CCLEAN

Central Coast Long-term Environmental Assessment Network

2001 ANNUAL REPORT

Lead Agency:

City of Watsonville

Prepared by:

Applied Marine Sciences

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2001 Annual Report

Central Coast Long-term Environmental Assessment Network

Submitted to:

California Regional Water Quality Control Board
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1.0 EXECUTIVE SUMMARY

Implementation of the CCLEAN monitoring program began on June 26, 2001, when the CCLEAN Steering Committee retained Applied Marine Sciences, Inc. (AMS) to provide technical direction for the program. Since that time, the following activities have been performed:

- A Quality Assurance Program Plan (QAPP) was written to guide sample analysis. This QAPP is performance based and does not prescribe analytical methods for many analytes.
- A Request for Proposals to perform monitoring was issued on September 5, 2001 and on October 9, 2001 Kinnetic Laboratories, Inc. and MEC Analytical Systems, Inc. were selected. Both consultants teamed with Axys Analytical for analysis of Persistent Organic Pollutants (POPs).
- The initial 30-day flow-proportioned sampling of effluent from four wastewater treatment plants was conducted in September and October 2001. The samples are currently being analyzed for POPs.
- Weekly grabs of effluent were collected during the 30-day flow-proportioned sampling for analysis ammonia, nitrates and total suspended solids.
- Monthly sampling of effluent at four wastewater treatment plants for analysis of urea and dissolved silica (silicates) began in April to August, depending on the plant.
- Sites were selected for collecting mussels for analysis of POPs and bacteria.
- Sites were selected for collecting sediment samples for analysis of benthic infauna, POPs, total organic carbon and grain size. Sediment sampling was performed on October 31, 2001 and benthic infauna analyses are complete. Analysis of POPs, total organic carbon and grain size is underway.
- Agreements were reached with the environmental health departments at the County of Santa Cruz and the County of Monterey to perform monthly collections of water from streams, rivers and Elkhorn Slough for the analysis of urea, silicates, total suspended solids and bacteria. This sampling will begin in January 2002.
- A database template was developed that will allow seamless entry of CCLEAN data into the Regional Board's CCAMP database.

While initial monitoring results are insufficient to support detailed analysis and interpretation, preliminary findings are as follows:

- Initial results from effluent grab samples indicate that Santa Cruz, Watsonville and the Monterey Regional Water Pollution Control Agency discharged similar estimated annual loads of nutrients, which were generally much greater than the loads discharged by Carmel Area Wastewater District.
- Initial results of benthic infaunal analyses suggest that the four depositional sites within Monterey Bay and the four reference sites outside Monterey Bay are similar within these site groups. While the two site groups are similar to each other for some parameters, they differ for other parameters. In particular, the depositional sites had higher abundances of the amphipod, *Protomedia articulata*.

Future Annual Reports, based on more data, will include full synthesis and interpretation of monitoring results. As results accumulate and as the monitoring activities are performed, experience will be gained that may lead to recommendations for changes to the program or the QAPP that would better enable the program to achieve its objectives. Major changes, resulting in a change of program emphasis, should not be contemplated before several years' data are available, unless results before then unequivocally indicate the need for a change.

2.0 INTRODUCTION

2.1 Background and Objectives

The CCLEAN monitoring program has been designed to fulfill several regulatory objectives. The Management Plan for the Monterey Bay National Marine Sanctuary includes a Memorandum of Agreement between eight federal, state, and regional agencies (including the Central Coast Regional Water Quality Control Board) to develop an ecosystem-based Water Quality Protection Program for the Sanctuary. The Regional Board has developed a framework for partial fulfillment of this Water Quality Protection Program called the Central Coast Ambient Monitoring Program (CCAMP). This multidisciplinary program includes sampling in watersheds that flow into coastal regions, in estuarine coastal confluences, and at coastal sites. The goal of CCAMP is to "collect, assess, and disseminate scientifically based water quality information to aid decision-makers and the public in maintaining, restoring, and enhancing water quality and associated beneficial uses." CCLEAN provides the initial nearshore component of CCAMP. It is being funded by the City of Santa Cruz, City of Watsonville, Duke Energy, Monterey Regional Water Pollution Control Agency, and Carmel Area Wastewater District, under the direction of the Regional Board. CCLEAN satisfies the NPDES receiving water monitoring and reporting requirements of program participants.

