D.W. ALLEY & Associates aquatic biology

SOQUEL CREEK LAGOON MONITORING REPORT, 1990-91

Prepared for

CITY OF CAPITOLA
420 Capitola Avenue
Capitola, California 95010

by

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February 22, 1992 Project # 106-01

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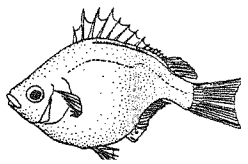
TABLE OF CONTENTS



Progress Report: 25 February 1992 Update on Recommended Enhancement Projects

1. Construction of baffles within the flume.

Status: A plank was installed inside flume to maintain depth at entrance. It worked successfully. Planks are placed at the flume exit as needed to maintain depth.

2. Design and production of Soquel Creek Streamside Care Guide.

Status: The guide has been completed. Special thanks go to the graphic artist, Sharon Erspamer. Text was written by the Santa Cruz Bird Club and the Santa Cruz Native Plant Society and D.W. Alley & Associates. The City is in the process of mailing out the pamphlet.

3. Construction and Placement of 30 bird houses.

Status: The houses were constructed by Mr. Baer and his high school students in Santa Clara. They were installed with guidance from Randy Morgan of the Santa Cruz Bird Club.

4. Collection of domestic geese and ducks.

Status: A geese and duck round-up was accomplished last winter, collecting 4 geese and 9 domestic ducks. One geese pair was missed. They produced offspring. Four (or 5) geese remain. 10-12 domestic ducks remain. Two large ducks with clipped wings were left at the lagoon this past summer.

5. Design and production of lesson plans for local schools.

Status: Lesson plans are nearing completion. A unit for elementary school students is being completed. Lessons for older kids are essentially completed. A target date for teacher workshops for presentation of materials will be set for sometime in April.

6. Preparation and installation of no bird feeding and interpretive signs.

Status: The signs were completed and delivered to the City. The interpretive signs will be installed this spring. The no bird feeding signs were installed in September, 1991. Special thanks go to Sharon Erspamer for design and Stokes Signs for construction. Technical input came from the Santa Cruz Bird Club, the Santa Cruz Native Plant Society and D.W. Alley & Associates.

7. **Preparation of a Natural History Display in the City Museum.**

Status: The display was completed. Special thanks go to Frank Perry for the design and construction of displays. Technical input came from the S.C. Bird Club, S.C. Native Plant Society and D.W. Alley & Associates.

8. **Monitoring of sandbar construction and breaching, water quality for aquatic habitat and health of riparian vegetation, waterbird use of the lagoon, compliance with the no bird feeding ordinance and analysis of fecal bacterial counts.**

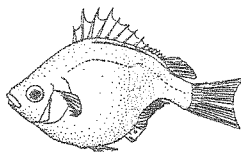
Status: Monitoring was completed and the report was finished. The questionnaire development and mailing to residence for feedback on satisfaction and attitudes will be completed after the residents have seen the interpretive signs and stream care guide.

9. **Start a Friends of Soquel Creek group.**

Status: The group has started. A steering committee has had several monthly meetings. The first social function is scheduled in May.

10. **Obtain cooperation from Esplanade restaurant owners to discourage roosting of gulls on rooftops.**

Status: A meeting was held at City Hall to discuss the subject. The turn-out was poor. More research will be done on types of devices. Then restaurant owners will be approached again.



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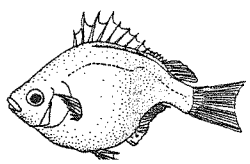
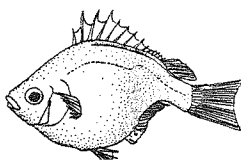


SOQUEL CREEK LAGOON MONITORING REPORT, 1990-1991

ACKNOWLEDGMENTS

We wish to 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 which called for lagoon monitoring. The monitoring was greatly facilitated by the complete cooperation of City personnel. We greatly appreciated the candor of Stephen Burrell (City Manager) in dealing with management issues. Susan Westman (Planning Director) was very receptive to our recommendations and concerns. She, Ed Morrison (Public Works Superintendent) and his fine cadre of Public Works personnel have shown a genuine, caring spirit for a lagoon that has been a positive part of their lives for many years. We appreciate their trust in our completing the management and enhancement projects in a high-quality manner. We have learned much more about the pressure and complexity of satisfying a plethora of interests. Jerry Smith (San Jose State University) and John Ricker (Santa Cruz County Environmental Health) have shared their knowledge and technical expertise, which proved invaluable. William Ihle did a good job of censusing birds and monitoring compliance with the City's no bird feeding ordinance.

We wish to thank the many caring residents and business owners who make up the Friends of Soquel Creek. The long term health and welfare of this special ecosystem, Soquel Creek Lagoon, in the midst of bustling humanity, will ultimately be left in theirs and the City's hands.



LAGOON AND ESTUARY FORMATION

Sandbar Construction, 1991. **Appendix A** provides photos of the various activities associated with sandbar closure.

15 May 1991. The City obtained a Fish and Game Permit (**Appendix B**) to close the lagoon which stated that no vehicles were to enter the wetted creekbed except within 25 feet of the flume. Operations to close the sandbar began. The Creek was flowing out east of the flume at low tide. Kelp had remained outside the lagoon until the 2 week period just prior to lagoon closure. Large amounts of kelp covering 3/4 of the lower lagoon bottom were decomposing on 15 May (Appendix A-1). The very experienced and cooperative equipment operator, Bill Casalegno, was moving sand from the beach over to the area of sandbar closure. He closed the lagoon before high tide could wash more kelp into the lagoon and built a dam on the west side of the flume to trap considerable kelp that had collected there.

16 May 1991. Mr. Casalegno opened the sandbar at 0630 hr at low tide (Appendix A-1). He stated that large amounts of kelp washed out of the lagoon. Two City public works employees and myself used hand rakes to move kelp out of the lower lagoon at low tide. Most kelp was raked by hand to the lagoon margins. Then a Jim Turcotte used a wheeled tractor with a rake behind it to take the kelp along the margins to a hole in the sandbar, west of the flume (Appendix A-1). It crossed the creek near the flume only. A large tracked vehicle used a large shovel with teeth to scrape kelp from beside the pilings and out into the water approximately 10 feet, as well as adjacent to the flume. This piece of equipment did not appear to be effective. The kelp collected by the shovel was deposited on the beach. Mr. Casalegno would then move it down to the beach with his bulldozer.

A school of 10 steelhead smolts, one adult female steelhead (left lagoon into the surf at 1030 hr), numerous sticklebacks and staghorn sculpins (hiding under kelp) were observed in the lower lagoon. A large school of sticklebacks was observed in a pool under the trestle. When one clump of kelp was removed, the

sculpins would move to another clump. A school of 15 steelhead smolts was observed holding position in the current in the channel adjacent to the flume.

Jim Turcotte supervised the activities associated with preparing the flume for sandbar closure, with direction from Ed Morrison who also directed the work of the bull-dozer. Ed, Jim and their fellow City employees did an outstanding job.

A notch was cut in one board, 8-10 inches wide and 12 inches tall, and placed in below another board to keep the hole submerged (**Appendix A-2**). A 12-inch tall plank was secured on the flume floor approximately 10 feet down from the flume opening to create a plunge pool into the flume opening (**Appendix A-2**).

The shroud was installed, and a pad of heavy black plastic sheeting was laid down around the flume within 25 feet of the opening and up the walls of the flume (**Appendix A-2**). Then a layer of sand was placed over the plastic. This was to prevent undermining of the flume and development of water movement along the flume after closure. The water depth was at a maximum just beyond the sheeting on the east side of the flume.

The sandbar was closed in early afternoon before the tide came in. The flume was leaking water 60-80 feet from its opening. 1/4 to 1/3 of the kelp still remained in the lagoon (**Appendix A-1**). Decomposition had progressed most in holes near the pilings of the Stockton Avenue Bridge. Considerable black ooze was stirred up as this kelp was raked up. However, it rapidly moved out of the lagoon as the water drained out. The water was clear by the time of sandbar closure.

17 May 1991. The lagoon had filled overnight and water had entered the flume. However, the lower end was plugged with sand. Mr. Casalegno unplugged the lower end of the flume to allow any trapped fish to leave before opening the lagoon at 0630 hr. Considerable kelp flushed out with the aid of a rake. No steelhead smolts were observed leaving the lagoon at the time of breaching. We raked as much kelp out as possible with hand rakes as the lagoon was draining. Additional kelp was raked up and

deposited under the Stockton Avenue Bridge and at the adjacent park. We raked out kelp at the landing just downstream of Noble Gulch at the request of a resident. A Public Works employee came with a pickup to haul this kelp from above the bulkhead away. Approximately 10 % of the kelp that had been present on 15 May still remained (Appendix A-1). The water was clear at the time of lagoon closure.

A large tree trunk was left near the west bridge piling for fish cover. The boulders along the wall at Venetian Court were left exposed for fish cover. The margins of the lagoon were graded to create a gradual incline into the lagoon. The bulldozer did not enter the water during grading. The kelp on the west side of the flume was buried in the sandbar.

Recommendations Regarding Sandbar Construction

1. Evaluate the structural integrity of the flume and its supports. Repair cracks and supports as necessary.

2. During the 2-3 days of construction, continue to close the lagoon each day before incoming tide can wash salt water and kelp into the lagoon. Continue to re-open the sandbar and unplug the flume each day at low tide to drain out more kelp.

3. Continue to rake as much kelp out of the lagoon as possible before final closure, including under the restaurants.

4. 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. Add this to 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, pers. comm.)

5. 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.

6. 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.

7. Examine the feasibility of filling the area under the restaurants with sand to make it dry underneath.

8. Obtain permission to fence off the area under the restaurants so that domestic waterfowl cannot use that area as a roost area. A 4-foot high wall of chicken wire will suffice.

9. Continue to maintain the portal in the flume entrance for adult fish passage until July 1.

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

11. 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.

11. Develop a system to move the lagoon out from under the restaurants during the summer months in order to reduce accidental pollution and pollution caused by daily cleaning of restaurant dining areas and sidewalks. This may be done by 1) attempting to add a layer of sand under restaurants adjacent to the lagoon sufficient to prevent standing water under the buildings, 2) contouring the lagoon during sandbar construction so that a sand berm is created between the restaurants and the lagoon, with expansion of the lagoon on the west side to make up for loss in volume on the east side, or 3) placement of an inflatable coffer dam alongside the restaurant pilings and back-filling the area under the adjacent to the restaurants with sand. The inflatable dam would be removed at the time of sandbar breaching in the fall/winter.

The bolt that was screwed into the piling for sandbar breaching is 1.77 feet above the top of the flume and could be used as an elevational reference point (Appendix A-3). If standing water occurs under the restaurants after one of these options is pursued, stagnation will probably lead to foul odors.

Permission from Fish and Game will be required to contour the lagoon so that the area adjacent to the restaurants is above the level of the water, while increasing the lagoon area on the Venetian Court side. Make sure that an equal area of equal depth is created on the Venetian Court side to make up for losses next to the restaurants. This contouring on the west side should be completed before the contouring on the east side. When working on the west side, it would be easier to avoid the wetted channel if the sandbar was open on the east side of the flume. When working on the east side of the lagoon, it would be easier to avoid the wetted channel if the sandbar was open on the west side. **It is crucial to leave the wetted channel undisturbed while moving sand.**

Sandbar Breaching During the 1990-91 Rainy Season .

25 October 1990. The City had notched the sandbar at the elevation of the piling bolt (1.77 feet above the elevation of the top of the sandbar and 1.32 feet above top of berm at 443 Riverview Avenue), in anticipation of any sandbar breaching (Appendix A-3).

31 October 1990. The first significant storm of the season had begun early in the morning. Soon after 0800 hr, 12 inches of boards had been removed on either side of the flume entrance and the metal portal on the top of the flume were removed. The boards/plates at the ocean side of the flume were removed on both sides. The Creek had risen 2 inches from pre-storm levels and was 2 inches below pre-storm levels by 1100 hr. The lagoon was tea-colored. The sandbar remained intact.

1 November 1990. After the storm flow subsided, one plate was reinstalled at the ocean side of the flume. The flume portal was

covered, and boards were reinstalled on either side of the flume opening to leave **8 inches of free board.**

7 February 1991. Small storms had occurred before this date. However, the flume was able to handle the flow. During one event, the first manhole cover on the top of the flume had been opened. The lagoon began breaching at 0830 hr. The water began flowing through the notch in the beach when the lagoon level was 2 inches above the piling bolt. At this point, 6 inches of free-board existed to the berm at 443 Riverview Avenue. No water was on the patio. By 0900 hr, the lagoon elevation was 8 inches above the piling bolt and the patio at 443 Riverview had 2 inches of standing water. Water was leaking through old sandbags forming a wall adjacent to the berm. We took sandbags off the top of the wall and jammed them in behind the wall to stop the leakage. The water level in the lagoon was 4-6 inches above the elevation of the patio. Water did not enter the house. By 0930 hr, the lagoon level was 3 inches below the piling pin as the lagoon was emptying. The notch in the sandbar was then 20-25 feet wide with a flow of over 100 cfs flowing out (Appendix A-3).

Sandbar Breaching During the 1991-92 Rainy Season.

26 October 1991. The storm the previous night was much larger than had been forecasted. Five years of drought had probably made us less believing in a forecast of rain. Ed Morrison, experienced Public Works Supervisor, was on vacation. Two 3"x 8" boards on the west side and one 3"x 8" board on the east side of the flume entrance had been removed previously, as was called for in the Management Plan. However, the first manhole cover on the flume had not been removed.

The space into the flume was insufficient to allow all of the storm flow through the flume. The lagoon level had reached approximately 3.5 inches above the piling bolt (1.77 feet above the elevation of the top of the flume and 1.32 feet above the top of the berm at 443 Riverview when the City facilitated breaching at 0730 hr (Ed Morrison, pers. comm.). We were notified at 0720 hr. that a breach was imminent. Ed Morrison had been in the

water attempting to remove more boards from the flume but could not. We were unable to arrive in time for the breach. By 0830 hr the lagoon level had decreased 0.5 inches. At 0845 hr we went 443 Riverview and observed no flooding with the lagoon level approximately 6 inches below the berm. The deck at the residence next door (439 Riverview Avenue), however, had water on it according to the homeowner. A notch had been cut previously in the sandbar and shovels were used to facilitate the final breaching.

Fortunately the creekflow had increased gradually. Consideration was made for attempting to reinstate the sandbar to prevent kelp from entering the lagoon. The City decided not to do so with more rain in the forecast.

By 1230 hr the lagoon had drained partially and no more flow was leaving. Some sea water and kelp had entered the lagoon by this time. The lagoon level was approximately 1 foot below the top of the flume.

Recommendations Regarding Sandbar Breaching

1) Recommend that the owners of 443 Riverview need to build a better bulk head to replace the old sandbag wall.

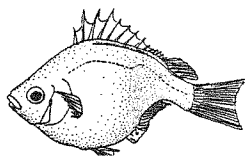
2) The notch in the sandbar should be cut slightly lower than the piling bolt. A new piling bolt for triggering sandbar breaching should be installed 6 inches below the old one. This will cause sooner breaching of the sandbar and allow a greater rise in lagoon elevation without flooding between the time the water begins to enter the notch in the sandbar and the time the notch begins to widen and deepen from streamflow.

3) Just before the first storm of the fall season, remove 2 boards from each side of the flume, clear the exit to the flume, take the plate off one side of the exit from the flume and clear the sand away from the top of the flume back to the first hole cover and remove the 1-foot plank inside the flume. Replace the hole cover. Leave the boards removed until the sandbar is

eventually breached during later, larger storms. Remove the hole cover if the entrance of the flume cannot handle the volume of the stormflow. After the stormflow subsides, replace the hole 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 at high tide, 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 and replace it with freshwater. 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.



PONDWEED AND ALGAL GROWTH WITH RESULTS OF AQUAZINE TREATMENT

The lagoon was divided into 3 reaches. Reach 1 extended upstream from the flume to Stockton Avenue Bridge (Appendix A-5). Reach 2 extended upstream from Stockton Avenue Bridge to the railroad trestle. Reach 3 extended upstream to a point just past the Shadowbrook Restaurant. Refer to Figure 1, Appendix G for a map.

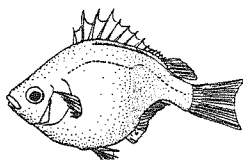
Pondweed and Algal Growth and Control, Late 1990

25 October 1990. At a time when the sandbar was in place, considerable decomposing garbage was present under the Beach House near the storm drains of the street. An odor of decomposition was evident. Adjacent to the Beach House near the pilings, the water and lagoon bottom were a light tan color. The source appeared to be the holes in the walkway between the restaurants, adjacent to the Beach House side door. Floating algae covered 70 % of the lower lagoon (downstream of Stockton Avenue Bridge). Threespine sticklebacks were abundant. No gulls were present in the lagoon or on the restaurant roofs at 1100 hr.

14 November 1990. Floating algae covered 40 % of the lower lagoon (Appendix A-4). Pondweed was present on the bottom over entire lower lagoon, normally less than 1 foot high, occasionally 1-2 feet high. No pondweed reached the surface.

16 November 1990. Algal mats covered 50 % of the lower lagoon. Floating algae and garbage was skimmed off the surface of the lagoon by Mike Clark and an assistant from the Shadowbrook Restaurant (Appendix A-4). It took them 4-5 hours to skim the entire lagoon up to the Restaurant. The men used a board about 10 feet long. Further up the lagoon away from the beach, a barge was used to collect the algae (Appendix A-4). Algae was left on the beach to be collected by the City (Appendix A-5). No dead fish and 5 bird carcasses were among the beached algae.

Pondweed and Algal Growth and Control, 1991



The sandbar was constructed 15-17 May. Two weeks after lagoon formation, algae covered only 5 % of the bottom in Reach 1, primarily around the Stockton Avenue Bridge piers. The other reaches had no aquatic vegetation yet. A month after lagoon formation (18 June), algae covered 25 to 35 % of the lagoon bottom and was 1-3 feet tall with about 5 % of the surface having floating algae. Seven weeks after lagoon formation (8 July), algal growth had increased to cover 50-60 % of the lagoon bottom and was 1-4 feet tall with about 5 % of the surface having floating algae (Appendix A-5). An algal bloom had occurred upstream of Reach 3, with most of the surface covered with algae for a 200 foot length of stream. According to Mr. Clark, this floating algae was skimmed off and removed by Mr. Clark and an assistant from the Shadowbrook Restaurant in 1-2 hours.

Aquazine was applied to Reaches 1 and 2 on 11 July. Red-breasted mergansers were seen hunting for fish for 4+ weeks following aquazine application (Thomas Mader, pers. comm.). Two weeks after aquazine application (27 July), algae was reduced to cover 30-40 % of the lagoon bottom, and was reduced to only 0.5 feet tall (Appendix A-5, A-6). The aquazine had affected algal growth in all three reaches. No pondweed had yet been detected, more than 2 months after lagoon formation.

After 3 months since lagoon closure (19 August), pondweed had appeared with algae surrounding it. On 19 August, 5.5 weeks after the first aquazine application, 60-75 % of the lagoon bottom was covered with pondweed and algae with none reaching the surface. On 26 August, 6.5 weeks after the aquazine application, pondweed and algae had decreased to between 40 and 60 % of the lagoon bottom with between 0 and 5 % of the surface having floating algae.

On 30 August, 7 weeks after the first aquazine application, the second treatment of aquazine was applied to Reach 1 only (Appendix A-6). It drifted through Reach 2 and into lower Reach 3 as well. Enough chemical was applied to control algae and pondweed, which was a mistake on the part of the applier. Only algae was to be controlled. On that day, 60-70 % of the bottom

in Reaches 1 and 2 were covered with pondweed and algae with 0-1 % of the surface having floating algae (Appendix A-6). After 3 days (2 September), algae was absent from the tops of pondweed plants. Algae was less than 1 foot tall, it being most abundant in Reach 3. Five days after aquazine application, algae was reduced to 10-20 % of the bottom in Reaches 1 and 2, but covered 70 % of the bottom in Reach 3, with 15 % of the surface having floating algae there.

The Begonia Festival occurred on 8 September. Four days after the Begonia Festival (12 September), algae covered 30-50 % of the bottom with 5-10 % of the surface covered with dead plant material. Five days after the Begonia Festival and 2 weeks after the aquazine treatment, all pondweed was dead in Reach 1, with algae covering 50 % of the bottom at less than 0.5 feet in height. In Reach 2, pondweed covered 10 % of the bottom and low-lying algae covered 50 % of the reach (Appendix A-6). Reach 3 had 85 % of the bottom covered with pondweed and algae, yet none reached the surface.

Seven weeks after the second aquazine application (11 October), aquatic vegetation was at its most abundant density since sandbar closure almost 5 months previous. Algae and pondweed covered 65-85 % of the bottom in Reaches 1-2 with 20 % of the surface having floating algae in Reach 1 (Appendix A-5). Aquatic vegetation had declined in Reach 3 to cover 35 % of the bottom and none on the surface.

Riparian vegetation along the west bank in Reaches 2 and 3 was observed throughout the summer and fall (Appendix A-6), 1991. Leaves did not change color. Nor did leaves senesce early with trees along that bank. Therefore, no negative effects of aquazine were detected.

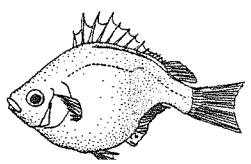
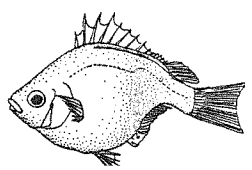


Table 1. Changes in Pondweed and Algae Densities, 1990-91.

Date	Reach #	Pondweed and Algae % covering bottom	Algae % covering bottom	Algae % surface
25Oct90	1	65		-
14Nov90	1	100		40
16Nov90	1	100		50
"	1,2,3	Surface algae skimmed off and collected on beach.		
7Feb90		Lagoon breached.		
15-17May91		Sandbar Constructed.		
20May91	1,2,3	No aquatic vegetation present.		
29May91	1	0	5	0
"	2	0	0	0
"	3	0	0	0
18Jun91	1	0	30 (1-2'high)	1
"	2	0	35 (1-3'high)	5
"	3	0	25 (1-2'high)	5
8July91	1	0	50 (1-3'high)	5
"	2	0	60 (1-4'high)	5
"	3	0	50 (1-2'high)	0
11July91	1,2	Aquazine applied-Reach1&2 (Not notified.)		
27July91	1	0 Mergansers present	40 (0.5'high)	0
"	2	0	35 (0.5'high)	0
"	3	0	30 (0.5'high)	0
19Aug91	1	60		0
"	2	50		0
"	3	75	Bloom at Noble Gulch	0
26Aug91	1	50		0
"	2	40		5
"	3	60		<5
30Aug91	1	70		1
"	2	60		0
30Aug91	1	Aquazine applied-Reach 1. (Notified.)		
2Sep91	1	30 (pondweed only)	5 (.5-1'high)	0
"	2	40 (pondweed only)	20 (,0.5'high)	0
"	3	20 (pondweed only)	60 (.5-1'high)	0
4Sep91	1	-	10	0
"	2	-	20	0
"	3	-	70	15
8Sep91		Begonia Festival		
10Sep91		Begonia Festival Clean-up		
12Sep91	1	- (No data)	30	5(dead)
"	2	- (No data)	30	5(dead)
		- (No data)	50	10(dead)
13Sep91	1	All pondweed dead	50 (<0.5'high)	0
"	2	10 (pondweed only)	50 (<0.5'high)	0
"	3	85 (most pondweed<1'high)		0
11Oct91	1	80 (1-3' high)		20
"	2	65 (1-3' high) Coots numerous		0
"	3	35 (1-2' high) Coots numerous		0
26Oct91		Sandbar breached.		



Effects of Aquazine Application on Invertebrate and Fish Populations, 1991

Background Information. Aquazine was approved by the resource agencies for the control of Algae in Soquel Creek Lagoon. The adopted recommendations in the Management Plan state that the City shall manually remove surface algal mats at times through the summer, based on the aesthetic judgment of the City. If algal production is deemed excessive before the Begonia Festival, the City may apply one low dose (5 pounds) of aquazine downstream of the Stockton Avenue Bridge. Subsequent to the approval of the Management Plan, members of the advisory board, including Fish and Game, agreed that two doses could be tried in 1991 with monitoring to assess the effects.

Aquazine was applied twice during summer, 1991. The first time was 11 July and could not be closely monitored due to a gap in communication between the City and the consultant. Aquazine was applied at that time from the flume to the railroad trestle. It was noted during regular monitoring that algae density was less on 27 July than the previous monitoring on 18 June. No pondweed was detected in the lagoon until mid-August.

On 30 August, Aquatics Unlimited applied 8-10 pounds of aquazine according to the technician to the lower lagoon, downstream of the Stockton Avenue Bridge. The applicator decided on his own the amount of chemical. It appeared that he estimated the weight of the chemical without actually measuring it. He assumed that the City wanted algae **and** pondweed controlled, which was not the case. It was the City's intention to control algae only. This would require only 4-5 pounds of aquazine, as was applied in past years.

The aquazine was applied at 0820 hr. By 0900 hr, aquazine had drifted on the surface, 0.8 of the way upstream from the Stockton Avenue Bridge to the railroad trestle. Ten percent of the surface area between the bridge and trestle was covered with aquazine. By 0940 hr, the aquazine surface film had reached 50 feet past the trestle into Reach 3, but was dissipating. By 1030 hr, a thick surface film persisted adjacent to Margaritaville.

No fish mortality was observed. No invertebrate mortality was observed.

Summary of Invertebrate Monitoring

A detailed account of invertebrate monitoring is provided in **Appendix C.** For the 30 August aquazine treatment, invertebrates were monitored the morning of 30 August before the application and on succeeding dates (2 September and 13 September) to qualitatively evaluate the effects on invertebrate populations.

Sampling was done with a dip net. One sample consisted of the invertebrates collected from one pass of the dip net through aquatic vegetation for a distance of 2-3 feet. The same motion was attempted during each sample. Therefore, the sampling results were intended to be qualitative and would detect only obvious changes in invertebrate densities.

Where vegetation was present, it appeared that invertebrate densities were much higher in pondweed surrounded by algae than in just algae by itself. This was consistent with 1988 sampling.

In Reach 1 after the aquazine application it appeared that water boatmen and threespine stickleback decreased among the vegetation but not at the trestle. Neomysis shrimp appeared to increase after aquazine application in Reaches 1 and 2. Mayfly larvae and isopods appeared equally abundant before and after the pondweed and algae died. In places where the pondweed had died, it still provided structure for the pondweed-algae mass, which may have been important. No obvious changes in invertebrates or numbers of sticklebacks were detected at the trestle or upstream, where pondweed and algae were present.

It would be difficult to state whether food density changed in among the pondweed and algae before and after aquazine treatment, even when the pondweed was standing dead. Steelhead are very opportunistic feeders. They love to eat water boatmen and Neomysis shrimp. However, it may be assumed that the overall food available to fish had been significantly reduced in conjunction with the die-back of pondweed. Dipnet samples in

open water yielded no invertebrates. And there was alot more open water after the pondweed died and disappeared. The apparent reduction in sticklebacks in the lower lagoon after aquazine application was consistent with this assumption. Neomysis shrimp usually multiply when the particulate matter increases, either phytoplankton or dead (detrital) material. The water did appear slightly cloudy in the lower lagoon after vegetation began to decompose, particularly around pondweed. Food for these shrimp may have increased.

Effects of Aquazine Treatment on Fish Cover

Fish cover was also reduced with the die-back of pondweed and algae. Open water offers poor escape cover from diving ducks. A streamside resident (Thomas Mader) stated that 3 red-breasted mergansers appeared on 12 July and remained for at least 4 weeks. We detected the 3 birds on our 27 July monitoring (Appendix A-7), but did not see them on our next visit, 19 August. It could be more than a coincidence that they fished the lagoon for 4+ weeks after the first aquazine application, 11 July. This is atypical behavior for this species, it being the first observation of such fish-eaters on the lagoon since monitoring began in 1988. Fish eating birds have been traditionally scarce in Soquel Lagoon in summer.

It would be difficult to determine the quantity of fish that they consumed and of what species. However, to have stayed on the lagoon for 4 weeks, the mergansers must have consumed considerable numbers of fish. By 19 August, pondweed had grown up in the lagoon to offer more cover for fish.

Recommendations Regarding Control of Algae

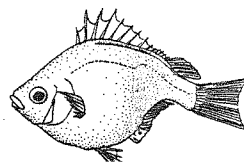
1. Establish criteria which may be used to decide when algae is excessive, keeping in mind that pondweed and algae provide necessary cover for fish from bird predators. Aquazine was applied in July when only about 5 % of the surface in Reach 1 had floating algae. Some residents thought there was an "algae problem" at that time and some did not. 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 from the lagoon and may slow future algal growth. Use of aquazine returns the nutrients to the lagoon during bacterial decomposition. This nutrient release stimulates faster algal growth afterwards. Considerable floating algae developed in October, 1990 and 1991.

Offer to donate funds to a volunteer group to skim algae off the lagoon 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 (5 pounds or even 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 at least in Reaches 2 and 3 at the time of 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.



FECAL COLIFORM/STREPTOCOCCUS COUNTS IN SOQUEL CREEK LAGOON AND NOBLE GULCH, 1990-91

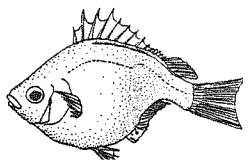
Background Information

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, so that the lagoon may once again be used for swimming.

Summer months of 1990 and 1991 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 collects weekly samples at various stations in the Soquel Creek Creek/Lagoon. Their data were analyzed to evaluate bacterial levels. The discussion will focus on the 3 reaches of the lagoon. 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. No station was present in 1990 or 1991 near the mouth of Noble Gulch until mid-September, 1991. Therefore, upper Reach 3 could not be analyzed. It must be realized that concentrations of bacteria may vary considerably from one place to another. Therefore, the data indicated bacterial levels in only a general way.

Computer print-outs of actual bacterial counts are in **Appendix D.**



Any counts above 4000 that end in 2, such as 4002 or 5002, had too many bacteria to count. In addition, Streptococcus counts of less than 100 may be suspect (J. Ricker, S.C. County Envir. Health, pers. comm.).

Fecal Bacterial Counts in Reach 1

Fecal coliform counts were consistently lower in 1991 compared to 1990 (**Figure 1**) in the lower lagoon. In 1990, 11 weekly samples were taken from sandbar closure to the Monday after Begonia Festival and 11 counts were greater than 200/ 100 ml at the flume. The sandbar had to be closed twice that year due to a Memorial weekend storm. In 1991, 17 weekly samples were taken and 14 counts were greater than 200/ 100 ml at the flume. One of the 3 low counts was right at 200. Therefore, though fecal coliform counts were lower 1991, they were still higher than the allowable level for swimming in 82 % of the weekly samples.

In both 1990 and 1991, coliform counts increased greatly in mid-July (week 11). However, the increase was more in 1990 than 1991. In early August (week 14), fecal coliform counts increased dramatically in 1990 but not in 1991.

Streptococcus counts were consistently lower in 1991 compared to 1990 (**Figure 2**) in the lower lagoon. They were extremely high in 1990 after the 2 sandbar closures and in mid-July (week 11) and early August (week 14). In 1991 there were much less Streptococcus after at sandbar closure. Counts increased in mid-July and early August in 1991, but not as much as in 1990.

Fecal Bacterial Counts in Upper Reach 2 and Lower Reach 3

Fecal coliform counts were consistently lower in 1991 than 1990 at the railroad trestle, except for mid-July (week 11) (**Figure 3**). In 1990, coliform counts were above the 200/ 100 ml cutoff for environmental safety in 9 of 11 weekly samples. In 1991, coliform counts were above the cutoff in only 6 of 17 (35 %) of the weekly samples. The great increase in mid-July 1991 was

accompanied by a similar, though smaller increase at the flume.

Fecal streptococcus counts were generally lower at the trestle in 1991 compared to 1990 except in early July (week 10) (**Figure 4**).

Comparison of Fecal Coliform Counts at the Flume and the Railroad Trestle, 1991.

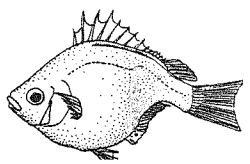
Fecal coliform counts were generally higher at the flume and usually at least twice as abundant there compared to at the railroad trestle (**Figure 7**). The one exception was in mid-July (week 11). In early August (week 14), when counts were so high at the flume, they were quite low at the trestle.

