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Santa Clara River Estuary Ecological Monitoring Program 1997 - 1999

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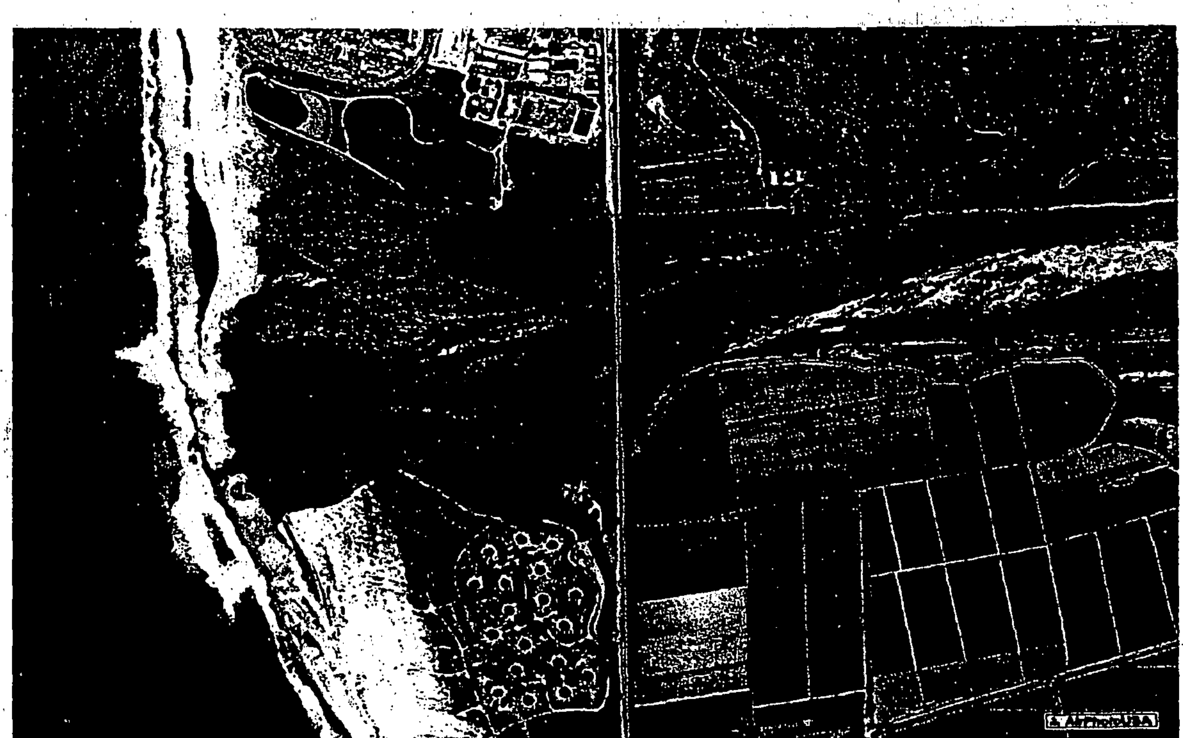

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EXECUTIVE SUMMARY

In July 1997, the State of California Department of Parks and Recreation (State Parks) contracted with the U.S. Fish and Wildlife Service (Service) to design and implement an ecological monitoring program in the Santa Clara River Estuary (SCRE) in Ventura County, California. The primary objective of this monitoring program was to characterize the SCRE for water quality, vegetation, invertebrate, fish, amphibian, and reptile species composition. A secondary objective was to attempt to investigate the influences of fluctuating estuary water levels upon these species.

Preliminary field investigations were initiated in July 1997. These preliminary field investigations were followed by 12 field surveys conducted on an approximate bimonthly schedule from October 1997 to July 1999. El Nino-influenced storms from December 1997 - March 1998 caused high flows in the Santa Clara River. In addition to keeping the SCRE mouth open for extended periods, El Nino-influenced winter flows in the Santa Clara River also created a large amount of scouring and deposition. In the SCRE, the major physical results of these El Nino-influenced storms appeared to include higher sediment levels, smaller sediment particle sizes, reduced water depths, and scouring out or submersion of terrestrial vegetation.

Seven sampling stations were established in the estuary for measuring water quality parameters. The estuary mouth was closed during six survey dates, and open during six survey dates. Surface water levels of the estuary fluctuated frequently among survey dates, and ranged from a low of 3.5 ft above mean sea level (MSL) to a high of 9.3 ft above MSL. Estuary surface levels typically were higher during the summer and fall months when the estuary mouth tended to remain closed, and typically were lower during winter and early spring months when the estuary mouth tended to remain open. Maximum sampling station depths ranged from 0 ft (dry substrate) to a maximum of 7.3 ft, with trends for high and low values paralleling the estuary surface levels. Water temperatures ranged from 13.94-29.04 °C, with the low and high extremes being recorded when the estuary mouth was closed. Values for pH ranged from 6.54-9.04, and the lowest values were typically found closest to the sewage discharge area adjacent to the City of San Buenaventura Water Renovation Facility. Dissolved oxygen levels ranged from 0.21->20mg/l, with the lowest values occurring in bottom strata of backwater areas and in the sewage discharge area. Salinity levels ranged from 0.6-32.8 parts per thousand (ppt) [conductivity: 1,148-49,887 micromhos (μmho)]. However, on most sampling dates, the salinity levels were in the oligohaline (0.5-5 ppt) to mesohaline (5.0-18 ppt) range in the mixohaline (brackish) category of salinity classification. Since the lowest salinity level recorded during our study was 0.6 ppt (1,220 μmho), we did not find true freshwater salinity levels on any sampling date in the SCRE. The highest and lowest salinity values were both encountered during periods when the estuary mouth was open to the ocean, with the lowest values at the upstream stations and the highest values at the downstream stations. Redox values ranged from (negative) -128-474 millivolts (mV), with the lowest values occurring in the bottom strata of backwater areas and in the sewage discharge area. No station appeared to consistently exhibit a trend for possessing the highest redox values. Secchi transparency ranged from 0.2-5.7 ft. The lowest Secchi values were collected during winter flood conditions, while the highest values were found during summertime high water conditions. Physical/chemical conditions which appeared potentially limiting to some estuarine species included periodic shallow water depths, silt deposition, low salinity, low DO, and low redox values.

Seven sampling stations were established for monitoring percent area cover by vegetation. Dominant vegetation at these sampling stations included arundo (*Arundo donax*), arroyo willow (*Salix lasiolepis*), bulrush (*Scirpus californicus*), cattail (*Typha* sp.), and water smartweed (*Polygonum lapathifolium*). The higher elevations on the river banks typically included arundo, arroyo willow, poison oak (*Toxicodendron diversilobum*), and cottonwood (*Populus fremontii*) as dominant species. All of these species were natives, except for arundo. Typically, the downstream stations were devoid of vegetation, while the upstream stations were heavily vegetated. Winter storms seemed to be a major controlling factor for estuary vegetation, since the Santa Clara River historically has periodic high flows which scour and deposit sediments on a major scale. The El Nino-influenced storms of December 1997 - March 1998 scoured virtually all vegetation out of the estuary. However, regrowth of vegetation was observed by April 1998 when river flows diminished. This vegetative regrowth consisted primarily of arundo and a small percentage of arroyo willow.

A total of 24 invertebrate taxa was collected by minnow trap (seven sampling stations), benthic core (five sampling stations), and seine (five sampling stations) during the 12 field surveys. All but two of these invertebrate taxa appeared to be freshwater organisms, and all but two species appeared to be native to southern California. Invertebrates were typically scarce or absent from samples during the winter months, and more abundant during the summer and fall months. A total of 254 individual organisms from six taxa were collected by minnow trap. Cumulatively, by number, these minnow trap-collected specimens were represented by 52% Physidae (freshwater snail), 26% *Palaemon macrodactylus* (oriental shrimp), 20% *Procambarus clarki* (Louisiana red crayfish), and 2% "others" (Fig. 2, Table 3). A total of 1,359 individual organisms from 16 taxa was collected by benthic core. Cumulatively, these benthic core-collected specimens were represented by 84% Chironomidae (chironomid midge larvae and pupae), 7% Oligochaeta (aquatic worms), 2% *Hyalella azteca* (amphipod), 2% Corixidae (water boatmen), and 5% "others." The heavy dominance of the benthic infauna by chironomids was thought to be indicative of stressful environmental conditions. An estimated total of 25,804 individual organisms from 11 taxa were collected by seine. Cumulatively, the dominant invertebrate taxa collected by seine were represented by 71% water boatmen, 21% Physidae, and 8% *Gammarus* sp.

A combined total of 14 fish species was collected by minnow trap (seven sampling stations and seine (five sampling stations) surveys. Five of these fish species are restricted to freshwater, while the other nine are considered to be euryhaline species. Ten of these fish species are native to southern California and four are considered to be exotics. For all fish sampling methods, abundance was generally greatest during spring and summer months. The minnow trap collections provided a cumulative total of 846 fish represented by 10 species. By cumulative numbers, these fishes collected by minnow trap were represented by 68% arroyo chub (*Gila orcutti*), 19% green sunfish (*Lepomis cyanellus*), 10% fathead minnow

(*Pimephales promelas*), and 3% "others." The seine collections provided a cumulative total of 1961 individual fish represented by 11 taxa. By cumulative numbers, the dominant fishes collected by seine were represented by 50% tidewater goby (*Eucyclogobius newberryi*), 27% striped mullet (*Mugil cephalus*), 10% mosquitofish (*Gambusia affinis*), 8% arroyo chub, and 5% topsmelt (*Atherinops affinis*).

A combined total of two amphibian species was collected by minnow trap (seven sampling stations) and seine (five sampling stations). These two species were African clawed frog (*Xenopus laevis*) and Pacific treefrog (*Hyla regilla*). The minnow trap survey produced a cumulative total of 165 amphibians. All of these amphibians were African clawed frogs, and they included 89 (54%) adults and 76 (46%) tadpoles. The seine surveys produced a total of 140 amphibians, represented by the two previously mentioned amphibian species. A total of 137 African clawed frog tadpoles was collected with the seine, and they constituted 98% of the amphibian catch. A total of three Pacific treefrog tadpoles was collected by seine, and they constituted 2% of the amphibian catch. No reptiles were collected in the estuary during the two years of field surveys. However, an unidentified turtle was observed during July 1998.

Species composition, abundance, and density data for plants, invertebrates, fishes, and amphibians often varied considerably for all sampling methods between sampling stations and survey dates. Due to the dynamic nature of the SCRE, the influence of El Nino conditions, the complexity of interactions, and the relatively short duration of this study, further surveys and data analysis are needed for proper assessment of the biota in the SCRE. The impact of changing water levels on the estuary biota is another complex issue which may best be analyzed with continued long-term ecological monitoring, more intensive analysis of the data from the present study, combined use of experimental studies, examination of previous SCRE biological reports, and comparison with studies of other southern California river mouth estuaries.

INTRODUCTION

In July 1997, the State of California Department of Parks and Recreation (State Parks) contracted with the U.S. Fish and Wildlife Service (Service) to design and implement an ecological monitoring program in the Santa Clara River Estuary (SCRE) in Ventura County, California. The primary objective of this monitoring program was to characterize the SCRE for water quality variables, vegetation, invertebrate, fish, amphibian, and reptile species composition. A secondary objective was to attempt to investigate the influences of fluctuating estuary water levels upon these species.

Preliminary field investigations were initiated in July 1997. These preliminary field investigations were followed by 12 field surveys conducted on an approximate bimonthly schedule from October 1997 to July 1999. This final report provides data obtained from the field investigations conducted during this period.

Site Description

The SCRE is located in Ventura County, California between the cities of Ventura and Oxnard (Figure 1). Much of the SCRE lies within the northern portion of McGrath State Beach, which is administered by State Parks. This estuary is located at the terminus of the Santa Clara River (river), the longest free-flowing river in Southern California. The approximate 70-mile length and 1,600 mi^2 watershed often provide for strong winter and spring river flows, frequently more than 100,000 cubic feet per second (cfs). Historical records indicate that flows have reached up to 160,000 cfs (Swanson et al. 1990).

In 1855 the SCRE covered an area as large as 870 acres (AC) (Swanson et al. 1990, State Coastal Conservancy et al. 1997). However, in recent years, the SCRE has been estimated to cover a maximum area of 230 AC (Swanson et al. 1990). The SCRE would be classified best as a river mouth estuary (Ferren 1989, Ferren et al. 1996), and displays berm patterns typical of other Southern California river mouth estuaries. In the winter and spring the SCRE mouth is typically open to the ocean as a result of the sandbar-breaching flows from seasonal rains. During the summer and early fall, the SCRE is typically closed to the ocean for longer periods. This longer duration for summer and early fall closures typically results from the lack of rainfall, lower river flows, and smaller surf.

The City of San Buenaventura Water Renovation Facility (hereafter called wastewater plant), at 1440 Spinnaker Drive, discharges an average of 8.4 million gallons per day (MGD) of tertiary-treated sewage into the SCRE (City of San Buenaventura 1999). The presence of wastewater treatment plant discharge creates an atypical hydrological situation in the SCRE. A steady year round flow of low salinity water is discharged directly into the estuary, which is atypical of most southern California lagoons and estuaries. Most southern California estuaries experience drought during the summer and fall when evaporation exceeds precipitation (Zedler 1982).

More detailed site descriptions of the SCRE and adjacent habitats are provided by Department of Parks and Recreation (1979), Swanson et al. (1990), and State Coastal Conservancy et al. (1997).

The present study concentrated efforts on the portion of the SCRE located seaward of the Harbor Boulevard Bridge. This bridge lies approximately 530 m upstream of the ocean (Fig. 1).

METHODS

Sampling Schedule

On 24 July 1997, the Service conducted preliminary field sampling activities in the SCRE, with assistance provided by State Parks. Field activities included vegetation surveys and sampling for water quality variables, invertebrates, fishes, and amphibians. Information provided from this preliminary survey was used to establish standardized field protocols.

Starting in October 1997, standardized field survey efforts were scheduled at approximate two month intervals. Sampling dates in 1997 were 16 and 17 October, and 17, 18, and 19 December. Sampling dates in 1998 were 23 and 24 March, 23 and 24 April, 23 and 24 July, 20 and 21 August, and 20 and 21 October. Sampling dates in 1999 were 14 and 15 January, 18 and 19 February, 26 and 27 April, 23 and 24 June, and 13 and 14 July.

These surveys were conducted by Service biologists, and normally required 16 to 28 hours over a two-day period to complete. The first field day was scheduled for setting baited minnow traps, measuring water quality parameters, conducting vegetation surveys, and sampling with a seine. The second field day was scheduled for retrieving baited traps and collecting benthic cores for invertebrates.

Sampling Stations

A total of seven sampling stations was established in the SCRE (Fig. 1). Sampling stations were identified using a stratified, non-random design. Selection of locations was largely based upon physical location, accessibility, and the ability to represent the wide diversity of habitats and environmental influences found in the SCRE. The station locations were:

- Station #1 was located near the south side of the river mouth and was selected for its downstream location, proximity to the ocean, and potential for intertidal influence.

- Station #2 was located near the north side of the river mouth and downstream of the wastewater plant discharge channel. This station was selected because it was in proximity to both the ocean and sewage discharge area, and appeared to have potential for strong influence from both seawater and wastewater.

- Station #3 was located at the mouth of the wastewater plant discharge channel on the north side of the SCRE. This station was selected because it appeared to have strong influence from the wastewater plant discharge and was located in a backwater area removed from the main channel area of the river.

- Station #4 was located approximately in the center of the SCRE. This station was selected because of its central location and likelihood for hydrological influence from both river and ocean.

- Station #5 was located at the end of a drainage canal on the north side of the river about 365 m downstream of the Harbor Boulevard Bridge. This station was selected because was in a backwater area and also because it contained a relatively deep pool surrounded by shallow wetland areas.

- Station #6 was located on the south side of the river about 250 m downstream of the Harbor Boulevard Bridge. This station was selected because of its location upstream of the wastewater plant discharge area, and also because it appeared to have its major hydrological influence directly from the river.

- Station #7 was located on the south side of the river about 50 m upstream of the Harbor Boulevard Bridge. This station was selected because of its location upstream of the wastewater plant discharge area, deeply cut and shaded banks with proximity to relatively deep pools, and because it appeared to receive its major hydrological influence from the river and some hydrological influence from local agricultural runoff.

Water Quality

Lagoon water levels were determined to the nearest 0.1 ft by using a weighted open reel tape to measure the distance from a fixed reference point on the Harbor Boulevard Bridge to the water's surface. Records indicate that benchmarks on the north end and south end of the Harbor Boulevard Bridge are located respectively at 25.052 ft and 25.103 ft above mean sea level (MSL) (Richard Morgan, County of Ventura, Public Works Agency, Department of Survey and Mapping, 1998, pers. comm.). The water level measuring station reference point was determined by the Service to be approximately 0.6 ft lower than the benchmark on the north end of Harbor Boulevard Bridge. Using these calculations, a determination was made that the water level measuring station reference point is approximately 24.5 ft above MSL. By using the calibration factor of 24.5 ft, the distance measured from the SCRE water level to the bridge reference point was converted to MSL data for each sampling date.

All seven stations were sampled for selected water quality parameters. For stations with depths of 2 ft or more, parameters were measured at surface, middle, and bottom strata. For stations with depths of 1-2 ft, parameters were measured at surface and bottom strata. For stations less than 1 ft, parameters were measured at middle strata only.

Temperature, pH, dissolved oxygen, salinity, conductivity, and redox potential were measured using a *Hydrolab Data Sonde 3* multi-probe unit coupled to a *Hydrolab Surveyor 2* display unit (Hydrolab Corporation 1994a, 1994b).

A 20 cm diameter Secchi disk equipped with a graduated line was used for turbidity and maximum water depth measurements at each station.

Vegetation

Aquatic Vegetation Surveys. For the purpose of this study, aquatic vegetation was defined as those plants which are required to be floating on water, or covered in water, to survive. Floating aquatic vegetation was defined as those plants which floated on the water's surface and were not attached to the substrate. Submerged aquatic vegetation was defined as those aquatic plants which were attached to the substrate. Emergent plants and other wetland plants were grouped with the terrestrial plants. The percent cover of aquatic plants was visually estimated at the seven water quality sampling stations. At each station the aquatic vegetation sampling area was defined as a plot 15 m long x 10 m wide, which was located adjacent to shore at each station. This size plot was selected because an 18m seine that was used for other components of this study stretched for approximately 15m when retrieved along the shoreline adjacent to the sampling stations. This retrieved seine provided a consistent reference point for conducting the vegetation surveys. Aquatic plants were identified to at least the genus level using Hickman (1993), and percent cover composition was estimated for each taxon.

Terrestrial Vegetation Surveys. The sampling location for terrestrial vegetation was determined to be located directly inland from each of the seven water quality sampling stations. At each station the sampling area for terrestrial vegetation was a plot 15 m long x 10 m wide, as described in the aquatic vegetation section above. A total of nine surveys was conducted for terrestrial plants. These surveys were conducted from April 1998 to July 1999. Terrestrial vegetation was described to at least the genus level using Hickman (1993) and percent cover composition was estimated for each taxon.

Invertebrates

Minnow Trap Sampling. Epibenthic and nektonic macroinvertebrates were collected using *Gee Minnow Traps* (Memphis Net and Twin Company, Memphis, Tennessee). These traps were 41.5 cm long and 21.5 cm wide cylinder-shaped devices composed of 6 mm (.25 in) wire mesh. These traps were baited with approximately 15 grams of *Nine Lives* seafood flavor dry cat food. Three *Gee Minnow Traps* were placed at each of the seven stations and allowed to remain overnight before retrieval.

Benthic Core Sampling. Benthic infaunal invertebrates were sampled using a pole-mounted vacuum coring device. This device was custom-built for this project by Service biologists with an 81.3 cm long x 10.2 cm diameter (32 in long x 4 in diameter) PVC cylinder, PVC pressure regulating valve, and threaded PVC handles for sampling depths down to about 7 meters (23 ft). Due to time constraints, only these five stations were sampled with the vacuum coring device for invertebrates: Stations #1, #2, #3, #4, and #7 (Fig. 1).

Initially, five replicate cores were collected with the vacuum coring device and composited at each station. The time required to sieve and sort these five replicate cores often took over an hour per station. Starting in the March 1998 survey, in an effort to reduce the time needed to process benthic samples, only three replicate cores were collected and composited at each station. Cores were taken at each station to an approximate depth of 15 cm (6 in), and composited in 19 liter (5 gallon) plastic buckets for sieving.

During both the preliminary survey in July 1997 and the October 1997 survey, initial attempts were made to sieve the benthic samples with a 500 micron (μ) mesh size. However, due to large sediment particle size, these samples proved to be non-sievable with 500 μ mesh. Due to the large sediment particle sizes encountered, and the prohibitively large amount of time that would be required to microscopically sort the retained sediments (approximately three to four hours per station), a decision was made to switch to a larger mesh size.

