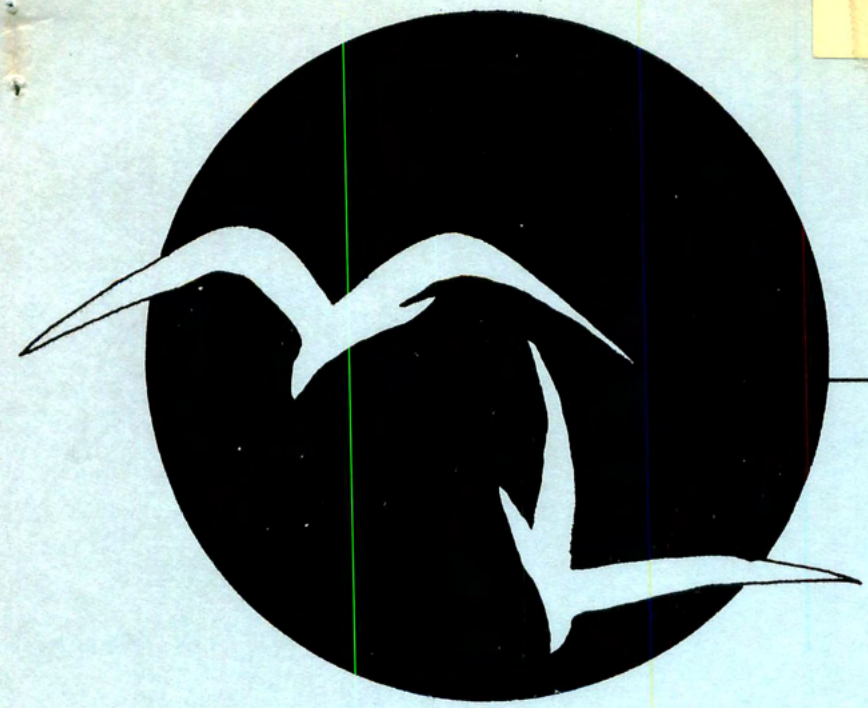

Moss Landing Marine Laboratories

ENVIRONMENTAL STUDIES OF MONTEREY BAY
AND THE CENTRAL CALIFORNIA COASTAL ZONE

Progress Report:
First half-year of operation--July 1970-February 1971

A NATIONAL SEA GRANT PROJECT

supported by the
OFFICE OF SEA GRANT PROGRAMS
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DEPARTMENT OF COMMERCE
Grant No. GH-94

by
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I. INTRODUCTION: SCOPE OF PROGRAM AND SUMMARY OF PROGRESS TOWARD OBJECTIVES

A. Program Scope (as defined in original project proposal)

The Moss Landing Marine Laboratories of the California State Colleges have completed the planning and early implementation stages for an innovative multi-level program of marine resources education, research and public information for the Monterey Bay region. This program was described in detail in our Sea Grant proposal of September 1969, from which selections are quoted in the paragraphs following. It was planned as a two-year project to provide requisite time for achievement of immediate goals and for effective demonstration of long-term values. The first year was funded by the Sea Grant Office in June 1970 (Grant No. GH-94; $106,000).

Our integrated education and research project proposed:

> ...immediate comprehensive expansions of educational and research commitments for marine and estuarine environmental studies into a single coordinated effort which will simultaneously develop data from five key nearshore environments, educate college students for service at three important levels of marine resources development, and provide appropriately organized information dissemination to marine resources developers and the general public. (1969:3)

The five environmental complexes to be incorporated into a single coordinated data collection and interpretation program are (cf proposal, 1969:4):

1) Sea-air-land zones of contact: the air-sea interface, with particular concern for weather and climate implications; shoreline characteristics with special attention to geological and physiographic characteristics in relation to modifications for exploitative purposes.
2) Shallow embayment (Elkhorn Slough): with particular attention to living resources of marshes, mudflats, and enclosed waters; to sedimentation and sediment transport; to physical factors relating to multiple use planning (harbor development, aquaculture, recreational and esthetic uses, etc.)

3) Rivers and estuaries (Pajaro, Salinas rivers): data collection and interpretation as for Elkhorn Slough...

4) Shallow waters of Monterey Bay: nearshore waters of a large open bay: particular attention to currents, sediment transport, thermal and chemical characteristics, and their implications for water quality control, management of pollution problems, and enhancement of fisheries, recreational, and esthetic resources.

5) Submarine canyon and open coast: data collection and interpretation in the deeper waters of the Monterey Canyon and along the open coast of Central California...

These environmental data collection and interpretation activities are designed to provide a practical field and laboratory internship as integral components in the educative process of three groups of participants:

1) Graduate students who are preparing for college and secondary school teaching careers serve as team leaders for the data collection process; other graduate students who have primarily research goals engage in pilot research projects related to, but not limited by, the overall data collection program.

2) Advanced undergraduate and beginning graduate students work as research participants under direct supervision of the team leaders assisting in collection, organization and display of environmental data, and in its coding for computer storage and manipulation.

3) Secondary school science teachers from the region participate in the data collection program in a uniquely practical in-service training operation.

Four major communication avenues are under development to assist with most effective possible development of the project, and with dissemination of information collected (1969:5-6):

1) An external Advisory Committee will be created, with membership drawn from other educational institutions of the region, from local, state, and federal agencies having responsibilities for ocean resources and management, and from such private industrial and commercial interests as fisheries, aerospace, electric power production, petroleum and chemical extraction.

2) The project will be coordinated carefully, wherever feasible, with related research activities at other regional educational institutions (eg intertidal and benthic researches at Stanford's Hopkins Marine Station and the University of California, Santa Cruz; physical oceanography and meteorology studies at the U.S. Naval Postgraduate School, and environmental investigations at the University of the Pacific's Dillon Beach Station).

3) Parallel or otherwise applicable procedures as other institutions in the nation will be evaluated, and research and management procedures adapted to improve the present project as is appropriate.

4) An Information and Interpretation Service will be developed to assure feedback of information to agencies and individuals engaged in the development of marine resources, and to the interested general public which is a consumer of their resources.

Public information and interpretation services are provided through a regional center with two primary functions (1969:6).

1) Bibliographic and data center for "collection of appropriate references, scientific and technical papers, data tables and other pertinent information, including that developed from the field environmental research of the education project; organization of a bibliographic indexing and retrieval system which will be compatible with both hand keysort and punchcard sorting and print-out; and creation of suitable mechanisms for distribution of information to users in industry, business, government, education and the general public."

2) Interpretive public information program, to be initiated during the second year of the project, "responsible for development of summarizing and other interpretive informational materials from scientific and technical sources in the general literature, and from specific researches in the immediate region. These materials will be regional in scope, and modeled to some extent after the very useful service materials prepared for agricultural users and the general public by schools of agriculture. Two kinds of publications seem appropriate: special bulletins devoted to a particular marine resource topic, and a serial newsletter emphasizing timely reports and summaries."

8. Progress Toward Objectives: July 1970-February 1971

Steps in planning and implementation of these objectives are summarized chronologically below with further details provided in later sections of this document as referenced.

1. Early planning and preparation: summer, 1970
   a. Five graduate teaching assistants selected for leadership of the environmental data collection teams.
   b. Courses developed for enrollment of research participants, and steps initiated for their administrative approval and management at the five participating colleges.
   c. General program plans revised to conform to the amended one year grant provisions; general management procedures developed; and purchase of necessary equipment and supplies begun.
2. Organization for detailed program operation: fall semester, 1970-71
   a. Specific areas of faculty responsibility delineated; oceanographic technician recruited, and chemical oceanographic laboratory facilities and resources developed.
   b. Graduate-level class organized (ML 255--Researches in Monterey Bay) to serve as a detailed program planning and development group; class comprised of ten graduate students, including five selected as leaders for the environmental data collection teams (cf pp 29-31 for further details). Class contributions to the Sea Grant effort included:

1) Detailed descriptions and maps for each environmental sub-area, with locations of permanent stations, and references to pertinent past researches.

2) Analysis of environmental sampling goals, techniques, and gear, and recommendations concerning scope and frequency of detailed sampling program.

3) Recommendations concerning ancillary research activities to be considered for pilot research project status.

3. Organization of the Regional Advisory Committee: October, 1970 (cf pp 34-36 for details)

a. Organizational meeting at Cabrillo College, November 16, 1970. Approximately 100 people attended representing educational, governmental, industrial, and political groups, and the general public.

b. Development of four operational subcommittees and an Executive Committee consisting of those committee chairmen to advise the program staff concerning program matters in four sub-areas:

1) Education and Research

2) Conservation and Development (particularly planning functions)

3) Living Marine Resources

4) Physical Marine Resources

c. Establishment of a general public information program via news releases to local newspapers, radio and television.

4. Completion of two major projects begun prior to inception of the Sea Grant program but of great significance and direct relation to it: December, 1970.

a. Kaiser Research Project; an evaluation of physical, chemical and biological impacts of calcium-enriched, magnesium-depleted industrial effluent on the marine environment. (Final report to be completed and submitted to Kaiser Refractories in April, 1971.)

b. Monterey Bay Bibliography; a 300-page document containing over 1000 citations of published and unpublished works relating to marine resources development for Monterey Bay and the Central California Coast (available about March 15, 1971).

5. Recruitment of five teams of Research Participants for spring semester from among regular students at Moss Landing Marine Laboratories and secondary science teachers of the region, and development of schedules for their effective deployment and support. (For further details on class format for ML 170--Marine Environment Research Participation, cf pp 30-31.)

6. Inception of full-scale environmental data collection program in February, 1971, involving approximately 60 graduate and undergraduate students and nine staff members for a total of more than 800 man-hours per week (cf p 32). Organized class groups include:
   a. 23 undergraduate students and participating science teachers enrolled in two sections of ML 170--Marine Environment Research Participation.
   b. 13 students in ML 135--Marine Meteorology; and ML 169f--Advanced SCUBA Marine Research.
   c. 16 graduate students engaged in individual or small group pilot researches through ML 255--Researches in Monterey Bay.

II. ENVIRONMENTAL DATA COLLECTION AND ANALYSIS PROGRAM

A. Planning and Preparation: Fall Semester, 1970

1. Organization of the program planning team operations (ML 255 graduate class plus faculty advisors)

Ten graduate students, including the five teaching assistants selected for the program, were organized into a research-planning class, and with council from the faculty were charged with development of detailed plans for the data collection and analysis program. Agenda for the semester's work included the following major steps:

a. General introductory briefing on operational goals and procedures for the Sea Grant program (cf Appendix A:1-3 for the briefing document)

This briefing stressed the planned balance between the three phases of the Sea Grant program (environmental data collection, pilot research activities, and public information and interpretation services) with emphasis during the first year on the data collection phases. This priority is consistent with the original intent in establishment of the Moss Landing Marine Laboratories, it is entirely compatible with our educational mission and mandate, and will provide the necessary data matrix and field operations to support a broad array of related and often non-fundable projects. Perhaps most important, these data and the interpretations and analyses from them are urgently needed by resource use planners and decision-makers of the region, state and nation. Particular stress is placed upon our twin objectives: environmental data collection for the above reasons and simultaneous functional education of our students. This educative process operates at two levels: first, in the early training of upper division and beginning graduate students who work as field and laboratory data collectors and processors; and second, at more advanced levels for students with greater experience who serve as team leaders for the data collection process.

Operationally this program involves three levels of input: faculty and staff provide overall planning and coordination; graduate teaching assistants translate these general guidelines into detailed field operational procedures and supervise data collection teams in action; and student research participants are organized into working teams to collect data and samples in the field and process them in the Laboratories. The briefing document spelled out specific individual responsibilities for personnel involved at all three levels.

b. Background preparation for the reasearch-planning class included review of pertinent literature in three areas (for preliminary bibliographic lists of Appendix A:4-9):

1) General works on field and laboratory methods, equipment, and procedures;
2) Specific environmental studies carried out by others, some broad and general in scope and others quite limited and specific;
3) Earlier researches in the Monterey Bay and Central California Coastal Region, including unpublished engineering reports and other data sources.

c. Application of literature review and faculty advice to specific plans for the data collection program

During the early part of the semester, the research planning class organized itself into sub-groups by environmental area for field reconnaissance of suggested permanent data collection stations, and for consideration of limits appropriate to the resources available for the work. These study teams continued throughout the semester. In addition, the ten students making up the planning group organized into study teams by subject area interest in order to analyze and make recommendations concerning equipment, methods and techniques for the major disciplines concerned. These teams consulted pertinent literature sources and faculty advisers and produced specific recommendations in the areas of: physical-chemical factors, meteorologic data requirements, plankton collections, chlorophyll and productivity analyses, sediment and sediment transport analyses, benthic biota sampling and analysis, and fishes and other net fauna collections. Procedures for field

mapping, station location, field data recording, and coding for machine storage and manipulation of data also were considered.

On the basis of these reviews and intensive deliberations, the teaching assistants responsible for the environmental sub-areas prepared tentative descriptions of their regions, designated permanent sampling stations, and indicated general scope of the sampling effort (cf section 2 of this document, pp 11-28).

Areas of specific faculty input were designated (Appendix A: 10-11) and procedures developed for particularly close cooperation of data collection teams working in contiguous areas (Appendix A: 12-13).

Also as outgrowth of these deliberations and with major assistance from the faculty and support staff, equipment and supplies were ordered, and in some instances special gear was designed, constructed, and tested.

Tentative plans for the scope of sampling operations in the various disciplines and procedures for carrying out sample processing are reported in Appendix A:14-17. A one-page check list summarizing factors for which data are collected in the several sub-areas is reproduced in Appendix A:18.

Tentative procedures for coding environmental data for machine storage and processing were developed for consideration by the faculty and all participants. These are reproduced in Appendix A as follows: Tentative MLML Cruise Report Form (physical-chemical-meteorological data), A:19; Instructions for Coding Surface Environmental Information, A:20; Procedures and Rationale for the Institutional Series Code, A:24; Instructions for Coding Sub-Surface Observations, A:26.

d. Consideration of ancillary research projects

Toward the end of the fall semester, members of the ML 255 class were asked to generate a recommended series of research projects which would be ancillary to the basic data collection program and might well be considered for eventual pilot research studies.

Projects proposed and discussed in some detail covered the full gamut of disciplines involved including climatological studies to determine the impact of the maritime air mass upon Salinas Valley crops, studies of sediment transport in relation to sand resources

of Monterey Bay, and biological studies on such problems as pesticide and heavy metals pollution, productivity and standing crop of salt marsh areas, species composition of selected habitats in Monterey Bay and its estuaries, and various impacts of industrialization and urbanization upon the marine environment. A selected and abridged list drawn from these suggestions was issued to members of the spring semester class in order to facilitate continuity from one group to the other (Appendix A: 29-30).

2. Description of the environmental data collection sub-areas

a. Sea-air-land zones of contact: meteorological aspects.

To adequately study the meteorological aspects of the Monterey Bay Area, all available meteorological data between San Jose ($37^{o}20'$ N latitude) to the north and San Ardo ($36^{o}01'$N) to the south, the Diablo Range in the east, and twenty miles into the Pacific Ocean in the west will be used. Included in these approximately 7500 square miles are all of Santa Cruz and San Benito counties, most of Monterey County, the southern portions of San Mateo and Santa Clara counties, as well as all of Monterey Bay.

The study area is dominated by a series of parallel valleys which head in the southeast and then gradually deepen and widen as they open toward the northwest onto various bays. The mountain ranges separating these valleys reach heights of 2000 to 4000 feet. They are quite effective in channeling marine air southeastward from the Pacific Ocean into the valleys and they thereby greatly influence the valley's climatic make-up.

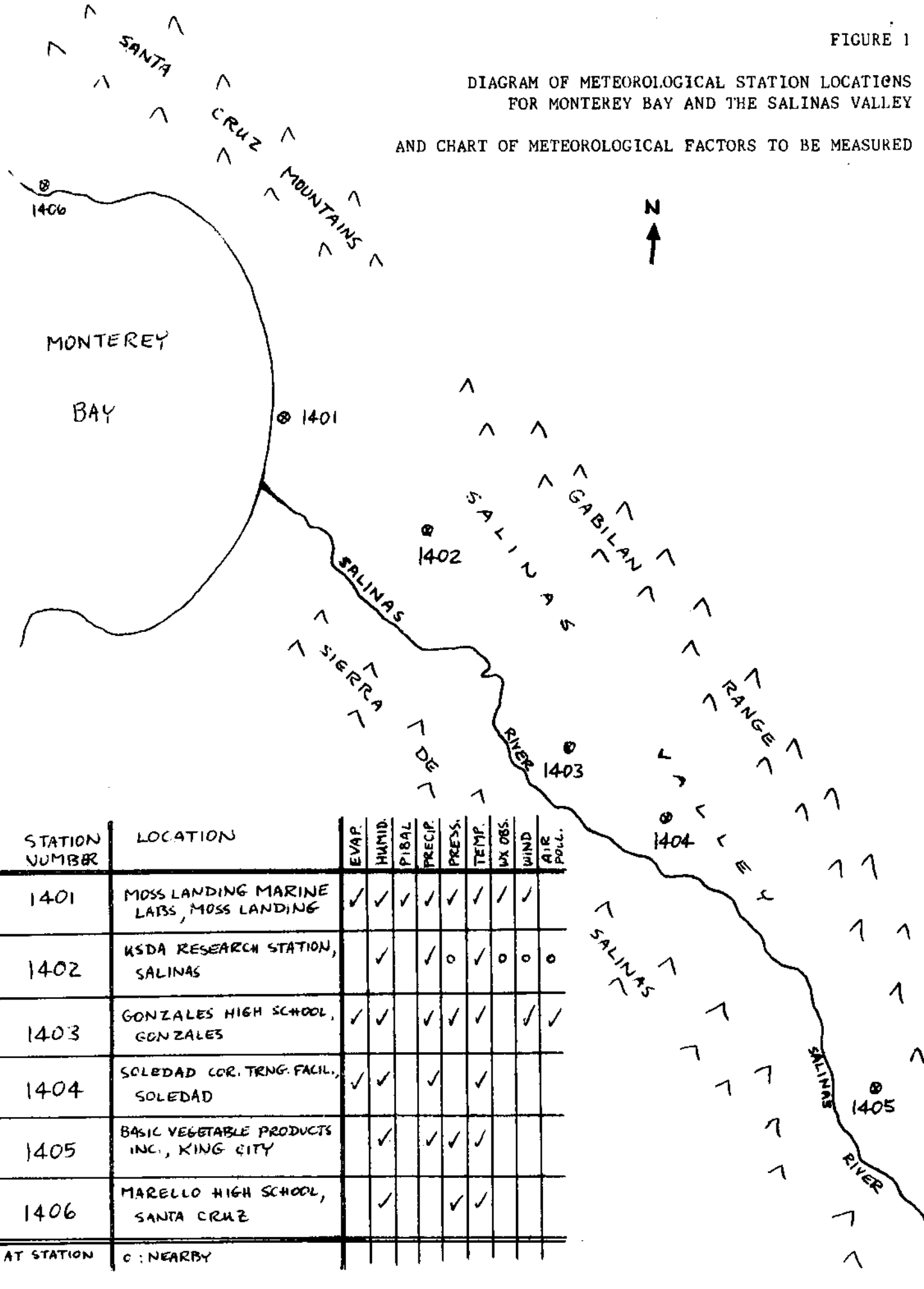
Since particular emphasis will be placed on marine air intrusion into the Salinas Valley, permanent stations have been established along the axis of the valley (oriented NW-SE) to measure various meteorological parameters (Figure 1, p 12; also Appendix C:6 for description of station locations). For these stations we will record continuous traces of temperature, humidity, and pressure; wind will be recorded at Moss Landing at the Pacific Gas and Electric Company and the Moss Landing Marine Laboratories, and at the high school in Gonzales; evaporation from black and white atmometers will be observed daily at Moss Landing Marine Laboratories, the Correctional Training Facility at Soledad, and Gonzales High School; and precipitation data will be available at or near all stations shown in Figure 1.

The proximity of the Pacific Ocean and the orientation of the local mountain ranges greatly influence the climatic patterns of the Monterey Bay Area. Precipitation occurs mainly during the winter months (November through April) and generally decreases inland and on the lee side of mountain ranges (eg from 18" annual precipitation at Castroville to 10" at King City, and from over

FIGURE 1

DIAGRAM OF METEOROLOGICAL STATION LOCATIONS FOR MONTEREY BAY AND THE SALINAS VALLEY

AND CHART OF METEOROLOGICAL FACTORS TO BE MEASURED



STATION NUMBER	LOCATION	EVAP.	HUMID.	PIBAL	PRECIP.	PRESS.	TEMP.	WX OBS.	WIND	AIR POLL.
1401	MOSS LANDING MARINE LABS, MOSS LANDING	✓	✓	✓	✓	✓	✓	✓	✓	
1402	USDA RESEARCH STATION, SALINAS		✓		✓	o	✓	o	o	o
1403	GONZALES HIGH SCHOOL, GONZALES	✓	✓		✓	✓	✓		✓	✓
1404	SOLEDAD COR. TRNG. FACIL., SOLEDAD	✓	✓		✓		✓			
1405	BASIC VEGETABLE PRODUCTS INC., KING CITY		✓		✓	✓	✓			
1406	MARELLO HIGH SCHOOL, SANTA CRUZ		✓			✓	✓			

✓: AT STATION o : NEARBY

60" in the Santa Cruz Mountains to 13" at San Jose). The mean annual temperatures increase as one leaves the moderating ocean behind and goes up the Salinas Valley (eg from 56.2°F at Monterey to 57.2°F at Salinas and 58.9°F at King City).

Elford and Stilz's typewritten climatological reports of the Santa Cruz-Santa Clara counties and of the Monterey County areas give the large-scale precipitation and temperature fields. From these and many other reports it becomes obvious that upper air data and surface wind and evaporation data are requisite for meaningful descriptions of the Monterey Bay area. Therefore, pibals (pilot balloons) will be used to obtain upper air wind data at Moss Landing Marine Laboratories six days a week, and at Salinas, Soledad, and on Monterey Bay during selected short-term experimental periods.

The sea-air-land project interacts closely with all other environmental sub-areas providing procedural guidelines and instrumentation for monitoring meteorological conditions on all field operations (cf Appendix A:19-24 for data coding form and general instructions).

BIBLIOGRAPHY: Meteorological References

_____ 1964. CLIMATOGRAPHY OF THE U.S. NO. 86-4: DECENNIAL CENSUS OF THE U.S. CLIMATE - CLIMATIC SUMMARY OF THE U.S. - SUPPLEMENT FOR 1951 THROUGH 1960 - CALIFORNIA, Weather Bureau, Washington, DC, 216 pp.

_____ 1967. THE CLIMATE OF SANTA CLARA AND SANTA CRUZ COUNTIES, ESSA, Environmental Data Services, San Francisco, Ca, (typewritten).

Elford, C.R. and J.E. Stilz. 1968. THE CLIMATE OF MONTEREY COUNTY, ESSA, Environmental Data Services, San Francisco, Ca, (typewritten).

Gilliam, H. 1962. WEATHER OF THE SAN FRANCISCO BAY AREA, Univ of Calif Press, Berkeley and Los Angeles, 72 pp.

U.S. Department of Commerce. Monthly. CLIMATOLOGICAL DATA: CALIFORNIA, NOAA, Environmental Data Services.

b. Monterey Bay (Monterey Canyon and north bay sub-areas combined for present report.)

Monterey Bay, located about 70 miles south of San Francisco, is California's second largest bay. It is shaped like a reversed C approximately 24 miles long north to south and 12 miles wide (Map 1, p 16). A 70-mile shoreline includes extensive broad sandy beaches and more limited expanses of rocky headlands and cliffs. Two major cities (Santa Cruz and Monterey) and a number of smaller municipalities are distributed along the shoreline. Agricultural development dominates the non-urban areas (Map 2, p 17). Three major tributaries empty into the bay, the Pajaro and Salinas rivers and Elkhorn Slough.

The Monterey Submarine Canyon is the most prominent geological feature of the bay (Map 3, p 18) cutting westward from the mouth of Elkhorn Slough to depths approaching 1000 meters only 12 miles from shore. On either side of this canyon the bay is a relatively shallow and gently contoured basin less than 100 meters deep.

