



SOQUEL CREEK LAGOON MONITORING

REPORT, 1993

Prepared for

**CITY OF CAPITOLA
420 Capitola Avenue
Capitola, California 95010**

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Project # 106-03



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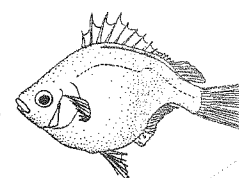
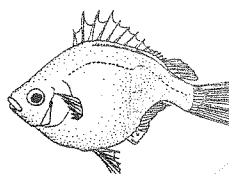


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SOQUEL CREEK LAGOON MONITORING REPORT, 1993

ACKNOWLEDGMENTS

We wish to again acknowledge the funding entities for this monitoring work. They were the Coastal Conservancy, with Jim King being the project analyst who obtained state funds, and the City of Capitola with its enlightened City Council which adopted the Soquel Creek Lagoon Management and Enhancement Plan in 1990, which called for lagoon monitoring. The monitoring was greatly facilitated by the Public Works personnel. We have all become familiar players in the summer activities at the lagoon. There was a caring attitude among City employees to protect the habitat of steelhead and other wildlife that use the lagoon. We worked closely with Ed Morrison and Jim Turcotte, They took the time to adjust the boards at the flume entrance to adequately manage lagoon levels when needed, day or night and weekends included.

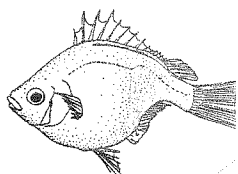
We wish to thank Joseph Urbani for his help in cleaning out the kelp before sandbar closing and keeping an eye on the lagoon. His observations are always very informative. We are fortunate that Daniel Morrison, Ed's son, was able to catch a steelhead in the lagoon in November, while the flume was still operating.

We wish to again thank Nels Westman and the Begonia Festival organizers for doing another effective job of cleaning up the flowers after the Festival in September, 1993. I had the pleasure of seeing the floats and soaking up the festive atmosphere this year. Boys from McDowell Youth Homes dismantled the floats and cleaned up afterwards.

We are again indebted to the volunteer efforts of Dr. Jerry Smith, several of his San Jose State students and friends, the Friends of Soquel Creek and lagoon visitors during the fish sampling in September and October, 1993. We heartily thank Harvey Rodgers of the San Lorenzo Steelheaders and his friends for helping with fish sampling. Patricia Anderson of the California Department of Fish and Game and Ann Lopez, a biologist from San Jose City College also provided their valuable time in sampling. Hopefully, we may obtain more volunteer help in 1994.

We wish to thank the Friends of Soquel Creek for their continued interest in the fish and wildlife of Soquel Lagoon, as well as upstream in the watershed. They, too, assisted in the fish sampling. The long-term health and welfare of Soquel Creek Lagoon will depend on Capitola's citizens.

The skill of Bill Casalegno in constructing the sandbar was again very appreciated. The cover's photographs were taken of Bill as he constructed the sandbar in May, 1993, and City staff. Bill is a Zen Master in the use of a D-8 Caterpillar tractor. It was memorable to watch him working the sand around the flume exit, his heavy blade swinging and cutting deliberately beside trusting, shoveling men, hurrying to beat an in-coming tide before it could engulf them.



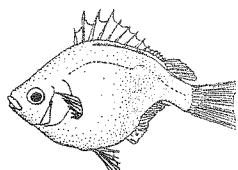
EXECUTIVE SUMMARY

In May, 1993, Soquel Creek meandered east across the beach to the rock jetty before emptying into the Monterey Bay, as it had in 1992. Fish that may have been in this eastward channel were herded back into the main estuary with a 1/4-inch mesh seine at the advisement of the Department of Fish and Game. We saw one staghorn sculpin in the channel and none down at the jetty during this operation. Then the channel was closed off for sandbar construction. The periphery of the lagoon was walked in search of tidewater gobies. None were seen. After sufficient sand was stockpiled by Mr. Casalegno, our clean up of the lagoon was begun. The process of sandbar construction involved a 4-day period of opening the sandbar at low tide near dawn, raking furiously for 2-3 hours and plugging the sandbar at high tide before salt water could wash in, from 18 May through 21 May 1993. The final preparation of the flume entrance and final sandbar closure was delayed due to rain. The sandbar continued to be opened on 3 more mornings, 24 May through 27 May until enough sand could be accumulated on the beach and the plastic could be positioned at the flume entrance. City personnel and Don Alley hand-raked decomposing kelp, sea grass and decomposed ooze out of the lagoon through the opening each day. Each day the sandbar was closed just before high tide in order to prevent salt water incursion. The sandbar had to be closed early each morning (0800-0915hr) in 1993, necessitating concentrated periods of raking. Large conglomerates of plant material above the water line were raked by tractor and spread out in the surf.

More than 90% of the decomposing plant material was removed before sandbar closure. Unlike 1992, in 1993 there was not much ooze on the bottom. The lagoon had less plant material for decomposition when the sandbar was closed in 1993. With 12 to 15 cfs as baseflow when the sandbar was installed, there was no need to use the shroud. The saltwater was flushed out the first week.

Water quality for aquatic life in the summer lagoon was generally good with regard to oxygen, salinity, conductivity and cover. A decline in oxygen level was detected at the bottom after the Begonia Festival. However, it posed no significant problem for fishes, and had increased by the next monitoring, a week later. Water temperatures were fair to good all summer, except in early August at the flume. This was a significant improvement over the previous summer. The lagoon gage height was usually 0.1-0.2 feet higher than the previous summer, and in September it was 0.5 feet higher for the entire month. A deeper lagoon in 1993 helped to maintain cooler conditions than in 1992 and slower plant growth. There was only an 8-day period in October, 1993, in which the lagoon level dropped excessively by 0.21 meters (0.7 feet) to create depths of one meter or less, except in the central channel where it was 1.5 meters maximum. Depth improved when the boards were re-installed.

Fish passage through the flume was excellent all summer. City

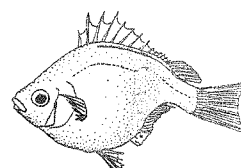


staff did an excellent job of preserving the sandbar early in the season when it rained in June. They did an excellent job in preserving the sandbar until a significant rain period ensued after December 9. Ed Morrison was out there on several nights in early and late November, pulling boards out of the flume. He was increasing the flume's capacity so as to maintain the sandbar until the rainy season began in earnest after Thanksgiving. Thus, the valuable steelhead nursery habitat was protected as long as possible in 1993. Smolts and adults were given good access through the sandbar when streamflows were high enough to maximize survival. In 1993, there was proof that adult steelhead swam through the flume into the lagoon in November because several were caught in the lagoon in November.

Fish sampling in September and October in which steelhead were marked and recaptured, indicated that the steelhead density in the lagoon was high. The juvenile steelhead population in the lagoon was estimated to be 2787 juveniles +/- 306. No hatchery fish were captured, indicating that they made it out the previous spring. The creek flowed continuously to the lagoon without the dry reach through Soquel Village as had occurred in earlier summers. Hydraulic continuity allowed large numbers of juvenile steelhead to down-migrate to the lagoon throughout the summer to utilize valuable nursery habitat there. The lowest estimated inflow to the lagoon was 1 cfs in September. Sacramento suckers had dramatically entered the lagoon in 1992 in high numbers and helped to control algal densities. However, sampling in 1993 indicated that the sucker population had declined. Tidewater gobies appeared absent downstream of the Stockton Avenue bridge in 1993, unlike in 1988 when the density was in the hundreds of fish. No searches for gobies were made in the upper lagoon, where some may have been present. The apparent decline and possible elimination of tidewater gobies in Soquel Lagoon may have been due to being flushed out of the system by more normal stormflows in the last couple of years since the drought. Soquel Creek lacks quiet backwater refuges at its mouth to shelter tidewater gobies. The gobies present during the drought may have colonized from Corcoran Lagoon. Threespine sticklebacks were abundant throughout the lagoon in 1993.

Regarding waterfowl, there was an additional goose in 1993, bringing the number to 4. This was considerably less than the 16 geese tallied back in July, 1989, before most were relocated. The density of mallards increased in 1993 over the previous year. This may be attributed to the greater reproductive success of wild mallards. The most significant increase in birds was the three-fold increase in pigeons using Reach 2, either roosting on the trestle or at the east park near the bridge.

There was an increase in fish-eating birds at the lagoon in 1993. A female merganser brought her 3 young to the lagoon. One young disappeared early on. But either the mother or two of her offspring were seen in the lagoon much of the summer. Pied-billed grebes were more common, too, with as many as 4 being seen feeding on fish in the lagoon at one time. We saw our first



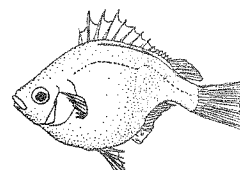
green-backed herons and black-crowned night heron at the lagoon in 1993. American coots again returned to the lagoon the second week of September and were abundant (> 100) by Thanksgiving.

Aquatic plant production was nil for the first month after sandbar closure in 1993. But in July there was a dramatic bloom of filamentous algae that filled the lagoon below the surface. It then died off in the reaches below the railroad trestle in early August. Reach 3 retained thick algae longer because it bloomed later than in the lower reaches. After the die off, algae did not cover more than 60% of the lagoon bottom for the remainder of the season and remained less than 2 feet thick. Pondweed was not observed until the time of the Begonia Festival in mid September, 3 1/2 months after sandbar closure. This delay was unusual compared to previous years when pondweed dominated for much of the season. Presumably, pondweed had difficulty in becoming established because of the lack of fine sediment and ooze on the lagoon bottom after the higher, more normal stormflows of the rainy season. Most of the pondweed appeared to be destroyed by the Begonia Festival activities in 1993, unlike previous years. However, it came back quickly and was at a seasonal high density just two weeks after the Begonia Festival. The filamentous algae had bounced back immediately after the Begonia Festival, presumably with the lack of competing pondweed.

Floating algae was only a very minor occurrence throughout the summer and fall of 1993 as in 1992. The exception was in early August when algae covered 35% of the surface in Reach 3 and 30% of the surface in Reach 2. It was gone two weeks later, however. The waterfowl apparently did a good job as biological controllers of pondweed and algae. No aquazine was required for algae control in 1993. The geese did not appear to feed so much on algae in 1993 as they did immediately after the no bird-feeding signs went up. In 1993, bird-feeding made a strong comeback.

Fecal bacterial levels were at an all time high during the summer of 1993, relative to the previous 3 years. Fecal coliform counts were above the safety standard during all monitoring except for one occurrence at the railroad trestle in August. The bacterial levels in the lagoon in-flow at Nob Hill were significantly higher than in 1992, as well. Two factors that increased fecal coliform were probably the two bridge constructions upstream and the increased in-flow that better carried the bacteria downstream from the pigeon colony at Soquel Avenue bridge. An additional factor probably was the three-fold increase in pigeons roosting on the railroad trestle.

No new management recommendations were forthcoming in this report. The most critical recommendations yet to be followed from past reports would be 1) better education/enforcement of the no bird-feeding ordinance and 2) the installation of gutters on the lagoon-side of the restaurants to capture garbage and excrement-laden water to be transported away from the lagoon. These measures will reduce the nutrient and bacterial inputs to the lagoon.



LAGOON AND ESTUARY FORMATION

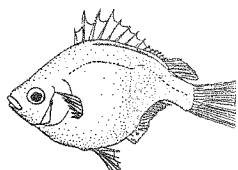
Sandbar Construction, 1993. Appendix A provides pictures of the various activities associated with sandbar closure.

The City obtained a multiple-year Fish and Game Permit (Appendix B) to close the sandbar. It stated that no vehicles were to enter the wetted creekbed except within 25 feet of the flume. The Creek was flowing east of the flume across the beach to the rock jetty as in 1992. The stream went laterally east from the flume and parallel to the coastline for approximately 150 meters and bent abruptly south at the jetty to empty into the surf. It was decided that fish in the east-coursing channel across the beach would be herded back into the lagoon before the sandbar was constructed around the lagoon.

17 May 1993. The periphery of the estuary was walked in search of tidewater gobies. None were observed. Fish that may have been in the eastward channel were herded back into the main estuary with a 1/4-inch mesh seine that extended the full width of the channel at the advisement of the Department of Fish and Game. We saw one staghorn sculpin in the channel and none down at the jetty during this operation. Then sand was quickly pushed across the channel by Mr. Casalegno to cut it off from the lagoon so that the sandbar could be constructed. Unlike the previous year, the lagoon bottom was firm rather than soft with ooze. The main channel was also deeper than 1992. These changes were undoubtedly due to scour of the higher winter flows of winter, 1992-93. There was no fish passage overnight. A ditch was dug adjacent to the flume to receive lagoon overflow.

18 May 1993. By 0600hr, the sandbar had been opened and was draining through a channel adjacent to the flume. It was 15 feet wide at the upper end and 30 feet wide at the surf. The lagoon looked like a creek channel once again. Mr. Casalegno had to close the lagoon early to prevent kelp from backwashing in. He continued to fill in the blocked off channel that had meandered toward the jetty. Jim Turcotte opened both ends of the flume. The outer half was full of sand. He opened all the portals on top of the flume. He and others used pumps to force water through the portals to flush out the sand. They were successful.

19 May 1993. Four City employees and myself were ready to begin raking at 0600hr when the sandbar was opened. The flume was open all night after being unplugged by 1500hr the previous day. A coarse screen covered the flume entrance that would allow adult and smolt-sized steelhead to pass through. There was a problem with a back eddy at the entrance of the trench through the sandbar. Mr. Casalegno filled in a hole there to facilitate flushing. The sandbar was closed at 0830hr, which was a bit late. A small amount of saltwater entered the lagoon before closure. Sand continued to be accumulated for the sandbar. There was less sand to work with than previous years.

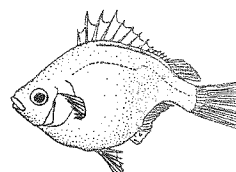


20 May 1993. Two City employees and myself began raking soon after 0600hr when the sandbar was opened. The flume had been open overnight for good fish passage. The eddy problem returned and Mr. Casalegno filled in the hole once again. After the margins of the lagoon became exposed above the water line, the cove near the restaurants was deepened and contoured up to the stairs for the pedal boat operator. The pedal boat operator specified the grade there and was satisfied. We emphasized to him the need to maintain a full summer lagoon. He understood. A hump between the cove and the flume was flattened out. The sandbar was plugged at 0810hr. Sand continued to be accumulated.

21 May 1993. Five City employees were available with myself to rake the kelp and seagrass out of the lagoon. The flume was open with good fish passage overnight before sandbar opening. The City staff worked hard in raking the lower lagoon while I went upstream of the bridge to free up deposits of plant material and pull them into the current. Many steelhead smolts were seen under the bridge and upstream to Noble Gulch. The lagoon bottom did not have the soft ooze that existed the previous year. I raked out the hole at the mouth of Noble Gulch to prevent anaerobic decay of plant material later in the summer. More than 90% of the plant material had been removed from the lagoon. One dead stickleback was observed in branches that had been raked onto the sand. The west side of the lagoon near Venetian Court was contoured above the water line. The sandbar was closed at 0910hr.

24 May 1993. The sandbar had remained closed over the weekend. The flume was open this morning and was observed open on Sunday morning. The sandbar was opened and I did some final raking in deep locations around the Stockton Avenue Bridge and around the logs under the bridge. As the lagoon level dropped, some steelhead and stickleback became trapped in depressions near the east pier of the bridge. I noticed when I saw fish flopping on the sand. I rescued all but 2 steelhead smolts and 15 sticklebacks which suffocated on the sand. Mr. Casalegno contoured the sand around the flume entrance. Ed Morrison thought it best to hold off the preparation of the plastic liner around the flume until the next day. Rain was forecasted that night, and there was concern that the sandbar would be lost. Sandbar construction had taken too many days this year. Fear of stormflow damage delayed the process. The waterfowl appeared very hungry. I herded them upstream where more plant material was available. However, they returned to the lower lagoon. A school of 10 steelhead smolts were observed in the lower lagoon after the sandbar was plugged. The side channel to the jetty was now 3/4 filled in.

25 May 1993. It rained overnight. The flume was able to receive the full streamflow, though the lagoon level approached the top of the flume. The sandbar was again opened today. However, the plastic liner was not prepared because more rain was forecasted.



26 May 1993. The sandbar was opened a last time, and the plastic liner was positioned at the flume entrance to prevent undercutting of the flume. The plastic was covered with a thin layer of sand. The screens were left over the flume entrance. It rained that morning.

27 May 1993. The lagoon was full to a height of approximately 1 foot above the base of the flume entrance. Water was passing freely through the screened entrance. Fish passage was good. The shroud was not installed because of the high streamflow this year.

1 June 1993. One side of the flume entrance was closed with plywood. The other side was screened and fully open. The water level was approximately 1 foot above the base of the flume entrance. Fish passage was good. Gage height = 1.60.

3 June 1993. Flume entrance with 2 boards on either side. Remainder of the opening screened with 6"x6" mesh. End ribs of screen removed at water line to make adult fish passage easy. The entrance and exit of the flume were 12 inches deep. Gage height = 1.79. Fish passage was good. Two steelhead smolts were observed at the mouth of Noble Gulch. A gray suspension was exiting Noble Gulch. It looked like cleaning water. Nine piles of dog excrement were present at the trestle park. Seven piles were counted along the path. Ten to 12 dogs were walked by their owners along the path mostly in the morning. For further details, refer to water quality in Appendix D.

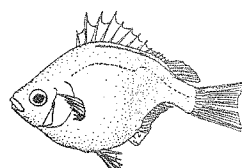
4 June 1993. At 2000hr the lagoon level was to the top of the inner ceiling of the flume. It could not pass much more water with the 2 boards in either side. Estimated streamflow 12-15 cfs.

5 June 1993. It began raining this Saturday morning at 0900hr. By 1100hr all of the boards had been removed from the lagoon entrance. The lagoon height went to 1 foot above the top of the flume. The sandbar remained intact.

7 June 1993. Two boards on each side with screens were reinstalled on flume entrance as were present on 4 June.

Recommendations Regarding Sandbar Construction

1. Bring Tim Calahan back to the lagoon-raking crew if he wishes to return. His sense of humor and light-heartedness were sorely missed in 1993.
2. Evaluate the structural integrity of the flume and its supports. Repair cracks and supports as necessary.
3. During sandbar construction, continue to close the lagoon each day before the incoming tide can wash salt water and kelp into the lagoon. Re-open the sandbar and unplug the flume, if necessary, each morning at low tide to drain out more kelp.



4. Continue to rake as much kelp and sea grass out of the lagoon as possible before final closure, including plant material trapped under the restaurants and in depressions around the bridge and at the mouth of Noble Gulch.

5. Dispose of kelp from the lagoon during sandbar closure in the bay rather than bury it in the sandbar. Disperse it up and down the beach so as to spread it out. Continue to include this in the Fish and Game permit for sandbar construction. County environmental health has no problem with this so long as kelp is spread out over a wide area (J. Ricker, County Env. Health, pers. comm.).

6. Seal off storm drains on the west side of the street in front of the Esplanade, as well as the portals in the walkway to the beach between the Beach House and Zelda's. This should be the case from May 15 to after the clean-up from the Wine Festival in mid-September. Seal off any storm drain pipes leading from the street to the lagoon in front of the restaurants. This will reduce pollution from restaurant clean-up.

7. Attempt to make the area around the flume the deepest part of the lagoon so that heavy salt water will collect there and be pulled out easily by the shroud.

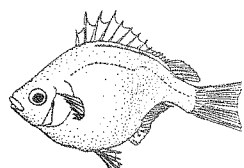
8. Continue to maintain the portal in the flume entrance for adult steelhead out-migration until June 1, while maintaining a notched top plank for steelhead smolt out-migration until July 1.

9. Continue to maintain the 1-foot high plank inside the flume until July 1 for smolt fish passage.

10. Continue to maintain an 8-inch depth at the outlet of the flume until July 1. Install two 4"x 4" planks in the outlet if necessary as per Fish and Game's suggestion.

Sandbar Breaching During the 1993-94 Rainy Season.

Thanks to the work of Ed Morrison, Jim Turcotte and other City employees, we were able to maintain an intact sandbar with streamflow passing through the flume until a prolonged rainy period began on 9 December 1993. There had been small storms during the nights of 14-15 October, 10-11 November and 28-30 November. The headwaters of Soquel Creek received an estimated 5+ inches of rain during 9-14 December. This was the first period that fish passage was good to the spawning areas above Soquel Village. Ed Morrison saw adult salmonids outside the flume exit the evening of 11 November after the rain. Steelhead were caught in the lagoon by Joe Urbani and Daniel Morrison, Ed's son, the first weekend after opening day of steelhead fishing season, 20-21 November. Another was caught by Daniel son on Thanksgiving Day. These catches indicated that the flume was very passable to adult steelhead.



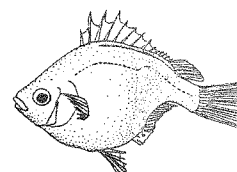
A perimeter fence was not placed around the flume entrance as recommended in the previous monitoring report. The feeling was that it would clog with algae and would require too much maintenance. The alternative approach was to leave the screening off the flume in the fall to allow algae to better pass through the flume. This worked well. There was not the density of aquatic plants, particularly pondweed, in the 1993 lagoon compared to 1992. Thus, clogging was not as big a problem.

9 December 1993. I was notified at 0630hr that a breach was necessary. The flume with 2 boards out on either side of the flume entrance could not pass enough water. According to Ed Morrison, at 0630hr the lagoon had filled and extended out onto the beach. No notch had been cut because the tractor was in the shop for repair. It had broken down the previous week while being used to cut the sandbar notch. Morrison had called for the backhoe at 0630hr. However, it was not needed because a notch was cut by shoveling that focused the water and began the sandbar breach. Upon my arrival at 0720hr, there was an estimated 125 cfs emptying through the sandbar. The lagoon elevation was 4-5 inches above the piling bolt. The lagoon had risen to about 10 inches above the bolt at its highest. The lagoon had just overtopped the bulkhead from the Stockton Avenue Bridge up to Noble Gulch. The bulkhead had suffered damage under the bridge. No flooding had occurred at the low-lying residences on Riverside Avenue. The gage height at 0800hr was down to 2.8. By 0930hr the gage height was down to 1.6.

Recommendations Regarding Sandbar Breaching

- 1) Recommend to the owners of 443 Riverview that they build a better bulk head to replace the old sandbag wall.
- 2) The notch in the sandbar should be cut slightly lower than the piling bolt.
- 3) Just before the first anticipated storm of the fall season, remove 1 board from each side of the flume. Clear the exit to the flume by removing the plate from one side of the exit. Clear the sand away from the top of the flume back to the first hole cover. Remove the cover and remove the 1-foot plank inside the flume. Replace the hole cover. By October 1, install a temporary perimeter fence in the lagoon around the flume entrance to prevent clogging of the flume with plant material unless the City is willing to leave the flume unscreened during stormflows. The fence should be 15 feet from the entrance and extend at least a foot higher than the top of the flume. Clean the pondweed and algae off the fence after each minor stormflow.

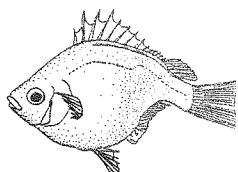
Replace the boards after each small storm and remove them before each storm until the sandbar is eventually breached during later, larger storms after approximately Thanksgiving. Remove the first flume portal cover if the entrance of the flume cannot handle the



volume of the stormflow in October and early November. After the stormflow subsides, replace the portal cover until the next minor storm.

4) If the sandbar breaches early in the rainy season, followed by a period of 2-4 weeks of a reformed sandbar that prevents water exchange with the ocean, attempt to pull the decomposing kelp out of the stagnating lagoon. Open the flume and encourage streamflow out with the shroud installed.

5) If a stagnant, kelp-filled lagoon forms in fall after an early breach and a dry period, do not empty the lagoon by breaching the sandbar. Instead, use the flume to pull salt water out. Breaching of the lagoon will increase the opportunity for more kelp to enter the lagoon and probably will not empty the entire lagoon at any rate. Fish passage need not be maintained through the flume. In fact, passage from the ocean into the lagoon should be discouraged until sufficient stormflows develop to allow good spawning passage up the Creek. If adult salmon or steelhead come in too early, they will become stranded in the lagoon. Artificial breaching without stormflow may strand adult fish.



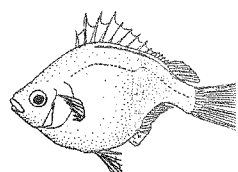
MONITORING OF PONDWEED AND ALGAL DENSITIES

The lagoon was divided into 3 reaches. Reach 1 extended upstream from the flume to Stockton Avenue Bridge (Figure 6). Reach 2 extended upstream from Stockton Avenue Bridge to the railroad trestle. Reach 3 extended upstream to a point just past the Shadowbrook Restaurant. Appendix A provides photos of pondweed and algae through the summer and fall months.

Table 1 provides a summary of pondweed and algae densities for 1993. In 1993, pondweed did not begin to grow until the time of the Begonia Festival in September. It had gotten started in July the previous summer. Filamentous algae did not get started until the beginning of July. However, it rapidly grew during the warm, sunny month of July, with the most noticeable production during the first 2 weeks in Reach 1 with relatively less in upstream reaches. By 27Jul93, all three reaches had between 80 and 95% of their bottoms covered, with thickness from 2 to 4 feet from upstream to downstream. This rapid algal production was partially due to the lack of competition with pondweed, which was not present. Within 2 weeks on 9Aug93, the algae had largely died off in Reaches 1 and 2 where it had been most abundant. It had probably used up the nutrients and crashed. Reach 3 still had a sizable amount of filamentous algae with the highest surface algae constituent for any reach the entire summer. Surface algae covered 35% of the surface in Reach 3 and 30% in Reach 2. Reach 1 had 5% of the surface covered. Though there was a scarcity of algae below surface in Reaches 1 and 2, surface algae was present. We wonder if it blew down from Reach 3.

The filamentous algae came back more slowly in the next 2 weeks of August in Reaches 1 and 2, with significant reduction in Reach 3. However, Reach 3 still had the most filamentous algae on 23Aug93. By early September, the algae density had become more equal in all 3 reaches. But more than 50% of the lagoon bottom had nothing more than a thin algal film. Surprisingly, on Begonia Festival Day, 12Sep93, all of the algae was associated with pondweed that had rapidly grown to 2-3 feet in height in just 2 weeks. The lagoon bottom was 70-75% bare in Reaches 1 and 3, with 50% bare in Reach 2. The boards on the flume were not pulled for the Festival. So the lagoon stayed full and cooler afterwards, compared to past years.

It appeared that activity of the Begonia Festival destroyed much of the pondweed in the 3 reaches and gave the filamentous algae a chance to bloom again in the last half of September. However, by the end of September, the pondweed had returned and was at its highest density and height of the summer on 6Oct93. All of the below-surface algae was associated with pondweed. Surface algae was at its maximum of 10% coverage in Reach 1 for most of September and the first part of October.



Monitoring in the last half of October and early November showed a seasonal decline in pondweed, with filamentous algae dominating the lagoon bottom as it had early in the season. There was no surface algae.

Noble Gulch continued to provide a nutrient in-flux to the lagoon in 1993, as indicated by the filamentous algal bloom that existed at its mouth all summer.

Plant growth in the 1993 lagoon was very different from 1992. The physical conditions were different in 1993. At sandbar closure, the lagoon bottom was cleaner without the layer of ooze found in 1992. The bottom was coarser sand and gravel in 1993 due to higher winter stormflows. The lagoon was deeper in 1993 with better management of the flume entrance. There was 10 times the flow volume passing through the lagoon in 1993 compared to 1992. The lagoon was 1-3 degrees C cooler all summer and fall, compared to 1992. It took much longer for pondweed to become established because it prefers finer sediments. Filamentous algae bloomed earlier and quicker in 1993 than 1992 without the competition from pondweed. But once the algae crashed in the first third of August in the lower 2 reaches, it never came back to its high density of July. Pondweed peaked in early October, 1993, and then declined. In 1992 it became abundant in early September and continued dense right through October. In 1993 the walking of the floats in the Begonia Festival seemed to have temporarily eliminated much of the pondweed, but not in 1992. Two weeks later the pondweed density was at a seasonal high.

In 1993 as a whole, there were lower densities of aquatic plant life than in 1992. However, the rapid growth of filamentous algae in July and rapid growth of pondweed in early September, 1993, indicated significant episodes of plant productivity.

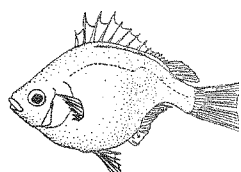
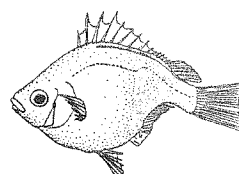


Table 1. Changes in Pondweed and Algae Densities, 1993.

Date	Reach #	Pondweed & assoc. Algae % covering bottom	Algae % bottom	Algae % surface
17-26May93		Sandbar Constructed.		
3Jun93	1,2,3	Slight planktonic algal bloom		
17Jun93	1,2,3	Slight planktonic algal bloom		
29Jun93	1,2,3	Slight planktonic algal bloom, algal film - bottom		
16Jul93	1	0	80(1-2' thick)	0
"	2	0	50(.2-.8' thick)	0
"	3	0	20(.2-.5' thick)	0
27Jul93	1	0	95(2-4' thick)	1
"	2	0	90(2-3' thick)	1
"	3	0	80(1-2' thick)	1
	Noble G.	0	40(1-1.5'thick)	0
9Aug93	1	0	30(.5-1'thick)	5
"	2	0	30(.1-.1' thick)	30
"	3	0	90(.1-1.2'thick)	35
	Noble G.	0	85(.1-1.5'thick)	15
23Aug93	1	- Fog came in 0730hr	- (too dark)	0
"	2	0 No glare - trestle	45(.5-1.5'thick)	0
"	3	0	35(.2-3' thick)	0
"	Noble G.	0	35(.2-1' thick)	5
3Sep93	1	0	- (too dark)	0
"	2	0 No glare - trestle	35(.5-2.5'thick)	0
"	3	0	40(.3-2' thick)	0
"	Noble G.	0	60(.5-2' thick)	0
12Sep93	Day of the Begonia Festival			
12Sep93	1	25 (1-2.5' high)	0	10
"	2	50 (.5-3' high)	0	0
"	3	30 (.5-2' high)	0	0
"	Noble G.	0	40(.5-2' thick)	0
13Sep93	1	- too turbid	-	5
"	2	- too turbid	-	1
"	3	- too turbid	-	0
14Sep93	Clean-up day for Begonia Festival			
20Sep93	1	5 (1-2.5' high)	60(.2-.6'thick)	1
"	2	5 (1-3' high)	60(.2-1'thick)	0
"	3	10 (1-3' high)	50(.2-.5'thick)	0
	Noble G.	-	60(.2-.5'thick)	0
26Sep93	First fish sampling in Reach 1			
27Sep93	1	40 (1-3' high)	20(1-3' thick)	10
"	2	40 (.5-3' high)	35(.5-2' thick)	2
"	3	15 (.5-3' high)	60(.2-2' thick)	1
6Oct93	1	70 (1-3' high)	0	10
"	2	40 (.5-2' high)	0	1
"	3	40 (.5-3' high)	0	3
10Oct93	Second fish sampling with algae skimming in Reach 1			
20Oct93	1	5 (1-1.5' high)	40(.2-1'thick)	1
"	2	10 (1-1.5' high)	65(.2-1' thick)	<1
"	3	5 (1-1.5' high)	40(.2-1' thick)	0
5Nov93	1	15 (2-3' high)	65(.3-2.5'thick)	0
"	2	15 (1-2' high)	20(.25-1' thick)	0
"	3	1 (1-1.5' high)	15(.5-.1.5'thick)	0



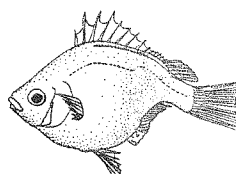
Recommendations for Control of Algae

1. Establish criteria which may be used to decide when algae is excessive, keeping in mind that pondweed and algae provide necessary cover for fish from bird predators. If aquazine is used in mid-summer, apply a low dose to the lower lagoon that will clear out the algae, making it easier for fish to move around and feed on invertebrates, as well as give pondweed a competitive advantage over the algae.