Fecal Bacterial Counts in Noble Gulch

The monitoring station was located at the entrance of the tunnel at Bay Avenue. Fecal coliform and streptococcus counts fluctuated widely in 1991 at this station and were consistently higher than in 1990 (**Figures 5 and 6**). In most cases, counts were at least twice, and many times more than 3 times, as high in 1991 compared to 1990. Counts in 1990 and 1991 in Noble Gulch were generally much higher than in Soquel Creek Lagoon. We do not know the effect of this pollution source on bacterial levels in the lagoon because data were unavailable from the County. Algal blooms were common where it entered the lagoon, indicating a nutrient input from Noble Gulch to the lagoon.

Conclusions from Fecal Bacterial Monitoring

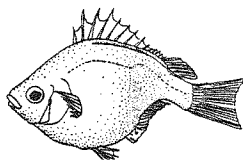
We concluded that fecal bacterial counts were reduced in 1991 compared to 1990 in reaches 1 and 2. However, in Reach 1 for 1991, the counts were still at unsafe levels for swimming during 82 % of the weeks from the time of sandbar closure to the weekend of the Begonia Festival. On the other hand, in Reach 2 the lagoon was at safe levels of coliform bacteria 65 % of the same time period.



The reasons for the great improvement of conditions in Reach 2 are questionable. Several may include 1) fewer feral ducks and geese were present in Reach 2 than in 1990. Censusing data are not available from 1990 for comparison. However, 4 geese and 9 domestic ducks had been removed between 1990 and 1991 summers, leaving fewer present to foul the water. 2) Fewer people were feeding the waterfowl in Reach 2 than the previous year, thus attracting fewer pigeons and waterfowl to Reach 2. The wild mallards tended to use Reach 3 while the domestic ducks and geese tended to use Reach 1 the most (**Appendix G**). 3) It may have been foggier in 1991 compared to 1990, keeping the water temperatures lower and slowing bacterial decomposition and bacterial growth. We have no data to substantiate this. It may be available next year.

Reductions in fecal bacteria in Reach 1 were detected, though they are not low enough to allow swimming. Some reasons may be similar to those given for improvements in Reach 2. There were fewer domestic ducks and geese in the lower lagoon than previously. There may have been less human handouts than before. The water may have been cooler than in 1990, slowing bacterial decomposition. Additional reasons may be that kelp was not buried under the lagoon in 1991 as was the case in 1990. Kelp was largely removed from the lagoon before sandbar closure in 1991. Therefore, decomposition was reduced in the sand with less bacteria leaching into the lagoon. There may have been fewer gulls using the lower lagoon for bathing in 1991 than 1990. There were no data available from 1990 for comparison, however.

Reasons for the dramatic increases in fecal bacteria counts during weeks 11 and 14 in both 1990 and 1991 are uncertain. The ratios of fecal coliform/streptococcus in 1990 would not indicate any human sewage contamination. The ratios in 1991 were high (177 at the trestle in mid-July and 10.4 and 12.7 in weeks 14 and 15 at the flume). Consistently high ratios would indicate chronic sewage contamination. These incidents may indicate small instances of contamination from the Esplanade restaurants or storm drain runoff or even dog feces near the trestle. However, no sewage spills were reported.



A more likely cause for the increased levels of bacteria in weeks 11 and 20 could be that they came about 10 days after the two aquazine applications in 1991. The algae and pondweed had died in the lower lagoon by week 20, and bacterial decomposition may have been high. There may have been some decomposing begonias as well. There may be a connection between aquazine application and subsequent high bacterial counts. However, more monitoring is needed to rule out coincidence.

Recommendations Regarding the Monitoring and Reduction of Fecal Bacteria

1. Encourage the mobile home park to allow the removal of domestic ducks that use Noble Gulch.

2. Remove the domestic ducks at the mobile home park on Noble Gulch with the cooperation of the residents.

3. Enforce the no-bird feeding ordinance at the lagoon.

4. 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.

5. Dispose of kelp from the lagoon during sandbar closure along the beach rather than bury it in the sandbar. Disperse it up and down the beach so as to spread it out. The backhoe with the rake may be used for dispersal. Add this to 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, pers. comm.)

6. Continue to open and close the lagoon at during outgoing tides and before incoming tides, respectively, during the 2-3 days that are required for sandbar closure.

7. 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.

8. Remove the remaining domestic geese and ducks from the lagoon and transplant them to an acceptable private pond.

9. Request that Santa Cruz County increase their number of fecal bacteria sampling stations for the period, May 15 to September 15. Request that they add one to Reach 1 adjacent to Venetian Court, one to Reach 2 adjacent the eastside park just upstream of Stockton Avenue Bridge and one in Soquel Creek at the mouth of Noble Gulch.

10. 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.

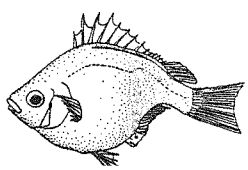
11. Establish a log of complaints/reports of pollution entering the lagoon as well as excessive algae. Record the date, time and names of the concerned parties.

12. Choose to manually skim off floating algae from the lagoon instead using aquazine, except just before the Begonia Festival in 1992.

13. Investigate the re-direction of all storm drains located downstream of Noble Gulch, as well as Noble Gulch, away from Soquel Creek Lagoon during the period of sandbar closure each year.

14. Pump water out of Noble Gulch (before it enters the tunnel) to irrigate public parks. A small check dam may be required.

15. 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.



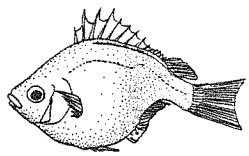
16. Examine the feasibility of sealing the storm drains at the Railroad trestle and under the restaurants during the period of sandbar closure.

17. Request that bypass tubes be connected to the drain pipes from the roof of the Edgewater 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.

18. Request 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.

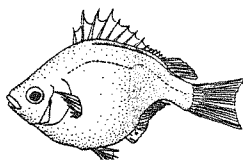
19. Develop a system to move the lagoon out from under the restaurants during the summer months in order to reduce accidental pollution and pollution caused by daily cleaning of restaurant dining areas and sidewalks. This may be done by 1) attempting to add a layer of sand under restaurants adjacent to the lagoon sufficient to prevent standing water under the buildings, 2) contouring the lagoon during sandbar construction so that a 5-10 foot wide sand berm is created between the restaurants and the lagoon and under the restaurants, with expansion of the lagoon on the west side to make up for loss in lagoon volume on the east side, or 3) placement of an inflatable coffer dam alongside the restaurant pilings and back-filling the area under the adjacent to the restaurants with sand. The inflatable dam would be removed after the sandbar has breached in the fall/winter. The bolt that was screwed into the piling for sandbar breaching is 1.77 feet above the top of the flume and could be used as an elevational reference point. If standing water occurs under the restaurants after one of these options is pursued, stagnation will probably lead to foul odors.

20. Request permission to construct a screen along the pilings of the restaurants so that domestic waterfowl may not use the area under the restaurants for roosting. A 4-foot high wall of chicken wire will suffice.



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

22. Set up an annual inspection program for evaluating the plumbing under Esplanade Restaurants. Have a City building official, a County sanitation representative and the monitoring consultant inspect for leaks before sandbar construction each year.



WATER QUALITY MONITORING, LATE 1990 and 1991

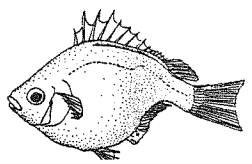
Introduction.

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 okay in Soquel Lagoon at water temperatures of 23-25 C for 1-2 hours toward the end of the day (Habitat Restoration Group 1990). Morning oxygen levels below 5 would be rated poor. Morning oxygen levels of 5 to 7 ppm were rated fair with above 7 ppm rated as good. Morning water temperatures of less than 20 C were rated good while those 20-21.5 C were rated fair. Temperatures above 21.5 would be rated poor. Water temperature could be expected to rise 3-4 degrees C by the end of a sunny day.

High levels of dissolved carbon dioxide in water will inhibit the 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 levels was unnecessary.

Water Quality, Late 1990 Before Sandbar Breaching

14 November 1990. Water temperatures and dissolved oxygen levels were good for aquatic organisms. Plants had depleted oxygen somewhat because full saturation would have been 10.8 parts per million (ppm). Appendix E provides more detailed water quality data.



Water Quality Monitoring After Sandbar Closure, 1991

Appendix F provides detailed data on water quality.

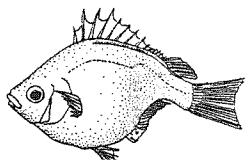
Lagoon Level. As of the first monitoring 4 days after sandbar construction on May 20, until sandbar breaching on October 26, good lagoon depth was maintained. We checked lagoon levels periodically (10 occasions) during this time, and City personnel checked gage height 3 times per week from 2 August to 10 October.

Flume Passability. According to the Management Plan, fish passage was to be maintained until July 1. Passage was in fact good until July 27, and the flume stayed open most of the time between then and August 28. Then the outlet stayed closed until October 10 when the City's record stopped.

Water Temperature. Lagoon water temperature was good until mid-June and was fair after that until after the Begonia Festival. After that it was good.

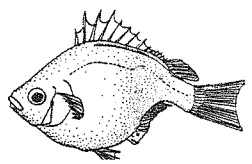
Dissolved Oxygen. Critical oxygen levels are lowest in the early morning before much photosynthesis may occur. This was the time that levels were measured and rated. Oxygen levels went from fair 4 days after sandbar closure to good until after the second aquazine treatment. Four days after the treatment, levels were fair, but returned to good within 12 days of treatment. On December 12, after 2 sandbar breaches in the fall oxygen levels were very poor, making aquatic life for fish impossible in Reaches 1 and 2 and some of Reach 3. Fish had to move upstream to obtain oxygen. Some may have stayed near the surface in Reach 3, where they were more vulnerable to predation.

Salinity. Within 4 days of sandbar closure at low tide, all but a small amount of salt water near the bridge piers was flushed from the lagoon with the aid of the shroud. The lagoon remained freshwater until after the first sandbar closure in late October. After that salinity fluctuated, requiring fish to acclimate to partial seawater. By December 12, a very salty lagoon had formed, requiring osmotic acclimation to full seawater. Sudden



shifts from freshwater to saltwater caused physiological stress to some fish, along with the loss of oxygen as kelp decomposed in a stagnant lagoon.

Conductivity. It was not a problem until early December when saltwater along with release of nutrients greatly increased conductivity, which may have induced osmotic stress for fishes.



Annual Bird Censusing and Monitoring of Bird Feeding Before and After Installation of Warning Signs

The detailed report may be found in **Appendix G.**

Avian use of the Soquel Creek Lagoon was monitored during two periods in 1991: August 19 to September 5 and from September 20 to October 13. The objectives of the study were to obtain quantitative data on the distribution of waterbirds using the lagoon and to determine the level of success the installation of no bird feeding signs had on discouraging bird feeding by humans. When censuses were conducted, each bird was assigned to one of 16 pre-defined sections of the lagoon. Birds were concentrated in Reach 1 of the lagoon with 58% occurring between the flume and Stockton Avenue Bridge, in Reach 2 with 19% occurring between Stockton Avenue and the railroad trestle and in Reach 3 with 23 % between the railroad trestle and a point slightly beyond the Shadowbrook Restaurant. Each species group exhibited a slightly different distribution in the lagoon.

Feeding behavior and interaction with humans were also recorded before and after installation of the no bird-feeding signs in early September. A statistical test was conducted by comparing the mean hourly rate of food offerings by humans to birds before and a period beginning 2 weeks after the no-feeding signs were installed. Both periods were preceded by the publicized adoption of the City's no bird-feeding ordinance. The mean feeding frequency was 2.6 times per hour before the signs and 1.4 times per hour after the signs were installed, which was statistically less than before. Commonly, more than 20 mallards along with geese and gulls were observed competing for human handouts. It was the impression of the data gatherer that the signs would be ignored if the no bird feeding ordinance was not enforced (Appendix 7). Interestingly, the domestic geese were observed for the first time to feed on algae and pondweed when the frequency of handouts diminished, offering some biological control of aquatic vegetation (Appendix 8).

Some comparisons were made between the results obtained in this

study regarding bird distribution with those found in the 1988 survey (Habitat Restoration Group 1990). As in 1988, the highest bird use of the lagoon was in Reach 1, it being dominated by gulls, domestic geese and feral ducks. Wild mallards fed primarily in Reach 3, though they were often seen in Reaches 1 and 2. They were observed roosting most visibly along primarily the margins of Reach 2 (Appendix 8). The primary roosting locations for rock doves (pigeons) were at the east and west parks (just upstream of the Stockton Avenue Bridge) and on the railroad trestle (Appendix 8). As many as 100 gulls at a time were observed roosting on building roof tops along the Esplanade.

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

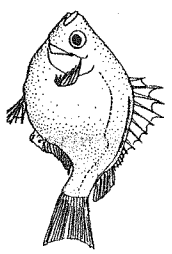
1. Maintain enforcement of the no bird feeding ordinance.

2. Request that Restaurant owners allow positioning of devices to the roof tops adjacent to the lagoon to discourage roosting of gulls.

3. Maintain the appearance and presence of no bird feeding signs in the 7 locations listed in **Appendix G.**

LITERATURE CITED

Soquel Creek Lagoon Management and Enhancement Plan 1990. Prepared by Habitat Restoration Group for the City of Capitola and Coastal Conservancy.



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

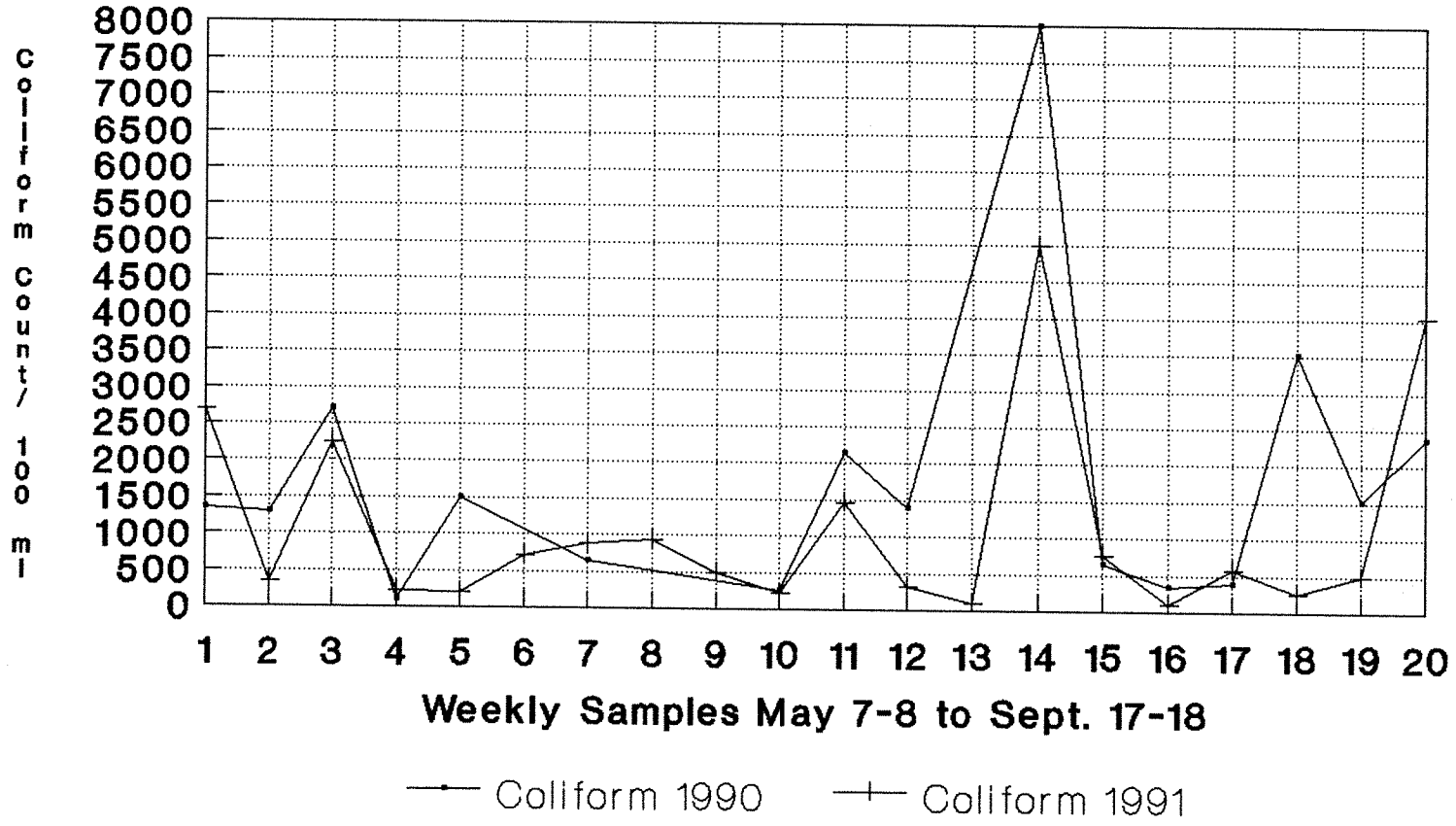
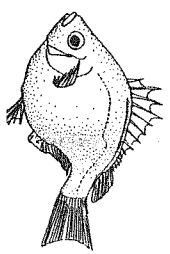


Figure 1. Fecal coliform counts at the Flume, comparing 1990 and 1991. (Santa Cruz County Data)



Fecal Streptococcus Counts
Soquel Creek Lagoon Weekly Samples
At the Flume

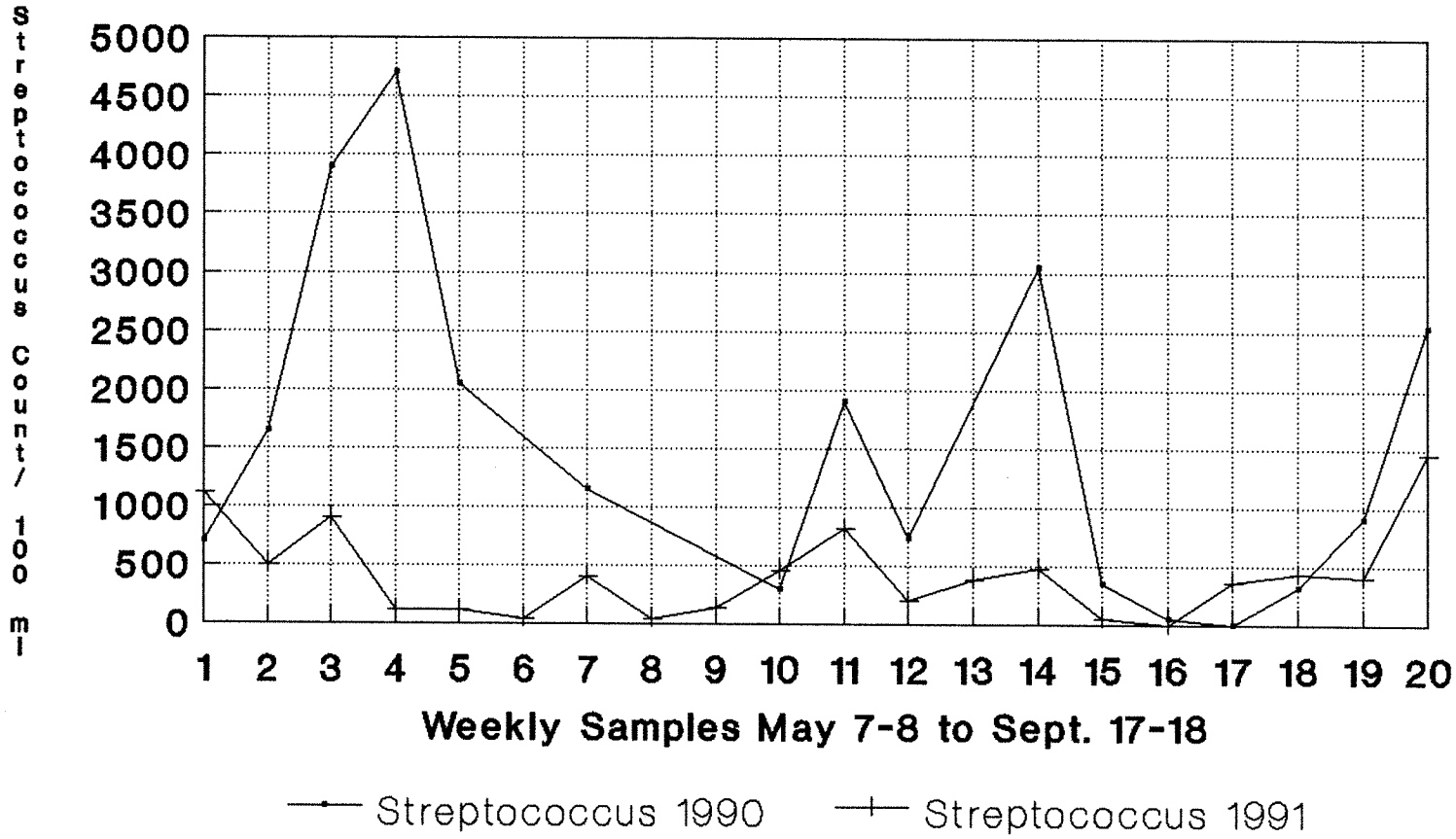
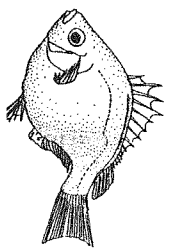


Figure 2. Fecal streptococcus counts at the flume, comparing 1990 and 1991. (Santa Cruz County Data)



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

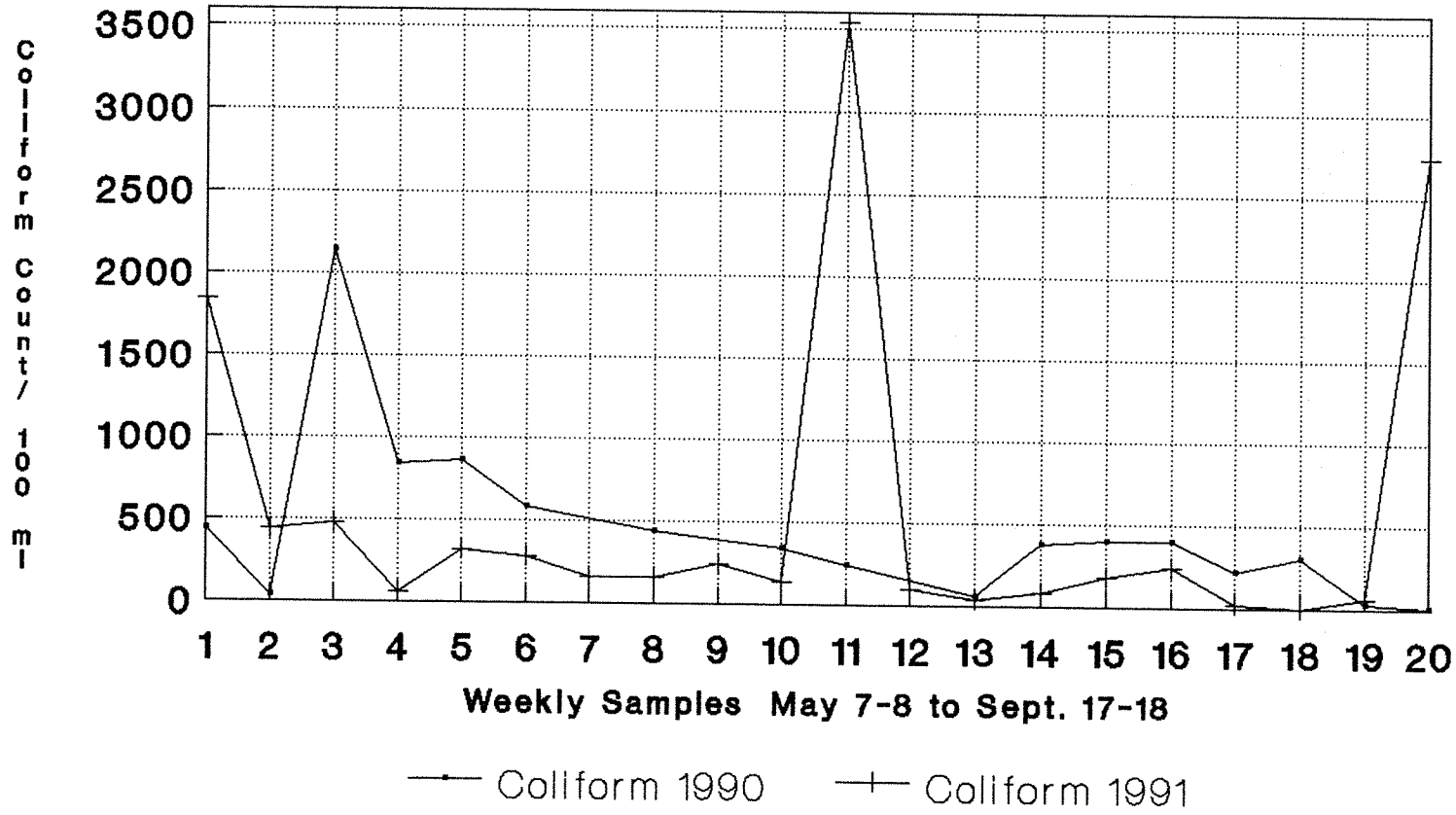


Figure 3. Fecal coliform counts at the railroad trestle, comparing 1990 and 1991. (S.C. County Data)

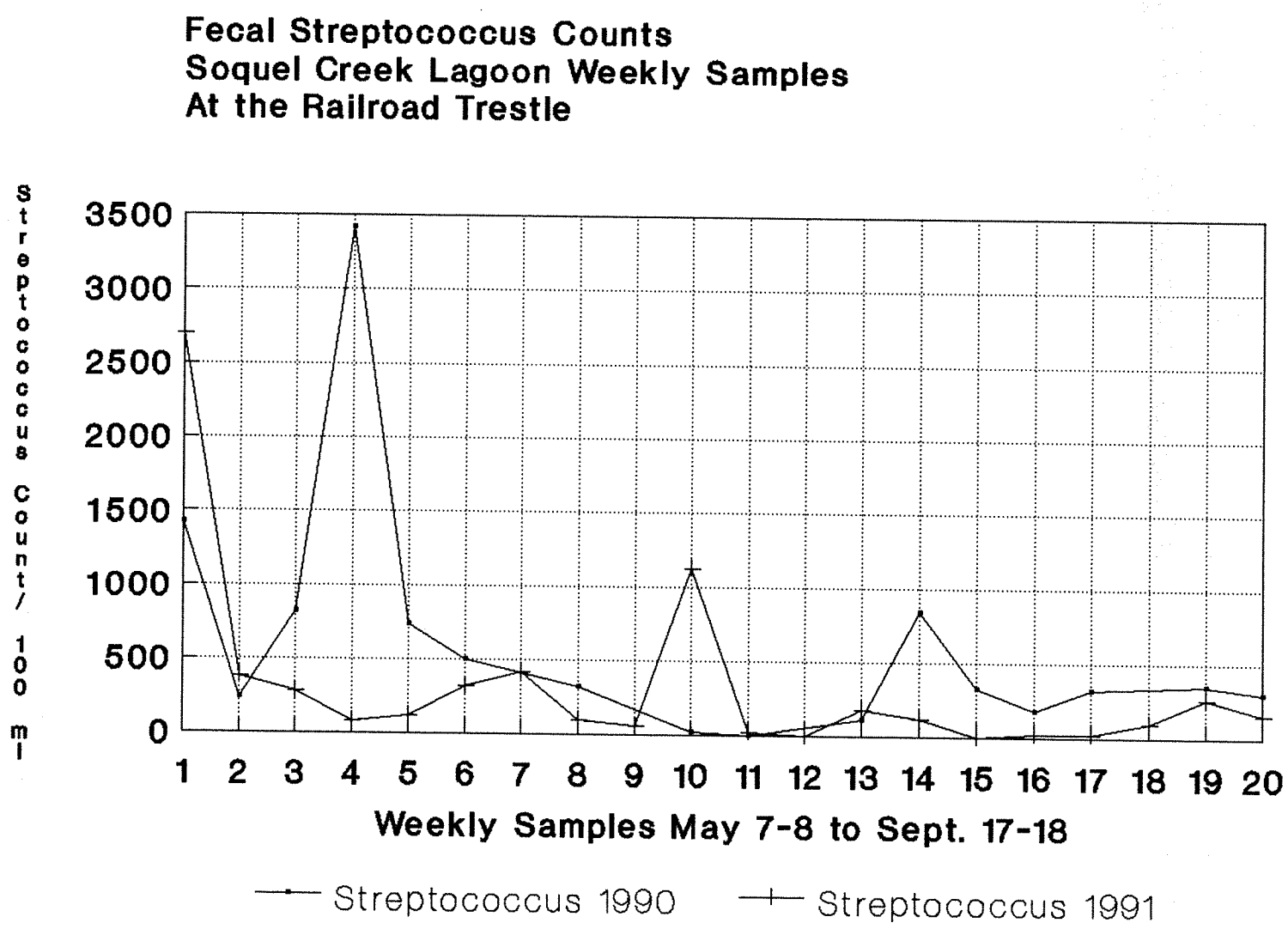
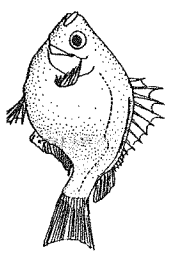


Figure 4. Fecal Streptococcus Counts at the railroad trestle, comparing 1990 and 1991. (S.C. County Data)



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

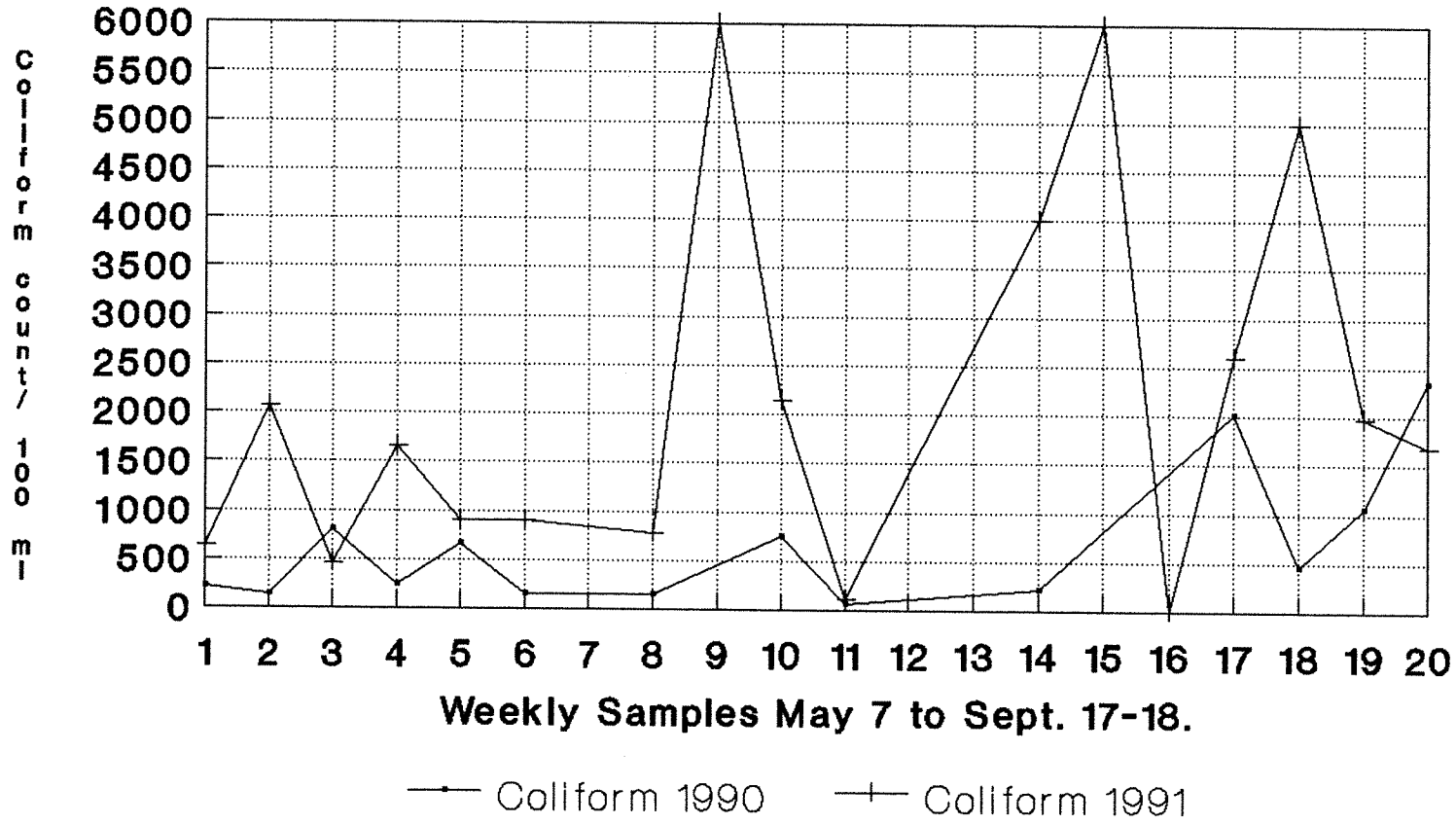
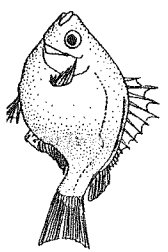


