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Initial Assessment of Existing Water Quality Monitoring Efforts in the Monterey Bay Region May 1995



Strategic Environmental Assessments Division
Office of Ocean Resources Conservation and Assessment
National Ocean Service
National Oceanic and Atmospheric Administration

Origin and Purpose

This assessment represents a starting point for understanding the scope of current water quality monitoring efforts in the Monterey Bay region. Information on several key programs is missing, including the monitoring conducted by Monterey and San Mateo Counties. In addition, several programs presented here have digital information available for assessment, but were unable to provide it in time to be included in this report.

This document contains information summarizing water quality monitoring programs currently operating in the Monterey Bay National Marine Sanctuary and its adjacent watersheds. It is organized in two parts: 1) a summary of general information concerning monitoring activities; and 2) a summary of the types of substances monitored and frequency of monitoring at sampling stations for three state-run programs. Also included is a description of the monitoring conducted by National Pollution Discharge Elimination System (NPDES) facilities as required by their permits.

The information presented here is being used to help identify monitoring needs relative to many water quality issues, and to address gaps and redundancies in existing monitoring efforts. The Project Development Team (PDT), with help from the U.S. EPA and a private contractor, will expand upon this work by identifying and assessing additional monitoring efforts. This will help the team develop a comprehensive water quality monitoring program to support the Water Quality Protection Program for the Monterey Bay National Marine Sanctuary.

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Prepared by

National Oceanic and Atmospheric Administration

Office of Ocean Resources Conservation and Assessment

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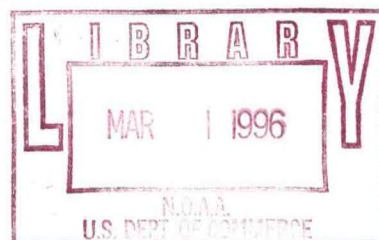
and

Office of Ocean and Coastal Resource Management

Sanctuaries and Reserves Division

In Cooperation with Participating Agencies

May 1995



Participating Agencies/Organizations

Federal

U.S. Department of Commerce, National Oceanic and Atmospheric Administration

State of California

California Coastal Commission

California Environmental Protection Agency

Department of Fish and Game

State Water Resources Control Board

San Francisco Regional Water Quality Control Board

Central Coast Regional Water Quality Control Board

University of California Sea Grant Extension Program

Local Agencies

Association of Monterey Bay Area Governments

Monterey County Planning

Santa Cruz County Planning

Other Organizations

Center for Marine Conservation

Introduction

This document provides material developed to assist persons building the Water Quality Protection Program (WQPP) for the Monterey Bay National Marine Sanctuary. It provides an overview, as well as an assessment of information on existing water quality monitoring efforts in the Sanctuary and its adjacent watersheds.

The Sanctuary

The Monterey Bay National Marine Sanctuary (MBNMS) was designated in September 1992 by the National Oceanic and Atmospheric Administration. It is the Nation's largest marine sanctuary, encompassing over 5000 square miles of coastal and ocean waters. The Sanctuary protects a wide variety of habitats, ranging from sand flats along the shoreline to the nation's most expansive kelp forests and largest underwater canyon.

The Sanctuary is immediately adjacent to California's Central Coast, stretching over 350 miles from southern Marin County southward to Cambria in San Luis Obispo County. This proximity to land makes the Sanctuary especially vulnerable to impacts from activities in the eleven major watersheds draining into it.

The Water Quality Protection Program

Recognizing that water quality is a key to ensuring protection for all Sanctuary resources, twenty-seven Federal, State and local agencies are working together to develop an integrated, ecosystem-based Water Quality Protection Program (WQPP) for the Monterey Bay Sanctuary and its watersheds. The program was initiated by a Memorandum of Agreement signed by key water quality agencies as a part of Sanctuary designation. To develop the WQPP, the agencies are using a comprehensive process to identify water quality problems, develop management strategies, and implement action plans to protect and enhance Sanctuary resources. Activities to be addressed include: urban runoff; agricultural runoff; marina and boating activities; water management; and point sources.

The primary goal of the WQPP is to restore and maintain the chemical, physical and biological integrity of the Sanctuary. A broad range of prob-

lems will be addressed by the program, including: toxic pollutants in sediments, fish and shellfish; human health problems; sedimentation and low flows in rivers and streams; wetlands alteration and habitat loss. Initial descriptions of these problems and their geographic distribution can be found in NOAA (1994, 1995).

Another goal of the WQPP is to establish a comprehensive water quality monitoring program to improve information on the sources of water quality problems, and enable managers to evaluate the effectiveness of management strategies and the program. To accomplish this, it is important first to identify and assess monitoring efforts currently operating in the region, then to determine how they can be coordinated to help achieve common goals.

Existing Monitoring Efforts

This document describes existing program-level water, sediment, and tissue quality monitoring efforts in California's central coast region. The information serves two purposes: 1) it provides background information for users to consider in determining monitoring requirements for addressing a wide variety of water quality issues; and 2) it provides a starting point for examining gaps and redundancies in existing monitoring programs. Knowledge of existing monitoring efforts is important in identifying programs to evaluate the effectiveness of management actions once they have been implemented. In addition, identifying gaps and redundancies in existing monitoring efforts will help establish a basis for integrating monitoring programs and sharing resources and information. Understanding the relationships between existing monitoring programs is crucial in the long-term for developing a comprehensive water quality monitoring effort to support the WQPP.

Over the past several months, the Project Development Team (PDT) identified 20 monitoring programs that are conducting, or have recently conducted, sampling within the Sanctuary and its adjacent watersheds (Table 1). A survey was then designed and sent to the lead agencies of each program. Thirteen of the programs returned surveys, and nine of these were selected for assessment. Two of the programs, EPA's Ocean Data Evaluation System and STORET System, are excluded since they organize and help evaluate monitoring data, but do not conduct monitoring. The Sanctuary's Seafloor

Geology and Sediment Transport program and Santa Cruz County's Groundwater Quality Monitoring program also were excluded, because they are not within the scope of the WQPP. Of the seven monitoring programs that did not respond to the survey, it should be noted that the Coastal Water and Sediment Quality programs conducted by Monterey County could add important information to the planning process. The PDT is continuing to solicit information on these programs, as well as monitoring conducted by San Mateo County.

This document is organized in two parts. First is a summary of general information concerning monitoring activities conducted by the nine programs. Following this is a summary of the types of substances monitored and frequency of monitoring at sampling stations for three state-run programs that provided digital information. Also included is a description of the monitoring conducted by National Pollution Discharge Elimination System (NPDES) facilities as required by their permits. Monitoring is also conducted in conjunction with California's Wastewater Discharge Requirements to determine a facility's compliance with its discharge permit.

However, this information is not in digital form, and is unavailable at this time. More detailed descriptions of all the monitoring programs which responded to the survey are found in Appendix A.

Summary of Monitoring Programs

All nine programs provide information and potential opportunities for addressing a wide variety of water quality issues. For example, the monitoring conducted for the Urban Runoff Water Quality Management Plan for the Monterey Bay Region focuses on the effects of urban activities on water quality, while the Santa Cruz County Surface Water Monitoring program measures several classes of constituents to determine baseline water quality and changes in water quality, and to identify sources of degradation.

Duration and Frequency. As indicated in Table 2, program-level monitoring has occurred in the Sanctuary and its adjacent watersheds for the past 25 years. State and county-level programs, such as the State Mussel Watch and Monterey County's Recreational Water Monitoring programs, have been active

Table 1. Programs that are involved with monitoring in the region.

Program Name	Lead Agency	Returned Survey
Federal Programs		
Resource Conservation and Recovery Act (RCRA)	EPA	No
Superfund Program - CERCLA	EPA	No
STORET	EPA	Yes
Ocean Data Evaluation System	EPA	Yes
National Status & Trends Program	NOAA	Yes
Seafloor Geology and Sediment Transport Program	USGS	Yes
State Programs		
Environmental Hazards Assessment Program	CA DPR	Yes
Basin Plan Regional Monitoring Program	SWRCB	No
*Bay Protection and Toxic Cleanup Program	SWRCB	Yes
*State Mussel Watch	SWRCB	Yes
*Toxic Substances Monitoring Program	SWRCB	Yes
Regional/County Programs		
Urban Runoff Water Quality Management Plan	AMBAG	Yes
Monterey County Coastal Sediment Quality	Monterey County	No
Monterey County Coastal Water Quality	Monterey County	No
Recreational Water Monitoring	Monterey County	Yes
Toxic Pits Cleanup Act	RWQCBs	No
Wastewater Discharge Requirements	RWQCBs	Yes
Water Quality Certification	RWQCBs	No
SC County Groundwater Monitoring	Santa Cruz County	Yes
SC County Surface Water Monitoring	Santa Cruz County	Yes

* These programs supplied digital information for sampling stations.

Table 2. General information about existing monitoring programs.

