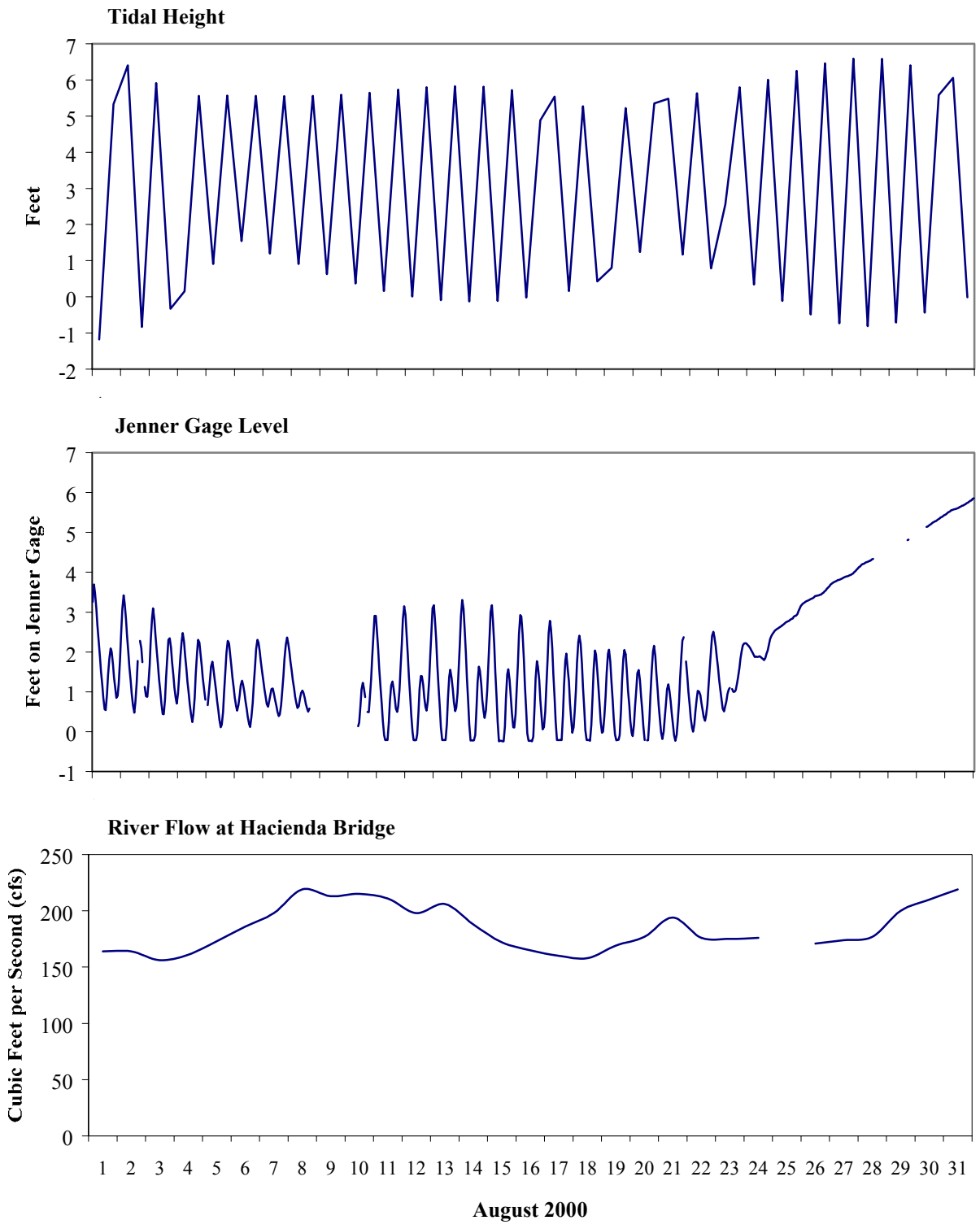


Figure 4-3. Tidal Heights, Jenner Gage Levels, and River Flows for August 2000.

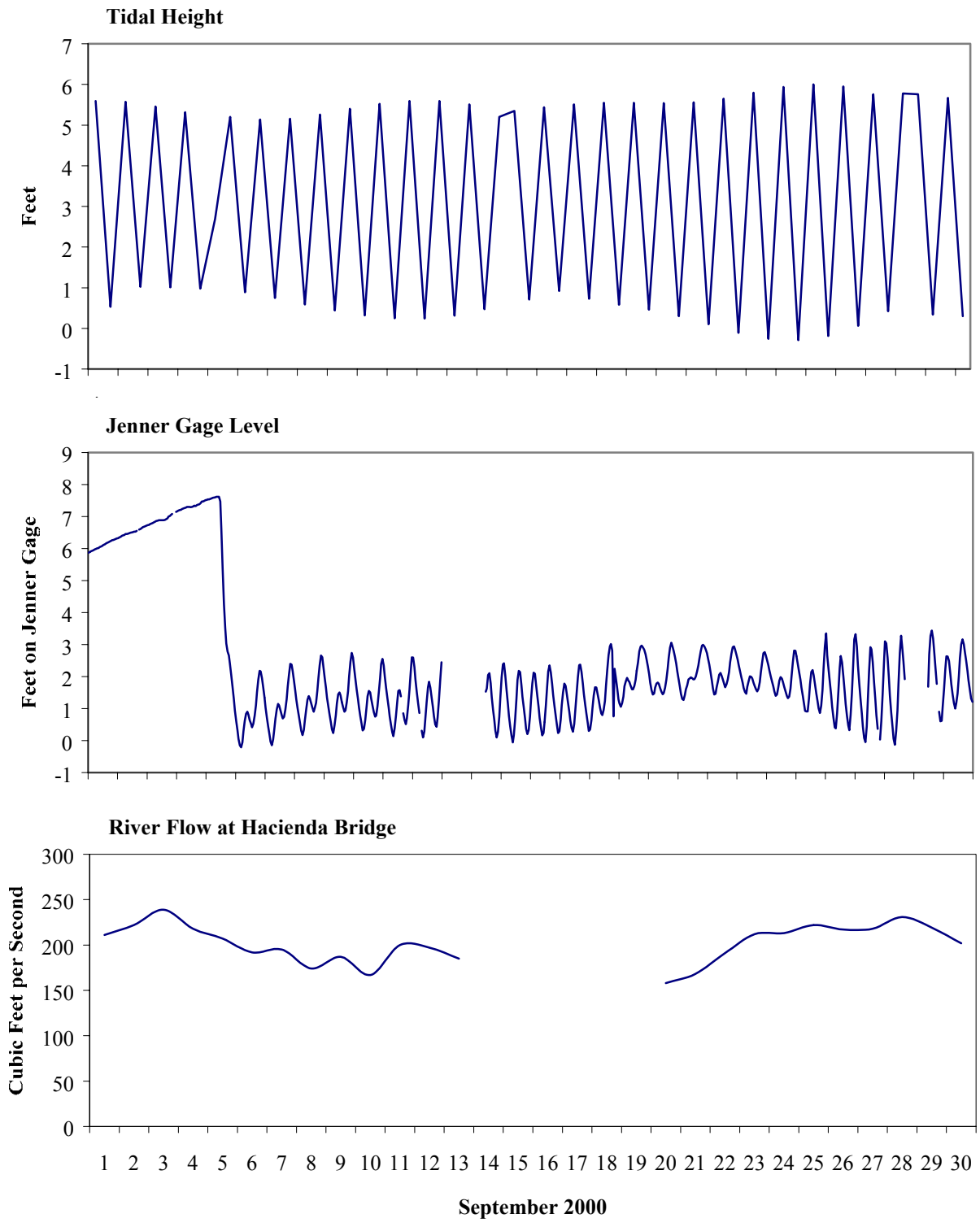


Figure 4-4. Tidal Heights, Jenner Gage Levels, and River Flows for September 2000.

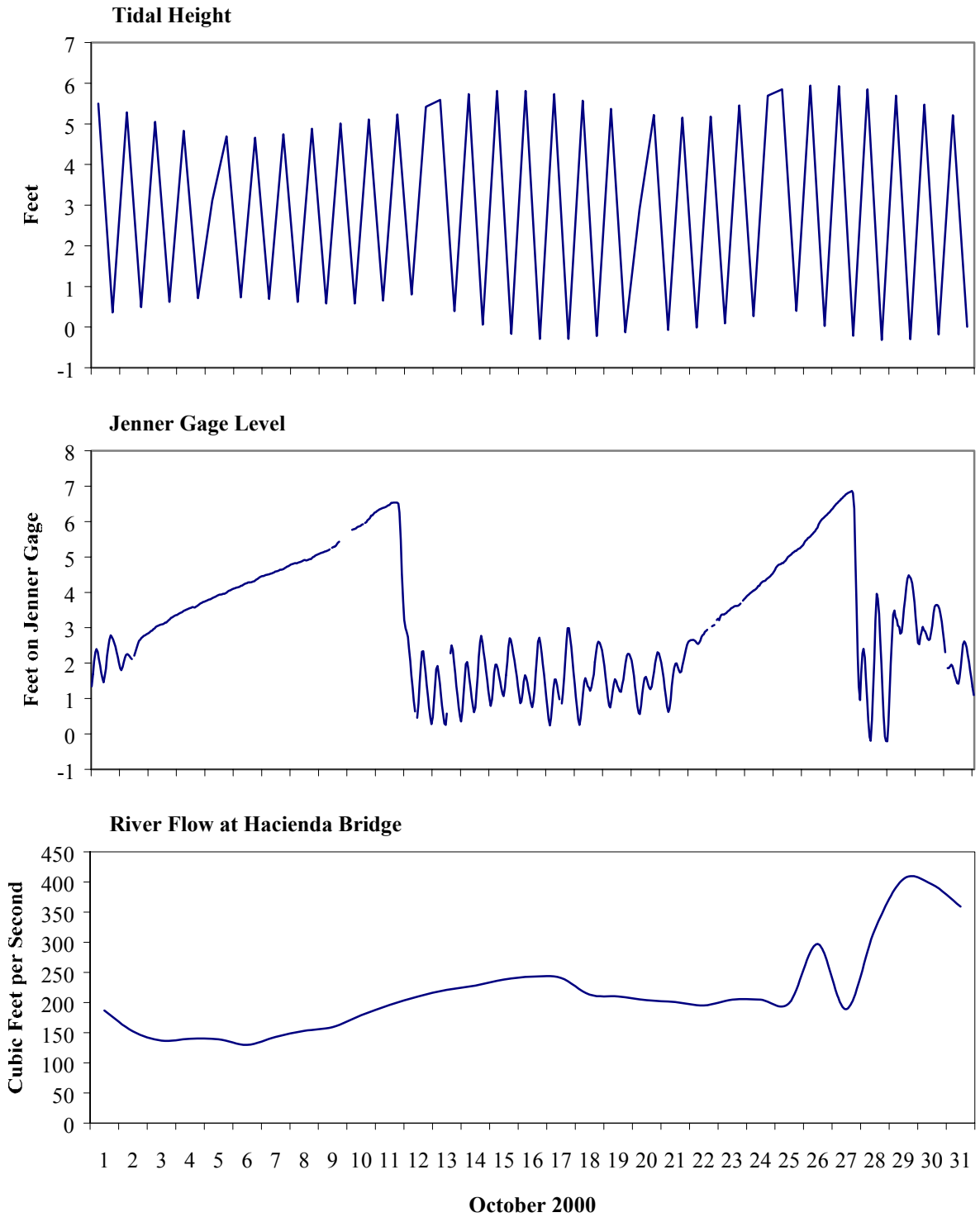


Figure 4-5. Tidal Heights, Jenner Gage Levels, and River Flows for October 2000.

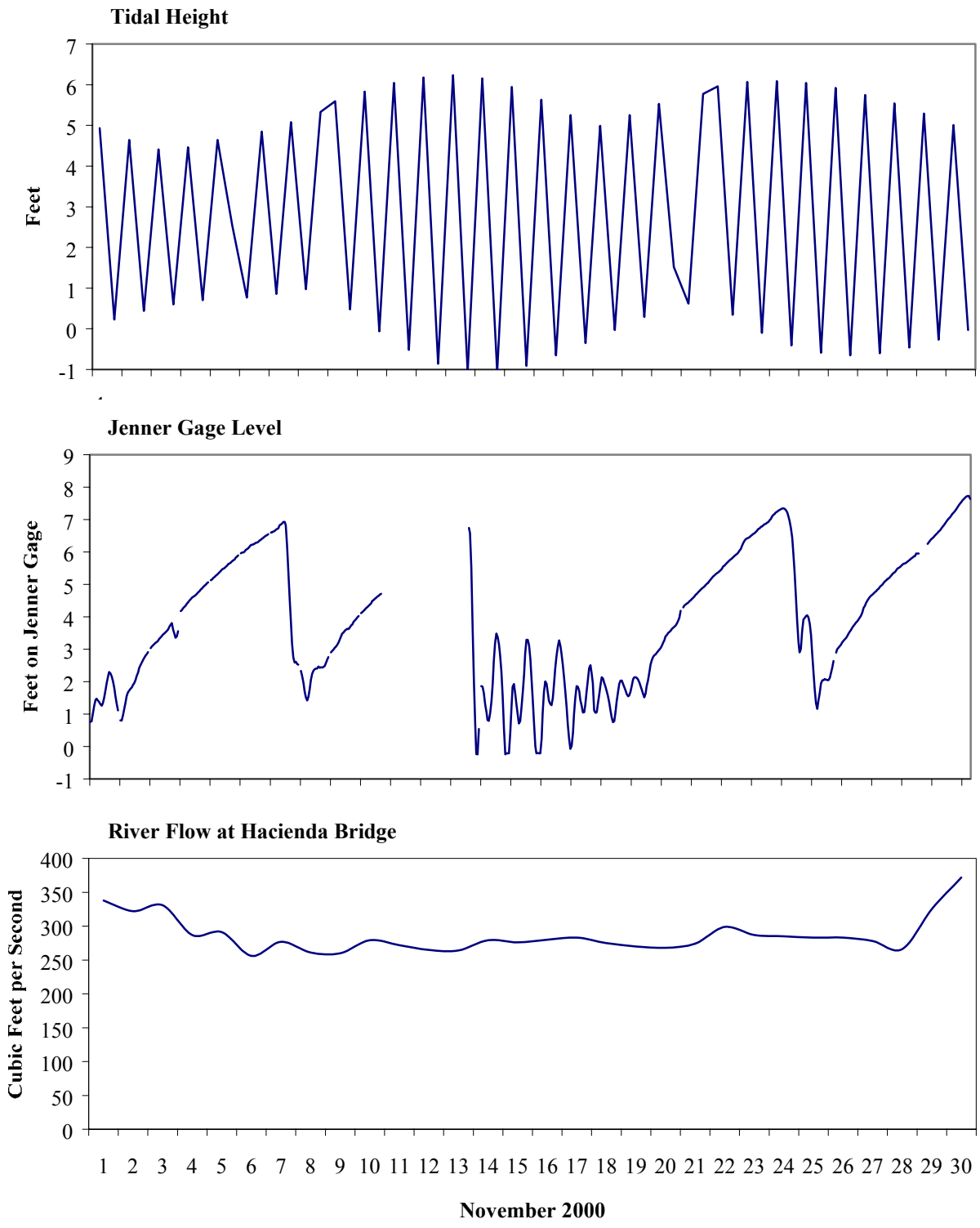


Figure 4-6. Tidal Heights, Jenner Gage Levels, and River Flows for November 2000.

Event I

On the day of the first pre-breaching survey (September 1, 2000), surface water salinity levels had increased to brackish levels at Stations 1 and 2, while remaining fresh at Stations 3 and 4 (Appendix A-1). All four stations were stratified at an approximate depth of 3 meters, with salinity levels increasing (average salinity level of 4 ppt at 2 meters and 28 ppt at 3 meters) and temperature levels decreasing with greater depth. Stations 2 and 3 began to show significant declines in DO levels at depths of 4 meters, even with colder temperatures than in the surface water layer. The DO declines were likely due to the fact that oxygen is less soluble in water with higher salinity levels. The sandbar at the mouth of the Estuary had been closed for approximately five days by the time the pre-breaching surveys were performed.

Draining surveys performed during Event I showed that the surface water layer had measurable salinity at all four stations, with stratification observed at a depth of 2 meters at Stations 1 through 3 (Appendix A-2). The fresher surface water layer had begun to thicken at Station 4 during the draining survey, with stratification observed at a depth of 4 meters. DO at Station 1 was fairly uniform at all depths during the draining survey. Stations 2 and 3 had significantly depleted DO levels at depths of 2 meters and greater, while Station 4 had low DO levels at depths of 6 meters and greater.

Tidal water quality profiles at Station 1 indicated that the location had begun to recover with fairly consistent DO levels at all measured depths (Appendix A-3). Near-bottom DO levels at Stations 2 and 3 began to improve during the tidal surveys with slightly increased levels over the draining survey, but were not fully recovered within three days of the artificial breach. Station 4 surface water quality improved with declines in salinity and increased DO, however, near-bottom conditions actually worsened. Near-bottom salinities at Station 4 remained consistent with the draining survey, but DO levels declined.

Water quality profiles were also taken at Station 3A and Station 3AA during Event I (Appendix A-4). Pre-breaching surveys were taken only at Station 3A; draining and tidal surveys were performed only at Station 3AA. The pre-breaching survey showed that stratification had formed with a freshwater lens present to a depth of 1 meter. Measurable salinities began at 1.5 meters from the surface, which corresponded to decreased DO (4.5 ppm). Further upstream at Station 3A, salinity levels were at the upper threshold for freshwater (0.5 ppt) at the surface and slightly more saline at 0.8 meters in depth (0.9 ppt). DO declined to less than optimal levels during the draining survey. Although salinity levels at Station 3A had increased by the time of the tidal survey, DO levels had begun to rebound.

Event II

Salinity stratification was evident between depths of 1 and 2 meters at all four stations during the pre-breaching survey of Event II (Appendix A-5). While Station 1 DO levels remained good ($\geq$ 7.0 ppm) throughout the water column, upstream stations had declining DO levels at depths of 4 meters and greater at Station 2 ($\leq$3.5 ppm), and depths of 3 meters or greater at Stations 3 and 4 (3.0 and 4.9 ppm, respectively). Near-anoxic conditions were present in the deepest profiles of Stations 2, 3, and 4.

Draining survey results showed that salinity levels near the surface had increased at all stations, however, salinity levels in the deeper sections declined slightly at Stations 2, 3, and 4 (Appendix A-6). Station 1 salinity levels at depths of 3 to 5 meters were fairly consistent with those observed during the pre-breaching surveys. Station 1 DO levels showed an overall decline from the pre-breaching results. Temperature levels at Station 1 increased at the surface from the pre-breaching survey, while temperature levels at depths of 1 meter and greater declined during the draining survey. Stations 2, 3, and 4 water temperatures at all depths increased over pre-breaching temperature levels. All stations also showed an overall decline in DO levels at all depths; anoxic conditions were present at a depth of 12 meters at Station 4.

Tidal survey results indicated that all stations had begun to recover within five days of artificial breaching (Appendix A-7). Station 1 had relatively unchanged salinity levels; however, temperatures declined at all depths, while DO levels increased. Stations 2, 3, and 4 temperatures declined at all depths. DO levels at Stations 1, 2, 3, and 4 increased over those during the pre-breaching and draining surveys. However, Station 4 still had low DO levels at depths of 5 meters and greater (ranging from 2.7 ppm at 5 meters deep to 0.2 ppm at a depth of 12 meters). Salinity levels at all stations showed stratification between the surface and a depth of 1 meter and an increase in salinity levels at all depths over levels during the draining survey. Salinity levels during the tidal survey were likely influenced by high tides while the water quality profiles were being performed.

Water quality profiles at Stations 3A and 3AA were incomplete during Event II (Appendix A-8). Pre-breaching and tidal surveys were performed only at Station 3A, while drainage surveys were conducted only at Station 3AA. Salinity was measurable at all depths during the pre-breaching survey and were at brackish levels (>0.5 ppt). Temperature and DO levels were higher at the surface than at a depth of 1 meter. However, at a depth of 2 meters, temperature was higher (17°C) than at the surface (15°C) and 1 meter deep (14.5°C), while DO levels were near-anoxic (0.4 ppm). The tidal survey at Station 3A had similar results. Overall, temperatures declined and DO levels increased. However, at the deepest profile (1.5 meters), temperature level was higher and DO levels were lower than the surface and shallower depths. DO levels were still near-anoxic (0.7 ppm) at 1.5 meters.

Event III

During the pre-breaching survey of Event III, all stations showed salinity stratification had formed at approximately 2 meters in depth (Appendix A-9). Temperatures were fairly consistent throughout the water column, varying only 1°C from the surface to a depth of 6 meters at Stations 1 and 3, and 2°C between the surface and a depth of 8.5 meters at Station 2. Station 4 had virtually identical temperatures at the surface (15°C) and at the deepest reading taken at a depth of 15 meters (15.1°C); however, there was a layer of slightly warmer water at depths between 3 and 5 meters (16.5 to 16°C, respectively). DO levels at Station 1 remained good ($\geq$6.3 ppm) during the pre-breaching survey, while Stations 2, 3, and 4 declined with greater depths.

The draining survey for Event III was performed during heavy rain; no profiles were taken at Station 4 because the meters became soaked and ceased to function. Water temperatures at Stations 1, 2, and 3 generally declined during the draining surveys compared with the results of the pre-breaching surveys, although near-surface salinity levels increased at these locations

(Appendix A-10). DO levels at Stations 1, 2, and 3 slightly declined at near-surface depths, however, levels at greater depths showed improvement. Tidal surveys performed at Stations 1, 2, 3, and 4 showed salinity stratification at 1 meter in depth and temperatures similar to those observed during the pre-breaching survey, however, DO levels at the deepest locations increased from the pre-breaching surveys (Appendix A-11).

Water quality profiles were taken at Station 3A during Event III; no profiles were taken at Station 3AA (Appendix A-12). During the pre-breaching survey, temperature, salinity, and DO levels were highest at the deepest profile (2 meters deep). DO levels remained good throughout the water column. Results of the draining survey showed that temperature and salinity levels were still higher near the bottom, but that DO levels declined to near-anoxic levels. The tidal survey results showed that conditions at Station 3A had improved over pre-breaching survey conditions, with salinity measurable only at a depth of 1.5 meters (0.4 ppt), consistent temperature throughout the water column, and DO levels improving.

Event IV

Pre-breaching survey results indicated that while water temperatures had little or no variation at Stations 1, 2, 3, and 4, salinity and DO levels showed stratification was present (Appendix A-13). Salinity stratification was evident at depths of approximately 3 meters from the surface at Stations 1, 2, and 3, and at a depth of 4 meters at Station 4. Salinity was not measurable at depths of up to 1 meter at Station 2 and depths up to 2 meters at Station 3. Low DO levels ($\leq$5 ppm) were observed at depths of 5.5 meters at Station 1 and at 4 meters at Stations 2, 3, and 4. The draining survey results showed few significant changes in water quality conditions over the pre-breaching survey results (Appendix A-14). Tidal survey results indicated that there were significant improvements in DO levels at all depths and all stations (Appendix A-15) compared to the results of the pre-breaching and drainage surveys. Salinity stratification had increased to a depth of 1 meter below the surface and salinity was measurable at the surface at all four stations.

Water quality profiles were taken at Station 3A during Event IV; no profiles were taken at Station 3AA (Appendix A-16). No measurable salinity was observed during the pre-breaching survey and DO levels were fair. Results of the draining survey showed an increase in salinity (to 0.2 ppt at the surface) and improvements in DO levels. The tidal survey showed that salinity had increased over the previous samples and that DO levels had significantly improved.

4.1.2 Minisondes

Minisondes were placed at Stations 3, 3A, and 3AA (Figure 3-1) during the fifth monitoring year. Stations 3A and 3AA monitored conditions inside Willow Creek, while Station 3 was used to monitor deep-water conditions within the Estuary. Records from Station 3 closely followed the results of water quality profiles performed during Events I through IV and showed significant declines in DO levels when the sandbar was closed and increases within several days of an artificial breaching event (Appendices A-17 through A-34). Salinity levels at Station 3 were generally high (approximately 30 ppt) for most of the months studied (June through November). Following several artificial breaching events, salinity levels would decline dramatically within one or two days only to rebound to previous levels within hours of the initial decline.

Station 3AA showed daily fluctuations in temperature, DO, and salinity levels while the sandbar was open. After the sandbar closed, temperature and salinity levels at the near-bottom would decline and would again show daily fluctuations within one or two days of an artificial breaching event (see Events I and II in Appendices A-32 and A-33). Station 3A showed similar trends during each monitored event. At both stations, DO levels continued to fluctuate daily whether the sandbar was opened or closed. This is due to the diurnal DO sag, which was explained in the 1999 monitoring report (Merritt Smith Consulting 2000). However, as discussed in the 1999 monitoring report, the greatest DO declines at both stations corresponded to the height at which the sandbar was artificially breached (the greater the water level measured at the Jenner gage during artificial breaching, the lower the DO levels measured at Stations 3A and 3AA).

4.2 FISH AND MACROINVERTEBRATE MONITORING

Fish and macroinvertebrate monitoring dates are provided in Table 4-2. A total of 18 fish species were caught in 2000 using otter trawls and beach seines (Table 4-3). Only one species, speckled sanddab (*Citharichthys stigmaeus*), was not caught in previous monitoring years, including the 1992-1993 study (Heckel 1994). In the five years of the monitoring study, a total of 43 species from 19 families were captured in the Russian River Estuary.

4.2.1 Otter Trawls

Overall, the total number of fish caught in the otter trawls during Events I through IV (1,194 individuals) in 2000 doubled the total number captured during the 1999 monitoring events (549 individuals total). However, the number of fish species captured in 2000 (16 species) was less than the number caught in 1999 (22 species). Table 4-4 summarizes the fish species and number of individuals captured in 2000. Otter trawls are used to capture deep-water (benthic and epibenthic) fish species and most of the species captured in 2000 are typically found in these habitats. Appendices B-1 through B-12 provide summaries of otter trawl results for Events I through IV.

Macroinvertebrate species captured in the otter trawls were similar to those observed in previous years (Appendices B-1 through B-12). *Neomysis mercedis* (opossum shrimp) was the most commonly captured invertebrate. *Crangon franciscorum* (bay shrimp) was observed less frequently than in all previous years. Other macroinvertebrate species commonly captured included *Cancer magister* (Dungeness crab), *Eogammarus confervicolus* (amphipods), and sphaeromatid isopods.

4.2.2 Beach Seines

Table 4-5 summarizes the fish species and number of individuals captured in beach seines in 2000. Station 2 was not sampled by beach seine because the beach slope is too steep for seine deployment during pre-breaching surveys (high water levels); seining was not possible during draining and tidal surveys (low water level) due to the large number of snags that have accumulated there since the 1997 field season. The total number of fish captured in beach seines at Stations 1, 3, and 4 (2,595 individuals) was similar to the number captured in 1999 (2,981 individuals). Similar to the otter trawl results, the total number of fish species captured in the beach seines was less in 2000 (10 species) than in 1999 (14 species). Appendices B-13 through B-25 provide summaries of beach seine results for Events I through IV.

Table 4-3. Fish Species Caught in the Russian River Estuary in 1992-1993 and Monitoring Years 1996-2000								
Family	**Scientific Name**	**Common Name**	**1992-1993**	**1996**	**1997**	**1998**	**1999**	**2000**
Atherinidae	*Atherinops affinis*	topsmelt		X	X	X	X	X
Bothidae	*Citharichthys sordidus*	Pacific sanddab	X	X	X	X	X	X
	Citharichthys stigmaeus	speckled sanddab						X
Catostomidae	*Catostomus occidentalis*	Sacramento sucker	X	X	X	X	X	X
Centrarchidae	*Lepomis cyanellus*	green sunfish	X	X				
	Lepomis macrochirus	bluegill		X				
	Micropterus dolomieui	smallmouth bass		X	X			
Clupeidae	*Clupea harengus pallasii*	Pacific herring	X	X	X	X	X	X
Cottidae	*Artedius lateralis*	smoothhead sculpin			X			
	Artedius notospilotus	bonyhead sculpin				X		
	Cottus asper	prickly sculpin	X	X	X	X	X	X
	Enophrys bison	buffalo sculpin			X			
	Enophrys taurina	bull sculpin			X			
	Leptocottus armatus	staghorn sculpin	X	X	X	X	X	X
	Scorpaenichthys marmoratus	cabezon		X	X		X	
	Sebastes paucispinis	bocaccio				X[1]		X
	Sebastes melanops	black rockfish				X	X	
	Sebastes sp.	unknown juv. sebastes	X		X			
	Sebastes sp.	juv. copper rockfish				X	X	
Cyprinidae	*Cyprinus carpio*	carp	X					
	Lavinia symmetricus navarroensis	Navarro roach	X	X		X		
	Mylopharodon conocephalus	hardhead	X					
	Ptychocheilus grandis	Sacramento pikeminnow		X		X	X	
Embiotocidae	*Cymatogaster aggregata*	shiner surfperch	X	X	X	X	X	X
	Hyperprosopon anale	spotfin surfperch			X			
	Hyperprosopon argenteum	walleye surfperch		X				
	Hyperprosopon ellipticum	silver surfperch					X	
	Hysterocarpus traskii	Russian River tuleperch		X				
Engraulididae	*Engraulis mordax*	northern anchovy	X		X	X		
Gadidae	*Gadus macrocephalus*	Pacific tomcod		X	X		X	X
Gasterosteidae	*Gasterosteus aculeatus*	threespine stickleback	X	X	X	X	X	X
	Aulorhynchus flavidus	tube-snout					X	
Gobiesocidae	*Gobiesox maendricus*	northern clingfish	X					
Gobiidae	*Clevelandia ios*	arrow goby		X				
Hexagrammidae	*Hexagrammos decagrammus*	kelp greenling			X			
	Ophiodon elongatus	lingcod		X	X		X	
Osmeridae	*Hypomesus pretiosus*	surf smelt	X	X	X	X	X	X
	Spirinchus thaleichthys	longfin smelt			X	X	X	X
		unidentified osmerid larvae					X	X
Pleuronectidae	*Isopsetta ischyra*	hybrid sole	X	X	X			
	Parophrys vetulus	English sole	X	X	X	X		
	Platichthys stellatus	starry flounder	X	X	X	X	X	X
	Psettichthys melanostictus	sand sole	X					
Pholididae	*Pholis ornata*	saddleback gunnel			X		X	
	Apodichthys flavidus	penpoint gunnel					X	
		unidentified juv. gunnel/prickleback						X
Poecillidae	*Gambusia affinis*	mosquitofish	X			X		

Table 4-3. Fish Species Caught in the Russian River Estuary in 1992-1993 and Monitoring Years 1996-2000								
Family	**Scientific Name**	**Common Name**	**1992-1993**	**1996**	**1997**	**1998**	**1999**	**2000**
Salmonidae	*Oncorhynchus mykiss*	steelhead	X	X	X	X	X	X
	Oncorhynchus tshawytscha	chinook salmon	X		X[2]		X	
Sciaenidae	*Genyonemus lineatus*	white croaker	X					
Syngnathidae	*Syngnathus griseolineatus*	bay pipefish	X	X	X	X	X	X
		unidentified fish larvae					X	
Total Number of Fish Species Caught Per Year:			**24**	**25**	**28**	**21**	**26**	**18**

1 The fish collected on September 15, 1998, at Station 1, previously reported as "*Sebastes* sp." has since been identified as a bocaccio.
2 Eighteen salmonid smolts collected in May and June 1997 were reported by Merritt Smith Consulting as coho salmon. Finclip samples from 11 of these were subsequently subjected to DNA analysis by Dr. Michael Banks of Bodega Marine Laboratory. The 11 analyzed samples were shown to be chinook, not coho salmon. We have assumed that the remaining seven smolts were also chinook salmon.

Table 4-4. Total Fish Catch in Otter Trawls in Russian River Estuary, 2000.						
Common Name	**Station 1 (13 trials)**	**Station 2 (12 trials)**	**Station 3 (12 trials)**	**Station 4 (12 trials)**	**Total**	**%**
threespine stickleback	7	3	1	834	845	70.8
prickly sculpin	98	52	18	59	227	19.0
bay pipefish	6	12	5	26	49	4.1
unidentified osmerid larvae	4	6	7	0	17	1.4
surf smelt	15	0	0	0	15	1.3
starry flounder	2	6	0	6	14	1.2
shiner surfperch	5	2	0	0	7	0.6
staghorn sculpin	2	1	2	0	5	0.4
Pacific tomcod	4	0	0	0	4	0.3
Pacific herring	2	0	0	1	3	0.3
topsmelt	1	1	0	0	2	0.2
longfin smelt	2	0	0	0	2	0.2
Pacific sanddab	1	0	0	0	1	0.1
speckled sanddab	1	0	0	0	1	0.1
bocaccio	1	0	0	0	1	0.1
unidentified juv. gunnel/prickleback	1	0	0	0	1	0.1
Total:	**152**	**83**	**33**	**926**	**1194**	**100.0**

Table 4-5. Total Fish Catch in Beach Seines in Russian River Estuary, 2000.						
Common Name	**Station 1 (11 trials)**	**Station 2 (0 trials)**	**Station 3 (12 trials)**	**Station 4 (12 trials)**	**Total**	**%**
threespine stickleback	115		736	479	1330	51.3
topsmelt	704		236	19	959	37.0
prickly sculpin	78		3	21	102	3.9
surf smelt	76		0	0	76	2.9
staghorn sculpin	68		0	0	68	2.6
starry flounder	35		6	1	42	1.6
Sacramento sucker	0		0	8	8	0.3
steelhead	0		7	0	7	0.3
shiner surfperch	2		0	0	2	0.1
bay pipefish	1		0	0	1	0.0
Total:	**1079**		**988**	**528**	**2595**	**100.0**

Seven steelhead (*Oncorhynchus mykiss*) were captured in beach seines in 2000, which comprised 0.3% of the total catch. This is similar to 1999 results when a total of nine steelhead (0.3% of total catch) were caught in the beach seines. In both years, seven steelhead were captured at Station 3. The number of steelhead captured in 2000 was the lowest of all five monitoring studies. Figure 4-7 provides a summary of the size distribution of steelhead captured in the Russian River Estuary from 1996-2000.

4.3 PINNIPED MONITORING

Seal counts and disturbances were monitored during artificial breaching Events I through IV in 2000 (Appendices C-1 and C-2). Pre-breaching, breaching, and post-breaching monitoring occurred during Events I and II (Table 4-6). Pre-breach monitoring was not performed during Events III and IV due to inclement weather conditions. Pinnipeds observed during the 2000 monitoring were primarily harbor seals (*Phoca vitulina*), although a single sea lion (*Zalophus californianus*) was hauled out during post-breaching monitoring of Event I on September 6, 2000. As observed in the previous four years of monitoring, the number of seals hauled out on the sandbar when it was closed was generally low (during pre-breach monitoring of Event I, no seals were observed) and then quickly increased once the sandbar was artificially breached. Figures 4-8 through 4-11 provide summaries of the seal count data.

Disturbances of seals during monitoring events also followed the general trends observed in previous years. Seals were primarily hauled out at the mouth of the Estuary during the morning hours. While seals often alerted to distance sources of disturbance, such as the sound of trucks braking on Highway 1 nearby, seals primarily fled the haulout as a result of disturbances on the beach. Disturbances on the beach typically increased as the morning progressed (greater number of visitors on the beach in the late mornings and early afternoons). On artificial breaching days that the Agency crews began breaching activities early in the morning, such as Events I, II, and IV, all seals hauled out left the sandbar when crew members walking on the beach approached the haulout.

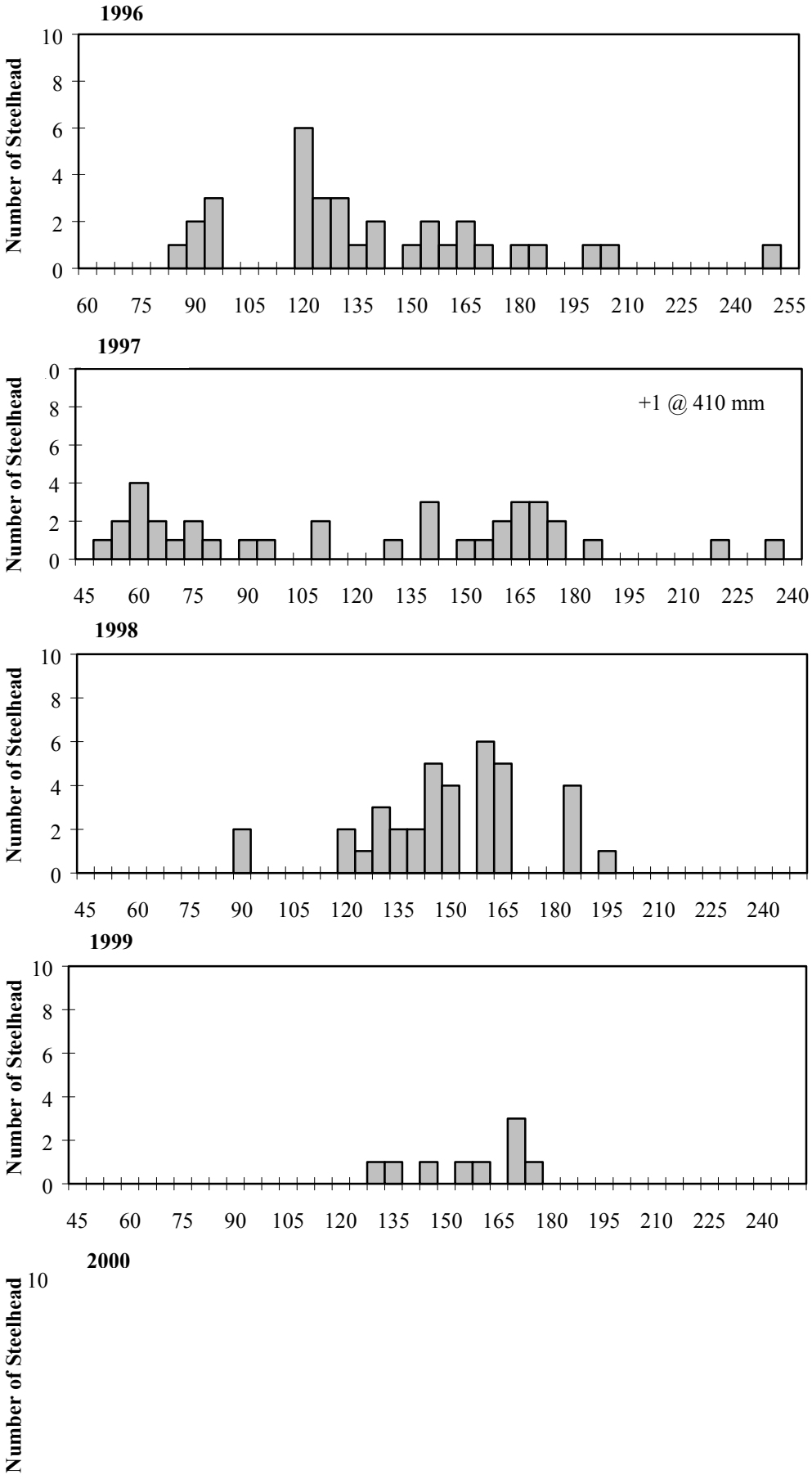


Figure 4-7. Steelhead (*Oncorhynchus mykiss*) Captured in the Russian River Estuary, 1996-2000.

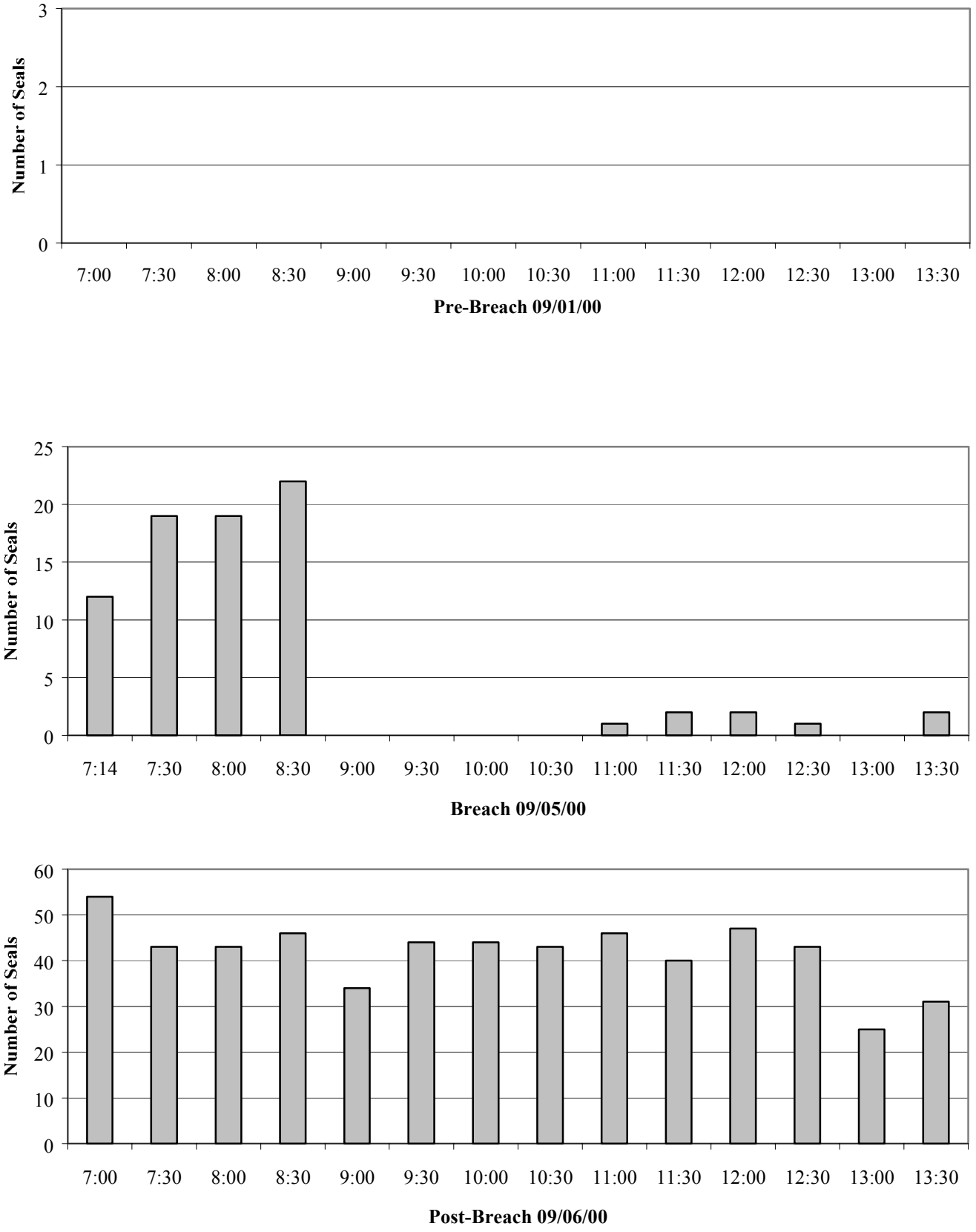
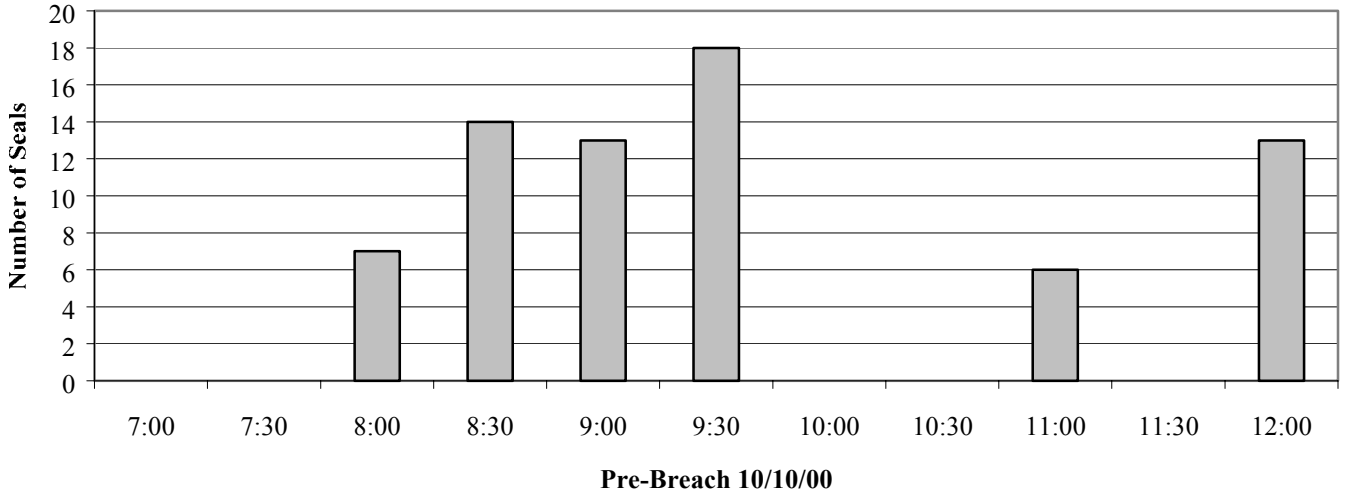
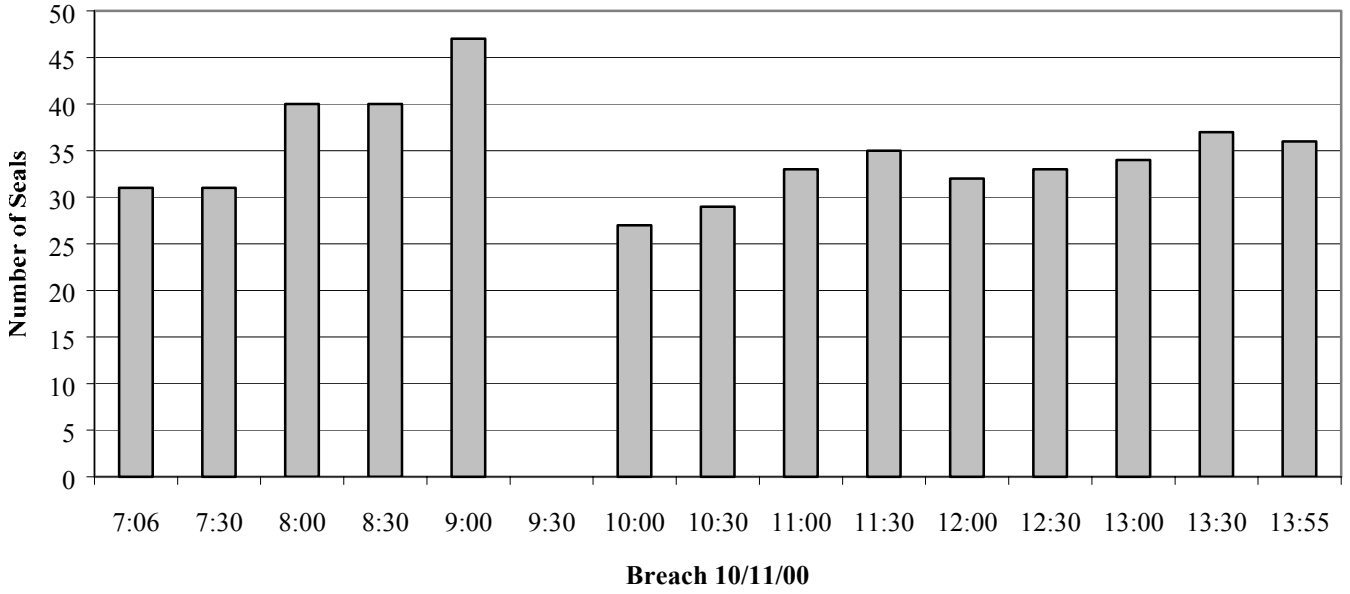


Figure 4-8. Daily Seal Counts for Russian River Estuary Monitoring Event I in 2000.