Figure 5. Fecal coliform counts at tunnel and Bay Street on Noble Gulch, comparing 1990 to 1991.(S.C.County Data)



Fecal Streptococcus Counts
Noble Gulch Weekly Samples
at Tunnel and Bay Street

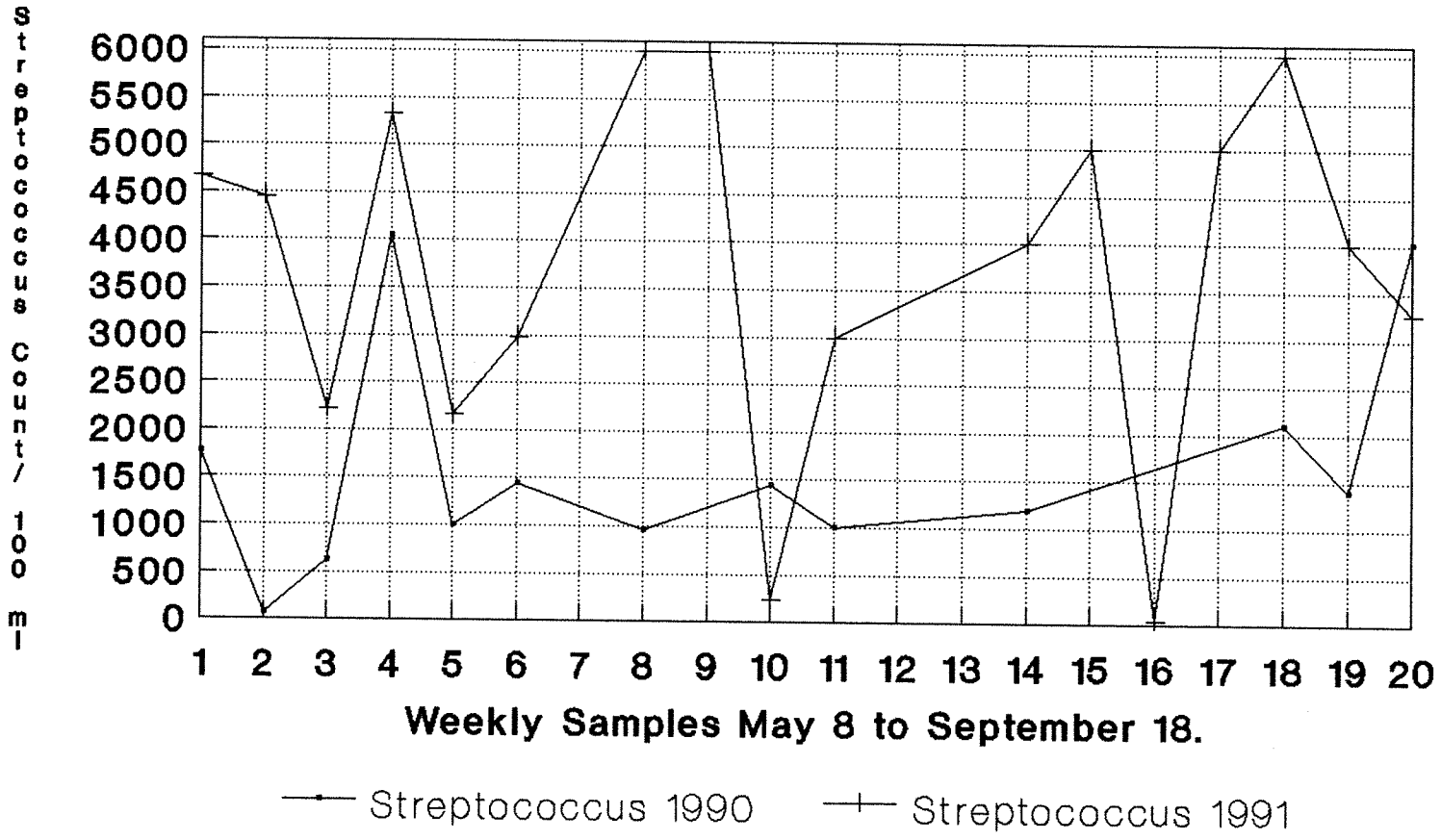
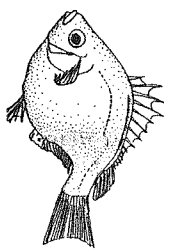


Figure 6. Fecal streptococcus count in Noble Gulch at tunnel and Bay Street, comparing 1990 to 1991.(S.C.County Data)



Fecal Coliform Bacterial Counts
Soquel Creek Lagoon Weekly Samples, 1991
Comparison of Stations

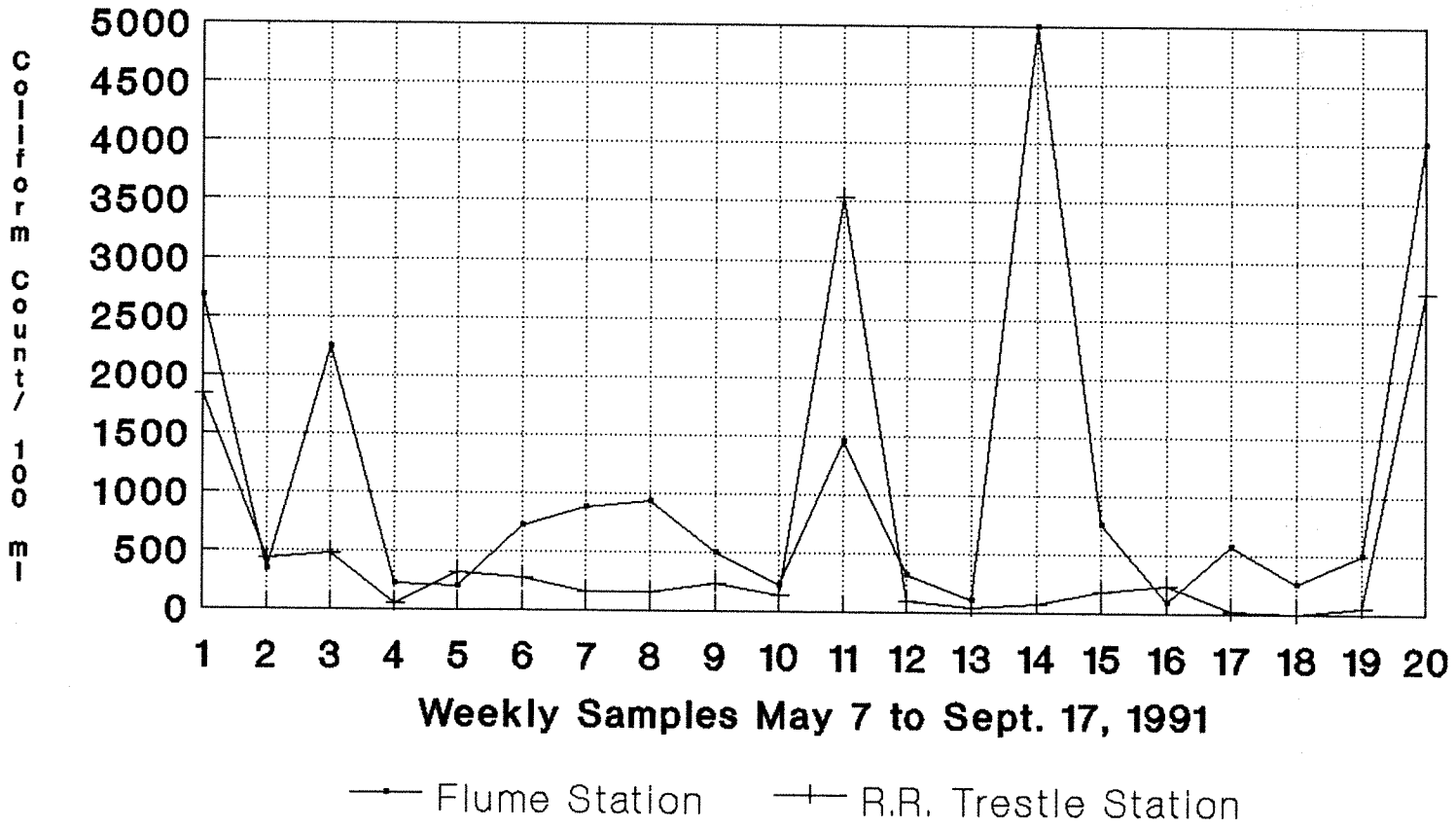
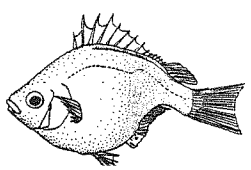


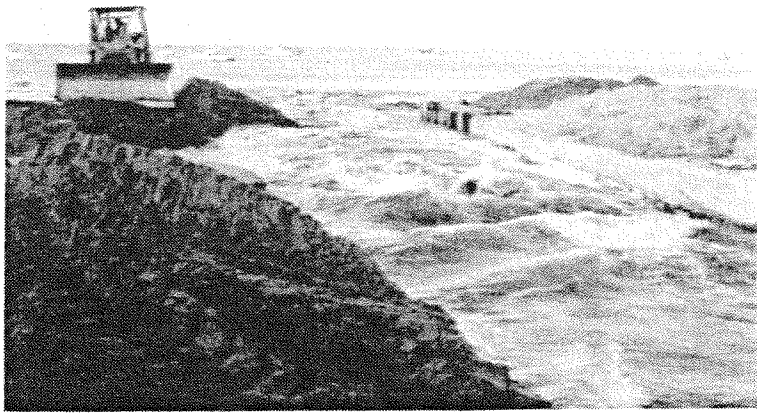
Figure 7. Comparison of Fecal Coliform Counts for the Flume and Trestle Stations, 1991. (S.C. County Data)

APPENDIX A.

PHOTOGRAPHS, 1990-91

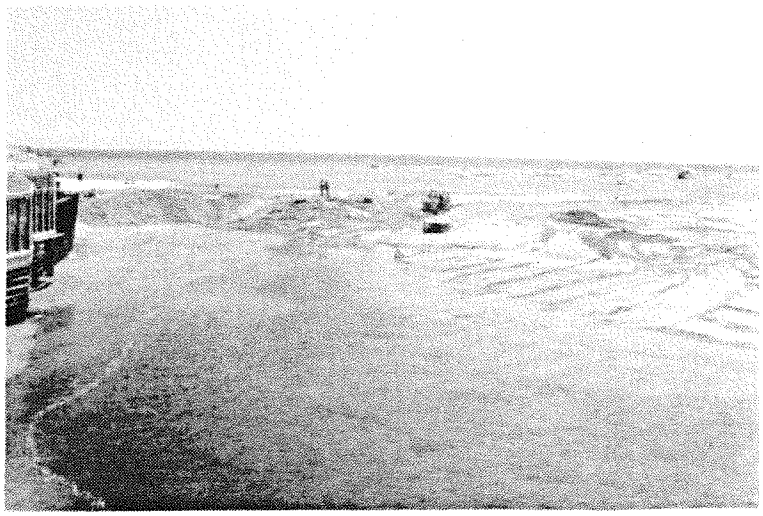


Sandbar Construction 15May91

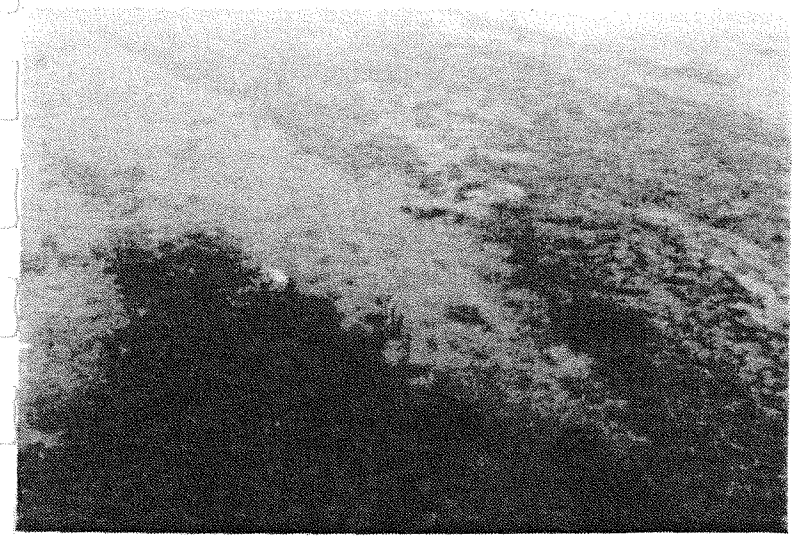


Sandbar Opening 16May91

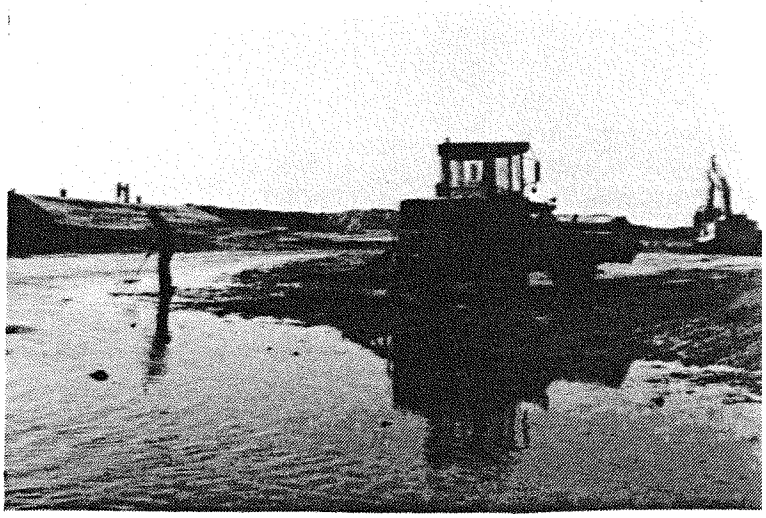
Sandbar Construction 16May91



Sandbar Construction 17May91

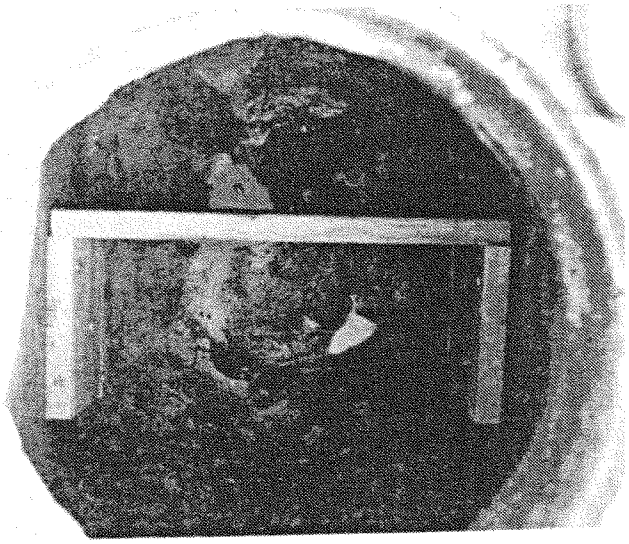


Decomposing Kelp, 15May91

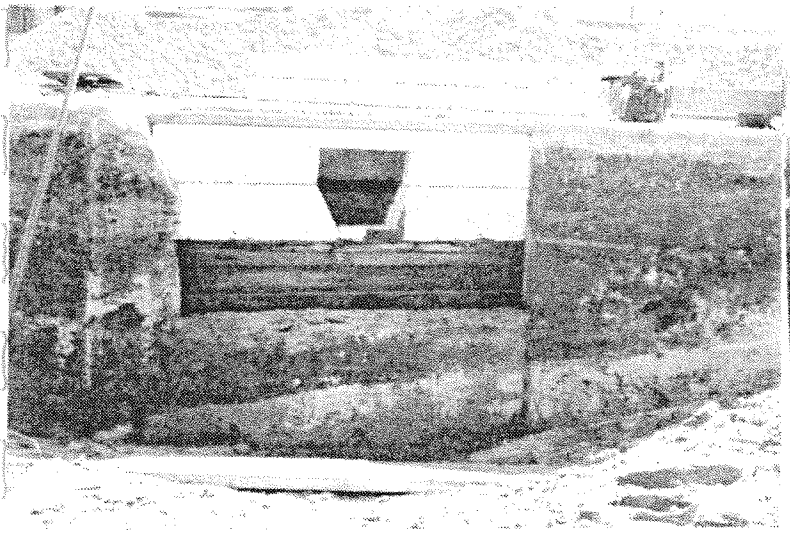


Hand Raking and Backhoe Raking

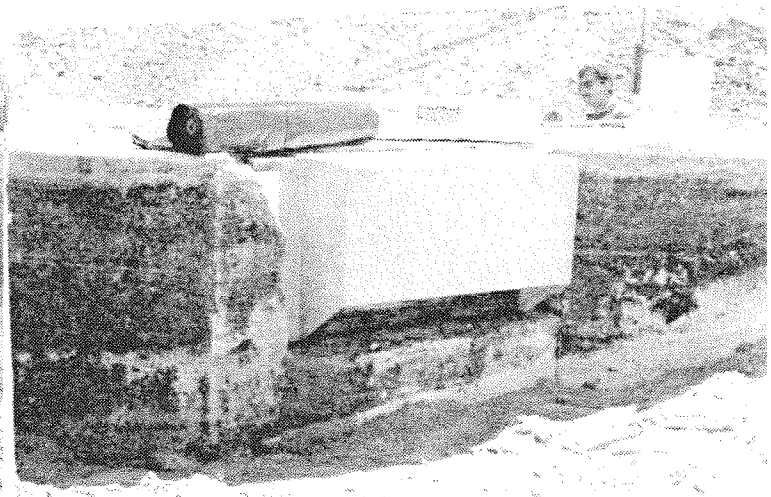
Plastic Sheeting, Flume Entrance



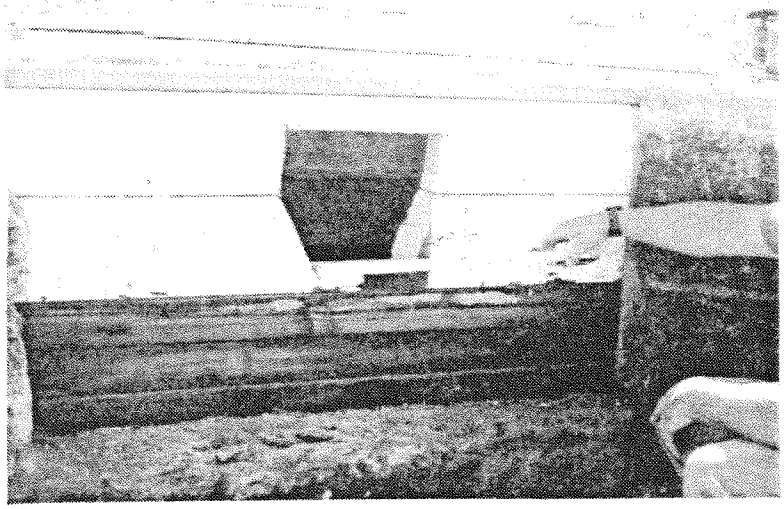
12" Plank Inside Flume



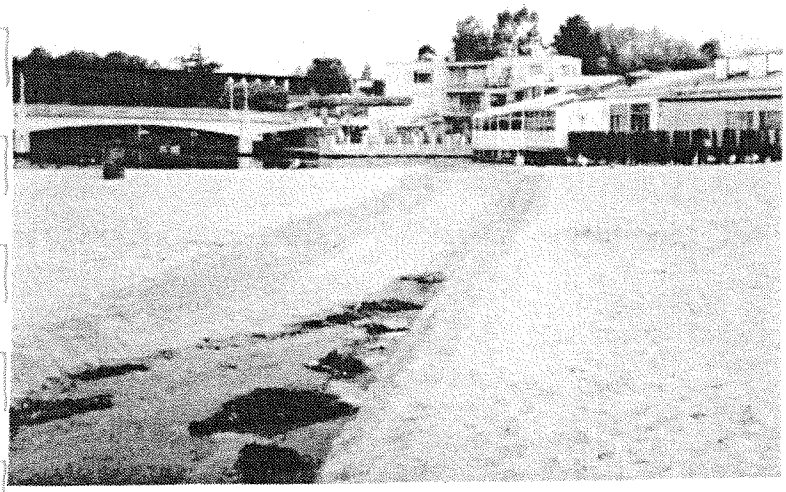
Side Portal for Adult Fish



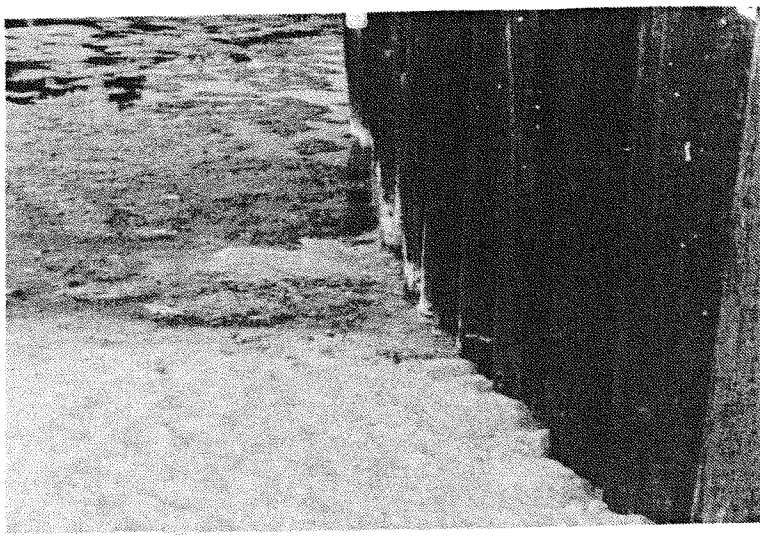
Shroud Over Flume Entrance



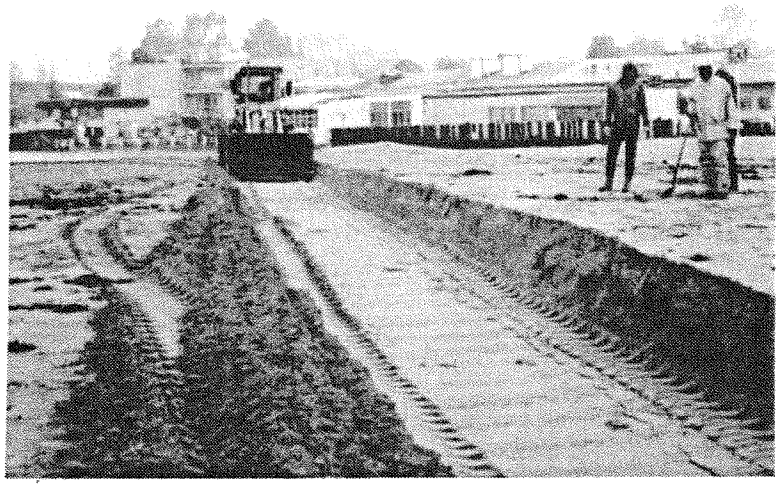
Portal 8" at Base



Notch in Sandbar, Early Fall, 1990



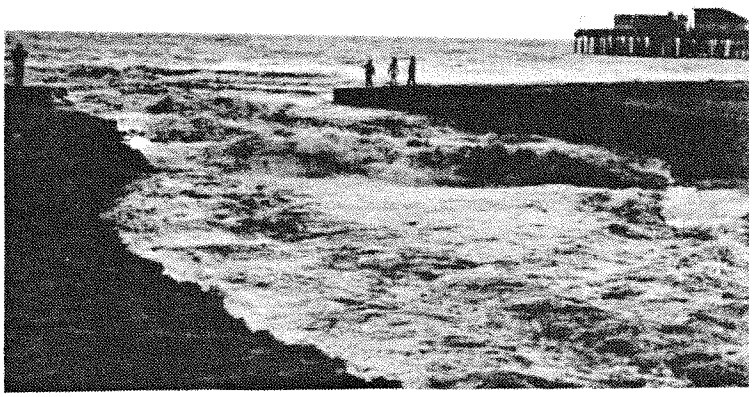
Piling Bolt Near Sand



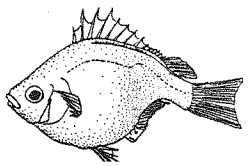
New Notch, Late-Season Breach, 7Feb91

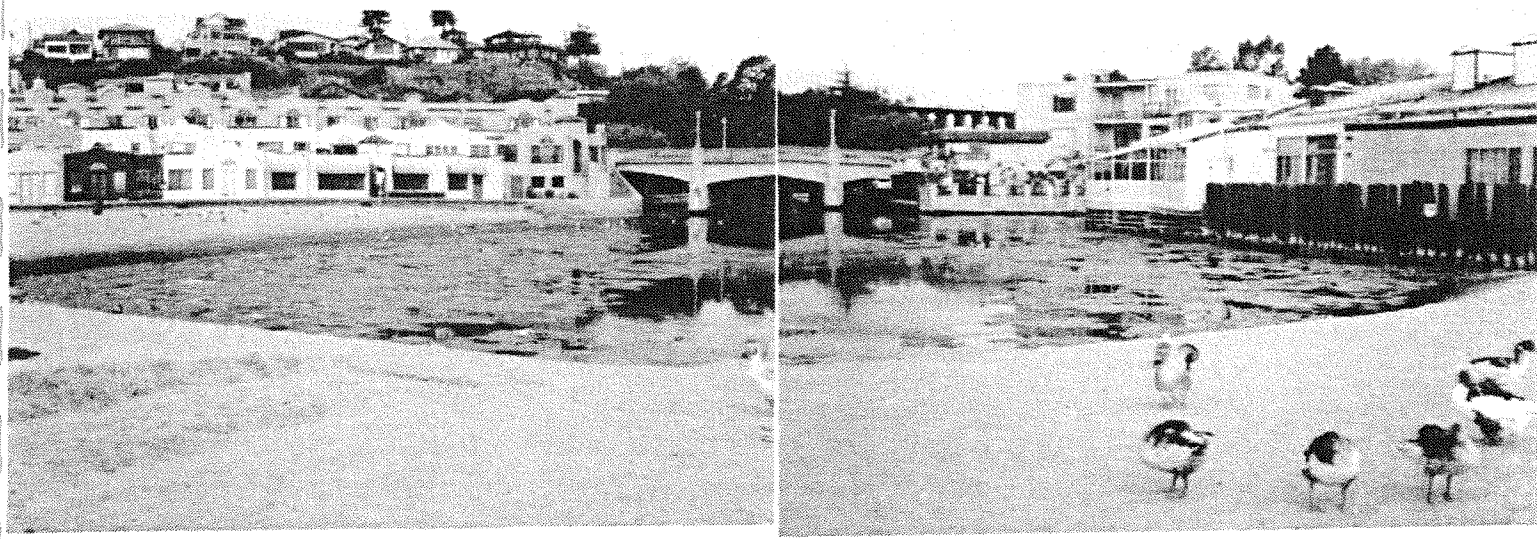
Breach with a Shovel

Notch Deepening, 7Feb91

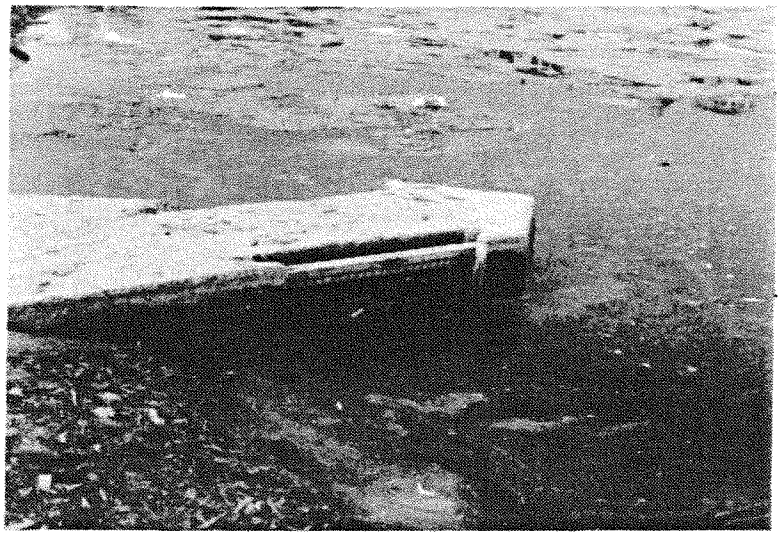


Full Breach, Foolish Observers

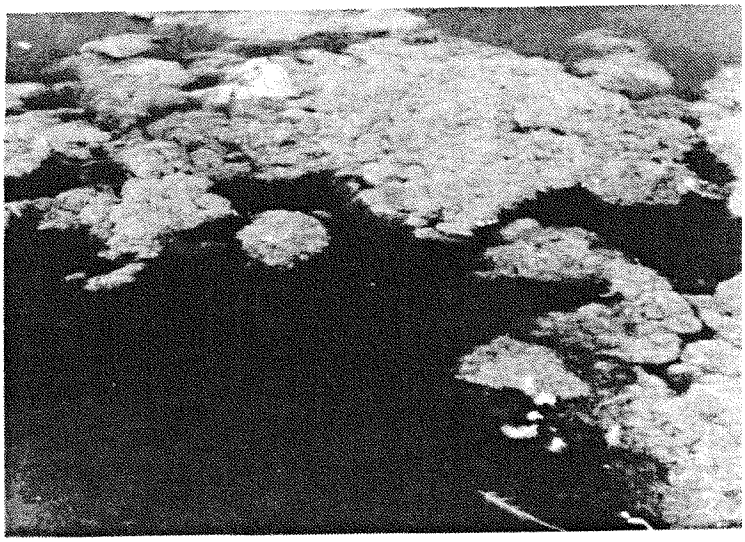




Floating Algae in the Lower Lagoon (Reach 1), 14Nov90

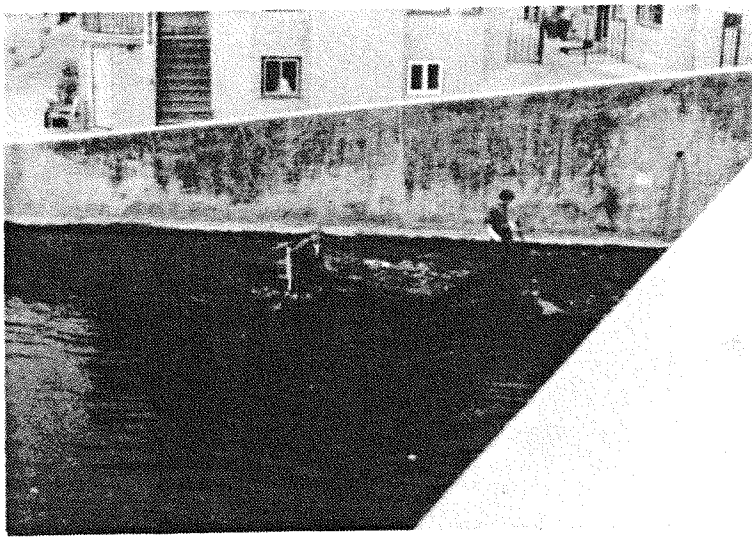


Flume Ready for Fall Storm 14Nov90

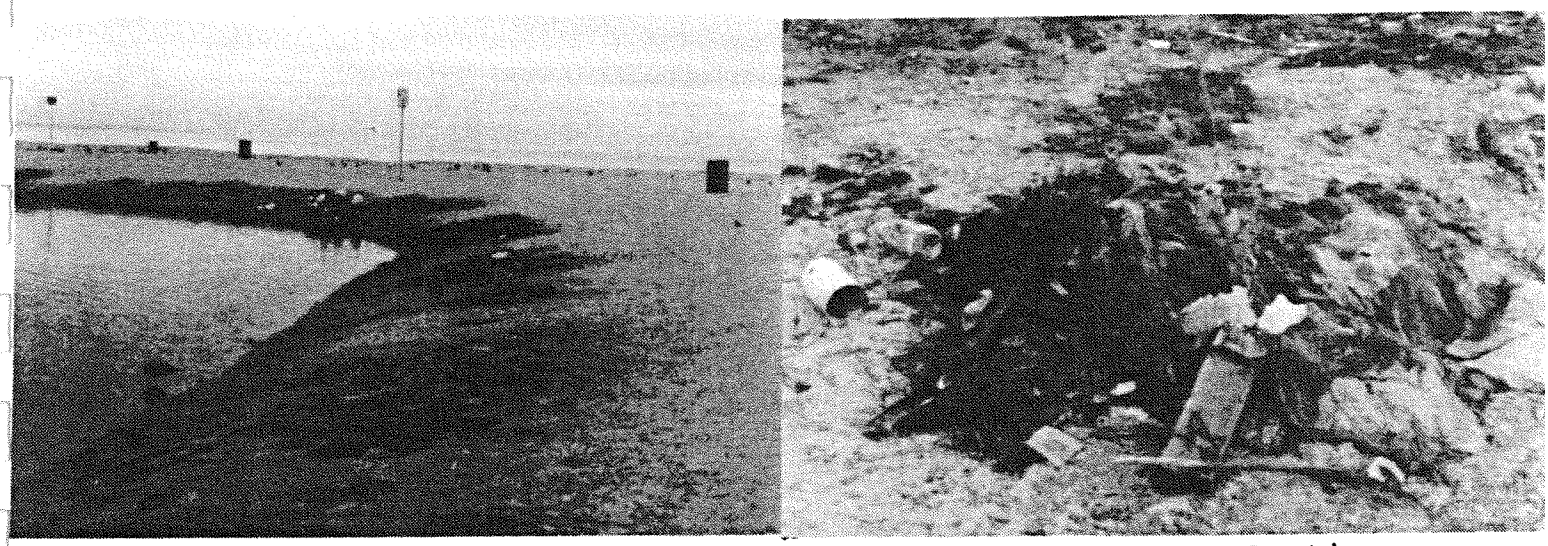


Algal Spires on Surface

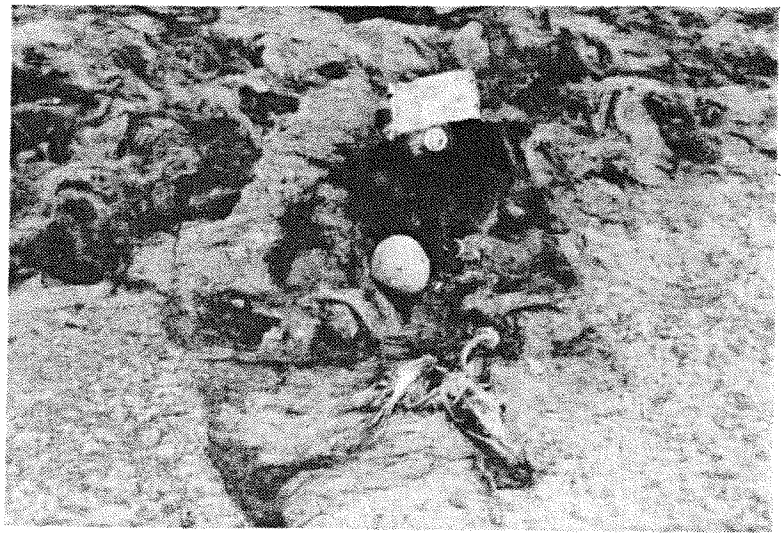
Algae Skimming to the Beach



Algae Collection With Barge



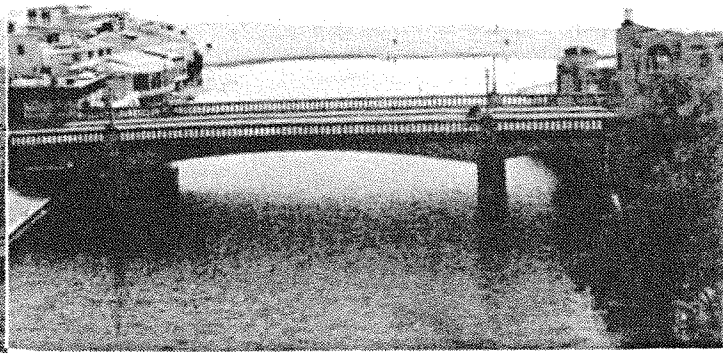
Skimmed Algae and Refuse at Lagoon Margin, Ready for Collection