Within the framework of CCAMP, the goal of the CCLEAN program is to assist stakeholders in maintaining, restoring, and enhancing nearshore water and sediment quality and associated beneficial uses in the Central Coast Region. The specific objectives of the program are as follows:

- Obtain high-quality data describing the status and long-term trends in the quality of nearshore waters, sediments, and associated beneficial uses.
- Determine whether nearshore waters and sediments are in compliance with the Ocean Plan.
- Determine sources of contaminants to nearshore waters.
- Provide legally defensible data on the effects of wastewater discharges in nearshore waters.
- Develop a long-term database on trends in the quality of nearshore waters, sediments and associated beneficial uses.
- Ensure that the nearshore component database is compatible with other regional monitoring efforts and regulatory requirements.
- Ensure that nearshore component data are presented in ways that are understandable and relevant to the needs of stakeholders.

For CCLEAN to successfully achieve these objectives, a minimum of five years' data are probably necessary to determine the status and trends in the quality of nearshore waters, sediments, and associated beneficial uses.

2.2 Program Design

CCLEAN was designed with substantial input from stakeholders, including NPDES permittees, state and federal regulatory agencies, the Monterey Bay National Marine Sanctuary, the scientific community, and business and public interest groups. The program focuses on measuring possible water quality stressors for four receiving water beneficial uses that were prioritized by the stakeholders for protection. These beneficial uses are as follows:

- marine habitat,
- rare, threatened, or endangered species,
- water contact recreation, and
- wildlife habitat.

Discussions with stakeholders and reviews of reports and scientific publications indicated that there are possible impairments of these beneficial uses related to the following:

- elevated concentrations of persistent organic pollutants (POPs) (e.g., petroleum hydrocarbons, chlorinated pesticides, polychlorinated biphenyls) in fish from the Monterey Submarine Canyon and sea otters,
- Declines in sea otter populations, which may be related to diseases and/or high concentrations of POPs,
- bird and mammal deaths due to blooms of toxic phytoplankton,
- impacts to benthic habitats caused by deposition of suspended sediments in rivers, and
- beach closures due to high bacterial concentrations.

These beneficial use impairments may be caused by four possible water quality stressors, as follows:

- POPs in water and sediment,
- nutrients,
- pathogens, and
- suspended sediments in rivers.

Readers are referred to the Final Report for design of the CCLEAN program for a complete presentation of the scientific data and discussion of the rationale for each of the possible beneficial use impairments and related possible water quality stressors (Applied Marine Sciences, 2000).

CCLEAN will measure inputs of these possible water quality stressors and effects in nearshore waters by sampling effluent, rivers and streams, mussels, sediments and benthic communities, and nearshore waters. Effluent for each municipal discharger and rivers will be sampled for POPs, nutrients, and suspended sediments using automated equipment to obtain 30-day flow-proportioned samples in the dry season and in the wet season. Each discharger will sample monthly along the 30-foot contour adjacent to their outfall for bacteria. Sixteen shoreline sites near streams and rivers also will be sampled monthly for nutrients, bacteria, and suspended sediments by personnel from the Department of Environmental Health for the counties of Santa Cruz and Monterey. Satellite imagery will be used to evaluate blooms of phytoplankton associated with discharges of high concentrations of nutrients. Mussels will be sampled at five locations to fill geographic gaps in other ongoing programs to measure POPs and bacteria.

Sediment will be sampled for POPs and benthic organisms once a year at eight sites within the depositional band that has been identified by U.S. Geological Survey in Monterey Bay.

2.3 Program Implementation

The program participants selected the City of Watsonville to serve as the lead agency for financial and contractual matters. Through a Memorandum of Agreement, which was approved by the respective city councils and boards governing the participants, a formula was established determine each participant's financial contribution to the program. This formula included an identical base amount paid by all participants, as well as a portion that varies according to total effluent discharged annually. As the relative volumes of discharged effluent vary in response to changes in population and patterns of wastewater reuse in each jurisdiction, the annual contribution of each participant may change over time.

On June 26, 2001, the CCLEAN participants contracted with Applied Marine Sciences, Inc. (AMS) to provide technical direction and oversight for the program. AMS answers directly to a Steering Committee that includes members from each program participant. AMS' general program responsibilities include the following:

- day-to-day management of the program,
- recommendation of consultants to perform technical components of the monitoring program,
- supervision of these consultants,
- final quality control checks and submittal of data to the Regional Board's database,
- data synthesis and reporting,
- recommendation of changes to the Quality Assurance Program Plan and,
- recommendation of program modifications.

