Southern California Bight
1998 Regional Marine Monitoring Survey
(Bight'98)

Field Operations Manual

Prepared by:
Bight'98 Steering Committee

Prepared for:
Commission of Southern California Coastal Water Research Project
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SOUTHERN CALIFORNIA BIGHT 1998 REGIONAL MARINE MONITORING SURVEY

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I. INTRODUCTION

Background

The Southern California Bight Pilot Project (SCBPP) was conducted in 1994 to begin addressing regional monitoring concerns. This project was the largest regional survey of environmental conditions on the mainland shelf in the Southern California Bight (SCB). It capitalized on the interest and cooperation existing in southern California and the resources available in current monitoring programs to develop an integrated and coordinated regional monitoring program that addresses the needs of the participating local, state, and federal agencies, and provided new management information. The SCBPP provided a much needed first "snapshot" of the state of the SCB. The SCBPP resulted in consistent regionwide data sets for describing pollution exposure and biological resources within the SCB. By sampling 261 sites on the mainland shelf of the SCB, an assessment was made of pollutant exposure, the status of biological resources and species diversity, and the presence of marine debris in the SCB.

Bight'98

The Southern California Bight 1998 Regional Marine Monitoring Survey (Bight'98) will continue the development of regional scale management information and will follow the general plan of the 1994 SCBPP. Bight'98 includes a substantial increase in the number of participants, who will provide additional resources thereby increasing the scope of the project and allowing the introduction of new indicators such as a shoreline microbiology component and analysis of biomarkers in fish. Increased participation will also allow for an expansion of the number of sample sites and habitats (e.g. San Diego Bay, Catalina Island, the Channel Islands, and historically sampled reference sites).

The proposed goal of Bight'98 is to make an assessment of the current environmental status of the mainland shelf and shoreline along the southern California. To accomplish this objective, a generalized question has been posed that can be paraphrased as "What is the extent and magnitude of change in an indicator measured in the SCB?". Subpopulations, or strata, of interest have been identified that will allow us to answer other related questions: 1) Is the degree of change similar throughout the SCB, or is it more severe in particular areas?; 2) Can changes be associated with identifiable sources of pollution, such as municipal wastewater outfalls, rivers, or harbors?; and 3) Are the associations identified the same throughout the SCB?

The Bight'98 Survey is organized into three technical components: 1) coastal ecology, 2) microbiology, and 3) water quality. Separate microbiology and water quality surveys will be conducted throughout the following year which will supplement the Bight'98 summer field study. These studies will be conducted according to protocols described in separate documents

produced by the microbiology and water quality working groups. The Bight'98 coastal ecology technical component's field sampling element will be conducted in July and August of 1998. The purpose of this document is to provide detailed instructions on all field sampling methods that will be used to conduct this study.

II. OVERVIEW OF FIELD SURVEY

Sampling Period

The index period for the Bight'98 study will extend from July 13, to September 4, 1998.

Sampling Design

The Bight'98 study will use a probability-based sampling design developed by EMAP that combines the strengths of systematic and random sampling. This sampling design consists of a grid of tessellated hexagons with a station selected at random within each hexagon. Sampling can be intensified in areas of special interest by decreasing the size of the hexagons, thereby increasing the number of hexagons in an area.

Bight'98 has identified 15 different strata of stations that will be sampled in this survey. These strata are classified as follows: Channel Islands (California Current influenced), Channel Islands (Davidson Current influenced), Catalina Island, shallow offshore (6 to 30 m), mid depth offshore (30 to 120 m), deep offshore (120 to 200 m), river mouths, small POTW outfalls, large POTW outfalls, historical sampling sites (30 m depth), historical sampling sites (60 m depth), marinas, port/industrial, other bays or harbor areas, and San Diego Bay.

Indicators of Ecosystem Health

The primary goal of the Bight'98 project is to provide an assessment of overall ecosystem condition of the SCB. To accomplish this goal, the following indicators of ecosystem health will be examined:

- Water-column -- microbiological indicators, temperature, salinity, depth, dissolved oxygen (DO), and transmissivity
- Benthic -- sediment characteristics, sediment contamination, infaunal assemblages, and sediment toxicity;
- Demersal fish and invertebrate assemblages, and fish gross pathology, biomarkers, and bioaccumulation
- Marine debris (including plastic, lumber, vegetation, glass, etc.)

III. DESCRIPTION OF FIELD TEAMS AND ACTIVITIES

Personnel

All field sampling will be conducted by personnel knowledgeable in field sampling (e.g., trawling, benthic sampling, and hydrocasting). Teams of field personnel will be on each research vessel participating in the sampling effort. These groups will vary in size depending on which organization is doing the field sampling. The main requirements are that the personnel on board the vessel:

- Have a good working experience with the different types of sampling devices
- Are able to troubleshoot problems when they arise
- Have the knowledge and experience necessary for conducting the field collection and analysis of benthic invertebrates and sediments, and trawl-caught demersal fish and megabenthic invertebrates

Each organization's vessel will have its own Boat Captain and crew. A Chief Scientist will be in charge of the scientific crew and will have the final decision on whether to abandon or sample a station. This person is also responsible for assuring the quality of the data and making sure that all data from a sampling cruise is delivered to appropriate information processing personnel in a timely manner.

Station Assignments

The mainland shelf of the Southern California Bight will be divided among the participating organizations according to the level of effort contributed by each. The number of stations to be sampled by each organization is summarized in Table 1. Maps and coordinates of the stations to be sampled by each organization are located in Appendices 1 and 2, respectively.

Table 1. Number of stations by sample type to be sampled by organizations participating in the Bight'98 study, summer 1998.

Organization	Benthic infauna	Sediment chemistry	Sediment toxicity	Fish assemb.	Tissue chemistry
CLAEMD	28	28	23	19	19
LACSD	19	19	16	20	20
OCSD	30	30	26	0	0
CSDMWWD	80	80	71	64	64
ABC	52	52	41	57	57
CINMS	51	51	0	64	64
USC	22	22	0	32	32
SPAWAR	7	7	7	16	16
MEC	2	12	7	106	106
MBC	89	89	82	0	0
SEAVENT	14	14	6	0	0
TOTAL	**404**	**404**	**279**	**378**	**378**

CLAEMD = City of Los Angeles, Environmental Monitoring Division
LACSD = Los Angeles County Sanitation Districts
OCSD = Orange County Sanitation Districts
CSDMWWD = City of San Diego Metropolitan Wastewater Department
ABC = Aquatic Bioassay & Consulting (City of Oxnard, L.A. Bays & Harbors)
CINMS = Channel Islands National Marine Sanctuary
USC = University of Southern California Wrigley Institute of Environmental Studies
MEC = Marine Ecological Consultants (Encina, San Elijo JPA)
MBC = Marine Biological Consultants
SPAWAR = US Navy, Space and Naval Warfare Systems Command (SPAWAR)
SEAVENT = SeaVentures (AWMA, SERRA)

Equipment

All groups or organizations involved in the sampling program will provide their own research vessel, crew, Van Veen grab, otter trawl, and any other equipment necessary to complete the sampling assignment. A list of equipment used during the survey is provided in Appendix 4. Characteristics of each vessel to be used in this survey are listed in Appendix 5.

Grab sampler

Each organization will have a minimum of two modified Van Veen grab samplers. Grab specifications are given in Section 7.

Trawl nets

Each organization will have a sufficient number of 7.6 m (headrope) trawl nets and sets of otter boards (doors) available. Net and door specifications are given in Section 8.

Cellular phones

Cellular phones are recommended, but not required, to facilitate communication between the Chief Scientist on the sampling vessels with land based Bight'98 project personnel. Vessel cellular telephone numbers are listed in Appendix 5.

Chain-Of-Command

The following chain of command is recommended to avoid confusion, identify responsible parties, and to ensure that proper sampling protocols and information flow are followed by each Organization:

- Each organization will establish the chain-of-command for their own vessels. The Chief Scientist is directly responsible for all field activities conducted by the crew.

- Any changes that are made to the established logistical plan that are outside of the jurisdiction of the Chief Scientist will be communicated to the Chief Scientist by either the Field Coordinator (Tim Rothans) or the Project Manager (Steve Weisberg). The teams will accept technical direction from no other authority. All changes to the sampling plan that occur during the field surveys must be documented.

- All technical matters, such as equipment problems, questions regarding station locations, sampling schedules, etc., will be addressed to the Field Coordinator by the Chief Scientist AS SOON AS POSSIBLE.

- For participants that are subject to field audits prior to the sampling period, the Quality Assurance/Quality Control (QA/QC) Specialist will inform the Chief Scientist of any areas where field operations need to be adjusted to meet Bight'98 protocol or where

there are problems in taxonomic identification. The Chief Scientist will be expected to take the appropriate action to correct the situation.

Weekly Communications

Each week a representative from each participating organization will fax to SCCWRP (ATTENTION: Larry Cooper) a schedule of proposed sampling days during the upcoming week, operations to be conducted, and general areas where sampling is likely to occur. This information is needed by QA/QC auditors who will be participating on different cruises on different days. Prior to a QA/QC audit, the auditor will contact each Chief Scientist to verify that the proposed schedule is still in place.

Daily Communications

At the completion of every sampling day, or when the vessel returns to port, each participating organization will fax to SCCWRP (ATTENTION: Larry Cooper) a listing of sampling that was conducted that day on the designated sample tracking forms (Appendix 6). A separate form will be submitted for trawls and benthic sampling. This information is needed to provide a summary of progress of the survey as needed to the Bight'98 Steering Committee and to determine the need for follow up sampling by a contractor.

Important Telephone Numbers

The names and phone numbers of appropriate personnel and emergency services are listed in Section 13 and Appendix 8. If a particular individual cannot be reached at the listed number, the caller should call SCCWRP, where an attempt will be made to provide a phone number where the individual can be reached.

IV. SAFETY

Collection of samples in field surveys is inherently hazardous and this danger is greatly compounded in bad weather. Thus, the safety of the crews and equipment is of paramount importance throughout the project. Each person working on board a vessel during the project should take personal responsibility for their own safety.

Many accidents at sea are preventable. Safety awareness by the Boat Captain and all crew members is the greatest single factor that will reduce accidents at sea. Each survey crew should follow established rules and provisions within their respective Organization's safety program. Sampling should be canceled or postponed during hazardous weather conditions. The final decision is made by the Boat Captain, who is responsible for the safety of everyone on board. As with any field program, the first priority is the safety of the people on board, followed by the safety of the equipment, and the recovery of the data.

V. QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Protocol Calibration/Quality Assurance Procedures

The Bight'98 survey will be conducted cooperatively by a number of organizations which routinely monitor the marine environment according to established protocols. It is important to the success of the Bight'98 study that comparable data are collected by each Organization. This Field Operations Manual will provide information on how field operations will be conducted to meet this requirement. Chief Scientists and Boat Captains will be instructed on the field procedures to be followed during the survey and they, in turn, will instruct their field personnel on the proper procedures for the survey.

The Chief Scientist of each organization is responsible for distributing the Bight'98 Field Operations Manual to all field personnel ensuring that their staff understands and uses the protocols detailed in the manual.

Chief scientist/boat captain protocol orientation meeting

Chief Scientists and Boat Captains of all organizations participating in the survey will be required to attend a protocol calibration meeting, conducted prior to the survey on June 24, 1998. The goals and objectives of the Bight'98 were discussed at this meeting as well as the responsibilities of the Chief Scientist and Boat Captains during the Bight'98 survey. Each participating organization has been provided with a workplan and Field Operations Manual for Bight'98 and has been instructed on field procedures to be used during the survey, including proper entry of data on field data forms. The meeting emphasized decision making procedures for determining whether a station should be abandoned and whether a sample is acceptable. Lines of communication within the project and QA/QC activities occurring on the boat during the survey was also discussed.

Scientific team training

The Chief Scientist of each organization will train their field personnel, as needed, on the field operations to be conducted during the survey. It will be the responsibility of the Chief Scientist of each organization to review the Workplan and Field Operations Manual with their field crews and to ensure that they understand that these procedures must be followed during the survey. It is also the Chief Scientist's responsibility to train their field crews, as needed, on operations to be performed. Personnel that cannot perform an operation as required by the project will not participate in that operation.

Benthic sampling (see section 7)

The participation of several different vessels and field sampling teams in Bight'98 requires that uniform procedures be followed in the field to ensure high quality samples and consistent results. Field personnel will be provided with the Bight'98 Field Operations Manual and

instruction on sampling procedures, application of sample acceptance criteria, sample processing, and use of field data forms. All participants are expected to understand and properly carry out all steps in the collection, screening, relaxation, and fixation of infaunal samples; and the subsampling and handling of sediment chemistry and toxicity samples.

An attempt will be made to ascertain field sampling capability by means of field audits conducted by the Field QA Specialist, or designee, prior to sampling for the Bight'98 study. These audits will be conducted by representatives of the organizations who participated in the SCBPP (CLAEMD, LACSD, MEC, CSDMWWD, and SCCWRP) and have adopted the field methods prescribed in that survey as standard operating methods for routine monitoring. The following organization pairs have been established to coordinate and complete the QA audits: SCCWRP and CINMS and WIES; MEC and SeaVentures; CSDMWWD and SPAWAR; LACSD and MBC; and CLAEMD and ABC.

During the field audits, the QA Specialist will provide corrective instruction as necessary. The Field QA Specialist (or designee) may also conduct subsequent audits on benthic sampling procedures during the Bight'98 survey to ensure that sampling is conducted in a uniform manner and all required information is recorded by all field crews.

The goal of the Bight'98 survey is to collect grabs at all sites. However, a Measurement Quality Objective (MQO) of 90% has been established for completeness for the collection of the benthic samples. This completeness goal is established in an attempt to derive the maximum statistical power of the sampling design and was not set at 100% in recognition that some sites will be difficult, if not impossible, to sample with a Van Veen grab. Nevertheless, field crews are expected to strive to collect samples at 100% of the stations.

Trawl sampling (see section 8)

Demersal fish and invertebrate assemblage data (species identification, enumeration, biomass, and length) are significantly influenced by the collection methods. Therefore, strict adherence to prescribed sampling protocols is critical. Fish catches are influenced by gear type and deployment, tow duration, and towing speed. All organizations collecting samples in the field must use standard nets and follow standard trawling procedures to ensure that comparable samples are collected. Field personnel will be provided with the Bight'98 Field Operations Manual. The Chief Scientist of each organization is responsible for ensuring that their staff understands and uses the protocols as detailed in the manual.

Several QA/QC activities will help to ensure the quality of the trawl survey data. These include intercalibration checks of equipment, sample processing, and taxonomic identification. Trawl equipment, deployment, and sample processing protocol will be checked in presurvey (for new organizations) and in-survey visits to each vessel by the QA/QC auditors. The auditors will assure that methods used are those prescribed in the Field Operations Manual.

The QA/QC auditor will check trawling procedures and equipment to ensure that trawling is conducted in the same way by each organization and that the appropriate data is recorded on a

Field QA/QC Checklist (Appendix 7). The auditor will check to make sure that the net is rigged properly, that the appropriate data are recorded, that the trawl is deployed and retrieved properly, and that the catch is properly processed. A check will also be made to see that the scales are calibrated at the start of each day, that other pertinent processing equipment are on board, and that processing is conducted according to methods described in the field manual (Appendix7). The Chief Scientist will be notified of the audit results so that any problems can be corrected prior to sampling.

Presurvey field audits will be conducted by a QA/QC auditor on vessels of new participating organizations prior to the survey to assess equipment, vessels, standard protocols, and to instruct the crew, as needed, on the trawling procedures described in the manual. Precruise QA audit data will be recorded on a Field QA/QC Checklist (Appendix 7). The five primary agencies who participated in the SCBPP (CLAEMD, LACSD, OCSD, CSDMWWD, and SCCWRP) have adopted the field methods prescribed in that survey as standard operating methods for their routine monitoring, and, therefore, will not be audited prior to the survey. These agencies will provide required measurements or descriptions of equipment and vessels to be used in the Bight'98 survey.

Lead Bight'98 fish and invertebrate taxonomists will be designated prior to the sampling period. In addition, each organization will identify lead fish and invertebrate taxonomists that will participate in their part of the survey. These individuals must have the required expertise in field identification of trawl-caught fishes and/or invertebrates of coastal southern California at depths of 5-200 m. They will be responsible for providing accurate identifications of species collected during the survey.

While it is expected that the lead taxonomists of each organization have a wide range of knowledge of the common caught trawl species, it is not expected that all persons making field identifications know all species. It is, therefore, very important that each individual realizes their taxonomic limitations and that any guessing be avoided when it comes to finalizing an identification. An error made in the identification of an organism may result in an irretrievable error in the data base due to the fact that most of the organisms that are identified in the field are returned to the sea. If no one on board knows the identity of a specimen, that specimen will be returned to the laboratory for final identification. Once the final identity of any specimen has been ascertained in the laboratory, that change will be noted on either the trawl fish, or the invertebrate species sheets.

Several QA/QC activities will help to assure accurate taxonomic identification of fishes and invertebrates during the survey. Three presurvey QA activities will help to ensure the accuracy of taxonomic identifications made during the survey by providing training and intercalibration among organizations:

1) Prior to the survey, a list of recommended taxonomic identification aids will be distributed to participating organizations. Lists of trawl-caught fish and invertebrate species for southern California will also be distributed. A reference collection of voucher specimens of species collected in the SCBPP is available at SCCWRP for individuals

wishing to see species likely to be encountered in the survey. In addition, it is recommended (but not required) that field taxonomists attend one or more of the presurvey information transfer meetings given at SCCWRP on the identification of expected trawl species.

2) Taxonomists from participating organizations will participate in a field presurvey intercalibration exercise to ensure that each organization makes similar identifications on common species.

3) Taxonomists from each organization will also participate in a presurvey intercalibration exercise to assess the probability of taxonomic error in the survey. In this exercise, each organization will identify specimens of representative trawl-caught species in a bucket of fish and in a bucket invertebrates passed between organizations. A numbered tag will be attached to each organism, so that the identification can be checked against the correct specimen. This exercise will focus on identification errors. Correct identifications or "Return for Further Identification" are acceptable. The latter indicates that the specimen would be returned to the laboratory (where additional information or expertise can be found) for final identification. Organizations with more than 5% misidentifications (fish and invertebrates combined) will redo the exercise with a new bucket of organisms.

Measurement Quality Objectives (MQOs) for the trawl fish and invertebrate sampling effort are defined in terms of accuracy, precision, and completeness. Acceptability criteria have been established for trawl sample collection. The goal of the Bight'98 trawl survey is to collect samples at all designated trawl and tissue stations, to identify all of the organisms correctly, and to obtain accurate counts, measurements, and weights on all species. However, the MQOs will be set at lower values in recognition of the realities of field sampling. Because some stations may occur on rocky bottom, the MQOs for the study completeness objective for trawl sample collection will be 90%. Of the samples collected, 100% will be processed, identified, counted, measured, and weighed. Accuracy expectations for the crew performance is 95% for identification and 90% for counting, lengths, and biomass. The precision objectives are 90% for fish lengths and within 0.2 kg for biomass.

VI. SAMPLING LOGISTICS

Navigation

Accurate location of sampling sites is crucial to the success of the Bight'98 survey. Station charts and coordinates (latitude and longitude) are located in Appendices 1 through 3. Vessel positioning will be determined by means of a Differential Global Positioning System (DGPS). If, during the course of a field sampling day, the differential signal is interrupted or lost, sampling may continue using standard GPS.

Sampling Schedules

The benthic and trawl surveys may begin July 13, 1998. All field work may be completed in the order that each Organization sees fit, as long as the survey is completed by September 4, 1998.

All samples will be collected between sunrise and sunset. Otter trawl samples must be collected between one hour after sunrise and one hour before sunset. Some types of samples can be processed after dark if necessary but sample collection must be done during the day.

Station Types

Fifteen different strata of stations will be sampled during the survey. These strata are classified as follows: Channel Islands (California Current influenced), Channel Islands (Davidson Current influenced), Catalina Island, shallow offshore (6 to 30 m), mid depth offshore (30 to 120 m), deep offshore (120 to 200 m), river mouths, small POTW outfalls, large POTW outfalls, historical sampling sites (30 m depth), historical sampling sites (60 m depth), marinas, port/industrial, other bays or harbor areas, and San Diego Bay. The specific strata connected to a sampling station is identified in Appendix 2. In the event that relocating a station moves the station into a different sampling strata, the station will still be sampled and the new strata will be noted in the comments section of the field data sheet.

Cruise Log

The Chief Scientist will be responsible for maintaining a Cruise Log (Appendix 6), which will record the basic vessel, crew, and tide information along with all relevant activities conducted throughout the sampling day.

Site Acceptability Criteria

The location of each station will be designated in advance as a set of coordinates (latitude and longitude). Upon arrival at the site, the station depth will be determined by fathometer. This will be regarded as the nominal station depth for all subsequent sampling at the station during the survey and will be used for calculating station acceptability if the station must be moved.

Sampling may not be possible at some stations for a variety of reasons (e.g., kelp beds, rocky bottom, falling outside depth range, etc.). The fathometer reading at a station should be examined to determine whether the bottom is unsuitable for sampling. If the station cannot be sampled, the following rules will be followed:

- The station may be moved no more than 100 m (.054 nautical miles) from any assigned coordinate site and $\pm$ 10% of the nominal depth. No station will be sampled at depths greater than 220 m, or less than 6 m for the offshore stations, or less than 3 m for stations in bays or harbors.

- If, after three attempts to locate a suitable station, the station still falls in an area unsuitable for sampling, the station may be abandoned and the reasons for station abandonment will be recorded.

Site Rejection Strategy

A sampling site may be rejected if any of the following occurs:

- If the location places the site on land or in an obviously unsuitable location.

- If the site exceeds the depth boundaries (+/- 10 %) established for the project (e.g. < 3 m in bays and harbors, and offshore depths of < 6 m, > 220 m for trawls, and > 132 m for benthics).

- For benthic sites, if suitable substrate is not found after three attempts at the nominal location, and up to three attempts at two other locations.

- For trawl sites, if the fathometer survey identifies unsuitable substrate at three locations, if any equipment is lost or damaged, or if the site is deemed unsuitable by the Chief Scientist, or their designate, for a valid reason.

VII. BENTHIC SAMPLING

Sampling Effort

A total of 404 benthic stations will be sampled during the survey. The total number of stations sampled by each organization and the parameters to be sampled at each of these sites are listed in Table 1 and Appendices 2 and 3.

Van Veen Grab

A 0.1 m2 modified Van Veen grab will be used to collect sediment samples for physical, chemical, and infaunal analysis (Stubbs et al. 1987). This device is manufactured by Kahl Scientific Instrument Corporation, 737 West Main Street, El Cajon, California 92022 (619/444-2158). The grab may be galvanized, stainless steel, or Teflon-coated. All surfaces of the grab must be clean and free of rust. Either single or tandem Van Veen grabs are acceptable.

Grab Sampling Procedures

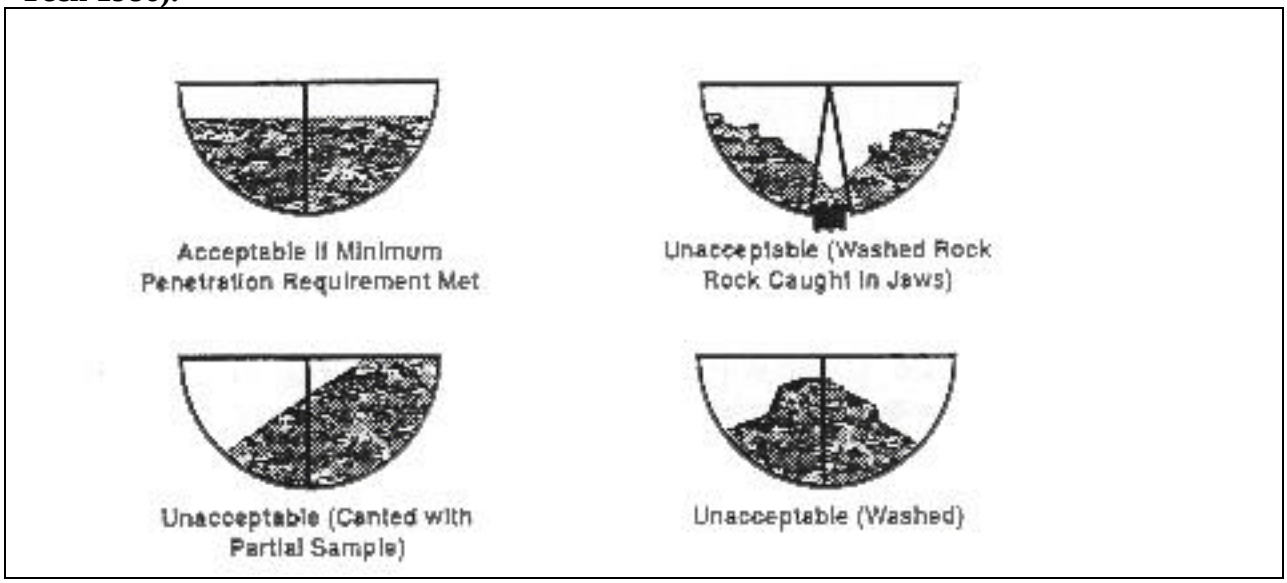
Prior to deployment, the grab is cocked with the safety key in place. The grab is then hoisted over the side, the safety key is removed, the grab is lowered at 2 m/sec until it is 5 m above the bottom where it is then lowered at 1 m/sec to minimize the effects of bow wave disturbance of the surface sediment. After bottom contact has been made (indicated by slack in the winch wire), the tension on the wire is slowly increased, causing the lever arms to close the grab. Once the grab is back on board, the top doors are opened for inspection. The first grab collected at a site should be used for the benthic infaunal sample. The chemistry and sediment toxicity samples will be collected from subsequent grabs.

Different sediment types (e.g. cobble, gravel, well sorted sands) and localities (e.g. canyons, slopes, rocky areas) may be difficult to sample. Sediments containing rocks create the most common problem by preventing complete closure of the grab by allowing sediment to wash out during retrieval. Some of the Bight’98 sampling sites may occur on these difficult sediment types or localities because of the randomized sampling design. Therefore, if after three unsuccessful attempts at a site and up to three more unsuccessful attempts at each of two other locations (within 100 m distance from and ±10% of the depth of the nominal site), the station should be abandoned.

Criteria for Acceptable Grab Samples

Upon retrieval of the grab the acceptability of the sample must be determined. Acceptability is based upon two characteristics of the sample: sample condition, and depth of penetration. Sample condition is judged using criteria for surface disturbance, leakage, canting, and washing (Figure 1).

Figure 1. Examples of acceptable and unacceptable grab sample condition (from Tetra Tech 1986).



An acceptable sample condition is characterized by an even surface with minimal disturbance and little or no leakage of the overlying water. Heavily canted samples are unacceptable. Samples with a large amount of "humping" along the midline of the grab indicating washing of the sample during retrieval are also unacceptable. While some humping will be evident in samples from firm bottoms where penetration has been poor, this is due to the closing action of the grab and is not evidence of unacceptable washing.

If the sample condition is acceptable, the overlying water is drained off and the depth of penetration determined by insertion of a plastic (rather than metal) ruler vertically along the grab midline and measuring to the nearest 0.5 cm. Sediment penetration depth must be at least 5 cm: however, penetration depths of 7-10 cm should be obtained in silt (fine sand to clay).

Extra caution should be taken to drain the overlying water from the grabs for chemistry and toxicity samples. It is recommended that a siphon be employed for these grabs to avoid disturbance and loss of the surface sediments. The overlying water in grabs intended for infaunal samples may be drained by slightly opening the jaws of the grab and allowing the water to run off, as long as all drained water is captured for screening with the sediments (see Sample Processing below).

If both sample condition and penetration are acceptable, sampling at the station proceeds with the collection of chemistry and sediment toxicity samples from successive grabs. It is required that all of the grabs taken at a station be of similar sediment type and depth penetration. If only one sample of a series of grab attempts is usable, the sediment sample should be kept for infaunal analysis.

Benthic Data Sheet

The Chief Scientist is responsible for the proper completion of the Benthic Data Sheet (Appendix 6) for each station. The information recorded on this sheet includes date, time of sampling, weather and sea state, navigational position, and other information applicable to the sampling site. For each sample collected (i.e. infaunal, chemistry, toxicity), sampling failures, grab penetration depth, sediment description (type, color, and odor), vessel location, and other sample handling information are to be recorded.

Sediment Description

The field description of sediments is required following measurement of penetration depth. The sediment should be characterized as being coarse sand, fine sand, silt or clay, gravel, or of a mixed type. The presence of petroleum tar and shell hash should also be recorded. Obvious odors, such as hydrogen sulfide (the odor of rotten eggs), petroleum, other odors, or a lack of noticeable odors should be recorded. General sediment colors (i.e., black, green, brown, red, olive, or gray) should also be recorded.

Sample Processing

Benthic Infaunal Samples

After the sample description has been completed, the sediment sample intended for biological analysis is washed from the grab and screened. All wash waters used on the sample are to be filtered in some fashion to prevent the accidental introduction of surface-water organisms. Thoroughly wash the sediment from the grab and transfer it to a sediment washing table for screening.

A means of capturing all water drained from the grab, the grab sample, and the wash water must be used. Typically, a tub ($\geq$70 L capacity) is positioned under the grab. The use of a sediment washing table is recommended, but not required. The table is useful in that provides a flat, smooth surface over which to spread and wash the sample, thereby providing a means of gently breaking up the sediment before it runs off the end of the table into the screen box. The screening box must be equipped with a stainless steel mesh with 1.0-mm openings. Wire diameter should be similar to that found in the U.S. Standard 1.00 mm Sieve (0.58 mm). The surface area of screen should be adequate to easily accept the sample without build up. Typical surface areas used in surveys in the Bight are 1500 to 2100 cm2. While washing the sample, control the water pressure to avoid damaging the organisms. Minimize direct application of water from the hose to the material and organisms collecting on the screen.