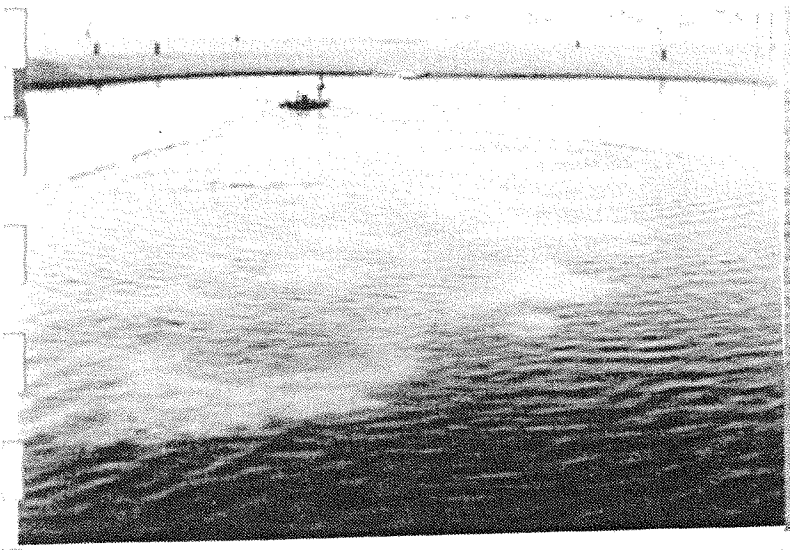
Refuse Collects in Algae 16Nov90

Reach 3 27July91

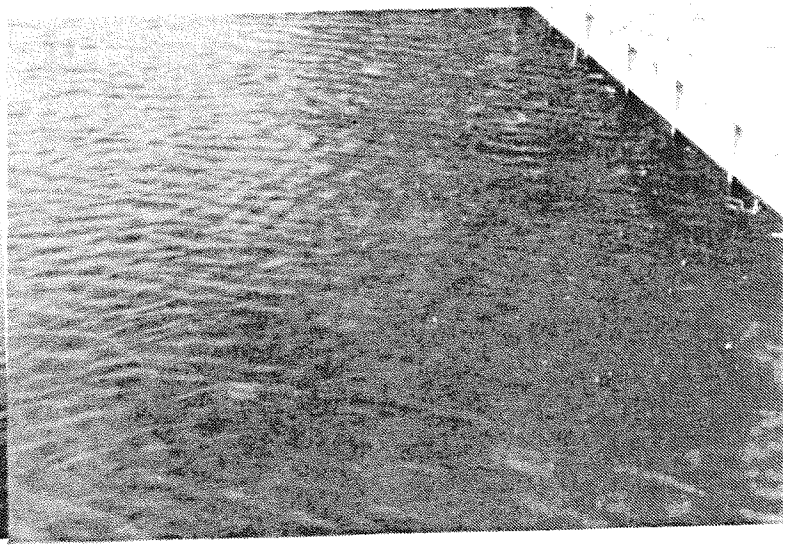
Reaches 1 and 2 11Oct91



Open Estuary March 1991

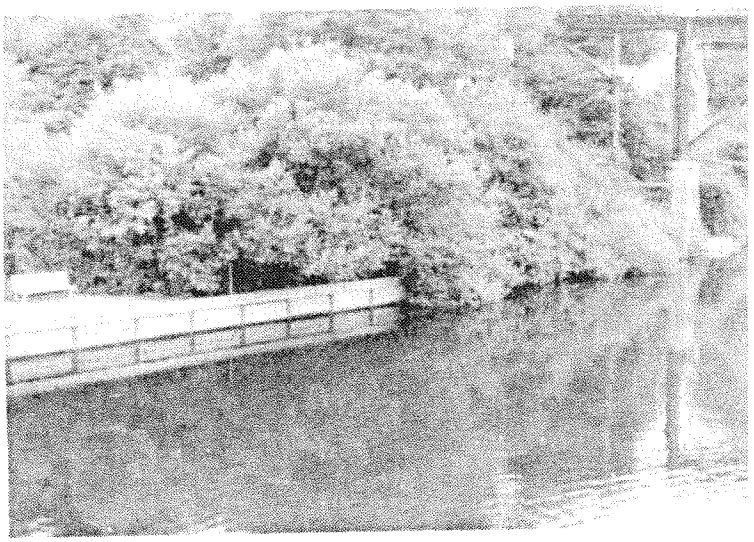


Aquazine Application 30Aug91

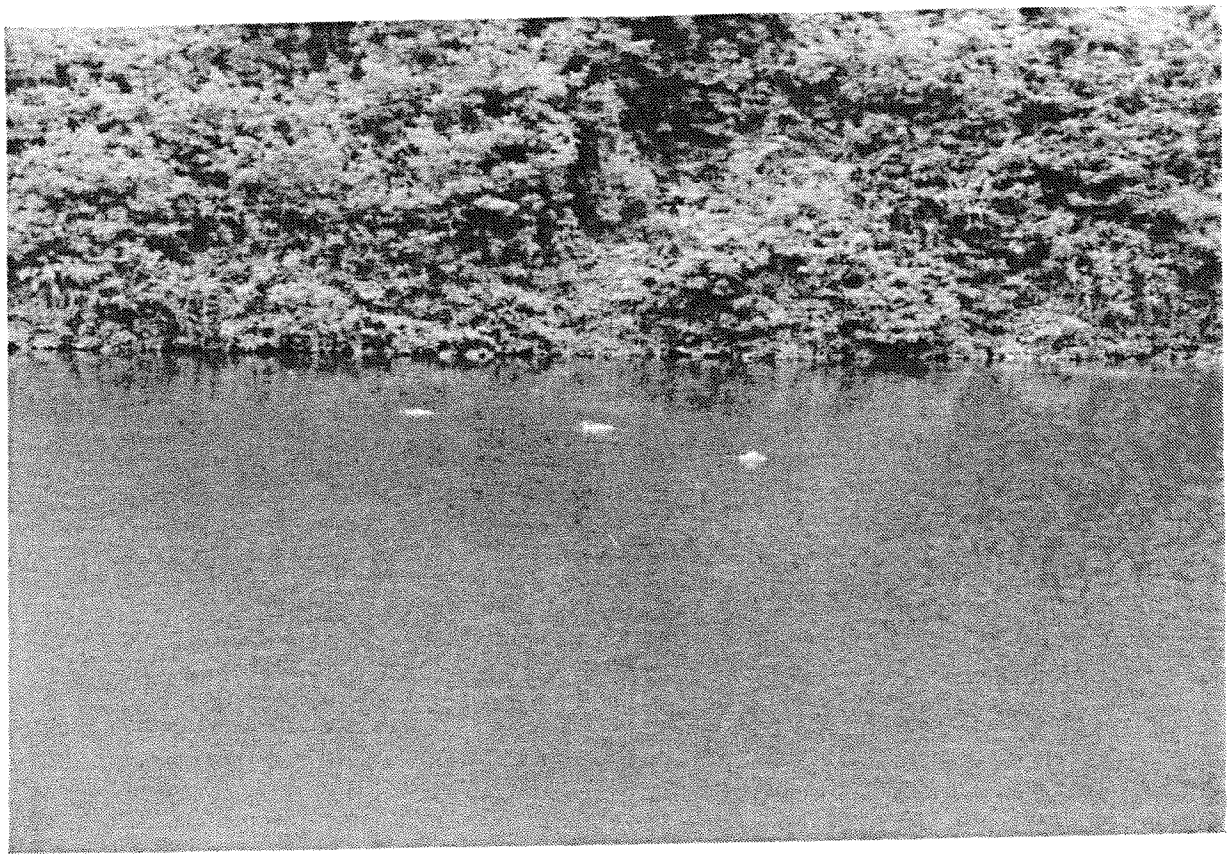


Low-lying Algae, Reach 2 12Sep91

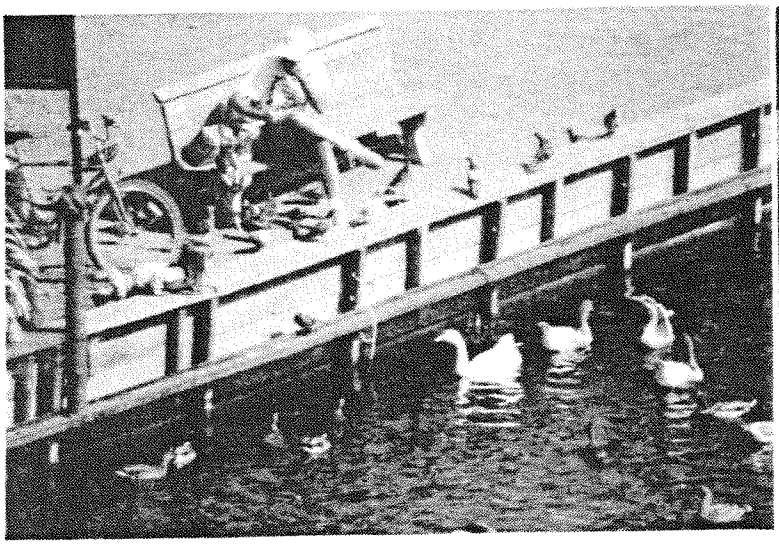
Algae & Pondweed, Reach 2 30Aug91



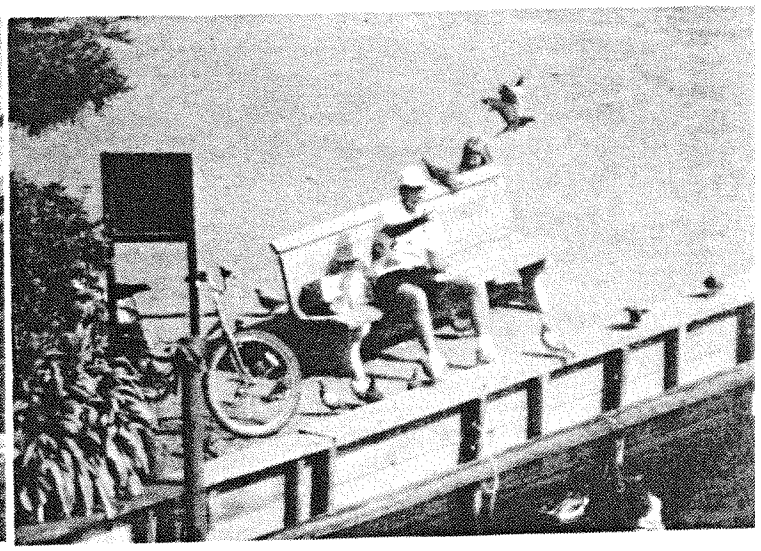
Riparian Vegetation 12Sep91



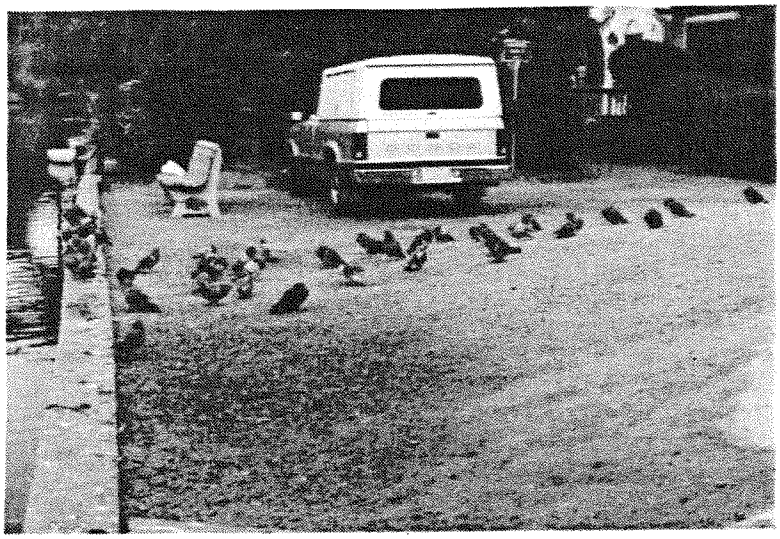
Red-breasted Mergansers in Formation, Reach 3 27July91



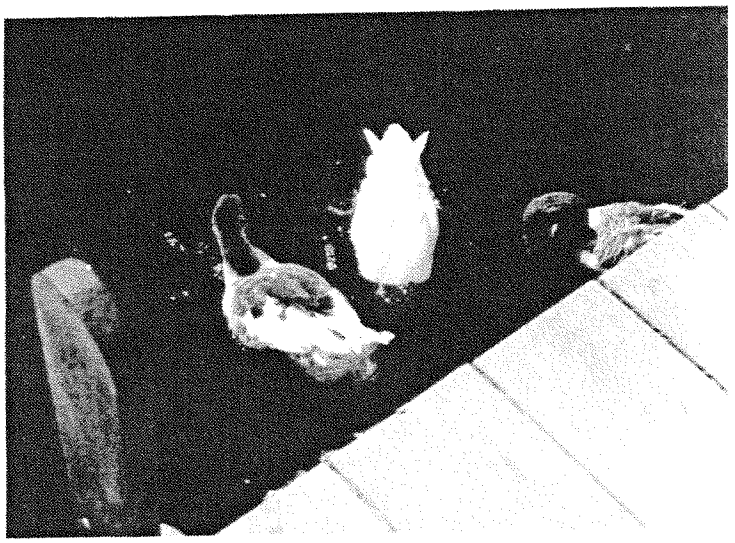
Bird Feeding During Monitoring



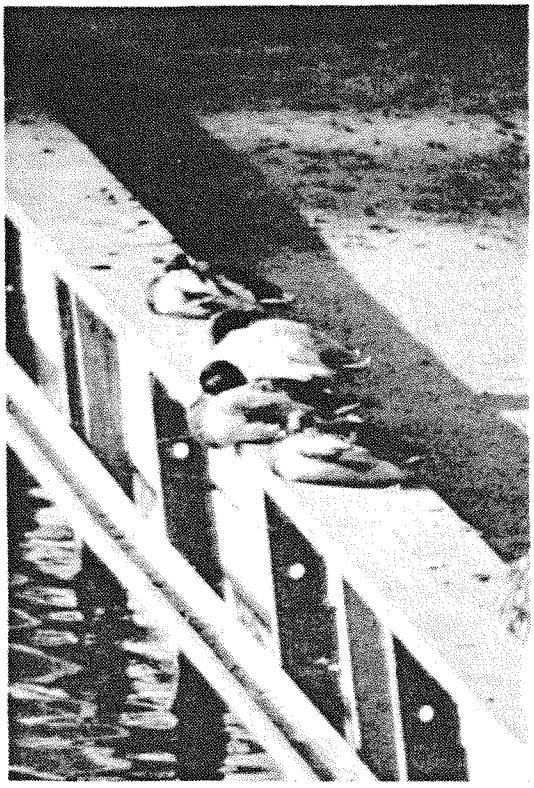
Warning Sign Used as a Bike Rest



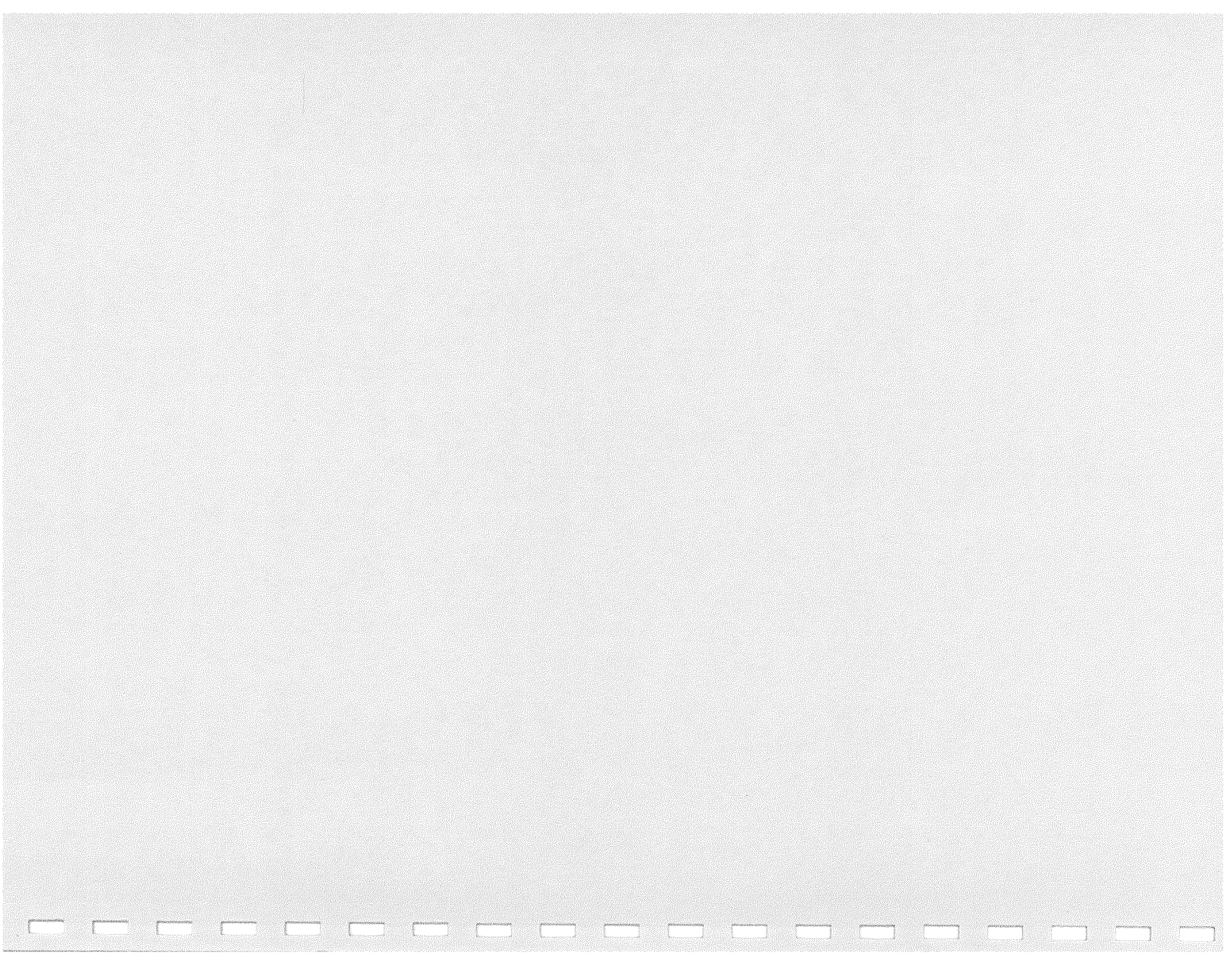
Pigeons Roosting at Park, Reach 2



Large Duck Teaching Geese to Feed on Aquatic Vegetation

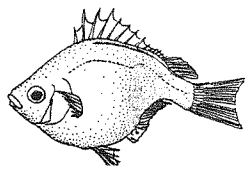


Domestic Mallards Roosting on the Bulkhead, Reach 2
Bird Droppings Nearby



APPENDIX B.

FISH AND GAME AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION



Notification No. III-450-91 THP No. _____

AGREEMENT REGARDING PROPOSED STREAM OR LAKE ALTERATION

THIS AGREEMENT, entered into between the State of California, Department of Fish and Game, hereinafter called the Departmen 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 10 day of May 19 91, notified the Department that he intends to substantially divert or obstruct the natural flow of, or substantially change the bec channel, or bank of, or use material from the streambed of, the following water: Soquel Creek, in the County o Santa Cruz, State of California, S - T - R -.

WHEREAS, the Department (represented by Dennis Baldwin has made an inspection of subject area on th 15 day of May, 19 91, and) has determined tha such operations may substantially adversely affect existing fish and wildlife resources including: Steelhead, salmon, Tidewater gobies, non-game fish, riperian strip bird life and animal life

THEREFORE, the Department hereby proposes measures to protect fish and wildlife during the operator's work. The operator hereb 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:

1. All work in or near the stream or lake shall be confined to the period May 15, 1991 to Oct. 15, 1991.
2. This project shall be limited to damming of Soquel Creek at the mouth, subject to 'below conditions.
3. All seaweed shall be removed from the channel bottom before damming occurs. (25' of the
4. No equipment shall be driven through the water (except for the minimum to cross to the other side to continue work) except for the actual closing. A backhoe bucket may be used only to skim seaweed from the lagoon. All digging shall occ
5. The steel/shroud placed in 1990 shall be placed on the flume.
6. All excess water shall go through the existing flume system.
7. Provisions shall be made to maintain a minimum of 8-12" of water through the flum
8. The flume shall be kept open to the ocean until at least July 1, 1991
9. After damming occurs, no drawdown will be allowed without prior DFG approval
10. Provisions shall be made to remove any beaches that enter the water from the beach fast
11. Operator shall contact DFG prior to breaching the sandbar unless flooding is imminent
12. The area within 25' of the flume and the 10' edge may be contoured with care. The work shall be done without affecting the existing water level.

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 Ed Morrison

Title Mgr. + Supt

Organization City of Capitola

Date 5-15-91

Department Representative

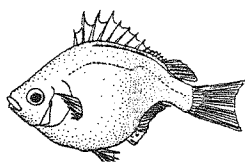
Title Game Warden

Department of Fish and Game, State of California

Date D.W. ALLEY & Associates

APPENDIX C.

DETAILED INVENTORY OF INVERTEBRATE SAMPLES



DETAILED INVENTORY OF INVERTEBRATE SAMPLES

30 August 1991. Invertebrate sampling was completed before the aquazine treatment. In Reach 1, downstream of the Stockton Avenue Bridge, algae and pondweed covered 70 % of the bottom, with all but 15 square feet being 1 foot below surface. The 15 square feet on the surface was near Margaritaville. It made up about 2 % of the surface downstream of the bridge.

Station: Near flume.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle- back
1	8	12					6
2	4	14	4	1			6
3	6	9					3
4	12	6					4

Station: Midway between flume and bridge

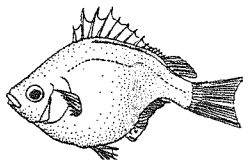
Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle- back
1		2					8
2		1					8
3		5					6

Station: Just upstream of Stockton Avenue Bridge

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle- back
1		2	1	60			

Station: Midway between Stockton Avenue Bridge and Trestle

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle- back
1 (algae only)		2					
2 (algae only)		1	1				
3 (algae only)		1					1
4 (algae only)		2					



5 (algae only)	1	1				1
6 (algae only)	2					
7 (algae only)	1					

Station: Near Railroad trestle

1	14	12		75	1	
2		20	2	80	50	2
3	12	6				4

Station: Adjacent Dock Downstream of Noble Gulch

Sample #	**Water boatmen**	**Mayfly larvae**	**Physa snails**	**Isopods**	**Neomysis shrimp**	**Aniso- gammurus**	**Stickle- back**
1	10	4					
2	5	3					

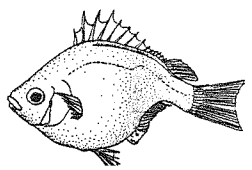
All samples were taken in pondweed with algae attached to it except where noted.

2 September 1991. In Reach 1, downstream of the Stockton Avenue Bridge, there was a 20-foot border around the entire margin of the lagoon without any vegetation. This was where the aquazine was applied in highest dosage. Of the remaining 50 % of the remaining lower lagoon, 60 % of the bottom was covered with pondweed with attached algae surrounding only the lower 20 % of each plant. 50 % of the pondweed appeared alive. Algae appeared reduced and was brownish-green. The algae had fallen away and 50 % of the algae appeared alive. 10 % of the bottom within the central 50 % of the lower lagoon was covered with algae alone that was 0.5 - 1 foot high. In summary, about 30 % of the lower lagoon was covered with pondweed and attached algae, and 5 % was covered with just algae. Before the aquazine application, algae clung to the pondweed. No fish mortality was observed. No invertebrates were found in dead algae by itself.

In Reach 2, between the bridge and the trestle, 40 % of the bottom was covered with pondweed, stripped of algae except near the base of plants. 20 % of the bottom was covered with brownish-green algae less that 0.5 feet high. 40 % of the bottom was bare sand. No fish mortality was observed.

In Reach 3, algae and pondweed were green. 20% of the bottom was pondweed with algae at its base and 60 % was algae less than 1 foot high. No fish mortality was observed.

Station: Near flume. Pondweed and algae mostly brown. A 20-



foot area around the entire perimeter of the lower lagoon was without any vegetation. This included about 50 % of the lower lagoon bottom.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle-back
1	4	10				1	2
2		2			85		1
3		1			40		2
4					70		2
5	2	12			80		6

Station: Midway from flume to Stockton Avenue Bridge. Most pondweed and algae was brown and presumed dead.

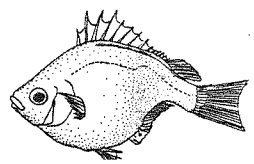
Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle-back
1		6			26		6
2		4			40		
3		7			50		4
4							1
5		1			4		

Station: Under Railroad trestle, east side. Pondweed was alive, but most of the algae was gone.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle-back
1	6	1		80		5	2
2	2	6	2	40		2	2
3	4	11		50			2

Station: Adjacent Dock downstream of Noble Gulch. Pondweed and algae appeared unaffected by aquazine treatment downstream.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso- gammurus	Stickle-back
1				85			
2	10	3		62			1



13 September 91. In Reach 1, all pondweed was dead. Invertebrates were found among dead pondweed with live algae around it. Algae was growing back with 3-4 inch high patches on 50 % of bottom. Pondweed was dead adjacent to Stockton Avenue park on east side near bridge. In Reach 2, 50 % of bottom was covered with algae, 3-4 inches high. 2/3 of pondweed has disappeared since 2 September, leaving about 10 % of bottom with pondweed. In Reach 3, 80 % of bottom with low-lying algae and pondweed 0.5 feet tall. Tall pondweed (1-3 feet high) has been reduced by 2/3 since 2 September, leaving it covering about 5 % of the bottom.

Station: Near flume.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso-gammurus	Stickle-back
1	4	7			72		5
2	1	14			102		4
3	1	7			106		1
4		7	4				1
5		2				4	

Station: Halfway from flume to Stockton Avenue Bridge.

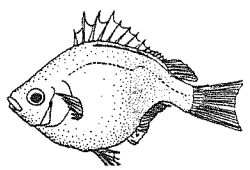
Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso-gammurus	Stickle-back
1		14					4
2		7			24	2	
3		4			18	5	

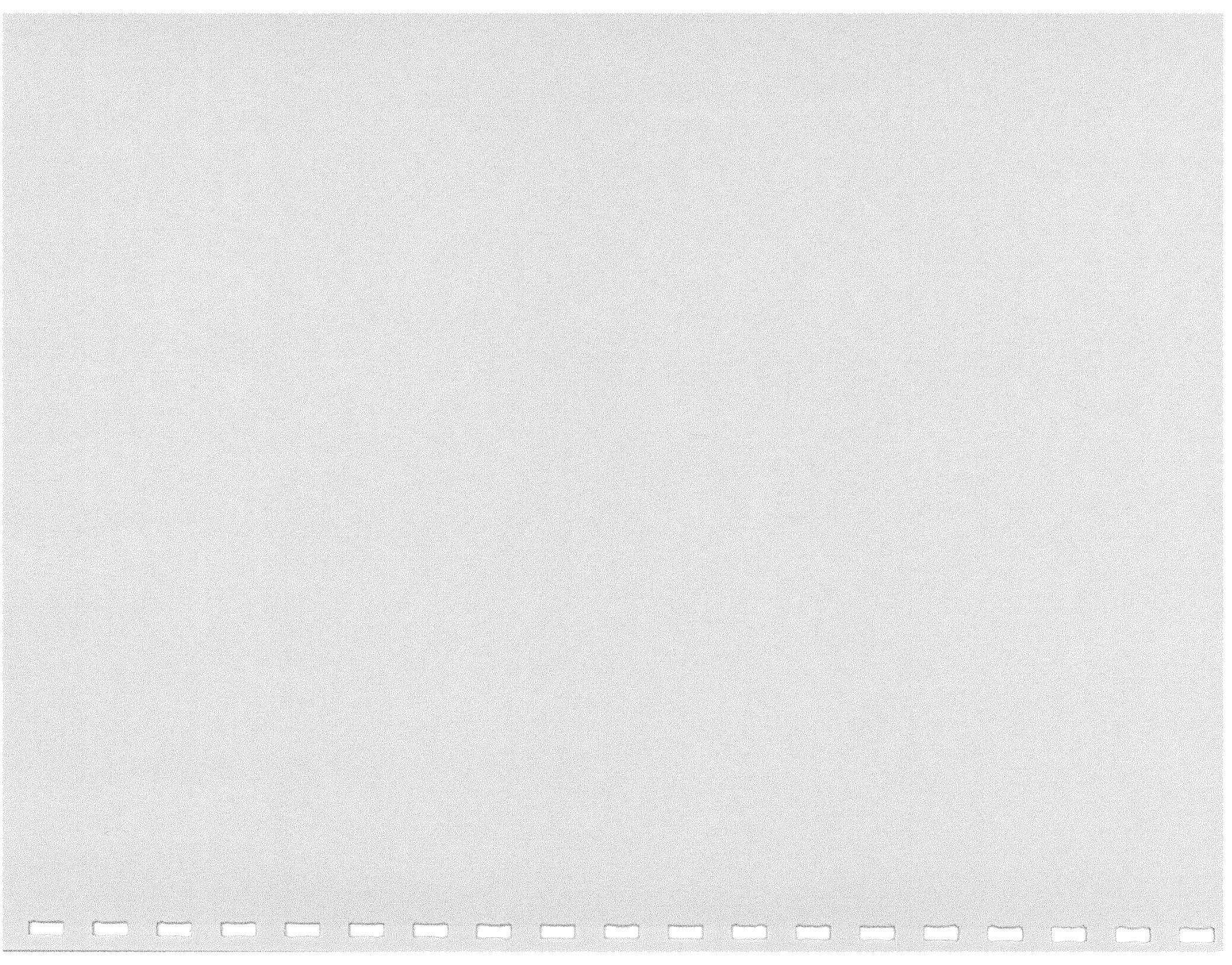
Station: Under trestle, east side.

Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso-gammurus	Stickle-back
1		4	5	120			

Station: Adjacent Dock downstream of Noble Gulch

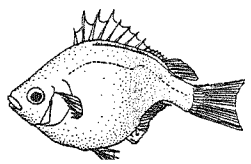
Sample #	Water boatmen	Mayfly larvae	Physa snails	Isopods	Neomysis shrimp	Aniso-gammurus	Stickle-back
1	35	37		85			





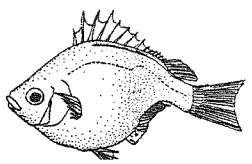
APPENDIX D.

Santa Cruz County Water Monitoring Data, 1990-91.

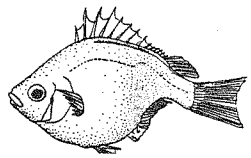


STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
S26	SOQUEL CREEK ABOVE SOQUEL DR.	03-Apr-90	12:10 PM	14		60	48	1.3	CLEAR WATER.
S26	SOQUEL CREEK ABOVE SOQUEL DR.	10-Apr-90	11:10 AM	15		80	104	0.8	WATER CLEAR.
S26	SOQUEL CREEK ABOVE SOQUEL DR.	01-May-90	12:10 PM	17		224	304	0.7	WATER CLEAR, SOME ALGAL DECAY.
S26	SOQUEL CREEK ABOVE SOQUEL DR.	08-May-90	12:45 PM	17		108	324	0.3	CLEAR H2O.
S26	SOQUEL CREEK ABOVE SOQUEL DR.	12-Jun-90	10:10 AM	16		796	804	1.0	
S26	SOQUEL CREEK ABOVE SOQUEL DR.	26-Jun-90	10:10 AM	16		230	530	0.4	
S26	SOQUEL CREEK ABOVE SOQUEL DR.	10-Jul-90	01:15 PM	22		240	310	0.8	
S26	SOQUEL CREEK ABOVE SOQUEL DR.	17-Jul-90	10:30 AM	19		380	560	0.7	
S26	SOQUEL CREEK ABOVE SOQUEL DR.	11-Sep-90	11:20 AM	19		110	180	0.6	SOME ALGAL GROWTH
S26	SOQUEL CREEK ABOVE SOQUEL DR.	16-Oct-90	10:15 AM	14		290	585	0.5	ALGAL GROWTH
S26	SOQUEL CREEK ABOVE SOQUEL DR.	23-Oct-90	11:25 AM	14		125	240	0.5	ALGAL GROWTH
S26	SOQUEL CREEK ABOVE SOQUEL DR.	30-Oct-90	10:15 AM	13		140	436	0.3	WATER CLEAR, ALGAL GROWTH ON BOTTOM
S26	SOQUEL CREEK ABOVE SOQUEL DR.	06-Nov-90	10:15 AM	10		75	130	0.6	WATER CLEAR
S26	SOQUEL CREEK ABOVE SOQUEL DR.	13-Nov-90	10:30 AM	12		72	132	0.5	WATER CLEAR, ALGAL GROWTH ON BOTTOM
S26	SOQUEL CREEK ABOVE SOQUEL DR.	27-Nov-90	10:00 AM	8		70	480	0.1	WATER CLEAR
S26	SOQUEL CREEK ABOVE SOQUEL DR.	15-Jan-91	11:45 AM	11		30	70	0.4	WATER CLEAR, ALGAL GROWTH
S26	SOQUEL C ABOVE SOQUEL DR	21-May-91	11:40 AM	14		190	1120	0.2	WATER CLEAR
S26	SOQUEL C ABOVE SOQUEL DR	11-Jun-91	11:30 AM	15		200	1540	0.1	WATER CLEAR
S254	SOQUEL CREEK BELOW SOQUEL DR.	24-Apr-90	12:25 PM	16		550	595	0.9	PIGEONS UNDER BRIDGE, CLEAR WATER.
S254	SOQUEL CREEK BELOW SOQUEL DR.	01-May-90	12:10 PM	17		520	690	0.8	PIGEONS UNDER BRIDGE.
S254	SOQUEL CREEK BELOW SOQUEL DR.	08-May-90	12:45 PM	17		675	655	1.0	PIGEONS UNDER BRIDGE, CLEAR H2O.
S254	SOQUEL CREEK BELOW SOQUEL DR.	15-May-90	10:30 AM	15		495	530	0.9	PIGEONS UNDER BRIDGE, 6 DUCKS UPSTREAM
S254	SOQUEL CREEK BELOW SOQUEL DR.	26-Jun-90	10:10 AM	17		770	970	0.8	PIGEONS UNDER BRIDGE
S254	SOQUEL CREEK BELOW SOQUEL DR.	10-Jul-90	01:15 PM	22		2500	1700	1.5	PIGEONS UNDER BRIDGE
S254	SOQUEL CREEK BELOW SOQUEL DR.	17-Jul-90	10:30 AM	19		5440	2180	2.5	PIGEONS UNDER BRIDGE
S254	SOQUEL CREEK BELOW SOQUEL DR.	07-Aug-90	11:40 AM	20		2820	1410	2.0	PIGEONS UNDER BRIDGE
S254	SOQUEL CREEK BELOW SOQUEL DR.	16-Oct-90	10:15 AM	14		1005	1005	1.0	WATER CLEAR, 3 DUCKS
S254	SOQUEL CREEK BELOW SOQUEL DR.	23-Oct-90	11:25 AM	13		1550	1740	0.9	ALGAL GROWTH, DECAYING ORGANIC MATTER
S254	SOQUEL CREEK BELOW SOQUEL DR.	30-Oct-90	10:15 AM	12		2780	2800	1.0	PIGEONS UNDER BRIDGE
S254	SOQUEL CREEK BELOW SOQUEL DR.	06-Nov-90	10:15 AM	10		2240	3040	0.7	WATER CLEAR
S254	SOQUEL CREEK BELOW SOQUEL DR.	13-Nov-90	10:30 AM	11		1020	1240	0.8	WATER CLEAR
S254	SOQUEL CREEK BELOW SOQUEL DR.	19-Nov-90	11:40 AM	13		620	860	0.7	MANY PIGEONS UNDER BRIDGE,6 DUCKS UPST
S254	SOQUEL CREEK BELOW SOQUEL DR.	27-Nov-90	10:00 AM	8		300	420	0.7	WATER CLEAR
S254	SOQUEL CREEK BELOW SOQUEL DR.	04-Dec-90	11:00 AM	7		180	60	3.0	WATER CLEAR
S254	SOQUEL C BELOW SOQUEL DR	11-Mar-91	11:05 AM	9		3860	2010	1.9	RAIN 3/10
S254	SOQUEL C BELOW SOQUEL DR	21-May-91	11:45 AM	14		330	1100	0.3	WATER CLEAR
S254	SOQUEL C BELOW SOQUEL DR	11-Jun-91	11:35 AM	15		600	2120	0.3	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	03-Apr-90	12:00 PM	15		1010	270	3.7	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	10-Apr-90	11:20 AM	16		670	500	1.3	WATER CLEAR.
S23	SOQUEL CREEK @ NOB HILL	17-Apr-90	12:30 PM	17		1080	380	2.8	WATER CLEAR, FISH.
S23	SOQUEL CREEK @ NOB HILL	24-Apr-90	12:35 PM	16		610	270	2.3	CLEAR WATER.
S23	SOQUEL CREEK @ NOB HILL	01-May-90	12:20 PM	17		560	410	1.4	FISH IN WATER.
S23	SOQUEL CREEK @ NOB HILL	08-May-90	12:55 PM	17		640	420	1.5	WATER CLEAR.
S23	SOQUEL CREEK @ NOB HILL	15-May-90	10:40 AM	15		270	310	0.9	WATER CLEAR.
S23	SOQUEL CREEK @ NOB HILL	22-May-90	10:45 AM	17		640	560	1.1	
S23	SOQUEL CREEK @ NOB HILL	29-May-90	10:20 AM	14		1160	3160	0.4	STRONG H2O FLOW.
S23	SOQUEL CREEK @ NOB HILL	05-Jun-90	10:45 AM	17		920	620	1.5	WATER CLEAR.
S23	SOQUEL CREEK @ NOB HILL	12-Jun-90	10:30 AM	16		220	1380	0.2	
S23	SOQUEL CREEK @ NOB HILL	26-Jun-90	10:20 AM	17		1120	900	1.2	

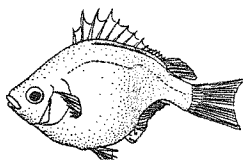
PRINT DATE: 07/02/91



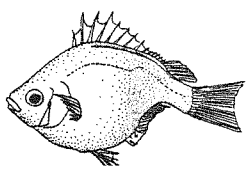
STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
23	SOQUEL CREEK @ NOB HILL	10-Jul-90	01:25 PM	21		340	520	0.7	
S23	SOQUEL CREEK @ NOB HILL	17-Jul-90	10:40 AM	19		600	740	0.8	
S23	SOQUEL CREEK @ NOB HILL	07-Aug-90	11:50 AM	19		60	340	0.2	
23	SOQUEL CREEK @ NOB HILL	13-Aug-90	10:30 AM	18		10	60	0.2	
23	SOQUEL CREEK @ NOB HILL	28-Aug-90	11:20 AM	19		120	210	0.6	WATER CLEAR.
S23	SOQUEL CREEK @ NOB HILL	04-Sep-90	11:25 AM	18		40	60	0.7	WATER CLEAR
23	SOQUEL CREEK @ NOB HILL	06-Sep-90	11:10 AM	15		60	ERR	ERR	SOME OILY SPOTS ON WATER
23	SOQUEL CREEK @ NOB HILL	11-Sep-90	11:30 AM	19		740	280	2.6	WATER SOMEWHAT CLOUDY
S23	SOQUEL CREEK @ NOB HILL	18-Sep-90	11:30 AM	19		0	100	0.0	VERY LITTLE H2O FLOW, GREYISH WATER.
S23	SOQUEL CREEK @ NOB HILL	25-Sep-90	10:55 AM			110	310	0.4	
23	SOQUEL CREEK @ NOB HILL	02-Oct-90	10:55 AM	17		170	500	0.3	CLEAR WATER
23	SOQUEL CREEK @ NOB HILL	10-Oct-90	12:25 PM	19		10	50	0.2	VERY LITTLE WATER FLOW, SLOW MOVING
S23	SOQUEL CREEK @ NOB HILL	16-Oct-90	10:30 AM	15		60	295	0.2	ALGAL GROWTH
23	SOQUEL CREEK @ NOB HILL	23-Oct-90	11:35 AM	16		20	85	0.2	ALGAL GROWTH
23	SOQUEL CREEK @ NOB HILL	30-Oct-90	10:25 AM	14		52	100	0.5	ALGAL GROWTH
S23	SOQUEL CREEK @ NOB HILL	06-Nov-90	10:25 AM	12		148	272	0.5	WATER CLEAR, ALGAE ON CREEK BOTTOM
S23	SOQUEL CREEK @ NOB HILL	13-Nov-90	10:15 AM	12		1216	1005	1.2	WATER SOMEWHAT OILY
23	SOQUEL CREEK @ NOB HILL	19-Nov-90	11:30 AM	14		30	90	0.3	ALGAL GROWTH
S23	SOQUEL CREEK @ NOB HILL	27-Nov-90	10:15 AM	9		276	476	0.6	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	01-Dec-90	11:45 AM	11		712	1592	0.4	WATER CLEAR, RAIN 12/10
23	SOQUEL CREEK @ NOB HILL	04-Dec-90	11:10 AM	10		20	40	0.5	ALGAL GROWTH
23	SOQUEL CREEK @ NOB HILL	18-Dec-90	10:00 AM	8		115	285	0.4	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	02-Jan-91	11:40 AM	7		20	175	0.1	WATER CLEAR
23	SOQUEL CREEK @ NOB HILL	08-Jan-91	10:30 AM	10		52	165	0.3	WATER CLEAR
23	SOQUEL CREEK @ NOB HILL	15-Jan-91	11:50 AM	11		35	35	1.0	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	28-Jan-91	11:35 AM	10		35	60	0.6	WATER CLEAR
S23	SOQUEL CREEK @ NOB HILL	11-Feb-91	11:20 AM	13		108.33	100	1.1	WATER CLEAR.
23	SOQUEL C @ NOB HILL	25-Feb-91	11:50 AM	14		98	66	1.5	WATER CLEAR, SETTLED ORGANIC MATTER
S23	SOQUEL C @ NOB HILL	11-Mar-91	11:15 AM	9		1144	566	2.0	RAIN 3/10
S23	SOQUEL C @ NOB HILL	18-Mar-91	10:40 AM	9		680	1180	0.6	RAIN SUNDAY
23	SOQUEL C @ NOB HILL	01-Apr-91	10:25 AM	12		340	1400	0.2	
23	SOQUEL C @ NOB HILL	08-Apr-91	11:50 AM	11		120	280	0.4	WATER CLEAR
S23	SOQUEL C @ NOB HILL	15-Apr-91	11:55 AM	12		120	380	0.3	WATER CLEAR
23	SOQUEL C @ NOB HILL	23-Apr-91	11:40 AM	13		140	200	0.7	WATER CLEAR
23	SOQUEL C @ NOB HILL	30-Apr-91	11:35 AM	15		120	100	1.2	WATER CLEAR
S23	SOQUEL C @ NOB HILL	07-May-91	10:45 AM	16		360	380	0.9	WATER CLEAR
S23	SOQUEL C @ NOB HILL	14-May-91	10:55 AM	14		680	1620	0.4	WATER CLEAR
23	SOQUEL C @ NOB HILL	21-May-91	12:00 PM	15		320	1360	0.2	WATER CLEAR
S23	SOQUEL C @ NOB HILL	28-May-91	12:45 PM	16		360	320	1.1	WATER CLEAR
S23	SOQUEL C @ NOB HILL	04-Jun-91	11:45 AM	14		420	1300	0.3	WATER CLEAR
23	SOQUEL C @ NOB HILL	11-Jun-91	11:50 AM	16		340	720	0.5	WATER CLEAR
23	SOQUEL C @ NOB HILL	18-Jun-91				260	280	0.9	
S23	SOQUEL C @ NOB HILL	25-Jun-91	10:30 AM	17		260	220	1.2	WATER CLEAR
12	NOBLE GULCH @ TUNNEL @ BAY AVE	03-Apr-90	11:50 AM	14		980	740	1.3	
12	NOBLE GULCH @ TUNNEL @ BAY AVE	10-Apr-90	11:30 AM	15		80	320	0.3	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	17-Apr-90	12:40 PM	16		100	220	0.5	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	24-Apr-90	12:45 PM	15		340	190	1.8	
12	NOBLE GULCH @ TUNNEL @ BAY AVE	30-Apr-90	12:30 PM	14		150	260	0.6	LOW H2O FLOW.
12	NOBLE GULCH @ TUNNEL @ BAY AVE	07-May-90	12:05 PM	15		220	1760	0.1	LOW H2O LEVEL, ALGAL DECAY.



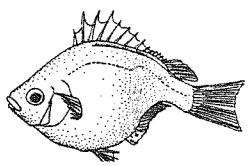
STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	14-May-90	12:45 PM	15		140	60	2.3	CLEAR H2O, LOW FLOW.
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	22-May-90	11:00 AM	17		810	620	1.3	CLEAR H2O
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	29-May-90	10:10 AM	16		240	4040	0.1	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	05-Jun-90	11:00 AM	16		660	1000	0.7	LOW H2O FLOW, CLEAR WATER.
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	12-Jun-90	10:40 AM	16		160	1440	0.1	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	26-Jun-90	10:30 AM	15		160	960	0.2	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	10-Jul-90	01:35 PM	21		760	1440	0.5	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	17-Jul-90	10:40 AM	19		60	1000	0.1	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	07-Aug-90	12:05 PM	18		220	1200	0.2	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	04-Sep-90	11:15 AM	16		2010	2100	1.0	WATER FLOW HIGHER THAN USUAL
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	06-Sep-90	10:30 AM	16		460	ERR	ERR	WATER FLOW LESS THAN TUESDAY
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	11-Sep-90	11:40 AM	17		1060	1400	0.8	WATER CLOUDY
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	18-Sep-90	11:20 AM	16		2340	4020	0.6	BRUSH CLEARED ALONG CREEK BANKS
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	25-Sep-90	11:05 AM			1200	2650	0.5	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	02-Oct-90	11:05 AM	16		600	4400	0.1	SOME OIL FILM ON WATER
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	10-Oct-90	12:15 PM	14		500	1600	0.3	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	16-Oct-90	10:40 AM	14		1850	5900	0.3	LOW WATER FLOW, SOMEWHAT CLOUDY H20
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	23-Oct-90	11:45 AM	13		4000	10050	0.4	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	30-Oct-90	10:35 AM	12		1200	3900	0.3	
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	06-Nov-90	10:35 AM	10		2050	4100	0.5	ORGANIC MATTER ON WATER
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	13-Nov-90	10:05 AM	10		2200	9550	0.2	LEAVES ON WATER, WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	19-Nov-90	11:20 AM	13		400	3900	0.1	LEAVES ON WATER
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	27-Nov-90	10:25 AM	8		1950	8600	0.2	WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	04-Dec-90	11:20 AM	7		1350	3950	0.3	WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	10-Dec-90	11:05 AM	9		300	8550	0.0	DOG FECES IN CREEK
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	11-Dec-90	11:55 AM	12		1050	10500	0.1	WATER SOMEWHAT CLOUDY, RAIN 12/10
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	18-Dec-90	09:45 AM	6		1100	800	1.4	WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	02-Jan-91	11:30 AM	6		150	50	3.0	LOW WATER FLOW, WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	08-Jan-91	10:45 AM	10		1600	950	1.7	WATER SOMEWHAT CLOUDY
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	15-Jan-91	12:00 PM	11		800	800	1.0	WATER SOMEWHAT CLOUDY AT ONE SPOT
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	28-Jan-91	11:25 AM	8		402.5	340	1.2	WATER CLEAR
S12	NOBLE GULCH @ TUNNEL @ BAY AVE	11-Feb-91	11:05 AM	12		730	468	1.6	WATER CLEAR.
S12	NOBEL G @ TUNNEL @ BAY	25-Feb-91	11:40 AM	12		1132	936	1.2	LOW WATER FLOW
S12	NOBEL G @ TUNNEL @ BAY	01-Mar-91	10:50 AM	10		790	1410	0.6	RAIN 3/10
S12	NOBEL G @ TUNNEL @ BAY	18-Mar-91	10:30 AM	11		940	2700	0.3	RAIN SUNDAY
S12	NOBEL G @ TUNNEL @ BAY	01-Apr-91	10:15 AM	13		620	780	0.8	LIGHT BROWN WATER
S12	NOBEL G @ TUNNEL @ BAY	08-Apr-91	11:40 AM	12		2700	14880	0.2	BROWNISH-COLORED WATER
S12	NOBEL G @ TUNNEL @ BAY	15-Apr-91	11:20 AM	12		1240	6500	0.2	GRAYISH WATER
S12	NOBEL G @ TUNNEL @ BAY	23-Apr-91	11:30 AM	14		840	980	0.9	SOMEWHAT GRAY WATER
S12	NOBEL G @ TUNNEL @ BAY	30-Apr-91	11:25 AM	14		1800	6680	0.3	GRAYISH WATER
S12	NOBEL G @ TUNNEL @ BAY	07-May-91	10:35 AM	15		640	4660	0.1	WATER SLIGHTLY CLOUDY
S12	NOBEL G @ TUNNEL @ BAY	14-May-91	10:40 AM	13		2060	4440	0.5	SLIGHTLY GRAY WATER
S12	NOBEL G @ TUNNEL @ BAY	21-May-91	12:10 PM	14		460	2220	0.2	WATER SOMEWHAT CLOUDY
S12	NOBEL G @ TUNNEL @ BAY	28-May-91	12:35 PM	14		1660	5320	0.3	WATER SLIGHTLY CLOUDY
S12	NOBEL G @ TUNNEL @ BAY	04-Jun-91	11:35 AM	14		900	2160	0.4	WATER CLEAR, SETTLED ORGANIC MATTER
S12	NOBEL G @ TUNNEL @ BAY	11-Jun-91	11:15 AM	14		900	2980	0.3	WATER SLIGHTLY CLOUDY
S12	NOBEL G @ TUNNEL @ BAY	25-Jun-91	10:15 AM	15		780	6002	0.1	WATER CLEAR
S1	SOQUEL C @ NOBEL G	06-Sep-90	11:00 AM	21	730	20	ERR	ERR	ALGAL GROWTH
S1	SOQUEL C @ NOBEL G	19-Nov-90	11:10 AM	13		160	200	0.8	SOMEWHAT MURKY WATER



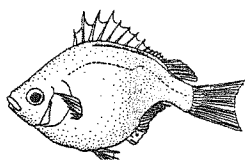
STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
S1	SOQUEL C @ NOBEL G	04-Dec-90	11:47 AM	10	760	20	180	0.1	SOME DUCKS
S1	SOQUEL C @ NOBEL G	11-Dec-90	12:10 PM	11		1770	3640	0.5	OILY WATER, RAIN 12/10
S1	SOQUEL C @ NOBEL G	18-Dec-90	10:15 AM	9		1330	6540	0.2	WATER CLEAR
S1	SOQUEL C @ NOBEL G	02-Jan-91	11:55 AM	8		20	80	0.3	WATER CLEAR, SOME BIRDS IN WATER
S1	SOQUEL C @ NOBEL G	08-Jan-91	11:05 AM	10		300	500	0.6	MURKY WATER
S06	SOQUEL CREEK AT TRESTLE	03-Apr-90	11:40 AM	15	1290	490	210	2.3	
S06	SOQUEL CREEK AT TRESTLE	10-Apr-90	11:40 AM	16	10	2530	1210	2.1	A FEW DUCKS IN WATER.
S06	SOQUEL CREEK AT TRESTLE	17-Apr-90	12:50 PM	21	10	680	240	2.8	WATER LEVEL LOW, CLEAR WATER.
S06	SOQUEL CREEK AT TRESTLE	24-Apr-90	12:55 PM	21	10	1180	1520	0.8	
S06	SOQUEL CREEK AT TRESTLE	01-May-90	12:30 PM	22	10	40	180	0.2	NO BIRDS, LOW H2O LEVEL, CLEAR WATER.
S06	SOQUEL CREEK AT TRESTLE	08-May-90	01:05 PM	23	10	440	1420	0.3	WATER CLEAR, LOW H2O LEVEL.
S06	SOQUEL CREEK AT TRESTLE	15-May-90	11:00 AM	18	1490	40	240	0.2	CLEAR H2O,PATCH OF BLACK DECAYING MATT
S06	SOQUEL CREEK AT TRESTLE	22-May-90	11:15 AM	19	1320	2140	820	2.6	DARK BROWN H2O, BIRDS IN WATER.
S06	SOQUEL CREEK AT TRESTLE	29-May-90	10:35 AM	15	630	840	3420	0.2	
S06	SOQUEL CREEK AT TRESTLE	05-Jun-90		19	10	860	740	1.2	SEAGULLS UPSTREAM, CLEAR H2O
S06	SOQUEL CREEK AT TRESTLE	12-Jun-90	10:50 AM	20	980	580	500	1.2	
S06	SOQUEL CREEK AT TRESTLE	26-Jun-90	10:40 AM	21	860	440	320	1.4	SOME DUCKS IN WATER.
S06	SOQUEL CREEK AT TRESTLE	10-Jul-90	01:40 PM	24	780	340	20	17.0	
S06	SOQUEL CREEK AT TRESTLE	17-Jul-90	10:50 AM	23	10	240	0	ERR	
S06	SOQUEL CREEK AT TRESTLE	07-Aug-90		22	920	60	110	0.5	
S06	SOQUEL CREEK AT TRESTLE	13-Aug-90	10:40 AM	22	1180	380	840	0.5	SOME DUCKS IN WATER, WATER LOOKS FILTH
S06	SOQUEL CREEK AT TRESTLE	20-Aug-90	10:20 AM	22	1980	400	330	1.2	
S06	SOQUEL CREEK AT TRESTLE	28-Aug-90	11:10 AM	22	660	400	180	2.2	
S06	SOQUEL CREEK AT TRESTLE	04-Sep-90	11:40 AM	23	870	220	320	0.7	WATER CLEAR
S06	SOQUEL CREEK AT TRESTLE	06-Sep-90	10:50 AM	21	730	300	ERR	ERR	WATER CLEAR
S06	SOQUEL CREEK AT TRESTLE	11-Sep-90	11:50 AM	22	1120	30	350	0.1	WATER CLEAR
S06	SOQUEL CREEK AT TRESTLE	18-Sep-90	11:40 AM	21	1420	10	300	0.0	
S06	SOQUEL CREEK AT TRESTLE	25-Sep-90	11:15 AM			250	70	3.6	
S06	SOQUEL CREEK AT TRESTLE	02-Oct-90	11:15 AM	20	1250	220	350	0.6	SOMEWHAT MURKY WATER
S06	SOQUEL CREEK AT TRESTLE	10-Oct-90	12:05 PM	19	1070	170	20	8.5	
S06	SOQUEL CREEK AT TRESTLE	16-Oct-90	10:50 AM	17	1440	110	140	0.8	ALGAL GROWTH, SOME DUCKS
S06	SOQUEL CREEK AT TRESTLE	23-Oct-90	12:05 PM	18	1130	40	70	0.6	ALGAL GROWTH + DUCKS
S06	SOQUEL CREEK AT TRESTLE	30-Oct-90	10:45 AM	16	1180	80	50	1.6	ALGAL GROWTH ON CREEK BOTTOM
S06	SOQUEL CREEK AT TRESTLE	06-Nov-90	10:45 AM	13	750	580	310	1.9	SOMEWHAT MURKY WATER
S06	SOQUEL CREEK AT TRESTLE	13-Nov-90	10:00 AM	14	600	10	30	0.3	WATER CLEAR, ALGAL GROWTH ON BOTTOM
S06	SOQUEL CREEK AT TRESTLE	19-Nov-90	11:00 AM	15	880	75	35	2.1	MANY DUCKS UPSTREAM
S06	SOQUEL CREEK AT TRESTLE	27-Nov-90	10:45 AM	11	760	760	930	0.8	WATER CLEAR, DUCKS IN WATER
S06	SOQUEL CREEK AT TRESTLE	04-Dec-90	11:28 AM	10	1750	30	50	0.6	WATE CLEAR, ALGAE ON BOTTOM
S06	SOQUEL CREEK AT TRESTLE	11-Dec-90		12	540	1140	1840	0.6	DUCKS UPSTREAM, RAIN 12/10
S06	SOQUEL CREEK AT TRESTLE	18-Dec-90	10:00 AM	9	780	90	300	0.3	WATER CLEAR
S06	SOQUEL CREEK AT TRESTLE	02-Jan-91	12:00 PM	7		50	130	0.4	SOME BIRDS IN WATER
S06	SOQUEL CREEK AT TRESTLE	08-Jan-91	11:00 AM	10	1880	270	360	0.8	MURKY WATER
S06	SOQUEL CREEK AT TRESTLE	15-Jan-91	12:10 PM	12	10	470	590	0.8	BIRDS IN WATER
S06	SOQUEL CREEK AT TRESTLE	28-Jan-91	11:15 AM	10	760	120	66	1.8	SOME DUCKS IN WATER
S06	SOQUEL CREEK AT TRESTLE	11-Feb-91	11:30 AM	14	10	376	314	1.2	DUCKS + LEAVES ON WATER.
S06	SOQUEL C @ TRESTLE	25-Feb-91	11:30 AM	16	10	128	148	0.9	SOME DUCKS IN WATER
S06	SOQUEL C @ TRESTLE	11-Mar-91	11:25 AM	11	950	920	508	1.8	RAIN 3/10
S06	SOQUEL C @ TRESTLE	18-Mar-91	10:50 AM	10	570	760	1360	0.6	RAIN SUNDAY
S06	SOQUEL C @ TRESTLE	01-Apr-91	10:35 AM	13	640	160	200	0.8	WATER CLEAR



STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
S06	SOQUEL C @ TRESTLE	08-Apr-91	12:10 PM	13	650	540	240	2.3	WATER CLEAR
S06	SOQUEL C @ TRESTLE	15-Apr-91	11:45 AM	12	840	80	740	0.1	WATER CLEAR
S06	SOQUEL C @ TRESTLE	23-Apr-91	11:50 AM	14	10	280	380	0.7	CLEAR WATER
S06	SOQUEL C @ TRESTLE	30-Apr-91	11:45 AM	17	10	280	960	0.3	CLEAR WATER
S06	SOQUEL C @ TRESTLE	07-May-91	10:55 AM	18	1190	1840	2700	0.7	WATER CLEAR, SOME DUCKS
S06	SOQUEL C @ TRESTLE	14-May-91	11:10 AM	15	10	440	380	1.2	WATER CLEAR
S06	SOQUEL C @ TRESTLE	21-May-91	12:35 PM	19	980	480	280	1.7	WATER CLEAR
S06	SOQUEL C @ TRESTLE	28-May-91	12:55 PM	17	1280	60	80	0.8	WATER CLEAR
S06	SOQUEL C @ TRESTLE	04-Jun-91	12:00 PM	17	1280	320	120	2.7	WATER CLEAR, SOME DUCKS
S06	SOQUEL C @ TRESTLE	11-Jun-91	12:05 PM	19	1050	280	320	0.9	GREENISH-LOOKING WATER
S06	SOQUEL C @ TRESTLE	18-Jun-91				160	420	0.4	
S06	SOQUEL C @ TRESTLE	25-Jun-91	10:40 AM	20	1330	160	100	1.6	CLEAR WATER, SOME DUCKS
S02	SOQUEL C ABOVE STOCKTON B	06-Sep-90	10:45 AM	21	730	320	ERR	ERR	ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	03-Apr-90	11:30 AM	16	10	10500	12600	0.8	BIRDS AND 2 CHILDREN IN WATER.
S0	SOQUEL CREEK @ FLUME	10-Apr-90	11:45 AM	17	10	3800	1600	2.4	MANY CHILDREN IN WATER.
S0	SOQUEL CREEK @ FLUME	17-Apr-90	01:00 PM	20	10	700	500	1.4	OPEN TO OCEAN,BLACK SAND,SOME DUCKS.
S0	SOQUEL CREEK @ FLUME	24-Apr-90	01:00 PM	20	10	1200	450	2.7	MANY BIRDS UPSTREAM.
S0	SOQUEL CREEK @ FLUME	01-May-90	12:40 PM	22	10	200	800	0.3	MANY SEAGULLS ON SHORE, NO SIGNS POSTE
S0	SOQUEL CREEK @ FLUME	08-May-90	01:15 PM	21	10	1350	700	1.9	SEAGULLS IN WATER, POSTED, SOME CHILDR
S0	SOQUEL CREEK @ FLUME	15-May-90	11:15 AM	19	10	1300	1650	0.8	BIRDS IN WATER.
S0	SOQUEL CREEK @ FLUME	~~15-May-90~~	~~11:00 AM~~	~~14~~		~~0~~	~~40~~	0.0	CLEAR WATER, ALGAL GROWTH.
S0	SOQUEL CREEK @ FLUME	22-May-90	11:05 AM	19	1440	2700	3900	0.7	MANY BIRDS IN WATER.
S0	SOQUEL CREEK @ FLUME	29-May-90		15	1720	100	4700	0.0	OPEN TO OCEAN, SOME BIRDS IN WATER.
S0	SOQUEL CREEK @ FLUME	05-Jun-90	11:10 AM	20	10	1500	2050	0.7	SOME SEAGULLS UPSTREAM. CLOSING MOUTH
S0	SOQUEL CREEK @ FLUME	12-Jun-90	11:05 AM	20	670	650	1150	0.6	FEW BIRDS IN WATER, PERMANENT SIGNS.
S0	SOQUEL CREEK @ FLUME	10-Jul-90	01:50 PM	25	740	250	300	0.8	
S0	SOQUEL CREEK @ FLUME	17-Jul-90	11:00 AM	24	930	2150	1900	1.1	SOME BIRDS IN WATER
S0	SOQUEL CREEK @ FLUME	23-Jul-90				1400	730	1.9	
S0	SOQUEL CREEK @ FLUME	07-Aug-90	12:15 PM	23	750	8000	3050	2.6	
S0	SOQUEL CREEK @ FLUME	13-Aug-90	10:50 AM	22	740	650	350	1.9	BIRDS IN WATER, ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	20-Aug-90	10:30 AM	23	1060	350	50	7.0	SOME DUCKS UPSTREAM
S0	SOQUEL CREEK @ FLUME	28-Aug-90	11:00 AM	22	740	400	0	ERR	ALGAL GROWTH, SOME SEAGULLS UPSTREAM
S0	SOQUEL CREEK @ FLUME	04-Sep-90	11:30 AM	22	10	3520	320	11.0	PIGEONS UPSTREAM, ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	~~06-Sep-90~~	~~10:40 AM~~	~~21~~	~~730~~	~~250~~	~~ERR~~	ERR	SOME SEAGULLS UPSTREAM,ALGAE CLEANING
S0	SOQUEL CREEK @ FLUME	11-Sep-90	12:00 PM	23	880	1520	900	1.7	ALGAE ON CREEK BOTTOM
S0	SOQUEL CREEK @ FLUME	18-Sep-90	11:50 AM	22	1040	2360	2540	0.9	SOME SEAGULLS IN H2O, MANY ON SHORE
S0	SOQUEL CREEK @ FLUME	25-Sep-90	11:25 AM			580	820	0.7	ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	02-Oct-90	11:25 AM	21	930	2020	2100	1.0	ALGAL GROWTH, SOME SEAGULLS IN WATER
S0	SOQUEL CREEK @ FLUME	10-Oct-90	11:55 AM	20	1340	1400	780	1.8	ALGAE, SCUM ON WATER
S0	SOQUEL CREEK @ FLUME	16-Oct-90	11:00 AM	18	940	4020	2140	1.9	ALGAL GROWTH, BIRDS ON SHORE
S0	SOQUEL CREEK @ FLUME	23-Oct-90	11:55 AM	18	1510	1850	8450	0.2	ALGAL GROWTH + SCUM ON WATER
S0	SOQUEL CREEK @ FLUME	30-Oct-90	10:55 AM	16	860	500	200	2.5	ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	06-Nov-90	11:00 AM	13	620	2000	980	2.0	ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	13-Nov-90	09:50 AM	13	670	4020	4020	1.0	ALGAL GROWTH
S0	SOQUEL CREEK @ FLUME	19-Nov-90	10:45 AM	14	1240	550	200	2.8	ALGAE CLEARED, SOME SEAGULLS IN WATER
S0	SOQUEL CREEK @ FLUME	27-Nov-90	10:35 AM	11	940	850	2100	0.4	DEBRIES ON WATER, SOME DUCKS UPSTREAM
S0	SOQUEL CREEK @ FLUME	04-Dec-90	11:37 AM	10	880	400	750	0.5	WATER CLEAR, SOME BIRDS,DEBRIES ON BOT
S0	SOQUEL CREEK @ FLUME	11-Dec-90	12:05 PM	11	880	2360	4800	0.5	WATER CLEAR, SEAGULLS, RAIN 12/10
S0	SOQUEL CREEK @ FLUME	18-Dec-90	10:30 AM	8	650	240	750	0.3	BIRDS UPSTREAM