Program Name	Lead Agency	Watersheds	Program Duration (Years)	# of Sampling Stations
Federal Programs				
National Status & Trends Program	NOAA	MB04, 6a, 7, 9	10	8
State Programs				
Environmental Hazards Assessment Program	CA DPR	MB06c	1	N/A
Bay Protection and Toxic Cleanup Program	SWRCB	MB03, 4, 5, 6a-c, 7	3	22
State Mussel Watch	SWRCB	All	18	102
Toxic Substances Monitoring Program	SWRCB	MB02 - 9	17	38
Regional/County Programs				
Urban Runoff Water Quality Management Plan	AMBAG	MB04, 5, 6c, 7	1	4
Recreational Water Monitoring	Monterey County	MB06a - 9	25	41
Wastewater Discharge Requirements	RWQCBs	MB02-9	N/A	N/A
SC County Surface Water Monitoring	Santa Cruz County	MB03 - 5	20	N/A

for many years and compiled a wealth of information. All of the programs are ongoing except for the monitoring for the Urban Runoff Water Quality Management Plan for the Monterey Bay Region, which ended in 1993, and the Environmental Hazards Assessment Program, which is expected to be completed in August 1995. The frequency of monitoring ranges from weekly to annually depending on the program, and also may vary from station-to-station within individual programs.

Spatial Coverage. Of the nine monitoring programs, the State Mussel Watch and Toxic Substances Monitoring programs collect samples throughout the region. Other programs, such as the Bay Protection and Toxic Cleanup Program focus on a more limited area. Overall, more monitoring programs operate in the watershed areas surrounding Monterey Bay than those to the north or south (Figure 1). The number of sampling stations per program within the Sanctuary or its adjacent watersheds ranges from 102, for the State Mussel Watch program, to four for the monitoring conducted for the Urban Runoff Water Quality Management Plan for the Monterey Bay Region. *Due to budget cuts, the State Mussel Watch program will only conduct monitoring at one station in the Monterey Bay region.*

The number and locations of sampling stations is determined by the purpose of the monitoring program. For example, to support the development of an Urban Runoff Water Quality Management Plan for the Monterey Bay Region, water samples were taken in four locations downstream of urban areas and analyzed to determine if the results were analogous to the findings of the National Urban Runoff Program (NURP) conducted in the 1970s. In contrast, the State Mussel Watch program analyzes tissues from marine and estuarine organisms statewide to help identify areas suffering from concentrations of

pollutants. Sampling stations for this program are determined by the Regional Water Quality Control Boards (RWQCB) and include some standard reference stations.

Environments and Media. Each program focuses on specific environments (fresh, estuarine, or marine waters), and samples specific media (Table 3), except for the Wastewater Discharge Requirements and Santa Cruz County's Surface Water Monitoring programs. For example, the State Mussel Watch program analyzes tissues from organisms found in marine and estuarine environments, while the Toxic Substances Monitoring program samples tissues from freshwater organisms. These differences reflect the goals, objectives, and magnitude of each program.

Constituents. Table 4 shows the different classes of constituents monitored by each program. Each class contains a number of parameters and constituents, including many that are important for assessing the effects of human activities on water quality. Within each class, a program monitors for a variety of constituents, depending on the program goals and the media sampled. Some programs, such as the State Mussel Watch and Toxic Substances Monitoring programs, monitor for a wide variety of substances, while others focus on a specific constituent or class of constituents. For example, Monterey County's Recreational Monitoring Program collects samples from water contact areas to measure levels of fecal coliform bacteria (FCB). Across the nine programs, monitoring of trace elements, organic substances, and pesticides is emphasized over other constituent classes.

Challenges. Based on the surveys and discussions with the PDT and representatives of other agencies, monitoring in the region is conducted with limited

Figure 1. Number of Existing Monitoring Programs Per Watershed Area

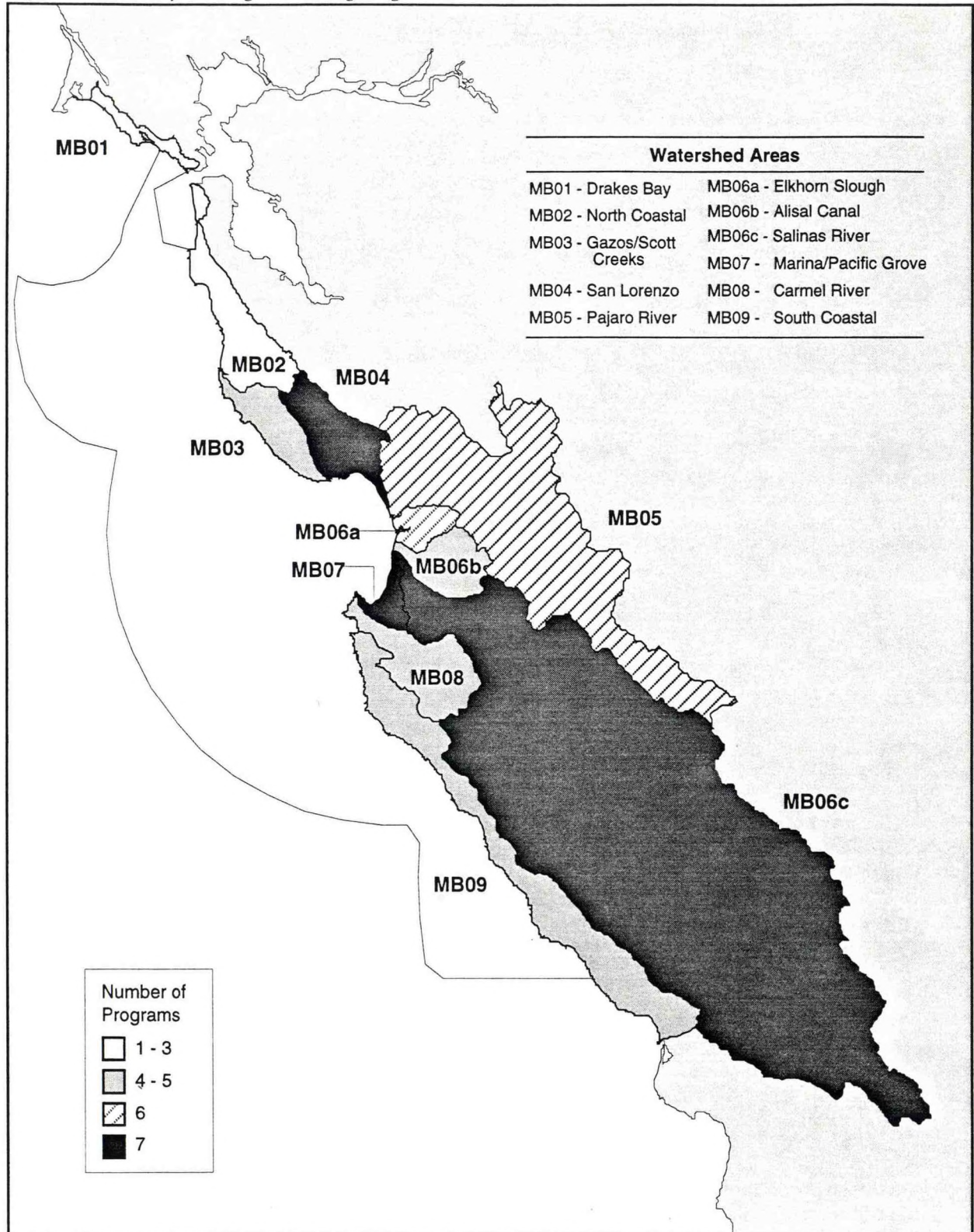


Table 3. Environment and media sampled by existing monitoring programs.

Program Name	Watersheds	Type of Environment				Media Sampled		
		Freshwater Still	Freshwater Flowing	Estuarine	Marine	Water	Sediment	Tissue
Federal Programs								
National Status & Trends Program	MB04, 6a, 7, 9			√	√		√	√
State Programs								
Environmental Hazards Assessment Program	MB06c		√			√		
Bay Protection and Toxic Cleanup Program	MB03, 4, 5, 6a-c, 7			√	√		√	
State Mussel Watch	All			√	√			√
Toxic Substances Monitoring Program	MB02 - 9	√	√					√
Regional/County Programs								
Urban Runoff Water Quality Management Plan	MB04, 5, 6c, 7		√			√		
Recreational Water Monitoring	MB06a - 9		√	√	√	√		
Wastewater Discharge Requirements	All	√	√	√	√	√	√	√
SC County Surface Water Monitoring	MB03 - 5	√	√	√	√	√		
Total		3	6	6	6	5	3	4

interaction between programs. This is because monitoring programs are established to address specific goals and objectives; little thought has been given to comprehensive monitoring needs across the region. This lack of integration has created many problems, including: difficulty in obtaining and using information for other programs/purposes; variability in the timing and frequency of monitoring; and variability in how samples are collected and measured.