Specific tasks for 2001 were as follows:

- establishment of agreements with the counties of Santa Cruz and Monterey to perform the monthly sampling at streams and rivers
- establishment of mussel sampling sites,
- development of data submittal templates
- design and installation of effluent sampling equipment and protocols,
- completion of scopes of work for technical components of the monitoring program
- development of a Quality Assurance Program Plan,
- development of a Request for Proposals and evaluation of consultants to conduct the sampling and laboratory analyses,
- implementation of the monitoring program.

On September 5, 2001, a Request for Proposals was sent to 14 potential consultants to perform sampling and analysis required for the monitoring program. Proposals were received on September 28 and on October 9 two consultants were selected. Kinnetic Laboratories, Inc. (KLI) was chosen to collect and analyze the 30-day samples of effluent and river water and collect and analyze mussels. MEC Analytical Systems, Inc. (MEC) was chosen to collect and analyze sediment. KLI and MEC each teamed with Axys Analytical in British Columbia for analysis of POPs in water and sediment, respectively. Selection of KLI and MEC was contingent upon satisfactory analysis by Axys of a blind check sample, in accordance with the performance-based CCLEAN Quality Assurance Program Plan (Applied Marine Sciences, 2001). Sampling of

effluent, sediment, mussels, and monthly sampling of streams and rivers is being implemented in the first program year, from July 1, 2001, through June 30, 2002. Thirty-day sampling of rivers will begin in the second program year.

2.4 Report Contents

This report presents CCLEAN program activities that have occurred during 2001, the current status of monitoring, and preliminary findings. Technical components included are effluent sampling, mussel sampling, and monthly stream and river sampling. Some of these components are currently being implemented, so their discussion will not include data. In subsequent years, synthesis and interpretation of program findings will allow evaluation of the program's ability to achieve its objectives. Future annual reports will include all data collected from July 1 through June 30, and will be submitted seven months after the conclusion of each one-year sampling period. Data synthesis and interpretation will be cumulative over the life of the program.

3.0 PROGRAM ACTIVITIES, FINDINGS AND CURRENT STATUS

3.1 Effluent Sampling

3.1.1 Activities and Findings

Effluent sampling includes collection of 30-day flow-proportioned samples twice per year (i.e., in the wet season and in the dry season) for analysis of POPs and grab samples for analysis of nutrients and general water quality parameters (Table 1). Grab samples are collected by personnel of the program participants and analyzed in their laboratories. The objective of this program component is to measure potential sources of POPs and nutrients to nearshore waters. The same sampling methods will be applied to four rivers (i.e., San Lorenzo, Pajaro, Salinas and Carmel) in the second year of the program.

Table 1. Effluent sampling parameters.

Parameters Sampled at Each Site	Frequency of Sampling	Applicable Water-quality Stressors
1) 30-day flow proportioned samples using automated pumping equipment, solid-phase-extraction techniques for POPs 2) During 30-day period, weekly grab samples of effluent for ammonia and nitrate, total suspended solids, temperature, conductivity, and pH	Twice per year (wet season and dry season)	POPs Nutrients
Grabs for urea and silicate in effluent	Monthly	Nutrients

The collection of 30-day flow-proportioned samples of effluent is accomplished with specialized equipment (Figure 1). Off-the-shelf equipment was obtained from suppliers and configured for each wastewater treatment plant. Programmable ISCO 3700 samplers were used to pump effluent through glass-fiber particle filters and Teflon™ columns packed with XAD-2

resin beads, which were obtained from Axys Environmental. All sampler tubing is composed of Teflon™ and stainless steel. The samplers were programmed to pump 1 l of effluent through the filter and column in response to electrical signals from the flow meter in each treatment plant. The estimated flow at each treatment plant was projected to ensure that 100 l of effluent would be pumped through the filter and column over an approximately 30-day period. In the laboratory, the particle filter and the XAD-2 resin are extracted and the extracts are combined for a single analysis of total POPs. POP concentration in the effluent is determined by dividing the total amount of each POP by the volume of effluent sampled.

Problems occurred at several treatment plants in obtaining satisfactory signals from the flow meters to control the ISCO samplers. These problems were usually due to poor signal quality or differences between the type of signal sent by the flow meter and the type of signal required by the sampler. These problems were resolved during the course of sampling at every treatment plant except Santa Cruz. At the Santa Cruz plant, the signal from the flow meter is used to trigger several other pieces of equipment with a long distance between the flow meter and the CCLEAN sampler, which resulted in insufficient current to trigger the CCLEAN sampler. Because the equipment required to solve this problem would not be available for approximately a month, the Santa Cruz sampler was programmed to collect 1-l samples on intervals of 8 hours.