2. Choose to skim off floating algae until just before the Begonia Festival, at which time aquazine may be used to reduce algae before people walk around in the lagoon. The skimming off of algae removes the nutrients stored in the algae and may slow future algal growth. Use of aquazine returns the nutrients to the lagoon during bacterial decomposition. This release of nutrients stimulates faster algal growth afterwards.

Offer to donate funds to a volunteer group to skim algae off the lagoon surface instead of paying to have the lagoon treated with aquazine.

3. If a mid-summer treatment of aquazine is deemed necessary, apply it in a low dose (3 pounds or less) well below the Stockton Avenue Bridge so that no pondweed is killed and only Reaches 1 and 2 will be affected. If pondweed is not present in Reaches 2 and 3 at the time of aquazine treatment, algae control will leave little or no cover for fish, requiring special concern about aquazine spreading upstream of Reach 1 after treatment. In such cases, we recommend that just 2-3 pounds of aquazine be applied near the flume only and in early morning before the onshore breeze develops.



ANALYSIS OF FECAL BACTERIA MONITORING

Fecal Coliform/Streptococcus Counts from Santa Cruz County Monitoring

The summer months were focused on, from the time of sandbar closure (usually mid-May before Memorial Day weekend) to the Begonia Festival (first weekend in September). These are the months in which recreational use of the lagoon would potentially be highest. These are the months in which reductions in fecal bacterial counts would allow swimming in the lagoon. A management goal is to reduce fecal coliform counts below the 200/100 ml level, which is deemed a hazard to health by the Environmental Protection Agency. If this can be done, the lagoon may once again be used for swimming.

Summer months of 1990, 1991, 1992 and 1993 were compared in order to detect any trends or improvements that may be related to initiation of the Lagoon Management and Enhancement Plan.

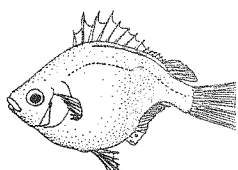
The Department of Environmental Health in Santa Cruz County collected weekly samples at primarily the flume entrance in the Soquel Creek Lagoon. Other weekly stations were on the Creek near Nob Hill and in Noble Gulch above the tunnel. Additional stations in the lagoon were occasionally monitored at the mouth of Noble Gulch and at the railroad trestle. Their data were analyzed to evaluate bacterial levels. The discussion will focus primarily on Reach 1 at the flume and at upstream end of the lagoon at Nob Hill because sampling was more restricted in 1993 than previous years. Reach 1 (lower lagoon) spanned from the flume to the Stockton Avenue Bridge. Reach 2 (middle lagoon) included the area from the Stockton Avenue Bridge to the railroad trestle. Reach 3 (upper lagoon) went from the trestle upstream to just beyond the Shadowbrook Restaurant.

The bacterial sampling station at the flume was used to represent counts in Reach 1. The station at the trestle was used to represent counts in upper Reach 2 and lower Reach 3. It was monitored 7 weeks in 1993. No station was present in 1990 or 1991 near the mouth of Noble Gulch until mid-September, 1991. The monitoring at the mouth of Noble Gulch continued through 1992. That station was monitored twice in 1993, making comparisons difficult. The County no longer measures streptococcus bacterial concentrations. It must be understood that concentrations of bacteria may vary considerably from one place to another. Therefore, the data only indicated bacterial levels in a general way.

Computer print-outs provided by the County of actual bacterial counts are in Appendix C.

Fecal Bacterial Counts in Reach 1

Week 3 was the week in which the sandbar was closed. Week 20 was



a week after the Begonia Festival. Counts in 1993 were generally at least twice those in 1992 (Figure 1). Exceptions were week 10 and 14. Summer, 1993, broke the pattern of drastic increases in coliform bacteria in week 14. Therefore, fecal coliform counts in 1993 were higher than the allowable level for swimming in 100% of the weekly samples at the flume.

Fecal Bacterial Counts in Upper Reach 2 and Lower Reach 3

Fecal coliform counts in 1993 were higher than those in 1992 in 6 of the 7 weeks measured in both years (Figure 2). In 1993, coliform counts were above the 200/100 ml cutoff for environmental safety in 6 of 7 (86%) weekly samples. Only in mid-August was it below 200. In 1992, the samples were below 200 in 61% of the time in Reach 2.

Fecal Bacterial Counts in Noble Gulch

The monitoring station was located at the entrance of the tunnel at Bay Avenue. Fecal coliform counts fluctuated wildly in 1993, as was the case in previous years. There were some weeks when it was quite low and others when they were relatively high (Figure 3).

Fecal Bacterial Counts in Reach 3 at the Mouth of Noble Gulch

In 1993, only 2 weeks monitored. However, it appeared that there was a concentrated source of coliform bacteria there in week 18 (7Sep93) (Figure 4). The County staff noted the presence of saw dust.

Comparison of Fecal Coliform Counts at the Flume, Railroad Trestle and the Mouth of Noble Gulch, 1993.

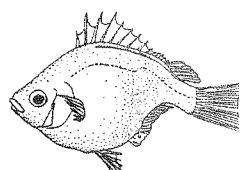
Fecal coliform bacterial counts were consistently higher in Reach 1 than in Reach 2 when both places were monitored. This followed the pattern of previous years. There were not enough measurements at Noble Gulch to make comparisons.

Comparison of Fecal Coliform Counts at Nob Hill in 1992 and 1993.

Counts were higher in 1993 in 12 of 16 weeks in which data were available for both 1992 and 1993. The rain in week 6 of 1992 made levels higher than. In the remaining 3 weeks, counts were essentially the same for both years. In 10 of 16 weeks in 1993, coliform counts were above 1000.

Conclusions from Fecal Bacterial Monitoring

In 1993, coliform levels were generally the worst of the last 4 years of monitoring. There was only 1 week in August in Reach 2 when the water met the health standard for human contact.



We had concluded that fecal bacterial counts were reduced in 1991 compared to 1990 in reaches 1 and 2 (Alley 1992). Counts in 1992 were similar to those in 1991. In Reach 1 the counts were at unsafe levels for swimming during 82% of the weeks in 1991 and 94% of the weeks in 1992 from the time of sandbar closure to the weekend of the Begonia Festival. On the other hand, in Reach 2 at the trestle, counts were at safe levels of coliform bacteria 65 % in 1991 and 61% in 1992 during the same time period.

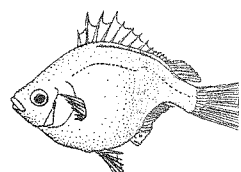
Reasons for the dramatic increase in fecal bacteria counts in 1993 may be due to at least 3 factors. According to John Ricker at the Santa Cruz County Environmental Health Department, two factors were probably the disturbances at the two bridge modifications upstream of the lagoon and the increased streamflow through the summer that better carried the bacteria downstream from the pigeon colony at Soquel Avenue bridge. An additional factor probably was the three-fold increase in pigeons roosting on the railroad trestle. An average of 16 pigeons were there during each monitoring in 1993, with a maximum of 30 observed at one time.

Monitoring of Dog Excrement - A Nasty Job, But Somebody's Got to Do It.

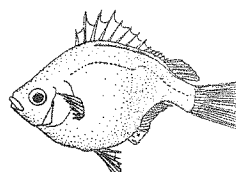
On 3 June, the first monitoring day after sandbar construction, 9 piles of dog excrement were present at the trestle park (private property). Seven fresh piles were counted along the path that parallels the lagoon. Ten of the 12 dogs observed on the path during the 2 hours that morning were ushered by their owners. On 17 June there were 4 fresh piles on the path. On 29 June there was one fresh pile on the path and 2 fresh piles at the trestle park. On 9 August there were 11 piles of excrement at the trestle park and 2 fresh piles along the path. The grass had been cut and the excrement removed from the trestle park prior to the Begonia Festival. Presumably the residents along the path clean up the excrement because the piles observed on the path are usually fresh. Who knows where the excrement is disposed of?

Recommendations Regarding the Monitoring and Reduction of Fecal Bacteria

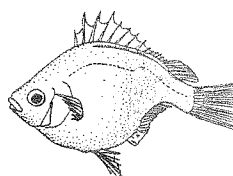
1. Pass an ordinance that prohibits walking of dogs along the path adjacent to the lagoon. This seems consistent with the dog ordinance for the beach area.
2. Encourage the mobile home park to allow the removal of domestic ducks that use Noble Gulch.
3. Remove the domestic ducks at the mobile home park on Noble Gulch with the cooperation of the residents.
4. Continue to enforce the no bird-feeding ordinance at the lagoon. Discourage feeding of fish at the lagoon, as well.



5. Set up a volunteer program to remove the kelp from Reaches 1 and 2 on a weekly basis from April 1 to lagoon closure as stated in the management and enhancement plan. Decomposing kelp adds nutrients and bacteria to the lagoon and is nearly impossible to remove when it becomes mushy.
6. Dispose of kelp from the lagoon during sandbar closure along the beach as in 1992 and 1993 rather than bury it in the sandbar as in 1991. Disperse it up and down the beach to spread it out.
7. Continue to open and close the lagoon during outgoing tides and before incoming tides, respectively, during the 2-3 days that are required for sandbar closure.
8. Spend the necessary time to remove as much kelp as possible from the lagoon with hand tools during the 3 or more days that are required for sandbar closure.
9. Remove the remaining domestic geese and ducks from the lagoon and transplant them to an acceptable private pond.
10. Maintain weekly fecal bacteria sampling stations at the flume, the park at Stockton Avenue Bridge (in front of Mrs. Hubback's house, and near the railroad trestle for the period, May 15 to September 15.
11. Discuss the feasibility of opening Reaches 2 and 3 to swimming if fecal coliform counts are consistently less than 200/100 ml in the samples.
12. Continue to maintain a log of complaints/reports of pollution entering the lagoon, as well as excessive algae. Record the date, time and names of the concerned parties.
13. Choose to manually skim off floating algae from the lagoon instead of using aquazine, except possibly before the Begonia Festival in 1993.
14. Continue to seal off storm drains on the west side of the street in front of the Esplanade, as well as the portals in the walkway to the beach between the Beach House and Zelda's. This should be the case from May 15 to after the clean-up from the Wine Festival in mid-September.
15. Examine the feasibility of sealing the storm drains at the Railroad trestle and continue to seal the drain under the restaurants during the period of sandbar closure.
16. Request that bypass tubes be connected to the drain pipes from the roof of Larry's Surf and Turf Restaurant such that they drain way from the lagoon for the period, May 15 until the sandbar is breached in the fall/winter. Request that they construct a gutter system under their windows which will prevent window-washing water from entering the lagoon.



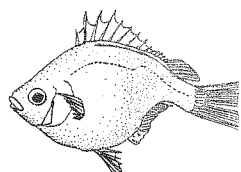
D.W. ALLEY & Associates



17. Require that Sea Bonne and Margaritaville Restaurants attach gutter systems to the concrete wall that will prevent wash-water and food particles from entering the lagoon when they hose off their decks.

18. Require that repairs of plumbing under the Esplanade restaurants be done with double pipes to prevent sewage leaks.

19. Continue the annual inspection program for evaluating the plumbing under Esplanade restaurants. Continue to have a City building official. Please keep a record of the inspections for the consultant's reference.



WATER QUALITY MONITORING, 1993

Rating Criteria

Water quality parameters were rated according to the tolerances of steelhead. This was because other fishes were more tolerant to low oxygen, higher salinity and higher temperatures than steelhead. Stress to freshwater acclimatized steelhead would probably not occur until conductivity levels reach 12,000 to 15,000 umhos with sudden increases in salinity to 10-12 parts per thousand. Water temperatures above 22 C (72 F) and oxygen levels below 5 parts per million (mg/l) are thought to stress steelhead. However, steelhead have been found surviving in pools in the Carmel River at 1-2 ppm for 1-2 hours at dawn. Based on 1988 monitoring, steelhead appear to survive in Soquel Lagoon at water temperatures of 23-25 C for 1-2 hours toward the end of the day (Habitat Restoration Group 1990). Critical oxygen levels were those in the lower 0.25 meters from the bottom where steelhead would inhabit. Morning oxygen levels below 2 mg/L were rated critical. Morning oxygen levels below 5 mg/L were rated poor. Morning oxygen levels of 5 to 7 mg/L were rated fair with above 7 ppm rated as good. Morning water temperatures in the lower 0.25 meters of the water column of less than 20 C were rated good while those 20-21.5 C were rated fair. Temperatures above 21.5 C were rated poor. Water temperature may rise 3-4 degrees C by the end of a sunny day.

High levels of dissolved carbon dioxide in water will inhibit absorption of oxygen by fish. However, in alkaline conditions that exist in Soquel Creek Lagoon, carbon dioxide is poorly dissolved and believed not to be a problem (Jerry Smith, pers. comm.). Therefore, monitoring of carbon dioxide was unnecessary.

Lagoon depth was monitored with the staff gage on the eastern bulkhead, upstream of the Stockton Avenue Bridge. Readings less than 1.85 were rated poor. Readings between 1.85 and 2.2 were rated fair. Readings above 2.2 were rated good. These criteria were somewhat arbitrary, being based on an as yet poorly defined relationship between lagoon depth and associated fish cover, water temperature and algae growth. If the upper lagoon becomes too shallow, steelhead habitat is eliminated and algae growth may be stimulated.

Results of Water Quality Monitoring After Sandbar Closure

Appendix D provides detailed data on water quality. Table 2 summarizes conditions at each monitoring time, based on the rating criteria.

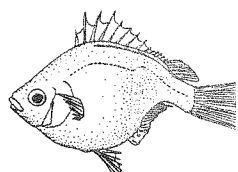
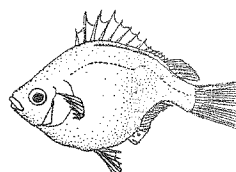


Table 2. Water Quality Ratings in Soquel Creek Lagoon, 1993.

Date	Flume Passage	Gage Height	Water Temperature	Oxygen	Salinity	Lagoon In-flow (cfs)	
1June93	open	poor 1.60	2 boards in on each side + screen				
3June93	open	poor 1.79	good (Baseflow 12-15 cfs)	-	good	12-15	
5June93	Rained hard in morning. All boards removed. Nearly lost sandbar. Morrison and Turcotte saved it!						
7June93	2 boards reinstalled both sides as on 3 June.						
12Jun93	Rained previous night.						
17Jun93	open	poor 1.64	good	-	good		
29Jun93	open	fair 2.00	good	good	good	4-5	
16Jul93	open	fair 1.97	good	good	good		
27Jul93	open	fair 1.94	fair fair* good*	good	good	3.5-4	
9Aug93	open	fair 1.94	<u>poor</u> fair	good good	good	3	
23Aug93	open	fair 1.97	good fair fair	fair good good	good		
3Sep93	open	fair 2.12	good fair	<u>poor</u> good good fair	good	1.5- 1.75	
12Sep93	Begonia Festival						
12Sep93	open	fair 2.18	fair fair good	good fair fair	good		
13Sep93	open	fair 2.13	fair good	good <u>poor</u>	good	1	
20Sep93	open	fair 2.17	good	good fair fair	good		
27Sep93	open	poor 1.78	-	-	-		
50Oct93	Mix up. 2 boards removed.						
60Oct93	open	poor 1.23	-	-	-	1	
80Oct93	Boards re-installed.						
80Oct93	open	poor 1.19	-	-	-		
14Oct93	open	fair 1.94	Rained previous night.				
16Oct93	open	fair 1.85	2 boards had been removed.				3.5
20Oct93	open	poor 1.80	Still 2 boards out.				1.3
10-11Nov93	Rained. Morrison removed boards and debris. Kept the sandbar intact!						
27Nov93	open	fair 1.89					
28Nov93	Rained. Morrison removed board, maintained sandbar.						
9Dec93	Sandbar had to be manually breached.						50-75

* If 3 ratings are listed, they refer to Reaches 1, 2 and 3.



Lagoon Level. As of the first monitoring, 7 days after sandbar construction on 26May93, until sandbar breaching on 9Dec93, 19 monitoring periods were performed at approximately 2-week intervals, except around times when boards were removed and replaced. Fair lagoon depth occurred on 12 occasions. Placement of plastic sheeting over the flume boards and having all of the flume boards in place improved lagoon depth. Poor lagoon depth occurred on 7 occasions. With the exception of an 8-day period in mid October in which the lagoon was very shallow, the City did an excellent job of maintaining a deeper lagoon in 1993. Late rains in June and early rains in November made it difficult to maintain the sandbar and lagoon intact. The City staff did an excellent job of passing the stormflows through the flume. When the sandbar finally had to be breached in December, there was a 5-6 day period of good rain and good stream passability for steelhead or coho salmon spawning. Smolts heading out had a healthy transition into the Monterey Bay.

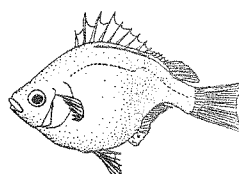
Flume Passability. According to the Management Plan, fish passage was to be maintained until July 1. Passage for steelhead smolts was in fact excellent all summer and fall. There was proof that adult steelhead could pass through the flume into the lagoon because adults were caught in the lagoon in November, when the sandbar was still intact.

Water Temperature. Lagoon water temperature was fair or good all summer and fall, except for one poor rating at the flume on 9 August. This was much better than in 1992, when in July and August the lagoon was warmer and entered the poor category much of the time. Pondweed and algae grew rapidly during this period. By September 1, the lagoon began to cool and was rated mostly fair until September 19, when water temperature was rated good until sandbar breaching.

Dissolved Oxygen. Critical oxygen levels are lowest in the early morning before plant photosynthesis may occur to produce oxygen. This was the time that levels were measured and rated. Interestingly, early morning oxygen levels in 1993 were consistently lower than in 1992. Oxygen levels were rated "fair" or "good" all summer and fall except for "poor" ratings at the mouth of Noble Gulch on 23 August and at the trestle the day after the Begonia Festival. Steelhead may have moved upstream to find better oxygen conditions at this time. Although the 3.82 mg/L oxygen level found there after the festival was considered stressful, it was well within the steelhead's tolerance range.

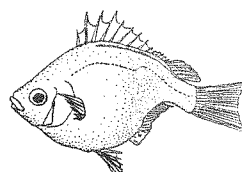
Salinity. Salinity was no problem all summer. In fact, there was so much streamflow at the time of sandbar closure (12-15 cfs baseflow), the shroud was not necessary.

Conductivity. It was not a problem during the monitoring period.



Recommendations to Improve Water Quality and Fish Habitat in the Lagoon

1. Do not allow the pedal boat operator to dictate the lagoon level.
2. Maximize lagoon depth while maintaining passage through the flume for adult steelhead until June 1 and steelhead smolts until July 1. If the lagoon level begins to drop below the notch for steelhead smolts on one side of the flume because of the hole for adult steelhead on the other side after June 1, close up the hole for adults. Close up the adult hole by July 1 in any event. If adult steelhead are seen in the lagoon after June 1 when the hole has been closed up, open the hole until the adults out-migrate.
3. After July 1, do not open the flume exit if it closes unless flooding is eminent. Install plastic sheeting on the outside of the flume boards to prevent leakage into the flume. Put as many boards as possible into the flume entrance to raise the lagoon level as much as possible.
4. If the lagoon level is reduced for the Begonia Festival, remove the board on the flume on the Friday before the festival and re-install it immediately after the festival clean-up. Avoid removing any boards for the Festival, if at all possible.



BIRD CENSUSING

Results of bird censusing in 1992 and 1993 were not directly comparable to those in 1991 because in 1991, censusing was carried out throughout the day. In 1992 and 1993, most censusing occurred early in the morning. In 1992, 5 of 16 censusing (31%) were done later in the morning and afternoon while in 1993, 7 of 19 censusing (37%) were done later. In early morning, some ducks were probably roosting and not in the water. At times, a large group of ducks were roosting on the beach near Venetian Court in the morning and were not counted.

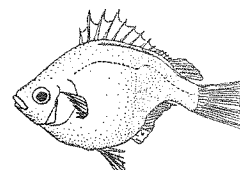
Comparisons were made regarding bird distribution between the results obtained in 1991 (Alley 1992), 1992 (Alley 1993) and 1993. In all three years, the highest bird use of the lagoon was in Reach 1, it being dominated by gulls, domestic geese and feral ducks (Table 3).

In 1992, there were 16 censusing before the sandbar breached (27May-27Oct) and 6 more after (5-12Nov). In 1993, there were 19 censusing (3Jun-27Nov93), with the breaching occurring 9Dec93. As in 1991 and 1992, birds were most concentrated in Reach 1 in 1993 (Table 3). However, the high density of pigeons roosting on the trestle in 1993 combined with fewer gulls bathing in Reach 1 during censusing had increased the relative density of birds in Reach 2.

Table 3. Comparison of bird densities by Reach in Soquel Creek Lagoon, including American Coots. Pigeons on the railroad trestle (Reach 2) were excluded in 1991 and included in 1992 and 1993.

YEAR	DATES	# OF CENSUSES	TOTAL BIRDS COUNTED	PERCENT COUNTED BY REACH		
				REACH 1	REACH 2	REACH 3
1991	19Aug-13Oct	24	1746 (55 coots)	58	19	23
1992	27May-27Oct	16	952 (145 coots, more counted later)	66	20	14
1993	3June-27Nov	19	1266 (304 coots)	45	37	18

Gulls roosted on building roof tops along the Esplanade. Larry's Surf and Turf positioned 3 stationary plastic owls on their roof in summer, 1992, to discourage gulls from roosting there. The owls worked very effectively for the first couple of weeks. After that they had more limited effect. If the owls were made to rotate, they may be more effective. Also, they could be taken down periodically and re-installed after a few days to possibly improve their effectiveness. In 1993 the owls appeared to be totally ineffective. We counted 21 gulls roosting on the roof



during one census. Any bird excrement left on the roof and sky-windows was washed into the lagoon each morning.

Refer to Table 4 for comparisons of average bird densities by groups between 1991, 1992 and 1993.

Nearly all of the censused gulls were in Reach 1, with them totaling 80% and 54% of the birds counted there in 1992 and 1993, respectively. The relative percentage of gulls in Reach 1 in 1993 dropped because there were fewer gulls (at least in the early morning) and more mallards and coots utilizing Reach 1. It was of interest that we observed fewer gulls using the lagoon for bathing in early morning in 1993 than 1992, though the average gull count on the beach was higher in 1993.

Over 90% of the pigeons were observed in Reach 2, making up 30% and 50% of the birds censused there in 1992 and 1993, respectively. In 1993, 88% of the pigeons were roosting on the trestle, and the remainder were at the east Stockton Avenue Park near Mrs. Hubback's house. Though pigeons were not regularly censused on the trestle in 1991 and were in 1992, there appeared to be fewer pigeons in 1992 than 1991. However, there was a significant increase in pigeons in 1993, with 3 times the number of pigeons counted in Reach 2 compared to 1992. In 1993, the average number of pigeons on the trestle was 16.2 with a standard deviation of 6.7 and range of 8-30 birds.

Wild mallards fed primarily in Reach 3, though they were often seen in Reaches 1 and 2. They roosted most visibly along primarily the margins of Reach 2 on the bulkhead and on the concrete base of the trestle. Four clutches of young mallards were detected in 1993. Two common clutches included 5 and 6 young per female. We observed only 2 clutches in 1992.

American coots appeared in mid-September, 1993, as they typically do. They fed primarily in Reach 3 early in the season and in all 3 reaches in November. The most coots censused were 101 on 12Nov93. There were 304 coot sightings in 1993 from 12Sep93 to 27Nov93 (10 censusings). There were 303 coot sightings in 1992 from 10Sep92 to 12Nov92 (11 censusings). The number of coots appeared to have stabilized by the end of November.

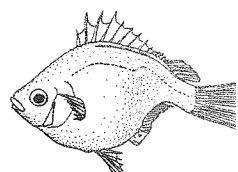


Table 4. Comparison of Average Bird Densities in Soquel Creek Lagoon during each censusing for 1991, 1992 and 1993. (Pigeons on trestle excluded in 1991 only.)

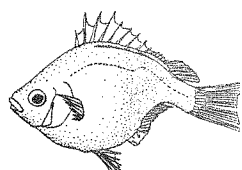
Group	Reach 1 Density			Reach 2 Density			Reach 3 Density		
	1991	1992	1993	1991	1992	1993	1991	1992	1993
Gulls*	30.4	31.6	<u>16.0</u>	3.2	0	0.2	1.1	0	0.1
Mallards (some domestic)	8.1	2.5	3.6	1.0	4.1	4.7	<u>14.0</u>	3.3	4.8
Domestic Ducks	0.4	2.0	1.7	1.0	0.1	0.2	0.6	0.4	0.2
Geese	2.3	0.3	2.6	0.2	0.6	0.6	0.9	0	0.2
Pigeons	0.8	0.1	0.9	7.8	3.5	<u>12.6</u>	0	0	0
Coots	1.6	6.6	8.2	0.8	5.1	11.8	3.3	9.0	10.4
Pied-billed Grebes		0.2	0.3		0.3	0.4		0.1	0.8
Cormorants		0.06	0		0.25	0		0.1	0

*Gulls were counted 8 times on the beach during early morning water quality monitoring in 1992, averaging 183 gulls per count, with a range of 61 (9Oct92) to 367 (1Sep92). Gulls were counted 13 times on the beach in 1993, averaging 196 gulls, ranging from 141 (12Nov93) to 347 (6Oct93) with a standard deviation of 66.

Five domestic geese used the lagoon in 1991, 3 in 1992 and 4 in 1993. The total domestic ducks (non-mallard) sightings in 1992 was greater than in 1991, and only 1 more was sited in 1993 than 1992 (40). This indicated a stable and not increasing number. The density in 1993 was similar to 1992. In 1993 there were at most 4 "popcorn ducks" censused at any one time at the lagoon.

Table 5. Fish-eating Bird Sightings at the Lagoon.

SPECIES	1992 Frequency (Sightings/17 day visits)	1993 Frequency (Sightings/19 day visits)
Black-crowned night heron	0	1
Cormorant	8	0
Great blue heron	1	1 (night)
Green-back heron	0	3
Kingfisher	8	5
Merganser	1	14
Pied-Billed Grebe	18	28



Bird-feeding by Humans

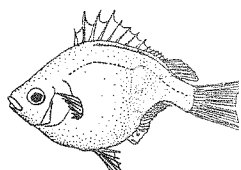
In 1993, there was an increase in human bird-feeding over 1992. We observed 6 instances of feeding during observation times comparable to those in 1992, when only 1 instance was observed. In 1993 the bird-feeders were a kitchen worker from the Beach House, a restaurant guest at Sea Bonne, Mrs. Hubback, 2 kids at different times, possibly a brother and sister from the same family residence, and a group of 5-6 young teen-agers who were passing through. We commonly saw bird seed near Mrs. Hubback's house. There were 3 times the number of pigeons in Reach 2 in 1993 compared to 1992.

Waterfowl as Biological Control of Aquatic Plants

The effectiveness of ducks that grazed on pondweed and algae was evident in 1993 because very little algae reached the surface. Sacramento suckers also grazed on algae along the lagoon bottom. Although geese were commonly seen feeding on natural vegetation in 1992, no such behavior was observed in 1993.

Recommendations Regarding Management of Bird-Feeding and Domestic, Non-native Waterfowl

1. Maintain enforcement of the no bird-feeding ordinance. Discourage fish-feeding, as well.
2. Request that Restaurant owners allow positioning of devices to the roof tops adjacent to the lagoon to discourage roosting of gulls. Artificial owls that rotate on poles may be more effective than stationary ones.
3. Maintain the appearance and presence of no bird-feeding signs around the lagoon.



FISH CENSUSING

Steelhead Plantings in Soquel Creek

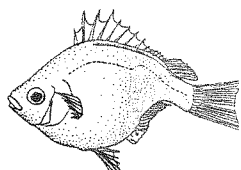
In 1993, 12,224 steelhead smolts were planted in Soquel Creek. On 10Mar93 approximately 4000 smolts were released near the Casalegno Store. On 13Mar93 the remainder were released at the end of Cherryvale Lane near a nursery. In 1994, 720 and 450 pounds were planted at 6.4 fish/pound (7488 fish) behind the Grange Hall on 22 and 24 March, 1994, respectively (Dave Strieg, pers. comm). They were seen in the estuary shortly thereafter.

Fish Sampling in Soquel Creek Lagoon

A very rough estimate of juvenile steelhead density in the lagoon in 1992 was probably a few hundred. This should be considered a significant number in terms of the population in the creek, though it was considerably less than the lagoon could support in other years. By comparison, in July, 1989, Jerry Smith had observed 900 juvenile steelhead at the mouth of Noble Gulch. If the lagoon becomes too shallow, the upper lagoon becomes too shallow for steelhead to use. That is another reason to keep the lagoon as deep as possible in the summer.

A mark and recapture effort for steelhead was accomplished in fall, 1993. On 26 September 1993, two seine hauls were made, one under the Stockton Avenue bridge and one just downstream with a 3/8-inch mesh 106-foot seine. Two other seine hauls were made along the margin of Reach 1 with a 30-foot, 1/4-inch mesh seine. A total of 1144 juvenile steelhead were captured (1110 in one haul) and 1046 steelhead were marked with a partial left pelvic clip. Our accommodations for holding fish during processing were overwhelmed, and unfortunately we lost 98 steelhead (8.6% mortality). We suspected from feeding activity during the morning monitorings that a sizable population was present, but had no idea that there would be so many fish captured. This was an abnormally high amount of mortality for typical seining activities. Refer to Table 6 for the sample summary with length-frequency data for steelhead in 1993. For comparison, the summaries for 1988 and 1992 are included in Tables 7 and 8. Unlike the previous fall, no hatchery-reared steelhead were captured. One California roach, 2 staghorn sculpins, 3 Sacramento suckers and thousands of Threespine stickleback were captured. No tidewater gobies were captured. An adult steelhead was seen in the lagoon near the bridge before sampling.