Sampling Information

State Monitoring Programs

California's State Mussel Watch program has conducted monitoring at 102 locations within the study area over the past 18 years. This program is designed to analyze the accumulated pollutants in tissue samples from organisms collected in coastal waters in order to identify areas with higher than normal concentrations. The Toxic Substances Monitoring program has monitored 38 locations within the study area over the past 17 years, and focuses on analyzing tissue samples from a variety of freshwater fish and other aquatic organisms. Although both are annual monitoring programs, many stations have few or no

records for specific classes of constituents due to budget constraints, priority setting, and changes in station locations as requested by the RWQCBs. For example, the State Mussel Watch program conducted little (one to three samples) or no monitoring for trace elements, organic substances, and pesticides at 89% (91 of 102) of the sampling stations. The Toxic Substances Monitoring program did not monitor for trace elements at 18 sites, organic substances at nine sites, or pesticides at nine sites.

The Bay Protection and Toxic Cleanup program was initiated in 1989, and established monitoring stations at 22 locations around Monterey Bay. This program focuses on measuring toxic substances in sediment and conducting bioassays on collected sediment. It is designed to identify toxic hotspots, develop sediment quality objectives, and provide information for remediation efforts. Eighteen of the 22 locations have been sampled at least once since the program's inception. Additional sampling is planned to confirm initial results.

As indicated in Figure 2, sampling stations for these three programs are concentrated around Monterey Bay, in the Lower Salinas Valley, and in the vicinity of Elkhorn Slough, Watsonville Slough, and the Lower Pajaro River. Appendix B contains a complete list of the parameters measured by these programs.

Table 4. Constituent classes monitored by existing programs.

Program Name	Watersheds	Constituent Classification						Total
		Physical	Trace Elements	Nutrients	Organic Substances	Pesticides	Pathogens	
Federal Programs								
National Status & Trends Program	MB04, 6a, 7, 9		√		√	√		3
State Programs								
Environmental Hazards Assessment Program	MB06c				√	√		2
Bay Protection and Toxic Cleanup Program	MB03, 4, 5, 6a-c, 7		√		√	√		3
State Mussel Watch	All		√		√	√		3
Toxic Substances Monitoring Program	MB02 - 9		√		√	√		3
Regional/County Programs								
Urban Runoff Water Quality Management Plan	MB04, 5, 6c, 7	√	√	√	√	√	√	6
Recreational Water Monitoring	MB06a - 9						√	1
Wastewater Discharge Requirements	All	√	√	√	√	√	√	6
SC County Surface Water Monitoring	MB03 - 5	√	√	√			√	4
Total		3	7	3	7	7	4	

Constituents and Frequency of Monitoring

The maps on the following pages (Figures 3-5) show the sampling stations used by the State Mussel Watch, Toxic Substances Monitoring, and Bay Protection and Toxic Cleanup programs to monitor for trace elements, organic substances, and pesticides. Also shown is the number of sampling years per station.

Figure 2. Location of Sampling Stations for Three State Monitoring Programs.

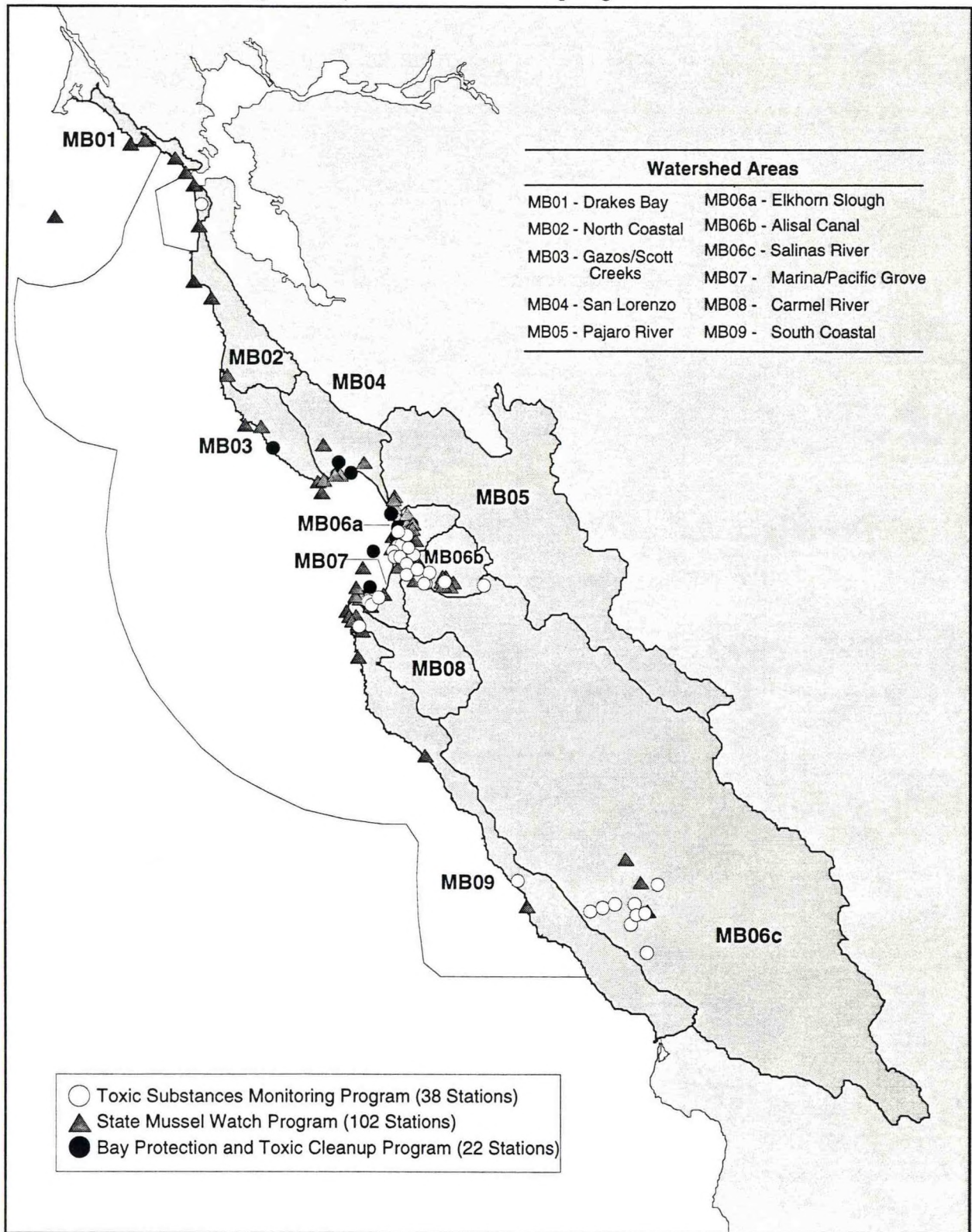
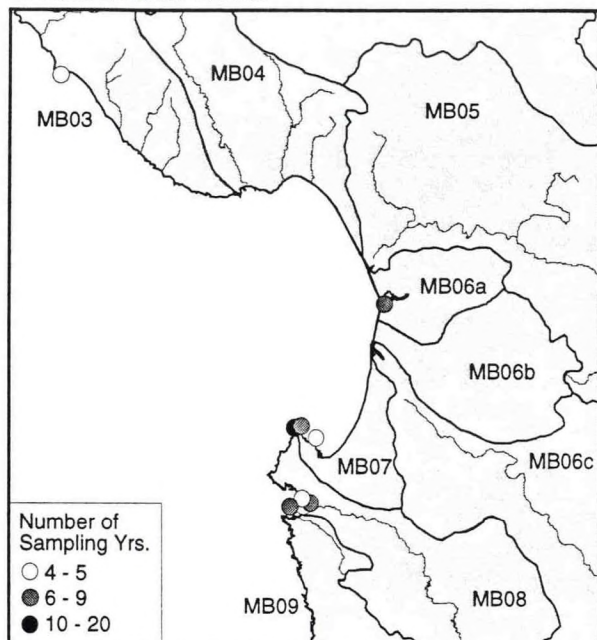
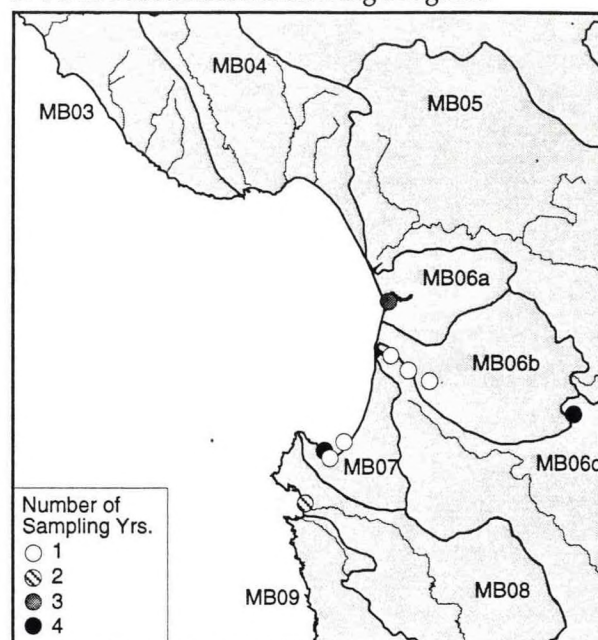


Figure 3 a - c. Stations that Monitor for Trace Elements in the Monterey Bay Region.