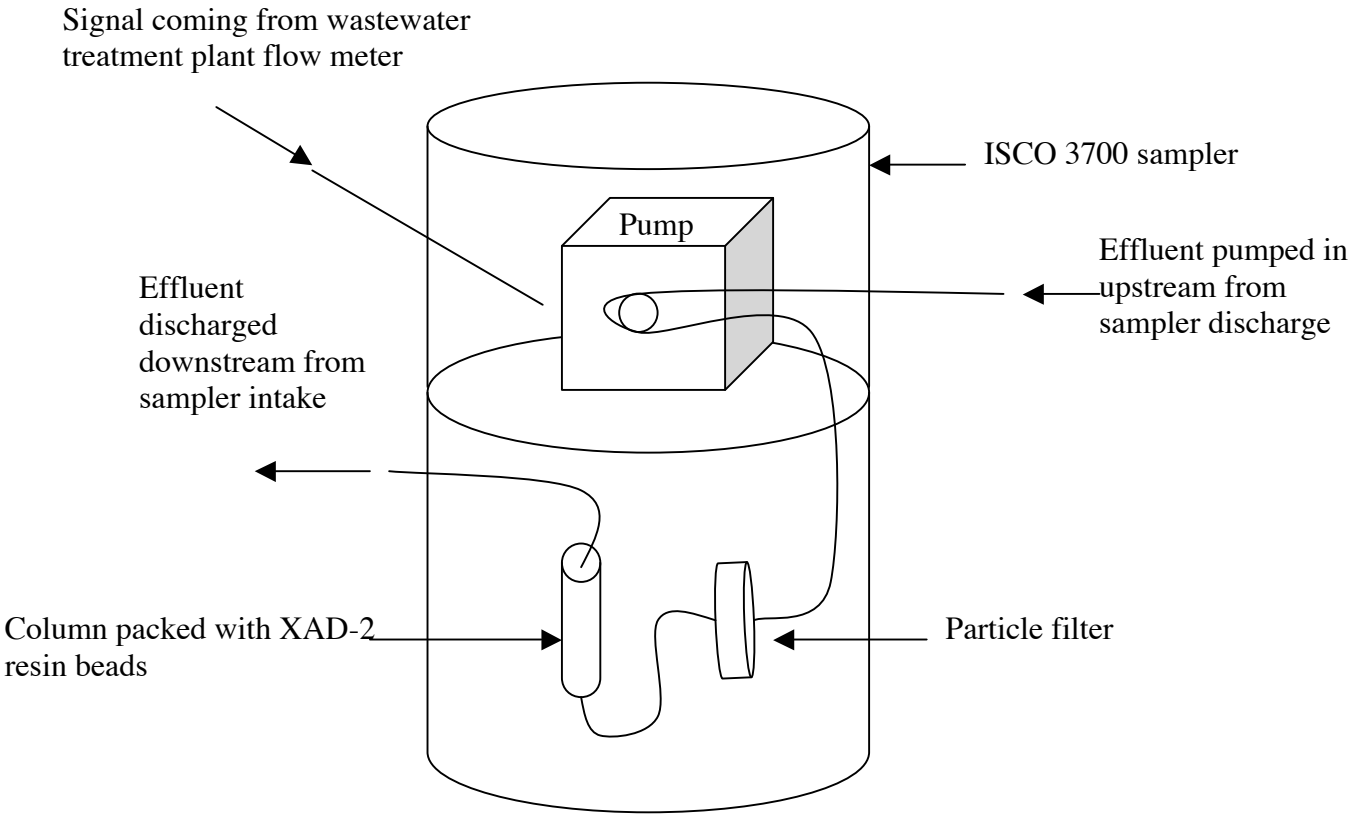

Figure 1. Configuration of ISCO samplers for CCLEAN effluent sampling.

The first effluent samples were collected with the ISCO equipment in September and October, 2001 (Table 2). More than 100 l were sampled at most sites because our flow-through configuration of the ISCO samplers prevents them from being programmed to stop sampling at a prescribed volume. Since the samplers are hard-wired to know that they cannot hold more than 30 l of sample, a programmed shutdown can be performed only after less than that volume. Differences among treatment plants in the period covered by sampling were due to the time required to solve the problems with the flow-meter signals mentioned above. A 100-l blank sample was collected at the Santa Cruz treatment plant on September 10, 2001 by pumping ultra-pure water through the equipment.