The final sieving protocol involved using two mesh sizes, 2,000 μ and 1,000 μ. The sieves used were 30 cm (12 in) diameter U.S. Standard Testing sieves. Samples which contained large amounts of debris and gravel were first passed through the 2,000 μ mesh sieve. Other samples were directly strained with the 1,000 μ mesh sieve. Materials retained on sieves were placed on white plastic bucket lids and field sorted by eye with forceps under approximately 5 mm of water. A few drops of 1% rose bengal solution were placed in the sieved sample to assist in sorting the specimens. Rose bengal selectively stains biological tissues with a rose color, and aids in sorting organisms from sediments and other inorganic materials. Invertebrate specimens were preserved in 70% isopropyl alcohol and later identified in the Ventura Fish and Wildlife Office (VFWO) laboratory with a Zeiss SV8 stereo dissecting microscope with magnification capabilities ranging from 8x to 128x.

To test for the efficiency of the sieve mesh sizes used, several samples collected during December 1997 and March 1998 were randomly selected for analysis without sieving. These selected samples were preserved with 10% formalin and brought back to the Service laboratory for microscopic sorting of unsieved sediments.

Seine Sampling. Invertebrates that were incidentally caught in seine hauls at Stations #1, #2, #3, #4 and #7 (to be discussed in the fishes method sections below) were identified and counted. When large numbers of invertebrates were collected in the seine hauls, their numbers were estimated.

Invertebrate Data Analysis. Invertebrate data analysis from the benthic core samples, minnow trap, and seine samples included numbers of individual taxa, percent composition of each taxa, and distribution by station. For the minnow trap data, catch per unit effort (CPUE) was calculated as the number of individuals collected per day (indiv/day) in all three replicate traps at each station. For the benthic core data, density per unit area (number indiv/m^2) was also calculated. Attempts were made to identify invertebrate specimens at least to the family level using Smith and Carlton (1975), Morris et al. (1980), Merritt and Cummins (1996), and Harrington and Born (1998).

Fishes

Minnow Trap Sampling. Fish collections were also made with the same baited traps at the seven stations that were previously discussed in the invertebrate section of this report.

Seine Sampling. After initial experimentation with several seine sizes and styles, collection of fishes by seine was standardized at the dimensions of 18 m long x 1.4 m high, with 1.4 m bag, constructed with 3 mm knotless nylon mesh (60 ft long x 4.5 ft high, with 4.5 ft bag, with 1/8 in mesh). This seine was manufactured by the Research Net Company, Bothell, Washington with an extra lead line. The extra lead line helped to keep the seine on the estuary bottom when strong currents were present.

Due to time constraints, only these five stations were established for sampling by seine for fishes: Stations #1, #2, #3, #4, and #7 (Fig. 1). Initially, three replicate seine hauls were composited at each station for analysis in the field. However, starting in the March 1998 surveys, due to time constraints and an apparent lack of great variance in numbers of individuals and species between hauls, only one replicate seine haul was conducted at each station.

Fish Data Collection. Upon collection of fishes, priority of handling was given to sensitive species such as tidewater goby, Santa Ana sucker, and arroyo chub, and these species were the first to be measured and returned to the water. All captured fish were identified to species and counted. A random subsample of up to 30 fish per taxon was measured for standard length (SL) to the nearest millimeter. As a precaution to minimize harm to collected fish, specimens estimated to be less than 20 mm SL were usually not measured. Miller and Lea (1972), McGinnis (1984), Bell (1978), and Swift et al. (1993) were used for fish identification and natural history accounts.

Fish Data Analysis. Data analysis for the seine and trapping surveys included numbers of individual fish species, percent composition of each species, length-frequency distribution, and distribution by station. For the seine data, density per unit area (number indiv/m^2) was also calculated. Due to the expected low abundance of several fish species, length-frequency data from minnow trap and seine collections for each species were pooled for analysis.

Amphibians and Reptiles

Amphibians were sampled with the same *Gee Minnow Traps* and seines previously discussed above in the invertebrate and fish sections. Snout-to-vent lengths (SVL) of collected adult frogs were measured to the nearest mm in the field. Total length (TL) of tadpoles were measured from the tip of the snout to the tip of the tail.

Observations of incidentally observed amphibians and reptiles were made at each of the fish and invertebrate sampling stations. Observations of incidentally observed amphibians and reptiles were also conducted when rowing, wading, and walking between stations. Stebbins (1985) was used for herptile species identification and natural history accounts.

RESULTS

Sampling Schedule

The winter of 1997-1998 was a time of great El Nino influence in California. The high flows prevalent in the river were attributed to the frequent El Nino-influenced winter storms. Lowest river flows during the El Nino storm period from December 1997 through April 1998 were estimated to be 200 cfs, and highest flows were estimated to range as high as 140,000 cfs (Dee Dee Taylor, Senior Hydrologist, County of Ventura, Public Works Agency, Flood Control Department, pers. comm. 1998). These were the highest flows in the river since 1969. Such river flows restricted access to the river for sampling activities from December 1997 until March 1998.

In addition to the severe weather and high river flows, equipment malfunctions sometimes caused the bimonthly sampling schedule to fluctuate. Due to these influences, some surveys were conducted one to three months apart rather than the planned two months apart.

Sampling Stations

In addition to keeping the SCRE mouth open for extended periods, the El Nino-influenced winter flows in the river during the winter of 1997-1998 also created a large amount of erosion and deposition. Approximately 200 m of the southern SCRE bank was eroded away, and Station #1 had to be relocated for the March 1998 and later surveys. Approximately 200 m of the northern SCRE bank was filled in by several feet of deposited river sediments so Station #2 had to be relocated for the March 1998 and later surveys. Deposition of sediments also created the need to relocate Station #5 about 10 m upstream and Station #7 about 100 m downstream of their original locations.

In addition to the strong river flows, strong tidal influence and breaking surf were found in the SCRE in the vicinity of Station #1, Station #2, and Station #4 during the December 1997 survey. The breaking 1-2 foot high ocean waves in the SCRE on 19 December 1997 demonstrated the strong physical marine influence on the SCRE during this time. A strong physical marine influence was not noticed during the other surveys.

Water Quality

Estuary Mouth Status. The SCRE mouth was closed to the ocean during six surveys, and open to the ocean during six surveys (Table 1). The SCRE was closed during the surveys of October 1997, July 1998, August 1998, February 1999, June 1999, and July 1999. The SCRE was open to the ocean during the surveys of December 1997, March 1998, April 1998, October 1998, January 1999, and April 1999. The El Nino-influenced flows caused the SCRE mouth to be continually open from December 1997 through April 1998, which included three surveys.

Water Level. The highest water levels recorded were 9.3 ft (feet above MSL) in October 1997 and 7.8 ft in June 1999. The lowest water levels recorded were 3.5 ft during December 1997 and 4.3 ft during March 1998.

Maximum Station Depth. The deepest water depths were recorded during the October 1997 survey with maximum values ranging from 4.2-7.3 ft. Deeper water was also found during the June 1999 survey, with maximum depths ranging from 3.0-7.2 ft. The maximum station depths recorded were 7.3 ft at Station #4 during the October 1997 survey, and 7.2 ft at Station #5 during the June 1999 survey. The shallowest water depths were recorded during the December 1997, March 1998, and April 1998 surveys, when the estuary mouth was open and maximum station depths were less than 2.0 ft.

Temperature. Water temperatures ranged from 13.94-29.04 °C, with the low and high extremes being recorded during periods when the SCRE mouth was closed. The coolest water temperatures were recorded during the February 1999 survey, with values ranging from 13.94-17.17 °C . The warmest water temperatures were recorded during the August 1998 survey, with readings ranging from 23.26-29.04 °C. Thermal stratification was not found to be a major feature in the SCRE, and surface-to-bottom temperature readings typically did not vary more than one to two degrees centigrade (Table 1).

pH. Values for pH ranged from 6.54-9.04. The lowest pH values were found during the July 1999 survey, with values ranging from 6.54-7.75. Typically the lowest pH values were found at Station #3 and Station #5. The highest pH values were found during the October 1997 survey, with values ranging from 8.17-9.04. Some of the highest pH values were also recorded during the August 1998 survey, with values ranging from 7.77-8.92 (Table 1).

Dissolved Oxygen. Dissolved oxygen (DO) concentrations varied considerably both during the surveys and among the surveys, with values ranging from 0.21 mg/l to greater than 20 mg/l. The lowest DO concentrations were recorded during the July 1999 survey, with values ranging from 0.21-12.10 mg/l. The lowest DO values were typically found at Station #5, and sometimes Station #3. Trends by station for occurrence of highest DO levels were not readily noticed from the data. The highest values of DO were encountered during the surveys of October 1997 and August 1998, with values greater than 20 mg/l frequently experienced. The survey of June 1999 provided some extreme DO data, with bottom values as low as 0.37 mg/l and surface values greater than 20 mg/l (Table 1).

Salinity/Conductivity. Since the salinity values are calculated internally in the *Hydrolab Data Sonde 3* using an algorithm based upon the conductivity values, salinity and conductivity trends will be discussed together. Salinity values ranged from 0.6-32.8 parts per thousand (ppt) [(conductivity: 1,148-49,887 micromhos (μmho)], and these values varied considerably over both temporal and spatial scales. Salinity levels were generally low (less than 8.0 ppt) in all strata, except during the following four surveys: December 1997, July 1998, October 1998, and February 1999. The highest salinity readings [32.8 ppt (conductivity: circa 50,000 μmho)] were collected during periods of tidal influence in December 1997 and October 1998 when the estuary mouth was open. During the December 1997 survey, halocline formation was evident at four sampling locations, Stations #1, #2, #3, and #4. Station #2 exhibited the most extreme stratification, with a surface to bottom salinity difference of 28.8 ppt (conductivity difference: 44,628 μmho) existing in 1.5 ft of water (Table 1). Stations #6 and #7 generally possessed the lowest salinity/conductivity values, while Stations #1, #2, and #5 generally possessed the highest salinity/conductivity values.

Redox Potential. Redox potential values ranged from a low of (negative) -128 mV to a high of 474 mV. The lowest readings were recorded during the July 1999 survey, with values ranging from (negative) -128-348 mV. Low readings were also recorded during the June 1999 survey, with values ranging from (negative) -112-472 mV. Station #5 often possessed the lowest redox values. No station appeared to consistently exhibit a trend for possessing the highest redox values. However, the highest redox values were recorded during the April 1999 survey, with values at all stations ranging from 390-474 mV (Table 1).

Secchi Transparency. Secchi transparency values ranged from 0.2-5.7 ft. The lowest Secchi values were collected during the March 1997 survey, ranging from 0.2-1.2 ft. The highest Secchi values were collected during the July 1999 survey, ranging from >3.8 -5.7 ft (Table 1).

Vegetation

Aquatic vegetation. Aquatic vegetation was generally sparse during the survey period. Neither floating nor submerged aquatic plants were prevalent in the sampling areas, and only three aquatic plant species were observed (Table 2).

Floating aquatic plants were observed at the sampling stations during three surveys. During July 1998, Stations #6 and #7 were observed respectively to have 25% and 5% surface coverage by green algae *(Enteromorpha* sp.). During August 1998, Station #5 displayed 5% surface coverage by duckweed (*Lemna* sp.). During April 1999, Station #4 displayed 5% surface coverage by *Enteromorpha* sp.

Submerged aquatic plants were observed during six of the field surveys. *Enteromorpha* sp. was observed during July 1998, with 80% benthic coverage at Station #6, during October 1998 with 20% benthic coverage at Station #7, during January 1999 with 40% benthic coverage at Station #7, and during April 1999 with 30% benthic coverage at Station #2. A few clumps of ditch-grass (*Ruppia* sp.) were observed at Station #3, during April 1998 and July 1999.

Terrestrial Vegetation. Preliminary field surveys conducted by Service biologists during July 1997 indicated that the portions of the SCRE closest to the ocean were bordered by a sandy berm and coastal dunes. Dunes in this area were dominated by sea rocket (*Cakile maritima*), Hottentot fig (*Calistygia macrostegia*), sand verbena (*Abronia spp.)*, arundo (*Arundo donax*), silver burweed (*Ambrosia chamissonsis*), and beach primrose (*Camissonia cheiranthifolia*). The portions of the SCRE inland from the beach were dominated by arundo and arroyo willow (*Salix lasiolepis*), with scattered populations of bulrush (*Scirpus californicus*), cattail (*Typha sp.*), water smartweed (*Polygonum lapathifolium*), poison oak (*Toxicodendron diversilobum*), and cottonwood (*Populus fremontii*).

During the winter months of 1998 and 1999, vegetation in most areas of the river channel was scoured away by high river flows. During the April surveys of 1998 and 1999, recolonization of plant communities was evident in the recently scoured shoreline areas of all seven stations. Fragments of arundo roots were widely dispersed throughout the shorelines and mud flats of the SCRE, and new arundo plants were observed to be sprouting prolifically from these root fragments in all areas of the SCRE. Also, a few arroyo willows were observed to be sprouting from flood-deposited stumps.

During all of the surveys, Stations #1, #2, #3, and #4 generally tended to be less vegetated than the other stations (Table 2). During the winter months of 1998 and 1999, these three stations were devoid of vegetation. Stations #5, #6, and #7 tended to be more densely vegetated than the other stations.

When vegetation was present, Stations #1 and #2 tended to be dominated by arundo. Station #3 tended to be dominated by low densities of arundo, arroyo willow, and bulrush. Station #4 tended to be barren, but during extended periods of low water, it was dominated by arundo and bulrush. Station # 5 generally was dominated by high densities of bulrush, arundo, and cattail. Station #6 tended to be dominated by poison oak, arundo, arroyo willow, and cottonwood. Station #7 generally was dominated by arroyo willow and arundo.

Invertebrates
A total of 24 taxa was collected by minnow trap, benthic core, and seine during the 12 field surveys (Figure 2, Table 3). These taxa were Louisiana red crayfish (*Procambarus clarki*), oriental shrimp (*Palaemon macrodactylus)*, freshwater snail (Physidae), yellow shore crab (*Hemigrapsus oregonensis*), dragonfly (Libellulidae), dragonfly (Corduliidae), damselfly (Coenagrionidae), toe biter (*Abedus* sp.*)*, midge (Chironomidae), crane fly (Tipulidae), dixid midge (Dixidae), mayfly (Baetidae), water boatman (Corixidae), unidentified aquatic beetle (Hemiptera), diving beetle (Dytiscidae), aquatic beetle (Hydrophilidae), amphipod (*Gammarus* sp.), amphipod (*Hyalella azteca*), unidentified amphipod (amphipod "A"), waterflea (*Daphnia magna*), unidentified copepod (Cyclopoida), unidentified bristle worm (Polychaeta), unidentified aquatic earthworm (Oligochaeta), and unidentified leech (Hirudinea).

Minnow Trap Sampling. The minnow trap collections generally provided low numbers of invertebrate specimens, with a total of 254 individual organisms collected in 83 samples among the seven sampling stations during the 12 field surveys. These organisms were sorted into six different taxa (Table 4). Cumulatively, by number, these collected specimens were represented by 52% freshwater snails, 26% oriental shrimp, 20% Louisiana red crayfish, and 2% "others" (Fig. 2, Table 3). A general trend in the minnow trap data was that species composition and abundance were lower during the winter and early spring surveys, and higher during the summer surveys (Figure 3). The cumulative number of taxa collected at each minnow trap station ranged from two to five. The lowest cumulative number of taxa was collected at Stations #1, #3, #5, and #6 (two taxa each), while Station #7 yielded five taxa. The greatest cumulative CPUE for invertebrates by minnow trap was provided at Stations #1 and #7, while the lowest cumulative CPUE was at Stations #3 and #5 (Table 4).

Most of the freshwater snails collected by minnow trap were captured at Station #7 during July 1999 when 120 individuals were collected. Freshwater snails were not collected by minnow trap at Stations #1, #2, or #6 (Table 4).

Oriental shrimp were collected by minnow trap during June 1999 and July 1999. A majority of these shrimp was collected at Stations #1 and #2. Oriental shrimp were not collected at Stations #3 or #5 (Table 4).

Most of the Louisiana red crayfish collected by minnow trap were captured at Stations #6 and #7. Stations #1 and #2 produced the lowest numbers of crayfish. Most of these crayfish were caught during the summer months of 1998. Only 2 out of a total of 51 crayfish were collected during 1999 (Table 4).

Four dragonfly larvae (family Libellulidae) were collected in July 1999 at Stations #4 and #7. One toe biter was collected at Station #7 in October 1998. One yellow shore crab was collected by minnow trap at Station #2 in January 1999 (Table 4), a period when the estuary mouth was open and tidal exchange was occurring (Table 1).

Benthic Core Sampling. The benthic core collections generally provided low numbers of specimens, with a total of 1,359 individual organisms collected in 60 samples among the five sampling stations during the 12 field surveys. These organisms were sorted into 16 different taxa (Table 5). Cumulatively, by number, these collected specimens were represented by 84% chironomid midge larvae, 7% oligochaetes, 2% *Hyalella azteca*, 2% corixids, and 5% "others" (Fig. 2, Table 3). The "others" group included tipulids, dixids, baetids, unidentified hemipterans, hydrophilids, *Gammarus* sp., amphipod "A", *Daphnia magna*, unidentified cyclopoida, unidentified polychaetes, and unidentified leeches. All of the species identified to the genus or species level from the benthic cores appeared to be native freshwater organisms. Station #7 yielded a total of nine taxa, while the other stations yielded a total of seven taxa. The greatest densities of total invertebrates collected with the benthic coring device were found at Stations #3 and #4, while the lowest densities of total invertebrates were found at Stations #2 and #7 (Table 6). Benthic invertebrates were typically scarce or absent from benthic cores during the winter months, and more abundant during the summer and fall months (Figure 4, Tables 5,6).

Chironomid larvae were found at all sampling stations. They were found in the highest densities during July 1998, August 1998, and October 1998 at Stations #1, #3, and #4. Chironomids were not collected, or were collected in very low numbers, during December 1997, March 1998, April 1998, January 1999, and February 1999 (Fig. 4, Table 5,6). Oligochaetes were the most abundant during January 1999 and April 1999, notably at Stations #3 and #7. *Hyalella azteca* was primarily collected at Station #3 during July 1998 and August 1998, and a few were collected at Station #7 during October 1998. Corixids were collected at all stations, during July 1998, August 1998, and October 1998.

Seine Sampling. The seine collections cumulatively provided an estimated 25,804 individual organisms collected in the 47 seine hauls among the five sampling stations during the 12 field surveys (Table 3, Table 7). Invertebrates collected with the seine were sorted into 11 different taxa, and cumulatively, by number, these collected specimens were represented by 71% water boatmen, 21% Physidae, and 8% *Gammarus* sp., and less than 1% "others" (Fig. 2, Table 3). The "others" category included *Daphnia magna*, *Palaemon macrodactylus*, *Procambarus clarki*, coenagrionids, libbelulids, corduliids, dytiscids, and chironomids (Table 3, Table 7).

The species composition of invertebrates was rather similar among the five seine sampling stations (Table 7). All five stations also tended to exhibit similar temporal trends, a paucity of invertebrates during the winter surveys, and an abundance of invertebrates only during the summer surveys (Table 7). During the summer surveys of 1998 and 1999, large numbers of physids, corixids, and/or *Gammarus* sp. were often collected in the seine (Table 7). During the July 1999 survey, hundreds of *Daphnia magna* at most of the stations were observed to escape through the mesh of the seine as it was pulled ashore.

Fishes

A combined total of 14 fish species was collected by minnow trap and seine during the 12 field surveys. These 14 species were tidewater goby (*Eucyclogobius newberryi*), arroyo chub (*Gila orcutti*), striped mullet (*Mugil cephalus*), green sunfish (*Lepomis cyanellus*), mosquitofish (*Gambusia affinis*), topsmelt (*Atherinops affinis*), fathead minnow (*Pimephales promelas*), prickly sculpin (*Cottus asper*), staghorn sculpin (*Leptocottus armatus*), California killifish (*Fundulus parvipinnis*), Santa Ana sucker (*Catostomus santaanae*), yellowfin goby (*Acanthogobius flavimanus*), arrow goby (*Clevelandia ios*), and partly armored three-spine stickleback (*Gasterosteus aculeatus microcephalus*) (Table 3).