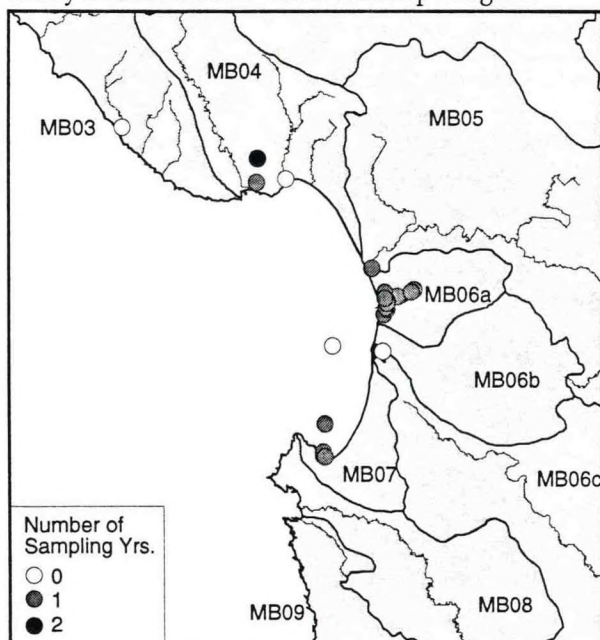
a. State Mussel Watch



b. Toxic Substances Monitoring Program



c. Bay Protection and Toxic Cleanup Program

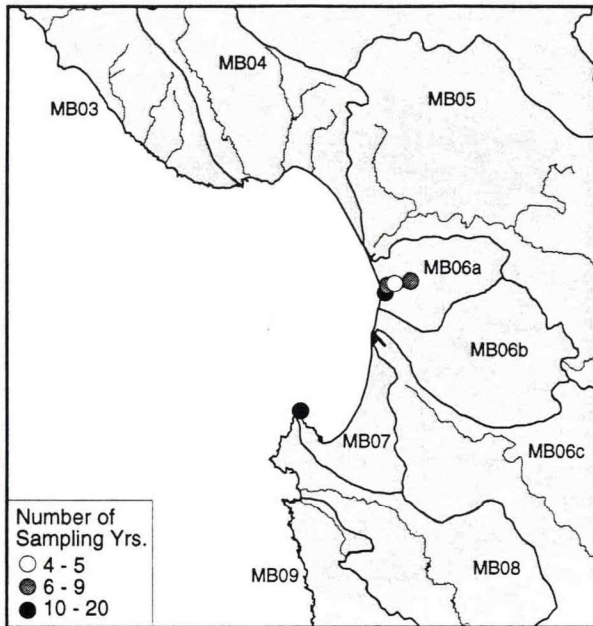


Trace Elements. Figures 3 a-c depict the distribution of sampling stations around Monterey Bay and its adjacent watersheds, and the number of years that samples were taken and analyzed for trace elements. Each program monitors for a wide range of trace elements at these stations.

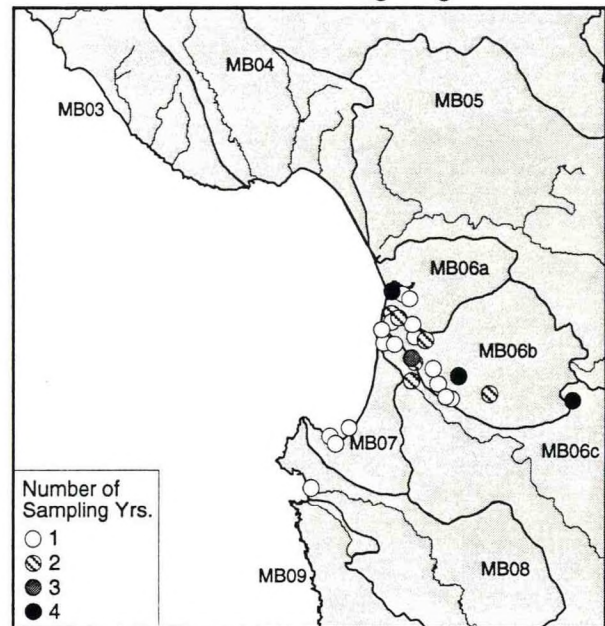
While Elkhorn Slough and the area surrounding the Monterey Peninsula have been monitored for trace elements over several years, the urban area from Santa Cruz to Aptos, and the cities of Watsonville, Castroville, and Salinas have only been monitored for trace elements to a limited extent. In addition, these programs have not conducted monitoring in several important water bodies, including the San Lorenzo, Pajaro, Salinas, and Carmel rivers, and Soquel Creek.

Figure 4 a - c. Stations that Monitor for Organic Substances in the Monterey Bay Region

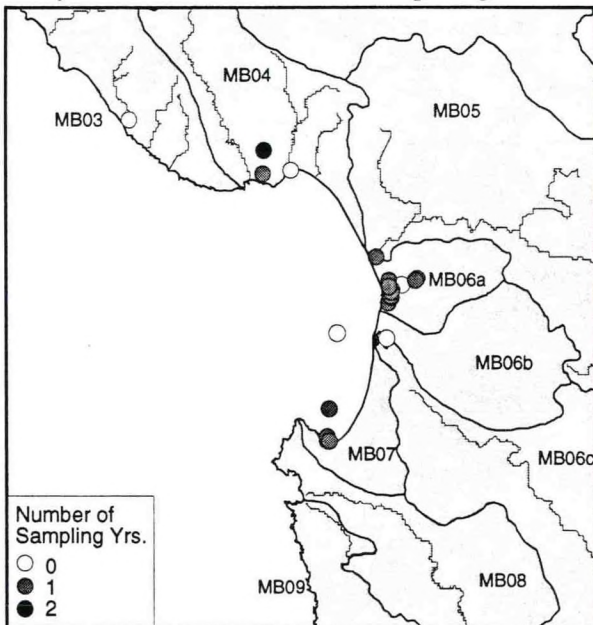
a. State Mussel Watch



b. Toxic Substances Monitoring Program



c. Bay Protection and Toxic Cleanup Program

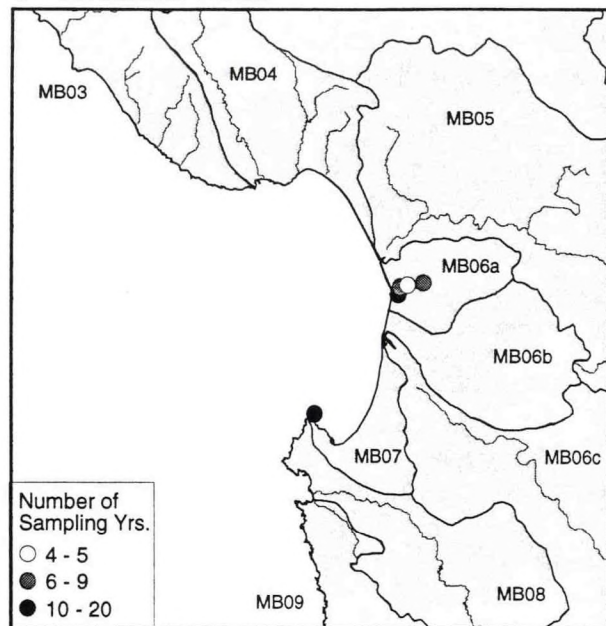


Organic Substances. Figures 4 a-c depict the distribution of sampling stations around Monterey Bay and its adjacent watersheds, and the number of years that samples were taken and analyzed for organic substances, including polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenols (PCB). None of the three programs analyzed samples for other petroleum hydrocarbons or oil and grease.

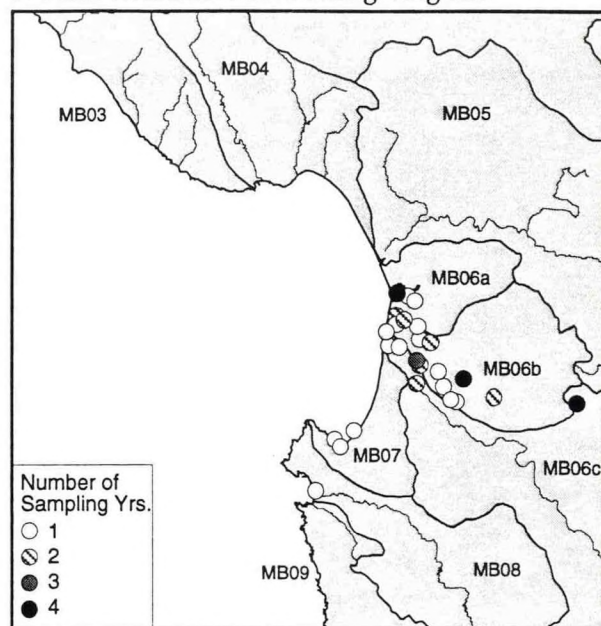
Organic substances have been monitored most frequently by the Toxic Substances Monitoring program in the vicinity of Salinas and Castroville, and in Elkhorn Slough, the Lower Salinas River, Moro Coho, and the Alisal Canal. Monitoring has been limited around the Monterey Peninsula and the urban area from Santa Cruz to Aptos, as well as along the San Lorenzo, Pajaro, and Carmel rivers, and San Lorenzo Creek.