On 10 October 1993, steelhead were recaptured with 2 more seine hauls from under the bridge and downstream with the 106-foot seine. This time we had a holding pin to put captured fish in until they could be examined for fin clips. We lost fewer steelhead (18 fish equal to 3.9% of the catch) than the previous sampling. Of the 461 juvenile steelhead captured, 173 were marked recaptures and 288 were unmarked. In an effort to minimize the handling time and mortality of steelhead, little data on other fish species were recorded. We measured a huge

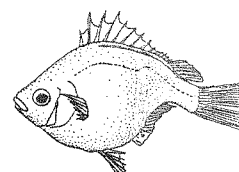


threespine stickleback that totaled 91 mm standard length (photo included in Appendix A). Two large steelhead juveniles measured 186 and 187 mm standard length. A dead adult Sacramento sucker was observed before sampling began. Four additional seine hauls were made with the 30-foot, fine-meshed seine around the margin of Reach 1. No tidewater gobies were captured. The seine was used to manually skim algae from Reach 1.

The population estimate for juvenile steelhead in Soquel Lagoon was calculated, based on the number of marked and recaptured steelhead. The estimate was 2787 juvenile steelhead, with a standard error of 153 fish. The typical confidence interval for a population estimate is 2 standard errors above and below the estimate. Therefore, the estimate was 2787 +/- 306. The estimate was based on the logic that the ratio of the number of marked recaptures divided by the total number captured on 10 October was equal to the ratio of the number of fish marked on 26 September divided by the total population of steelhead in the lagoon. In order for this relationship to be accurate, we must assume that the samples were random, that the survival of marked fish was not lessened by the marking process, that marked fish were equally vulnerable to recapture as unmarked fish, and that marked fish randomly redistributed after first captured. If the original capture of steelhead and partially clipping their fins caused some to die before the next sampling (mark-induced mortality), then the population size was overestimated.

The conditions under which an accurate estimate of population size could be ascertained were not entirely met during our mark and recapture efforts. But we did the best we could. No dead steelhead were observed the day following the first capture and fin-clipping. However, some marked fish probably died due to stress after their release. The loss of fish during seining was certainly indicative of stress. The samples were not random. The beach in Reach 1 was chosen because it offered the best landing for the seine. We are uncertain of the degree of randomness of distribution of marked individuals after their release. The marked fish may have stayed in the vicinity of Reach 1 and the bridge instead of mixing more randomly, thus leading to an underestimation of the population size. This is because the marked individuals may have been more likely of recapture. Despite the limitations of sampling method, we feel the estimate of nearly 2800 steelhead in the lagoon was in the ball park of the actual population size.

Only 2 tidewater gobies were captured in the lower lagoon in fall, 1992. None were detected in Reach 1 in fall, 1993. No sampling was done upstream of the Stockton Avenue bridge in 1993. In contrast, in 1988 hundreds of tidewater gobies were captured in Reach 1 (Table 7 from Appendix A of the 1990 Management Plan). The lengths of 107 were measured. In the summer of 1988, an intensive monitoring of the entire lagoon was done by Dr. Jerry Smith. He found tidewater gobies to be common on 21 May 88 from approximately 100 meters upstream of the Shadowbrook Restaurant at the fir tree to approximately 300 meters upstream, which was



close to the upper end of the lagoon. On 22Jul88, he saw small (20-30mm long) gobies from the fir tree upstream approximately 200 meters. This upper lagoon may have been the breeding location for tidewater gobies.

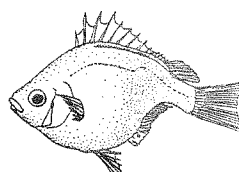
In summer of 1989, Dr. Smith could not visually locate any tidewater gobies in the lagoon. We were scheduled to sample the lagoon in the fall, 1989. However, the Loma Prieta earthquake occurred on 17 October, making transportation between San Jose State University (where the equipment was) and Capitola very difficult. It rained a few days later, and the sandbar was breached by 27 October. The lagoon was not sampled again until fall, 1992.

Discussion of Results of Fish Sampling

The mark and recapture work in 1993 indicated a significant increase in steelhead densities in Soquel Lagoon over the previous year. This several-fold increase in steelhead numbers may be attributed to two factors. First, with the increased streamflow in winter, spawning access, egg incubation and survival of young-of-the-year and yearling steelhead were all probably greater than previously drier winters and springs. Therefore, there were more steelhead upstream of the lagoon that might choose to use the lagoon as nursery habitat than in previous years. In addition, down-migrating steelhead had access to the lagoon all summer in 1993, while access was blocked the two previous years when the streamchannel went dry in Soquel Village. In 1993, Soquel Lagoon flowed continuously from its headwaters to the lagoon all summer, with a minimum estimated flow of 1 cfs entering the lagoon in September. The two previous years, the stream had gone dry in the vicinity of Soquel Village and downstream to a point between Porter Street and Highway 1. The streamchannel was dry at the East Walnut Street - Main Street intersection from at least 12 August to 30 October in 1992. Flow re-surfaced in those drier years before reaching the lagoon. But late summer in-flows diminished to less than 0.2 cfs.

Though there was the dramatic appearance of Sacramento suckers in the lower lagoon in 1992, their numbers appeared significantly reduced in 1993. California roach and staghorn sculpin were at similarly low densities in 1993 as found in 1992 in the lower lagoon (Reach 1). Staghorn sculpin were more abundant in Reach 3 in 1992, but no sampling was done there in 1993 because of previous difficulties in landing the seine.

It appeared that tidewater goby numbers were severely reduced from 1988 to 1992. However, the only heavily sampled area was downstream of the Stockton Avenue Bridge. Tidewater gobies may have been present upstream of the Shadowbrook Restaurant. This reach has not been surveyed for gobies since 1989. One explanation for their disappearance or severe reduction is that winter flows of 1991 and 1992 washed the population out of the winter estuary. There are no backwater areas in lower Soquel



Creek that may serve as refuge for small fish that have very limited swimming ability. Tidewater goby may have colonized Soquel Creek and become established during the drought of the 1987 or 1988 from Corcoran Lagoon approximately 1 mile up the coast. In the mid to late 1970's when Cam Swift was sampling Santa Cruz County for tidewater gobies, he found them in lagoons on either side of Soquel Creek, those being Corcoran Lagoon in 1975 and Aptos Creek lagoon in 1977 (a drought year). However, he found none in Soquel Creek Lagoon.

Recommendations Regarding Fish Management

1. Maximize lagoon depth after July 1 by adding boards to the flume and sealing them with plastic.
2. Do not unplug the flume exit after July 1 until the Begonia Festival.
3. Replace the flume boards immediately after the Begonia Festival if any are removed for the Festival.
4. Maintain the lagoon in fall until streamflow has increased enough to prevent stranding of spawning adult steelhead and osmotic stress in lagoon-inhabiting steelhead. Install a perimeter fence with 2"x4" mesh with 6-foot panels around the flume entrance by October 1. This will prevent plugging of the flume's screen with aquatic vegetation during the first minor storms of fall.

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- Alley, D.W. 1993. Soquel Creek Lagoon Monitoring Report, 1991-92. Prepared by D.W. ALLEY & Associates for the City of Capitola and Coastal Conservancy.
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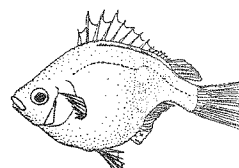


Table 6. Fish sampling results, 26 September 1993.

SOQUEL CREEK LAGOON FISH SAMPLING
26 September 1993

	Steelhead	Caliif. Roach	Sacramento Sucker	Threespine Stickleback	Staghorn Sculpin
Seine #1 (<Bridge)	34	1	2	4000+	2
Seine #2 (Bridge)	1110		1	2000+	
Small Seines				2000+	

No tidewater goby captured in 4 seine hauls (2 with fine mesh seine)

1046 juvenile steelhead marked with partial L pelvic clip

Mortality = 98 fish, due to algae in net

Steelhead Standard Lengths
(n=255)

90 - 94 mm	*****10
95 - 99	*****21
100-104	*****30
105-109	*****28
110-114	*****41
115-119	*****43
120-124	*****21
125-129	*****11
130-134	*****10
135-139	*****5
140-144	*****9
145-149	*****11
150-154	*****6
155-159	****4
160-164	*
165-169	**
170-174	*
175-179	
180-184	
185-189	*

Stickleback Plate Morphs	High Plate	Partial Plate	Low Plate
	47	23	3
	64%	32%	4%
	32		

D.W. ALLEY & Associates

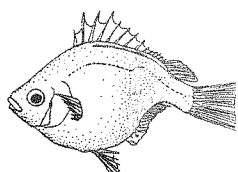


Table 7. Fish sampling results, 17 November 1988.

SOQUEL CREEK LAGOON FISH SAMPLING
17 November 1988

Standard Lengths	Steelhead (n = 157)	Staghorn Sculpin (n = 69)	Starry Flounder (n = 20)
75 - 79 mm	1		
80 - 84			
85 - 89	1	XX3	
90 - 94	1	X2	
95 - 99	1	XXXXXXXX8	
100-104	XX3	XXXXXXXXXXXXX14	X2
105-109	XXXXXXXX8	XXXXXX7	
110-114	XXXXXXXXXXXXX12	XXXXXXXXXXXXXXXXX16	XX3
115-119	XXXXXXXX8	XXXXXXXXXXXXX11	XX3
120-124	XXXXXXXXXXXXX11	XX3	XXX4
125-129	XXXXXXXXXXXXX11	XXX4	1
130-134	XXXXXXXXXXXXXXXXXXXXX17	1	X2
135-139	XXXXXXXXXXXXXXXXXXXXX20		X2
140-144	XXXXXXXXXXXXXXXXXXXXX17		1
145-149	XXXXXXXX8		X2
150-154	XXXX5		
155-159	XXXXXXXX9		
160-164	XXXXX6		
165-169	XX3		
170-174	XX3		
175-179	X2		
180-184	X2		
185-189	X2		
190-194			
195-199	1		
200-204			
205-209	X2		
220-224	1		
225-229	1		
510-514	1		

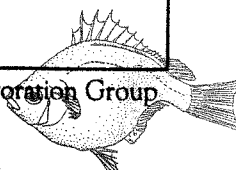


Table 7. Fish sampling results, 17 November 1988.

SOQUEL CREEK LAGOON FISH SAMPLING
 17 November 1988

Sampling Summary

Species	Site		
	Below Bridge	Trestle	Noble Gulch
Steelhead			
Adults	1		
Juveniles	147	3	6
Starry Flounder	19		1
Staghorn Sculpin	59	2	8
Prickly Sculpin	1		
Threespine Stickleback	242+	3+	7+
Tidewater Goby	102+	+	+
Effort			
Large Seine Hauls (106' x 6' x 3/8")	5	1	3
Small Seine Hauls (30' x 4' x 3/16")	2		

Standard Lengths
 Tidewater Goby
 (n = 107)

25 - 29 mm *****40
 30 - 34 *****38
 35 - 39 *****26
 40 - 44 3

Threespine Stickleback
 Plate Morphs
 (n = 102)

High Plate *****61
 Partial *****29
 Low **12

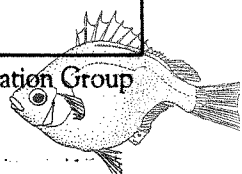


Table 8. Fish sampling results, 24 October 1992.

SOQUEL CREEK LAGOON FISH SAMPLING
24 October 1992

CAPTURE SUMMARY

Seine	-----Steelhead-----			Sac.	Staghorn	Calif.	Stickle-
	Wild	Hatch.	Recap.	Sucker	Sculpin	Roach	back
1	43	7		32	1	2	1000+
2	7	2	18	40	2		1000+
3	6	3	4	40	1	2	1000+
4	4			21	26		1000+

Standard Lengths

	Steelhead (n=60 wild; 12 hatchery) (Marked: partial L pect. clip)	Sacramento Sucker (n=112) (21 not measured)	Staghorn Sculpin (n=30)
90 - 94 mm			*
95 - 99	**	**	***
100-104	***		****
105-109	***	****	*****
110-114	****	**	*****
115-119	*****	****	*****
120-124	*****	*****	***
125-129	****	*****	*
130-134	****	*****	
135-139	****	*****	
140-144	****	*****	
145-149	*****	*****	
150-154	*****	*****	
155-159	****	*****	
160-164	*	****	
165-169	*	****	
170-174	* H	***	
175-179	H	*	
180-184	HHH		
185-189			
190-194			
195-199			
200-204	HH		
205-209	H		
210-214	H		
215-219			
220-224	H		
225-229		*	
230-234	H		
255-259	H		

California Roach SL: 70, 90, 140, 155

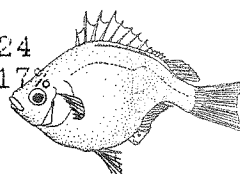
Tidewater Goby SL: 33, 37

Threespine Stickleback: HighPlate:77 Partial:39 Low Plate:24

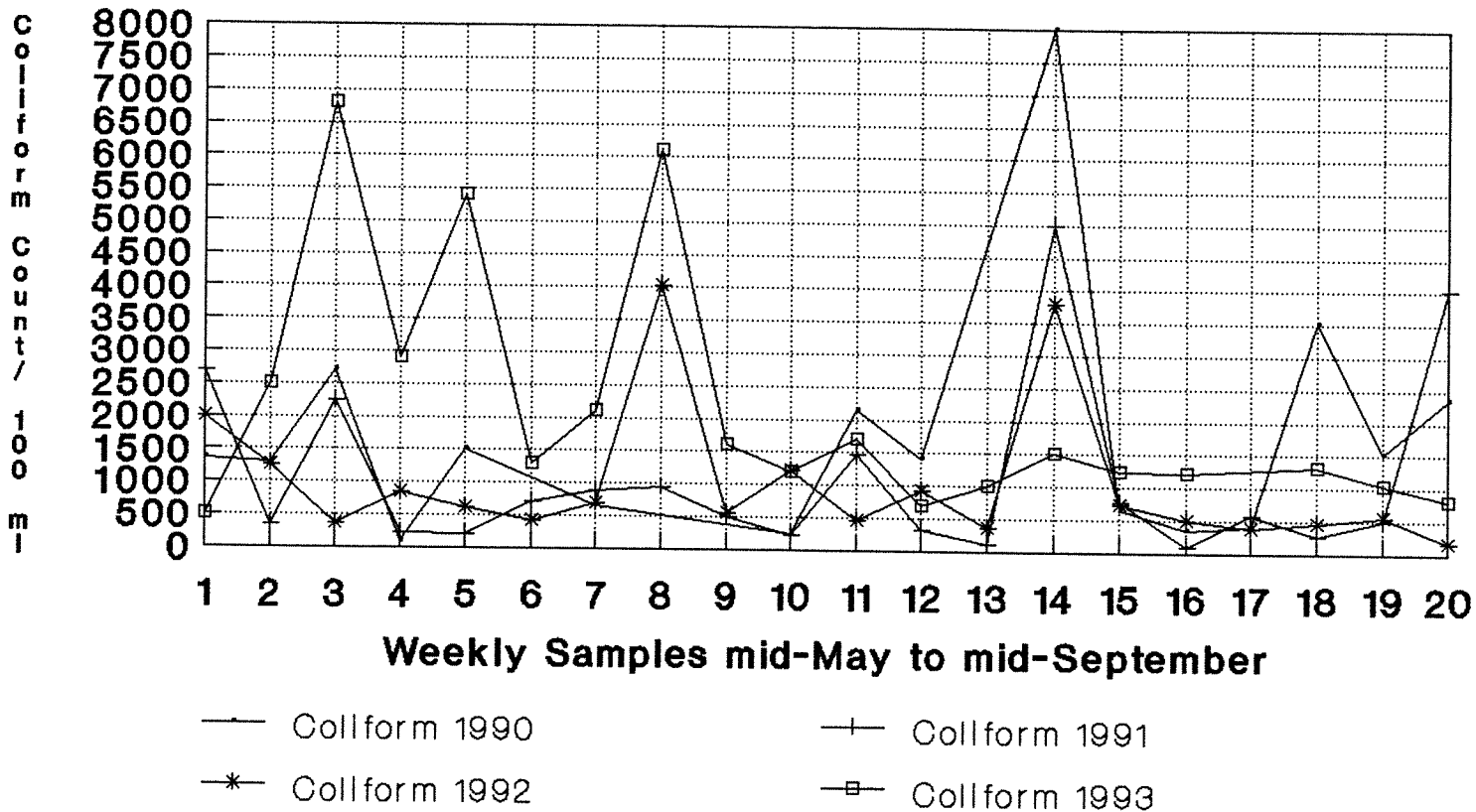
55%

28%

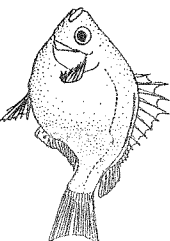
17%



Fecal Coliform Bacterial Counts Soquel Creek Lagoon Weekly Samples At the Flume



**Figure 1. Fecal coliform counts
at the Flume, comparing 1990, 1991, 1992
and 1993. (Santa Cruz County Data)**



**Fecal Coliform Bacterial Counts
Soquel Creek Lagoon Weekly Samples
At the Railroad Trestle**

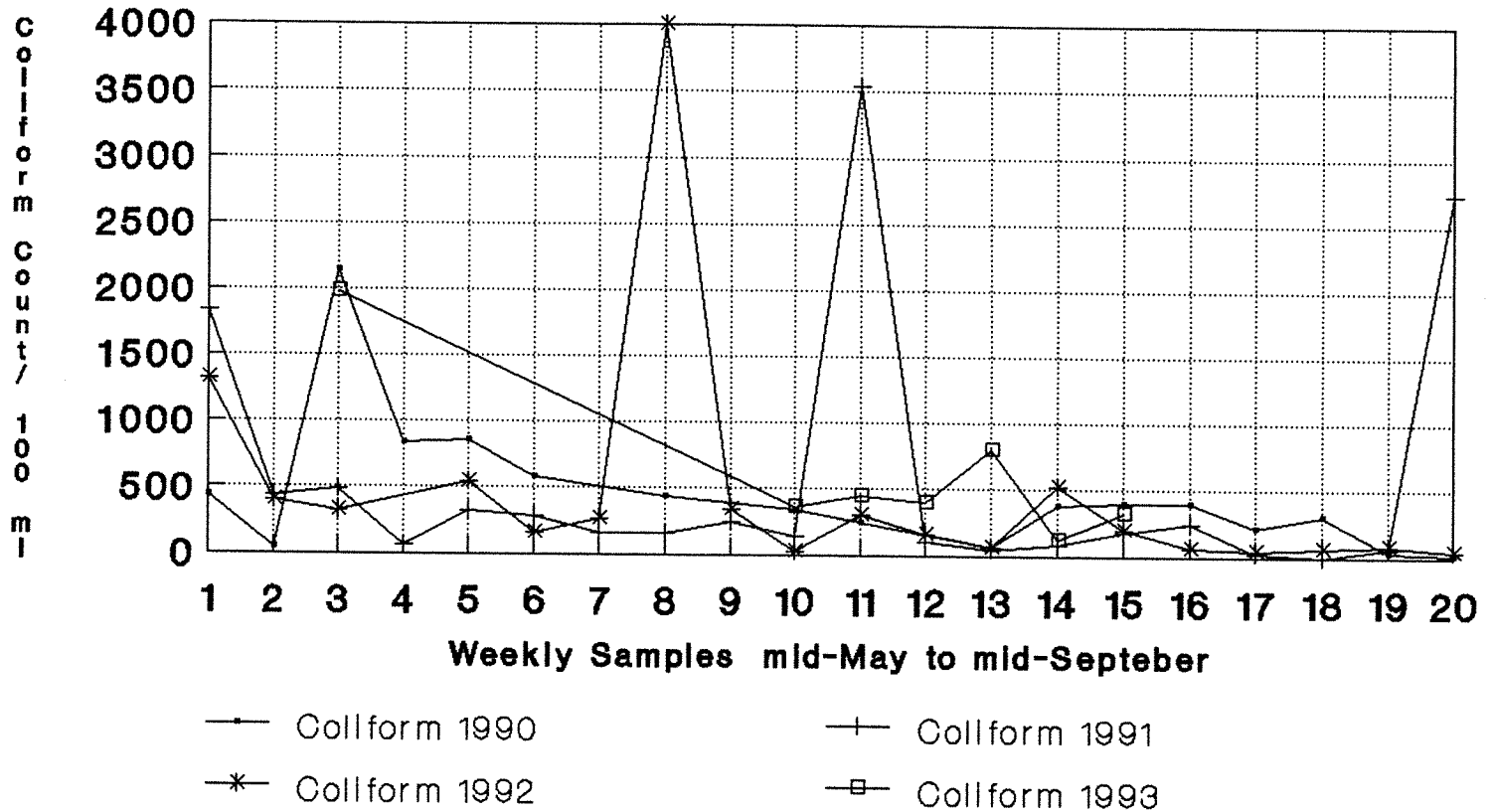
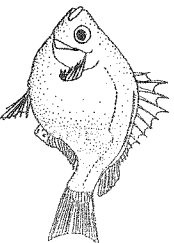


Figure 2. Fecal collform counts at the Railroad Trestle, comparing 1990 1991, 1992, 1993. (S.C. County Data)



**Fecal Collform Bacterial Counts
Noble Gulch Weekly Samples
At Tunnel and Bay Street**

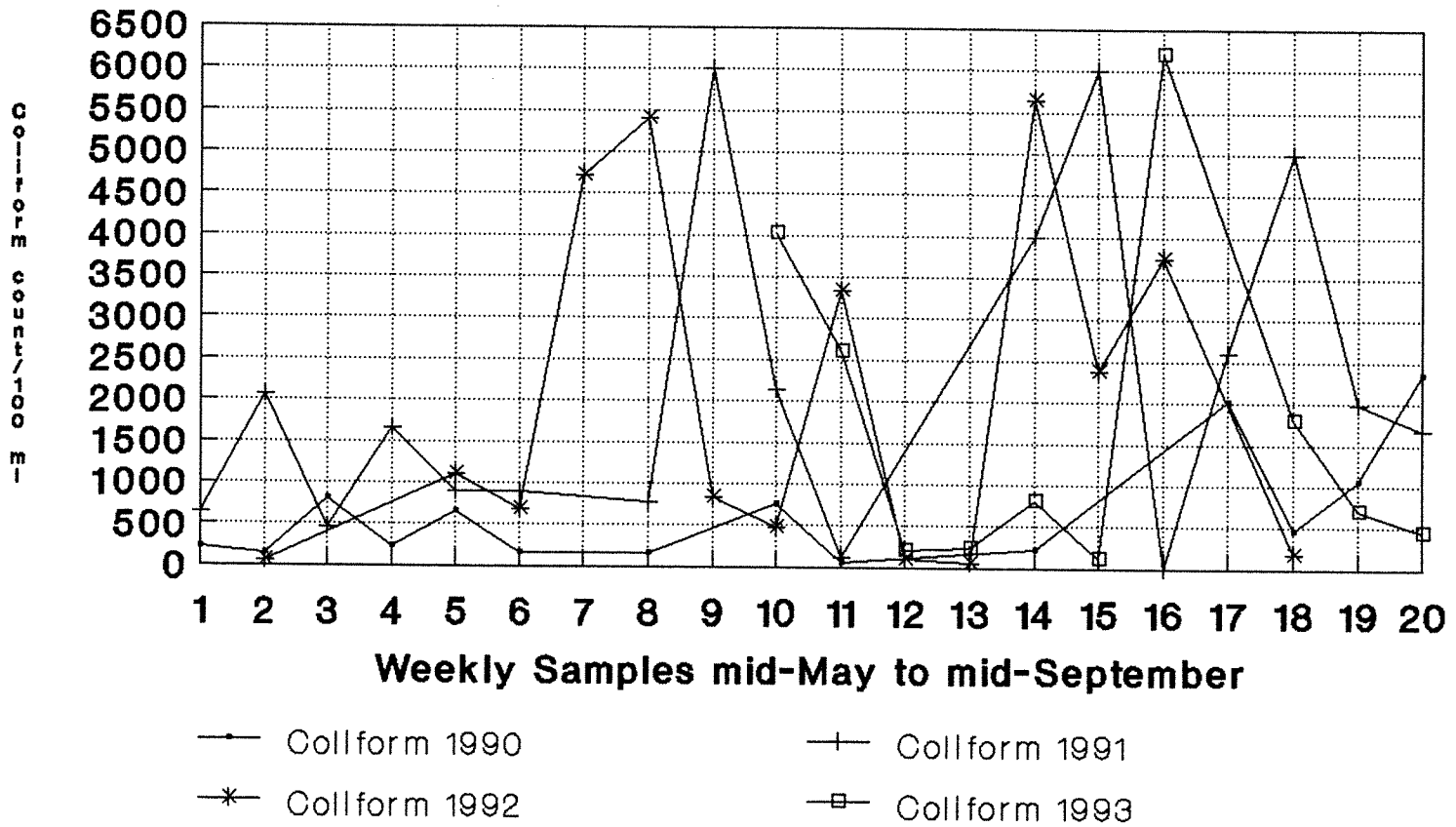
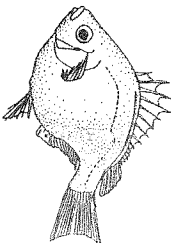


Figure 3. Fecal collform counts at Bay St. tunnel on Noble Gulch, comparing 1990, 1991, 1992, 1993. S.C. County Data



**Fecal Collform Bacterial Counts
 Soquel Creek Lagoon Weekly Samples
 Mouth of Noble Gulch**

1000 COLIFORM BACTERIA / 100 ML

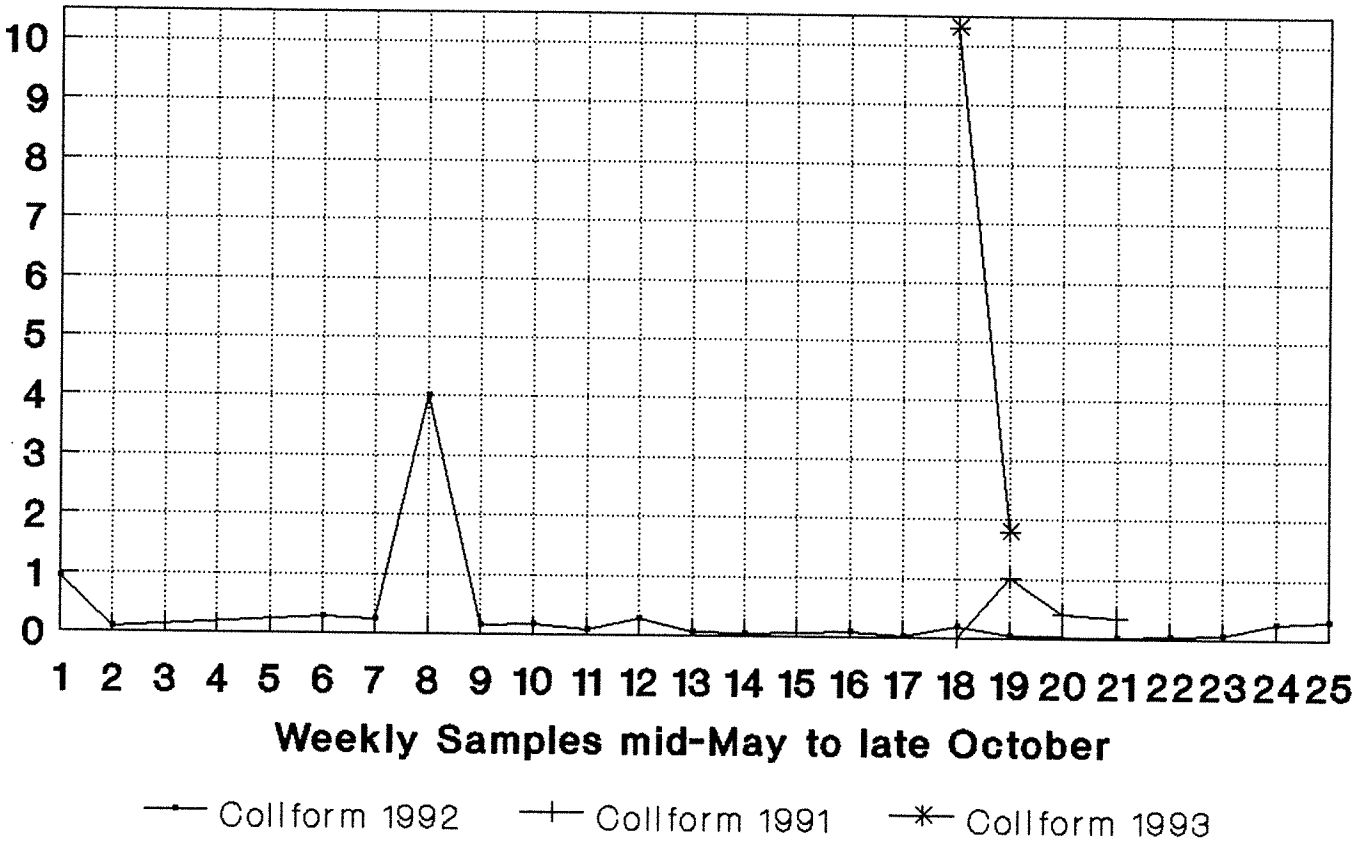
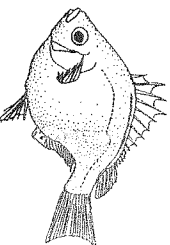


Figure 4. Fecal Collform count at the Mouth of Noble Gulch, comparing 1992 to 1991. (S.C. County Data)