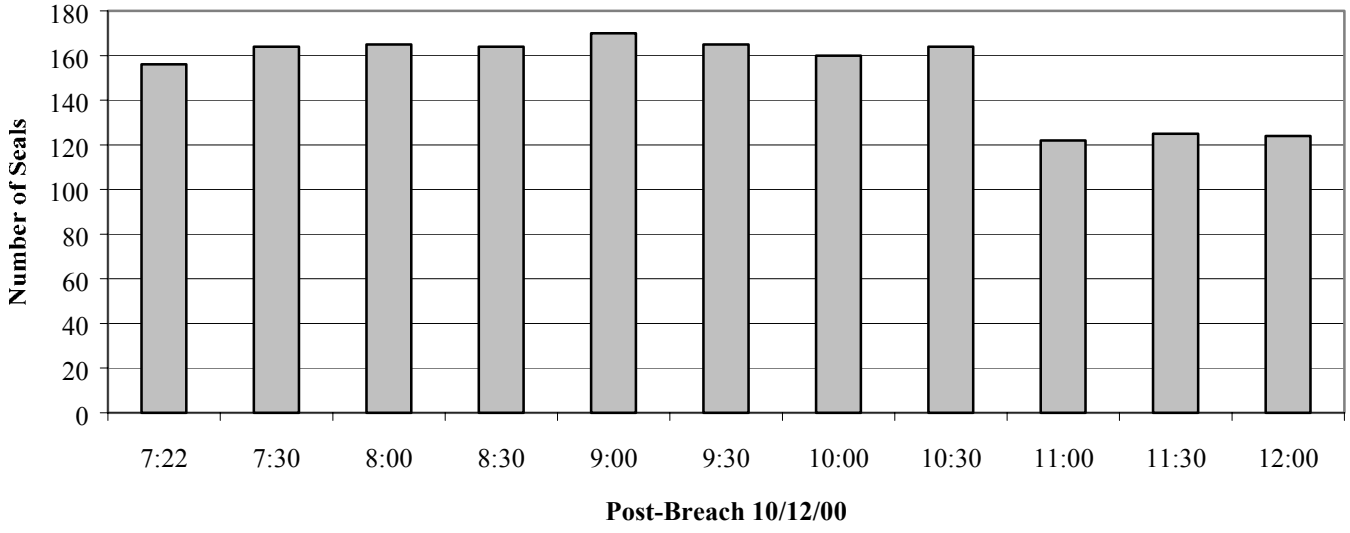
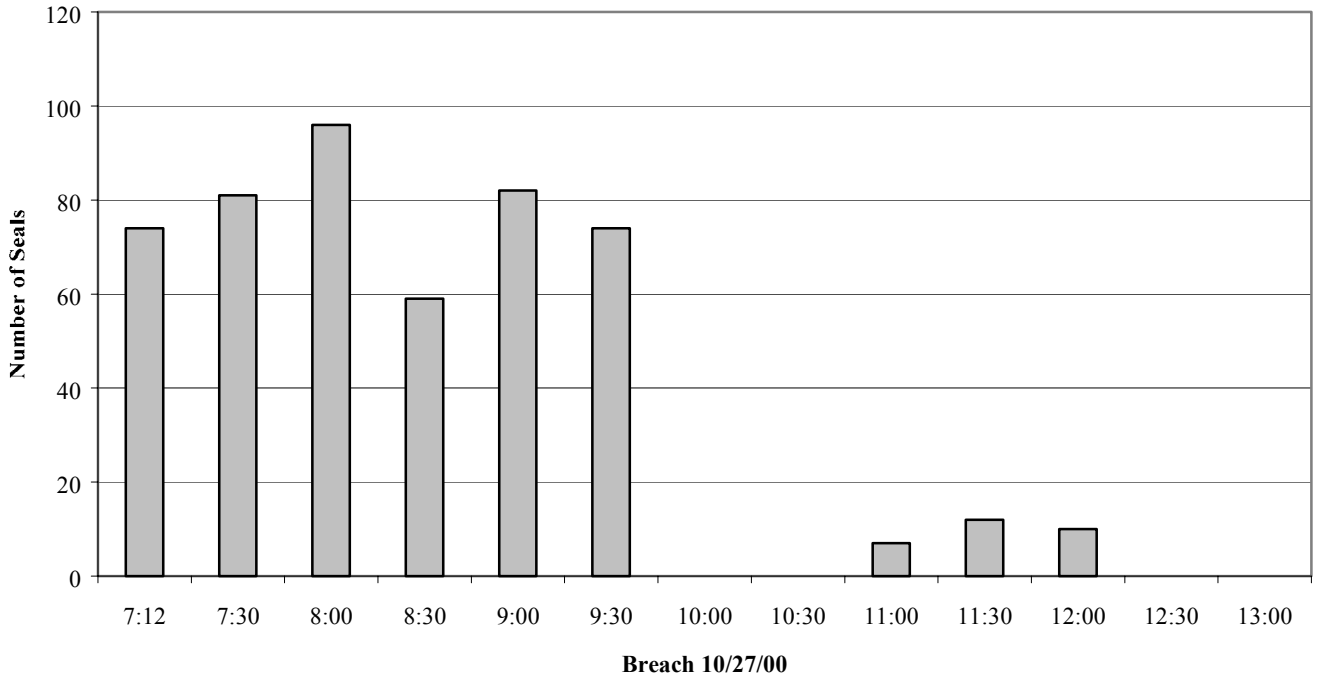


Figure 4-9. Daily Seal Counts for Artificial Breaching Event II Monitored in 2000.



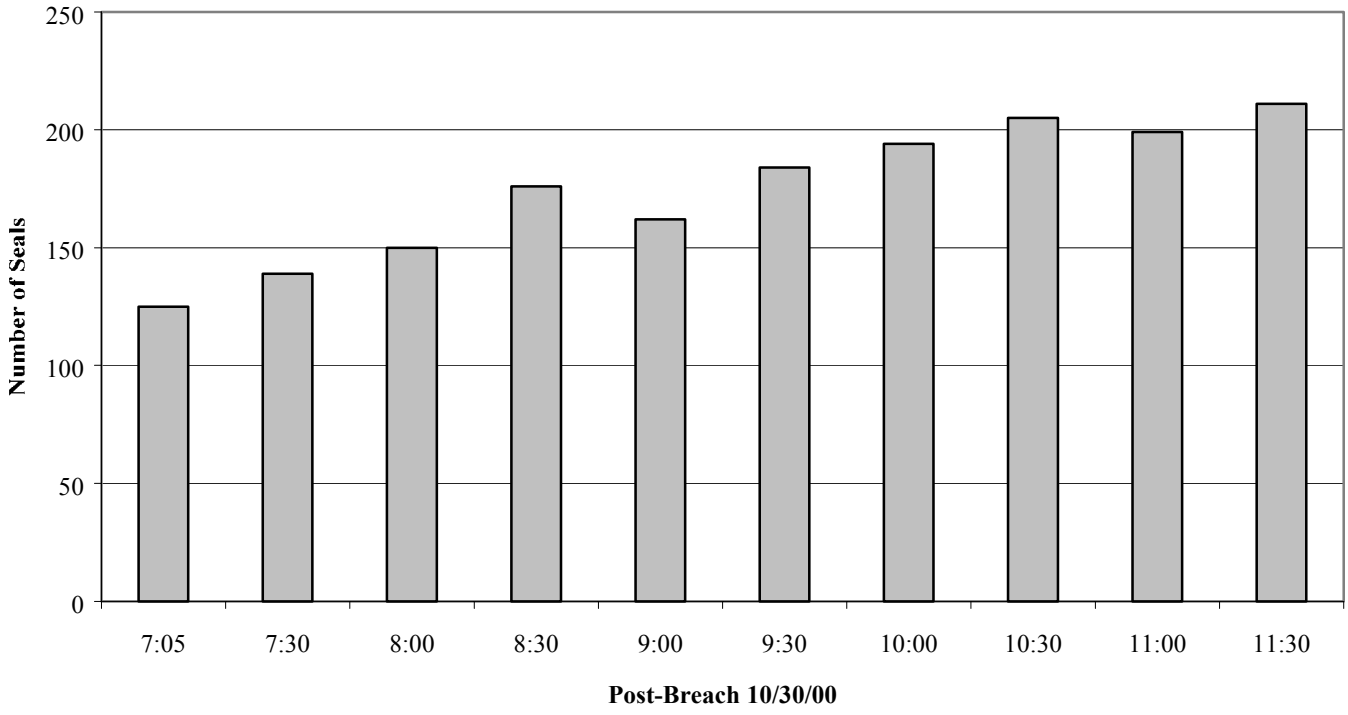
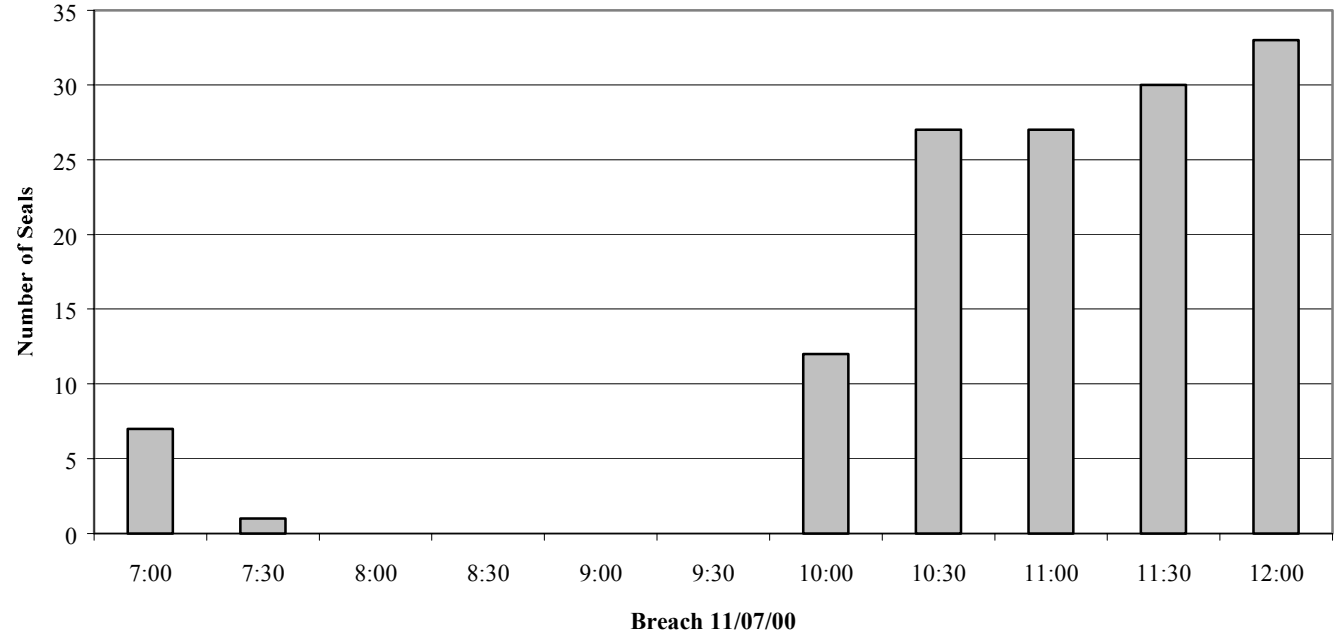


Figure 4-10. Daily Seal Counts for Artificial Breaching Event III Monitored in 2000.



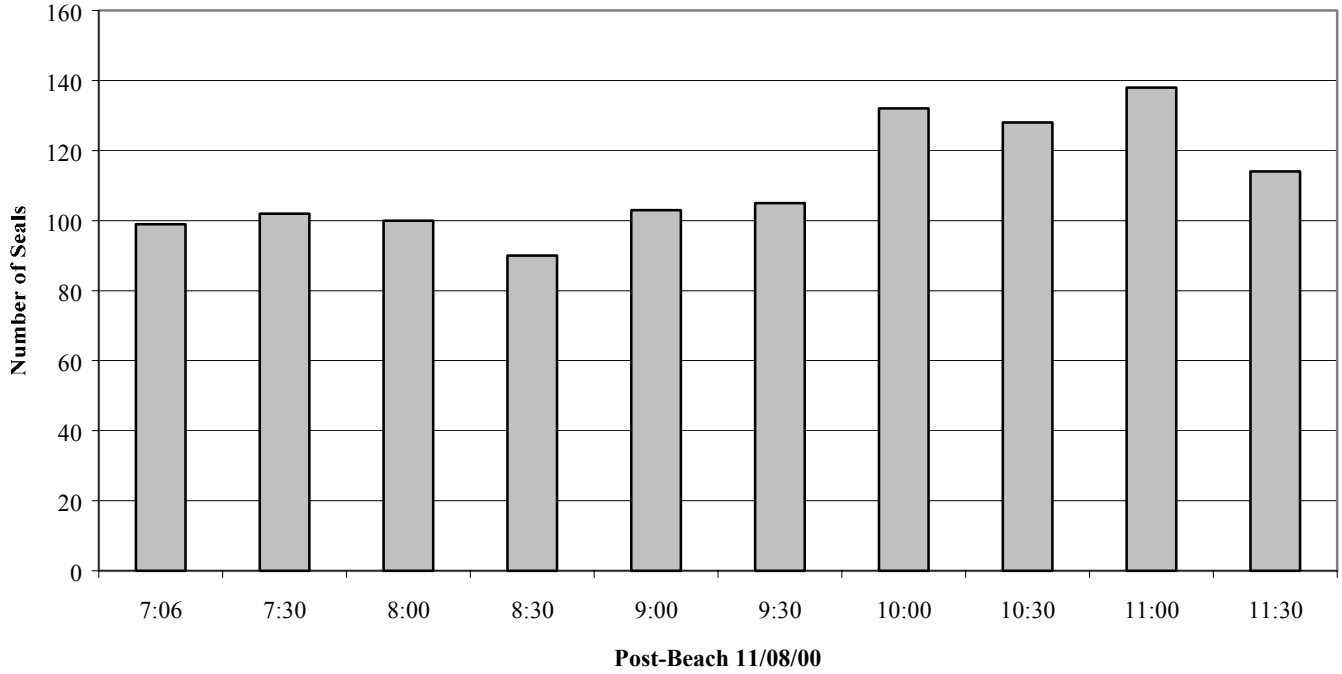


Figure 4-11. Daily Seal Counts for Artificial Breaching Event III Monitored in 2000.

5.0 DISCUSSION

Results of the 2000 monitoring activities support the overall conclusions identified in the 1999 report (Merritt Smith Consulting 2000). Following five years of monitoring artificial breaching of the sandbar at the Russian River Estuary, no significant impacts to the biota of the Estuary have been identified. The following sections discuss results of each portion of the monitoring program in 2000, and over the entire five-year monitoring period.

5.1 WATER QUALITY MONITORING

During Events I through IV in 2000, salinity stratification was evident during the pre-breaching monitoring and continued through the tidal survey, as shown by both the water quality profile and Minisonde data. It appears that salinity stratification is usually present within the Estuary and that the freshwater lens fluctuates in depth based upon tides, river flows, and bar-open or bar-closed conditions. Minisonde records at Station 3 in 2000 show that near-bottom salinity levels ranged between 28 and 32 ppt in 2000, regardless of whether the sandbar was open or closed. DO levels appear to be more closely connected with bar conditions, usually staying above 5.0 ppm when the bar was open, and dropping below 5.0 ppm when the sandbar is closed. It appears to take more than one tidal cycle for the DO levels at upstream stations (Stations 2, 3, and 4) to recover, as DO levels often remained near-anoxic at deep water locations during the first tidal survey.

After the first four years of monitoring, Merritt Smith Consulting (1999) concluded "renewal of DO in the saline near-bottom layers of deep pools is mediated by an interplay between river flow and tidal action (spring/neap cycle) in addition to post-breaching flushing." Therefore, although low DO levels in the near-bottom layers of deep water stations, such as Stations 2, 3, and 4, are often associated with bar-closed conditions, anoxia also develops when the bar is open during neap tides and/or low river flows.

Monitoring of water quality conditions in Willow Creek began in 1998 to investigate possible causes of a series of fish and macroinvertebrate mortalities at the mouth of the creek (Merritt Smith 1999 and 2000). No mortalities were observed following draining of Willow Creek in 2000. This is likely due to the fact that most of the artificial breaches were performed at approximately 7.0 feet (on the Jenner visitor's center gage). During the Russian River Estuary Study in 1992-1993 (Heckel 1994), a breaching event with Estuary water levels in excess of 9.0 feet resulted in prickly sculpin (*Cottus asper*) and mysid mortalities. This event was believed to be a result of flooding of a great area of Willow Creek marsh, which becomes anoxic during summer months due to low water inflow and high biochemical oxygen demand, and then subsequent draining of the marsh when the sandbar is breached. Anoxic water draining from the marsh results in mortalities of fish and macroinvertebrates caught in the draining water. This phenomenon is apparently not restricted to the Russian River Estuary, as it has been observed in other estuaries (Portnoy 1991). In 1998, mortalities of juvenile prickly sculpin were associated with draining of Willow Creek following a breaching event at 8.2 feet. When water levels are greater than 8.0 feet, near-bottom DO levels in Willow Creek become anoxic within a few days of closure. Upon breaching the sandbar, this anoxic water drains out of Willow Creek and may

result in fish and macroinvertebrate mortality. Artificial breaching of the sandbar when Estuary water levels are less than 8.0 feet does not appear to have similar results.

5.2 FISH AND MACROINVERTEBRATE MONITORING

Monitoring events in 2000 occurred during the fall and early winter months (September, October, November). Although Events I and II had higher numbers of fish captured in the otter trawls during pre-breaching surveys, Events III and IV showed little difference in the numbers of fish captured between pre-breach, draining, and tidal surveys. The total number of fish captured during Event I accounted for approximately 74 percent of the total captured during all four monitored events. A majority of the fish captured in Event I (and over all four events) were threespine stickleback (*Gasterosteus aculeatus*) observed during the pre-breaching and draining surveys at Station 4.

Seventy-one percent of all fish captured in beach seines were captured during Event II at Stations III and IV (mostly threespine stickleback). During Event I, threespine stickleback was captured most often in the beach seines followed by sculpin (prickly and staghorn), and surf smelt. Topsmelt was captured most frequently during Event III. Threespine stickleback was the dominant catch during Event IV.

As discussed in the 1999 monitoring report (Merritt Smith Consulting 2000), the trend observed during the monitoring studies was that fish species diversity and abundance did not appear to be driven by sandbar conditions (bar-closed or bar-open) as much as by seasonal variability. Many estuarine fish species are apparently more abundant during spring and summer months when they enter the Estuary to spawn or rear young. Fish species diversity and abundance declines during the fall months when fish move out of estuaries, probably due to unfavorable thermal conditions (Merritt Smith Consulting 2000). Otter trawl and beach seine results for 2000 support these conclusions.

5.3 PINNIPED MONITORING

In all five monitoring studies, the number of pinnipeds (primarily harbor seals) observed hauled out at the mouth of the Estuary declined when the sandbar was closed, and increased soon after artificially breaching the sandbar. Appendix C-1 provides a summary of seal counts during the 2000 monitoring study. Artificial breaching of the sandbar appears to have no significant negative effects on the seal haul out. Seals hauled out at the mouth of the Estuary appear to respond most negatively to human disturbances on the beach (typically beach visitors approaching the haulout). Appendix C-2 summarizes disturbances to seals hauled out on the sandbar during the 2000 monitoring study. Agency crews post signs 24 hours prior to breaching the sandbar and remove the signs 24 hours after breaching is complete. Many beach visitors will walk past the signs (with and without reading the signs) and approach the haulout, usually resulting in seals fleeing back into the Estuary.

5.4 RECOMMENDATIONS

Future artificial breaching of the sandbar at the mouth of the Russian River Estuary should be performed prior to water levels in the Estuary reaching 7.0 feet on the Jenner visitor's center gage to reduce the potential of fish and macroinvertebrate mortalities at the mouth of Willow Creek. Fish and macroinvertebrate mortalities at Willow Creek have been the most significant impacts associated with artificial breaching, but appear to be preventable if breaching occurs when the water levels in the Estuary are less than 8.0 feet at the Jenner gage.

Merritt Smith Consulting (2000) provided recommendations for further monitoring studies. They recommended that water quality sampling of breaching events be limited to maintaining Datasondes (or Minisondes) to monitor near-bottom temperature, salinity, and DO in and near the mouth of Willow Creek (such as Stations 3 and 3AA). A program of monthly biological samplings (otter trawls and beach seines) conducted year-round at Stations 1 through 4 was recommended to provide more basic and valuable information on seasonal use and general biological health of the Estuary. The recommendation included replicating samples one or more times at each station, where possible.

Posting signs and cordons on the sandbar 24 hours prior to breaching and removing them 24 hours following the breaching event should be continued. Placing the signs and cordons further south of the jetty would likely reduce the number of visitors bypassing the signs and approaching the haul out (seals hauled out at the sandbar are not as visible from south of the jetty). Agency staff should continue to keep crew members posted at the jetty during artificial breaching activities to prevent visitors from walking past the signs into the breaching area.

6.0 REFERENCES

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Merritt Smith Consulting. 1997. *Biological and Water Quality Monitoring in the Russian River Estuary, 1996*. Prepared for Sonoma County Water Agency. February 21, 1997.

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Portnoy, J.W. 1991. Summer oxygen depletion in a diked New England estuary. Estuaries. 14(2): 122-129.

7.0 CONTRIBUTORS

The following people implemented the 2000 monitoring program:

Water Quality Monitoring

Water Quality Profiles:	Michael Fawcett, Merritt Smith Consulting Jim Roth, Merritt Smith Consulting
Minisondes:	Steve Brady, Sonoma County Water Agency Shawn Chase, Sonoma County Water Agency

Fish and Macroinvertebrate Monitoring

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Jim Roth, Merritt Smith Consulting

Pinniped Monitoring

Jessica Martini-Lamb, Sonoma County Water Agency

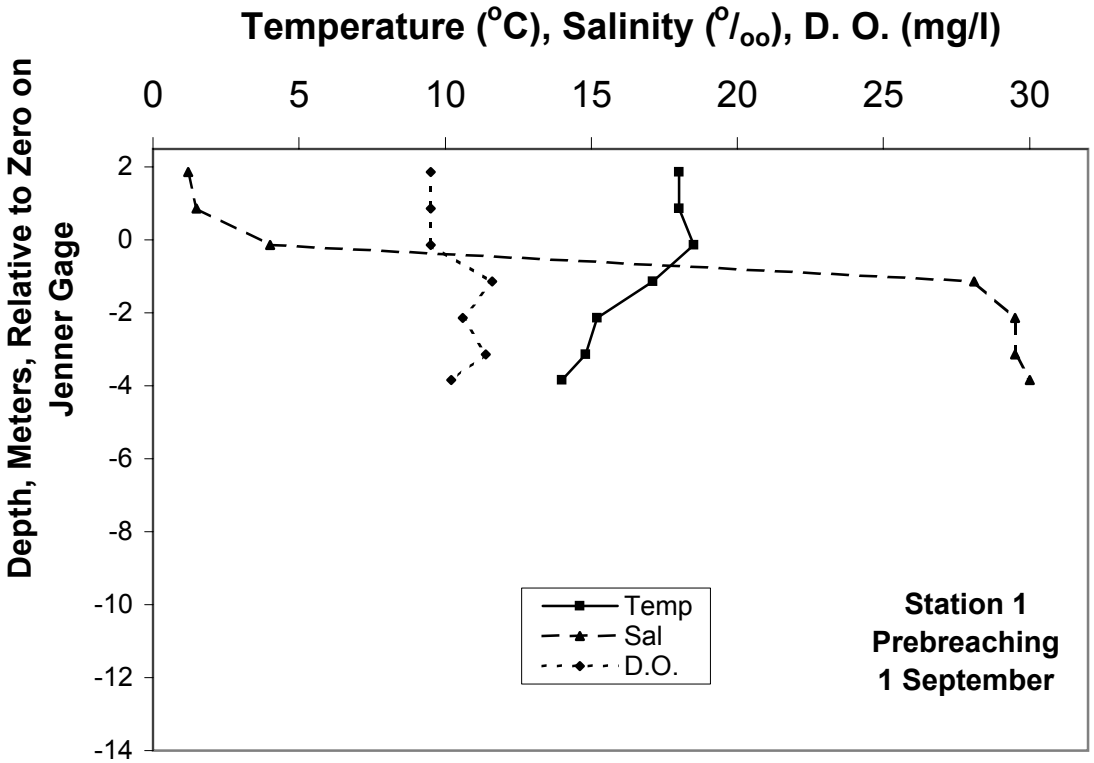
APPENDICES

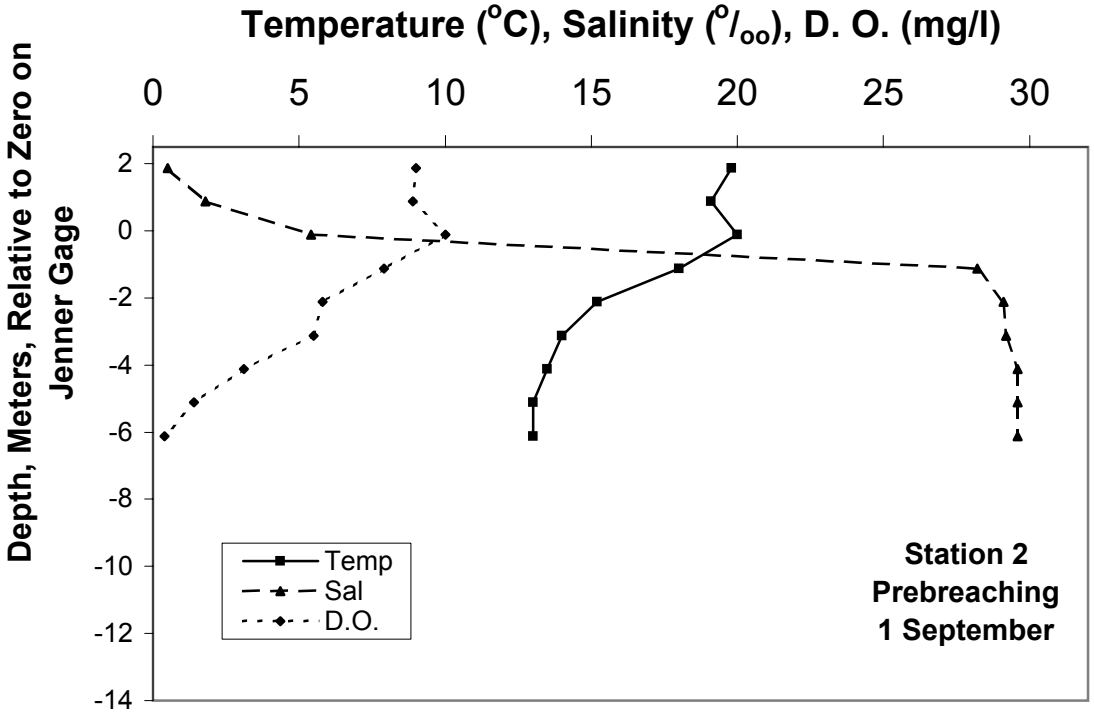
Appendix A: Water Quality Profiles and Minisonde Data

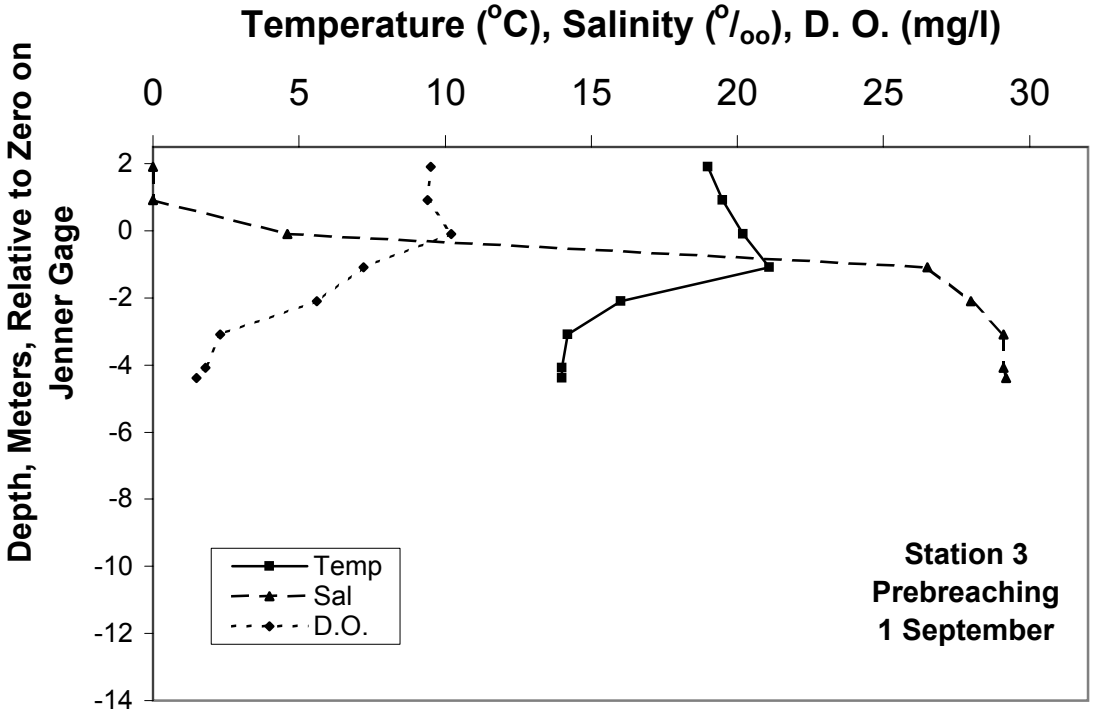
Appendix A-1. Prebreaching Water Quality Profiles at Russian River Estuary Stations 1-4, Event I, 1 September 2000.

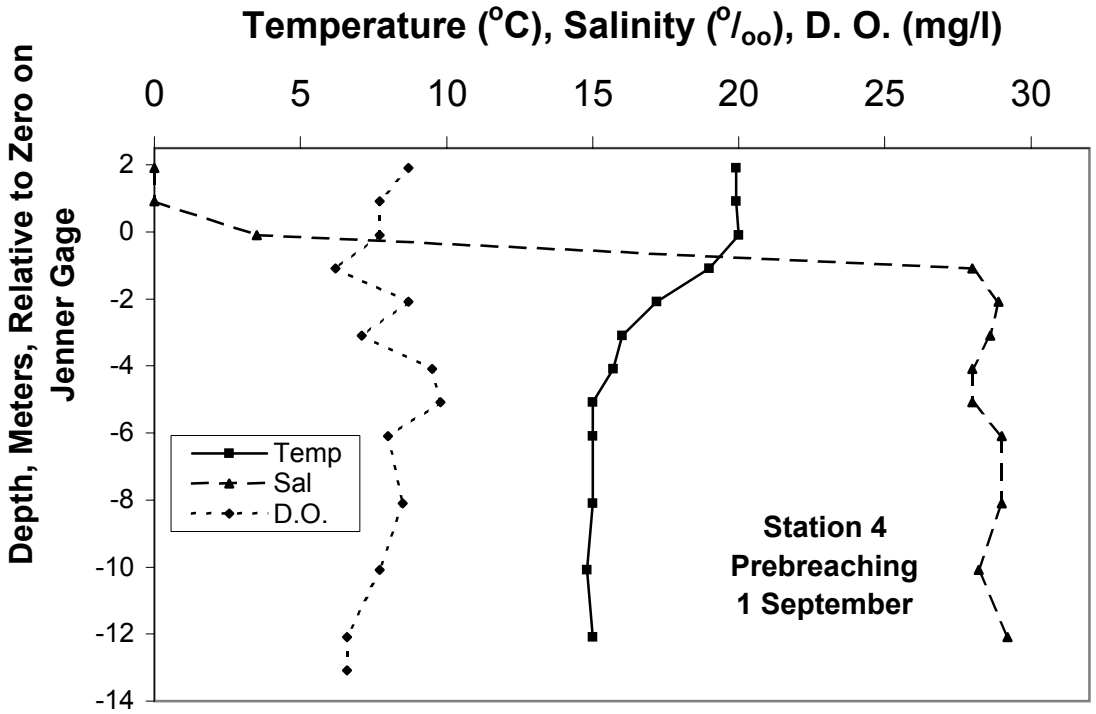
1-Sep-00

	Station 1(1200 hr PDT)				Station 2 (1330 hr PDT)				Station 3 (1510 hr PDT)				Station 4 (1700 hr PDT)			
	water level, m		1.86	(6.1 ft)	water level, m		1.88	(6.2 ft)	water level, m		1.91	(6.3 ft)	water level, m		1.91	(6.3 ft)
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	18.0	1.2	2000	9.5	19.8	0.5	1200	9.0	19.0	0.0	510	9.5	19.9	0.0	400	8.7
1	18.0	1.5	2290	9.5	19.1	1.8	2200	8.9	19.5	0.0	550	9.4	19.9	0.0	400	7.7
2	18.5	4.0	5400	9.5	20.0	5.4	8000	10.0	20.2	4.6	7000	10.2	20.0	3.5	3500	7.7
3	17.1	28.1	37200	11.6	18.0	28.2	38100	7.9	21.1	26.5	36100	7.2	19.0	28.0	39000	6.2
4	15.2	29.5	37200	10.6	15.2	29.1	37000	5.8	16.0	28.0	37100	5.6	17.2	28.9	38100	8.7
5	14.8	29.5	37000	11.4	14.0	29.2	36100	5.5	14.2	29.1	36100	2.3	16.0	28.6	37000	7.1
5.7	14.0	30.0	36900	10.2	-	-	-	-	-	-	-	-	-	-	-	-
6					13.5	29.6	36000	3.1	14.0	19.1	36000	1.8	15.7	28.0	37000	9.5
6.3	-	-	-	-	-	-	-	-	14.0	29.2	36000	1.5	-	-	-	-
7					13.0	29.6	35800	1.4					15.0	28.0	36900	9.8
8					13.0	29.6	35800	0.4					15.0	29.0	36800	8.0
9													-	-	-	-
10													15.0	29.0	36700	8.5
11													-	-	-	-
12													14.8	28.2	35300	7.7
13													-	-	-	-
14													15.0	29.2	369	6.6
15													-	-	-	6.6


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Prebreaching
1 September


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Prebreaching
1 September

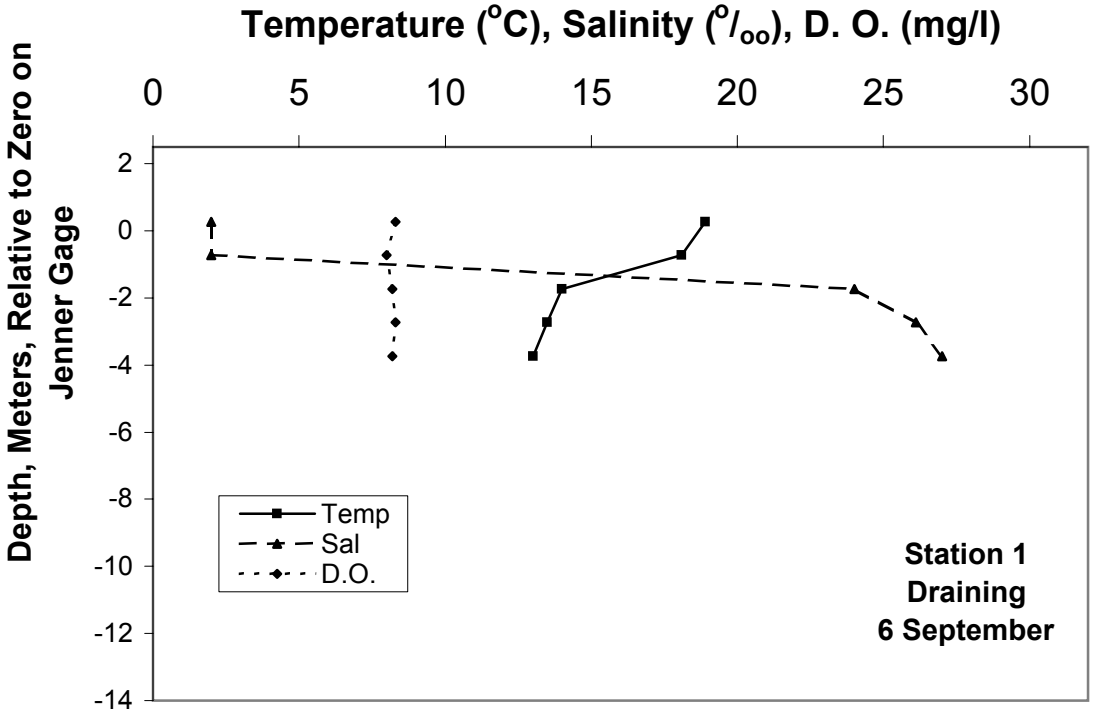

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Prebreaching
1 September

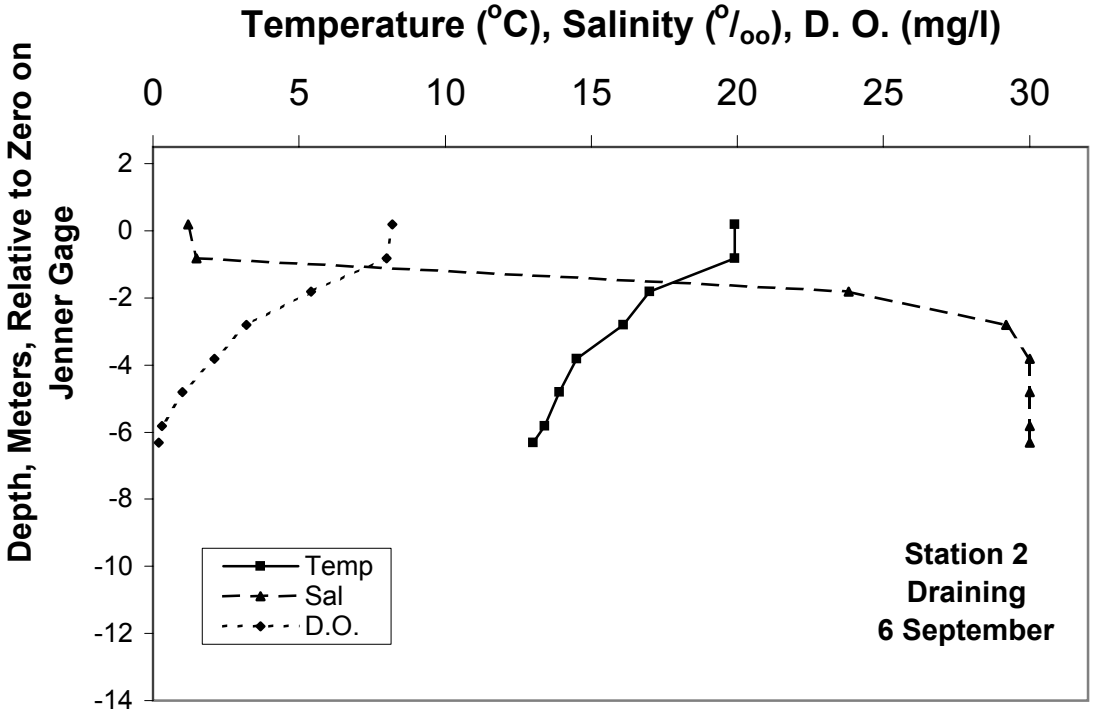

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 4
Prebreaching
1 September

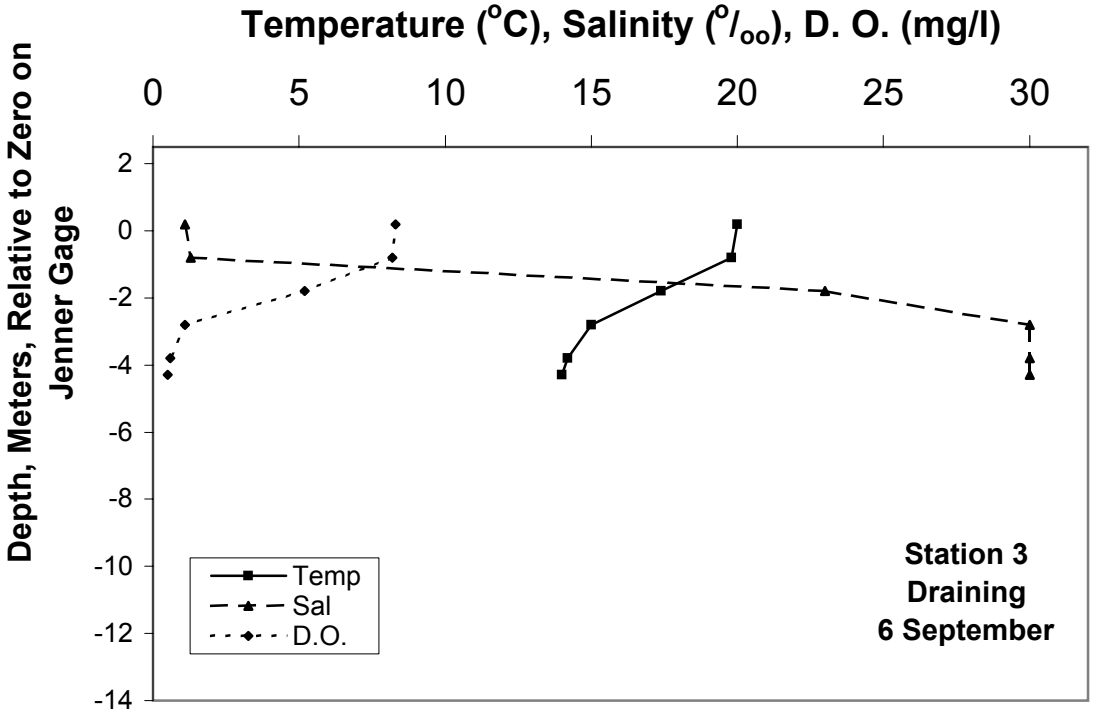
Appendix A-2. Draining Water Quality Profiles at Russian River Estuary Stations 1-4, Event I, 6 September 2000.