Figure 5 a - c. Stations that Monitor for Pesticides in the Monterey Bay Region.

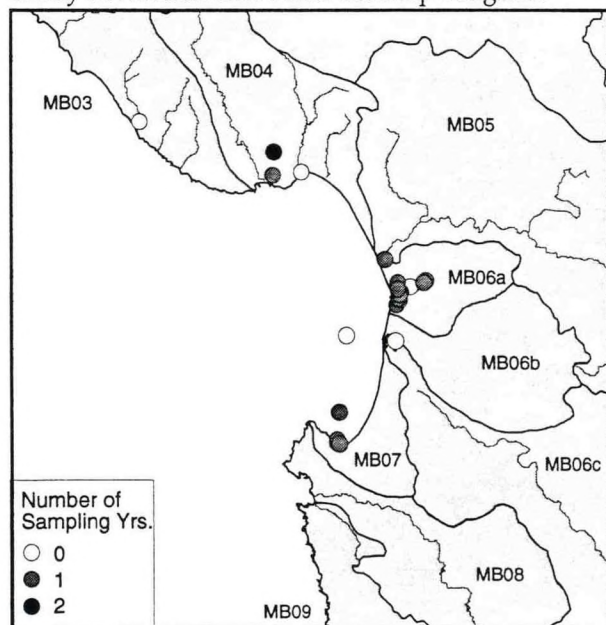
a. State Mussel Watch



b. Toxic Substances Monitoring Program



c. Bay Protection and Toxic Cleanup Program



Pesticides. Figures 5 a-c depict the distribution of sampling stations around Monterey Bay and its adjacent watersheds, and the number of years that samples were taken and analyzed for pesticides.

Similar to organic substances, pesticides have been monitored most frequently by the Toxic Substances Monitoring program in the vicinity of Salinas and Castroville, and in Elkhorn Slough, the Lower Salinas River, Moro Coho, and the Alisal Canal. Monitoring has been limited around the Monterey Peninsula and the urban area from Santa Cruz to Aptos, as well as along the San Lorenzo, Pajaro, and Carmel rivers, and San Lorenzo Creek.

NPDES Monitoring

Permit Requirements. NPDES permits require each facility to monitor for specific substances depending on the amount and type of effluent discharged. A facility may be required to monitor water quality in many different locations, including upstream, within the discharge, and various downstream locations to determine the total contribution of substances discharged by the facility. Although this type of monitoring is specific to point source discharges, an understanding of where the facilities are located, the type of substances they monitor for, and the frequency of monitoring may be useful in determining how to develop a nonpoint monitoring strategy. For example, the information collected from a station upstream of a facility but downstream of an urban area could be used to assess urban runoff. In addition, many facilities are required to monitor for constituents or parameters that are not measured by other programs, such as a wide range of physical parameters and nutrients. Appendix B contains a complete list of the parameters measured by NPDES facilities.

Summary of Facilities. Of the 12 major and 40 minor NPDES facilities in the Sanctuary and its adjacent watersheds, 41 are located around Monterey Bay. Of these facilities, 31 are industrial, nine are wastewater treatment plants (WWTP), and one is a power plant (Figure 6). Water bodies that receive numerous discharges include: Tembladero Slough (six facilities); the Salinas River (five facilities); and Watsonville Slough (four facilities). The Pacific Ocean receives discharge from 12 facilities, including several in Monterey Bay and two in Carmel Bay. In general, monitoring at these locations is conducted frequently, depending on permit requirements and the substance to be measured. For example, all facilities monitor physical parameters such as flow on a weekly, daily, or even continual basis. The number of monitoring stations associated with each facility in this region ranges from 21 for the Watsonville WWTP to one for 14 minor facilities that are required only to monitor their discharge.

Constituents Sampled. Figures 7a-e depict the location of permitted facilities and frequency of monitoring for trace elements, nutrients, organic substances, pesticides, and pathogens. Several of the facilities that monitor for these classes of constituents are located in or around the urban areas of Santa Cruz, Scotts Valley, Capitola, Watsonville, Salinas, and Carmel. The frequency of monitoring for trace elements and nutrients ranges from weekly to annually; for patho-

gens from daily to quarterly. Organic substances and pesticides are monitored either on a weekly or monthly basis.

Concluding Remarks

This report provides an initial assessment of existing program-level water quality monitoring efforts in and around the Sanctuary. It serves as a starting point for designing and implementing a comprehensive water quality monitoring program that can address a number of important water quality issues, and provide feedback to management agencies directly responsible for maintaining water quality. As such, it provides the basis for: 1) assessing redundancies and gaps in existing water quality monitoring efforts; 2) collecting additional information and data; and 3) establishing water quality monitoring requirements which support the WQPP.

Assessment of Redundancies and Gaps. While there appears to be little redundancy among the monitoring programs presented here, managers and planners must ask themselves if monitoring water, sediment, and tissues in similar media, locations, and a similar time-scale, is cost-effective or adequate to address their concerns.

As noted previously, there appears to be several gaps in the spatial coverage of existing monitoring programs, especially around urban areas. There also appears to be a scarcity of monitoring stations in the northern section of Monterey Bay. This may be significant since ocean currents are weaker in this area, possibly contributing to a longer residence time for pollutants. In addition, monitoring efforts appear to focus on only a few water bodies, such as the Lower Salinas River and Elkhorn Slough, while others, such as the Pajaro River, appear under-monitored.

There also appears to be temporal gaps in existing monitoring efforts. Programs which monitor for a wide range of substances, such as the State Mussel Watch program, do so annually, while programs which monitor for a narrower range of substances, such as the Environmental Hazards Assessment Program, do so monthly. As noted previously, variations in the frequency of sampling from station-to-station can be extreme. *Identifying other important monitoring programs that may be filling these gaps is an important step in developing the comprehensive water quality monitoring program.*

Plans for Future Data and Information Collection.

The PDT plans to continue this assessment in conjunction with the U.S. EPA and a private contractor. This will include identifying and assessing additional water quality monitoring programs, particularly those conducted by the counties adjacent to the Sanctuary. A more complete assessment will provide the additional information on ongoing water quality monitoring efforts required to develop a practical regional water quality monitoring program that coordinates existing federal, state, and local monitoring efforts.

A more complete assessment of existing monitoring efforts also will help clarify the spatial and temporal patterns of water quality problems, allowing managers to determine the effectiveness of specific strategies (as well as the program as a whole), and to target them more precisely to problem areas.

Establishing Water Quality Monitoring Requirements to Support the WQPP. To provide a focus for building a comprehensive monitoring program, it is important to establish feasible goals and objectives that are directly correlated to the WQPP, and recognize that there is only a limited amount of money available to conduct monitoring. It is critical to design a program that is cost effective, but still provides information that can be used for making management decisions. Therefore, it is important to:

- Determine which strategies are directly related to reducing levels of pollutants -- not all strategies will require monitoring.
- Identify where monitoring should occur in relation to these strategies. It may be more cost effective to monitor a few representative areas rather than all water bodies affected by the strategies.
- Based on specific pollutant reduction targets, determine what type of monitoring (water, sediment, tissue) will provide the best information, and how frequently samples should be taken.

Once these questions are addressed, the team can determine if any of the existing monitoring programs can be utilized or easily modified to meet these needs. It is critical for those involved in the planning process to begin to address these questions, and determine how a comprehensive water quality monitoring program could best be designed to help answer management questions.

Data Available at the Sanctuary Office

The data that were used to develop this document, and the original data bases supplied by the State Water Resources Control Board have been transferred to the Monterey Bay National Marine Sanctuary office for the PDT to use and develop further.

In addition, a Macintosh-based desktop data management and mapping system developed by the SEA Division has been installed on computers at the Sanctuary office and the Central Coast Regional Water Quality Control Board. This system can be used to query data bases, organize information, and produce maps and graphics. It also can be used to help analyze specific sampled values.

Figure 6. Location and Type of NPDES Permitted Facilities.