After the completion of the 30-day effluent sampling in October, it was determined that the sampling point at the Santa Cruz wastewater treatment plant was upstream of the point where effluent from the City of Scotts Valley enters the discharge pipe. While is may be difficult to ensure that effluent samples from the Santa Cruz treatment plant provide a well-mixed composite from both cities, the sampling point will be moved downstream for subsequent collections to increase the likelihood that Scotts Valley's effluent is represented.

Table 2. Dates and volumes of effluent samples, fall 2001.

Treatment Plant	Start Date	End Date	Number of Liters Sampled
Santa Cruz	September 10, 2001	October 13, 2001	100
Watsonville	September 10, 2001	October 12, 2001	101
Monterey Regional	September 14, 2001	October 24, 2001	104
Carmel Area	September 19, 2001	October 20, 2001	102

The five samples from this initial effort are currently being analyzed. The extracts from the particle filter and resin beads are being combined for measurement of total POP concentrations from each treatment plant.

In their proposal for CCLEAN monitoring, KLI expressed concern for one aspect of the equipment configuration for effluent sampling. To prevent contamination of subsequent samples with effluent from previous samples, the pump initiates a purge cycle by reversing its direction of flow at the conclusion of each sample episode. KLI was concerned that this flow reversal might cause a loss of particles from the particle filter and a loss of organic contaminants absorbed to the resin beads. To alleviate this possibility prior to the next sampling effort in February 2002, check valves will be installed in the sample tubing immediately upstream from the particle filter to allow that tubing to be purged, while preventing material from being drawn back through the column and particle filter.

The collection of grab samples by treatment plant personnel began at various times, depending upon when the municipal laboratories developed their capabilities for analysis of urea. All program participants have analyzed from at least five months for urea and silicate and one participant analyzed samples from eight months (Table 3). Between four and 10 samples were analyzed for ammonia, nitrate and total suspended solids. Based upon parameter concentrations

and the volume of effluent discharged, annual loads to receiving waters can be estimated for each of these parameters.

The analysis of urea has required special arrangements among program participants. The traditional method of urea analysis involves analysis of sample aliquots for ammonia nitrogen, followed by digestion with urease and reanalysis for ammonia nitrogen. Urea is estimated by subtracting the post-digestion value from the pre-digestion value. Because low urea concentrations were anticipated in CCLEAN samples, the program adopted an oceanographic method from the scientific literature (Goeyens et al., 1998; Mulvenna et al., 1992). Assistance in applying this method to the CCLEAN program has been provided by Drs. Raphael Kudela and William Cochlan of University of California at Santa Cruz and San Francisco State University, respectively. The analysis of urea by this method requires fresh standards for each batch of analyses. The laboratory at the City of Watsonville's wastewater treatment plant became familiar with the method and agreed to analyze urea for each of the other treatment plants. Barbara Pierson of Watsonville has written a Standard Operating Procedure for analysis of urea based upon her experience with the method from the scientific literature, which is used for all analyses of urea in the CCLEAN program. Other parameters are being analyzed by each plant.

Initial results for concentrations of nutrients in effluent indicate some differences among discharges (Table 3). Santa Cruz, Watsonville and Monterey Regional contributed roughly comparable loads of urea and silicate, with the loads from Carmel Area being approximately an order of magnitude below the others. Among the three larger discharges, Watsonville had substantially smaller loads of ammonia and nitrate nitrogen than did the other two, whereas Carmel Area's load of nitrate was approximately half that from Watsonville and its load of ammonia was an order of magnitude below the others.

While it is premature to interpret these initial data, no ecological effects of the wastewater nutrients have been observed. There also may be seasonal variation in effluent characteristics that limits the value of estimated loads based upon a single 30-day period. Nevertheless, we can suggest how more extensive data will be examined in the future. Urea has been shown to be an important nutrient for phytoplankton that cause red tides along the California coast and elsewhere (Glibert et al., 1998; Kudela et al., 2000). There also is evidence that increases in nitrates and phosphates accompanied by decreases in silicates can cause increased abundances of dinoflagellates (Rabalais et al., 1996), the type of phytoplankton responsible for red tides. In the future, contributions of nutrients from streams, rivers and wastewater effluent will be examined for temporal and spatial patterns that are associated with high concentrations of chlorophyll, especially red tides or toxic phytoplankton.