Minnow Trap Sampling. During 12 field surveys a cumulative total of 846 fish, represented by 10 species, was collected in 83 minnow trap samples (Table 3,4). These 10 species were arroyo chub, green sunfish, fathead minnow, tidewater goby, Santa Ana sucker, mosquitofish, staghorn sculpin, prickly sculpin, yellowfin goby, and partly armored threespine stickleback (Tables 3, 5, 6). By cumulative numbers, these collected specimens were represented by 68% arroyo chub, 19% green sunfish, 10% fathead minnow, and 3% "others" (Fig. 2, Table 3). Fish species numbers collected per station ranged from 4-7, with Stations #3 and #7 yielding the lowest number of species, and Station #6 the highest number (Table 4). The greatest fish abundance in minnow trap collections was generally at Stations #6 and #7, while the lowest abundance was generally at Stations #1 and #2 (Figure 5, Table 4). Fish abundance in minnow traps was generally greatest in spring and summer months (Fig. 5).

The greatest numbers of arroyo chub were collected during March 1998, April 1998, and April 1999. Arroyo chub were most common at Stations #4, #5, #6, and -#7, while Stations #1, #2, and #3 typically yielded low numbers of this species. Green sunfish were only collected during the surveys of August 1998, June 1999, and July 1999. This species was collected at all seven sampling stations. The highest yield for green sunfish occurred during the June 1999 survey at Station #3. Stations #1 and #2 yielded the lowest numbers. Fathead minnows were collected at all stations except for Station #7. This species was collected only during the surveys of August 1998, June 1999, and July 1999. The highest yield for fathead minnows was at Station #6 during July 1999. Prickly sculpin were collected at all stations except for Stations #3 and #4, during March 1998, April 1998, October 1998, January 1999, and February 1999. This species was not collected with minnow traps during summer months. Tidewater gobies were collected at all stations except for Stations # 3 and #7. These gobies were collected during April 1998, July 1998, January 1999, April 1999, and July 1999. Mosquitofish were collected at Stations #3, #4, and #7 during July 1998, October 1998, and April 1999. One Santa Ana sucker was collected at Station #6 during March 1998, and another one was collected at Station #2 during April 1998. A single yellowfin goby was collected at Station #6 during August 1998. A single staghorn sculpin was collected at Station #6 during January 1999. A single partly armored threespine stickleback was collected at Station #1 during July1999.

Seine Sampling. A total of 1961 individual fish from 11 species was collected by seine with 47 seine samples during 12 survey dates (Table 3, Table 8). These 11 species were tidewater goby, striped mullet, mosquitofish, arroyo chub, topsmelt, staghorn sculpin, California killifish, green sunfish, Santa Ana sucker, prickly sculpin, and arrow goby (Table 8, 9). By cumulative numbers, these fishes were represented by 50% tidewater goby, 27% striped mullet, 10% mosquitofish, 8% arroyo chub, and 5% topsmelt, and less than 1% "others" (Fig. 2, Table 3). Fish species numbers collected by seine per station ranged from 3-10, with Station #4 yielding the lowest number of species, and Station #1 the highest number (Table 8). Fish abundance in seine hauls was generally greatest during spring and summer months (Figure 6, Table 8).

Tidewater gobies were collected at all seine stations, with the greatest numbers typically found at Stations #1, #4, and #7. The greatest abundance of this goby was observed during October 1997, August 1998, June 1999, and July 1999 (Fig. 6, Table 8). During July 1999, a single seine haul produced 652 tidewater gobies (11.5 indiv/m^2) at Station #7. The lowest tidewater goby densities were found at Stations #3 and #4 (Table 9). Tidewater gobies were not found during February 1999, and they were scarce during March 1998, April 1998, July 1998, and April 1999 (Table 8).

Striped mullet were found at all seine stations, but were common only during December 1997 and April 1998. The greatest striped mullet abundance typically was at Stations #1, #2, and #3 (Fig. 6, Table 8). During December 1997, a single seine haul produced 407 striped mullet (0.783 indiv/m^2) at Station #1. The lowest striped mullet abundance typically was found at Stations #4 and #7 (Table 8, 9). Striped mullet were not collected during March 1998, July 1998, August 1998, February 1999, June 1999, or July 1999 (Table 8).

Mosquitofish were only common during October 1997 and July 1998, but were captured at all seine stations (Table 8). The greatest mosquitofish abundance was usually found at Stations #1 and #3. The lowest abundance of mosquitofish was typically at Stations #4 and #7 (Fig. 6, Table 8).

Arroyo chub were captured at all seine stations, except for Station #4 (Table 8). The greatest abundance of arroyo chub was found at Stations #7 and #3. The largest collections of arroyo chub occurred during July 1998, June 1999, and July 1998. This species was not collected during December 1997, August 1998, February 1999, or April 1999 (Fig. 6, Table 8, 9).

Topsmelt were captured at Stations #1 and # 2, and were collected during December 1997, July 1998, and October 1998 (Table 8). The greatest abundance of topsmelt was found at Station #2 during December 1997, when 77 individuals (0.550 indiv/m^2) were collected (Fig. 6, Tables 8, 9).

Staghorn sculpin were collected at Stations #1 and #7 during April 1999 and July 1999 (Table 8). California killifish were collected at Stations #1 and #2 during December 1997 and April 1999. Green sunfish were collected at Stations #1 and #7 during June 1999. Santa Ana sucker were collected at Station #1 during March 1998, and Station #3 during July 1998 and October 1998. One prickly sculpin was collected at Station #3 during July 1998. One arrow goby was collected at Station #1 during October 1998.

Fish Length Measurements. Fishes collected using minnow traps and seines were generally of small size. SL of collected fishes ranged from a 9 mm mosquitofish to a 178 mm topsmelt (Appendix A). Striped mullet estimated to range up to 400 mm SL were observed on several occasions. Also, mullet of this size class were netted in several seine hauls on several different survey dates, but they managed to successfully jump over or swim around the netting and escape.

A summary of fish species SL trends would include the following (Appendix A): Mullet ranged from 20-98 mm. The smallest mullet size classes were most common during the winter surveys, and the largest mullet were collected during the April 1999 survey. Mosquitofish ranged from 9-41 mm, and the greatest abundance of smaller size class mosquitofish occurred during the July 1998 survey. Arroyo chubs ranged from 16-102 mm, and the smallest arroyo chubs were most abundant during the summer months. Topsmelt ranged from 18-178 mm, and during December 1997 most of the 77 topsmelt collected appeared to be spawning adults. Green sunfish ranged from 17-52 mm, and all of the green sunfish captured appeared to be young-of-the-year (YOY).

Amphibians and Reptiles

A total of two amphibian species was collected by minnow trap and seine during the12 field surveys (Fig. 2, Table 3). These two species were African clawed frog (*Xenopus laevis*) and Pacific treefrog (*Hyla regilla*).

Minnow Trap Sampling. A cumulative total of 165 amphibians was collected in 83 minnow trap samples during 12 field survey dates. All of these amphibians were African clawed frogs, and they included 89 (54%) adults, and 76 (46%) tadpoles (Fig. 2, Table 3).

African clawed frog adults were most abundant at Stations #5, #6, and #7 (Fig. 5, Table 4). The greatest abundance of these frogs was during March 1998 and July 1999. No adult African clawed frogs were collected with minnow traps during October 1998 and April 1999 (Fig. 5, Table 4).

African clawed frog tadpoles were most abundant at Stations #3 and #7. These tadpoles were only collected by minnow trap on three survey dates: July 1998, June 1999, and July 1999 (Fig. 5, Table 4).

Seine Sampling. A total of two amphibian species was collected in 47 samples during 12 field survey dates using the seine. The two collected species were African clawed frog and Pacific treefrog. A total of 137 African clawed frog tadpoles was collected with the seine, and they constituted 98% of the amphibian catch. A total of three Pacific treefrog tadpoles was collected, and they constituted 2% of the amphibian catch (Fig. 2, Table 3). No adult African clawed frogs or adult Pacific treefrogs were collected by seine (Tables 3, 7). Amphibian numbers and density data from seine collections varied considerably between sampling stations (Fig. 5, Table 8, 9). Species numbers collected at each station ranged from zero to two species. Station #4 produced no amphibian species with seine hauls, while Stations #1 and #7 each produced two amphibian species (Table 8).

African clawed frog tadpoles were collected by seine during October 1997, July 1998, August 1998, June 1999, and July 1999. African clawed frog tadpoles were found at all seine stations, but were most common at Stations #1 and #7. Most of these tadpoles were collected during June 1999 and July 1999 (Fig. 6, Table 8).

Pacific treefrog tadpoles were collected by seine during July 1998 and June 1999. These tadpoles were only collected at Stations #1 and #7 (Table 8).

Amphibian Length Measurements. The two Pacific treefrog tadpoles that were measured had TL of 32 mm and 48 mm (Appendix B). The African clawed frog tadpoles ranged in total length from <20-95 mm. SVL of African clawed frog adults ranged from 23-104 mm. The smallest adult African clawed frogs were collected during July 1999, while the largest adults were collected during March 1998 (Appendix B).

Incidental Observations. Incidental observations were made of African clawed frogs and Pacific treefrogs when traveling between sampling stations. During the July 1999 survey, an estimated 700 adult Pacific treefrogs were observed in the brackish marsh adjacent to the north side of the McGrath State Beach campgrounds. An estimated 300 African clawed frog tadpoles were also observed in this area during July 1999.

During July 1998 an unidentified turtle was observed swimming along the south bank of the Santa Clara River at the washed-out levy site between Station #1 and Station #6. No other reptiles were observed in the study area. However, three species of reptiles were observed just outside of the study area, including silvery legless lizard (*Anniella pulchra pulchra*), Great Basin fence lizard (*Sceloporus occidentalis biseriatus*), and San Diego gopher snake (*Pituophis melanoleucus annectens*). Suitable habitat for all three of these species exists within the project area.

DISCUSSION

Sampling Stations

Based upon incidental observations, the erosion and deposition associated with the El Nino-influenced winter flows in the river appeared to result in a net gain of sediment in the SCRE.

We base this assumption of a net gain in sediments on the need to relocate Stations #2, #5, and #7, which could no longer be sampled after the winter of 1998. The sediment deposition from the winter 1998 storms caused these three stations, and many other previously submerged areas of the SCRE, to become elevated above the estuary surface waters.

Water Quality

During the winter months of the study period, the Santa Clara River produced heavy flows for most of the winter and early spring months, especially during the aforementioned El Nino-influenced storms of 1997 and 1998. High river flows kept the estuary mouth open from approximately December 1997 until April 1998, which allowed for tidal exchange, often resulting in increased salinity levels at stations near the mouth. These flows also deposited sediment, mainly in the form of silt, into the SCRE. This sediment deposition appeared to cause a general decrease in water depth throughout the estuary. Turbidity levels tended to be high during heavy flows, likely due to high sediment loads.

During the summer months the SCRE mouth was typically closed for longer periods of time. This closure resulted in higher water levels and prohibited tidal action which otherwise would have introduced ocean water into the estuary. Surf tended to be smaller during the summer months, and overwash of ocean waves into the estuary was typically less frequent than in winter months when larger surf typically occurred. While the mouth was closed, the discharge from the wastewater plant continually added an average of 8.4 MGD of effluent (City of San Buenaventura 1999). Also, a small discharge from the Santa Clara River also added water to the SCRE. During 1998, conductivity of the wastewater plant effluent averaged from about 1,800-2,200 µmho (ca. 0.9-1.2 ppt) (City of San Buenaventura 1999), and these averages also are typical of other years (Don Davis, City of San Buenaventura Department of Public Works, pers. comm., 1999).

By standardized definition, freshwater has salinity levels less than 0.5 ppt (<800 µmho) (Odum 1971, Cowardin et al. 1979). With this definition in mind, wastewater plant effluent would not be considered freshwater. According to the classification of Cowardin et al. (1979), the range of salinity levels recorded in the SCRE on all sampling dates were in the mixohaline [0.5-30 ppt ("brackish")] to euhaline [30-40 ppt ("saltwater")] range. However, on most sampling dates, the salinity levels were in the oligohaline (0.5-5 ppt) to mesohaline (5.0-18 ppt) range in the mixohaline category. Since the lowest salinity level recorded during our study was 0.6 ppt (1,220 µmho), we did not not find true freshwater salinity levels on any sampling date in the SCRE.

Stations #1 and #2 possessed high salinity/conductivity values on several dates likely due to their locations near the estuary mouth and consequent tidal exchange (Table 1).

Stations #2 and #3 exhibited conditions of low DO and redox values during June 1999. We suspect that for Stations #2 and #3 these conditions existed due to the presence of a high biochemical oxygen demand (BOD) probably caused, at least partially, by a higher presence of organic compounds in the substrates at these stations. Other factors which probably contributed to these low DO and redox values were a lack of water strata mixing due to halocline formation and estuary mouth closure. Stations #2 and #3 also exhibited periodic low pH readings comparable to wastewater plant effluent (City of San Buenaventura 1999). Because Stations #2 and #3 are downstream of the sewage effluent discharge canal, we suspect that these stations experienced lower pH levels due to influence from sewage effluent.

Station #4 typically did not exhibit any extreme water quality readings, likely due to its central location within the SCRE.

Station #5 possessed high salinity/conductivity values, low DO, and low redox levels in the bottom strata, likely as a result of its backwater location and evaporative processes. During the July 1998, June 1999, and July 1999 surveys, the formation of a halocline at Stations #5 appeared to encourage the existence of anoxic and reducing conditions in the bottom strata, as represented by low DO and redox values. On all three of these dates, the estuary mouth was closed. As we suggested above for Stations #2 and #3, the conditions at Station #5 were likely present as a result of a high BOD coupled with a lack of water strata mixing. The low pH ratings periodically found in the bottom strata of Station #5 was likely due to a combination of factors related to halocline formation, reducing conditions, low DO values, and low primary productivity.

Stations #6 and #7 generally possessed the lowest salinity/conductivity values, likely due to their upstream locations. The high DO readings that were frequently recorded at several of the stations during summer and fall months may be the result of an increase in primary production due to increasing day length and warmer temperatures.

Secchi transparency values ranged from 0.2-5.7 ft (Table 1). The lowest Secchi values were collected during the March 1997 survey, ranging from 0.2-1.2 ft. The highest Secchi values were collected during the July 1999 survey, ranging from 3.8 -5.7 ft. We suspect that the high Secchi values occurring during July 1999 were a result of several factors, including lack of suspended sediments due to reduced river flows, reduced phytoplankton densities due to grazing by high densities of *Daphnia magna* and other herbaceous zooplankters, and lack of strong breezes which may cause turbulence in estuary waters.

Vegetation

Although the vegetation surveys were not a major component of the present study, our frequent sampling schedule allowed us to conduct estuary-wide vegetation observations for two years. Our observations suggest that the vegetation present in the SCRE was typical of other southern California river mouth estuaries, such as the Ventura River Estuary (Ferren et al. 1990).

The presence of arundo as the major regrowth component of the estuary vegetation is a condition which needs to be addressed. We suggest that consideration be given to an arundo eradication project in the estuary and adjacent areas. While we recognize the large standing crop of arundo upstream and the unavoidable deposition downstream into the estuary, we still feel there is great ecological value in maintaining native plant communities in the SCRE. The Service and California Department of Fish and Game (CDFG) should be consulted before eradication programs are extended into the estuary.

Invertebrates

Except for the yellow shore crab and amphipod "A", which are marine or estuarine species, all of the collected invertebrates that were identified to at least genus level appeared to be freshwater taxa (Smith and Carlton 1975, Morris et al. 1980, Pennak 1989, Merritt and Cummins 1996). Given the generally low salinity levels recorded in the SCRE (Table 1), the dominance of the invertebrates by freshwater forms and the lack of estuarine or marine forms is not surprising. Except for the Louisiana red crayfish and the oriental shrimp, all of the identified invertebrate species collected appeared to be native. However, identification of specimens to the species level might indicate that perhaps more exotic invertebrates are actually present in the SCRE.

The trend for greater abundance of invertebrates during the summer months may be a result of several confounded factors. The prevailing summertime conditions characterized by relatively stable lower salinity levels were favorable to the dominant freshwater taxa observed in the SCRE. Many of the invertebrate species also may have their primary breeding seasons during summer months. Estuary water levels and corresponding station depths also tended to be higher in summer months when the estuary mouth was closed. When water levels were higher, fewer shorebirds were observed in the SCRE. The presence of fewer shorebirds would result in less shorebird predation on invertebrates. These combined factors may be at least partly responsible for the greater abundance of invertebrates observed in the SCRE during summer months.

Low abundance of invertebrates was typically experienced during the winter months in the benthic cores, and this trend likely is a result of several confounded factors. The first suspected cause of this low winter abundance was the relatively large mesh size (1,000 μ) of the sieve that was used to process the benthic cores. However, several samples collected during December 1997 and March 1998 were randomly selected for analysis without sieving. This microscopic examination 10 x and 30 x magnifications produced similar results as the samples examined by eye in the field; organisms were not observed. This information suggested that the 1,000 μ mesh size was likely not responsible for some of the low benthic invertebrate counts that were periodically experienced during the winter months. Also, the minnow trap (Fig. 3, Table 4) and seine collections (Table 7) produced low abundances of invertebrates during the winter months. Despite the findings of these microscopic analyses during the winter months, we suspect that during other times the 1,000 μ mesh size may have allowed smaller organisms to pass through. Thus, this mesh size likely would be biased towards detection of larger invertebrate species and individuals.

The Santa Clara River tends to produce its highest discharges during the winter months. These winter flows tend to cause strong currents, plus erosion and deposition of sediments in the estuary. Such currents, erosion, and deposition cause physical disturbance which discourages the presence of invertebrates. During winter months the estuary mouth tended to remain open for longer periods of time, and, therefore, was subject to more tidal influence. Such tidal influence may cause rises in salinity (Table 1) to levels which may not be tolerated by freshwater invertebrates. However, the winter flows of the Santa Clara River appeared to limit the area of tidal exchange to areas near the mouth. The winter floods also tended to deposit and scour sediments in the estuary, which would cause the existing benthic invertebrates to be buried or scoured away. The silt deposition from these winter floods generally appeared to have lowered estuary water depths, which may have accounted for greater predation on invertebrates by shorebirds. Prior to the March 1998 survey, the sediment particles at most stations generally would not pass through the 1,000 μ sieve. Our observations at that time suggested that the sediments in the SCRE were dominated by larger-sized sand particles. However, beginning with the March 1998 survey, sediment particles at most stations generally would pass through the 1,000 μ sieve. This observation of sediment particle size suggests that the winter storms of 1997-1998 tended to deposit a large amount of silt-laden sediments into the SCRE. The small particle size of such silt deposition adversely may affect the benthic infauna (Onuf 1987). Such deposition of sediments into the SCRE probably also lowered the volume of the tidal prism, which would reduce the volume and frequency of tidal exchange in the estuary (Zedler 1982).

The presence of such species as Louisiana red crayfish and chironomid midge as dominant species presents ecological implications which indicate that having more species numbers and more numbers of individuals is not always a positive indication of ecosystem quality. Louisiana red crayfish is an introduced species which has a reputation as a nuisance species in southern California and many other areas where it is introduced. However, since only two out of a total of 51 crayfish (4%) were collected during 1999 (Table 4), a possible population decline of crayfish in the SCRE during the course of this study was suggested. Dominance by chironomids in benthic samples is often considered to be indicative of a stressed environment (Plafkin et al. 1989). Accordingly, the dominance by such species as Louisiana red crayfish and chironomids may be indicative that the SCRE benthic community exists in a stressed state.

The trends found in the SCRE for greater abundance of invertebrates during summer months and lesser abundance of invertebrates during winter months have also been found in other southern California estuaries and lagoons:

- Greenwald (1984) noticed a paucity of invertebrates during the period from January 1984 - March 1984 in San Dieguito Lagoon, San Diego County. However, toward the middle of April 1984, invertebrates became very abundant in San Dieguito Lagoon.

- Onuf (1987) reported winter declines in invertebrate abundance during 1978 and 1983 in Mugu Lagoon, Ventura County.

- Greenwald and Britton (1987), using a sampling design and gear similar to the current study, also experienced severe winter declines in invertebrate abundance during 1985 and 1986 in Los Penasquitos Lagoon, San Diego County. However, invertebrates were abundant in the spring and summer of 1985 and 1986.

- Swift and Holland (1998) noticed widespread mortality of invertebrates and fishes during December 1996 in the Santa Margarita River Estuary. These observations occurred during a period of freshwater flushing in the estuary.

When comparing ecological features of estuaries, care must be taken to compare geomorphologically similar estuary types. Since the SCRE is a river mouth estuary, the best comparisons would be to other southern California river mouth estuaries. Southern California river mouth estuaries that are most geomorphologically comparable to the SCRE include Ventura River Estuary, Ventura County; Santa Ynez River Estuary, Santa Barbara County; and Santa Margarita River Estuary and San Luis Rey River Estuary, San Diego County (Wayne Ferren, University of California Reserve System, pers. comm., 1999).