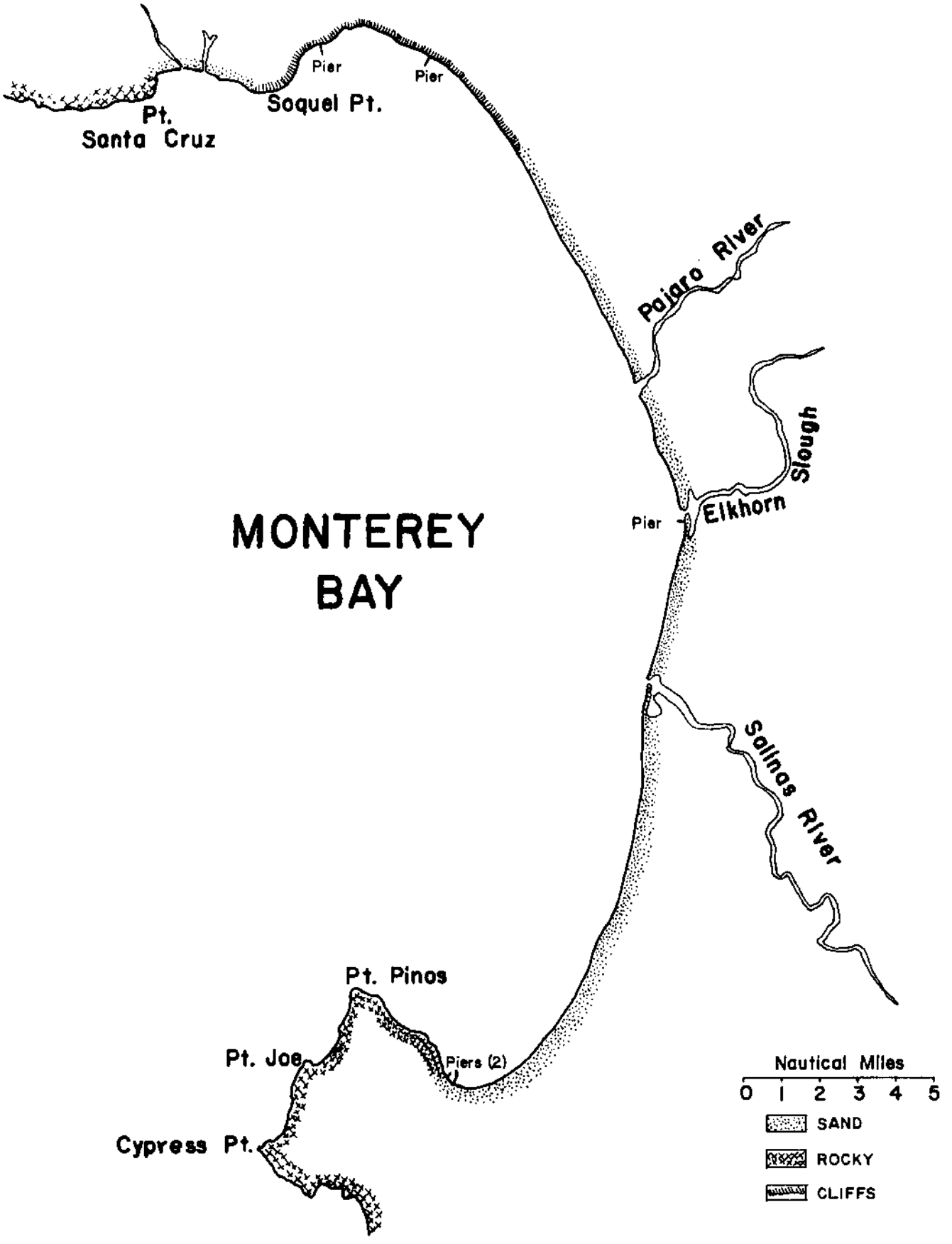
Two portions of Monterey Bay were selected for detailed study in the Data Collection Program; a roughly five mile square sector at the head of the Monterey Canyon, and a shallow-water area along the north bay shoreline. The Monterey Canyon sector is of particular interest because: 1) it receives fresh water from the Pajaro and Salinas rivers; 2) it is influenced by tidal flow from the adjacent Elkhorn Slough; 3) it receives industrial waste waters from the Pacific Gas and Electric Company power station (thermal effluent) and Kaiser Refractories (calcium-enriched, magnesium-depleted waters); and, 4) vertical circulation over the head of the canyon is seasonally modulated by prevailing wind patterns. Because of these factors, it is expected that large seasonal changes will occur in the distributions of properties in the study areas. The monthly hydrographic sampling program is designed to delineate seasonal changes in water properties and to investigate possible correlations with meteorological and biological factors. (Refer to Map 4, p 19, for locations of these sampling stations, and the Appendix C:7-8 for their more detailed description.)

This concentrated monthly sampling program in the Monterey Canyon sector is paralleled by the program for the north bay where permanent hydrographic stations are positioned along the 15 and 35 meter depth contours (to permit hydro-casts to 10 and 30 meters). Five permanent beach transect stations are located at strategic intervals along the north and west shorelines for systematic study of seasonal changes in beach profiles and sediment transport mechanisms (cf Map 5, p 20, hydro-stations numbered 1151-1157 and beach transects numbered 1180-1184; and Appendix C:9-10, for more detailed descriptions). The Sea Grant program will bypass sampling in the south bay for the present since Hopkins Marine Station and the U.S. Naval Postgraduate School are developing their own cooperative benthic study in that area.

Biological data collections in Monterey Bay include two major components. First, at five of the hydrographic stations in the Monterey Canyon sector, researchers on monthly plankton cruises collect water samples at selected depths traversing the photic zone for phytoplankton analysis and chlorophyll determination; at the same stations they also make oblique zooplankton tows. Second, fishes and benthic organisms are sampled bimonthly at four of the permanent hydrographic stations in order to compare benthic communities off the Pajaro River and off a stretch of undifferentiated beach to the north (Manresa Beach). According to standardized procedures, 15 and 35 meter depths at those locations are sampled to permit reasonable quantification of results (stations 1105, 1155, 1156, 1154, Map 5). Previous studies of Monterey Bay providing useful background for the planning of this program are listed in the attached partial bibliography. Particularly useful are Odemar, Wild and Wilson (1968) on benthos and fisheries; Wolf (1968) on current patterns; Starke and Howard (1968) on the Monterey Canyon; Yancey (1968) and Greene (1970) on geology and sediments.

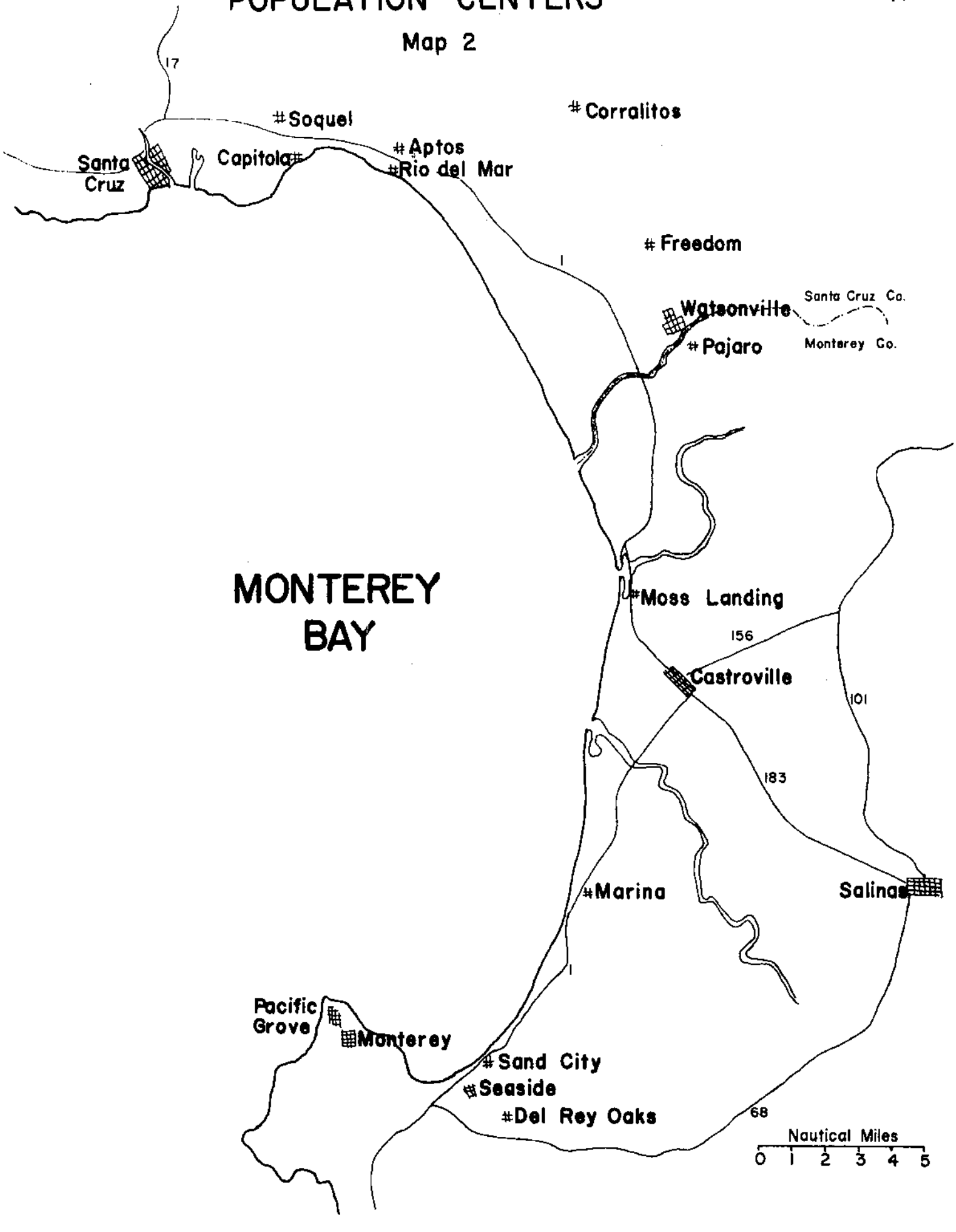
SHORELINE FEATURES

Map 1



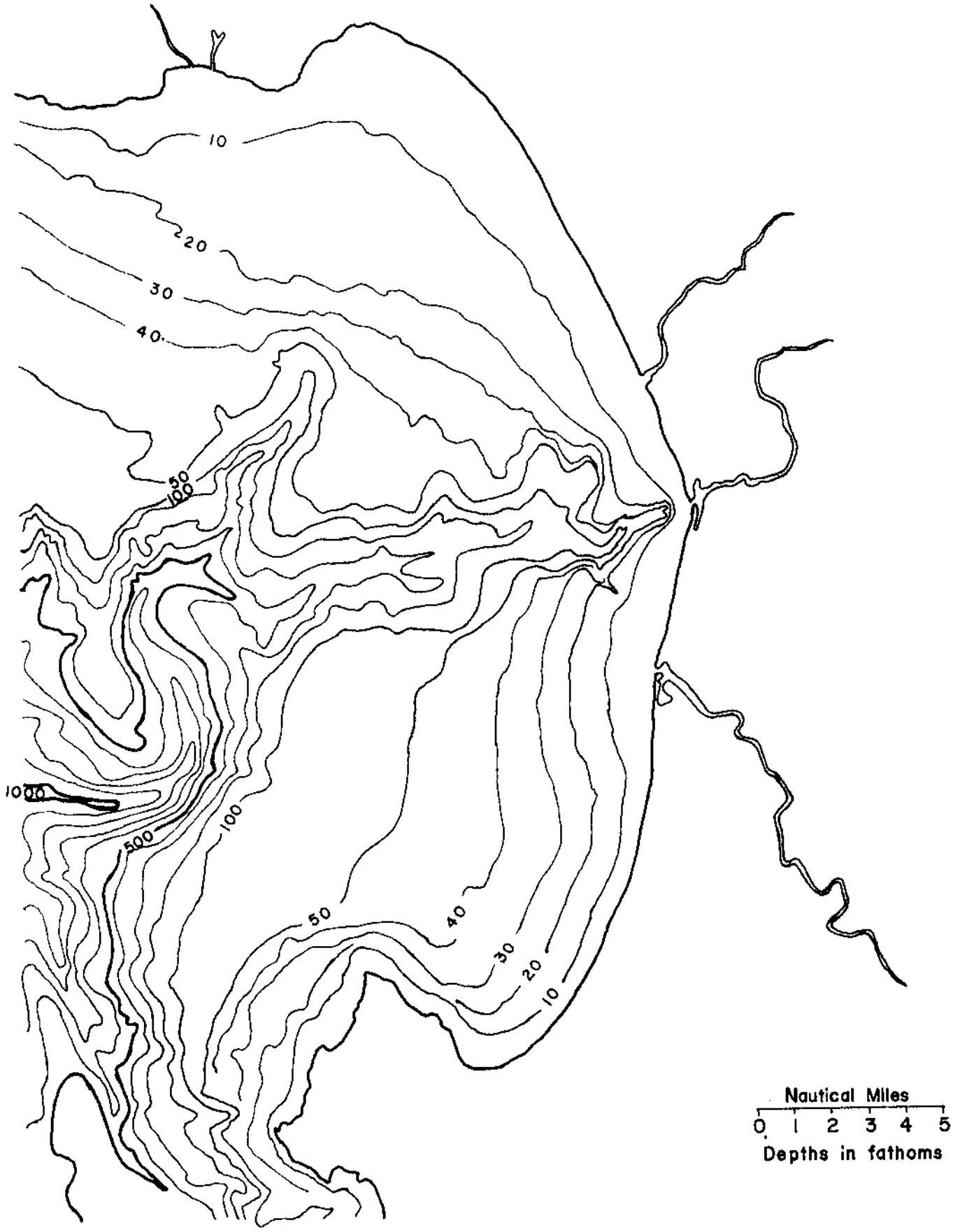
POPULATION CENTERS

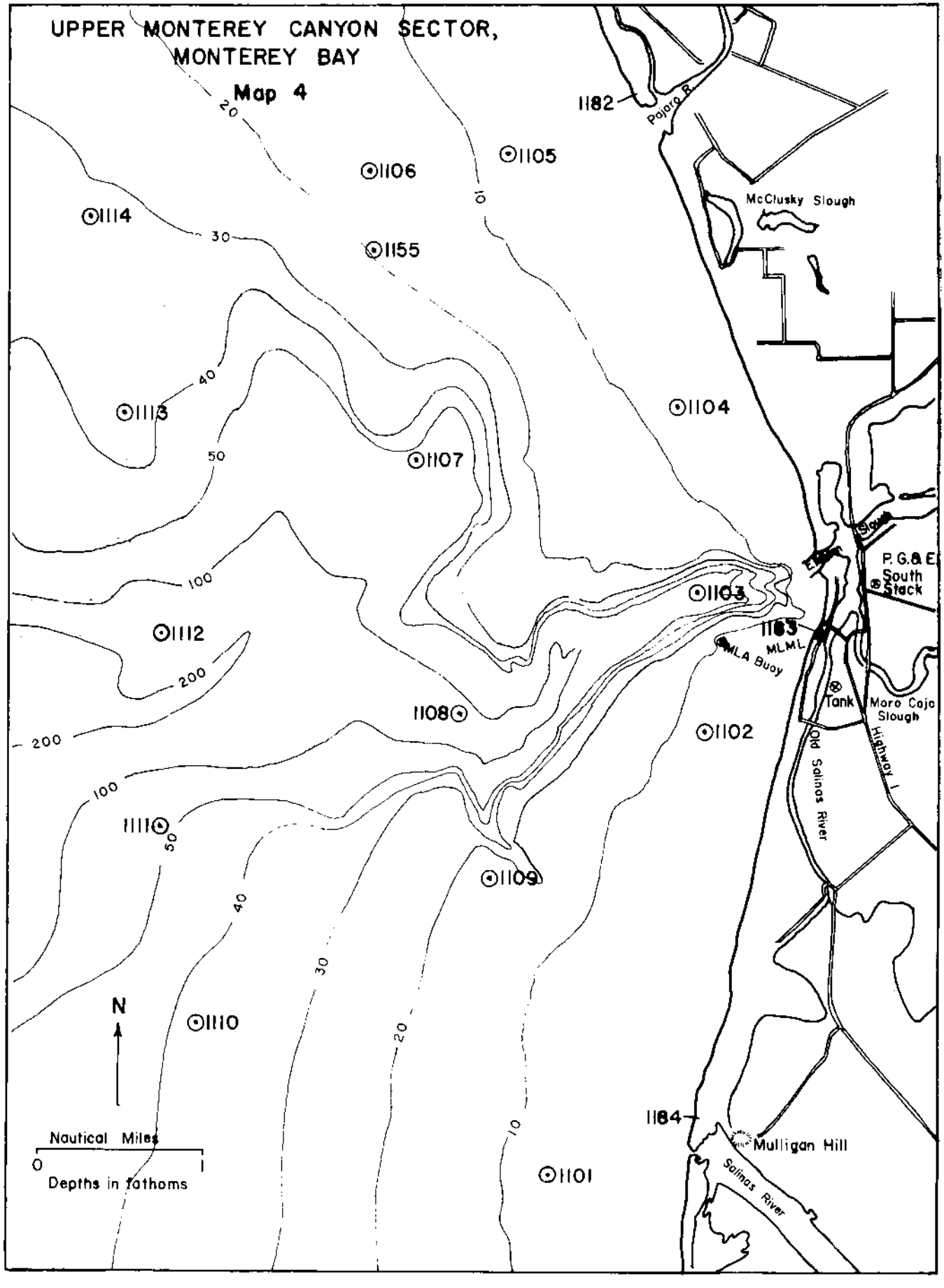
Map 2

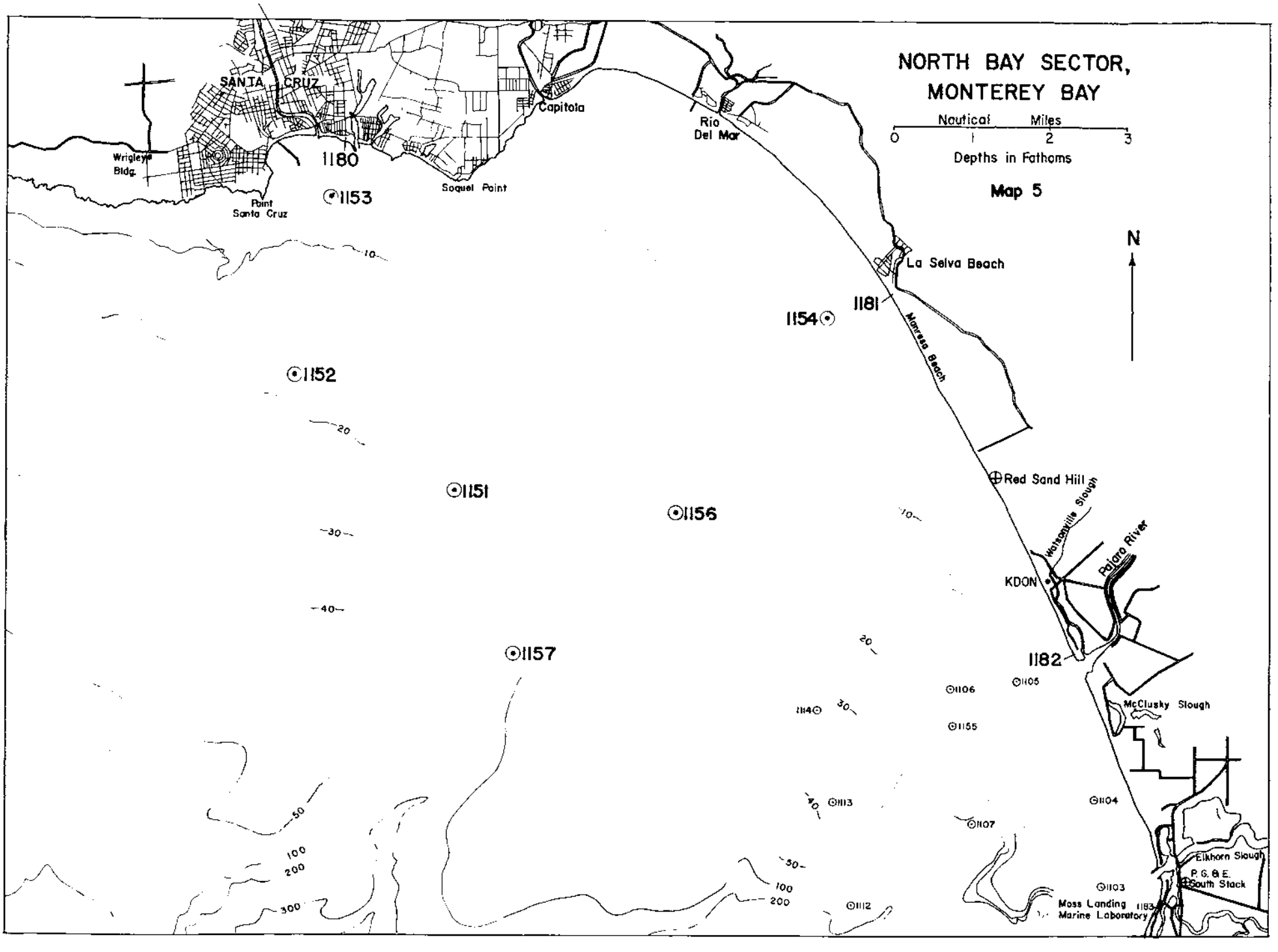


Bathymetry of Monterey Bay

Map 3




UPPER MONTEREY CANYON SECTOR,
MONTEREY BAY
Map 4
1182
Pajaro R.
1105
1106
1114
1155
McClusky Slough
1113
1104
1107
P.G.&E.
South
Stack
1103
1112
1183
MLML
MLA Buoy
Tank
Moro Cojo
Slough
1108
1102
Old Salinas River
Highway 1
1111
1109
N
1110
1184
Mulligan Hill
Salinas River
1101
Nautical Miles
0
1
Depths in fathoms


NORTH BAY SECTOR,
MONTEREY BAY
Nautical Miles
0 1 2 3
Depths in Fathoms
Map 5
N
SANTA CRUZ
Wrigley's Bldg.
Point Santa Cruz
Capitola
Soquel Point
Rio Del Mar
La Selva Beach
Manresa Beach
Red Sand Hill
Watsonville Slough
Pajaro River
KDON
McClusky Slough
Elkhorn Slough
P.G.&E. South Stack
Moss Landing Marine Laboratory
1180
1181
1182
1183
1151
1152
1153
1154
1155
1156
1157
1102
1103
1104
1105
1106
1107
1112
1113
1114
10
20
30
40
50
100
200
300

SELECTED BIBLIOGRAPHY: Monterey Bay Projects

Bolin, Rolf L., et al. 1964. HYDROGRAPHIC DATA FROM THE AREA OF THE MONTEREY SUBMARINE CANYON, 1951-1955, Hopkins Marine Station, Stanford Univ, Pacific Grove, Ca.

Galliher, Wayne E. 1932. SEDIMENTS OF MONTEREY BAY, CALIFORNIA. In: MINING IN CALIFORNIA, Calif Div Mines and Geol, 28(1):42-79.

Greene, H. Gary. 1970. GEOLOGY OF SOUTHERN MONTEREY BAY AND ITS RELATIONSHIP TO THE GROUND WATER BASIN AND SALT WATER INTRUSION, Preliminary Report, U.S. Dept Int Geological Survey, 49 pp.

Martin, Bruce D. 1964. MONTEREY SUBMARINE CANYON, CALIFORNIA: GENESIS AND RELATIONSHIP TO CONTINENTAL GEOLOGY, PhD thesis, Univ So Calif, 249 pp, 4 tables, 29 illus.

Miller, Daniel J. and Melvyn W. Odemar. 1968. OCEAN SPORTFISH CATCH AND EFFORT FROM THE GOLDEN GATE TO YANKEE POINT, MONTEREY COUNTY, CALIFORNIA FOR THE YEAR 1966, Marine Resources Operations, MRO ref no.68-15, Oct 1968, 70 pp.

Odemar, Melvyn W., Paul W. Wild and Kenneth C. Wilson. 1968. A SURVEY OF THE MARINE ENVIRONMENT FROM FORT ROSS, SONOMA COUNTY TO POINT LOBOS, MONTEREY COUNTY, Final Report of Calif Dept Fish and Game to San Francisco Bay-Delta Water Quality Control Program, 238 pp.

Reid, Joseph L., Gunnar Roden and John Wyllie. 1957. STUDIES OF THE CALIFORNIA CURRENT SYSTEM, Progress Report Calif Coop Fish Invest (CalCOFI), July 1, 1956 to Jan 1, 1958, pp 27-56.

Starke, George W. and Arthur D. Howard. 1968. POLYGENETIC ORIGIN OF MONTEREY SUBMARINE CANYON, Geol Soc Amer Bull 79(7):813-826, 5 figs, July 1968.

Wolf, Stephen Connelly. 1968. CURRENT PATTERNS AND MASS TRANSPORT OF CLASTIC SEDIMENTS IN THE NEARSHORE REGIONS OF MONTEREY BAY, Unpub MS Thesis, San Jose State Coll, Ca.

Wong, Walter F. 1970. A STUDY OF THE BACTERIOLOGICAL QUALITY OF MONTEREY AND CARMEL BAYS, APRIL 1969 THROUGH MAY 1970, Board of Supervisors of the Counties of Monterey and Santa Cruz, Dec 1970, 139 pp.

Yancey, T.F. 1968. RECENT SEDIMENTS OF MONTEREY BAY, CALIFORNIA, Tech Report HEL-2-18, contracted by Corps of Engineers, U.S. Army, Univ Calif, Berkeley.

c. Elkhorn Slough

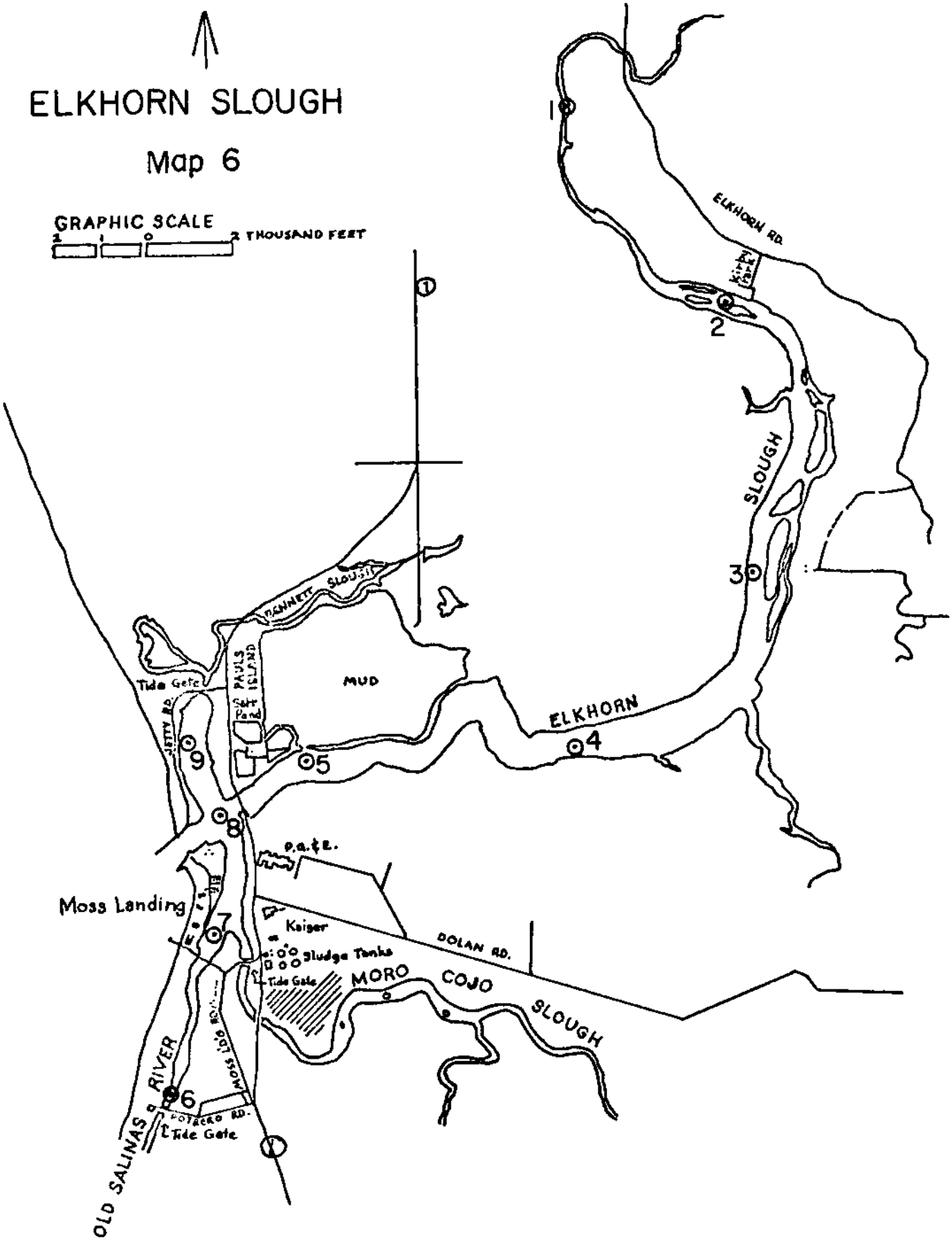
Elkhorn Slough is a shallow, tidely influenced,coastal embayment lying approximately halfway between Monterey and Santa Cruz, California, on Monterey Bay. The drainage basin for the slough is relatively small, only 220 square miles. The normal wet-winter, dry-summer climatic regime produces typical estuarine salinity gradients during winter runoff periods only; during the dry summer months hypersaline conditions develop in the upper reaches of the slough. Analysis of the hydrologic and biological effects of these seasonal variations is the primary objective of this study.