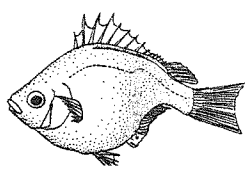


STANUM	LOCATION	DATE	TIME	TEMP-C	ELCOND	FECOLI	FECSTR	FCFSRA	NOTES
SO	SOQUEL CREEK @ FLUME	02-Jan-91	12:10 PM	6	750	80	100	0.8	BIRDS UPSTREAM, SOME ALGAL GROWTH
SO	SOQUEL CREEK @ FLUME	08-Jan-91	11:15 AM	10	1090	260	550	0.5	MANY BIRDS IN WATER
SO	SOQUEL CREEK @ FLUME	15-Jan-91		12	1520	2960	5060	0.6	FOAMY WATER, BIRDS
SO	SOQUEL CREEK @ FLUME	28-Jan-91	11:00 AM	10	980	312	472	0.7	CLEAR WATER, BIRDS
SO	SOQUEL CREEK @ FLUME	11-Feb-91	11:40 AM	15	10	380	192	2.0	OPEN TO OCEAN, BIRDS IN WATER.
SO	SOQUEL C @ FLUME	25-Feb-91	11:15 AM	15	10	168	156	1.1	MANY BIRDS IN WATER, OPEN TO OCEAN
SO	SOQUEL C @ FLUME	11-Mar-91	11:35 AM	13	1240	1492	728	2.0	SEAGULLS IN WATER, RAIN 3/10
SO	SOQUEL C @ FLUME	18-Mar-91	11:00 AM	10	450	700	2360	0.3	HIGH TIDE, RAIN SUNDAY
SO	SOQUEL C @ FLUME	01-Apr-91	10:45 AM	13	660	460	180	2.6	HIGH TIDE, LIGHT BROWN WATER
SO	SOQUEL C @ FLUME	08-Apr-91	12:20 PM	14	800	260	340	0.8	CLEAR WATER, FEW BIRDS IN WATER
SO	SOQUEL C @ FLUME	15-Apr-91	11:34 AM	13	1150	1480	900	1.6	CLEAR WATER, SOME BIRDS
SO	SOQUEL C @ FLUME	23-Apr-91	12:00 PM	14	10	2260	1120	2.0	CLEAR WATER
SO	SOQUEL C @ FLUME	30-Apr-91	11:55 AM	19	10	320	520	0.6	CLEAR WATER
SO	SOQUEL C @ FLUME	07-May-91	11:05 AM	18	1380	2680	1120	2.4	WATER CLEAR, SOME GEESE
SO	SOQUEL C @ FLUME	14-May-91	11:00 AM	16	10	340	500	0.7	WATER CLEAR, BUT SEWER SMELL
SO	SOQUEL C @ FLUME	21-May-91	12:25 PM	19	1750	2240	900	2.5	CLEAR WATER, NO BIRDS ← Clos
SO	SOQUEL C @ FLUME	28-May-91	01:05 PM	19	780	220	120	1.8	WATER CLEAR
SO	SOQUEL C @ FLUME	04-Jun-91	12:10 PM	18	790	200	120	1.7	WATER CLEAR, SEAGULLS
SO	SOQUEL C @ FLUME	11-Jun-91	12:15 PM	19	760	720	40	18.0	WATER CLEAR, MANY SEAGULLS
SO	SOQUEL C @ FLUME	18-Jun-91				880	400	2.2	
SO	SOQUEL C @ FLUME	25-Jun-91	10:50 AM	21	670	940	40	23.5	WATER CLEAR, SOME ALGAL GROWTH

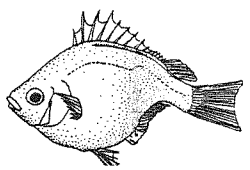


STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	FECSTR	FCFSRA	NOTES
S254	SOQUEL C BELOW SOQUEL DR	10-Sep-91	10:55 AM	17	2010	2001	1.0	WATER CLEAR
S254	SOQUEL C BELOW SOQUEL DR	17-Sep-91	09:40 AM	16	2010	990	2.0	CLEAR WATER, LOW FLOW
S254	SOQUEL C BELOW SOQUEL DR	01-Oct-91	09:45 AM	16	2010	2010	1.0	CLEAR WATER
S254	SOQUEL C BELOW SOQUEL DR	03-Dec-91	12:10 PM	9	60	220	0.3	CLEAR WATER
S254	SOQUEL C BELOW SOQUEL DR	17-Dec-91	11:40 AM	10	200	360	0.6	CLEAR WATER
S254	SOQUEL C BELOW SOQUEL DR	07-Jan-92	11:20 AM		1800	7240	0.2	BROWN WATER,RAIN 1/6 & 1/7
S254	SOQUEL C BELOW SOQUEL DR	04-Feb-92	11:18 AM	9	80	160	0.5	CLEAR WATER
S23	SOQUEL C @ NOB HILL	01-Jul-91	10:50 AM	19	380	500	0.8	WATER CLEAR
S23	SOQUEL C @ NOB HILL	09-Jul-91	10:45 AM	17	380	320	1.2	CLEAR WATER, ALGAE ON BOTTOM
S23	SOQUEL C @ NOB HILL	16-Jul-91	01:05 PM	20	1360	1940	0.7	CLEAR WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	22-Jul-91			80	180	0.4	
S23	SOQUEL C @ NOB HILL	29-Jul-91			100	140	0.7	
S23	SOQUEL C @ NOB HILL	06-Aug-91	01:20 PM	19	200	260	0.8	WATER CLEAR
S23	SOQUEL C @ NOB HILL	13-Aug-91	10:35 AM	20	0	100	0.0	CLEAR WATER
S23	SOQUEL C @ NOB HILL	19-Aug-91			20	0	ERR	
S23	SOQUEL C @ NOB HILL	27-Aug-91	12:35 PM	18	0	320	0.0	CLEAR WATER
S23	SOQUEL C @ NOB HILL	03-Sep-91	11:30 AM	18	20	220	0.1	CLEAR WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	10-Sep-91	11:05 AM	18	100	200	0.5	GRAYISH WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	17-Sep-91	10:00 AM	18	60	140	0.4	CLEAR WATER, LOW FLOW
S23	SOQUEL C @ NOB HILL	23-Sep-91			40	140	0.3	
S23	SOQUEL C @ NOB HILL	01-Oct-91	10:15 AM	17	80	120	0.7	OILY FILM ON WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	08-Oct-91	11:50 AM	18	1980	40	49.5	OILY FILM ON WATER
S23	SOQUEL C @ NOB HILL	15-Oct-91	12:00 PM	19	4020	2640	1.5	STAGNANT WATER, ALGAL GROWTH
S23	SOQUEL C @ NOB HILL	22-Oct-91	10:25 AM	17	700	20	35.0	OILY FILM ON WATER,SLOW MOVING H2O
S23	SOQUEL C @ NOB HILL	28-Oct-91	11:40 AM	14	620	1240	0.5	CLEAR WATER, RAIN 10/26
S23	SOQUEL C @ NOB HILL	12-Nov-91			200	120	1.7	
S23	SOQUEL C @ NOB HILL	19-Nov-91	10:15 AM	11	1380	820	1.7	CLEAR WATER
S23	SOQUEL C @ NOB HILL	25-Nov-91	11:15 AM	11	720	40	18.0	WATER CLEAR
S23	SOQUEL C @ NOB HILL	03-Dec-91	12:20 PM	10	220	920	0.2	CLEAR WATER
S23	SOQUEL C @ NOB HILL	09-Dec-91	11:20 AM		360	ERR	ERR	
S23	SOQUEL C @ NOB HILL	17-Dec-91	11:25 AM	11	240	40	6.0	CLEAR WATER
S23	SOQUEL C @ NOB HILL	30-Dec-91	11:25 AM	11	680	ERR	ERR	BROWNISH WATER, RAIN 12/29
S23	SOQUEL C @ NOB HILL	07-Jan-92	11:05 AM		2260	7120	0.3	BROWN WATER, RAIN 1/6 & 1/7
S23	SOQUEL C @ NOB HILL	13-Jan-92	12:05 PM	7	100	60	1.7	CLEAR WATER
S23	SOQUEL C @ NOB HILL	21-Jan-92	11:05 AM	8	140	160	0.9	CLEAR WATER
S23	SOQUEL C @ NOB HILL	28-Jan-92	10:20 AM	11	4002	1400	2.9	GREYISH WATER, RAIN 1/28
S23	SOQUEL C @ NOB HILL	04-Feb-92	11:25 AM	10	160	60	2.7	CLEAR WATER
S224	SOQUEL C @ 533 RIVERVIEW	09-Jul-91	10:55 AM	7	320	4002	0.1	ALGAL GROWTH
S15	NOBEL G BELOW #60	22-Oct-91	11:15 AM		4020	2420	1.7	
S15	NOBEL G BELOW #60I	28-Oct-91	11:20 AM	13	4020	7220	0.6	BROWNISH/STANDING WATER, RAIN 10/26
S14	NOBEL G BELOW #2	22-Oct-91	11:30 AM		980	240	4.1	
S14	NOBEL G BELOW #2	28-Oct-91	11:30 AM	13	2760	1240	2.2	LIGHT YELLOW WATER, RAIN 10/26
S13	NOBEL G BELOW TRAILER P	22-Oct-91	10:55 AM		3840	8520	0.5	WATER CLEAR, NO NESSLER'S
S12	NOBEL G @ TUNNEL @ BAY	01-Jul-91	10:35 AM	17	6002	6002	1.0	WATER CLEAR
S12	NOBEL G @ TUNNELL @ BAY	09-Jul-91	10:35 AM	15	2140	240	8.9	CLEAR WATER
S12	NOBEL G @ TUNNEL @ BAY	16-Jul-91	01:15 PM	17	120	3000	0.0	WATER SLIGHTLY CLOUDY
S12	NOBEL G @ TUNNEL @ BAY	06-Aug-91	01:10 PM	18	4002	4002	1.0	CLEAR WATER
S12	NOBEL G @ TUNNEL @ BAY	13-Aug-91	10:20 AM	18	6002	5002	1.2	CLEAR WATER
S12	NOBEL G @ TUNNEL @ BAY	19-Aug-91			0	40	0.0	

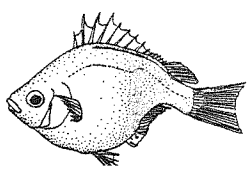
PRINT DATE: 02/13/92



STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	FECSTR	FCFSRA	NOTES
S12	NOBEL G @ TUNNEL @ BAY	27-Aug-91	12:25 PM	16	2600	5002	0.5	SLIGHTLY CLOUDY WATER, LOW FLOW
S12	NOBEL G @ TUNNEL @ BAY	03-Sep-91	11:20 AM	17	5002	6002	0.8	CLEAR WATER
S12	NOBEL G @ TUNNEL @ BAY	10-Sep-91	11:20 AM	15	1980	4002	0.5	WATER CLEAR
S12	NOBEL G @ TUNNEL @ BAY	17-Sep-91	10:15 AM	15	1680	3260	0.5	CLEAR WATER, VERY LITTLE FLOW
S12	NOBEL G @ TUNNEL @ BAY	23-Sep-91			780	220	3.5	
S12	NOBEL G @ TUNNEL @ BAY	01-Oct-91	10:30 AM	16	1400	4020	0.3	CLEAR WATER, LOW FLOW
S12	NOBEL G @ TUNNEL @ BAY	08-Oct-91	12:05 PM	15	4020	4020	1.0	WATER CLEAR
S12	NOBEL G @ TUNNEL @ BAY	15-Oct-91	11:50 AM	15	8280	3740	2.2	CLEAR WATER
S12	NOBEL G @ TUNNEL @ BAY	22-Oct-91	10:40 AM		3200	7480	0.4	WATER CLEAR, NO NESSLER'S
S12	NOBEL G @ TUNNEL @ BAY	28-Oct-91	11:05 AM	12	2760	3680	0.8	CLEAR WATER, LOW FLOW, RAIN 10/26
S1	NOBEL G @ SOQUEL C	10-Sep-91	11:30 AM	20	10	90	0.1	SOMEWHAT OILY WATER
S1	NOBEL G @ SOQUEL C	17-Sep-91	11:10 AM	20	1010	190	5.3	ALGAL GROWTH
S1	NOBEL G @ SOQUEL C	01-Oct-91	10:40 AM	19	420	60	7.0	GREENISH LOOKING WATER
S1	NOBEL G @ SOQUEL C	08-Oct-91	12:15 PM	21	350	60	5.8	CLEAR WATER
S1	NOBEL G @ SOQUEL C	12-Nov-91			2400	3000	0.8	
S1	NOBEL G @ SOQUEL C	19-Nov-91	10:25 AM	12	2760	3640	0.8	GREENISH WATER
S1	NOBEL G @ SOQUEL C	25-Nov-91	11:25 AM	12	320	1400	0.2	WATER CLEAR
S1	NOBEL G @ SOQUEL C	03-Dec-91	12:30 PM	11	380	1660	0.2	DUCKS NEARBY
S1	NOBEL G @ SOQUEL C	09-Dec-91	11:30 AM	12	440	3200	0.1	GREYWATER, SEWER SMELL
S1	NOBEL G @ SOQUEL C	17-Dec-91	10:55 AM	11	680	1220	0.6	GREYWATER-NO SMELL
S1	NOBEL G @ SOQUEL C	30-Dec-91	11:35 AM	11	880	ERR	ERR	CLEAR WATER, RAIN 12/29
S1	NOBEL G @ SOQUEL C	07-Jan-92	10:55 AM		1600	7020	0.2	BROWN WATER, RAIN 1/6 & 1/7
S1	NOBEL G @ SOQUEL C	13-Jan-92	11:50 AM	8	320	100	3.2	CLEAR WATER
S1	NOBEL G @ SOQUEL C	21-Jan-92	11:15 AM	11	140	140	1.0	CLEAR WATER
S1	NOBEL G @ SOQUEL C	28-Jan-92	10:30 AM	13	6002	2740	2.2	GREYISH WATER, RAIN 1/28
S1	NOBEL G @ SOQUEL C	04-Feb-92		12	120	100	1.2	CLEAR WATER
S06	SOQUEL C @ TRESTLE	01-Jul-91	11:00 AM	22	240	60	4.0	WATER CLEAR, NO BIRDS
S06	SOQUEL C @ TRESTLE	09-Jul-91	11:05 AM	20	140	1120	0.1	WATER CLEAR, SOME DUCKS
S06	SOQUEL C @ TRESTLE	16-Jul-91	01:25 PM	21	3540	20	177.0	WATER CLEAR
S06	SOQUEL C @ TRESTLE	22-Jul-91			100	0	ERR	
S06	SOQUEL C @ TRESTLE	29-Jul-91			40	180	0.2	
S06	SOQUEL C @ TRESTLE	06-Aug-91	01:30 PM	21	80	120	0.7	WATER CLEAR
S06	SOQUEL C @ TRESTLE	13-Aug-91	10:45 AM	23	180	0	ERR	CLEAR WATER, ALGAL GROWTH
S06	SOQUEL C @ TRESTLE	19-Aug-91			240	20	12.0	
S06	SOQUEL C @ TRESTLE	27-Aug-91	12:45 PM	20	20	20	1.0	CLEAR WATER, ALGAL GROWTH AT BOTTOM
S06	SOQUEL C @ TRESTLE	03-Sep-91	11:40 AM	22	0	100	0.0	CLEAR WATER, 4 DUCKS
S06	SOQUEL C @ TRESTLE	10-Sep-91	11:40 AM	20	60	260	0.2	WATER CLEAR
S06	SOQUEL C @ TRESTLE	17-Sep-91	11:20 AM	20	2740	160	17.1	CLEAR WATER
S06	SOQUEL C @ TRESTLE	23-Sep-91			20	100	0.2	
S06	SOQUEL C @ TRESTLE	01-Oct-91	10:40 AM	19	180	140	1.3	CLEAR WATER
S06	SOQUEL C @ TRESTLE	08-Oct-91	12:25 PM	20	1460	80	18.3	CLEAR WATER
S06	SOQUEL C @ TRESTLE	15-Oct-91	12:10 PM	20	20	80	0.3	CLEAR WATER
S06	SOQUEL C @ TRESTLE	22-Oct-91	10:10 AM	18	880	220	4.0	ALGAL GROWTH, CLEAR WATER
S06	SOQUEL C @ TRESTLE	28-Oct-91	11:50 AM	15	1880	2020	0.9	CLEAR WATER, RAIN 10/26
S06	SOQUEL C @ TRESTLE	05-Nov-91	02:10 PM	17	7300	6480	1.1	CLEAR WATER
S06	SOQUEL C @ TRESTLE	12-Nov-91			2700	760	3.6	
S06	SOQUEL C @ TRESTLE	19-Nov-91	10:35 AM	12	1460	1140	1.3	GREENISH WATER
S06	SOQUEL C @ TRESTLE	25-Nov-91	11:35 AM	11	480	1040	0.5	WATER CLEAR
S06	SOQUEL C @ TRESTLE	03-Dec-91	12:40 PM	11	240	80	3.0	GREYISH WATER

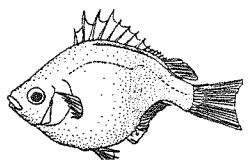


STANUM	LOCATION	DATE	TIME	TEMP-C	FECOLI	FECSTR	FCFSRA	NOTES
SO6	SOQUEL C @ TRESTLE	09-Dec-91	11:40 AM	12	380	2660	0.1	GREYWATER, SEWER SMELL
SO6	SOQUEL C @ TRESTLE	17-Dec-91	11:05 AM	11	960	920	1.0	GREYWATER-NO SMELL
SO6	SOQUEL C @ TRESTLE	30-Dec-91	11:45 AM	11	400	ERR	ERR	BROWNISH WATER, RAIN 12/29
SO6	SOQUEL C @ TRESTLE	07-Jan-92	10:45 AM		2600	8820	0.3	BROWN WATER, RAIN 1/6 & 1/7
SO6	SOQUEL C @ TRESTLE	13-Jan-92	11:40 AM	8	100	100	1.0	CLEAR WATER
SO6	SOQUEL C @ TRESTLE	21-Jan-92	11:25 AM	11	100	260	0.4	GREENISH-CLEAR WATER
SO6	SOQUEL C @ TRESTLE	28-Jan-92	10:40 AM	13	960	3800	0.3	GREYISH WATER, RAIN 1/28
SO6	SOQUEL C @ TRESTLE	04-Feb-92	12:40 PM	12	80	160	0.5	CLEAR WATER
SO4	SOQUEL C @ BOAT RAMP	17-Dec-91	11:15 AM	11	1220	720	1.7	GREYWATER-NO SMELL
SO	SOQUEL C @ FLUME	01-Jul-91	11:10 AM	22	500	140	3.6	LIGHT-BROWN WATER, SOME SEAGULLS
SO	SOQUEL C @ FLUME	09-Jul-91	11:15 AM	21	220	460	0.5	WATER CLEAR
SO	SOQUEL C @ FLUME	16-Jul-91	01:30 PM	23	1460	820	1.8	CLEAR WATER
SO	SOQUEL C @ FLUME	22-Jul-91			320	200	1.6	
SO	SOQUEL C @ FLUME	29-Jul-91			110	380	0.3	
SO	SOQUEL C @ FLUME	06-Aug-91	01:35 PM	22	5002	480	10.4	CLEAR WATER, SOME DUCKS
SO	SOQUEL C @ FLUME	13-Aug-91	10:55 AM	23	760	60	12.7	CLEAR WATER
SO	SOQUEL C @ FLUME	19-Aug-91			100	0	ERR	
SO	SOQUEL C @ FLUME	27-Aug-91	12:55 PM	21	580	360	1.6	CLEAR WATER, SOME SEAGULLS
SO	SOQUEL C @ FLUME	03-Sep-91	11:50 AM	22	260	440	0.6	CLEAR WATER, SEAGULLS
SO	SOQUEL C @ FLUME	10-Sep-91	11:50 AM	20	500	400	1.3	CLEAR WATER, SEAGULLS
SO	SOQUEL C @ FLUME	17-Sep-91	11:30 AM	21	4020	1460	2.8	CLEAR WATER, SEAGULLS
SO	SOQUEL C @ FLUME	23-Sep-91			1000	600	1.7	
SO	SOQUEL C @ FLUME	01-Oct-91	10:50 AM	21	760	20	38.0	CLEAR WATER
SO	SOQUEL C @ FLUME	08-Oct-91	12:35 PM	21	2820	600	4.7	CLEAR WATER
SO	SOQUEL C @ FLUME	15-Oct-91	12:20 PM	20	1200	140	8.6	CLEAR WATER, ALGAL GROWTH
SO	SOQUEL C @ FLUME	22-Oct-91	10:00 AM	18	680	440	1.5	ALGAL GROWTH
SO	SOQUEL C @ FLUME	28-Oct-91	12:00 PM	16	1760	700	2.5	CLEAR WATER,HIGH TIDE,GULLS,RAIN 10/26
SO	SOQUEL C @ FLUME	05-Nov-91	02:00 PM	17	11540	1400	8.2	BIRDS, CLEAR WATER
SO	SOQUEL C @ FLUME	12-Nov-91			4020	3240	1.2	
SO	SOQUEL C @ FLUME	19-Nov-91	10:45 AM	13	1120	180	6.2	CLEAR WATER, SOME FOAM
SO	SOQUEL C @ FLUME	25-Nov-91	11:45 AM	10	760	1460	0.5	CLEAR WATER, HIGH TIDE, SEAGULLS
SO	SOQUEL C @ FLUME	03-Dec-91	12:45 PM	13	4220	4260	1.0	CLEAR WATER, SEAGULLS
SO	SOQUEL C @ FLUME	09-Dec-91	11:50 AM	13	1740	3280	0.5	GREYWATER,C OPEN AT MOUTH,SEWER SMELL
SO	SOQUEL C @ FLUME	17-Dec-91	10:45 AM	10	1400	880	1.6	GREYWATER-NO SMELL
SO	SOQUEL C @ FLUME	30-Dec-91	11:55 AM	11	520	ERR	ERR	BROWNISH WATER,SEWER SMELL,SEAGULLS
SO	SOQUEL C @ FLUME	07-Jan-92	10:35 AM		2420	8840	0.3	HIGH TIDE/BROWN WATER, RAIN 1/6 & 1/7
SO	SOQUEL C @ FLUME	13-Jan-92	11:30 AM	8	520	300	1.7	CLEAR WATER/MANY SEAGULLS
SO	SOQUEL C @ FLUME	21-Jan-92	11:35 AM	13	240	260	0.9	CLEAR WATER/HIGH TIDE
SO	SOQUEL C @ FLUME	28-Jan-92	10:50 AM	13	600	1460	0.4	BLACKISH WATER/SEWER SMELL,RAIN 1/28
SO	SOQUEL C @ FLUME	04-Feb-92		13	280	80	3.5	CLEAR WATER/HIGH TIDE,SEAGULLS,CHILDREN



APPENDIX E.

Monitoring of Water Quality and Observations of Aquatic Plant Density, Late 1990 and Early 1991 until Sandbar Breaching



Monitoring of Water Quality and Observations of Aquatic Plant Density, Late 1990 and Early 1991 until Sandbar Breaching

14 November 1990. Station: Flume at 0810 hr, overcast. Gage Height = 1.18 with one board removed at the flume.

Depth	**Temp.(C)**	**Oxygen (ppm)**
Surface	12.3	10.2
Bottom	12.3	10.2

Station: Stockton Avenue Bridge, 0820 hr, overcast.

Surface	12.3	9.2
Bottom	12.3	9.5

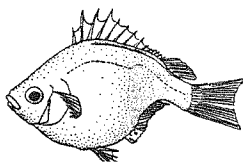
Station: Railroad trestle, 0830 hr. Overcast

Surface	12.0	7.7
Bottom	12.0	7.5

Floating algae covered 30 % of the lower lagoon. 52 pigeons were counted at the Stockton Avenue Park, east side. American Coots were present and eating floating algae. Pondweed was present on the bottom over entire lower lagoon, normally less than 1 foot high, occasionally 1-2 feet high. None reached the surface.

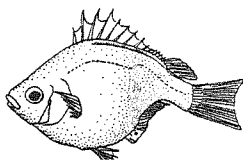
Conclusion: Water temperatures and dissolved oxygen levels were good for aquatic organisms. Plants had depleted oxygen somewhat because full saturation would have been 10.8 parts per million (ppm).

16 November 1990. Algal mats covered 50 % of the lower lagoon. Floating algae was skimmed off the surface of the lagoon by Mike Clark and an assistant from the Shadowbrook Restaurant. It took them 4-5 hours to skim the entire lagoon up to the Restaurant. Algae was left on the beach. No dead fish and 5 bird carcasses were among the algae. The men used a board about 10 feet long.



APPENDIX F.

Water Quality Data and General Observations of Aquatic Vegetation Density, 20 May - 12 December, 1991



Water Quality Data and General Observations of Aquatic Vegetation Density, 20 May - 12 December, 1991

20 May 1991

One board was removed from each side of the flume opening. At 1100 hr the tide was out, the flume was functioning with water depth over the flume boards at 0.5 feet. Water depth at the flume opening was 1.8 feet with the depth at the exit being 1.6 feet. The lagoon gage reading was 2.42 feet.

21 May 1991

Station: Flume, 1110 hr, overcast and cool. Gage Height= 1.82

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	17.0	0.05	8.65	1520
0.25	17.0	0.05	8.55	1520
0.50	17.0	0.05	8.47	1520
0.60(bot)	17.0	0.05	8.35	1520

Station: Adjacent the Edgewater Cafe. 1120 hr.

surf.	16.5	0.05	8.55	
0.25	16.5	0.05	8.60	
0.50	16.6	0.02	8.41	
0.75	16.6	0.04	8.40	
0.90(bot)	16.8	0.05	9.20	

Station: Under Stockton Avenue Bridge, 1150 hr.

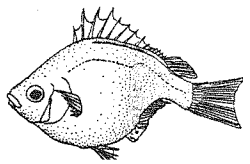
surf	16.5	0.05	8.60	1350
0.25	16.5	0.06	8.60	
0.50	16.5	0.05	8.40	
0.75	16.4	0.05	8.35	
1.00	16.5	0.05	8.35	
1.25	16.5	1.50	7.80	
1.50(bot)	18.0	12.50	6.20	

Station: Stockton Avenue Bridge, east pier, 1210 hr.

surf	16.6	0.05	8.70	1350
0.25	16.5	0.06	8.55	
0.50	16.5	0.05	8.55	
0.75	16.4	0.05	8.60	
1.00	16.5	0.05	8.55	
1.25	17.0	3.00	8.55	
1.50	20.5	13.50	6.80	
1.75(bot)	20.5	23.00	1.38	

Station: Noble Gulch, 1220 hr, overcast. No salt water detected. Gage height at 1255 hr = 1.96.

Conclusion: After just 4 days of closing the the sandbar and use



of the shroud, the lagoon had nearly been flushed of salt water except at the deeper holes such as around the piers of the Stockton Avenue Bridge. Conductivity was still higher than a freshwater lagoon, but not near lethal levels. Quality was go cool enough water temperature (< 21 C) and oxygen levels near full saturation except in the hole at the pier. Full saturation would be 9.67 ppm at 17 C. The water column was clear to the bottom at all stations.

In the future, the kelp should not be buried because it may leach bacteria into the lagoon from the sandbar. The kelp should be shoved into the ocean instead. In addition, a closer monitoring is needed of kelp in the lagoon area from April 1 until sandbar closure. Kelp needs to be removed on a weekly basis during that time so that it cannot decompose in the lagoon.

29 May 1991

Station: Flume, 0930 hr. Exit of flume had been unplugged this morning. Lagoon full and spilling through flume with the shroud still present. Overcast is just beginning to burn off. Gage height = 2.75. Air temp. = 17 C.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	16.5	0.0	9.4	
0.25	16.6	0.0	9.3	
0.50	16.6	0.0	9.3	
0.75	16.5	0.0	9.3	
1.00	16.7	0.0	9.3	
1.25	16.7	0.0	9.4	

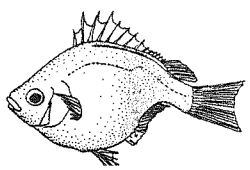
Station: Adjacent Edgewater Cafe, 0940 hr.

surf.	16.8	0.0	9.55	
0.25	17.0	0.0	9.45	
0.50	16.8	0.0	9.35	
0.75	16.8	0.0	9.30	
1.00	16.8	0.0	9.30	
1.25	16.8	0.0	9.25	
1.40(bot)	16.7	0.0	9.25	

Station: Adjacent Margaritaville, 1010 hr.

surf.	17.0	0.0	9.50	710
0.25	17.0	0.0	9.50	710
0.50	17.0	0.0	9.50	710
0.75	16.0	0.0	9.45	710
1.00	16.0	0.0	9.45	710
1.25(bot)	17.0	0.0	9.40	710

Station: Stockton Avenue Bridge. east pier, 1010 hr. Algae had begun to grow at the base of the pier.



surf.	17.0	0.0	9.6	
0.25	17.0	0.0	9.4	
0.50	17.0	0.0	9.35	
0.75	16.8	0.0	9.25	
1.00	16.8	0.0	9.2	
1.25	16.8	0.0	9.2	
1.50	16.8	0.0	9.15	
1.75	16.8	0.0	9.15	
1.90(bot)	18.0	3.5	9.15	

Station: Under Stockton Avenue Bridge, 1030 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	17.0	0.0	9.55	
0.25	17.0	0.0	9.4	
0.50	17.0	0.0	9.35	
0.75	16.8	0.0	9.25	
1.00	16.8	0.0	9.25	
1.25	16.8	0.0	9.2	
1.50	16.8	0.0	9.2	
1.65(bot)	16.8	0.0	9.15	

Station: Halfway between Stockton Bridge and Railroad trestle, 1050 hr.

surf.	17.0	0.0	9.45	
0.25	16.7	0.0	9.35	
0.50	16.7	0.0	9.20	
0.75	17.0	0.0	9.40	
1.00	16.7	0.0	9.20	
1.25(bot)	16.7	0.0	9.20	

Station: Railroad trestle, 1100 hr.