The presence of 24 invertebrate species in the SCRE, in the form of 22 native taxa, and at least two introduced species, is much less than the numbers of invertebrate taxa found in the Santa Margarita River Estuary in another study. The Service (1992) conducted field studies in the Santa Margarita River on 24 January 1992, which yielded 35 taxa of invertebrates. These invertebrates were primarily dominated by coastal marine and estuarine brachyuran crabs and annelids. Several species of coastal marine and estuarine crustaceans and molluscs were also collected. In addition to having greater total number of invertebrate taxa, the Santa Margarita River Estuary possessed a greater number of estuarine and marine invertebrate taxa than the SCRE.

Fishes

Five of the 14 fish species collected in the SCRE are primarily freshwater species: arroyo chub, green sunfish, mosquitofish, fathead minnow, and Santa Ana sucker. The other nine species are considered to be more euryhaline in nature, and may be found in marine, estuarine, or freshwater habitats (Bell 1978, Swift et al. 1993). Ten of these species are considered native, while four of these species are considered exotic. The exotic species are green sunfish, mosquitofish, fathead minnow, and yellowfin goby (Bell 1978, McGinnis 1984, and Swift et al. 1993). The Santa Ana sucker (Swift et al. 1993) and arroyo chub (Bell 1978) are native to southern California, but may not be native to the Santa Clara River watershed. Several of the fishes have sensitive status, including the tidewater goby (federally endangered), the Santa Ana sucker (federal candidate for listing), and the arroyo chub (a state species of special concern).

The trend for greater abundance of fishes during the spring and summer months may be a result of several of the same confounded environmental and biological factors that were discussed above in the invertebrate section. The trend for higher fish abundance in the spring is primarily a reflection of the increased occurrence of arroyo chub during these months (Fig. 5,6). The summer peak of abundance was a reflection of increased occurrence of several species, but primarily tidewater goby, arroyo chub, green sunfish, and mosquitofish.

Topsmelt and striped mullet were only collected in large numbers during periods when the estuary mouth was open. Since these are primarily coastal marine species, water quality conditions in the estuary were likely more optimal when the mouth was open. Topsmelt were only collected at Stations #1 and #2, the stations closest to the estuary mouth where water quality parameters were likely most optimal for this species. We suspect that the other stations, which are located further upstream from Stations #1 and #2, likely possess salinity levels which are too low for survival of topsmelt. Striped mullet, which are more tolerant of freshwater conditions than topsmelt, were collected at all seine stations. However, striped mullet were most abundant at Stations #1 and #2, again where water quality parameters were likely most optimal for this species.

When addressing the number of fish species collected in the SCRE, consideration must be given to the bias presented by the fish sampling gear. As previously mentioned, mullet were able to outswim or jump over the seine. Other larger estuarine or riverine species such as California halibut (*Paralichthys californicus*), diamond turbot (*Hypsopsetta guttulata*), largemouth bass (*Micropterus salmoides*), or southern steelhead (*Oncorhynchus mykiss*) likely would be able to outswim the seine and avoid capture. Also, adults of these larger species would not physically be able to enter the minnow traps. Therefore, both the seine and the minnow traps favored the collection of smaller sized fishes, and the use of such gear would tend to cause an underestimation or even a lack of detection of larger-sized fish species.

Although a total of 14 fish species was collected during the present study, two other fish species are known to use the SCRE, but were not collected. The federally endangered southern steelhead (*Oncorhynchus mykiss*) and the Pacific lamprey (*Lampetra tridentata*) are known to at least pass through the estuary during their anadromous migrations, and should be added to the fish species list (Bell 1978, Swift et. al 1993, John Southwick, Cachuma Operations and Maintenance Board, pers. comm., 1999). The addition of the steelhead and lamprey to the list would indicate that at least 16 species of fish use the estuary, either as short-term or long-term habitat. This presence of 16 species, in the form of 12 native species and four exotic species, appears to be somewhat similar to records of fish species numbers in other southern California river mouth estuaries:

- Hunt and Lehman (1992) reported that 17 species of fishes inhabit the Ventura River Estuary, including 11 native species and six introduced species. Many of these species were also found in the SCRE in the present study. Arroyo chub, partly armored threespine stickleback, and mosquitofish were noted as abundant.

- The Service (1992) conducted seine and gill net sampling in the Santa Margarita River Estuary, from May 1986 to January 1992, and collected 24 species of fish. Native estuarine and marine species accounted for 23 of these species. Dominant species were topsmelt, California killifish, diamond turbot, striped mullet, and staghorn sculpin.

- Swift et al. (1993) conducted seining activities during the fall of 1993 in the Santa Margarita River Estuary, and collected 22 species of fish. Native estuarine and marine species accounted for 14 of these species. California killifish and mosquitofish were noted as abundant.

- The Santa Ynez River Technical Advisory Committee (SYRTAC) (1993, 1999, plus unpublished data) has conducted periodic seine and fyke net surveys in the Santa Ynez River Estuary since 1993. To date, SYRTAC biologists have identified 13 species of fishes in the Santa Ynez River Estuary. Dominant species have included topsmelt, Pacific herring (*Clupea harengus*), starry flounder (*Platichthys stellatus*), staghorn sculpin, and arroyo chub.

- Swift and Holland (1996) conducted seining activities during the spring and fall of 1996 in the Santa Margarita River Estuary, and collected 25 species of fish. Native estuarine and marine species accounted for 10 of these species. Deepbody anchovy (*Anchoa compressa*), California killifish, mosquitofish, and topsmelt were among the species noted as abundant.

While somewhat similar numbers of fish species were found when comparing the SCRE and some other southern California river mouth estuaries, differences in species composition were evident. The main differences noticed were the lack of certain estuarine and marine fish species and the high number of freshwater species in the SCRE. In particular, the SCRE was noticed to lack certain coastal marine fishes such as diamond turbot, California halibut, deepbody anchovy (*Anchoa compressa),* and shiner surfperch (*Cymatogaster aggregata*), which are typically common in the Santa Ynez River Estuary, Santa Margarita River Estuary, and other southern California river mouth estuaries. However, the fish species composition of the SCRE and the Ventura River Estuary compared very closely. Perhaps this closeness in species composition is a result of such common factors as geographic proximity, local climatic patterns, and sewage discharges.

Amphibians
The African clawed frog is an exotic species and the Pacific treefrog is a native species. None of these amphibians have sensitive or protected status. However, the African clawed frog is often considered to be an invasive pest species (Stebbins 1985, Lafferty and Page 1997).

The presence of African clawed frogs and Pacific treefrogs appeared to be associated with periods of lower salinity levels. Distribution of both of these frog species appeared to be more restricted during periods of salt water intrusion. The greatest abundance of African clawed frogs in minnow traps at Stations #3, #6, and #7 likely resulted because these stations typically had the lowest salinity levels (Table 1) and also provided good shoreline vegetation cover (Table 2). All of the adult African clawed frogs were captured by minnow trap and none were captured by seine (Table 3). Lafferty and Page (1997) also did not collect African clawed frogs with their seine and only collected them by minnow trap. Since seine hauls in both studies were conducted during daylight hours, and minnow traps were left out overnight, perhaps this lack of success with catching African clawed frogs by seine is related to nocturnal habits of this frog. However, more studies are needed to determine the actual reason for the absence of African clawed frogs in seine hauls.

As seen above for African clawed frogs, the greatest numbers of Pacific tree frogs were observed during June 1999 and July 1999 when the estuary mouth was closed, water levels were high, salinity levels were low, and flooding of the adjacent marsh and woodlands had occurred.

Impacts of Changing Water Levels
Changing water levels may have a number of impacts on the biota of the SCRE. However, evaluating these impacts is a complex consideration which is not easily accomplished. Many factors such as water quality, sediment type, contaminants, competition, predation, parasitism, reproduction, and habitat availability are confounded with changing water levels in the estuary. In a dynamic ecosystem such as the SCRE, isolating these confounded factors as direct causes is a difficult task. Due to this confounding, longer survey periods would be needed to accurately describe the relationship between estuary levels and such parameters as species composition and abundance. Experimental research would likely be needed to supplement field surveys to properly evaluate these relationships.

Recommendations
Due to the dynamic nature of the SCRE, and the complexity of interactions, further surveys and data analysis are needed for proper assessment of the biotic communities in the SCRE. Some modifications of the current study design are suggested for future studies.
For the current study, which was designed to be a preliminary survey on a limited budget, the use of 1,000 μ mesh size for the sieves was adequate. The use of 1,000 μ mesh size sieves for benthic invertebrate sampling in estuaries with a strong marine influence is not uncommon. However, most freshwater benthic invertebrate studies use a mesh size of 500 μ. Due to the prevalence of freshwater invertebrates in the SCRE, we recommend that future benthic invertebrate surveys use 500 μ mesh size for the sieves. Using this mesh size would allow for reduction of potential losses of smaller-sized freshwater organisms, and less biased comparisons to other freshwater benthic invertebrate studies. Since greater field and lab

times would be required to work with a smaller mesh size, the use of this smaller mesh size will require a much greater expenditure of funds. Also, identifying the benthic invertebrate taxa to at least genus level would provide more useful data for analysis. However, providing genus-level identification would require more time than for the family-level identifications conducted in the current study, and this extra time requirement should be considered when designing future studies.

The use of throw nets and small fyke nets may be useful for collecting some of the more evasive species such as striped mullet, southern steelhead, and California halibut. Throw nets and small fyke nets may prove to be a cost effective method to collect fishes in the SCRE. Future studies in the SCRE may benefit by exploring the use of these nets. However, proper permitting must first be secured before these methods are implemented.

Further studies which target the African clawed frog may prove beneficial towards understanding their behavior and control. More data about African clawed frog feeding habits, salinity tolerances, and impacts on other species would be useful. A combination of experimental studies and field surveys may be the best method to better understand the ecological interactions of the African clawed frog in the SCRE, and may help towards developing effective eradication methods for this species.

Observations during this study indicated that sediment levels and sediment particle size may be critical components toward understanding the patterns of distribution and abundance of benthic invertebrates in the SCRE. Due to these implications, we suggest that future ecological studies in the SCRE incorporate sediment monitoring in the sampling design.

The impacts of changing water levels on the estuary biota is another complex issue which may best be analyzed with continued ecological monitoring, more intensive analysis of the data from the present study, combined use of experimental studies, and comparison with studies of other southern California river mouth estuaries.

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Figures 1 - 6

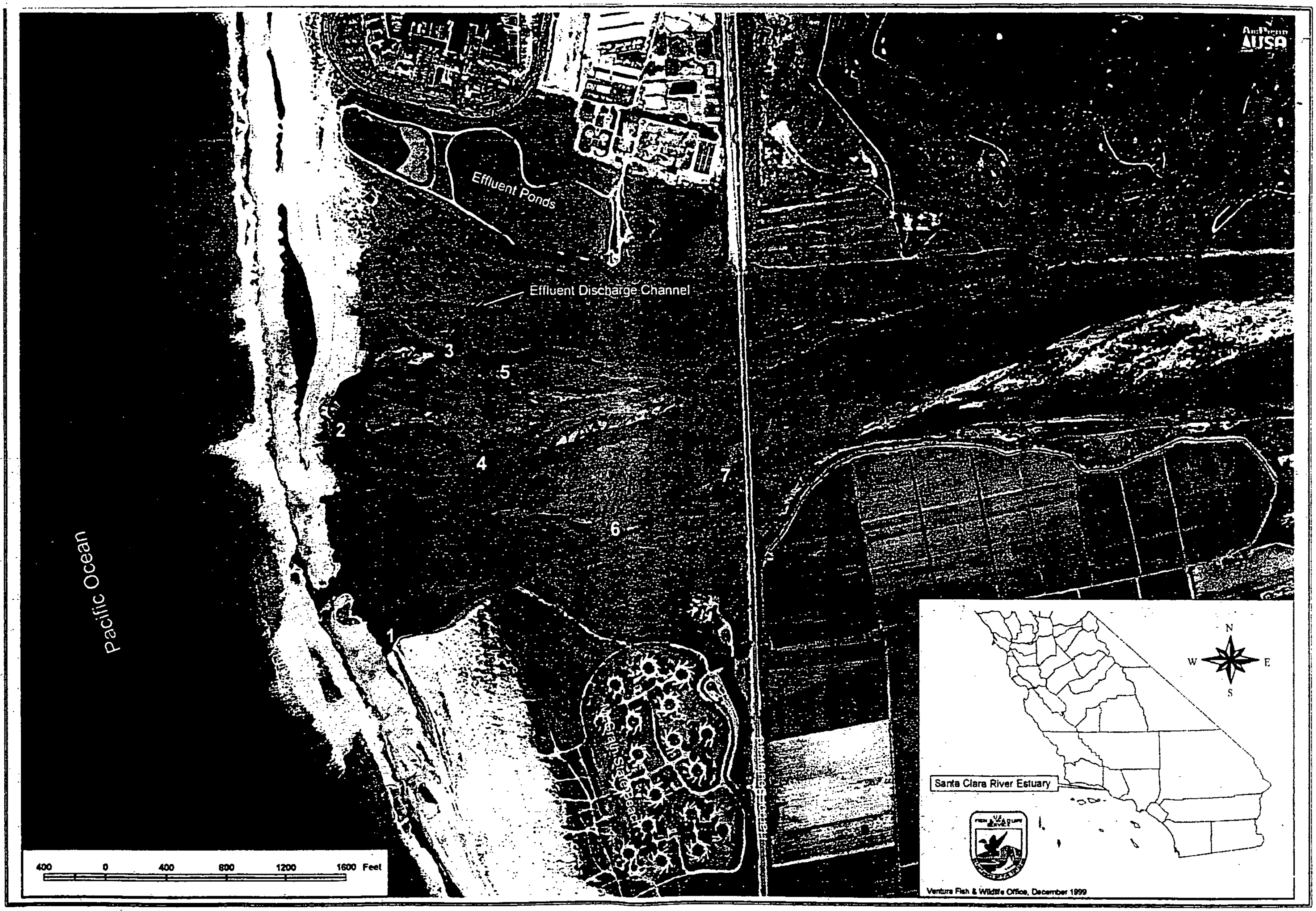

Figure 1. Aerial image (December 1998) of Santa Clara River Estuary, Ventura County, California. Numbers indicate approximate locations of seven sampling stations used for ecological monitoring study, October 1997 - July 1999.

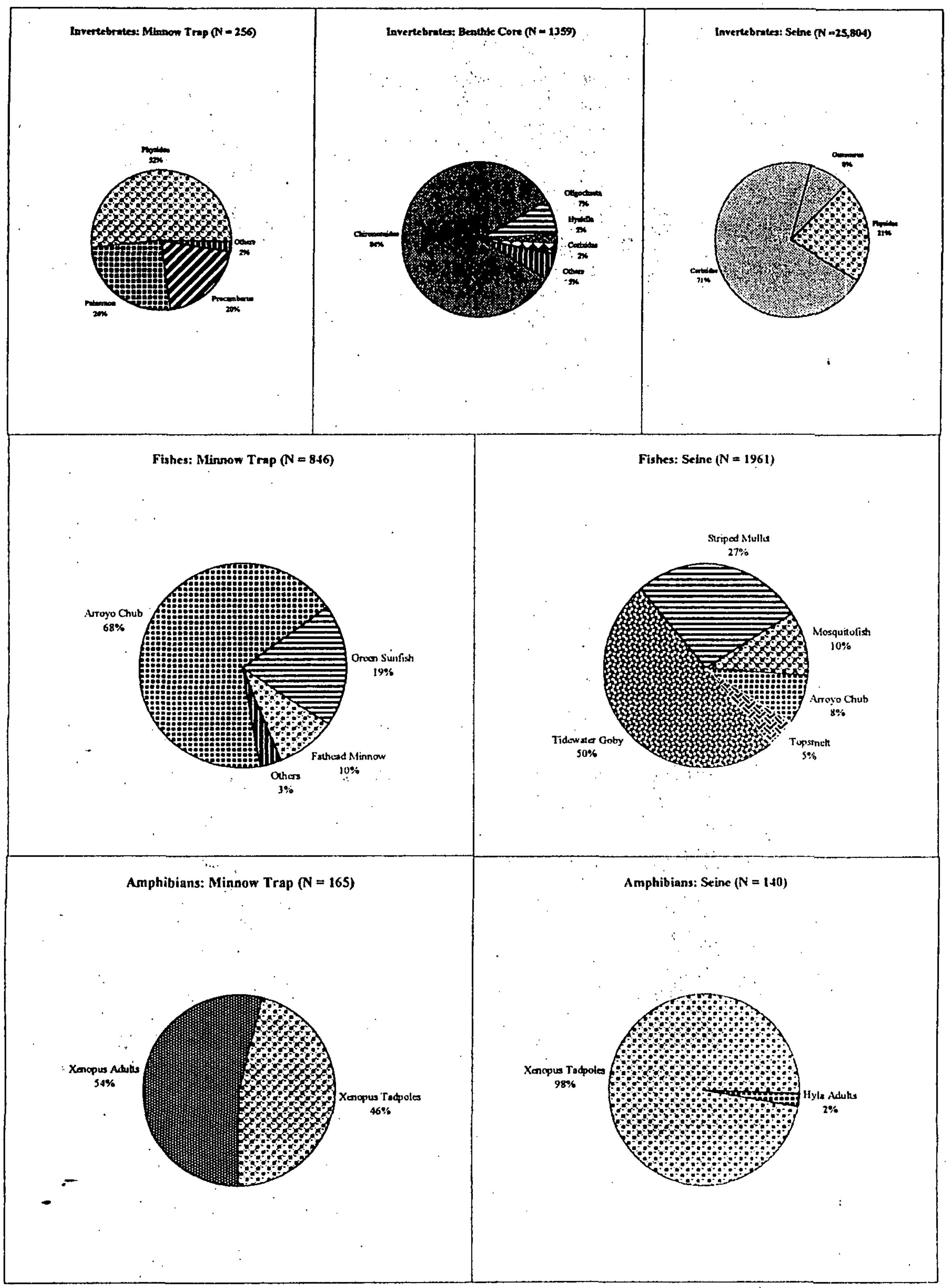

Fig. 2. Cumulative composition for total numbers of invertebrate, fish, and amphibian individuals collected in the Santa Clara River Estuary, Ventura County, California, by benthic core (sum of five sampling stations), baited minnow trap (sum of seven sampling stations), and/or seine (sum of five sampling stations), October 1997 - July 1999. Invertebrate numbers for collections with the seine were usually estimated, not counted. Physidae = (freshwater snail); Procambarus = *Procambarus clarki* (Louisiana red crayfish); Palaemon = *P. macrodactylus (oriental* shrimp); Chironomidae = midge larvae and pupae; Oligochaeta = aquatic earthworms; Hyalella = *Hyalella azteca* (amphipod); Corixidae = water boatmen; Gammarus = *Gammarus* sp.(amphipod); Xenopus = *Xenopus laevis* (African clawed frog); Hyla = *Hyla regilla* (Pacific treefrog).