Once the sample has been washed through the screen, transfer the material (debris, coarse sediment, and organisms) retained on the screen to a sample container. The sample container is to be labeled with an external label containing the station name, sample type, date, and "split number" (i.e. 1 of 1, 2 of 3, etc.) if required. An internal label bearing the same information is placed inside the infaunal samples. This label is written in pencil or indelible ink on 100% rag paper, poly-paper, or other paper of a quality suitable for wet labels. The sample container must have a screw-cap closure and be sufficiently large to accommodate the sample material with a head space of at least 50% of the container volume. A sample may be split between two or more containers. However, each container must have external and internal labels (as described above) with the appropriate "split number" clearly marked. Field crews should have a broad range of sample container sizes available to them with none less than 16 oz (0.47 L) capacity.

Gently remove the material retained on the screen, taking care to avoid damaging the organisms. The sample container should be filled approximately 50 to 70% of capacity with screened material. After the bulk of material has been transferred to the container, closely examine the screen for any organisms caught in the mesh. Remove any organisms with forceps and add them to the sample container. Thoroughly wash the screen box and scrub the mesh before the next sample is screened.

All infaunal samples will be treated with relaxant solution for approximately 30 minutes prior to fixation. Either an epsom salts (MgSO4) solution or a propylene phenoxytol solution (formulations below) may be used for this purpose. Relaxant solutions may be used as the diluent water for the fixative, or may be decanted after exposure and replaced with diluted fixative. If it is used as diluent water, fill the sample container to 85 to 90% of its volume, close the container and invert it several times to distribute the solution. Leave the sample in the relaxant for 30 minutes. After 30 minutes top off the container with enough sodium borate buffered formaldehyde to achieve a 10% formalin solution. Close the container, once again, and invert it several times to assure mixing. Store the sample for return to the laboratory.

If the relaxant solution is not used as the diluent water, the relaxant must be removed from the sample container and replaced with 10% formalin. After the 30 minutes treatment, decant the relaxant from the sample through a screen with a mesh size of 1.0 mm or less. Insure that all animals are removed from the screened and placed in the sample container, then fill the container with sodium borate buffered 10% formalin rather than undiluted formaldehyde. Close the container, invert it several times to assure mixing, and store it for return to the laboratory. Relaxant and fixative stock solution alternatives are as follows:

Epsom salts relaxant solution:	1.5 kg Epsom salts ($MgO_4@7H_2O$) per 20 L of fresh water.
Propylene phenoxytol solution:	30 ml propylene phenoxytol to 20 L of seawater.
Buffered formalin solution:	50 g sodium borate ($Na_2B_4O_7$) per liter of formalin.
Buffered 10% formalin solution:	1 part buffered formalin to 9 parts fresh or salt water.

Sediment chemistry samples

Following collection of benthic infauna, the next grab(s) will be taken for sediment chemistry samples. Sediment in contact with, or within, 1 cm of the metal sides of the grab will be avoided in all cases, with the exception of grain size, to prevent sample contamination. Sediment samples will be collected from the top 2 cm for grain-size, total organic carbon (TOC), trace metal, and trace organic analyses by randomly subsampling undisturbed surface material with a stainless steel, Teflon-coated stainless steel, or plastic scoop. Samples will also be collected for acid volatile sulfur-simultaneously extracted metals (AVS-SEM) analyses using a plastic or a Teflon-coated metal scoop. At the very minimum, the scoop will be washed with soap and water and rinsed with deionized (DI) water between stations. It may also be rinsed with methanol, followed by acetone, hexane, or methylene chloride between stations but these solutions must be disposed of as hazardous waste. Use of a new scoop with each sample is also acceptable. Samples should be placed in precleaned sample containers provided by the analytical laboratory responsible for the sample analysis. The following container types, samples sizes, and storage requirements should be used with the analytical laboratory supplying all sample containers for all parameters except mineralogy:

- **AVS-SEM** -- Approximately 200 g of sediment material will be collected at each station with a plastic or a teflon coated metal scoop. Sample containers should be filled as quickly as possible to minimize contact with air. Each sample will be placed into a 250 mL polycarbonate centrifuge bottle without stirring (sample containers to be provided by EPA Newport, Oregon Laboratory). Avoid obvious macroorganisms, sticks, debris, etc. and take samples from at least three locations in the grab, at least 1 cm from any grab wall (if grab is not coated, or if it is teflon coated and in obviously poor condition). Containers are to be filled completely, leaving no head space. Samples should be stored at approximately 40C by placing them on wet ice or in a refrigerator until returned to the laboratory. Do not freeze these samples. Samples may be held for no more than three days before transport to SCCWRP. The inter-laboratory transport time will not exceed 24 hours.

- **Sediment Grain Size** -- Approximately 100 g of sediment material will be collected at each station by filling one 4-oz (118 mL) whirlpak, plastic, or glass container, taking care to leave an air space at the top. For the samples being analyzed by the City of San Diego, place tape around the snap lock cap to ensure that the sample remains closed during transport. Samples should be stored at approximately 4o C by placing them on wet ice or in a refrigerator until returned to the laboratory. Do not freeze these samples. They should be returned to the analytical laboratory within a week of sampling.

- **Total Organic Carbon** -- Approximately 200 g of sediment material will be collected at each station by filling one 8-oz (236 mL) plastic or glass container with a Teflon-lined lid, taking care to leave an air space at the top. Samples should be stored at <4o C by placing them on wet ice or in a refrigerator but must be frozen within 24 hours. If frozen, they should be returned to the laboratory within a week. If not frozen, they

should be returned to the analytical laboratory within 24 hours. If samples need to be transported, they should be packed in dry ice and shipped via overnight express or a local carrier.

- **Trace Metals** -- Approximately 200 g of sediment material will be collected at each station by filling one 8-oz (236 mL) plastic or glass container with a Teflon-lined lid, taking care to leave an air space at the top. Samples should be stored at <4o C by placing them on wet ice or in a refrigerator but must be frozen within 24 hours. If frozen, they should be returned to the laboratory within a week. If not frozen, they should be returned to the analytical laboratory within 24 hours. If samples need to be transported, they should be packed in dry ice and shipped via overnight express or a local carrier.

- **Trace Organics** -- Approximately two 200 g replicates or one 500 g sample of sediment material will be collected at each station by filling two 8-oz (236 mL) or one 16-oz (472 mL) glass containers with Teflon-lined lids, taking care to leave an air space at the top. Samples should be stored at <4o C by placing them on wet ice or in a refrigerator but must be frozen within 24 hours. If frozen, they should be returned to the laboratory within a week. If not frozen, they should be returned to the analytical laboratory within 24 hours. If samples need to be transported, they should be packed in dry ice and shipped via overnight express or a local carrier.

- **Mineralogy** -- 40 mL will be collected at each station and placed into a whirlpak or other suitable plastic container. Do not freeze these samples. There are no other special temperature holding requirements. These samples will be transported to SCCWRP.

Labeling of sample containers will be the responsibility of the field sampling groups with the following minimum information required on each sample label: station number, sampling date, parameter, split (if required).

<u>Sediment toxicity samples</u>

Following the collection of sediment chemistry samples, grabs will be taken for sediment toxicity analysis. The sediment collected will be used for three different types of tests: amphipod survival, Qwiklite luminescence, and sediment water interface. Sediment from all toxicity stations will be sampled for the amphipod survival test. Additional sediment from a subset of these stations (203) will be collected for the Qwiklite test. Samples for sediment water interface tests will be collected from 30 stations. Separate sediment samples are required for each of these tests.

As with other parts of the program, sample containers will be provided by the toxicity laboratories performing the required analysis. High-density polyethylene (HDPE) containers will be used for collection of amphipod and Qwiklite sediment samples. Sediment water interface samples will be collected in polycarbonate tubes. All sample containers will be provided by the analytical laboratory. Labeling of sample containers will be the responsibility of the field sampling

groups with the following minimum information required on each sample label: station number, sampling date, parameter, split (if required).

Sediment samples for amphipod and Qwiklite tests shall be collected from the top 2 cm by sampling the undisturbed surface material with a scoop. Scoops can be made of plastic (e.g., HDPE, Teflon, polycarbonate) or Teflon-coated material. Scoops should be stored in plastic bags when not in use. Contact with sediment within 1 cm of the metal sides of the grab should be avoided to prevent sample contamination. Sample volume requirements for each test are:

- Amphipod – 2.25 L (minimum of 1.25 L), distributed into two 1L containers and a 250 mL container

- Qwiklite – 125 mL (placed in a 250 mL container)

When taking sediment toxicity samples, the sediment from the grabs should be proportionally distributed into each sample container. A 1.5 L minimum will be required for sediment toxicity analysis, with at least 60 mL in the Qwiklite sample container. The station will be considered completed if 1.5 L of sediment has been collected with 5 or more grabs. If the required minimum 1.5 L has been collected with fewer than 5 grabs, then additional grabs will be taken until either 2.0 L have been collected, or 5 total sediment toxicity grabs have been taken. Sediments will not be homogenized in the field. Each labeled container should then be refrigerated, or placed on wet ice.

Samples to be analyzed by the Organization conducting the collection will be returned to their laboratory by the field crew. Samples to be analyzed by other laboratories will be transported to SCCWRP with a completed chain of custody sheet. The samples will be stored at SCCWRP for later distribution (Appendix 3).

Additional samples will be collected for sediment water interface tests (see Appendix 2) by personnel from the Marine Pollution Studies Laboratory. A grab will be subsampled with a series of small subcores. The subcore will be inserted to the sediment to a depth of 5 cm and a maximum of six subcores can be collected from a grab of sufficient penetration. A minimum grab penetration of approximately 10 cm will be needed to enable collection of a complete set of sample cores. The bottom of the subcore is then closed with a gloved hand for removal, the ends are fitted with caps and then wrapped with parafilm for a final seal. The subcores will be stored upright in an ice chest and to be later hand delivered by MPSL staff to the laboratory. Six subcores will be collected from 15 stations and 11 subcores collected from an additional 15 stations.

Any sample collection equipment which comes in contact with the sediment should be cleaned between stations with the procedures described above. Collection equipment should be stored in plastic bags when not in use. Alternatively, cleaned "sets" of sample collection equipment may be individually prepared and wrapped in plastic per station prior to sampling.

Samples may be held in the field, or laboratory, on wet ice, or in a refrigerator at 4o C, for

no more than three days before transport to the designated toxicity laboratories. The inter-laboratory transport time will not exceed 24 hours. Upon arrival to the analytical laboratory, the samples will continue to be stored at 4oC. Testing should begin within two weeks of sample collection. Chain of custody procedures should be followed throughout the sampling and analysis procedures.

VIII. TRAWL SAMPLING

Purpose

The purpose of trawl sampling is to obtain data on the abundance, biomass, diversity, and disease prevalence of demersal fish and invertebrate assemblages. It is also used to collect fish and invertebrates for tissue contaminant analysis. This information is useful in characterizing possible anthropogenic effects on demersal fish and invertebrate populations. Mearns and Allen (1978) provides a comprehensive description of how small otter trawls should be designed and used for conducting biological surveys in coastal waters.

Sampling Effort

A total of 378 trawl stations will be sampled during the survey. The total number of stations sampled by each organization and the parameters to be sampled at each of these sites are listed in Table 1 and Appendix 1, respectively

Collection Permits

The local office of the California Department of Fish and Game (CDFG) (San Diego, 619/237-7311; northern area, 562/590-5132) must be contacted prior to collecting fish and invertebrates. The caller will be asked for his or her name; scientific collector's permit number; date, time, and area of sampling; type of gear to be used; vessel size, color, and CF number or documentation; number of persons in party; and what organisms will be collected.

The permit must be on-board during sampling and must be presented to any CDFG warden or personnel who request to see it.

Otter-Trawl Specifications

A semiballoon otter trawl will be used to collect epibenthic invertebrates and demersal fish. Net dimensions are the following: 7.6-m headrope (25 ft); 8.8-m footrope (29 ft); 3.8-cm (1.5 in) body mesh; and a 1.3-cm cod-end mesh (0.5 in). This net will have 22.9-m (75 ft) long bridles made of 1.0-1.6 cm (3/8 to 5/8 in) diameter rope (e.g., Samson braid). The otter boards (doors) will have a width of 76.2 cm (30 in), height of 50.8 cm (20 in), and a suggested weight of 15.9 kg (35 lb). Slight deviations (< 10%) from these dimensions are acceptable. The door chains should be 5-mm (3/16 in) in diameter and should have the following numbers of links: front top -- 12; front bottom -- 11; back top -- 17; back bottom -- 16. At least 700 m (2296 ft) of wire is necessary to obtain a trawl at a depth of 200 m.

Pretrawl Survey

Trawl gear is likely to be lost if the trawl is hung up on bottom obstructions and replacement of nets can be costly. The bottom along a trawl course at a previously unsampled station can be examined by a fathometer. A pretrawl survey can enable the navigator to avoid

uncharted reefs and other obstacles that may cause damage to trawl gear. This survey should always be conducted at a new sampling site to determine whether the station is acceptable, or it should be abandoned.

The pretrawl survey should follow the expected trawl course along the isobath and the fathometer reading will be examined for rocks and other obstacles. If the first run indicates that the site is unacceptable, another survey will be conducted within 100 m and 10% of the depth of the original site. If this attempt is unsuccessful, a third attempt will be conducted at a different location using the same protocols. If after three unsuccessful surveys, the site will be abandoned.

Trawl Data Sheet

The Chief Scientist is responsible for ensuring that the proper data is logged on the Trawl Data Sheet (Appendix 6). The information recorded in the log includes water depth, length of tow wire used, times and coordinates (latitude and longitude) for net on the bottom and end of trawl (beginning of trawl retrieval); coordinates for net over and net on deck may also be recorded. Any anomalous conditions such as rocky bottom, rocks in the catch, and torn net will also be recorded in the log.

Net Preparation

The trawl should be properly prepared prior to trawling so that the net can be deployed in an orderly and safe manner. The net is laid out and stacked on the stern of the vessel in the same configuration that it will fish, with the cod-end to the stern, the floats up, and the footrope down. The trawl should be checked to make sure that the cod-end is tied, that the doors are connected properly to the leg lines, and that the bridles are connected to the doors and tow wire.

Trawling

The station coordinates must lie within the course of the trawl. Trawls will be towed along, rather than across, isobaths. While the vessel is underway the Boat Captain will order that the net be placed in the water. It is important that the floats skim the surface and that the net is not entangled while deploying the bridles. This small step could mean the difference between a successful or unsuccessful trawl. The bridles should be paid out by a person(s) on each side of the net, being careful to stand outboard of the bridle lines.

Use of the proper scope (i.e., length of wire paid out versus the water depth) is important to conducting successful trawls. After the net touches the bottom, a sufficient length of hydrowire (towing wire) should be deployed to ensure that the net is pulled from a horizontal rather than a vertical position. Insufficient scope will prevent the net from consistently fishing the bottom and will result in a no-catch, or a short-catch situation. In general, the required scope declines with increasing depth because the additional weight of the hydrowire enhances the horizontal component of the towing forces (Table 2).

Table 2. Recommended scope and length of wire for trawling at different depths in the Southern California Bight.

Water Depth (m)	Tow Wire Out (m)[1]	Approximate Scope (m)
<5	50	10.0:1
10	80	8.0:1
30	180	6.0:1
60	300	5.0:1
100	400	4.0:1
150	550	3.6:1
175	625	3.5:1
200	700	3.5:1

[1]Note that 25 m of bridle is included in this scope.

These scopes are for 0.6 cm (0.25 in) to 1.0 cm (0.38 in) tow wire.

Once on the bottom, the net is towed for 10 min (5 to 10 min in bays and harbors) at a speed over ground of 1.0 m/sec or 1.5 to 2.0 kn as determined by DGPS, a distance equal to about 600 m (300 to 600 m in bays and harbors).The distance covered during a trawl along with the known width of the net can be used to determine the area of bottom sampled. Trawl speed and duration will be recorded on the Trawl Data sheet.

At the end of 10 min, the net is retrieved and brought on-board the vessel. The cod-end is opened and the catch is dumped into a tub or holding tank where it can then be processed by the scientific crew.

Criteria for Accepting a Trawl

If the trawl is retrieved with little or no catch, its acceptability will be evaluated according to whether the trawl was conducted properly. A trawl is conducted properly if the proper depth, scope, speed, and distance or duration are maintained, if it is not fouled (net tangled), and if there is some evidence (e.g., rocks, benthic invertebrates, benthic fish) that the net was on the bottom. If any of the trawl procedures were not followed, if the net was fouled, or if there was no evidence of contact with the bottom, the trawl will be considered unacceptable and another trawl will be conducted at that site.

If the net is torn sufficiently to allow escapement during the course of a trawl, the station will be abandoned. If the trawl hangs up on the bottom, the site can be resampled or abandoned at the discretion of the Chief Scientist. If retrawling that station proves unsuccessful after another two attempts, the site will be abandoned.

Sample Processing

Sorting

The trawl catch will be sorted on deck into containers. Initially the catch will be rough sorted into major categories (e.g., urchins, shrimp, other invertebrates, flatfish, rockfish, other fishes). The categories used are not important but it is more efficient to sort into rough categories before identifying to species. Debris should also be sorted into containers for processing.

Identification

An attempt will be made to identify all trawl-caught organisms in the field using the recommended taxonomic keys and field guides. If unresolvable conflicts arise in the field over the identification of an organism, a note will be made on the appropriate data sheet and the organism will be returned to the laboratory for identification. When the identification has been resolved, the correct identity of the species will be recorded on the original data sheet. If the laboratory identity differs from that recorded in the field, the original name should be crossed out with a line. Do not erase the original name.

Under no circumstances should an organism be discarded if the identity is questioned. Each organization must know its own limitations in identifying organisms.

All fish will be identified, however, only invertebrates meeting specific criteria will be identified. There are likely to be many small infaunal and pelagic species that are incidental to the trawl catch, but only organisms that are greater than 1 cm in any dimension will be identified. Colonial and pelagic organisms will be noted, but not enumerated and infaunal organisms will not be documented. The presence of obvious free-occurring fish parasites, such as leeches or cymothoid isopods, will also be noted.

A recommended list of field guides and taxonomic aids for identifying fish and invertebrates will be distributed to all of the participating organizations prior to the survey. The most basic and comprehensive guides for fish are Miller and Lea (1972) and Eschmeyer et al. (1983). Allen (1977) provides information for identifying juvenile rockfishes (*Sebastes* spp.) and Kramer et al. (1995) provides information for identifying flatfishes. Generally, there are no widely comprehensive guides to the epibenthic invertebrates.

Either common or scientific names of fish may be used in the field. Only standard common and scientific names of fishes given in Robins et al. (1991), or a list of California fishes

(Allen in prep.) will be acceptable. Scientific names of invertebrates will be used in the field (SCAMIT 1998).

Each organization should have a kit containing a variety of tools which will aid in field identification. This kit should include forceps (small with sharp points and large with blunt points); a hand lens; dividers or calipers; dissecting needles; scalpel with scalpel blades; probe; and plastic ruler in millimeters.

Length Measurement

All fish will either be measured using a measuring board or, for very large specimens, using a meter stick or tape measure. A measuring board typically consists of either a flat or trough shaped board with a part of a meter rule embedded in the base. A smaller board is attached perpendicular to the zero-end of the meter stick. Trough-shaped boards are useful in keeping groups of fish on the board during measurement. Centimeter size-classes are marked along the side of the measuring board with the number of the size class marked next to the appropriate centimeter.

During measurement, the anterior portion of the fish is pushed up against the board at the zero-end of the measuring rule. Maximum (board) standard length (i.e., anterior tip of head to base of caudal fin) will be measured on bony fishes (Figure 2) and total length will be measured on cartilaginous fishes; wingspan will also be measured for stingrays because the tips of their tails are frequently broken off. The length of all fish specimens will be reported in size classes of 1 cm intervals (Mearns and Allen 1978). The first centimeter size class (size class number 1) extends from 0.1 to 1.0 cm; size class 2 extends from 1.1 to 2.0 cm, and so forth (Figure 3).

All species will be recorded on the Trawl Fish Species Data Sheet, or Trawl Invertebrate Species Data Sheet (Appendix 6). For species with 10 or fewer individuals, measurements (e.g., size-class 8) will be written on the Trawl Fish Species Data Sheet, separated by commas (Appendix 6). For species with greater than 10 individuals, the size classes will be recorded on the Trawl Fish Size-Class Sheet (Appendix 6) while only the names, the weights and the total number of individuals will be recorded on the Trawl Fish Species Data Sheet.

An attempt should be made to size-class all fish. For the rare occasions when size classing is not possible (e.g., a huge catch of a single species), a subsample of several hundred fish should be measured and the reason for deviating from prescribed procedures should be documented. (Note: Catches of greater than 2,300 individuals of a single species have been measured in past surveys). Lengths of invertebrate species will not be measured.

Figure 2. Endpoints for maximum standard length (SL) and total length (TL) for bony fish.

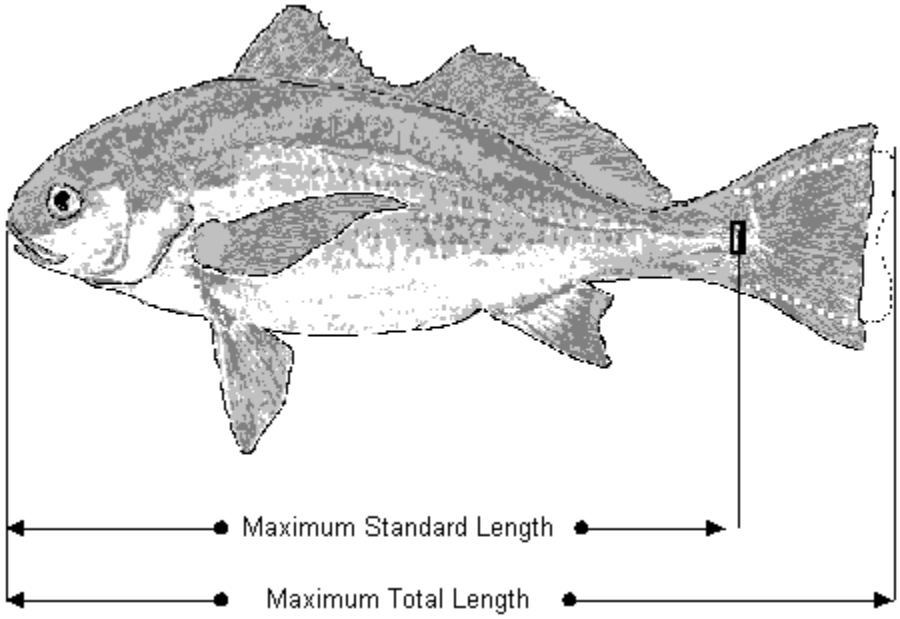
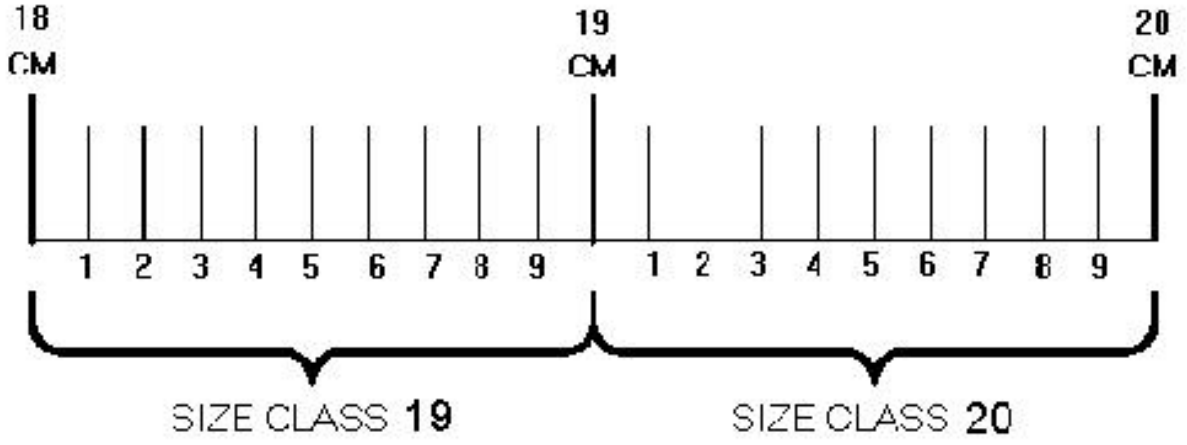


Figure 3. Relationship of cm size classes to mm values using cm and mm marks on a meter stick where size class 20 is defined as 19.1 to 20.0 mm.



Weighing

At a minimum, each Organization should have a range of spring scales that are capable of weighing to the nearest 0.1 kg, and a tare bucket with holes through the bottom or another suitable container (e.g., net bag) on board. Spring scales should be calibrated on a daily basis using a standard set of at least three weights. Tare buckets should be washed periodically to remove slime.

The biomass of each species will be measured with a spring scale. Species with a biomass greater than 0.1 kg will be recorded to the nearest 0.1 kg. The tare container will be weighed while empty and this weight will be subtracted from the weight of the gross weight (species plus tare container) to give the weight of the species (net weight). Tare and gross weight can be recorded on the data sheet but are not required. Small species weighing less than 0.1 kg will be set aside and weighed together to provide a composite weight. Composite weights greater than 0.1 kg will be recorded to the nearest 0.1 kg. Composite weights of less than 0.1 kg will not be rounded; they are to be recorded as "<0.1 kg". There will be one composite weight for fish and one composite weight for invertebrates. These weights will be used in calculating the total biomass of the catch.

Large organisms may be weighed individually. Individual weights of smaller specimens may also be collected using a range of scales capable of weighing to the nearest 0.1 g.

Debris weights should be quantified on the Trawl Debris Data Sheet (Appendix 8?) by classifying specific types identified on the data sheet by quantity categories: trace (<0.1 kg); low (approx. 0.1-1.0 kg); moderate (approx. 1.1-10.0 kg); and high (>10.0 kg).

Enumeration

Total numbers of fish will be tallied following the measurement of lengths. The total number of each species (including those size-classed) should be recorded on the Fish Species List and Fish Size-class Data Sheets.

Most invertebrates will be enumerated following identification. If the number of individuals in particularly abundant species make individual counts impractical, the total number will be estimated from the total biomass of the species. A known number of representative individuals will be subsampled from the catch and weighed. The remainder will then be weighed and the total number of individuals will be calculated (i.e. divide the total biomass by the subsample weight).

Presence of trawl debris should be noted on Trawl Debris Data Sheets (Appendix X) by identifying specific debris types and estimating quantities.

Examination for gross pathology

During the identification and measurement procedures, fish and invertebrates will be examined for gross pathology. This involves scanning an individual organism for anomalies and noting any observed pathology for fish (by abbreviation) next to the length of organisms during measurement on the appropriate data sheet. Cooper (in prep.) provides information for identifying anomalies in local fishes and invertebrates. The following anomalies will be noted for fish:

- Fin (and tail) erosion
- Tumors
- External parasites (e.g., copepods, isopods, leeches)
- Color anomalies (ambicoloration, albinism) (Mearns and Haaker 1973)
- Skeletal deformities
- Lesions
- Other anomalies

An observation should be noted next to the individual length on the Fish Species Data Sheet.

For invertebrates, burnspots and other anomalies will be noted in the comment section of the Trawl Invertebrate Species Sheet (Appendix 6).

Fin erosion can be found on the dorsal, anal, and caudal fins of flatfishes, and on the lower caudal fin and pelvic fins of bilaterally symmetrical fishes. Tail erosion occurs on the top and bottom of the caudal fins of bilaterally symmetrical fishes. Tumors can be smooth and rounded (angioepithelial nodules) or furrowed (epidermal papillomas). Externally obvious copepod parasites occur on the eye, fins, or body of fish. Cymothoid isopods occur in the gill cavities of fish or on the body; they often fall off. Leeches occur on the body of some flatfishes. Skeletal deformities include crooked backs, snub noses, or bent fin rays. Lesions include sores that do not appear to be due to net damage. Burnspot disease is found on crabs and some shrimps; its lesions resemble cigarette burns.

Representatives of fish and invertebrates with each disease or parasite should be vouchered. All fish with tumors, fin erosion, and lesions, as well as all invertebrates with burnspot diseases will be returned to the laboratory and vouchered.

Processing stage monitoring

Accidental omissions can be occasionally made if a bucket of organisms is not processed. This can be avoided by attaching a colored rubber tag (made of a square with a slit in one side) to the handle of each bucket to indicate a particular stage of processing. For instance, different tags can represent that the bucket is ready for identification, measurement, weighing, preservation, or discarding. As the bucket progresses to the next stage, the current tag can be pulled off and a new tag can be added. This procedure is not necessary for small catches but may be helpful when catches are large. Tags with commonly caught species names can also be temporarily attached to

buckets to facilitate sorting and processing.

Safe handling of organisms

Field personnel are likely to encounter a variety of organisms that are potentially harmful. The California scorpionfish (*Scorpaena guttata*) has venomous fin spines with which even a small wound can cause severe pain throughout much of the body. Handle this species with leather gloves or pliers. Hot water, meat tenderizer, or ammonia should be applied to any wound resulting from being stuck by a spine. Heat is effective in breaking down the protein in the venom. Several other species of rockfishes and the spotted ratfish (*Hydrolagus colliei*) also have mildly venomous spines which can cause a burning sensation. The round sting ray (*Urolophus halleri*), the California butterfly ray (*Gymnura marmorata*), and the bat ray (*Myliobatis californica*) all have venomous spines on their tails.

Pacific electric ray (*Torpedo californica*) can emit a strong electric shock. When handling this species, hold it by the tail. Do not grasp the disk with both hands!

The Pacific angel shark (*Squatina californica*), the spiny dogfish (*Squalus acanthias*), the spotted ratfish, the Pacific electric ray, and the California halibut (*Paralichthys californicus*) can give painful bites.

Care must also be taken in handling the blueleg mantis shrimp (*Hemisquilla ensigera*). This species can inflict severe cuts with its raptorial appendages. Care should also be taken in handling any of the large crab specimens.