Literature on Elkhorn Slough is scattered and of widely varying scope and quality. The Salinas County Library historical file on Moss Landing Harbor and Elkhorn Slough contains a collection of local newspaper articles giving at best a sketchy view of the natural history of the area. In 1935 MacGinitie published an ecological study based on nine years of data collection in the lower portions of the slough. Recent work has been carried out by the State Department of Health and by various engineering firms commissioned by local units of government. These works deal primarily with water quality and sewage disposal. Also in the files of Moss Landing Marine Laboratories a few student and faculty papers are available on various aspects of slough biology and hydrography.

The nine stations indicated on the accompanying map (Map 6, p 23) were chosen for practical as well as scientific reasons. There is need to assess the seasonal variation in the water chemistry and circulation patterns of Elkhorn Slough. Given limited manpower and equipment, stations must be chosen so that the full gradient of slough conditions will be sampled and so that relative impacts of various external influences upon water quality can be assessed. Average depth of the slough at low water ranges from approximately one meter at the upper end to more than four meters near the mouth. Tidal incursions of four to six feet occur twice daily. With these factors in mind, the nine stations are sampled monthly during slack high water at the surface, at one meter below

ELKHORN SLOUGH

Map 6



the surface, and at one foot off the bottom (with middle sample omitted in shallower depths).

In addition to this extended sampling program for seasonal studies of the hydrology of Elkhorn Slough, quarterly short-term intensive investigations are planned of diurnal and tidal variations in the physical properties of the water mass.

Biological and geological studies also are under way, with sediment samples collected periodically from channel and inter-tidal zones at all nine stations. Intensive benthic sampling programs are planned for two stations initially, and for others later in the program as manpower resources permit. Fishes are being collected at selected stations on a regular basis using gill nets and beach seines for sampling purposes. Biological studies generally parallel in scope, frequency, and objectives those described for Monterey Bay.

SELECTED BIBLIOGRAPHY: Elkhorn Slough

Bascom, Willard. 1947. BEACH SURVEYS AT MOSS LANDING, CALIFORNIA, JUNE 6, 1946 TO MARCH 31, 1947, Lab Memo HE-116-243, Univ Calif, Coll Engineering, Berkeley, April 25, 1947.

Barrett, Elinore M. 1963. THE CALIFORNIA OYSTER INDUSTRY, Calif Dept Fish and Game, Fish Bull 123, 103 pp.

California State Department of Public Health, Bureau of Sanitary Engineering. 1967. SANITARY ENGINEERING INVESTIGATION OF QUALITY OF WATER AND SHELLFISH IN THE ESTUARY SYSTEM AT MOSS LANDING, MONTEREY COUNTY, 68 pp.

Elford, C. Robert and John E. Stilz. 1968. THE CLIMATE OF MONTEREY COUNTY, prepared by ESSA Environmental Data Service (unpublished).

Greene, Gary H. 1970. GEOLOGY OF SOUTHERN MONTEREY BAY AND ITS RELATIONSHIP TO THE GROUND WATER BASIN AND SALT WATER INTRUSION, Open File Report, U.S. Geological Survey.

MacGinitie, George E. 1935. ECOLOGICAL ASPECTS OF A CALIFORNIA MARINE ESTUARY, American Midland Naturalist 16(5):629-725.

Martin, Bruce Delwin. 1946. MONTEREY SUBMARINE CANYON, CALIFORNIA: GENESIS AND RELATIONSHIP TO CONTINENTAL GEOLOGY, PhD Thesis, Univ So Calif, Geology Dept.

Salinas Library. Historical file on Moss Landing, California.

Starke, G.W. and A.D. Howard. 1968. POLYGENETIC ORIGIN OF THE MONTEREY SUBMARINE CANYON, Geol Soc Amer Bull 79:813-826.

Stump, Arthur D. 1967. MOSS LANDING HARBOR: INDUSTRIAL INFLUENCE ON ITS CIRCULATION, STRATIFICATION AND CHEMISTRY, Dept of Chem, San Jose State Coll (unpublished).

Water Resources Engineers Inc. 1968. EVALUATION OF ALTERNATIVE WATER QUALITY CONTROL PLANS FOR ELKHORN SLOUGH AND MOSS LANDING HARBOR, Presented to the California State Water Resources Control Board and the Central Coastal Regional Water Quality Control Board, approx 70 pp.

Wong, Vincent Don. 1970. MOSS LANDING HARBOR, CALIF.: A CASE HISTORY, (unpublished).

Yoder-Trotter-Orlob Associates. 1968. WATER SUPPLY AND DISTRIBUTION AND WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL FOR THE MOSS LANDING AREA OF MONTEREY COUNTY, approx 150 pp.

d. Pajaro River Estuary

The Pajaro is relatively typical of West Coast rivers, with heavy freshwater runoff during rainy winter months and much decreased flows during the dry summer season. The lower reaches of such rivers are true estuaries but with great seasonal fluctuation in salinity gradients due to these variations in freshwater input.

The Pajaro River drains approximately 1300 square miles of Central California flowing westward into Monterey Bay. Its lower estuarine portion is approximately 2.5 miles long, confined between flood control levees to average channel width of about 100 meters. During non-flood periods and at low tide the river follows a sinoidal channel between these levees with an average depth of about 1.5 meters in its estuarine portion. Water depth and flow rates are of course strongly influenced by the semi-diurnal tides, with water level variations of four to six feet at the river mouth.

The estuary substrate is composed of sand and larger particles over most of its area with clay and organic materials confined to the banks, peripheral mudflats and upper estuary. At low tides only a narrow S-shaped channel provides water exchange with Monterey Bay at the river mouth.

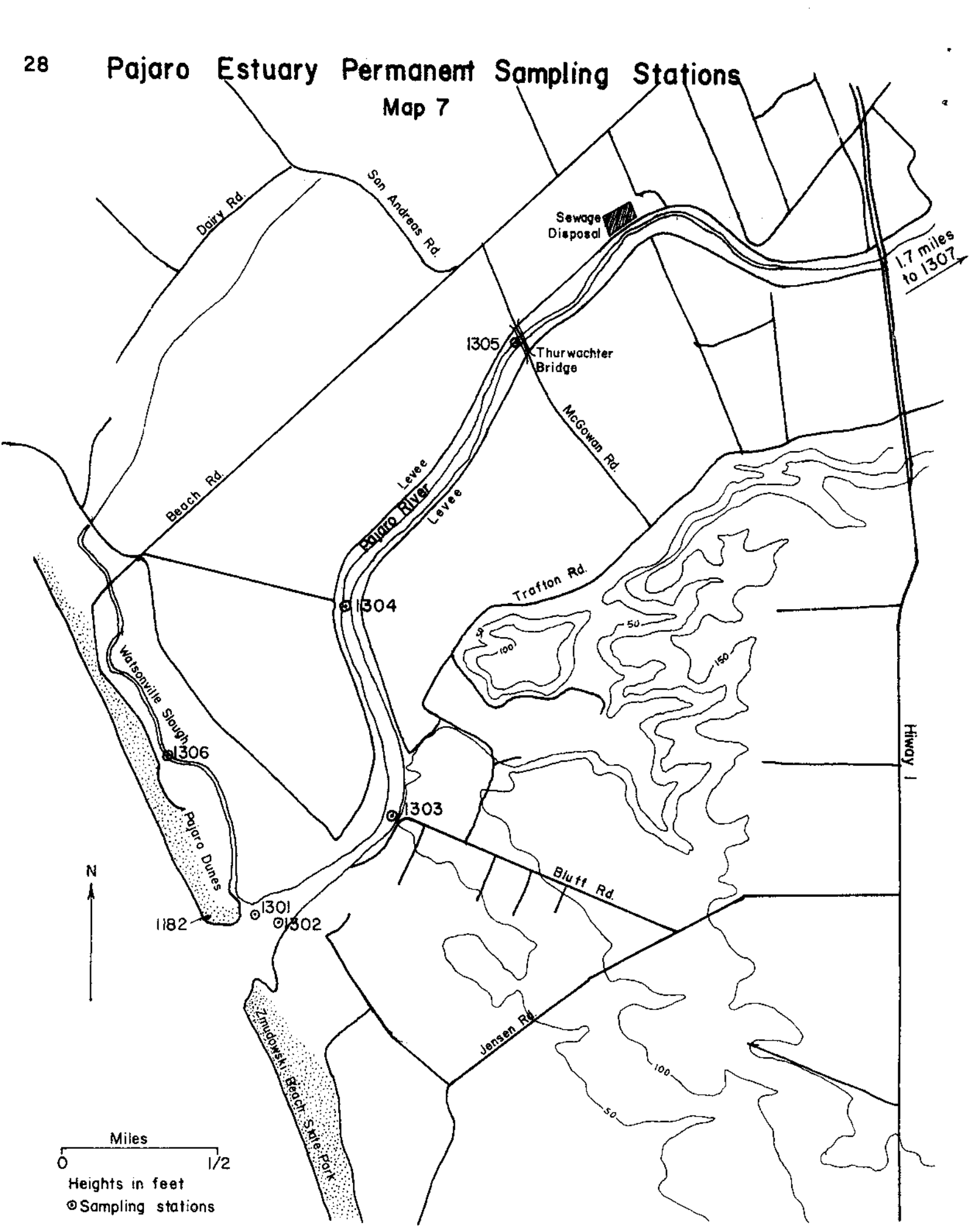
The Pajaro River provides a continuous flow of cold, well-oxygenated water to the estuary, though in very low volume during the dry summer season. The Pajaro supports a significant steelhead trout run each winter and is a popular fishing area, though of diminishing significance in recent years due to attrition of the steelhead population. No significant shellfish populations occur in the estuary, though they have been present in the recent past. The estuary does support a diversified invertebrate and fish fauna, and its banks provide riparian habitats for an extensive bird population.

Since the Pajaro estuary is easily accessible via county roads and levee maintenance roads, and since it possesses an array of typical estuarine characteristics and properties, it is a useful model for environmental studies. The Data Collection Program for the Pajaro has been designed to parallel that for Elkhorn Slough as closely as practicable. Six sampling stations have been established in the estuarine portion of the river (Map 7, p 28), and a seventh is located up-river of tidal influence in order to provide a chemical and physical check on freshwater inflow. As for Elkhorn Slough, hydrologic data are collected monthly at all seven stations. Biologic sampling (benthos and fishes) and correlated sediment studies are concentrated at two stations for economy of manpower. These studies will be expanded to other stations as resources permit.

The U.S. Army Corps of Engineers recently (August, 1970) issued its ENVIRONMENTAL REPORT: A PRELIMINARY REPORT ON THE PAJARO RIVER FLOOD CONTROL PROJECT which analyzes possible ecological effects of further river channelization for flood control purposes. Beyond this document only scattered data reports and summaries prepared by governmental agencies deal specifically with the Pajaro River (eg local climate, water flow rates, flood damage, etc.) General papers dealing with Monterey Bay and environs, and cited in bibliographies for other environmental sub-areas, have been helpful in planning the data collection program for the Pajaro estuary.

Pajaro Estuary Permanent Sampling Stations

Map 7



B. Recruitment of Participants: Environmental Data Collection Program

1. Faculty assignments and recruitment

Regular Moss Landing Marine Laboratories faculty members listed with their biographies in the 1969 proposal and participating in the Sea Grant project this year are: Dr. Robert Arnal, marine geology and sediment transport; Dr. William Broenkow, chemical and physical oceanography; Mr. Robert Read, meteorology; Mr. Patrick Albin, underwater diving support; and Dr. John Harville, marine ecology-fisheries, and program director. Areas of special concentration for the faculty members are outlined in Appendix A:10-11.

Additional faculty help in the biological field was needed due to the decision of one regular faculty member not to participate. Dr. Mary Silver, who recently completed her Ph.D. degree in biological oceanography at Scripps Institution of Oceanography, was added to the staff on a full-time basis for the spring semester to provide much-needed program support in invertebrate zoology and plankton studies. In addition, Mr. Richard Parrish, fisheries biologist with the California Department of Fish and Game, was appointed to the faculty on a part-time basis to assist particularly with design operation of fish collection procedures.

2. Technical support

Mr. David Seielstad joined the staff as full-time oceanographic technician in October, 1970. His experience includes two years with Hopkins Marine Station's support program for the Te Vega. Mr. Seielstad's knowledge, experience, and energy have made a major contribution to the success of the program.

3. Graduate assistants

a. The five teaching assistants and their environmental sub-areas of responsibility are: Arndt Lorenzen, sea-air-land zones of contact; Gary McDonald, Monterey Canyon sector; Roger Hilaski, North Bay perimeter; Scott Dailey, Pajaro River estuary; and Richard Smith, Elkhorn Slough.

b. Three additional graduate assistants also have major teaching and research responsibilities for the spring semester only. David Garrison is responsible for support of all projects in field collection and laboratory processing and sorting of benthic invertebrates. Gary Kukowski has similar responsibilities for all projects on fishes. James Locke provides field and laboratory leadership in the geologic processing of sediment samples. In all cases, assignments are a combination of research and teaching functions.

c. Three graduate students are assigned for the spring semester to quarter-time research and support functions as follows: Judy Hansen, chlorophyll and plankton samples from the Monterey Canyon sector; Barry Turner, measurements of salt marsh vegetation standing crops; Daniel Varoujean, census of Monterey Bay bird fauna and operation of our 26-foot work boat.

4. Student research participants

Four organized classes taught in the spring semester enroll students for direct participation in the Sea Grant environmental data collection program. The general nature of this participation is summarized below. (For catalog descriptions of the four Sea Grant program courses, see Appendix 8:1, a brochure describing all courses taught in the spring semester, 1971, at the Moss Landing Marine Laboratories.)

a. ML 170--Marine Environment Research Participation

This three-unit field and laboratory course provides the organizational base for the five data collection teams. Classes meet all day on the day scheduled (one section on tuesdays, the other on saturdays). Students are divided into working teams of five or six people, each assigned to a particular graduate student leader. Team assignments continue for the entire semester, with each participant exposed to all subject areas in the data collection program, though with some degree of specialization in terms of interest and special talents. Space was reserved in the saturday class for ten secondary school science teachers from the region, to be recruited for their interest in participation in such a practical "hands-on" program, with priority going to those recommended by their districts for

purposes of curriculum development or other local needs. A letter announcing this opportunity was sent by way of county offices to all high schools in the four counties of the region (copy provided, Appendix B:2). Eleven teachers were selected for participation in this program from the more than twenty that applied.

b. ML 255--Researches in Monterey Bay

During the spring of 1971, all students in this three-unit graduate course engage in independent researches associated in some way with the Sea Grant program. Many of these studies will be direct outgrowths of research suggestions made by the fall-semester ML 255 class (Appendix A:29-30). Student demand for this course far exceeded expectation, with a capacity class of sixteen enrolling. Research interests are primarily in the biological field with benthic invertebrate studies and fish ecology projects being the most heavily subscribed.

c. ML 169f--Advanced SCUBA Marine Research

This class is open only to students who have completed the beginning SCUBA course and have the approval of diving captain Albin. A capacity class of eight has been enrolled committed to diving support of the Sea Grant program wherever this is needed. SCUBA techniques are being used extensively for evaluating effectiveness of collecting gear and for taking samples in the surf zone and elsewhere as required for most effective research support. The class will undergo intensive training in techniques of underwater work, including underwater installations, navigation and mapping, and establishment of both permanent and temporary sampling quadrats. Each student in the class has an individual research project in addition to participation in other activities of the group as a whole.

d. ML 135--Marine Meteorology

Students in this three-unit course participate as a part of their regular laboratory assignments in the collection of daily meteorological data and in the reduction of these data for analytical purposes. They also participate in intensive short-term project studies of marine air mass movements from Monterey Bay down the Salinas Valley.

e. Sea Grant research support from general classes at Moss Landing Marine Laboratories.

Other classes also participate in the program by providing data from field projects and organized studies in a form that can be coded as a part of the data collection program. Some classes, such as ML 102, the marine science techniques course, are undertaking specific short-term studies designed to provide direct support to the overall project. In addition, a number of students engaged in independent studies will orient their work not only to benefit from the basic data collection program of the Sea Grant project, but to provide additional materials for the project through their own efforts.

C. Full-Scale Data Collection Operations: Spring Semester, 1971

The present progress report is too early in the semester to provide more than a brief account of these full-scale operations. General plans outlined in the previous sections have been put into effect. The Tuesday Section of the research participation class is assigned to the Monterey Canyon sector and as support of the daily meteorological observations of the sea-air-land zones of contact project. The considerably larger Saturday Section is divided among three projects: the North Monterey Bay project, the Pajaro River estuary, and the Elkhorn Slough. Assignment schedules have been developed for the first four to six weeks which provide for training of all groups in techniques required for the various kinds of data that must be collected.

Certain of the materials issued to the research participation classes provide a useful indication of the program operation. These are reproduced in Appendix C as follows:

1. Saturday class team assignments and February 20 schedule; Appendix C: 1-3.
2. Assignment schedule: ML 170 class, saturdays, 0800 to 1630; Appendix C:4.
3. Assignment schedule: ML 170 class, tuesdays, 0800 to 1630; Appendix C:5.

III. PUBLIC INFORMATION AND INTERPRETATION SERVICES

During the initial few months of Sea Grant program operation, two major projects have further strengthened the role of the Moss Landing Marine Laboratories as a public information and interpretation resource for the Monterey Bay region. First, an extensive bibliography of researches, management studies, and data resources relating to Monterey Bay and the Central California Coastal Region has been completed and will be ready for distribution by mid-March.

Second, an active Regional Advisory Committee has been established pursuant to the general guidelines presented in our 1969 proposal (reproduced in the present document, Appendix D:1-3). Working subcommittees have been organized, and a series of meetings of these groups held to consider the present program and future plans of the Sea Grant program. As an informational component of Regional Advisory Committee activities, particularly to keep the general public informed on the project as a whole, the program director has spoken by invitation to a number of local and regional groups, and periodic news releases have been written and circulated to local news media.

A. The Monterey Bay Bibliography

This document is a 300-page publication listing scientific and general papers, reports, books and miscellaneous publications which deal directly or indirectly with the Central California Coast. References which are known to contain specific data on Monterey Bay are so indicated. It has required more than three years of effort in production, with final steps completed with Sea Grant support.

The main body of the bibliography consists of approximately 2000 citations arranged by subject according to Library of Congress classification. A major exception to the Library of Congress system is that the systematic divisions for the section on Zoology were adapted from GENERAL ZOOLOGY, Fourth Edition, by Tracy I. Storer and Robert L. Usinger, McGraw Hill, New York, 1965, and from A LIST OF COMMON AND SCIENTIFIC NAMES OF FISHES FROM THE UNITED STATES AND CANADA, Second Edition, by the American Fisheries Society, Committee on Names of Fishes, Ann Arbor, Michigan, 1960.

An author index and subject index are provided to facilitate use of the publication. Appendices list references which were located too late to be integrated into the main bibliography.

In order to make periodic up-dating of the bibliography as convenient as possible, IBM key-punch cards were used to produce the list of references and the author index. The key-punching program was designed to permit mechanical insertion of new citations into the original list in proper subject-matter sequence. Revisions are planned at two-year intervals.

This project has been a joint endeavor of the Moss Landing Marine Laboratories and the Association of Monterey Bay Area Governments, which assisted materially with funding of bibliographic researchers and publication costs.

B. Regional Advisory Committee

1. Purpose

In order to assure effective flow of information between the Moss Landing Marine Laboratories and the people of the region to be served by the Sea Grant program, a communication link with the various sectors of the supporting community is desirable. The Regional Advisory Committee forms the link for informing regional organizations and individuals concerning the program and its goals and procedures; reciprocally it also provides a mechanism through which representatives of local agencies and organizations, in light of special interests or particular expertise, can recommend modifications in scope or procedures, and suggest specific priorities for future action.

Four particular areas for Regional Advisory Committee consideration were suggested in the 1969 proposal:

a. Analysis of particular threats to the long-term well-being of the marine environment of the region (eg from pollution, erosion, dredging and filling, etc.)

b. As an outgrowth of (a), definition of coastal zone problems facing society as a result of man's encroachments on the sea, and assignment of priorities for study of these problems.

c. Delineation of particularly promising avenues for marine resources development for the Monterey Bay region, with particular concern for their compatibility with problems defined in (b).

d. Recommendations of pilot research activities suitable for exploration of selected areas as defined in (c).

2. Composition of committee

To serve its broad communication and advisory functions, the committee had to be representative of educational institutions, governmental agencies concerned with marine affairs, industrial and commercial interests of the region, regional and local political units, and organizations and individuals representing the general public.

Letters of invitation to the organization meeting of the Regional Advisory Committee were sent to approximately 80 organizations and individuals representative of this broad spectrum. This organizational meeting also functioned as an open public information meeting concerning the new Sea Grant program and was so announced in the local news media (cf Appendix D:4 for text of the invitational letter, D:7-8 for institutions invited, D:9-12 for a listing of individuals participating in total committee functions).

3. Organization of working subcommittees

While a large committee of the whole is desirable to provide broadest possible representation, specific advisory functions can best be performed by small working units. Accordingly four subcommittees were established at the organizational meeting following the general guidelines presented at that time by the program director (cf Appendix D:5-6). These committees have met periodically for consideration of the general areas indicated below:

a. Education and Research Subcommittee particularly concerned with facilitating effective interactions among the several educational institutions of the Monterey Bay area in regard to marine researches and education.

b. Conservation and Development Subcommittee centrally interested in planning for effective management of the coastal zone for long-term protection and widest possible use of marine and estuarine resources.

c. Living Marine Resources Subcommittee particularly concerned with the Sea Grant data collection program and pilot research projects which relate to fisheries and other marine and estuarine living resources.

d. Physical Marine Resources Subcommittee concerned particularly with water quality enhancement and effective use of non-living marine resources.

4. Related public information activities

As outgrowth of the environmental data collection program generally, and the activities of the Regional Advisory Committee specifically, the program director was invited to speak on the project by a number of local organizations, and also to consult with local and state agencies on problems of environmental quality. Since these activities represent a very significant public service function of the Sea Grant program, a partial chronological listing of these functions is provided herewith:

26 August 1970
Association of Monterey Bay Area Governments (presentation: Sea Grant Program)

8 September 1970
Board of Supervisors, Santa Cruz County (presentation: Sea Grant Program)

29 September 1970
and
4 March 1971
California Ocean Area Plan staff, Department of Navigations and Ocean Development, Sacramento (consultations regarding Sea Grant data collection program and possible inputs from it into California Ocean Area Plan)

23-25 November 1970
California Cooperative Oceanic Fisheries Investigations annual meeting (consultations regarding fisheries related pilot research studies)

4-5 December 1970
California Advisory Commission on Marine and Coastal Resources (participation as Commissioner and Chairman of Education and Research Committee in consideration of priorities and procedures for establishment of marine educational reserves in California)

6 December 1970
and
16 February 1971
County Health Departments, Monterey and Santa Cruz counties (invited panel participant in public forums on pollution problems and solutions for Monterey Bay)

February 1971
Sports Fisheries and Wildlife, U.S. Department of the Interior, Sacramento. (consultation regarding potential environmental impacts of proposed dredge spoil deposition from Moss Landing Harbor into Monterey Bay)

8 February 1971
Monterey Institute of Foreign Studies (invited convocation speaker; "Monterey Bay--Quo Vadis?")

23 February 1971
Monterey-Santa Cruz Counties Unified Air Pollution Control District, and Department of Meteorology, U.S. Naval Postgraduate School (conference of Moss Landing Marine Laboratories meteorological and support staff to develop general guidelines for cooperative research areas with the agencies)

4 March 1971
California State Water Quality Control Board, Sacramento (invited participant, discussion meeting of scientists and Board chairman and staff regarding long-range policies and procedures for waste-water management for Monterey Bay specifically, California generally)

5 March 1971
Kaiser Refractories management and engineer, Moss Landing (discussion meeting with Moss Landing Marine Laboratories faculty regarding Kaiser plans for development of an ocean outfall for effluent)

6 March 1971
Central California Sportsmen's Council, Carmel. (invited banquet speaker, quarterly meeting, to discuss Sea Grant program and environmental protection)

News releases have been prepared and circulated to regional news media concerning major development in the Sea Grant program. Good newspaper coverage has been accorded the first "shakedown cruise" of our environmental data collection program (Appendix D:13); an intensive meteorological study in the Salinas Valley (D:14); publication of the Monterey Bay Bibliography (D:17), and a succession of activities of the Regional Advisory Committee (D:15-17).