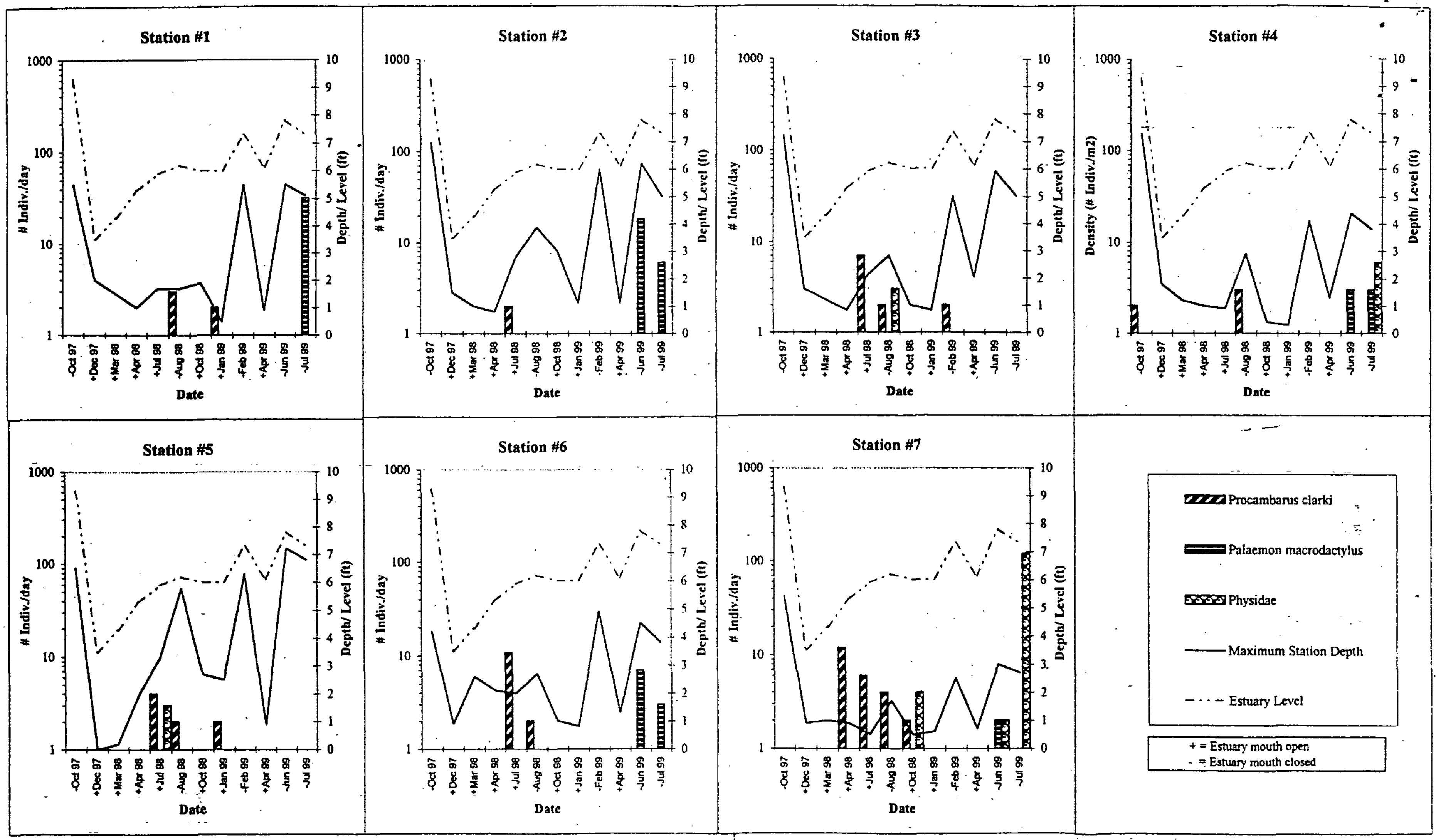

Fig. 3. Catch per unit effort (# individuals/day) of common invertebrates, maximum station depth (ft), and estuary level (ft above mean sea level) for collections with baited minnow traps in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Graphed values are = x +1.001. Station #5 was dry during the December 1997 survey, and was not sampled on this date. *Procambarus clarki* = Louisiana red crayfish; *Palaemon macrodactylus* = oriental shrimp; Physidae = freshwater snail.

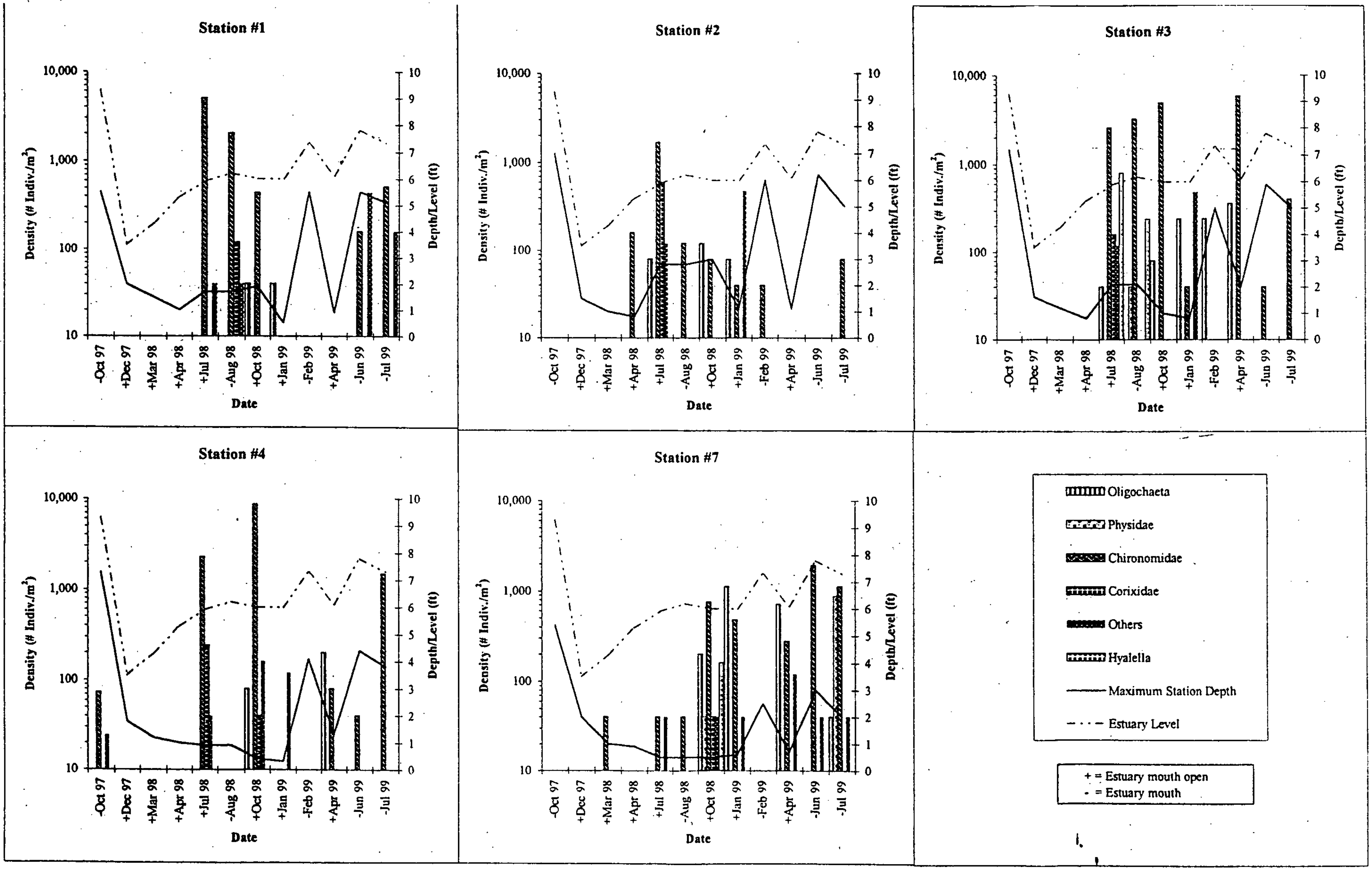

Fig. 4. Invertebrate taxa density (# individuals/m²), maximum station depth (ft), and estuary level (ft above mean sea level) for collections with benthic core in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Graphed values are equal to x+0.001. Oligochaeta = aquatic earthworm; *Physidae* = freshwater snail; Chironomidae = midge larvae and pupae; Corixidae = water boatman; Hyalella = *Hyalella azteca* (amphipod).

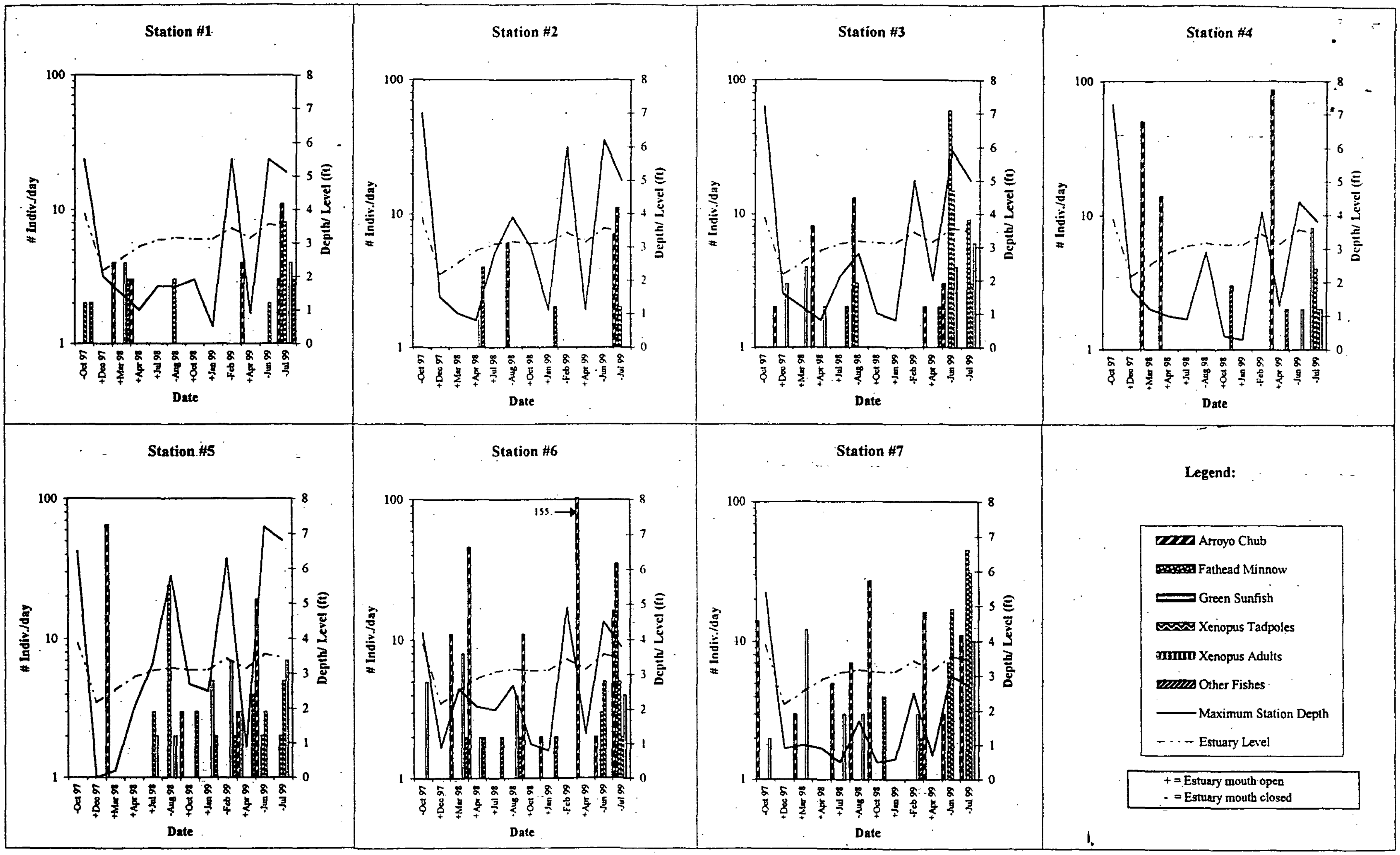

Fig. 5. Catch per unit effort (# individuals/day) of dominant fish and amphibian taxa, maximum station depth (ft), and estuary level (ft above mean sea level) for collections with baited minnow traps in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Graphed values are = x +1.001. Station #5 was dry during the December 1997 survey, and was not sampled on this date.

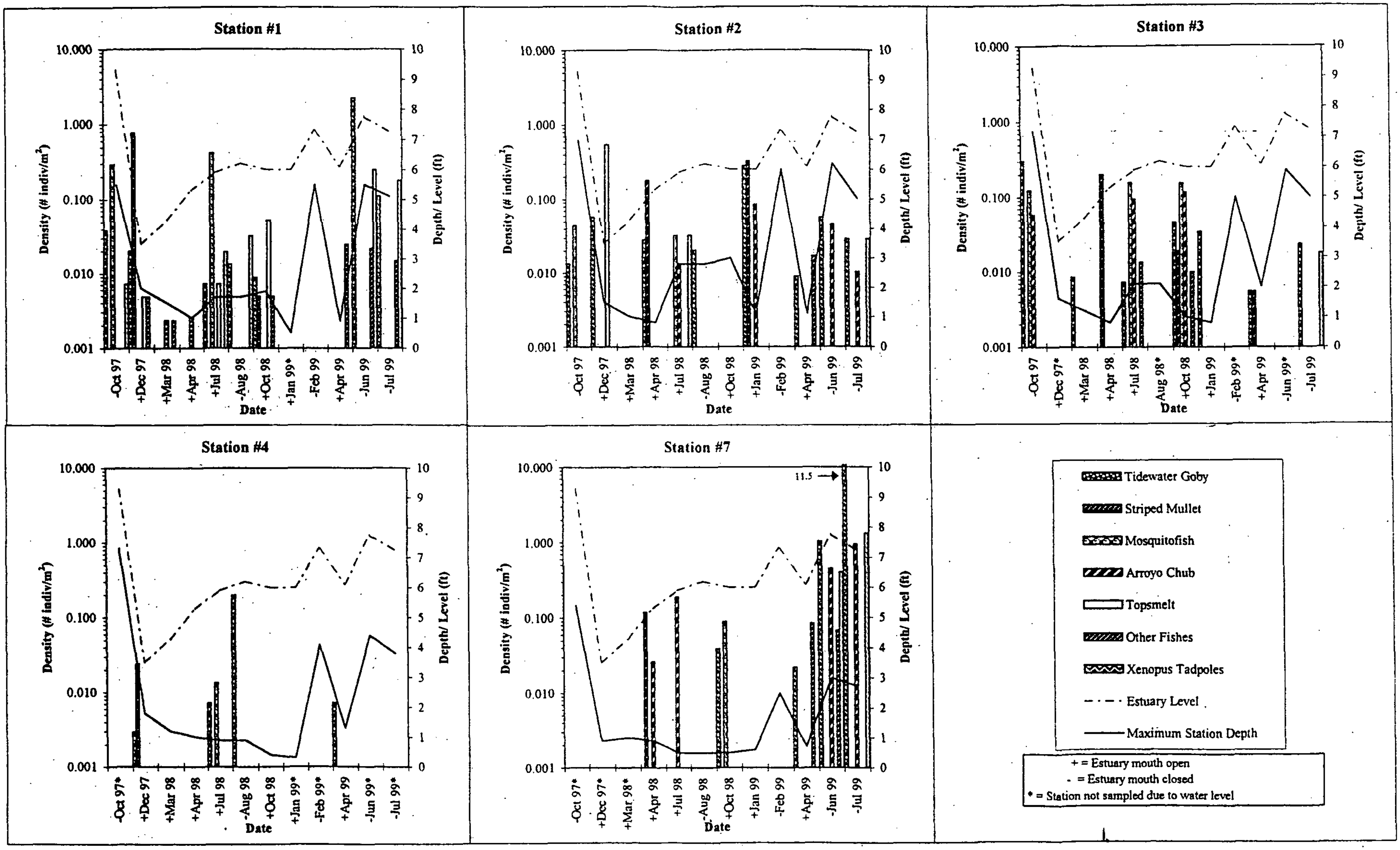

Fig. 6. Fish and amphibian density (# individuals/m^2), maximum station depth (ft), and estuary level (ft above mean sea level) for collections with seine in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Graphed values are equal to x+0.001.

Tables 1 - 9

Table 1. Water quality data collected in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Abbreviations: for mouth status, 0 = closed, 1 = open; MSL = mean sea level; S = surface; M = middle; B = bottom; * = station dry, no readings taken. (Page 1 of 3.)

Date (Year/Month/Day)	Station	Time (hrs)	Mouth Status	Surface Level, MSL (ft)	Depth, Maximum (ft)	Secchi Visibility (ft)	Strata (1=S,2=M,3=B)	Strata Depth (ft)	Temperature (oC)	DO (mg/l)	Conductivity (µmho)	Salinity (ppt)	pH	Redox (mV)
971016	1	1010	0	9.3	5.5	1.3	1	0.1	20.33	17.21	6,575	3.7	8.90	280
							2	2.8	19.56	12.64	6,638	3.7	8.77	289
							3	5.0	19.50	7.43	6,844	3.8	8.70	289
971016	2	1200	0	9.3	7.0	1.8	1	0.1	19.78	12.87	6,592	3.7	8.76	296
							2	3.5	19.56	10.87	6,710	3.7	8.73	299
							3	7.0	20.28	4.86	7,486	4.2	8.53	318
971016	3	1230	0	9.3	7.2	1.9	1	0.1	21.50	11.32	5,279	2.9	8.42	297
							2	3.6	20.22	10.06	6,905	3.8	8.67	294
							3	7.0	20.56	1.33	7,587	4.2	8.17	323
971016	4	1255	0	9.3	7.3	1.2	1	0.1	20.45	15.73	6,850	3.8	8.88	292
							2	3.7	20.45	15.02	6,866	3.8	8.85	299
							3	7.0	20.06	8.40	7,037	3.9	8.66	312
971016	5	1310	0	9.3	6.5	1.8	1	0.1	21.89	12.70	4,705	2.6	8.39	213
							2	3.3	20.61	7.53	6,914	4.0	8.56	164
							3	6.0	20.56	5.92	7,218	4.0	8.47	79
971016	6	1330	0	9.3	4.2	1.3	1	0.1	21.34	>20	6,741	3.7	9.00	252
							2	2.1	21.17	>20	6,719	3.7	8.97	254
							3	3.8	20.95	>20	6,769	3.7	8.95	261
971016	7	1555	0	9.3	5.4	1.3	1	0.1	21.72	>20	6,785	3.8	9.04	254
							2	2.5	21.61	>20	6,786	3.8	9.01	259
							3	5.0	20.84	15.59	6,794	3.8	8.88	271
971217	1	945	1	3.5	2.0	1.9	1	0.1	15.71	8.51	42,684	30.1	8.48	375
							2	0.8	15.87	8.28	48,891	31.9	8:20	377
							3	1.5	15.94	8.72	49,887	32.8	8.19	376
971217	2	1007	1	3.5	1.5	1.5	1	0.1	15.22	9.30	3,848	2.9	7.64	349
							2	0.8	15.85	9.54	46,904	30.1	8.18	355
							3	1.5	16.06	9.10	48,476	31.7	8.25	352
971217	3	1045	1	3.5	1.6	1.6	1	0.1	16.54	8.33	2,296	1.2	7.45	336
							2	0.8	16.24	10.54	9,325	6.0	7.33	341
							3	1.6	16.05	10:19	38,101	25.1	8.05	331
971217	4	1301	1	3.5	1.8	1.8	1	0.1	17.71	14.57	19,015	11.2	8.21	290
							2	0.9	17.74	13.42	39,893	25.6	8.40	292
							3	1.8	17.42	13.32	45,463	30.8	8.39	296
971217	5	1350	1	3.5	0.0	*	*	*	*	*	*	*	*	*
971217	6	1415	1	3.5	0.9	0.9	2	0.5	17.83	8.68	3,294	1.8	8.22	280
971217	7	1439	1	3.5	0.9	0.9	2	0.5	18.33	7.86	3,059	1.7	8.23	278
980323	1	1350	1	4.3	1.5	0.4	1	0.1	21.02	8.93	1,353	0.7	7.90	360
							2	0.8	21.00	8.97	1,354	0.7	7.90	363
							3	1.5	21.02	9.22	1,353	0.7	7.90	369
980323	2	1430	1	4.3	1.0	1.0	2	0.5	21.97	10.45	6,468	3.6	7.40	386
980323	3	1500	1	4.3	1.2	1.2	1	0.1	21.78	10.59	2,239	1.2	7.33	381
							2	0.6	21.80	10.54	2,286	1.2	7.34	381
							3	1.2	21.80	10.29	2,285	1.2	7.34	380
980323	4	1605	1	4.3	1.2	0.3	2	0.6	21.06	8.78	1,389	0.7	7.87	352
980323	5	1525	1	4.3	0.2	0.2	2	0.1	22.91	10.43	4,558	2.5	7.71	341
980323	6	1620	1	4.3	2.6	0.3	2	1.3	21.14	8.87	1,363	0.7	7.84	335
980323	7	1705	1	4.3	1.0	0.3	2	0.5	20.05	12.27	2,541	1.4	7.63	324
980423	1	1115	1	5.3	1.0	0.8	1	0.1	16.84	10.84	1,237	0.7	8.09	263
							3	1.0	16.84	10.80	1,213	0.6	8.11	263
980423	2	1300	1	5.3	0.8	0.8	1	0.1	23.07	10.82	2,624	1.4	7.62	124
							3	0.8	23.05	8.59	2,611	1.4	7.63	184
980423	3	1340	1	5.3	0.8	0.8	1	0.1	22.74	12.28	2,483	1.3	7.55	291
							3	0.8	22.69	12.25	2,501	1.3	7.55	293
980423	4	1400	1	5.3	1.0	0.6	1	0.1	21.81	9.42	1,276	0.7	8.17	286
							3	1.0	21.90	9.15	1,148	0.6	8.18	289
980423	5	1445	1	5.3	2.0	1.5	1	0.1	22.52	11.01	5,230	2.9	7.39	291
							2	1.0	19.72	10.17	5,502	3.0	7.41	291
							3	2.0	19.01	8.51	5,343	2.9	7.43	292
980423	6	1730	1	5.3	2.1	0.5	1	0.1	20.47	9.50	1,221	0.6	8.11	311
							2	1.0	20.48	10.32	1,222	0.6	8.10	315
							3	2.0	20.48	10.43	1,220	0.6	8.12	327
980423	7	1500	1	5.3	0.9	0.6	1	0.1	21.25	9.76	1,300	0.7	8.08	288
							3	0.9	21.31	9.11	1,265	0.7	8.08	291
980723	1	1046	0	5.9	1.7	1.7	1	0.1	20.79	9.39	1,921	1.0	8.13	361
							2	0.9	20.92	9.32	1,991	1.0	8.13	354
							3	1.7	25.00	15.31	2,300	1.2	8.27	346
980723	2	1330	0	5.9	2.8	1.2	1	0.1	25.00	>20	2,907	1.6	8.63	387
							2	1.4	25.00	>20	3,045	1.7	8.66	383
							3	2.8	25.06	13.55	14,057	8.1	8.22	383
980723	3	1418	0	5.9	2.1	1.1	1	0.1	26.09	10.63	2,235	1.2	7.64	424
							2	1.0	26.10	10.11	2,243	1.2	7.57	423
							3	2.1	26.10	10.35	2,245	1.2	7.56	422

Table 1. Continued (page 2 of 3).