Preservation of samples

Fish and invertebrate specimens may be preserved or documented for QC or identification purposes in one of three ways: 1) fixing in buffered formalin-seawater; 2) freezing; or 3) photographing.

Most smaller specimens and fish with fin erosion, tumors, or lesions will be fixed in 10% buffered formalin-seawater. Buffered formalin is made by mixing 50 g Na2B4O7 (sodium borate) per liter of formaldehyde or 5 g per liter of 10% formalin. All specimens with tumors, fin erosions, or lesions should be fixed in this manner. If the specimen is larger than 60 mm, the body cavity should be slit with a scalpel on the right (for most bilaterally symmetrical fish), blind (for flatfish), or ventral side (for dorsoventrally flattened fish, such as rays) thereby allowing the formalin to bathe the internal organs. Note that by convention, bilaterally symmetrical fish are photographed or drawn with their heads facing left and, hence, dissections are conducted only on the right side of the fish. Fish and invertebrates will be placed in plastic bags or plastic jars and fixed in 10% buffered formalin-seawater. Fish should be inserted tail-first into jars so that they can be removed easily without destroying the fin rays or spines.

Fish should remain in formalin for up to a week before being transferred to freshwater. The fish should be left in the freshwater for a minimum of two days, making sure to change the water at least once during that period. The fish should then be transferred to 50% isopropanol (isopropyl alcohol) or 70% ethanol for preservation.

Trawl-caught invertebrates will also be fixed in 10% buffered formalin-seawater and preserved in 70% ethanol. If specimens in formalin are retained at the collecting Organization's laboratory for more than one week, it is the responsibility of that laboratory to complete the preservation of the specimens (i.e., rinse in water and transfer to isopropanol or ethanol). Specimens that are returned to SCCWRP within one week will be processed for final preservation, then vouchered by SCCWRP.

Larger specimens can be placed in plastic bags and frozen on dry ice or placed in a freezer if sufficiently large containers are not available or if large quantities of fixative are required. These can then be thawed and fixed in the laboratory with 10% buffered formalin solution. However, large specimens with tumors, fin erosion, or lesions should be fixed in the field with formalin rather than frozen.

Small invertebrates (e.g., nudibranchs) may be kept cold in seawater and returned alive to the lab for identification.

Large specimens (and colorful species) of fish and invertebrates can be vouchered in the field by photographing them with color slide film. For larger specimens only, the photographs will document the species of organism; for smaller species, a voucher specimen must be preserved. Photographs should attempt to show the overall appearance of the specimen, as well as any important identifying features. Photographs of unidentified rockfishes should be taken as soon as possible after capture because their color, which is an important taxonomic character, fades during preservation. Bilaterally symmetrical fish and dorsoventrally flattened fish (skates, rays) should be photographed facing left. Flatfishes should be photographed with the eyed side up. The left-eyed species should be photographed facing to the left and the right-eyed species should face to the right. The gill cover should cut the lower profile of the body. If anomalies occur on any specimens being photographed, those features will be also be photo-documented. All specimens should be photographed on a light background with a meter stick along side and a label giving date, station number, and species in large bold letters. Note should be made of character states that can aid in identification (e.g., counts of fin rays, gill rakers, and scales).

Specimens preserved for further identification must be noted on the field data sheet. Note whether the organism is fixed, frozen, or photographed. A photograph log should be kept during the survey, documenting species name, the frame number, the date and the station location of each photograph.

Fish Samples for Bioaccumulation/Biomarker Studies

Target Species

The geographic and depth range of the study precludes selecting a single species. The fish bioaccumulation study will target two categories of fish:

Category 1 -- sanddab guild species: speckled sanddab (*Citharichthys stigmaeus*), longfin sanddab (*Citharichthys xanthostigma*), Pacific sanddab (*Citharichthys sordidus*), gulf sanddab (*Citharichthys fragilis*), slender sole (*Eopsetta exilis*), small (<20 cm) petrale sole (*Eopsetta jordani*), and small (<20 cm) juvenile California halibut (*Paralichthys californicus*);

Category 2 -- turbot guild species: diamond turbot (*Hypsopsetta guttulata*), spotted turbot (*Pleuronichthys ritteri*), C-O sole (*Pleuronichthys coenosus*), horneyhead turbot (*Pleuronichthys verticalis)*, curlfin sole *(Pleuronichthys decurrens*), Dover sole (*Microstomus pacificus*), English sole (*Pleuronectes vetulus*), and rock sole (*Pleuronectes bilineatus*).

Composites/resampling

For Category I (sanddab guild) species, a sample composite will consist of six fish of an age class, whereas, for Category II (turbot guild) species, a sample composite will consist of 3-6 fish less than 20 cm (size classes 5 to 20) (Table 3). At each station, composites should be made for each age class of all Category I species and similarly, composites should be made for all Category II species.

Table 3. Age size classes (cm) for bioaccumulation target fish species.

Category	Species	Age Class 0	Age Class 1	Age Class 2
I	speckled sanddab	5-7	8-10	11-16
I	longfin sanddab	5-8	9-13	14-16
I	gulf sanddab	5-7	8-10	11-14
I	Pacific sanddab	5-8	9-13	14-16
I	petrale sole (juv)	5-7	8-14	15-20
I	slender sole	5-8	9-10	11-12
I	California Halibut (juv)	5-9	10-20	
II	diamond turbot		5 - 20	
II	C-O sole		5 - 20	
II	spotted turbot		5 - 20	
II	Horneyhead turbot		5 - 20	
Category	**Species**	**Age Class 0**	**Age Class 1**	**Age Class 2**

II	curlfin sole	5 - 20
II	Dover sole	5 - 20
II	English sole	5 - 20
II	rock sole	5 - 20

Bioaccumulation fish will be collected from the first trawl at a station after it has been processed for assemblage data. If no individuals of Category I species are encountered during the first trawl, no additional trawls will be required and the station will be abandoned (keep any complete composites of Category II species). If six individuals of an age class of a Category I species are collected during the first trawl, tissue sampling at that station is complete and no additional trawling is necessary.

If category I species are collected in the first trawl, but with fewer than six individuals in an age class, additional trawls will be required to complete an entire composite. If six individuals of an age class of a Category I species are collected in the second trawl, tissue sampling at that station will be considered complete and no additional trawls will be required for bioaccumulation. By the end of the third trawl (30 min total trawl time), if an insufficient number of fish are collected for bioaccumulation or biomarkers, no further trawl samples will be collected. No more than 30 minutes of trawling will be required at any of the trawling sites in Bight'98 with the first trawl only at each station processed for assemblage data.

At the end of trawling at a station, all complete composites should be saved for all Category I and II species (i.e. any age of any Category I species with six fish, as well as any Category II species with 3-6 individuals). This will be done because the best combination of species and age classes for chemical analysis will not be known until the end of the survey.

Preservation

Whole fish age-class composite samples for each species will be packaged in Ziploc plastic bags and placed on dry ice, or in a freezer. Fish samples (composites) will be recorded on the Trawl Cover Sheet (Appendix 6). A label including the date, station, species, and number collected should be placed in each bag and an external label must be stuck on the outside of the bag. In addition, the bag should be labeled on the outside with a felt-tip marker. Any samples to be processed in-house will be transported to the analytical laboratory of that organization. If the analysis is to be run elsewhere, the samples will be shipped to SCCWRP within a week of collection.

Biomarkers

Overview of sampling design

Blood and liver/gall bladder samples for biomarker measurement will be obtained from fish collected from two strata: bays and harbors; and Channel Island sites. Fish collection methods will be the same as those used for collection of fish bioaccumulation studies. Because biomarkers degrade rapidly after a fish has died, the fish will be dissected on board by trained personnel soon after collection, and tissues immediately frozen using liquid nitrogen or dry ice.

Equipment and procedures

Fish from San Diego Bay will be dissected on board by SPAWAR Systems Center San Diego (SPAWAR) personnel. The sampling schedule for San Diego bay should be coordinated with Scott Steinert (619-553-5615), who will provide dissection personnel for these samples. Fish from other locations will be dissected by SCCWRP staff or the field crew (after SCCWRP training). Additional samples from selected nearshore reference areas may be collected if samples can be obtained without additional sampling effort (i.e., extra fish are available during a cruise when dissection personnel are present). In order to make the necessary arrangements for biomarker trawls that are to be staffed with SCCWRP personnel, Jeff Brown at SCCWRP (714-894-2222) should be contacted with at least 24 h advance notice.

A minimum of five fish from a single fish species of the sanddab guild will be processed at each site for the biomarkers study. Additional individuals (maximum of 10) will be processed if they are available and time permits. The most abundant target species (at minimum) at that station will be dissected. Fish for the biomarkers study may come from the same trawl as fish collected for the bioaccumulation study, or from additional trawls if insufficient numbers of fish were collected. The same specimens will not, however, be shared between the two studies.

Dissections should be done in an area of the boat that is as free as possible from sources of PAH's (e.g., diesel fumes). Standard length, species, sex, maturity, time of dissection, and condition of fish will be recorded for each specimen. Blood will be collected by cutting a gill arch, and collecting the resulting blood separately for each specimen in prelabeled plastic microfuge tubes containing PBS/Pronase K/10% DMSO. Dissections will be conducted on boards covered with clean polyethylene sheeting using scissors and forceps. Livers and gall bladders will be removed from each fish as a single unit and put into 19 x 51 mm glass shell vials. All tissues will be frozen on dry ice immediately after dissection. Dissection tools will be cleaned by rinsing with deionized water between samples. Polyethylene sheeting will be replaced as needed. Prior to each day of sampling, instruments will be cleaned by a detergent scrub, followed by acid, methanol, and deionized water rinses.

SPAWAR will keep blood samples from fish collected in San Diego Bay and those collected on SPAWAR vessels in LA/Long Beach Harbor. Blood samples from other locations, and all liver/gall bladder samples will be delivered to SCCWRP within 24 h by field personnel, or shipped by overnight courier. The blood samples will then be sent to SPAWAR.

Shipping information for liver/gall bladder samples:

Jeff Brown, SCCWRP
7171 Fenwick Lane
Westminster, CA 92683

Quality Control Procedures

In addition to the presurvey QA/QC protocols, the following QC activities will check on the accuracy of taxonomic identifications and counts made during the survey:

- During the survey, taxonomic identifications will be checked during at least one visit to each vessel by SCCWRP designated taxonomists. They will observe species identification by each organization in the field and record the data on a Taxonomy QA/QC Data Sheet (Appendix 7). Their duties include rechecking the identifications of at least 25% of the species collected during the day and noting any problems with the identification of pathologies. The Chief Scientist will be informed of any problems and the field personnel will be instructed regarding the appropriate identifications as needed. Each vessel will be expected to have appropriate taxonomic identification aids during the survey.

- During the survey, QA/QC data will also be collected on variability in trawl data collection. On each survey day, the Chief Scientist, or a delegate, will reprocess two randomly selected fish species (of at least 10 fish) that have already been counted, measured, and weighed. These species will be recounted, reweighed, and remeasured. A record of the counts, weights, and lengths of these quality control checks along with the original values will be maintained on a separate size class data sheet and a note will be made in the trawl comments on the original trawl data sheet that the recount was taken.

- Voucher specimens of each species collected by each organization will be preserved and returned to SCCWRP during the survey (see Voucher Collection below). The identification of these specimens will be checked by a qualified taxonomist following the survey to further ensure that identifications were made correctly. Errors in species identifications must be corrected in the data. Anomalies will be verified by a qualified pathologist.

Voucher Collection

The Bight’98 voucher collection of trawl organisms will be developed during the course of the survey and will be housed at SCCWRP. This collection will document the species taken during the survey and what names were applied to each. It will also document the types of diseases or anomalies found in the gross pathology examinations. It is also recommended that

each organization develop a voucher collection at their organization. The voucher collection will consist of preserved organisms and photographs of organisms.

Each organization will be provided with a list of trawl fish and invertebrate species. For every species caught, each organization will provide at least one representative of that species to the Bight'98 voucher collection. Thus for many species, the Bight'98 voucher collection will contain representatives from all organizations involved in data collection. As species are collected, they will be checked off the list. Each Organization will give specimens to the Bight'98 voucher collection, before including them in their own collection.

IX LABELING AND SHIPPING OF SAMPLES AND FIELD DATA SHEETS

Sample Labels/Tracking

Each sample will be identified and tracked by the station, parameter, date sampled, and split number if required. Individual log numbers may be used at the discretion of the sampling organization. Sample log numbers will be handled by SCCWRP for the samples shipped to SCCWRP that are not run by the organization that collected them in the field.

Labels

Labels will be printed by the Organization responsible for field sampling prior to the survey and will include, at a minimum, the station number, parameter, date, and split (i.e., 1 of 1, 2 of 3, etc.). Dates will be reported as day/month/year. External labels should be covered with clear postal tape to prevent them from falling off the container if they will not stick on some surfaces.

Field Data Sheets

Benthic data sheets and cruise logs are to be retained by the sampling organization until sampling is completed. Trawl data sheets will be returned to the Organization's laboratory and held there until all species identifications are complete. Data on species identified in the laboratory must be added to the data sheets and verified within the laboratory. Upon completion of laboratory identifications, original field data sheets are to be sent to SCCWRP with copies retained by the sampling organization. Trawl fish and invertebrate data will be submitted as hard copies and either electronically or on diskettes to SCCWRP as soon as the data sheets are complete.

Shipping of Samples

All sediment, tissue chemistry, and toxicity samples not analyzed by the field sampling organization's laboratory will be shipped to SCCWRP along with the trawl voucher collection specimens. Most samples do not have to be delivered on the day of collection but can be held for a few days and shipped once a week. All shipping of samples will be the responsibility of the field sampling organizations. See Appendix 9 for detailed SCCWRP shipping information.

Chain of Custody Forms

Chain of custody forms (Appendix 6) are to be filled out at the end of each sampling day detailing the transfer of samples from the vessel crew to the laboratory, or to delivery personnel. A form is to be filled out for each set of samples that will be transferred to a specific location. The sample and container type is to be included on the form to identify the samples being transferred. This form is to be signed by the crew member transferring the samples and the laboratory staff member receiving them. A copy of the form is to be kept and the original form

with signatures will accompany the samples. If samples are shipped by carrier, a copy of the chain of custody form is to be faxed to SCCWRP for tracking purposes.

X. CONTINGENCY PLANS

Purpose

Any field program can be affected by factors outside the control of the sampling crews. Weather, equipment failure, errors in designating station locations, and accidents can all prevent the field crews from obtaining samples at one or more stations. Contingency plans made in advance of the survey can greatly facilitate decision-making in the field. It is the responsibility of the Chief Scientist to make most of these decisions in the field, based on the protocol described below. If there is any question regarding which protocol to follow, the Field Coordinator should be notified immediately.

Adverse Weather Conditions

It is the responsibility of both the Boat Captain and the Chief Scientist to determine if weather conditions are sufficiently bad to prevent sampling. The Chief Scientist should evaluate all alternatives, such as changing the sampling plan to more protected areas or returning to the prescribed schedule when the weather improves. Every attempt should be made to avoid wasting the entire day. However, the safety of the crew is the number one priority.

Station Inaccessibility

Stations can be inaccessible because 1) they were incorrectly positioned on land 2) in water too shallow for the boat, or 3) they cannot be sampled for unforeseen circumstances. If it cannot be sampled, the sampling site will be moved to a location within 100 m horizontal distance from the original site, staying within 10% of the depth of the original site. If it still cannot be sampled, the station will be abandoned. No station should be sampled in less than 3 m or more than 220 m.

Lost Gear

Lost gear can potentially have a significant effect on the sampling program. Equipment can be expensive and spares may not be available in a timely manner. Crews should take every precaution against the loss of gear by properly tightening shackles and other connectors.

If important gear is lost, notify the Boat Captain immediately, so he can record the position using the vessel’s navigation system. If possible, deploy a buoy at that exact location so relocation is made easier. Attempt to recover the equipment for a reasonable amount of time. If unsuccessful, use spare equipment (when available) or continue sampling without that particular equipment. Notify the Field Coordinator as soon as possible when equipment is lost.

XI. WASTE DISPOSAL

Proper disposal of all waste is an important component of field activities. At no time will any waste be disposed of improperly. The proper methods of waste disposal are outlined below:

Routine Garbage

Regular garbage (paper towels, paper cups, etc.) is placed in trash containers on board the boats. It can then be disposed on land in public receptacles or recycled.

Detergent Washes

Biodegradable detergents are recommended for cleaning the Van Veen Grab, or deck.

Chemicals

Acetone, formalin, hexane and methylene chloride are hazardous materials and should be disposed of by following all appropriate regulations. They should never be disposed at sea.

Fish Waste

After each trawl catch has been processed completely, the remaining catch should be disposed of at sea. Discretion should be used. For sampling conducted nearshore or in bays and harbors, return only live fish and invertebrates to the area that trawling occurred. All of the remaining fish should be disposed of offshore. Under no circumstances should fish be given to the public.

XII. FIELD DATA BASE MANAGEMENT

A field computer system has been developed for the Bight'98 that includes the forms with all of the fields for all of the field data sheets. This system employs lap-top computers and has an instruction manual for training and reference. Use of the field computer system is optional during the Bight'98 survey.

The data entry screens are identical to the field data sheets. Data can either be entered into the computer while at sea, or it can be taken from the data forms at a later time. Although hard copies of all field data sheets are mandatory, these can either be hand-written, or hard copy print-outs from the computer.

The data entered into each field of the electronic forms is checked automatically by the software and it provides a warning when the data do not fall within an expected range. After entering the data into the field computer system, it will be printed out to hard copy and checked by the Chief Scientist against the original handwritten data sheets. Once the data have been checked, corrected (if necessary) and accepted by the Chief Scientist, the crew will not be granted access to the data any further.

XIII. BIGHT'98 PROGRAM ORGANIZATION

Steering Committee

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SCCWRP
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George Robertson (Co-Chair)
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QA Officer

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XIV. LITERATURE CITED

Allen, M. J. 1977. Southern California trawl-caught juvenile rockfishes (Preliminary). S. Calif. Coastal Water Res. Proj., El Segundo, CA. Proc. Taxonomic Standardization Program 5 (4): 25-32.

Allen, M.J. In prep. Annotated checklist of marine and freshwater fishes of California.

Cooper, L.D. In prep. Guide to gross external diseases and anomalies of trawl-caught fishes and invertebrates of southern California.

Eschmeyer, W. N., E. S. Herald, and H. Hammann. 1983. A field guide to Pacific Coast fishes of North America. Houghton Mifflin Co., Boston, MA. 336 pp.

Kramer, D. E., W. H. Barss, B. C. Paust, and B. E. Bracken. 1995. Guide to northeast Pacific flatfishes. University of Alaska, Fairbanks, Alaska Sea Grant College Program, Fairbanks, AK. 104 pp.

Mearns, A. J., and M. J. Allen. 1978. Use of small otter trawls in coastal biological surveys. U. S. Environ. Prot. Agcy., Environ. Res. Lab., Corvallis, OR. EPA-600/3-78-083. 33 pp.

Mearns, A. J., and P. L. Haaker. 1973. Identifying and coding color anomalies in flatfishes. S. Calif. Coastal Water Res. Proj., El Segundo, CA. TM 200. 6 pp.

Miller, D. J., and R. N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Dep. Fish Game, Fish. Bull. 157. 249 pp.(addendum in 1976).

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. 5th edition. Am. Fish. Soc., Spec. Publ. 20. 183 pp.

SCAMIT. See Southern California Association of Marine Invertebrate Taxonomists.

Southern California Association of Marine Invertebrate Taxonomists. 1998. A taxonomic listing of soft bottom macro and megainvertebrates from infaunal and epibenthic monitoring programs in the Southern California Bight. Edition 3. S. Calif. Assoc. Mar. Invert. Tax., San Pedro, CA. 168 pp.

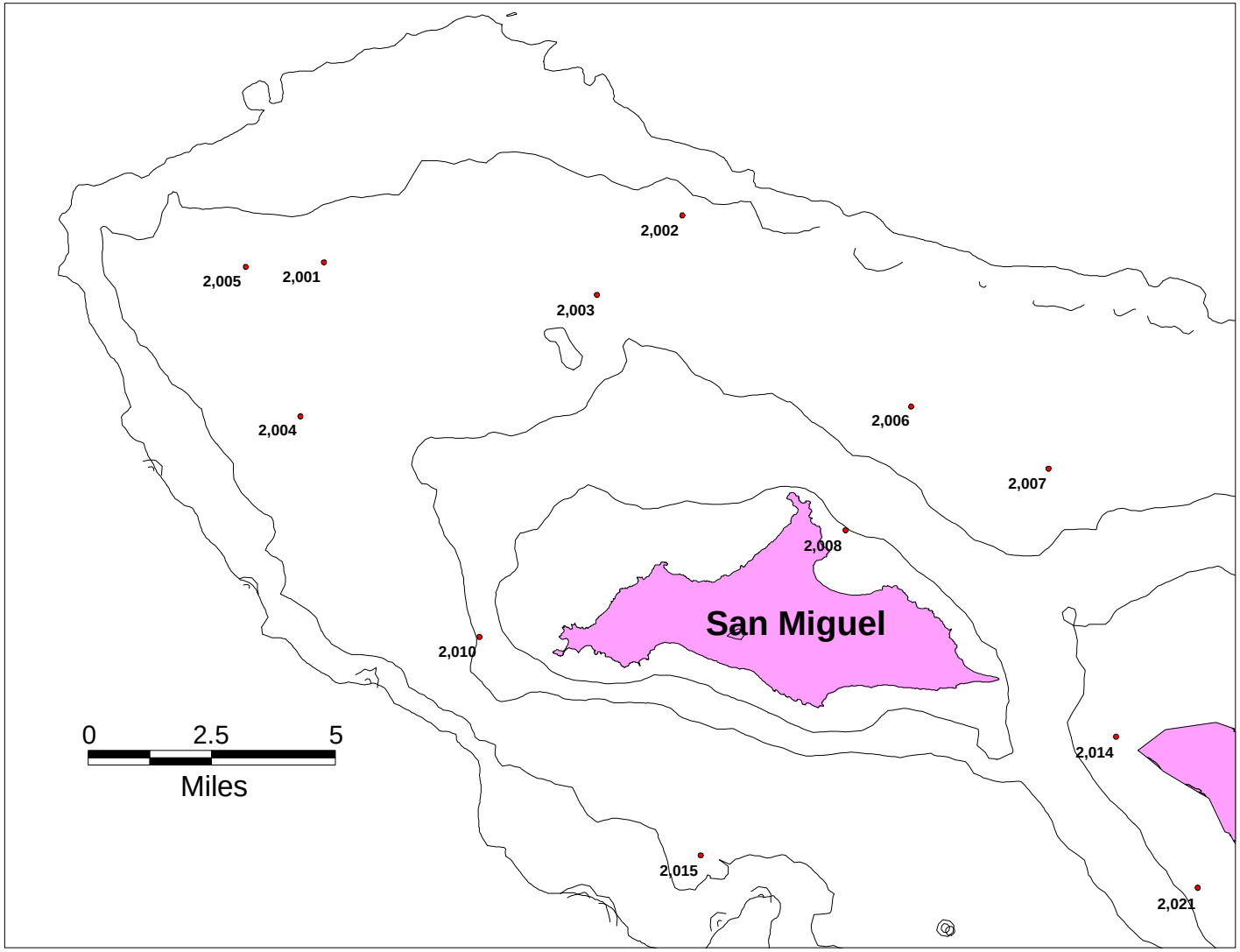
Stubbs, H. H., D. W. Diehl, and G. P. Hershelman. 1987. A Van Veen grab sampling method. S. Calif. Coastal Water Res. Proj., Long Beach, CA. Tech. Rep. 276. 4 pp.

Tetra Tech. 1986. Quality Assurance and Quality Control for 301(h) Monitoring Programs: Guidance on field and laboratory methods. Final report prepared for U. S. Environ. Prot. Agency, MOD/OMEP. Contract No. 68-01-6938.