Spot radio and television coverage also has been accorded the project, with emphasis on its possible contributions to solution of Monterey Bay pollution problems. Cable television production groups in Monterey and Santa Cruz counties are in process of developing feature reports

on the project as a part of their "local origination" commitments. News media throught the area have indicated real interest in this program of obvious newsworthy significance in light of its local service implications.

5. Pilot research project recommendations of the Regional Advisory Committee

As outgrowth of work sessions December through February, the subcommittees of the Regional Advisory Committee produced a series of suggestions regarding regional problems that require study. These have been organized into a single document for referral to the Moss Landing Marine Laboratories faculty as an indication of areas of community concern. The subcommittees recognize that these recommendations constitute essentially a "research suggestion bank" for staff consideration, and that priorities for action on them must necessarily be conditioned by resources available.

Because these recommendations constitute so substantive an output of the Sea Grant program for these first few months of operation, they are attached to the body of the present document (eight pages following).

IV. PROGRAM PLANS: BALANCE OF FISCAL YEAR (February-July, 1971)

The Sea Grant Environmental Data Collection Program is in full-scale operation as of February, 1971, and will proceed during the spring semester according to plans outlined in previous sections (pp 11-28). This will provide the first four months of the coordinated interdisciplinary program originally proposed as a two-year effort. This program will have long-term significance only if its primary organized thrust is maintained through at least another year of effective operation.

An annual report will be prepared in June as a supplement to the present document consisting principally of a summary of substantive findings of the first half-year of environmental data collection, and a fiscal report.

Moss Landing Marine Laboratories of the
CALIFORNIA STATE COLLEGES at Fresno, Hayward, Sacramento, San Francisco, San Jose
P.O. Box 223, Moss Landing, California 95039

Environmental Studies, Monterey Bay Region
National Sea Grant Program

SOME MARINE RESEARCH PROBLEM AREAS FOR THE MONTEREY BAY REGION

suggested by the

Working Subcommittees of the Regional Advisory Committee
Moss Landing Marine Laboratories Sea Grant Program

1 March 1971

Subcommittees:

Education and Research: Chm., Milton Bristow, Monterey Peninsula College.

Conservation and Development: Chm., Capt. Sid Brooks, Council on Monterey Bay.

Physical Marine Resources: Chm., Walter Wong, Monterey County Health Dept.

Living Marine Resources: (acting for the Chm.), Earl Ebert, Calif. Fish and Game.

INTRODUCTION

As direct outgrowth of our definition of functions at the November 16 organizational meeting, the working subcommittees of the Regional Advisory Committee have addressed themselves to two major questions during the past several months. First, they have provided reactions to the present plans and program of the Sea Grant project, generally approving of progress as outlined by the project director, and making a number of useful suggestions concerning areas they considered worthy of particular priority or emphasis.

Second, the subcommittees have considered a series of research areas on problems which they believe have significance for marine resources development in the Monterey Bay region. They have outlined these problem areas in general terms only, recognizing that detailed definition is a function of the specialist who choses to undertake a given research effort.

These recommendations are viewed as a "research suggestion bank" for consideration by the Sea Grant program staff. They are not organized with any priority sequence, since priorities for action on them must be left up to the Sea Grant staff. These priorities inevitably will be a reflection of research interests of the faculty, and of course will be limited by the physical resources available at the Moss Landing Marine Laboratories.

The recommendations which follow are grouped by subcommittee. Some overlap is apparent, and has been retained in this report with only minor editing, since this demonstrates significant similarities of concern among the several working groups. This document has been prepared by project director Harville, for the Subcommittees. Copies have been provided the Sea Grant program staff, and have been mailed to all members of the Regional Advisory Committee.

A second public meeting is planned for the Regional Advisory Committee featuring an illustrated progress report on the first year of activities, and outlining Sea Grant plans for the future. The tentative date is Monday, May 24, 7:30 p.m.; the place, Monterey Peninsula College. An agenda and other details will be mailed in late April.

SUGGESTED AREAS FOR PILOT RESEARCH PROJECTS

Education and Research Subcommittee Recommendations.

1. That the Sea Grant Program gather information on current marine research in and around Monterey Bay.

2. That this information, as well as new information generated by Sea Grant research, be disseminated in the form of a periodic newsletter written for the interested laymen, hopefully published several times a year, and circulated to agencies, schools, and others interested in Monterey Bay. (The subcommittee will help with the development of a mailing list.)

3. That occasional information bulletins be prepared which discuss a subject in greater depth.

4. That occasional public meetings be held (annually?) for topics of unusual public interest.

Conservation and Development Subcommittee Recommendations.

A. Coastal Sands and Dunes of the Monterey Bay Area: Statement of the Problem.
The coastal sands and dunes of the Monterey Bay area are an economic, aesthetic and environmental asset of the region. Dune and beach sands have been mined commercially for many years and used in abrasives, glass manufacture and construction materials. Replenishment of beach sands appears to have been principally from local river sands. Recent surveys made by the U. S. Army Corps of Engineers indicate critical erosion of sandy beaches exists in a number of areas along the Monterey Bay shoreline. Public controversy over issuance of sand mining permits in the Del Monte Forest properties has focused attention on the recreational and environmental values of beach dunes. Hotel and residential construction on beach sites have raised controversial issues of ecological damage, "view pollution", structural safety and loss of recreational values. Not nearly enough data is available on sand transport, origin of sediments, changing patterns of sand transport caused by inter-tidal construction, by damming of rivers and by other factors which affect replenishment of sand beaches and dunes.

The burgeoning population of California, increasing leisure time, increasing tourism, and public awareness of the scarcity and recreational values of the shoreline, all point toward a need for evaluation of the present and future availability of adequate beach and dune areas to satisfy public demand. Changes in interpretation of the laws with regard to beach access, and pending legislation on coastal planning emphasize the need for base-line data from which to evaluate and plan for the future. Continuing conflicts between public interest and the traditional rights of the private property owner point up the urgent need for such planning. Methods of evaluating the impact of coastal development, of determining multi-compatible uses and of establishing priorities for exclusive use are essential if the best interests of the public are to be served.

The following suggested pilot research projects are an expression of the interests and concerns of the Subcommittee on Conservation and Development. They are stated in general rather than specific terms with the intention that scientists more familiar with research techniques will be able to formulate research proposals based on available data, equipment and expertise. Members of the Subcommittee will be happy to meet with laboratory staff members for more detailed discussions if desired.

B. SUGGESTED PILOT RESEARCH PROGRAMS

1. Investigate and record existing beach and sand dune formations of the Monterey Bay Area. Extensive bibliographic review, and collection of existing photographic and historical data will provide the background information for the following specific studies:

   a. Develop an overall view of sources of beach sand replenishment, sand transport, changes created by man-made structures; make recommendations for specific actions which would preserve existing desirable values and retard deteriorating conditions.

   b. Compile a historical record of commercial utilization of beach and dune sands; record known effects on beaches and dunes as to ecological and environmental values; forecast possible deleterious effects based on present mining rates.

   c. Delineate existing and known planned uses of sand beach areas, ownership data, characteristics of unique areas, erosion danger, etc.

   d. Evaluate effects of existing beach construction (housing, roads, jetties, hotels, etc.) on beaches and adjacent dunes. Record original conditions and monitor changes which occur as a result of on-going beach development.

2. Planning for optimal allocation of limited coastal resources is vital and urgent if the many economic, aesthetic, environmental and social values of the coastline are to be preserved. Pending state legislation may require development of "coastline elements" to existing Master Plans. Techniques for such planning are at best rudimentary and experimental. The interdisciplinary nature of this planning process and the need for a systems approach to an acceptable solution mitigate against success if the conventional methods of local planning, based primarily on economic consideration, are continued.

   a. Set up a team to evaluate both terrestrial and marine coastal resources of Monterey Bay; identify unique sites; recommend preferred uses of specific sites on a priority basis.

   b. Set up a research team to work with City and County planning agencies in developing coastline plans; investigate in detail the application of the matrices developed for the California Ocean Area Plan to specific sites and uses; investigate methods of quantifying many of the factors enumerated in the matrix systems.

Physical Resources Subcommittee Recommendations.

A. A geologic pilot research project.
Representatives from both State and Federal agencies concerned with natural resources and geologic problems recommend consideration for the following pilot studies for Monterey Bay and the central California coastline:

1. A comprehensive investigation of geologic hazards is essential as a preliminary step before any residential or recreational development is permitted along the coastline. Areas of concern should be areas of potential instability, such as the sand dunes along the central and southern shorelines of the bay. In addition areas where wave activity is important should be under observation and monitored for at least a year. An example for such investigation would be the zone of cliff erosion along the northern shoreline of the bay. A third possibility would be an investigation of submarine slumping in Monterey Canyon as this could generate very destructive tidal waves (tsunamis).

2. A detailed study of the sand budget in Monterey Bay is essential. Sand is a critical resource in this area. It provides beaches for recreation and protects the coastline against the energy of waves; without this protection millions of dollars of losses can be expected. Problems that need to be investigated include the following:

   a. What is the rate of recession of the shoreline, particularly critical areas of the coast?

   b. What is the annual sand yield of the Pajaro and Salinas Rivers, and how irregular is this supply?

   c. What are the relative stabilities of various sizes and sortings of sands, with particular reference to possible importation of sand for shoreline protection, as may be necessary along portions of the northern shoreline of Monterey Bay?

B. Further Studies of Sewage Impact on Shellfish. There is a need to study the effects of sewage and manure waste on shellfish. Not only should coliform bacteria be used as indicators of effect, but also the toxicity effect of pesticides and heavy metals should be considered. Elkhorn Slough has been posted for highly contaminated shellfish for the past two years. The high coliform counts have been due to sewage, manure waste, and agricultural run-off.

Enforcement actions against several dairies discharging into Elkhorn Slough will eliminate the direct discharge of manure waste into Elkhorn Slough by August, 1971. Base-line evaluation of these discharges on shellfish can be presently established, and changes in shellfish that occur after elimination of the pollution problem can thus be evaluated.

Evaluation of the effect from sewage effluent, manure waste, pesticides, and heavy metals should be made of not only the gaper and Washington clams in Elkhorn Slough, but also for pismo clams in Moss Landing and Palm Beach areas. The Monterey County Health Department is making routine surveillance coliform tests of the shellfish-growing waters for compliance with the Health and Safety Code. This task is often performed cooperatively with the staff of the Moss Landing Marine Laboratory, and these areas of cooperative effort could be expanded.

Because of increasing concern for the effects of mercury on fishes and shellfish, a study should be undertaken to identify potential sources of mercury contamination of the marine environment, and to evaluate the impact of this element on selected marine organisms.

Living Resources Subcommittee Recommendations

Several members of the Subcommittee suggested the following areas of particular emphasis:

A. Need for information on biology of important shellfish species.
Information on the distribution, abundance, population structure and life histories of shellfish species of Monterey Bay and environs is woefully lacking. Limited studies have been accomplished in the intertidal zone, but we know almost nothing of subtidal populations or distributions.

A dense subtidal population of the gaper clam, Tresus nuttalli, is known to exist in the general vicinity of the Monterey City harbor. Similarly, substantial populations of gapers and Washington clams, Saxidomus nuttalli, exist within Elkhorn Slough. Also, significant populations of the pismo clam, Tivela stultorum, are present in Monterey Bay. These three species are considered important to the sport fishery.

Life history studies of both the gaper and Washington clams should be undertaken. Also, we should attempt to define population sizes and structure (age and size compositions) in selected regions of the Bay.

B. Studies of impact of heated effluents on marine organisms.
The general outline for pilot research studies in this area contained in the 1969 Sea Grant project proposal, is commended for further consideration and action. Pertinent sections of that proposal are as follows (pp. 43-44, 1969 proposal to the Sea Grant Office):

> "The Moss Landing power generating station of the Pacific Gas and Electric Company is the second largest in the world, with a steam plant cooling system producing more than half a million gallons of warm water effluent per minute...

"1. What is the effect of deep-water injection of warm water on forage species in the receiving waters? We have observed heavy concentrations of terns and small gulls feeding in the "boil" created by the P.G.& E. warm-water effluent. The mechanical structure of the coolant system makes it unlikely the forage organisms have been carried through the plant in the coolant waters. If these waters have a stunning or disorienting effect on some species of forage fishes, this might have significant implications for outfall design. It also might suggest a positive use of such an outfall to attract desirable predator species and render them particularly available to a sport or commercial fishery.

"2. What is the effect of entrainment in the cooling system of various plankters, including larval fishes, and what are the implications in regard to impacts on marine food chains? What are the implications for coolant system design?

"3. What are the effects upon shellfish and demersal fish populations of the smaller volume warm-water discharges into Elkhorn Slough? Since these discharges are in an area of extensive and diversified shellfish production, a natural laboratory exists for these studies, which have extensive implications for aquaculture."

LIST OF INCLUDED MATERIALS IN APPENDIX A

Selected preparatory papers and background research sources provided for the faculty and graduate research planning group of the Sea Grant Environmental Data Collection Program.

Memo SG70-2 22 September 1970

TO: Faculty, Graduate Assistants, and Staff

FROM: John P. Harville

RE: A further attempt to describe goals and processes of our Sea Grant Program in operational terms

A. INTRODUCTION

Our project has three inter-dependent components, all funded to begin this year, but the first by far the most important in terms of immediate priorities:

1. Environmental data collection and analysis program (funding from Federal sources approx. $63,000; cf. proposal pp.3-6, 15-41, 52-55 for details).

2. Pilot research activities (Federal funding: $3,000 for this fiscal year, all committed; probably ten-fold increase for next year;cf.pp.42-48,56).

3. Public information and interpretation services--bibliographic and data center (Federal funding approx. $8,000; cf.pp.6, 56-61).

From discussions with individual faculty members, I believe we can best achieve clarity as to our goals, and our processes for achieving them, if we concentrate on the first component (data collection), recognizing that this task is distinct from a virtually limitless array of specific research projects which also are environmentally oriented, but are less general and pervasive in scope. These latter activities fall under our second component --this year very minor in funding and extent, but next year a major effort, assuming success with our primary task.

B. THE ENVIRONMENTAL DATA COLLECTION PROGRAM: WHY FIRST?

The rationale for this entire effort is spelled out quite carefully in the proposal; indeed is the reason we were funded for it. Let me try here to pull out a few specific points which indicate why we have committed ourselves to the scope of interdisciplinary effort that this project entails.

1. We committed ourselves to this kind of broad interdisciplinary effort in 1965 when we sought funding from NSF to purchase and establish MLML. We never would have received this funding for "just another marine station" devoted to a miscellany of unrelated biological studies--NSF pointed out then, and repeatedly since, that this would be costly duplication of facilities and funding. (There presently are some sixty marine stations on the Pacific Coast!)

2. This approach is totally compatible with our educational mission and mandate, involving undergraduate and graduate students, with guidance from an interdisciplinary staff, in a systems approach to the ecosystem (to be redundant).

3. This project will provide the necessary data matrix, and establish field operations to extend that matrix, which are requisite to a virtually infinite number of more restricted and specific studies; and the field activities will provide facilities which directly support other (often non-fundable) projects.

4. These data and the interpretations and analyses from them are most urgently needed by the region,state,and nation;thus are fundable(as our grant shows).

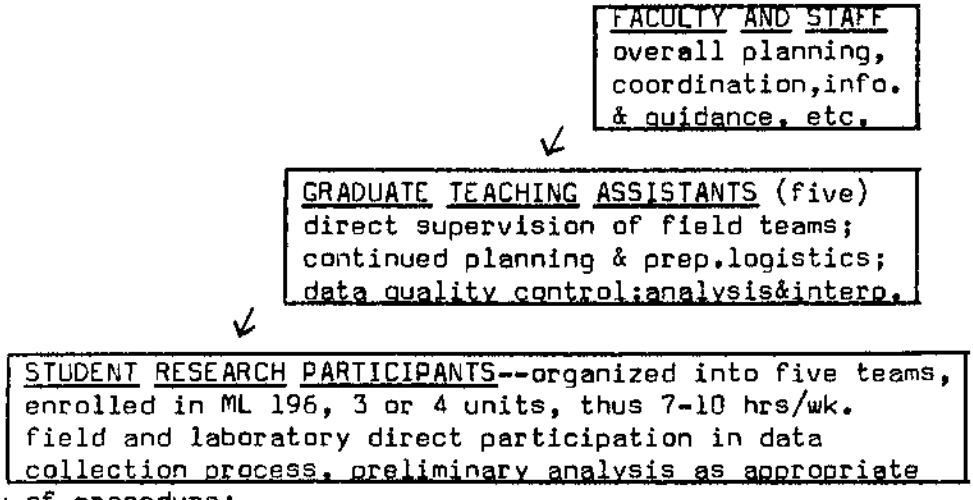
5. Other institutions, all more experienced than we, have seen the need for this same priority of effort (viz. the Gulf of Mexico Estuarine Inventory, five states participating, led by Mississippi's Gulf Coast Research Laboratory; the San Francisco Bay Delta Studies, for which the University of California provided major early input and continuing guidance; Virginia Institute of Marine Science's Coastal Wetlands of Virginia study, now in the first year of a three-year program; the University of Maine's three-year, $400,000 ecological study of the Damariscotta River in relation to potential thermal effects of a nuclear power station, etc. etc.)

C. ENVIRONMENTAL DATA COLLECTION AND ANALYSIS--HOW?

1. Rationale: We have twin objectives: environmental data collection; and simultaneous functional education of our students. Our project design therefore must involve our students at levels appropriate to their background and interests, in the data collection and analysis process. Undergraduates and generalists (e.g. science teachers involved in a realistic in-service training process) will participate in field collection and laboratory display, coding, and preliminary analysis. Graduate teaching assistants will direct their efforts, be responsible for the quality of the output, and be involved directly in analysis of results. Other students, either as individuals or as members of appropriate classes (e.g. marine meteorology) will participate in data analysis. The faculty and staff will provide appropriate overall direction and coordination of effort, quality control of output, and long-term continuity of approach.

2. Approach to full-scale operations in the spring semester and thereafter.

a. Three levels of input, as implicit in the rationale above:



b. Summary of procedure:

1) Student research participants:
   a) enrolled in 3 or 4 units ML 196, thus all day monday or saturday, plus additional hours by arrangement if 4 units.
   b) organized into five "permanent" teams (same team stays together for term) of 3-5 participants each.
   c) each team assigned first half of semester to one environmental subdivision; second half to another of contrasting kind.
   d) class time divided between field and lab activities so that stations in subdivision are occupied at least once every 6 weeks (oftener as required for key situations or needs).
   e) collected data covering all disciplines.

2) Graduate teaching assistants:

a) Assigned for full academic year, each to his own environmental area:

Sea-air-land zones of contact	Arndt Lorenzen
Elkhorn Slough	Richard Smith
Rivers and estuaries	Scott Dailey
Shallow waters, Monterey Bay	Gary McDonald
Submarine canyon, open coast	Roger Hilaski

b) Responsible for logistics planning and execution, training and supervision of research participant teams in his own area.

c) Responsible, with faculty/staff advice and help, for quality of data, for coding processes, preliminary analysis, etc.

d) Responsible for input in field of individual competence to efforts of total project (probably through team efforts with one or more other graduate assistants) to increase multidisciplinary approach and effect.

3) Faculty and staff: Each professional faculty and staff member will:

a) Advise all teaching assistants in matters relating to his own special area of competence--data collection gear, procedures, sensitivity of results expected, interpretation of anomalies, preliminary analysis of results, etc.

b) Provide some field and laboratory surveillance in relation to his own discipline in order to assure reasonable quality control and afford teaching assistants reasonable professional "back-stopping".

c) Provide supervision of graduate students engaged in related research (and enrolled in appropriate courses).

d) Assist Project Director through general surveillance of one or more of the project environmental areas.

e) Such other functions as may prove desirable for the success of the project.

3. Fall Semester Operations (planning and preparation for February):

a. Faculty input to the planning effort (limited assigned time available)

1) Overall team input by way of monday meetings and such additional effort as can be arranged,in relation to project as a whole, incl:
   a) guidelines & advice for library, lab, field work of T/A team;
   b) decisions regarding environmental factors to be measured/collected; gear to be used, levels of sensitivity achieved,etc.
   c) approval of data coding and management procedures;
   d) advise concerning Regional Advisory Committee organization and operation;
   e) such other matters as become required or desirable.

2) Specific individual inputs consistent with disciplinary interest and competences would appear obvious from considerations for needs of spring term.

b. Graduate teaching assistant input will involve planning, library, laboratory, and field activities required to make ready for spring, and including preparation of materials covered under Phase I:Project Goals (cf. memo SG70-4).

SOME INTRODUCTORY AND GENERAL REFERENCES ON MATERIALS AND METHODS

Examine the following references which have been placed on reserve in the library in order to be familiar with their scope and be aware of resources for research approaches and specific techniques. The following are arranged from the more general to the more specific:

A. General introductions to conditions to be measured, equipment and techniques, etc.

Lagler, Karl F. 1956. Freshwater Fishery Biology, Wm.C.Brown, Dubuque, Iowa, 421 pp. While designed for freshwater fisheries, still one of the best "how to do it" resources. See especially Ch.XVIII & XIX, Fishery surveys in lakes, ponds, etc. Good general overview; particularly useful sections on mapping gear and techniques. Appendix B has sample form for recording data.

Smith, Robert L. 1966. Ecology and Field Biology, Harper & Row, 688 pp. See particularly Ch.III, Aquatic Habitats, and Appendix B, Environmental Measurements. A general ecology text with useful brief review of techniques.

Williams, Jerome. 1962. Oceanography--an Introduction to the Marine Sciences, Little, Brown & Co., Boston, 242 pp. See especially Ch. XVII, Oceanographic Instruments, Tools, and Techniques. Viewpoint of Naval Acadamy; excellent general introduction.

B. More detailed and specialized works on methods, equipment, techniques, etc.

Hola, Ilmo and Taivo Laevastu. 1961(?). Fisheries Hydrography, Fishing News, 137 pp. Deals very well with hydrographic surveys and interpretation in relation to fisheries. International in scope; authors Finnish. Not so much a book on methods as on environmental factors and their interpretation.

Platt, Robert B. and John F. Griffiths. 1964. Environmental Measurement and Interpretation, Reinhold Publ.Corp., New York, 235 pp. A detailed and scholarly work which takes the next logical steps after those listed under A above. Introductory chapters on concepts and principles, and experimental design; then treatment of factors to be measured. Useful appendices.

Strickland, J.D.H. and T.R. Parsons. 1968. A Practical Handbook of Seawater Analysis, Bulletin 167, Fisheries Research Board of Canada, Ottowa, Canada, 311 pp.

U.S. Oceanographic Office, 1968. Instruction Manual for Obtaining Oceanographic Data,(Third Edition), Publ. No. 607, U.S. Oceanographic Office, Supt. Documents, U.S. Govt. Printing Office, Wash.DC,($1.25).

Welch, Paul S. 1948. Limnological Methods. McGraw-Hill, New York, 381 pp. Excellent reference with major sections on hydrographic mapping and morphometry, physical, chemical, and biological survey methods. Extensive tables in appendix. Designed for lake and pond work, thus useful for nearshore and estuary and bay work. One of best available sources on plankton collection and lab.prep.techniques.

C. Treatments of Scope of Research, Including Examples of Parallel Studies

California Cooperative Oceanic Fisheries Investigations--annual reports. Search through them for illustrations of researches along Pacific Coast.

Engineering Science Inc. 1968. Proposed Study for a Marine Water Resources Planning and Management Program, Engineering Science, Oakland, Ca. A research proposal by a major engineering firm--useful example. See especially sections on ecological and oceanographic studies.

Intergovernmental Oceanographic Commission, UNESCO. (date?) Draft of a General Scientific Framework for World Ocean Study, UNESCO, France, 76 pp. Preliminary and incomplete draft as title indicates; gives global scope.

Kaiser Engineers. 1969. Final Report to the State of California--San Francisco Bay-Delta Water Quality Control Program, (Preliminary Edition), Kaiser Engineers, San Francisco (?). This huge volume is the final document to date summarizing a most extensive and expensive study of the Delta water quality program. See especially Section C--Special Studies, Chapters X, XI, & XIII.

Mooers, C.N.K., et al. 1968. A Compilation of Observations from Moored Current Meters and Thermographs (and of Complementary Oceanographic and Atmospheric Data), Department of Oceanography, Oregon State University, Corvallis, Oregon, 98 pp. Excellent general work as well as coverage of topics in title.

Turner, Charles H., et al. 1965. Survey of the Marine Environment Prior to Installation of a Submarine Outfall, California Fish & Game 51(2):81-112.

Turner, Charles H., et al. 1966. The Marine Environment in the Vicinity of the Orange County Sanitation District's Ocean Outfall, California Fish & Game 52(1):28-48.

The above two papers deal with somewhat similar concerns as the Water Resources Engineers report, though for a different area, and primarily from the point of view of the California Department of Fish and Game, hence resources management.

Water Resources Engineers, Inc. 1967. Effects of Ocean Discharge of Waste Water on the Ocean Environment near the City of San Diego Outfall, Water Resources Engineers, Inc., Walnut Creek, Ca., 57 pp. plus appendices. A most interesting paper and useful example of an engineering firm's comprehensive study. Useful (though certainly not perfect) model.

Scan these documents to see how others have attacked the task of extensive environmental studies, both in terms of scope of project, and methods and techniques employed in the studies.