3.1.2 Current Status

The next 30-day sampling of effluent will be performed in February or March, with some modifications from the first effort. The next sampling will incorporate flow proportioning and a revised location at the Santa Cruz wastewater treatment plant, as discussed above. Moreover, check valves will be installed to minimize reversal of flow direction in the particle filters and resin-bead columns, also as discussed above.

Table 3. Analytical results from grab samples of effluent for nutrients and total suspended solids for the CCLEAN program in 2001.

Parameter	Measurement	Santa Cruz	Watsonville	Monterey Regional	Carmel Area
Urea	# Samples	5	6	6	8
	Ave. Daily Load, kg	8.4	9.2	6.6	2.3
	Est. Annual Load, kg	3,062	3,348	2,422	853
Silicate	# Samples	5	6	6	8
	Ave. Daily Load, kg	1,392	1,348	1,138	142
	Est. Annual Load, kg	508,056	491,908	415,476	51,753
Ammonia-N	# Samples	4	9	8	5
	Ave. Daily Load, kg	1135	542	978	57
	Est. Annual Load, kg	414,453	197,909	356,860	20,913
Nitrate-N	# Samples	4	4	6	5
	Ave. Daily Load, kg	51	23	48	14
	Est. Annual Load, kg	18,582	8,433	17,346	4,951
TSS	# Samples	4	10	10	5
	Ave. Daily Load, kg	196	430	202	23
	Est. Annual Load, kg	71,653	156,942	73,621	8,554

3.2 Sediment Sampling

3.2.1 Activities and Findings

Sediment sampling involves collecting annual 0.1-m^2 samples at eight sites along the 80-m contour in Monterey Bay. These samples are analyzed for benthic infauna, POPs, total organic carbon and sediment grain size. Site coordinates and depths are shown in Table 4. The reference grouping of sites are located northwest of Santa Cruz between Terrace Point and El Jarro Point. The deposition grouping of sites are located within Monterey Bay from Santa Cruz to just south of the Salinas River. The objectives of this program component are to measure concentrations of POPs in sediments where the sediments are most likely to be deposited after washing out of rivers and off the land, and the effects of POPs on benthic infauna..

Sediment sampling was conducted on October 31, 2001. Analysis of benthic infauna has been completed and analysis of POPs, total organic carbon and grain size will soon be completed.

Table 4. Names and locations of CCLEAN sediment sampling sites.

Site Name	Depth, m	Latitude	Longitude
Sediment Reference #1	81.7	36° 59.155’	122° 16.800’
Sediment Reference #2	80.7	36° 56.615’	122° 12.610’
Sediment Reference #3	81.3	36° 55.490’	122° 10.640’
Sediment Reference #4	81.9	36° 54.745’	122° 09.370’
Sediment Deposition #1	80.9	36° 51.800’	122° 02.3664’
Sediment Deposition #2	80.0	36° 50.245’	121° 55.910’
Sediment Deposition #3	80.0	36° 45.670’	121° 52.290’
Sediment Deposition #4	80.0	36° 43.145’	121° 53.225’

Data from the first sediment sampling event suggest high consistency among sites within the reference and deposition groups (Table 5). Sites within the reference group were always dominated by the polychaetes *Axinopsida serricata* and *Mediomastus* spp. Sites within the deposition group always had high numbers of the amphipod, *Protomedia articulata*. Generally low coefficients of variation also indicate high similarity among sites within each site group. The groups also are similar in most regards, but are also different in some regards. The reference and deposition site groups were quite similar in total abundance, annelida abundance and the number of mollusca taxa. The reference sites were substantially higher than the deposition sites in the number of annelida taxa, mollusca abundance and echinoderm abundance. Conversely, the reference sites were substantially lower than the deposition sites in arthropod abundance and the number of echinoderm taxa. The higher arthropod abundances at the deposition sites were primarily due to the higher abundances of *P. articulata*.

3.2.2 Current Status

The analysis of sediment samples for POPs, total organic carbon and grain size will soon be completed. These data will be analyzed with the infauna data for the next CCLEAN Annual Report to determine whether there are correlations between sediment contaminants or other parameters and infauna. As the database expands in subsequent years, any trends in contaminants and infauna will be examined for statistical associations.

Sampling will be performed annually in the late summer or early fall. This period corresponds to peak infaunal abundances and optimum weather and sea conditions for efficient sampling.