APPENDICES

APPENDIX 1

BIGHT'98 STATION LOCATION CHARTS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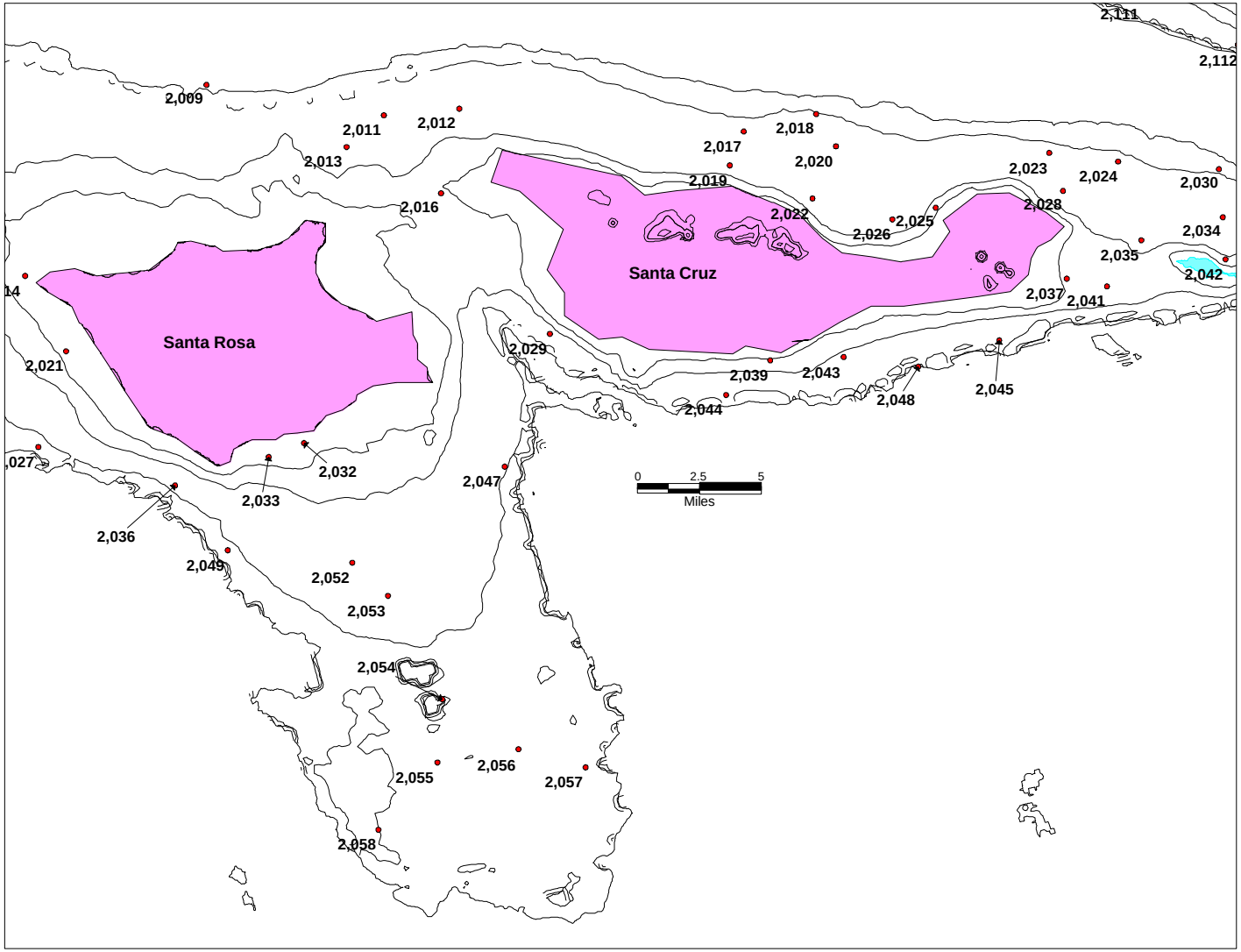
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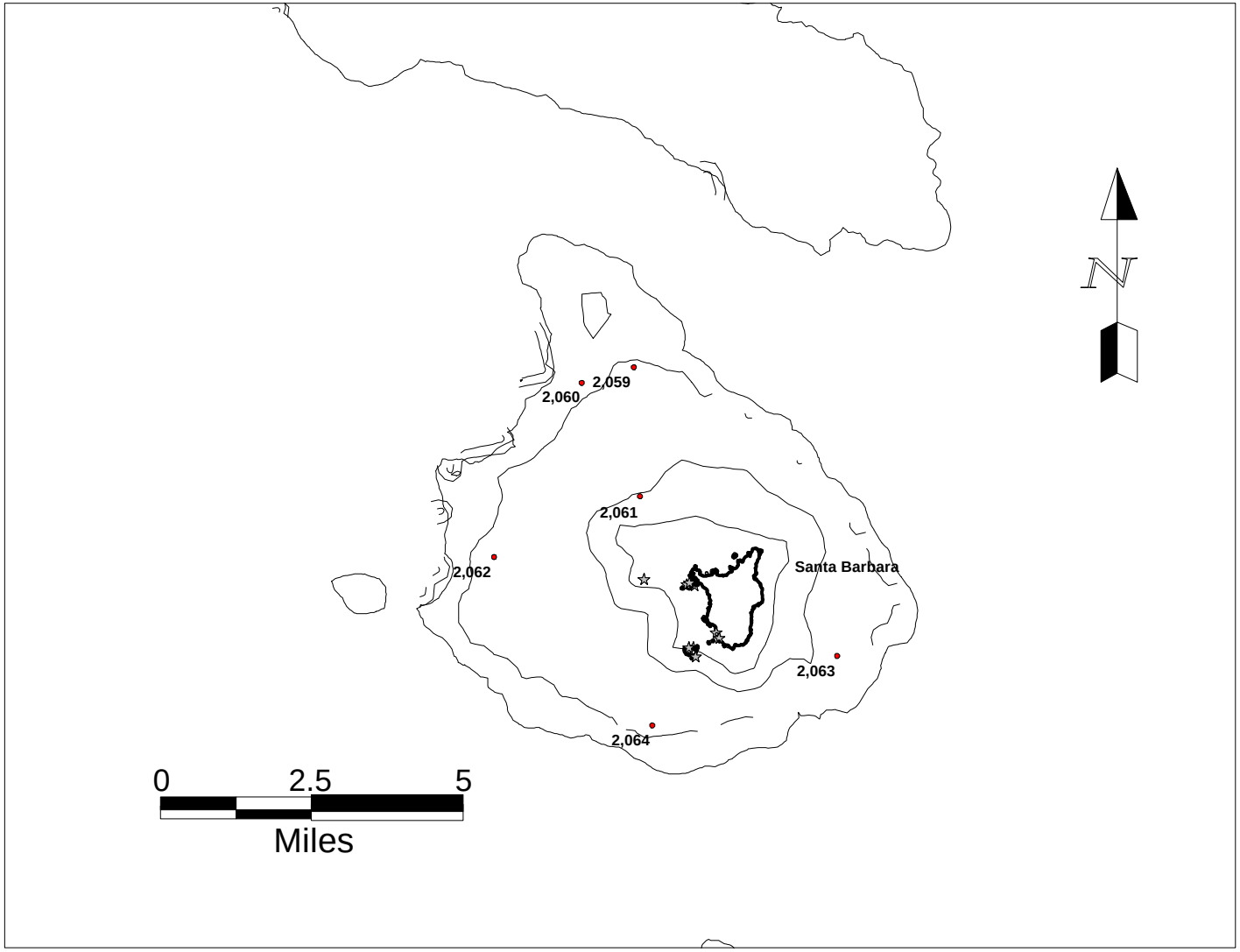
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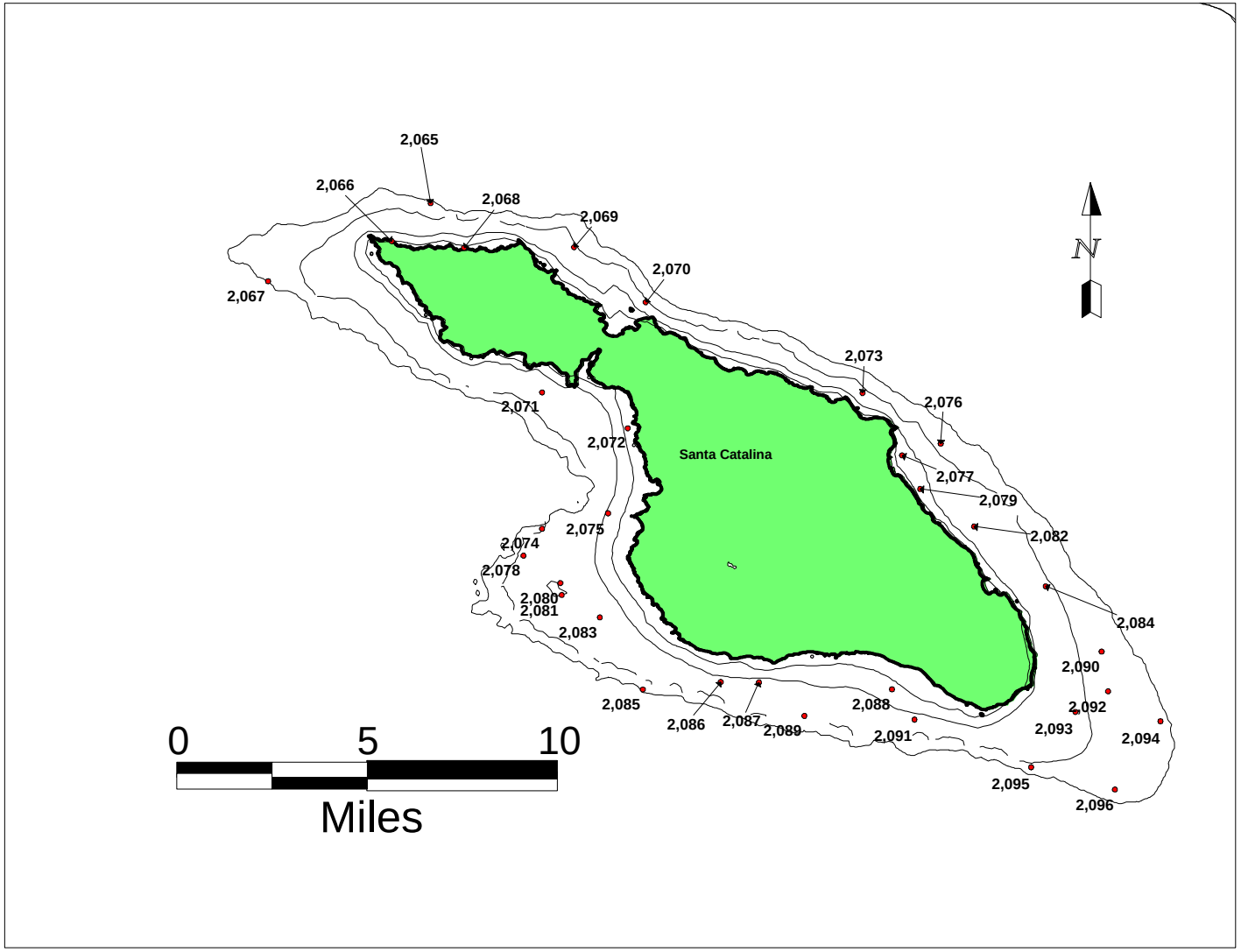
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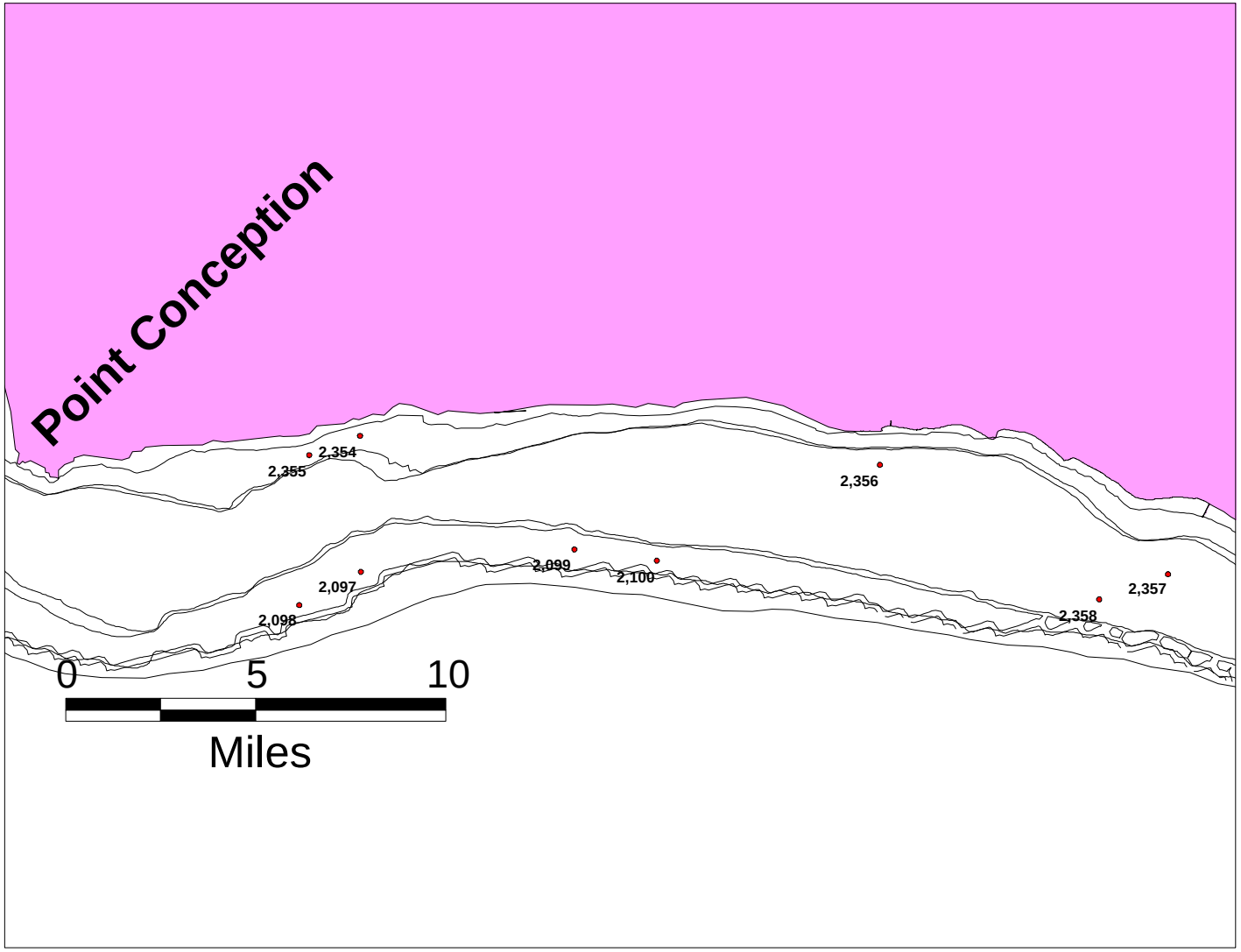
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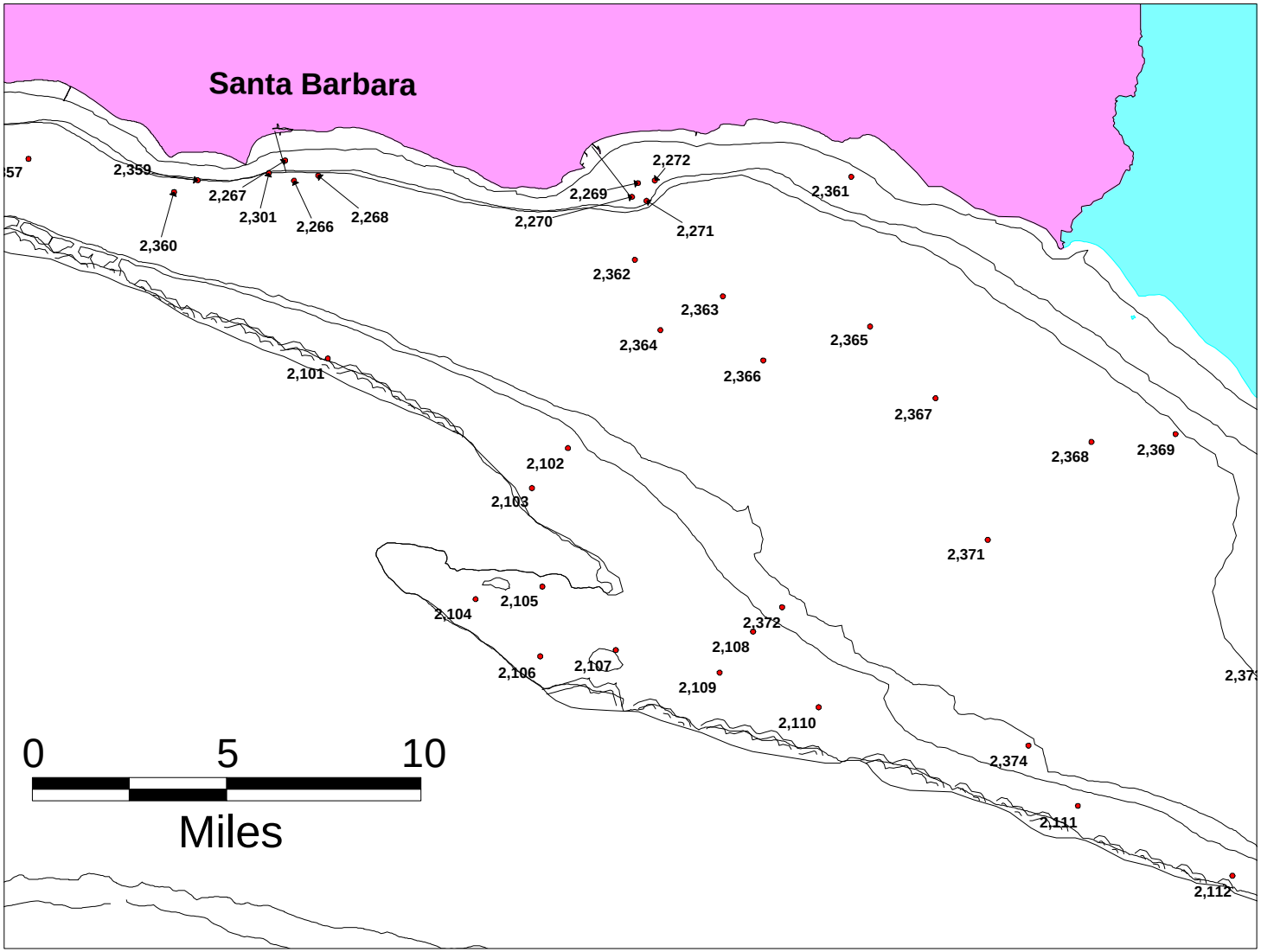
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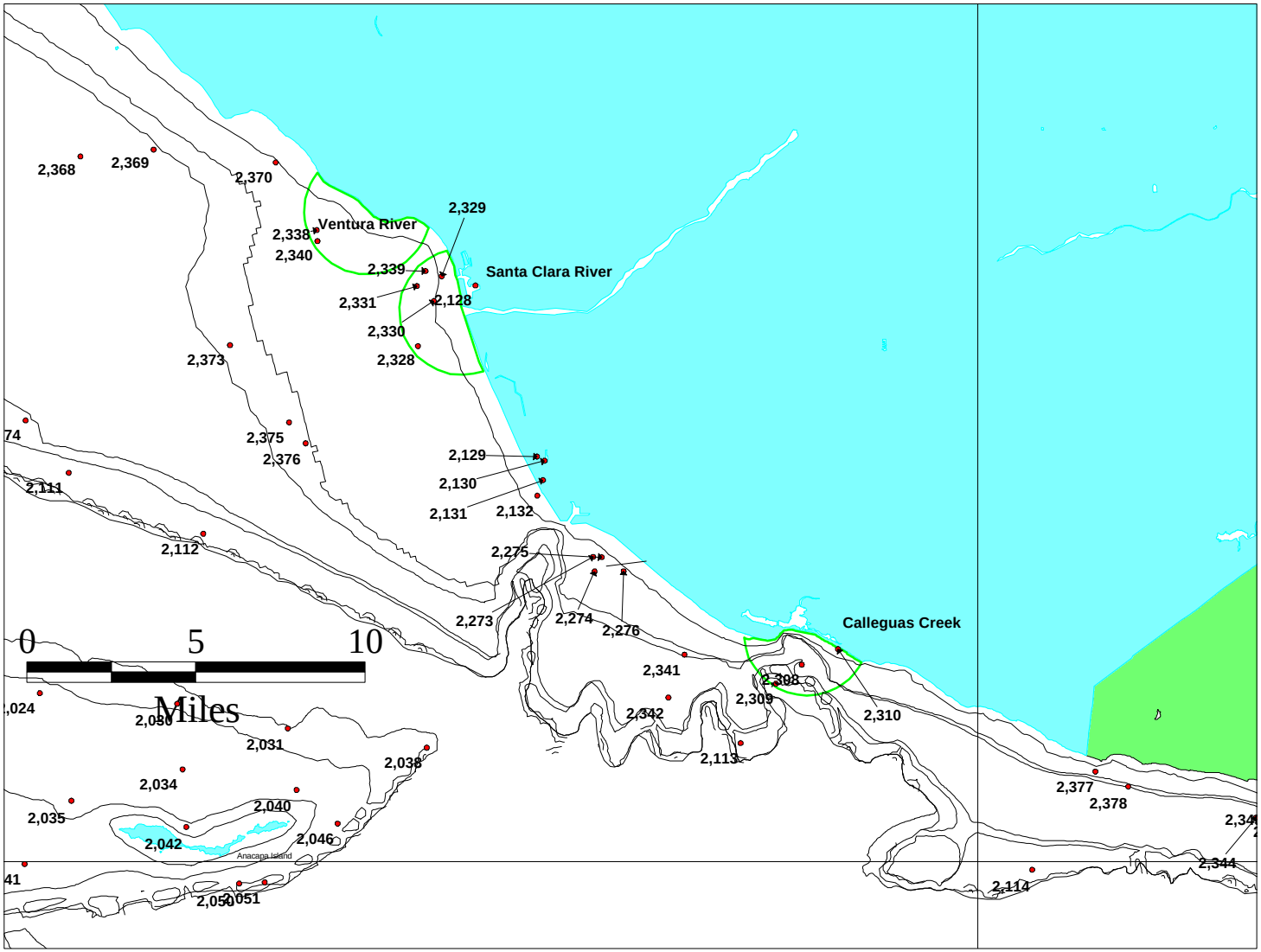
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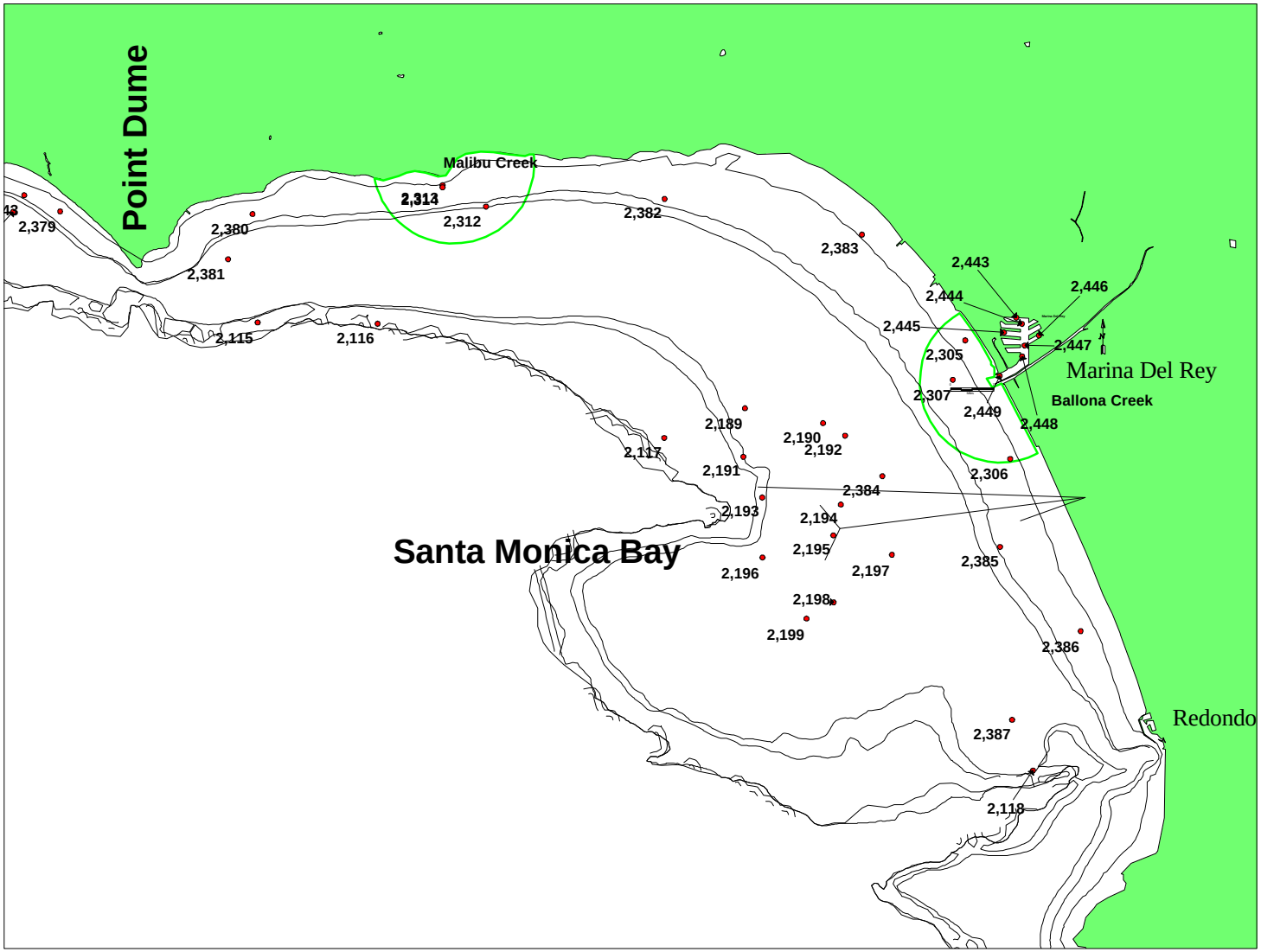
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Malibu Creek
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2,445
2,447
2,305
Marina Del Rey
Ballona Creek
2,307
2,449
2,448
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2,190
2,192
2,117
2,191
2,306
2,384
2,193
2,194
Santa Monica Bay
2,195
2,196
2,197
2,385
2,198
2,199
2,386
Redondo
2,387
2,118


