"QUANTITATIVE RESPONSE CHARACTERISTICS OF COASTAL FISH AND BENTHIC INVERTEBRATE COMMUNITIES"

EPA GRANT R801152

14 November 1974

Revised Work Plan and Schedules

Major tasks required to complete the objectives and prepare a comprehensive final report include:

1. Completion and report on field tests of various grab sample devices at sea and comparison of results with previous reports and findings.

2. Completion of a report on methods for conducting routine trawl surveys, including information about gear, operational procedures, sampling methodology, grids, replication and associated physical/chemical data.

3. Report on methods of trawl data analysis including population characteristics, diversity, faunal similarity, biomass and parasite and disease patterns in populations.

4. Evaluate analytical and mathematical methods for describing community structure. Select data from ongoing biological surveys for keypunching, data storage and analysis and conduct special cruises to:

   A. Sample areas unaffected by major wastewater discharges.

   B. Refine depth-associated discontinuities of both infaunal and demersal organisms (fishes and invertebrates).

   C. Refine methods for assessing and defining changes in diseased fish populations.

Continue to explore variations in cluster, factor, divers correlation and other analyses that appear to improve the ecological meaning of biological surveys.

5. Complete a report on analytical techniques describing site and species cluster analyses and other methods and their application to benthic biological data.

6. Complete a report on the kinds and distribution of diseased fish populations in southern California waters.

7. Complete a fourth quarterly survey in the vicinity of the presently unused Hyperion one-mile outfall site (Santa Monica Bay) and prepare a report comparing sediment quality, fish and infauna with earlier data obtained during discharge (e.g. Hartmann and SWRCB studies, Carlisle- 6 year trawl study).

8. Use existing and new data to prepare a report on stress and recovery of marine communities at present and previously used discharge sites.

9. Prepare final report including an assessment of the health, diversity and abundance of benthic fish and invertebrate communities in southern California.

Schedules

The work will cover a 10 month period from January to October 1975. Major efforts will be spread evenly over the 10 month period, but tasks will be completed at various times during this period.

7. Stress and Recovery from Ocean Discharge (Revised 1/24/75)

The Problem:

On 31 March 1971, a discharge of 133 MGD of primary treated wastewater was diverted from a one-mile outfall to a five-mile long outfall off the Orange County Coast by the County Sanitation Districts of Orange County. Biological data taken by Marine Biological Consultants and by Gary Smith (S.I.O.) and sediment metals data taken by D. Young and J. Galloway suggested that after 17 years of continuous discharge (from 27 to 133 MGD) the inshore benthic environment at the nearshore outfall recovered within a year. In addition, offshore data suggested that no major effects in the benthic environment were found during the first year of discharge out the long outfall.

We propose to re-examine these data, complete analyses of remaining un-analyzed samples (especially from Smith) and initiate sampling at sites not now being surveyed. Such a program should provide urgently needed data on both the reversibility of effects from nearshore discharge of a large volume of primary effluent and provide insight into the kinds of environmental responses (or lack of them) engendered by a modern, well-designed sub-thermocline diffuser system.

Objectives:

To quantitatively characterize the extent of faunal and sediment changes that may have occurred as a result of diversion of effluent off Orange County.

Research Plan:

A. Previous data (cited above) will be collated and reviewed for its adequacy to describe the significance of

environmental changes which may have occurred at the old outfall site as a result of effluent diversion. This will include pre- and post-discharge switch quantitative information on fish abundance, diversity and disease incidences, benthic infaunal species abundances and diversities and on sediment metals and chlorinated hydrocarbons.

B. Completion of Benthic Infaunal Samples. Between July 1970 and September 1972, Dr. Gary Smith, Scripps Institution of Oceanography, collected a total of 342 benthic samples at six stations near the outfalls and at two control stations. The outfall stations involved one transect at each outfall with stations at 0.25, 0.5 and 1.0 mile downcoast of the outfalls. Sampling was approximately bimonthly with six samplings before and six after the discharge switch. Two replicates from each station were analyzed for total sulphides ($mgS^{=}/g$ sediment dry weight) in the upper 1 cm layer and for total organic carbon (% organic carbon, dry weight basis). However, only the 0.25 mile stations were completely analyzed for benthic infaunal species. The remaining samples (288), now at the Allan Hancock Foundation, are available for further analysis to confirm or supplement Dr. Smith's conclusions. We propose to initially analyze two samples from each of the 0.5 and 1.0 mile stations (4 stations) for six of the 12 sampling periods. This amounts to 48 samples at an approximate cost of $60/sample (total $3,000) by a qualified outside laboratory (U.S.C. or M.B.C.).