Table 5. Summary statistics for species richness and abundance of benthic invertebrates in major taxonomic groupings for the Sediment Reference and Sediment Deposition station groups.

Taxa Summary	SedRef Sites (#1 - #4) Mean No/0.1 m^2	STD[a] No/0.1m^2	CV[b] %	SedDep Sites (#1 - #4) Mean No/0.1m^2	STD[a] No/0.1m^2	CV[b] %	Difference Ref/Dep %
Total Abundance	1386.0	250.3	18.1	1352.8	257.2	19.0	102.5
Total Taxa	140.0	8.5	6.1	122.0	9.4	7.7	114.8
Annelida Abundance	780.3	134.8	17.3	766.0	246.1	32.1	101.9
Annelid Taxa	82.8	6.3	7.6	68.8	3.3	4.8	120.4
Arthropod Abundance	88.5	19.7	22.2	185.3	91.1	49.2	47.8
Arthropod Taxa	24.8	3.6	14.5	21.3	8.5	40.2	116.5
Mollusca Abundance	386.5	131.5	34.0	299.0	72.5	24.2	129.3
Mollusca Taxa	24.3	1.0	3.9	22.5	3.1	13.8	107.8
Echinoderm Abundance	76.5	11.1	14.5	58.0	16.9	29.1	131.9
Echinoderm Taxa	2.5	1.0	40.0	3.8	1.7	45.5	66.7
Misc. Abundance	51.0	14.2	27.8	43.8	15.0	34.3	116.6
Misc. Taxa	4.8	1.3	26.5	5.3	0.5	9.5	90.5

[a] = Standard deviation
[b] = Coefficient of variation (i.e., Mean÷STD)

3.3 Mussel Sampling

3.3.1 Activities and Current Status

Mussel sampling consists of collecting mussels twice a year from for analysis of POPs and bacteria. The base program includes sampling at five sites, although the Highlands Inn and Highlands Sanitary Association have contributed funds to the CCLEAN program as a condition of their NPDES permits for sampling mussels for one year in Wildcat Cove, where their discharge is located. The objective of this program element is to determine the extent to which POPs and pathogens might be incorporated into components of the food web that are consumed by sea otters.

A field survey to select sites for mussel sampling was conducted on August 7 and 8, 2001. The sites selected and their descriptions are presented in Table 6. The best way to access Wildcat Cove is still being explored. The first sampling of mussels will be conducted in February or March, 2002, at which time latitudes and longitudes will be recorded for each site.

Table 6. Site names and descriptions for CCLEAN mussel sampling locations.

Site Name	Site Description
Scott Creek mussels	Park off Highway 1 near the bridge across Scott Creek, approximately 12.5 miles north of Santa Cruz. Go down the embankment toward the ocean and proceed to the north (right) end of the beach. The mussel collection site is on the outer portion of the first rocky shelf north of the beach.
Laguna Creek mussels	Park in the parking area on the east side of Highway 1 just north of the north end of Laguna Road, approximately 6 miles north of Santa Cruz. Cross Highway 1 and take the shore access trail on the opposite of the highway from the emergency call telephone. Proceed to the beach and go north to the first rocky shelf. The mussel collection site is on the outer portion of this first rocky shelf.
The Hook mussels	Park in the parking lot for The Hook coastal access at the south end of 41st Avenue in Santa Cruz/Capitola. Take the stairs down to the beach and proceed southwest to the western end of the beach. The mussel collection site is on a rock approximately 25 feet across located just east of the rocky point at the west end of the beach.
Fanshell Overlook mussels	Park in the Fanshell Overlook, just west of the intersection of Spyglass Hill Road and 17 Mile Drive. Take the stairs down to the beach from the south side of the parking lot. Proceed to the rocks on the outer right side of the beach. The mussel collection site is on the first set of rocks with mussels, proceeding out from the beach.
Carmel River Beach mussels	Park on the west side of Ocean View Avenue in Carmel, where it ends at Scenic Road. Take the nearby coastal access stairs to the beach and proceed to the rocks on the west (right) edge of the beach. The mussel collection site is on a rock approximately half way from the first rocks at edge of the beach and the outer wash rocks further to the southwest.
Wildcat Cove mussels	The best route of access is currently being explored.