Date (Year/Month/Day)	Station	Time (hrs)	Mouth (0 = Cl, 1 = Op)	Surface Level, MSL (ft)	Depth, Maximum (ft)	Secchi Visibility (ft)	Strata (1=S,2=M,3=B)	Strata Depth (ft)	Temperature (oC)	DO (mg/l)	Conductivity (μmho)	Salinity (ppt)	pH	Redox (mV)
980723	4	930	0	5.9	0.9	0.9	1	0.1	20.93	8.89	2,205	1.2	8.09	352
							3	0.9	20.80	8.56	2,275	1.2	8.09	348
980723	5	1530	0	5.9	3.3	1.3	1	0.1	24.85	>20	4,548	2.1	8.44	239
							2	1.6	25.70	10.22	18,836	11.7	7.86	235
							3	3.3	24.75	0.39	23,293	14.2	7.15	-21
980723	6	1040	0	5.9	2.0	2	1	0.1	20.43	9.02	1,742	0.9	8.10	298
							2	1.0	20.46	8.90	1,744	0.9	8.10	302
							3	2.0	20.49	8.28	1,854	0.9	8.03	273
980723	7	1135	0	5.9	0.5	0.5	2	0.3	21.18	9.70	1,721	0.9	8.13	354
980820	1	1050	0	6.2	3.7	2.9	1	0.1	23.39	>20	3,014	1.6	8.92	351
							2	1.8	23.26	>20	3,028	1.6	8.92	352
							3	3.5	24.31	>20	14,385	6.6	8.67	368
980820	2	1225	0	6.2	3.9	2.2	1	0.1	23.84	>20	3,563	1.9	8.81	336
							2	1.9	23.46	>20	4,974	2.8	8.82	337
							3	3.4	24.26	>20	12,973	7.7	8.84	340
980820	3	1316	0	6.2	2.8	1.5	1	0.1	25.77	10.86	2,559	1.4	7.89	385
							2	1.0	25.16	10.92	2,555	1.4	7.83	390
							3	2.5	23.38	11.96	2,829	1.9	8.04	393
980820	4	1457	0	6.2	2.9	1.7	1	0.1	24.49	>20	2,493	1.3	8.88	365
							2	1.5	24.52	>20	2,545	1.4	8.88	366
							3	2.5	24.51	>20	2,533	1.4	8.88	369
980820	5	1341	0	6.2	5.8	1.7	1	0.1	26.33	9.33	2,625	1.4	8.04	278
							2	2.9	24.21	9.33	5,440	3.0	7.93	260
							3	5.0	24.49	9.46	7,363	4.1	7.77	199
980820	6	1655	0	6.2	2.7	2.0	1	0.1	28.24	>20	1,875	1.0	8.56	369
							2	0.4	28.23	>20	1,872	1.0	8.56	369
							3	2.3	27.91	>20	1,890	1.0	8.58	368
980820	7	1457	0	6.2	1.7	1.7	1	0.1	29.04	>20	1,841	1.0	8.57	349
							2	0.9	29.02	>20	1,840	1.0	8.58	347
							3	1.5	28.95	>20	1,828	1.0	8.59	345
981020	1	1027	1	6.0	1.9	1.1	1	0.1	15.45	9.98	28,722	18.8	8.21	409
							3	1.8	16.16	9.70	45,212	29.4	8.27	386
981020	2	1117	1	6.0	3.0	1.8	1	0.1	18.34	11.59	15,167	9.2	8.08	416
							3	2.6	17.29	2.43	50,044	32.8	8.28	411
981020	3	1155	1	6.0	1.0	1.0	2	0.5	21.61	9.57	2,255	1.2	7.80	394
981020	4	1335	1	6.0	0.4	0.4	2	0.2	26.14	15.01	2,084	1.1	8.68	311
981020	5	1250	1	6.0	2.7	1.3	1	0.1	20.21	9.04	3,840	2.0	7.76	357
							2	1.4	19.23	7.00	3,976	2.2	7.64	294
							3	2.3	17.55	0.27	3,823	2.1	7.63	287
981020	6	1615	1	6.0	1.0	1.0	2	0.5	23.47	8.44	1,821	0.9	8.42	370
981020	7	1605	1	6.0	0.5	0.5	2	0.3	20.88	9.69	2,269	1.2	8.21	371
990114	1	1623	1	6.0	0.5	0.5	2	0.3	16.72	11.88	3,098	1.7	7.94	370
990114	2	1351	1	6.0	1.1	1.1	1	0.1	18.65	10.21	7,492	4.4	7.23	337
							3	1.0	18.69	11.32	11,266	6.4	7.22	315
990114	3	1512	1	6.0	0.8	0.8	2	0.4	17.80	11.23	2,164	1.2	7.05	447
990114	4	1225	1	6.0	0.3	0.3	2	0.3	19.38	16.00	1,938	1.0	8.10	381
990114	5	1530	1	6.0	2.5	2.0	1	0.1	15.58	10.46	3,295	1.8	7.06	365
							2	1.2	15.56	10.43	3,297	1.8	7.05	369
							3	2.3	15.36	10.29	3,315	1.8	7.03	401
990114	6	1150	1	6.0	0.8	0.8	2	0.4	16.96	12.40	1,962	1.0	7.90	425
990114	7	1110	1	6.0	0.6	0.6	2	0.3	15.37	12.10	1,967	1.0	7.76	426
990218	1	1025	0	7.3	5.5	3.3	1	0.1	14.28	9.93	3,496	1.9	7.98	369
							2	2.8	14.09	10.06	22,436	13.3	7.78	393
							3	5.0	13.94	10.27	30,424	18.4	7.77	398
990218	2	1150	0	7.3	6.0	3.3	1	0.1	15.26	10.18	4,581	2.5	8.00	383
							2	3.0	15.65	14.51	25,252	15.4	7.98	392
							3	5.3	15.63	17.85	35,045	22.3	8.21	393
990218	3	1217	0	7.3	5.0	4.9	1	0.1	16.17	5.97	3,289	1.8	7.36	415
							2	2.5	15.94	14.43	20,995	13.4	7.95	398
							3	4.3	16.72	>20	32,149	19.5	8.23	393
990218	4	1345	0	7.3	4.1	3.9	1	0.1	16.05	10.33	5,246	2.9	8.02	387
							2	2.0	16.05	14.03	9,451	4.6	8.04	394
							3	3.3	16.29	>20	26,679	16.4	8.18	394
990218	5	1240	0	7.3	6.3	4.0	1	0.1	17.17	7.42	3,236	1.8	7.46	411
							2	3.2	16.55	15.80	26,574	16.6	8.06	394
							3	5.9	16.77	15.45	32,718	20.6	8.03	398
990218	6	1530	0	7.3	4.9	4.7	1	0.1	16.05	11.98	4,471	2.4	7.99	385
							2	2.4	16.16	14.13	21,075	12.8	8.01	398
							3	4.3	16.78	>20	28,897	17.8	8.19	400
990218	7	1503	0	7.3	2.5	2.5	1	0.1	16.47	11.33	2,203	1.2	8.04	392
							2	1.3	16.01	9.29	2,626	1.4	7.99	409
							3	2.1	16.56	13.28	4,485	2.5	7.91	414

Table 1. Continued (page 3 of 3).

Date (Year/Month/Day)	Station	Time (hrs)	Mouth (0 = Cl, 1 = Op)	Surface Level, MSL (ft)	Depth, Maximum (ft)	Secchi Visibility (ft)	Strata (1=S,2=M,3=B)	Strata Depth (ft)	Temperature (oC)	DO (mg/l)	Conductivity (µmho)	Salinity (ppt)	pH	Redox (mV)
990426	1	910	1	6.1	0.9	0.9	1	0.1	14.48	11.72	1,911	1.0	7.92	440
							2	0.9	14.45	11.63	1,918	1.0	7.88	436
							3	2.1	14.37	12.10	1,908	1.0	7.87	435
990426	2	1049	1	6.1	1.1	1.1	1	0.1	18.77	9.55	2,489	1.3	7.44	461
							2	1.2	18.76	10.22	2,665	1.4	7.54	464
							3	2.3	18.57	11.63	3,434	1.8	7.64	463
990426	3	1130	1	6.1	2.0	2.0	1	0.1	21.53	9.67	2,222	1.2	7.20	469
							2	1.0	21.42	9.30	2,233	1.2	7.21	470
							3	1.9	20.58	9.97	2,348	1.3	7.27	474
990426	4	1530	1	6.1	1.3	1.3	1	0.1	24.38	>20	2,170	1.2	8.90	390
							3	1.1	24.39	>20	2,145	1.1	8.88	391
990426	5	1151	1	6.1	0.9	3.0	1	0.1	18.57	10.74	3,065	1.7	7.14	420
							2	1.6	18.32	10.31	3,342	1.8	7.09	416
							3	3.3	18.09	10.42	3,386	1.8	7.11	429
990426	6	1445	1	6.1	1.3	1.3	1	0.1	25.75	13.09	1,895	1.0	7.99	446
							3	0.9	25.75	12.72	1,897	1.0	7.98	448
990426	7	1428	1	6.1	0.7	0.7	2	0.4	24.15	>20	2,236	1.2	7.89	454
990623	1	1402	0	7.8	5.5	1.3	1	0.1	22.69	>20	3,709	2.0	8.96	332
							2	2.8	22.56	>20	4,093	2.0	8.89	322
							3	4.5	21.17	0.46	14,949	7.7	7.53	296
990623	2	1552	0	7.8	6.2	1.8	1	0.1	23.06	>20	3,595	1.9	8.62	186
							2	3.1	21.62	1.03	9,204	4.9	7.37	104
							3	5.4	21.01	0.55	17,184	10.2	7.23	-112
990623	3	1614	0	7.8	5.9	1.9	1	0.1	23.11	>20	3,078	1.7	8.28	227
							2	3.0	22.68	16.54	3,101	1.7	8.25	211
							3	4.7	21.13	0.50	14,471	8.7	7.20	-67
990623	4	1645	0	7.8	4.4	1.6	1	0.1	23.14	>20	3,609	2.0	8.89	242
							2	2.2	23.14	>20	3,611	2.0	8.88	239
							3	3.5	23.11	>20	3,622	2.0	8.80	234
990623	5	1630	0	7.8	7.2	1.8	1	0.1	23.85	>20	2,918	1.6	8.38	161
							2	3.6	20.05	3.63	2,855	1.5	7.30	37
							3	6.5	20.31	0.37	22,139	13.5	6.89	-112
990623	6	1145	0	7.8	4.5	1.5	1	0.1	22.21	>20	3,516	1.9	8.75	421
							2	2.2	22.31	>20	3,487	1.9	8.74	419
							3	3.4	22.13	>20	3,519	1.9	8.68	411
990623	7	1112	0	7.8	3.0	1.4	1	0.1	21.97	>20	3,219	1.7	8.30	471
							2	1.5	21.95	>20	3,202	1.7	8.30	472
							3	2.3	21.95	>20	3,205	1.7	8.28	468
990713	1	940	0	7.3	5.1	>5.1	1	0.1	25.15	5.58	3,203	1.7	7.65	321
							2	2.5	25.07	5.57	3,332	1.8	7.66	324
							3	4.8	25.21	3.93	8,052	4.6	7.56	348
990713	2	1150	0	7.3	5.0	>5.0	1	0.1	25.85	5.68	3,147	1.7	7.58	314
							2	2.5	25.51	5.40	3,654	1.8	7.58	314
							3	4.6	25.59	5.53	6,838	3.9	7.52	318
990713	3	1312	0	7.3	5.0	>5.0	1	0.1	25.78	3.55	2,373	1.3	7.12	345
							2	2.5	24.91	2.84	2,390	1.3	7.12	345
							3	4.7	25.42	4.41	6,061	4.2	7.18	348
990713	4	1350	0	7.3	3.8	>3.8	1	0.1	26.87	4.28	2,821	1.5	7.36	254
							2	1.9	26.84	4.32	2,814	1.5	7.40	256
							3	3.5	26.75	5.27	2,866	1.5	7.45	249
990713	5	1325	0	7.3	6.8	5.7	1	0.1	26.45	3.01	2,389	1.3	7.08	154
							2	3.4	23.57	1.31	2,653	1.4	7.03	27
							3	5.8	23.15	0.21	22,354	13.5	6.54	-128
990713	6	1430	0	7.3	3.8	>3.8	1	0.1	27.28	7.19	2,898	1.6	7.61	266
							2	1.9	27.25	7.24	2,892	1.6	7.61	261
							3	3.5	27.25	7.42	2,892	1.6	7.63	260
990713	7	1500	0	7.3	2.7	>2.7	1	0.1	27.94	12.10	2,791	1.5	7.75	283
							2	1.4	27.83	11.93	2,789	1.5	7.73	282
							3	2.4	27.21	11.74	2,808	1.5	7.70	283

Table 2. Estimated percent areal cover for aquatic and terrestrial vegetation in the Santa Clara River Estuary, Ventura County, California. Aquatic vegetation data from October 1997 - July 1999. Terrestrial vegetation data from April 1998 - July 1999.

				Aquatic Vegetation % Coverage						Terrestrial Vegetation % Coverage																
				Floating			Submerged																			
Date (Year/Month/Day)	Lagoon Level, MSL (ft)	Lagoon Mouth Status	Station #	Total Floating Aquatic Veg.	Enteromorpha intestinalis	Lemna sp.	Total Submerged Aquatic Veg.	Enteromorpha intestinalis	Ruppia maritima	Total Terrestrial Veg. Cover	Rorippa nasturtium-aquaticum	Typha latifolia	Scirpus californicus	Scirpus maritimus	Arundo donax	Populus fremontii	Salix lasiolepis	Toxicodendron diversilobum	Polygonum lapathifolium	Cakile maritima	Cyperus eragrostis	Distichlis spicata	Leptochloa sp.	Atriplex patula	Cynodon dactylon	Others
971016	9.3	Closed	1	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			2	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			3	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			4	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			5	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			6	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			7	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
971218	3.5	Open	1	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			2	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			3	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			4	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			5	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			6	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			7	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
980323	4.3	Open	1	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			2	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			3	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			4	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			5	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			6	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
			7	0	0	0	0	0	0	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
980423	5.3	Closed	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	1	0	1	6	0	0	2	0	2	0	2	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	50	0	0	0	0	10	0	40	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	60	0	20	20	0	20	0	0	0	0	0	0	0	0	0	0	0
			6	0	0	0	0	0	0	35	0	0	0	0	5	0	20	10	0	0	0	0	0	0	0	0
			7	0	0	0	0	0	0	90	0	0	0	0	25	0	65	0	0	0	0	0	0	0	0	0
980723	5.9	Closed	1	0	0	0	0	0	0	27	0	0	0	0	25	0	0	0	0	2	0	0	0	0	0	0
			2	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	60	10	0	0	0	10	0	0	0	5	0	30	0	0	0	0	5
			4	0	0	0	0	0	0	20	1	5	0	1	5	0	0	0	0	0	0	0	0	0	0	8
			5	0	0	0	0	0	0	100	10	20	15	0	40	0	0	0	10	0	0	0	0	0	0	5
			6	25	25	0	80	80	0	50	0	0	0	0	0	0	10	25	0	0	0	5	0	0	0	10
			7	5	5	0	0	0	0	60	0	0	0	0	40	0	20	0	0	0	0	0	0	0	0	0
980820	6.2	Closed	1	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	11	0	0	0	0	10	0	0	0	0	1	0	0	0	0	0	0
			3	0	0	0	0	0	0	100	5	0	0	0	15	0	0	0	50	0	15	0	15	0	0	0
			4	0	0	0	0	0	0	80	0	40	5	0	20	0	0	0	15	0	0	0	0	0	0	0
			5	5	0	5	0	0	0	95	0	20	20	0	20	0	0	0	10	0	0	0	25	0	0	0
			6	0	0	0	0	0	0	50	0	0	0	0	10	5	15	5	3	0	0	10	0	0	0	0
			7	0	0	0	0	0	0	100	0	0	0	0	50	0	50	0	0	0	0	0	0	0	0	0
981020	6.0	Open	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	70	0	0	0	0	2	0	0	0	20	0	30	0	15	0	0	3
			4	0	0	0	0	0	0	60	0	40	0	0	10	0	0	0	5	0	0	0	0	0	0	5
			5	0	0	0	0	0	0	85	0	30	20	0	5	0	0	0	20	0	0	0	10	0	0	0
			6	0	0	0	0	0	0	27	2	0	0	0	5	10	0	2	3	0	0	5	0	0	0	0
			7	10	10	0	20	20	0	80	5	0	0	0	20	0	50	0	0	0	0	0	0	0	0	5
990114	6.0	Open	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	52	0	20	2	0	30	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	90	0	50	30	0	10	0	0	0	0	0	0	0	0	0	0	0
			6	0	0	0	0	0	0	30	0	0	0	0	10	0	20	0	0	0	0	0	0	0	0	0
			7	0	0	0	40	40	0	90	0	0	0	0	50	0	40	0	0	0	0	0	0	0	0	0
990218	7.3	Closed	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	10	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	100	0	50	30	0	10	0	0	0	0	0	0	0	0	0	0	10
			6	0	0	0	0	0	0	30	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0
			7	0	0	0	0	0	0	90	0	0	0	0	45	0	45	0	0	0	0	0	0	0	0	0
990426	6.1	Open	1	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	30	0	20	0	0	10	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	90	0	30	10	0	10	0	0	0	0	0	0	0	0	20	20	0
			6	0	0	0	0	0	0	11	0	2	0	0	0	2	5	0	0	0	0	0	0	0	2	0
			7	0	0	0	0	0	0	75	0	0	0	0	25	0	50	0	0	0	0	0	0	0	0	0
990623	7.8	Closed	1	0	0	0	0	0	0	20	0	0	0	0	15	0	0	0	0	5	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	60	0	55	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	90	0	30	30	0	30	0	0	0	0	0	0	0	0	0	0	0
			6	0	0	0	0	0	0	85	0	0	0	0	20	0	10	40	0	0	0	0	0	0	0	15
			7	0	0	0	0	0	0	100	0	0	0	0	30	0	70	0	0	0	0	0	0	0	0	0
990713	7.3	Closed	1	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	2	0	2	10	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	32	0	30	0	0	2	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	80	0	20	40	0	20	0	0	0	0	0	0	0	0	0	0	0
			6	0	0	0	0	0	0	80	0	0	0	0	20	5	15	40	0	0	0	0	0	0	0	0
			7	0	0	0	0	0	0	100	0	0	0	0	30	0	70	0	0	0	0	0	0	0	0	0

Table 3. List of invertebrate, fish, and amphibian taxa collected by baited minnow trap, benthic core, and/or seine in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. An asterisk (*) indicates a non-native taxon. Numbers of invertebrates collected in seine hauls were often estimated. Unabbreviated name of stickleback is partly armored threespine stickleback (*Gasterosteus aculeatus microcephalus*).