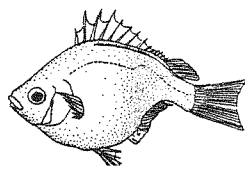
surf.	17.0	0.0	9.35	500
0.25	17.0	0.0	9.20	500
0.50	17.0	0.0	9.10	500
0.75	17.0	0.0	9.05	500
1.00	16.6	0.0	9.05	500
1.25(bot)	16.5	0.0	8.75	500

Station: Adjacent Shadowbrook, 1115 hr.

surf.	16.5	0.0	8.75	500
0.25	16.3	0.0	8.55	
0.50	16.3	0.0	8.40	
0.75	16.0	0.0	8.20	
1.00	15.3	0.0	8.15	
1.10(bot)	15.0	0.0	8.10	480

Station: Mouth of Noble Gulch, 1130 hr.

surf.	16.3	0.0	8.65	510
0.25	16.6	0.0	8.55	



0.50	16.3	0.0	8.30	
0.75	16.1	0.0	8.35	
1.00	15.6	0.0	8.35	
1.25(bot)	15.2	0.0	8.55	490

At 1220 hr, both sides of the flume with the notched boards and hole on the west side were working properly. Water depth at the entrance was 2.2 feet while depth at the exit was also 2.2 feet. The tide was beginning to come in. Algae was beginning to grow and covered 5 % of the lagoon bottom. In the lower lagoon there were 5 mallards, 5 geese (one adult pair and 3 young), 10 pigeons along the sand with only 1 gull. One adult goose had a broken leg. The City was notified that they could remove the shroud.

Conclusion: Water quality conditions were excellent for aquatic organisms. Water temperature was cool enough and oxygen levels were near full saturation, which would be 9.67 ppm at 17 C. The water column was clear to the bottom. The only salt water still present was at the bridge piers. This indicates that in years when scour around the piers is extensive, saltwater may remain in the depressions for awhile. Note that algae began to grow first in the depression at the pier, water temperature was highest. Sand bags could be placed in these depressions a week after sandbar closure and opened to fill the holes. We would not recommend grading into the holes during sandbar closure because fish tend to collect there at sandbar closure time. The flume was working well for fish passage.

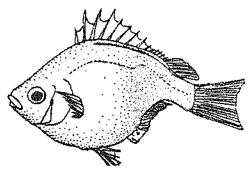
11 June 1991

At 1200 hr, the inlet to the flume was 2.4 feet deep and the outlet was 2.3 feet. During a Creek survey, 53 steelhead smolts were seen in pools from the lagoon upstream to Soquel Avenue Bridge. Streamflow was estimated to be 2-3 cfs. A significant cobble dam had been built under the Soquel Avenue dam with a side pool created to apparently herd steelhead into for capture. Water depth over the dam was less than 0.1 feet. Fish entrails were present. I destroyed the dam.

Conclusion: Steelhead smolts were still migrating to the ocean as late as mid-June, making it important to keep streamflow continuous to the lagoon and through the flume in June. The flume was working excellently.

18 June 1991

A high tide with sandbar overwash had occurred on 14-16 June. Water quality measurements were made to detect the concentration of saltwater and any temperature inversion caused by saltwater. No pondweed was present in the lagoon. Gage height was 1.69 feet. The tide was outgoing. Depth at the flume inlet was 2.0 feet with outlet depth of 0.6 feet. Sand was present in the flume, but allowed sufficient depth to pass fish. Water clarity extended to the bottom.



Station: Flume, 0845 hr. Water temperature was 18 C through the water column with no saltwater detected.

In lower lagoon (Reach 1 from the flume to the bridge), 5 geese, 4 domestic ducks, 17 gulls bathing. 25 gulls on beach next to lagoon. Considerable trash was in the lagoon next to Sea Bonne and Margaritaville Restaurants. There is an eddy that brings the trash to that area.

Station: Stockton Avenue Bridge, east pier, 0800 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	18.7	0.02	8.88	790
0.25	19.0	0.02	8.70	790
0.50	19.0	0.02	8.82	780
0.75	19.0	0.02	8.75	780
1.00	19.0	0.02	8.70	780
1.25	19.0	0.02	8.70	780
1.50	19.0	0.03	8.72	780
1.75	19.0	0.03	8.65	780
1.95(bot)	19.0	0.03	8.70	780

Downstream of bridge, 2 clumps of algae at surface near Margaritaville, each 8 inches in diameter, totaling about 1 % of the surface. 30 % of bottom with algae (1-2 feet high).

Station: Railroad trestle, Reach 2, 0820 hr. Water temperature through the water column was 18.5 C. Salinity was 0.02 ppt, top to bottom. Conductivity was again 780, top to bottom. Upstream of bridge, 6 algae clumps on surface near eastside park, 8 spires of algae visible underwater (2-3 feet high) near there. 10 % of the surface in Reach 2 with algae mats, with 35 % of the bottom covered (1-3 feet high). 11 pigeons at park eastside and 2 feral ducks.

Station: Mouth of Noble Gulch, Reach 3, 0830 hr. Water temperature ranged from 17.2 to 16.0, surface to the bottom. Salinity was 0.02, top to bottom. Conductivity was reduced to 710 through the column. Algal mats developing adjacent dock between Railroad trestle and Noble Gulch, totaling 5 % of surface. Algae covering 25 % of bottom (1-2 feet high). Bottom with gravel 1/2-1 inch diameter present.

Conclusion: High tides in the 6.0 to 6.8 foot range caused very little impact on water quality in the lagoon. Water quality was still excellent. However, sandbar height must be made high enough during construction to prevent much overwash at these high tide levels.

27 July 1991

We learned this day that aquazine had been applied on July 11 from the flume to the Railroad trestle. The gage height was 2.04 feet at 0720 hr. Depth at the flume entrance was 1.5 feet. At

the flume outlet it was 0.4 feet, with all but the upper 0.5 feet full of sand. No pondweed was present.

Station: Flume, 0735 hr, overcast with light drizzle.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	20.4	0.00	11.6	800
0.25	20.4	0.00	11.6	800
0.50	20.4	0.00	11.7	800
0.75(bot)	20.4	0.00	11.5	800

A thin algae scum near the flume. Clarity to bottom. 15 ducks, including 2 new domestic ducks (gray and white and black and white coloration) with clipped wings, along lagoon on Venetian Court side. Algae covering 40 % of the bottom (0.5-1 foot high) in lower lagoon, none reaching surface.

Station: Stockton Avenue Bridge, east pier, 0755 hr.

surf.	20.5	0.00	11.2	800
0.25	20.7	0.00	11.2	800
0.50	20.7	0.00	11.3	800
0.75	20.8	0.00	11.2	800
1.00	20.8	0.00	11.2	800
1.25	20.8	0.00	10.9	800
1.50	20.8	0.00	10.8	800
1.75(bot)	20.8	0.00	10.5	800

Station: Railroad trestle, 0835 hr.

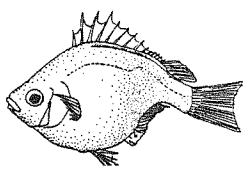
surf.	20.3	0.00	9.55	820
0.25	20.3	0.00	9.5	820
0.50	20.3	0.00	9.4	820
0.75	20.3	0.00	9.4	820
1.00	20.3	0.00	9.45	820
1.25	20.3	0.00	9.4	820
1.35(bot)	20.3	0.00	9.2	820

Algae density 40 % of the bottom covered (0.5 feet high) with none on surface above the Stockton Avenue Bridge in lower Reach 2. Algae covering 30 % of bottom (0.5-1 foot high) in upper Reach 2, at least one duck-neck length from surface. Pigeons roosting on the trestle. Clarity to the bottom.

Station: Mouth of Noble Gulch, 0845 hr.

surf.	19.5	0.00	9.48	795
0.25	19.5	0.00	9.15	795
0.50	19.5	0.00	9.16	795
0.75	19.5	0.00	9.05	795
1.00(bot)	18.2	0.00	8.40	795

Algae over 30 % of the bottom with none reaching the surface.



Conclusion: Algae density was less than in June, presumably because of the aquazine application on July 11. The fact that pondweed was not present may have been due to aquazine application. Oxygen levels were already supersaturated just after dawn on an overcast day, indicating no oxygen depletion overnight.

19 August 91

Water depth at flume inlet was 2.2 feet. Exit was 0.3 feet with sand to within 0.75 feet from the surface. At 0645 hr counted 18 mallards, 5 geese, the two large domestic ducks with clipped wings, one large white duck, 17 gulls bathing, one Caspian tern flying overhead.

Station: Flume, 0715 hr, overcast.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	21.7	0.00	10.1	860
0.25	21.8	0.00	10.05	860
0.50	21.8	0.00	10.2	860
0.75(bot)	21.8	0.00	10.1	860

No algae on surface.

Station: Stockton Avenue Bridge, east pier, 0720.

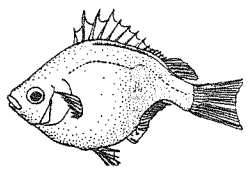
surf.	21.5	0.00	10.0	870
0.25	21.6	0.00	9.70	870
0.50	21.7	0.00	9.95	870
0.75	21.7	0.00	10.05	870
1.00	21.7	0.00	9.98	870
1.25	21.7	0.00	9.80	870
1.50	21.7	0.00	9.75	870
1.75	21.7	0.00	9.6	870
1.95(bot)	21.7	0.00	9.10	900

Algae and pondweed covering 50 % of bottom in lower lagoon. None on surface.

Station: Railroad trestle, 0745 hr.

surf.	21.6	0.00	9.8	640
0.25	21.6	0.00	9.8	640
0.50	21.6	0.00	9.8	640
0.75	21.6	0.00	9.85	640
1.00	21.7	0.00	9.95	640
1.05(bot)	21.8	0.00	9.1	640

Algae and pondweed 40 % of bottom in Reach 2. None on surface.



Station: Mouth of Noble Gulch, 0800 hr.

surf.	21.0	0.02	9.14	910
0.25	21.0	0.00	9.14	
0.50	21.0	0.00	9.15	
0.75	21.0	0.00	9.05	
1.00	20.1	0.00	7.29	
1.12(bot)	20.0	0.00	2.05	885

Thick algal mat from bottom to 1 foot above maximum, covering 75 % of bottom near culvert, 40 % pondweed and algae on bottom elsewhere in Reach 3. Algae more than 1 foot from surface for most part, forming a thin layer on bottom. Oxygen depleted near bottom overnight.

Conclusion: Oxygen levels were supersaturated everywhere except at Noble Gulch, indicating no oxygen depletion over nearly all of the lagoon. Water temperature was warm for steelhead, certainly by midday. Temperatures above 21 C are not preferred by steelhead. Food requirements are high at these temperatures. The only surface algae was in front of Shadowbrook Restaurant (150 sq.ft.) and upstream of a little near Noble Gulch (6 square feet). The algal bloom at the mouth of Noble Gulch implies a source of organic pollution from an unknown source. Pondweed has appeared since July monitoring.

26 August 1991

This monitoring was done before the aquazine application. Gage Height = 1.96 feet. Entrance to the flume = 1.2 feet. Exit from flume = 0.8 feet. Weather was overcast.

Station: Flume, 0710 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	20.0	0.00	9.1	910
0.25	20.0	0.00	9.1	910
0.50	20.0	0.00	9.1	910
0.75(bot)	20.0	0.00	9.1	910

Very little algae near the flume. 25 gulls on beach. 5 gulls in lower lagoon and 12 ducks. Clarity to bottom.

Station: Stockton Avenue Bridge, 0720 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	20.0	0.00	10.0	914
0.25	20.0	0.00	9.7	914
0.50	20.5	0.00	9.8	913
0.75	20.5	0.00	9.6	912
1.00	20.5	0.00	9.6	912
1.25	20.5	0.00	9.5	912
1.50	20.5	0.00	9.5	912

1.75	20.5	0.00	9.4	912
1.95(bot)	20.5	0.00	9.0	910

Algae and pondweed covered 60 % of the bottom with none on the surface. Clarity to bottom.

Station: Railroad trestle, 0730 hr.

surf.	20.0	0.00	9.9	910
0.25	20.1	0.00	9.7	910
0.50	20.1	0.00	9.6	910
0.75	20.1	0.00	9.6	910
1.00	20.1	0.00	9.6	910
1.25(bot)	20.1	0.00	9.4	910

No birds seen near station. Algae and pondweed covering 50 % of bottom and 5 % of the surface with algae. Vegetation within one deck-length from the surface. Clarity to bottom.

Station: Mouth of Noble Gulch, 0737 hr.

surf.	19.5	0.00	9.4	950
0.25	19.5	0.00	9.2	940
0.50	19.4	0.00	9.2	910
0.75	19.0	0.00	9.2	900
1.00	19.0	0.00	8.2	885
1.25(bot)	19.0	0.00	7.8	870

Algae and pondweed covering 70 % of the bottom and less than 5 % of surface with algae in Reach 3. No birds seen near station.

Conclusion: Water quality conditions for aquatic organisms were good, They were improved slightly over the previous week with regard to water temperature. Algae levels were highest thus far in the season, but little reached the surface.

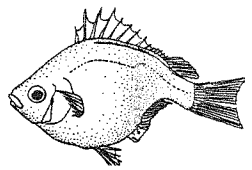
4 September 1991

Aquazine had been applied 30 August downstream of Stockton Avenue Bridge. See aquazine section for more details. Weather was foggy. Gage height = 2.0 feet. Inlet to flume = 1.9 feet. Exit to flume data not collected. Outside the flume = 1.7 feet.

Station: Flume, 0615 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	21.0	0.05	7.1	990
0.25	20.9	0.00	7.1	990
0.50	20.9	0.00	7.1	990
0.75(bot)	20.9	0.00	7.1	980

Clarity to the bottom. 8 gulls, 2 clipped wing ducks, 7 mallards (some may be domestic). No algae present on bottom or surface.



Station: Stockton Avenue Bridge, 0625 hr.

surf.	21.0	0.00	10.0	950
0.25	21.1	0.00	9.7	950
0.50	21.1	0.00	9.8	950
0.75	21.1	0.00	9.6	950
1.00	21.1	0.00	9.6	950
1.25	21.1	0.00	9.5	950
1.50	21.1	0.00	9.5	950
1.75	21.1	0.00	9.4	950
1.95(bot)	21.1	0.00	9.0	950

Clarity to bottom. Algae and pondweed less than 10 % of bottom, near bottom. None on surface.

Station: Railroad Trestle, 0636 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**	**Oxygen(ppm)**	**Cond. (umhos)**
surf.	20.9	0.00	6.95	990
0.25	20.9	0.00	6.9	990
0.50	20.9	0.00	6.9	990
0.75	20.9	0.00	6.9	990
1.00	20.9	0.00	6.93	990
1.25(bot)	20.9	0.00	6.85	990

Clear to bottom. 4 mallards, algae and pondweed less than 20 % of bottom, small amount on surface.

Station: Mouth of Noble Gulch, 0648 hr.

surf.	20.0	0.00	9.1	990
0.25	20.0	0.00	9.05	875
0.50	19.8	0.00	9.05	800
0.75	18.0	0.00	8.85	650
1.00	18.0	0.00	8.85	650
1.25(bot)	18.0	0.00	8.75	1050

No birds were observed. Algae and pondweed covering 70 % of bottom and 15 % of surface.

Conclusion: There was evidence of oxygen depletion during the night, presumably due to decomposition of dead algae and pondweed at some stations. However, oxygen levels were still high and offered no problems for aquatic organisms. Full saturation of oxygen at 21 C would be 9.82 ppm. Algae had been eliminated near the flume and covered only small percentage of the bottom at the bridge and trestle. Some of it may have been dead/dying. No fish mortality was observed. Aquazine had no apparent effect at Noble Gulch. Refer to section on Aquazine application and invertebrate sampling for more details.

12 September 1991

The Begonia Festival was September 8. On 12 September the gage height was 1.97. The entrance to the flume was boarded up. Depth inside the entrance was 1.9 feet. Depth outside the exit of the flume was 1.8 feet. No measurement was made at the exit. Weather was foggy.

Station: Flume, 0700 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	19.1	0.01	12.4	990
0.25	19.1		12.2	990
0.50	19.1		12.1	990
0.75(bot)	19.1	0.01	12.0	990

Algae dead near the flume with 10 % of surface covered with dead fragments. In the lower lagoon there were 12 gulls and 12 ducks (some wild mallards and some domestic type mallards).

Station: Stockton Avenue Bridge, 0710 hr.

surf.	19.1	0.01	11.65	990
0.25	19.5	0.01	11.59	990
0.50	19.5	0.01	11.50	990
0.75	19.5	0.01	11.40	990
1.00	19.5	0.01	11.35	990
1.25	19.5	0.01	11.25	990
1.50	19.5	0.01	11.25	990
1.75(bot)	19.7	0.01	11.10	990

Clear to bottom. Just below the bridge algae and pondweed covered less than 30% of bottom with 5 % of surface covered with dead algae. Much of algae may have been dead on the bottom because it looked brown. Refer to aquazine section.

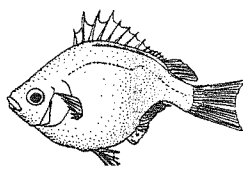
Station: Railroad trestle, 0720 hr.

surf.	19.2	0.01	10.6	1000
0.25	19.4	0.01	10.4	1000
0.50	19.3	0.01	10.4	1000
0.75	19.3	0.01	10.4	1000
1.00	19.3	0.01	10.4	1000
1.25	19.3	0.01	10.3	1000

Water clarity to bottom. No birds observed. 30 % of bottom covered with pondweed and algae with 5 % of surface covered with dead algae.

Station: Mouth of Noble Gulch, 0735 hr.

surf.	18.7	0.00	8.75	995
0.25	18.6	0.00	8.6	995
0.50	18.7	0.00	8.7	990



0.75	18.3	0.00	8.7	975
1.00	16.5	0.00	8.9	950
1.25(bot)	16.5	0.00	8.2	725

No birds observed. Algae and pondweed covering 50 % of bottom and 10 % of surface covered with algae.

On 13 September the pondweed was dead in the lower lagoon, but the algae was beginning to grow again. This new growth was apparently sufficient to promote photosynthesis just after dawn to supersaturate the water there and not deplete oxygen levels overnight. Adjacent Noble Gulch conditions were more shaded from the sunrise and oxygen levels were still slightly below full saturation, indicating some oxygen depletion overnight. However, water quality conditions were still very good for aquatic organisms. No fish mortality was observed.

11 October 1991

Observations were made during lunch hour, 1210-1310 hr.

In Reach 1 (downstream of Stockton Avenue Bridge), 20 % of the lagoons surface was covered with floating algae, most of it being beside the restaurants, and 80 % of bottom with pondweed and algae, . Unsightly trash floated on top of the algae. 3 gulls swam adjacent to Sea Bonne Restaurant, waiting for handouts. None were seen given food in 10 minutes of observation. 42 gulls floated in the lower lagoon, most of whom were bathing. 15 coots were also present with 5 geese on the beach adjacent to Venetian Courts. One brown pelican was floating near the bridge.

Observations from the trestle of Reach 2 (Stockton Avenue Bridge to trestle) indicated that algae and pondweed covered 65 % of the bottom and none reached the surface. 30 pigeons were sitting near the bench at the eastside park near the bridge. Coots were numerous.

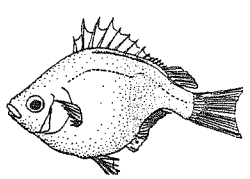
In Reach 3 (trestle to Shadowbrook Restaurant) 35 % of the bottom and none of the surface was covered with pondweed and algae. The upper portions of pondweed plants were devoid of algae, indicating grazing by ducks and coots. One cormorant was present in Reach 3, and coots were numerous.

6 November 1991

Gage height = 2.61 feet. 10 days after the breach. Weather was clear.

Station: Stockton Avenue Bridge, east pier, 1540 hr.

Depth(m)	**Temp.(C)**	**Salin.(ppt)**
surf.	17.0	8.5
0.25	16.5	9.3



0.50	15.8	19.0
0.75	15.5	23.6
1.00	14.7	25.0
1.25	14.8	25.3
1.50	15.0	27.6
1.75	15.5	28.0
2.00	15.9	28.7
2.25(bot)	16.0	28.6

The sandbar was closed at low tide but overwash was great at high tide. Kelp was abundant in the lagoon.

Conclusion: Water quality would worsen if the sandbar built up and kelp began to decompose. The suggestion was made to build up the sandbar and use the flume to run freshwater out. The decision was to wait because the sandbar did not appear to be building up more, and it might rain soon.

10 December 1991

According to City staff, the sandbar had built up by then and lagoon level had reached the piling bolt after light rain on 7 December. The sandbar was breached to avoid flooding. It drained partially, according to Mr. Clark of the Shadowbrook Restaurant. He detected decaying odor after the rain. The lagoon turned black after the rain and then a milky color after a day or two.

12 December 1991

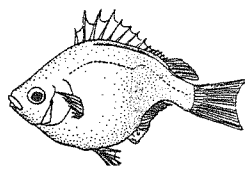
Station: Stockton Avenue Bridge, 1530 hr. Weather was clear.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	12.5	6.0	0.9	7500
0.25	11.8	8.3	0.7	10000
0.50	11.3	17.8	0.5	21000
0.75	12.0	28.0	0.5	32800
1.00	12.5	30.5	0.42	35000
1.25	12.7	31.2	0.4	36500
1.30(bot)	12.5	31.2	0.35	36600

A rotten egg and methane smell was evident. Water was milky gray with visibility 0.25 m. Domestic ducks mostly, with a few mallards and coots were present. A local passer-by said he noticed the smell after the last rain.

Station: Railroad Trestle, 1550 hr.

surf.	10.3	2.5	1.85	5500
0.25	10.2	5.0	1.2	6500
0.50	12.0	18.0	0.4	19000
0.55(bot)	12.0	23.0	0.35	25000



Less rotten egg smell and more methane. Visibility down 0.5 m. Water a milky gray color.

Station: Mouth of Noble Gulch, 1600 hr.

Depth(m)	Temp.(C)	Salin.(ppt)	Oxygen(ppm)	Cond. (umhos)
surf.	9.3	1.8	9.2	1800
0.25	11.0	5.0	1.75	6200
0.50	13.0	19.1	0.4	21600
0.55(bot)	13.4	20.5	0.32	25800

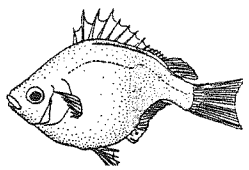
Slight rotten egg smell. Color - milky gray. Visibility down 0.35 m.

Conclusion: An aquatic dead zone had been created from the flume to near Noble Gulch due to anaerobic decomposition of kelp in a stagnant lagoon. Steelhead could survive only near the surface at Noble Gulch. Bottom fish such as staghorn sculpin and tidewater goby probably moved up the lagoon as far as possible to where oxygen was present on the bottom. This would be the case up near Nob Hill where a riffle entered the lagoon.

It would have been better to run the water out the flume rather than breaching the sandbar. That way, the shroud could have been placed on the flume to pull saltwater off the bottom while preventing more saltwater from coming in from the ocean. The lagoon could then be converted to freshwater in 3-4 days. Fortunately, it rained on 17 December to flush the lagoon.

APPENDIX G.

BIRD CENSUSING AND MONITORING OF HUMAN BIRD FEEDING, 1991.



BIRD CENSUSING AND MONITORING OF HUMAN BIRD FEEDING, 1991.

by William Ihle

ABSTRACT

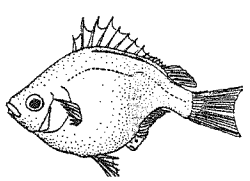
Bird use of the Soquel Creek Lagoon was monitored during two periods in 1991: August 19 to September 5 and from September 20 to October 13. The objectives of the study were to obtain quantitative data on the distribution of waterbirds using the lagoon and to determine the level of success the installation of no bird feeding signs had on discouraging bird feeding by humans. When censuses were conducted, each bird was assigned to one of 16 pre-defined sections of the lagoon. Birds were concentrated in Reach 1 of the lagoon, with 58% occurring between the flume and Stockton Avenue Bridge, in Reach 2 with 19% occurring between Stockton Avenue and the railroad trestle and in Reach 3 with 23 % between the railroad trestle and a point slightly beyond the Shadowbrook Restaurant. Each species group exhibited a slightly different distribution in the lagoon.

Feeding behavior and interaction of birds with humans were also recorded, both before and after installation of the no bird-feeding signs in early September. A statistical test was conducted by comparing the mean hourly rate of food offerings by humans to birds before and a period beginning 2 weeks after the no-feeding signs were installed. The mean feeding frequency was 2.6 times per hour before the signs and 1.4 times per hour after the signs were installed, which was statistically less than before. It was the impression of the data gatherer that the signs would be ignored if the no bird feeding ordinance was not enforced. On 7 separate occasions, 20 or more mallards were observed to compete for human handouts. Interestingly, the domestic geese began to feed voraciously on algae and pondweed when the frequency of handouts diminished, offering some biological control of aquatic vegetation.

Some comparisons also were made between the results obtained in this study regarding bird distribution with those produced in the 1988 survey. As in 1988, the highest bird use of the lagoon was in Reach 1, it being dominated by gulls, domestic geese and feral ducks. Wild mallards fed primarily in Reach 3, though they were often seen in Reaches 1 and 2. They were observed roosting most visibly along primarily the margins of Reach 2. The primary roosting locations for rock doves (pigeons) were at the east and west parks (just upstream of the Stockton Avenue Bridge) and on the railroad trestle. As many as 100 gulls at a time were observed roosting on building roof tops along the Esplanade.

METHODS

Avian use of the Soquel Lagoon was monitored on 20 days from August 19 to October 13, 1991. Twenty-four censuses were made. Census duration ranged from 5 to 82 minutes. The average census



period was 41 minutes. Censuses were performed between 8:12 A.M. and 7:15 P.M. PST. Four groups of birds were censused: mallards, American Coots (coots), gulls (at least three species present: Western, California, and Heerman's Gulls), and domestic geese/ducks. The study area was divided into 3 reaches and quadrats within each reach (**Figure 1**). Reach 1 extended from the flume upstream to Stockton Avenue Bridge. Reach 2 extended from the bridge upstream to the railroad trestle. Reach 3 extended from the trestle to a point upstream of Noble Gulch and the Shadowbrook Restaurant.

Vantage points allowed the entire lagoon to be censused. Each census consisted of the biologist viewing the lagoon from the south side of Stockton Avenue, the north side of Stockton Avenue, the east side of the railroad trestle, and two spots further upstream from the trestle. The bank of the lower lagoon, downstream from Stockton Avenue, was frequented by many birds, especially gulls. In this portion of the lagoon, only those individuals within one foot of the lagoon were included in the census. This method included birds that were interacting with the lagoon, but excluded those that were simply present near the lagoon. Upstream from Stockton Avenue, only Mallards were noted on the banks of the lagoon. These individuals were recorded separately from the Mallards that were in the lagoon itself.

Feeding of bread or other handouts was recorded when observed, along with the location of the feeding, the type of food, and the number of birds that were responding.

During the analysis of the effects of the no bird feeding signs, 9.08 hours of observation were made during 13 visits to the lagoon from 18 August to 5 September before the signs were installed. A 2-week period was allowed to elapse before observations were made after the signs were installed. 9.23 hours of observation were made during 12 visits to the lagoon from 20 September to 13 October. A one-tailed Student's t-test was used to compare the frequency of feeding observations before and after sign installation.

RESULTS

The total number of individuals in the species groups of interest ranged from 15 to 175 on each census. The ranges observed for each group for a single census were as follows: wild mallards (7-93), domestic geese and ducks (0-8), coots (0-19), and gulls (3-137). As observed in the October 1988 study, the general patterns of avian use of the lagoon did not differ noticeably from day to day and no discernible difference in the distribution of the birds in the lagoon were obvious at different times of the day.

The average numbers of each censused group are presented in Table 1. As in 1988, the highest bird use of the lagoon was in Reach 1, it being dominated by gulls and domestic geese and feral

ducks. Wild mallards fed primarily in Reach 3, though they were often seen in Reaches 1 and 2. Mallards were observed roosting primarily along the margins of Reach 2. The primary roosting locations for rock doves (pigeons) were at the east and west parks just upstream of the Stockton Avenue Bridge and on the railroad trestle.

Distribution of Birds in the Lagoon

As indicated in Figure 2, birds used the entire lagoon but were not uniformly distributed throughout its confines. Figure 3A indicates that 58% of all birds tallied were observed in Reach 1 of the lagoon, 19% in Reach 2, and 23% in Reach 3. The quadrats in which the greatest number of birds were observed were W2, E2, and W1 (18.5%, 11.1%, and 8.8% respectively) with percentages based on the total number of individuals recorded in all 16 quadrats (Figure 2). This finding coincides closely with the 1988 study where quadrats W1 and W2 were noted to have large numbers of birds. It should be noted that in the current study, the overwhelming majority (82.8%) of birds observed in quadrats W1 and W2 were gulls bathing, drinking, and resting in the lagoon. A comparison of the distribution of all species groups combined throughout the lagoon revealed the same general allotment of birds by reach for 1988 and 1991, albeit a greater percentage of birds occurred in Reach 3 in 1991 (Figure 3A). It is worth mentioning that while the current study was conducted from mid-August to mid-October, however, the 1988 census occurred entirely in late October. Since the coot population was virtually nonexistent until late September 1991, their numbers had little effect on the overall species group distribution analysis (see Figures 3A and 3B).

As noted in the 1988 survey, each species group had a unique distribution in the lagoon. Mallards used the entire lagoon. However, 45% were concentrated in Reach 3 (Figure 4A). Reaches 1 and 2 had almost equal use by mallards at 26% and 30%, respectively. Roosting mallards showed a very strong (81%) preference for Reach 2 (Figure 4B). A relatively small number of mallards were seen roosting in Reach 3 (9%). Mallards were observed roosting on top of the seawalls located on the west edge of quadrat W4, at the east edge of quadrat E4, and on the west side of the lagoon under the railroad trestle. Smaller numbers of mallards were seen roosting on the "whale float" in quadrat W7 and also on rocks located near the Shadowbrook Restaurant in quadrat W8. Forty-three percent of roosting mallards were observed at a particular portion of the east edge of quadrat E4. This specific mallard roost site appeared to offer greater relief from outside disturbance than other sites as it was part of a fenced-in private residence.

Domestic geese and ducks were seen throughout the lagoon but were seen more often (51%) in Reach 1 (Figure 5A). Primary human handout sites for domestic geese/ducks were in quadrats E1, E3, and W3. 47.5% of observations of domestic geese occurred in these

three quadrats alone. Geese were frequently observed swimming upstream to sites where humans offered food to them in Reaches 2 and 3.

Although late arrivals for the 1991 study, coots exhibited a preference for Reach 3. Sixty percent of observations of coots occurred in Reach 3 (Figure 5B).

Eighty-eight percent of observations of gulls occurred in Reach 1 (Figure 6), where gulls bathed and rested in relatively large numbers compared to the other groups observed. Moving upstream from Reach 1, gulls were still present albeit in vastly reduced numbers (Figure 6). This finding is consistent with the results of the 1988 study where 95% of observations of gulls occurred in Reach 1.

Feeding Behavior of Lagoon Dwelling Birds

Invertebrates, aquatic plants, fishes, carrion, and food offered by humans were the most readily apparent sources of food at the lagoon for the four groups of birds observed. No carrion was observed in the lagoon during the 1991 survey.

In general, food was offered by humans to birds throughout the lagoon. In two instances, people offered food to birds from small boats and canoes while paddling around the lagoon. But most food handouts to birds were done by people standing and sitting on or near the edges of the lagoon (except for the lagoon's west bank from quadrat W5 upstream).