**Fecal Collform Counts
Soquel Creek Weekly Samples
At Nob Hill**

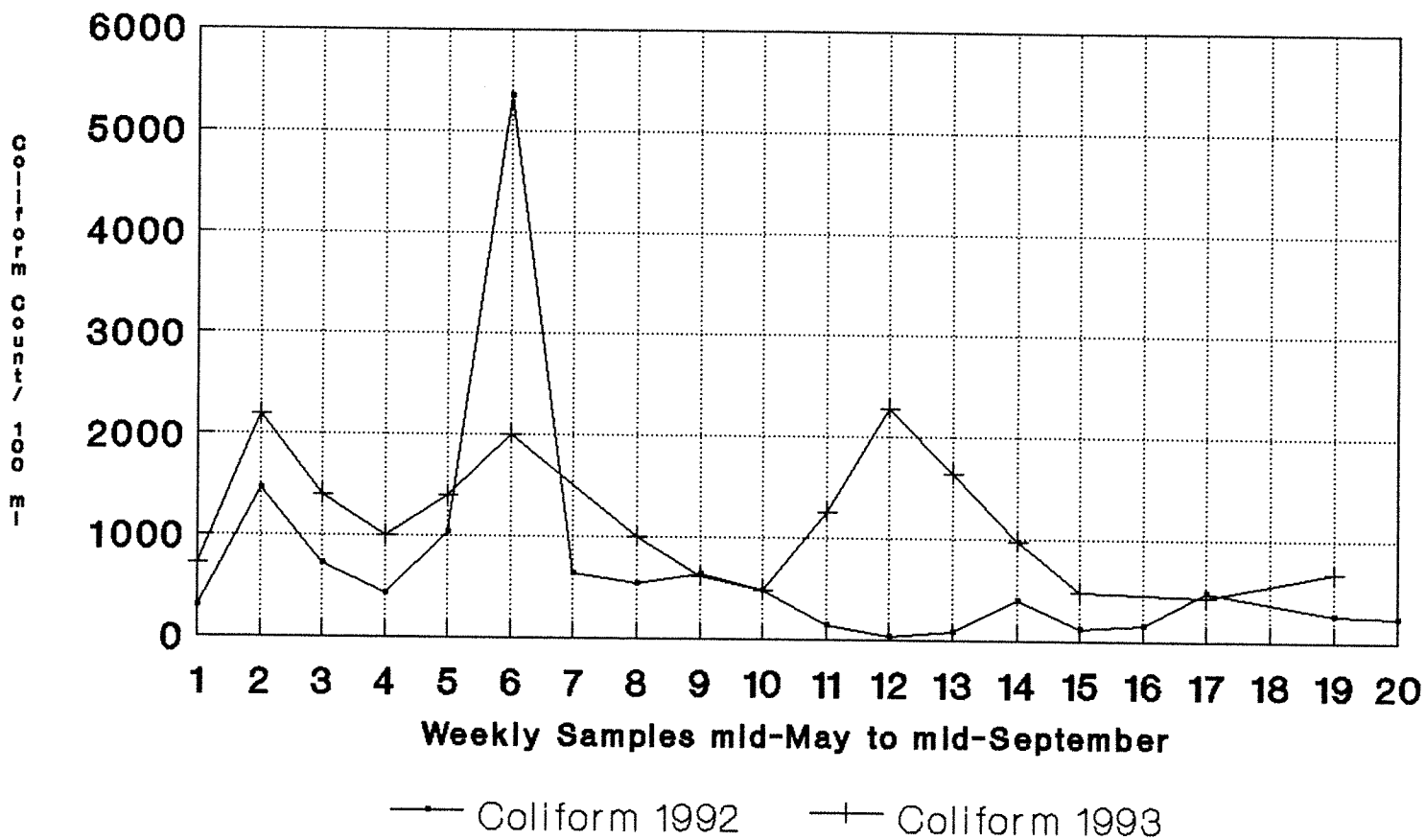
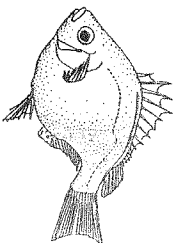


Figure 5. Fecal Collform Counts at Nob Hill, comparing 1992 and 1993. (S.C. County Data)

40



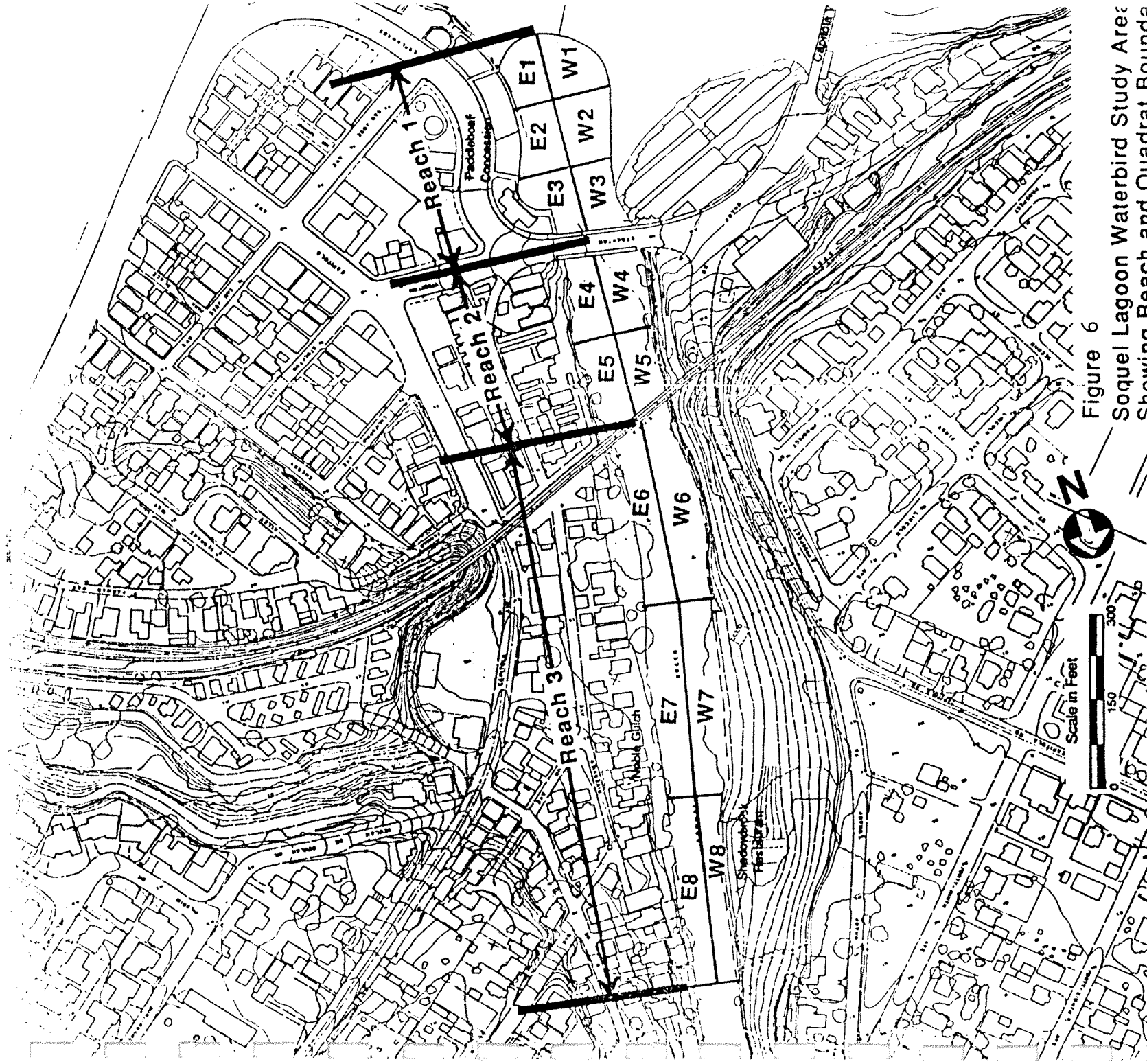
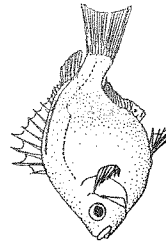
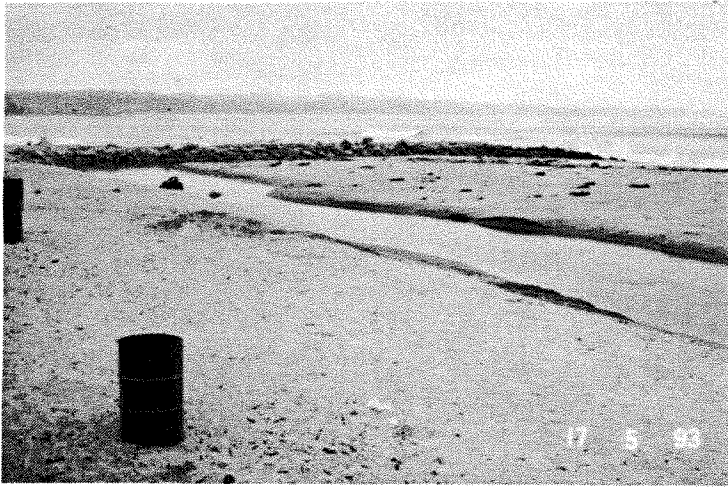


Figure 6

Soquel Lagoon Waterbird Study Area
Showing Reach and Quadrat Bounda



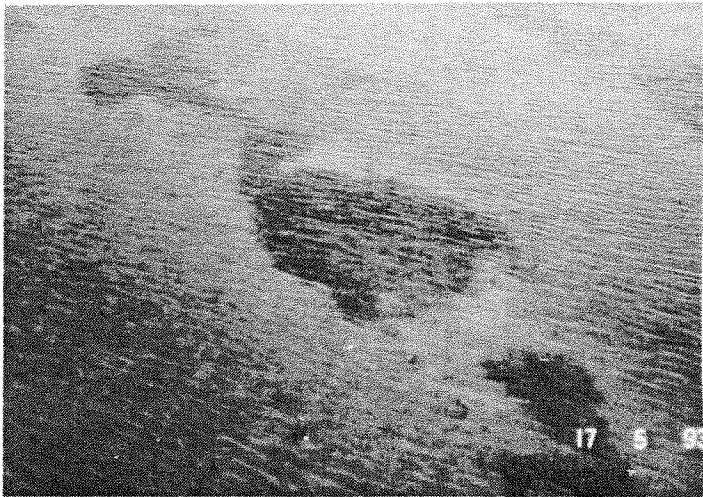
APPENDIX A.
PHOTOGRAPHS, 1993



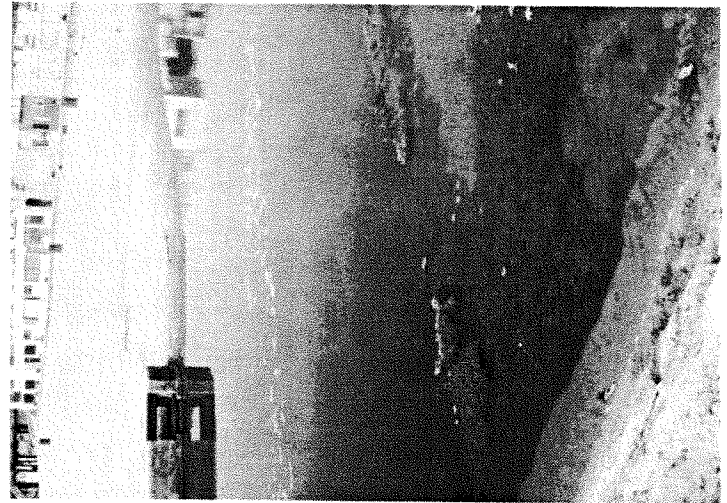
East Channel to the Jetty 17May93



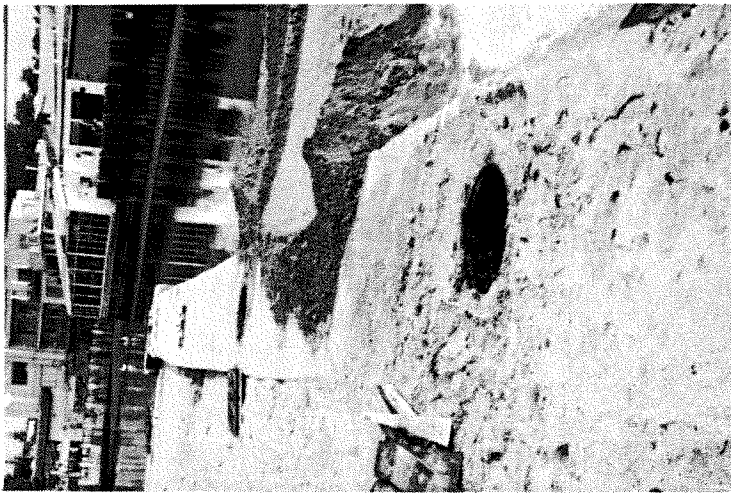
Closing off East Chan.17May93



Kelp and Seagrass 17May93



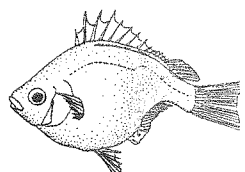
Kelp and Seagrass 19May92

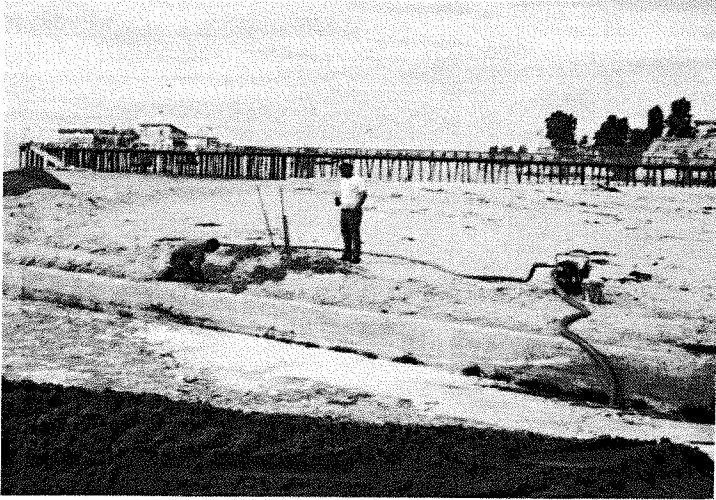


Portals Exposed on Flume 18May

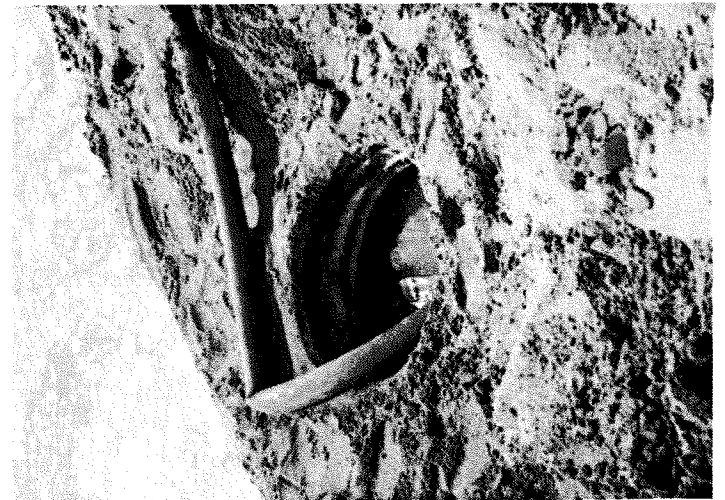


Men at Work 18May93





Flushing Sand out of Flume 18May



Water into the Portal 18May



Opening the Flume Exit 18May93



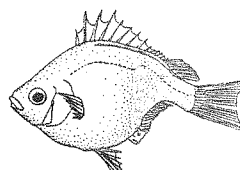
Popcorn Ducks Feeding 19May93

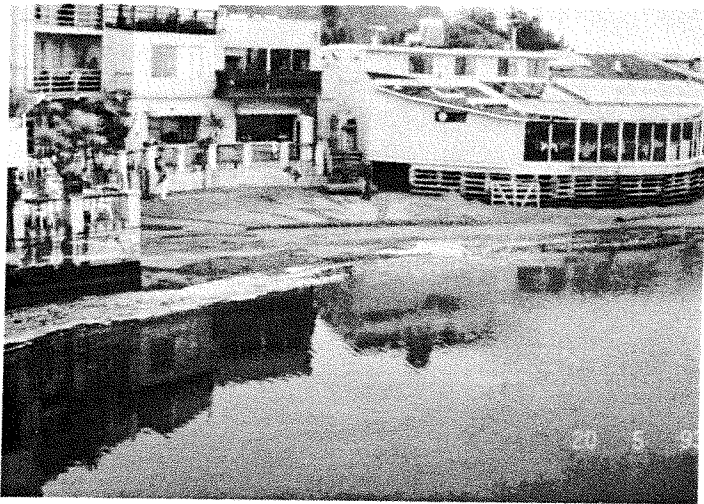


Preparing Flume Entrance 18May

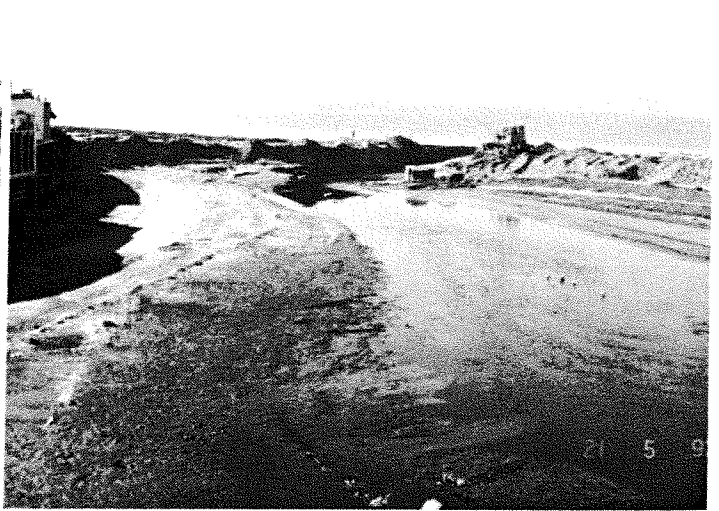


Lowered Lagoon Upstream 19May





Boat Operator Satisfied 20May



East Side Contoured 21May



West Side Contoured 21May93



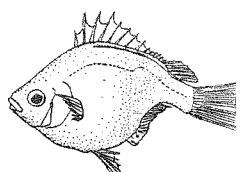
Closing Off Outflow 21May93

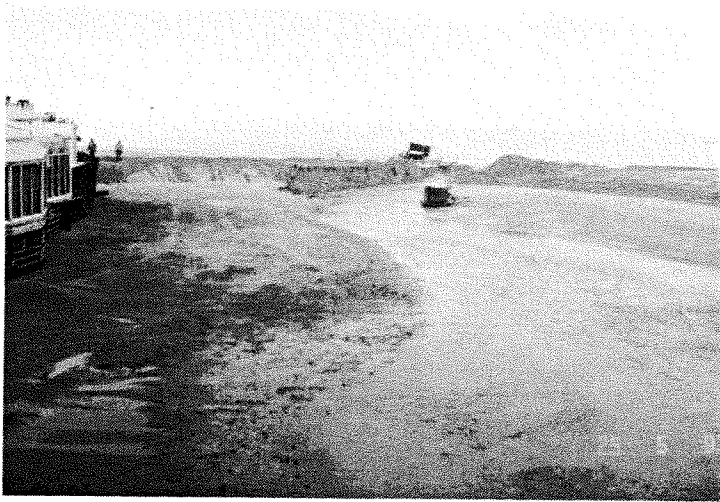


The Raking Crew 24May93

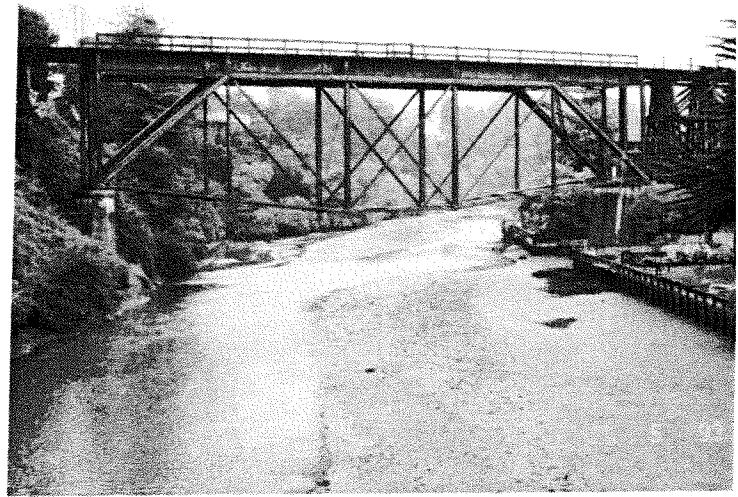


Remaining Kelp after Raking 24May

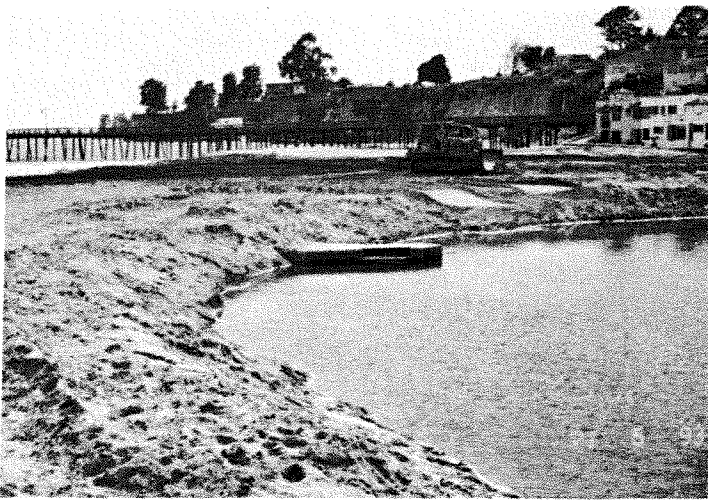




Drained Lagoon 25May93



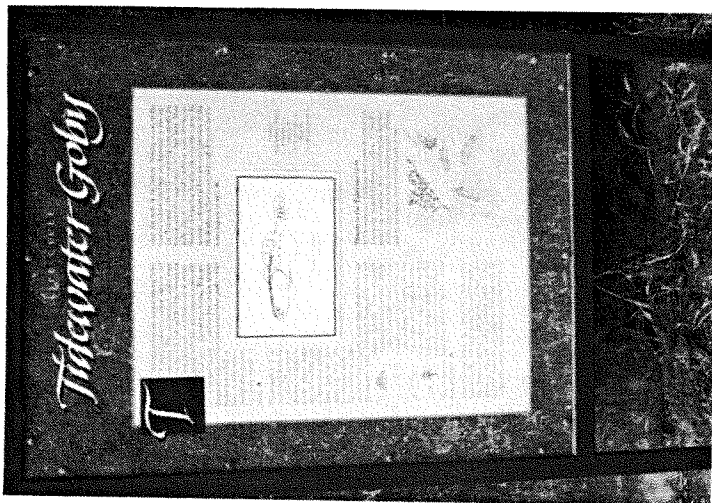
Lower Lagoon 25May93



Completed Sandbar Construction 27May



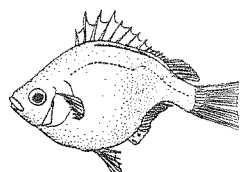
Full Lagoon 27May93

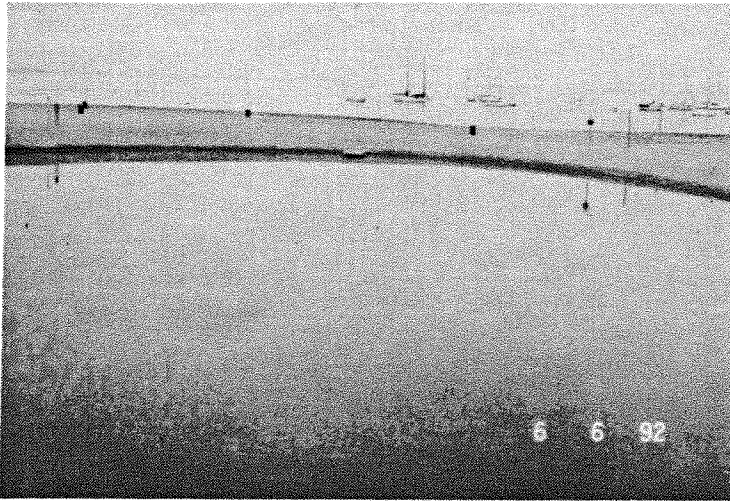


Tidewater Goby Sign 27May93



Water Bird Sign 27May93

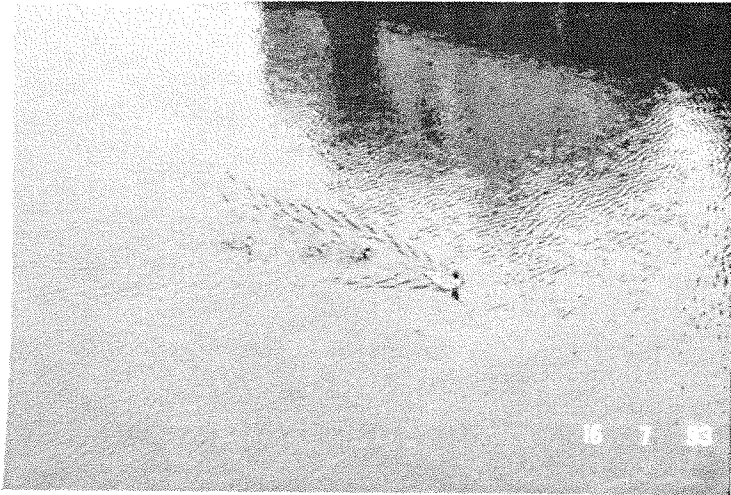




Reach 1 6June93



Reach 3 6June93



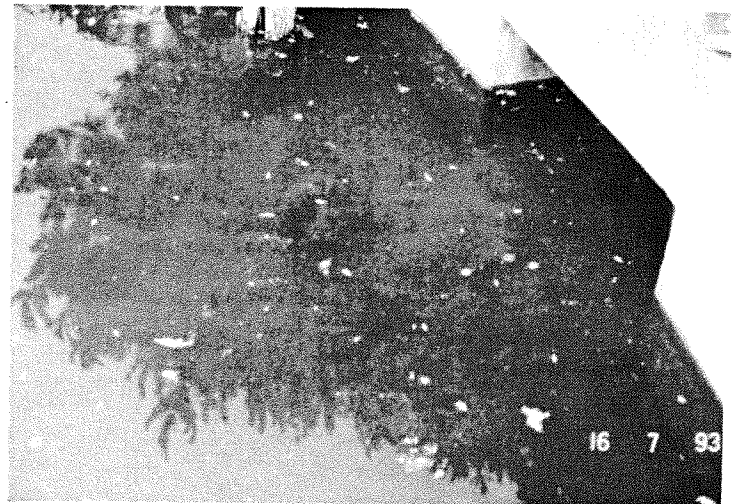
Mamma Merganser and Young 16July



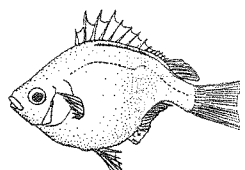
Harrassing Popcorn Duck 16Jul93

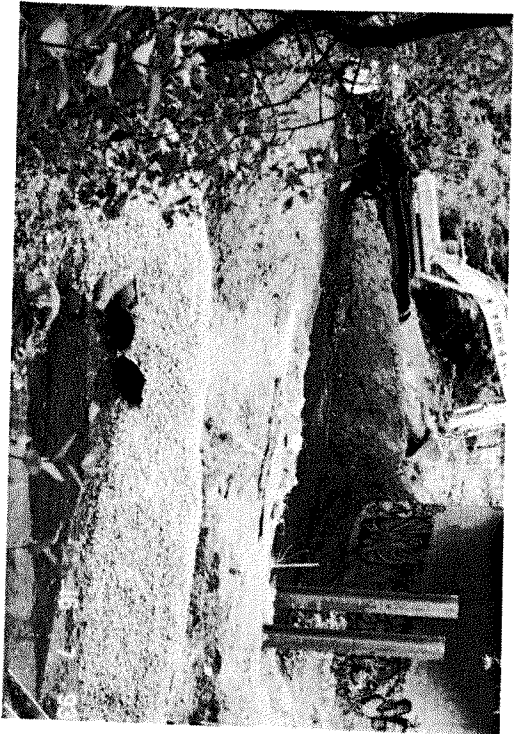


Flume Entrance 16Jul93



Noble Gulch 16Jul93





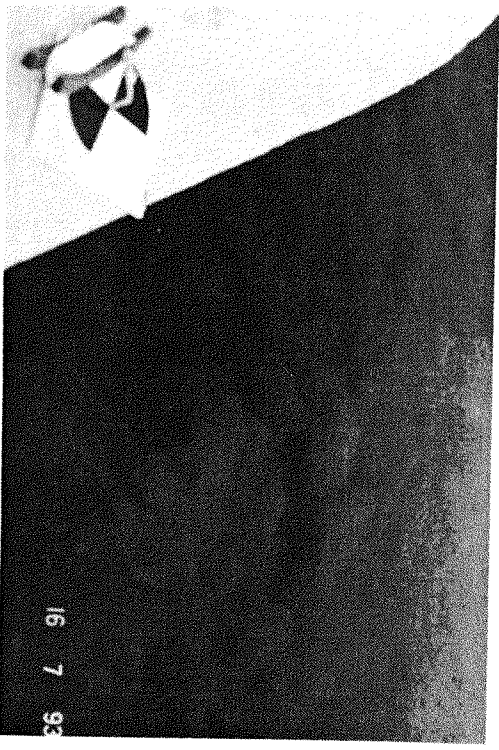
Inlet Culverts Porter St. 16July Outlet Culverts Porter 16Jul93



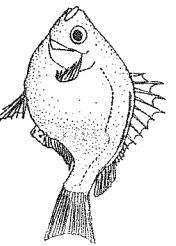
Inlet Culverts at Hwy 1 16July Outlet Culverts at Hwy 1 16July