		Benthic Core		Minnow Trap		Seine	
Taxon/Species	**Common Name**	# Indiv Collected	% of Catch	# Indiv Collected	% of Catch	# Indiv Collected	% of Catch
Invertebrates (24 Taxa):							
Hemigrapsus oregonensis	yellow shore crab	0	0.0	1	0.4	0	0.0
Palaemon macrodactylus	oriental shrimp	24	1.8	66	25.8	6	0.0
Gammarus sp.	amphipod	6	0.4	0	0.0	2,064	8.0
Procambarus clarki	Louisiana red crayfish	0	0.0	51	19.9	1	0.0
Hyalella azteca	amphipod	30	2.2	0	0.0	0	0.0
amphipod "A"	unidentified amphipod	8	0.6	0	0.0	0	0.0
Daphnia magna	waterflea	15	1.1	0	0.0	9	0.0
Cyclopoida	cyclopid copepod	1	0.1	0	0.0	0	0.0
Hemiptera	unidentified aquatic beetle	2	0.1	0	0.0	0	0.0
Abedus sp.	toe biter	0	0.0	1	0.4	0	0.0
Hydrophilidae	aquatic beetle	2	0.1	0	0.0	0	0.0
Dytiscidae	diving beetle	0	0.0	0	0.0	1	0.0
Corduliidae	dragonfly	0	0.0	0	0.0	12	0.0
Tipulidae	crane fly	6	0.4	0	0.0	0	0.0
Libellulidae	dragonfly	0	0.0	4	1.6	1	0.0
Coenagrionidae	damselfly	0	0.0	0	0.0	1	0.0
Corixidae	water boatman	30	2.2	0	0.0	18,250	70.7
Baetidae	mayfly	4	0.3	0	0.0	0	0.0
Chironomidae	chironomid midge	1,132	83.3	0	0.0	32	0.1
Dixidae	dixid midge	2	0.1	0	0.0	0	0.0
Physidae	freshwater snail	0	0.0	133	52.0	5,427	21.0
Oligochaeta	unidentified aquatic earthworm	92	6.8	0	0.0	0	0.0
Polychaeta	unidentified bristle worm	4	0.3	0	0.0	0	0.0
Hirudinea	unidentified leech	1	0.1	0	0.0	0	0.0
	Total:	1,359	100.0	256	100.0	25,804	100.0
Fishes (14 Species):							
Eucyclogobius newberryi	tidewater goby			9	1.1	971	49.5
*Acanthogobius flavimanus**	yellowfin goby			1	0.1	0	0.0
Clevelandia ios	arrow goby			0	0.0	1	0.1
Gila orcutti	arroyo chub			575	68.0	156	8.0
*Gambusia affinis**	mosquitofish			7	0.8	193	9.8
*Pimephales promelas**	fathead minnow			80	9.5	0	0.0
Fundulus parvipinnis	California killifish			0	0.0	4	0.2
*Lepomis cyanellus**	green sunfish			162	19.1	4	0.2
Atherinops affinis	topsmelt			0	0.0	94	4.8
Mugil cephalus	striped mullet			0	0.0	526	26.8
Cottus asper	prickly sculpin			8	0.9	1	0.1
Leptocottus armatus	staghorn sculpin			1	0.1	8	0.4
Catostomus santaanae	Santa Ana sucker			2	0.2	3	0.2
Gasterosteus acul. micro.	p.a. threespine stickleback			1	0.1	0	0.0
	Total:			846	100.0	1,961	100.1
Amphibians (2 Species):							
*Xenopus laevis**	African clawed frog			165	100.0	137	97.9
Hyla regilla	Pacific treefrog			0	0.0	3	2.1
	Total:			165	100.0	140	100.0

Table 4. Number of individuals of invertebrates, fishes, and amphibians collected with baited minnow traps in the Santa Clara River Estuary, Ventura County, California, October 1997 - July 1999. Abbreviations: ACF = African clawed frog. An asterisk (*) indicates that Station 5 was dry, and was not sampled on this date.

Date (Yr/Mo/Dy)	Lagoon Level, MSL (ft)	Lagoon Mouth Status	Station #	Number of Taxa: Invertebrate Taxa	Number of Taxa: Fish Species	Number of Taxa: Amphibian Species	# Invertebrate Individuals: Total Invert. Indiv.	Procambarus clarki	Palaemon macrodactylus	Hemigrapsus oregonensis	Libellulidae	Abedus sp.	Physidae	# Fish Individuals: Total Fish Indiv.	Tidewater Goby	Santa Ana Sucker	Arroyo Chub	Prickly Sculpin	Staghorn Sculpin	Mosquitofish	Fathead Minnow	Green Sunfish	Threespine Stickleback	Yellowfin Goby	#Amphibian Individuals: Total Amphibian Indiv.	ACF Adults	ACF Tadpoles
971017	9.3	Closed	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0
			7	0	1	1	0	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	0	1	1	0
971219	3.5	Open	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	2	0
			4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
			6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980324	4.3	Open	1	0	2	1	0	0	0	0	0	0	0	5	0	0	3	2	0	0	0	0	0	0	3	3	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0
			4	0	1	0	0	0	0	0	0	0	0	49	0	0	49	0	0	0	0	0	0	0	0	0	0
			5	0	1	0	0	0	0	0	0	0	0	64	0	0	64	0	0	0	0	0	0	0	0	0	0
			6	0	2	1	0	0	0	0	0	0	0	11	0	1	10	0	0	0	0	0	0	0	7	7	0
			7	0	1	1	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	11	11	0
980424	5.3	Closed	1	0	1	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0
			2	0	2	1	0	0	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0	0	1	1	0
			3	0	1	1	0	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	0	1	1	0
			4	0	1	1	0	0	0	0	0	0	0	13	0	0	13	0	0	0	0	0	0	0	2	2	0
			5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			6	0	2	1	0	0	0	0	0	0	0	46	0	0	45	1	0	0	0	0	0	0	1	1	0
			7	1	0	0	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980724	5.9	Closed	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1	1	0	6	6	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	2	0	1	5	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	1	2
			6	1	1	0	10	10	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
			7	1	1	1	5	5	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	2	2	0
980821	6.2	Closed	1	1	1	0	2	2	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0
			2	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0
			3	2	2	0	3	1	0	0	0	0	2	14	0	0	0	0	0	0	12	2	0	0	0	0	0
			4	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	1	1	1	1	1	0	0	0	0	0	23	0	0	0	0	0	0	0	23	0	0	1	1	0
			6	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	3	3	0
			7	1	1	1	3	3	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	0	2	2	0
981021	6.0	Open	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
			5	0	2	0	0	0	0	0	0	0	0	4	0	0	2	2	0	0	0	0	0	0	0	0	0
			6	0	1	0	0	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	0	0	0	0	0
			7	3	2	0	5	1	0	0	0	1	3	29	0	0	26	0	0	3	0	0	0	0	0	0	0
990115	6.0	Open	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1	1	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
			3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	4	4	0
			6	0	2	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0
			7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990219	7.3	Closed	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			5	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	6	6	0
			6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2	2	0
990427	6.1	Open	1	0	1	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0
			2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	2	0	0	0	0	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0
			4	0	2	0	0	0	0	0	0	0	0	86	1	0	85	0	0	0	0	0	0	0	0	0	0
			5	0	3	0	0	0	0	0	0	0	0	7	3	0	2	0	0	0	2	0	0	0	0	0	0
			6	0	1	0	0	0	0	0	0	0	0	155	0	0	155	0	0	0	0	0	0	0	0	0	0
			7	0	1	0	0	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	0	0	0	0	0
990624	7.8	Closed	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
			2	1	0	0	17	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0	2	1	0	0	0	0	0	0	0	60	0	0	2	0	0	0	0	58	0	0	17	3	14
			4	1	0	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
			5	0	2	1	0	0	0	0	0	0	0	19	0	0	18	0	0	0	0	1	0	0	2	0	2
			6	1	2	1	6	0	6	0	0	0	0	3	0	0	1	0	0	0	0	2	0	0	4	0	4
			7	2	2	1	2	0	1	0	0	0	1	8	0	0	2	0	0	0	0	6	0	0	16	0	16
990714	7.3	Closed	1	1	5	1	31	0	31	0	0	0	0	21	1	0	2	0	0	0	10	7	1	0	3	3	0
			2	1	3	0	5	0	5	0	0	0	0	17	0	0	6	0	0	0	10	1	0	0	0	0	0
			3	0	1	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	8	0	0	7	5	2
			4	3	2	1	8	0	2	0	1	0	5	10	0	0	0	0	0	0	7	3	0	0	2	1	1
			5	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	10	6	4
			6	1	3	1	2	0	2	0	0	0	0	53	0	0	15	0	0	0	34	4	0	0	4	3	1
			7	2	2	1	123	0	0	0	3	0	120	54	0	0	10	0	0	0	0	44	0	0	39	9	30
Total:							256	51	66	1	4	1	133	846	9	2	575	8	1	7	80	162	1	1	165	89	76
Mean:							4.3	0.6	0.8	0.0	0.0	0.0	1.6	10.2	0.1	0.0	6.9	0.1	0.0	0.1	1.0	2.0	0.0	0.0	2.0	1.1	0.9
% Invert Comp:								19.9	25.8	0.4	1.6	0.4	52.0														
% Fish Comp:															1.1	0.2	68.0	0.9	0.1	0.8	9.5	19.1	0.1	0.1			
% Amphibian Comp:																										53.9	46.1

Table 5. Summary of abundance data for invertebrate individuals collected with a benthic coring device in the Santa Clara River Estuary, Ventura County, California. Samples were collected from October 1997 to July 1999.

							Number of Individuals Collected																
Date (Yr/Mo/Dy)	Lagoon Level, MSL (ft)	Lagoon Mouth Status	Station #	Depth, Maximum (ft)	# Cores	Total Area Cored (m2)	Chironomidae	Tipulidae	Dixidae	Baetidae	Corixidae	Unidentified Hemiptera	Hydrophilidae	Gammarus sp.	Hyalella azteca	Amphipod "A"	Daphnia magna	Cyclopoida	Physidae	Polychaeta	Oligochaeta	Hirudinea	Total Invertebrates
971017	9.3	Closed	1	5.5	5	0.041	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
			2	7.0	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	7.2	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	7.3	5	0.041	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
			7	5.4	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
971217	3.5	Open	1	2.0	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1.5	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.6	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.8	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.9	5	0.041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980323	4.3	Open	1	1.5	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1.0	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.2	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.2	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	1.0	3	0.025	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
980423	5.3	Open	1	1.0	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0.8	3	0.025	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
			3	0.8	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.0	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.9	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980724	5.9	Closed	1	1.7	3	0.025	125	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	126
			2	2.8	3	0.025	42	1	2	0	15	0	0	0	0	0	0	0	0	0	2	0	62
			3	2.1	3	0.025	64	0	0	0	4	0	0	0	20	0	0	0	0	0	1	0	89
			4	0.9	3	0.025	57	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	64
			7	0.5	3	0.025	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
980821	6.2	Closed	1	1.7	3	0.025	51	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	55
			2	2.8	3	0.025	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
			3	2.1	3	0.025	80	0	0	0	0	0	0	0	6	0	0	0	1	0	0	0	87
			4	0.9	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.5	3	0.025	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
981021	6.0	Open	1	1.9	3	0.025	11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	12
			2	3.0	3	0.025	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	5
			3	1.0	3	0.025	122	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	125
			4	0.4	3	0.025	216	3	0	0	1	0	1	0	0	0	0	0	0	0	2	0	223
			7	0.5	3	0.025	19	0	0	0	1	0	1	0	4	0	0	0	1	0	5	0	31
990115	6.0	Open	1	0.5	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
			2	1.1	3	0.025	1	0	0	0	0	0	0	0	0	8	0	0	0	4	2	0	15
			3	0.8	3	0.025	1	0	0	0	0	0	0	1	0	0	0	0	0	0	6	0	8
			4	0.3	3	0.025	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
			7	0.6	3	0.025	12	0	0	0	0	0	0	0	0	0	0	1	0	0	28	0	41
990219	7.3	Closed	1	5.5	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	6.0	3	0.025	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			3	5.0	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6
			4	4.1	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	2.5	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990427	6.1	Open	1	0.9	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1.1	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	2.0	3	0.025	144	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	153
			4	1.3	3	0.025	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	7
			7	0.7	3	0.025	7	0	0	3	0	0	0	0	0	0	0	0	0	0	18	0	28
990623	7.8	Closed	1	5.5	3	0.025	4	0	0	0	0	0	0	1	0	0	10	0	0	0	0	0	15
			2	6.2	3	0.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	5.9	3	0.025	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			4	4.4	3	0.025	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			7	3.0	3	0.025	48	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	49
990724	7.3	Closed	1	5.1	3	0.025	13	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	17
			2	5.0	3	0.025	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
			3	5.0	3	0.025	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
			4	3.8	3	0.025	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
			7	2.7	3	0.025	28	0	0	0	0	0	0	0	0	0	1	0	22	0	1	0	52
Total:							**1132**	**6**	**2**	**4**	**30**	**2**	**2**	**6**	**30**	**8**	**15**	**1**	**24**	**4**	**92**	**1**	**1359**
Percent Composition:							**83.3**	**0.4**	**0.1**	**0.3**	**2.2**	**0.1**	**0.1**	**0.4**	**2.2**	**0.6**	**1.1**	**0.1**	**1.8**	**0.3**	**6.8**	**0.1**	

Table 6. Summary of density data (# individuals/m^2) for invertebrates collected with a benthic coring device in the Santa Clara River Estuary, Ventura County, California. Samples were collected from October 1997 to July 1999.

							Invertebrate Taxa Density (#indiv/m^2)															
Date (Yr/Mo/Dy)	Lagoon Level, MSL (ft)	Lagoon Mouth Status	Station #	Depth, Maximum (ft)	# Cores	Total Area Cored (m^2)	Chironomidae	Tipulidae	Dixidae	Baetidae	Corixidae	Unidentified Hemiptera	Hydrophilidae	Gammarus sp.	Hyalella azteca	Amphipod "A"	Daphnia magna	Cyclopoida	Physidae	Polychaeta	Oligochaeta	Hirudinea	Total Invertebrates
971017	9.3	Closed	1	5.5	5	0.041	439.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	439.0
			2	7.0	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3	7.2	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4	7.3	5	0.041	73.2	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.6
			7	5.4	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
971217	3.5	Open	1	2.0	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2	1.5	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3	1.6	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4	1.8	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			7	0.9	5	0.041	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
980323	4.3	Open	1	1.5	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2	1.0	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3	1.2	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4	1.2	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			7	1.0	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
980423	5.3	Open	1	1.0	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2	0.8	3	0.025	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	160.0
			3	0.8	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4	1.0	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			7	0.9	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
980724	6	Open	1	1.7	3	0.025	5,000.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5,040.0
			2	2.8	3	0.025	1,680.0	40.0	80.0	0.0	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	2,480.0
			3	2.1	3	0.025	2,560.0	0.0	0.0	0.0	160.0	0.0	0.0	0.0	800.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	3,560.0
			4	0.9	3	0.025	2,280.0	0.0	0.0	0.0	240.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,560.0
			7	0.5	3	0.025	40.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0
980821	6	Closed	1	1.7	3	0.025	2,040.0	0.0	0.0	0.0	120.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,200.0
			2	2.8	3	0.025	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0
			3	2.1	3	0.025	3,200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	240.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	3,480.0
			4	0.9	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			7	0.5	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
981021	6.0	Open	1	1.9	3	0.025	440.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	480.0
			2	3.0	3	0.025	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	200.0
			3	1.0	3	0.025	4,880.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	40.0	5,000.0
			4	0.4	3	0.025	8,640.0	120.0	0.0	0.0	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	8,920.0
			7	0.5	3	0.025	760.0	0.0	0.0	0.0	40.0	0.0	40.0	0.0	160.0	0.0	0.0	0.0	40.0	0.0	200.0	0.0	1,240.0
990115	6.0	Open	1	0.5	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	40.0
			2	1.1	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	320.0	0.0	0.0	0.0	160.0	80.0	0.0	600.0
			3	0.8	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	240.0	0.0	320.0
			4	0.3	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0
			7	0.6	3	0.025	480.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	1,120.0	0.0	1,640.0
990219	7.3	Closed	1	5.5	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2	6.0	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
			3	5.0	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	240.0	0.0	240.0
			4	4.1	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			7	2.5	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
990427	6.1	Open	1	0.9	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2	1.1	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3	2.0	3	0.025	5,760.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	360.0	0.0	6,120.0
			4	1.3	3	0.025	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0	280.0
			7	0.7	3	0.025	280.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	720.0	0.0	1,120.0
990623	7.8	Closed	1	5.5	3	0.025	160.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	400.0	0.0	0.0	0.0	0.0	0.0	600.0
			2	6.2	3	0.025	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3	5.9	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
			4	4.4	3	0.025	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
			7	3.0	3	0.025	1,920.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	1,960.0
990724	7.3	Closed	1	5.1	3	0.025	520.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	680.0
			2	5.0	3	0.025	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0
			3	5.0	3	0.025	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0
			4	3.8	3	0.025	1,480.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,480.0
			7	2.7	3	0.025	1,120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	880.0	0.0	40.0	0.0	2,080.0

Table 7. Summary of abundance data (number of individuals) for invertebrates collected by seine in the Santa Clara River Estuary, Ventura County, California. Samples were collected from October 1997 to July 1999. Areas shaded in gray indicate values that were obtained during sampling efforts when water depths exceeded the height of the seine (4.5'). Numbers of invertebrates were often estimated. For estuary mouth status: 0 = closed, 1 = open.

								# Invertebrate Individuals											
Date (Year/Month/Day)	Lagoon Level, MSL (ft)	Mouth Status	Station #	Depth, Max (ft)	Approx. Area Fished (m2)	# Replicates	# Invertebrate Taxa	Total Invert. Individuals	Procambarus clarki	Palaemon macrodactylus	Gammarus sp.	Daphnia magna	Physidae	Corixids	Coenagrionidae	Libellulidae	Corduliidae	Dytiscidae	Chironomids
971016	9.3	0	1	4.8	160	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	7.2	160	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	4.0	122	1	0	0	0	0	0	0	0	0	0	0	0	0	0
971218	3.5	1	1	2.5	520	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	2.5	140	1	0	0	0	0	0	0	0	0	0	0	0	0	0
971219	3.5	1	4	2.0	520	1	0	0	0	0	0	0	0	0	0	0	0	0	0
980324	4.3	1	1	2.0	757	6	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1.0	474	3	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.0	267	5	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	0.8	430	4	0	0	0	0	0	0	0	0	0	0	0	0	0
980423	5.3	1	1	1.0	651	4	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	0.8	222	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0.8	95	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.0	139	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.8	120	2	0	0	0	0	0	0	0	0	0	0	0	0	0
980723	5.9	1	1	1.7	160	1	0	3005	0	0	0	0	0	3000	0	0	5	0	0
			2	2.8	160	1	2	3002	1	0	0	0	0	3000	0	0	1	0	0
			3	2.1	160	1	1	3000	0	0	0	0	0	3000	0	0	0	0	0
			4	0.9	160	1	1	2000	0	0	0	0	0	2000	0	0	0	0	0
			7	0.5	150	1	1	1	0	0	0	0	0	0	0	0	1	0	0
980820	6.2	0	1	3.7	160	1	2	1002	0	0	0	0	0	1000	0	0	2	0	0
			2	3.9	260	1	3	505	0	0	0	0	2	500	0	0	3	0	0
			4	2.3	100	1	1	100	0	0	0	0	100	0	0	0	0	0	0
			7	1.7	150	1	0	0	0	0	0	0	0	0	0	0	0	0	0
981020	6.0	1	1	1.9	255	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	3.0	189	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.0	112	2	1	20	0	0	0	0	0	20	0	0	0	0	0
			4	0.4	56	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.5	80	1	2	102	0	0	0	0	2	100	0	0	0	0	0
990114	6.0	1	2	1.1	96	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0.8	60	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.6	80	1	0	0	0	0	0	0	0	0	0	0	0	0	0
990218	7.3	0	1	5.5	270	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	3.2	432	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	3.2	240	1	0	0	0	0	0	0	0	0	0	0	0	0	0
990426	6.1	1	1	2.0	126	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	1.1	126	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.0	224	1	1	3	0	0	3	0	0	0	0	0	0	0	0
			4	1.3	160	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.7	48	1	0	0	0	0	0	0	0	0	0	0	0	0	0
990623	7.8	0	1	5.5	48	1	9	129	0	2	11	9	3	100	1	0	0	1	2
			2	2.1	90	1	3	2603	0	3	600	0	0	2000	0	0	0	0	0
			7	4.5	45	1	3	651	0	0	500	0	0	150	0	1	0	0	0
990713	7.3	0	1	5.1	72	1	2	1150	0	0	150	0	0	1000	0	0	0	0	0
			2	3.0	108	1	3	2600	0	0	300	0	300	2000	0	0	0	0	0
			3	5.0	180	1	4	550	0	0	200	0	20	300	0	0	0	0	30
			7	2.7	56.52	1	4	5381	0	1	300	0	5000	80	0	0	0	0	0
Total:								25,804	1	6	2,064	9	5,427	18,250	1	1	12	1	32
% Invert Comp:									0.0	0.0	8.0	0.0	21.0	70.7	0.0	0.0	0.0	0.0	0.1

Table 8. Summary of abundance data (number of individuals) for fishes and amphibians collected by seine in the Santa Clara River Estuary, Ventura County, California. Samples were collected from October 1997 to July 1999. Areas shaded in gray indicate values that were obtained during sampling efforts when water depths exceeded the height of the seine (4.5'). For estuary mouth status: 0 = closed, 1 = open. ACF = African clawed frog, PTF = Pacific treefrog.