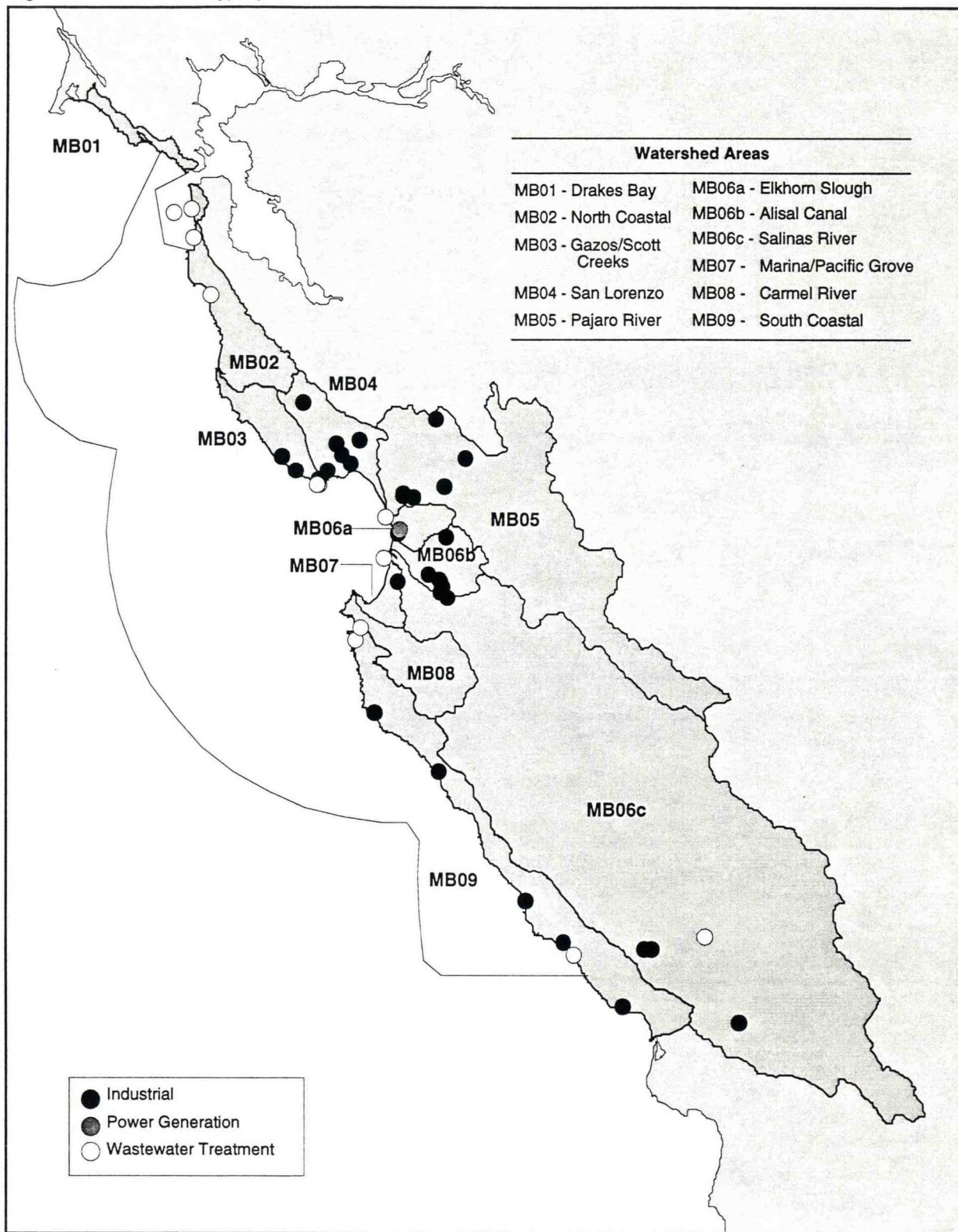
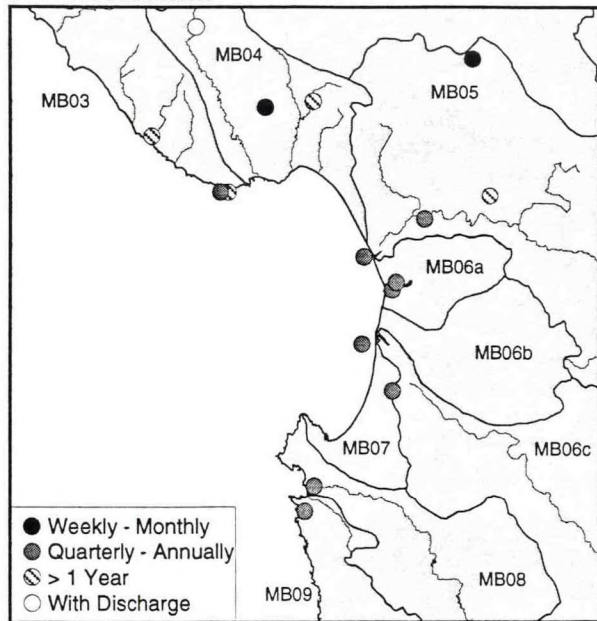
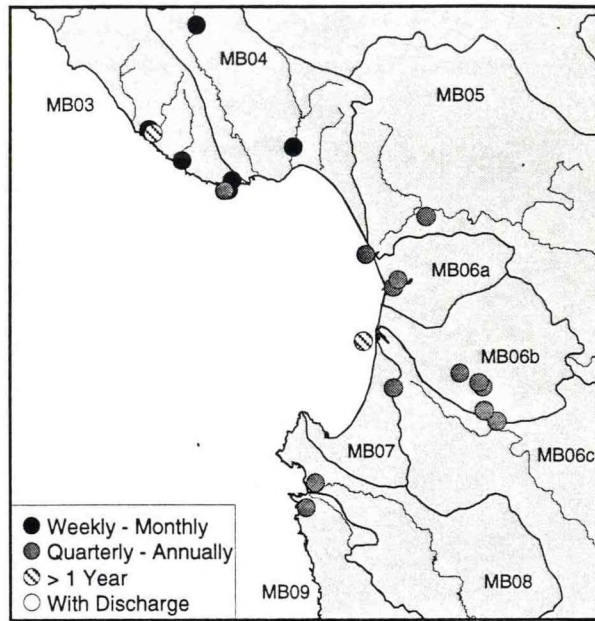


Figure 7 a - d. NPDES Facilities that Monitor for Trace Elements, Nutrients, Organic Substances, and Pesticides

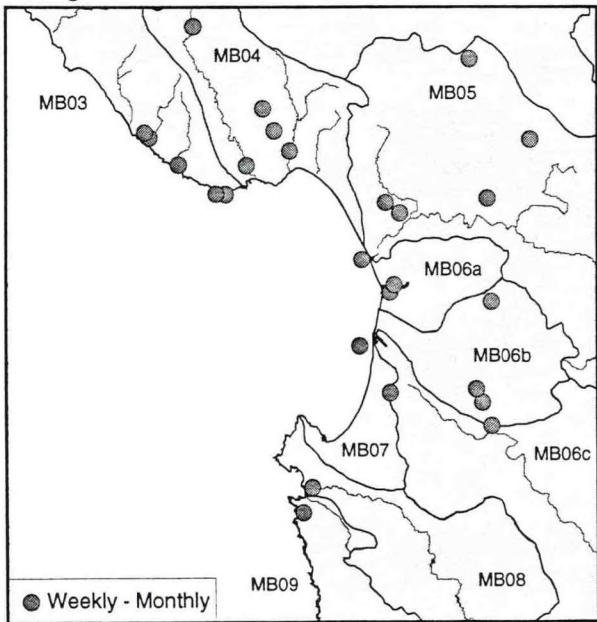
a. Trace Elements



b. Nutrients



c. Organic Substances



d. Pesticides

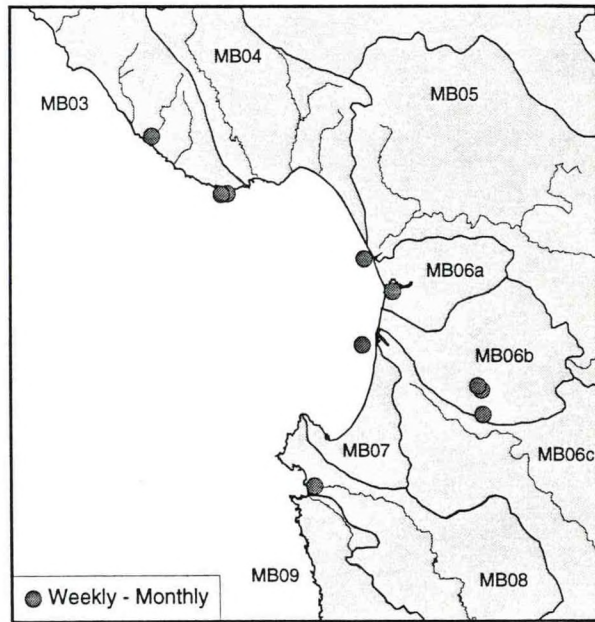
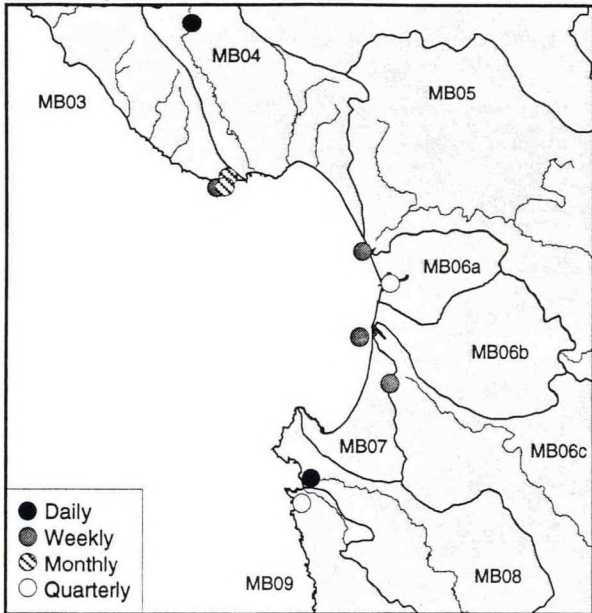


Figure 7 e. NPDES Facilities that Monitor for Pathogens.

e. Pathogens



Appendix A URBAN RUNOFF MONITORING PROGRAMS

Federal Monitoring Programs

USGS: Monterey Bay National Marine Sanctuary Seafloor and Sediment Transport Program

This research program is designed to describe seafloor geology and sediment throughout the Sanctuary. Seafloor samples are collected to characterize the geology of the nearshore shelf area and the Monterey Canyon. Sonar images of the seafloor will be used to map the area, while current meters will collect long-term data on physical oceanographic conditions on the continental shelf and in the Monterey Canyon.