Marina Del Rey
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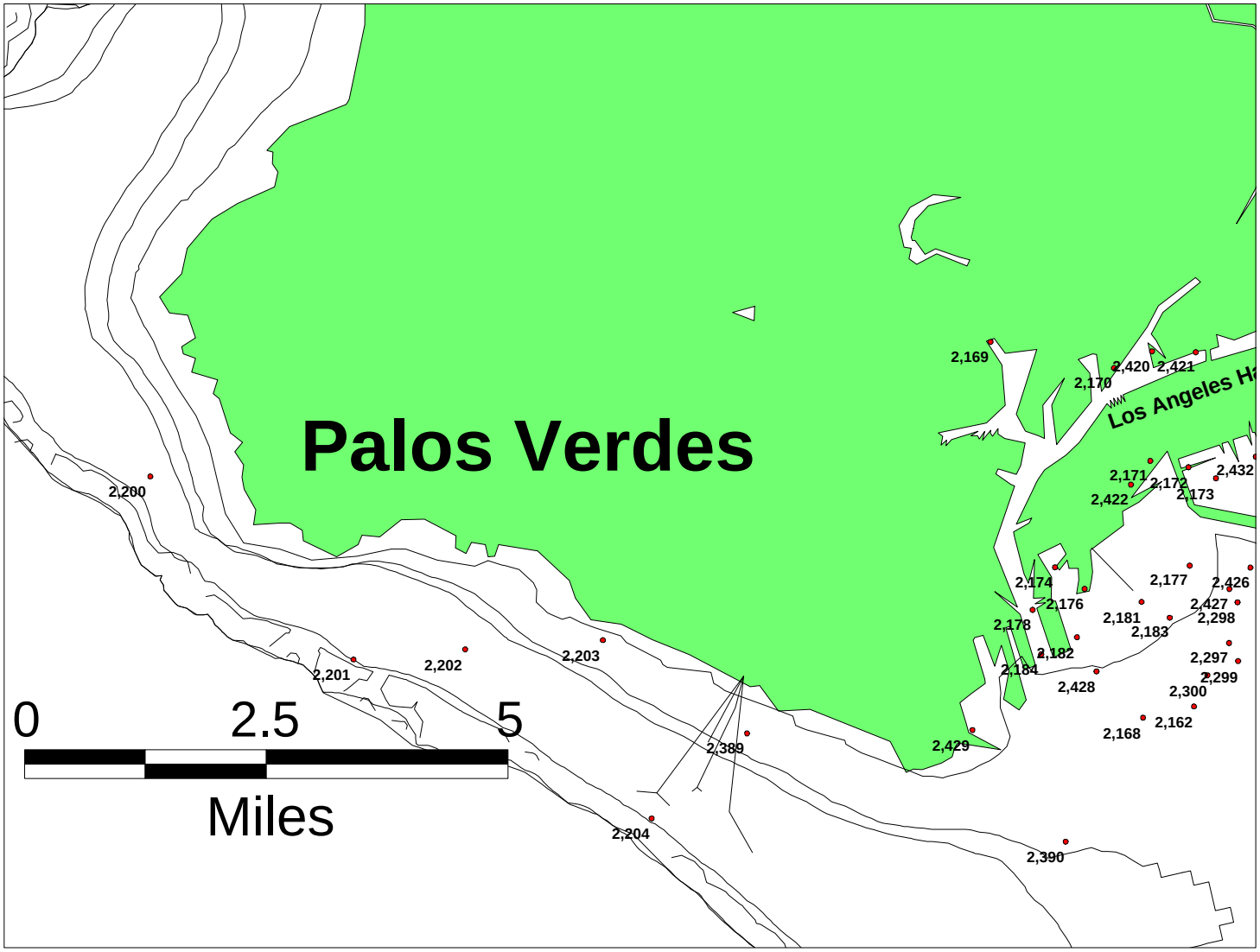
Ballona Creek
N
Marin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2,426
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2,178
2,183
2,182
2,297
2,184
2,299
2,428
2,300
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5
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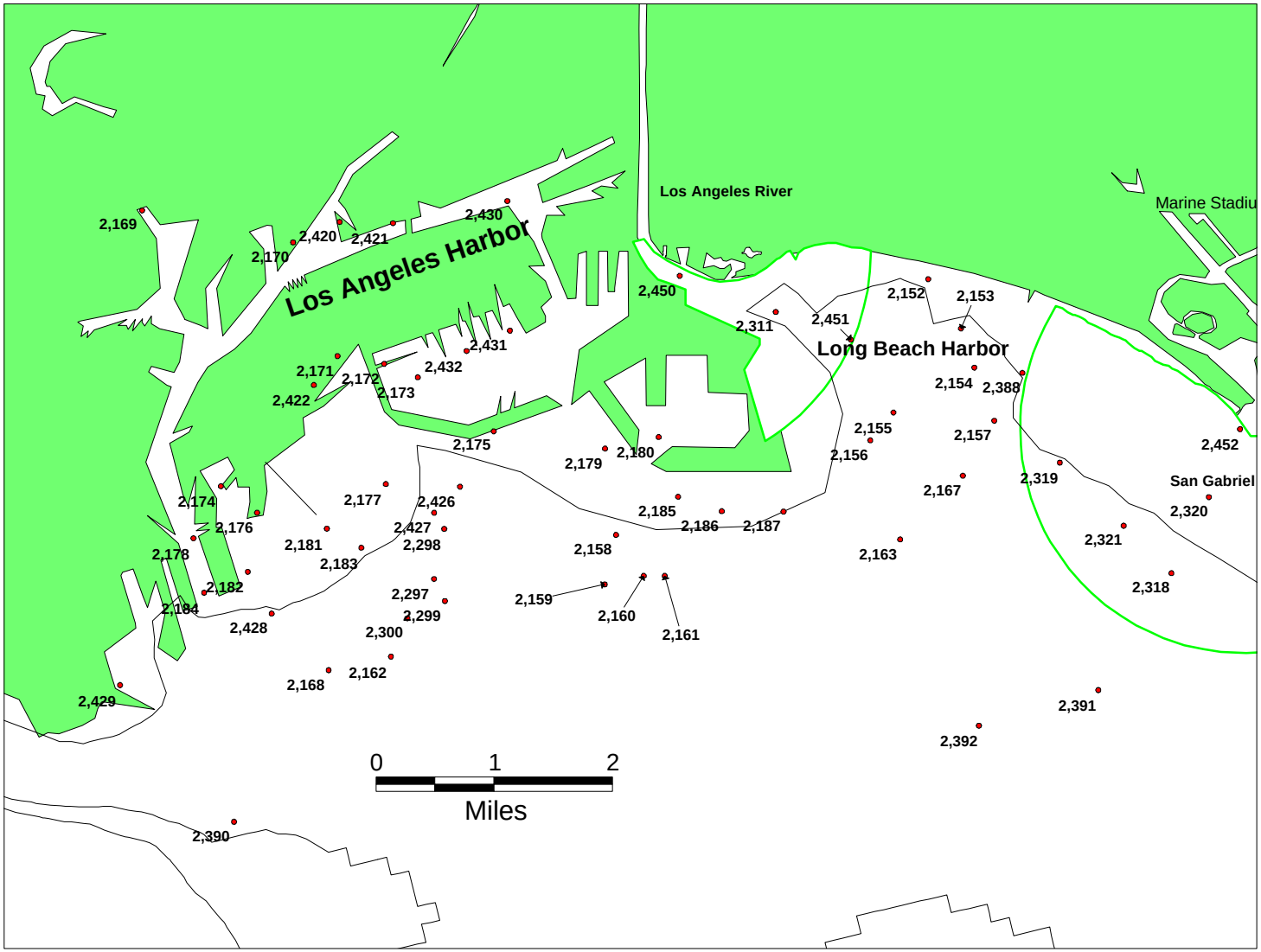
Los Angeles River
Marine Stadiu
Los Angeles Harbor
Long Beach Harbor
San Gabriel
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2,153
2,311
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2,422
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2,155
2,157
2,452
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2,319
2,167
2,174
2,177
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2,320
2,176
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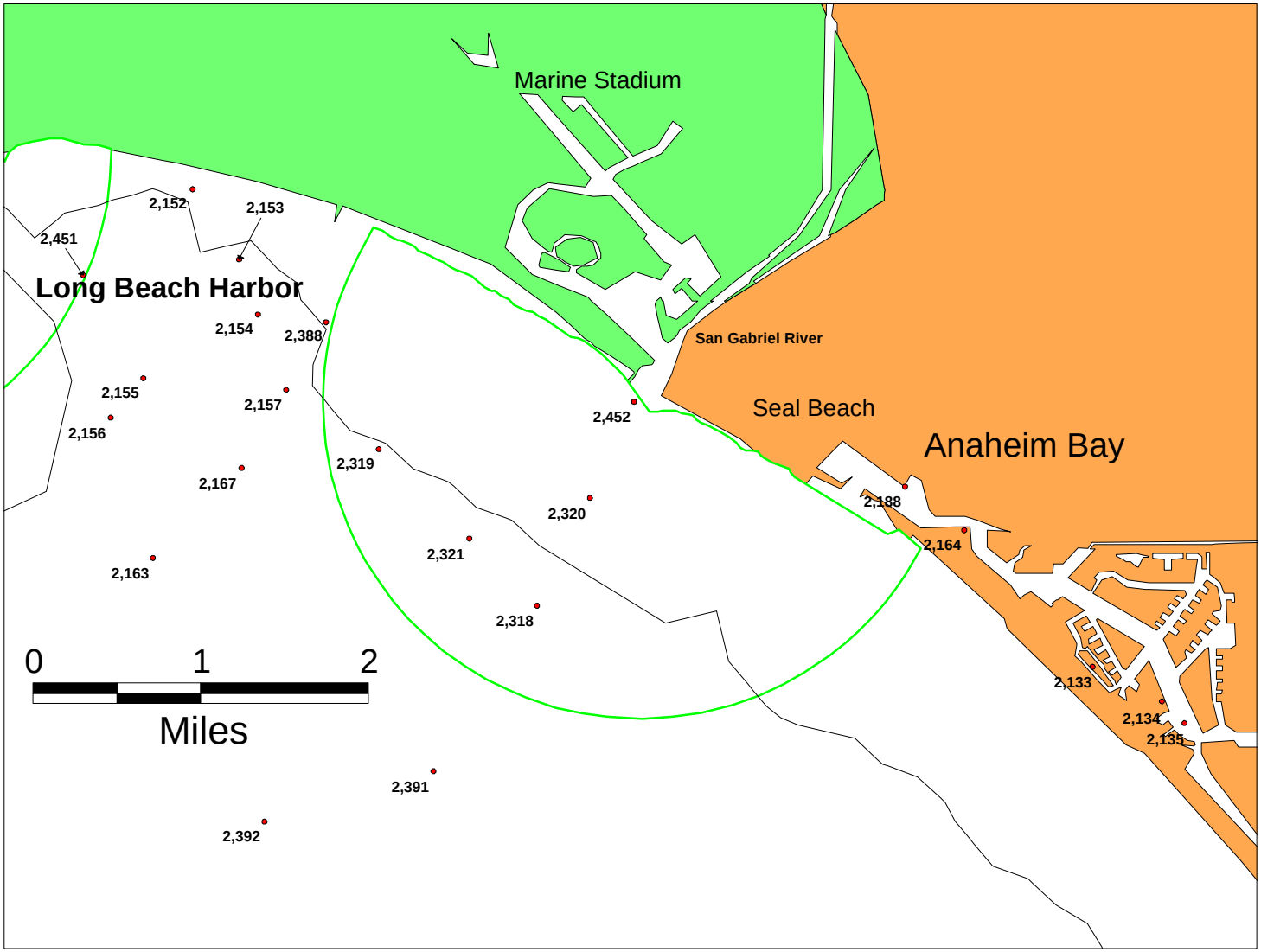
Miles
2,390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Long Beach Harbor
San Gabriel River
Seal Beach
Anaheim Bay
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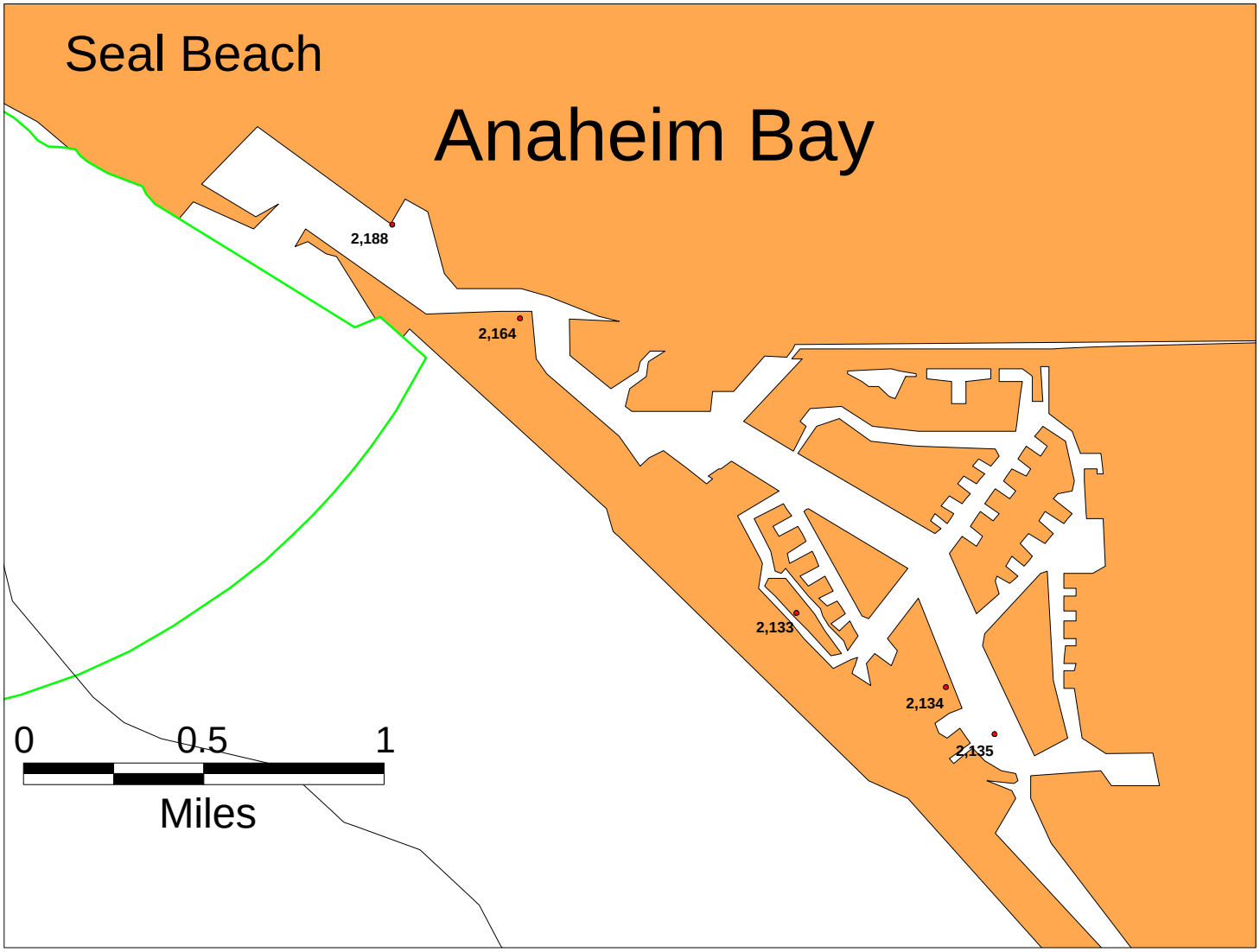
Miles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Anaheim Bay
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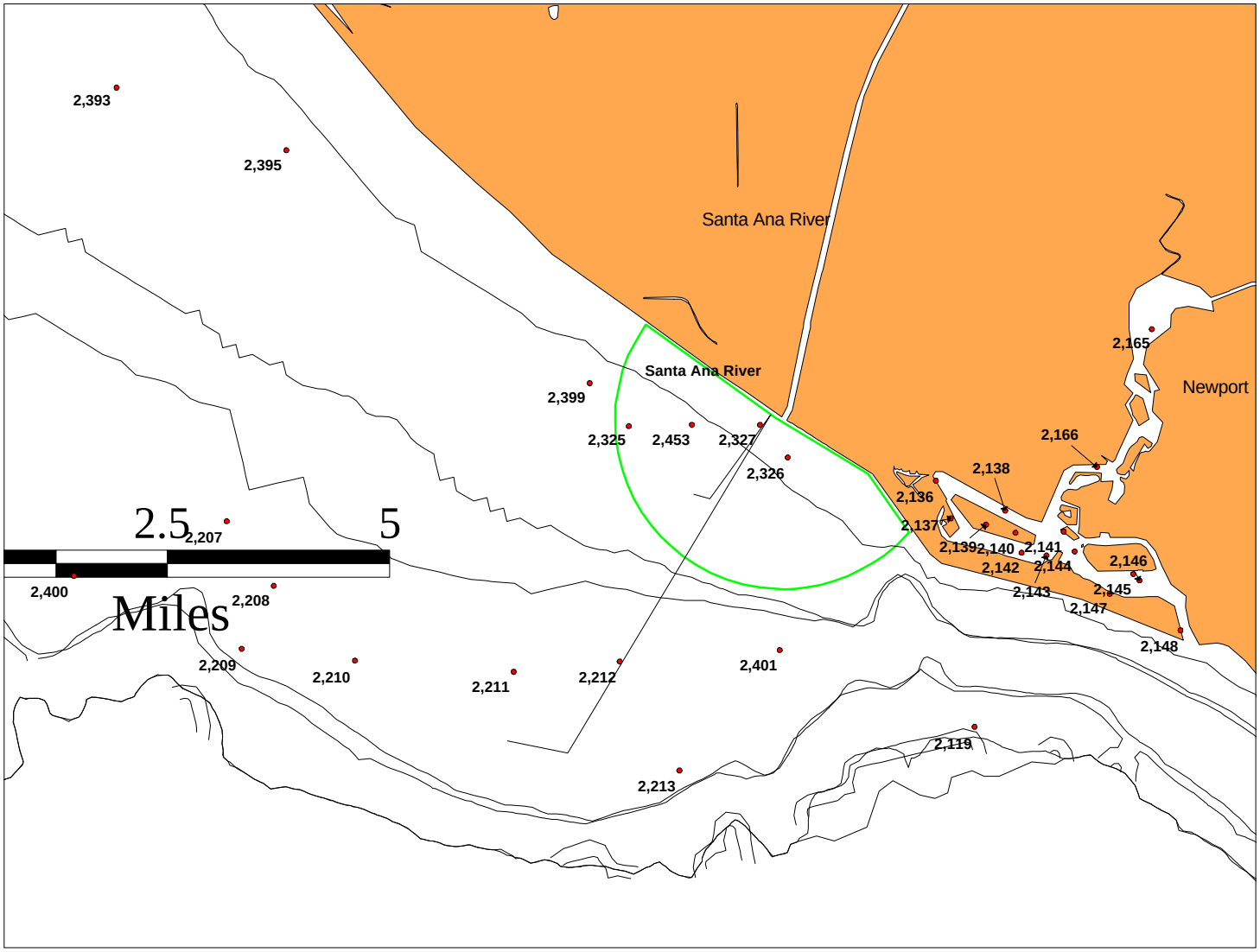
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Santa Ana River
Santa Ana River
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2,165
Newport
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2,136
2,137
2,139
2,140
2,141
2,142
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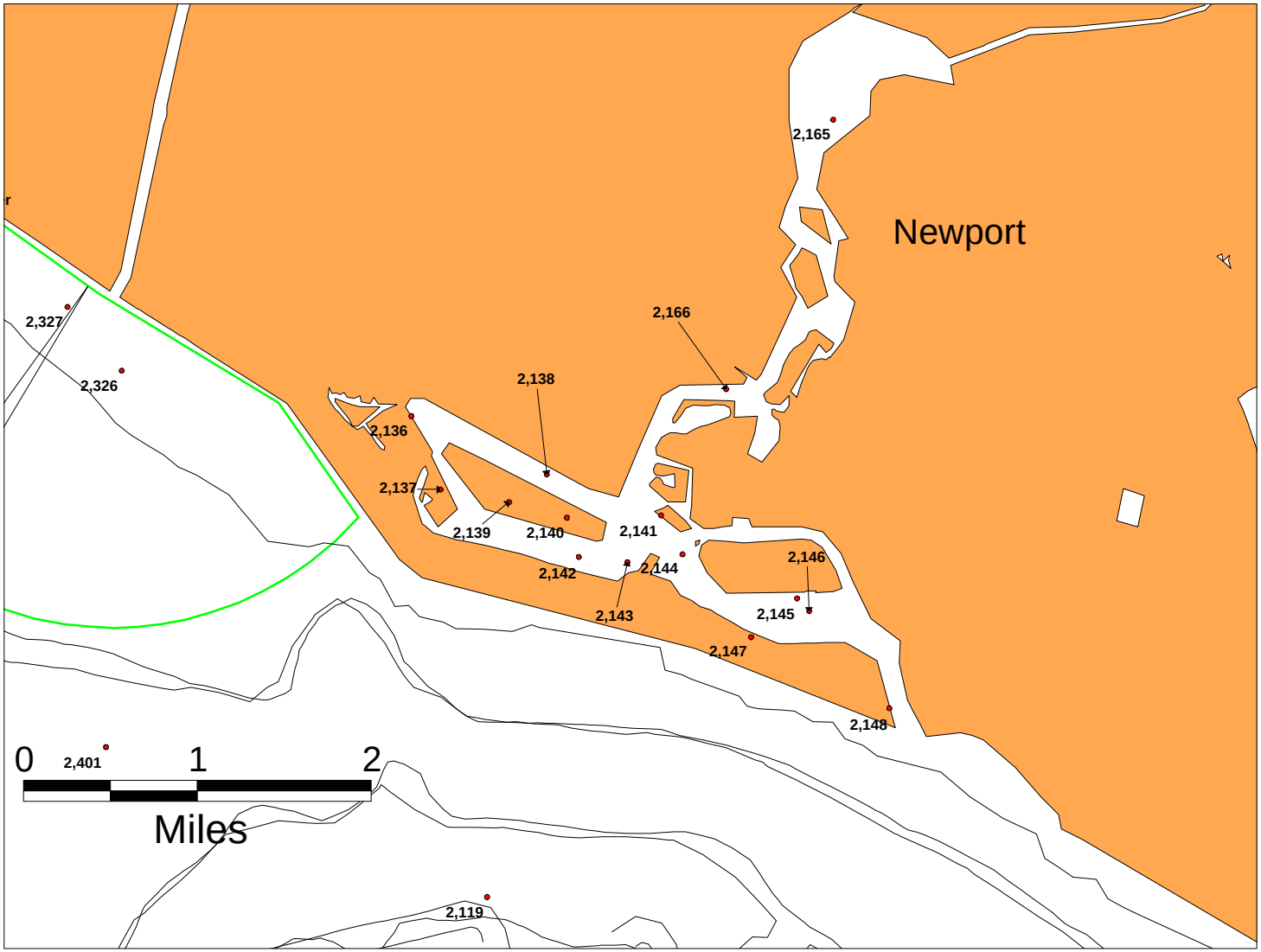
2,212
2,401
2,119
2,213


Newport
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Miles
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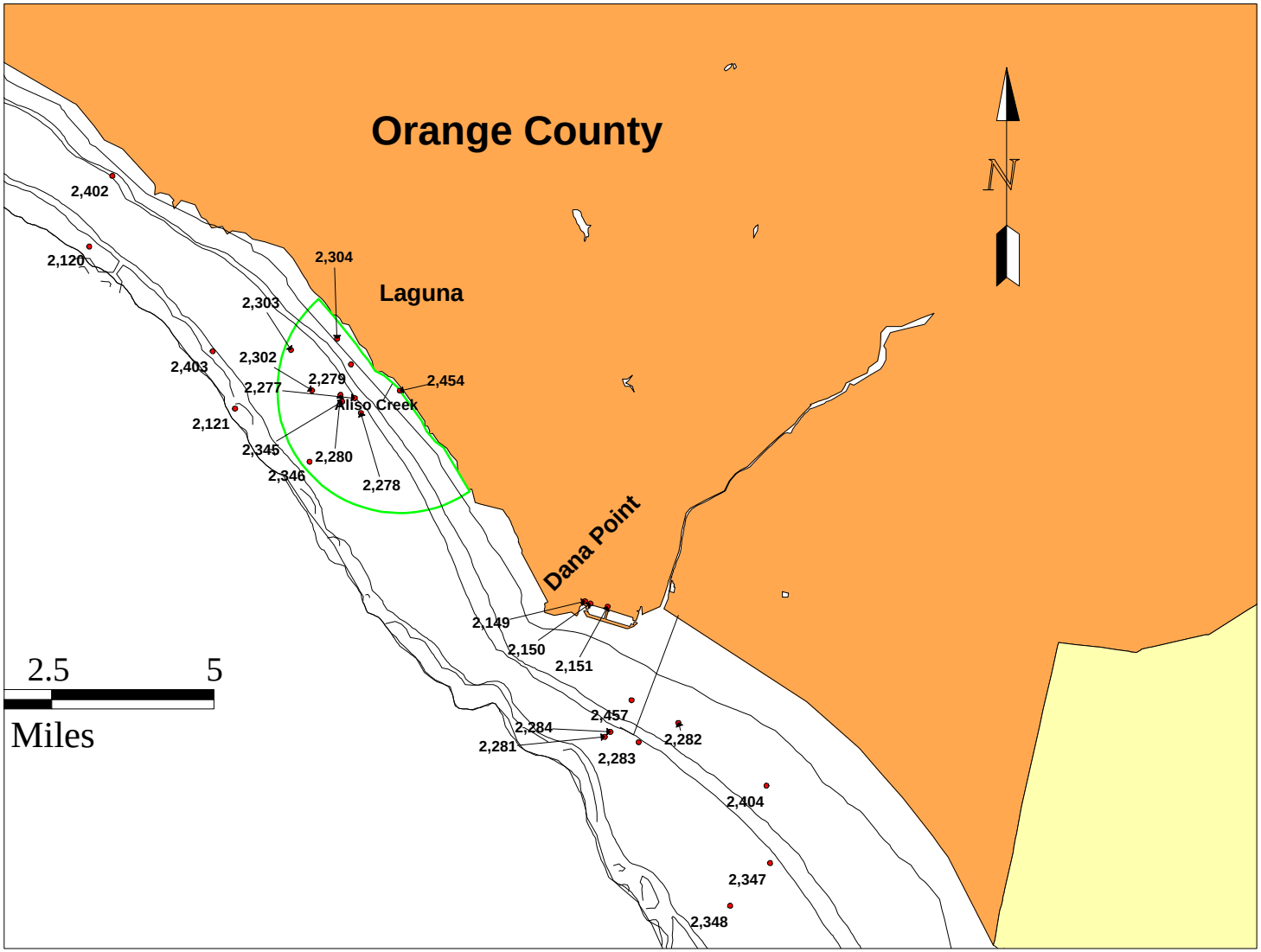
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N
Laguna
Aliso Creek
Dana Point
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2,121
2,345
2,280
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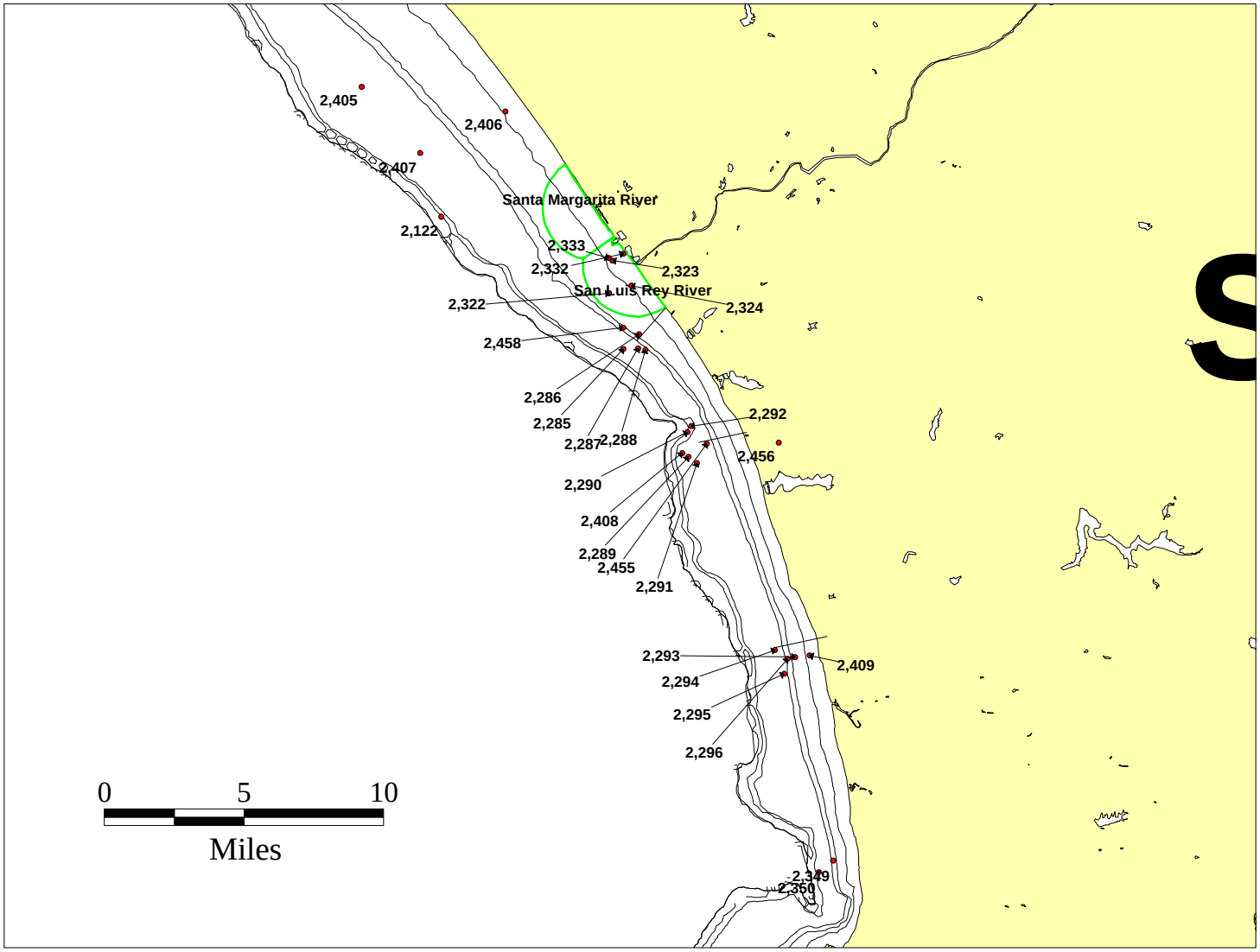
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Santa Margarita River
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San Luis Rey River
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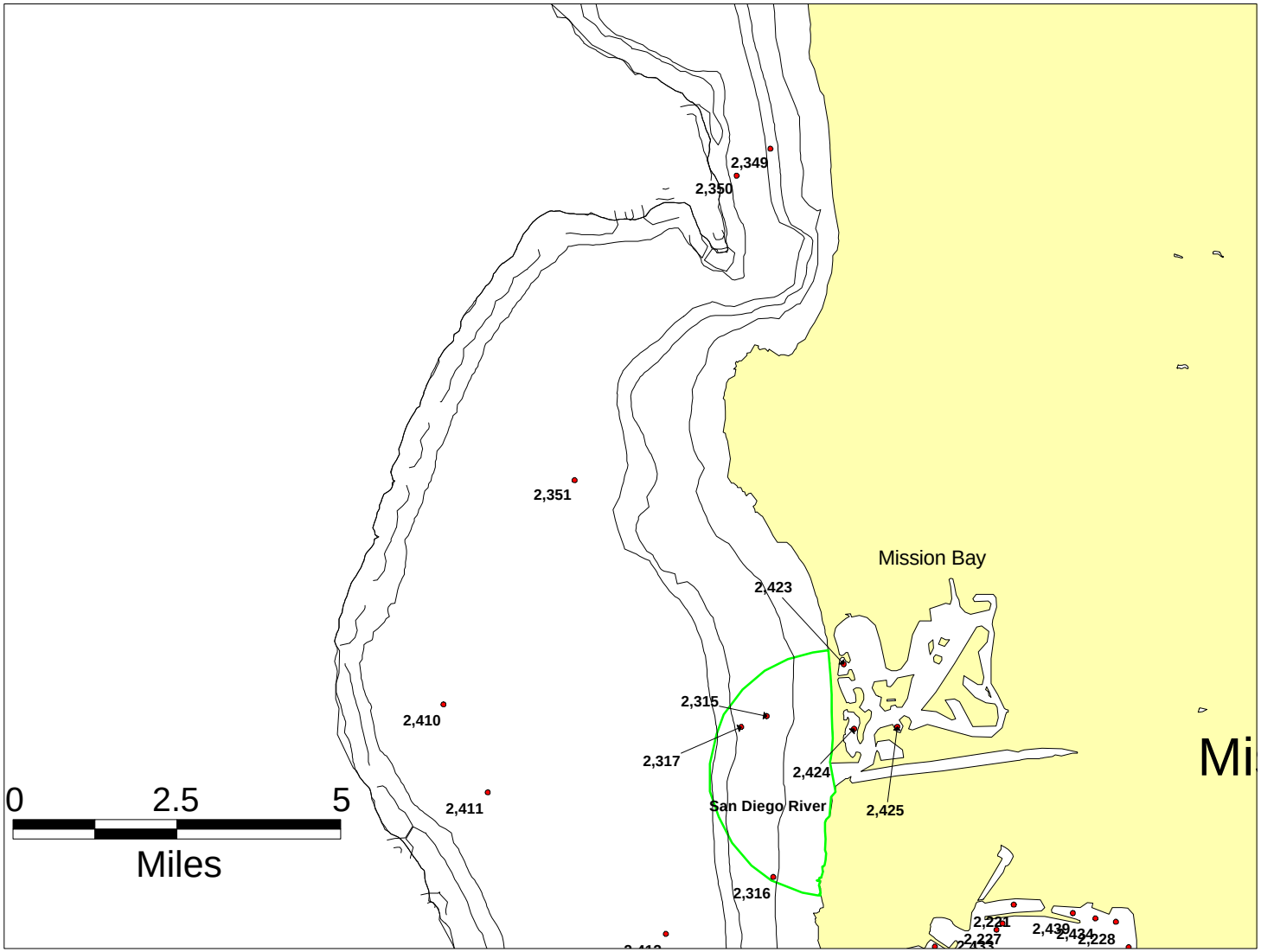
Miles
2,349
2,350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Mission Bay
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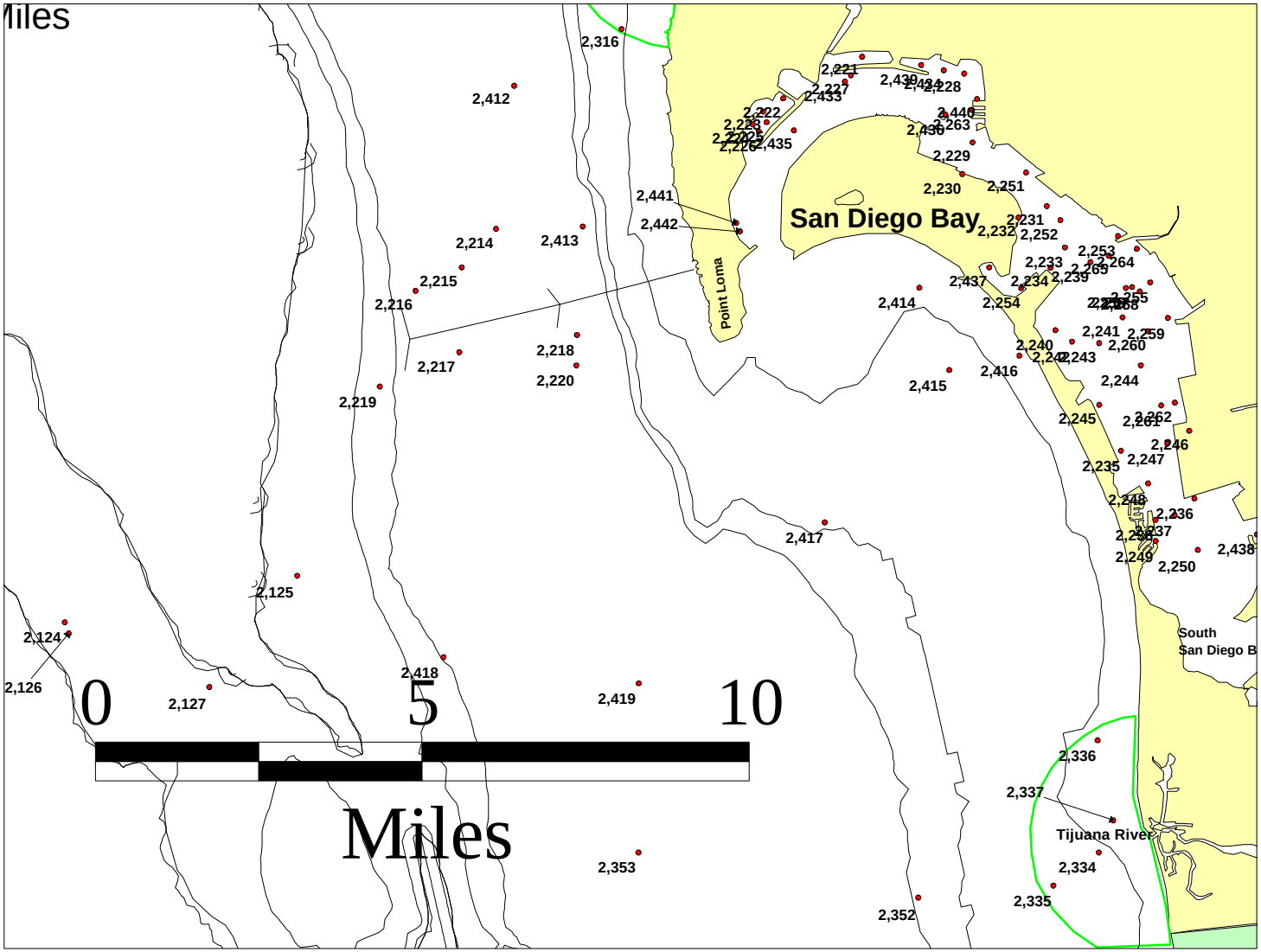
Miles
San Diego Bay
Point Loma
South
San Diego B
Tijuana River
2,316
2,412
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2,234
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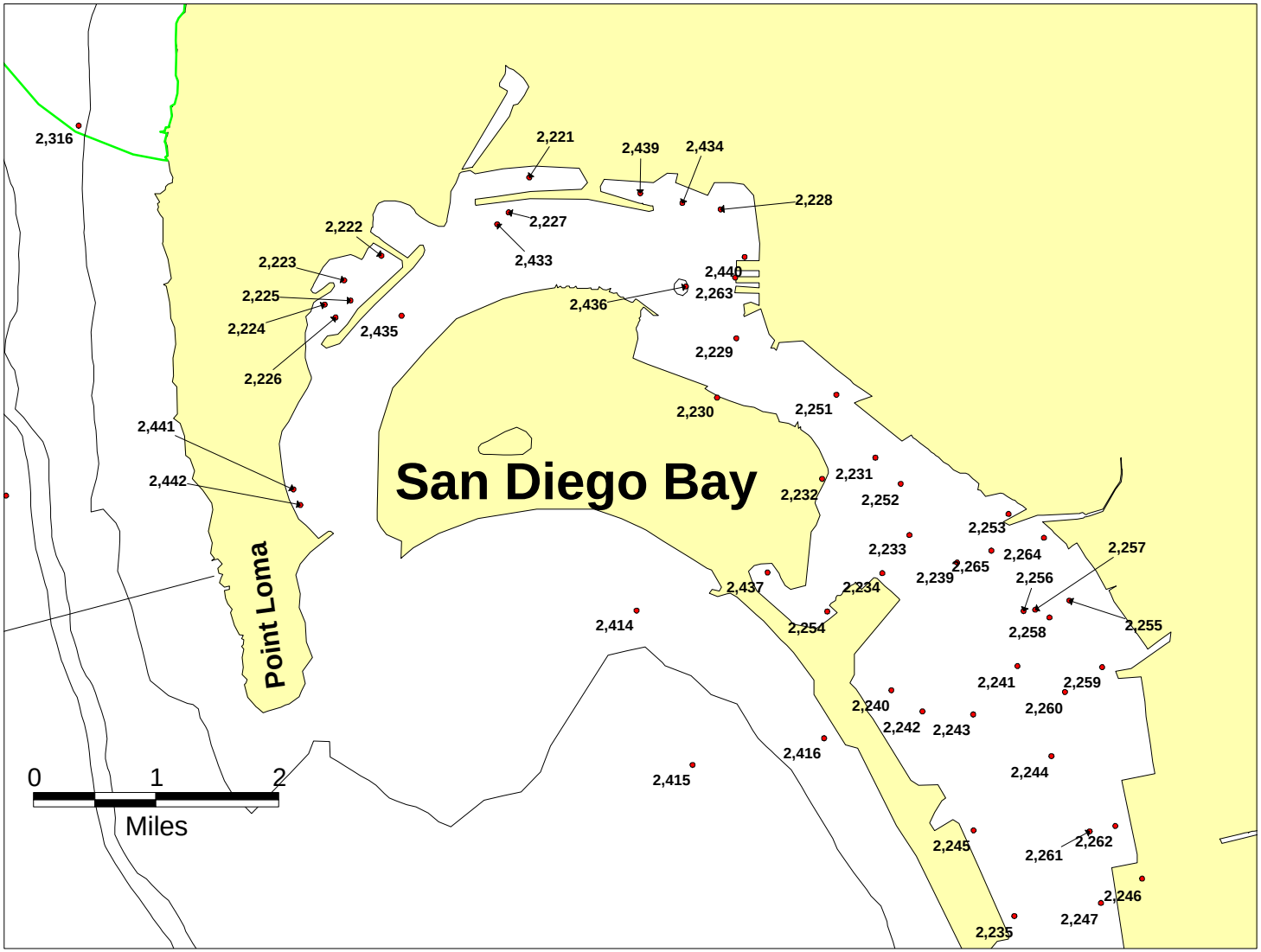
Miles