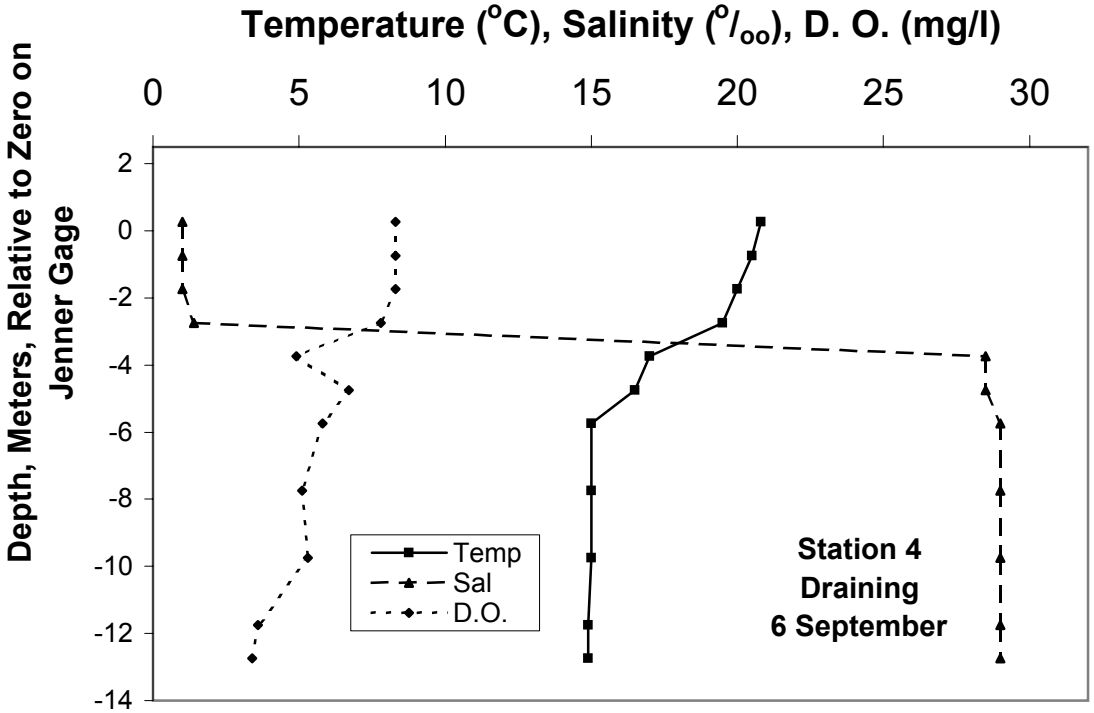
6-Sep-00

	Station 1(0950 hr PDT)				Station 2 (1120 hr PDT)				Station 3 (1215 hr PDT)				Station 4 (1440 hr PDT)			
	water level, m		0.27	(0.9 ft)	water level, m		0.19	(0.6 ft)	water level, m		0.2	(0.7 ft)	water level, m		0.26	(0.9 ft)
Depth Meters	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm
0	18.9	2.0	2820	8.3	19.9	1.2	2110	8.2	20.0	1.1	2100	8.3	20.8	1.0	1350	8.3
1	18.1	2.0	2980	8.0	19.9	1.5	2530	8.0	19.8	1.3	2040	8.2	20.5	1.0	1400	8.3
2	14.0	24.0	30200	8.2	17.0	23.8	32000	5.4	17.4	23.0	31400	5.2	20.0	1.0	1800	8.3
3	13.5	26.1	32200	8.3	16.1	29.2	38000	3.2	15.0	30.0	37800	1.1	19.5	1.4	2200	7.8
4	13.0	27.0	32900	8.2	14.5	30.0	37100	2.1	14.2	30.0	37000	0.6	17.0	28.5	37500	4.9
4.5					-	-	-	-	14.0	30.0	37000	0.5	-	-	-	-
5					13.9	30.0	36900	1.0					16.5	28.5	37000	6.7
6					13.4	30.0	36400	0.3					15.0	29.0	36800	5.8
6.5					13.0	30.0	36100	0.2					-	-	-	-
7													-	-	-	-
8													15.0	29.0	36700	5.1
9													-	-	-	-
10													15.0	29.0	36800	5.3
11													-	-	-	-
12													14.9	29.0	36800	3.6
13													14.9	29.0	36800	3.4


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Draining
6 September


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Draining
6 September

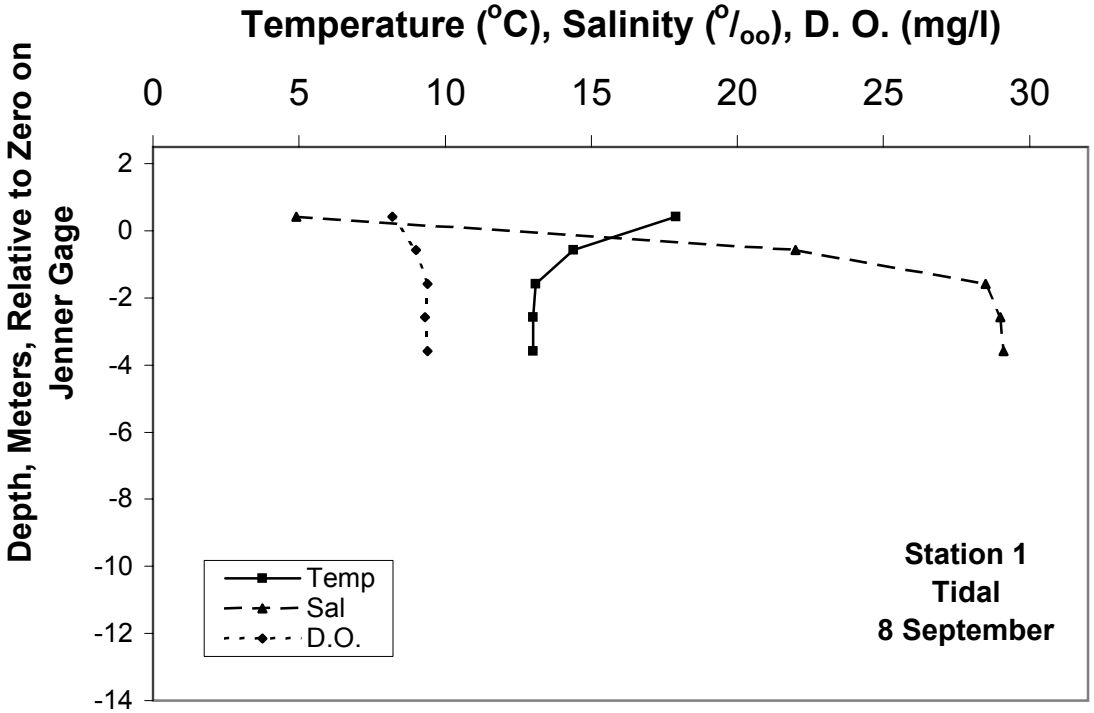

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Draining
6 September

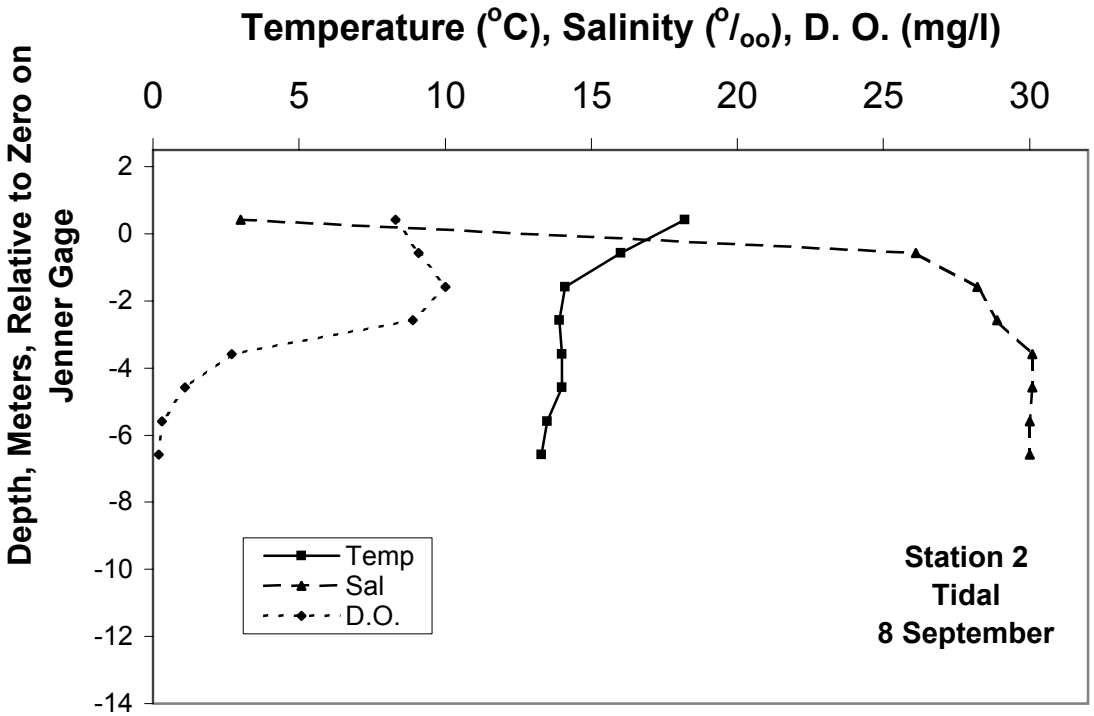

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 4
Draining
6 September

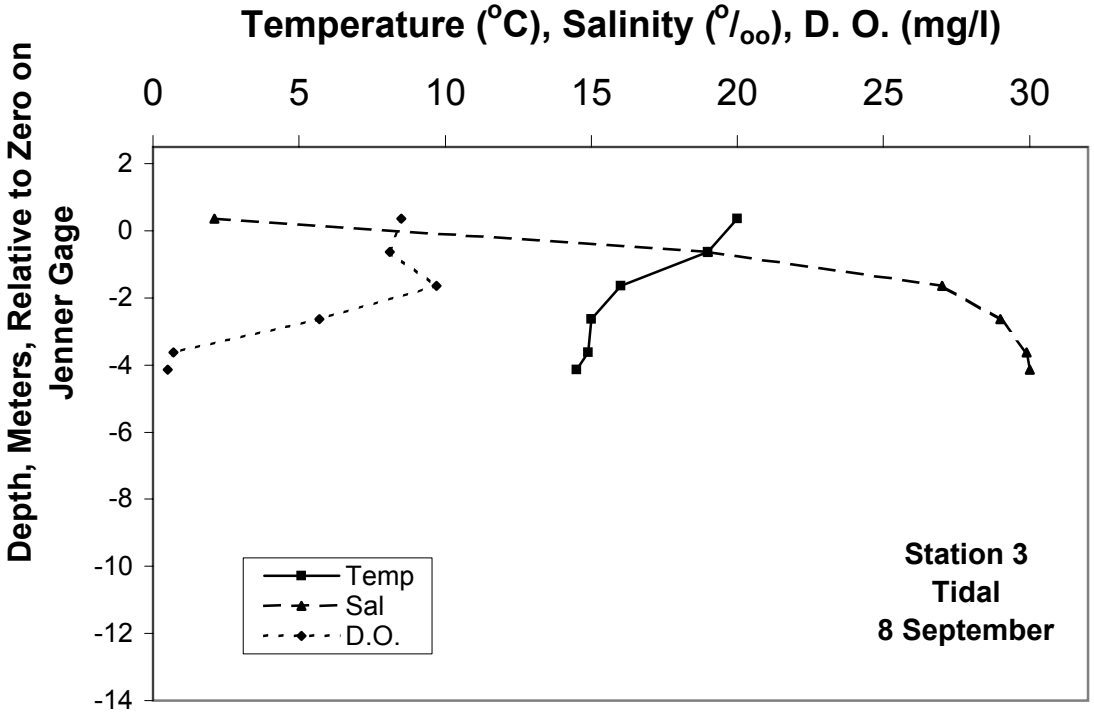
Appendix A-3. Tidal Water Quality Profiles at Russian River Estuary Stations 1-4, Event I, 8 September 2000.

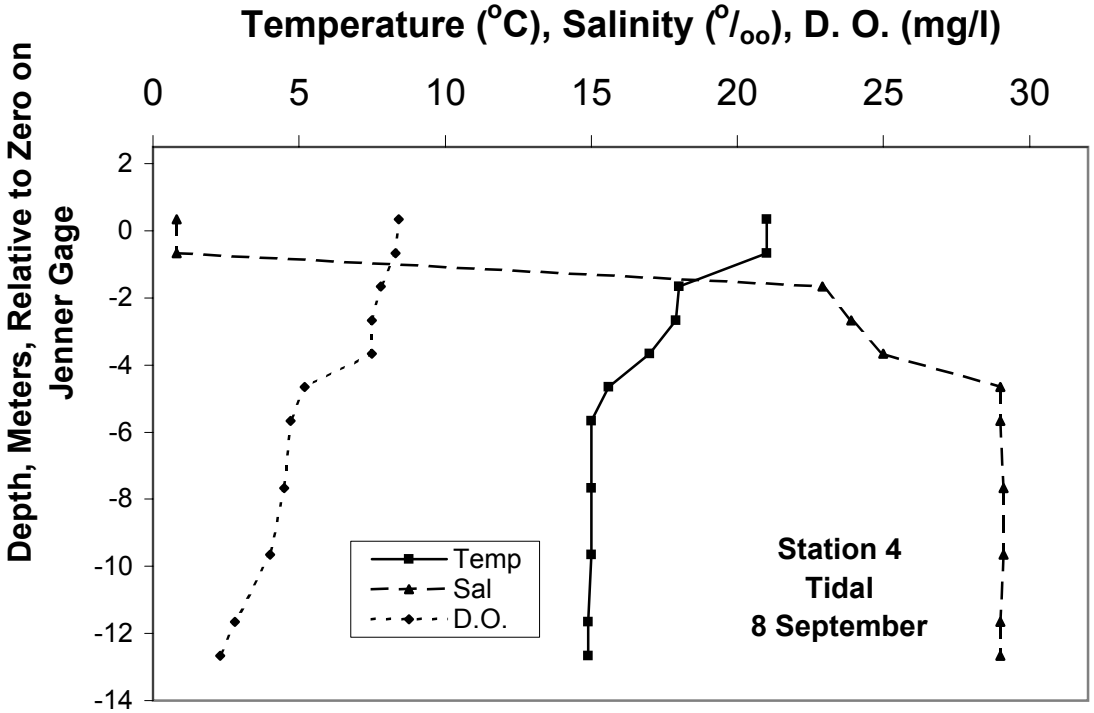
8-Sep-00

	Station 1(0945 hr PDT)				Station 2 (1155 hr PDT)				Station 3 (1345 hr PDT)				Station 4 (1515 hr PDT)			
	water level, m		0.42	(1.4 ft)	water level, m		0.42	(1.4 ft)	water level, m		0.37	(1.2 ft)	water level, m		0.34	(1.1 ft)
Depth Meters	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm
0	17.9	4.9	7000	8.2	18.2	3.0	4100	8.3	20.0	2.1	3430	8.5	21.0	0.8	1110	8.4
1	14.4	22.0	28000	9.0	16.0	26.1	34000	9.1	19.0	19.0	24000	8.1	21.0	0.8	1150	8.3
2	13.1	28.5	34400	9.4	14.1	28.2	35000	10.0	16.0	27.0	35000	9.7	18.0	22.9	31800	7.8
3	13.0	29.0	35000	9.3	13.9	28.9	35100	8.9	15.0	29.0	36300	5.7	17.9	23.9	32900	7.5
4	13.0	29.1	35200	9.4	14.0	30.1	37000	2.7	14.9	29.9	37000	0.7	17.0	25.0	33200	7.5
4.5					-	-	-	-	14.5	30.0	37100	0.5	-	-	-	-
5					14.0	30.1	37000	1.1					15.6	29.0	37000	5.2
6					13.5	30.0	36500	0.3					15.0	29.0	37000	4.7
7					13.3	30.0	36100	0.2					-	-	-	-
8													15.0	29.1	36900	4.5
9													-	-	-	-
10													15.0	29.1	36900	4.0
11													-	-	-	-
12													14.9	29.0	36900	2.8
13													14.9	29.0	36900	2.3


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Tidal
8 September


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Tidal
8 September


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Tidal
8 September


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Tidal
8 September

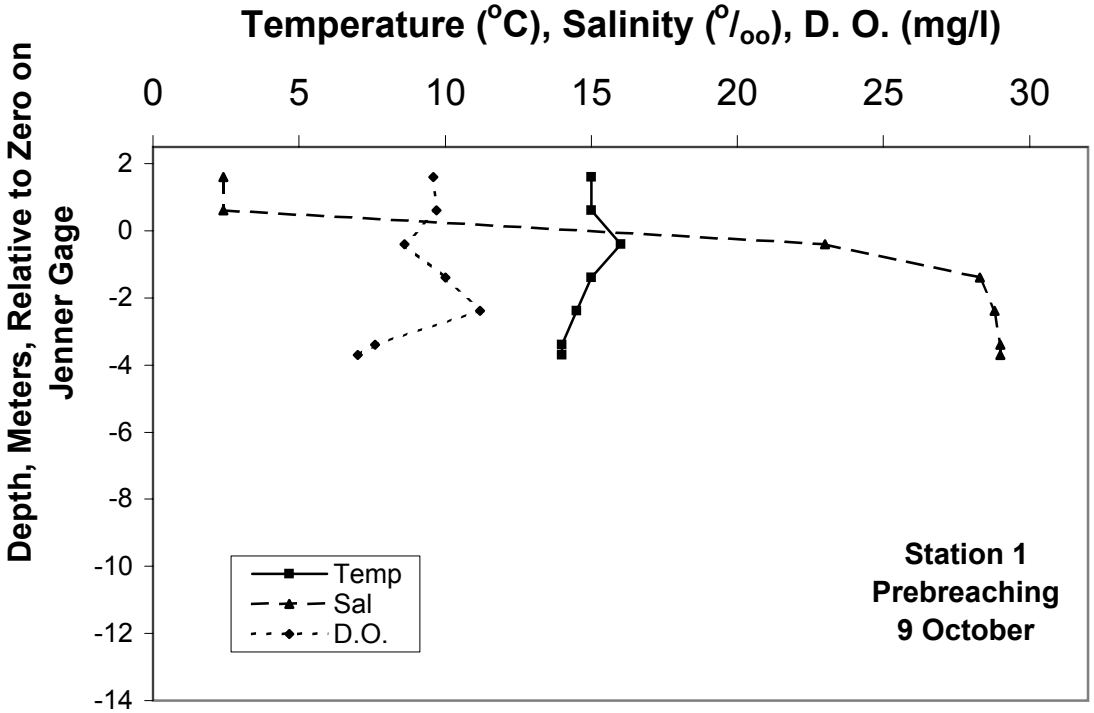
Appendix A-4. Water Quality Profiles in Willow Creek at Stations Near its Confluence with the Russian River During Event I, Breached 5 September 2000.

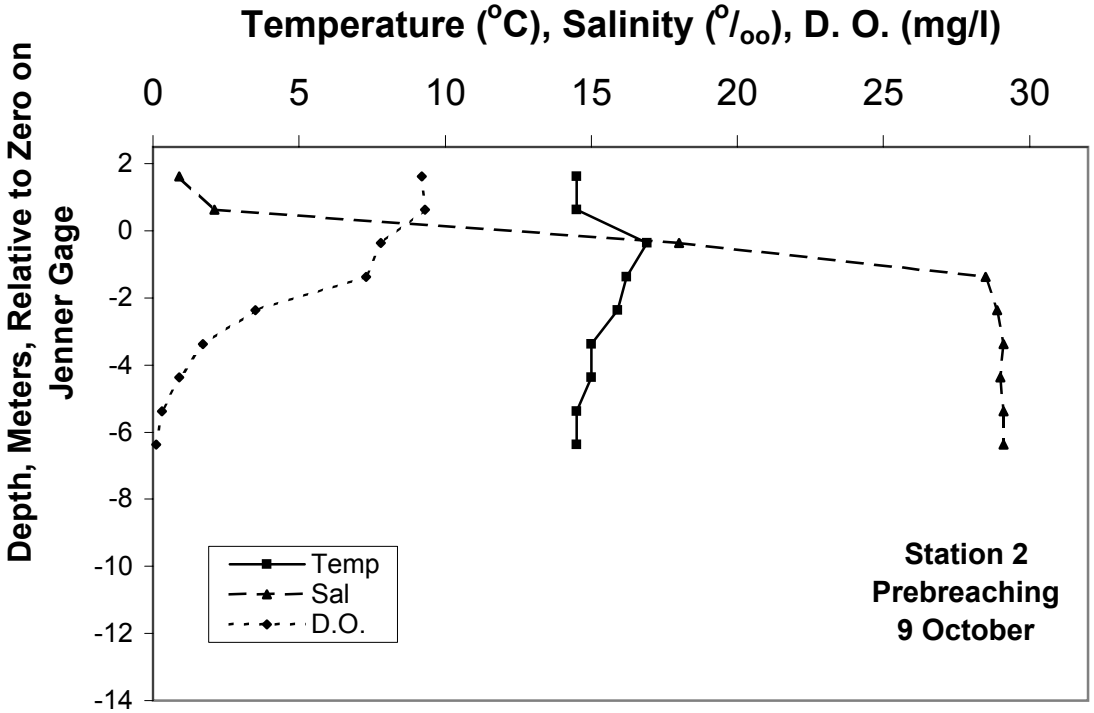
Station 3A (0.5 km upstream of bridge)												
	Prebreaching Survey 1 September (1500 hr PDT)											
Depth Meters	Temp °C	Sal °/oo	Cond µmho	D. O. ppm								
0	19.0	0.0	590	8.4								
1	19.0	0.0	600	8.2								
1.5	19.0	0.5	940	4.5								
2	23.0	8.5	13500	1.2								
2.5	24.0	15.0	24100	0.1								

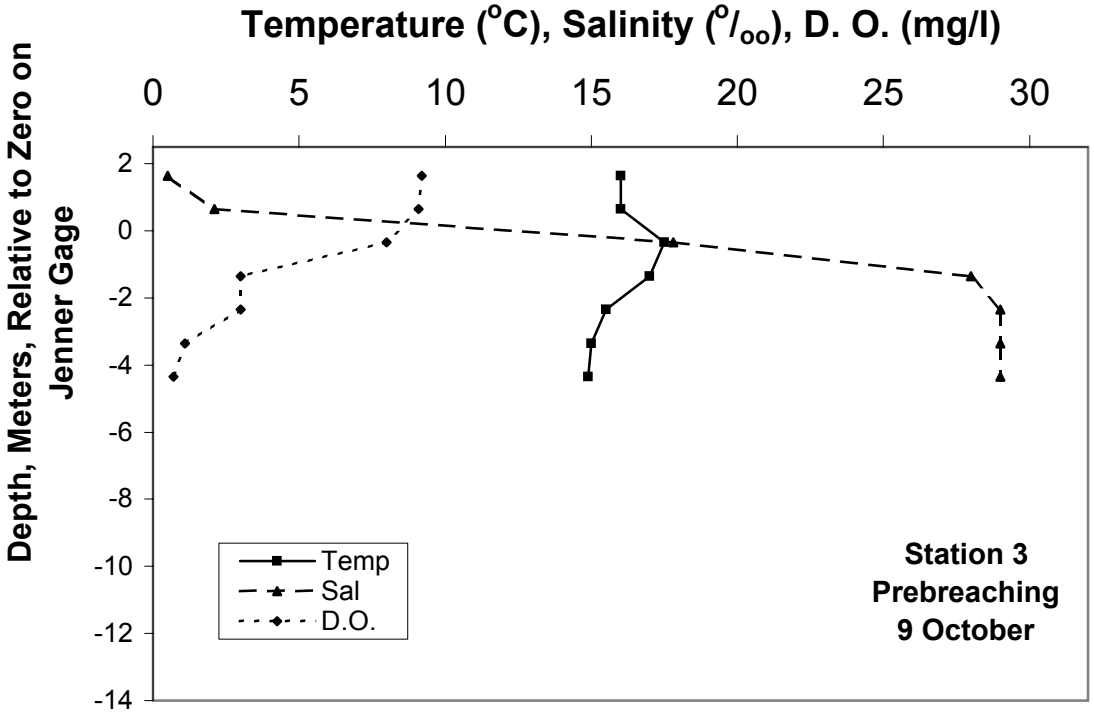
Station 3AA (near bridge)												
					Draining Survey 6 September (1230 hr PDT)				Tidal Survey 8 September (1330 hr PDT)			
Depth Meters					Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm
0					16.0	0.5	1100	4.2	18.0	1.2	1900	6.8
0.8					15.1	0.9	1220	3.9	17.5	3.0	2710	5.5

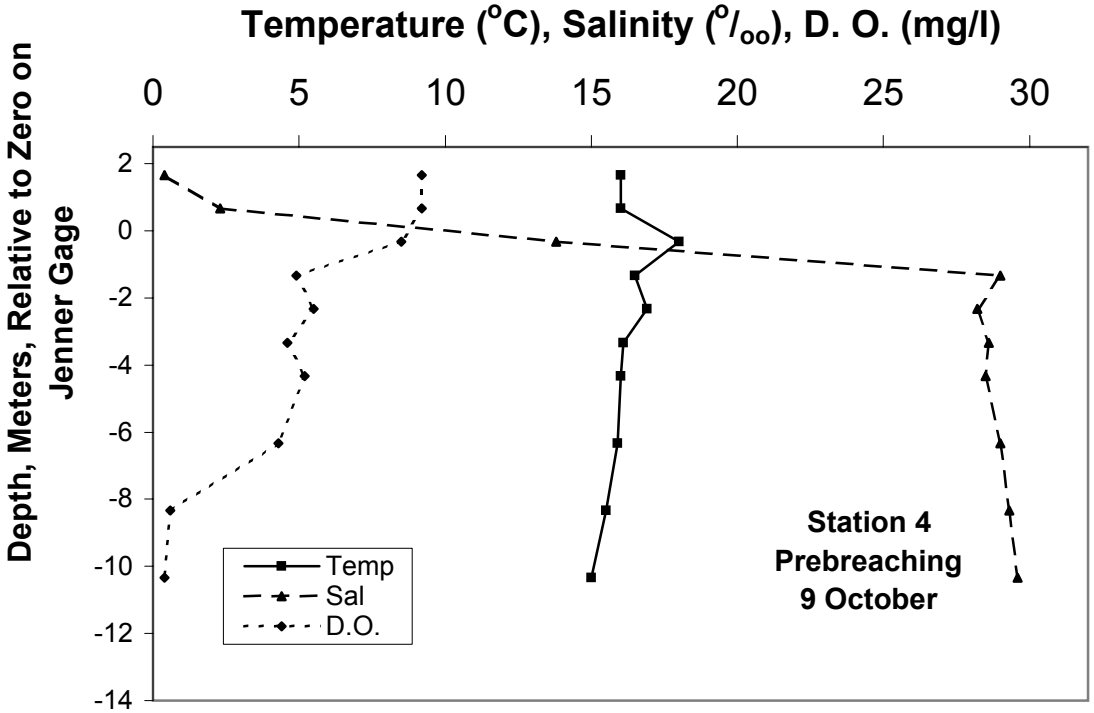
Appendix A-5. Prebreaching Water Quality Profiles at Russian River Estuary Stations 1-4, Event II, 9 October 2000.

9-Oct-00																
	Station 1(1125 hr PDT)				Station 2 (1245 hr PDT)				Station 3 (1425 hr PDT)				Station 4 (1555 hr PDT)			
	water level, m		1.61	(5.3 ft)	water level, m		1.63	(5.3 ft)	water level, m		1.65	(5.4 ft)	water level, m		1.67	(5.5 ft)
Depth Meters	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm	Temp °C	Sal °/oo	Cond µmho	D. O. ppm
0	15.0	2.4	3200	9.6	14.5	0.9	1210	9.2	16.0	0.5	990	9.2	16.0	0.4	800	9.2
1	15.0	2.4	3250	9.7	14.5	2.1	2990	9.3	16.0	2.1	3000	9.1	16.0	2.3	1400	9.2
2	16.0	23.0	30000	8.6	16.9	18.0	24900	7.8	17.5	17.8	25000	8.0	18.0	13.8	19500	8.5
3	15.0	28.3	35800	10.0	16.2	28.5	37000	7.3	17.0	28.0	37400	3.0	16.5	29.0	37500	4.9
4	14.5	28.8	36000	11.2	15.9	28.9	37000	3.5	15.5	29.0	37100	3.0	16.9	28.2	37200	5.5
5	14.0	29.0	36000	7.6	15.0	29.1	36900	1.7	15.0	29.0	37000	1.1	16.1	28.6	37100	4.6
5.3	14.0	29.0	36000	7.0	-	-	-	-	-	-	-	-	-	-	-	-
6					15.0	29.0	36700	0.9	14.9	29	36800	0.7	16.0	28.5	37000	5.2
7					14.5	29.1	36400	0.3					-	-	-	-
8					14.5	29.1	36100	0.1					15.9	29.0	37000	4.3
9													-	-	-	-
10													15.5	29.3	37100	0.6
11													-	-	-	-
12													15.0	29.6	37400	0.4


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Prebreaching
9 October

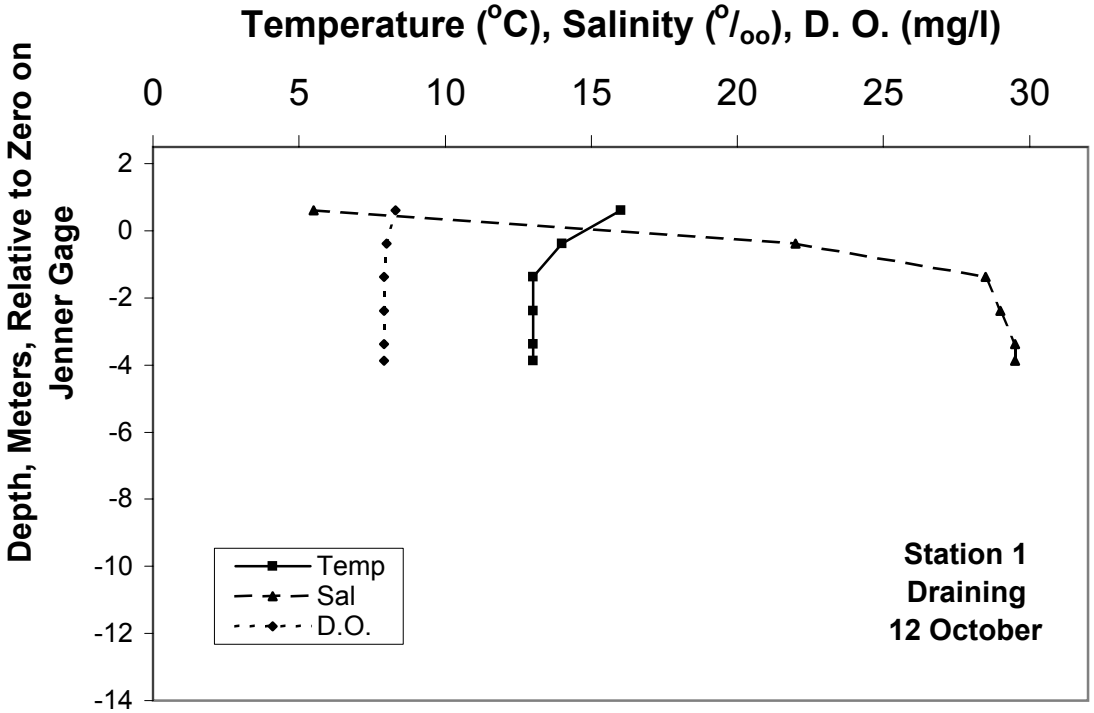

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Prebreaching
9 October

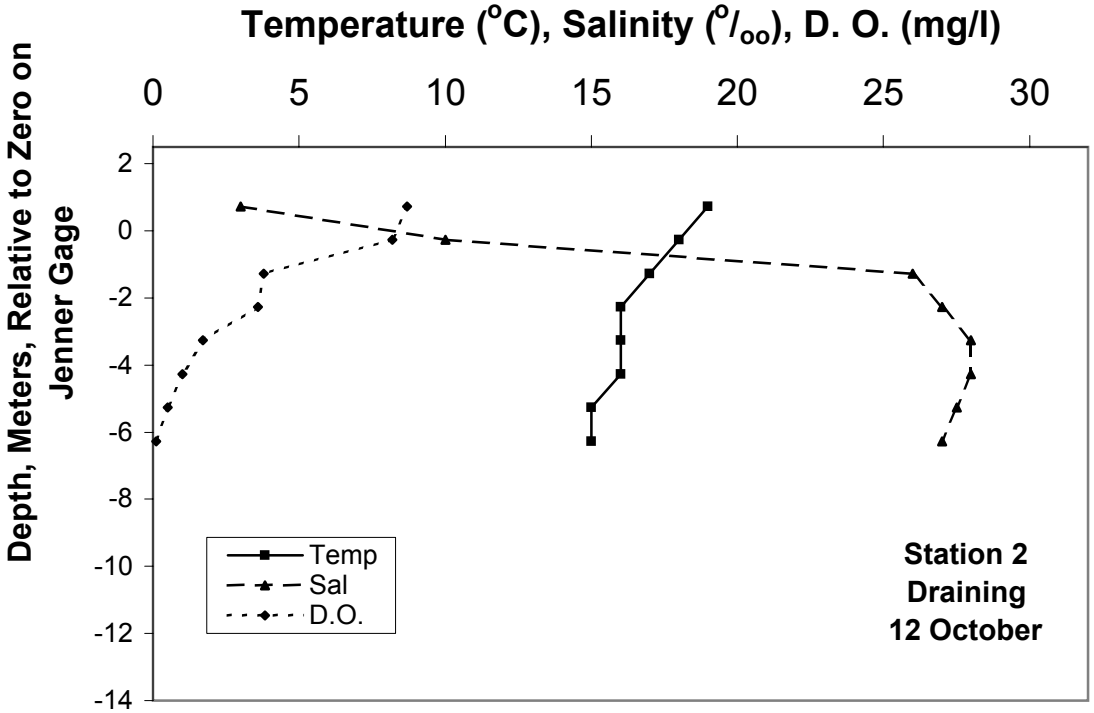

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Prebreaching
9 October

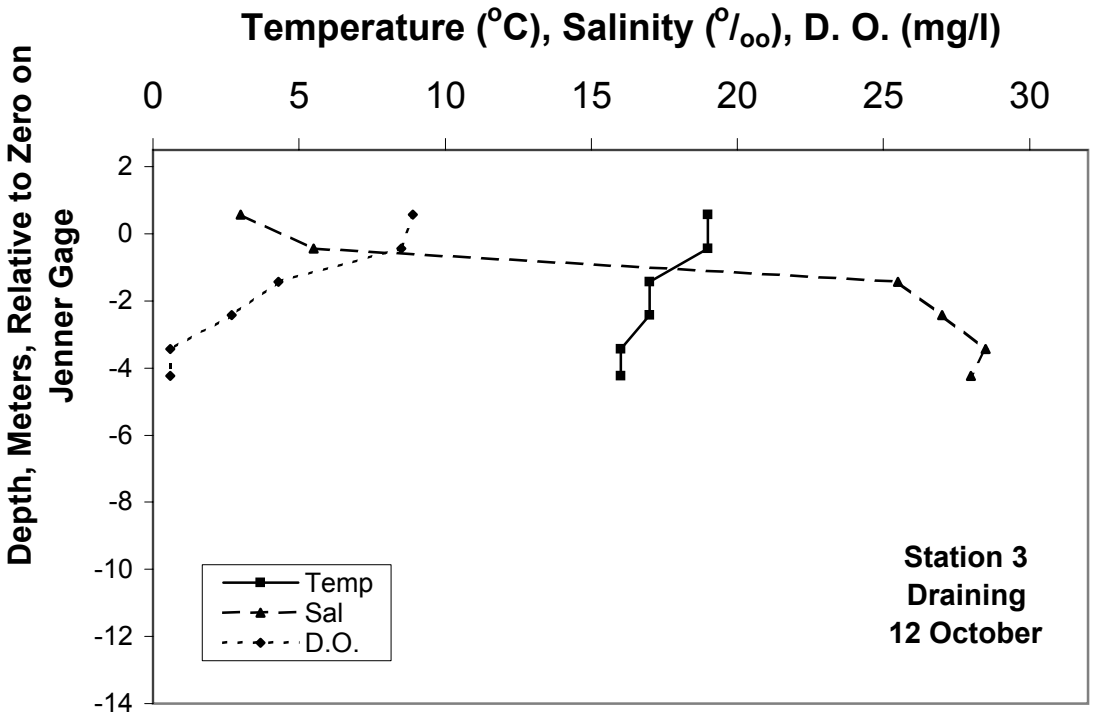

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Prebreaching
9 October

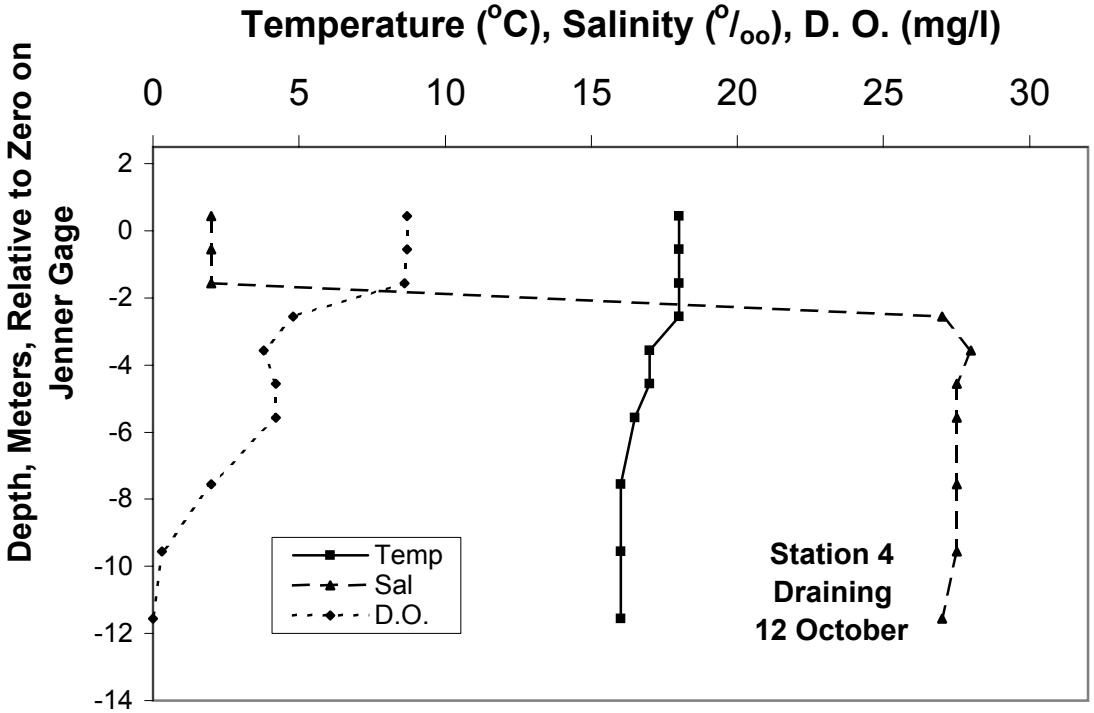
Appendix A-6. Draining Water Quality Profiles at Russian River Estuary Stations 1-4, Event II, 12 October 2000.

12-Oct-00																
	Station 1(1100 hr PDT)				Station 2 (1315 hr PDT)				Station 3 (1430 hr PDT)				Station 4 (1645 hr PDT)			
	water level, m		0.62	(2.0 ft)	water level, m		0.73	(2.4 ft)	water level, m		0.57	(1.9 ft)	water level, m		0.44	(1.4 ft)
Depth Meters	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm
0	16.0	5.5	7000	8.3	19.0	3.0	5000	8.7	19.0	3.0	4000	8.9	18.0	2.0	3000	8.7
1	14.0	22.0	26000	8.0	18.0	10.0	15000	8.2	19.0	5.5	8000	8.5	18.0	2.0	3000	8.7
2	13.0	28.5	34000	7.9	17.0	26.0	35000	3.8	17.0	25.5	34000	4.3	18.0	2.0	3000	8.6
3	13.0	29.0	35000	7.9	16.0	27.0	35000	3.6	17.0	27.0	36000	2.7	18.0	27.0	36000	4.8
4	13.0	29.5	36000	7.9	16.0	28.0	36500	1.7	16.0	28.5	37000	0.6	17.0	28.0	37000	3.8
4.5	13.0	29.5	35500	7.9	-	-	-	-	-	-	-	-	-	-	-	-
4.8					-	-	-	-	16.0	28.0	36000	0.6	-	-	-	-
5					16.0	28.0	36500	1.0					17.0	27.5	37000	4.2
6					15.0	27.5	36000	0.5					16.5	27.5	37000	4.2
7					15.0	27.0	36000	0.1					-	-	-	-
8													16.0	27.5	37000	2.0
9													-	-	-	-
10													16.0	27.5	37000	0.3
11													-	-	-	-
12													16.0	27.0	36000	0.0


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Draining
12 October

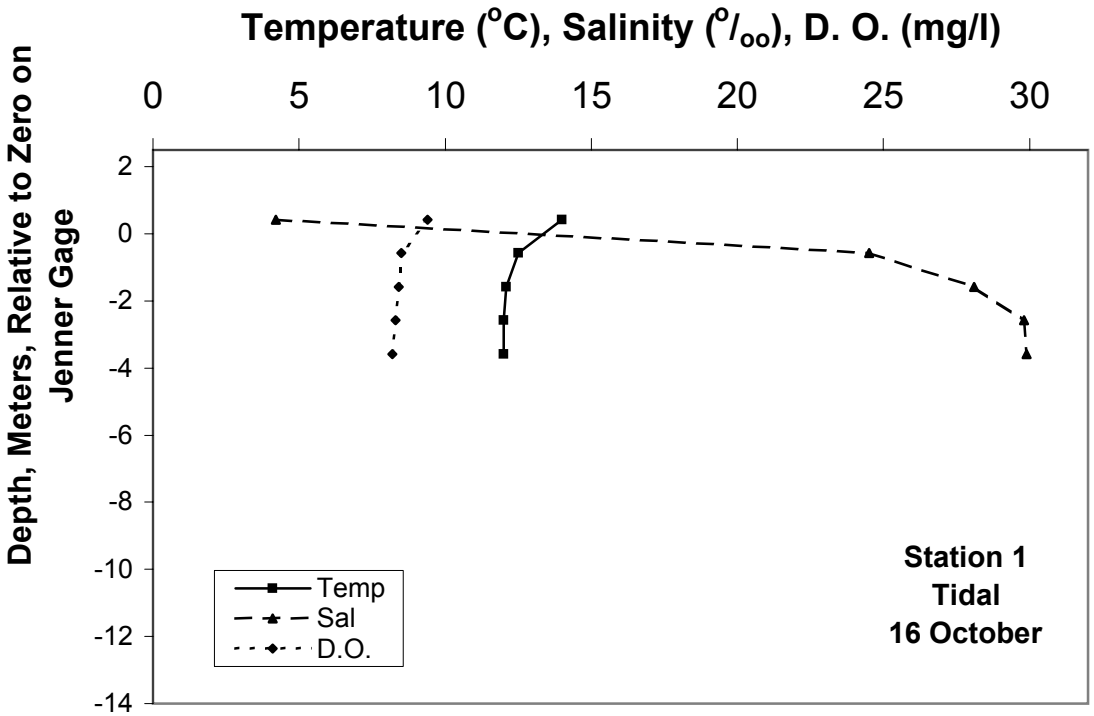

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Draining
12 October

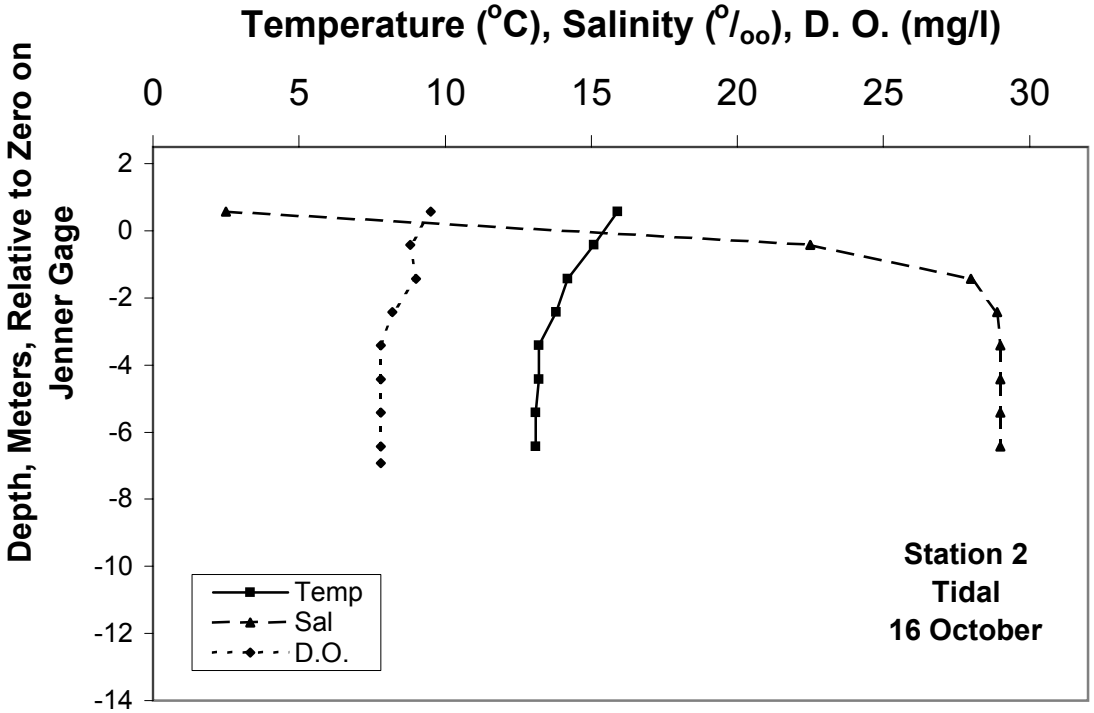

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Draining
12 October

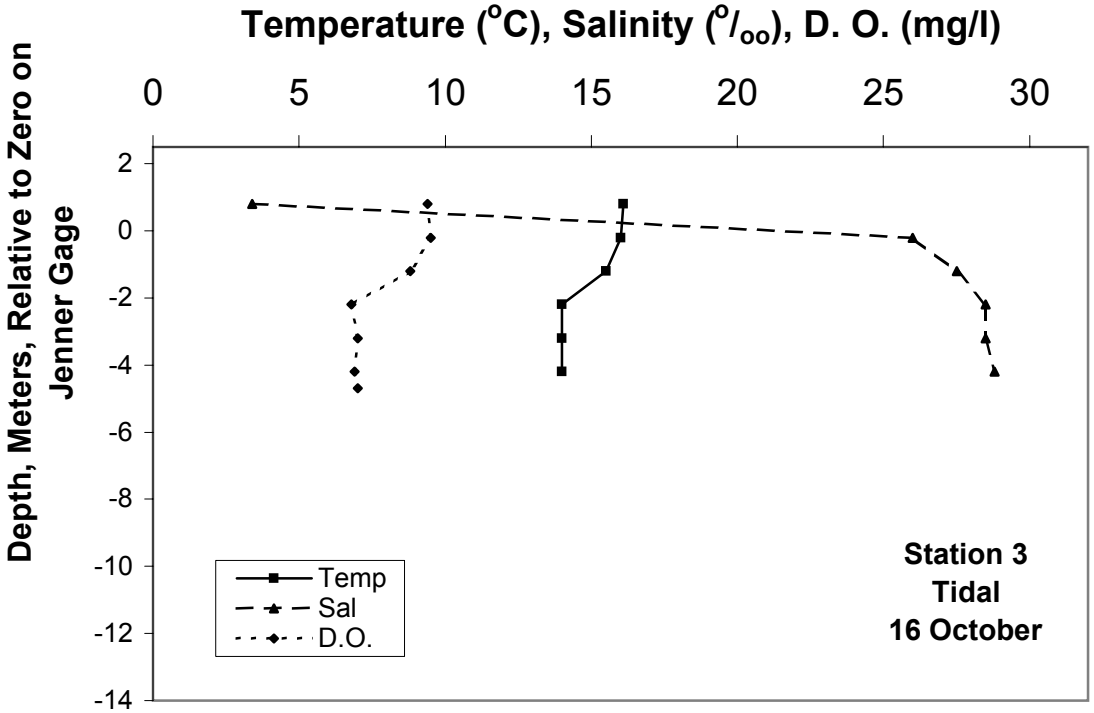

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Draining
12 October

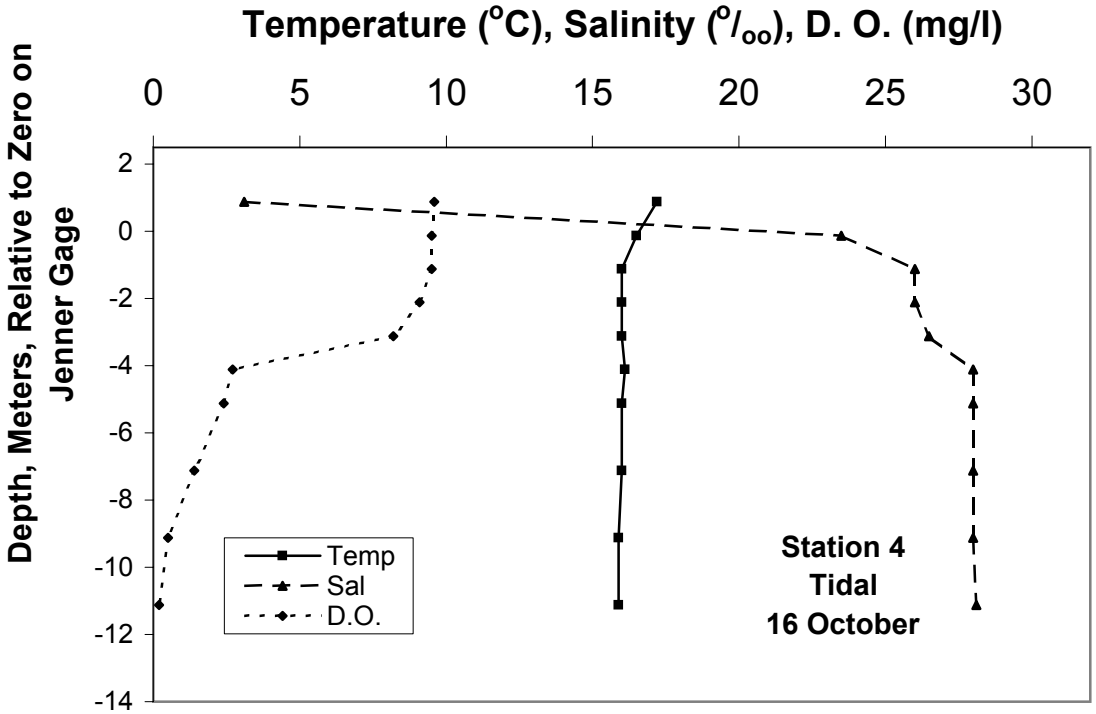
Appendix A-7. Tidal Water Quality Profiles at Russian River Estuary Stations 1-4, Event II, 16 October 2000.