The data base system is ARC/INFO and the USGS's Pacific Marine Geology Data Bank. Data are output in ARC/INFO or ASCII format. Data files contain station location, constituent sample, periods, frequency and sampling interval.

The sampling interval is fixed, and the classifications of constituents sampled include physical properties, turbidity/suspended matter, and currents. Specific constituents include grain size, toxic chemical sampling, organic geochemistry, physical properties, and mineralogy. Data are characterized as sparse, and can be used for research by Federal, State and local agencies and academia.

Contact: Steve Eittrheim, USGS 345 Middlefield Road, Mail Stop 995, Menlo Park, CA 94025, telephone (415) 354-3162.

NOAA: National Status and Trends Program

This program is designed to observe and assess the status and trends in environmental quality conditions in estuarine and coastal waters throughout the Nation. Its purpose is to identify the relationships between human activities and these conditions. The program is organized into two components: the National Mussel Watch Project, and Benthic Surveillance Project. Together they operate eight stations in the Sanctuary, and monitor marine and estuarine waters, sediment, and tissues once every two years. A variety of substances are monitored, including pesticides, PCBs, PAHs, petrochemicals, trace elements, and other inorganic and organic constituents.

Station information from the projects is available in digital, map, and hard copy form, and can be easily input to a variety of software applications, including Microsoft Excel and Lotus. Information from the projects also is being made available over the internet. The program has been in operation since 1986, and data is characterized as moderately complete.

Contact: Gunnar Lauenstein, NOAA 1305 East West Hwy., SSMC-4 Room 10651, Silver Spring, MD 20910, telephone (301) 713-3028.

State Monitoring Programs

CA DPR: ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

The DPR Environmental Hazards Assessment Program monitors the spatial and temporal distribution of pesticide contamination and aquatic toxicity. Water samples have been collected weekly since August 1994, and analyzed for pesticides. Collected near Gonzales in Monterey County on the Salinas River (Sanctuary Watershed MB06c), these samples are used for research and State and local government planning. Pesticide

and bioassay data for this project are characterized as complete, but data are available in hard copy only. The program is expected to conclude by August 1995.

Contact: Adrian Bradley, CA EPA, DPR, 1020 N Street, Room 161, Sacramento, CA 95814-5624, telephone (916) 324-4339.

SWRCB: Bay Protection and Toxic Cleanup Program (BPTCP)

The BPTCP is a state monitoring program designed to identify toxic hot spots in river deltas, estuaries and coastal areas in California, and includes many sampling stations in the Sanctuary's watersheds. Chemical analyses, toxicity tests and biological assessments are performed.

Numeric and qualitative data are available in digital files and map form. The data base uses Oracle, and the information can be translated into ARC/INFO, ARC/VIEW, dBASE, Lotus, Harvard Graphics, or ASCII format. Data files are organized by latitude and longitude, constituent classification, and date of collection. Media sampled include marine water, sediment, estuarine water and tissue. Data are used for planning and management by State and local governments. The constituents sampled include: physical properties, metals, organic chemicals, pesticides, nutrients, and bioassays.

The period and frequency of the sampling program varies with identification of potential hot spots. The sampling design is statistical, and the data characterized as moderately complete.

Contact: Mary Tapple, SWRCB, 901 P Street, Sacramento, CA 95812, telephone (916) 657-0637; Stan Martinson, SWRCB, 901 P Street, Sacramento, CA 95814, telephone (916) 857-1134.

SWRCB: State Mussel Watch Program (SMW)

The SMW program conducts tissue analysis of caged, transplanted or resident mussels or clams to detect chemicals that bioaccumulate. Some sediment analyses have also been conducted. The data format is R/Base and can be converted to dBASE. Data are organized by sampling station, constituent classification, and date of collection. The Mussel Watch data base is characterized as complete from 1977 to 1988, but summary data for 1988 through the present have not been published formally.

The SMW program conducts sampling at many locations in coastal areas of the Sanctuary's watersheds and throughout the state. Constituents sampled include metals, pesticides, PCBs, and some organic chemicals. Concentrations are reported in dry weight, wet weight, and lipid-normalized weight. The RWQCBs determine sampling locations, including reference stations. Sampling occurs annually, but the same sampling stations are not monitored each year. Information from this program is used for research, planning and management by local, state and federal agencies and academia.

Contact: Del Rasmussen, SWRCB, 901 P Street, Sacramento, CA 95814, telephone (916) 657-0916; Deborah Johnston, California Department of Fish and Game, 20 Lower Ragsdale Drive, Monterey CA 93940, telephone 649-7141; Mark Stephenson, Department of Fish and Game, Pollution Studies Lab, PO Box 747, Moss Landing, CA 95039, telephone (408) 633-0128.

SWRCB: Toxic Substances Monitoring Program (TSM)

The TSM Program measures metals, pesticides, PCBs and other organic chemicals in fish and bivalve tissues. Trace metals, pesticides, PCBs and PAHs are analyzed in the test species' tissues.

The data base system is R/Base, and numeric data are reported by sampling sites. Data files are available for all Sanctuary watersheds except MB01. Media sampled include tissue and limited sediment sampling. Data are used for research, planning and management activities, and by local, state and federal government agencies and academia.

Data from 1978 to the present are available. Sampling is conducted on an annual basis, and sampling sites vary from year to year depending upon the needs of the Regional Boards.

Contact: Del Rasmussen, SWRCB, 901 P Street, Sacramento, CA 95814, telephone (916) 657-0916; Michael Thomas, RWQCB, 81 Higuera, Suite 200, San Luis Obispo, CA 93401, telephone (805) 542-4623.

Regional and County Monitoring Programs

RWQCBs: NPDES Permits and Waste Discharge Requirements (WDR)

The RWQCBs issue NPDES Permits under authority delegated to them by EPA under the Clean Water Act Section 402. They also issue Waste Discharge Requirements (WDR) under the State's Porter-Cologne Act. There are about 50 active NPDES permits and hundreds of active WDRs issued to permittees throughout the Sanctuary and its watersheds. The Sanctuary has an NPDES permit tracking data base that is updated each month, containing information on the parameters monitored and the monitoring frequency. The RWQCB in San Luis Obispo also has an NPDES permit tracking data base in dBASE II for Region #3. The RWQCB's WDR information is difficult to access because data are in hard copy form.

The permittees are required to sample influent, effluent and receiving water stations for various parameters, depending on the type of discharge and the discharge location. Most of the monitoring data for both the NPDES and WDR programs are numeric and in hard copy form for specific monitoring stations. However, some data may be obtained from the dischargers in a digital format. Media sampled include freshwater, estuarine water, marine water, sediment, and tissue. The data are used by the RWQCBs and other State and local governments for planning and compliance monitoring. The duration of monitoring for each permit is variable. The classifications of constituents monitored include physical properties, metals, nutrients, organic chemicals, pesticides, microorganisms, and bioassays.

Contacts: Michael Thomas, RWQCB, Central Coast Region, San Luis Obispo, 81 Higuera Street, Suite 200, San Luis Obispo, CA 93401-5414, telephone (805) 549-3147; Michael Carlin, RWQCB, San Francisco Bay Region, 2101 Webster Street, Suite 500, Oakland, CA 94612, telephone (510) 286-1255; Patrick Cotter, MBNMS, 299 Foam Street, Suite D, Monterey, CA 93940, telephone (408) 647-4252..

AMBAG Urban Runoff Water Quality Management Plan for the Monterey Bay Region

This project evaluated pollution from storm drains in urban areas around Monterey Bay. Data from the project are available in digital, map and hard copy format, and were collected at four sites in Santa Cruz and Monterey Counties (Sanctuary watersheds MB04, MB05, MB06c and MB07). Data collected during winter storm events between February 1992 and February 1993 were compared with the results of the National Urban Runoff Program (NURP) conducted in the 1970s, and are used for Federal, State and local government planning. Data, including physical properties, metals, pesticides, nutrients, organic chemicals and microorganisms, are characterized as sparse.

Contact: Frank Barron, AMBAG, PO Box 809, Marina, CA 93933-0809, telephone (408) 883-3750.