A PARTIAL BIBLIOGRAPHY OF USEFUL REFERENCES FOR BACKGROUND AND PATTERNS OF APPROACH

Note that some of these are unpublished and may not be quoted, loaned, or discussed outside. JPK

A. References relating specifically to the Monterey Bay region.

California Cooperative Oceanic Fisheries Investigations (CalCOFI) Progress Reports 1952-1953. 44 pp. Marine Research Committee, Calif. Dept. of Fish & Game. cf. esp. pp. 9-19: "The Ocean Climate, 1949-52."

_____ 1956-1958. Marine Research Committee, Calif. Dept. of Fish & Game, 57 pp. cf. esp. pp. 14-17, report of activities, Hopkins Marine Station, Stanford University; also 27-56: "Studies of the California Current System" w/bibliography.

_____ see also other later reports of this landmark program including extensive data reports.

California Department of Fish and Game, 1968. A SURVEY OF THE MARINE ENVIRONMENT FROM FORT ROSS, SONOMA COUNTY, TO POINT LOBOS, MONTEREY COUNTY. Final Report to the San Francisco Bay-Delta Water Quality Control Program prepared by Melvyn W. Odemar, Earl W. Wild, and Kenneth C. Wilson. 238 pp.

California State Department of Public Health, Bureau of Sanitary Engineering. 1967. Sanitary Engineering Investigation of Quality of Water and Shellfish in the Estuary System at Moss Landing, Monterey County. 68 pp.

Dorman, Craig E., 1968. THE SOUTHERN MONTEREY BAY LITTORAL CELL: A PRELIMINARY SEDIMENT BUDGET STUDY. (thesis) United States Navy Postgraduate School, 234 pp.

Engineering Science, Inc., 1968. PROPOSED STUDY FOR A MARINE WATER RESOURCES PLANNING AND MANAGEMENT PROGRAM. (submitted to the Association of Monterey Bay Area Governments). Chapters I, II, III for engineering-oriented approach.

_____ 1968. OCEANOGRAPHIC WASTE DISPOSAL STUDIES IN MONTEREY BAY Prepared for East Cliff & Capitola Sanitation districts, Santa Cruz County, California. approx. 150 pp.

Santa Cruz, City of; 1964. GENERAL PLAN FOR FUTURE DEVELOPMENT OF CITY OF SANTA CRUZ, CALIFORNIA. Adopted by the Santa Cruz City Planning Commission Dec. 18, 1963; adopted by Santa Cruz City Council, 1964. 35pp. cf. also background study attached, by Pacific Planning & Research.

Santa Cruz County, 1963. SANTA CRUZ COUNTY RESOURCES--THEIR USE AND DEVELOPMENT. 15 pp.

Water Resources Engineers Inc. 1968. FIRST PROGRESS REPORT: INVESTIGATION TO DEVELOP A WATER QUALITY CONTROL PLAN FOR MOSS LANDING HARBOR AND ELKHORN SLOUGH, MONTEREY COUNTY. 36 pp.

_____ 1969. EVALUATION OF ALTERNATIVE WATER QUALITY CONTROL PLANS FOR ELKHORN SLOUGH AND MOSS LANDING HARBOR. Presented to the California State Water Resources Control Board and the Central Coastal Regional Water Quality Control Board. approx. 70 pp.

Yodar/Orlob Associates, 1968. WATER SUPPLY AND DISTRIBUTION AND WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL FOR THE MOSS LANDING AREA OF MONTEREY COUNTY. approx. 150 pp A report to the Monterey County Board of Supervisors County Service Area 46.

_____ 1969. A PLAN FOR A COMPREHENSIVE WATER QUALITY MANAGEMENT INVESTIGATION. 75 pp. Prepared for the Assoc. of Monterey Bay Area Governments

A-1

B. References relating to San Francisco Bay and the Bay Delta region.

California Dept. of Fish and Game and Department of Water Resources, 1966. ANNUAL REPORT (1965-66), DELTA FISH AND WILDLIFE PROTECTION STUDY. 51 pp.

California Department of Fish and Game, Marine Resources Operations, 1967. BIOLOGICAL SURVEY OF SAN FRANCISCO BAY, 1963-1966. MRO Ref. # 67-4. 131 pp.

California Division of Mines and Geology, 1969. GEOLOGIC AND ENGINEERING ASPECTS OF SAN FRANCISCO BAY FILL. Special Report 97, Ferry Bldg., San Francisco, Calif. 130 pp.

SAN Francisco Bay Conservation and Development Commission (BCDC), 1969. SAN FRANCISCO BAY PLAN. 43 pp. plus maps. For all background papers etc. see: SAN FRANCISCO BAY PLAN SUPPLEMENT. 572 pp.

State Water Resources Control Board (California) 1969. SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM: Final Report, Abridged Preliminary Edition, prepared by the Program Staff, State Water Resources Control Board. approx. 120 pp

See also two following references upon which this summary was based:

Kaiser Engineers, 1969. SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM. Final Report (Preliminary Edition) to the State of California. over 300 pp.

Kaiser Engineers, 1968. SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM. Final Report, Task VII-1a SPECIAL OCEANOGRAPHIC STUDIES. over 200 pp.

Note also that the State Water Resources Control Board report (1969) also included summation of materials provided in the Calif. Fish & Game Survey of the Marine Environment from Fort Ross, Sonoma County, to Point Lobos, Monterey Co. (cf. pg. 1)

University of California, College of Engineering, Sanitary Engineering Research Lab. 1963 A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY 1961-62. 221 pp.

1963 APPENDIXES TO A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY, 1961-62.

1964 A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY, 1962-63. Third Annual Report.

1964 APPENDIXES TO A COMPREHENSIVE STUDY H OF SAN FRANCISCO BAY 1962-63

1965 A COMPREHENSIVE STUDY OF SAN FRANCISCO BAY, 1963-64 Fourth Annual Report

1965 APPENDIXES TO A COMPREHENSAME STUDY OF SAN FRANCISCO BAY 1963-64

C. References illustrative of researches carried out in other areas--arranged by states. Note that this is a very incomplete list, including only those readily at hand.

California

California Department of Fish and Game, 1968. THE MARINE ENVIRONMENT OFFSHORE FROM POINT LOMA, SAN DIEGO COUNTY. Fish Bulletin 140, by Charles H. Turner Earl E. Ebert, and Robert R. Givin, Marine Resources Operations. 85 pp.

Water Resources Engineers Inc. 1967. EFFECTS OF OCEAN DISCHARGE OF WASTE WATER ON THE OCEAN ENVIRONMENT NEAR THE CITY OF SAN DIEGO OUTFALL. Presented to the State Water Quality Control Board and the San Diego Regional Water Quality Control Board. approx. 70 pp.

Alabama

Florida State University Sedimentological Research Laboratory, 1969. A SEDIMENTOLOGIC STUDY OF MOBILE BAY, ALABAMA, by John J. Ryan. 110 pp.

_____ 1968. A SEDIMENTOLOGIC STUDY OF PERDIDO BAY AND ADJACENT OFFSHORE ENVIRONMENTS, BY Neal M. Parker. 56 pp.

Louisiana

Louisiana State University, Department of Marine Sciences, Office of Sea Grant Development, 1970. COASTAL ZONE STUDIES BULLETIN NO. 5--Special Sea Grant Issue. 184 pp.

Maryland

University of Maryland, Natural Resources Institute, 1969. THE EFFECTS OF THERMAL LOADING ON ESTUARINE PRIMARY PRODUCTION, prepared by D. A. Flemer, D.H. Hamilton, J.A. Mihursky, & C.W. Keefe of the Chesapeake Biological Laboratory. approx 100 pp

_____ 1969. BIOLOGICAL AND GEOLOGICAL RESEARCH ON THE EFFECTS OF DREDGING AND SPOIL DISPOSAL IN THE UPPER CHESAPEAKE BAY. REF #68-2-F. FINAL REPORT: PHYTOPLANKTON. by David A. Flemer, Chesapeake Biol. Lab. ca. 50 pp.

_____ 1969. PATUXENT THERMA STUDIES: SUMMARY AND RECOMMENDATIONS. N.R.I. Report #1, Joseph A. Mihursky, Chairman, Department of Environmental Research, Chesapeake Biological Laboratory. 20 pp.

Massachussets

Division of Marine Fisheries, Dept. of Natural Resources, Massachusetts, 1967. A STUDY OF THE MARINE RESOURCES OF PLEASANT BAY, by John D. Fiske, Clinton E. Watson, and Philip G. Coates. Monograph Series #5, 56 pp.

_____ 1967. A STUDY OF THE MARINE RESOURCES OF BEVERLY-SALEM HARBOR by Wm. C. Jerome Jr., A.B. Chesmore, & Chas. O. Anderson Jr. Monograph Series #4, 74 pp

C. References from other areas, arranged by States (continued)

Oregon

Oregon State University Department of Oceanography, 1968. A COMPILATION OF OBSERVATIONS FROM MOORED CURRENT METERS AND THERMOGRAPHS (AND OF COMPLEMENTARY OCEANOGRAPHIC AND ATMOSPHERIC DATA) Volume II, Oregon Continental Shelf, August-September, 1966; by C.N K.Mooers, L.M.Bogert, R.L. Smith, and J.G. Pattullo. 98 pp.

Virginia

Virginia Institute of Marine Science, 1969. COASTAL WETLANDS OF VIRGINIA. INTERIM REPORT. Special Report of Applied Marine Science and Ocean Engineering Number 10 by Marvin L. Wass and Thomas D. Wright. 154 pp.

SEA GRANT PROGRAM
SG70-6

A-10

4 October, 1970

PROGRESS REPORT: FACULTY ASSIGNMENTS AND SPECIAL INTERESTS (per meeting 28 Sept. 1970)

John Harville

Total Program Support.

Each Sea Grant faculty member will provide advice and guidance to all segments of the total project in his own area of special expertise, and in addition will contribute to the overall policy guidance of the total project. During the first (Fall) semester, faculty advisors will concentrate on decisions regarding environmental factors to be measured at each station: priority of importance, degree of resolution of data (significant digits), gear and procedures to be utilized, etc. Faculty members also will conduct such briefing sessions as are necessary for the Graduate Teaching Assistant team, so that all members of that team will be generally literate in all techniques and equipment.

Mr. Dave Seielstad, Oceanographic Technician for the project, will provide continuing assistance throughout, particularly in relation to equipment, techniques, and standards, and with special attention to field and laboratory management of chemical factors. Mr. Seielstad joined our project team October 1, after two years as technician for the Te Vega program at Hopkins Marine Station, and before that, two years at the College of Marin Bolinas station.

During the second semester, general faculty input will take the form of continuing professional advice on data collection methods and procedures, with particular attention to quality evaluation and control. Since this project is student-operated, rather than one in which specialized technicians carry out processing of samples, it follows that quality assessment and control are particularly important, both to meed our educational obligations, and to provide a means whereby the reliability of our data can be indicated and defended. Our graduate teaching assistants will have primary operational responsibility here, with faculty providing guidance and spot-checking assistance. Faculty members also will be contributing as appropriate to progress-reporting and analysis of data as it accumulates.

Areas of faculty concentration:	marine geology and sediment transport:	Dr. Arnal
	Chemical and physical oceanography	Dr. Broenkow
	Meteorology	Mr. Read
	marine ecology-fisheries	Dr. Harville
	underwater diving support	Mr. Albin
	marine ecology-invertebrates	to be assigned
	plankton, microbenthos, productivity	? ? ?

Special Areas of Concentration (based on my notes from the meeting of 28 Sept.)

1. Dr. Arnal is particularly interested in sediment transport and beach profile changes through time, and will concentrate on a series of beach transects located at strategic points from Santa Cruz to the Salinas River mouth. Each transect will include a series of sampling stations across the beach and outward perpendicularly from the shore to a depth at which sediment transport is apparently limited (probably several hundred meters). Changes with time will be analyzed, including changes in profile contour, sediment size, organic content, and such other characteristics as are appropriate. All data will be correlated with meteorologic and near-shore oceanographic conditions.

   This area of concentration involves particularly two environmental subdivisions of the project: sea-air-land interface (Lorenzen), and shallow bay (McDonald).

2. Mr Read will concentrate particularly on development of a meteorologic data bank which stresses those factors most related to fog and evaporation conditions (the two most significant elements of Monterey Bay climate as it effects agriculture, human living conditions, recreation, etc.). He will develop a central meteorological station at MLML, and a series of substations in the surrounding area, particularly "down-wind" along the Salinas Valley. His efforts will include a number of sub-projects involving his marine meteorology class and other cooperating groups, with particular focus on deliniation of the maritime air mass and its description.

   This concentration involves particularly the Air-Sea-Land zone of contact (Lorenzen).

3. Dr. Broenkow will concentrate particular attention on the chemical constituents of seawater in Elkhorn Slough and Monterey Bay. Through sampling along the Slough and at a series of Bay stations, information can be developed regarding water mass movements and input of materials from a major Bay tributary.

   This concentration involves particularly the Elkhorn Slough subarea (Smith) and the Submarine Canyon-Open Coast subarea (Hilaski).

4. Mr. Albin will develop an advanced scientific diving course which will include instruction in a series of techniques required for scientific divers (e.g., installation of concrete moorings, underwater navigation and mapping, installation and data collection at underwater transects and quadrats, etc.). The small team of divers engaged in this course also will serve as a diver task force to support other elements of the program (e.g. collection of sediment samples from the surf zone in support of Dr. Arnal's area of special interest). Each student also will have a special project of his own (e.g., installation and periodic sampling of a permanent subtidal quadrat or transect).

   This concentration will support all project subareas, but especially those involving Monterey Bay installations and data collection in relatively shallow water.

5. Dr. Harville will of necessity concentrate primarily on overall project coordination, and will endeavor to provide biological input in all areas, pending the addition of a marine ecologist to the project team. He will give particular support to the river estuary effort, and to fisheries aspects and implications of all subareas.
   A marine ecologist will be recruited for the Spring semester, with specialty either in the invertebrates field, or in the area of plankton and primary productivity. For this spring, adequate staffing is available for two persons, one in each area, if appropriate selection of courses is made to fill out the faculty assignment.

space has been left between items for corrections and additions as required. Please let me know of these so that we can keep a corrected master copy. JAS.

12 Oct 1970 A-14

Progress Report: Week of 5-10 October, 1970

A. Consolidation of Data Collection Teams (Faculty recomendation)

1. Purposes:

a. To permit each research participant to concentrate for an entire semester (rather than only half a semester as originally planned on a particular array of data collection and processing for an environmental subdivision.

b. To provide a dual teaming of Graduate Teaching Assistants and therefore produce a multidisciplinary leadership team through pooling of special talents and backgrounds.

c. For both above reasons, to increase the general reliability of data collected and processed.

2. Procedures: scheduling.

a. The Elkhorn Slough team and the Deep Bay Team will be coordinated as a single operational unit under Roger Hilaski and Rick Smith. Roger and Rich will continue to have logistical responsibility for their separate geographic areas; however, they will be able to concentrate academically on their areas of major discipline (Smith on physical sciences; Hilaski on biological sampling). Details of this shared responsibility will be clarified as the program develops.

b. The River Estuary and Shallow Bay teams will be similarly consolidated under Scott Dailey and Gary McDonald. Each will continue his general logistical responsibility, for his separate area; this consolidation will permit concentration in areas of major interest, particularly in laboratory supervision of sample sorting and processing.

c. The Sea-Air-Land Zone of Contact team, under Arndt Lorenzen, will coordinate closely with Mr. Read's Marine Meteorology class for meteorology class for meteorological phases of the project. Hopefully some of the research participants in this team also will be enrolled in Mr. Read's class. This team also will coordinate with the Shallow Bay team in management of shoreline data along the Bay perimeter. Details of this interaction will be clarified as the project as a whole develops.

3. Procedure: operational.

a. Each research participant will "specialize" in a particular needed area of data collection and sample processing (e.g., hydrocast and physical-chemical processing of water samples; benthic samples: sediments; benthic samples: biota, etc.)

b. Additionally, each participant will have his schedule so programmed that he "assists" across the board in other categories of data collection, so that he has reasonable experience with these sampling and processing procedures as well.

c. Faculty members will supply professional advice and guidance as indicated earlier (cf. SG70-5). As is apparent from the consolidation of areas and the special research interests of faculty, Dr. Arnal will work particularly closely with Dailey, McDonald, and Lorenzen; Dr. Broenkow will have a similarly close relationship to Smith and Hilaski, and Mr. Read will concentrate attention on Lorenzen's project, with considerable attention also to the shoreline work of McDonald's group.

B. Physical-chemical Data Collection for Elkhorn Slough: tentative outline prepared by Richard Smith and approved by Dr. Broenkow.

I. Monthly samples at 8 permanent stations at a maximum of 3 depths.

Samples will be taken at slack high water ± 45 min. This will require 2 boats w/ 4 observers for about 2½ hours.

A. Salinity
B. Temperature
C. Nitrate, nitrite (ammonia, perhaps)
D. Phosphate
E. Silicate
F. Dissolved oxygen
G. pH (alkalinity, perhaps)

II. Sampling to be done on a selective basis:

A. Sediment analysis, 1 or 2 times (wet and dry season?)
1. Three sample c/s taken at approx. 4 stations.

a. size analysis
b. organic analysis
c. carbonate analysis
d. mineral analysis (x-ray defraction, SJSC?)
e. oxygen demand - putrification H_2S? or interstitial water analysis

B. Productivity
1. Benthic production
2. Oxygen production or C^{14} uptake of micro-organisms in solution

C. Tidal cycle monitor
1. Salinity and temperature c/s over full tidal cycle at at least two stations

D. Continuous temperature and salinity monitor along the axis of the slough

E. Wurvey of benthic and nonbenthic populations

F. Establish tidal lag and height at various distances from Moss Landing Harbor

SEA GRANT PROGRAM 3 December 1970

SOME THOUGHTS ON PRIORITIES AND SCOPE OF DATA COLLECTION EFFORTS as generated by group reports, consultation with outside authorities, staff comments, etc. Tentative reactions only--not to be taken at this stage as "directives".

A. Regarding general physical/chemical oceanographic data--no specific comments appear required. All concerned have recommended the fairly standard approaches close to those of NODC; Dr. Broenkow has made recommendations on sampling stations for MLML region. We still need to decide on those to support beach transects along-shore. Related stations for Pajaro River and Elkhorn Slough are reasonably well established.

B. Regarding <u>benthic</u> sampling (exclusive of fishes and netting procedures).

1. It appears we should take cores at all permanent hydro-stations, ideally simultaneous, with hydrocasts (single core at each). Cores should be split down the middle, one half for particle size and organic analysis, one half preserved for future study.

2. Bottom grab samples for combined benthos/physical studies might best be:

   a. made with Ponar grab, modified so that screens on back are removable;

   b. be sub-sampled as earlier discussed, one sub-sample for particle size/organics; one for preservation for later analysis for microorganisms;

   c. be described physically per NODC and other standards;

   d. be sieved aboard vessel (after volumetric determination--gross measure only) per procedures modified after those used by Odemar et al, California Fish and Game. General consensus is that 1 mm seive is fine enough for this program;

   e. be sorted, enumerated, biomass determined, per techniques modified after Chartock, Mayer, Houck & others of PG & E, Kaiser, C F & G studies at MLML. Sorting to be into major categories only, with provision for further study by specialists (cf. Chartock procedures);

   f. sampling program to concentrate on two or three stations in each major subdivision with replicate sampling to permit statistical treatment of results and some indication of community structure for the area; replication to be assured by use of temporary buoys at station, with all samples at buoy;

   g. frequency of sampling much less than hydrocasts; perhaps twice per semester.

   h. "milk-carton" corer still seems best sampler for stations reached by hand (intertidal).

3. Gear needed includes:

   a. coring device (gravity type), sample tubes, carrying gear.

   b. bottom grab, sieving and washing unit, including wet-table which will drain wastewater over-side.

   c. lab gear including freezer, sorting trays and microscopes, preserving containers (large one for station sample, with included vials for sorted biota), specimen labels.

   d. special field gear for estuaries, including "milk-carton" corer, transect lines.

4. See section following for detailed suggestions regarding sediment analysis per Richard Smith's working committee.

C. Proposed benthic sampling for MLML Sea Grant program

1. Investigations to be carried out on samples taken from all stations.

   a. biological analysis

      1) sieve grabs through 0.5 mm mesh on station, retain microfauna and identify as completely as possible. (1,2)

      2) preserve a suitable sub-sample for future microfaunal analysis.

   b. geological analysis

      1) size analysis

         a) Emery settling tube for coarse fraction, 2 mm - 0.031 mm.(3)

         b) pipette analysis for fine fraction. (4)

      2) a small portion of the sample should be retained for future mineral analysis, approximately 10 cm^3 required for clays.

   c. chemical analysis

      1) calcium and magnesium analysis by either atomic absorption or an EDTA complexiometric titration should be carried out to determine the carbonate content of the sediment. (4,5,6)

      2) total oxidizable matter should be carried out by wet ashing with chromic acid and titration of the incompletely reduced chromic acid with ferrous iron. (4,7)

2. Further analysis suggested for areas of high organic content or where pollution is evident.

   a. a quantitative assessment of the reducing environment by one or more of the following methods:

      1) quantitative oxidation of a known volume of sediment with dissolved iodine (Winkler reagents).

      2) biological oxygen demand determined for a volume of sediment.

      3) interstitial water analysed for an indicator ion such as sulfate, ferrous iron, sulfide, etc.

      4) oxidation-reduction potential Eh determined.

   b. productivity of sediments obtained in the intertidal and photic zones.

      1) light vs dark bottle oxygen production determined per unit surface area. (8)

      2) chlorophyll-a extracted and determined florometricly. (8)

3. Sediment transport

   a. estimates of sediments contributed by run-off.

      1) for Elkhorn Slough or any other tidal area, siphon samplers left out over several tidal periods should be sufficient. (9)

      2) for the Pajaro, filtration methods will be necessary.

   b. littoral drift.

      1) monthly or bimonthly beach transect at established stations using the method described by K.O. Emery. When possible, diving teams should continue profile through the surf zone. (10)

      2) sand samples should be obtained from each transect station at least seasonally to establish any possible variation in the size distribution or sorting at the various beaches. (4,5)

SEA GRANT PROGRAM

10 December 1970

FISHES COLLECTION AND PROCESSING: some tentative conclusions developed from discussions to date.

A. Stations

As for benthic sampling, we will need to restrict the number of stations to be occupied; also their frequency of sampling, in order to be able to meet reasonable limitations on time. Where possible, stations for benthic and fish sampling should be the same. Sampling period should be about two months.

I suggest two primary stations for the Canyon sector, and perhaps four along the Bay perimeter (coincident with beach transects and/or river mouth stations), and two each in the Pajaro and Elkhorn Slough.

B. Sampling

1. Otter trawl hauls, 10 minutes each, should be replicated adjacent to a buoy marker (three or four hauls per station where possible) at Bay stations, and where possible, in Elkhorn Slough.
2. Beach seine (200 ft) should be laid out approximately 200 ft from shore and parallel with shore; retrieved by shore team, at near-shore stations in Bay. 100 ft seine may be more practicable for Elkhorn and Pajaro; distance offshore will need reduction, but should be standard for all hauls at a given station.
3. Gill nets (standard sampling sequence) should be set overnight and daylight where practicable, at all standard stations.
4. Biological dredges and larval fish nets should be hauled at all stations for general reconnaissance: 10 minute hauls.
5. Experimentation with long-lines and traps should be encouraged.
6. Collected specimens should be preserved for future study, as necessary for data recording purposes.

C. Data

1. Standard catch data (subsampling where necessary if sample is large) should include total weight and number of each species or group, and individual weights and lengths of largest and smallest individuals from each species.
2. Length and weight frequency data for all individuals should be collected where possible; also sex and fecundity information.
3. Special attention should be directed to trophic relations, with stomach content analysis undertaken for representative species and for locations. Special preservative techniques will be required for success here.

12/14/70

TENTATIVE CHECKLIST OF ENVIRONMENTAL FACTORS FOR WHICH DATA WILL BE COLLECTED IN THE MLML SEA GRANT PROGRAM, INCLUDING TENTATIVE NUMBER OF STATIONS, FREQUENCY OF SAMPLING, AND OTHER CONSIDERATIONS, FOR FOUR PRIMARY SUB-AREAS OF STUDY.

	MONTEREY CANYON	ELKHORN SLOUGH	PAJARO RIVER	PER...
A. STATION IDENTIFICATION DATA (all stations)				
Station number, latitude, longitude, date, time	x	x	x	x
UTM grid (1 kilometer square) and perhaps hectare grid		x	x	x
Depth to bottom, and maximum depth sampled	x	x	x	x
B. METEOROLOGIC DATA AND SURFACE OBSERVATIONS OF WATER. (all stations)				
air temperature, wet and dry bulb, and barometric pressure	x	x	x	x
wind direction & force; weather, cloud cover, visibility	x	x	x	x
wave direction, height, interval	x			x
current direction & force (surface)	x	x	x	x
tide stage, height, etc.		x	x	x
C. HYDROGRAPHIC STATIONS				
approximate number for which full hydrographic series will be taken	8	8	5	6
sampling interval (months between successive samplings)	1	1	2	1
sampling depths (standard) 0, 10, 20, 30, 50, 75, 100, 200, 300 meters	x			x
sampling depths surface, near bottom, intermediate depth		x	x	
Environmental factors for which data will be collected & recorded:				
water temperature, salinity, pH, transparency, O_2 (all depths)	x	x	x	x
nitrate, nitrite, ammonia, phosphate, silicate (all depths)	x	x	x	x
D. BIOLOGIC-GEOLOGIC STATIONS (selected hydrographic stations for which biologic-geologic data also are taken)				
approximate number	2	3	3	3
sampling interval (months between successive samplings)	2	2	2	2
basic station and hydrographic data concurrent with biologic sampling	x	x	x	x
Sediments--physical-chemical				
particle size (percentages, phi scale) & total organics	x	x	x	x
general condition, color, odor, other descriptive qualities	x	x	x	x
Benthic organisms sorted to major groups: number, biomass, dominants	x	x	x	x
fishes sorted to species: number, biomass, length frequency, sex	x	x	x	x
Microbiota subsamples preserved for future reference & study	x	x	x	x
Plankton samples preserved for future reference & study	x	x	x	x
Chlorophyll/phaeopigment ratios	x	x	x	x

Please give me any suggestions for major additions, deletions, or other changes. John Steinbeck

MOSS LANDING MARINE LABORATORIES CRUISE REPORT
PHYSICAL, CHEMICAL, METEOROLOGICAL DATA.