16-Oct-00																
	Station 1(1100 hr PDT)				Station 2 (1215 hr PDT)				Station 3 (1350 hr PDT)				Station 4 (1530 hr PDT)			
	water level, m		0.42	(1.4 ft)	water level, m		0.58	(1.9 ft)	water level, m		0.8	(2.6 ft)	water level, m		0.88	(2.9 ft)
Depth Meters	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm
0	14.0	4.2	5900	9.4	15.9	2.5	3900	9.5	16.1	3.4	4900	9.4	17.2	3.1	4900	9.6
1	12.5	24.5	29200	8.5	15.1	22.5	29100	8.8	16.0	26.0	34000	9.5	16.5	23.5	32500	9.5
2	12.1	28.1	33100	8.4	14.2	28.0	34900	9.0	15.5	27.5	35100	8.8	16.0	26.0	33900	9.5
3	12.0	29.8	35000	8.3	13.8	28.9	35000	8.2	14.0	28.5	35000	6.8	16.0	26.0	34000	9.1
4	12.0	29.9	35000	8.2	13.2	29.0	35000	7.8	14.0	28.5	35000	7.0	16.0	26.5	34100	8.2
5					13.2	29.0	34900	7.8	14.0	28.8	35000	6.9	16.1	28.0	36000	2.7
5.5					-	-	-	-	-	-	-	7.0	-	-	-	-
6					13.1	29.0	34900	7.8					16.0	28.0	36100	2.4
7					13.1	29.0	34900	7.8					-	-	-	-
7.5					-	-	-	7.8					-	-	-	-
8													16.0	28.0	36000	1.4
9													-	-	-	-
10													15.9	28.0	36000	0.5
11													-	-	-	-
12													15.9	28.1	36000	0.2


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Tidal
16 October


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 2
Tidal
16 October

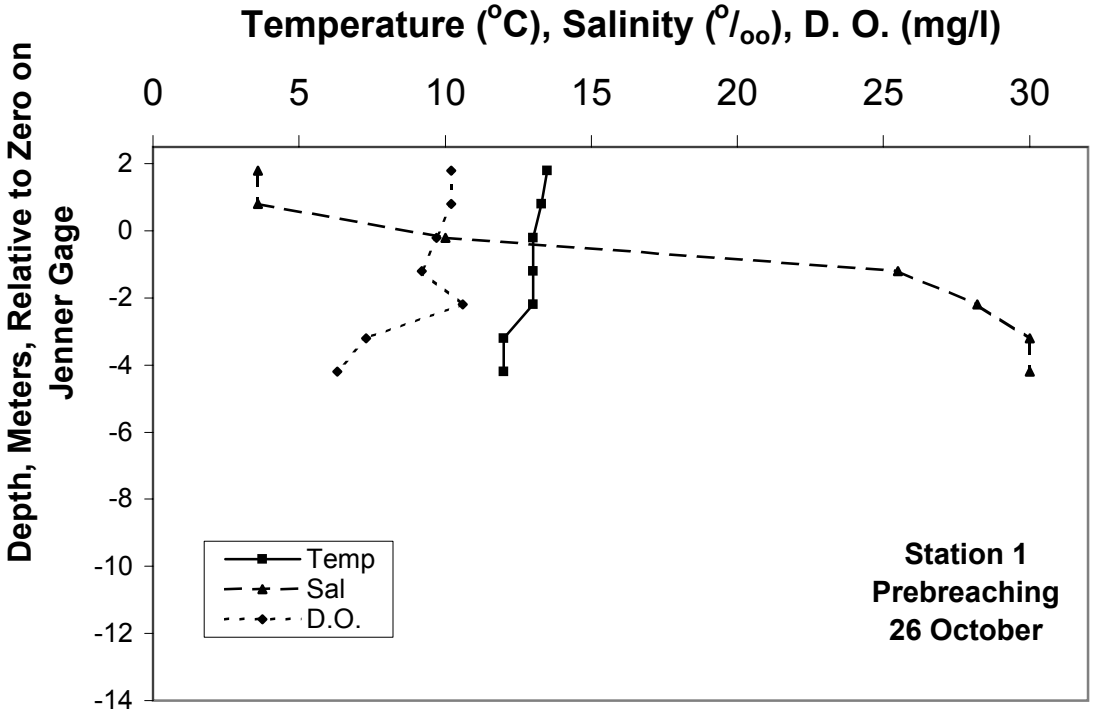

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Tidal
16 October

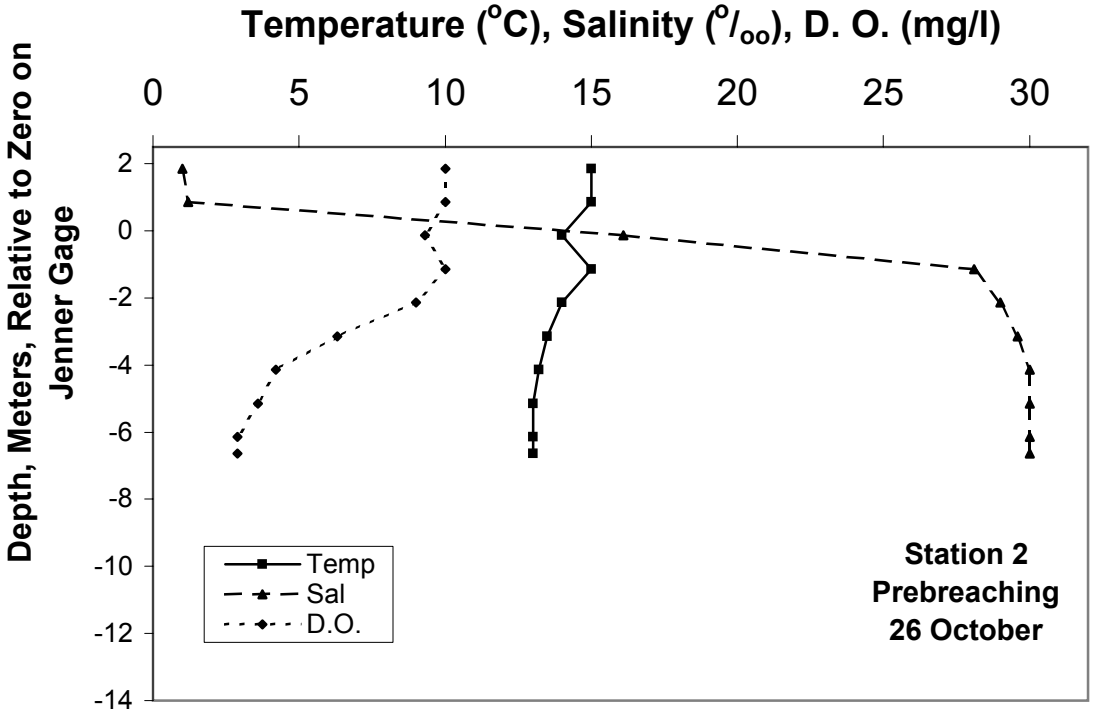

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Tidal
16 October

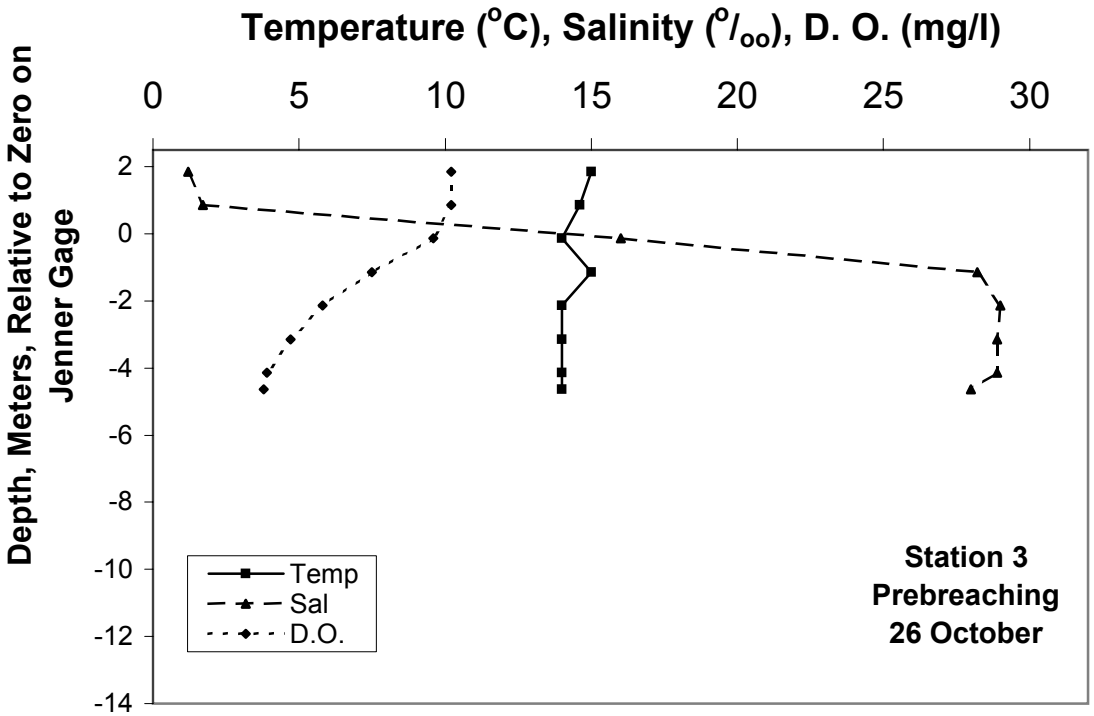
Appendix A-8. Water Quality Profiles in Willow Creek at Stations Near its Confluence with the Russian River During Event II, Breached 11 October 2000.

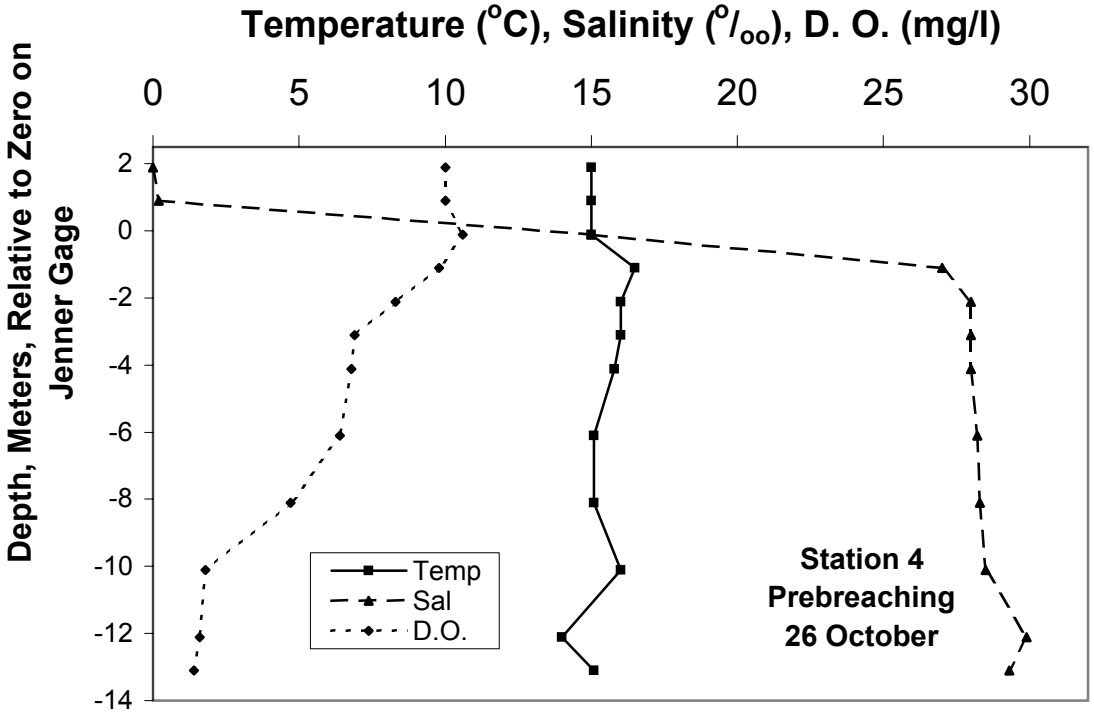
Station 3A (0.5 km upstream of bridge)												
	Prebreaching Survey 9 October (1405 hr PDT)								Tidal Survey 16 October (1330 hr PDT)			
Depth Meters	Temp °C	Sal °/oo	Cond µmho	D. O. ppm					Temp °C	Sal °/oo	Cond µmho	D. O. ppm
0	15.0	0.9	1200	8.5					14.0	2.0	2490	8.9
0.5	-	-	-	-					14.0	2.0	2490	8.9
1	14.5	1.0	1610	6.8					13.5	2.0	2860	6.7
1.5	-	-	-	-					15.5	4.8	6800	0.7
2	17.0	5.0	7900	0.4								

Station 3AA (near bridge)												
					Draining Survey 12 October (1450 hr PDT)							
Depth Meters					Temp °C	Sal °/oo	Cond µmho	D. O. ppm				
0					16.0	1.1	1800	7.5				
0.9					16.5	2.0	2600	7.4				


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Prebreaching
26 October

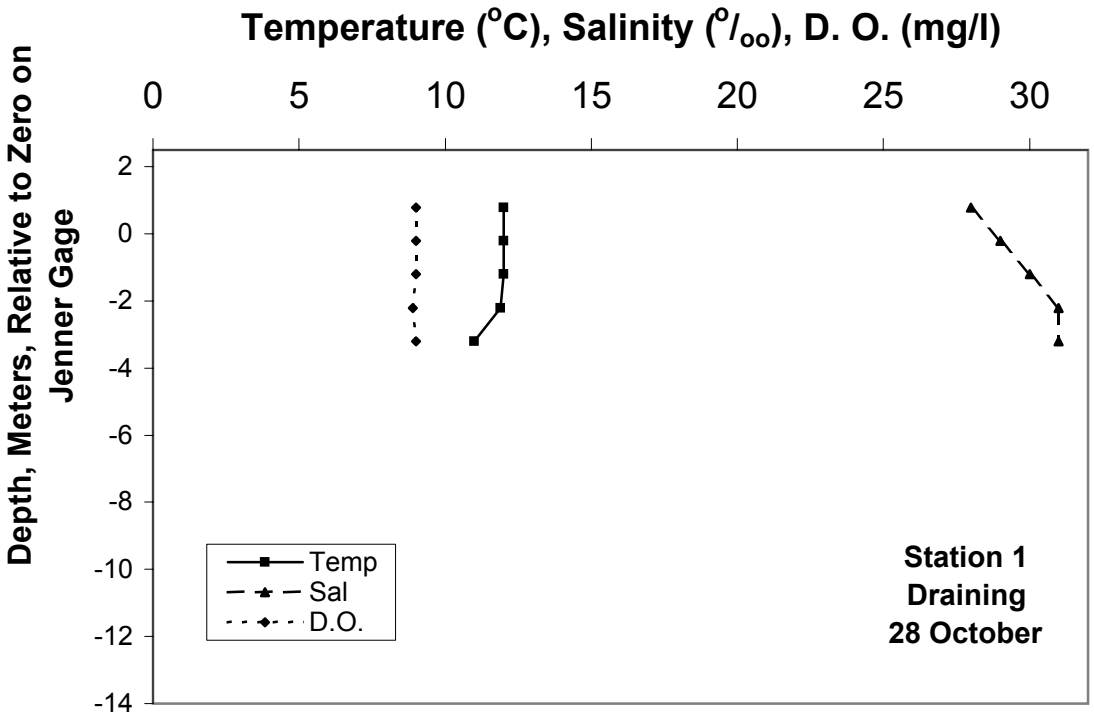

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Prebreaching
26 October

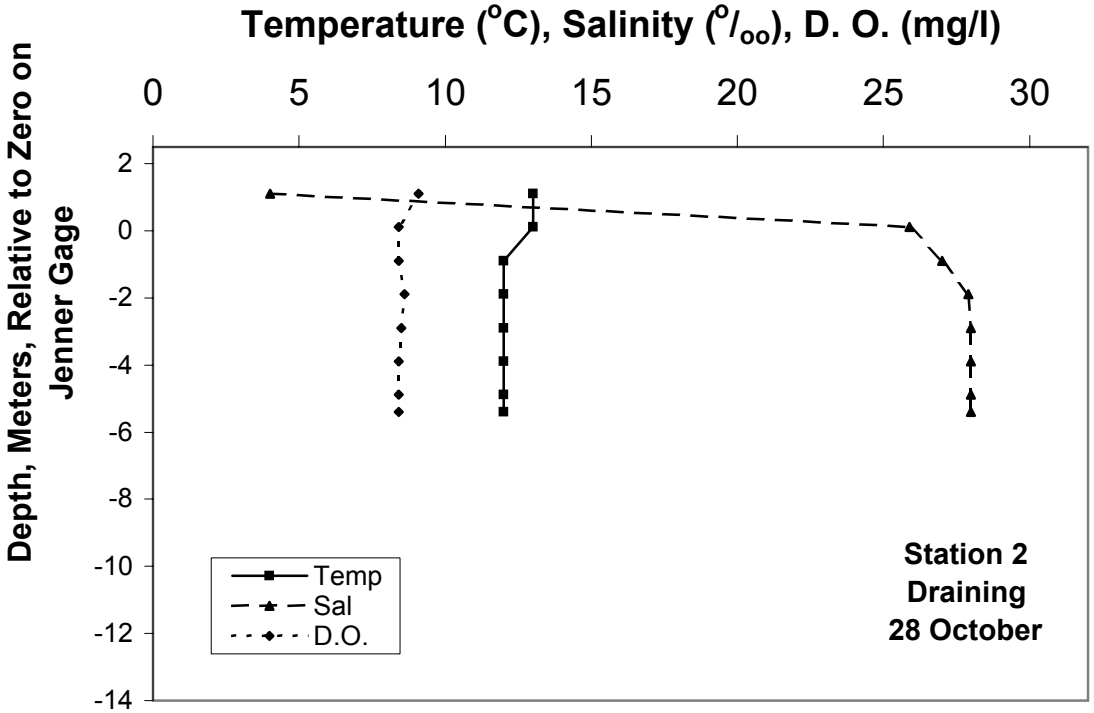

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Prebreaching
26 October

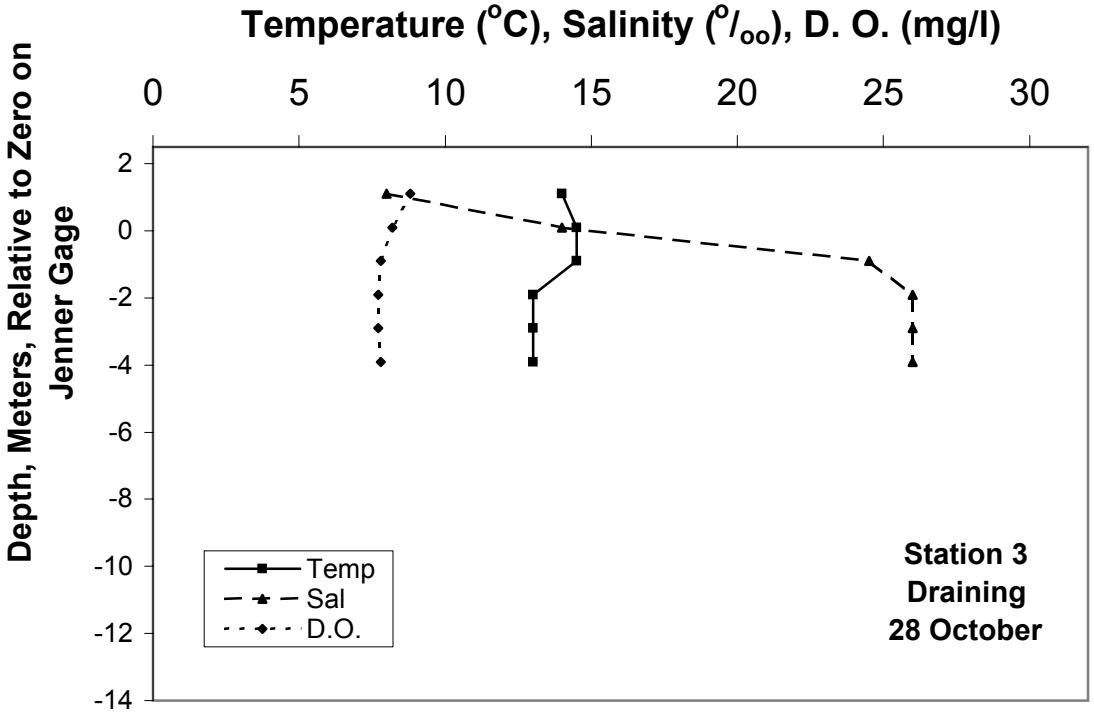

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Prebreaching
26 October

Appendix A-9. Prebreaching Water Quality Profiles at Russian River Estuary Stations 1-4, Event III, 26 October 2000.

26-Oct-00																
	Station 1(1145 hr PDT)				Station 2 (1335 hr PDT)				Station 3 (1440 hr PDT)				Station 4 (1610 hr PDT)			
	water level, m		1.8	(5.9 ft)	water level, m		1.86	(6.1 ft)	water level, m		1.86	(6.1 ft)	water level, m		1.89	(6.2 ft)
Depth Meters	Temp ᵘC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵘC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵘC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵘC	Sal °/₀₀	Cond μmho	D. O. ppm
0	13.5	3.6	4900	10.2	15.0	1.0	1500	10.0	15.0	1.2	1900	10.2	15.0	0.0	510	10.0
1	13.3	3.6	4900	10.2	15.0	1.2	1900	10.0	14.6	1.7	2000	10.2	15.0	0.2	510	10.0
2	13.0	10.0	12500	9.7	14.0	16.1	20900	9.3	14.0	16.0	20400	9.6	15.0	15.0	19800	10.6
3	13.0	25.5	31000	9.2	15.0	28.1	35500	10.0	15.0	28.2	36000	7.5	16.5	27.0	35800	9.8
4	13.0	28.2	34000	10.6	14.0	29.0	36000	9.0	14.0	29.0	35500	5.8	16.0	28.0	36100	8.3
5	12.0	30.0	35000	7.3	13.5	29.6	36000	6.3	14.0	28.9	35500	4.7	16.0	28.0	36100	6.9
6	12.0	30.0	35000	6.3	13.2	30.0	36000	4.2	14.0	28.9	35500	3.9	15.8	28.0	36000	6.8
6.5					-	-	-	-	14.0	28.0	35500	3.8	-	-	-	-
7					13.0	30.0	36000	3.6					-	-	-	-
8					13.0	30.0	36000	2.9					15.1	28.2	36000	6.4
8.5					13.0	30.0	36000	2.9					-	-	-	-
9													-	-	-	-
10													15.1	28.3	36000	4.7
11													-	-	-	-
12													16.0	28.5	36500	1.8
13													-	-	-	-
14													14.0	29.9	36400	1.6
15													15.1	29.3	36500	1.4

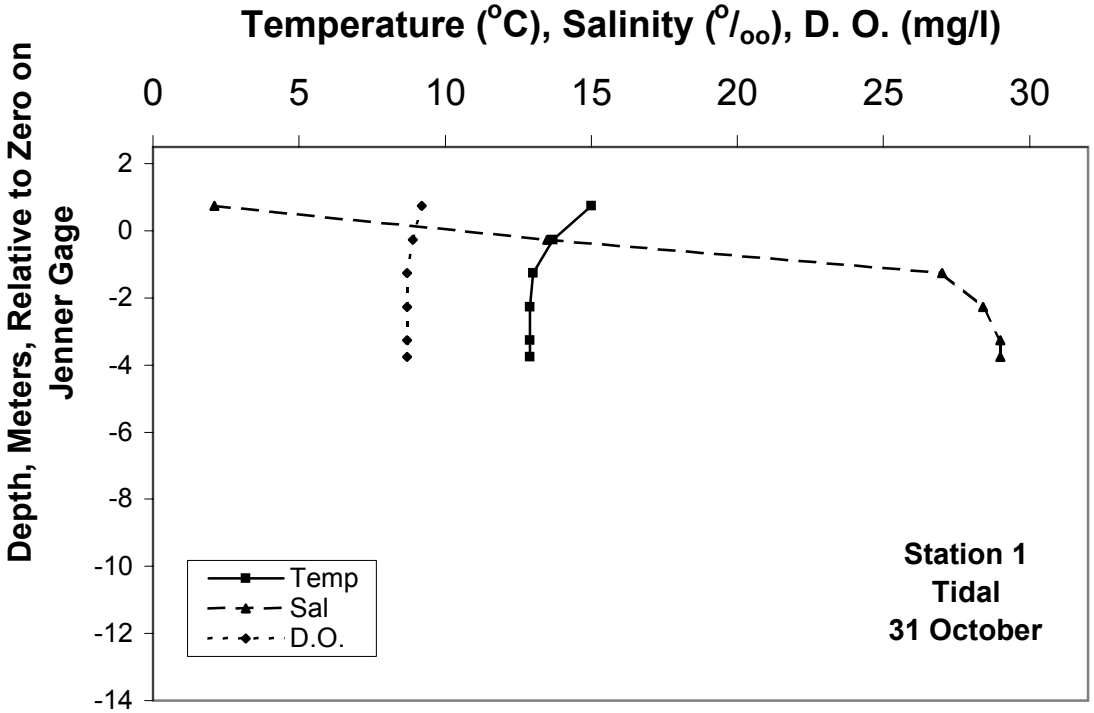

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Draining
28 October

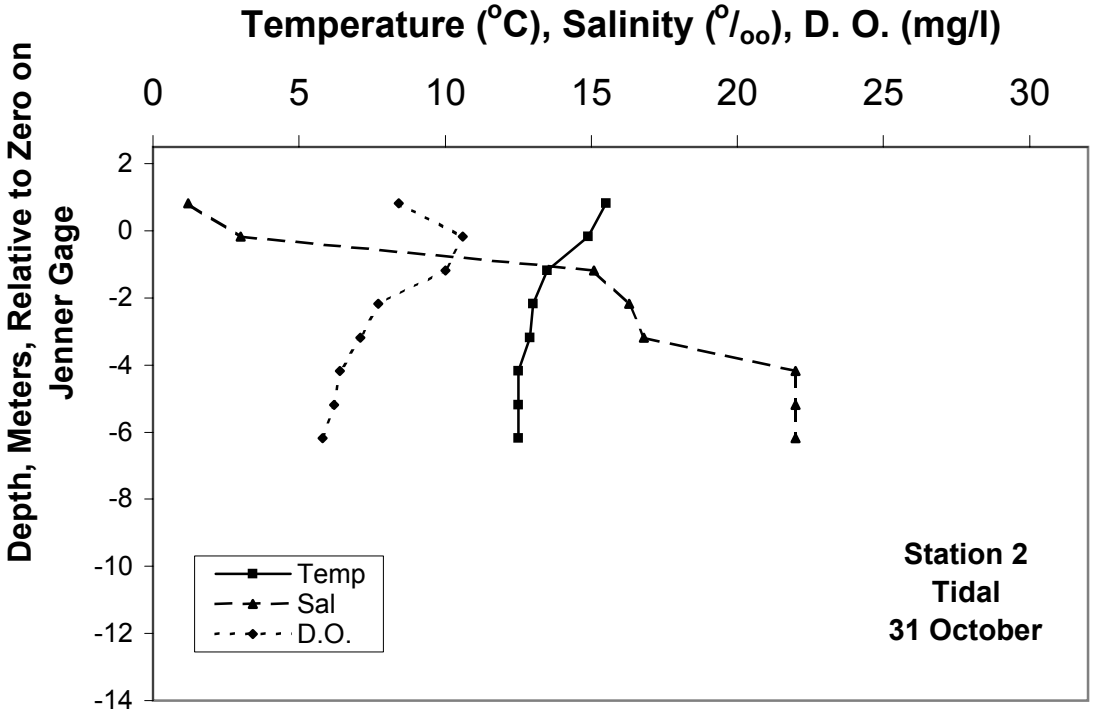

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Draining
28 October

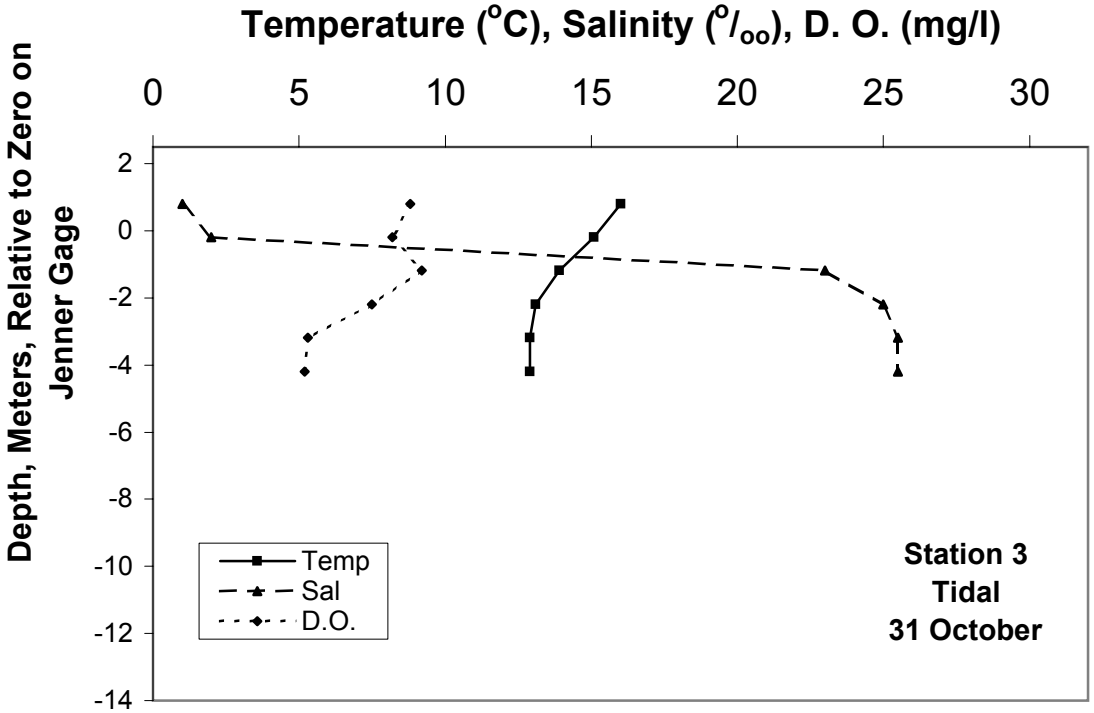

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 3
Draining
28 October

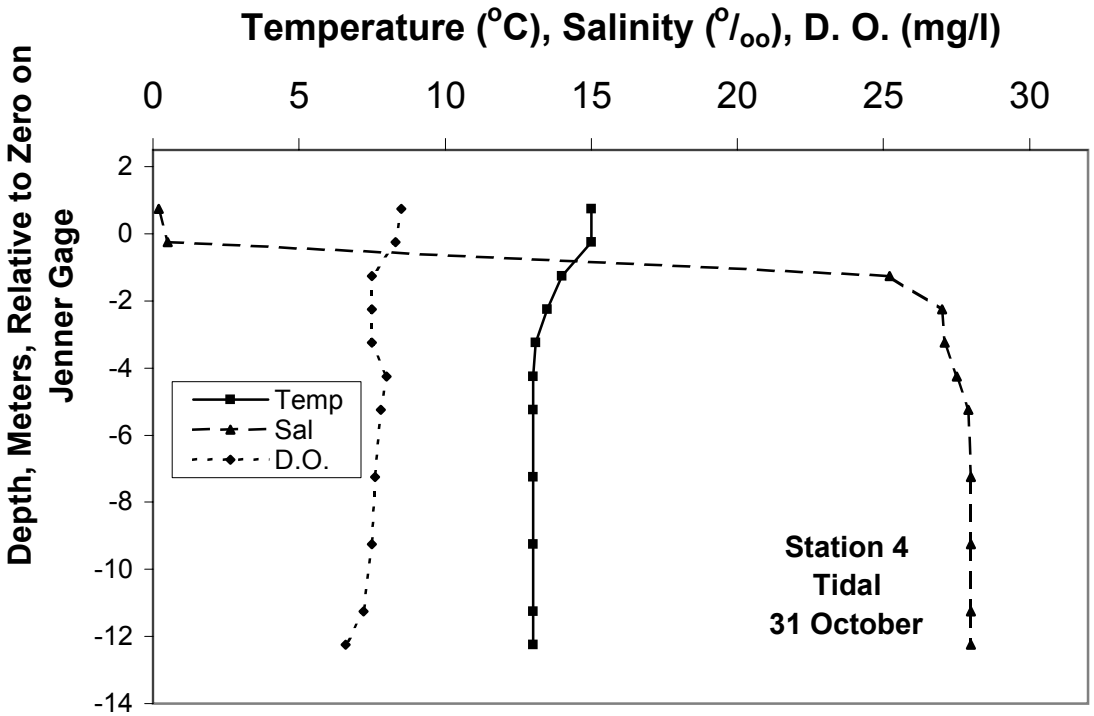
Appendix A-10. Draining Water Quality Profiles at Russian River Estuary Stations 1-4, Event III, 28 October 2000.

28-Oct-00																
	Station 1(1025 hr PDT)				Station 2 (1135 hr PDT)				Station 3 (1240 hr PDT)				Station 4 (hr PDT)			
	water level, m 0.79 (2.6 ft)				water level, m 1.11 (3.6 ft)				water level, m 1.10 (3.6 ft)				water level, m (ft)			
Depth Meters	Temp ºC	Sal º/oo	Cond µmho	D. O. ppm	Temp ºC	Sal º/oo	Cond µmho	D. O. ppm	Temp ºC	Sal º/oo	Cond µmho	D. O. ppm	Temp ºC	Sal º/oo	Cond µmho	D. O. ppm
0	12.0	28.0	32000	9.0	13.0	4.0	4000	9.1	14.0	8.0	10000	8.8	no profiles			
1	12.0	29.0	35000	9.0	13.0	25.9	38000	8.4	14.5	14.0	17000	8.2	(meter soaked in rain)			
2	12.0	30.0	35100	9.0	12.0	27.0	32200	8.4	14.5	24.5	30000	7.8				
3	11.9	31.0	35900	8.9	12.0	27.9	33000	8.6	13.0	26.0	31500	7.7				
4	11.0	31.0	35900	9.0	12.0	28.0	33000	8.5	13.0	26.0	31500	7.7				
5					12.0	28.0	33000	8.4	13.0	26.0	31500	7.8				
6					12.0	28.0	33200	8.4								
6.5					12.0	28.0	33000	8.4								


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Tidal
31 October


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Tidal
31 October


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Tidal
31 October


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Tidal
31 October

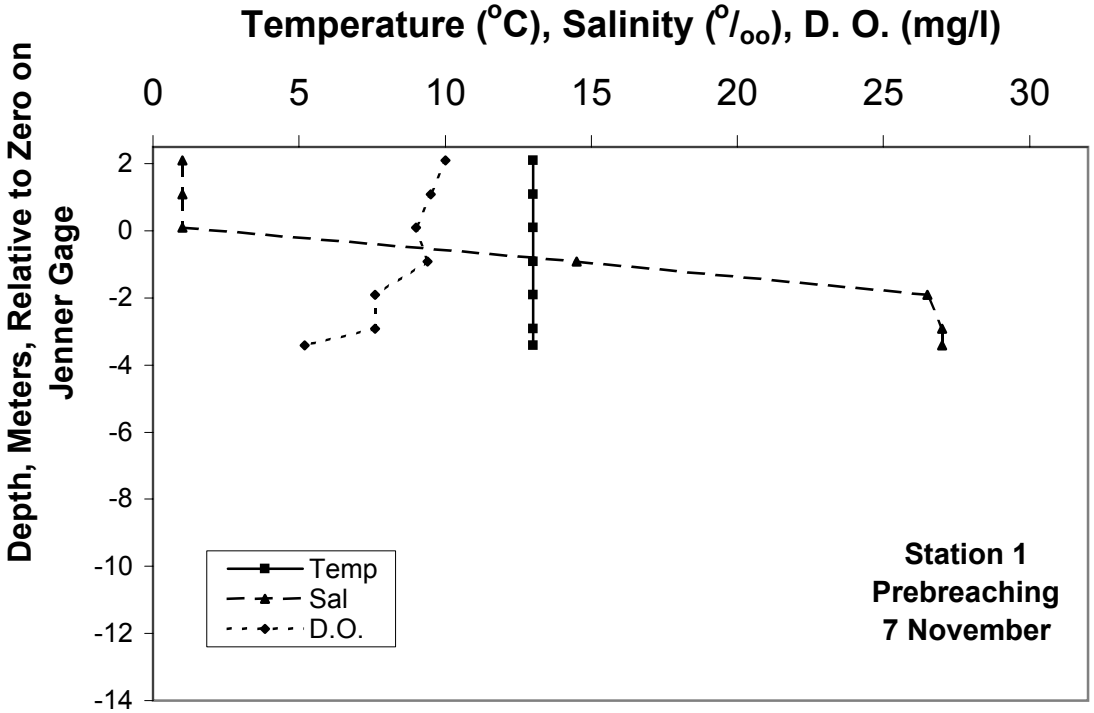
Appendix A-11. Tidal Water Quality Profiles at Russian River Estuary Stations 1-4, Event III, 31 October 2000.

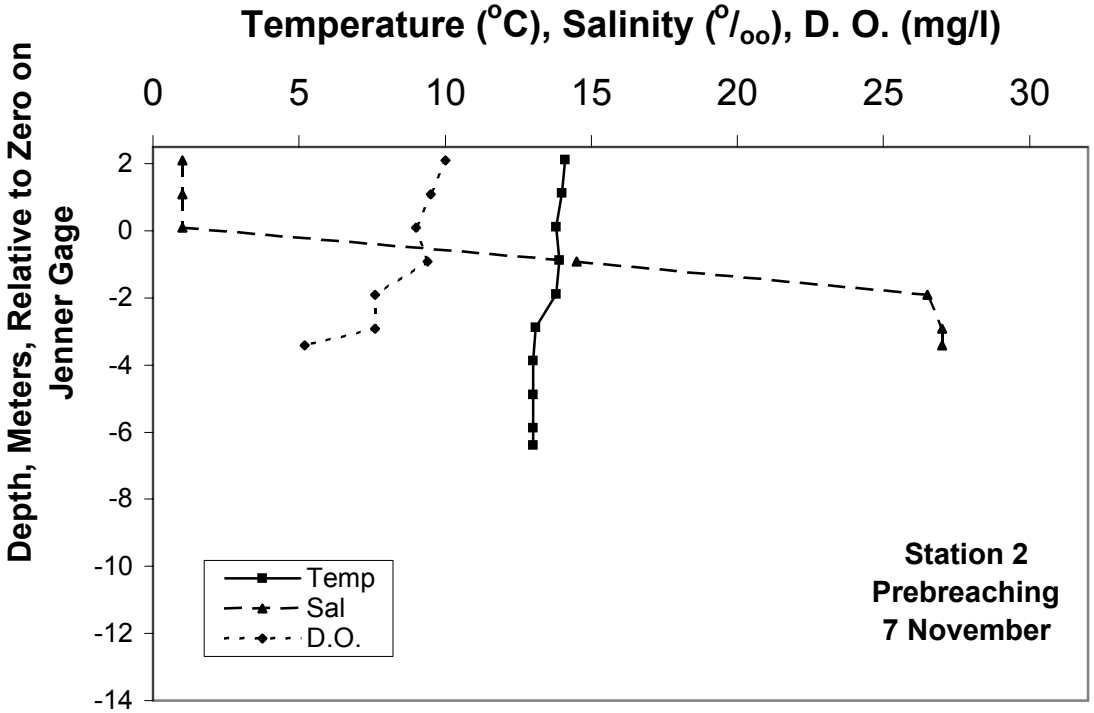
31-Oct-00																
	Station 1(1215 hr PST)				Station 2 (1405 hr PST)				Station 3 (1515 hr PST)				Station 4 (1700 hr PST)			
	water level, m		0.74	(2.4 ft)	water level, m		0.82	(2.7 ft)	water level, m		0.81	(2.7 ft)	water level, m		0.75	(2.5 ft)
Depth Meters	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm	Temp ᵛC	Sal °/₀₀	Cond μmho	D. O. ppm
0	15.0	2.1	3000	9.2	15.5	1.2	1980	8.4	16.0	1.0	1700	8.8	15.0	0.2	710	8.5
1	13.7	13.5	18000	8.9	14.9	3.0	3500	10.6	15.1	2.0	2900	8.2	15.0	0.5	770	8.3
2	13.0	27.0	33000	8.7	13.5	15.1	19500	10.0	13.9	23.0	29000	9.2	14.0	25.2	31500	7.5
3	12.9	28.4	34000	8.7	13.0	16.3	20800	7.7	13.1	25.0	30600	7.5	13.5	27.0	33000	7.5
4	12.9	29.0	34200	8.7	12.9	16.8	20800	7.1	12.9	25.5	31000	5.3	13.1	27.1	33000	7.5
4.5	12.9	29.0	34200	8.7	-	-	-	-	-	-	-	-	-	-	-	-
5					12.5	22.0	27000	6.4	12.9	25.5	31000	5.2	13.0	27.5	33200	8.0
6					12.5	22.0	27500	6.2					13.0	27.9	33200	7.8
7					12.5	22.0	25500	5.8					-	-	-	-
8													13.0	28.0	33500	7.6
9													-	-	-	-
10													13.0	28.0	33500	7.5
11													-	-	-	-
12													13.0	28.0	33800	7.2
13													13.0	28.0	34000	6.6

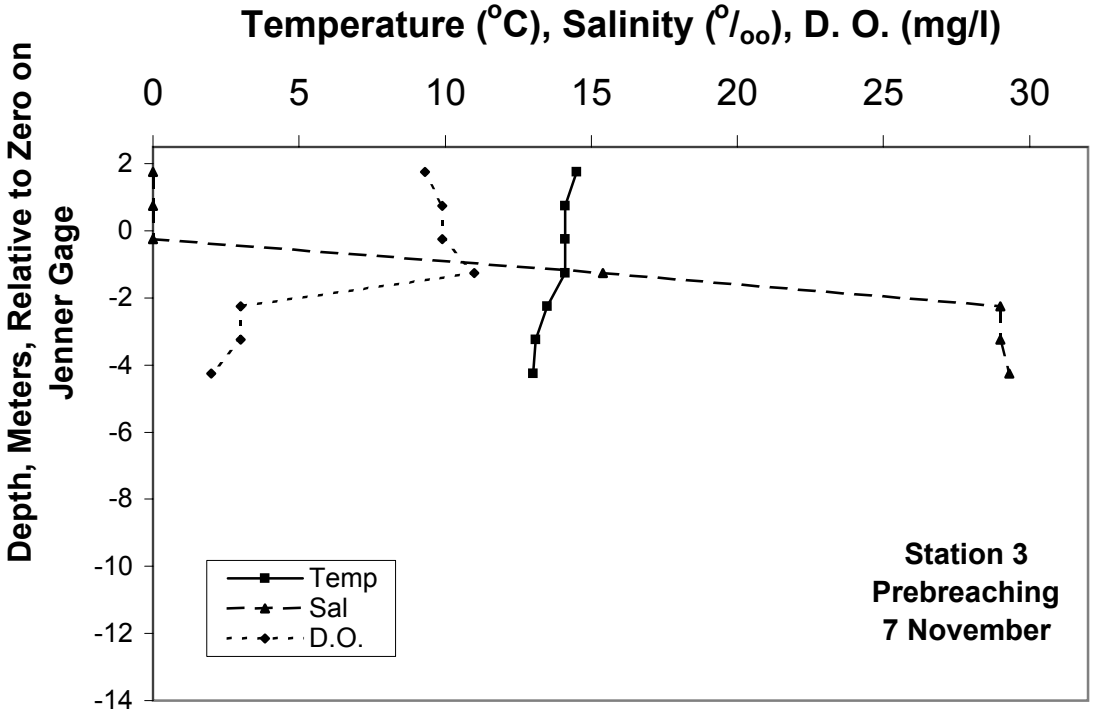
Appendix A-12. Water Quality Profiles in Willow Creek at Stations Near its Confluence with the Russian River During Event III, Breached 27 October 2000.