									# Fish Individuals													# Amphibian Individuals				
Date (Year/Month/Day)	Lagoon Level, MSL (ft)	Mouth Status	Station #	Depth, Max (ft)	Approx. Area Fished (m2)	# Replicates	# Fish Species	# Amphibian Species	Total Fish Individuals	Tidewater Goby	Striped Mullet	Mosquitofish	Arroyo Chub	Topsmelt	Staghorn Sculpin	California Killifish	Green Sunfish	Santa Ana Sucker	Prickly Sculpin	Arrow Goby	Total Amphibian Indiv	ACF Tadpoles	ACF Adults	PTF Tadpoles	PTF Adults
971016	9.3	0	1	4.8	160	1	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	0	0	0	0	0	0	0	0	1	1	0	0	0
			2	7.2	160	1	[illegible]	0	[illegible]	2	0	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	4.0	122	1	3	0	59	37	0	15	7	0	0	0	0	0	0	0	0	0	0	0	0
971218	3.5	1	1	2.5	520	1	4	0	422	10	407	0	0	3	0	2	0	0	0	0	0	0	0	0	0
			2	2.5	140	1	2	0	85	8	0	0	0	77	0	0	0	0	0	0	0	0	0	0	0
971219	3.5	1	4	2.0	520	1	2	0	13	1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980324	4.3	1	1	2.0	757	6	2	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
			2	1.0	474	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.0	267	5	1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	0.8	430	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980423	5.3	1	1	1.0	651	4	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
			2	0.8	222	2	2	0	45	6	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	0.8	95	2	1	0	19	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.0	139	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.8	120	2	2	0	17	0	14	0	3	0	0	0	0	0	0	0	0	0	0	0	0
980723	5.9	1	1	1.7	160	1	3	2	69	1	0	67	0	1	0	0	0	0	0	0	4	3	0	1	0
			2	2.8	160	1	2	1	7	0	0	5	2	0	0	0	0	0	0	0	5	5	0	0	0
			3	2.1	160	1	5	0	43	1	0	25	15	0	0	0	0	1	1	0	0	0	0	0	0
			4	0.9	160	1	2	0	3	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.5	150	1	1	0	28	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0
980820	6.2	0	1	3.7	160	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0
			2	3.9	260	1	1	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	2.3	100	1	1	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	1.7	150	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
981020	6.0	1	1	1.9	255	1	4	0	17	2	1	0	0	13	0	0	0	0	0	1	0	0	0	0	0
			2	3.0	189	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3	1.0	112	2	5	0	38	5	2	17	13	0	0	0	0	1	0	0	0	0	0	0	0
			4	0.4	56	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.5	80	1	2	0	10	3	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
990114	6.0	1	2	1.1	96	1	3	0	66	27	31	0	8	0	0	0	0	0	0	0	0	0	0	0	0
			3	0.8	60	1	1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.6	80	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990218	7.3	0	1	5.5	270	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			2	3.2	432	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	3.2	240	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990426	6.1	1	1	2.0	126	1	1	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
			2	1.1	126	1	2	0	3	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
			3	1.0	224	1	2	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			4	1.3	160	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			7	0.7	48	1	2	0	5	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
990623	7.8	0	1	5.5	48	1	[illegible]	[illegible]	110	108	0	1	0	0	0	0	1	0	0	0	12	12	0	0	0
			2	2.1	90	1	2	0	9	5	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
			7	4.5	45	1	3	2	69	46	0	0	20	0	0	0	3	0	0	0	20	18	0	2	0
990713	7.3	0	1	5.1	72	1	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	[illegible]	[illegible]	0	0	0	0	13	13	0	0	0
			2	3.0	108	1	2	1	4	3	0	0	1	0	0	0	0	0	0	0	3	3	0	0	0
			3	5.0	180	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	[illegible]	[illegible]	0	0	0
			7	2.7	56.5	1	2	1	705	652	0	0	53	0	0	0	0	0	0	0	74	74	0	0	0
Total:									**1,961**	**971**	**526**	**193**	**156**	**94**	**8**	**4**	**4**	**3**	**1**	**1**	**140**	**137**	**0**	**3**	**0**
% Fish Comp:										***49.5***	***26.8***	***9.8***	***8.0***	***4.8***	***0.4***	***0.2***	***0.2***	***0.2***	***0.1***	***0.1***					
% Amphibian Comp:																						**97.9**	**0.0**	**2.1**	**0.0**

Table 9. Summary of density data (# individuals/m^2) for fishes and amphibians collected by seine in the Santa Clara River Estuary, Ventura County, California. Samples were collected from October 1997 to July 1999. Areas shaded in gray indicate values that were obtained during sampling efforts when water depths exceeded the height of the seine (4.5').

							Fish Species Density (#indiv./m^2)												Amphibian Taxa Density (# indiv. /m^2)				
Date (Year/Month/Day)	Lagoon Level, MSL (ft)	Mouth Status (0 = Cl, 1 = Op)	Station #	Depth, Max (ft)	Area Fished (m^2)	# Replicates	Total Fish Density	Tidewater Goby	Striped Mullet	Mosquitofish	Arroyo Chub	Topsmelt	Staghorn Sculpin	California Killifish	Green Sunfish	Santa Ana Sucker	Prickly Sculpin	Arrow Goby	Total Amphibian Density	African Clawed Frog Tadpoles	African Clawed Frog Adults	Pacific Tree Frog Tadpoles	Pacific Tree Frog Adults
971016	9.3	0	1	4.8	160	1	[illegible]	0.038	0.000	[illegible]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.000	0.000	0.000
			2	7.2	160	1	[illegible]	[illegible]	0.000	[illegible]	0.000	0.000	[illegible]	[illegible]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	4.0	122	1	0.484	0.303	0.000	0.123	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
971218	3.5	1	1	2.5	520	1	0.810	0.019	0.783	0.000	0.000	0.004	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			2	1.5	140	1	0.607	0.057	0.000	0.000	0.000	0.550	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
971219	3.5	1	4	1.8	520	1	0.025	0.002	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
980324	4.3	1	1	2.0	757	6	0.003	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			2	1.0	474	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	1.0	267	5	0.007	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			4	0.8	430	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
980423	5.3	1	1	1.0	651	4	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			2	0.8	222	2	0.203	0.027	0.176	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	0.8	95	2	0.200	0.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			4	1.0	139	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	0.9	120	2	0.142	0.000	0.117	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
980723	5.9	1	1	1.7	160	1	0.431	0.006	0.000	0.419	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.019	0.000	0.000	0.006
			2	2.8	160	1	0.044	0.000	0.000	0.031	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.031	0.000	0.000	0.000
			3	2.1	160	1	0.269	0.006	0.000	0.156	0.094	0.000	0.000	0.000	0.000	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000
			4	0.9	160	1	0.019	0.006	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	0.5	150	1	0.187	0.000	0.000	0.000	0.187	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
980820	6.2	0	1	3.7	160	1	0.013	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.031	0.000	0.000	0.000
			2	3.9	260	1	0.019	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			4	2.3	100	1	0.200	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	1.7	150	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
981020	6.0	1	1	1.9	255	1	0.067	0.008	0.004	0.000	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000
			2	3.0	189	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	1.0	112	2	0.339	0.045	0.018	0.152	0.116	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			4	0.4	56	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	0.5	80	1	0.125	0.038	0.000	0.088	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
990114	6.0	1	2	1.1	96	1	0.688	0.281	0.323	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	0.8	60	1	0.033	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	0.6	80	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
990218	7.3	0	1	5.5	270	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			2	3.2	432	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	3.2	240	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
990426	6.1	1	1	2.0	126	1	0.024	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			2	1.1	126	1	0.024	0.008	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			3	1.0	224	1	0.009	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			4	1.3	160	1	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	0.7	48	1	0.104	0.021	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
990623	7.8	0	1	5.5	48	1	2.271	2.250	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.250	0.250	0.000	0.000	0.000
			2	2.1	90	1	0.100	0.056	0.000	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			7	4.5	45	1	1.533	1.022	0.000	0.000	0.444	0.000	0.000	0.000	0.067	0.000	0.000	0.000	0.444	0.400	0.000	0.000	0.044
990713	7.3	0	1	5.1	72	1	0.125	[illegible]	0.000	0.000	0.000	0.000	[illegible]	0.000	0.000	0.000	0.000	0.000	0.181	0.181	0.000	0.000	0.000
			2	3.0	108	1	0.037	0.028	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.028	0.000	0.000	0.000
			3	5.0	180	1	0.022	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.017	0.000	0.000	0.000
			7	2.7	57	1	12.473	11.536	0.000	0.000	0.938	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.309	1.309	0.000	0.000	0.000

Appendices A - B

Tidewat… Goby (*Eucyclogobius newberryi*)

Total Collected: 980

Total Measured: 206 — Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971021	s	1	6	0																														
971021	s	3	37	0																														
971017	s	2	2	0																														
971218	s	1	10	10	35	27	30	22	30	30	30	31	21	28																				
971218	s	2	8	6	35	33	32	21	23	22																								
971219	s	4	1	1	26																													
980324	s	3	2	2	32	34																												
980423	s	2	6	6	36	42	41	42	40	34																								
980424	t	2	2	2	41	44																												
980723	s	1	1	1	40																													
980723	s	3	1	1	40																													
980723	s	4	1	1	17																													
980724	t	6	1	1	45																													
980820	s	1	2	2	33	23																												
980820	s	2	5	5	17	19	27	32	22																									
980820	s	4	20	9	<20	<20	24	24	24	21	21	22	22	27	24	20	27	24	19	19	20	<20	18	19										
981020	s	1	2	2	38	28																												
981020	s	3	5	5	27	33	34	35	27																									
981020	s	7	3	3	32	30	37																											
990114	s	2	27	27	22	25	27	31	21	25	22	19	40	17	31	24	30	22	27	32	29	33	30	18	28	27	19	22	21	22	23			
990114	s	3	2	2	24	34																												
990115	t	5	1	1	44																													
990426	s	2	1	1	37																													
990426	s	3	1	1	29																													
990426	s	4	1	1	38																													
990426	s	7	1	1	42																													
990427	t	4	1	1	41																													
990427	t	5	3	3	45	45	42																											
990623	s	1	108	30	26	25	22	23	27	35	37	22	38	21	18	22	<20	<20	<20	21	21	22	33	33	28	45	37	<20	37	<20	23	<20	<20	<20
990623	s	2	5	5	45	41	33	32	32																									
990623	s	7	46	30	40	33	38	38	35	35	35	26	22	26	28	28	18	<20	<20	<20	32	<20	41	28	28	24	15	20	30	22	32	27	30	22
990713	s	1	8	8	21	21	37	22	23	37	37	38																						
990713	s	2	3	3	46	38	27																											
990713	s	3	4	4	28	17	17	22																										
990713	s	7	652	30	17	21	22	20	20	22	22	20	18	19	23	19	17	20	22	20	17	20	18	20	21	18	20	16	20	22	19	21	34	32
990714	t	1	1	1	33																													

Mosquitofish (*Gambusia affinis*)

Total Collected: 200

Total Measured: 94 — Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971017	s	1	47	0																														
971017	s	2	7	0																														
971016	s	3	15	0																														
980723	s	1	67	30	15	23	16	15	13	15	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	25	25	21
980723	s	2	5	5	<20	<20	<20	<20	<20																									
980723	s	3	25	25	<20	28	<20	21	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20					
980723	s	4	2	2	<20	<20																												
980724	t	3	1	1	38																													
981020	s	3	17	17	9	21	18	11	23	18	10	22	23	20	18	23	21	26	14	13	16													
981020	s	7	7	7	25	22	18	17	9	16	14																							
981020	t	4	2	2	35	28																												
981021	t	7	3	3	32	37	41																											
990426	t	3	1	1	35																													
990623	s	1	1	1	17																													

Arrow Goby (*Clevelandia ios*)

Total Collected: 1

Total Measured: 1 — Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
981020	s	1	1	1	35																													

Appendix A. Standard Length (SL) measurements (mm) of fishes collected by seine and minnow trap in the Santa Clara River Estuary, Ventura County, California, October 1997- July 1999. For sampling method, s = collected by seine, t = collected by minnow trap. Page 1 of 4.

Green Sunfish (*Lepomis cyanellus*)

Total Collected: 165

Total Measured: 123 Standard Length (mm)

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
980821	t	1	2	2	27	29																												
980821	t	3	2	2	35	33																												
980821	t	5	23	23	38	35	37	33	41	33	37	25	34	22	26	34	35	45	32	48	32	28	32	26	25	33	32							
990623	s	7	3	3	17	28	25																											
990624	t	3	58	30	22	28	24	28	28	24	24	27	26	28	29	24	29	27	28	28	25	25	25	24	25	25	25	25	24	23	28	27	29	24
990624	t	5	1	1	25																													
990624	t	6	2	2	25	27																												
990624	t	7	6	6	32	25	24	33	24	26																								
990714	t	1	7	7	56	47	41	48	48	43	37																							
990714	t	2	1	1	38																													
990714	t	3	8	8	52	32	40	34	30	31	35	41																						
990714	t	4	3	3	32	48	21																											
990714	t	5	1	1	30																													
990714	t	6	4	4	31	34	42	53																										
990714	t	7	44	30	50	49	37	34	39	40	34	44	32	42	37	39	52	38	45	34	57	52	41	46	42	47	50	47	34	42	34	55	48	38

Arroyo Chub (*Gila orcutti*)

Total Collected: 731

Total Measured: 453 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971016	s	3	7	7	52	32	35	32	51	47	49																							
971017	t	7	13	13	51	64	64	76	76	76	76	76	76	89	89	102	102																	
971219	t	3	1	0																														
980323	s	1	1	1	50																													
980324	t	1	3	3	82	69	78																											
980324	t	4	49	30	70	57	59	44	70	55	62	72	55	70	52	42	71	63	56	64	77	41	48	70	57	46	77	63	54	52	53	51	67	54
980324	t	5	64	30	45	92	47	53	75	88	66	44	51	72	44	50	54	49	56	44	58	57	44	63	57	55	61	57	47	50	72	51	46	49
980324	t	6	10	8	90	85	74	74	80	68	57	54																						
980324	t	7	2	2	33	32																												
980423	s	1	1	1	58																													
980423	s	7	3	3	54	59	55																											
980424	t	1	2	2	55	60																												
980424	t	3	7	7	58	82	72	77	60	75	50																							
980424	t	4	13	12	67	58	49	50	51	57	54	52	63	57	54	45																		
980424	t	6	45	27	70	77	84	62	70	74	61	68	54	58	68	67	55	60	66	74	73	75	63	61	72	65	68	67	56	49	56			
980723	s	2	2	2	40	34																												
980723	s	3	15	15	49	32	29	78	38	26	<20	25	38	28	27	28	37	27	30															
980723	s	7	28	28	22	20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		
980724	t	7	4	4	55	56	57	55																										
980821	t	7	6	6	32	32	37	25	34	37																								
981020	s	3	13	13	50	50	47	42	41	20	23	25	26	28	20	25	26																	
981021	t	5	2	2	60	40																												
981021	t	6	10	10	53	42	47	33	45	47	49	52	38	43																				
981021	t	7	26	26	40	38	37	42	43	34	34	40	48	37	43	32	40	44	33	32	42	34	37	34	34	37	40	37	33	33				
990114	s	2	8	8	46	62	52	59	51	52	48	40																						
990115	t	6	1	1	42																													
990427	t	1	3	3	52	41	50																											
990427	t	3	1	1	54																													
990427	t	4	85	30	46	49	51	50	56	49	50	57	55	45	51	55	55	47	56	43	56	50	54	50	54	50	52	56	50	51	62	51	52	57
990427	t	5	2	2	58	50																												
990427	t	6	155	30	62	52	52	53	59	58	47	45	62	54	57	52	62	56	59	49	47	50	53	58	47	62	60	50	58	50	62	60	51	55
990427	t	7	15	15	48	57	42	53	54	46	41	48	51	50	49	52	47	49	49															
990622	s	2	4	4	22	22	25	23																										
990622	s	7	20	20	37	20	22	25	<20	28	32	<20	26	30	<20	31	24	27	22	21	23	<20	35	28										
990624	t	3	2	2	64	62																												
990624	t	5	18	18	58	54	60	62	54	54	50	62	58	59	54	44	55	60	60	55	57	60												
990624	t	6	1	1	44																													
990624	t	7	2	2	62	71																												
990713	s	2	1	1	18																													
990714	t	1	2	2	37	37																												
990714	t	2	6	6	48	49	52	50	55	50																								
990714	t	6	15	15	42	37	55	40	40	48	41	41	55	39	51	42	55	41	41															
990714	s	7	53	30	18	25	23	32	27	33	27	16	34	32	18	27	24	25	32	38	38	28	29	27	22	28	36	31	33	31	28	32	36	16
990714	t	7	10	10	62	68	35	68	70	67	37	60	51	60																				

Topsmelt (*Atherinops affinis*)

Total Collected: 94

Total Measured: 25 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971218	s	1	3	3	41	43	43																											
971218	s	2	77	8	147	130	178	104	108	108	111	118																						
980723	s	1	1	1	22																													
981020	s	1	13	13	22	21	22	20	24	21	20	19	22	18	21	20	22																	

Fathead Minnow (*Pimephales promelas*)

Total Collected: 80

Total Measured: 76 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
980821	t	2	5	5	58	57	54	52	55																									
980821	t	3	12	12	51	53	57	57	53	52	53	54	54	57	57	54																		
990426	t	5	2	2	67	68																												
990714	t	1	10	10	53	52	61	58	52	47	58	53	57	52																				
990714	t	2	10	10	57	60	50	57	63	58	53	52	57	55																				
990714	t	4	7	7	59	60	62	59	52	54	51																							
990714	t	6	34	30	52	54	48	67	54	57	49	52	55	59	62	55	54	58	52	53	50	55	57	51	52	58	53	53	50	56	53	50	53	47

Prickly Sculpin (*Cottus asper*)

Total Collected : 9

Total Measured: 9 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
980324	t	1	2	2	94	81																												
980424	t	6	1	1	92																													
980723	s	3	1	1	32																													
981021	t	5	2	2	47	59																												
990115	t	2	1	1	65																													
990219	t	5	1	1	79																													
990219	t	7	1	1	98																													

Staghorn Sculpin (*Leptocottus armatus*)

Total Collected: 9

Total Measured: 9 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
990426	s	1	3	3	42	44	40																											
990426	s	7	4	4	40	35	34	34																										
990115	t	6	1	1	134																													
990713	s	1	1	1	76																													

Santa Ana Sucker (*Catostomus santaanae*)

Total Collected: 5

Total Measured: 5 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
980324	s	1	1	1	86																													
980324	t	6	1	1	98																													
980424	t	2	1	1	84																													
980723	s	3	1	1	61																													
981020	s	3	1	1	45																													

California Killifish (*Fundulus parvipinnis*)

Total Collected: 4

Total Measured: 4 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971218	s	1	2	2	51	48																												
990426	s	2	2	2	68	72																												

Partly Armored Threespine Stickleback (*Gasterosteus aculeatus microcephalus*)

Total Collected: 1

Total Measured: 1 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
990713	t	1	1	1	35																													

Yellowfin Goby (*Acanthogobius flavimanus*)

Total Collected: 1

Total Measured: 1 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
980821	t	6	1	1	112																													

Striped Mullet (*Mugil cephalus*)

Total Collected: 526

Total Measured: 136 Standard Length (mm):

Date (Yr/Mo/Day)	Sampling Method	Station #	# Collected	# Measured	Length #1	Length #2	Length #3	Length #4	Length #5	Length #6	Length #7	Length #8	Length #9	Length #10	Length #11	Length #12	Length #13	Length #14	Length #15	Length #16	Length #17	Length #18	Length #19	Length #20	Length #21	Length #22	Length #23	Length #24	Length #25	Length #26	Length #27	Length #28	Length #29	Length #30
971218	s	1	407	27	22	25	21	24	24	23	23	22	22	22	23	22	20	21	22	26	21	43	22	23	22	22	23	26	22	22	23	22		
971219	s	4	12	12	45	47	22	30	24	28	22	24	22	23	27	22																		
980423	s	2	39	30	77	92	95	80	98	69	78	74	98	86	74	85	96	80	76	71	78	65	73	68	84	69	69	80	79	69	83	78	74	65
980423	s	3	20	20	45	42	43	56	43	44	49	61	39	50	50	47	44	47	42	35	52	58	44	45										
980423	s	7	14	13	70	43	45	45	45	54	46	47	57	46	40	46	41																	
981020	s	1	1	1	22																													
981020	s	3	2	2	21	22																												
990114	s	2	31	31	34	36	43	31	50	40	32	38	30	33	32	34	38	35	42	40	37	39	31	53	40	38	35	47	35	35	32	35	38	34