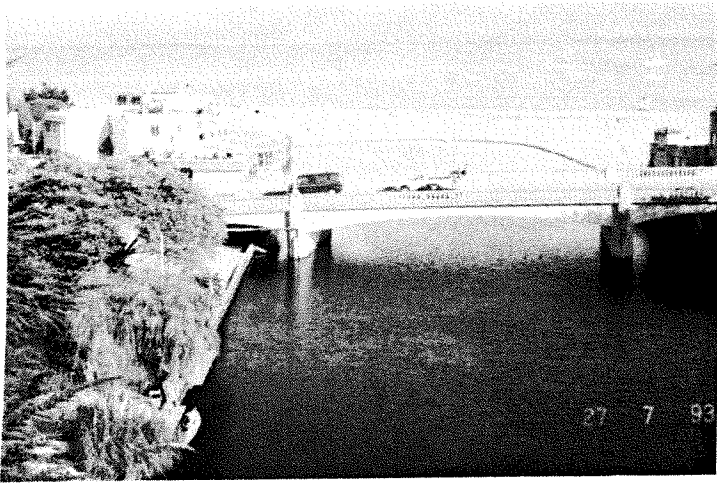


Algae in Reach 2 16Jul93

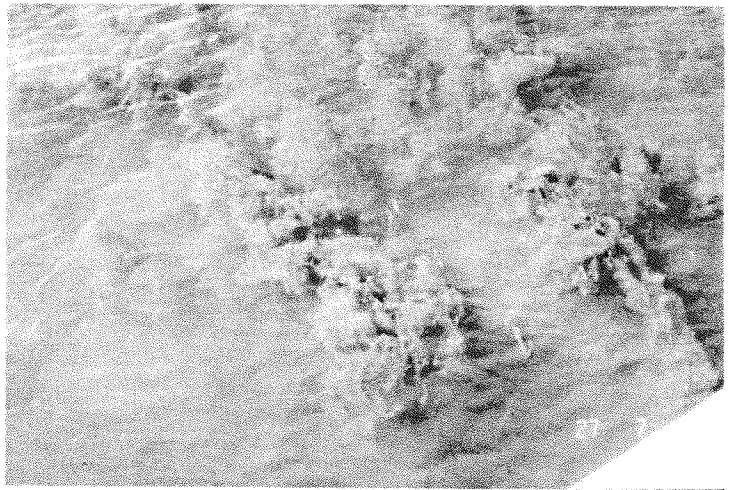


Algae in Reach 1 16Jul93





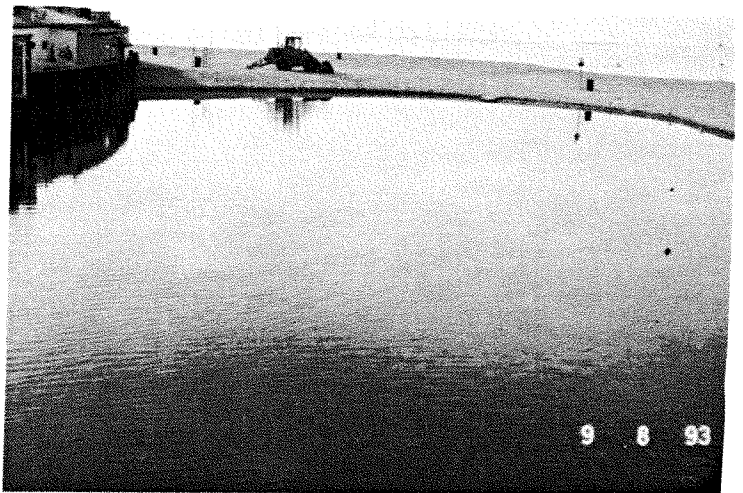
Reaches 1 and 2 27Jul93



Algal Spires Reach 1 27Jul93



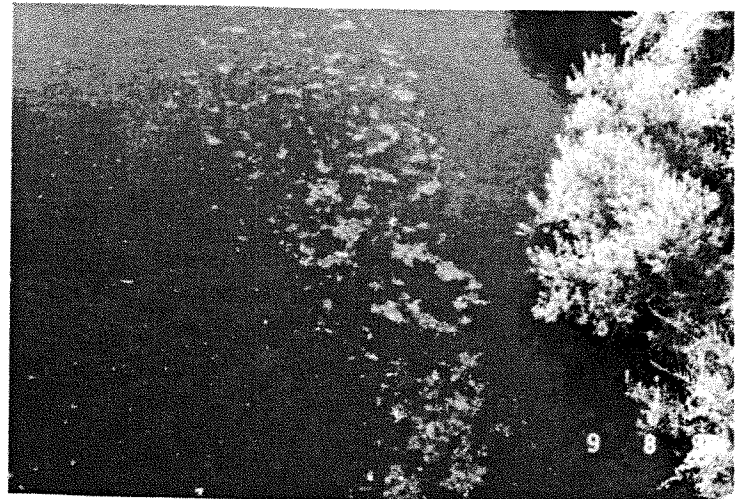
Algae Forest 27Jul93



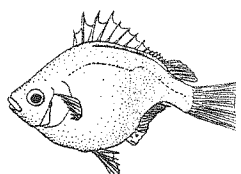
Reach 1 9Aug93

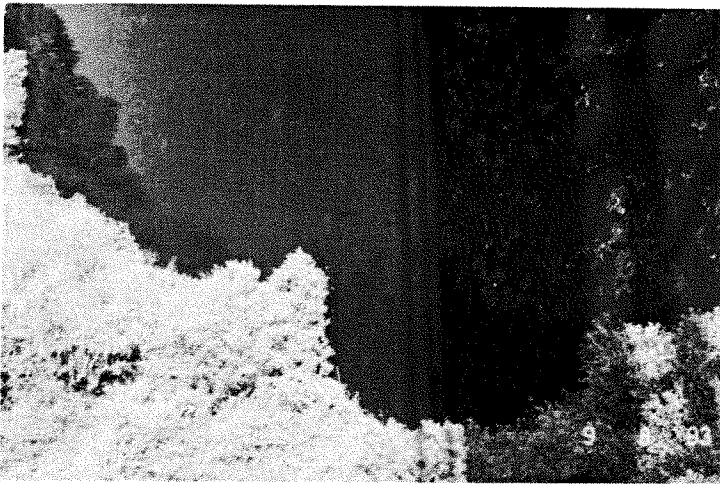


Reach 2 9Aug93

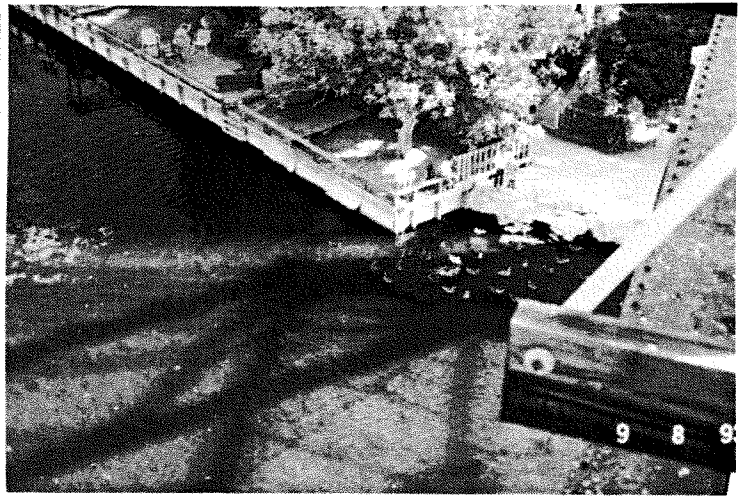


Reach 2 9Aug93

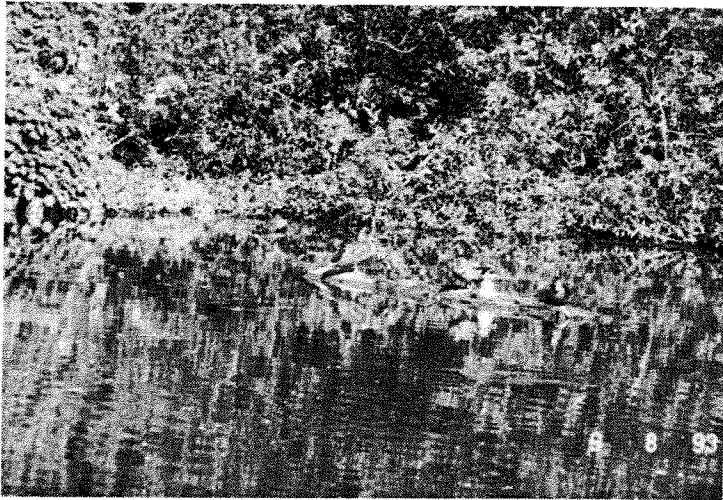




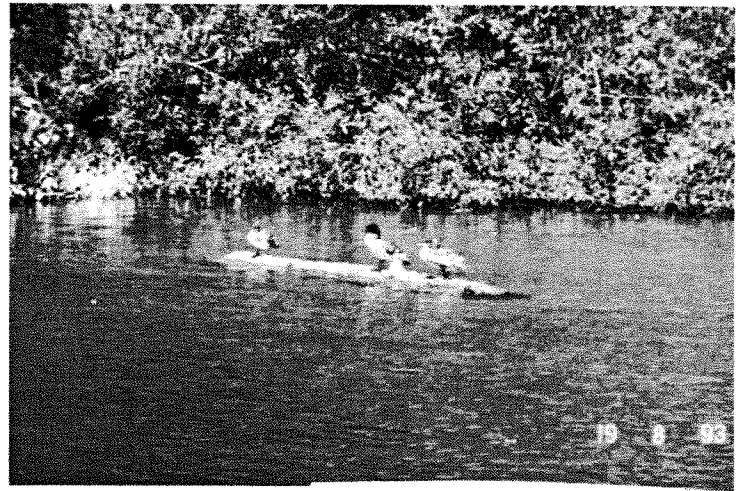
Reach 3 West Side 9Aug93



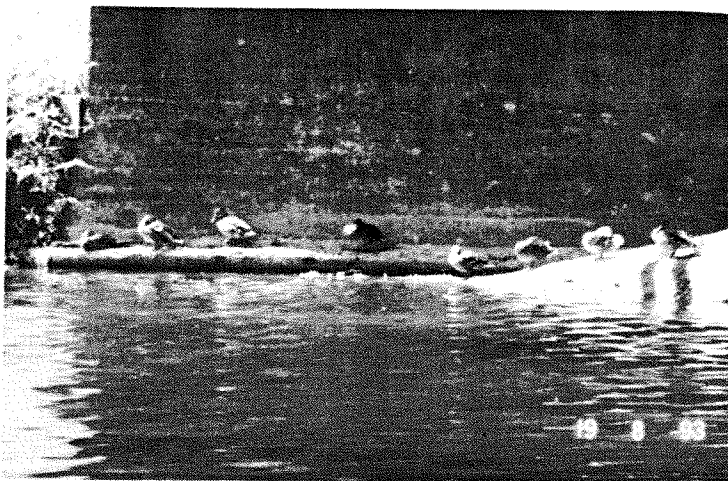
Bird-feeding near Trestle 9Aug93



Roosting on Log Rch 3 9Aug93



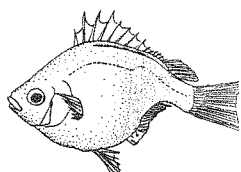
Roosting on Log Rch 3 19Aug93

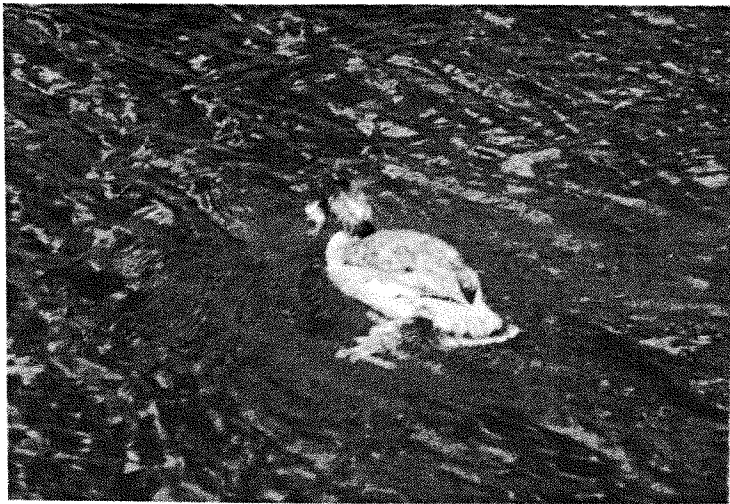


Roosting at Base of Trestle 19Aug93

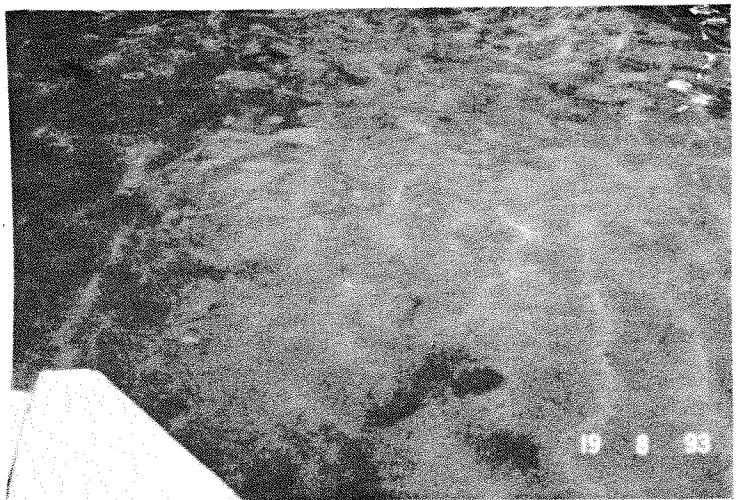


Merganser 19Aug93





Merganser With Fish 19Aug93



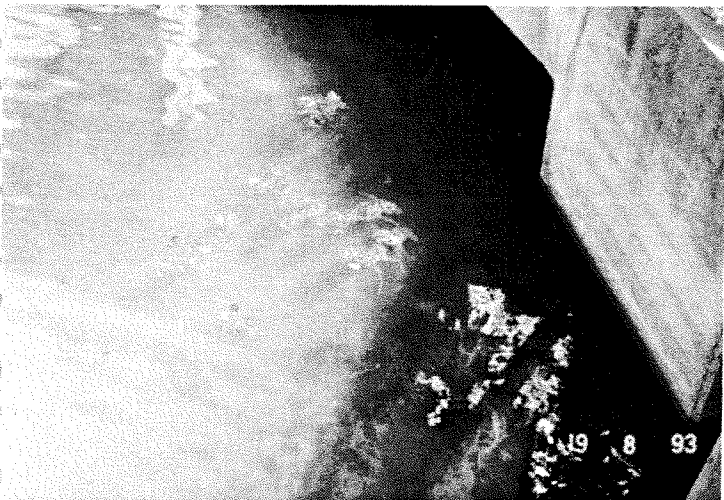
Lagoon Bottom at Flume 19Aug93



Flume 19Aug93



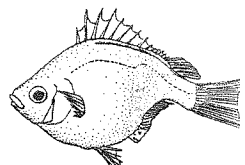
Pigeons Roosting Stockton Pk 19Aug93

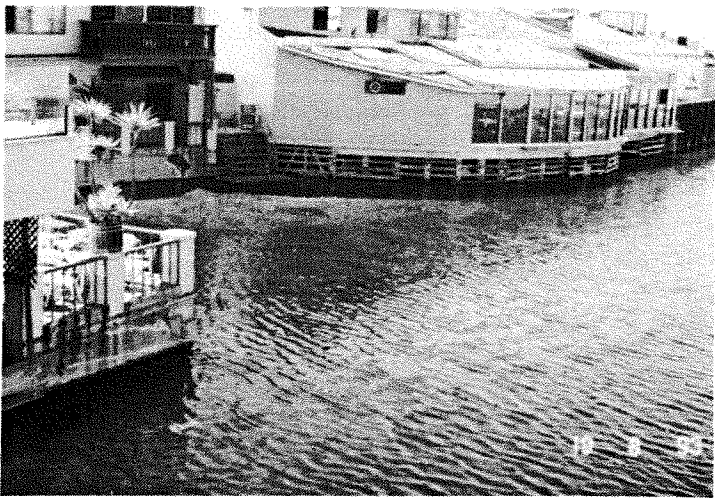


Noble Gulch 19Aug93

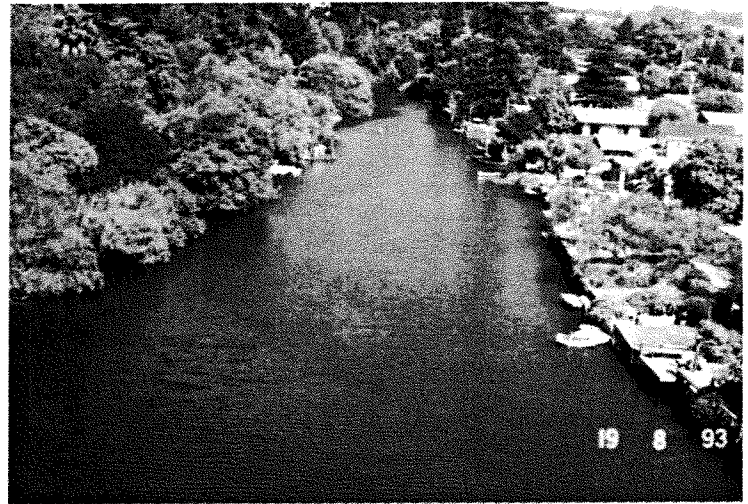


Bird-Feeding at Venetian 19Aug93

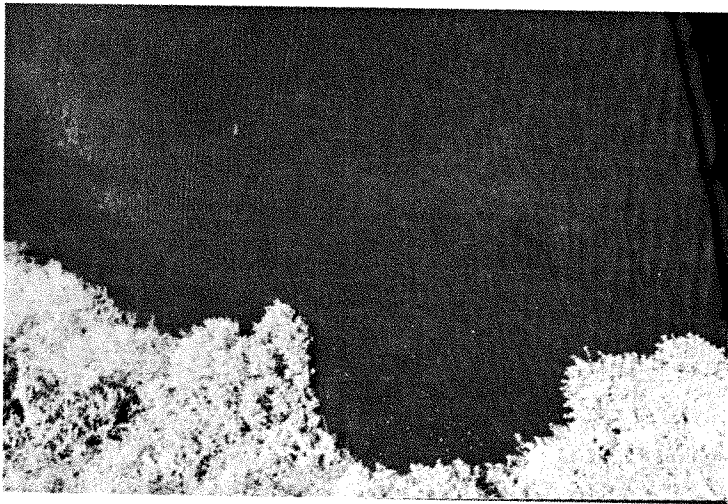




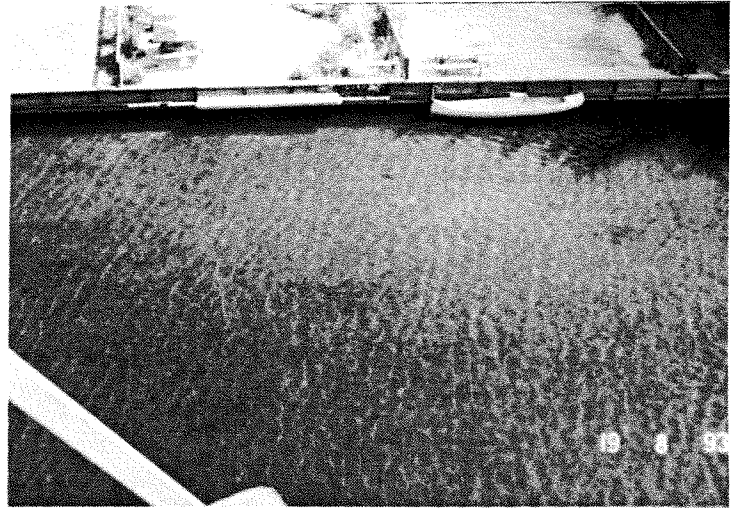
Restaurant Cove 19Aug93



Reach 2 19Aug93



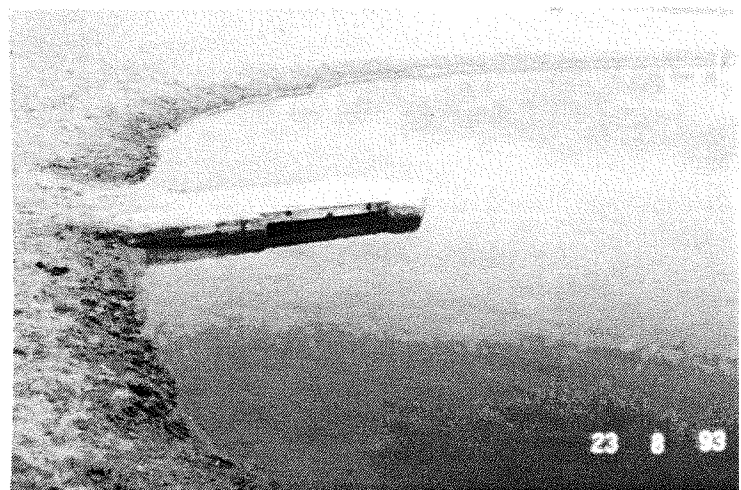
Reach 3 19Aug93



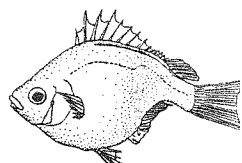
Reach 3 19Aug93



Two Young Mergansers-Venetian 23Aug



Flume 23Aug93

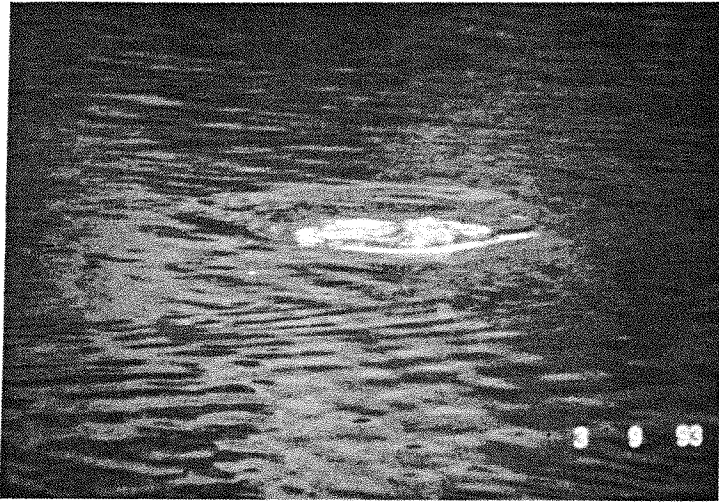




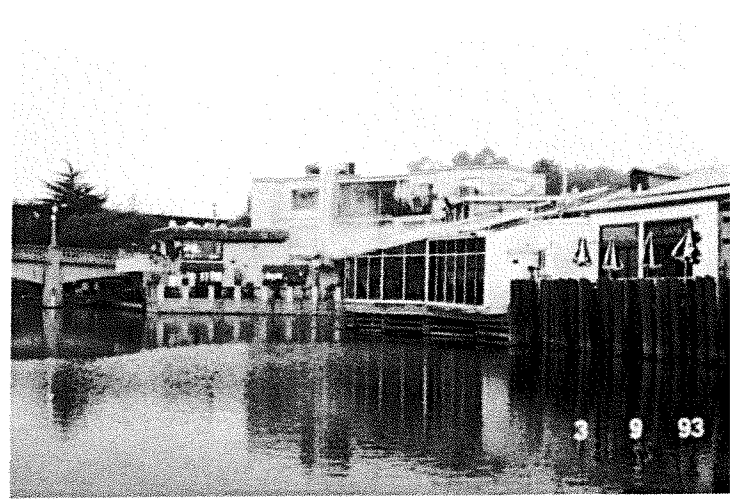
Merganser is Hunting 3Sep93



Pied-Billed Grebe 3Sep93



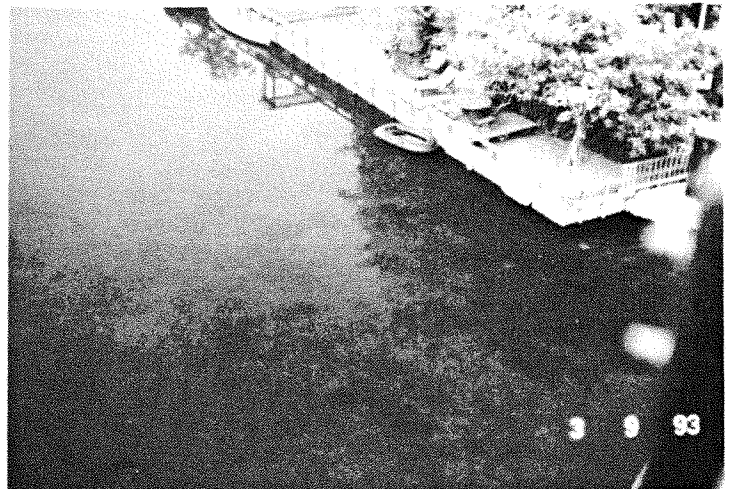
Diving Pied-Billed Grebe 3Sep93



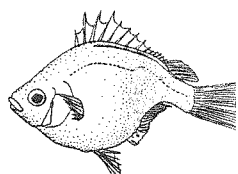
Steam-cleaning Larry's 3Sep93

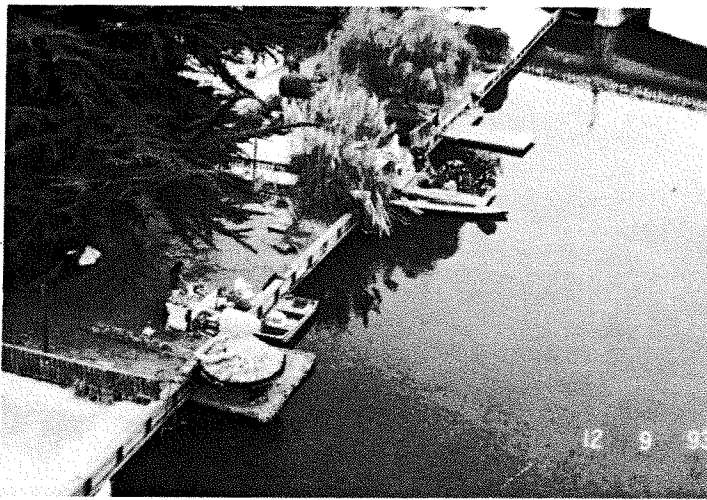


Reach 2 3Sep93

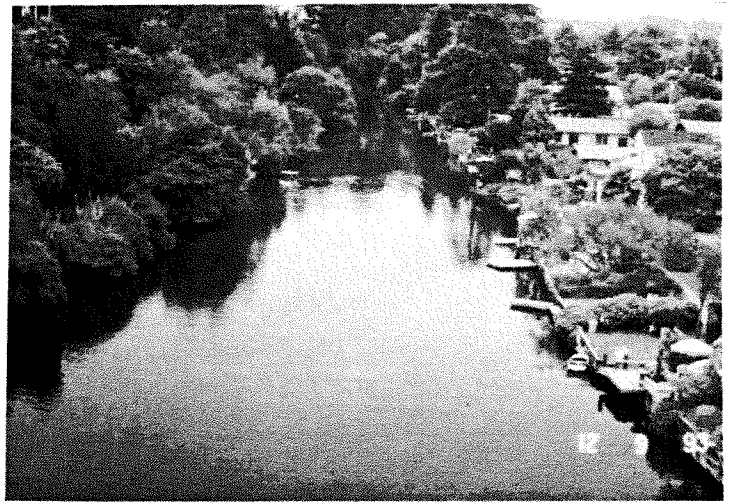


Reach 3 3Sep93





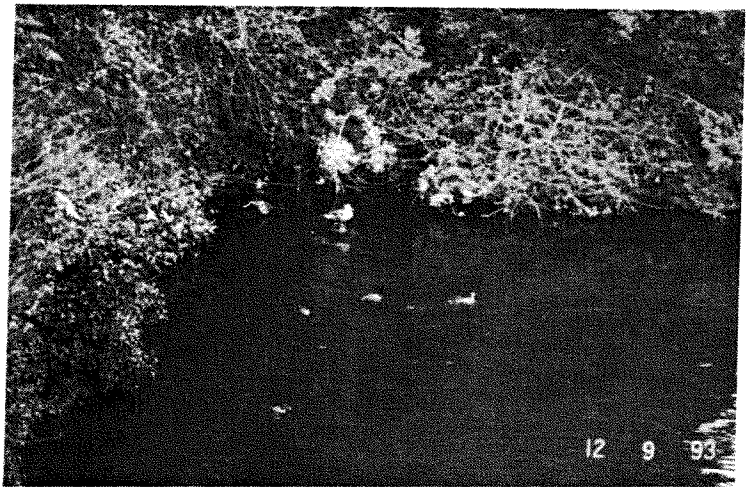
Begonia Floats Reach 2 12Sep93



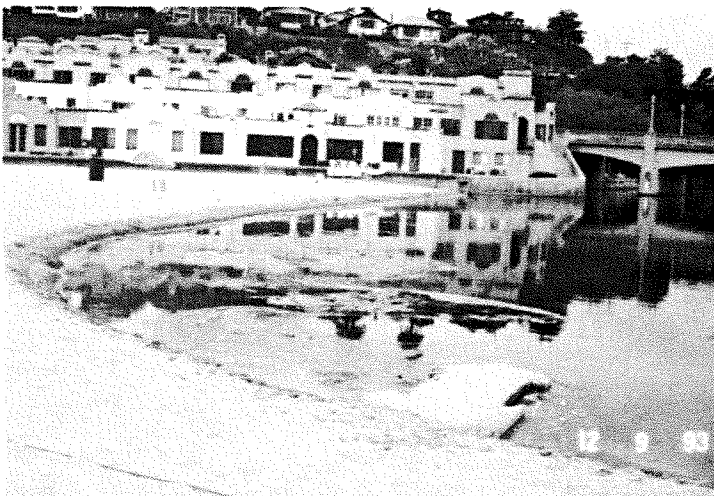
Begonia Floats Reach 3 12Sep93



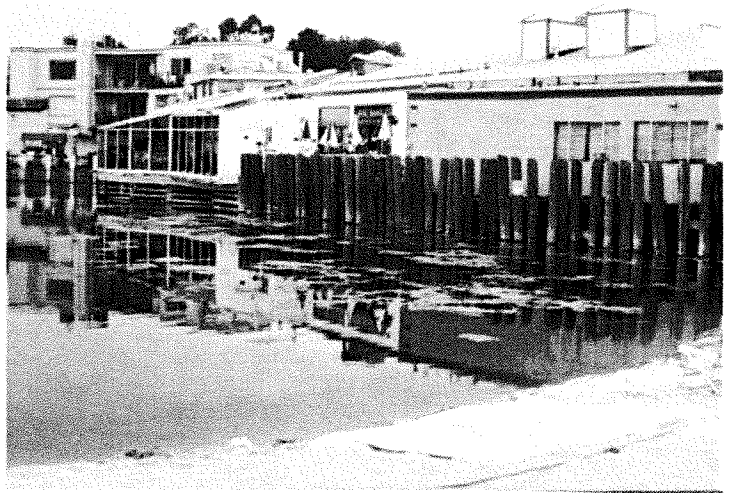
Jurassic Park 12Sep93



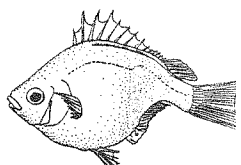
Ducks Lying Low in Cover 12Sep93



Reach 1 Before Festival 12Sep93



Rch 1 Before Festival 12Sep93

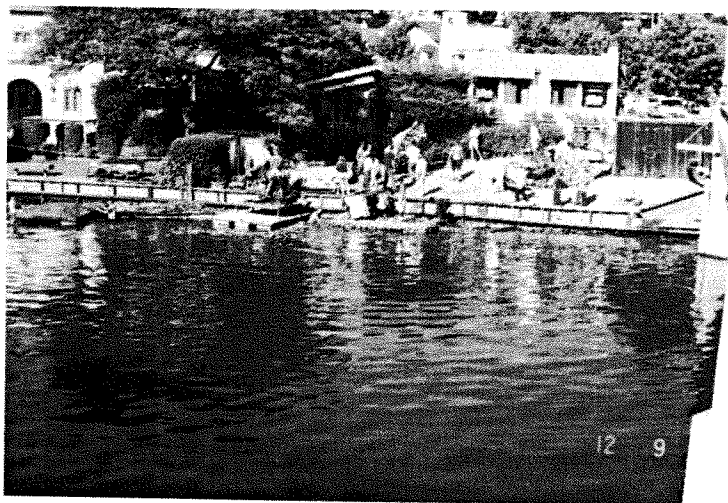




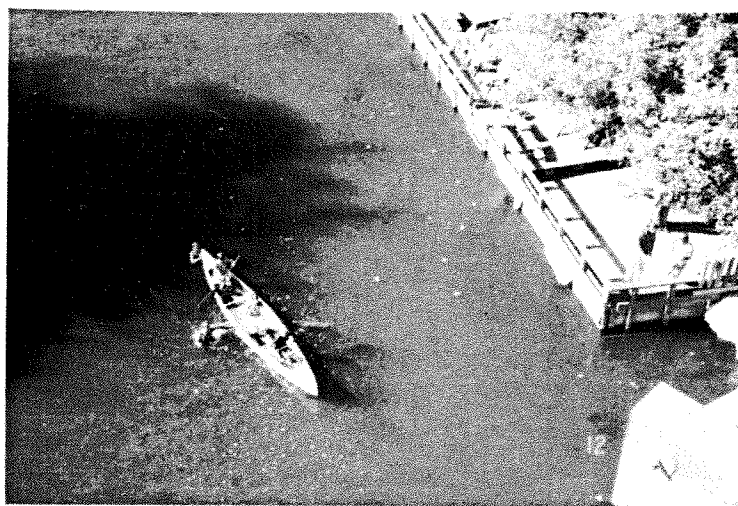
Feeding the Geese 12Sep93



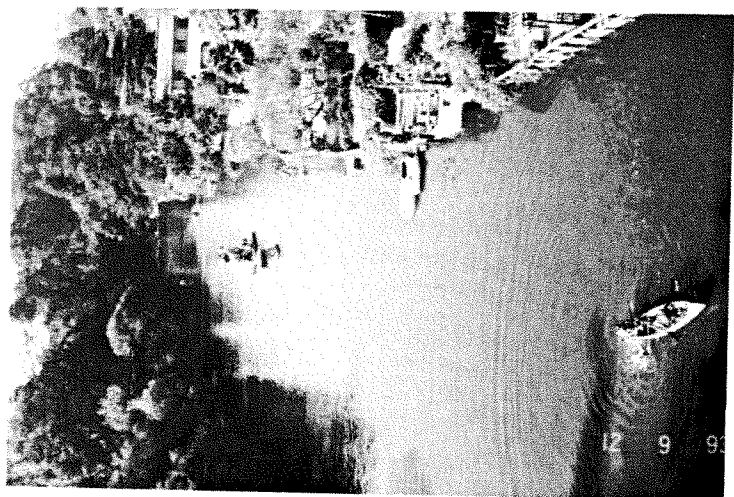
Rch 2 After the Festival 12Sep



Dismantling the Floats 12Sep93



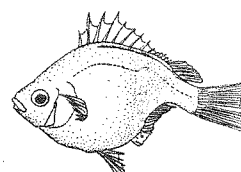
Rch 3 after Festival 12Sep93

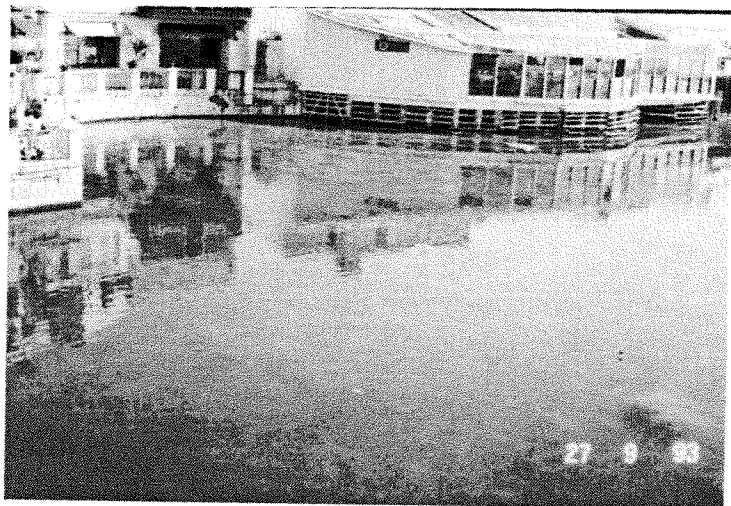


Reach 3 after Festival 12Sep93



Reach 1 27Sep93





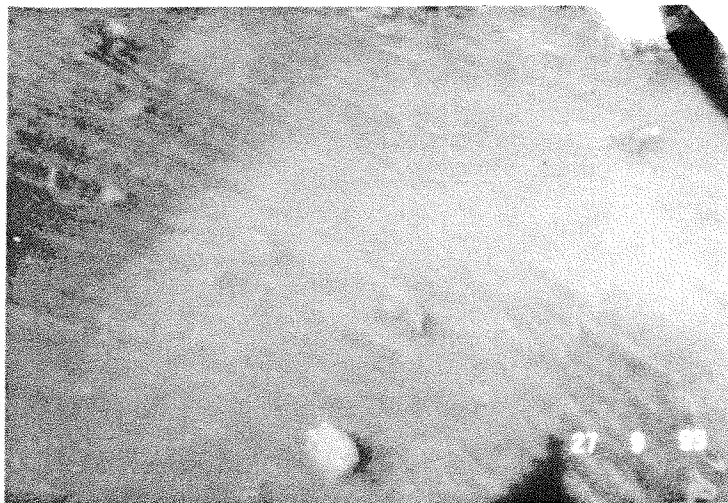
Reach 1 27Sep93



Reach 2 27Sep93



Reach 3 West Side 27Sep93



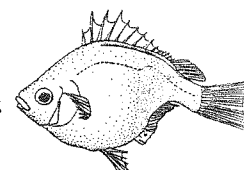
Noble Gulch 27Sep93



Hydraulic Continuity E. Walnut
6Oct93



Flow near E. Walnut 6Oct93
Estimated 0.75 cfs





Inflow to the Lagoon @ Nob Hill
Estimated 1.0 cfs 60Oct93



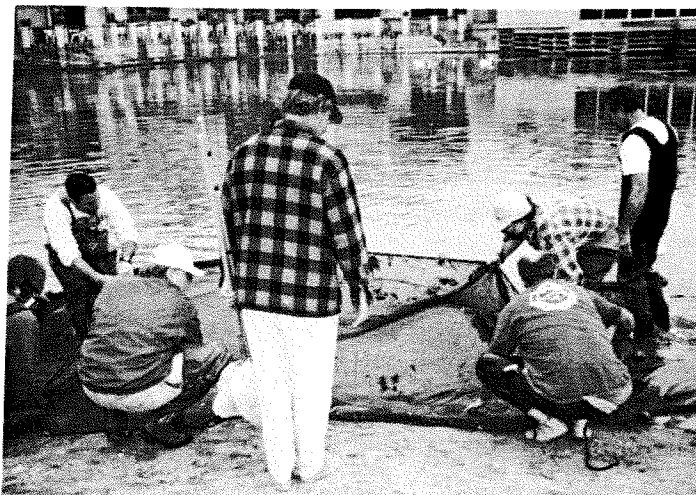
Poor Lagoon Level 60Oct93



Heermann's Gulls 60Oct93



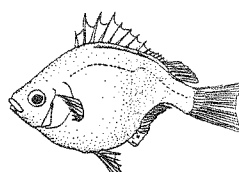
Reach 1 60Oct93

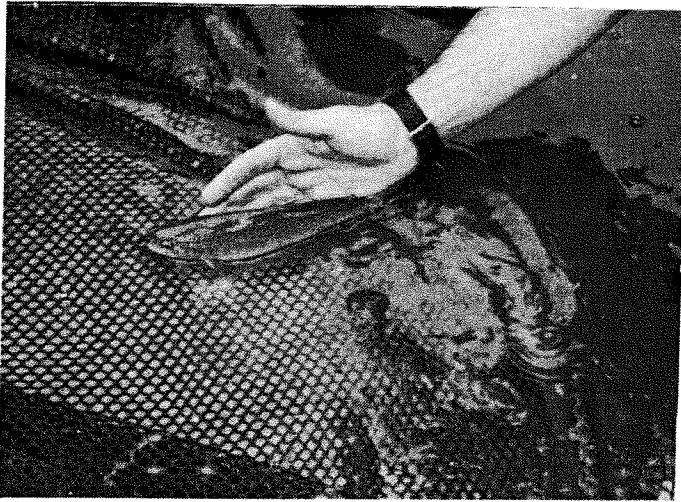


Pulling in Seine 100Oct93



Searching for Steelhead 100Oct





Finding the Steelhead 10Oct93



Transfer to the Live Car 10Oct93



Transfer from the Holding Pen



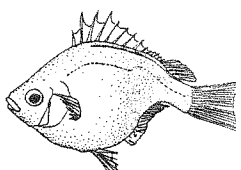
Looking for Clipped Fin



Very Large Stickleback 10Oct93



Seine Back in the Boat 10Oct93

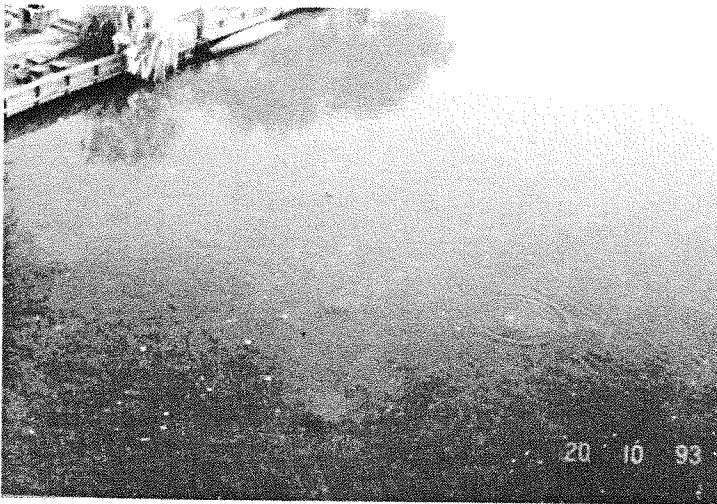




Rch 1 after Algae Skimming 10Oct93



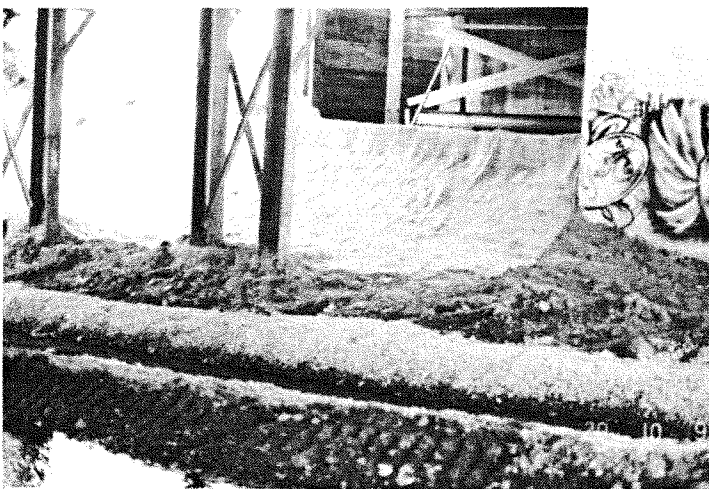
Young Ducks Feeding 20Oct93



Rch 2 After First Rain 20Oct93



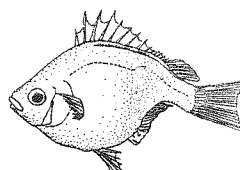
Rch 3 After First Rain 20Oct93

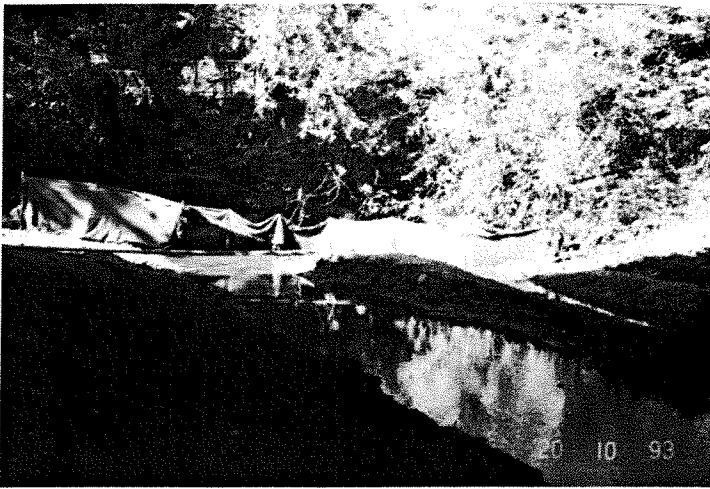


2 Channels Under Porter St bridge 20Oct



Sediment-Porter St 20Oct

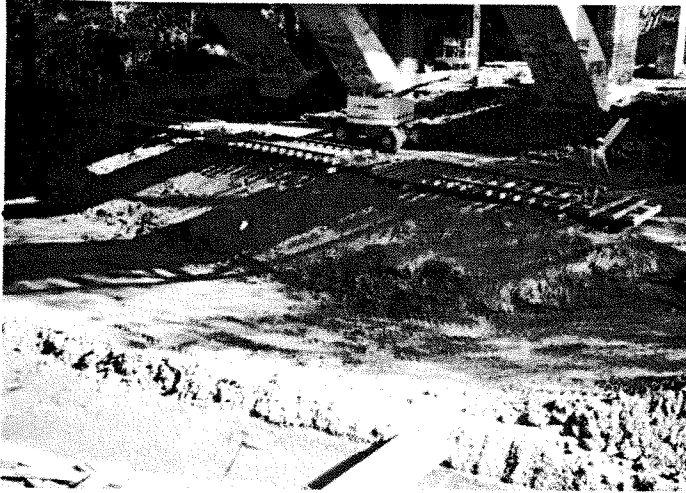




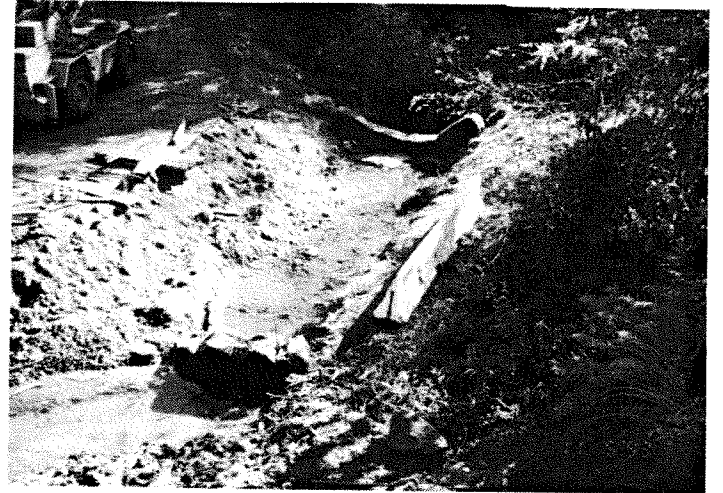
Sediment Screen-Porter St. 20Oct



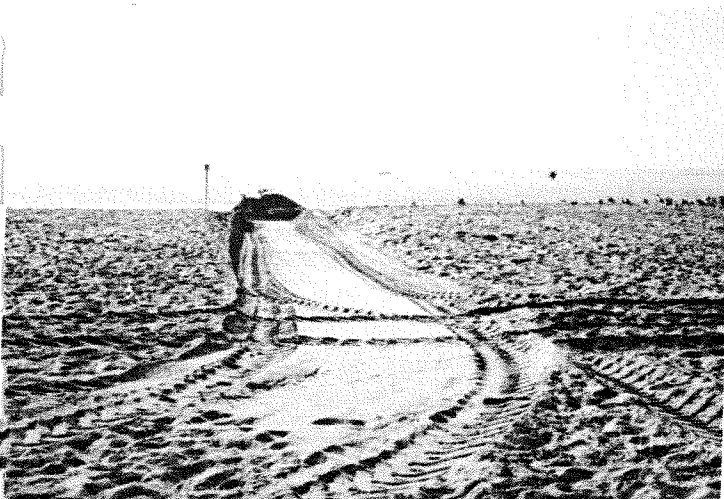
Channel Under Hwy 1 5Nov93



Loose Sediment Under Hwy 1 5Nov



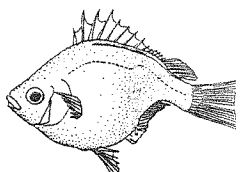
Sediment Dams @ Hwy 1 5Nov93

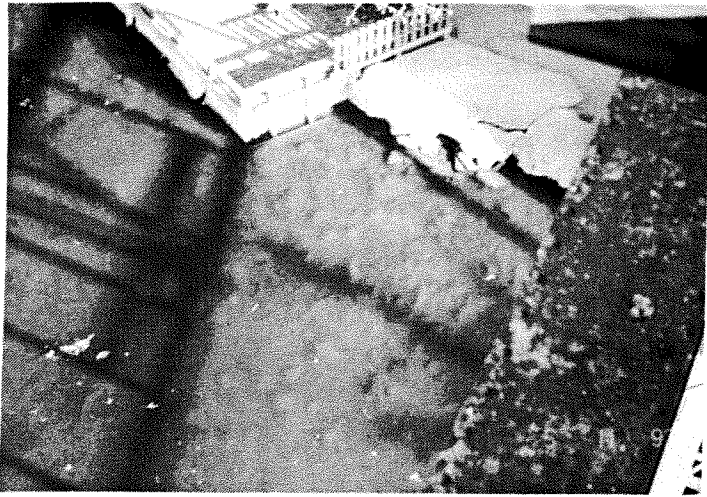


Notch in Sandbar 2 5Nov93



Reaches 1 and 2 5Nov93





Reach 2 5Nov93



Reach 3 5Nov93



Sandbar Breach 9Dec93



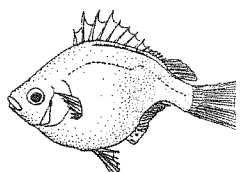
Channel Through Beach 9Dec93

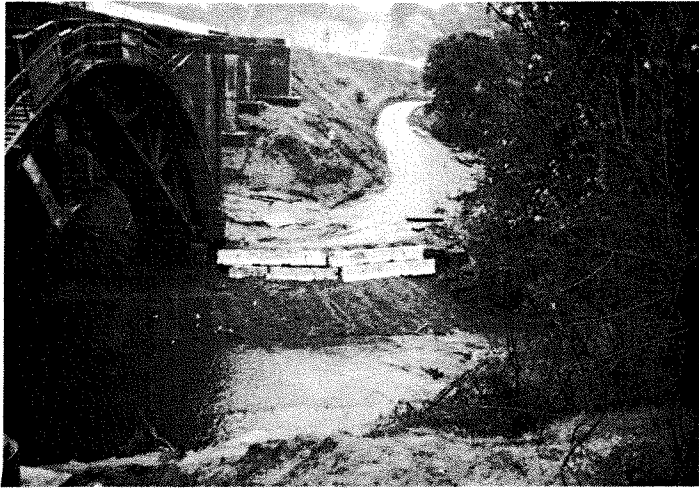


Where Fish Biologist Was 9Dec93



Tide Incoming After Breach 9Dec

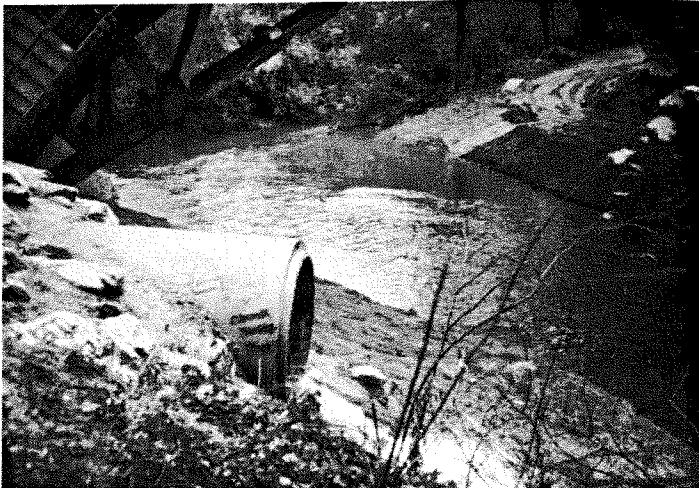




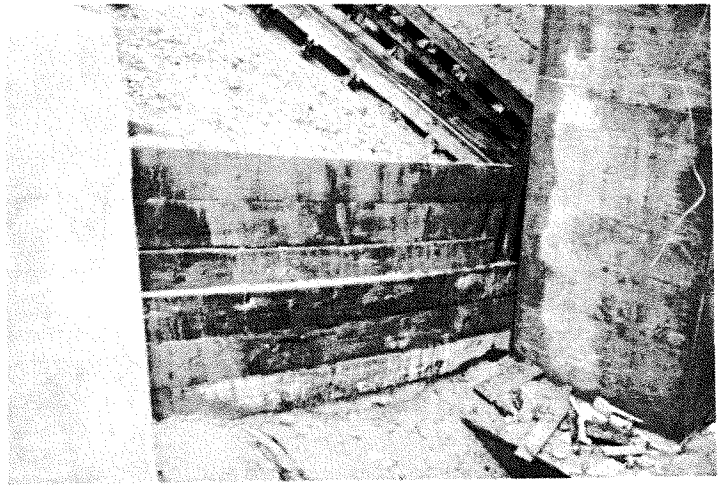
Erosion Control Hwy 1 9Dec93



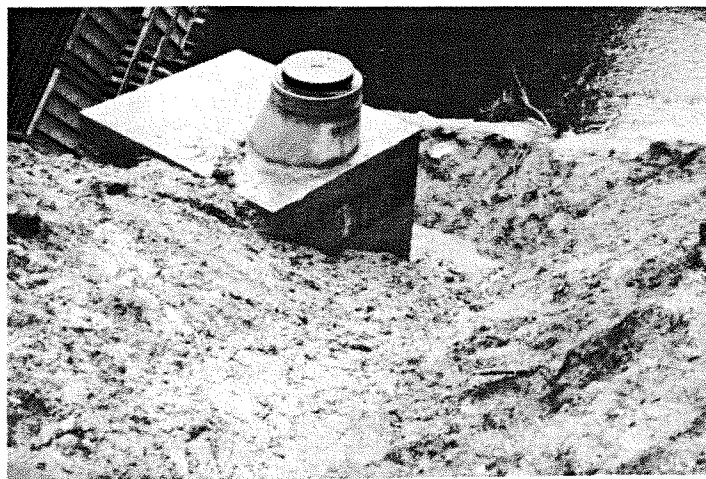
Streamflow Below Hwy 1 9Dec93



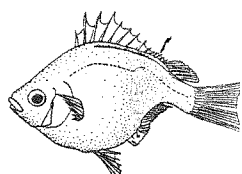
41st Ave Culvert Into Creek 9Dec



Retaining Wall Hwy 1 9Dec93

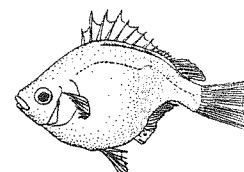


Mudslide, West Bank Soquel Cr., Hwy 1 9Dec93



APPENDIX B.

**FISH AND GAME AGREEMENT REGARDING PROPOSED STREAM OR
LAKE ALTERATION**



AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION

THIS AGREEMENT, entered into between the State of California, Department of Fish and Game, hereinafter called the Department, and City of Capitola of Capitola, State of California, hereinafter called the operator, is as follows:

WHEREAS, pursuant to Division 2, Chapter 6 of California Fish and Game Code, the operator, on the 21 day of April, 1993, notified the Department that he intends to substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed of the following water: Soquel Creek, in the County of Santa Cruz, State of California, S__ T__ R__.

WHEREAS, the Department (represented by Dennis Baldwin has made an inspection of subject area on the 28 day of April 28, 1993, and) has determined that such operations may substantially adversely affect existing fish and wildlife resources including: Salmon, steelhead, Tidewater gobies, non-game fish, riparian strip birdlife and animal life.

THEREFORE, the Department hereby proposes measures to protect fish and wildlife during the operator's work. The operator hereby agrees to accept the following recommendations as part of his work: Numbers 7, 10, 20, 21, 22 (649-2870) from the list of recommendations on the back of this page and the following special recommendations:

- *THIS IS A THREE (3) YEAR AGREEMENT, VALID FOR THE TIME PERIODS:
 - May 10, 1993 - October 15, 1993
 - May 10, 1994 - October 15, 1994
 - May 10, 1995 - October 15, 1995
- 1. All work in or near the stream or lake shall be confined to the period