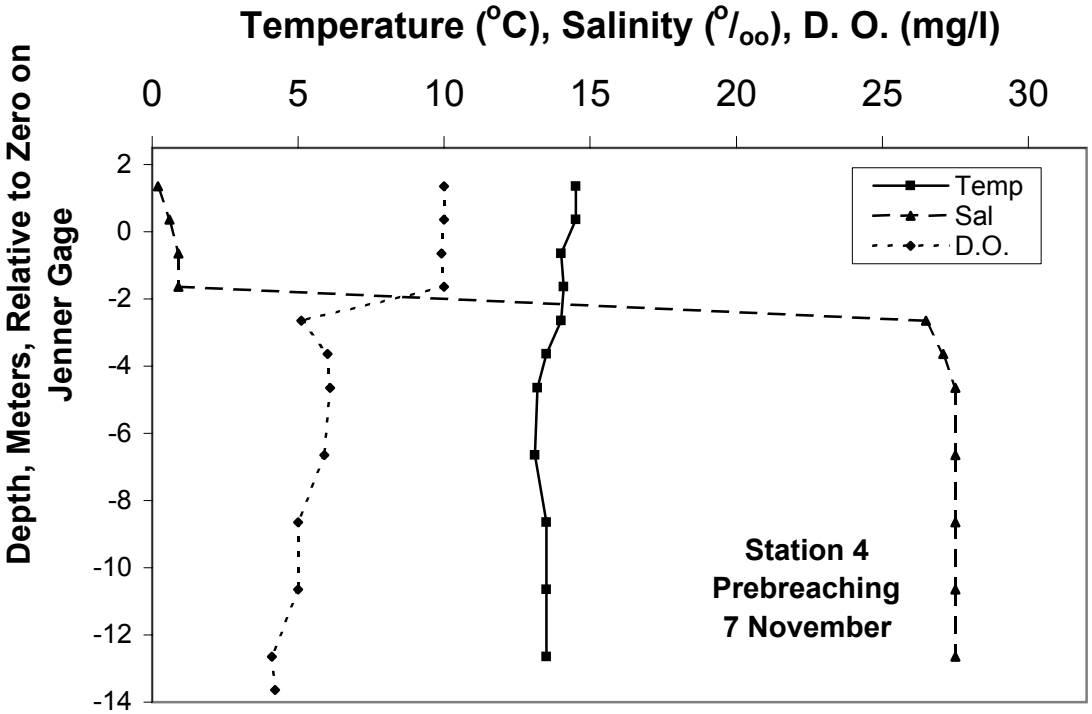
Station 3A (0.5 km upstream of bridge)												
	Prebreaching Survey 26 October (1425 hr PDT)				Draining Survey 28 October (1307 hr PDT)				Tidal Survey 31 October (1500 hr PST)			
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	14.9	1.5	2000	9.4	12.5	0.1	600	6.6	11.9	0.0	280	8.3
1	14.8	2.1	2000	9.0	13.0	1.0	1400	5.8	11.9	0.0	400	8.3
1.5	-	-	-	-	14.0	6.3	8500	1.3	11.9	0.4	720	6.2
2	15.0	8.1	11100	10.0								

Station 3AA (near bridge)												
Depth Meters												
0												
0.9												


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Prebreaching
7 November

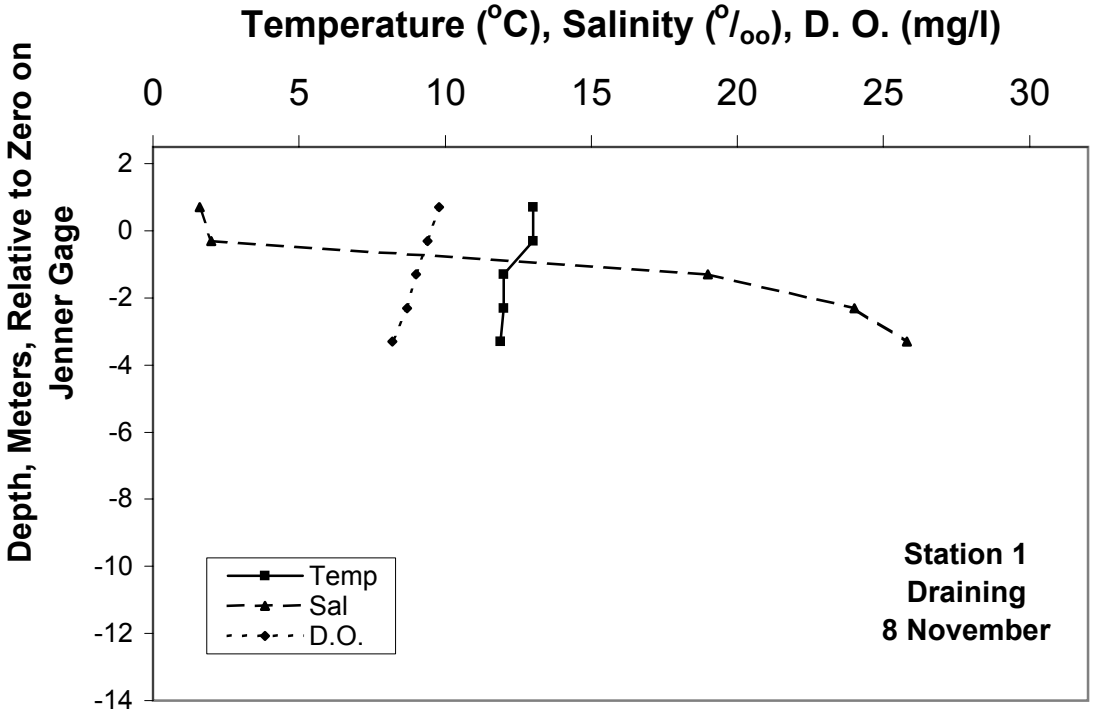

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Prebreaching
7 November

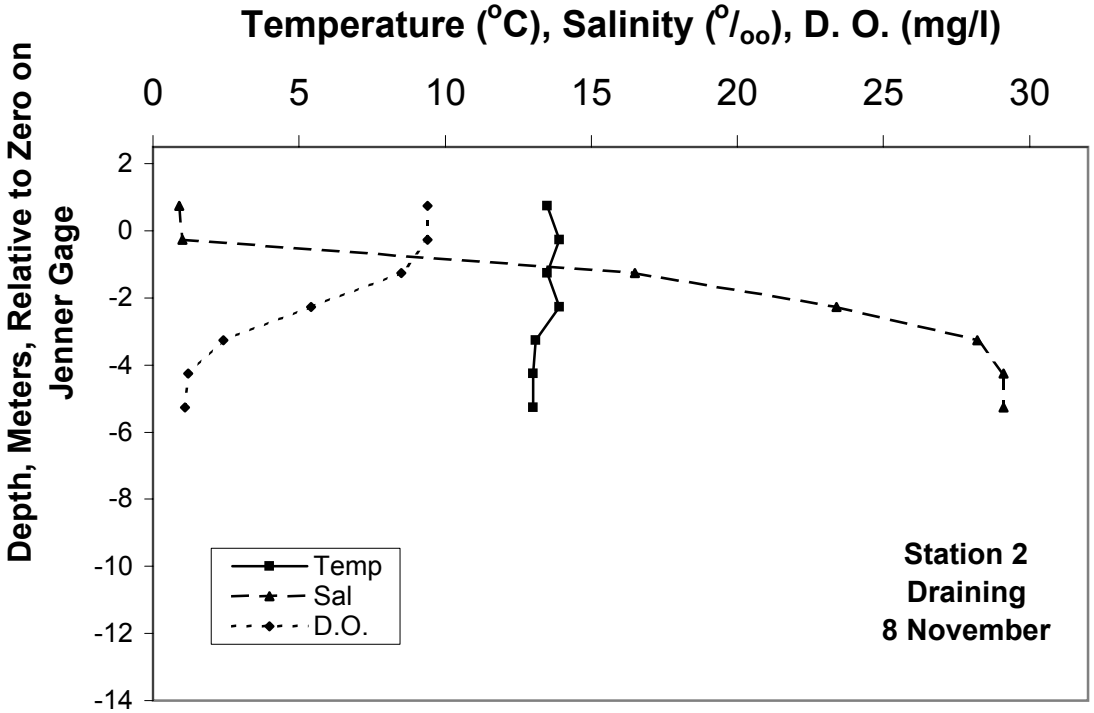

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Prebreaching
7 November

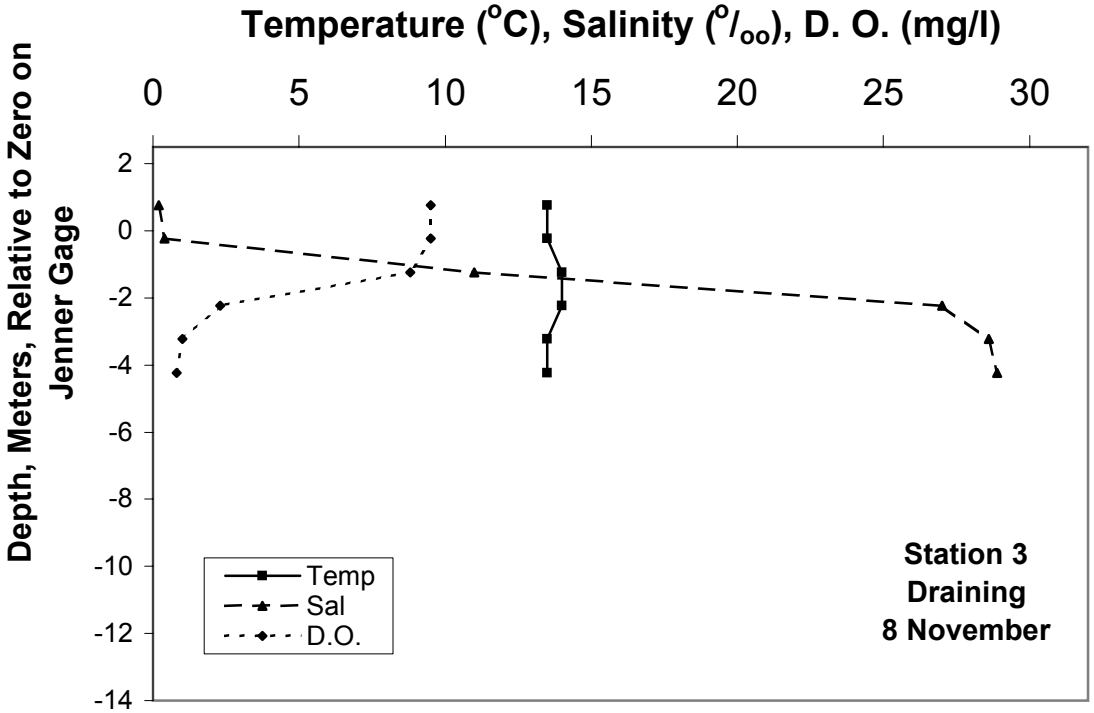

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 4
Prebreaching
7 November

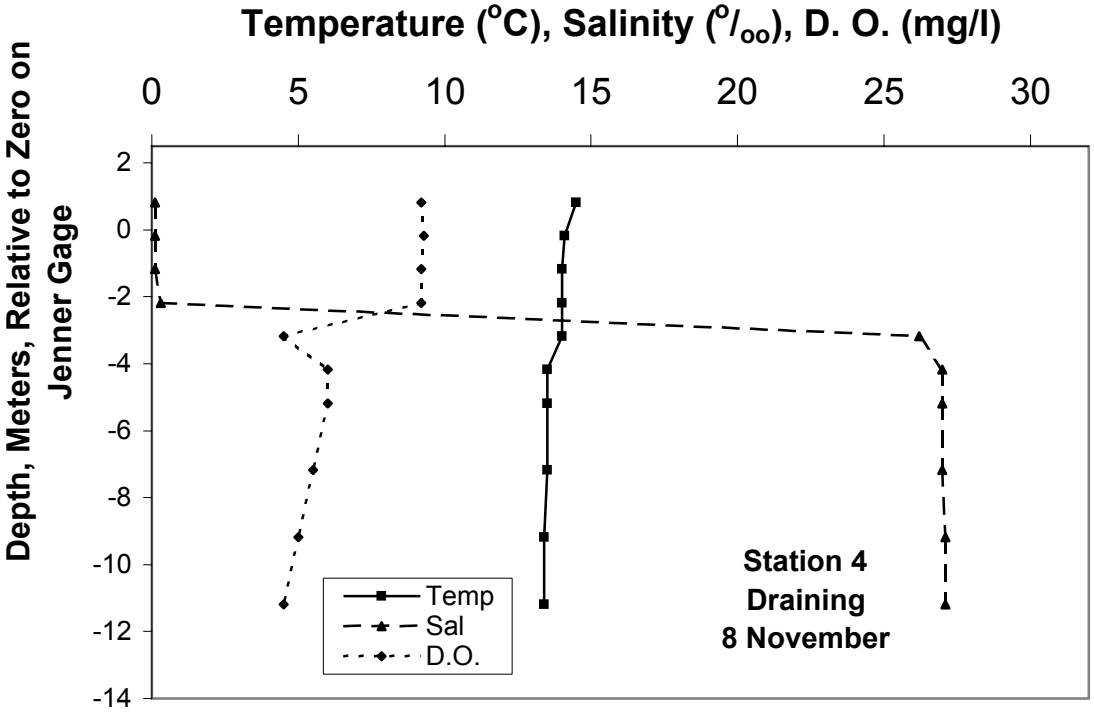
Appendix A-13. Prebreaching Water Quality Profiles at Russian River Estuary Stations 1-4, Event IV, 7 November 2000.

7-Nov-00																
	Station 1(1040 hr PST)				Station 2 (1140 hr PST)				Station 3 (1345 hr PST)				Station 4 (1525 hr PST)			
	water level, m		2.09	(6.9 ft)	water level, m		2.12	(7.0 ft)	water level, m		1.75	(5.7 ft)	water level, m		1.36	(4.5 ft)
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	13.0	1.0	1500	10.0	14.1	0.0	400	10.0	14.5	0.0	390	9.3	14.5	0.2	1000	10.0
1	13.0	1.0	1500	9.5	14.0	0.0	400	9.9	14.1	0.0	390	9.9	14.5	0.6	1000	10.0
2	13.0	1.0	1700	9.0	13.8	1.0	1700	9.8	14.1	0.0	390	9.9	14.0	0.9	1200	9.9
3	13.0	14.5	18000	9.4	13.9	14.0	18200	10.8	14.1	15.4	20400	11.0	14.1	0.9	2700	10.0
4	13.0	26.5	33000	7.6	13.8	27.0	33000	5.1	13.5	29.0	35000	3.0	14.0	26.5	33000	5.1
5	13.0	27.0	33000	7.6	13.1	29.5	35100	2.3	13.1	29.0	35100	3.0	13.5	27.1	33000	6.0
5.5	13.0	27.0	33100	5.2	-	-	-	-	-	-	-	-	-	-	-	-
6					13.0	30.0	35500	1.2	13.0	29.3	35100	2.0	13.2	27.5	33200	6.1
7					13.0	30.0	35500	1.1					-	-	-	-
8					13.0	30.0	35500	1.0					13.1	27.5	33200	5.9
8.5					13.0	30.0	35400	0.9					-	-	-	-
9													-	-	-	-
10													13.5	27.5	33500	5.0
11													-	-	-	-
12													13.5	27.5	33500	5.0
13													-	-	-	-
14													13.5	27.5	33500	4.1
15													-	-	-	4.2


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 1
Draining
8 November

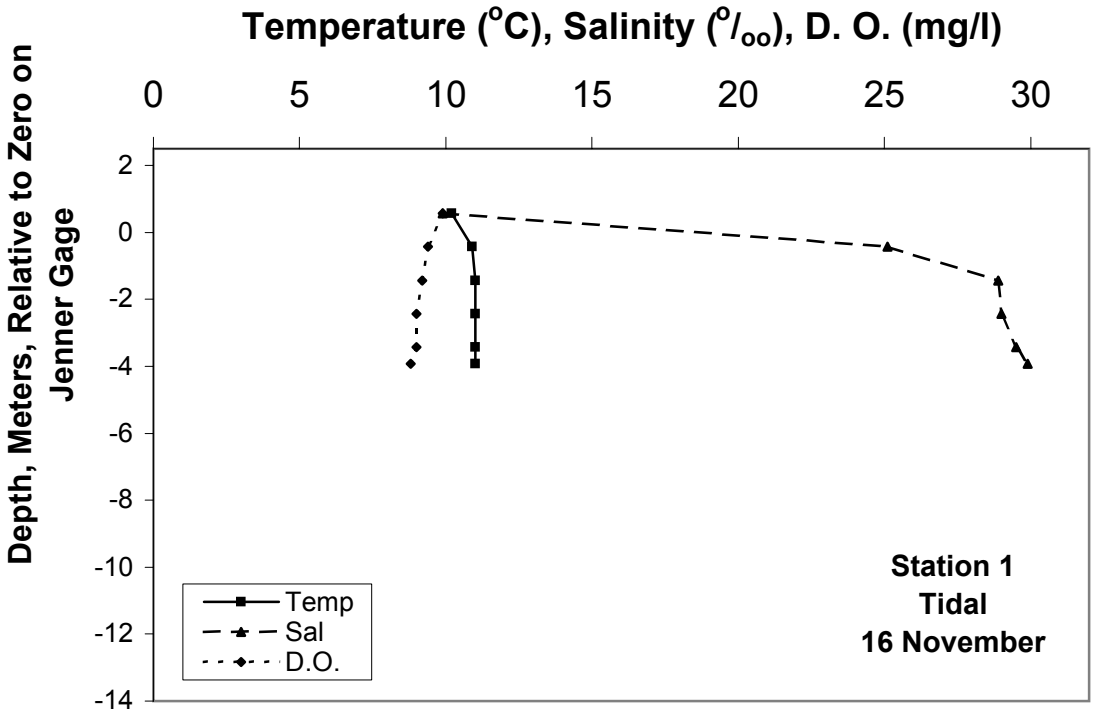

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 2
Draining
8 November

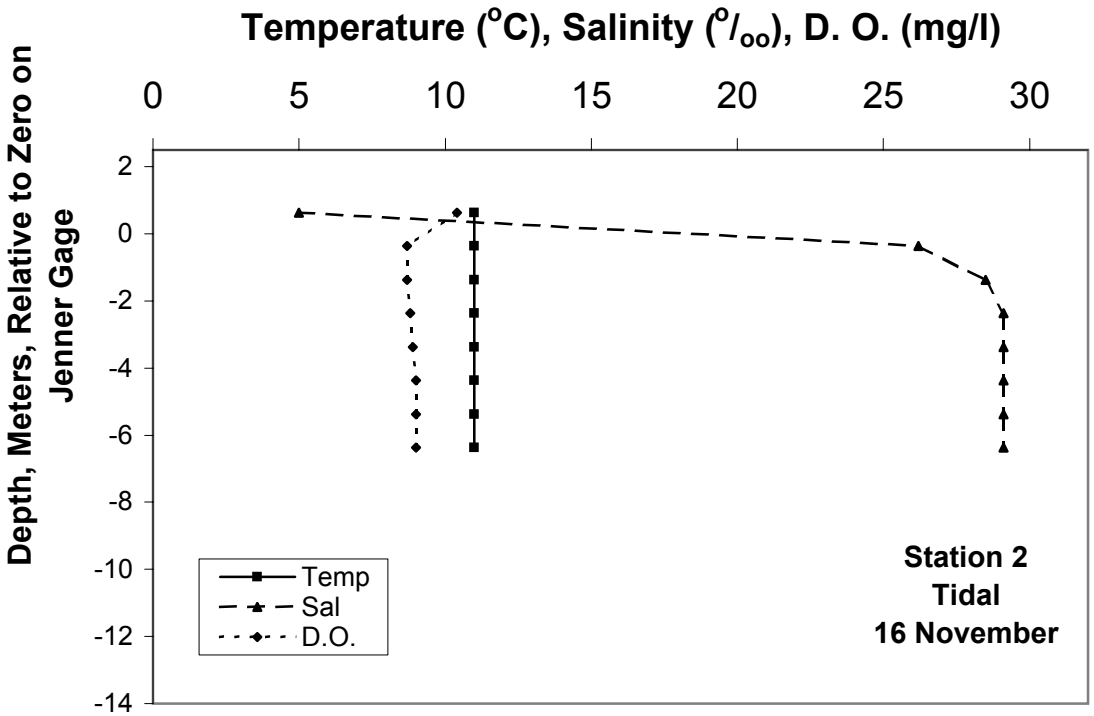

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Draining
8 November

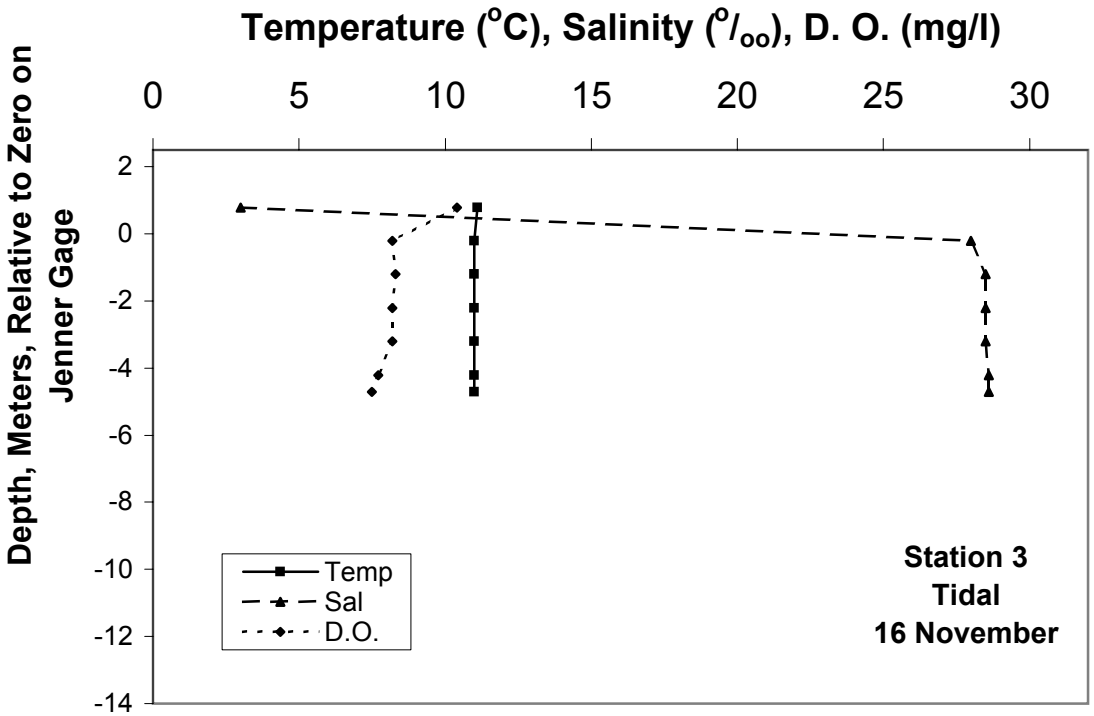

Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 4
Draining
8 November

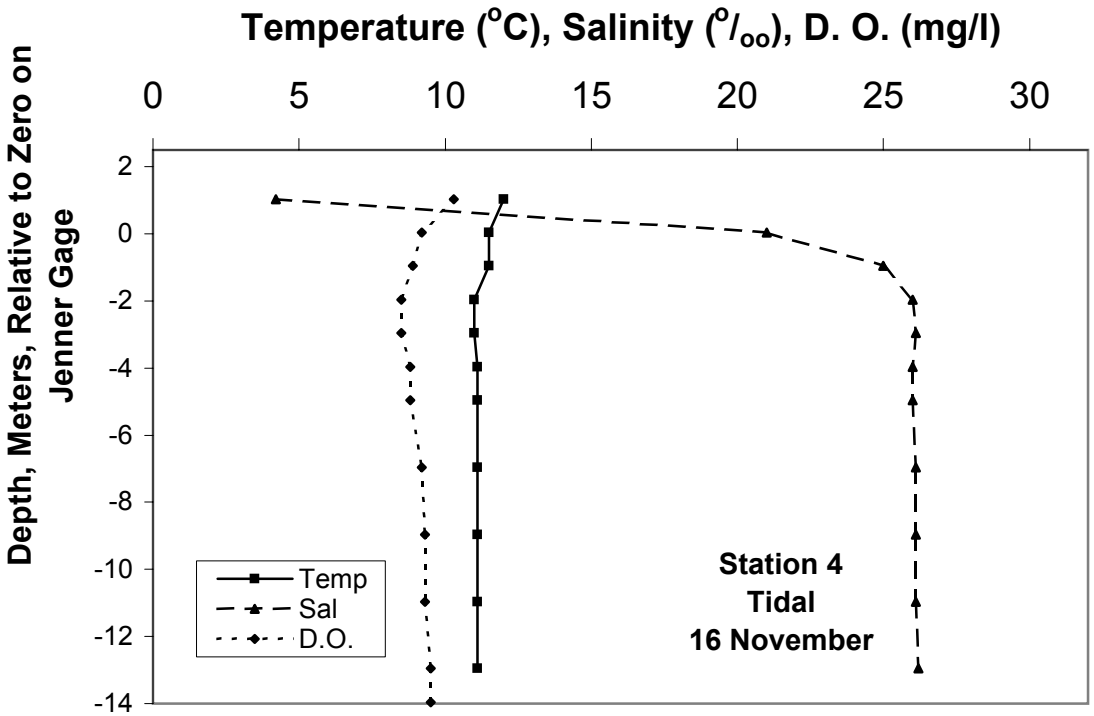
Appendix A-14. Draining Water Quality Profiles at Russian River Estuary Stations 1-4, Event IV, 8 November 2000.

8-Nov-00																
	Station 1(0945 hr PST)				Station 2 (1100 hr PST)				Station 3 (1155 hr PST)				Station 4 (1420 hr PST)			
	water level, m		0.7	(2.3 ft)	water level, m		0.74	(2.4 ft)	water level, m		0.77	(2.5 ft)	water level, m		0.82	(2.7 ft)
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	13.0	1.6	2310	9.8	13.5	0.9	1280	9.4	13.5	0.2	800	9.5	14.5	0.1	590	9.2
1	13.0	2.0	2500	9.4	13.9	1.0	1320	9.4	13.5	0.4	800	9.5	14.1	0.1	570	9.3
2	12.0	19.0	24000	9.0	13.5	16.5	22000	8.5	14.0	11.0	14000	8.8	14.0	0.1	650	9.2
3	12.0	24.0	28500	8.7	13.9	23.4	30000	5.4	14.0	27.0	33000	2.3	14.0	0.3	750	9.2
4	11.9	25.8	30100	8.2	13.1	28.2	35000	2.4	13.5	28.6	34900	1.0	14.0	26.2	33000	4.5
5					13.0	29.1	35100	1.2	13.5	28.9	34900	0.8	13.5	27.0	33000	6.0
6					13.0	29.1	35100	1.1					13.5	27.0	33300	6.0
7													-	-	-	-
8													13.5	27.0	33200	5.5
9													-	-	-	-
10													13.4	27.1	33200	5.0
11													-	-	-	-
12													13.4	27.1	33500	4.5


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 1
Tidal
16 November


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 2
Tidal
16 November


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
2
0
-2
-4
-6
-8
-10
-12
-14
Depth, Meters, Relative to Zero on Jenner Gage
Temp
Sal
D.O.
Station 3
Tidal
16 November


Temperature (°C), Salinity (°/oo), D. O. (mg/l)
0
5
10
15
20
25
30
Depth, Meters, Relative to Zero on Jenner Gage
2
0
-2
-4
-6
-8
-10
-12
-14
Temp
Sal
D.O.
Station 4
Tidal
16 November

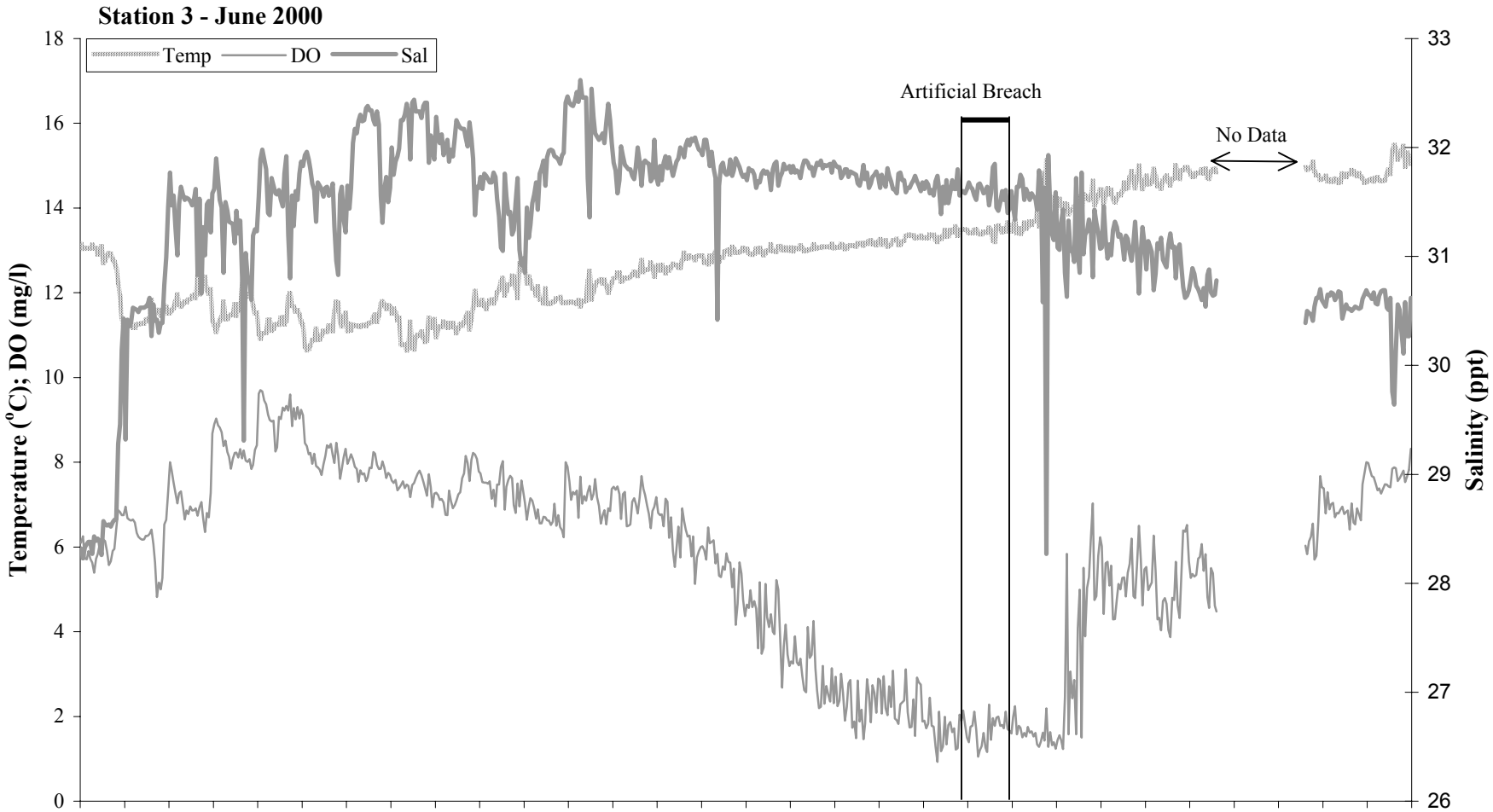
Appendix A-15. Tidal Water Quality Profiles at Russian River Estuary Stations 1-4, Event IV, 16 November 2000.

16-Nov-00																
	Station 1(0955 hr PST)				Station 2 (1110 hr PST)				Station 3 (1210 hr PST)				Station 4 (1430 hr PST)			
	water level, m		0.57	(1.9 ft)	water level, m		0.63	(2.1 ft)	water level, m		0.79	(2.6 ft)	water level, m		1.04	(3.4 ft)
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	10.2	9.9	12100	9.9	11.0	5.0	6000	10.4	11.1	3.0	3900	10.4	12.0	4.2	5500	10.3
1	10.9	25.1	29100	9.4	11.0	26.2	30900	8.7	11.0	28.0	32500	8.2	11.5	21.0	25000	9.2
2	11.0	28.9	33000	9.2	11.0	28.5	32800	8.7	11.0	28.5	33000	8.3	11.5	25.0	29000	8.9
3	11.0	29.0	33500	9.0	11.0	29.1	33500	8.8	11.0	28.5	33000	8.2	11.0	26.0	30000	8.5
4	11.0	29.5	33900	9.0	11.0	29.1	33500	8.9	11.0	28.5	33000	8.2	11.0	26.1	30200	8.5
4.5	11.0	29.9	34000	8.8	-	-	-	-	-	-	-	-	-	-	-	-
5					11.0	29.1	33500	9.0	11.0	28.6	33000	7.7	11.1	26.0	30200	8.8
5.5					-	-	-	-	11.0	28.6	33000	7.5	-	-	-	-
6					11.0	29.1	33500	9.0					11.1	26.0	30200	8.8
7					11.0	29.1	33500	9.0					-	-	-	-
8													11.1	26.1	30800	9.2
9													-	-	-	-
10													11.1	26.1	30800	9.3
11													-	-	-	-
12													11.1	26.1	30800	9.3
13													-	-	-	-
14													11.1	26.2	30900	9.5
15													-	-	-	9.5

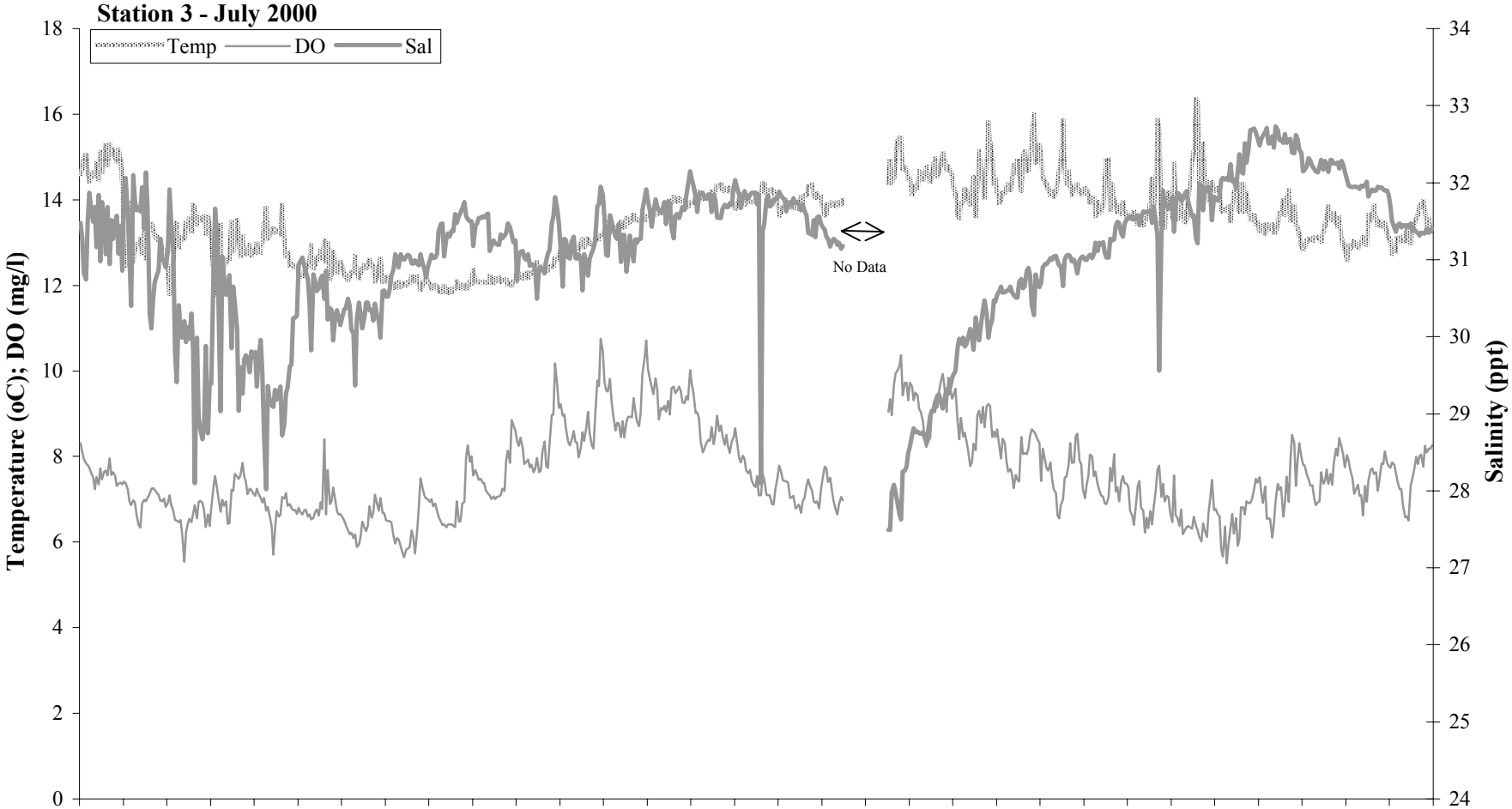
Appendix A-16. Water Quality Profiles in Willow Creek at Stations Near its Confluence with the Russian River During Event IV, Breached 7 November 2000.

Station 3A (0.5 km upstream of bridge)												
	Prebreaching Survey 7 November (1325 hr PST)				Draining Survey 8 November (1220 hr PST)				Tidal Survey 16 November (1255 hr PDS)			
Depth Meters	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm	Temp ˚C	Sal °/oo	Cond µmho	D. O. ppm
0	12.9	0.0	300	5.9	10.5	0.2	520	7.3	9.9	1.0	1800	9.4
1	12.1	0.0	300	5.9	10.3	0.1	510	7.4	10.0	5.8	7000	9.8
1.5	-	-	-	-					10.0	6.0	7500	9.0
2	12.0	0.0	300	5.9								

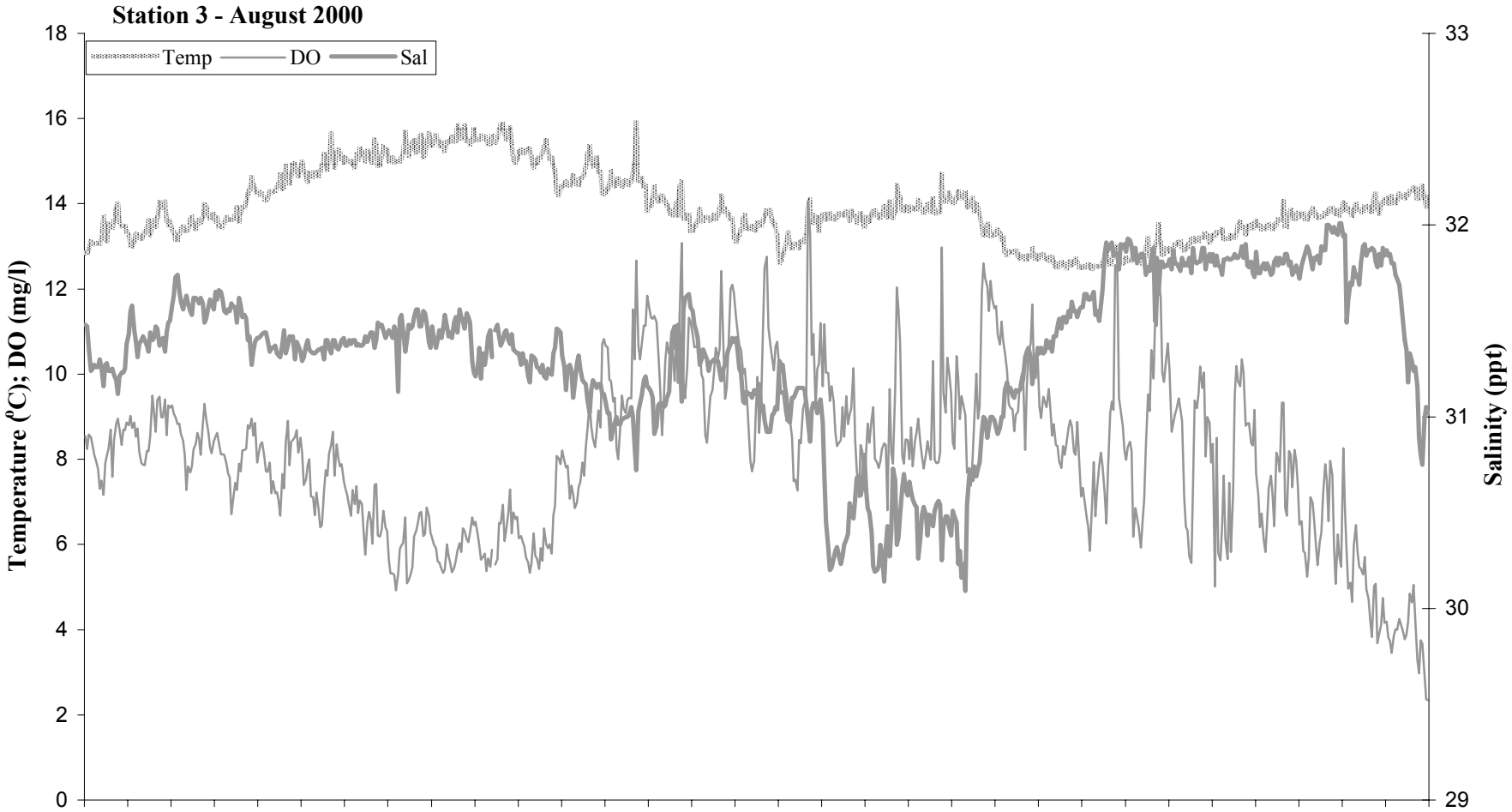
Station 3AA (near bridge)												
Depth Meters												
0												
0.9												



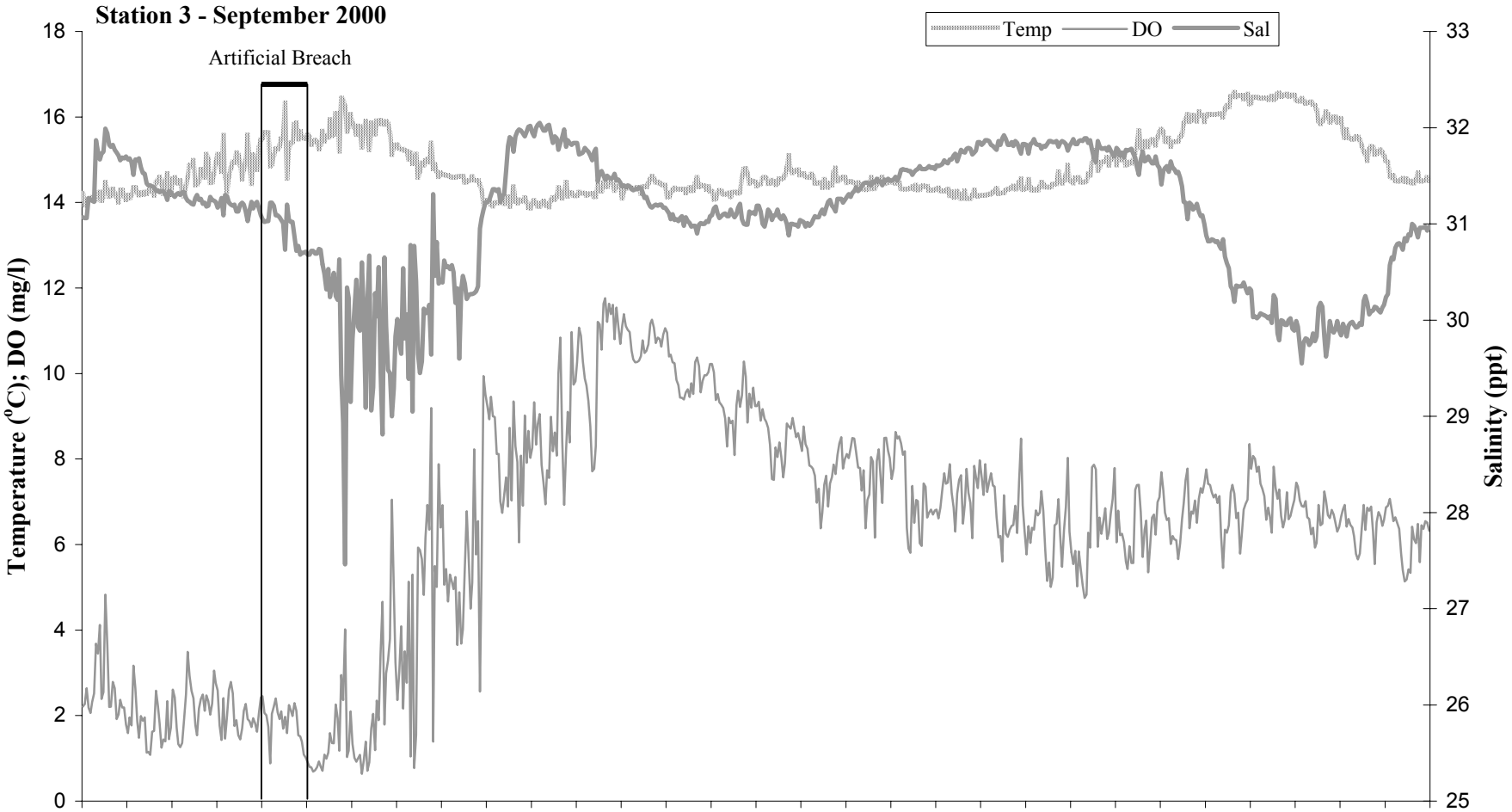
Appendix A-17. Minisonde Records at Station 3, June 2000.