PROJECT _____
VESSEL _____ DATE _____

Document Draft 12/30/...

PERMANENT STATION REFERENCE NUMBER												NORTH LATITUDE						WEST LONGITUDE						UTM E-W/			UTM N-S/			DEPTH TO				SAMPLE DEPTH/		WATER			
INST./SERIES				YEAR		MO.		DAY		HOUR	%	DEGR.		MIN.		10		DEGREES			MIN.		10	MARSDEN			MARSD.1°			BOTTOM M(F)				MAXIM		NUMBR.	COLOR		TRANS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41

WAVES				TIDE CONDITION							WIND				BAROMET.			AIR TEMPERATURE							CLOUD			REMARKS/PROCESSING.											6D. TYP
DIR.		H. P.		+/-	HT.		ST.	RANGE		CUR	DIR.		FORCE		PRESSURE			DRY BULB			WET BULB			WEATH		TYP	COV	VIS	1	72	73	74	75	76	77	78	79	80
42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70											1

SUBSURFACE OBSERVATIONS AND WATER CHEMISTRY

TIME, HR TO	DEPTHS OF SAMPLES	M I	TEMPERATURE	M I	SALINITY	M I	OXYGEN	M I	PO_4-P PHOSPHATE	M I	TOTAL PHOSPHOR	M I	NO_2 - N NITRITE	M I	NO_3 - N NITRATE	M I	NH_3 AMMONIA	M I
3 14 15	16 17 18	19	20 21 22 23	24	25 26 27 28	29	30 31 32	33	34 35 36	37	38 39 40	41	42 43 44	45	46 47 48	49	50 51 52	53

SiO_3 -Si SILICATE	M I	pH	M I	TURBIDITY	M I	ALKALINITY	M I	REMARKS & PROCESSING	CD. TYP
54 55 56	57	58 59 60	61	62 63 64	65	66 67 68	69	70 71 72 73 74 75 76 77 78 79	80
									2
									2
									2
									2
									2
									2

GENERAL REMARKS AND NOTES

recorder

INSTRUCTIONS FOR CODING THE MASTER CARD (NO. 1) FOR SURFACE ENVIRONMENTAL INFORMATION

Cols.

1 - 4 INSTITUTIONAL SERIES CODE
Enter alpha-numeric code for cruise and station as assigned by project leader per MLML standard procedures (see Appendix A.).

5 - 6 YEAR: enter last two digits.

7 MONTH: 12 digit code:

Jan.	F.	Mar.	Apr.	May	Jn.	Jl.	Aug.	S	O	N	D
1	2	3	4	5	6	7	8	9	0	-	+

8 - 9 DAY: 01 - 31 (note: Day starts and ends at midnight)

10-12 TIME: use local time (Standard or Daylight--date will permit subsequent conversions if necessary). Enter time on 24 hr. basis (from midnight). Record tenths of hours in Col. 12. Minutes to 1/10 hr. conversion table:

Min.	00-05	06-11	12-17	18-23	24-29	30-35	36-41	42-47	48-53	54-59
Hr./10	0	1	2	3	4	5	6	7	8	9

NOTE: ABOVE SERIES CONSITUTES PERMANENT STATION REFERENCE NUMBER, REPEATED ON FIRST COLUMNS OF ALL CARDS.

A note regarding tables referenced in the following sections: these will be assembled in Appendix C as taken directly from NODC Publication M-2 (revised Aug. 1964). Each reference indicates the NODC Table number, followed by the page (s) on which it is found (e.g., NODC Table 3: 33-35.)

NORTH LATITUDE

13-14 Degrees.

15-16 Minutes.

17 Tenths of minutes. For conversion of seconds to min/10, apply time conversion table (min. to hrs./10) used for Col. 12

WEST LONGITUDE

18-20 Degrees.

21-22 Minutes

23 Tenths of minutes. Conversion as for Col. 17 (table for Col. 12).

A-21

24-29 MARSDEN SQUARE or UTM DESIGNATIONS (OPTIONAL)

Marsden Square designations normally are not entered in the field, since they can be determined later from latitude-longitude coordinates. The Marsden square provision is provided in our system particularly to permit location of stations outside our usual working zone (e.g., in the southern hemisphere, where Marsden Square designation would signal a south latitude rather than the north latitude used in our regular system). Refer to table 3: 33-35 for coding procedures. (Appendix C, NODC Publication M-2) UTM (Universal Transverse Mercator) designations will be developed for all permanent estuarine and shoreline stations, to provide for designation of cells (areas) 1,000 meters square (1 km^2). Coordinates are derived from USGS topographic maps. Refer to Appendix B (in preparation) for procedures.

30-33 DEPTH TO BOTTOM. Record in meters as standard oceanographic procedure. Fill columns left of significant digits with zeros (e.g. 50 meters = 0050). For inland or shallow waters, data may be recorded in feet. Signal feet by inserting the symbol + in Col. 30. Fill other columns to left of significant digits with zeros. (e.g. 3 feet = +008). (See NODC Table 5: 37-38 for conversion of fathoms to meters; Table 6:37-40 for conversion of feet to meters.)

34-35 MAXIMUM SAMPLE DEPTH. Enter depth of deepest sample (or data) to the nearest 10 meter interval. Code intervals as follows:

meters=code	meters=code	meters = code	meters = code	meters = code
0- 9 = 00	50-59 = 05	100-109= 10	150-159= 15	200-209= 20
10-19 = 01	60-69 = 06	110-119= 11	160-169= 16	210-219= 21
20-29 = 02	70-79 = 07	120-129= 12	170-179= 17	220-229= 22
30-39 = 03	80-89 = 08	130-139= 13	180-189= 18	230-239= 23
40-49 = 04	90-99 = 09	140-149= 14	190-199= 19	240-249= 24
				etc.

36-37 NUMBER OF OBSERVED DEPTHS. Enter total number of observed depths (Should equal number reported on card 2).

38-39 WATER COLOR according to code based on Forel-Ule scale (NODC Table 7:41)

40-41 WATER TRANSPARENCY in meters using a standard Secchi disk. For inland or other low transparency waters, data may be recorded in feet, signalled by a + in col. 40.

WAVES:

42-43 DIRECTION from which dominant waves come, in 10° intervals (NODC Table 8:42)

44 HEIGHT of dominant waves in ½ meter intervals (according to WMO code 1555; NODC Table 10:44). If waves are 16 ft. or higher, signal this by adding 50 to wave direction code (col. 42-43)
Sea State data as alternative procedure: cf. next entry.

45 PERIOD of dominant waves in 2 second intervals (according to WMO Code 3155 NODC Table 11: 45).

SEA STATE data as alternate procedure: signal use of Sea State observations instead of wave height and period, by placing a + in col. 44 and entering the Sea State code in Col. 45 (according to WMO Code 3700, NODC Table 12: 46).

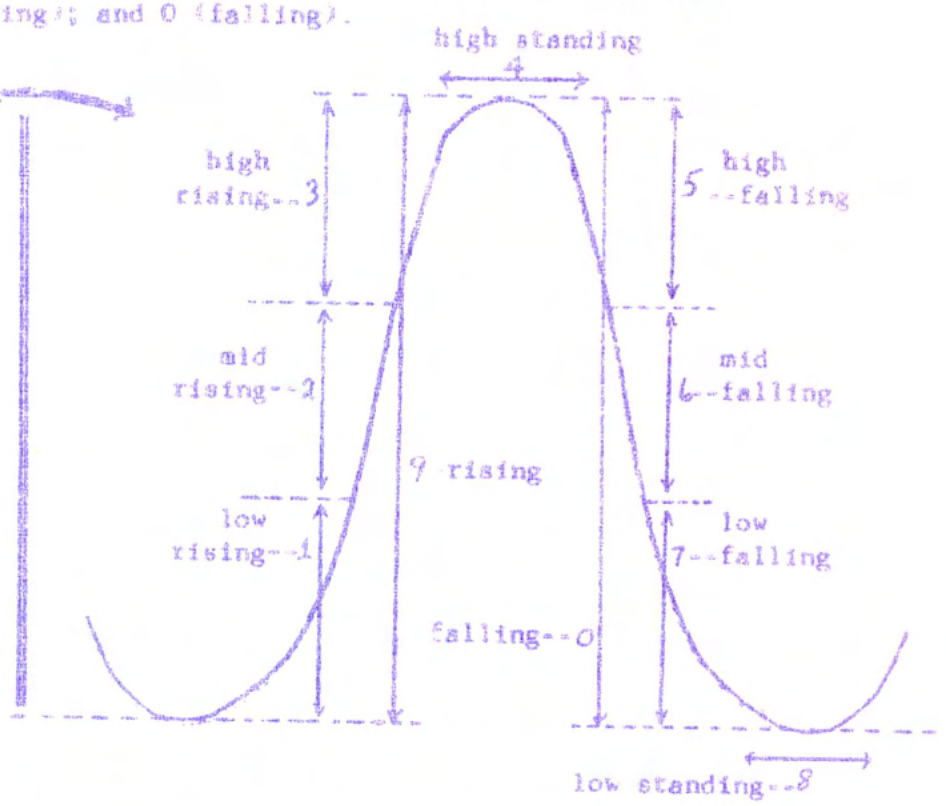
TIDE CONDITIONS: data particularly important in estuary work, but also of significance for many bay programs. Include wherever practicable. Procedures modified after GMEI (Gulf of Mexico Estuarine Inventory).

46 TIDE + or -. Enter + or - to indicate whether tide is above or below datum (mean lower low water).

47-48 TIDE HEIGHT to nearest one tenth (1/10) foot. (Minus heights will be so signalled from col. 46.)

49 TIDE STAGE, according to code below (after GMEI). Where more detailed analyses are not possible or appropriate, use Codes 4 (high standing); 8 (low standing); 9 (rising); and 0 (falling).

Tide Stage Code--see Fig.	
low rising	1
mid rising	2
high rising	3
high standing	4
high falling	5
mid falling	6
low falling	7
low standing	8
rising	9
falling	0



50-51 TIDE RANGE. Enter greatest range of tide to nearest one-tenth (1/10) foot for date (not tide cycle) of observation.

52 TIDAL CURRENT according to following code:
1 = flooding; 2 = ebbing; 3 = slack.

WIND

53-54 DIRECTION from which wind blows according to 10° intervals (NODC Table 8:42).

55-56 SPEED of wind in knots, or alternatively:
WIND FORCE according to Beaufort Scale.
If wind force is used, signal by placing + in Col. 55, and code for Beaufort scale in Col. 56 (NODC Table 17:51).

57-59 BAROMETRIC PRESSURE in millibars. Enter tens, units, and tenths only (example: 1015.9 mbs records as 15.9). See NODC Tables 18 and 19: 52-55, for conversions of inches and millimeters of mercury to millibars.

AIR TEMPERATURE (N. B., leave tenths column blank if instrumentation is inadequate).

60-62 Dry bulb in degrees C to tenths.

63-65 Wet bulb in degrees C to tenths. (Refer to NODC Table 20:56-63, for conversion F° to C°)

66-67 WEATHER. Preferred method: place + in Col. 66 and enter single digit weather code in col. 67 according to WMD Code 4501. (NODC Table 23:66.) Alternative: use two digit WMD Code 4677 (NODC Table 24: 70. See also Tables 22-23, pp. 65-69, for conversions from other weather reporting systems.)

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68 CLOUD TYPE (genus), according to WMD code 0500, (NODC Table 25:74).

69 CLOUD AMOUNT, the fraction of the sky covered by clouds, in eighths, according to WMD code 2700 (NODC Table 26:75).

70 VISIBILITY at the surface, in meters, according to WMD Code 4300 (NODC Table 27:76).

71-79 REMARKS and PROCESSING: provides room for expansion as needed; also space for comments plus such coding procedures as necessary for processing.

---

80 CARD TYPE: Data sheets (and cards) are pre-marked I to indicate this is a Master Card, Type I, which identifies each oceanographic station and records general surface environmental information.

INSTITUTIONAL SERIES CODE: PROCEDURES AND RATIONALE

(for cols. 1-4 on all cards--
first four digits of Permanent Station Reference Number)

Col. 1 Institutional master number (or letter) unique for all operations generated at that particular station.

1 : designates Moss Landing Marine Laboratories.

9 : designates transient (miscellaneous) users of the system.

Other institutions developing heavy use of this system will be assigned numbers 2-8 as necessary; more occasional users may be assigned letters A-Z to establish a unique retrieval mechanism.

Col. 2 Institutional series number (or letter) assigned to separate special projects or series for efficient machine retrieval (e.g. Sea Grant permanent stations; Ano Nuevo project; Kaiser; P.G. & E.; or other special project stations).

1 : Sea Grant permanent hydrographic station series, Monterey Bay & adjacent ocean (99 numeric stations available; more w/alpha.)
2 : Sea Grant permanent Elkhorn Slough stations.
3 : Sea Grant (plus cooperators) permanent shore stations (those not related by location to stations in series 1 - 3, such as inland meteorologic or vegetational analyses stations.)
9 : Transient (miscellaneous) stations not forming part of a series.

Col. 3-4 Numeric stations within a series (1-98) are assigned by the project director. These are assumed to be "permanent" in the sense that they will be re-sampled in the forseeable future. The number 99 should be reserved for non-permanent transient stations within the series, for which repeat sampling is not planned.

Additional Notes, with explanation of rationale.

A. The "9 series" for transient, occasional uses (miscellaneous). While careful control is necessary to preserve the integrity of the series code for permanent stations and long-term projects, there also must be provision for machine storage of data collected by occasional users, visitors, etc. The "9 series" provides for this important occasional (miscellaneous) use. Coupled with date and time, a "9 series" designation still provides unique identification of data collected, in the form of a 12 digit number. The Institutional series code 9999 is always available to any user. Within any given project, the director should reserve the - - 99 number for transient or occasional data collections which are pertinent to his project (and could be retrieved for its use by calling on the first two digits).

B. Master File must be maintained and consulted to insure integrity of the permanent station series codes. This file will be housed permanently in the library, with occasional up-dated copies available to frequent users. The Master file will have three sections, corresponding to the three components of the Institutional Series Code. The Sea Grant Program Director is responsible for the first two, and only he can designate new code numbers. Each project leader, in consultation with the Sea Grant Director, is responsible for section 3 (numeric stations). For all permanent stations assigned, he must provide maps and coordinates for inclusion in that section.

A-25

C. Rationale for the MLML Institutional Series Code. This code is an outgrowth of extensive analyses of other projects, including that of the National Oceanographic Data Center. Personnel from those projects have contributed generously to its development.

There are four primary objectives of this coding procedure:

1. To produce a unique (sensu strictu) identification number for all data from a given cruise and station.

2. To provide real data in that number (e.g. institution, project, date, time).

3. To permit machine retrieval by such real categories (e.g. all data for Sea Grant Elkhorn Slough, or all data from permanent station 03 of Elkhorn Slough).

4. To produce the most succinct possible code for ready retrieval by card-sorter rather than computer (thus through use of fewest possible columns, and numeric coding in preference to alphabetic designations).

INSTRUCTIONS FOR CODING THE SUBSURFACE OBSERVATIONS
CARD TYPE 2. WATER CHEMISTRY.

Cols.

1-12 PERMANENT STATION REFERENCE NUMBERS repeated from Master Card Type 1.

13-15 MESSENGER TIME. Enter hour and tenths of hour in local time (standard or daylight). Conversion table: for minutes to tenths of hours:

min. / hr	00-05	06-11	12-17	18-23	34-29	30-35	36-41	42-47	48-53	54-59
10	0	1	2	3	4	5	6	7	8	9

16-18 DEPTHS OF SAMPLES. Record each depth sampled on a separate line. Record in meters as standard oceanographic procedure. Fill columns left of significant digits with zeros (e.g. 50 meters= 050). For inland or shallow waters, depths may be recorded in feet. by inserting the symbol + in Col. 16. Fill columns left of significant digits with zeros (e.g. 8 ft. = +08).

19 *METHOD/INSTRUMENT. Place a - in col. 19 to indicate depth determined by "wire-out" (metered wire, marked sounding line, etc.). Where depths are thermometrically established (protected and unprotected thermometer readings for such depths) place a + in col. 19.

20-23 TEMPERATURE: enter in degrees C to hundredths if instrument is capable of this sensitivity.*

24 *M/I. If additional decimal place of resolution is possible, enter extra digit in Col. 24. Otherwise code instrument used for temperature measurement as follows:

- Reversing thermometers (paired protected) . . . . . +
- Reversing thermometer (single protected) . . . . . -
- Bucket surface thermometer (or other relatively precise thermometer measuring a sample not in situ) . Z
- Thermistor (e.g. on salimometer, oxygen probe, etc.). . . . . T
- Pocket thermometer or other relatively non-precise thermometer X
- Uncertain reliability---doubtful data. . . . . U

---

*A note on precision of measurement, and on M/I columns: Never record more decimal places of resolution than is proper for instrumentation used; and never fill unused decimal places with zeros. Example: thermometer is reliable only to tenths and reads 19.30 C:

Col	20	21	22	23	24
record it thus: →	1	9	3	.	X
NOT: →	1	9	3	0	X

The M/I columns at end of each field have several possible uses:
(a) recording data to an additional decimal place, where instrumentation permits (thus numeric entries should be reserved for this purpose);
(b) indicating type of instrument or method used for data collection;
(c) indicating uncertain reliability (doutful data) by letter U.
(d) signalling a change in use of the entire field for special purposes (e.g., the alkalinity field, cols. 66-69, could be converted for mercury recording purposes by insertion of a designated code letter in Col. 69).

A-27

24-28 SALINITY in parts per thousand, to hundredths. (As for oxygen, enter only to level of precision possible with instrument used; indicate instrumentation in Col. 29.)

29 M/I can be used for additional decimal place of resolution. Otherwise code instrumentation as follows:

silver nitrate titration	+
laboratory precision induction salinometer	-
field in situ induction salinometer	T
refractometer	Z
hydrometer	X
uncertain reliability--doubtful data	U

30-32 OXYGEN in milliliters per liter ; to hundredths.

33 M/I may be used to add an additional (thousandths) decimal. or indicate uncertain reliaility (U).
Code for instrumentation/ method:

Winkler determination--laboratory precision	+
Winkler determination--field conditions	-
Oxygen analyzers, polarographic etc.	T
Field colorimetric or other approximation methods	X

34.36 PHOSPHATE in microgram-atoms per liter to hundredths.

37. M/I:

38-40 TOTAL PHOSPHORUS in microgram-atoms per liter to hundredths.
41. M/I:

42-44 NITRITE-NITROGEN in microgram-atoms per liter to hundredths.
45 M/I:

46-48 NITRATE-NITROGEN in microgram-atoms per liter to tenths.
49 M/I:

A-28

50-52 AMMONIA
53 M/I:

54-56 SILICATE-SILICON in microgram-atoms per liter to whole units
57 M/I:

58-60 pH to hundredths
61 M/I:

62-64 TURBIDITY
65 M/I:

66-68 ALKALINITY as equivalent CO_3 - $CaCO_3$ in microgram-atoms per liter to hundredths.
69 M/I:

70-79 REMARKS and PROCESSING

80 CARD TYPE: Data sheets and cards are pre-marked 2 to indicate Sub-surface observations and water chemistry data.

ML 255 Spring 1971
Researches in Monterey Bay Dr. Harville

SOME SPECIAL RESEARCH PROJECTS SUGGESTED BY THE FALL SEMESTER CLASS

1. A study in depth of the beach profile of an open wave area to determine the seasonal and physical changes that occur, and the effect of those changes on the biota of the beach.

2. A climatological study of the immediate area around the city of Salinas to determine the rate of degeneration of the lower layer moisture content. With this information we could predict losses of tuberous crops and recommend alternate crop rotations.

3. Ecological value of Sea Grant study areas: Individuals with an ecology background could make an assessment based upon collected data of what long-range plans should be developed regarding utilization of each environ under study. I strongly feel that all studies are subordinate to the fact that careful planning must be undertaken and somehow enforced to develop the natural resources of this area to their fullest without further destruction of the habitats.

4. Sand; sediment transport: Secondary studies in this area will be of immediate concern to persons planning various used of shore areas. Insufficient information is available to predict the future fate of local beaches.

5. Mariculture: Studies designed to assess and encourage successful mariculture in the Moss Landing area should be encouraged. Local fisheries are in poor financial condition and mariculture might provide significant benefits to this relatively depressed area.

6. Pollution: The several studies suggested which involve tracing man-caused pollution to its source and noting possible damage are vital. Sewage, pesticides, and heavy metals and air pollution are all areas where persons interested in the local environment should concentrate their efforts.

7. Salt marsh vegetation is important in primary productivity of the estuary. Nutrient transformation and consequent breakdown of those plant materials is of vital importance to the food webs of local marine habitats. Standing crop measurements by clipping plots are of considerable value. The standing crop will be most equal to annual production at the end of the growing season. Ton-per-acre data for each common marsh plant can be determined. These data combined with future vegetation charts will provide figures on total estuary primary productivity ascribed to salt marsh vegetation. This project is not too demanding; is anybody interested?

8. Compile a species list of flora along the Monterey Bay shoreline back to a distance of a few hundred yards from the shore. Extinctions and introductions should be noted. I assume similar list of aquatic flora and fauna will also be part of the Sea Grant data bank.

9. The paradigm indicator of polluted waters is low oxygen concentration. Adding O_2 to polluted rivers and streams is a current practice in Europe. Experiments are now under way in the United States. The addition of O_2 to an anaerobic, well defined, and relatively closed body of water would make an interesting study with many potential "byproduct" rewards. A standard 244 cubic feet oxygen bottle plus regulator would provide 48,400 cubic feet with an O_2 concentration of 5 ppm. This is approximately a six foot cube of water. A well-defined body of water is needed in an anaerobic condition. It should be a relatively closed system. An alternative would be an effluent with a well-defined path of flow.

10. From the fishes collected in the Sea Grant program, several projects would be possible and valuable in terms of general goals. These include:
    a. Stomach content analysis in relation to available food supplies.
    b. Age class determination from examination of otoliths, scales, etc.
    c. Preparation of an embryologic series for a species from larval and zooplankton collections (or for live-bearing forms through removal from females).
    d. Study of growth rates and/or tolerance limits to environmental stresses through aquarium experimental procedures.

11. Air pollution: The Moss Landing area is ideal for studying the dispersion/diffusion from a point-source, such as Kaiser or P G & E. No other industrial plants will interfere with their emissions (as in major cities where the plume from a single plant cannot be separated from those of neighbors) as they spread over Monterey Bay and into the Salinas Valley. Surface observations on the Bay and in the Valley (including air samples), pibal (balloon release) data on vertical wind distribution, and data supplied by other agencies would make this a feasible and worthwhile study.

12. Urbanization: When rural areas become urbanized, definite changes in climate occur. These effects need to be documented so that future changes in temperature, moisture, cloudiness, precipitation, air pollution, can be anticipated correctly (ie, land use planning would then be based on actual facts). Surface observations (special field trips as well as our permanent stations) and special upper air wind data (temporary pibal stations) and perhaps temperature, moisture, air pollution data, obtained from aircraft operated by other agencies in the study area would yield some of the essential data for this study.

13. A complete faunal list for a specific group: A specific group (eg, fish family, polychaete group, opisthobranchs, prosobranchs) should be selected, and all available forms identified to the lowest possible taxon (ideally species). A reference collection of preserved animals including examples of each identified taxon should be made for permanent lab use. A definite area should be selected for this study, and frequency of sampling predetermined. Distribution within the study area should be determined, and principal associations among species. Relative abundance of major species should be established.

14. Moss Landing has the unique characteristic of possessing an unlimited supply of calcium-rich, magnesium deficient seawater. Possibilities for relevant short- and long-term projects are unlimited. Comparison of magnesium-calcium ratios for clam shells within the harbor and those of the same species from offshore or from a complely different area, such as Bodega Bay, would require little time and might yield interesting results. Dispersion of P G & E offshore outfall might be analysed through magnesium-calcium ratios also, along with temperature effects.

B1

Moss Landing Marine Laboratories of the
CALIFORNIA STATE COLLEGES at Fresno, Hayward, Sacramento, San Francisco, San Jose
P.O. Box 223, Moss Landing, California 95039

Environmental Studies, Monterey Bay Region
National Sea Grant Program

NOTICE OF NEW COURSE

9 Dec. 1970

MARINE ENVIRONMENTAL RESEARCH PARTICIPATION: Moss Landing Marine Laboratories, spring semester, 1971. 3 units Saturday; ML170 (matriculated students) or ML 170x (Extension)

Are you concerned about the quality of our marine environment?

Environmental quality is a bit like the weather: everyone talks about it, but not nearly enough of us **do much** about it Certainly as **science** teachers, we need to be as fully literate as possible in the actual techniques of environmental **data collection** and analysis. Here is a chance to develop real hands-on experience.

As a part of our new Sea Grant program of environmental studies of Monterey Bay and its environs, the Moss Landing Marine Laboratories have established a new research participation course, with space reserved for a maximum of ten in-service science teachers. The class meets all day on Saturdays, with research participants engaged in field collection and laboratory analysis of physical, chemical, biological, and geological data from the shallower waters of Monterey Bay and the Pajaro River. Field and laboratory work will be under direct supervision of Dr. John Harville, assisted by two specially trained graduate teaching assistants.