Monterey County: Recreational Water Monitoring

This program monitors total and fecal coliform bacteria concentrations in water contact areas. Numeric data are available in hard copy form. A data base system is not used at this time. Data are organized by sampling sites.

The program focuses on Monterey County only (Sanctuary watersheds MB06a-c). Media sampled include fresh, estuarine, and marine water. Data are used for management by local and State governments. Samples are taken monthly at fixed intervals; information has been collected since the 1970s. Data are characterized as moderately complete.

Contact: Bruce Welden, Monterey County Division of Environmental Health, 1270 Natividad Road, Salinas, CA 93906-3198, telephone (408) 755-4880.

Santa Cruz County: Groundwater Quality Monitoring Program

This program samples water from wells in coastal areas to track seawater intrusion and nitrate increases in agricultural aquifers. Numeric data are in digital form. The data base is R/Base, and output can be formatted in ASCII, dBASE, or Lotus. Digital files are available by station, constituent sampled, period, frequency, and interval. The scope of the project is Santa Cruz County only (Sanctuary watersheds MB03, MB04 and MB05). The media sampled is groundwater, data are used for planning and research by local and State governments.

The frequency of sampling varies, the sampling interval is fixed, and the sampling design is statistical. Constituents sampled include nutrients, heavy metals, and other organic chemicals. Data are characterized as moderately complete.

Contact: Robert Golling, County of Santa Cruz, 401 Ocean Street, Santa Cruz, CA 95060, telephone (408) 454-4624.

Santa Cruz County: Surface Water Monitoring Program

This monitoring program measures baseline water quality concentrations and changes in water quality, and identifies sources of water quality degradation in Santa Cruz County. Data are used for research and planning by local and State governments.

The data base is Symphony (Lotus), R/Base, and SPSS, and is characterized as moderately complete. Data are available in digital and hard copy formats, and the information is reported numerically.

Samples are taken monthly and the sampling interval is intermittent. Media sampled include freshwater, flowing freshwater, estuarine water, and marine water. Parameters measured include physical properties (temperature, pH, dissolved oxygen), nutrients, microorganisms (fecal coliform bacteria), turbidity/suspended matter, and heavy metals.

Contact: John Ricker, Santa Cruz County Environmental Health Department, 4501 Ocean Street, Santa Cruz, CA 95060, telephone (408) 454-3128.

Federal Data Bases

U.S. EPA: Ocean Data Evaluation System (ODES)

ODES is a computer-based program created by EPA that provides a standardized format for reporting water, sediment and biological monitoring data for many different marine environmental management programs and wastewater dischargers throughout the Nation. Information from a variety of media, including marine water, sediment, effluent, and bioassays from tissue sampling are in the data base, and include information on constituent classifications such as physical properties, metals, organic chemicals, nutrients, microorganisms and bioassays. Data can be extracted and used by local, state and federal government agencies and academia to create digital files, maps, and hard copy output.

Numeric and qualitative data are reported by sampling site, and files (station, constituents, period, frequency, and interval) are available for many monitoring programs. Most programs reporting to ODES conduct monthly and annual monitoring at fixed intervals, although data completeness is sparse. EPA has examined the data base and determined that no data exist in the data base for outfalls in the Sanctuary.

Contact: Robert Hall, U.S. EPA, Region IX (W-2-3), 75 Hawthorne Street, San Francisco, CA 94105, telephone (415) 744-1936.

U.S. EPA: STORET

The STORET data base is comprised of water, sediment, and biological data submitted to Federal and State agencies from local and regional dischargers under the Clean Water Act Section 402 NPDES permitting program. Numeric and qualitative data are available in digital, map and hard copy formats. The data base system is PL1. Output formats include: Arc/INFO, dBASE, Lotus and special STORET formats. Data are reported by specific sampling sites, and are moderately complete from 1920 to the present.

The Sanctuary suspects that the data base covers all Sanctuary drainages, but the EPA has not verified this. They have been contacted to obtain accurate information. Depending on the location of a facility and its permit requirements, freshwater, marine water, estuarine water, sediment, effluent, and tissue may be sampled. Monitoring at the facilities occurs daily, weekly, monthly and/or annually at fixed intervals as defined by the NPDES permit. The sample designs for the NPDES permits include random, statistical and modeling programs.

Classifications of constituents sampled include physical properties, heavy metals, nutrients, organic chemicals, chlorophyll, microorganisms and pesticides depending on the permit. Data are used for research, planning and management by local, state and federal government agencies and academia.

Contact: Eric Wilson, U.S. EPA Region IX (W-2), 75 Hawthorne Street, San Francisco, CA 94105, telephone (415) 744-1964.

Comparison of parameters measured by selected monitoring programs.

	BPTCP (22 Stations)	SMW (102 Stations)	TSM (38 Stations)	AMBAG (4 Stations)
Physical				
Conductivity				√
Hardness				√
pH				√
Temperature				√
Total Suspended Solids (TSS)				√
Turbidity				√
Total	0	0	0	6
Trace Elements				
Arsenic	√	√	√	√
Aluminum	√	√		
Antimony	√			
Cadmium	√	√	√	√
Chromium, Total	√	√	√	√
Copper	√	√	√	√
Iron	√			
Lead	√	√	√	√
Manganese	√	√		
Mercury	√	√	√	√
Nickel	√	√	√	√
Selenium	√	√	√	√
Silver	√	√	√	√
Tin	√			
Titanium		√		
Zinc	√	√	√	√
Total	15	13	10	10
Organic Substances				
PAHs	√	√	√	√
PCBs	√	√		
Tributyltin	√	√		
Total	3	3	1	1
Pesticides				
Aldrin & Dieldrin	√	√	√	
Chlorobenside		√		
Chlordane & Deriv.	√	√	√	
Chlordane & Derivatives	√	√	√	
Chlorpyrifos	√	√	√	
Dacthal	√	√	√	
DDT & Derivatives	√	√	√	√
Diazinon		√	√	
Dichlorobenside		√		
Dichlorobenzophenone	√		√	
Dicofol		√	√	
Endosulfan (3)	√	√	√	
Endrin	√	√	√	
Ethion		√	√	
Ethylparathion		√	√	
Heptachlor	√	√	√	
Hexachlorobenzene	√	√	√	
Hexachlorocyclohexane (HCH)	√	√	√	
Methoxychlor	√	√	√	
Methylparathion		√	√	
Mirex	√			
Nonachlor	√	√	√	
Oxadiazon	√	√	√	
Oxychlordane	√	√	√	
Pentachlorophenol		√	√	
Phenol		√		
Ronol		√		
Tetrachlorophenol		√	√	
Tetradifon		√		
Toxaphene	√	√	√	
Total	18	28	24	1

Types of parameters measured by NPDES facilities.

Physical	Trace Elements	Nutrients	Organic Substances	Pesticides	Pathogens
Carbon, Total Organic	Aluminum	5-Day Biologic Oxygen Demand (BOD)	Cyanide	Aldrin & Dieldrin	Coliform, Fecal
Dewatered Sludge	Antimony	5-Day Chemical Oxygen Demand (COD)	Hydrocarbons	Chlordane & Deriv.	Coliforms, Total
Flow	Arsenic	Ammonia	Oil & Grease	DDT & Derivatives	Enterococci
Particle Size	Barium	Ammonia, Un-ionized	PAHs	Endosulfan	
pH	Boron	Dissolved Oxygen	PCBs	Endrin	
Radioactivity	Cadmium	Nitrate	Petroleum Hydrocarbons	Hexachlorocyclohexane (HCH)	
Rainfall	Chloride	Nitrite	Phenolics, Chlorinated	Toxaphene	
Settleables	Chlorine, Total Residual	Nitrogen, Total	Phenolics, Nonchlorinated		
Solids, Total Dissolved	Chromium III	Nitrogen, Total Kjeldahl	Tributyltin		
Solids, Total Volatile	Chromium VI	Phosphorous, Total	Other Table B Noncarcinogens (19)		
Temperature	Chromium, Total		Other Table B Carcinogens (27)		
Total Suspended Solids (TSS)	Copper				
Turbidity	Iron				
	Lead				
	Mercury				
	Nickel				
	Selenium				
	Silver				
	Sodium				
	Sulfate				
	Sulfides				
	Thallium				
	Zinc				
14	25	10	10	7	2

Each facility monitors for a subset of these constituents as required by their permit.

References

National Oceanic and Atmospheric Administration (NOAA). 1994. *Monterey Bay National Marine Sanctuary Water Quality Protection Program Workshop summary: Preliminary identification of issues and strategies*. Silver Spring, MD: Strategic Environmental Assessments Division, Office of Ocean Resources Conservation and Assessment. 113 pp.

National Oceanic and Atmospheric Administration (NOAA). 1995. *Monterey Bay National Marine Sanctuary Water Quality Protection Program Working document: Comparison of the California Water Quality Assessment and the January 1994 workshop results*. Silver Spring, MD: Strategic Environmental Assessments Division, Office of Ocean Resources Conservation and Assessment. 80 pp.



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Initial Assessment of Existing Monitoring Efforts in the Monterey Bay Region
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