San Diego Bay
Point Loma
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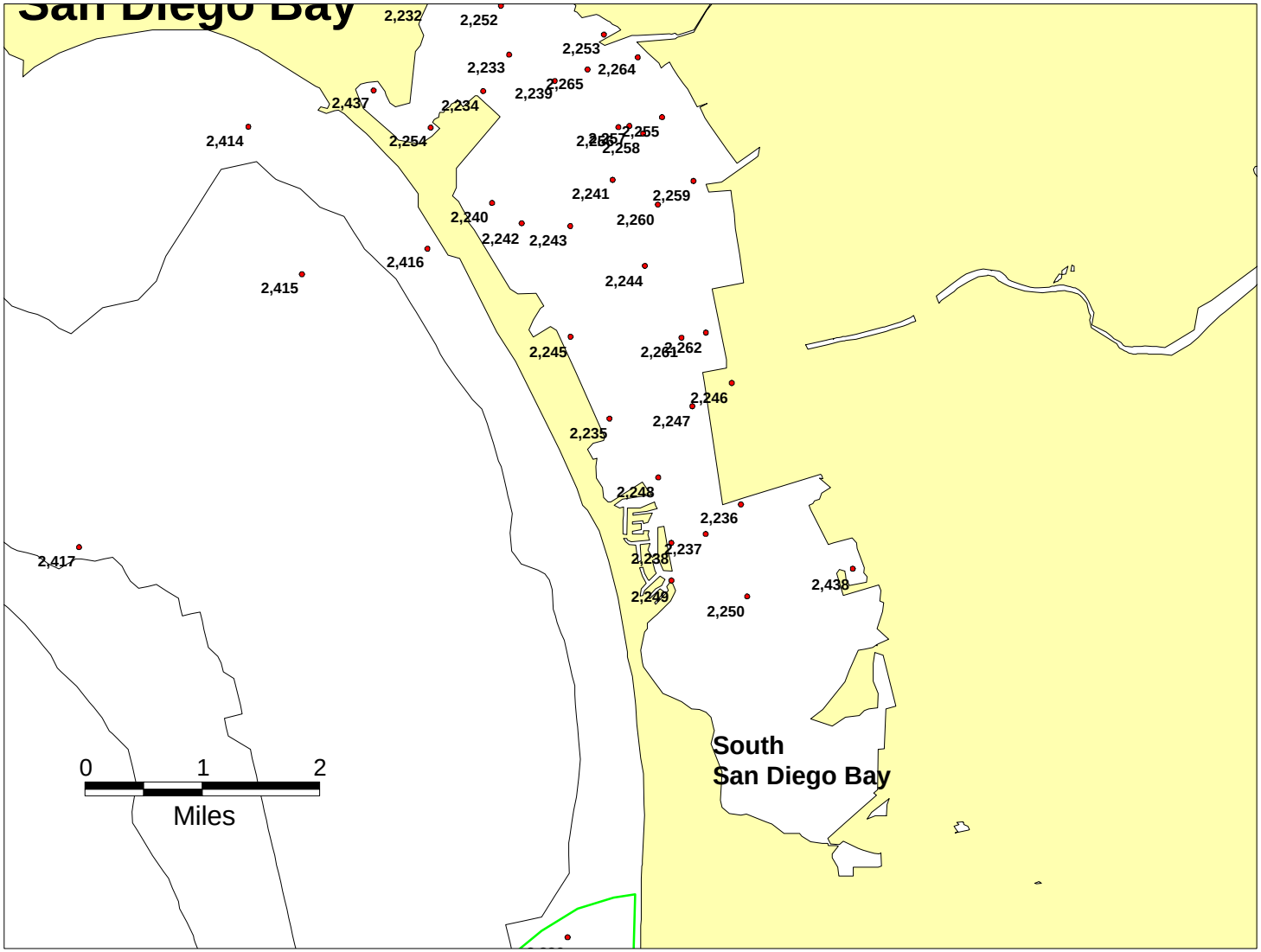
Miles


San Diego Bay
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2,417
2,238
2,438
2,250
South
San Diego Bay
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2
Miles

APPENDIX 2

BIGHT'98 FIELD SAMPLING

SAMPLING ORGANIZATIONS

LEGEND TO SAMPLING ORGANIZATIONS

ABC = Aquatic Bioassay & Consulting Laboratories
CINMS = Channel Islands National Marine Sanctuary
HYP = City of Los Angeles Bureau of Sanitation (Hyperion Treatment Plant)
LACO = Los Angeles County Sanitation District
MBC = MBC Applied Environmental Sciences
MBC* = MBC sites including Marine Pollution Studies Lab sediment toxicity sampling
MEC = MEC Analytical Systems, Inc.
OCSD = Orange County Sanitation District
SD = City of San Diego, Metropolitan Wastewater Department
SEAVEN = Sea Ventures
USN = U. S. Navy (SPAWAR)
WIES = University of Southern California Wrigley Institute for Environmental Studies

				SAMPLING ORGANIZATION					
SITE	STRATA	LATITUDE	LONGITUDE	fish comm	fish tissue	benthic infauna	sed chemistry	sed toxicity	biomarker
2065	Catalina	33 29.494	118 34.708	WIES	WIES				
2066	Catalina	33 28.631	118 35.767	WIES	WIES	WIES	WIES		
2067	Catalina	33 27.717	118 39.146	WIES	WIES				
2068	Catalina	33 28.479	118 33.794	WIES	WIES	WIES	WIES		
2069	Catalina	33 28.494	118 30.789	WIES	WIES	WIES	WIES		
2070	Catalina	33 27.239	118 28.832	WIES	WIES	WIES	WIES		
2071	Catalina	33 25.180	118 31.661	WIES	WIES	WIES	WIES		
2072	Catalina	33 24.364	118 29.321	WIES	WIES	WIES	WIES		
2073	Catalina	33 25.166	118 22.907	WIES	WIES	WIES	WIES		
2074	Catalina	33 22.069	118 31.661	WIES	WIES				
2075	Catalina	33 22.424	118 29.857	WIES	WIES	WIES	WIES		
2076	Catalina	33 24.011	118 20.770	WIES	WIES				
2077	Catalina	33 23.745	118 21.827	WIES	WIES	WIES	WIES		
2078	Catalina	33 21.457	118 32.169	WIES	WIES	WIES	WIES		
2079	Catalina	33 22.979	118 21.334	WIES	WIES	WIES	WIES		
2080	Catalina	33 20.833	118 31.162	WIES	WIES	WIES	WIES		
2081	Catalina	33 20.559	118 31.124	WIES	WIES	WIES	WIES		
2082	Catalina	33 22.122	118 19.862	WIES	WIES	WIES	WIES		
2083	Catalina	33 20.048	118 30.083	WIES	WIES	WIES	WIES		
2084	Catalina	33 20.757	118 17.904	WIES	WIES	WIES	WIES		
2085	Catalina	33 18.404	118 28.908	WIES	WIES				
2086	Catalina	33 18.574	118 26.780	WIES	WIES	WIES	WIES		
2087	Catalina	33 18.568	118 25.736	WIES	WIES	WIES	WIES		
2088	Catalina	33 18.406	118 22.103	WIES	WIES	WIES	WIES		
2089	Catalina	33 17.802	118 24.494	WIES	WIES	WIES	WIES		
2090	Catalina	33 19.268	118 16.377	WIES	WIES				
2091	Catalina	33 17.717	118 21.487	WIES	WIES	WIES	WIES		

2092	Catalina	33	18.362	118	16.195	WIES	WIES				
2093	Catalina	33	17.893	118	17.093	WIES	WIES	WIES	WIES		
2094	Catalina	33	17.679	118	14.769	WIES	WIES				
2095	Catalina	33	16.632	118	18.301	WIES	WIES				
2096	Catalina	33	16.124	118	16.010	WIES	WIES				
2097	Deep	34	24.436	120	18.746	MEC	MEC				
2098	Deep	34	23.678	120	20.446	MEC	MEC				
2099	Deep	34	24.948	120	12.847	MEC	MEC				
2100	Deep	34	24.691	120	10.570	MEC	MEC				
2101	Deep	34	19.929	119	48.373	ABC	ABC				
2102	Deep	34	17.932	119	41.900	ABC	ABC				
2103	Deep	34	17.042	119	42.875	ABC	ABC				
2104	Deep	34	14.566	119	44.393	ABC	ABC				
2105	Deep	34	14.846	119	42.592	MEC	MEC				
2106	Deep	34	13.295	119	42.650	ABC	ABC				
2107	Deep	34	13.431	119	40.613	ABC	ABC				
2108	Deep	34	13.846	119	36.909	ABC	ABC				
2109	Deep	34	12.931	119	37.810	ABC	ABC				
2110	Deep	34	12.157	119	35.141	MEC	MEC				
2111	Deep	34	09.963	119	28.148	MEC	MEC				
2112	Deep	34	08.403	119	23.984	MEC	MEC				
2113	Deep	34	03.035	119	07.346	MEC	MEC				
2114	Deep	33	59.789	118	58.315	MEC	MEC				
2115	Deep	33	58.902	118	45.443	MEC	MEC				
2116	Deep	33	58.878	118	42.530	HYP	HYP				
2117	Deep	33	56.578	118	35.576	MEC	MEC				
2118	Deep	33	49.880	118	26.625	LACO	LACO				
2119	Deep	33	34.736	117	55.184	MEC	MEC				
2120	Deep	33	32.513	117	50.151	MEC	MEC				
2121	Deep	33	30.353	117	47.823	MEC	MEC				
2122	Deep	33	13.638	117	30.628	MEC	MEC				

2128	marina	34 14.762	119 15.554			MBC	MBC	MBC	
2129	marina	34 10.379	119 13.645	ABC	ABC	ABC	ABC	ABC	ABC
2130	marina	34 10.272	119 13.410			ABC	ABC	ABC	
2131	marina	34 09.775	119 13.462			ABC	ABC	ABC	
2132	marina	34 09.378	119 13.639			ABC	ABC	ABC	
2133	marina	33 43.105	118 04.162			MBC	MBC	MBC	
2134	marina	33 42.927	118 03.730			MBC	MBC	MBC	
2135	marina	33 42.814	118 03.590			MBC	MBC	MBC	
2136	marina	33 37.135	117 55.637			OCSD	OCSD	OCSD	
2137	marina	33 36.769	117 55.462	MEC	MEC	OCSD	OCSD	OCSD	MEC
2138	marina	33 36.845	117 54.827			OCSD	OCSD	OCSD	
2139	marina	33 36.707	117 55.052			OCSD	OCSD	OCSD	
2140	marina	33 36.629	117 54.705			OCSD	OCSD	OCSD	
2141	marina	33 36.640	117 54.141			OCSD	OCSD	OCSD	
2142	marina	33 36.433	117 54.635			OCSD	OCSD	OCSD	
2143	marina	33 36.406	117 54.343			MBC	MBC	MBC	
2144	marina	33 36.446	117 54.013			OCSD	OCSD	OCSD	
2145	marina	33 36.226	117 53.327			OCSD	OCSD	OCSD	
2146	marina	33 36.163	117 53.255			OCSD	OCSD	OCSD	
2147	marina	33 36.033	117 53.602	MEC	MEC	OCSD	OCSD	OCSD	MEC
2148	marina	33 35.678	117 52.775			OCSD	OCSD	OCSD	
2149	marina	33 27.782	117 42.226			SEAVEN	SEAVEN	SEAVEN	
2150	marina	33 27.749	117 42.140			SEAVEN	SEAVEN	SEAVEN	
2151	marina	33 27.710	117 41.864			SEAVEN	SEAVEN	SEAVEN	
2152	other	33 45.578	118 09.763	USN	USN	MBC	MBC	MBC*	USN
2153	other	33 45.215	118 09.474	USN	USN	MBC	MBC	MBC*	USN
2154	other	33 44.930	118 09.357	USN	USN	MBC	MBC	MBC*	USN
2155	other	33 44.600	118 10.069	USN	USN	MBC	MBC	MBC*	USN
2156	other	33 44.395	118 10.273			MBC	MBC	MBC*	
2157	other	33 44.540	118 09.181			MBC	MBC	MBC*	
2158	other	33 43.703	118 12.515	USN	USN	MBC	MBC	MBC*	USN

2159	other	33	43.340	118	12.614			MBC	MBC	MBC*	
2160	other	33	43.403	118	12.270			MBC	MBC	MBC*	
2161	other	33	43.403	118	12.086			MBC	MBC	MBC*	
2162	other	33	42.811	118	14.497	HYP	HYP	HYP	HYP	HYP	HYP
2163	other	33	43.669	118	10.010			MBC	MBC	MBC*	
2164	other	33	43.813	118	04.960			MBC	MBC	MBC	
2165	other	33	38.614	117	53.111	MEC	MEC	OCSD	OCSD	OCSD	MEC
2166	other	33	37.270	117	53.752			OCSD	OCSD	OCSD	
2167	other	33	44.136	118	09.458	USN	USN	MBC	MBC	MBC*	USN
2168	other	33	42.711	118	15.047	HYP	HYP	HYP	HYP	HYP	HYP
2169	port	33	46.081	118	16.690			MBC	MBC	MBC*	
2170	port	33	45.847	118	15.360			MBC	MBC	MBC*	
2171	port	33	45.013	118	14.968			MBC	MBC	MBC*	
2172	port	33	44.957	118	14.557			MBC	MBC	MBC*	
2173	port	33	44.858	118	14.261			MBC	MBC	MBC*	
2174	port	33	44.059	118	15.996	MEC	MEC	MBC	MBC	MBC	MEC
2175	port	33	44.462	118	13.593			MBC	MBC	MBC*	
2176	port	33	43.866	118	15.677			MBC	MBC	MBC	
2177	port	33	44.075	118	14.543			MBC	MBC	MBC	
2178	port	33	43.678	118	16.238			MBC	MBC	MBC	
2179	port	33	44.336	118	12.610			MBC	MBC	MBC*	
2180	port	33	44.419	118	12.139	MEC	MEC	MBC	MBC	MBC	MEC
2181	port	33	43.749	118	15.063			MBC	MBC	MBC*	
2182	port	33	43.432	118	15.759			MBC	MBC	MBC*	
2183	port	33	43.608	118	14.759			MBC	MBC	MBC*	
2184	port	33	43.279	118	16.145	USN	USN	MBC	MBC	MBC*	USN
2185	port	33	43.982	118	11.967			MBC	MBC	MBC*	
2186	port	33	43.876	118	11.583	USN	USN	MBC	MBC	MBC*	USN
2187	port	33	43.874	118	11.039			MBC	MBC	MBC*	
2188	port	33	44.039	118	05.329			MBC	MBC	MBC	
2189	LPOTW	33	57.175	118	33.617	MEC	MEC	HYP	HYP		

2190	LPOTW	33	56.875	118	31.723	MEC	MEC	HYP	HYP	HYP	
2191	LPOTW	33	56.197	118	33.658	HYP	HYP	HYP	HYP	HYP	
2192	LPOTW	33	56.623	118	31.187	HYP	HYP	HYP	HYP	HYP	
2193	LPOTW	33	55.376	118	33.197	HYP	HYP	HYP	HYP		
2194	LPOTW	33	55.234	118	31.290	HYP	HYP	HYP	HYP		
2195	LPOTW	33	54.616	118	31.471	HYP	HYP	HYP	HYP	HYP	
2196	LPOTW	33	54.171	118	33.192	HYP	HYP	HYP	HYP		
2197	LPOTW	33	54.227	118	30.049	MEC	MEC	HYP	HYP	HYP	
2198	LPOTW	33	53.266	118	31.462	HYP	HYP	HYP	HYP		
2199	LPOTW	33	52.937	118	32.123	MEC	MEC	HYP	HYP	HYP	
2200	LPOTW	33	44.873	118	25.749	LACO	LACO	LACO	LACO		
2201	LPOTW	33	43.232	118	23.557	LACO	LACO	LACO	LACO	LACO	
2202	LPOTW	33	43.324	118	22.354	LACO	LACO	LACO	LACO	LACO	
2203	LPOTW	33	43.405	118	20.869	LACO	LACO	LACO	LACO	LACO	
2204	LPOTW	33	41.808	118	20.344	LACO	LACO	LACO	LACO		
2205	LPOTW	33	40.612	118	18.347	LACO	LACO	LACO	LACO	LACO	
2206	LPOTW	33	40.506	118	17.598	LACO	LACO	LACO	LACO		
2207	LPOTW	33	36.740	118	03.938	MEC	MEC	OCSD	OCSD		
2208	LPOTW	33	36.111	118	03.388	MEC	MEC	OCSD	OCSD	OCSD	
2209	LPOTW	33	35.497	118	03.764	MEC	MEC	OCSD	OCSD	OCSD	
2210	LPOTW	33	35.381	118	02.437	MEC	MEC	OCSD	OCSD		
2211	LPOTW	33	35.273	118	00.580	MEC	MEC	OCSD	OCSD		
2212	LPOTW	33	35.374	117	59.339	MEC	MEC	OCSD	OCSD	OCSD	
2213	LPOTW	33	34.310	117	58.639	MEC	MEC	OCSD	OCSD		
2214	LPOTW	32	41.389	117	18.061	SD	SD	SD	SD	SD	
2215	LPOTW	32	40.879	117	18.601	SD	SD	SD	SD		
2216	LPOTW	32	40.568	117	19.329	SD	SD	SD	SD		
2217	LPOTW	32	39.754	117	18.641	SD	SD	SD	SD	SD	
2218	LPOTW	32	39.983	117	16.787	SD	SD	SD	SD	SD	
2219	LPOTW	32	39.298	117	19.890	SD	SD	SD	SD		
2220	LPOTW	32	39.580	117	16.799	SD	SD	SD	SD		

2221	sdmari	32 43.674	117 12.300			SD	SD	SD	
2222	sdmari	32 43.120	117 13.543			SD	SD	SD	
2223	sdmari	32 42.946	117 13.856	SD	SD	SD	SD	SD	SD
2224	sdmari	32 42.775	117 14.020			SD	SD	SD	
2225	sdmari	32 42.803	117 13.802	SD	SD	SD	SD	SD	SD
2226	sdmari	32 42.683	117 13.928			SD	SD	SD	
2227	sdmari	32 43.426	117 12.474			SD	SD	SD	
2228	sdmari	32 43.448	117 10.692			SD	SD	SD	
2229	sdother	32 42.536	117 10.560	SD	SD	SD	SD	SD	SD
2230	sdother	32 42.115	117 10.722	USN	USN	USN	USN	USN	USN
2231	sdother	32 41.691	117 09.392	SD	SD	SD	SD	SD	SD
2232	sdother	32 41.541	117 09.839	USN	USN	USN	USN	USN	USN
2233	sdother	32 41.144	117 09.107	SD	SD	SD	SD	SD	SD
2234	sdother	32 40.874	117 09.334			SD	SD	SD	
2235	sdother	32 38.449	117 08.224	SD	SD	SD	SD	SD	SD
2236	sdother	32 37.814	117 07.069	SD	SD	SD	SD	SD	SD
2237	sdother	32 37.595	117 07.379			SD	SD	SD	
2238	sdother	32 37.529	117 07.681	SD	SD	SD	SD	SD	SD
2239	sdother	32 40.949	117 08.705	SD	SD	SD	SD	SD	SD
2240	sdother	32 40.046	117 09.257	SD	SD	SD	SD	SD	SD
2241	sdother	32 40.217	117 08.197	SD	SD	SD	SD	SD	SD
2242	sdother	32 39.896	117 08.996	SD	SD	SD	SD	SD	SD
2243	sdother	32 39.875	117 08.569	SD	SD	SD	SD	SD	SD
2244	sdother	32 39.580	117 07.913	SD	SD	SD	SD	SD	SD
2245	sdother	32 39.055	117 08.567	SD	SD	SD	SD	SD	SD
2246	sdother	32 38.713	117 07.150	SD	SD	SD	SD	SD	SD
2247	sdother	32 38.541	117 07.496	SD	SD	SD	SD	SD	SD
2248	sdother	32 38.013	117 07.796	SD	SD	SD	SD	SD	SD
2249	sdother	32 37.250	117 07.680	SD	SD	SD	SD	SD	SD
2250	sdother	32 37.132	117 07.014	SD	SD	SD	SD	SD	SD
2251	sdport	32 42.136	117 09.719			SD	SD	SD	

2252	sdport	32	41.506	117	09.179			SD	SD	SD	
2253	sdport	32	41.293	117	08.272			USN	USN	USN	
2254	sdport	32	40.603	117	09.796	USN	USN	USN	USN	USN	USN
2255	sdport	32	40.681	117	07.762			SD	SD	SD	
2256	sdport	32	40.607	117	08.146	SD	SD	SD	SD	SD	SD
2257	sdport	32	40.616	117	08.049			SD	SD	SD	
2258	sdport	32	40.560	117	07.929	SD	SD	SD	SD	SD	SD
2259	sdport	32	40.209	117	07.486	SD	SD	SD	SD	SD	SD
2260	sdport	32	40.034	117	07.799			SD	SD	SD	
2261	sdport	32	39.048	117	07.591	SD	SD	SD	SD	SD	SD
2262	sdport	32	39.086	117	07.376	SD	SD	SD	SD	SD	SD
2263	sdport	32	42.965	117	10.569			SD	SD	SD	
2264	sdport	32	41.124	117	07.976			USN	USN	USN	
2265	sdport	32	41.034	117	08.417			SD	SD	SD	
2266	SPOTW	34	23.892	119	49.284	ABC	ABC	ABC	ABC		
2267	SPOTW	34	24.342	119	49.524	ABC	ABC	ABC	ABC	ABC	
2268	SPOTW	34	24.006	119	48.636	ABC	ABC	ABC	ABC	ABC	
2269	SPOTW	34	23.838	119	40.014	ABC	ABC	ABC	ABC		
2270	SPOTW	34	23.532	119	40.176	ABC	ABC	ABC	ABC		
2271	SPOTW	34	23.442	119	39.780	ABC	ABC	ABC	ABC	ABC	
2272	SPOTW	34	23.898	119	39.558	ABC	ABC	ABC	ABC		
2273	SPOTW	34	07.812	119	11.910	ABC	ABC	ABC	ABC	ABC	
2274	SPOTW	34	07.434	119	11.862	ABC	ABC	ABC	ABC		
2275	SPOTW	34	07.800	119	11.640	ABC	ABC	ABC	ABC	ABC	
2276	SPOTW	34	07.440	119	10.968	ABC	ABC	ABC	ABC		
2277	SPOTW	33	30.492	117	45.906	MEC	MEC	SEAVEN	SEAVEN	SEAVEN	
2278	SPOTW	33	30.294	117	45.810	MEC	MEC	SEAVEN	SEAVEN		
2279	SPOTW	33	30.942	117	45.966	MEC	MEC	MBC	MBC		
2280	SPOTW	33	30.534	117	46.134	MEC	MEC	MBC	MBC		
2281	SPOTW	33	25.974	117	41.910	MEC	MEC	SEAVEN	SEAVEN		
2282	SPOTW	33	26.160	117	40.734	MEC	MEC	SEAVEN	SEAVEN		

2283	SPOTW	33	25.902	117	41.370	MEC	MEC	SEAVEN	SEAVEN		
2284	SPOTW	33	26.040	117	41.820	MEC	MEC	SEAVEN	SEAVEN		
2285	SPOTW	33	09.540	117	23.892	MEC	MEC	MBC	MBC		
2286	SPOTW	33	09.996	117	23.316	MEC	MEC	MBC	MBC	MBC	
2287	SPOTW	33	09.558	117	23.352	MEC	MEC	MBC	MBC		
2288	SPOTW	33	09.516	117	23.076	MEC	MEC	MBC	MBC	MBC	
2289	SPOTW	33	06.192	117	21.486	MEC	MEC	MEC	MEC	MEC	
2290	SPOTW	33	06.960	117	21.522	MEC	MEC	MEC	MEC	MEC	
2291	SPOTW	33	06.000	117	21.174	MEC	MEC	MEC	MEC	MEC	
2292	SPOTW	33	07.146	117	21.384	MEC	MEC	MEC	MEC		
2293	SPOTW	32	59.988	117	17.544	MEC	MEC	MEC	MEC	MEC	
2294	SPOTW	33	00.204	117	18.288	MEC	MEC	MEC	MEC		
2295	SPOTW	32	59.466	117	17.946	MEC	MEC	MEC	MEC	MEC	
2296	SPOTW	32	59.934	117	17.820	MEC	MEC	MEC	MEC		
2297	SPOTW	33	43.380	118	14.118	USN	USN	MBC	MBC	MBC	
2298	SPOTW	33	43.746	118	14.028	USN	USN	MBC	MBC	MBC	
2299	SPOTW	33	43.218	118	14.022	HYP	HYP	HYP	HYP	HYP	
2300	SPOTW	33	43.092	118	14.352	HYP	HYP	HYP	HYP	HYP	
2301	SPOTW	34	24.060	119	49.968	ABC	ABC	ABC	ABC		
2302	River	33	30.594	117	46.590	MEC	MEC	MBC	MBC	MBC	
2303	River	33	31.134	117	46.926	MEC	MEC	MBC	MBC	MBC	
2304	River	33	31.284	117	46.188	MEC	MEC	MBC	MBC	MBC	
2305	River	33	58.542	118	28.272	HYP	HYP	HYP	HYP	HYP	
2306	River	33	56.154	118	27.180	HYP	HYP	HYP	HYP	HYP	
2307	River	33	57.750	118	28.572	MEC	MEC	HYP	HYP	HYP	
2308	River	34	05.046	119	05.448	ABC	ABC	ABC	ABC	ABC	
2309	River	34	04.554	119	06.252	MEC	MEC	MBC	MBC	MBC	
2310	River	34	05.442	119	04.326	ABC	ABC	ABC	ABC	ABC	
2311	River	33	45.336	118	11.106	USN	USN	MBC	MBC	MBC*	
2312	River	34	01.236	118	39.900	MEC	MEC	HYP	HYP	HYP	
2313	River	34	01.668	118	40.956	HYP	HYP	HYP	HYP	HYP	