- 2. This agreement does not take effect until the appropriate yearly fees have been received in the Regional Office and yearly approval has been received from the warden for the area of your project. It is the operator's responsibility to contact DFG at (707) 944-5520 for the fees for each year.
- 3. This project shall be limited to damming of Soquel Creek at the mouth, subject to the below conditions:
- 4. A new, straight line breach may be made. The existing channel shall be seized, with all fish being placed in the Lagoon, prior to a plug of sand being placed at the head of the outflow channel. Prior to the filling of any holes along the edge of the Lagoon, these areas shall be seized and netted off to prevent fish from re-entering the area.
- 5. Operator shall put the flume in operation during all construction and during all daily closures during construction.
- 6. All seaweed shall be removed from the channel bottom before damming occurs.
- 7. The steel shroud put in place in 1992, shall be placed on the flume. A minimum of 8-12 inches of water shall be maintained through the-flume. The flume shall be kept open to the ocean until at least July 1 of each year. After final damming, no draw down will be allowed without prior DFG approval. Operator shall contact DFG prior to breaching unless flooding is imminent.

The operator, as designated by the signature on this agreement, shall be responsible for the execution of all elements of this agreement. A copy of this agreement must be provided to contractors and subcontractors and must be in their possession at the work site.

If the operator's work changes from that stated in the notification specified above, this agreement is no longer valid and a new notification shall be submitted to the Department of Fish and Game. Failure to comply with the provisions of this agreement and with other pertinent Code Sections, including but not limited to Fish and Game Code Sections 5650, 5652 and 5948, may result in prosecution.

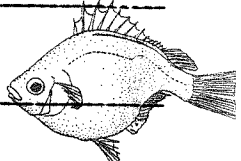
Nothing in this agreement authorizes the operator to trespass on any land or property, nor does it relieve the operator of responsibility for compliance with applicable federal, state, or local laws or ordinances.

THIS AGREEMENT IS NOT INTENDED AS AN APPROVAL OF A PROJECT OR OF SPECIFIC PROJECT FEATURES BY THE DEPARTMENT OF FISH AND GAME. INDEPENDENT REVIEW AND RECOMMENDATIONS WILL BE PROVIDED BY THE DEPARTMENT AS APPROPRIATE ON THOSE PROJECTS WHERE LOCAL, STATE, OR FEDERAL PERMITS OR OTHER ENVIRONMENTAL REPORTS ARE REQUIRED.

This agreement becomes effective on when signed by both parties.

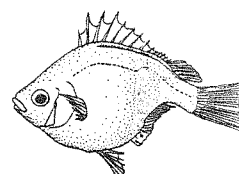
Operator P. D. Morrison
 Title Marine Survey
 Organization City of Capitola
 Date May 3, 1993

Department Representative Dennis Baldwin
 Title Patrol Lieutenant
 Department of Fish and Game, State of California
 Date May 3, 1993
D.J. & Associates



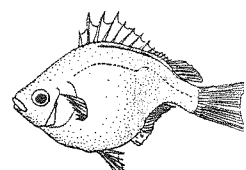
APPENDIX C.

Santa Cruz County Water Monitoring Data, 1993.



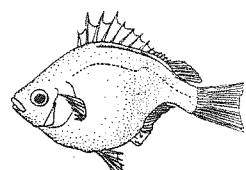
STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
23	SOQUEL C @ NOB HILL	18-May-93	11:35 AM	17	720	CLEAR WATER.
23	SOQUEL C @ NOB HILL	01-Jun-93	11:55 AM	18	2200	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	08-Jun-93	12:20 PM	18	1400	CLEAR WATER, ALGAL GROWTH.
S23	SOQUEL C @ NOB HILL	15-Jun-93	12:20 PM	19	1000	CLEAR WATER, ALGAL GROWTH.
23	SOQUEL C @ NOB HILL	22-Jun-93	01:00 PM	17	1400	CLEAR WATER, ALGAL GROWTH.
S23	SOQUEL C @ NOB HILL	29-Jun-93	11:50 AM	18	2000	GREYISH WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	07-Jul-93	11:40 AM	17	1000	CLEAR WATER, ALGAL GROWTH.
23	SOQUEL C @ NOB HILL	13-Jul-93	12:25 PM	17	620	CLEAR WATER, ALGAL GROWTH
23	SOQUEL C @ NOB HILL	20-Jul-93	12:32 PM	19	480	CLEAR WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	28-Jul-93	12:20 PM	18	1250	CLEAR WATER, ALGAL GROWTH.
S23	SOQUEL C @ NOB HILL	03-Aug-93	12:25 PM	20	2280	CLEAR WATER, ALGAL GROWTH.
23	SOQUEL C @ NOB HILL	10-Aug-93	11:40 AM	18	1640	CLEAR WATER, ALGAL GROWTH.
S23	SOQUEL C @ NOB HILL	17-Aug-93	11:45 AM		980	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	24-Aug-93	12:20 PM	18	480	CLEAR WATER.
23	SOQUEL C @ NOB HILL	07-Sep-93	10:55 AM	17	440	CLEAR WATER.
23	SOQUEL C @ NOB HILL	21-Sep-93		16.5	670	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	04-Oct-93	01:05 PM	17	510	CLEAR WATER.
23	SOQUEL C @ NOB HILL	13-Oct-93	02:10 PM	16	16440	GREYISH WATER.
23	SOQUEL C @ NOB HILL	18-Oct-93	01:10 PM	15	3480	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	25-Oct-93	11:15 AM	15	840	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	01-Nov-93	12:55 PM	15	1040	CLEAR WATER.
23	SOQUEL C @ NOB HILL	09-Nov-93	12:00 PM	13	640	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	15-Nov-93			820	
S23	SOQUEL C @ NOB HILL	07-Dec-93	12:32 PM		0	
23	SOQUEL C @ NOB HILL	14-Dec-93	11:25 AM		268	BROWNISH WATER.
23	SOQUEL C @ NOB HILL	20-Dec-93	01:15 PM	8	860	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	03-Jan-94	12:35 PM	10	280	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	11-Jan-94	01:45 PM	9	180	CLEAR WATER.
23	SOQUEL C @ NOB HILL	31-Jan-94	02:30 PM		40	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	14-Feb-94		8	60	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	23-Feb-94	11:05 AM	10	340	CLEAR WATER.
23	SOQUEL C @ NOB HILL	07-Mar-94	01:05 PM	15	150	CLEAR WATER.
S23	SOQUEL C @ NOB HILL	14-Mar-94	01:55 PM	16	1800	BROWNISH WATER.
S23	SOQUEL C @ NOB HILL	21-Mar-94	12:00 PM	13	70	2 DUCKS, CLEAR WATER.
6	NOBEL G @ 360 BROOKVALE T.	20-Jul-93	01:25 PM	21	150	CLEAR WATER, NO ODOR.
6	NOBEL G BELOW SWIMMING POOL	11-Jan-94	01:30 PM	9	7620	CLEAR WATER.
S15	NOBEL G @ PLUM ST	20-Jul-93	01:40 PM	22	50	GREYISH WATER, NO SEEPAGES, NO ODOR.
S15	NOBEL G @ #36 PLUM	<i>Dupe</i> 11-Jan-94	01:20 PM	9	0	ORGANIC MATTER, CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	13-Jul-93	12:00 PM	16	4020	GREYISH WATER.
S12	NOBEL G @ TUNNEL @ BAY	20-Jul-93	01:55 PM	19	2600	GREYISH WATER, NO ODOR.
S12	NOBEL G @ TUNNEL @ BAY	28-Jul-93	11:55 AM	18	200	SLIGHTLY GREYISH WATER.
2	NOBEL G @ TUNNEL @ BAY	03-Aug-93	11:40 AM	19	240	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	10-Aug-93	11:30 AM		804	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	17-Aug-93	12:45 PM	22	120	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	24-Aug-93	12:10 PM	17	6200	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	07-Sep-93	10:45 AM	16	1800	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	13-Sep-93	11:15 AM	15	700	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	20-Sep-93		16	450	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	28-Sep-93		17	600	GREYISH WATER.