3.4 Stream and River Sampling

3.4.1 Activities and Current Status

Monthly stream and river sampling is being conducted at 16 coastal sites in Santa Cruz and Monterey counties for analysis of urea, silicates, ammonia nitrogen, nitrate nitrogen, total suspended solids, and total and fecal coliform and enterococcus bacteria. Site descriptions are presented in Table 7. Sampling is being conducted by personnel of the departments of environmental health in each county. Data from this sampling will be combined with data from bacteria sampling being done in receiving water by the dischargers and data collected by CCAMP at coastal confluences with the objective of measuring potential sources of nutrients, suspended sediments and bacteria to nearshore waters.

Table 7. Sites being sampled by Santa Cruz and Monterey counties for CCLEAN.

Sampler	Site Name	Site Location
Santa Cruz County	Waddell Creek	at Hwy 1
Santa Cruz County	Scott Creek	at Hwy 1
Santa Cruz County	Laguna Creek	at mouth
Santa Cruz County	Moore Creek	at mouth
Santa Cruz County	San Lorenzo River	at Laurel Street Bridge
Santa Cruz County	Branciforte Creek	at Isbel Drive
Santa Cruz County	Porter Gulch	at New Brighton Beach
Santa Cruz County	Soquel Creek	under RR trestle
Santa Cruz County	Aptos Creek	at Winfield Street
Santa Cruz County	Pajaro River	at Thurwacher Bridge
Monterey County	Elkhorn Slough	at Kirby Park
Monterey County	Elkhorn Slough	at North Jetty
Monterey County	Salinas River (Lower)	Salinas River at Davis Road
Monterey County	Carmel River	at Garland Park
Monterey County	Carmel River	at Hwy 1
Monterey County	Big Sur River	at Andrew Molera State Park downstream of Hwy 1

Refinement of sampling protocols will be made early in this sampling effort. First, the latitude and longitude of each site will be recorded. Second, methods will be explored for visually estimating stream flow so that loads of nutrients, total suspended solids and bacteria can be estimated from these sources where stream gauges are not available.

Various scenarios were considered to accomplish this sampling, including participation of the Regional Board through its Coastal Confluences CCAMP sampling program. It was eventually decided that the Regional Board's budget for sampling was tenuous enough that CCLEAN should execute agreements with the counties. Moreover, substantial effort also was devoted by the counties to evaluate their ability to analyze urea according to the CCLEAN protocol. Ultimately, both decided to have a commercial laboratory, Monterey Bay Analytical Services (MBAS), do these analyses according to the CCLEAN protocols. All of these considerations resulted in a delay of implementing this component of the CCLEAN program until January 2002.

3.5 Database

3.5.1 Activities and Current Status

A database template was developed that will allow CCLEAN data to be provided by consultants and program participants in a consistent format for seamless incorporation into the Regional Board's CCAMP database. The goal of developing a standardized data reporting format is to provide field personnel, analytical laboratories and reporting agencies a uniform

procedure for submitting data. Standardized data can be easily loaded into the CCAMP database for further analysis and linking to larger state and federal databases, such as STORET. The standardized data reporting format was developed from the foundation other regional monitoring programs, principally the Southern California Coastal Water Research Project and the Regional Monitoring Program of the San Francisco Estuary, with extensive consultation with Mr. Dave Paradies. Both of these programs have developed extensive data reporting guidelines that aid in managing and manipulating large volumes of data.

The standardized data reporting format consists of three data templates and a series of table that define valid entries to the templates. The data templates, all Microsoft Excel files, are composed of a "metadata" template that defines sample metadata (sample collection information), a "data" template that defines the analytical data generated from a sample, and a "QAQC" template that defines analytical QAQC information for a sample. Definitions of allowable data types are provided for select key fields that are listed in the data templates. Fields that require specific definitions are "site name", "sample type", "sample matrix", "parameter name", "qualifier", and "unit". Additional field definitions will be developed as the program matures.

The templates have been provided to KLI and MEC. They have been asked to familiarize themselves with the templates and submit their sample and analytical data using the standardized format. Clarifications and additional documentation currently are being provided in response to questions received from the consultants. When it has been verified that submitted data matches the standardized format, it can be entered into the CCLEAN database. The CCAMP database has been designed to be forgiving of data entry errors such as key field entries that do not match definitions. Thus, although laboratories are encouraged to provide standardized data, the CCAMP database is equipped to handle new data structures that have not been standardized. This is especially relevant for laboratory QAQC data, which often are reported differently among laboratories. Foreseeing this problem, the standardized data reporting format provides methods to link external sources of data and reports, such as narrative laboratory QA reports and documentation.

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