These data will be examined for changes in diversity and abundance and their relation to the available physical data

and to the already analyzed 0.25 mile infaunal data.

C. New SCCWRP and ORCOSAN Sampling and Analysis. Until September 1974, the County Sanitation Districts had no benthic sampling program other than special sampling for metals and pesticides. Thus, a nearly two-year gap exists in our knowledge between Smith's last sampling and the new program instituted at the new outfall site by ORCOSAN.

ORCOSAN sampling will continue quarterly as of September 1974 and will provide information on benthic infaunal and chemistry changes from that time on the new outfall site. However, the sampling will not provide additional data on recovery at the one-mile outfall nor an assessment of the benthic fauna and chemistry over a larger region surrounding both outfalls.

Such information will be necessary to adequately assess past and future effects. Therefore, we propose to conduct one major, but complementary, benthic sampling program at sites about ORCOSAN's present grid of stations and to include three of Dr. Smith's previous sites at the one-mile outfall. This program is described below.

In addition, we will continue to participate in the continuing quarterly otter trawl program (established in 1969).

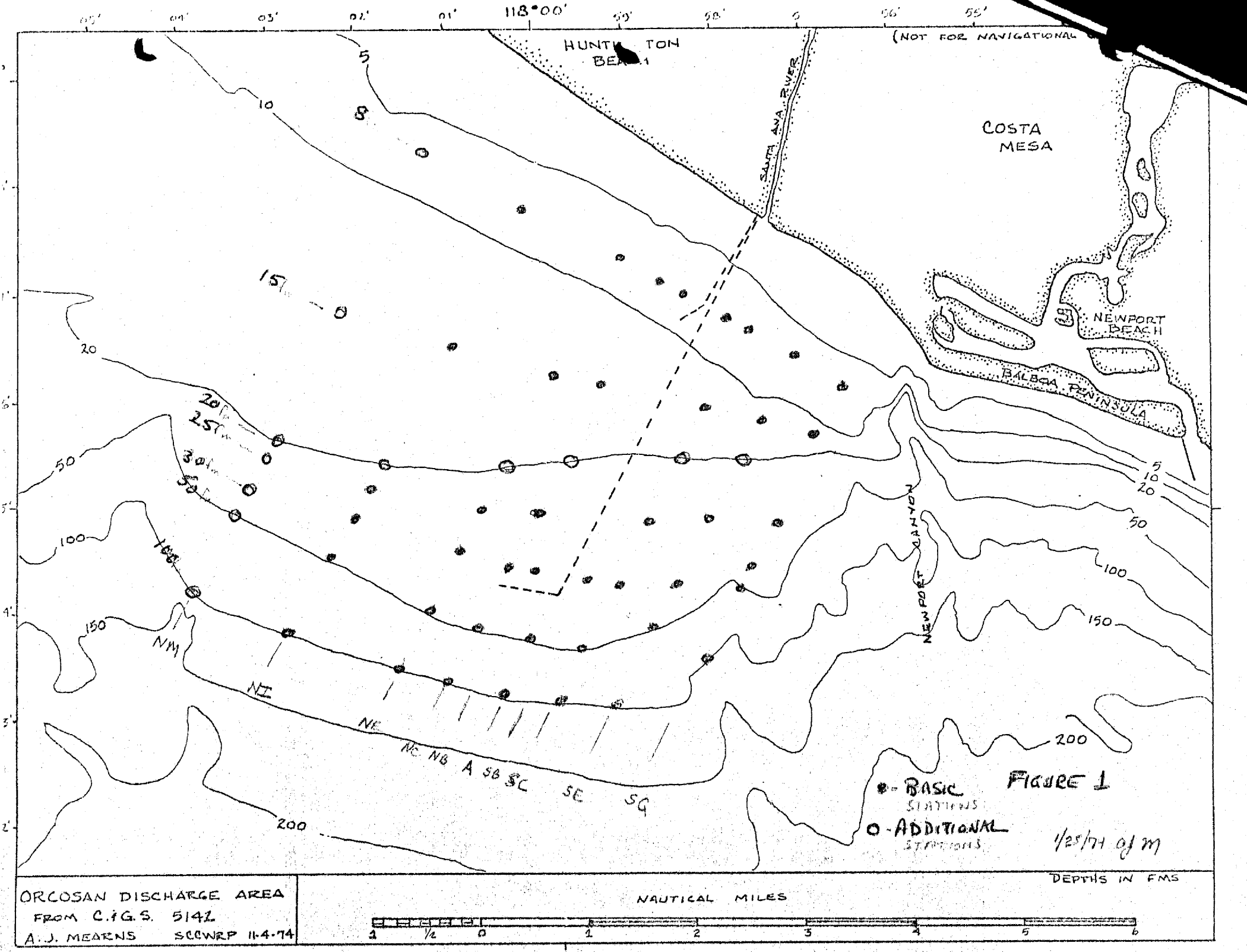
Benthic sampling will be conducted at a grid of 42 stations spaced along transects laid perpendicular to shore and parallel to the five-mile outfall. The grid (Figure 1) was derived from more basic plan involving transects laid every quarter nautical mile to the north (NB, NC, ND...etc.) and south (SB, SC, SD...etc.) of the outfall. The present grid is based on a selection of transects at the outfall (A) and to the north (NB, NC, NE, NI, NM) and to the south (SB, SC, SE and SG). Intermediate transects may be taken in the future if required to refine geographical patterns.