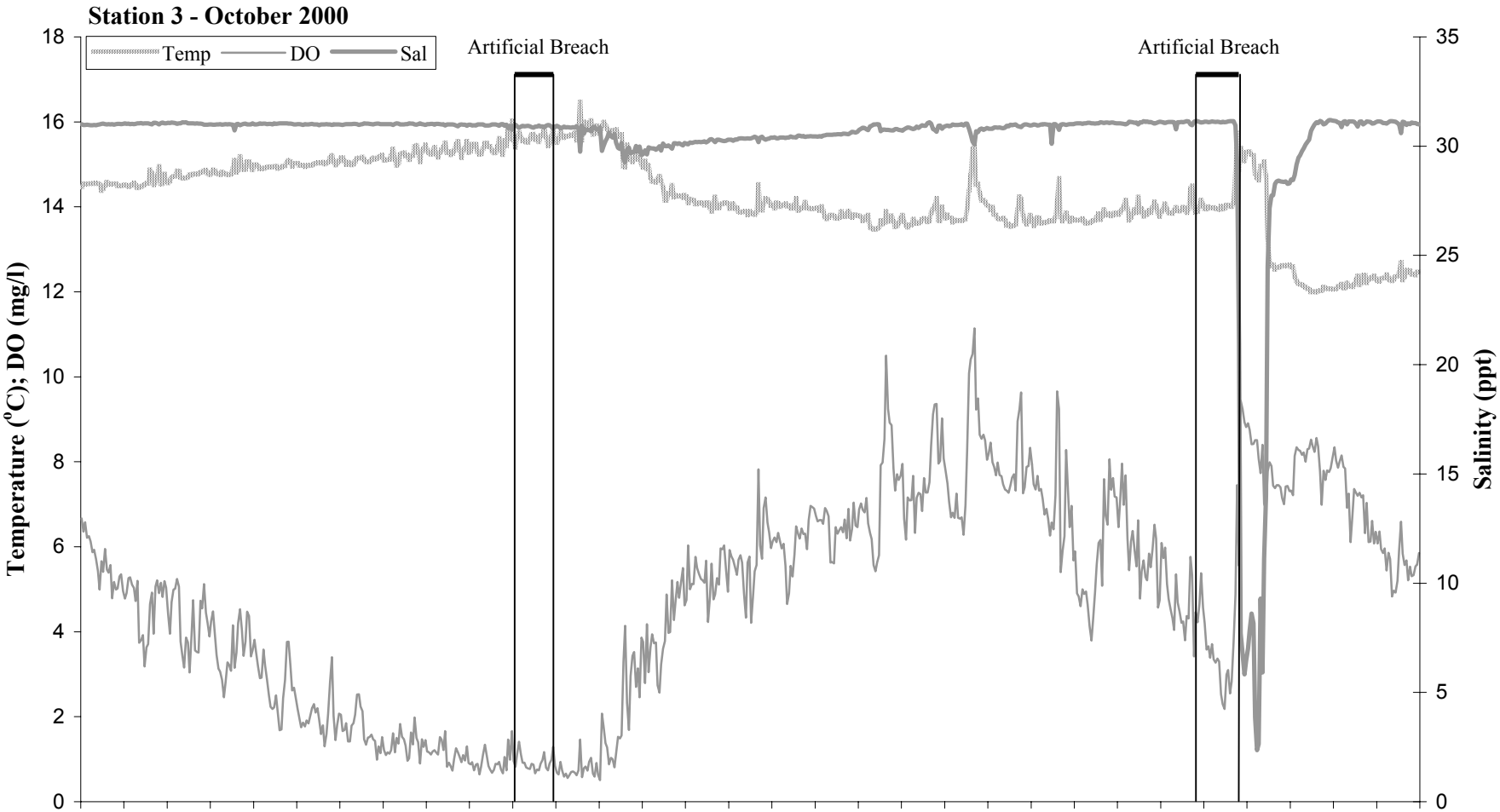
Appendix A-18. Minisonde Records at Station 3, July 2000.



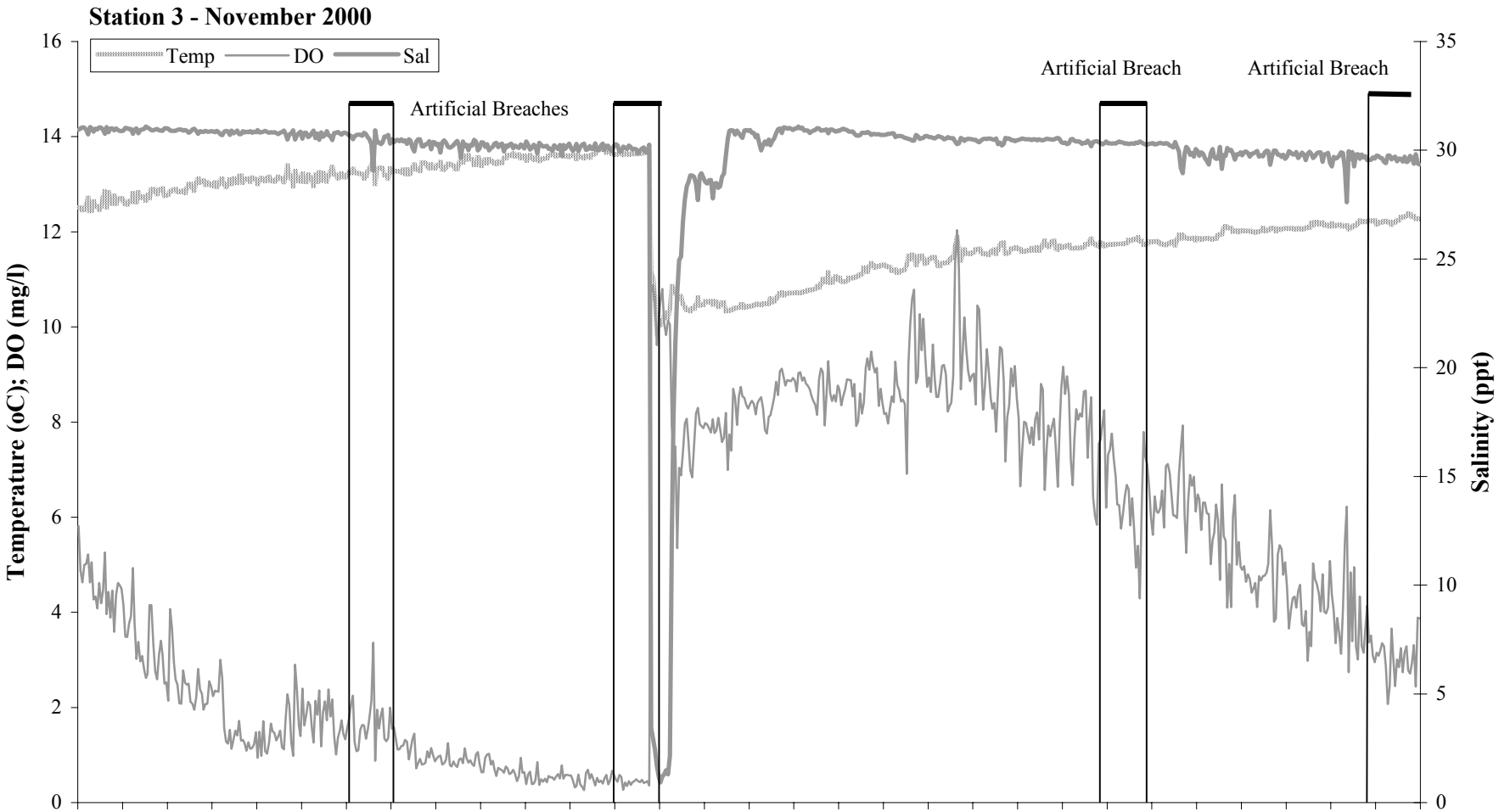
Appendix A-19. Minisonde Records at Station 3, August 2000.



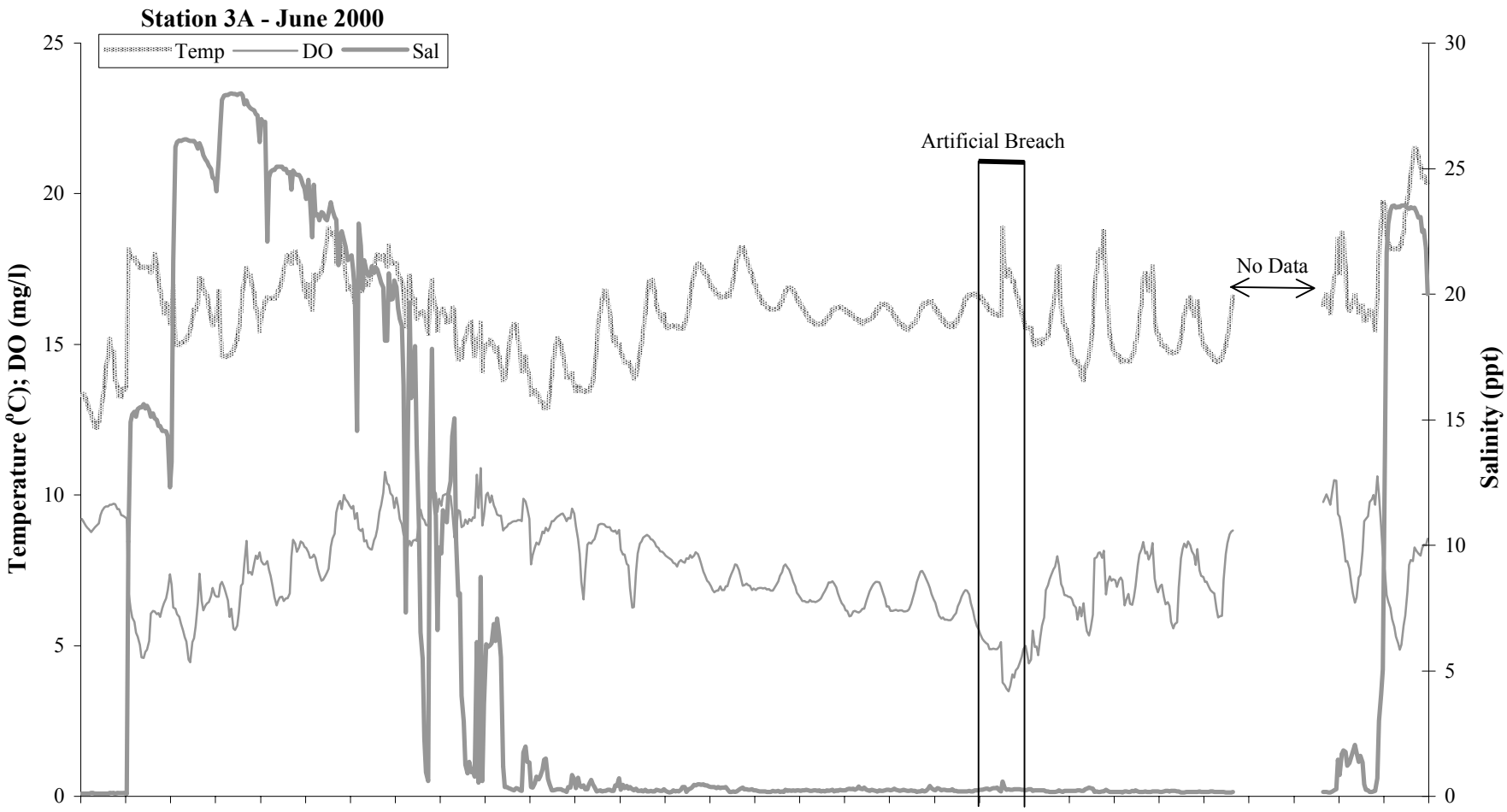
Appendix A-20. Minisonde Records at Station 3, September 2000.



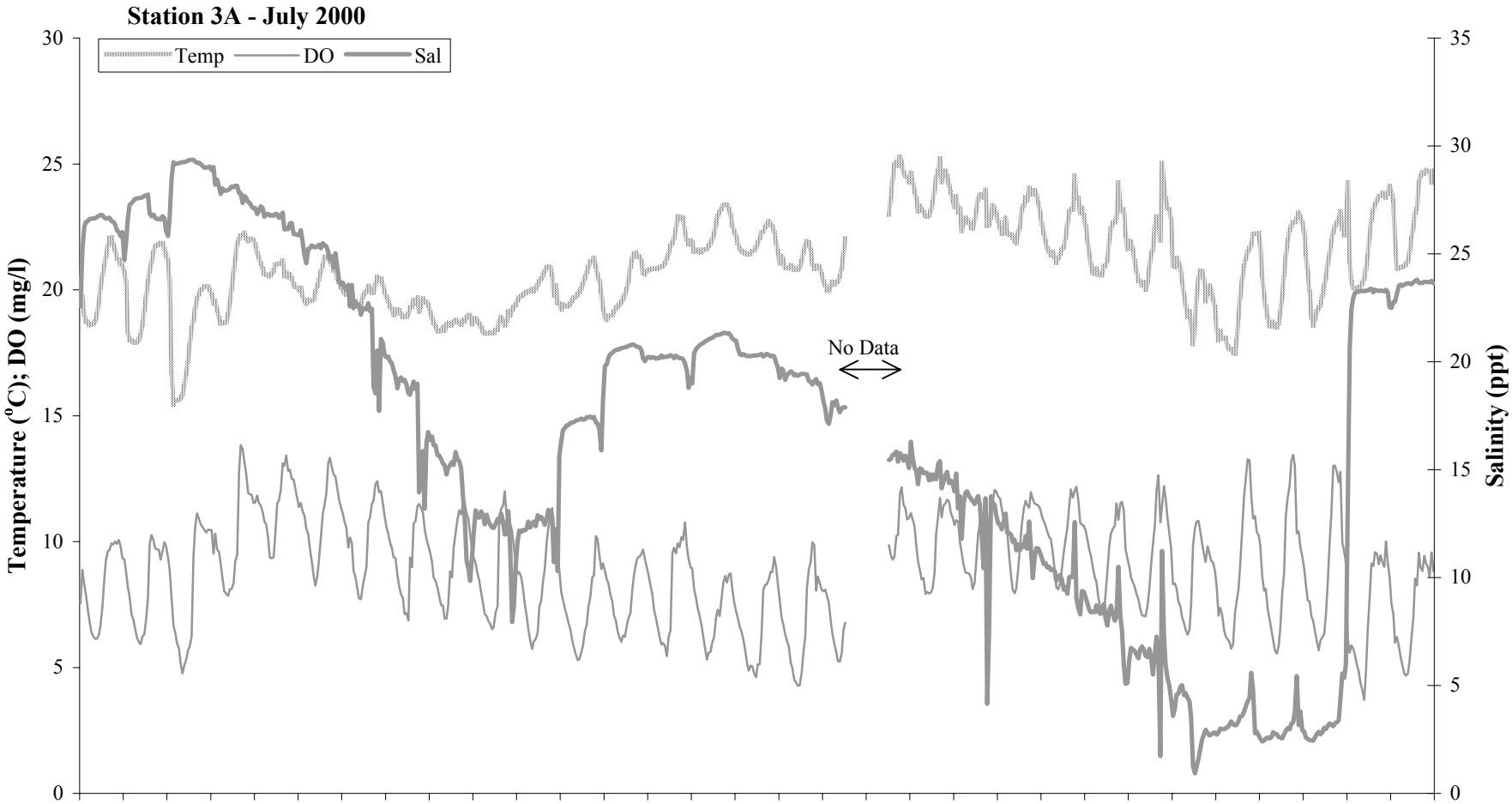
Appendix A-21. Minisonde Records at Station 3, October 2000.



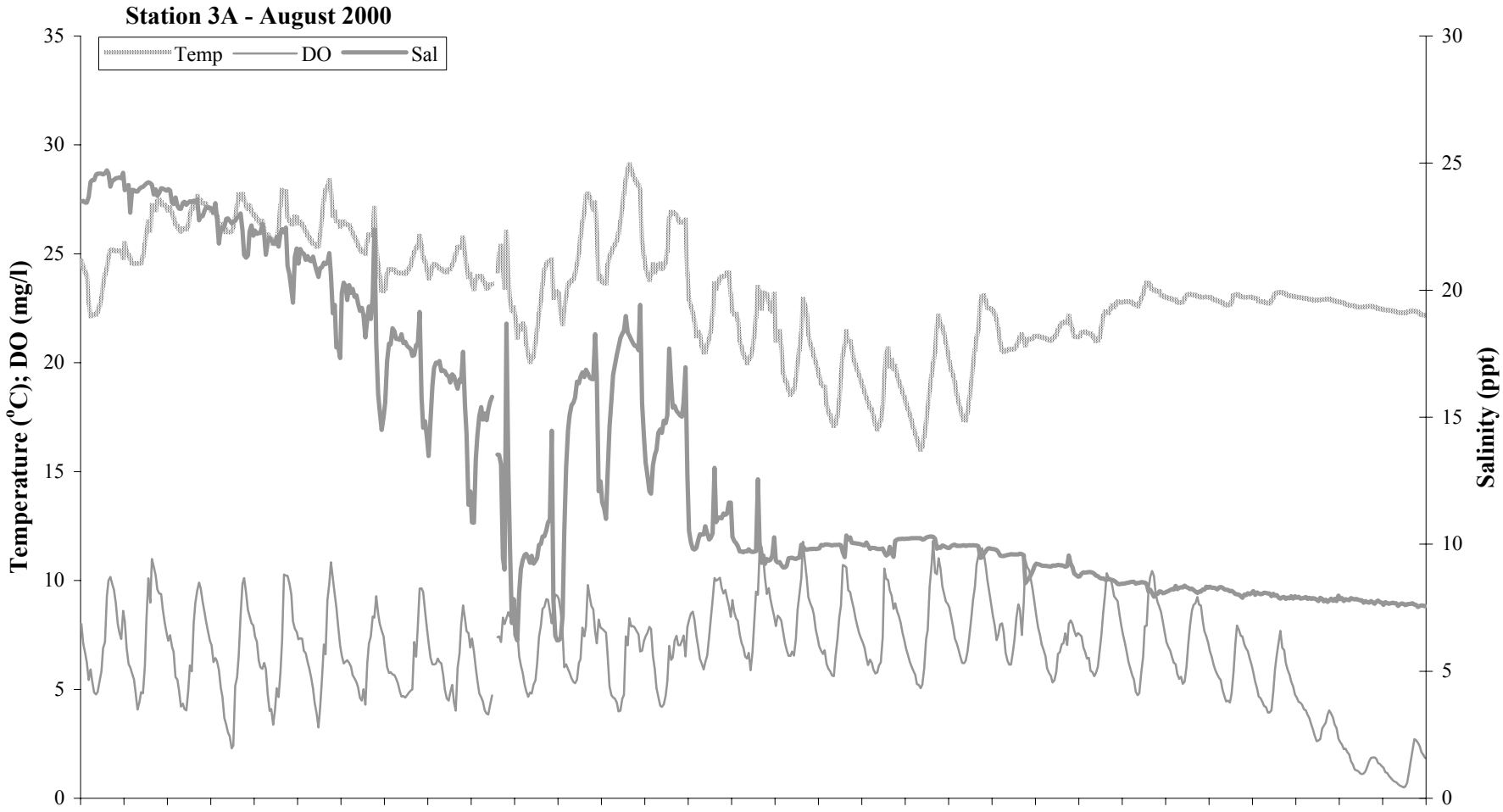
Appendix A-22. Minisonde Records at Station 3, November 2000.



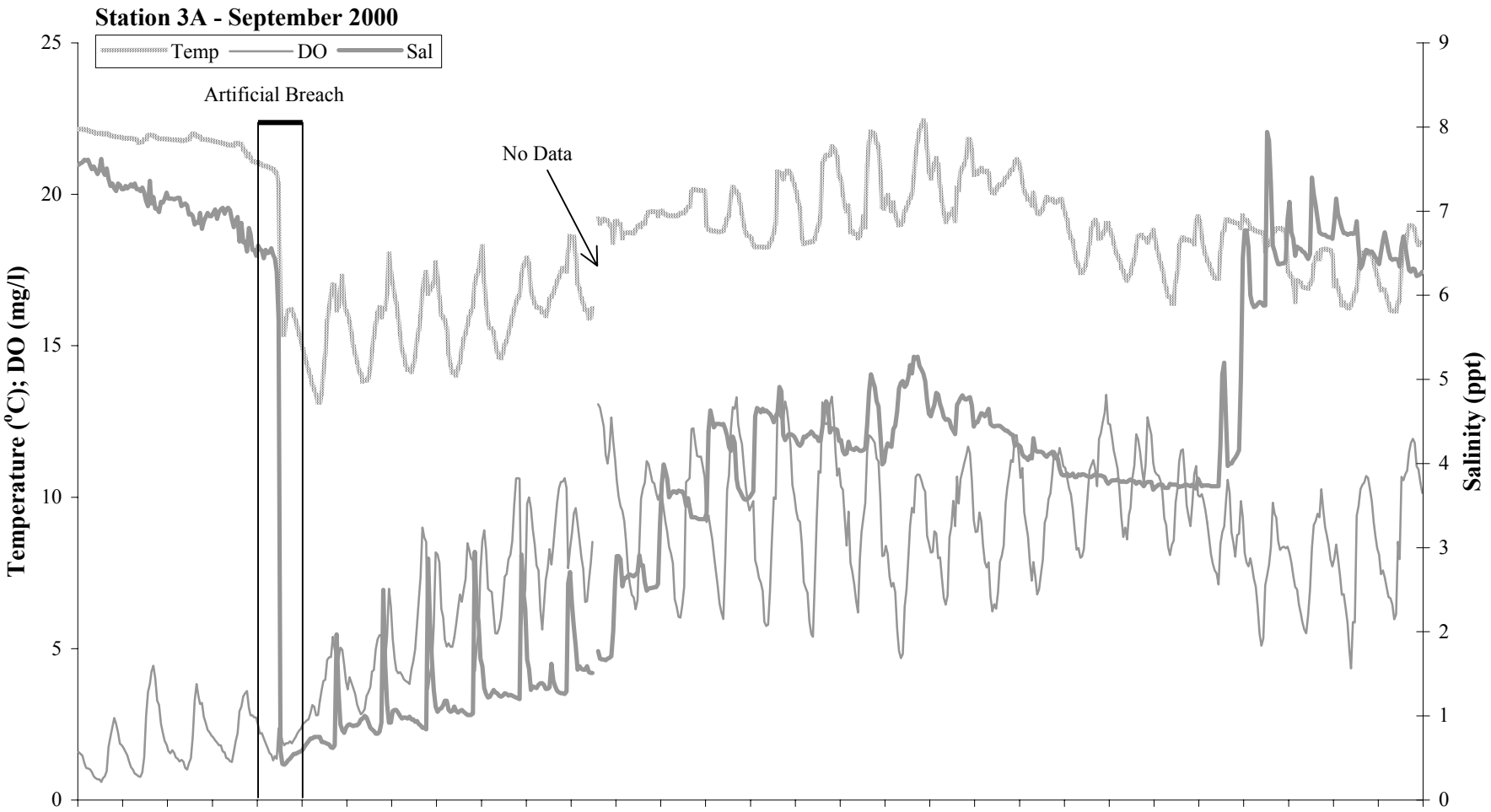
Appendix A-23. Minisonde Records at Station 3A, June 2000.



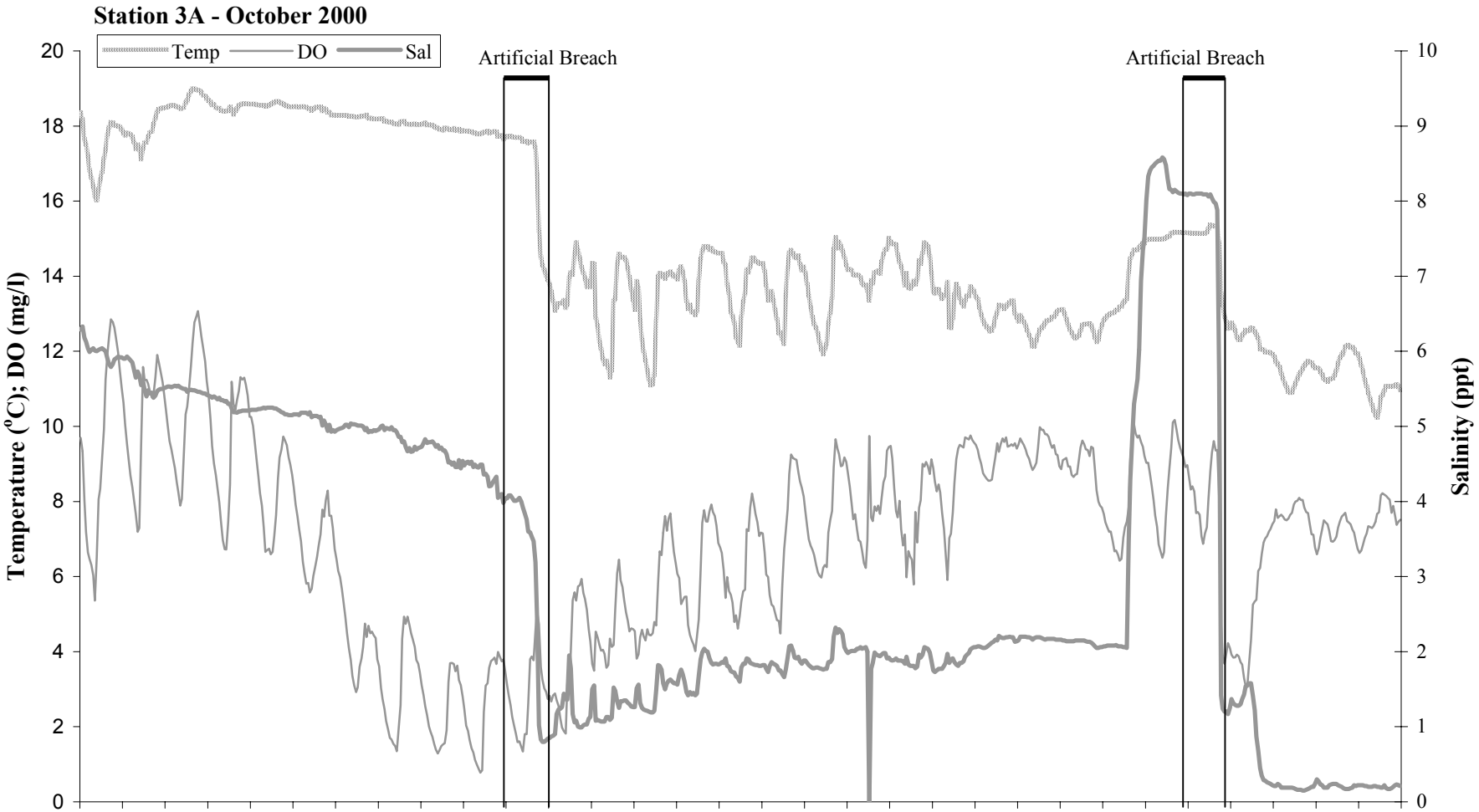
Appendix A-24. Minisonde Records at Station 3A, July 2000.



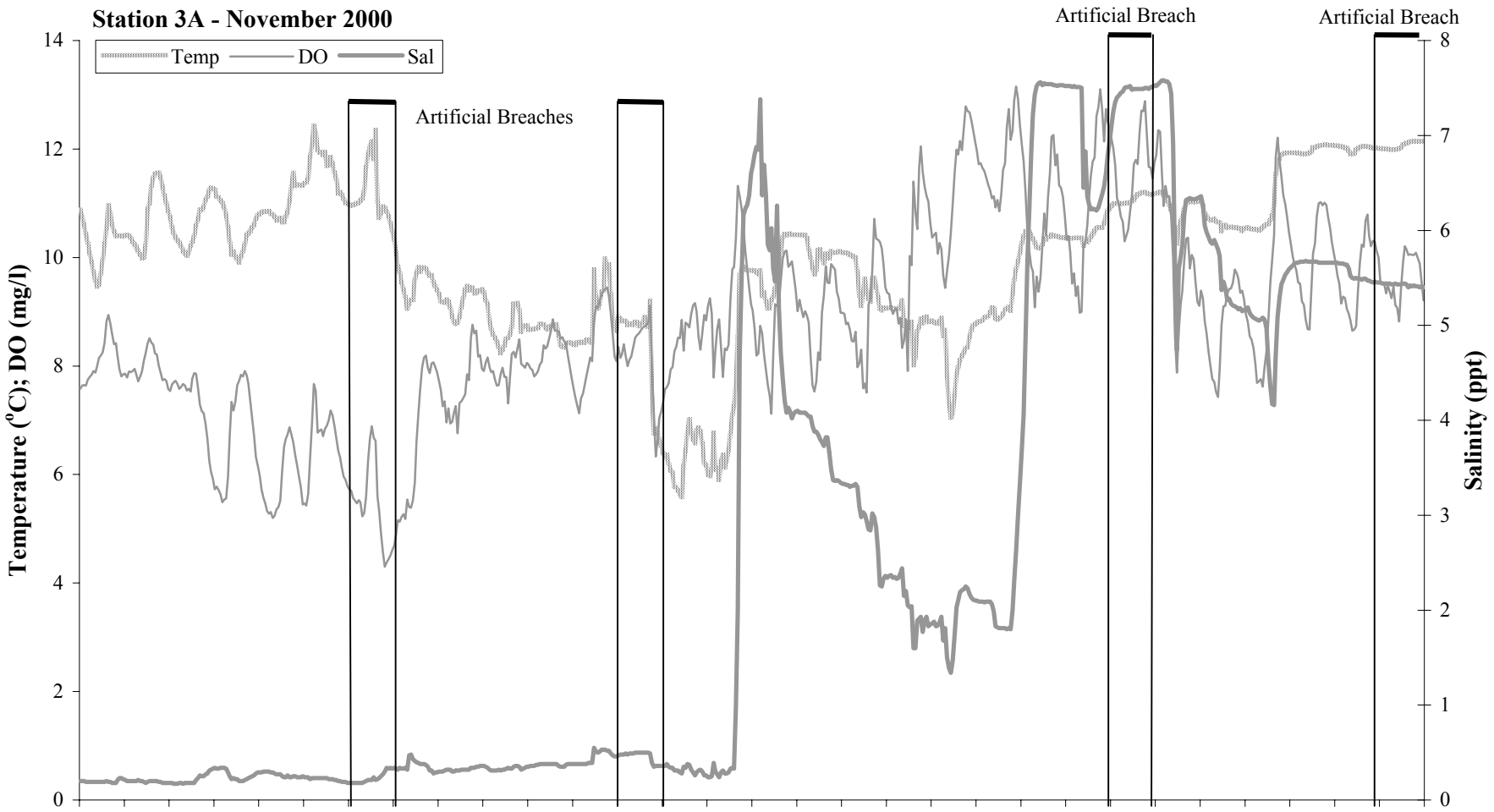
Appendix A-25. Minisonde Records at Station 3A, August 2000.



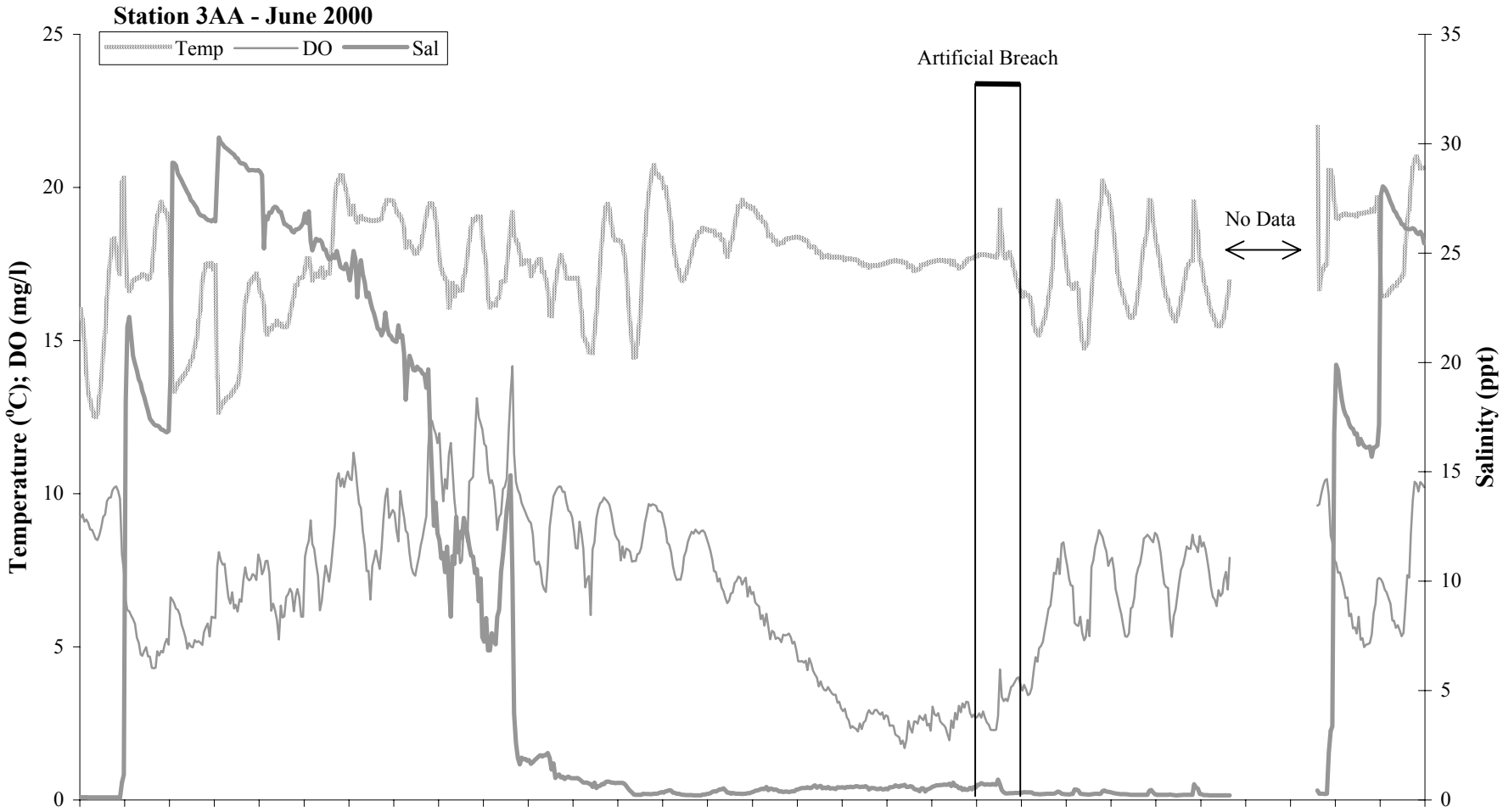
Appendix A-26. Minisonde Records at Station 3A, September 2000.



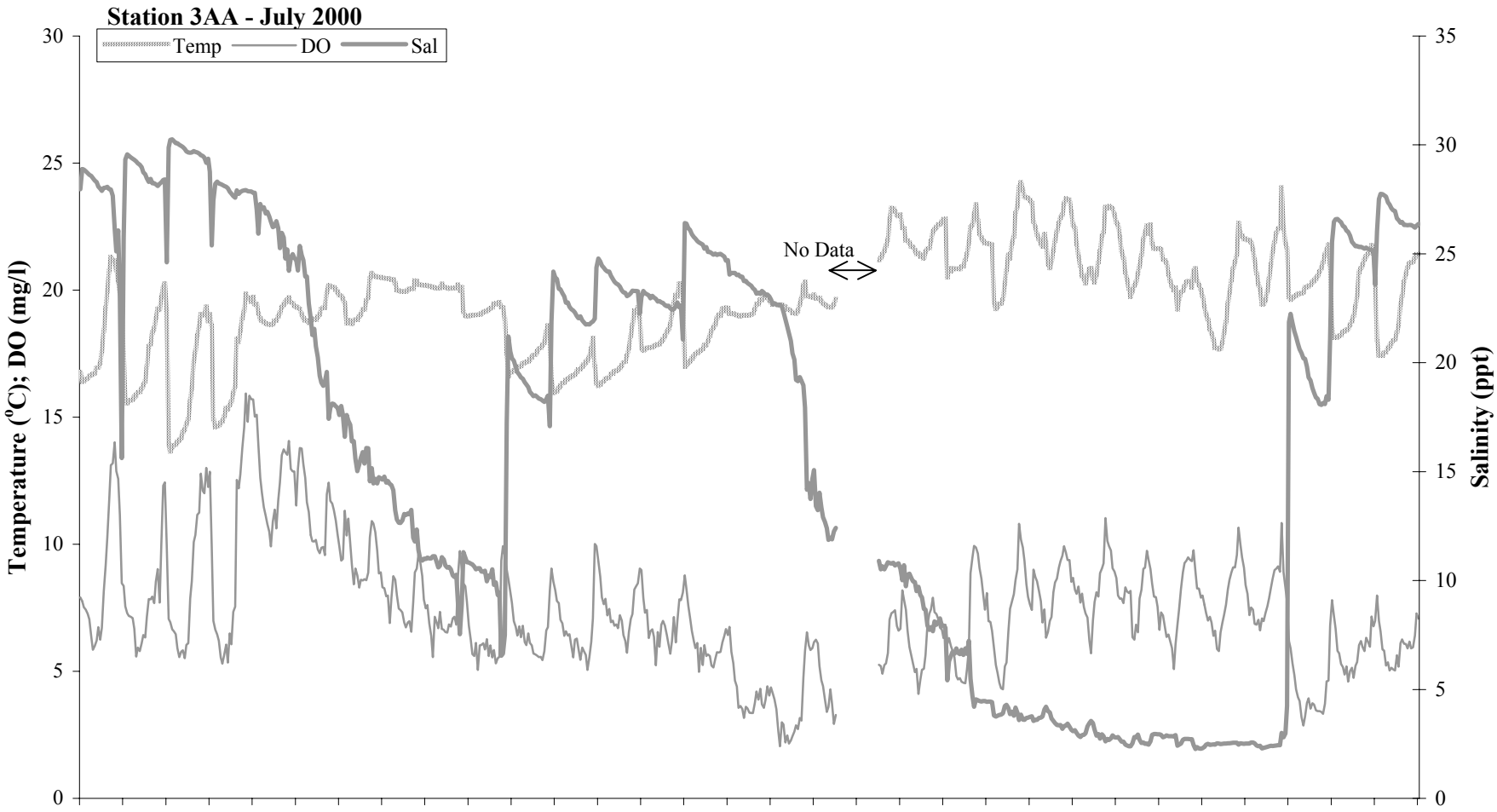
Appendix A-27. Minisonde Records at Station 3A, October 2000.



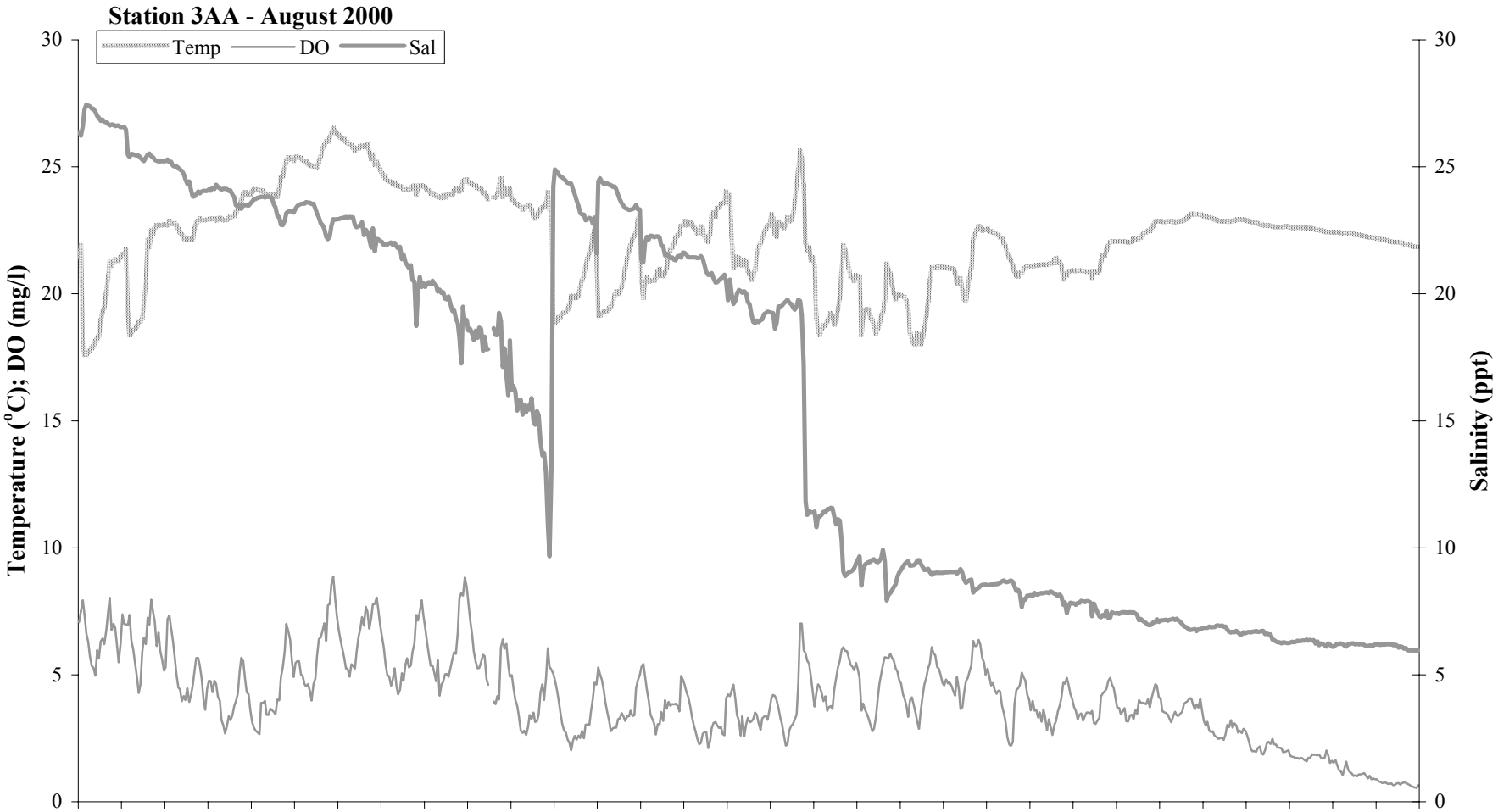
Appendix A-28. Minisonde Records at Station 3A, November 2000.