Two surveys of food offerings by humans were done: one before installation of no bird-feeding warning signs, and one after. Prior to the signs being erected, humans were seen offering food to lagoon birds a total of 26 times on 13 of the 14 surveys (93%). Food was offered at a mean rate of 2.6 times per hour. Human handouts to lagoon birds occurred most frequently along the banks of quadrat E7 (Figure 7). This segment of the lagoon's east bank consisted entirely of summer rental properties and private residences. Rental unit customers were frequently observed offering food to lagoon birds, particularly in the period corresponding to late summer (late August-early September). Children frequently were accompanied by adults during food handouts to birds. Most handouts by people to birds were observed in the areas described above, which border the lagoon along the eastern perimeter of quadrats E4, E5, and E7. Sixty-two percent of the total number of feedings of birds by humans were observed in these three quadrats (Figure 7). Other quadrats where frequent human handouts occurred were W3 and W2 (Figure 7). Humans were observed feeding birds in the lagoon twice in quadrat W2 and once in five additional quadrats: E1, W1, E2, E3, and W6 (Figure 7).

On September 11, 1991, seven warning signs intended to discourage bird-feeding were posted at the following locations

around and in the general vicinity of Soquel Lagoon:

1.)approximately 50 yards north of quadrat E1 at Capitola Beach;

2.)in the immediate vicinity of quadrat E1 on the beach near the walkway leading between the Beach House and Zelda's Restaurant;

3.)in immediate vicinity of quadrat W3 near Venetian Courts;

4.)at the entrance to the park area adjacent to quadrat W4;

5.)directly adjacent to the bench located in park area near quadrat E4;

6.)directly beneath the railroad trestle beside the park near the east bank of quadrat E5;

7.)at the point of access to the footpath near Noble Gulch (quadrat E7).

The sites chosen for posting signs coincided with those locations at which the highest incidences of human handouts to birds were recorded. After a two-week acclimatization period, subsequent surveys were performed in an attempt to gauge the efficacy of the warning signs.

Humans were observed to offer food to birds a total of 14 times in seven of the 12 surveys (58.3%) conducted two weeks after the signs had been erected. During this period (September 20 to October 13, 1991) food was offered to birds by humans an average of 1.4 times per hour. People continued to feed birds at various sites throughout the lagoon in spite of the presence of the warning signs as handout feeding was observed in quadrats E3, E4, E5, E7, W2, W3, and W4 (Figure 7). A one-tailed Student's t-test indicated, however, that there was a **significantly lower mean hourly rate of bird-feeding by humans** in the period after the installation of no bird-feeding warning signs (alpha=.05,P=.05,df=18).

Mallards regularly fed on invertebrates living on filamentous algae and pondweed by grabbing small clumps of the vegetation both above and below the water surface and nibbling on them for their food content. Mallards were observed dabbling in particularly high numbers in quadrat E7 (near Noble Gulch) where very thick pondweed and algal growth was observed. On one occasion three mallards were observed diving completely underwater and swimming to the bottom of the lagoon, whereupon they broke loose small clumps of algae and pondweed and returned to the surface to feed. Mallards readily accepted food offered by humans. Mallards were present at 82.9% of observed human handouts (Figure 8). On seven separate occasions when human handouts were observed, 20 or more mallards were seen competing for food morsels. It is worth noting that not all individual birds present at these feedings were actually exploiting the artificial food source; these birds were merely present to

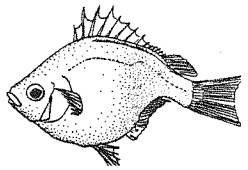
compete with the others for whatever food was offered by humans for however long it was offered. It would be very difficult to determine what percentage of mallards or any other bird group present were **actually consuming** the food offered by humans. So, in this study no attempt was made to do so. Human bird-feeding events ranged in duration from less than 1 minute to 17 minutes.

Domestic geese were present at 37.1% of the observed human bird-feeding events (Figure 8). Due to their aggressive behavior, large size, and superior strength, the geese in the lagoon competed very effectively for human handouts against the smaller, less aggressive domestic ducks, mallards, and gulls. In addition, the people who participated in bird-feeding activity seemed to show a preference for feeding the geese by frequently tossing bits of food in their specific direction. During the 1991 study, geese were also observed using natural food sources in the lagoon; at quadrat E7 (near Noble Gulch) on September 24, four geese were seen dabbling in duck-like fashion on pondweed and algae for a total feeding time of 16 minutes. Unlike mallards, which often appeared to merely nibble on vegetation for its invertebrate content, the geese would reach down with their bills to the lagoon bottom, break off a **large clump** of pondweed/algae, bring it to the surface, and quickly devour the entire mass of vegetation. Earlier, on September 19, the same four geese had been observed feeding in this voracious manner on natural vegetation in a small shallow area of the lagoon beneath the trestle in quadrat E6. A few of the geese were also observed nibbling on the ends of pampas grass leaves which dangled a short distance above the water surface on the bank of quadrat E4. Geese were not observed feeding on natural vegetation prior to the installation of the bird-feeding warning signs.

Domestic ducks readily availed themselves of natural and artificial food sources both before and after installation of the signs. This small group remained tight knit throughout the study, often roosting, swimming, and feeding in the absence of other birds. Domestic ducks were present at 17.1% of human bird-feeding events (Figure 8).

American Coots, late arrivals in this study, were never observed accepting food from humans. Rather, coots were assiduous consumers of both surface algae and submerged pondweed, for which they were frequently observed diving throughout the lagoon.

On the other hand, opportunistic gulls were observed taking food offered by humans, attempting to steal food already procured by other birds (including gulls). On one occasion they were observed taking human food directly from vacated tables at the outdoor dining section at Margaritaville. Gulls were present at 57.1% of observed human bird-feeding events (Figure 8). Gulls were frequently observed roosting in large numbers (at times exceeding 100 individuals) on the roofs of buildings along the Esplanade.



DISCUSSION

In general, the observed distribution of birds in this study coincided fairly closely with that reported in 1988. In terms of percent, fewer birds were observed in Reach 2, and larger numbers were seen in Reach 3 than were seen in 1988 (Figure 3A).

A larger percentage of mallards were observed using Reach 3 in this study than was reported in 1988 (45% versus 26%, respectively (Figure 4A). Large numbers of mallards were frequently observed dabbling in quadrats E7, W7, and W8. This portion of the lagoon was relatively shallow and contained luxurious stands of pondweed and filamentous algae (good sources of natural food for mallards) located just beneath and often at the surface. This was true particularly in the area of the Noble Gulch drainage. Mallards were also frequently observed dabbling for food in the immediate area of the Shadowbrook Restaurant.

Domestic geese and ducks were observed approximately 50% of the time in Reach 1 (Figure 5A), presumably to take advantage of human handouts. However, this group of birds also spent a large portion of their time budget (49%) in Reaches 2 and 3 combined, where humans were frequently observed offering food to lagoon birds particularly in quadrats E4, E5, and E7 (Figure 5A, Figure 7).

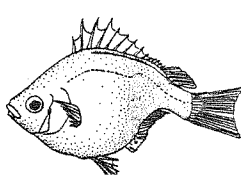
In 1991, gulls of several species (notably Western, California, and Heerman's) were observed in large numbers in Reach 1; eighty-eight percent of observation's of gulls occurred in Reach 1 (Figure 6) as compared to 95% in 1988.

Efficacy of No Bird-Feeding Warning Signs

Reaction by Birds

Gulls, which were probably using the lagoon mostly for drinking, resting, and bathing, appeared to show minimum impact in reaction to the no-feeding policy. Likewise, mallards appeared to be little affected, since they were regularly observed consuming natural food throughout the current study. Coots, while small in number, subsisted entirely on natural food in this study.

Human compliance with the no bird-feeding policy appeared to be strongest in the period immediately after the signs were installed. This was corroborated by the behavioral change of a specific group of birds in the study, the domestic geese. Perhaps, because the geese relied more heavily on human generosity than the other groups of birds observed (i.e., gulls, domestic ducks, mallards, and coots) they also exhibited the most dramatic changes in feeding behavior in reaction to the no bird-feeding policy. **Prior to installation of the signs, geese were not observed exploiting the natural food sources offered by the lagoon.** Two weeks after the new feeding policy was adopted, four of the five geese present in the lagoon were seen dabbling for



natural vegetation in the same manner as wild mallards and domestic ducks. However, unlike mallards, while feeding in this manner, the geese brought large clumps of vegetation to the surface and quickly consumed the entire mass before immediately dabbling for more. The geese were observed feeding on algae and pondweed in this intense manner for periods which exceeded 15 minutes. At the time of the study, a fifth goose was present at the lagoon, however, due to the physical handicap of a broken leg it was probably unable to feed successfully on submerged vegetation. This specific individual was never observed consuming natural food at any time during the 1991 study. These observations suggest the following:

1) of all the bird groups studied, geese were impacted most severely by the no bird-feeding policy; 2) geese will not necessarily desert the lagoon voluntarily when deprived of human handouts, at least in the short term; 3) based on their observed behavior after the warning sign acclimatization period, geese may potentially be recruited as powerful biological agents in helping to control excessive pondweed and algal growth (such as occurs in late summer in the lagoon) but only if an **effective** no bird-feeding policy is maintained.

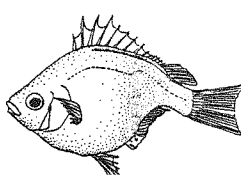
Human Reaction

It was noted that as certain people began to ignore the no bird-feeding signs, improper human bird-feeding behavior appeared to become more prevalent. This happened in spite of the obvious presence of the signs. Late in the study, compliance with the no bird-feeding ordinance appeared to become more of a problem. However, insufficient data were available to confirm this. Some people at the lagoon behaved as if they believed that so long as they were not feeding birds in the immediate vicinity of a warning sign that they were not actually violating the ordinance. Others appeared to ignore the signs outright.

Based on observations of human and avian behavior in the vicinity of the Soquel Creek Lagoon from September 24 to October 13, 1991, the anti-bird-feeding policy instated by the City of Capitola shows genuine potential for contributing to a biologically enhanced lagoon environment. However, this outlook is valid only if **effective enforcement** is soon brought in to accompany the visual and educational program already in place.

LITERATURE CITED

Soquel Creek Lagoon Management and Enhancement Plan 1990. Prepared by Habitat Restoration Group for the City of Capitola and Coastal Conservancy.

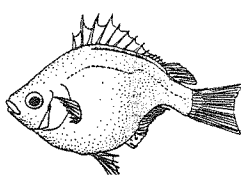


Bird Counts at Soquel Creek Lagoon, 1991.
24 Censusings, 19Aug-13Oct, 14Sep-13Oct for Coots

Group	Reach 1 West	Reach 1 East	Reach 1 Total	Reach 2 West	Reach 2 East	Reach 2 Total	Reach 3 West	Reach 3 East	Reach 3 Total
Gulls	18.4	12.0	30.4	1.0	2.2	3.2	0.5	0.6	1.1
Mallards (some domestic)	5.9	2.2	8.1	3.7	5.9	9.6	8.0	6.0	14.0
Domestic Ducks	0.3	0.1	0.4	0.5	0.5	1.0	0.3	0.3	0.6
Geese	1.3	1.0	2.3	0.2	0	0.2	0.5	0.4	0.9
Pigeons	0.8	0	0.8	3.5	4.3	7.8	0	0	0
Coots	0.1	1.5	1.6	0.6	0	0.6	2.9	0.4	3.3
Total Density			47.3			22.4			19.9

Density is expressed as the mean number of birds counted in 24 censusings for all groups except coots. Mean number of coots was calculated from 10 censusings after they arrived on the lagoon. Counts included birds on the water and within 1 foot of the lagoon margin, excluding the railroad trestle and including the areas around the park benches in in Reach 2. Roosting mallards beyond the 1-foot margin were not censused here.

Table 1. Bird Counts at Soquel Creek Lagoon, 1991



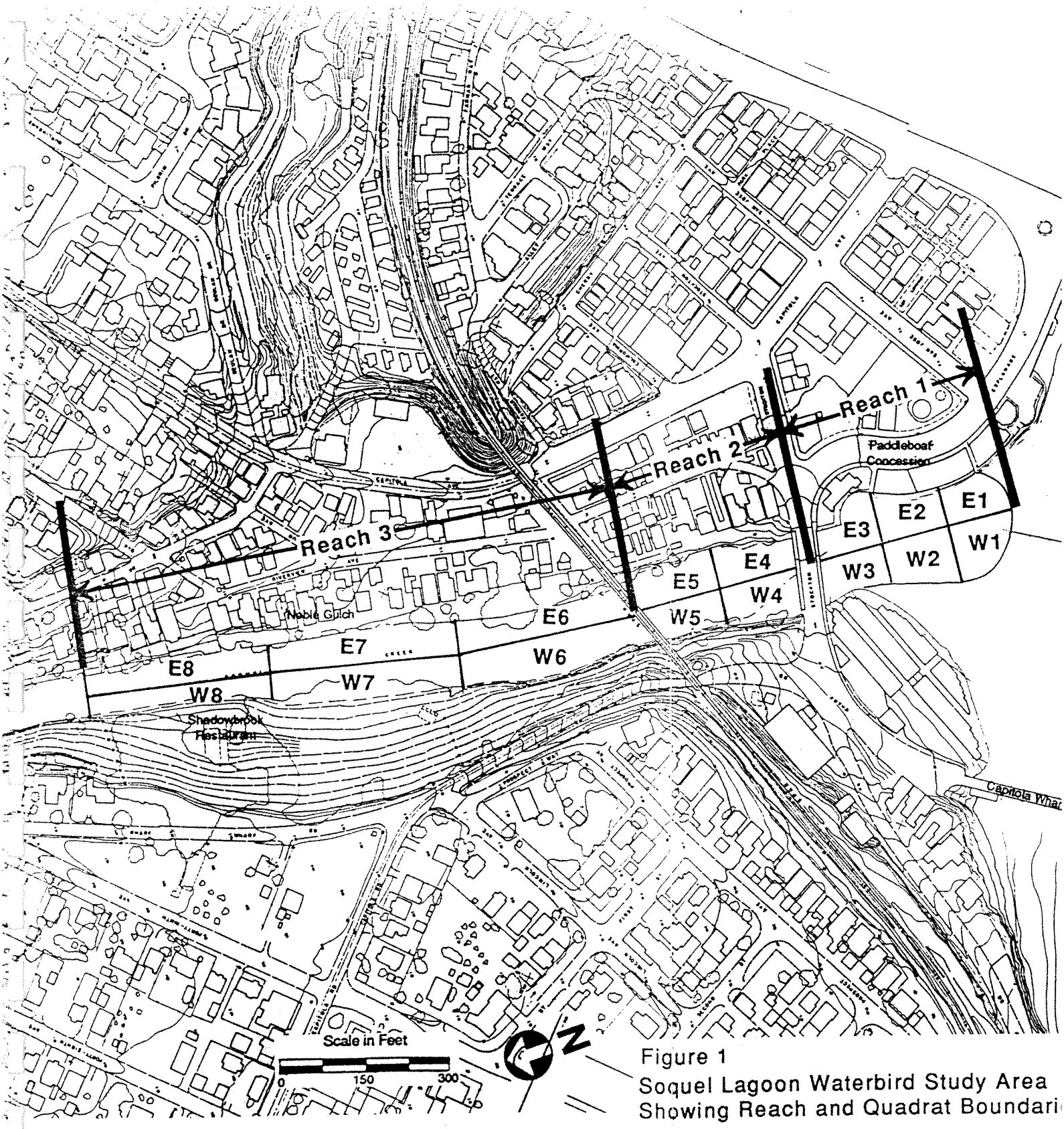


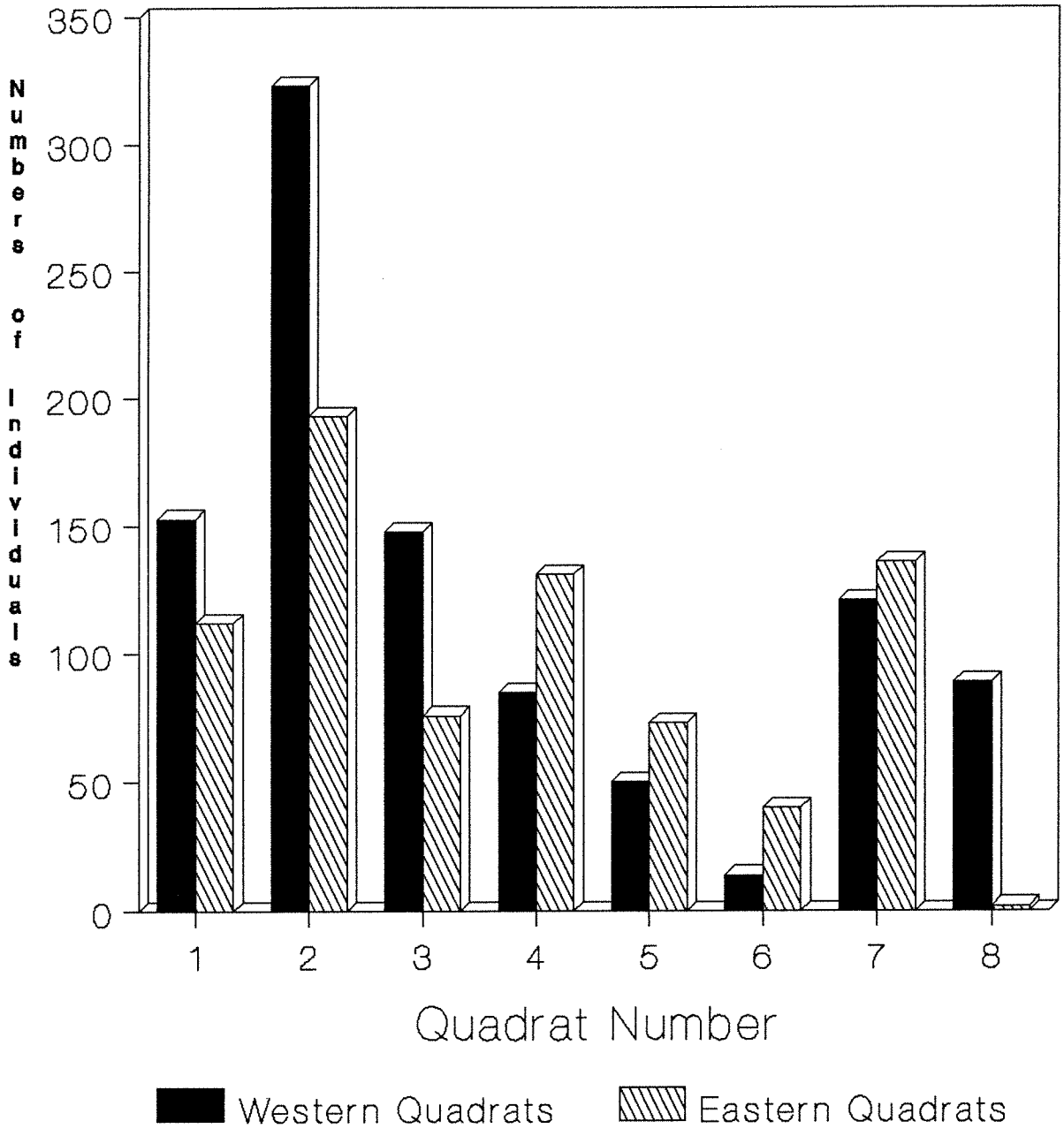
Figure 1
Soquel Lagoon Waterbird Study Area
Showing Reach and Quadrat Boundari

SOQUEL LAGOON Management & Enhancement Plan	Habitat Restoration Group	May 1990 424-01

D.W. ALLEY & Associates

CUMULATIVE NUMBER OF INDIVIDUALS OBSERVED IN EACH QUADRAT

All Species Combined



N = 1746

Figure 2.

PERCENT OF OBSERVATIONS IN EACH REACH
All Species Combined

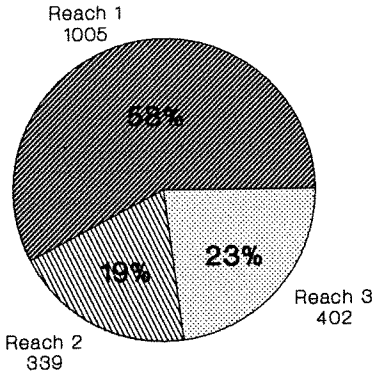


Figure 3A.

N = 1746

PERCENT OF OBSERVATIONS OF ALL SPECIES
Excluding American Coot, In Each Reach

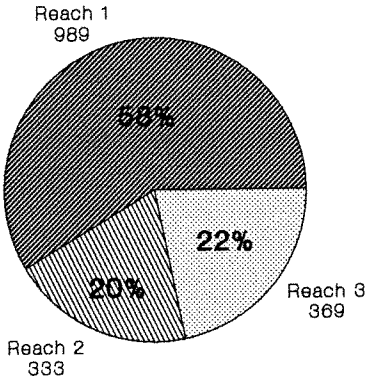


Figure 3B.

N = 1691

PERCENT OF OBSERVATIONS OF
MALLARDS IN EACH REACH

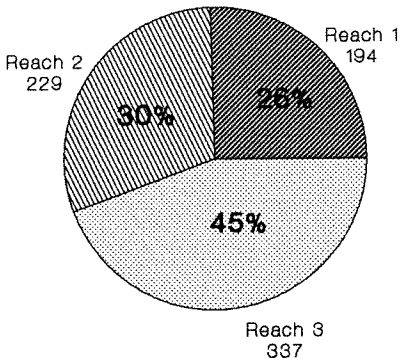


Figure 4A.

N = 760

PERCENT OF OBSERVATIONS OF ROOSTING
MALLARDS IN EACH REACH

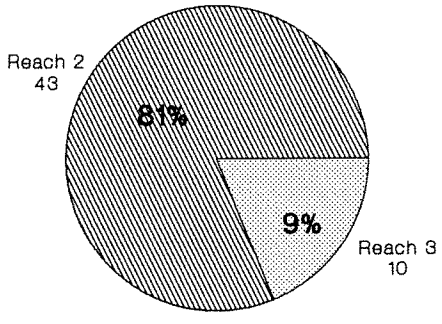


Figure 4B.

N = 53

PERCENT OF OBSERVATIONS OF DOMESTIC GEESE AND FERAL DUCKS IN EACH REACH

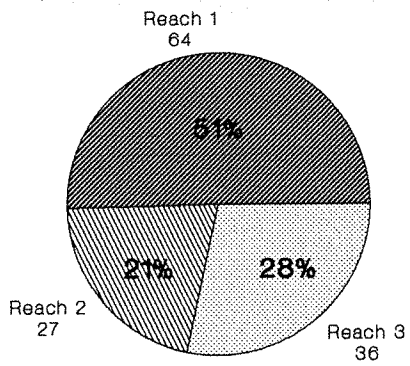


Figure 5A.

N = 127

PERCENT OF OBSERVATIONS OF AMERICAN COOTS IN EACH REACH

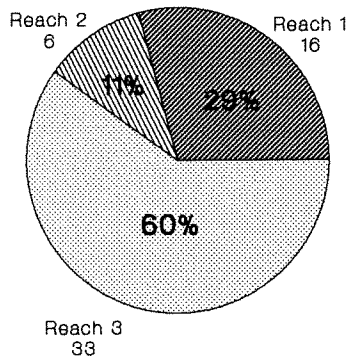


Figure 5B.

N = 55

PERCENT OF OBSERVATIONS OF GULLS IN EACH REACH

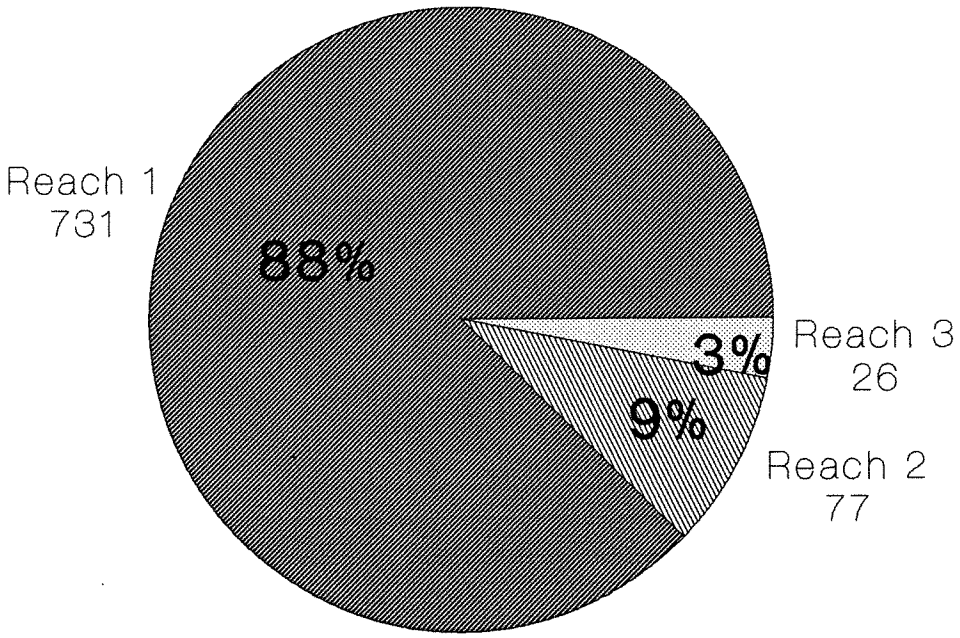


Figure 6.

N = 834

NUMBER OF HUMAN BIRD-FEEDING EVENTS PER QUADRAT

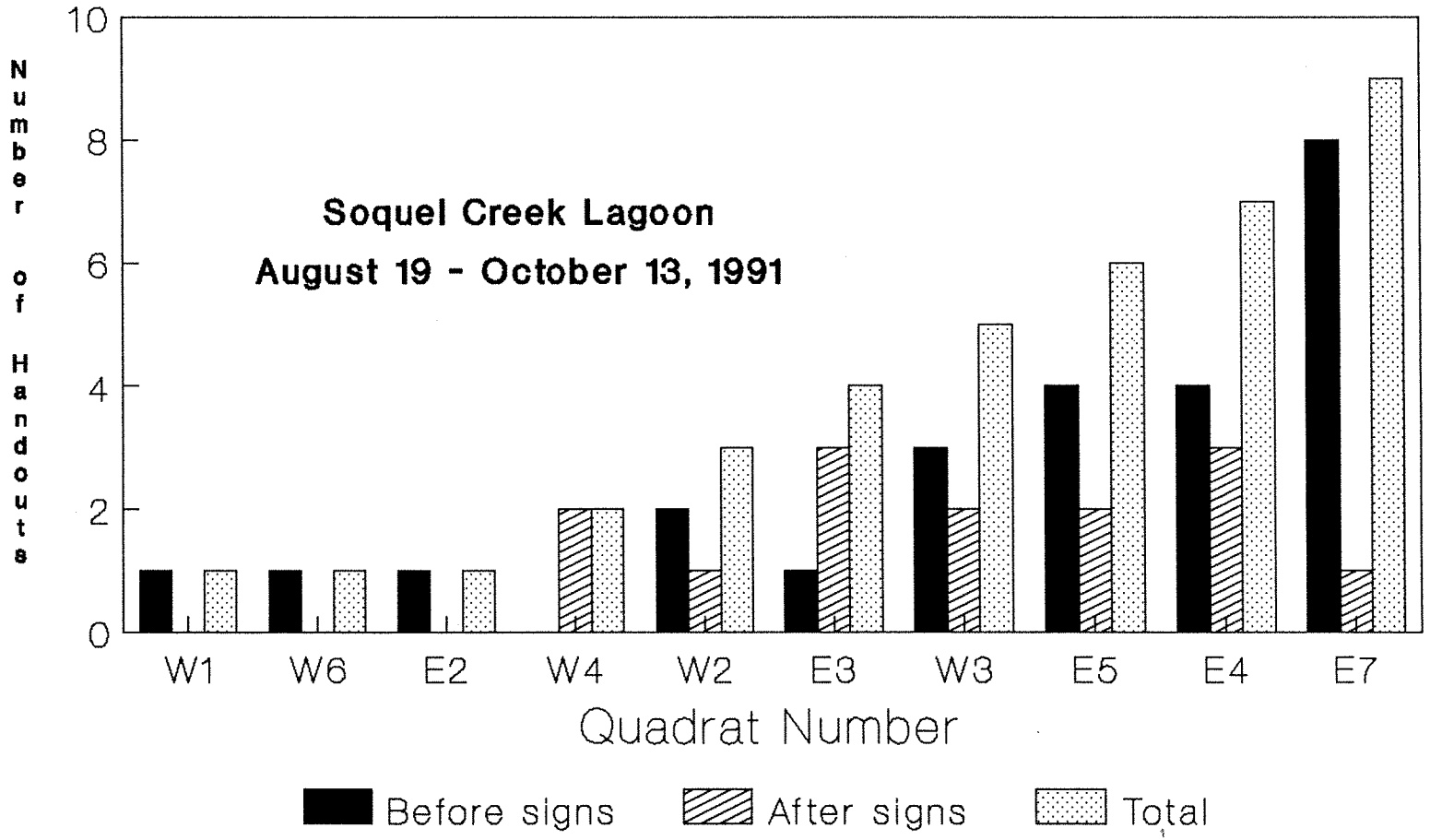


Figure 7.

N = 40

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PERCENT OF TIME A SPECIES GROUP WAS PRESENT DURING HUMAN FEEDING EVENTS

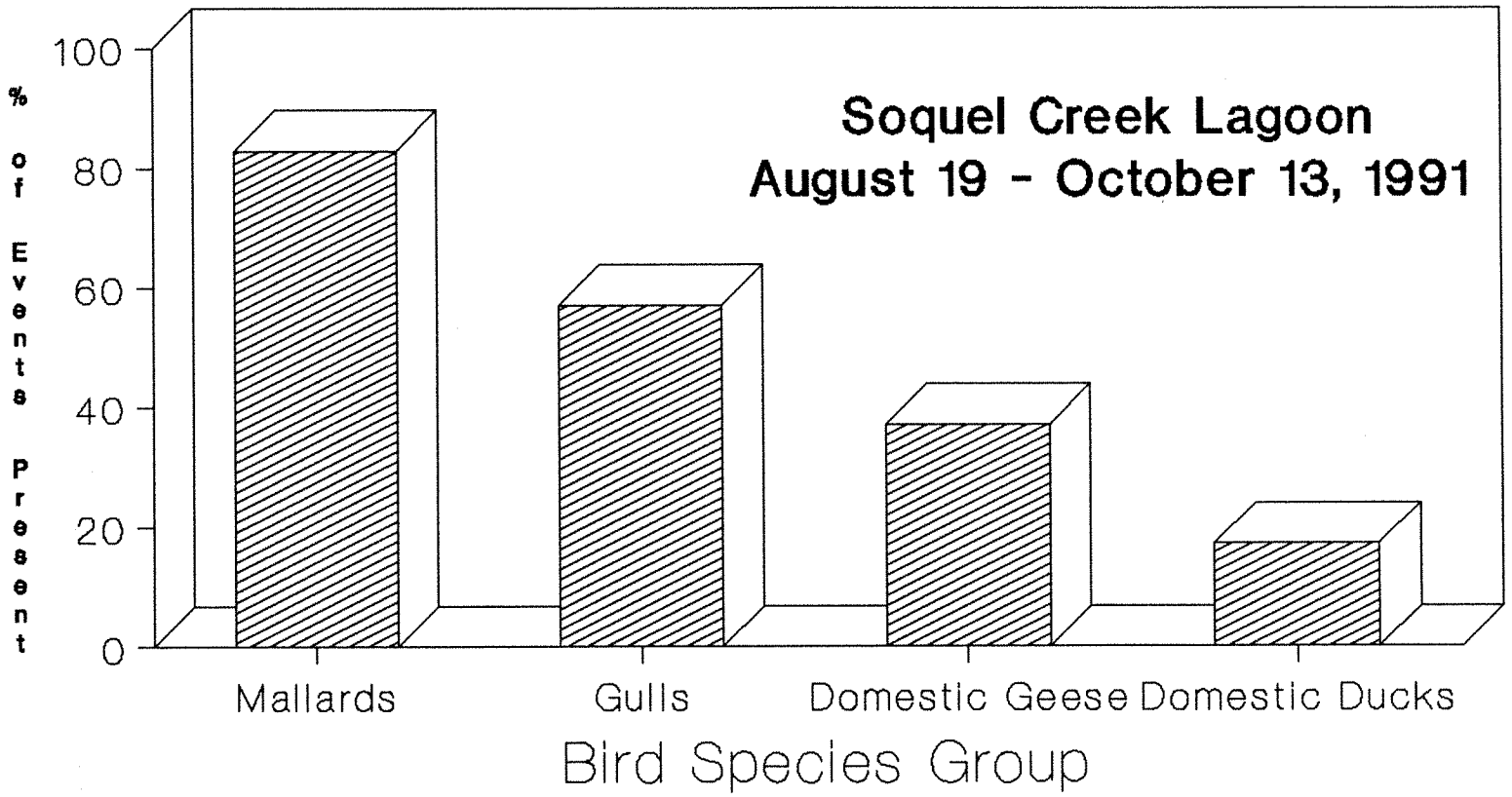

Figure 8.

N = 35

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