Depths

Equal effort per depth interval was chosen as a basic sampling criteria in order to simplify standardizing effects expected to be due to depth. The following depth intervals were chosen: 8, 15, 20, 25, 30, 50 and 100 fm. The 8 and 30 fm depths are compatible with Gary Smiths S and D sites and with the present Sanitation District sites at about 30 fm (the diffuser, outfall 2).

At least two benthic survey cruises will be conducted during 1975. The first cruise (February, 1975) will sample the grid shown in Figure 1 taking one Van Veen sample per station. The purpose will be to obtain preliminary biological and chemical data to describe general aspects of the coastal shelf and provide a basis for a more detailed, replicate sampling survey. The second survey will be conducted in April or May, 1975. The choice of survey stations will be based on preliminary indication (from survey 1) of depth effects and outfall related effects which in our evaluation require intensive and replicate samples.

The first cruise will sample 42 stations (Figure 1, black dots, transects NI to SG, depths 8, 15, 25, 30, 50 and 100 fm) and twelve optional stations (open circles) to be taken as time permits. Van Veen grab samples will be subsampled for determination of volatile solids and particle size distribution, washed through 0.1 mm mesh and rough sorted to identify and enumerate dominant organisms. These data will be tabulated and reviewed for trends in order to prepare a grid for the second survey.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SANTA ANA RIVER
COSTA MESA
NEWPORT BEACH
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NM
NI
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NC NB A SB SC SE SQ
* - BASIC STATIONS
O - ADDITIONAL STATIONS
FIGURE 1
1/25/74 AJM
ORCOSAN DISCHARGE AREA
FROM C.&G.S. 5142
A.J. MEARNS SCCWRP 11-4-74
NAUTICAL MILES
DEPTHS IN FMS

The second cruise will involve

Three replicate samples at each station. Each sample will be examined for sediment color and consistency, then placed in a bucket to measure wet volume. Each sample will then be washed separately through 0.5 mm mesh screen. Retained organisms will be preserved in buffered formalin and later transferred to isopropyl alcohol for sorting, identification, weighing and counting.

One or two additional grab samples will be taken at each station to obtain sediment samples for:

a. particle size distribution - 100 gm
b. volatile solids determination - 100 gm
c. B.O.D. determination - 100 gm
d. metals determination - 100 gm (chromium, copper, zinc)

These physical and chemical data (including sediment color and consistency) will be used to prepare geographical charts showing gradients in these parameters. These data will then be examined for possible gradients associated with the discharge sites and with other important factors such as depth. Analyses will then be conducted to determine if correlations exist between these physical parameters and the biological data such as diversity, species richness, site-groupings, abundance and

dominant species.

Following this survey, we will examine the data to determine sites and sampling frequencies for future surveys which will adequately assess chronic effects of the discharges and separate such effects from seasonal fluctuation in species and physical parameters.

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