INT DATE: 03/31/94

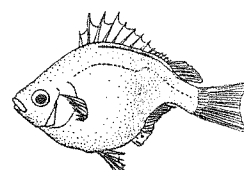


STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
2	NOBEL G @ TUNNEL @ BAY	04-Oct-93	12:55 PM	18	2140	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	13-Oct-93	02:00 PM	16	4090	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	18-Oct-93	01:40 PM	15	660	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	25-Oct-93	11:30 AM	14	2800	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	01-Nov-93	12:45 PM	15	680	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	09-Nov-93	11:55 AM	15	800	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	15-Nov-93			760	
2	NOBEL G @ TUNNEL @ BAY	22-Nov-93		13	80	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	08-Dec-93	02:00 PM	13	36	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	13-Dec-93		12	1340	BROWNISH WATER.
2	NOBEL G @ TUNNEL @ BAY	20-Dec-93	01:00 PM	8	220	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	03-Jan-94	12:25 PM	11	1850	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	11-Jan-94	01:20 PM	9	230	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	24-Jan-94	01:20 PM	12	13200	RAIN 1/24.
2	NOBEL G @ TUNNEL @ BAY	27-Jan-94	12:10 PM	10.5	1100	BROWNISH WATER, RAIN 1/26.
S12	NOBEL G @ TUNNEL @ BAY	31-Jan-94	02:20 PM		120	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	14-Feb-94		10	500	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	23-Feb-94	10:55 AM	10	160	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	28-Feb-94		15	80	CLEAR WATER.
S12	NOBEL G @ TUNNEL @ BAY	07-Mar-94	12:50 PM	16	60	CLEAR WATER, ORANGE RESIDUE ON BANK.
2	NOBEL G @ TUNNEL @ BAY	14-Mar-94	01:40 PM	17	310	CLEAR WATER.
2	NOBEL G @ TUNNEL @ BAY	21-Mar-94	11:50 AM	14	0	CLEAR WATER.
S07	SOQUEL C @ NOBEL G	07-Sep-93	11:10 AM	19	10300	CLEAR WATER, SOME SAWDUST ON WATER.
S07	SOQUEL C @ NOBEL G	13-Sep-93	11:30 AM	18	1800	CLEAR WATER.
6	SOQUEL C @ TRESTLE	25-May-93	12:15 PM		1980	GREYISH WATER, RAIN 5/24.
6	SOQUEL C @ TRESTLE	20-Jul-93	12:20 PM	21	360	CLEAR WATER.
S06	SOQUEL C @ TRESTLE	28-Jul-93	12:30 PM	21	450	CLEAR WATER, 1 DUCK.
6	SOQUEL C @ TRESTLE	03-Aug-93	12:35 PM	21	400	CLEAR WATER, 6 DUCKS.
6	SOQUEL C @ TRESTLE	10-Aug-93	11:50 AM	21	800	CLEAR WATER, 7 DUCKS.
S06	SOQUEL C @ TRESTLE	17-Aug-93	12:40 PM	22	120	CLEAR WATER, BOATS.
6	SOQUEL C @ TRESTLE	24-Aug-93	12:30 PM	21	320	CLEAR WATER.
SO	SOQUEL C @ FLUME	04-May-93	01:05 PM	18	600	CLEAR WATER, 10 BIRDS UPSTREAM.
SO	SOQUEL C @ FLUME	12-May-93	02:00 PM	19	500	CLEAR WATER, SEAGULLS UPSTREAM.
SO	SOQUEL C @ FLUME	18-May-93	11:45 AM	23	2500	LAGOON BEING CLOSED, CLEAR WATER.
SO	SOQUEL C @ FLUME	25-May-93	12:05 PM	21	6800	GREYISH WATER, L BEING CLOSED, RAIN 5/24.
SO	SOQUEL C @ FLUME	01-Jun-93	11:35 AM	19	2900	CLEAR WATER.
SO	SOQUEL C @ FLUME	08-Jun-93	12:13 PM	18	5400	CLEAR WATER.
SO	SOQUEL C @ FLUME	15-Jun-93	12:10 PM	21	1300	CLEAR WATER.
SO	SOQUEL C @ FLUME	22-Jun-93	12:10 PM	20	2100	CLEAR WATER.
SO	SOQUEL C @ FLUME	29-Jun-93	11:35 AM	19	6100	7 SEAGULLS, CLEAR WATER.
SO	SOQUEL C @ FLUME	07-Jul-93	11:25 AM	19	1600	CLEAR WATER, NO BIRDS.
SO	SOQUEL C @ FLUME	13-Jul-93	12:15 PM	18	1200	CLEAR WATER, 10 BIRDS.
SO	SOQUEL C @ FLUME	20-Jul-93	12:10 PM	21	1700	CLEAR WATER, 10 SEAGULLS.
SO	SOQUEL C @ FLUME	28-Jul-93	12:40 PM	21	700	CLEAR WATER.
SO	SOQUEL C @ FLUME	03-Aug-93	12:45 PM	23	1000	CLEAR WATER.
SO	SOQUEL C @ FLUME	10-Aug-93	12:00 PM	22	1500	CLEAR WATER.
SO	SOQUEL C @ FLUME	17-Aug-93	12:30 PM	22	1240	CLEAR WATER, SEAGULLS.
SO	SOQUEL C @ FLUME	24-Aug-93	12:40 PM	21	1220	CLEAR WATER.
SO	SOQUEL C @ FLUME	07-Sep-93	11:20 AM	20	1320	CLEAR WATER, 13 SEAGULLS.

7 WKS

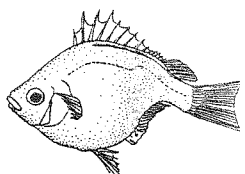


STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	NOTES
	SOQUEL C @ FLUME	13-Sep-93	10:57 AM	19	1040	CLEAR WATER.
	SOQUEL C @ MOUTH	20-Sep-93		18	800	CLEAR WATER, MANY SEAGULLS.
SO	SOQUEL C @ FLUME	27-Sep-93	01:10 PM	20	860	30 SEAGULLS, SOME ALGAL GROWTH.
SO	SOQUEL C @ FLUME	04-Oct-93	01:20 PM	19	880	CLEAR WATER, SOME ALGAL GROWTH, 24 BIRDS
	SOQUEL C @ FLUME	13-Oct-93	02:10 PM	18	3300	CLEAR WATER, 40 SEAGULLS.
SO	SOQUEL C @ FLUME	18-Oct-93	01:25 PM	17	980	CLEAR WATER, 40 SEAGULLS.
SO	SOQUEL C @ FLUME	25-Oct-93	11:50 AM	17	540	CLEAR WATER, MANY SEAGULLS.
	SOQUEL C @ FLUME	01-Nov-93	01:10 PM	17	440	CLEAR WATER, MANY SEAGULLS UPSTREAM.
	SOQUEL C @ FLUME	09-Nov-93	12:15 PM	15	560	CLEAR WATER, 20 SEAGULLS.
SO	SOQUEL C @ FLUME	15-Nov-93		12	500	CLEAR WATER, BIRDS.
	SOQUEL C @ FLUME	22-Nov-93		13	220	CLEAR WATER, MANY SEAGULLS.
	SOQUEL C @ FLUME	30-Nov-93	01:15 PM	12	3670	25 BIRDS ON BROWNISH WATER, RAIN 11/29.
SO	SOQUEL C @ FLUME	07-Dec-93	12:25 PM		160	
SO	SOQUEL C @ FLUME	13-Dec-93		12	670	BROWNISH WATER.
	SOQUEL C @ FLUME	16-Dec-93	02:40 PM		400	BROWNISH WATER.
SO	SOQUEL C @ FLUME	20-Dec-93	01:30 PM	11	220	CLEAR WATER, MANY SEAGULLS.
SO	SOQUEL C @ FLUME	03-Jan-94	12:45 PM	11	210	CLEAR, STANDING WATER.
	SOQUEL C @ FLUME	11-Jan-94	02:00 PM	13	1816	CLEAR WATER, MANY SEAGULLS.
	SOQUEL C @ FLUME	24-Jan-94	01:30 PM	13	19800	RAIN 1/24.
SO	SOQUEL C @ MOUTH	27-Jan-94	12:25 PM	11	1500	BROWNISH WATER, RAIN 1/26.
SO	SOQUEL C @ FLUME	31-Jan-94			1820	CLEAR WATER, SEAGULLS.
	SOQUEL C @ FLUME	14-Feb-94		10	60	CLEAR WATER, 10 BIRDS.
SO	SOQUEL C @ FLUME	23-Feb-94	11:15 AM	10	400	GREYISH WATER.
SO	SOQUEL C @ FLUME	28-Feb-94		15	160	CLEAR WATER.
	SOQUEL C @ FLUME	07-Mar-94	01:20 PM	16	60	CLEAR WATER.
	SOQUEL C @ FLUME	14-Mar-94	01:25 PM	21	650	CLEAR WATER.
SO	SOQUEL C @ FLUME	21-Mar-94	12:10 PM	15	60	CHILDREN, CLEAR WATER.



APPENDIX D.

**Water Quality Data and General Observations of Birds and
Aquatic Vegetation 3 June - 27 November, 1993**



**Water Quality Data and General Observations of Birds and
Aquatic Vegetation 3 June - 27 November, 1993**

3 June 1993. Flume entrance with 2 boards on either side. Remainder of the opening screened with 6"x6" mesh. End ribs of screen removed at water line to make adult fish passage easy. The entrance and exit of the flume were 12 inches deep. Gage height = 1.79. Fish passage was good. Two steelhead smolts were observed at the mouth of Noble Gulch. Slight planktonic algae bloom throughout the lagoon. No other aquatic vegetation. A gray suspension was exiting Noble Gulch. It looked like cleaning water. Nine piles of dog excrement were present at the trestle park. Seven piles were counted along the path. Ten to 12 dogs were walked by their owners along the path mostly in the morning. The water column was clear to the bottom at all stations, though a slight planktonic algae bloom had begun. Two steelhead smolts seen near the mouth of Noble Gulch. Gray suspension entering the lagoon from Noble Gulch indicated pollution source up the gulch. It looked like wash water.

Station: Flume at 1240 hr, Hazy sunshine. Gage Height= 1.79

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	17.9	0.00	-	610
0.25	17.9	0.00	-	610
0.50	17.8	0.00	-	610
0.75(bot)	17.5	0.00	-	600

Station: Stockton Avenue Bridge, NW pier/SE pier, 1210 hr.
Secchi depth to bottom.

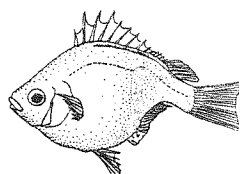
surf	17.2/18.0	0.0/0.0	-	620/620
0.25	17.1/18.0	0.0/0.0	-	620/620
0.50	17.1/17.8	0.0/0.0	-	620/620
0.75	17.0/17.5	0.0/0.0	-	620/610
1.00	16.9/17.3	0.0/0.0	-	620/610
1.25	16.9/17.2	0.0.5.0	-	620/ -
1.50	16.9/19.1	0.3/7.2	-	1100/10500
1.75(bot)	16.9/19.8	7.2/9.6	-	10500/14300

Birds in Reach 1: 3 geese. 14 gulls bathing. 21 gulls on restaurant roof. 2 gulls near restaurant in water awaiting handout.

Birds in Reach 2: 10 pigeons on trestle.

Birds in Reach 3: 1 pair of wild mallards.

Conclusion: As was the case the previous year, 7 days after final sandbar closure and installation of the shroud, the lagoon was nearly flushed of salt water except at the deeper holes, such as around the piers of the Stockton Avenue Bridge. This occurred without the help of the shroud. Water quality was excellent for aquatic organisms except around the bridge piers. Conductivity



was typical of a freshwater lagoon. Water quality was good with cool enough water temperature (< 18 C) and oxygen levels were assumed to be near full saturation except in the holes at the Stockton Avenue pier and near. Water temperature was 2-3 degrees C cooler this year than last, presumably due to the higher streamflow. There was noticeably cooler surface water on the shady side of the bridge, and presumably under the bridge. The cooler water and the cover provided by the bridge probably caused steelhead to congregate under the bridge. Conductivity was somewhat less, presumably for the same reason. There appeared to be a new pollution source this year in Noble Gulch.

17 June 1993. Sunny. Gage height = 1.64. Again a white/gray suspension was visible in the lagoon coming from Noble Gulch. 4 piles of dog excrement on the path. Slight plankton bloom.

Station: Stockton Avenue Bridge. SE and NW piers, 0930 hr. Planktonic algal bloom visible. Secchi depth to bottom.

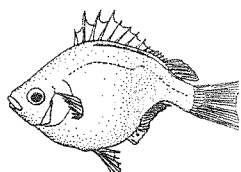
	SE/NW	SE/NW		SE/NW
surf.	20.5/20.0	0.0/0.0	-	680/680
0.25	20.5/19.5	0.0/0.0	-	680/680
0.50	20.0/19.2	0.0/0.0	-	660/660
0.75	18.5/18.2	0.0/0.0	-	660/660
1.00	18.2/18.0	0.0/0.0	-	660/650
1.25	18.1/18.0	0.0/0.0	-	660/650
1.50(bot)	18.1/18.0	0.0/0.0	-	660/650

Station: Railroad trestle, 1010 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	18.4	0.0	-	650
0.25	18.3	0.0	-	650
0.50	17.7	0.0	-	630
0.75	17.3	0.0	-	610
1.00(bot)	17.1	0.0	-	600

Conclusion: Water quality conditions were fair to good for steelhead in the lower lagoon and good above the bridge. The lagoon level was shallow (rating of poor) and needed to be raised for fear that water temperatures would become stressfully high by the end of sunny days. Ed Morrison was notified and more boards were placed in the flume entrance. All of the salt water appeared to have been flushed from the lagoon by this time without the use of the shroud. Visible pollution from Noble Gulch becoming chronic. The algae bloom was not as well-developed as the previous year at this time.

18 June 1993. At 1715hr it was becoming foggy with the tide coming in. It had been cloudy for the past 3 hours. The flume boards had been installed. The water level was within 0.3 feet of the top of the flume's ceiling. A large notch was present on



the west side of the entrance with dimensions 0.9 feet deep and 0.6 feet wide. There was 0.3 feet of water over the boards on both sides with the notch inundated. Water temperature was 22.3 degrees C from the surface to 0.75 meters at the flume. Depth at the flume exit was 2 feet, allowing excellent fish passage. Gage height was 2.06 which was rated fair and considerably improved over the previous day. Water temperatures were tolerable for steelhead.

29 June 1993. It was clear this morning with a cool air temperature of 50 degrees F. Fish passage was good through the flume with entrance depth of more than 1 foot and exit depth of 0.8 feet with the tide out. Gage height was 2.00. There was a thin algal film on the lagoon bottom and still only a slight planktonic algal bloom. But no tufts of algae or pondweed were present. No algae was on the surface. Algae had begun to grow by 14 June the previous summer with a more shallow lagoon and more ooze on the bottom. The tidewater goby and no bird-feeding signs under the trestle had been scratched with tar from the trestle smeared on the goby sign. No-fishing signs were posted at Hubback landing and Noble Gulch. The County contamination signs were up on the beach. The geese approached me for handouts on the beach. One pile of dog excrement on the path, 2 piles at trestle park. Large cloud of gray suspension, measuring 15 feet in diameter present at Noble Gulch mouth. One young-of-the-year steelhead seen at Hubback landing. In-flow to the lagoon was estimated at 4-5 cfs.

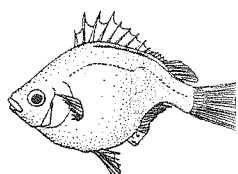
Station: Flume, 0530hr. Weather clear. Flume entrance not measured. Flume exit = 0.8 feet. Gage height = 2.0

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.4	0.00	8.62	700
0.25	19.6	0.00	8.65	700
0.50	19.5	0.00	8.65	700
0.75	19.5	0.00	8.62	690
0.85(bot)	19.5	0.00	8.60	690

Station: Stockton Avenue Bridge, east pier, 0550 hr. Secchi depth to bottom.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.5	0.00	8.00	700
0.25	19.6	0.00	7.95	700
0.50	19.6	0.00	8.05	700
0.75	19.6	0.00	8.05	700
1.00	19.7	0.00	8.03	700
1.25	19.5	0.00	8.05	700
1.50	19.5	0.00	8.05	700
1.60(bot)	19.6	0.00	7.75	680

Station: Railroad trestle, 0615 hr.



surf.	18.0	0.00	7.79	690
0.25	18.0	0.00	7.90	690
0.50	18.0	0.00	7.70	690
0.75	17.9	0.00	7.80	680
0.90(bot)	17.9	0.00	7.73	680

Station: Mouth of Noble Gulch, 0635 hr.

surf.	17.3	0.00	7.15	660
0.25	17.2	0.00	7.20	660
0.50	17.2	0.00	7.25	660
0.75	17.2	0.00	7.35	650
1.00	17.0	0.00	7.60	620
1.25(bot)	17.0	0.00	7.45	620

Birds on the Beach: 137 gulls. 4 geese near restaurants.

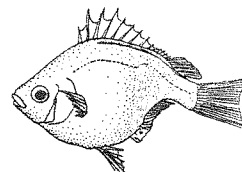
Birds in Reach 1: 3 domestic ducks. 3 wild mallards. 8 gulls bathing.

Birds in Reach 2: 14 pigeons on the trestle. 3 wild mallards. 4 swallows flying overhead.

Birds in Reach 3: 3 swallows feeding on insect emergence. No ducks observed, though they were heard under overhanging willows.

Conclusion: Water quality conditions related to oxygen and temperature were good. I was becoming concerned about the Noble Gulch pollution. A resident walking on the path stated that the new managers of the restaurant on Capitola Avenue were washing their mats off in the gutter. I notified Susan Westman. She said that she had all ready complained to them and refused to eat their any more. The water quality right at the mouth of Noble Gulch was good, it being better than in 1992 because I had raked out the plant material from the hole during sandbar closure. The elevation of the lagoon was fair.

16 July 1993. It was a warm morning with an air temperature of 58.1 degrees F (14.5 degrees C) and overcast. Fish passage was excellent through the flume with a depth of 2.1 feet at the entrance and 1.0 foot at the exit. Gulls were bathing in the flume exit water. The large notch was still in place for adult passage out of the lagoon. Steelhead were hitting the surface in great numbers. An adult female with 3 young mergansers were attempting to capture the steelhead in all 3 reaches. There were 87 hits/minute in reach 1. Filamentous algae was beginning to cover most of the bottom of Reach 1 and less upstream. Pied-billed grebes were also present. Many swallows were feeding. The no fishing sign was gone from the trestle. A small island with pampas grass existed adjacent to the Shadowbrook Restaurant. There had been heavy winds the previous night and the lagoon had many willow leaves. Tom Mader had seen an adult steelhead the previous Sunday (July 10) in the lagoon. A young girl, 8-9 years old was feeding the ducks near the trestle park at 1030hr. Frank



Hayford said Noble Gulch was an open streamchannel until 1923 or 1924. Steelhead would use it and turtles were very common along that creek. The boardwalk went beyond Noble Gulch to Gilroy Drive, he said. Approximately 4 cfs was entering the lagoon at Nob Hill.

The Don Caputo Construction Company was modifying the Porter Street and Highway 1 bridges over Soquel Creek. At Porter Street the stream ran through 2, 24-inch culverts. The riparian vegetation was cleared for 30-40 feet up and downstream of the existing bridge on both sides of the creek. Under Highway 1 the entire channel was made into a flat pad where the creek channel was directed through 2, 24-inch culverts for approximately 200 feet. Approximately 100 feet of riparian vegetation was removed downstream of the Highway 1 bridge and 20 feet upstream. They left the large cottonwood tree on the east bank. There had been no reports of unusual turbidity in the lagoon.

Station: Flume, 0545 hr. Weather overcast. Gage height = 1.97. Air temp. = 14.5 C. Depth at flume entrance = 2.1 feet. Flume exit = 1.0 foot.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.3	0.00	9.1	710
0.25	19.3	0.00	9.2	700
0.50	19.4	0.00	9.1	700
0.75	19.4	0.00	9.05	700
0.85(bot)	19.4	0.00	9.05	700

87 steelhead hits/minute by 0600hr. Mergansers chasing. A pied-billed grebe with a young-of-the-year steelhead in its beak.

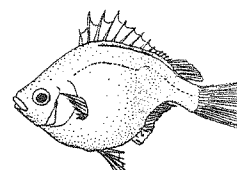
Station: Stockton Avenue Bridge, west pier, 0620 hr.

surf.	19.6	0.00	8.65	710
0.25	19.6	0.00	8.64	705
0.50	19.5	0.00	8.60	700
0.75	19.5	0.00	8.62	700
1.00	19.5	0.00	8.55	700
1.25	19.5	0.00	8.45	700
1.50	19.5	0.00	8.45	700
1.65(bot)	19.5	0.00	8.40	700

Reach 1: no algae on surface. 80% of bottom covered, 1-2 feet thick.

Station: Railroad trestle, 0705 hr.

surf.	18.8	0.00	8.20	710
0.25	18.9	0.00	8.10	710
0.50	18.9	0.00	8.10	710
0.75	18.8	0.00	8.16	710
1.00(bot)	18.8	0.00	7.98	710



Reach 2: no algae on surface. 50% of bottom covered, 0.2-0.8 feet thick.

Station: Mouth of Noble Gulch, 0755 hr.

surf.	17.3	0.00	7.25	660
0.25	17.3	0.00	7.20	670
0.50	17.3	0.00	7.16	670
0.75	17.1	0.00	7.16	670
1.00(bot)	16.5(near culv)	0.0	8.10	660
1.25(bot)	18.7(in hole)	0.00	6.10	620

Reach 3: no surface algae. 20% of bottom covered, 0.3-0.5 feet thick.

Birds on the Beach: 298 gulls on beach.

Birds in Reach 1: 18 gulls bathing. 3 domestic ducks. 10 swallows, 4 mergansers.

Birds in Reach 2: 1 wild male mallard. 3 immature male mallards (greenish yellow bill). 3 female wild mallards (orange bills). 1 domestic male mallard. 8 pigeons on the trestle. 1 kingfisher.

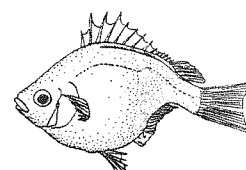
Birds in Reach 3: 3 young mergansers up from Reach 1. 1 black-crowned night heron roosting in dogwood across creek. 1 female mallard with 5 young. 1 female mallard with 2 young. 4 geese.

Conclusion: Water temperature good. Oxygen good but not at full saturation. Growth of filamentous algae had developed over the past 2 weeks with most rapid growth in Reach 1. This was presumably because there were more nutrients available there from bird excrement. Construction at the bridge crossings upstream appeared to have no adverse effects on the summer lagoon thus far. Streamflow was still remarkably high into the lagoon.

27 July 1993. Water depth at flume inlet was 2.0 feet. Exit was 1.2 feet. Weather was overcast, misty and breezy. Air temperature a warm 17.1 C. Lagoon gage height = 1.94 at 0620hr. Secchi depth to bottom = 1.5 meters. The City had moved the tidewater goby sign from the trestle area where it had been vandalized. It was moved to the Stockton Avenue park, east side. The Wharf to Wharf race had been on 25 July. Streamflow into the lagoon was still high at 3.5-4 cfs. A boy was seen feeding the ducks near the trestle park at 1830hr. This was the same location that the girl had been seen feeding them the time before. Could this be the same family doing the feeding?

Station: Flume, 0530 hr, overcast.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.8	0.00	9.10	720



0.25	20.8	0.00	9.10	720
0.50	20.8	0.00	9.10	710
0.75	20.8	0.00	9.15	710
0.85(bot)	20.8	0.00	9.15	710

Reach 1: 1% of surface with algae 15% of surface area with algae near surface. 95% of bottom with algae 2-4 feet thick.

Station: Stockton Avenue Bridge, east pier, 0600 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.6	0.00	9.05	720
0.25	20.6	0.00	9.03	720
0.50	20.6	0.00	8.97	720
0.75	20.6	0.00	8.95	720
1.00	20.6	0.00	8.95	720
1.25	20.6	0.00	8.95	720
1.50	20.6	0.00	8.84	720
1.65	20.6	0.00	5.35	730
1.70(bot)	20.6	0.00	0.45	900

Station: Railroad trestle, 0630 hr.

surf.	20.2	0.00	8.30	700
0.25	20.2	0.00	8.15	705
0.50	20.2	0.00	8.06	705
0.75	20.1	0.00	7.86	705
0.88(bot)	20.0	0.00	7.40	680

Reach 2: 1% of surface with algae. 15% of surface with algae near surface. 90% of bottom with filamentous algae, 2-3 feet thick.

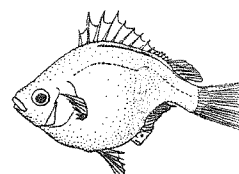
Station: Mouth of Noble Gulch, 0700 hr/ 1850 hr

surf.	19.0/20.8	0.00	7.63	720
0.25	19.0/20.8	0.00	7.63	720
0.50	18.9/20.8	0.00	7.60	720
0.75	18.7/20.8	0.00	7.58	720
1.00(bot)	18.3/20.8(culv)	0.0	7.60	650
1.25(bot)	18.5/19.8(hole)	0.0	7.36	650

Reach 3: 80% of the bottom with filamentous algae, 1-2 feet thick. None on surface. At Noble Gulch mouth the algae covered 40% of the bottom, 1-1.5 feet thick. There was a mat of surface algae across from the Shadowbrook in a 15 by 5-foot area.

Birds on the Beach: 143 gulls.

Birds in Reach 1: 3 domestic ducks. 3 geese appeared at 0615hr. 1 goose and 12 pigeons on beach near Venetian Court. 12 gulls bathing.



Birds in Reach 2: 1 mallard under overhanging willows. 10 pigeons on trestle.

Birds and fish in Reach 3: 3 wild male mallards in eclipse plumage, 2 female wild mallards, 1 pied-billed grebe, 2 young mergansers. 7 steelhead surface hits/min by willows.

Conclusions: The lagoon was warm in mid-July with a water temperature rating of fair. Oxygen levels were good, but not at full saturation. There had been a dramatic surge in filamentous algae growth in just 2 weeks! Algae was not nearly so abundant the previous year, presumably because pondweed was present. However, in 1993, there was still no pondweed observed. The absence of pondweed competition for nutrients may have allowed algae to grow so quickly. There must have been a high proportion of warm, fogless days. Oxygen levels were about the same as 2 weeks previous, with Noble Gulch having the lowest. However, there was no oxygen problem there. Interestingly, there had been a pocket of anaerobic conditions near the Stockton Avenue bridge pier.

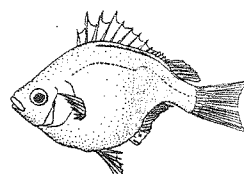
7 August 1993. Bird count in late morning (1120hr).

Reach 1: 8 gulls bathing. 4 pigeons along edge.

Reach 2: 4 mallards plus 1 female mallard with 6 young. 1 pied-billed grebe. 2 pigeons roosting on Stockton Avenue Park bulkhead, west side. 16 pigeons roosting on trestle. 11 mallards roosting at trestle base.

Reach 3: 4 swimming mallards. Some may have been domestic mallards.

9 August 1993. Gage height fair at 1.94. Flume was very passable with entrance depth of 1.8 feet and exit depth at 1.2 feet with the tide out. Air temperature was a cool 12.6 C. Secchi depth to bottom at 1.7 meters. Very clear water. The notch in the flume entrance had been partially covered with plywood at my request to maintain the lagoon level. The gage height was higher than the previous year, but the depths at the stations were about the same. The lagoon had filled in some this year at the margins. Streamflow into the lagoon was about 3.0 cfs. 11 piles of dog excrement at trestle park. 2 piles on the path. Where there had been a family of 4 mergansers earlier, now there was just the adult female. 5 kids feeding ducks just upstream of trestle. Congregation of 15 ducks, 4 geese and 3 gulls. Construction at both bridges upstream looked okay. Silt screens in place at downstream exit of culverts at Porter Street.



Station: Flume, 0625hr. High cirrus clouds. No overcast.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	21.9	0.00	9.78	720
0.25	22.0	0.00	9.80	720
0.50	22.0	0.00	9.75	720
0.75	21.8	0.00	9.80	720
0.85	21.8	0.00	9.75	720

Reach 1: 5% of the surface with floating algae. 30% of the bottom with algae 0.5-1 foot thick. 30% of bottom with dead algae about 2 inches thick. 40% of lagoon bottom bare sand.

Station: Stockton Avenue Bridge, 0645 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.7	0.00	9.65	720
0.25	20.8	0.00	9.65	720
0.50	20.8	0.00	9.75	720
0.75	20.8	0.00	9.85	720
1.00	20.8	0.00	9.90	720
1.25	20.7	0.00	9.85	720
1.50	20.7	0.00	9.70	720
1.65(bot)	20.6	0.00	8.25	720

At 0850hr in the shade of the bridge 80 juvenile steelhead seen. Most were 3-4 inches standard length. Some were 6 inches. 38 steelhead surface hits/min.