Science teachers wishing to participate must have had reasonable experience with laboratory techniques in a basic science, and be prepared for a full day of active field and laboratory work every Saturday (8 A.M. - 3:30 P.M.) Feb. 13 through May 29, 1971.

Clip and mail the application form below to John P. Harville, Sea Grant Program, at letterhead address.

DEADLINE FOR APPLICATIONS: January 25, 1971. For further information, phone 633-3304.

APPLICATION FOR SPACE RESERVATION IN ML 170 MARINE ENVIRONMENTAL RESEARCH

PARTICIPATION 3 units, Spring Semester, Feb. 13 - May 29 1971.

Name:_____ Telephone:_____

Mailing address:_____ Zip:_____

Teaching at:_____ School. Subjects:_____

Academic major:_____ Minor:_____

Subject area or discipline of greatest interest (underline): Marine geology, physical-chemical oceanography, invertebrates, fishes, plankton.

Regular college enrollment (ML170) for presently matriculated students at a participating State College (underline school of matriculation): CSCH, FSC, SSC, SFSC, SJSC; or Extension credit desired (ML170x)____. Tuition: $18.00

TO: Research Participants, Saturday Teams 20 February 1971

FROM: John P. Harville, Sea Grant Program Director

RE: TEAM ASSIGNMENTS (TENTATIVE) AND FEBRUARY 20 SCHEDULE

A. General Notes

Since we held no class on the 13th, in order to avoid interference with the long weekend, we will need to telescope certain of our planned introductory activities in order to move directly into our scheduled field program. Therefore these general notes are particularly important.

1. All participants will be in the field Saturday the 20th. Wear field clothes, including boots or other "wettable" foot gear; bring coats and rain-gear if rain is likely; bring your lunch, as field teams will not return until afternoon. Bring a field notebook for your own records and notes.

2. Meet promptly at 8 a.m. in Rm 109, MLML, for 20 min briefing. The Monterey Bay hydrographic cruise departs at 8:30; other field parties approximately at 9:00.

3. Help your Team Leader to organize a coherent operating team quickly and efficiently. On this first day most teams will operate as a single unit; on subsequent saturdays teams will be divided into two subgroups for more efficient and diversified activities.

4. Study the attached tentative schedule with the following general points in mind:

   a. All participants will receive reasonable exposure to all subject areas in the data collection program, though of necessity (for the sake of efficiency) with some degree of specialization in terms of primary assignments and responsibilities.

   b. The first month of the schedule is designed to provide necessary training of teams in all the subject areas. Note that not every individual on a team receives exactly the same array of training; we expect a "cross-fertilization" process in future weeks where team members will train each other in certain specific areas.

   c. Assignments to teams as far as possible are consistent with the areas of special interest or background experience you noted on your questionnaire response. We will try to make adjustments if our interpretations were in error or if for other reasons changes prove necessary. It is important that teams concentrate on a specific segment of the total environment in order to develop the levels of expertise and continuity of action requisite for an effective program. During the latter half of the term, we will provide opportunities for participation by those so desiring in alternate elements of the program (eg a hydrographic cruise for those assigned to estuarine studies).

5. I hope you share with us on the staff a feeling of excitement and commitment as this program gets underway. Ours is one of about 70 Sea Grant programs in the US; it is unique among all in its effort to combine an ideal learning situation for students with the collection of meaningful information concerning the marine environment. Our success with this pioneering effort will depend ultimately on the input of each individual in the project.

B. Special Notes to Teachers in the Program

1. If you are enrolling under the Extension program, be sure to fill out the card enclosed, and attach to it your check for $18.00 made out to San Jose State College Extension.

2. Note that we are counting on you for some special areas of support to our program. Your teaching experience will be useful in helping make our logistical operations effective. Also we are counting on your flexibility as a subject-matter generalist knowing that all phases of our program will provide valuable background for your own teaching. Let me add a special request for your strongest possible support of our graduate student leaders. They have been working for a full semester on the necessary subject matter and logistical preparations for the program. They are assigned leadership responsibility for their teams, and for many this is a first experience in such a group process. Please help them in every way you can with your experience, but in the context of their team leadership responsibilities.

3. I will be interested in knowing more about your own teaching program and possible contributions to it of this Research Participation project. Particularly I'll appreciate any suggestions for the future you might wish to make as the semester progresses.

C. Tentative Team Assignments (please group with your Team Leader immediately upon arrival Saturday morning at 8:00 a.m.)

1. Monterey Bay — Leader: Roger Hilaski

Paul Herrschaft, Mike Weesner, John Whisler, Pauline Sinclair ----->
(assigned to hydrographic cruise 0830-1630, 20 Feb. Sub-team X)

Stephen Clark, Kathleen Eakes, Steve Pace, Jim Grady ----->
(Note special time schedule 20 Feb: Sub-team Y assigned to meet with Mr. Locke at 1300 for reconnaissance of Monterey Bay shore stations; assist boat unloading and oxygen determination at 1630.)

2. Elkhorn Slough — Leader: Richard Smith

John Berney, William Giguiere, Warren Long, Daniel Lovick, Christopher Rezendes ----->
20 Feb. reconnaissance of stations; invertebrate sampling techniques.

3. Pajaro Estuary — Leader: Scott Dailey

Robert Ballering, Robert Byington, Theodore Calmer, Ray Kruse, David Schumaker ----->
20 Feb. reconnaissance of stations; fishes sampling techniques.

4. Sea-Air-Land Interface — Leader: Arndt Lorenzen (meteorology and navigation)

All participants

5. Monterey Canyon Sector (Tuesday section) Leader: Gary McDonald

D. Faculty and Staff and Sea Grant-related responsibilities.

Genny (Mrs Shane) Anderson	Receptionist -- student personnel
Mr Pat Albin	Diving master
Dr Robert Arnal	Marine geology -- sedimentology
Mr John Bell	Building and ground maintenance
Mr Ray Bernard	Superintendent, buildings and grounds
Dr William Broenkow	Chemical-physical oceanography
Mr David Garrison	Invertebrates
Judy (Mrs John) Hansen	Plankton-chlorophyll analysis
Dr John Harville	Sea Grant project director
Mr Gary Kukowski	Fishes
Mr James Locke	Sedimentology
Mr Frank Monnich	Master, research vessel Ameo
Mr Richard Parrish	Fishes
Mr Robert Read	Meteorology
Mr David Seielstad	Oceanographic technician
Dr Mary Silver	Invertebrates, plankton
Mr Barry Turner	Salt marsh standing crop
Mr Daniel Varoujean	Operator, workboat Orca
Mr Russ Waidelich	Equipment technician
Pat (Mrs Frank) Wilson	MLML secretary

C-4

TENTATIVE ASSIGNMENT SCHEDULE: ML 170 CLASS, SATURDAYS 0800-1630 (approx.) 2/8/71

Three periods are indicated for each day: AM, PM, and X (for special assignments that are of indeterminate or unusual time--if considerable extra time required, compensating time is provided). Shedules for the first few weeks are quite tightly structured to provide for necessary training sessions in various techniques. In later weeks, schedule will be more open, though priorities for lab use will of necessity be assigned.

Symbols used for field:

R = field reconnaisance
H = hydrographic cruise or trip
B = biological cruise or trip
S = sediment sampling program
F = fishes collection
I = invertebrates collection
D = data reduction from field & lab.

for laboratory processing:

O = oxygen & salinity sample processing
N = nutrients processing
P = plankton-productivity sample processing
(S) = sediments lab
(F) = fishes lab
(I) = invertebrates lab
M = meteorological data col. & processing

DATE	TIME	P. ALBIN	R. PARRISH	R. ARNAL	M. SILVER	A. LORENZEN	D. GARRISON	G. KUKOWSKI	S. DAILEY	R. HILASKI	J. LOCKE	R. SMITH	D. SEIELSTAD	MONTEREY BAY TEAM X	MONTEREY BAY TEAM YY	PAJARO RIVER TEAM X	PAJARO RIVER TEAM Y	ELKHORN SLOUGH TEAM X	ELKHORN SLOUGH TEAM Y	TIDES: TIME AND HEIGHT
2/20	AM		F		I	H	I	F	R	H		R	H	H		R — R		R — R		0500 5.0
	PM		F	(S)	I	H	I	F	F	H	(S)	I O	H	H	(S) O	F — F		I — I		1300 -0.3
	X																			
2/27	AM		F		H			F	H	F		H		F — F		H — H		H — H		1200 5.0
	PM				(I)		(I)	F	O		(S)	O	O	(S)	(F)	O	(F)	O	(I)	1748 0.6
	X																			
3/6	AM					M		(F)	(F)	N	(S)	N	N	N	M	(F)	M	M	(S)	0600 5.0
	PM		F		(I)		I	F	I	N		N	N	N	(I)	I — I		F — F		1324 -0.3
	X																			
3/13	AM		B		B	M	B	B	F	B		N	N	M	B	M	(F)	N	M	1120 4.2
	PM		B		B		B	B	D	B	(S)	N	N	D	B	(S)	D	N	(I)	1700 1.2
	X																			
3/20	AM	S		S		S		(E)	N	H	S	N	H	H	S		N	(F) — (F)		1124 -0.1
	PM	S		S	(I)	S	(I)		N O	H	S	N O	H	H	S	(I) O	N	(I)	(S) M	1900 3.5
	X																			
3/27	AM				(I)		(I)		H		(S)	H		(I)	(S)	H	H	H	H	1100 4.8
	PM				(I)	M	(I)	(F)	(I)	D	(S)	OD	OD	(F) D	D (I)	D	(I)	O	D M	1630 1.0
	X																			

Three periods are shown for each day: AM, PM, and X which designates time indeterminate or unusual (e.g O_2 & salinity processing in late afternoon; meteorologic data collection). Where such assignments require considerable time, schedule will be relaxed elsewhere, and divisions of day into two parts is very approximate. X and Y teams will receive essentially the same balance of assignments over the full semester period. Schedule for the first few weeks will emphasize training activities; later weeks will be more open.

Symbols used:

for field activities
- H = hydrographic cruise (12 hr.)
- B = biological cruise (8 hr.)
- P = plankton cruise (Mondays)
- F = fishes sampling
- I = invertebrates sampling
- M = meteorologic data collection

for laboratory processing activities
- N = nutrients
- O = oxygen & salinity
- (P) = plankton
- (F) = fishes lab
- (I) = invertebrates lab
- (S) = sedimentation lab processing
- D = data reduction, general catch-up, etc.

DATE	TIME PERIOD	W. BROENKOW	M. SILVER	R. READ	A. LORENZEN	G. McDONALD	D. GARRISON	G. KUKOWSKI	J. LOCKE	R. SMITH	D. SEIELSTAD	TEAM X	TEAM Y
2/9	AM		X		X	X						overview	
	PM			M	M		(I)					M(D)	M(D)
2/16	AM	H			H	H					H	H	
	PM	H			H	H			(S)		H	H	(S)
	X	H			H	H		D		O	H	H	DO
2/23	AM	N				N		F		N	N	N	F
	PM	N				N	I			N	N	N	I
	X				M								M
3/2	AM	N				N	I			N	N	I	N
	PM	N				N			(S)	N	N	(S)	N
	X				M							M	
3/9	AM		B			B	B	B		N	N	N	B
	PM	D	B			B	B	B		N	N	N	B
	X	D			M							M	
3/15	MONDAY		P			P	P	P					
3/16	AM	H	P		H	H					H	H	
	PM	H			H		(I)		(S)		H	H	(IS)
	X	H			H			D			H	H	DO

Sea Grant Program
SG71-4

SYNOPSIS OF PERMANENT SAMPLING STATIONS
Air-sea-land zones of contact
(Main Stations in the Salinas Valley)

Reporter: Arndt Lorenzen

8 Mar 71

STATION NUMBER (4-DIGIT)	STATION NAME OR DESCRIPTION (eg 30 m depth off Pajaro mouth)	ELEVATION (ft)	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth reading, etc. Be complete.)
					INSTRUMENTS LOCATED:
1401	Moss Landing Marine Labs Moss Landing, Ca. 95039 (Arndt Lorenzen, 408:633-3304)	9	36°48.2'	121°47.2'	On and just south of Moss Landing Marine Labs classroom building
1402	USDA Research Station 1636 East Alisal Salinas, Ca.93901 (Dr. McFarland, 408:424-6428)	84	36°39.9'	121°36.4'	Field east of administration buildings and north of (east) Hartnell College campus
1403	Gonzales High School 501 Fifth Street Gonzales, Ca. 93926 (Vernon Silver, 408:675-3666)	120	36°30.6'	121°26.8'	On and just east of science classroom building
1404	Soledad Correctional Training Facility Post Office Box 686 Soledad, Ca. 93960 (Sid L. Flint, 408:678-2616)	200	36°27.8'	121°22.5'	Near treatment plant
1405	Basic Vegetable Products, Inc. Post Office Box 905 King City, Ca. 93930 (R.J. Nample, 408:385-5453 #21)	370	36°13.6'	121°7.3'	Field (fenced) just west of processing plant and north of parking lot
1406	Marello High School 550 West Cliff Drive Santa Cruz, Ca. 95060 (John Hansen, 408:423-7659)	40	36°57.2'	122°1.6'	Field just west of main (2-story) classroom building

SYNOPSIS OF PERMANENT SAMPLING STATIONS
Monterey Canyon sector

Reporter: Gary McDonald

8 Mar 71

C17

STATION NUMBER (4-DIGIT)	STATION NAME OR DESCRIPTION (eg 30 m depth off Pajaro mouth)	DEPTH (m)	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth reading,etc. Be complete.)
1101	Salinas River - nearshore (3/4 mile)	12	36°44.8'	121°49.0'	Range line: 70° from mouth of Salinas Compass bearing: 10°So.PG&E stack Depth: 12 m
1102	MLA Buoy	10	36°47.8'	121°48.0'	Range line: MLA-PG&E buoy Compass bearing: 50°ML harbor tank Depth: 10 m
1103	Moss Landing - nearshore	110	36°48.3'	121°48.2'	Range line: outfall-So.stack Compass bearing: 85° pier Depth 110 m
1104	Pacific Gas & Electric Co. Buoy	12	36°49.3'	121°49.1'	Range line: PG&E-MLA buoy Compass bearing: 115° So.stack Depth: 12 m
1105	Pajaro River - nearshore (3/4 mile)	12	36°51.0'	121°49.2'	Range line: west of Pajaro River mouth Compass bearing: 330° Red Sand Hill 45° Pajaro River Depth: 12 m
1106	Pajaro River - offshore (1-3/4 miles)	25	36°50.7'	121°50.6'	Range line: PG&E buoy-So.stack Compass bearing: 55° Pajaro River 350° Red Sand Hill Depth: 25 m
1107	Monterey Canyon - north side (2 miles offshore)	110	36°49.1'	121°50.3'	Range line: No.jetty-So.stack Compass bearing: 15° Pajaro River 345° Red Sand Hill Depth: 110 m

STATION	STATION NAME OR DESCRIPTION	DEPTH (m)	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC.
1108	Mid-Canyon (2 miles offshore)	240	36°47.6'	121°50.0'	Range line: MLA buoy-pier Compass bearing: 130° Mulligan Hill 70° ML harbor tank Depth 240 m
1109	Monterey Canyon - south side (2 miles NW of Salinas River mouth)	30	36°46.6'	121°49.8'	Range line: MLA buoy-No.jetty Compass bearing: 120°Mulligan Hill 45°ML harbor tank Depth: 30 m
1110	Salinas River - offshore (3 miles)	70	36°45.6'	121°52.0'	Range line:MLA buoy-harbor range line Compass bearing: 80°Mulligan Hill 45°ML harbor tank Depth: 70 m
1111	Monterey Canyon - south side (3½ miles offshore)	70	36°46.8'	121°52.2'	Range line: MLA buoy-pier Compass bearing: 100°Mulligan Hill 15°Pajaro River Depth:70 m
1112	Monterey Canyon - center (4 miles W of ML Harbor entrance)	240	36°48.1'	121°52.2'	Range line: outfall-So.stack Compass bearing: 115°Mulligan Hill 25°Pajaro River 5°Red Sand Hill Depth: 240 m
1113	Monterey Canyon - north side (3½ miles offshore)	70	36°49.3'	121°52.5'	Range line: MLA buoy-ML harbor tank Compass bearing: 10°Red Sand Hill 45°Pajaro River Depth: 70 m
1114	Pajaro River - offshore (3½ miles)	55	36°50.5'	121°52.7'	Range line: PG&E buoy-So.stack Compass bearing: 20°Red Sand Hill 60°Pajaro River Depth: 55 m
1155	Pajaro River - offshore (1.85 miles)	35	36°50.3'	121°50.6'	Compass bearing: 50°Pajaro R.mouth Depth: 35 m

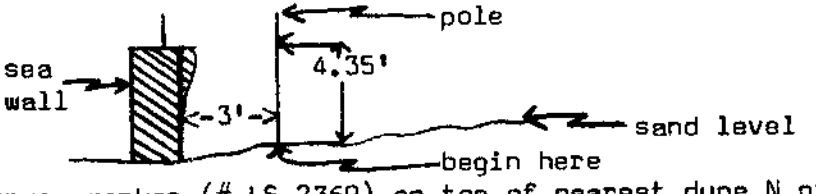
SYNOPSIS OF PERMANENT SAMPLING STATIONS
North Monterey Bay sector

Reporter: Roger Hilaski

STATION NUMBER (4-DIGIT)	STATION NAME OR DESCRIPTION (eg 30 m depth off Pajaro mouth)	DEPTH (m)	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth reading, etc. Be complete.)
1151	Manresa State Beach (6.1 nautical miles from shore)	35	36°53.3'	121°58.5'	50° mag. from pink house about 75 yd south of Manresa State Beach Depth: 35 m
1152	Santa Cruz Harbor (3.1 nautical miles from shore)	35	36°54.8'	122°01.0'	355° mag. from whistle buoy in Santa Cruz Harbor Depth: 35 m
1153	Santa Cruz Harbor (0.8 nautical miles from shore)	15	36°57.1'	122°00.4'	174° mag. from whistle buoy in Santa Cruz Harbor Depth: 15 m
1154	Manresa State Beach (0.9 nautical miles from shore)	15	36°55.5'	121°52.6'	50° mag. from pink house about 75 yd south of Manresa State Beach Depth: 15 m
1155	Pajaro River mouth (1.85 nautical miles from shore)	35	36°50.3'	121°50.6'	50° mag. from Pajaro Dunes Project Depth: 35 m
1156	Red Sand Hill (4.1 nautical miles from shore)	35	36°53.0'	121°55.0'	66° mag. from Red Sand Hill Depth: 35 m
1157	Head of Soquel Canyon off Red Hill (6.8 nautical miles from shore)	183	36°51.2'	121°52.6'	66° mag. from KDON radio towers Depth: 183 m

SYNOPSIS OF PERMANENT SAMPLING STATIONS
Beach transects

Reporter: Roger Hilaski

STATION NUMBER	STATION NAME OR DESCRIPTION	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth readings, etc. Be complete.)
1180	Santa Cruz Harbor Beach Transect	36°57.85'	122°00.25'	Starting position: at the base of the metal pole at the base of the cliff below the yellow house with the flag pole. The yellow house is about 75 yd E of the stairway at the end of Fourth Street in Santa Cruz. (Hgwy 1 ---> Soquel Av --(SW)-> Seabright Av--(S)-> Atlantic Av --(E)-> Fourth St --(S)-> dead end ---> stairway ---> beach) Transect line: about 174° to whistle buoy in Santa Cruz Harbor, in line with flag pole and metal pole at the base of the cliff.
1181	Manresa Beach Beach Transect	36°55.8'	121°51.6'	Starting position: level with the 11th step below the gate of the stairs leading from the pink house which is about 75 yd S of Manresa State Beach parking lot. Begin the transect on the N side of the step; marked with an "X" transect line to be about 230° which is roughly in line with the S corner of the pink house and the step.
1182	Pajaro River Beach Transect	36°51.2'	121°47.3'	Start: on the ledge (painted red) of the boulder in front of the Pajaro Dunes apartment building closest to the Pajaro River mouth. Also, a red arrow on an adjacent boulder pointing to the ledge. The transect should be about 230° which is in line with the S corner of the building, and the fire hydrant and the ledge.
1183	Moss Landing Beach Transect	36°48.0'	121°47.3'	Start: in line with the S wall of the lab, 3' from the base of the sea wall and 4.35' down from the top of the sea wall (measure with the poles). Transect in line with the S wall of the lab. 
1184	Salinas River Beach Transect	36°45.1'	121°48.1'	Start: on the survey marker (# LS-2369) on top of nearest dune N of the Salinas River mouth. Marker is about 3° to the PG&E stacks and about 75° to Fremont Peak. Survey marker is near two red stakes. Transect line to be about 270° from the survey marker.

SYNOPSIS OF PERMANENT SAMPLING STATIONS
Elkhorn Slough

Reporter: Richard Smith

STATION NUMBER (4-DIGIT)	STATION NAME OR DESCRIPTION (eg 30 m depth off Pajaro mouth)	DEPTH (m)	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth reading, etc. Be complete.)
1201	Upper Slough	0.8	36°51.2'	121°45.7'	Mid-channel adjacent to small slough tributary marked by fence Depth: 0.8 m
1202	Kirby Park	1.5	36°50.4'	121°44.7'	Mid-channel 30 yd N of Kirby Park turn-off Depth 1.5 m
1203	Elkhorn Dairies	2.4	36°49.5'	121°44.7'	Mid-channel in line with road leading to Elkhorn Dairies pump Depth: 2.4 m
1204	Horseshoe Bend Dairies	3.3	36°48.8'	121°45.6'	Mid-channel approximately 30 yd off dairy drainage outlet channel Depth 3.3 m
1205	P. G. & E. Outfall	3.8	36°48.8'	121°46.6'	Mid-channel opposite P.G. & E. slough outfall Depth: 3.8 m
1206	Prescott Road Tide Gate	0.3	36°47.5'	121°47.6'	Mid-channel 50 yd N of tide gates adjacent to station marker stake Depth: 0.3 m
1207	Moss Landing Harbor	4.8	36°48.1'	121°47.9'	Middle of Moss Landing Harbor next to General Fish unloading scales Depth: 4.8 m
1208	Range Marker	4.0	36°48.6'	121°48.0'	Between channel sighting markers at Hwy #1 bridge Depth 4.0 m
1209	Yacht Club	2.2	36°48.9'	121°47.7'	Just outside north dock of the Elkhorn Yacht Club Depth: 2.2 m

SYNOPSIS OF PERMANENT SAMPLING STATIONS

Pajaro River

Reporter: E.S. Dailey

STATION NUMBER (4-DIGIT)	STATION NAME OR DESCRIPTION (eg 30 m depth off Pajaro mouth	COORDINATES Lat.(N)	Long.(W)	LOCATION AIDS, WITNESS LINES, ETC. (azimuths from landmarks, loran, depth reading, etc. Be complete.)
1301	Lower Pajaro estuary near mouth, center of channel, 30 meters south of north bank where levee road ends at Watsonville Slough	36°51.1'	121°48.3'	Station is located in the channel of the wide estuary area before it narrows and joins the Watsonville Slough. 30 meters south of the granite and gravel north bank.
1302	South estuary lagoon area, 30 meters north of south bank	36°51.0'	121°48.3'	Station located just south of the 1301 station in the more quiet pooling area of the lower estuary. More suitable area for algae and productivity studies.
1303	Hunt's Landing, mid-channel, mid-estuary area at base of high cliff which overlooks the estuary from Jensen Road entrance	36°51.4'	121°48.0'	Mid-channel, just before river turns north. Line up with Bluff Rd. and go to mid-channel, 40 meters from new tire landing.
1304	Foster's Hole, at point where river turns to northeast towards Watsonville	36°52.1'	121°48.1'	5 meters from north bank, near farm house. Just off the bank where levee and access road intersect.
1305	Thurwachter Bridge	36°52.8'	121°48.0'	In channel 50 meters from north side of bridge on Monterey Bay (west) side, 3 meters from bank.
1306	Watsonville Slough, boat dock channel	36°51.8'	121°48.5'	3 meters from end of boat pier of Pajaro Dunes.
1307	Southern Pacific Railroad bridge, under bridge in mid-channel, Watsonville, near PG&E substation	1,195,000E	583,000N	Mid-way between main pilings supporting tressle. Just below bridge.

Moss Landing Marine Laboratories of the
CALIFORNIA STATE COLLEGES at Fresno, Hayward, Sacramento, San Francisco, San Jose
P.O. Box 223, Moss Landing, California 95039

Environmental Studies, Monterey Bay Region
National Sea Grant Program

OUTLINE

MOSS LANDING MARINE LABORATORIES REGIONAL ADVISORY COMMITTEE

(reprinted from project proposal to the National Science Foundation, pp. 66-68)

3. The Regional Advisory Committee will provide a most important advisory function to the total Sea Grant project. Members of the Committee will serve without salary, though certain of their expenses will be paid by the project in relation to special conferences and other consultative functions.

   a. Representation on the Committee (tentative):

      1) In relation to living resources of the sea, the Regional Advisory Committee should include local representation from:

         California Department of Fish and Game
         California Division of Beaches and Parks
         California Department of Conservation
         Hopkins Marine Station
         University of California, Santa Cruz
         Resources for the Future
         Commercial fishing interest
         Sports fishing interests

      2) In relation to non-living marine resources, the following should be represented:

         California Division of Mines and Geology
         California Department of Water Resources
         California Regional Water Quality Control Board
         U.S. Army Engineers
         U.S. Naval Postgraduate School
         County Health Department
         Aerospace industry (e.g. Lockheed)
         Petroleum industry (e.g. Chevron)
         Extractive industry (Kaiser Refractories)
         Power generation (Pacific Gas and Electric)
         Scientific instruments (e.g. CM^2)

      3) To represent the general public, and particularly to speak for agencies and groups specifically concerned with marine resources and their

development, the following agencies should be represented:

Monterey Bay Ocean Sciences Council
Association of Monterey Bay Area Governments
Monterey County Industrial Development
California Advisory Commission on Ocean Resources.