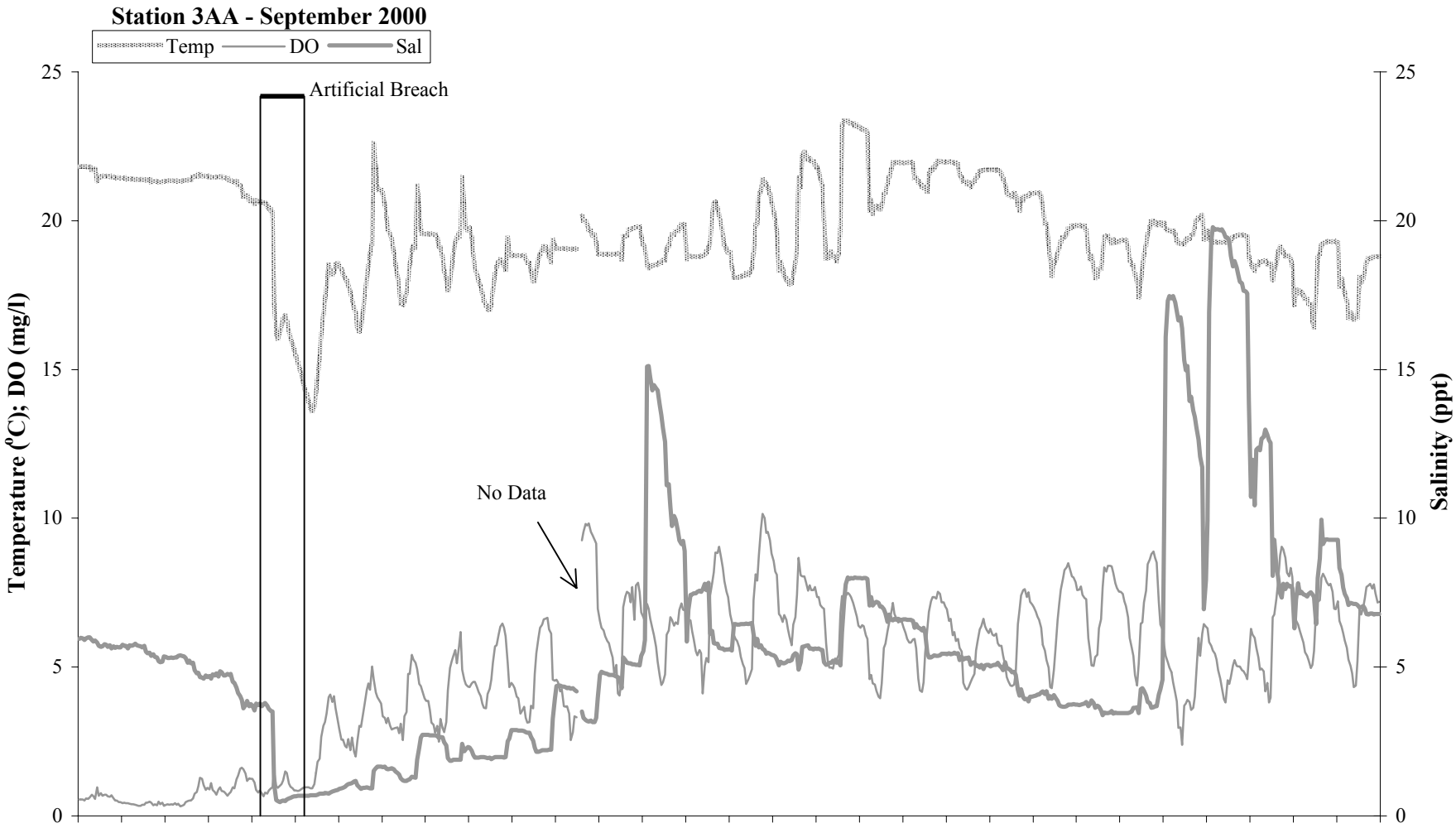
Appendix A-29. Minisonde Records at Station 3AA, June 2000.



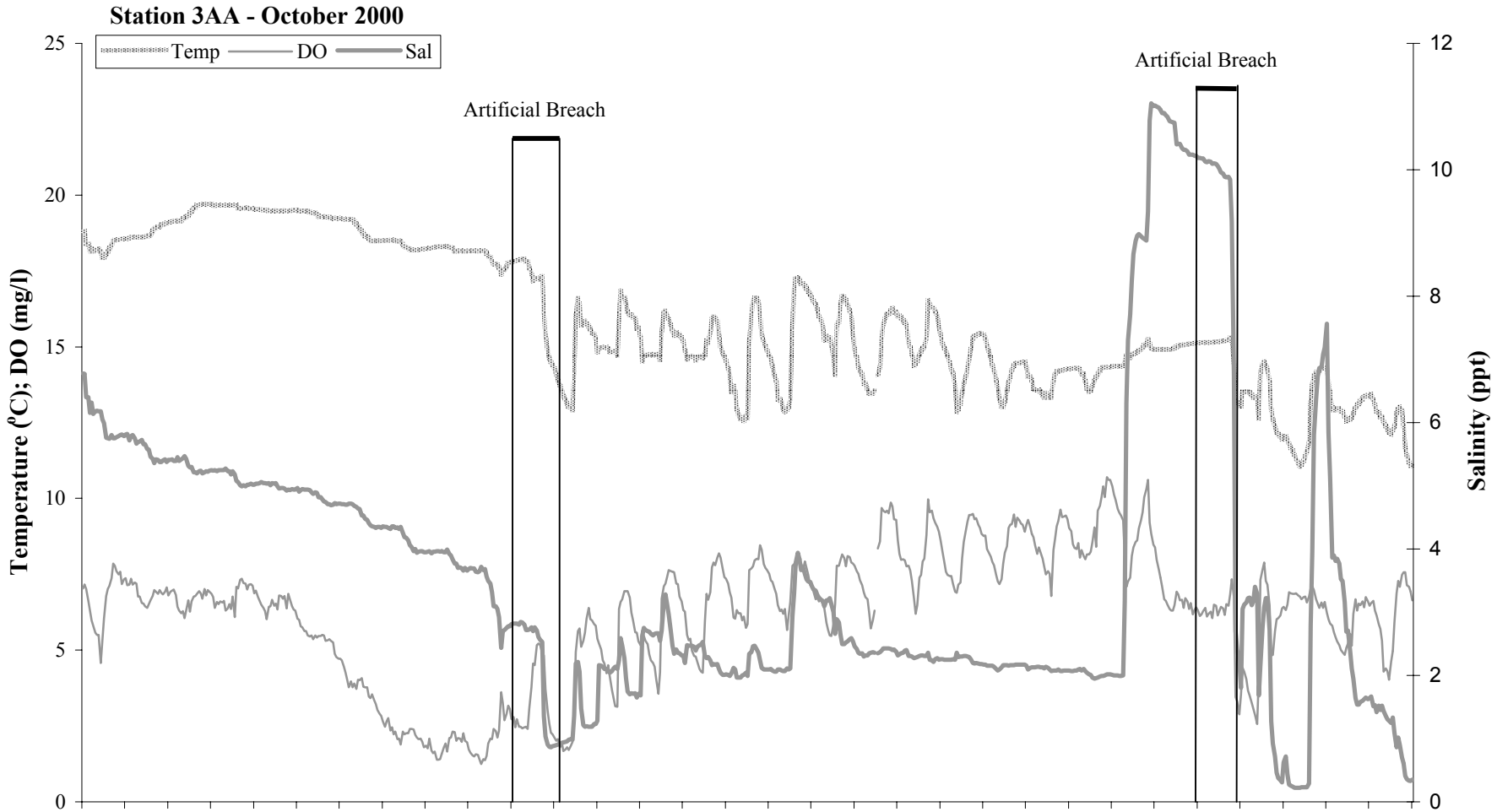
Appendix A-30. Minisonde Records at Station 3AA, July 2000.



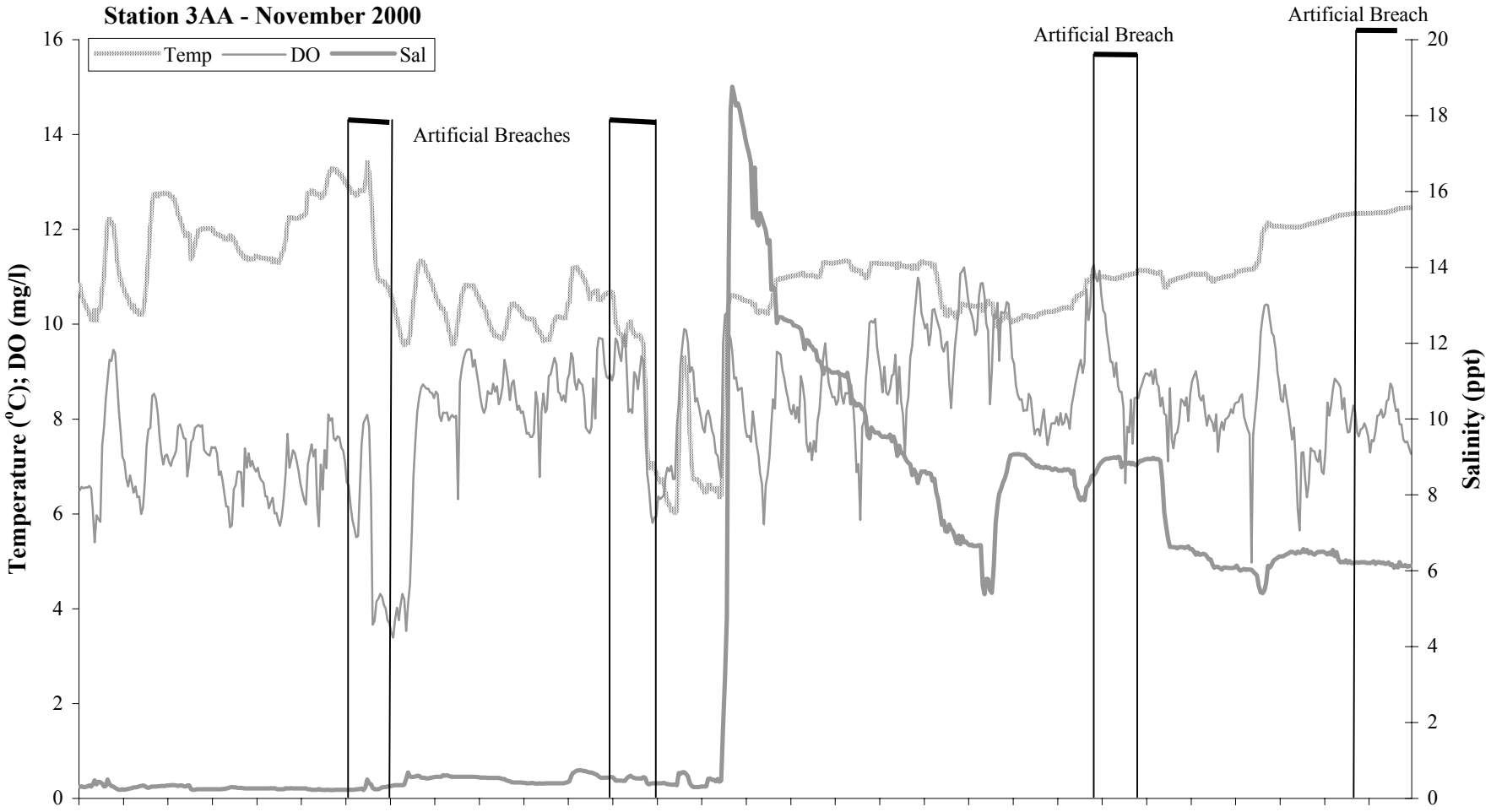
Appendix A-31. Minisonde Records at Station 3AA, August 2000.



Appendix A-32. Minisonde Records at Station 3AA, September 2000.



Appendix A-33. Minisonde Records at Station 3AA, October 2000.



Appendix A-34. Minisonde Records at Station 3AA, November 2000.

Appendix B: Otter Trawl and Beach Seine Data

Appendix B-1. Prebreaching Otter Trawl Catch Summary, Event I, 1 September 2000.

	1-Sep-00							
	Station 1 4-min tow 1215 hr PDT Avg. Depth 25 ft		Station 2 4-min tow 1345 hr PDT Avg. Depth 8 ft		Station 3 4-min tow 1405 hr PDT Avg. Depth 9 ft		Station 4 4-min tow 1555 hr PDT Avg. Depth 14 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring							1	0.25
Prickly sculpin							2	0.5
Staghorn sculpin	2	0.5						
Bocaccio	1	0.25						
Shiner surfperch								
Pacific tomcod	1	0.25						
Threespine stickleback							323	80.75
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder							2	0.5
Unidentified juv. gunnel/prickleback	1	0.25						
Steelhead								
Bay pipefish							2	0.5
Number of fish species	4		0		0		5	
Total fish	5	1.25	0	0	0	0	330	82.5

Invertebrates								
Crangon franciscorum							21	
Neomysis mercedis							1	
Cancer magister	4		3					
Eogammarus confervicolus					10			
Sphaeromatid isopods			1		10			
Other invertebrates*	a							
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Appendix B-2. Draining Otter Trawl Catch Summary, Event I, 6 September 2000.

	6-Sep-00							
	Station 1 4-min tow 1005 hr PDT Avg. Depth 17 ft		Station 2 4-min tow 1130 hr PDT Avg. Depth 5 ft		Station 3 4-min tow 1150 hr PDT Avg. Depth 5 ft		Station 4 4-min tow 1350 hr PDT Avg. Depth 11 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring	2	0.5						
Prickly sculpin	1	0.25	35	8.75	2	0.5	31	7.75
Staghorn sculpin					2	0.5		
Bocaccio								
Shiner surfperch	3	0.75	2	0.5				
Pacific tomcod	3	0.75						
Threespine stickleback	5	1.25	1	0.25			304	76
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder	1	0.25	1	0.25				
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish			3	0.75	3	0.75	2	0.5
Number of fish species	6		5		3		3	
Total fish	15	3.75	42	10.5	7	1.75	337	84.25

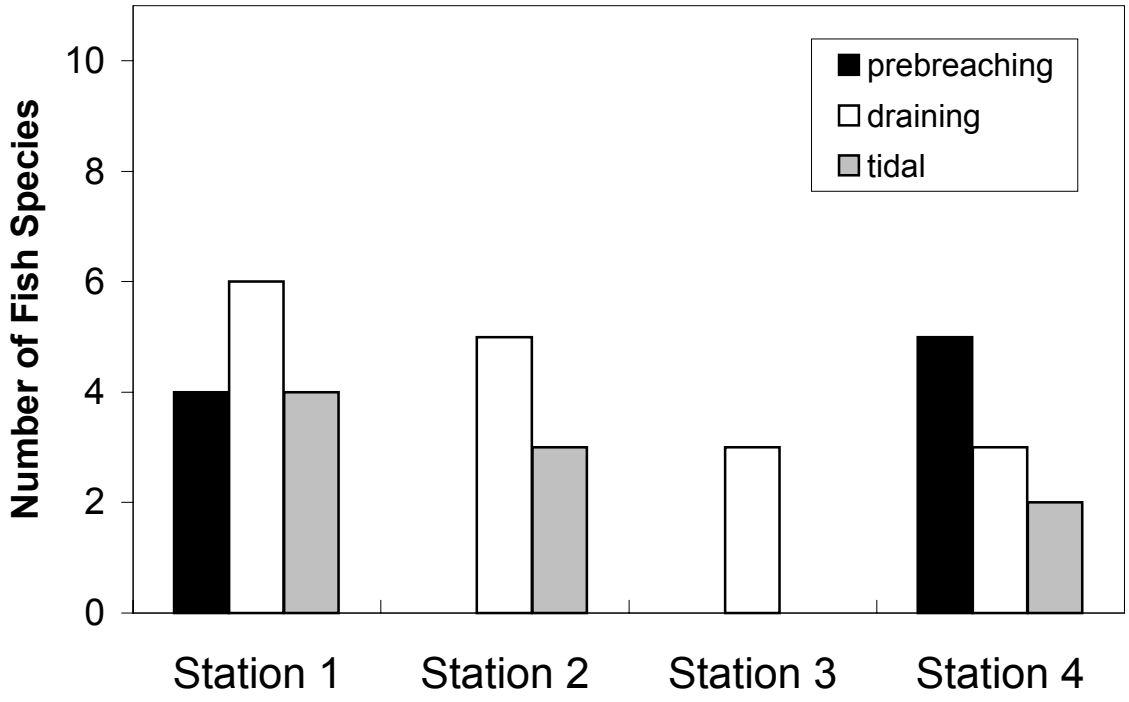
Invertebrates								
Crangon franciscorum			7		3		4	
Neomysis mercedis	10		100		50		50	
Cancer magister	5		8		1			
Eogammarus confervicolus	10		10		20			
Sphaeromatid isopods			5		20			
Other invertebrates*	b							
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

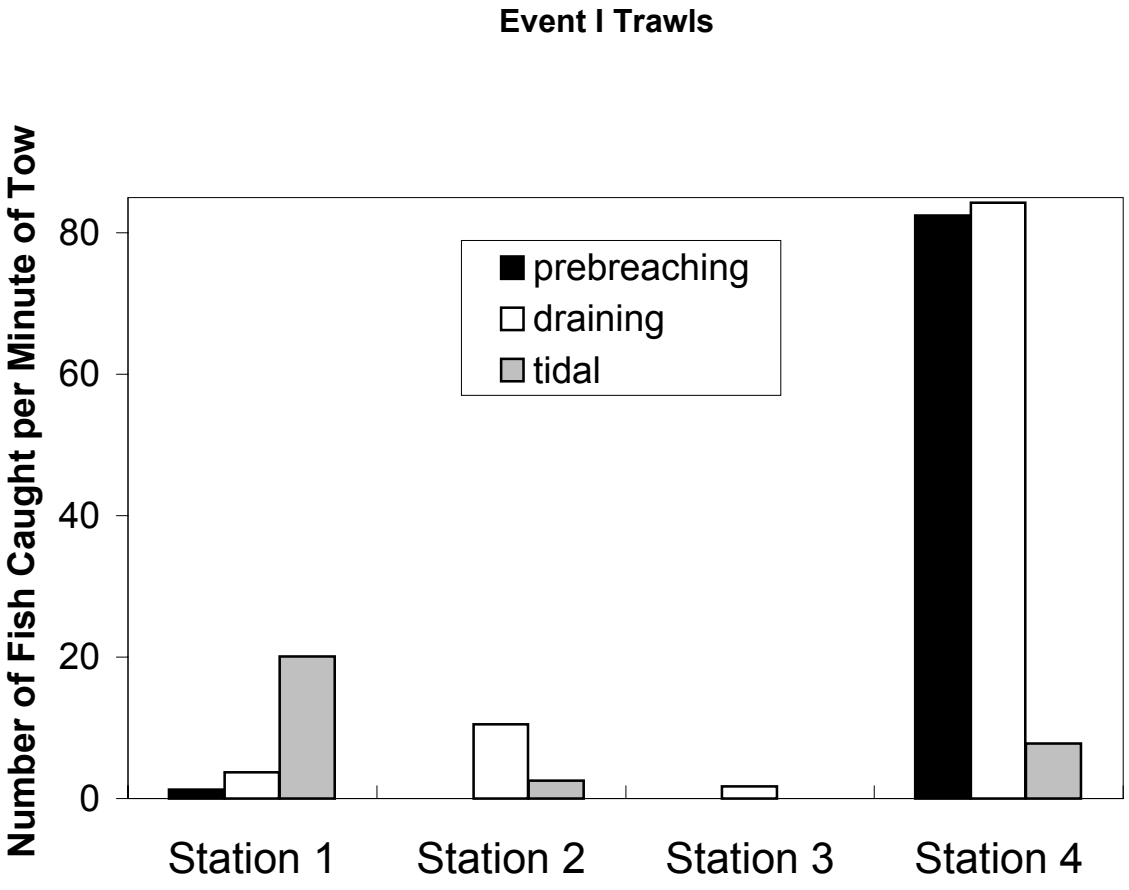
Appendix B-3. Tidal Otter Trawl Catch Summary, Event I, 8 September 2000.

	8-Sep-00									
	Station 1 2.5-min tow 1005 hr PDT Avg. Depth 13 ft		Station 1 4-min tow 1030 hr PDT Avg. Depth 17 ft		Station 2 4-min tow 1210 hr PDT Avg. Depth 6 ft		Station 3 4-min tow 1230 hr PDT Avg. Depth 6 ft		Station 4 4-min tow 1425 hr PDT Avg. Depth 10 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt										
Pacific sanddab			1	0.25						
Speckled sanddab										
Sacramento sucker										
Pacific herring										
Prickly sculpin	93	37.2	1	0.25	2	0.5			4	1
Staghorn sculpin										
Bocaccio										
Shiner surfperch										
Pacific tomcod										
Threespine stickleback	2	0.8							27	6.75
Surf smelt	1	0.4								
Longfin smelt										
Unidentified osmerid larvae										
Starry flounder			1	0.25	4	1				
Unidentified juv. gunnel/prickleback										
Steelhead										
Bay pipefish	1	0.4	2	0.5	4	1				
Number of fish species	4		4		3		0		2	
Total fish	97	38.8	5	1.25	10	2.5	0	0	31	7.75

Invertebrates										
Crangon franciscorum			1		1		1		2	
Neomysis mercedis	200		50		75		30			
Cancer magister	13		8		4		2			
Eogammarus confervicolus							10		1	
Sphaeromatid isopods							30			
Other invertebrates*										
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*									

Event I Trawls




Event I Trawls
Number of Fish Caught per Minute of Tow
0
20
40
60
80
prebreaching
draining
tidal
Station 1
Station 2
Station 3
Station 4

Appendix B-4. Prebreaching Otter Trawl Catch Summary, Event II, 9 October 2000.

	9-Oct-00							
	Station 1 4-min tow 1150 hr PDT Avg. Depth 18 ft		Station 2 4-min tow 1255 hr PDT Avg. Depth 8 ft		Station 3 4-min tow 1320 hr PDT Avg. Depth 9 ft		Station 4 4-min tow 1515 hr PDT Avg. Depth 11 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin					2	0.5	4	1
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback							172	43
Surf smelt	1	0.25						
Longfin smelt	1	0.25						
Unidentified osmerid larvae	1	0.25						
Starry flounder								
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish							7	1.75
Number of fish species	3		0		1		3	
Total fish	3	0.75	0	0	2	0.5	183	45.75

Invertebrates								
Crangon franciscorum							5	
Neomysis mercedis			100		10			
Cancer magister			3		3		2	
Eogammarus confervicolus			50		10			
Sphaeromatid isopods			50		10			
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Appendix B-5. Draining Otter Trawl Catch Summary, Event II, 12 October 2000.

	12-Oct-00							
	Station 1 4-min tow 1130 hr PDT Avg. Depth 13 ft		Station 2 4-min tow 1400 hr PDT Avg. Depth 7 ft		Station 3 4-min tow 1415 hr PDT Avg. Depth 7 ft		Station 4 4-min tow 1540 hr PDT Avg. Depth 13 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab	1	0.25						
Sacramento sucker								
Pacific herring								
Prickly sculpin			7	1.75	1	0.25		
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback			1	0.25				
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder							1	0.25
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish			1	0.25	1	0.25	2	0.5
Number of fish species	1		3		2		2	
Total fish	1	0.25	9	2.25	2	0.5	3	0.75

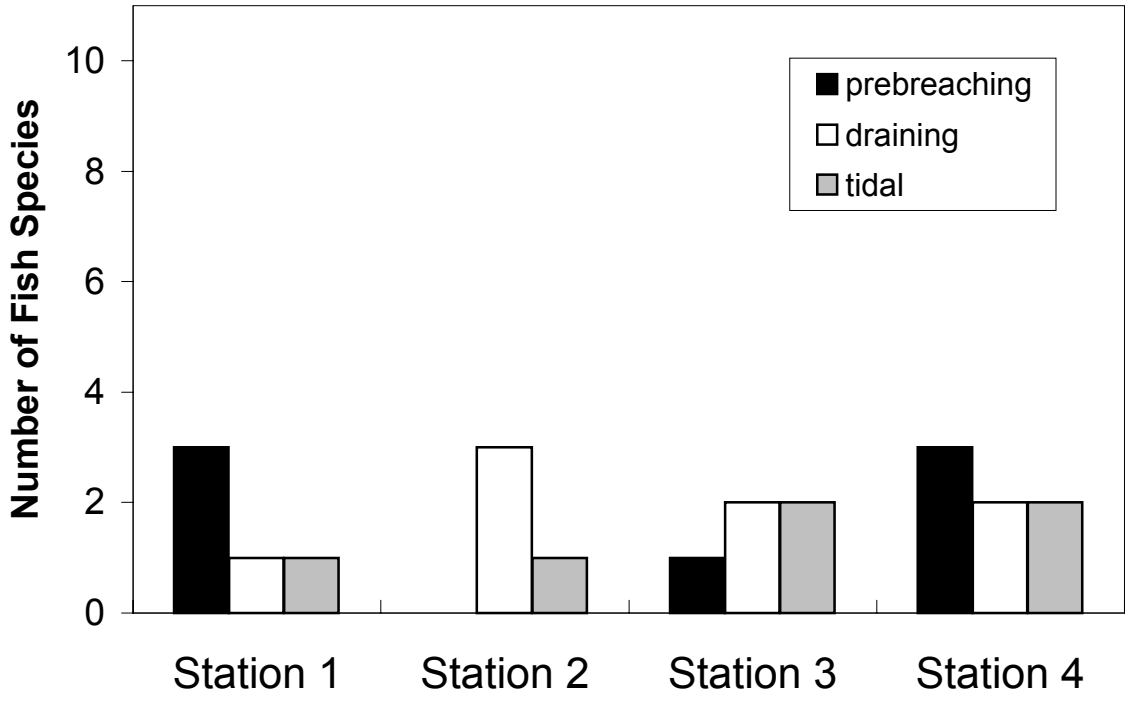
Invertebrates								
Crangon franciscorum	2		11		2		16	
Neomysis mercedis	50		100					
Cancer magister	3		16		9		1	
Eogammarus confervicolus	20						5	
Sphaeromatid isopods								
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

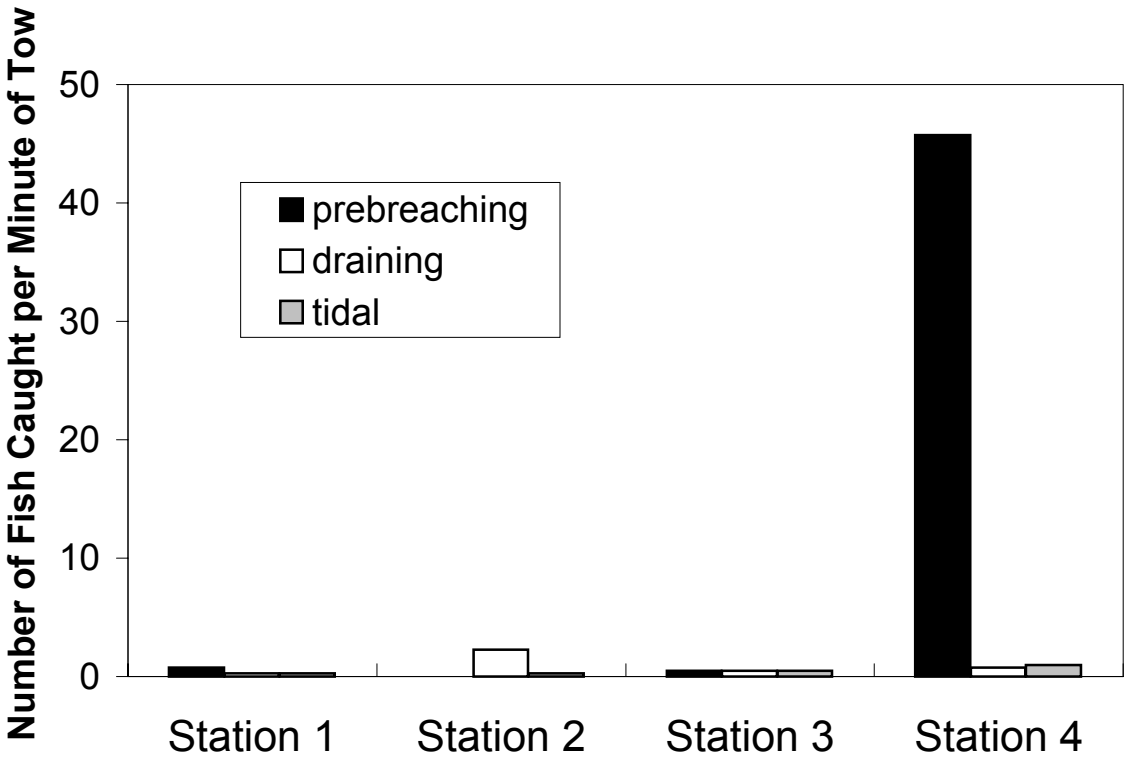
Appendix B-6. Tidal Otter Trawl Catch Summary, Event II, 16 October 2000.

	16-Oct-00							
	Station 1 4-min tow 1110 hr PDT Avg. Depth 14 ft		Station 2 4-min tow 1225 hr PDT Avg. Depth 6 ft		Station 3 4-min tow 1240 hr PDT Avg. Depth 6 ft		Station 4 4-min tow 1445 hr PDT Avg. Depth 11 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt			1	0.25				
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin	1	0.25			1	0.25	2	0.5
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback					1	0.25		
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder							2	0.5
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish								
Number of fish species	1		1		2		2	
Total fish	1	0.25	1	0.25	2	0.5	4	1

Invertebrates								
Crangon franciscorum			2				21	
Neomysis mercedis	15		10		2		10	
Cancer magister	3				1			
Eogammarus confervicolus			10		8		20	
Sphaeromatid isopods			5					
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Event II Trawls




Event II Trawls
Number of Fish Caught per Minute of Tow
50
40
30
20
10
0
prebreaching
draining
tidal
Station 1
Station 2
Station 3
Station 4

Appendix B-7. Prebreaching Otter Trawl Catch Summary, Event III, 26 October 2000.

	26-Oct-00							
	Station 1 4-min tow 1200 hr PDT Avg. Depth 23 ft		Station 2 4-min tow 1345 hr PDT Avg. Depth 9 ft		Station 3 4-min tow 1405 hr PDT Avg. Depth 8 ft		Station 4 4-min tow 1525 hr PDT Avg. Depth 14 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin					3	0.75	2	0.5
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback			1	0.25				
Surf smelt								
Longfin smelt	1	0.25						
Unidentified osmerid larvae	1	0.25			3	0.75		
Starry flounder								
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish	1	0.25	1	0.25				
Number of fish species	3		2		2		1	
Total fish	3	0.75	2	0.5	6	1.5	2	0.5

Invertebrates								
Crangon franciscorum							13	
Neomysis mercedis	5						25	
Cancer magister	2		1					
Eogammarus confervicolus					10		5	
Sphaeromatid isopods			5		20		10	
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Appendix B-8. Draining Otter Trawl Catch Summary, Event III, 28 October 2000.

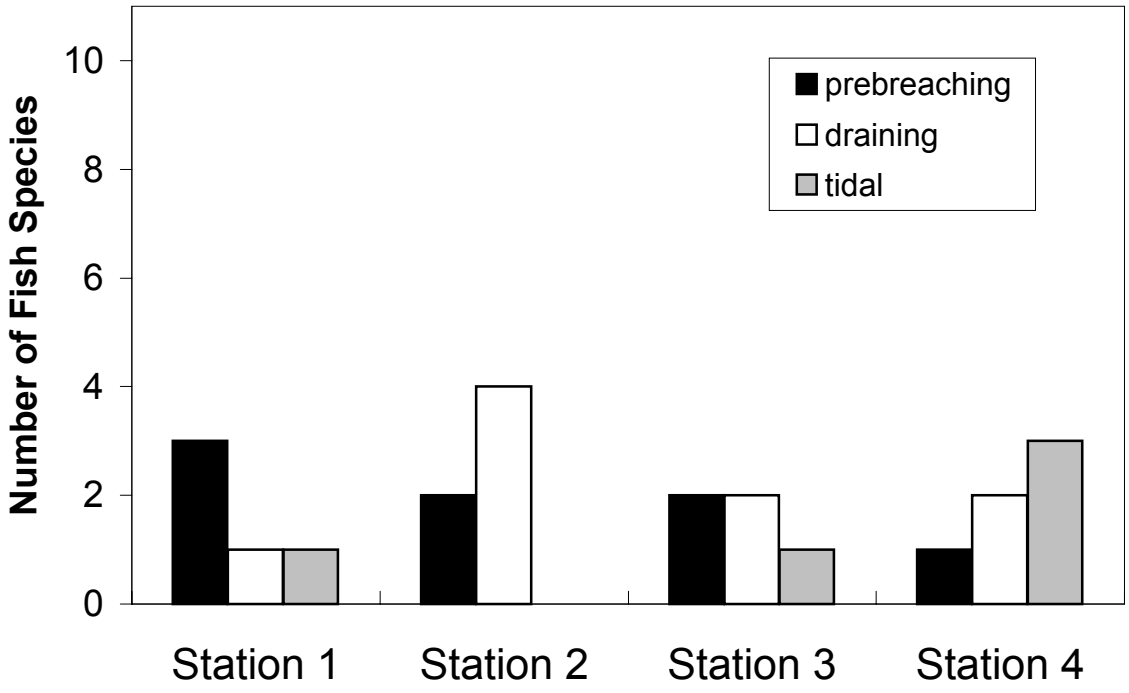
	28-Oct-00							
	Station 1 4-min tow 1047 hr PDT Avg. Depth 20 ft		Station 2 4-min tow 1202 hr PDT Avg. Depth 8 ft		Station 3 4-min tow 1220 hr PDT Avg. Depth 9 ft		Station 4 4-min tow 1440 hr PDT Avg. Depth 12 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin			4	1	2	0.5		
Staghorn sculpin			1	0.25				
Bocaccio								
Shiner surfperch	1	0.25						
Pacific tomcod								
Threespine stickleback							1	0.25
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder			1	0.25				
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish			1	0.25	1	0.25	2	0.5
Number of fish species	1		4		2		2	
Total fish	1	0.25	7	1.75	3	0.75	3	0.75

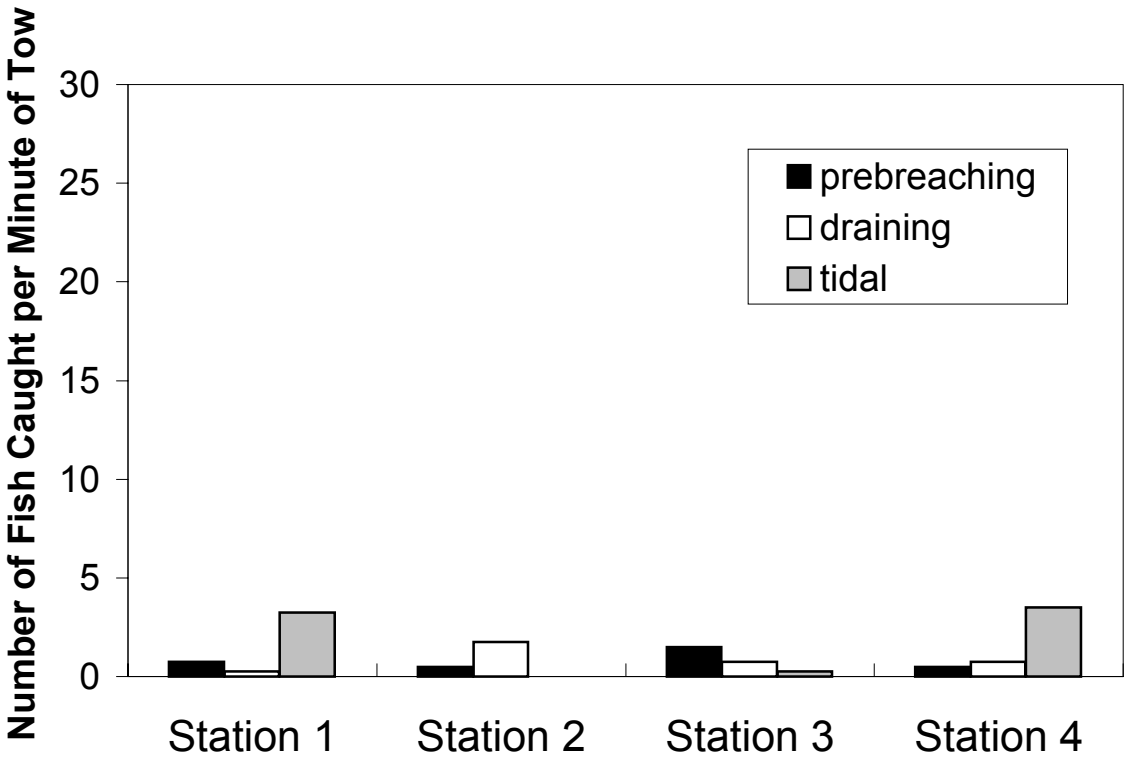
Invertebrates								
Crangon franciscorum	1		1		1		2	
Neomysis mercedis					50			
Cancer magister	7		1					
Eogammarus confervicolus			50		50		50	
Sphaeromatid isopods			50		50		50	
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Appendix B-9. Tidal Otter Trawl Catch Summary, Event III, 31 October 2000.

	31-Oct-00							
	Station 1 4-min tow 1225 hr PDT Avg. Depth 17 ft		Station 2 4-min tow 1410 hr PDT Avg. Depth 7 ft		Station 3 4-min tow 1435 hr PDT Avg. Depth 10 ft		Station 4 4-min tow 1615 hr PDT Avg. Depth 11 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin					1	0.25	4	1
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback							2	0.5
Surf smelt	13	3.25						
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder								
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish							8	2
Number of fish species	1		0		1		3	
Total fish	13	3.25	0	0	1	0.25	14	3.5
Invertebrates								
Crangon franciscorum			1				16	
Neomysis mercedis	1		30		20		50	
Cancer magister	1		2		2			
Eogammarus confervicolus			20		20		40	
Sphaeromatid isopods	1				10		40	
Other invertebrates*	c							
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Event III Trawls




Event III Trawls
Number of Fish Caught per Minute of Tow
30
25
20
15
10
5
0
prebreaching
draining
tidal
Station 1
Station 2
Station 3
Station 4

Appendix B-10. Prebreaching Otter Trawl Catch Summary, Event IV, 7 November 2000.

	7-Nov-00							
	Station 1 4-min tow 1115 hr PDT Avg. Depth 24 ft		Station 2 4-min tow 1206 hr PDT Avg. Depth 10 ft		Station 3 4-min tow 1330 hr PDT Avg. Depth 8 ft		Station 4 4-min tow 1445 hr PDT Avg. Depth 20 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt	1	0.25						
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin			2	0.5			3	0.75
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback								
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae								
Starry flounder								
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish			1	0.25			1	0.25
Number of fish species	1		2		0		2	
Total fish	1	0.25	3	0.75	0	0	4	1

Invertebrates								
Crangon franciscorum	1		2				16	
Neomysis mercedis	1		200		50		75	
Cancer magister	3				1			
Eogammarus confervicolus			100		20		75	
Sphaeromatid isopods			100		50		75	
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Appendix B-11. Draining Otter Trawl Catch Summary, Event IV, 8 November 2000.

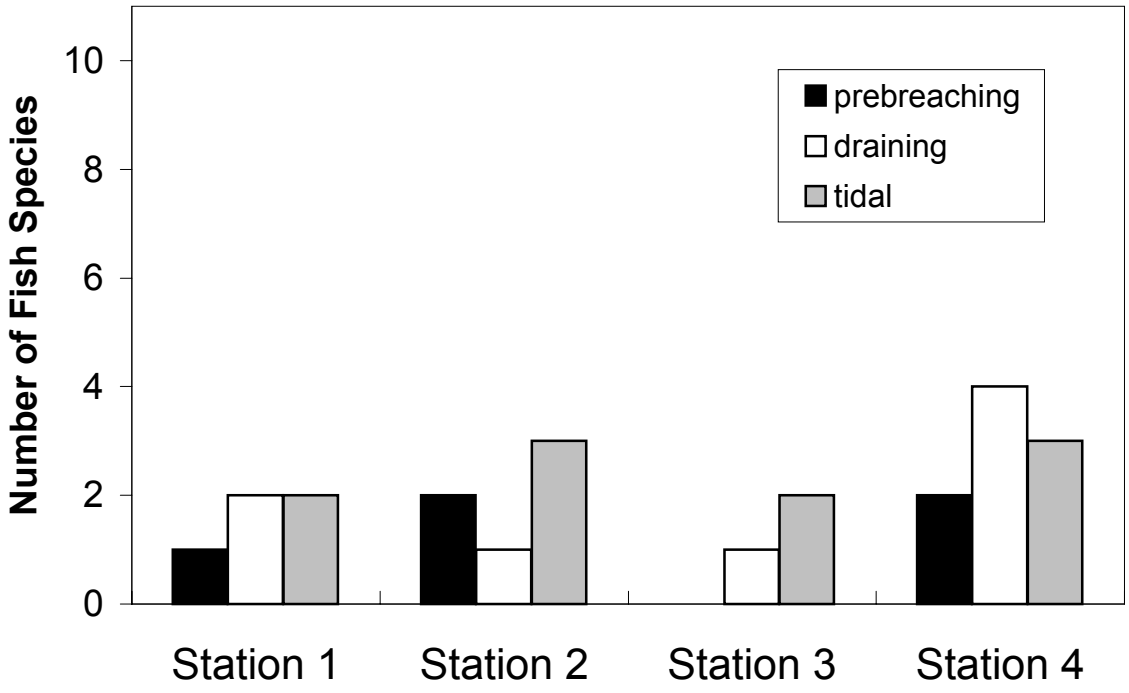
	8-Nov-00							
	Station 1 4-min tow 1002 hr PDT Avg. Depth 15 ft		Station 2 4-min tow 1115 hr PDT Avg. Depth 6 ft		Station 3 4-min tow 1135 hr PDT Avg. Depth 8 ft		Station 4 4-min tow 1335 hr PDT Avg. Depth 11 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin					2	0.5	4	1
Staghorn sculpin								
Bocaccio								
Shiner surfperch	1	0.25						
Pacific tomcod								
Threespine stickleback							3	0.75
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae	2	0.5	1	0.25				
Starry flounder							1	0.25
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish							1	0.25
Number of fish species	2		1		1		4	
Total fish	3	0.75	1	0.25	2	0.5	9	2.25
Invertebrates								
Crangon franciscorum	4		4				14	
Neomysis mercedis	30		100		100		35	
Cancer magister	3		6		3			
Eogammarus confervicolus			100		100		50	
Sphaeromatid isopods			100		100		50	
Other invertebrates*								
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

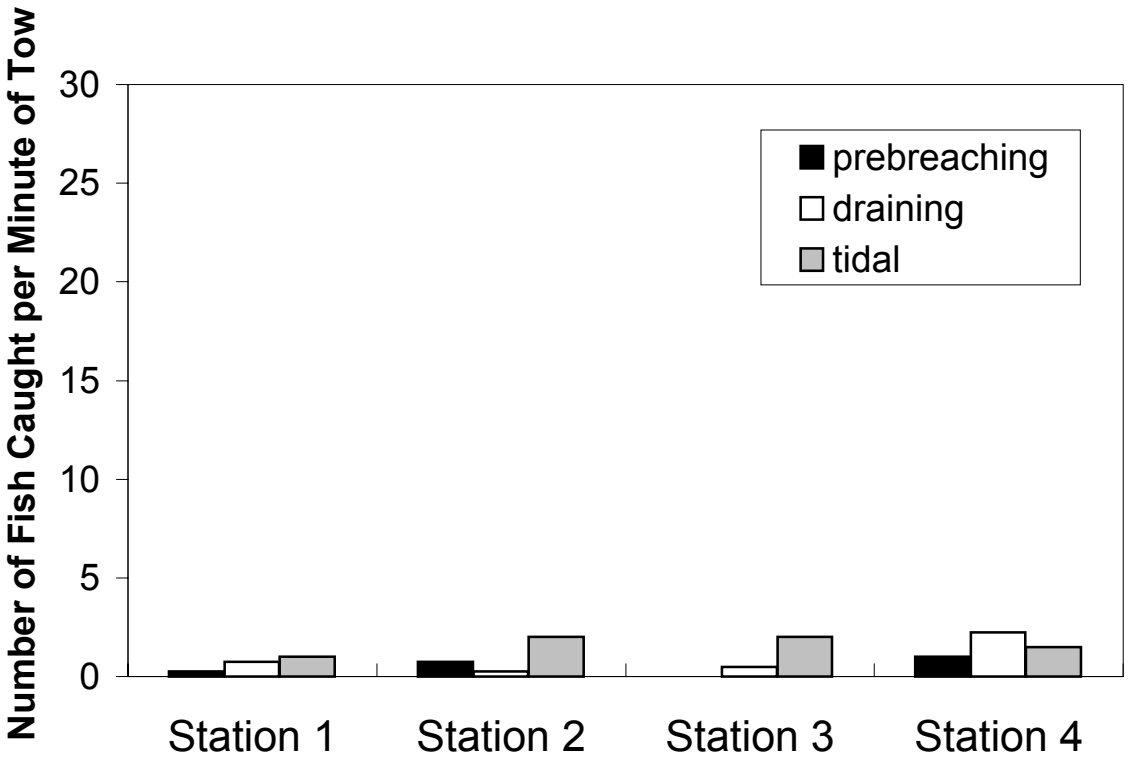
Appendix B-12. Tidal Otter Trawl Catch Summary, Event IV, 16 November 2000.