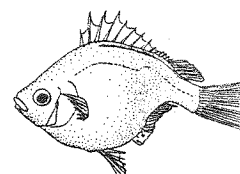
Station: Railroad trestle, 0710 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond.
surf.	20.5	0.00	9.8	710
0.25	20.5	0.00	9.82	710
0.50	20.5	0.00	9.85	710
0.75	20.5	0.00	9.90	710
0.92(bot)	20.5	0.00	9.75	700

In Reach 2, 30% of bottom with algae 2-3 inches thick. 30% of bottom with dead algae. 15% of bottom with algal spires 0.5-1 foot high. 15% of bottom with bare sand. 30% of surface with floating algae.

Station: Mouth of Noble Gulch, 0730 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	18.2	0.00	8.0	680
0.25	18.2	0.00	7.7	670
0.50	18.1	0.00	7.65	660
0.75	18.0	0.00	7.65	660
0.95(bot)	18.0(culv)	0.00	6.10	650
1.25(bot)	17.8(hole)	0.00	5.95	680



Reach 3: 20% of bottom with algae 0.5 to 1.2 feet thick. 70% of bottom with algae 2-4 inches thick. 10% bottom with bare sand. 35% of surface with floating algae.

Birds on the Beach: 212 gulls. Half the gulls on the beach were Heermann's gulls.

Birds and fish in Reach 1: 120 steelhead surface hits/min. 8 gulls bathing. 7 mallards. 2 domestic ducks (popcorn). 3 geese had swum down from upstream. One female mallard with 6 young. 4 pigeons on beach near Venetian court. A feral cat seen going under restaurants.

Birds in Reach 2: 2 mallards. 1 merganser. 23 pigeons on the trestle.

Birds and fish in Reach 3: 6 wild mallards. 2 domestic mallards. female mallard with 2 young. 4 geese were up here now. 6 steelhead hits/min.

Conclusion: The filamentous algal bloom had crashed. All of the nutrients must have been used up, and the algae died. It was starting to come back, but there was still dead algae on the bottom. Still no pondweed was visible. The oxygen levels were higher than 10 days previous. The lower lagoon (Reach 1) was quite warm in the poor range. However the other two reaches were in the fair to good range as one traveled upstream. Dramatically, water temperature in Reach 3 at Noble Gulch was 4 degrees cooler than at the flume, just about 350 meters apart.

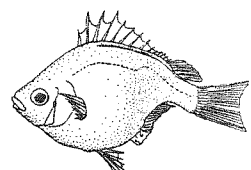
19 August 1993. Bird and algae survey at 1050hr.

Reach 1: Young girl feeding birds; 11 mallard types - some domestic and some wild, along with 4 geese. 50% of bottom covered with filamentous algae 0.5 to 2 feet high. It was thickest in restaurant cove. Still no pondweed in lagoon.

Reach 2: 8 pigeons roosting on bulkhead near Mrs. Hubback's house. 12 mallards roosting on concrete base of trestle.

Reach 3: 3 feeding mergansers. One female mallard and 5 young. 40% of bottom covered with filamentous algae 0.3-1.0 feet high. None on surface except at mouth of Noble Gulch where it was 1-3 feet high in a 10x25 foot area.

Flume entrance sealed off on west side as I requested. Gage height fair at 1.96. Graffiti seen on upper trestle for the first time.



23 August 1993. Overcast but not foggy. Flume still very passable with entrance at 1.7 feet deep and exit at 1.0 feet deep. Gage height = 1.97. Air temperature of 14.8 C.

Station: Flume, 0620 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	21.3	0.00	9.25	720
0.25	21.3	0.00	8.96	720
0.50	21.4	0.00	9.20	720
0.75	21.4	0.00	9.21	720
0.87(bot)	21.4	0.00	8.96	730

In Reach 1, algae near surface for 5% of area. Too dark to see algae under surface. It was very green but not visible enough to make an estimate. Fog came in at 0730hr, making it impossible to estimate algae below the surface.

Station: Stockton Avenue Bridge, 0700 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	21.2	0.00	8.40	720
0.25	21.3	0.00	8.50	720
0.50	21.3	0.00	8.52	720
0.75	21.4	0.00	8.55	720
1.00	21.4	0.00	8.56	730
1.25	21.3	0.00	8.40	740
1.50	21.4	0.00	8.25	750
1.65(bot)	21.5	0.00	0.70	760

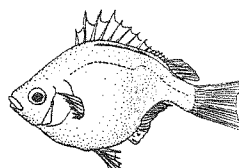
Station: Railroad Trestle, 0720 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf	20.8	0.00	7.90	720
0.25	20.9	0.00	7.73	720
0.50	20.8	0.00	7.80	720
0.75	21.0	0.00	7.85	720
0.88(bot)	21.0	0.00	7.30	730

Reach 2: Lower portion with 50% of bottom with algae 0.5-1.5 feet thick. Upper portion with 40% of bottom covered. No surface algae.

Station: Mouth of Noble Gulch, 0730 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.5	0.00	7.35	710
0.25	19.6	0.00	7.25	710
0.50	19.6	0.00	7.40	700
0.75	18.8	0.00	7.21	690
1.00(bot)	18.4(culvert)	0.00	4.55	630
1.25(bot)	18.8(in hole)	0.00	5.65	-



Reach 3: 35% of bottom covered with filamentous algae 0.2-1 foot thick. However, in mid-channel the algae was 2-3 feet thick. 5% of the surface with floating algae.

Birds on the Beach: 241 gulls. 4 geese on sand near Venetian Court.

Birds and steelhead in Reach 1: 20 bathing gulls early. 3 domestic popcorn ducks. 1 domestic mallard feeding. 2 pied-billed grebes near restaurants. 235 steelhead hits/min @ 0635hr. 25 hits/min @ 0710hr. Later at 0815hr: 43 gulls bathing, 6 domestic mallards, 7 wild mallards, 3 popcorn ducks, 1 pied-billed grebe, 2 young mergansers (male and female) preening by Venetian Court.

Birds and steelhead in Reach 2: 2 pigeons roosting at Stockton Avenue park. 19 roosting pigeons on the trestle. 1 domestic mallard. 16 steelhead hits/min @ 0720hr.

Birds in Reach 3: 3 wild mallards and 1 domestic mallard feeding, 2 young mergansers (mother not present). 3 kingfishers.

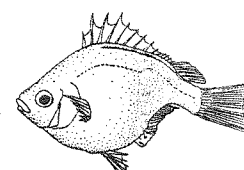
Conclusion: Water temperatures were slightly cooler than 2 weeks before, with Reach 2 barely being fair, Reach 2 being fair and Reach 3 being good. Oxygen levels were good but not full saturation. The lagoon elevation had been increased by 0.03 with the flume modification, despite a reduction in streamflow to an estimated 2 cfs. Evidence of large steelhead population in the lagoon this year. Asked Ed Morrison to add boards to east side of flume entrance.

30 August 1993. Additional 4"x4" and 2"x4" boards had been placed in flume entrance. Lagoon gage height was 2.19 and almost into the good rating of above 2.20.

3 September 1993. Overcast, misty and windy. Warm at 15 C air temperature. Gage height = 2.12, well into the fair range. Flume still very passable with entrance at 1.6 feet deep and exit at 1.2 feet deep. Streamflow into the lagoon had diminished to 1.5-1.75 cfs, which was still wonderful when you consider that it was trickling in at less than 0.1 cfs in previous years with dry stretches upstream.

Station: Flume, 0620 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.8	0.00	7.95	720
0.25	20.8	0.00	7.83	720
0.50	21.0	0.00	7.87	720
0.75	21.0	0.00	7.85	720
0.90(bot)	21.0	0.00	7.83	720



In Reach 1 there was no algae on surface. Too dark to see bottom.

Station: Stockton Avenue Bridge, 0636 hr.

surf.	20.8	0.00	7.95	720
0.25	20.8	0.00	7.95	720
0.50	21.0	0.00	7.95	720
0.75	21.0	0.00	7.96	720
1.00	21.0	0.00	7.95	720
1.25	21.0	0.00	7.85	720
1.50	21.0	0.00	7.80	730
1.75(bot)	21.0	0.00	0.35	740

Station: Railroad trestle, 0710 hr.

surf.	20.8	0.00	7.26	720
0.25	20.8	0.00	7.30	720
0.50	20.8	0.00	7.28	720
0.75	20.9	0.00	7.20	720
1.00(bot)	20.9	0.00	6.95	700

Reach 2 had no surface algae with 35% of bottom with algae 0.5-2.5 ft thick. Evidence of some die back.

Station: Mouth of Noble Gulch, 0729 hr.

surf.	19.8	0.00	5.95	710
0.25	19.9	0.00	5.85	710
0.50	20.0	0.00	5.85	710
0.75	20.0	0.00	6.00	700
1.00(bot)	19.5(culvert)	0.00	0.55	620
1.25(bot)	19.5(in hole)	0.00	5.30	730

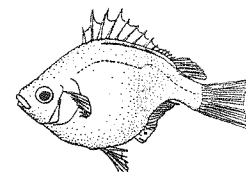
In Reach 3, 40% of the bottom was algae 0.3 to 2 feet thick. None was on the surface. At the mouth of Noble Gulch, 60% of the bottom had algae 0.5-2 feet high with no surface algae.

Birds on the Beach: At 0625hr there were no gulls on the beach, but 50 out in surface. By 0805hr there were 164 gulls.

Birds and steelhead in Reach 1: At 0620hr, 4 domestic ducks at margin. 4 swallows overhead. Steelhead began hitting surface at 0630hr and were nearly finished by 0750hr. 260 hits/min @ 0635hr. At 0655hr, 10 gulls bathing, 35 preening near margin.

Birds and steelhead in Reach 2: 1 female mallard with 5 large young. One other wild mallard. 200 steelhead hits/min @ 0638hr. 8 pigeons on the trestle.

Birds and steelhead in Reach 3: 1 female mallard with 5 small young. 7 other wild mallards. 1 large merganser (mother?). 2 pied-billed grebes. 1 kingfisher. 3 swallows overhead. 2 green-backed herons flew by. 11 mallards flew down creek in formation.



Conclusions: Water temperature was somewhat cooler than 10 days previously by 0.3-0.5 degrees. Days were shorter, and the lagoon was 0.07 feet shallower. due to drop in streamflow. Oxygen levels were 3 ppm less this year than 1992 at this time of year. Noble Gulch was consistently lower with oxygen than other stations, though it posed no water quality problem yet. The bottom at the culvert was nearly anaerobic, and the hole approached 5 ppm, which would be stressful to steelhead. But elsewhere oxygen levels were above 7 ppm. The other low oxygen spot was at the bridge pier. The generally diminished oxygen levels this year would indicate that more plant growth was going on than when there was pondweed in 1992. Duck production appeared better this year. The evidence of a late clutch was good.

12 September 1993 Day of the Begonia Festival. Arrived there before dawn. Air temperature = 16.5 C. The gage height was at the upper end of the fair category, it being 2.18 and as high as any time during the season. The City had not removed boards as was done the previous year prior to the Festival. This was fortunate. The flume was still passable with 2.1 feet of depth at the entrance and 0.4 feet of depth at the exit. A few begonias floated near flume. The tide wa in-coming and flume exit was 2/3 full of sand. No ocean water was making it into the lagoon. A kitchen worker from the Beach House was feeding the geese bread slices. The weather was sunny.

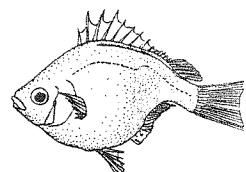
Station: Flume, 0630 hr. Still dark.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.5	0.00	9.4	700
0.25	19.8	0.00	9.4	700
0.50	19.8	0.00	9.45	700
0.70(bot)	20.0	0.00	9.35	700

In Reach 1, the bottom was covered with 25% pondweed and associated algae, 1-2.5 feet high. Surface algae covering 10%.

Station: Stockton Avenue Bridge, 0650 hr. Secchi depth to bottom.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.8	0.00	9.0	720
0.25	19.8	0.00	8.8	720
0.50	19.6	0.00	8.8	720
0.75	20.0	0.00	8.8	720
1.00	20.0	0.00	8.81	720
1.25	20.0	0.00	8.8	720
1.50	20.0	0.00	8.6	720
1.70(bot)	20.1	0.00	5.5	720



Station: Railroad trestle, 0720 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	18.8	0.00	7.35	700
0.25	19.0	0.00	7.30	700
0.50	19.2	0.00	7.20	700
0.75	19.3	0.00	7.15	700
1.00(bot)	19.7	0.00	6.05	720

In Reach 2, 50% of the bottom was pondweed with algae growing on it, .5 to 3 feet high and averaging 1.5 feet. No surface algae.

Station: Mouth of Noble Gulch, 0740 hr.

surf.	18.5	0.00	5.95	680
0.25	18.5	0.00	5.80	680
0.50	18.6	0.00	5.86	680
0.75	18.6	0.00	5.65	680
0.95(bot)	19.7(culvert)	0.00	4.45	680

In Reach 3, pondweed and associated algae covered 30% of the bottom, 0.5-2 feet high and averaging 1.5 feet. At Noble gulch there was algae only, covering 40% of the bottom, 0.5-2 feet thick and averaging 1.5 feet.

Birds on the Beach: None at dark. 123 gulls by 0645hr.

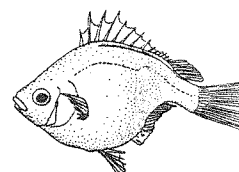
Birds and fish in Reach 1: 8 bathing gulls. 8 wild mallards feeding. One female mallard with 5 small young. 3 popcorn ducks and 4 geese on beach margin. 280 steelhead surface hits/min at 0650hr. 2 coots feeding on algae. 1 domestic mallard present at 0840hr. No ducks in Reach 1 at 0930hr.

Birds and fish in Reach 2: 1 pied-billed grebe. 30 pigeons and 1 gull on the trestle. 105 steelhead surface hits/min at 0715hr.

Birds in Reach 3: 1 coot diving. 2 pied-billed grebes. 5 steelhead hits/min at 0738hr. The female mallard and 5 young have moved upstream to a rock by the Shadowbrook by 0840hr. The domestic ducks are feeding nearby by 0940hr. 1 gull roosting on a rock by 0940hr.

Station: Flume, 1640 hr. 12 September after the Festival. Gage height = 2.09.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	22.0	-	-	730
0.25	22.0	-	-	730
0.50	22.0	-	-	730
0.75	22.0	-	-	730
1.00(bot)	21.8	-	-	730



Station: Stockton Avenue Bridge, 1720 hr. Secchi depth = 1.1 meter at 1630 hr.

surf.	22.0	-	-	750
0.25	22.0	-	-	740
0.50	22.0	-	-	740
0.75	21.8	-	-	740
1.00	21.9	-	-	740
1.25	21.5	-	-	730
1.50	21.4	-	-	730
1.70(bot)	21.4	-	-	730

Station: Railroad trestle, 1650 hr.

surf.	20.5	-	-	720
0.25	20.5	-	-	720
0.50	20.5	-	-	720
0.75	20.5	-	-	720
1.00(bot)	20.5	-	-	720

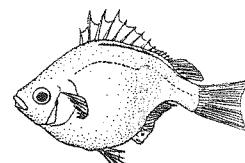
Station: Mouth of Noble Gulch, 1700 hr.

surf.	21.5	-	-	730
0.25	21.5	-	-	730
0.50	21.5	-	-	720
0.75	21.5	-	-	720
1.00(bot)	19.7(culvert)	-	-	670
1.25(bot)	19.8(in hole)	-	-	680

Conclusions: Water temperature and oxygen levels were similar to 9 days previously. As then, oxygen decreased progressively upstream and approached stressful levels at Noble Gulch. We have no explanation for this lower oxygen level at the Gulch. Compared to the previous year, water temperature was about 1 degree cooler throughout the day in 1993, with the lagoon level 0.5 feet deeper. Oxygen levels were less in 1993. We saw our first coots and pondweed. The pondweed had grown very quickly. There was not nearly the amount of aquatic vegetation as the previous year at this time. Yet the oxygen levels were considerably lower in the mornings. The activities along the lagoon appeared to have attracted a seasonal high of pigeons to the trestle. The waterfowl appeared to have moved upstream as the morning progressed. The geese had even moved upstream to Reach 3 to perch on a log out in the channel. A sound system had been set up on the beach.

After the Begonia Festival in late afternoon, the lagoon was somewhat turbid and conductivity was slightly increased due to the suspended sediments stirred up by the procession of floats. However, water quality was good. Conductivity had been lower all summer compared to the previous year. Water temperatures were warm near the end of the day, but not stressful for steelhead.

13 September 1993 Weather overcast, misty and windy on the day after the Begonia Festival. Secchi depth to bottom at 1.5 m. at



0715hr. Flow at Nob Hill entering the lagoon was approximately 1.0 cfs.

Station: Stockton Avenue Bridge, 0650 hr. Gage ht. = 2.13

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.5	0.0	8.30	710
0.25	19.8	0.0	8.45	710
0.50	19.8	0.0	8.35	710
0.75	19.8	0.0	8.10	710
1.00	19.9	0.0	8.15	710
1.25	20.0	0.0	8.02	710
1.50	20.0	0.0	7.80	710
1.70(bot)	20.0	0.0	1.10	710

In Reach 1, 5% of the surface had floating algae.

Station: Railroad trestle, 0720 hr.

surf.	19.2	0.0	7.2	700
0.25	19.2	0.0	7.18	700
0.50	19.5	0.0	7.10	700
0.75	19.5	0.0	7.10	700
1.00(bot)	19.6	0.0	3.82	700

In Reach 2, 1% of the surface had floating algae. Reach 3 had none.

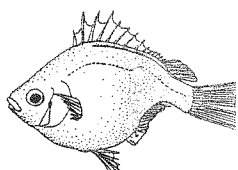
Birds on the Beach: Not counted.

Birds and fish in Reach 1: 40 bathing gulls. 2 wild mallards feeding. One female mallard with 5 small young. 3 popcorn ducks. Only 2 steelhead hits/min.

Birds and fish in Reach 2: 4 geese. 2 steelhead hits/min.

Birds in Reach 3: 1 coot. 2 wild mallards and 2 domestic mallards. Only 2 steelhead hits/min.

Conclusions: The conductivity and turbidity had declined to pre-festival levels. Water temperature was fair. Oxygen levels were good in the upper water column, but stressfully low for steelhead near the lagoon bottom of the lower lagoon. This indicated that considerable decomposition of dead plant material was probably going on at the bottom. Steelhead can tolerate the oxygen levels present, but may have moved upstream this morning. We have observed steelhead at oxygen levels below 3 mg/L in early morning for weeks in other lagoons. The number of steelhead feeding on the surface was considerably reduced from the number yesterday before the Festival. This indicated that either their patterns had been temporarily disturbed or the insects that may have been emerging that morning had been disturbed during the Festival. The mother mallard and her young had survived the Festival without incident.



14 September 1992 Weather cool and misty throughout the day. Gage height = 2.25 at 1845hr. After the Begonia Festival cleanup. Very few begonias left in the lagoon. Those were only at the beach end of the lagoon. No begonias were left along the margins of the lagoon. They did a good job of cleaning up. Nels Westman had found and removed 9 patches of water hyacinths from the upper lagoon. The largest was 3x3 feet. They are sold at a store in Nob Hill shopping center adjacent to the creek.

20 September 1993 Light fog soon to burn off. Gage height = 2.17. Air temperature cooler than earlier in the summer at 12.6 C at 0706 hr. This is a week after the Begonia Festival. The flume is still very passable to fish with the entrance depth at 1.7 feet and the exit at 0.9 feet. Willow leaves on riparian trees, west side, senescing (turning yellow). A man living in a rental adjacent Reach 3 stated that the steelhead were feeding heavily the night before.

Station: Flume, 0700 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	17.8	0.0	9.1	670
0.25	17.8	0.0	9.1	670
0.50	17.8	0.0	9.04	670
0.75	17.8	0.0	9.15	670
1.00(bot)	17.7	0.0	9.00	680

In Reach 1, 1% of the surface with floating algae. 60% of bottom with algae 0.2-0.6 feet thick. 5% of bottom with algae and pondweed in clumps 1-2.5 feet high.

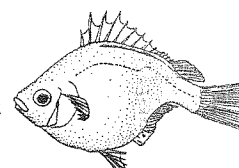
Station: Stockton Avenue Bridge, 0718 hr.

surf.	17.9	0.0	8.9	680
0.25	18.0	0.0	8.8	680
0.50	18.2	0.0	8.85	680
0.75	18.2	0.0	8.8	680
1.00	18.2	0.0	8.8	680
1.25	18.2	0.0	8.78	680
1.50	18.2	0.0	8.63	680
1.70(bot)	18.3	0.0	5.30	690

Station: Railroad trestle, 0743 hr.

surf.	17.8	0.0	8.2	670
0.25	17.8	0.0	8.1	670
0.50	17.8	0.0	8.1	670
0.75	17.9	0.0	8.05	670
1.00(bot)	17.9	0.0	5.70	680

In Reach 2, 60% of the bottom covered with algae 0.2-1 foot thick. 5% of the bottom with algae and pondweed 1-3 feet high. No surface algae.



Station: Mouth of Noble Gulch, 0805 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	16.8	0.0	6.65	650
0.25	17.0	0.0	6.52	650
0.50	17.0	0.0	6.50	650
0.75	17.0	0.0	6.55	620
1.00(bot)	17.9	0.0	5.70	680

In Reach 3, the bottom was 50% covered with algae 0.2-0.5 feet thick. 10% of the bottom with algae and pondweed 1-3 feet high. No algae on the surface. Aquatic vegetation at Noble Gulch was similar to the rest of the lagoon with 60% of the bottom with algae 0.2-0.5 feet thick and none on the surface.

Birds on the Beach: 164 gulls.

Birds and fish in Reach 1: 19 bathing gulls. 3 popcorn ducks and 2 domestic mallards feeding on algae. 1 wild male mallard. 4 geese on beach by restaurants. Later 2 coots and one small female merganser. Where is her brother? 3 steelhead hits/min at 0800hr. Later, geese seen feeding on aquatic algae until a young couple with a 3-4 year old daughter came from the walkway. The geese chased them across the beach. The parents shielded their child from the geese.

Birds and fish in Reach 2: 2 pied-billed grebe. 16 pigeons on the trestle. 1 coot. 1 steelhead surface hits/min at 0758hr.

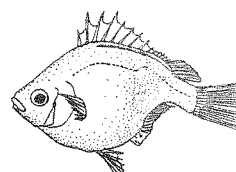
Birds in Reach 3: 2 more pied-billed grebes, one with a stickleback. 1 coot (same as the one in Reach 2. 26 mallards flying downstream, overhead.

Conclusions: The lagoon was seasonally cooling off and was 1-2 degrees C cooler than the previous year at this time. This was presumably because the lagoon was more than 0.5 feet deeper this year. Oxygen levels were good except at Noble Gulch where they were fair for the most part. Reaches 2 and 3 had lagoon bottom oxygen levels approaching stressful levels, but not being a problem. The wild mallards were scarce this time of year at the lagoon. No evidence of sediment input from activities at the bridges upstream.

27 September 1993. Bird and aquatic vegetation monitoring. Gage Height = 1.78. 3 previous days of hot weather.

Reach 1: 10% of the surface with algae. 40% of the bottom with pondweed and algae 1-3 feet high. 20% of the bottom with algae alone, 1-3 feet spires. At 1245hr, 39 gulls bathing, 5 gulls over by restaurants awaiting handouts. 4 geese on beach.

Reach 2: 2% of the surface with algae. 40% of bottom with



pondweed and algae 0.5-3 feet high. 35% of the bottom with algae alone, 0.5-2 feet high. 4 coots, 2 pied-billed grebes, 1 female mallard and 4 young. Mallards and coots feeding on vegetation. 4 domestic ducks roosting at trestle's concrete abutment - west side. 1 gull roosting at west park near bridge.

Reach 3: 1% of the surface with algae. 15% of the bottom with algae and pondweed 0.5-3 feet high. 60% of bottom with algae 0.5-2 feet thick. 2 other pied-billed grebes.

6 October 1993. Bird and aquatic vegetation monitoring. The City took out 2 boards on 5 October and said they would be re-installed on 7 October at my request. Gage Height = 1.23. Willows leaf senescence well under way. Estimated 1 cfs entering lagoon. Estimated 0.75 cfs flowing at Walnut and Main Street. Survey done 1005-1115hr.

Beach: 347 gulls. Two species at least. 10 pigeons.

Reach 1: Surface algae on 10% of surface. Bottom with 70% algae and pondweed 1-3 feet high. 1 mallard feeding on algae. 3 popcorn ducks and 4 geese on beach near Venetian Courts.

Reach 2: 1% of surface with algae. 40% of bottom with algae and pondweed 0.5-2 feet high. 8 pigeons on trestle over lagoon. 17 other pigeons on road bed further east on trestle. 6 pigeons near Mrs. Hubback's house at park. 2 pied-billed grebes, 1 coot.

Reach 3: 3% of the surface with algae. 40% of bottom with algae and pondweed 0.5-3 feet high. 12 coots, 2 other pied-billed grebes.

8 October 1993 Both boards had been re-installed in flume, but lagoon gage height only 1.19.

14 October 1993. Light rain last night. One board had been removed. Gage Height = 1.94 at 1100hr.

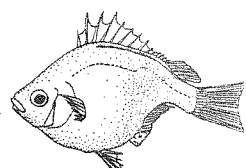
16 October 1993. 0945hr. Estimated 3.5 cfs entering lagoon. 2 boards out on west and 1 board out on east side of flume entrance. Too turbid to see vegetation. Gage height = 1.85.

Reach 1: 15 gulls bathing.

Reach 2: 10 mallards (some domestic), 4 geese, 2 gulls, 6 brown mallards (probably mother and 5 young). Birds congregating around 3 women sitting on west park bench near bridge, expecting to be fed.

Reach 3: 18 coots, 1 pied-billed grebe, 2 domestic mallards.

20 October 1993. Bird and aquatic vegetation monitoring. Survey at 1030hr. Gage Height = 1.80. Estimated 1.3 cfs entering the



lagoon. Porter Street culverts removed. 2 gravel trenches remain. Gravel 1-2 inches in diameter. Gravel extended up bank 3 feet on north and none on south bank. Juke nettings on slopes with hay-bail walls. Some sediment deposition evident next to stream. Street culvert outlet on stream bank with some erosion protection. Lagoon slightly turbid.

Beach: 180 gulls.

Reach 1: 1% of surface with algae. 40% of bottom with algae alone, .2-1 foot thick. 5% of bottom with algae and pondweed. 17 gulls bathing, 4 young wild mallards. 4 geese on margin near Venetian.

Reach 2: 65% of bottom with algae alone, .2-1 foot thick, averaging 0.5 feet. 10% algae and pondweed 1-1.5 feet high. Surface algae covering less than 1% of area. 14 pigeons on trestle, 5 coots, 1 domestic mallard.

Reach 3: 40% of bottom algae alone, .2-1 foot thick, averaging 0.5 feet. 5% of bottom with pondweed and algae, 1-1.5 feet high. 15 coots, 1 pied-billed grebe, 4 mallards (some domestic).

5 November 1993. 0830hr. Bird and vegetation survey.

Beach: 200+ gulls.

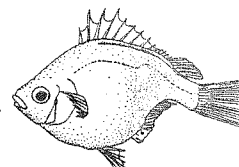
Reach 1: 65% of the bottom with green algae tufts 0.3-2.5 feet in diameter. Algae and pondweed making up 15% of bottom 2-3 feet high. No surface algae. 1 pied-billed grebe, 12 coots, 6 bathing gulls, 61 pigeons and 4 geese on beach near Venetian Court.

Reach 2: Green algae tufts covering 20% of bottom, .25-1 foot diameter. Pondweed and algae making up 15% of bottom 1-2 feet high. None on surface. 12 coots, 2 domestic mallards.

Reach 3: Very green algae tufts covering 15% of bottom, 0.5-1.5 feet in diameter. 1% of bottom with grazed pondweed and algae, 1-1.5 feet tall. 2 pied-billed grebes, 1 kingfisher, 36 coots, 1 gull roosting on log. Saw aggression between a black-crowned night heron and a green-backed heron over lagoon across from Maders. Both birds retreated to separate trees, west side.

10 November 1993. Began raining and continued overnight. At 1400hr Ed Morrison took 1 6-inch board out on one side and 3 4-inch boards out on the other side. At 1730hr, Ed removed another 6-inch board when water level was 3-4 inches above flume. He saw 3 small salmonids, approximately 15 in length near the flume exit. None tried to go into the flume.

Between 0100 and 0230hr 11Nov93, lagoon level went 14 inches above the flume. Ed cleared debris out from in front of flume at 0230hr. At 0630hr, lagoon level 2 inches below piling bolt (18-20 inches above flume). Ed cleared debris again, including a log



jammed in one side. By 1030hr, lagoon had dropped significantly to 1 foot below top of flume. Good work in saving the sandbar and lagoon!

12 November 1993. 0900hr. Bird count. Water too turbid to see vegetation. Boards had been replaced earlier this morning by the City when the gage height was 1.87 so that 1 board was out on either side of flume entrance. Scum line visible 2 inches below piling bolt. High tide previous night bud did not reach lagoon. It came 1/2 way up beach through notch constructed in sandbar. Estimated 3.5 cfs passing Porter Street. No erosion visible there from small storm. Estimated 4 cfs at Highway 1 bridge. All work had stopped there. A backhoe was stuck in the mud on west side at Wharf Road elevation. Water had come down road and past drain to run down bare bank with erosion evident. Hay-bail dam at downstream end of construction area in stream had been blown out. The channel was now 25 feet wide. Erosion gullies evident from northeast road coming down bank to go under bridge. At Nob Hill there was an estimated 5 cfs. Construction forms were in backwater there. Alders had been cut on west bank. There size was 4-5 inches in diameter. Water was clear. Stormflow had been an estimated 40-50 cfs.

Beach: 141 gulls.

Reach 1: 20 gulls bathing, 14 coots, 1 pied-billed grebe.

Reach 2: 18 pigeons on trestle. 81 coots, 2 domestic mallards, 4 geese. Then Mrs. Hubback began feeding the birds at 0910hr. Congregation included 4 geese, 8 gulls, 6 wild mallards (probably the mother and clutch) and 10 pigeons.

Reach 3: 6 coots, 3 popcorn ducks, 6 mallards (2 domestic).

27 November 1993. Gage height = 1.89. Bird count. 2 boys fishing off bridge. One man feeding geese, etc., from Sea Bonne Restaurant.

Reach 1: 52 coots, 1 pied-billed grebes, 5 mallards, 4 geese, 3 popcorn ducks, 1 dead gull, 13 live gulls.

Reach 2: 14 coots, 2 pied-billed grebes, 2 mallards.

Reach 3: 15 mallards, 14 coots.

28 November 1993. Raining hard at my house, so I headed toward lagoon. at 1805hr, lagoon level 2 inches above flume. Increased 2 inch in 1/2 hour. I left message with police department to notify Ed Morrison. Scattered showers on way home. Ed kept an eye on the lagoon.

9 December 1993. Lagoon was breached at about 0700hr with shovels. Notch in sandbar not present due to equipment breakdown.