4) It is at once apparent that this Committee will be far too large to function effectively as a total body, except for general policy review and approval purposes. Most of the actual work of the Committee will be carrried out by smaller working subcommittees in association with appropriate faculty members. A large committee of the whole is required in order to offer representation to the broad array of interest both public and private which have major concern for development of marine resources and for protection of the marine environment.

b. Planning activities of the Regional Advisory Committee--tentative schedule for the first year.

1) Committee appointments verified as soon as possible after this project is approved.

2) Organizational meeting as early as possible in the project to:

-establish a steering subcommittee;
-approve a general plan of operations including target objectives and dates;
-make assignments of members (and faculty support staff) to working subcommittees;

3) Subcommittee meetings as necessary according to time priorities established by the Committee (with a faculty member providing appropriate staff support).

4) Annual meeting at end of first year for the Committee as a whole to review, modify, and approve progress to date, and to plan for the second year.

(Success of these committee activities will depend heavily upon good staff work in preparation for meetings and in on-going support of them. Funds requested in the budget for planning conferences support will be used in part to provide for staff expenses during the first year preparation period when other funds are not available. It is assumed that travel expenses in most cases will be borne by the agencies providing the representation on the committees. Some funds must be held in reserve for instances where this is not possible, however.)

c. Policy guidance of the Sea Grant Program by the Regional Advisory Committee will stem in part from the planning activities outlined. In addition,

this Committee will assist the staff in deciding matters of emphasis and priority in relation to implementation phases of the total project. Since the Committee represents the "consumers" of the public information and interpretation services proposed for this project, its counsel should be sought in development of guidelines for those services. Similarly the Committee should advise in matters of priority for the pilot research activities which are engendered by the planning phases of the project. Certainly it is to be expected also that Committee members will advise their own agencies and institutions in relation to development of external financial and other support for appropriate research activities.

d. Some particular areas for consideration by the Regional Advisory Committee. A first task for staff and Regional Advisory Committee will be development of a more detailed outline for the program desired, particularly in relation to relative weights to be placed on its various components. As indicated in the Introduction to this proposal, however, certain areas have obvious importance.

1) An analysis of particular threats to the long-term well-being of the marine environment (e.g. from pollution, beach and shore erosions, siltation, stream channelization, dredging and filling, and other natural or man-made environmental modifiers).

2) As an outgrowth of (1), definition of a priority series of problems facing society as a result of the encroachments of civilization upon the sea, with particular attention to systems approaches for solution of those problems.

3) Delineation of particularly promising avenues for marine resources development in the Monterey Bay area, with particular concern for their compatibility with problems considered under (2), and including recommendations for possible approaches or guidelines for such development. (Some immediately apparent possible areas include a systems approach to harbor development in terms of multiple uses of resources concerned; possible beneficial uses of warm coolant waters from electric power generating stations; fisheries development for under-utilized species; aquaculture possibilities in thermal industrial effluents; anadromous fish farming in stream diversions, with food injection from the sea.)

4) Recommendation of pilot research activities suitable for exploration of selected resource development areas as identified in (3).

D-4

Moss Landing Marine Laboratories of the
CALIFORNIA STATE COLLEGES at Fresno, Hayward, Sacramento, San Francisco, San Jose
P.O. Box 223, Moss Landing, California 95039

Environmental Studies, Monterey Bay Region
National Sea Grant Program

The Moss Landing Marine Laboratories of the California State Colleges have been awarded a National Sea Grant of $106,000 for the first year of a long-term environmental study of Monterey Bay and its environs. Enclosed is a brief overview of this project. In order to guide this study most effectively and assure its functional relationship to the needs of the area, we are establishing a Regional Advisory Committee with representation from educational, governmental, and industrial sectors of the Monterey Bay region. We would very much like to have your organization represented on that committee.

We hope that representatives to the Regional Advisory Committee can indicate to us their organization's interests and concerns in relation to the ocean and marine resources, and that they will provide feedback to their organizations regarding our Sea Grant operations, needs, and potential values. Additionally, we hope to benefit from their expert advice in areas of their own special interests and competences.

Attached are three pages from our Sea Grant proposal which outline the general scope and function of this committee. We anticipage that the entire group will meet only twice this fiscal year. Small subcommittees organized by subject area will be established to deal with specific needs and problems. These sub-groups may choose to meet several additional times, as needed.

A public information open meeting is scheduled for Monday, November 16, 7:30 P.M., in the Fireside Lounge of Cabrillo College (see enclosed map for location and parking). There will be first an introductory session describing the project generally, then a coffee break, followed by our Regional Advisory Committee organizational meeting.

If your organization wishes to participate in this important research and educational effort through representation on our Regional Advisory Committee, please send us the name and mailing address of your representative, his title or official function, and a brief note as to any special technical expertise he may be able to provide.

The Regional Advisory Committee will fill an important role in assuring that our efforts provide maximum possible service to the greater Monterey Bay region. We look forward to an active and productive year.

Yours sincerely,

John P. Harville
Director, Sea Grant Program

Enclosures

Regional Advisory Committee, Sea Grant Program
Moss Landing Marine Laboratories

16 November 1970

A TENTATIVE OUTLINE FOR SUBCOMMITTEE ORGANIZATION

A. EDUCATION SUBCOMMITTEE

1. Central interest: ocean-oriented educational programs and related researches.

2. Representation: educational institutions offering marine studies instruction and related research activities at the several levels of education.

3. Special contributions:

   a. Review of MLML Sea Grant program in relation to educational needs and values, with recommendations for future modifications or other developments;

   b. Inventory and review of marine studies and related research programs of other institutions of the Monterey Bay area; recommendations regarding appropriate interactions among such programs; summarization for public information purposes (perhaps ideal subject for next meeting of Regional Advisory Committee?)

   c. Recommendations regarding possible interactions between above educational and research programs and those of public agencies and industry, with particular attention to possible areas for mutually beneficial cooperative efforts.

B. CONSERVATION AND DEVELOPMENT (PLANNING) SUBCOMMITTEE

1. Central interest: planning for effective management of the coastal zone for long-term protection and wisest possible use of its natural resources.

2. Representation: conservation groups, concerned citizens, planning and development agencies and organizations.

3. Special contributions:

   a. Review of MLML Sea Grant program with particular attention to array of data being collected, its display and management, and its relevance for planning purposes; suggestions as necessary for improvements.

   b. Definition of particularly urgent problems of use allocations in the Monterey Bay area coastal zone; suggestions of priority for their detailed study; particular attention to environmental data required for decision-making.

   c. Recommendations regarding possible pilot research projects for future action, including priorities (relative urgency) and possible cooperative interactions with other agencies and groups.

C. LIVING RESOURCES SUBCOMMITTEE

1. Central interest: long-term protection and effective use of living marine resources.
2. Representation: agencies and individuals particularly concerned with commercial, recreational, and esthetic values of fishes and wildlife and other living resources.
3. Special contributions:
   a. Review of MLML Sea Grant program in relation to data collection plans regarding living resources, with recommendations for modifications as needed.
   b. Definition of particular problems or areas requiring concentrated study efforts--threatened species or habitats, living resources of particular potential value and presently unused or abused, or other problems particularly meriting special study. Recommendations for pilot research projects--guidelines and priorities.
   c. Exploration of possibilities and procedures for cooperative efforts among interested groups and agencies in development and support of pilot research projects.

D. NON-LIVING RESOURCES (including water quality) SUBCOMMITTEE

1. Central interest: long-term protection and effective use of non-living marine resources, including water quality as the prime element of such concern.
2. Representation: agencies and individuals particularly concerned with water quality enhancement and with effective use of non-living resources (eg extractive, heat management, transportation, and other uses).
3. Special contributions:
   a. Review of MLML Sea Grant program with regard to data collection plans pertinent to water quality considerations and to non-living marine resources.
   b. Definition of particular problems or areas requiring concentrated study efforts beyond those in the present program--specific habitats, locations, or resources which should be considered for pilot research projects. Recommendations of priorities and guidelines for these pilot research projects.
   c. Exploration of possibilities and procedures for cooperative efforts among interested groups and agencies for development and support of pilot research projects.

E. PUBLIC INFORMATION AND INTERPRETATION SUBCOMMITTEE

1. Central interest: development of an effective and relevant public information program.
2. Representation: communications media, libraries, interested individuals.
3. Special contributions:
   a. Review of present plans for information and interpretation program with particular attention to recommendations for effective implementation this year, and any modifications or additions desirable for subsequent years.
   b. Recommendations for, and assistance with, most effective possible local communications--news releases, press coverage, etc.
   c. Recommendations particularly relating to publications needs and plans.

16 November 1970

REGIONAL ADVISORY COMMITTEE, SEA GRANT PROGRAM

Moss Landing Marine Laboratories, California State Colleges

A Partial Listing of Organizations and Individuals Invited to Participate

STATE and FEDERAL AGENCIES

California Department of Fish and Game

California Department of Parks and Recreation

California Division of Mines and Geology

California Ocean Area Plan
Department of Navigation and Ocean Development

U.S. Geological Survey

U.S. Army Corps of Engineers

COUNTY and REGIONAL AGENCIES

Association of Monterey Bay Area Governments

Board of Supervisors, Monterey County

Board of Supervisors, San Benito County

Board of Supervisors, San Luis Obispo County

Board of Supervisors, Santa Cruz County

Council on Monterey Bay

Monterey County Health Department

Monterey Peninsula Area Planning Commission

Monterey-Santa Cruz County Unified Air Pollution
Control District

Pajaro Valley Joint Water Committee

Regional Water Quality Control Board

CITIES

- Capitola
- Carmel
- Del Rey Oaks
- Monterey
- Pacific Grove
- Salinas
- Seaside
- Sand City
- Santa Cruz
- Watsonville

EDUCATION

- Cabrillo College
- California State Colleges
- Hartnell College
- Hopkins Marine Station
- Monterey County Schools
- Monterey Institute of Foreign Studies
- Monterey Peninsula College
- Santa Cruz County Public Schools
- University of California, Santa Cruz
- U.S. Naval Postgraduate School

INDUSTRIAL - RESEARCH

- Beta Research Oceanographic Labs
- Chevron Oil Research
- Kaiser Refractories
- Litton Systems, Inc.
- Lockheed Palo Alto Research Laboratories
- Ocean Science Services
- Pacific Gas and Electric Company
- Stanford Research Institute
- Sylvania Electronics Systems
- Yoder-Trotter-Orlob Associates

PUBLIC

- Audubon Society-Monterey Peninsula
- Audubon Society-Santa Cruz
- Human Factors Society, Monterey Bay Chapter
- League of Women Voters
- Monterey County Sportsmen's Council
- Monterey Peninsula Herald
- Monterey Peninsula Jaycees
- Register-Pajaronian
- Santa Cruz Sentinel
- Sierra Club

(plus individuals known to have particular interest in marine affairs)

MASTER LIST
of
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PAGE FIVE

Monterey Peninsula Herald Monday, February 8, 1971.

FULL PAGE FEATURE
WITH PICTURES, IN THE
MONTEREY PENINSULA HERALD

The 55-foot Amigo is pictured tied up at its Moss Landing berth, awaiting first orientation cruise in Monterey Bay under the National Sea Grant program.

Amigo Sails on Maiden Cruise

Beginning a program funded by the National Sea Grant Office for scientific research in Monterey Bay, the 55-foot Amigo took its maiden orientation cruise over the weekend. The vessel set out Friday from the Moss Landing Marine Laboratories with four faculty advisors, seven research assistants and the first of a series of student teams. At the wheel was Frank Monnich, pilot-owner who has made the Amigo available.

An examination was made of eight marine sampling stations which are to provide environmental data expected to have a direct bearing on plans of local and regional governmental agencies, private enterprise, professional associations and citizens groups, for short and long-term use of the waters of the bay.

Among the questions to be answered, according to Richard Smith, graduate student specializing in physical and chemical studies, and David B. Seielstad, oceanographic technician, are:

What is the value of Elkhorn Slough, with or without a deep-water harbor?

Location

Where can sewer outfalls, underwater parks and gardens best be located?

In what areas should sand dunes be preserved?

The two apprentice scientists say that they hope the public's link with their work will help persuade bay communities to plan multiple use of the bay waters without further damaging the total environment.

Others in the spring term operation of the Sea Grant program include graduate teaching assistants Arndt Lorenzen, in charge of the sea-air-land zone of contact studies; Gary McDonald, Monterey canyon sector; Roger Hilaski, Monterey Bay open coast; Scott Dailey, Pajaro River estuary. They are participating in the planning and execution of the studies and in the training and direction of student teams working with them.

"These teams can claim a direct and highly practical service to the bay communities and at the same time can acquire a unique capstone for their academic careers through experience in the working processes of scientific inquiry," said John P. Harville, program director.

Stations

At the sampling stations the student crews will check out an extended and meticulous series of procedures:

Observing at all stations the air temperature, wind force, barometric pressure, cloud cover, wave direction and period.

At the hydrographic stations, measuring water temperature, salinity, dissolved oxygen, five different nutrients at standard depths to 500 feet.

At geologic and biologic stations, noting particle size of bottom sediments, general condition, color, odor, organic content of sand; the varied fauna of the bay bottom and intermediate waters, fishes, invertebrates and plankton.

Research

All told, Dr. Harville said, this schedule of primary studies will commit the Sea Grant participants to hundreds of research chores weekly in coming semesters.

The student scientists will gather data about the profile of the beaches, the movement of sand, the sea-air-land interface of the area, the shallow waters and the current along their edge, under the supervision of Robert E. Arnal, marine geologist and interim director of the laboratories.

Evaporation, considered vital in its impact on recreation, agriculture and daily living comfort, and the maritime air mass, will be studied under Robert Read, meteorologist; chemical characteristics of the water of Elkhorn Slough and the bay, water movements in input of materials from bay tributaries, under William Broenkow, chemical oceanographer.

Concern

Fisheries and the food webs that support them, with particular concern for the productivity and shelter values of estuaries, will be examined under the direction of Dr. Harville; techniques for underwater navigation and mapping, installation of underwater test plots and diver collection of environmental data, under diving captain Patrick Albin.

Laboratory technician Seielstad will guide all participants in use of equipment, standards for sampling and processing materials, and quality control of laboratory anaylses.

Salinas Valley Farmland Facing Threat of Pollution

By JOHN WOOLFENDEN
Herald Staff Writer

The Salinas Valley, known as the most productive valley in the world in terms of cold weather vegetables, is beginning to be polluted with urban sprawl and highway development. What is now good producing land will be out of production in another 10 years in a manner similar to what has happened in the Santa Clara Valley.

Such are the conclusions of Robert G. Read, associate professor of meteorology at San Jose State College, who last weekend with a team of 52 investigators sent out to test his theories and to determine the microclimate of the Salinas Valley before it is destroyed.

His field study of the effects of marine air on crops and animals was the first project made possible by the National Sea Grant of $106,000 awarded to the Moss Landing Marine Laboratories by the National Science Foundation. San Jose State is one of five state colleges which operate the laboratories.

Follow-up

The project is a follow-up to a study made by Read and his students last year in Carmel Valley.

"The Salinas Valley," Read explained, "opens out onto Monterey Bay and hence comes under the influence of the sea breeze which blows in from the bay daily. A large part of the year the large scale circulation is such that the prevailing winds are from the northwest and hence are off the bay. The water temperatures in the bay and off the coast are generally in the vicinity of 50 to 58 degrees F. all year. Since the flow is generally onshore, except for periods in December, January and February, the surface winds blowing over the bay bring in cool moist air over the coast and deep into the valley.

"Because of this flow the relative humidity seldom falls below 60 per cent, and in the immediate coastal area the temperature range is from 40 to 65 degrees F. Temperatures in Salinas and vicinity are much higher than this, 35 to 85 degrees F., and as one proceeds south into the valley, the temperatures are much harsher, being hot in the summer and cold in the winter.

Zones Established

"As a result of this prevailing onshore wind field, agricultural zones have been established.

"The coastal zone has year-round crops of artichokes, cabbages, broccoli, brussels sprouts and other cold-weather-loving plants. In the next adjoining zone landward, crops of lettuce, carrots, celery and other common truck vegetables are grown the year around. In the next zone landward warm weather vegetables such as tomatoes are grown during the summer. It is desirable to know just where the edges of these zones are located to define the climate by its environmental factors of potential evapotranspiration, temperature, humidity and wind field.

"This whole area is now beginning to be polluted with urban sprawl and highway development, and what is now good producing land will be out of production in another 10 years. It therefore becomes important to determine this climate before it is gone and its description lost forever.

Lost Acres

"It is estimated that for every acre of land that is to be used for urban residence, about 8 to 10 acres will be lost to urban sprawl, which is defined as land put into parking lots, supermarkets, highways, city streets, public utility easements and the like. At this rate, it will not be long before this climate is modified by man as agricultural land is utilized for urbanization."

It had been raining when the first of the students reported to Moss Landing to pick up the equipment for the weekend studies. More rain appeared in prospect. With his associates, Peter Lester, Ken McCay and Robert Bornstein, plus cloud physicist Roger Renking, Read went over the assignments, which called for stations to be set up at Moss Landing, in the Aromas-Watsonville area, at Oak Hill, on the agriculture campus of Hartnell College in Salinas, at Chualar, Gonzales and Soledad, with one roaming station. There were to be three students at each, taking sleeping bags and enough food and water for one night and one day in the field.

"Fortunately, the farmers have been very cooperative and have promised us overnight shelter if necessary," said Read. Measurements were to be taken every hour from 6 a.m. to 6 p.m., the roaming observer operating at one-mile intervals from Moss Landing to Soledad. Air, sea and wet bulb temperatures, rate of evaporation, wind speed and direction and pibal winds were to be determined, with balloons to be released hourly on the coast, at Salinas and Soledad to obtain a detailed picture of what the wind looks like at 5,000 feet.

Water Use

"The ground is so wet," said Read, "that all the solar energy will go into evaporating the moisture. Too bad the weatherman couldn't give us a better day, but we're going ahead because the students are available. Preliminary results should show the field water use as we go from the coast to Soledad. During the hottest part of the day Soledad uses 10 times as much water as the coast.

"Main purpose of the study is to determine the extent to which marine air penetrates the Salinas Valley at crop levels and to make estimates of moisture zoning along the floor of the valley. There is little known yet about this zoning and its association with the ecology of plants and animals.

24 Thurs., Sept. 10, 1970 San Jose News

Monterey Bay Sea Study Planned With U.S. Grant

SANTA CRUZ — Moss Landing Marine Laboratories will begin a two or three-year environmental study off Monterey Bay as a National Sea Grant Project.

The study is aimed at keeping the bay free of pollution and making it a world sea laboratory. An offshore, mile-deep trench in the bay makes it ideal for such studies.

The Moss Landing study will dovetail with an even more extensive project proposed by the Association of Monterey Bay Area Governments (AMBAG).

AMBAG officials, attempting to get federal funds, are emphasizing the bay is one of the few left relatively free of pollution and could eventually have world-wide significance as a sea study area.

The federal government already has appropriated $106,000 for the first year of the sea grant study, and state colleges will pay about $200,000 for the education value it provides students.

AMBAG's study would be much more costly and will be carried out by consultants. Much of the information developed by the Sea Grant study will be used by AMBAG, according to Dr. John Harville, marine laboratory director.

One of the bay's major mysteries is in its currents. Scientists are not sure whether an offshore submarine canyon is making the bay "lake-like" and preventing sewage from being pulled to sea or if currents could pull sewage down from the San Francisco area into Monterey Bay.

The need of a study was brought home to County supervisors recently when the controversial Bay-Delta study was released. The study proposed a giant outfall system off the San Mateo County coastline to dispose of sewage effluent from the San Francisco Bay Area.

12— Santa Cruz Sentinel Sun., November 15, 1970

Monday At Cabrillo

Bay Study Advisory Group To Organize

Moss Landing Marine Laboratories has been awarded a National Sea Grant of $106,000 to finance the first year of a long-term environmental study of Monterey Bay and its environs, according to John Harville, program director.

The laboratories, operated by five state colleges, are asking area educational, governmental and industrial agencies to name representatives to an advisory committee to guide the study and "assure its functional relationship to the needs of the area. . ."

A public information meeting on the project will be held Monday at 7:30 p.m. in the Fireside Lounge of Cabrillo College. An organizational meeting of the advisory committee will follow.

Particular areas of consideration in the study will be:

1. An analysis of particular threats to the long-term well being of the marine environment.
2. Definition of a priority series of problems facing society as a result of the encroachments of civilization upon the sea.
3. Delineation of particularly promising avenues for marine resources development.
4. Recommendation of pilot research activities suitable for exploration of resource development areas.

MONTEREY PENINSULA HERALD, NOV. 2, 1970

Advisers Sought for Monterey Bay Study

By JOHN WOOLFENDEN
Herald Staff Writer

An advisory committee from educational, governmental and industrial sectors of the Monterey Bay region, is being sought by the Moss Landing Marine Laboratories to guide an environmental study of the bay for which a National Sea Grant of $106,000 was awarded in July.

The funding from the National Science Foundation is to cover the first year of a proposed longterm study.

A public information meeting has been scheduled by John P. Harville, director of the sea grant program, for Monday, Nov. 16, at 7:30 p.m. in the fireside lounge of Cabrillo College. At this introductory session the project will be described to groups invited to participate.

Interests

Representatives to the committee will be asked to indicate their interests and concerns in relation to the ocean and marine resources.

In the project proposal to the National Science Foundation, the laboratories, operated jointly by state colleges at Fresno, Hayward, Sacramento, San Francisco and San Jose, suggested the following representation:

California Departments of Fish and Game, Beaches and Parks and Conservation; Hopkins Marine Station, University of Californiat at Santa Cruz, Resources for the Future, commercial and sports fishing interests; California Division of Mines and Geology; Department of Water Resources and Regional Water Quality Control Board; U. S. Army Engineers, U.S. Naval Postgraduate School, Monterey County Health Department; aerospace, petroluem and extractive industries (Kaiser Refractories), power generation (Pacific Gas and Electric) and scientific instruments.

For Public

To represent the general public, and to speak for agencies and groups specifically concerned with marine resources and their development, it was also suggested that the Council of Monterey Bay, Association of Monterey Bay Area Governments, Monterey County Industrial Development and California Advisory Committee on Ocean Resources be included.

"It is apparent," said Harville, "that the committee will be too large to function effectively as a total body, except for general policy review and approval purposes. Most of the actual work will be carried out by smaller working subcommittees in association with appropriate faculty members."

Some of the areas for consideration by the regional committee include:

Threats

An analysis of particular threats to the marine environment from pollution, beach and shore erosion, silting, stream channelization, dredging and filling, and other natural or man-made environmental modifiers.

Definition of a priority series of problems, with attention to systems approaches for solution.

Delineation of particularly promising avenues for marine resources in the Monterey Bay area, such as multipleuse harbor development, possible beneficial uses of warm coolant waters from electric power generating stations, fisheries development for underutilized species, aquaculture possibilities in thermal industrial effluents, anadromous fish farming in stream diversions, with food injection from the sea.

Recommendations on pilot research activities in these development areas will be sought from the committee.

Organizations wishing to participate are invited to send the name and address of their representative, his title or official function, and a brief note on any special technical expertise he may provide, to John P. Harville, P.O. Box 223, Moss Landing, 95039. He will return Nov. 11 from conferences on the East Coast and in Washington, D.C., in connection with the grant.

MONTEREY PENINSULA HERALD, FEBRUARY 27, 1971

Monterey Bay Bibliography, Four Years in Making, Ready

A 300-page bibliography of Monterey Bay literature has been prepared by the Moss Landing Marine Laboratories.

The work, undertaken in 1967 in response to requests from local communities and the needs of the laboratory, was delivered this week.

The volume was compiled by the staff and graduate students at the laboratory and scientists and librarians at neighboring institutions under direction of the laboratory's librarian, Doris Baron.

Distribution of the 400-copy limited edition has already begun. The Association of Monterey Bay Area Governments, which helped finance the book, has ordered 150 copies.

Certain government officials, scientists and librarians will receive gift copies, and a limited number will be sold at the laboratory at $4 each.

The document will become a part of the environmental data being collected by the laboratory's public information and interpretation section recently established under auspices of the Sea Grant Program.

The more than 2,000 listings relate to the central California coast from Tomales Bay to Morro Bay. The earliest listing, dated 1855, concerns features of the area between the Pajaro and Salinas rivers.

Listings

Some listings concern ecological problems such as erosion, earthquakes, fill deposits, fisheries and salt water pollution of fresh water lagoons.

Other listings should be of interest to sportsmen, commercial fishermen and scuba divers.

Assisting in the compilation were Alan Baldridge, librarian at the Hopkins Marine Station; George Luckett, librarian at the Naval Postgraduate School; Ethel Solliday, Monterey city librarian; and Stuart Baillie, director of the San Jose State College Library.

Adviser

John Phillips, director of the Hopkins Marine Station, advised on retrieval systems and developed the key punch programs used to print the bibliography and which will be used for updating the document.

Corrections and additions will be made constantly, according to John Harville, laboratory director, and a 1971 supplement is already being prepared.

A second edition will be published within three years, and users are urged to make recommendations for it.

Cabrillo Times & Green Sheet, Thursday, March 4, 1971

Public views sought on environmental questions

People who have views on environmental problems plaguing Monterey Bay now have an opportunity to tell someone what they are and which of the problems they think are the most pressing.

Views of the public are being solicited by the Regional Advisory Committee of the National Sea Grant Program project at Moss Landing Marine Laboratories.

The laboratory has been given a $106,000 grant by the federal government to analyze the bay's physical and living resources, how they may be conserved and developed, and to collect and disseminate this research data to governmental, business, educational and scientific organizations, and to anyone else who can make use of it.

The executive committee of the three-county regional advisory committee met last week at the laboratories at Moss Landing to begin the preparation of a report which will summarize data gathered by other subcommittees, and will present it at a meeting of the full committee in June.

The executive committee wants the views of the public on the environmental problems, and invites those who live in Santa Cruz, Monterey and San Benito Counties to make them known to the members of the advisory group.