2314	River	34	01.626	118	40.956	MEC	MEC	HYP	HYP	HYP	
2315	River	32	46.170	117	16.188	SD	SD	SD	SD	SD	
2316	River	32	44.040	117	16.086	SD	SD	SD	SD	SD	
2317	River	32	46.026	117	16.590	SD	SD	SD	SD	SD	
2318	River	33	43.422	118	07.620	MEC	MEC	MBC	MBC	MBC	
2319	River	33	44.232	118	08.604	MEC	MEC	MBC	MBC	MBC	
2320	River	33	43.980	118	07.290	MEC	MEC	MBC	MBC	MBC	
2321	River	33	43.770	118	08.040	MEC	MEC	MBC	MBC	MBC	
2322	River	33	11.268	117	24.426	MEC	MEC	MBC	MBC	MBC	
2323	River	33	12.282	117	24.294	MEC	MEC	MBC	MBC	MBC	
2324	River	33	11.508	117	23.598	MEC	MEC	MBC	MBC	MBC	
2325	River	33	37.668	117	59.232	MEC	MEC	OCSD	OCSD	OCSD	
2326	River	33	37.362	117	57.372	MEC	MEC	OCSD	OCSD	OCSD	
2327	River	33	37.680	117	57.696	MEC	MEC	OCSD	OCSD	OCSD	
2328	River	34	13.212	119	17.334	ABC	ABC	ABC	ABC	ABC	
2329	River	34	15.000	119	16.596	ABC	ABC	ABC	ABC	ABC	
2330	River	34	14.364	119	16.842	ABC	ABC	ABC	ABC	ABC	
2331	River	34	14.748	119	17.364	ABC	ABC	ABC	ABC	ABC	
2332	River	33	12.492	117	23.892	MEC	MEC	MBC	MBC	MBC	
2333	River	33	12.360	117	24.438	MEC	MEC	MBC	MBC	MBC	
2334	River	32	33.120	117	08.574	SD	SD	SD	SD	SD	
2335	River	32	32.682	117	09.288	SD	SD	SD	SD	SD	
2336	River	32	34.608	117	08.592	SD	SD	SD	SD	SD	
2337	River	32	33.546	117	08.346	SD	SD	SD	SD	SD	
2338	River	34	16.182	119	20.466	ABC	ABC	ABC	ABC	ABC	
2339	River	34	15.132	119	17.100	ABC	ABC	ABC	ABC	ABC	
2340	River	34	15.900	119	20.448	ABC	ABC	ABC	ABC	ABC	
2341	Hist30	34	05.301	119	09.080	ABC	ABC	ABC	ABC		
2342	Hist60	34	04.204	119	09.579	ABC	ABC	ABC	ABC		
2343	Hist30	34	01.465	118	51.108	ABC	ABC	ABC	ABC		
2344	Hist60	34	01.130	118	51.378	ABC	ABC	ABC	ABC		

2345	Hist30	33	30.445	117	46.107	MEC	MEC	MBC	MBC		
2346	Hist60	33	29.643	117	46.628	MEC	MEC	MBC	MBC		
2347	Hist30	33	24.290	117	39.265	MEC	MEC	SEAVEN	SEAVEN		
2348	Hist60	33	23.721	117	39.905	MEC	MEC	SEAVEN	SEAVEN		
2349	Hist30	32	53.676	117	16.130	SD	SD	SD	SD		
2350	Hist60	32	53.321	117	16.663	SD	SD	SD	SD		
2351	Hist60	32	49.290	117	19.212	SD	SD	SD	SD		
2352	Hist30	32	32.522	117	11.414	SD	SD	SD	SD		
2353	Hist60	32	33.120	117	15.820	SD	SD	SD	SD		
2354	bath-30	34	27.532	120	18.770	MEC	MEC	MBC	MBC	MBC	
2355	bath-30	34	27.096	120	20.174	MEC	MEC	MBC	MBC	MBC	
2356	bath-120	34	26.873	120	04.407	MEC	MEC	MBC	MBC	MBC	
2357	bath-120	34	24.379	119	56.447	MEC	MEC	MBC	MBC	MBC	
2358	bath-120	34	23.809	119	58.350	MEC	MEC	MBC	MBC	MBC	
2359	bath-30	34	23.903	119	51.886	MEC	MEC	MBC	MBC	MBC	
2360	bath-120	34	23.640	119	52.523	MEC	MEC	MBC	MBC	MBC	
2361	bath-30	34	23.981	119	34.264	ABC	ABC	ABC	ABC	ABC	
2362	bath-120	34	22.130	119	40.097	ABC	ABC	ABC	ABC	ABC	
2363	bath-120	34	21.317	119	37.726	ABC	ABC	ABC	ABC	ABC	
2364	bath-120	34	20.564	119	39.410	ABC	ABC	ABC	ABC	ABC	
2365	bath-120	34	20.645	119	33.755	ABC	ABC	ABC	ABC	ABC	
2366	bath-120	34	19.888	119	36.635	MEC	MEC	MBC	MBC	MBC	
2367	bath-120	34	19.045	119	31.989	ABC	ABC	ABC	ABC	ABC	
2368	bath-120	34	18.071	119	27.786	ABC	ABC	ABC	ABC	ABC	
2369	bath-120	34	18.248	119	25.520	ABC	ABC	ABC	ABC	ABC	
2370	bath-30	34	17.919	119	21.738	ABC	ABC	ABC	ABC	ABC	
2371	bath-120	34	15.890	119	30.580	ABC	ABC	ABC	ABC	ABC	
2372	bath-120	34	14.389	119	36.128	MEC	MEC	MBC	MBC	MBC	
2373	bath-30	34	13.233	119	23.153	ABC	ABC	ABC	ABC	ABC	
2374	bath-120	34	11.305	119	29.483	MEC	MEC	MBC	MBC	MBC	
2375	bath-30	34	11.255	119	21.324	ABC	ABC	ABC	ABC	ABC	

2376	bath-30	34	10.720	119	20.812	ABC	ABC	ABC	ABC	ABC	
2377	bath-30	34	02.305	118	56.359	ABC	ABC	ABC	ABC	ABC	
2378	bath-30	34	01.921	118	55.337	ABC	ABC	ABC	ABC	ABC	
2379	bath-30	34	01.140	118	50.237	ABC	ABC	ABC	ABC	ABC	
2380	bath-30	34	01.086	118	45.566	MEC	MEC	HYP	HYP	HYP	
2381	bath-120	34	00.177	118	46.160	HYP	HYP	HYP	HYP	HYP	
2382	bath-30	34	01.393	118	35.569	HYP	HYP	HYP	HYP	HYP	
2383	bath-30	34	00.671	118	30.777	MEC	MEC	HYP	HYP	HYP	
2384	bath-120	33	55.808	118	30.281	MEC	MEC	HYP	HYP	HYP	
2385	bath-30	33	54.383	118	27.424	HYP	HYP	HYP	HYP	HYP	
2386	bath-30	33	52.687	118	25.469	LACO	LACO	LACO	LACO	LACO	
2387	bath-120	33	50.900	118	27.133	LACO	LACO	LACO	LACO	LACO	
2388	bath-30	33	44.890	118	08.933	USN	USN	MBC	MBC	MBC	
2389	bath-30	33	42.570	118	19.316	LACO	LACO	LACO	LACO	LACO	
2390	bath-30	33	41.600	118	15.881	LACO	LACO	LACO	LACO	LACO	
2391	bath-30	33	42.565	118	08.264	LACO	LACO	LACO	LACO	LACO	
2392	bath-30	33	42.304	118	09.316	LACO	LACO	LACO	LACO	LACO	
2393	bath-30	33	40.969	118	05.229	LACO	LACO	LACO	LACO	LACO	
2394	bath-120	33	39.062	118	14.944	LACO	LACO	LACO	LACO	LACO	
2395	bath-30	33	40.357	118	03.242	LACO	LACO	LACO	LACO	LACO	
2396	bath-120	33	38.880	118	08.970	LACO	LACO	LACO	LACO	LACO	
2397	bath-30	33	39.001	118	07.565	LACO	LACO	LACO	LACO	LACO	
2398	bath-120	33	37.152	118	08.584	LACO	LACO	LACO	LACO	LACO	
2399	bath-30	33	38.087	117	59.690	MEC	MEC	OCSD	OCSD	OCSD	
2400	bath-120	33	36.208	118	05.727	MEC	MEC	OCSD	OCSD	OCSD	
2401	bath-120	33	35.484	117	57.466	MEC	MEC	OCSD	OCSD	OCSD	
2402	bath-30	33	33.455	117	49.783	MEC	MEC	OCSD	OCSD	OCSD	
2403	bath-120	33	31.116	117	48.178	MEC	MEC	OCSD	OCSD	OCSD	
2404	bath-30	33	25.322	117	39.325	MEC	MEC	SEAVEN	SEAVEN	SEAVEN	
2405	bath-120	33	17.667	117	33.574	MEC	MEC	MBC	MBC	MBC	
2406	bath-30	33	16.898	117	28.262	MEC	MEC	MBC	MBC	MBC	

2407	bath-120	33	15.612	117	31.411	MEC	MEC	MBC	MBC	MBC	
2408	bath-120	33	06.308	117	21.715	MEC	MEC	MEC	MEC	MEC	
2409	bath-30	33	00.042	117	17.000	MEC	MEC	MEC	MEC	MEC	
2410	bath-120	32	46.325	117	21.275	SD	SD	SD	SD	SD	
2411	bath-120	32	45.160	117	20.579	SD	SD	SD	SD	SD	
2412	bath-120	32	43.287	117	17.776	SD	SD	SD	SD	SD	
2413	bath-120	32	41.422	117	16.697	SD	SD	SD	SD	SD	
2414	bath-30	32	40.610	117	11.399	SD	SD	SD	SD	SD	
2415	bath-30	32	39.518	117	10.928	SD	SD	SD	SD	SD	
2416	bath-30	32	39.707	117	09.824	SD	SD	SD	SD	SD	
2417	bath-30	32	37.497	117	12.887	SD	SD	SD	SD	SD	
2418	bath-120	32	35.712	117	18.889	SD	SD	SD	SD	SD	
2419	bath-120	32	35.363	117	15.817	SD	SD	SD	SD	SD	
2420	marina	33	45.997	118	14.950	MEC	MEC	MBC	MBC	MBC	MEC
2421	marina	33	45.988	118	14.479			MBC	MBC	MBC	
2422	marina	33	44.801	118	15.177			MBC	MBC	MBC	
2423	marina	32	46.856	117	14.976			SD	SD	SD	
2424	marina	32	46.001	117	14.812			SD	SD	SD	
2425	marina	32	46.029	117	14.131			SD	SD	SD	
2426	other	33	44.056	118	13.889	MEC	MEC	MBC	MBC	MBC	MEC
2427	other	33	43.865	118	14.116	USN	USN	MBC	MBC	MBC	USN
2428	other	33	43.126	118	15.549			HYP	HYP	HYP	
2429	other	33	42.601	118	16.885			MBC	MBC	MBC*	
2430	port	33	46.150	118	13.472	MEC	MEC	MBC	MBC	MBC	MEC
2431	port	33	45.200	118	13.449			MBC	MBC	MBC*	
2432	port	33	45.051	118	13.831			MBC	MBC	MBC*	
2433	sdother	32	43.343	117	12.570			SD	SD	SD	
2434	sdother	32	43.492	117	11.015	SD	SD	SD	SD	SD	SD
2435	sdother	32	42.695	117	13.373	SD	SD	SD	SD	SD	SD
2436	sdother	32	42.902	117	10.985	SD	SD	SD	SD	SD	SD
2437	sdmari	32	40.879	117	10.298			SD	SD	SD	

2438	sdmari	32	37.337	117	06.086	SD	SD	SD	SD	SD	SD
2439	sdport	32	43.562	117	11.368	SD	SD	SD	SD	SD	SD
2440	sdport	32	43.111	117	10.490			SD	SD	SD	
2441	sdport	32	41.467	117	14.282			USN	USN	USN	
2442	sdport	32	41.356	117	14.224			USN	USN	USN	
2443	marina	33	58.999	118	27.033	ABC	ABC	ABC	ABC	ABC	ABC
2444	marina	33	58.875	118	26.894	ABC	ABC	ABC	ABC	ABC	ABC
2445	marina	33	58.700	118	27.331	ABC	ABC	ABC	ABC	ABC	ABC
2446	marina	33	58.640	118	26.486	ABC	ABC	ABC	ABC	ABC	ABC
2447	marina	33	58.442	118	26.831	ABC	ABC	ABC	ABC	ABC	ABC
2448	marina	33	58.219	118	26.892	ABC	ABC	ABC	ABC	ABC	ABC
2449	marina	33	57.826	118	27.433	ABC	ABC	ABC	ABC	ABC	ABC
2450	river	33	45.602	118	11.953	MEC	MEC	MBC	MBC	MBC	
2451	river	33	45.133	118	10.444	MEC	MEC	MBC	MBC	MBC	
2452	river	33	44.478	118	07.016	MEC	MEC	MBC	MBC	MBC	
2453	river	33	37.682	117	58.494	MEC	MEC	OCSD	OCSD	OCSD	
2454	river	33	30.591	117	45.184	MEC	MEC	SEAVEN	SEAVEN	SEAVEN	
2455	SPOTW	33	06.603	117	20.807			MEC	MEC		
2456	SPOTW	33	06.633	117	18.150			MEC	MEC		
2457	SPOTW	33	26.463	117	41.482			SEAVEN	SEAVEN		
2458	SPOTW	33	10.200	117	23.900			MBC	MBC		
2459	Deep	32	38.806	117	26.647	SD	SD				
2460	Deep	32	36.173	117	24.851	SD	SD				
2461	Deep	32	36.790	117	21.192	SD	SD				
2462	Deep	32	36.026	117	24.788	SD	SD				
2463	Deep	32	35.314	117	22.574	SD	SD				
2464	ChannelNWS	34	02.058	120	27.084	CINMS	CINMS	CINMS	CINMS		CINMS
2465	ChannelNWS	34	04.132	120	23.514	CINMS	CINMS	CINMS	CINMS		CINMS
2466	ChannelNWS	34	00.926	120	18.024	CINMS	CINMS	CINMS	CINMS		CINMS
2467	ChannelNWS	33	57.910	119	51.156	CINMS	CINMS	CINMS	CINMS		CINMS
2468	ChannelNWS	34	03.776	120	24.804	CINMS	CINMS	CINMS	CINMS		CINMS

2469	ChannelNWS	34	00.673	120	22.332	CINMS	CINMS	CINMS	CINMS		CINMS
2470	ChannelNWS	34	00.572	119	53.214	CINMS	CINMS	CINMS	CINMS		CINMS
2471	ChannelNWS	34	03.367	120	27.240	CINMS	CINMS	CINMS	CINMS		CINMS
2472	ChannelNWS	34	00.728	119	53.844	CINMS	CINMS	CINMS	CINMS		CINMS
2473	ChannelNWS	34	03.193	119	48.810	CINMS	CINMS	CINMS	CINMS		CINMS
2474	ChannelNWS	34	03.704	120	27.828	CINMS	CINMS	CINMS	CINMS		CINMS
2475	ChannelNWS	34	02.858	119	54.696	CINMS	CINMS	CINMS	CINMS		CINMS
2479	ChannelNWS	34	04.129	119	46.194	CINMS	CINMS	CINMS	CINMS		CINMS
2480	ChannelNWM	34	09.004	120	21.270	CINMS	CINMS	CINMS	CINMS		CINMS
2481	ChannelNWM	34	08.353	120	29.712	CINMS	CINMS	CINMS	CINMS		CINMS
2482	ChannelNWM	33	53.608	120	01.728	CINMS	CINMS	CINMS	CINMS		CINMS
2483	ChannelNWM	34	04.837	120	07.626	CINMS	CINMS	CINMS	CINMS		CINMS
2484	ChannelNWM	34	01.637	120	11.520	CINMS	CINMS	CINMS	CINMS		CINMS
2485	ChannelNWM	33	50.536	120	02.178	CINMS	CINMS	CINMS	CINMS		CINMS
2486	ChannelNWM	34	03.195	120	04.050	CINMS	CINMS	CINMS	CINMS		CINMS
2487	ChannelNWM	34	00.865	120	26.238	CINMS	CINMS	CINMS	CINMS		CINMS
2488	ChannelNWM	33	59.926	120	15.384	CINMS	CINMS	CINMS	CINMS		CINMS
2489	ChannelNWM	33	56.621	120	14.436	CINMS	CINMS	CINMS	CINMS		CINMS
2490	ChannelNWM	34	02.729	120	29.406	CINMS	CINMS	CINMS	CINMS		CINMS
2494	ChannelNWD	33	47.498	120	02.220	CINMS					CINMS
2495	ChannelNWD	33	56.218	119	53.766	CINMS					CINMS
2496	ChannelNWD	34	05.522	120	34.770	CINMS					CINMS
2497	ChannelNWD	33	47.016	119	57.432	CINMS					CINMS
2498	ChannelNWD	33	43.781	119	52.038	CINMS					CINMS
2499	ChannelNWD	34	06.690	119	46.692	CINMS					CINMS
2500	ChannelNWD	33	47.396	119	53.862	CINMS					CINMS
2501	ChannelNWD	33	39.040	119	52.464	CINMS					CINMS
2502	ChannelNWD	34	10.409	120	24.150	CINMS					CINMS
2503	ChannelNWD	33	42.106	119	55.974	CINMS					CINMS
2504	ChannelNWD	33	39.445	120	00.528	CINMS					CINMS
2505	ChannelNWD	33	47.791	119	54.612	CINMS					CINMS

2509	ChannelSES	34	02.091	119	20.088	CINMS	CINMS	CINMS	CINMS		CINMS
2510	ChannelSES	34	00.164	119	28.926	CINMS	CINMS	CINMS	CINMS		CINMS
2511	ChannelSES	33	30.582	119	04.560	CINMS	CINMS	CINMS	CINMS		CINMS
2512	ChannelSES	33	28.567	119	00.036	CINMS	CINMS	CINMS	CINMS		CINMS
2513	ChannelSES	33	59.461	119	23.268	CINMS	CINMS	CINMS	CINMS		CINMS
2514	ChannelSES	34	01.976	119	30.552	CINMS	CINMS	CINMS	CINMS		CINMS
2515	ChannelSES	34	05.062	119	40.050	CINMS	CINMS	CINMS	CINMS		CINMS
2516	ChannelSES	34	03.997	119	35.334	CINMS	CINMS	CINMS	CINMS		CINMS
2517	ChannelSES	34	01.154	119	28.482	CINMS	CINMS	CINMS	CINMS		CINMS
2518	ChannelSES	34	05.803	119	44.226	CINMS	CINMS	CINMS	CINMS		CINMS
2519	ChannelSES	33	58.156	119	37.866	CINMS	CINMS	CINMS	CINMS		CINMS
2520	ChannelSES	34	01.861	119	25.374	CINMS	CINMS	CINMS	CINMS		CINMS
2524	ChannelSEM	33	57.586	119	28.956	CINMS	CINMS	CINMS	CINMS		CINMS
2525	ChannelSEM	34	03.272	119	19.950	CINMS	CINMS	CINMS	CINMS		CINMS
2526	ChannelSEM	34	06.241	119	44.058	CINMS	CINMS	CINMS	CINMS		CINMS
2527	ChannelSEM	33	31.190	119	01.620	CINMS	CINMS	CINMS	CINMS		CINMS
2528	ChannelSEM	34	04.306	119	25.152	CINMS	CINMS	CINMS	CINMS		CINMS
2529	ChannelSEM	34	03.168	119	17.730	CINMS	CINMS	CINMS	CINMS		CINMS
2530	ChannelSEM	33	32.678	119	03.594	CINMS	CINMS	CINMS	CINMS		CINMS
2531	ChannelSEM	34	05.251	119	30.216	CINMS	CINMS	CINMS	CINMS		CINMS
2532	ChannelSEM	34	02.330	119	18.006	CINMS	CINMS	CINMS	CINMS		CINMS
2533	ChannelSEM	33	58.248	119	31.824	CINMS	CINMS	CINMS	CINMS		CINMS
2534	ChannelSEM	34	05.129	119	32.868	CINMS	CINMS	CINMS	CINMS		CINMS
2535	ChannelSEM	33	55.847	119	47.658	CINMS	CINMS	CINMS	CINMS		CINMS
2539	ChannelSED	34	00.796	119	26.058	CINMS					CINMS
2540	ChannelSED	33	57.678	119	42.726	CINMS					CINMS
2541	ChannelSED	33	28.052	119	02.526	CINMS					CINMS
2542	ChannelSED	33	27.735	119	01.794	CINMS					CINMS
2543	ChannelSED	34	00.205	119	25.722	CINMS					CINMS
2544	ChannelSED	34	02.384	119	36.210	CINMS					CINMS
2545	ChannelSED	34	01.153	119	21.882	CINMS					CINMS

2546	ChannelSED	34 00.633	119 24.294	CINMS					CINMS
2547	ChannelSED	34 03.257	119 34.410	CINMS					CINMS
2548	ChannelSED	33 59.270	119 32.862	CINMS					CINMS
2549	ChannelSED	33 59.222	119 35.316	CINMS					CINMS
2550	ChannelSED	33 29.504	119 04.062	CINMS					CINMS

APPENDIX 3

BIGHT'98 SAMPLE PROCESSING

ANALYTICAL LABORATORIES

LEGEND TO ANALYTICAL LABORATORIES

ABC = Aquatic Bioassay & Consulting Laboratories
CAS = Columbia Analytical Services
CRG = CRG Marine Laboratories, Inc.
EPA = Environmental Protection Agency
HYP = City of Los Angeles Bureau of Sanitation (Hyperion Treatment Plant)
LACO = Los Angeles County Sanitation District
MEC = MEC Analytical Systems, Inc.
MPSL = Marine Pollution Studies Lab (Granite Canyon)
OCSD = Orange County Sanitation District
SCCW = Southern California Coastal Water Research Project
SD = City of San Diego, Metropolitan Wastewater Department
USGS = United States Geologic Service
USN = U. S. Navy (SPAWAR)

ANALYTICAL LABORATORY

	fish		Sediment Chemistries							Sediment Toxicity				Biomarkers	
SITE	tissue chem	benthic infauna	grain size	TOC	metals	organics	LAB's/ PAH	minerol.	AVS-SEM	amph.	qlite	RGS-450	mtox	DNA	Bile
2065	HYP														
2066	HYP	HYP	archive	archive	archive	archive	archive	archive							
2067	HYP														
2068	CRG	HYP	archive	archive	archive	archive	archive	archive							
2069	CRG	HYP	archive	archive	archive	archive	archive	archive							
2070	CRG	HYP	archive	archive	archive	archive	archive	archive							
2071	CRG	HYP	archive	archive	archive	archive	archive	archive							
2072	CRG	HYP	archive	archive	archive	archive	archive	archive							
2073	CRG	HYP	archive	archive	archive	archive	archive	archive							
2074	CRG														
2075	CRG	HYP	archive	archive	archive	archive	archive	archive							
2076	CRG														
2077	CRG	HYP	archive	archive	archive	archive	archive	archive							
2078	CRG	ABC	archive	archive	archive	archive	archive	archive							
2079	CRG	ABC	archive	archive	archive	archive	archive	archive							
2080	CRG	ABC	archive	archive	archive	archive	archive	archive							
2081	CRG	ABC	archive	archive	archive	archive	archive	archive							
2082	CRG	ABC	archive	archive	archive	archive	archive	archive							
2083	CRG	ABC	archive	archive	archive	archive	archive	archive							
2084	CRG	ABC	archive	archive	archive	archive	archive	archive							
2085	CRG														
2086	CRG	ABC	archive	archive	archive	archive	archive	archive							
2087	CRG	ABC	archive	archive	archive	archive	archive	archive							
2088	CRG	ABC	archive	archive	archive	archive	archive	archive							
2089	CRG	ABC	archive	archive	archive	archive	archive	archive							
2090	CRG														
2091	CRG	ABC	archive	archive	archive	archive	archive	archive							

2092	CRG														
2093	CRG	ABC	archive	archive	archive	archive	archive	archive							
2094	CRG														
2095	CRG														
2096	CRG														
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2099	CRG														
2100	CRG														
2101	CRG														
2102	CRG														
2103	CRG														
2104	CRG														
2105	CRG														
2106	CRG														
2107	CRG														
2108	CRG														
2109	CRG														
2110	CRG														
2111	CRG														
2112	HYP														
2113	HYP														
2114	HYP														
2115	HYP														
2116	HYP														
2117	HYP														
2118	LACO														
2119	CRG														
2120	CRG														
2121	CRG														
2122	CRG														
2128		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		

2129	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2130		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2131		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2132		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2133		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2134		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2135		ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2136		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2137	CRG	ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD	USN	SCCW
2138		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2139		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2140		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2141		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2142		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2143		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2144		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2145		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2146		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2147	OCSD	ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD	USN	SCCW
2148		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2149		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2150		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2151		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2152	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2153	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2154	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2155	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2156		ABC	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2157		ABC	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2158	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2159		ABC	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2160		ABC	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		

2161		ABC	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2162	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD	USN	SCCW
2163		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2164		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2165	OCSD	ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD	USN	SCCW
2166		ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2167	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2168	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD	USN	SCCW
2169		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2170		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2171		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2172		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2173		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2174	CRG	ABC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	HYP	USN	CAS	OCSD	USN	SCCW
2175		HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2176		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2177		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2178		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2179		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2180	HYP	HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD	USN	SCCW
2181		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2182		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2183		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2184	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2185		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2186	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD	USN	SCCW
2187		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2188		HYP	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2189	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS				CAS			
2190	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2191	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2192	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		

2193	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS				CAS			
2194	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS				CAS			
2195	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2196	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS				CAS			
2197	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2198	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS				CAS			
2199	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2200	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS				CAS			
2201	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2202	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2203	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2204	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS				CAS			
2205	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2206	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS				CAS			
2207	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS				CAS			
2208	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2209	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2210	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS				CAS			
2211	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS				CAS			
2212	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2213	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS				CAS			
2214	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2215	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2216	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2217	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2218	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2219	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2220	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2221		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2222		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2223	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2224		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		

2225	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2226		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2227		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2228		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2229	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2230	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2231	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2232	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2233	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2234		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2235	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2236	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2237		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2238	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2239	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2240	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2241	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2242	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2243	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2244	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2245	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2246	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2247	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2248	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2249	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2250	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2251		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2252		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2253		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2254	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2255		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2256	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW

2257		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2258	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2259	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2260		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2261	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2262	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2263		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2264		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2265		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2266	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2267	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2268	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2269	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2270	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2271	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2272	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2273	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2274	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2275	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2276	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2277	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2278	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2279	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2280	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2281	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2282	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2283	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2284	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2285	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2286	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2287	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2288	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		

2289	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2290	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2291	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2292	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2293	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2294	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2295	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2296	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2297	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2298	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	MEC	USN	CAS	OCSD		
2299	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2300	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2301	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2302	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		MEC		CAS			
2303	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		MEC		CAS			
2304	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		MEC		CAS			
2305	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2306	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2307	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS		HYP		CAS			
2308	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2309	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS		MEC		CAS			
2310	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2311	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS		MPSL		CAS			
2312	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2313	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2314	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2315	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2316	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2317	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2318	CRG	MEC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2319	CRG	MEC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2320	CRG	MEC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			

2321	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2322	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2323	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2324	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2325	OCSD	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2326	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2327	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2328	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		ABC		CAS			
2329	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2330	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		ABC		CAS			
2331	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		ABC		CAS			
2332	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		MEC		CAS			
2333	CRG	ABC	SD	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2334	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2335	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2336	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2337	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2338	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2339	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2340	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2341	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2342	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2343	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2344	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2345	CRG	ABC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2346	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2347	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2348	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS				CAS			
2349	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2350	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2351	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2352	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			

2353	SD	SD	SD	SCCW	SD	SD	SCCW	USGS				CAS			
2354	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2355	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2356	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2357	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2358	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2359	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2360	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2361	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2362	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2363	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2364	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2365	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2366	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2367	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2368	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2369	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2370	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2371	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2372	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2373	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2374	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2375	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2376	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2377	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2378	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD		
2379	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		ABC		CAS			
2380	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2381	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2382	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			
2383	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2384	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS		HYP		CAS			

2385	HYP	HYP	HYP	SCCW	HYP	HYP	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2386	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		HYP		CAS			
2387	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2388	LACO	MEC	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2389	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2390	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2391	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2392	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2393	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2394	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2395	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2396	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2397	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2398	LACO	LACO	HYP	SCCW	LACO	LACO	SCCW	USGS		SCCW		CAS			
2399	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2400	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2401	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2402	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2403	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2404	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2405	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2406	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2407	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2408	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	OCSD	USN	CAS	OCSD		
2409	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2410	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2411	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2412	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2413	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2414	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2415	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2416	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		

2417	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2418	SD	SD	SD	SCCW	SD	SD	SCCW	USGS		SD		CAS			
2419	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SD	USN	CAS	OCSD		
2420	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2421		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2422		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2423		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2424		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2425		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2426	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2427	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2428		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	HYP	USN	CAS	OCSD		
2429		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2430	CRG	MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2431		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2432		MEC	SD	SCCW	CAS	CRG	SCCW	USGS	EPA	MPSL	USN	CAS	OCSD		
2433		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2434	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2435	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2436	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2437		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2438	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2439	SD	SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD	USN	SCCW
2440		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2441		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2442		SD	SD	SCCW	SD	SD	SCCW	USGS	EPA	SCCW	USN	CAS	OCSD		
2443	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2444	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2445	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2446	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2447	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2448	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW

2449	CRG	ABC	HYP	SCCW	CAS	CRG	SCCW	USGS	EPA	ABC	USN	CAS	OCSD	USN	SCCW
2450	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2451	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2452	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2453	CRG	MEC	HYP	SCCW	OCSD	OCSD	SCCW	USGS		OCSD		CAS			
2454	CRG	MEC	HYP	SCCW	CAS	CRG	SCCW	USGS		OCSD		CAS			
2455		MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2456		MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2457		MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2458		MEC	HYP	SCCW	CAS	CRG	SCCW	USGS				CAS			
2459	SD														
2460	SD														
2461	SD														
2462	SD														
2463	SD														
2464	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2465	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2466	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2467	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2468	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2469	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2470	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2471	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2472	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2473	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2474	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2475	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2479	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2480	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2481	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2482	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2483	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW

2484	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2485	LACO	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2486	HYP	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2487	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2488	HYP	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2489	HYP	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2490	HYP	LACO	archive	archive	archive	archive	archive	archive						USN	SCCW
2494	HYP													USN	SCCW
2495	HYP													USN	SCCW
2496	HYP													USN	SCCW
2497	HYP													USN	SCCW
2498	HYP													USN	SCCW
2499	HYP													USN	SCCW
2500	HYP													USN	SCCW
2501	HYP													USN	SCCW
2502	HYP													USN	SCCW
2503	HYP													USN	SCCW
2504	HYP													USN	SCCW
2505	HYP													USN	SCCW
2509	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2510	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2511	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2512	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2513	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2514	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2515	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2516	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2517	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2518	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2519	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2520	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2524	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW

2525	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2526	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2527	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2528	HYP	HYP	archive	archive	archive	archive	archive	archive						USN	SCCW
2529	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2530	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2531	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2532	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2533	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2534	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2535	HYP	SD	archive	archive	archive	archive	archive	archive						USN	SCCW
2539	HYP													USN	SCCW
2540	HYP													USN	SCCW
2541	HYP													USN	SCCW
2542	HYP													USN	SCCW
2543	HYP													USN	SCCW
2544	HYP													USN	SCCW
2545	HYP													USN	SCCW
2546	HYP													USN	SCCW
2547	HYP													USN	SCCW
2548	HYP													USN	SCCW
2549	HYP													USN	SCCW
2550	HYP													USN	SCCW

APPENDIX 4

BIGHT'98 FIELD SAMPLING

EQUIPMENT AND SUPPLY LISTS

BIGHT'98
EQUIPMENT AND SUPPLY LIST

GENERAL

SCBPP Field Operation Manual
SCBPP Workplan
Ship's Log Data Sheets
Field Data Sheets
Clipboards
No. 2 Pencils
Waterproof Markers
Waterproof Paper Tags
First Aid Kits
Sunscreen
Protective Glasses
Gloves - Leather and Formalin
Hand Tools - Channel Locks or Pliers
Field Thermometers
Paper Towels and Cotton Towels
Kimwipes
Squirt Bottles
Floats/Anchors (to mark lost equipment)

TRAWL SURVEYS

7.6-M otter trawl net, doors, bridles (and extras)
Spare Chain, Shackles, and Rope
Sorting Buckets, Tubs and Tags
Field Guides and Keys
Ice Chest with Wet Ice
Ice Chest with Dry Ice
Dissecting Kits
Spring Scales, Tare Buckets, and Calibration Weights
Fish Measuring Boards
Jars
Ziplock
Plastic Bags and Whirlpack Bags
Buffered Formalin
Camera, Film, and Camera Board

BENTHIC SURVEYS

Modified Van Veen Grab Sampler
Plastic Centimeter Ruler
Timers
Screening Box with 1.0 mm Screen
Large Plastic Tubs
Relaxant in Seawater
Buffered Formalin
Sediment Scoops
Ice Chest with Wet Ice
Jars
- Sediment Chemistry
- Toxicity

Deionized Water
Brushes

APPENDIX 5

BIGHT'98 FIELD SAMPLING

SAMPLING VESSEL SPECIFICATIONS

Specifications of ocean sampling vessels participating in the Bight '98 survey, summer 1998.