	16-Nov-00							
	Station 1 4-min tow 1015 hr PDT Avg. Depth 18 ft		Station 2 4-min tow 1130 hr PDT Avg. Depth 8 ft		Station 3 4-min tow 1145 hr PDT Avg. Depth 8 ft		Station 4 4-min tow 1345 hr PDT Avg. Depth 12 ft	
Common Name	No.	CPU	No.	CPU	No.	CPU	No.	CPU
Topsmelt								
Pacific sanddab								
Speckled sanddab								
Sacramento sucker								
Pacific herring								
Prickly sculpin	2	0.5	2	0.5	4	1	3	0.75
Staghorn sculpin								
Bocaccio								
Shiner surfperch								
Pacific tomcod								
Threespine stickleback							2	0.5
Surf smelt								
Longfin smelt								
Unidentified osmerid larvae			5	1.25	4	1		
Starry flounder								
Unidentified juv. gunnel/prickleback								
Steelhead								
Bay pipefish	2	0.5	1	0.25			1	0.25
Number of fish species	2		3		2		3	
Total fish	4	1	8	2	8	2	6	1.5

Invertebrates								
Crangon franciscorum							10	
Neomysis mercedis	30		30		50		200	
Cancer magister	13		1					
Eogammarus confervicolus			30		50		30	
Sphaeromatid isopods	10		50		50		50	
Other invertebrates*	d							
*Key to other invertebrates	a *Pandalus danae;* b *Pugettia producta;* c *Heptacarpus brevirostris;* d *Heptacarpus paludicola*							

Event IV Trawls




Event IV Trawls
Number of Fish Caught per Minute of Tow
30
25
20
15
10
5
0
prebreaching
draining
tidal
Station 1
Station 2
Station 3
Station 4

Appendix B-13. Prebreaching Beach Seine Catch Summary, Event I, 1 September 2000.

	1-Sep-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	1300 hr PDT	no seine	1535 hr PDT	1620 hr PDT
Topsmelt				
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin			1	
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback			1	
Surf smelt	7			
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder				
Unidentified juv. gunnel/prickleback				
Steelhead			3	
Bay pipefish				
Number of fish species	1	-	3	0
Total fish	7	-	5	0

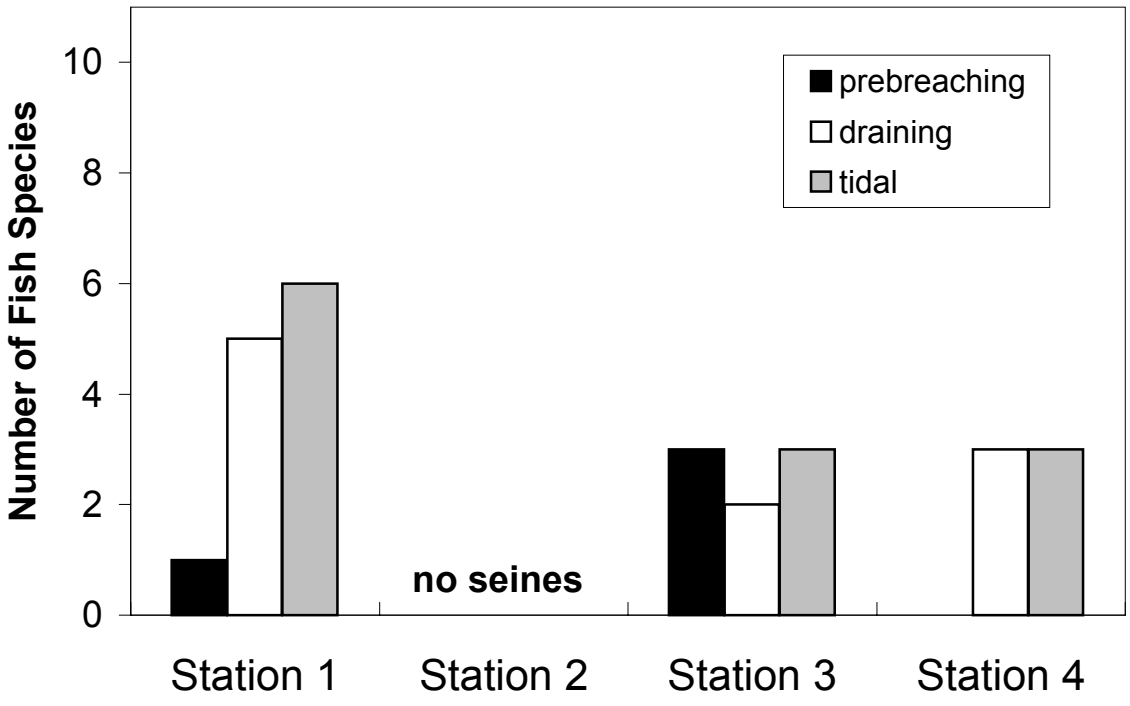
Appendix B-14. Draining Beach Seine Catch Summary, Event I, 6 September 2000.

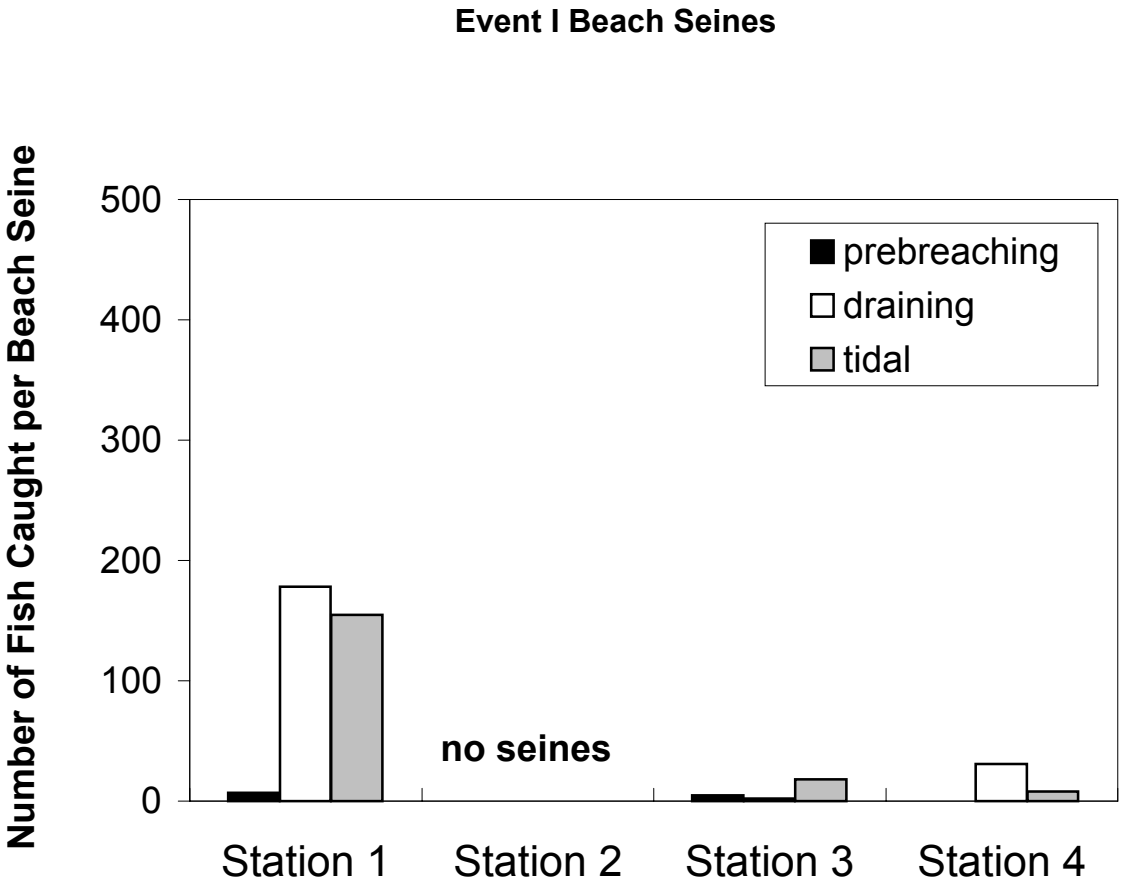
	6-Sep-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	1040 hr PDT	no seine	1250 hr PDT	1420 hr PDT
Topsmelt				
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				5
Pacific herring				
Prickly sculpin	34			5
Staghorn sculpin	17			
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback	58		1	21
Surf smelt	68			
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1			
Unidentified juv. gunnel/prickleback				
Steelhead			1	
Bay pipefish				
Number of fish species	5	-	2	3
Total fish	178	-	2	31

Appendix B-15. Tidal Beach Seine Catch Summary, Event I, 8 September 2000.

Common Name	8-Sep-00 Stn 1 1100 hr PDT	Stn 2 no seine	Stn 3 1355 hr PDT	Stn 4 1440 hr PDT
Topsmelt				
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				1
Pacific herring				
Prickly sculpin	32		1	5
Staghorn sculpin	43			
Bocaccio				
Shiner surfperch	2			
Pacific tomcod				
Threespine stickleback	50		16	2
Surf smelt	1			
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	27			
Unidentified juv. gunnel/prickleback				
Steelhead			1	
Bay pipefish				
Number of fish species	6	-	3	3
Total fish	155	-	18	8
Invertebrates				
Cancer magister	3000		3	

Event I Beach Seines




Event I Beach Seines
Number of Fish Caught per Beach Seine
500
400
300
200
100
0
prebreaching
draining
tidal
no seines
Station 1
Station 2
Station 3
Station 4

Appendix B-16. Prebreaching Beach Seine Catch Summary, Event II, 6 October 2000.

	9-Oct-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	1215 hr PDT	no seine	1450 hr PDT	1540 hr PDT
Topsmelt				
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin				
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback				1
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder				
Unidentified juv. gunnel/prickleback				
Steelhead			2	
Bay pipefish				
Number of fish species	0	-	1	1
Total fish	0	-	2	1

Appendix B-17. Draining Beach Seine Catch Summary, Event II, 12 October 2000.

	12-Oct-00			
Common Name	Stn 1 1220 hr PDT	Stn 2 no seine	Stn 3 1515 hr PDT	Stn 4 1305 hr PDT
Topsmelt	55		93	1
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				1
Pacific herring				
Prickly sculpin	5		1	5
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback	3		24	450
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1		3	
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish	1			
Number of fish species	5	-	4	4
Total fish	65	-	121	457

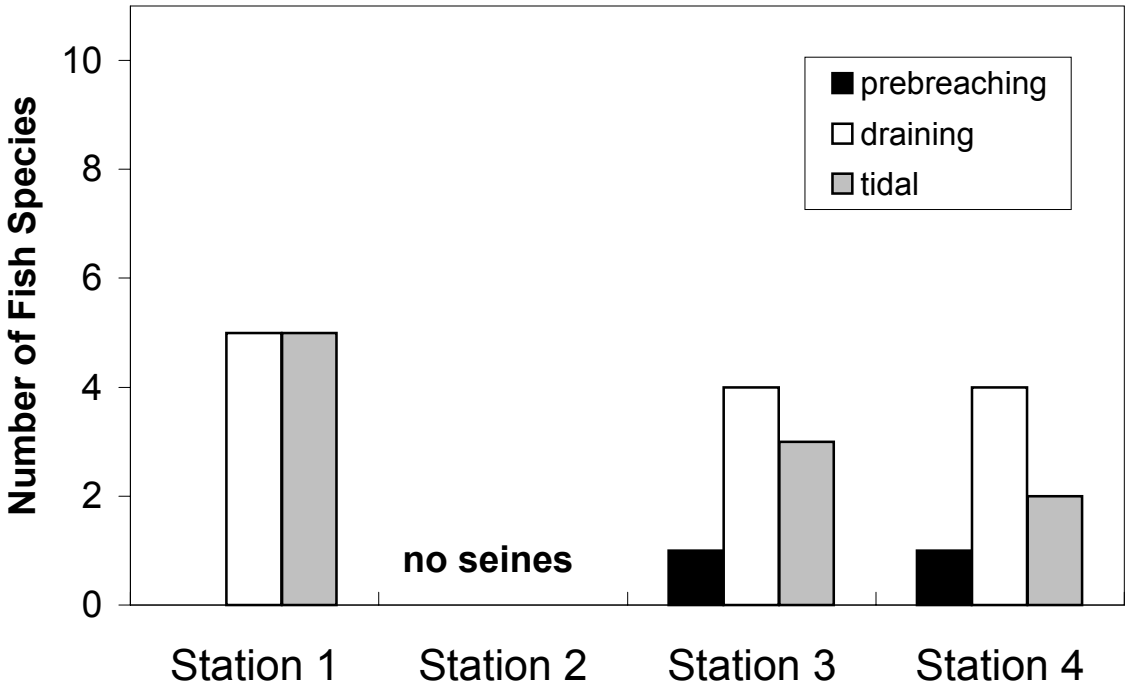
Invertebrates				
Cancer magister	1			

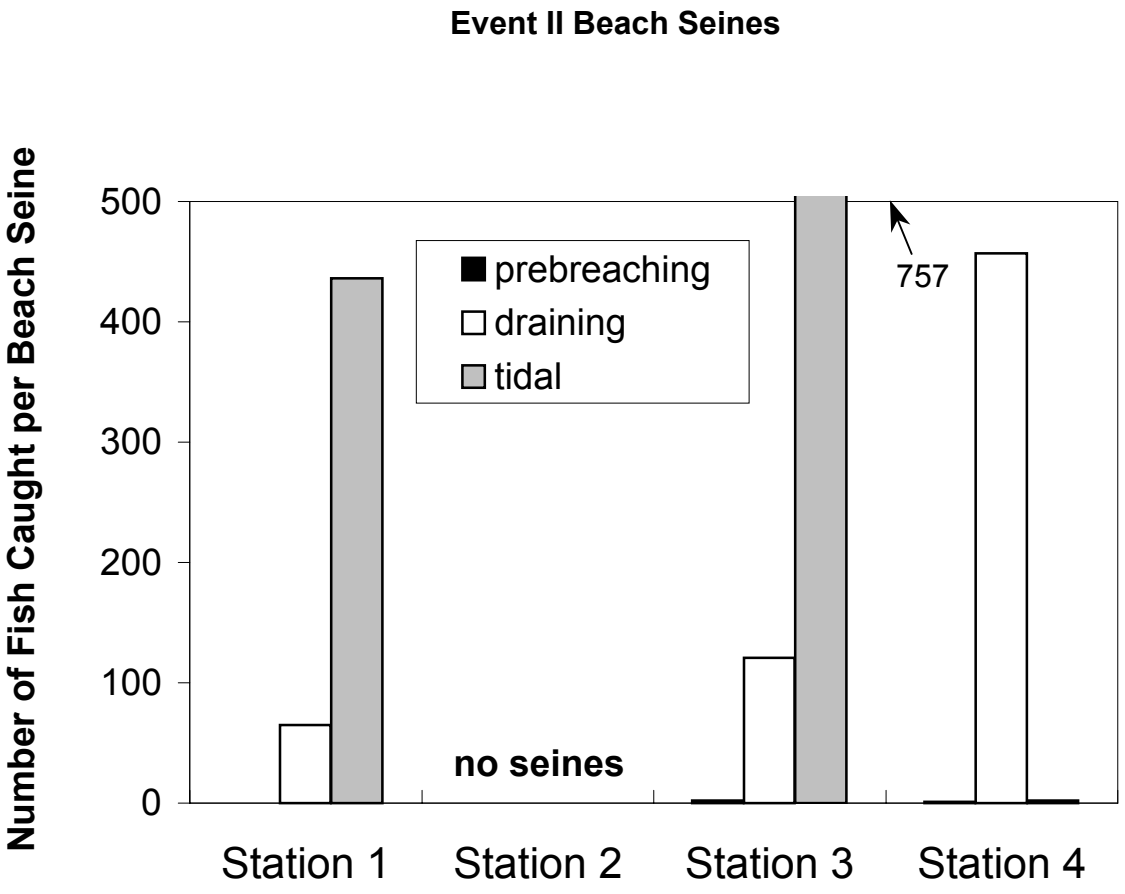
Appendix B-18. Tidal Beach Seine Catch Summary, Event II, 16 October 2000.

	16-Oct-00			
Common Name	Stn 1 1130 hr PDT	Stn 2 no seine	Stn 3 1400 hr PDT	Stn 4 1520 hr PDT
Topsmelt	425		99	
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin	4			1
Staghorn sculpin	2			
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback	3		657	1
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	2		1	
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	5	-	3	2
Total fish	436	-	757	2

Invertebrates				
Crangon franciscorum	4			
Cancer magister	82		6	

Event II Beach Seines




Event II Beach Seines
Number of Fish Caught per Beach Seine
500
400
300
200
100
0
prebreaching
draining
tidal
757
no seines
Station 1
Station 2
Station 3
Station 4

Appendix B-19. Prebreaching Beach Seine Catch Summary, Event III, 26 October 2000.

	26-Oct-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	1230 hr PDT	no seine	1510 hr PDT	1540 hr PDT
Topsmelt	36		12	14
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin				
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback				
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1		1	
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	2	-	2	1
Total fish	37	-	13	14

Appendix B-20. Draining Beach Seine Catch Summary, Event III, 28 October 2000.

	28-Oct-00			
Common Name	Stn 1 1121 hr PDT	Stn 2 no seine	Stn 3 1402 hr PDT	Stn 4 1504 hr PDT
Topsmelt	72		28	
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				1
Pacific herring				
Prickly sculpin	1			2
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback				4
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder				
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	2	-	1	3
Total fish	73	-	28	7

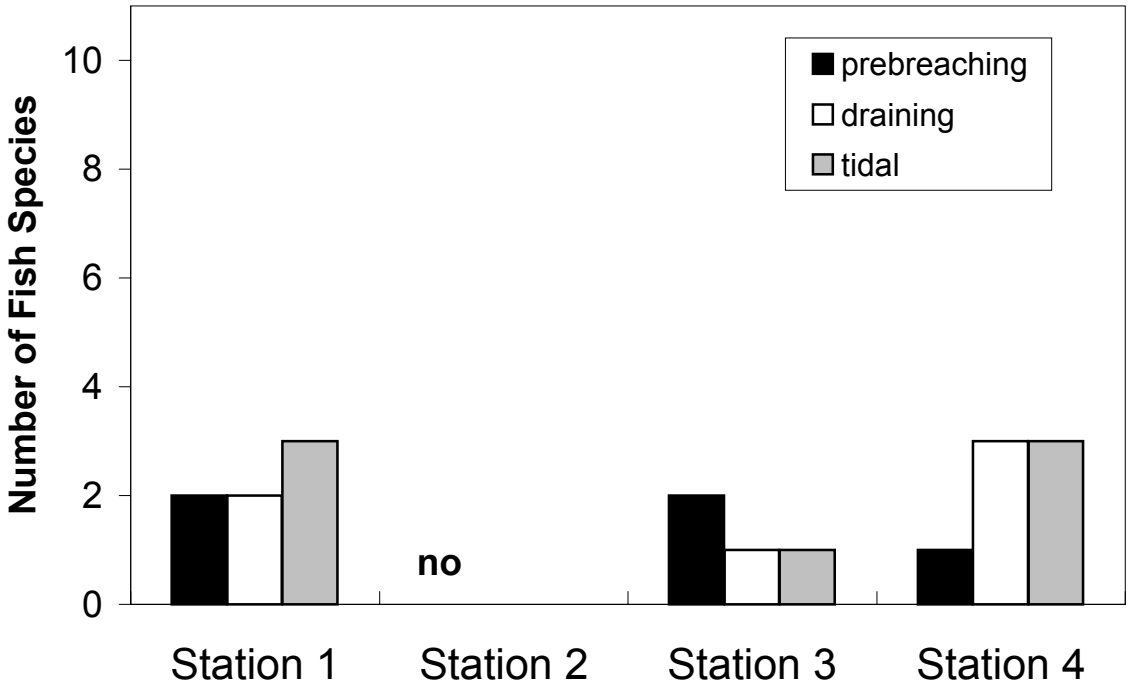
Invertebrates				
Cancer magister	12			1

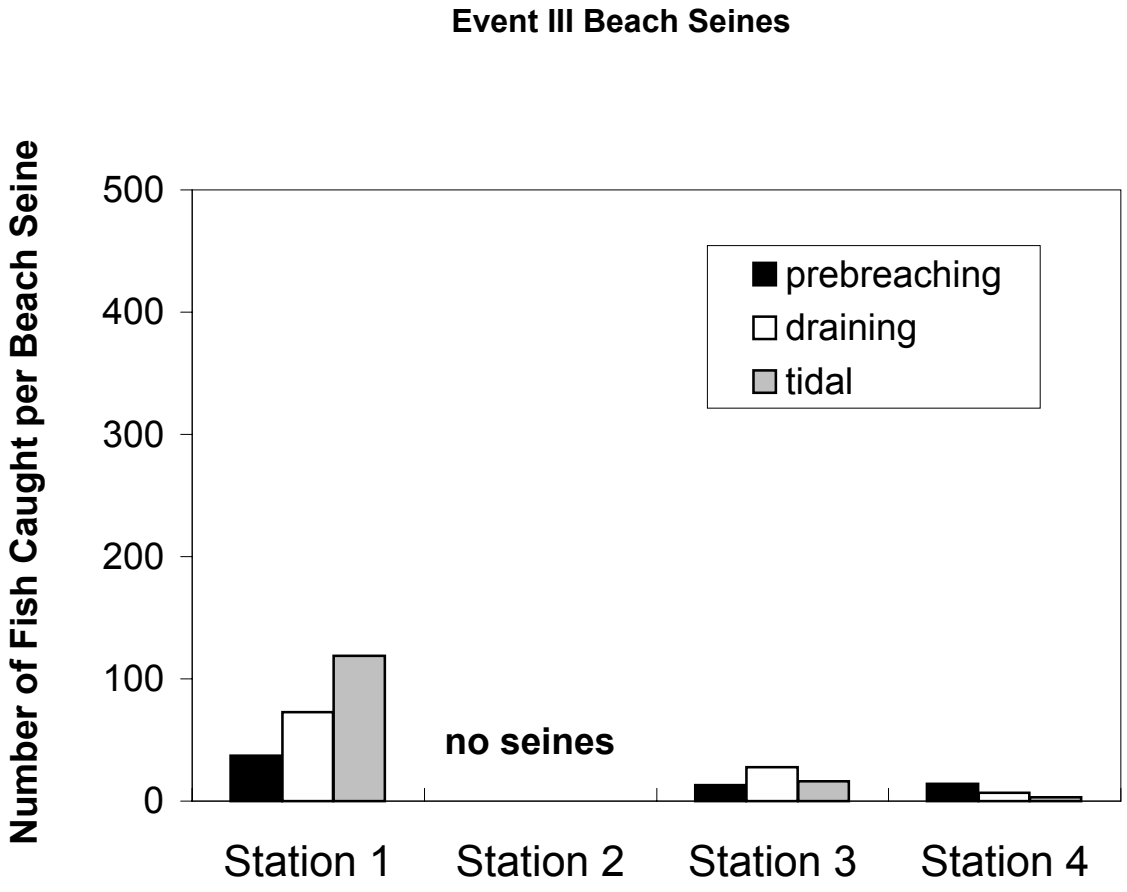
Appendix B-21. Tidal Beach Seine Catch Summary, Event III, 31 October 2000.

	31-Oct-00			
Common Name	Stn 1 1245 hr PDT	Stn 2 no seine	Stn 3 1525 hr PDT	Stn 4 1645 hr PDT
Topsmelt	115			1
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin				1
Staghorn sculpin	3			
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback			16	
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1			1
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	3	-	1	3
Total fish	119	-	16	3

Invertebrates				
Cancer magister	60			

Event III Beach Seines




Event III Beach Seines
Number of Fish Caught per Beach Seine
500
400
300
200
100
0
prebreaching
draining
tidal
no seines
Station 1
Station 2
Station 3
Station 4

Appendix B-22. Prebreaching Beach Seine Catch Summary, Event IV, 7 November 2000.

	7-Nov-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	no seine	no seine	1350 hr PDT	1518 hr PDT
Topsmelt				1
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin				
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback				
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder				
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	-	-	0	1
Total fish	-	-	0	1

Appendix B-23. Draining Beach Seine Catch Summary, Event IV, 8 November 2000.

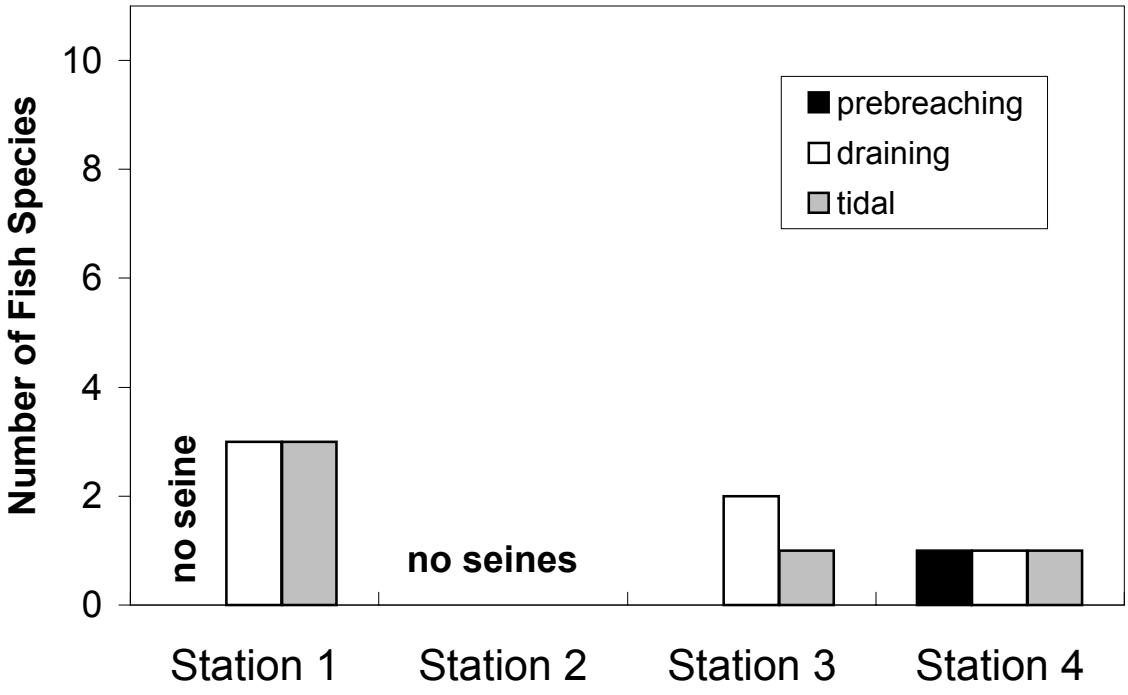
	8-Nov-00			
	Stn 1	Stn 2	Stn 3	Stn 4
Common Name	1030 hr PDT	no seine	1245 hr PDT	1405 hr PDT
Topsmelt	1		4	
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin				2
Staghorn sculpin				
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback	1		21	
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1			
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	3	-	2	1
Total fish	3	-	25	2

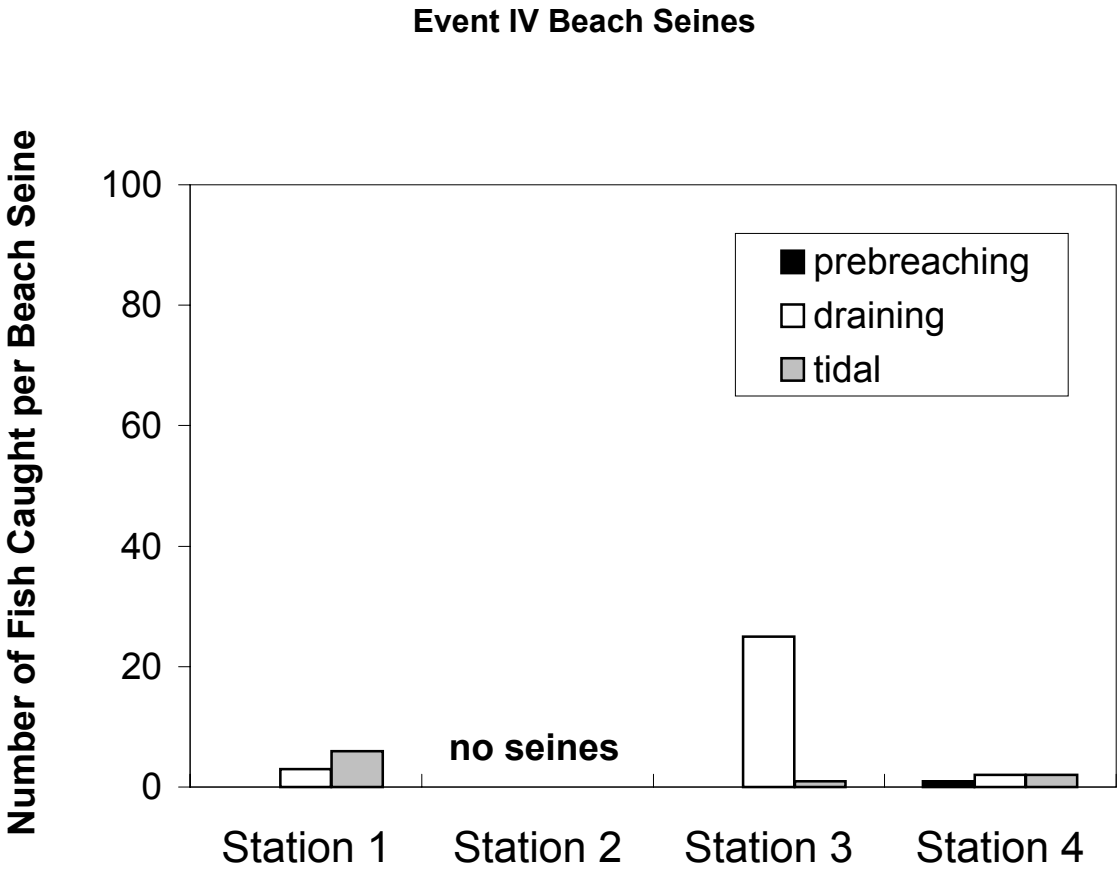
Appendix B-24. Tidal Beach Seine Catch Summary, Event IV, 1 16 November 2000.

	16-Nov-00			
Common Name	Stn 1 1045 hr PDT	Stn 2 no seine	Stn 3 1322 hr PDT	Stn 4 1415 hr PDT
Topsmelt				2
Pacific sanddab				
Speckled sanddab				
Sacramento sucker				
Pacific herring				
Prickly sculpin	2			
Staghorn sculpin	3			
Bocaccio				
Shiner surfperch				
Pacific tomcod				
Threespine stickleback				
Surf smelt				
Longfin smelt				
Unidentified osmerid larvae				
Starry flounder	1		1	
Unidentified juv. gunnel/prickleback				
Steelhead				
Bay pipefish				
Number of fish species	3	-	1	1
Total fish	6	-	1	2

Invertebrates				
Cancer magister	20			

Event IV Beach Seines




Event IV Beach Seines
Number of Fish Caught per Beach Seine
100
80
60
40
20
0
prebreaching
draining
tidal
no seines
Station 1
Station 2
Station 3
Station 4

Appendix B-25. Fork Lengths (millimeters) of Steelhead Smolts Captured in Beach Seines in the Russian River Estuary, 2000.

Steelhead					
		Station Number			
date	Survey Type	stn 1	stn 2[1]	stn 3	stn 4
1-Sep-00	Prebreaching			155 161 158	
6-Sep-00	Draining			135	
8-Sep-00	Tidal			185	
9-Oct-00	Prebreaching			188 173	

[1]seine not deployed at station 2 in 2000

Appendix C: Pinniped Monitoring Data

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
EVENT I					
Pre-Breaching					
09/01/00	7:00		0	0	0
09/01/00	7:30		0	0	0
09/01/00	8:00		0	0	0
09/01/00	8:30		0	0	0
09/01/00	9:00		0	0	0
09/01/00	9:30		0	0	0
09/01/00	10:00		0	0	0
09/01/00	10:30		0	0	0
09/01/00	11:00		0	0	0
09/01/00	11:30		0	0	0
09/01/00	12:00		0	0	0
09/01/00	12:30		0	0	0
09/01/00	13:00		0	0	0
09/01/00	13:30		0	0	0
				Total for Date	**0**
Breaching					
09/05/00	7:14	A	11	1	12
09/05/00	7:30	A	18	1	19
09/05/00	8:00	A	18	1	19
09/05/00	8:30	A	21	1	22
09/05/00	9:00		0	0	0
09/05/00	9:30		0	0	0
09/05/00	10:00		0	0	0
09/05/00	10:30		0	0	0
09/05/00	11:00	B	1	0	1
09/05/00	11:30	B	1	1	2
09/05/00	12:00	B	1	1	2
09/05/00	12:30	B	1	0	1
09/05/00	13:00		0	0	0
09/05/00	13:30	B	2	0	2
				Total for Date	**80**
Post-Breaching					
09/06/00	7:00	A	15	5	20
09/06/00	7:00	B	27	7	34
Subtotal	7:00		42	12	54
09/06/00	7:30	A	13	6	19
09/06/00	7:30	B	19	5	24

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
Subtotal	7:30		32	11	43
09/06/00	8:00	A	12	6	18
09/06/00	8:00	B	20	5	25
Subtotal	8:00		32	11	43
09/06/00	8:30	A	9	6	15
09/06/00	8:30	B	23	8	31
Subtotal	8:30		32	14	46
09/06/00	9:00	A	2	1	3
09/06/00	9:00	B	23	8	31
Subtotal	9:00		25	9	34
09/06/00	9:30	B	33	11	44
09/06/00	10:00	B	33	11	44
09/06/00	10:30	B	32	11	43
09/06/00	11:00	B	32	14	46
09/06/00	11:30	B	27	13	40
09/06/00	12:00	B	33	14	47
09/06/00	12:30	B	29	13	42
09/06/00	12:30	C	1	0	1
Subtotal	12:30		30	13	43
09/06/00	13:00	B	10	14	24
09/06/00	13:00	C	1	0	1
Subtotal	13:00		11	14	25
09/06/00	13:30	B	16	14	30
09/06/00	13:30	C	1	0	1
Subtotal	13:30		17	14	31
				Total for Date	**583**
EVENT II					
Pre-Breaching					
10/10/00	7:00		0	0	0
10/10/00	7:30		0	0	0
10/10/00	8:00	A	4	3	7
10/10/00	8:30	A	11	3	14
10/10/00	9:00	A	10	3	13
10/10/00	9:30	A	14	4	18
10/10/00	10:00		0	0	0
10/10/00	10:30		0	0	0
10/10/00	11:00	A	6	0	6
10/10/00	11:30		0	0	0
10/10/00	12:00	A	11	2	13

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
				Total for Date	**71**
Breaching					
10/11/00	7:06	A	24	7	31
10/11/00	7:30	A	20	11	31
10/11/00	8:00	A	29	11	40
10/11/00	8:30	A	31	9	40
10/11/00	9:00	A	32	15	47
10/11/00	9:30	A	0	0	0
10/11/00	10:00	B	24	3	27
10/11/00	10:30	B	20	9	29
10/11/00	11:00	B	23	10	33
10/11/00	11:30	B	25	10	35
10/11/00	12:00	B	23	9	32
10/11/00	12:30	B	26	7	33
10/11/00	13:00	B	27	7	34
10/11/00	13:30	B	26	11	37
10/11/00	13:55	B	26	10	36
				Total for Date	**485**
Post-Breaching					
10/12/00	7:22	A	40	13	53
10/12/00	7:22	B	53	9	62
10/12/00	7:22	C	37	4	41
Subtotal	7:22		130	26	156
10/12/00	7:30	A	46	13	59
10/12/00	7:30	B	53	8	61
10/12/00	7:30	C	33	11	44
Subtotal	7:30		132	32	164
10/12/00	8:00	A	50	7	57
10/12/00	8:00	B	46	12	58
10/12/00	8:00	C	42	8	50
Subtotal	8:00		138	27	165
10/12/00	8:30	A	54	13	67
10/12/00	8:30	B	21	14	35
10/12/00	8:30	C	40	22	62
Subtotal	8:30		115	49	164
10/12/00	9:00	A	48	22	70
10/12/00	9:00	B	25	12	37
10/12/00	9:00	C	49	14	63
Subtotal	9:00		122	48	170

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
10/12/00	9:30	A	46	21	67
10/12/00	9:30	B	24	10	34
10/12/00	9:30	C	40	24	64
Subtotal	9:30		110	55	165
10/12/00	10:00	A	45	20	65
10/12/00	10:00	B	20	10	30
10/12/00	10:00	C	41	24	65
Subtotal	10:00		106	54	160
10/12/00	10:30	A	45	19	64
10/12/00	10:30	B	18	4	22
10/12/00	10:30	C	65	13	78
Subtotal	10:30		128	36	164
10/12/00	11:00	A	32	4	36
10/12/00	11:00	C	73	13	86
Subtotal	11:00		105	17	122
10/12/00	11:30	A	30	4	34
10/12/00	11:30	C	75	16	91
Subtotal	11:30		105	20	125
10/12/00	12:00	A	25	3	28
10/12/00	12:00	C	78	18	96
Subtotal	12:00		103	21	124
				Total for Date	**1679**
EVENT III					
Breaching					
10/27/00	7:12	A	42	16	58
10/27/00	7:12	B	14	2	16
Subtotal	7:12		56	18	74
10/27/00	7:30	A	53	7	60
10/27/00	7:30	B	18	3	21
Subtotal	7:30		71	10	81
10/27/00	8:00	A	65	6	71
10/27/00	8:00	B	23	2	25
Subtotal	8:00		88	8	96
10/27/00	8:30	A	28	6	34
10/27/00	8:30	B	21	4	25
Subtotal	8:30		49	10	59
10/27/00	9:00	A	38	7	45
10/27/00	9:00	B	34	3	37
Subtotal	9:00		72	10	82

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
10/27/00	9:30	A			44
10/27/00	9:30	B			30
Subtotal	9:30				74
10/27/00	10:00		0	0	0
10/27/00	10:30		0	0	0
10/27/00	11:00	C			7
10/27/00	11:30	C			12
10/27/00	12:00	C			10
10/27/00	12:30		0	0	0
10/27/00	13:00		0	0	0
				Total for Date	**495**
Post-Breaching					
10/30/00	7:05	A	85	9	94
10/30/00	7:05	B	23	8	31
Subtotal	7:05		108	17	125
10/30/00	7:30	A	86	10	96
10/30/00	7:30	B	35	8	43
Subtotal	7:30		121	18	139
10/30/00	8:00	A	91	9	100
10/30/00	8:00	B	46	4	50
Subtotal	8:00		137	13	150
10/30/00	8:30	A	102	6	108
10/30/00	8:30	B	67	1	68
Subtotal	8:30		169	7	176
10/30/00	9:00	A	94	6	100
10/30/00	9:00	B	58	4	62
Subtotal	9:00		152	10	162
10/30/00	9:30	A	106	11	117
10/30/00	9:30	B	66	1	67
Subtotal	9:30		172	12	184
10/30/00	10:00	A	116	5	121
10/30/00	10:00	B	71	2	73
Subtotal	10:00		187	7	194
10/30/00	10:30	A	121	6	127
10/30/00	10:30	B	72	6	78
Subtotal	10:30		193	12	205
10/30/00	11:00	A	116	9	125
10/30/00	11:00	B	71	3	74
Subtotal	11:00		187	12	199

Appendix C-1. Russian River Estuary Pinniped Monitoring Seal Counts for 2000.

Date	Time	Site	Number of Seals		
			Adults	Pups	Total
10/30/00	11:30	A	143	7	150
10/30/00	11:30	B	61	0	61
Subtotal	11:30		204	7	211
				Total for Date	**1745**
EVENT IV					
Breaching					
11/07/00	7:00	A	7	0	7
11/07/00	7:30	A	1	0	1
11/07/00	8:00		0	0	0
11/07/00	8:30		0	0	0
11/07/00	9:00		0	0	0
11/07/00	9:30		0	0	0
11/07/00	10:00	B	12	0	12
11/07/00	10:30	B	26	1	27
11/07/00	11:00	B	26	1	27
11/07/00	11:30	B	28	2	30
11/07/00	12:00	B	31	2	33
				Total for Date	**137**
Post-Breaching					
11/08/00	7:06	A	93	6	99
11/08/00	7:30	A	94	8	102
11/08/00	8:00	A	96	4	100
11/08/00	8:30	A	88	2	90
11/08/00	9:00	A	100	3	103
11/08/00	9:30	A	101	4	105
11/08/00	10:00	A	127	5	132
11/08/00	10:30	A	123	5	128
11/08/00	11:00	A	131	7	138
11/08/00	11:30	A	109	5	114
				Total for Date	**1111**

Appendix C-2. Russian River Estuary Pinniped Monitoring Disturbances for 2000.

Start Time	Duration (mins)	Response[1]	No. Disturbed	No. Fled	Distance to Source (ft)	Source[2]
EVENT I						
Pre-breaching 9/01/2000						
No pinnipeds hauled out						
Breaching 9/05/2000						
08:43	2	F	22	21		6 - bulldozer
08:51	1	M	1		200	6 - bulldozer
08:59	1	F		1		6
12:38	18	None	0	0	150	1
12:41	15	None	0	0	150	1
12:43		None	0	0		1
12:44		None	0	0		1
12:49		None	0	0		1
12:57	2	None	0	0	150	1
12:58		F	1	1	150	1
13:00	5	None	0	0		6 - ranger
13:11		None	0	0		1
Post-breaching 9/06/2000						
07:27	4	A, M, F	34	18	25	1 (4)
08:00	0.5	A	4	0	300	6 – truck
08:22	0.5	A	2	0	300	6 – truck
08:33	3	A, M	5		200	1
08:38	< 1	M, F	15	12	250	1, 6 – truck
08:43	< 1	A, F	2	1	50	6 – great blue heron
08:44	< 1	A, M	1	0	300	6 - truck
08:47	< 1	A, M, F	30	3	300	1, 2
08:50	< 1	A, F	2	2	300	1
09:02	< 1	A, F	31	0	300	6 – truck
09:34	< 1	A	2	0	300	6 – truck
09:43	< 1	A	20	0	300	6 - RV
10:44	18	A	4	0	150	1
12:35		None	0	0		1
12:45		M, F	32	28	100	1
12:49		None	0	0		1
EVENT II						
Pre-breaching 10/10/2000						
09:42	17	F	19	19	75	1
10:16	< 1	F	2	2	900	6 – kite
10:43	1	F	1	1	1000	6 - truck
11:20	4	A, F	14	1	900	1
11:26	9	F	19	19	50	1
11:46	< 1	A	6	0	1000	1

Appendix C-2. Russian River Estuary Pinniped Monitoring Disturbances for 2000.

Start Time	Duration (mins)	Response[1]	No. Disturbed	No. Fled	Distance to Source (ft)	Source[2]
Breaching 10/11/2000						
08:07	2	M	3	3	n/a	unknown
08:19		None	0	0		1
08:42	< 1	A	40	0		6 – wave
09:02	< 1	A	3	0		6 - seals
09:22		None	0	0		6 – dozier
09:24	2	A, M, F	40	35	600	6 – dozier
09:29		F	18	18		6 – dozier
09:34		A, F	18	4		1
09:42	< 1	F		11		6 – dozier
09:43	< 1	F		3		6 – dozier
11:06	< 1	F		2		unknown
Post-breaching 10/12/2000						
08:31	< 1	A	20	0	1000	6 – truck
09:12	16	n/a	0	0		1
10:05	14	n/a	0	0		1
10:50	11	A, F	14	6	100	1 - SCWA
11:34	3	n/a	0	0	1000	1 SCWA
11:40	2	n/a	0	0	1000	1
11:52			0	0		1
11:54		n/a	0	0	500	1
EVENT III						
Breaching 10/27/2000						
08:30	< 1	A, M, F	64	30	300	6 – truck
09:30	10	A, M, F	74	58	25	1, 2
09:52		A, M, F	57	57		6 – dozier/truck
13:30			0	0		6 – bulldozer
13:38			0	0		1
Post-breaching 10/30/2000						
09:30	< 1	A	10	0	10	6 – seal
09:35	< 1	A	5	0	900	6 – car
10:42	2	A	5	0	500	3
10:43	< 1	A	< 10%	0		6–helicopter
10:52	< 1	A	3	0	900	6 – car
11:04	2	A, M, F	125	3	100	3
11:21	1	A, F	5	1	100	3
EVENT IV						
Breaching 11/07/2000						
07:15	< 1	A, F	4	3		6 – waves
08:57	< 1	A	5	0	1000	6 – dozier

Appendix C-2. Russian River Estuary Pinniped Monitoring Disturbances for 2000.

Start Time	Duration (mins)	Response[1]	No. Disturbed	No. Fled	Distance to Source (ft)	Source[2]
11:22	< 1	A	10	0	500	6 – dozier
Post-breaching 11/08/2000						
09:06	3	A, M	40	0	300	1 – SCWA
09:13			0	0		1
11:06	5	A, M, F	130	60	75	1

[1] A = Alert; F = Flight; M = Move
[2] 1 = People; 2 = Photographer; 3 = Kayak; 4 = Other Boat; 5 = Surfer; 6 = Other (specify)