Specification	1	2	3	4
agency/owner	City of L.A.	City of L.A.	L.A.C.S.D.	L.A.C.S.D.
vessel name	La Mer	Marine Surveyor	Ocean Sentinel	Phaon
length (ft)	85	65	66	25
home port	Marina del Rey	San Pedro	Cabrillo	Cabrillo
call sign	WAM7628	WO5232	WAA9057	WTA5037
cellular phone	None	None	310/613-5434	None
nav. equip.				
radar	Yes	Yes	Yes	Yes
fathometer	Yes	Yes	Yes	Yes
GPS	Yes	Yes	Yes	Yes
DGPS	Yes	Yes	Yes	Yes
sampling equip.				
puller cat-head	Yes	Yes	Yes	Yes
wire dia/puller (in)	N/A	N/A	N/A	N/A
wire length/puller(ft)	N/A	N/A	N/A	N/A
winch/grab	Yes	Yes	Yes	No
wire dia/grab (in)	1/4	5/32	3/16	N/A
wire length/grab (ft)	2000	2000	3000	N/A
winch/trawl	Yes	Yes	Yes	No
wire dia/trawl (in)	3/8	5/16	3/8	N/A
wire length/trawl (ft)	3500	4000	4000	N/A
davit	Yes	Yes	Yes	Yes
A/H - frame	Yes	No	No	No
articulated crane	Yes	No	Yes	No
refrigerator	Yes	Yes	Yes	No
freezer	Yes	Yes	Yes	No

Specifications of ocean sampling vessels participating in the Bight '98 survey, summer 1998.

Specification	5	6	7	8
agency/owner	City of S.D.	City of S.D.	U.S. Navy	So. Cal. Mar. Inst.
vessel name	Monitor III	Metro	ECOS	Yellowfin
length (ft)	42	30	42	76
home port	Driscoll's Wharf	Driscoll's Wharf	San Diego	Terminal Island
call sign	WUV9304	WUV9304	Florida 25	WSA3704
cellular phone	619/520-1926	619/520-1933	619/988-7986	310/519-3172
nav. equip.				
radar	Yes	Yes	Yes	Yes
fathometer	Yes	Yes	Yes	Yes
GPS	Yes	Yes	Yes	Yes
DGPS	Yes	Yes	Yes	Yes
sampling equip.				
puller cat-head	No	No	No	No
wire dia/puller (in)	N/A	N/A	N/A	N/A
wire length/puller(ft)	N/A	N/A	N/A	N/A
winch/grab	Yes	Yes	Yes	Yes
wire dia/grab (in)	1/4	1/4	3/16	5/16
wire length/grab (ft)	750	750	325	5000
winch/trawl	Yes	No	No	Yes
wire dia/trawl (in)	5/16	N/A	N/A	7/16
wire length/trawl (ft)	3000	N/A	N/A	16,000
davit	Yes	Yes	Yes	Yes
A/H - frame	Yes	No	Yes	Yes
articulated crane	No	No	No	Yes
refrigerator	Yes	No	No	Yes
freezer	No	No	No	Yes

Specifications of ocean sampling vessels participating in the Bight '98 survey, summer 1998.

Specification	9	10	11	12
agency/owner	So. Cal. Mar. Inst.	MBC/Conshelf	ABC	Seaventures
vessel name	Sea Watch	Westwind	Hey Jude	Early Bird
length (ft)	65	50	40	32
home port	Terminal Island	Newport Beach	Channel Islands Harbor	Dana Point
call sign	WUV6093	WYZ9810	WYB3631	WAR 6030
cellular phone	310/560-9930	714/321-8204	805/340-0184	714/397-0596
nav. equip.				
radar	Yes	Yes	Yes	Yes
fathometer	Yes	Yes	Yes	Yes
GPS	Yes	Yes	Yes	Yes
DGPS	Yes		Yes	Yes
sampling equip.				
puller cat-head	No	Yes	Yes	Yes
wire dia/puller (in)	N/A	1/4	N/A	1/4
wire length/puller(ft)	N/A	5000	N/A	7000
winch/grab	Yes	Yes	Yes	Yes
wire dia/grab (in)	5/32	1/4	9/16	1/4
wire length/grab (ft)	2500	5000	4000	7000
winch/trawl	Yes	Yes	Yes	Yes
wire dia/trawl (in)	3/8	1/4	9/16	1/4
wire length/trawl (ft)	4000	5000	4000	7000
davit	Yes	No	Yes	No
A/H - frame	Yes	Yes	No	Yes
articulated crane	No	No	No	No
refrigerator	Yes	Yes	Yes	Yes
freezer	Yes	Yes	No	Yes

Specifications of ocean sampling vessels participating in the Bight '98 survey, summer 1998.

Specification	13	14
agency/owner	NOAA	P. Howorth
vessel name	Ballena	Spirit of Santa Barbara
length (ft)	56	48
home port	Santa Barbara Harbor	Santa Barbara Harbor
call sign		WCB 7713
cellular phone	805/688-5954	805/689-7448
nav. equip.		
radar	Yes	Yes
fathometer	Yes	Yes
GPS	Yes	Yes
DGPS	Yes	Yes
sampling equip.		
puller cat-head	No	Yes
wire dia/puller (in)	N/A	1/2
wire length/puller(ft)	N/A	500
winch/grab	Yes	Yes
wire dia/grab (in)	.322	1/2
wire length/grab (ft)	2600	500
winch/trawl	Yes	Yes
wire dia/trawl (in)	.322	1/4
wire length/trawl (ft)	2600	2000
davit	Yes	No
A/H - frame	Yes	Yes
articulated crane	No	No
refrigerator	Yes	Yes
freezer	Yes	Yes

APPENDIX 6

BIGHT'98 FIELD SAMPLING

DATA SHEETS

CRUISE LOG Page ____ of ____

Date:

Agency:		Vessel:	
Depart Dock:		Arrive Dock:	
Navigation equipment (circle one):	DGPS	GPS	
Ship Captain/crew:			
Chief Scientist/scientific crew:			
High Tide (ft):	Time:	Low Tide (ft):	Time:
High Tide (ft):	Time:	Low Tide (ft):	Time:

TIME /SAMPLING EVENT

TIME /SAMPLING EVENT

BENTHIC DATA SHEET Page ____ of ____

Station:	Agency:	Date:
Vessel Name:	Arrive Time:	Depart Time:
Grab 1- Depth (m):	**Latitude:	**Longitude:
** If subsequent grab positions differ from the position above, record those positions on back of sheet		
Weather[1]:	Wind (Kts/dir):	Swell: Ht.(ft): Period (sec): Dir[2]:

Station Failure[3]: Grab Failure[4]: 1____ 2____ 3____ 4____

Time of day in: relaxant:_____ fixative _____

Grab Num.	Pen. Depth (cm)	Sed. Comp.[5]	Sed. Odor[6]	Sed. Color[7]	Grab Type[8]	Sample Type[9]
1					infauna	infauna
2						
3						
4						
5						
6						
7						
8						

[1] Weather List: clear, partly cloudy, continuous cloud layer, fog, haze, drizzle, rain, showers, thunderstorms
[2] Direction in compass headings: N, S, E, W, NE, NW, SE, SW
[3] Station Failure List: rocky bottom, kelp bed, reef, obstructions, <3m (bay), <6m (ocean), >120m
[4] Grab Failure Codes: A=canted, B=washed out, C=poor closure, D=disturbed surface, E=<5cm.
[5] Sediment Composition: coarse sand, fine sand, silt/clay, gravel, mixed (include shell hash if approp.)
[6] Sediment Odor: none, petroleum, hydrogen sulfide,other
[7] Sediment Color: brown, black, gray, olive green, red
[8] Grab Types: infauna, sed chemistry, toxicity
[9] Sample Types: infauna, grain size, TOC, Metals, Organics, AVS-SEM, bioassay, quick-lite., MPSL

Grab 2 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 3 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 4 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 5 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 6 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 7 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 8 Depth (m) :_____

Latitude:_____ Longitude:_____

Grab 9 Depth (m) :_____

Latitude:_____ Longitude:_____

Comments:_____
__

_____
__

_____
__

TRAWL DATA SHEET

Page ____ of ____

Station:	Agency:		Date:	
Vessel Name:		Arrive Time:	Depart Time:	
Depth (m):	Latitude:		Longitude:	
Weather[1]:	Wind (Kts/dir):	Swell: Ht.(ft):	Period (sec):	Dir[2]:
Comments:				

Station Failure[3]:_____ Trawl Failure[4]:_____

NET DEPLOYMENT

NET OVER	TIME:	DEPTH:	
LATITUDE:		LONGITUDE:	
TRAWL START	TIME:	DEPTH:	
LATITUDE:		LONGITUDE:	
TRAWL END	TIME:	DEPTH:	
LATITUDE:		LONGITUDE:	
NET ON DECK	TIME:	DEPTH:	
LATITUDE:		LONGITUDE:	
WIRE LENGTH (m):	TRAWL DIRECTION:	VESSEL SPEED (kn):	

[1] Weather List: clear, partly cloudy, continuous cloud layer, fog, haze, drizzle, rain, showers, thunderstorms

[2] Direction in compass headings: N, S, E, W, NE, NW, SE, SW

[3] Station Failure List: rocky bottom, kelp bed, reef, obstructions, <3m (bay), <6m (ocean), >200m

[4] Trawl Failure List: fouled net, torn net, no contact with bottom, improper time/distance

CATEGORY I SPECIES— SANDDAB GUILD

Target 6 individuals per age class for each species.
If 6 individuals are collected in 1 age class of 1 species, then no additional trawls are required.
For all species, save all age classes with 6 individuals.

Species		Age Class 0	1	2
speckled sanddab	Size Class	5 - 7	7 - 10	10 - 16
	Number			
longfin sanddab	Size Class	5-8	9-13	14-16
	Number			
pacific sanddab	Size Class	5 - 8	9 - 13	14 - 16
	Number			
slender sole	Size Class	5 - 8	9 - 10	11 - 12
	Number			
California halibut (juv)	Size Class	5-9	10-20	
	Number			
petrale sole	Size Class	5 - 7	8 - 14	15 - 20
	Number			

CATEGORY II SPECIES — TURBOT GUILD

Save 3 to 6 individuals of each species with a size class range of 5 - 20 cm.

Species	No. Individuals
diamond turbot	
spotted turbot	
C-O turbot	
hornyhead turbot	
curlfin sole	

Dover sole	
English sole	
rock sole	

TRAWL FISH SPECIES Station:_____

Date:_____

_____

Page:_____

_ of _____

SPECIES NAME	Size Class (up to 10 individuals)	FID	**WEIGHT (Kg)** Total			
			Gross	Tare	Net	

Anomaly Abbreviations: (list as superscript by specimen measurement)

A= ambicolorism	D = skeletal deformity	F = fin erosion
B = albinism	G =diffuse pigmentation	L = lesion
P = parasite	T = tumor	

FID = Further Identification

Comments:_____

_____

_____

Station:_____

TRAWL FISH SIZE CLASS

SPECIES NAME:_____ Date:_____

WEIGHT (Kg): Gross:_____ Tare:_____ Net:_____ Page:_____ of _

Size (mm)	Class	Tally	**Total**
1-10	**1**		
11-20	**2**		
21-30	**3**		
31-40	**4**		
41-50	**5**		
51-60	**6**		
61-70	**7**		
71-80	**8**		
81-90	**9**		
91-100	**10**		
101-110	**11**		
111-120	**12**		
121-130	**13**		
131-140	**14**		
141-150	**15**		
151-160	**16**		
161-170	**17**		
171-180	**18**		
181-190	**19**		
191-200	**20**		
201-210	**21**		
211-220	**22**		
221-230	**23**		
231-240	**24**		
241-250	**25**		
251-260	**26**		
261-270	**27**		
271-280	**28**		
281-290	**29**		
291-300	**30**		
301-310	**31**		
311-320	**32**		

Total:

Anomaly Abbreviations:	A = ambicoloration	D = skeletal deformity	F = fin erosion
	B = albinism	G = diffuse pigmentation	L = lesion
	P = parasite	T = tumor	

Comments:_____

___

_____

___

_____

Completed

By:

TRAWL INVERTEBRATE SPECIES Station:_____

Date:_____

Page:_____ of _____

WEIGHT (Kg)

SPECIES NAME	FID	Total	Gross	Tare	Net

Anomaly Abbreviations: B = burnspot disease P = parasite

FID = Further Identification

Comments:_____

TRAWL DEBRIS DATA Station:_____

Date:_____

	ESTIMATED	
TYPE	**NUMBER**	**WEIGHT**
Rocks		
Terrestrial Vegetation		
Marine Vegetation		
Lumber		
Plastic		
Metal Debris		
Cans		
Glass Bottles		
Fishing Gear		
Tires		
Other		

NUMBER CODES:

Present	P = 1
Low	L = 2 - 10
Moderate	M = 11 - 100
High	H = > 100

WEIGHT CODES:

Trace	T = 0.0 - 0.1 Kg
Low	L = 0.2 - 1.0 Kg
Moderate	M = 1.1 - 10 Kg
High	H = > 10 Kg

Comments:_____

CHAIN OF CUSTODY FORM

Page____ of ____

Agency:	Vessel:	Date:
Samplers:	Contact Name:	Phone #:

Station	Sample Type	Container Type	# of Containers

Relinquished by: _____ Accepted by: _____
Agency: _____ Agency: _____
Sign: Sign:

Date:_____ Time: _____

Relinquished by: _____ Accepted by: _____
Agency: _____ Agency: _____
Sign: Sign:

Date:_____ Time: _____

Relinquished by: _____ Accepted by: _____
Agency: _____ Agency: _____
Sign: Sign:

Date:_____ Time: _____

Comments:

Rev. 6/98

Bight 98' Sample Tracking FAX Transmittal Sheet

AGENCY:_____

DATE:_____

NAME:_____

PAGE:_____ **OF** _____

Station[1]	Sample Description	Sample Disposition

1- Include all stations that have been abandoned during the sampling day(s) and describe the reason for each instance of

abandonment.

Bioaccumulation Fish Tracking Sheet

AGENCY:_____ DATE:_____

STATION:_____ Completed By:_____

_

CATEGORY I SPECIES — SANDDAB GUILD

		Age Class		
___ Species		0	1	2
speckled sanddab	Size Class class	5 - 7	8 - 10	11 - 16
	Number			
longfin sanddab	Size Class	5-8	9-13	14-16
	Number			
Pacific Sanddab	Size Class	5 - 8	9 - 13	14 - 16
	Number			
Gulf sanddab	Size Class	5 - 7	8 - 9	10 -14
	Number			
slender sole	Size Class Clalss	5 - 8	9 - 10	11 - 12
	Number			
California halibut (juv)	Size Class	5-9	10-20	
	Number			
petrale sole	Size Class	5 - 7	8 - 14	15 - 20
	Number			

CATEGORY II SPECIES — TURBOT GUILD

Species	No. Individuals
diamond turbot	
spotted turbot	
C-O turbot	
hornyhead turbot	
curlfin sole	
Dover sole	
English sole	
rock sole	

APPENDIX 7

BIGHT'98 FIELD SAMPLING

QA/QC DATA SHEETS

BIGHT'98
FIELD QA/QC BENTHIC SAMPLING CHECKLIST

Agency: _____ Vessel: _____ Date: _____

PART 1 BENTHIC SAMPLE PROCESSING EQUIPMENT

Benthic Infaunal Samples	YES	NO	COMMENTS
Catchment for grab overlying and wash waters			
Plastic ruler (mm)			
Wash table (recommended)			
Screen box with 1.0mm mesh screen			
Borate buffered Formalin			
(50 g/L undiluted formalin)			
Relaxant Solution (check one) ___MgSO4 (1 kg/20 L fresh water)		___Propylene phenoxytol (30 ml/20 L seawater)	
Data sheets/field computer			
BIGHT'98 format sample labels (external & internal)			
Forceps for picking screen			
Scrub brush for cleaning screen			
Sample containers (none <16 oz capacity)			
Adequate size range of sample containers			

Sediment Chemistry & Toxicity Samples					
Plastic scoop for sub-sampling					
Soap & water wash for scoop					
scoop rinse (circle one or more)	DI water	methanol	acetone	hexane	methylene chloride
BIGHT'98 format sample labels (external)					
4 oz plastic or glass containers for Grain Size					
8 oz pre-cleaned plastic or glass containers with					
TFE lined lids for TOC					
8 oz pre-cleaned plastic or glass containers with					
TFE lined lids for Trace Metals					
8 oz pre-cleaned glass containers with					
TFE lined lids for Trace Organics					
250 ml polycarb centrifuge bottle for AVS-SEM					
(supplied by EPA-Newport)					
1 liter pre-cleaned HDPE containers					
(supplied by SCCWRP) for Sed Tox					
250 ml pre-cleaned HDPE containers					
(supplied by SCCWRP) for Sed Tox					
125 ml glass containers for Quicklite					
Refrigerator or wet ice for cooling					
Freezer or dry ice for freezing					

Comments: _____

BIGHT'98
FIELD QA/QC BENTHIC SAMPLING CHECKLIST

PART 2 BENTHIC SAMPLE PROCESSING PROCEDURES

Infaunal Sample Acceptance and Screening	YES	NO	COMMENTS
Properly applies sample acceptance			
Means of collecting wash water/sample			
Penetration depth properly measured (plastic ruler)			
Filters wash water			
Uses wash table (recommended			
Screen mesh size = 1.0 mm			
Screen surface area adequate for washing			
Gentle treatment of sample during washing & screening			
Screen washed and scrubed between samples			
Infaunal Sampling Handling			
Labeling requirements met			
Sample container <50% full of sample material			
Adequate volume of relaxant used (85-90% jar volume			
Sample agitated to assure exposure to relaxant solution			
Proper duration of exposure to relaxant (approx. 30 mins)			
Measures to avoid environmental extremes during Sample relaxation			
Adequate fixative added to achieve approx. 10% Formalin			
Sample agitated to assure exposure to fixative			
Complete data entry			
Sediment Chemistry & Toxicity Sample Handling			
Properly applies sample acceptance criteria (sample must Be similar to infaunal sample)			
Appropriate care draining overlying water from grab (use of siphon recommended)			
Avoids potential sources of contamination (deck surface, Winch wire, engine exhaust, cooling ice, etc)			
Subsamples to specified depth (top 2 cm)			
Avoids scoop contact with sides of grab			
Labeling requirements met			
Sample holding conditions met			
Washes scoop between stations			
Complete data entry			

Comments:_____

BIGHT'98 Benthic QA Specialist:_____Agency Chief Scientist::_____

Send copies to Agency Chief Scientist, BIGHT'98 Field Coordinator

BIGHT '98 FIELD QA/QC

Trawl Equipment Checklist

Agency:_____ **Vessel:**_____ **Date:**_____

TRAWLING EQUIPMENT

Equipment	Yes	No	N/A	Comments
Net Headrope 7.6 m				
Body Mesh Size 4.13 cm				
Cod-end Mesh Size 5.08 cm				
Cod-end Liner Size 1.27 cm				
Headrope Flotation				
Footrope Chain				
Otter Boards 20 x 30 in				
Bridle Length 22.9 m				
Properly deployed				
Proper Wire Scope				
Bottom Time 10 min				
Successful Trawl				
Qualified Crew				

Notes:_____

BIGHT '98 FIELD QA/QC
Trawl Processing Checklist: Part 1

Agency:_____ Vessel:_____ Date:_____

TRAWL PROCESSING EQUIPMENT

Equipment	Yes	No	N/A	Comments
Sorting				
Live Holding Tank				
Measuring Boards				
Data Sheets:				
Trawl Cover Sheets				
Trawl Fish Species				
Trawl Fish Size				
Trawl Invertebrate				
Trawl Debris Data				
Tare Container				
Spring Scales				
3 Kg				
15 Kg				
Other				
Field Guides and				
Miller and Lea				
Eschmeyer et al				
Field ID Aid				
Other				
Field ID Toolkit				
Wide-mouth Jars				
Plastic Bags				
10% Buffered				

SPRING SCALE CALIBRATION CHECK

Weight (Kg)

Test Weight	Scale A **Kg**	Scale B **Kg**	Scale C **Kg**	Scale D **Kg**	Scale E **Kg**
0.15 Kg	_____	_____	_____	_____	_____
0.30 Kg	_____	_____	_____	_____	_____
0.45 Kg	_____	_____	_____	_____	_____

Trawl Processing Checklist: Part 2

Agency:_____ Vessel:_____ Date:_____

TRAWL PROCESSING PROCEDURES

Equipment	Yes	No	N/A	Comments
Proper Trawl Acceptance				
Remove All Organisms From Net				
Species Identifications:				
Qualified Crew				
Accurate ID of Common Species				
Return Difficult Species to Lab				
Length Measurement:				
Proper Designation of Size Class				
Bony Fish (Board Standard Length)				
Shark, Rays (Total Length)				
Rays (Wingspan)				
Weight Measurement:				
Scales Calibrated				
Tare Bucket Weight Checked				
Proper Weighint Procedures:				
Species Greater Than 0.1 Kg				
Species Less Than 0.1 Kg				
Invertebrate Counts Made				
Invertebrate Counts From Weights				
Pathology Examination Conducted:				
Proper Pathology Identifications				
Debris Assessment Conducted				
FID/QC Preservation				
10% Formalin				
Slitting Body Cavity of Fish				
Proper Labeling				
Pr:per Photographic Techniques:				
Photographic Log				
Tissue Sampling:				
Proper Choice of Species				
Proper Labeling				

Proper Freezing Techniques				
Completion of Data Sheets:				
Trawl Cover Sheets				
Trawl Fish Species Sheets				
Trawl Fish Size Class Sheets				
Trawl Invertebrate Species Sheets				
Trawl Debris Data Sheets				

BIGHT '98 FIELD QA/QC

Trawl Processing Checklist: Part 3

Agency:_____ **Vessel:**_____ **Date:**_____

MEASUREMENT QUALITY OBJECTIVE AUDIT

Trawls		**Species Identification**	**Fish**	**Invert**
Attempted		Number Species Examined		
Successful		Number Species Correct		
Percent		Percent Species Correct		

Difficult species	**Anomaly Identification**	**Fish**	**Invert**
	Number Species Examined		
	Number Anomalies Correct		
	Percent Anomalies Correct		

		Count				**Weight (Kg)**		
	Species	**Listed**	**Audit**	**%Diff**	**Size**	**Listed**	**Audit**	**%Diiff**
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Stations Sampled:								

Bight '98 Trawl QA/QC Specialist _____

Agency Chief Scientist _____

Send copies to the following:

Agency Chief Scientist
Agency QA Liason
Bight '98 QA/QC Officer
Bight '98 Field Coordinator

Comments:_____

APPENDIX 8

BIGHT'98 FIELD SAMPLING

ORGANIZATION CONTACTS

SAMPLING ORGANIZATION & ANALYTICAL LABORATORY CONTACTS

Algalita Marine Research Foundation, Inc.
7037 Hanbury
Long Beach, CA 90808-2321
Charles Moore (562) 496-4072

Aquatic Bioassay and Consulting Laboratories
29 North Olive St., Ventura, CA 93001
Michael Machuzak (805) 643-5621
timmikel@msn.com

Channel Islands National Marine Sanctuary
113 Harbor Way
Sant Barbara, CA 93109
Sarah Fangman (805) 884-1473
sfangman@cinms.nos.noaa.gov

Columbia Analytical Services
6060 Corte del Cedro
Carlsbad, CA 92009
Jack Anderson (760) 930-0417

CRG Marine Laboratories
820 South Seaside Avenue
Terminal Island, CA 90731
Richard Gossett (310) 519-4007

USEPA
2111 S.E. Marine Science Drive
Newport, OR 97365
Robert Ozretich
(541) 867-4036

Los Angeles County Sanitation Districts
24501 S. Figueroa St., Carson CA 90740
Dave Montagne (310) 830-2400 x402
dmontagne@lacsd.org

City of Los Angeles, Environmental Monitoring Division
12000 Vista del Mar, Playa del Rey, CA 90293
Ann Dalkey (310) 648-5544
cam@san.ci.la.ca.us

SAMPLING ORGANIZATION & ANALYTICAL LABORATORY CONTACTS

MBC Applied Environmental Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626
Chuck Mitchell (714) 850-4830

MEC Analytical Systems, Inc.
2433 Impala Drive
Carlsbad, CA 92008-7227
Douglas Diener (760) 931-8081

Orange County Sanitation District
10844 Ellis Ave., Fountain Valley, CA 92728-7018
Mike Mengel (714) 593-7465
mjmengel@ocsd.com

City of San Diego
Metropolitan Wastewater Dept., Environmental Monitoring and Technical Services Div.
4918 North Harbor Drive, Suite 101
San Diego, CA 92106
Tim Rothans (619) 692-4914
tcr@mwharbor.sannet.gov

Southern California Coastal Water Research Project
7171 Fenwick Lane
Westminster, CA 92683
Jim Allen (714) 894-2222
jima@sccwrp.org

SeaVentures
33207 Paseo Cerveza
San Juan Capistrano, CA 92675
Ken Nielsen (714) 492-3143 home, (714) 397-0596 boat, (714) 248-4208 fax

SPAWAR (USN)
Marine Environmental Quality Branch (0362)
SPAWARSYSCEN San Diego
53475 Strothe Road, Bayside (Bldg 111, Rm 259)
San Diego, CA 92152-6310
Jeff Grovhoug (619) 553-5475/2773 (Sec), (619) 553-6305/6553
grovhoug@nosc.mil or grovhoug@spawar.navy.mil

SAMPLING ORGANIZATION & ANALYTICAL LABORATORY CONTACTS

USC Wrigley Institute for Environmental Studies
Allan Hancock Foundation 232
Los Angeles, CA 90089-0371
or ship to:
USC Wrigley Institute c/o SCMI
820 South Seaside Ave., Terminal Island, CA 90731
Liz Caporelli (213) 740-6794
caporell@wrigley.usc.edu

APPENDIX 9

BIGHT'98 FIELD SAMPLING

SCCWRP SAMPLE SHIPPING INFORMATION

Bight '98 Sample Shipping Information

Contact: Darrin Greenstein
Phone: (714) 894-2222 ext. 224
Pager: (562) 795-9532
FAX: (714) 894-9699

Shipping Address:

SCCWRP
7171 Fenwick Lane
Westminster, CA 92683
Attn: Darrin Greenstein

Please call ahead to let us know if you are going to deliver samples. There will be someone at SCCWRP to receive samples between 7:00 a.m. and 5: p.m. Monday through Friday. We can make arrangements to receive samples outside of these hours or on the weekend if necessary.

If you send samples by a commercial carrier, such as Fed Ex., please FAX Darrin a copy of the weigh bill so that the samples can be tracked down if they don't arrive when they should.

Darrin Greenstein will be the main contact for coordinating sample handling at SCCWRP and the following people will be assisting and can be contacted if Darrin is not available. Shelly Moore, Valerie Raco, Charlie Yu, and Andrew Jirik.