Evaluation of Monitoring Methods

Monitoring of the marine environment to determine the effects of wastewater discharge has been conducted since the late 1950s in southern California. Currently, the four largest wastewater dischargers in the region spend over $4 million per year on mandated monitoring programs. These activities have produced an enormous amount of data that have seldom been evaluated. Regional analyses of all monitoring data have not been made.

Beginning about 1978, regulatory agencies, dischargers, and SCCWRP staff began discussing the possibility of a regional monitoring program. These discussions blossomed into a concept called ROMP--Regional Ocean Monitoring Program. Committees to determine sampling design and data management were established and made recommendations on how to set up such a program. Everyone agreed that regional monitoring should be established, but disagreement among regional, state, and federal regulators concerning who should administer the program essentially brought the discussions to a halt.

SCCWRP's role in the regional monitoring discussions was to coordinate the program and provide information necessary for making decisions about monitoring practices in the region. One of the main issues in regional monitoring is the selection of reference sites. SCCWRP felt that under current monitoring programs, the reference sites being sampled were not providing an adequate view of reference areas along the coast. To provide information about reference areas in the region, the 1985 Reference Site Survey was conducted (Thompson et al. 1987). Another issue was that of replication. SCCWRP and EcoAnalysis, Inc. (Ojai, CA) conducted analyses of power and precision of infaunal sampling and trawling (Bernstein et al. 1985, Cross 1983).

The subject of regional monitoring began to surface again in 1987 when the National Research Council (NRC) decided to investigate monitoring practices in the United States with the Southern California Bight as a case study (see p. 85; SCCWRP 1988, NRC [in press]).

The staff of SCCWRP fully agrees with the NRC's findings that regional monitoring is sorely needed in southern California. Setting up such a program will be very difficult. It is essential that all discharge agencies, regional and state boards, and the U.S. Environmental Protection Agency (EPA) agree to participate and to determine program structure and administration. It is also important that representatives of environmental organizations have opportunities for input in the development of the plan and review of progress.

In reviewing the National Pollution Discharge Elimination System (NPDES) monitoring programs of the major sewage dischargers for the NRC, we found that it is not possible to put together a comprehensive regional data base with that data.

By using offshore benthic monitoring programs as an example, different times, depths, numbers of replicates or composite samples, and different suites

Table 1. Partial listing of benthic parameters measured in 1987 southern California monitoring programs.[a]

Parameter		Oxnard	L.A. City Hyperion	L.A. County[b]	Orange County	San Diego Pt. Loma
	No. of sites:	7	39	18 (44)[c]	13 (40)[d]	18
	Depth (m):	16-20	18-150	23-305	30-304	16-83
Sediments						
Sulfides		S	A	-	Q (A)	Q
Grain size		S	A	-	Q (A)	Q
TVS		-	-	S	Q (A)	-
TOC		S	A	-	-	-
BOD		S	-	-	-	Q
Metals		S	A[e]	5 yr	Q[e] (A)	S[e]
DDTs		S	A	5 yr	Q (A)	S
PCBs		S	A	5 yr	Q (A)	S
PAHs		A	A	5 yr	Q (A)	S
Biology						
Infauna		S	S	S	Q (A)	Q
Trawls		S (3 sta.)	Q (6 sta.)	Q (12 sta.)	S (8 sta.)	S (6 sta.)
Tissue chemistry		A	A	-	S	-

[a]Abbreviations: A, annual; S, semiannual; Q, quarterly; -, not measured.
[b]The NPDES monitoring program was modified in 1988 to include more frequent sediment chemistry monitoring than these data indicate.
[c]An extended 44-station survey is to be conducted every 5 yr or after any major event. Trace chemistry is conducted at these times.
[d]Monitoring is done quarterly at 13 sites and annually at 40 sites.
[e]Metals, DDTs, PCBs, and PAHs are measured as priority pollutants.

of sediment contaminants are sampled in each monitoring program (Table 1).

Infaunal data are collected by all agencies, and all agencies participate in the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT), whose goal is taxonomic standardization. Species names submitted to the Ocean Discharge Evaluation System (ODES) may be consistent within a discharge agency, but there is no provision to merge species lists from two or more agencies and check for standardized species names so that a regional analysis of the data may be accomplished.

Similar problems exist for sediment data. For example, Hyperion, Orange County, and Point Loma are required to measure priority pollutants in sediments, but Los Angeles County is required to measure selected contaminants every five years. Point Loma does not measure total volatile solids (TVS) or total organic carbon (TOC). Although not shown in Table 1, some agencies measure two Aroclor mixtures (polychlorinated biphenyls [PCBs]) while others measure seven. The Southern California Environmental Chemists Society (see p. 91) was organized to standardize analytical chemistry methods which must also be addressed in a regional monitoring program. Not all dischargers use ODES. Therefore, data would have to be requested and verified manually. Most multivariate analyses cannot be performed with data sets that contain such gaps. Standardized regional monitoring could resolve these problems.

Many other technical issues must be resolved before regional monitoring can be established. A few of the important questions

are the following:

(1) Which parameters are useful?
(2) How could compliance be determined for each parameter measured?

For example, for sediment contaminants, should the 95% confidence intervals of reference values, or toxicity limits be used as compliance criteria.

(3) How should reference sites be used in monitoring programs?
(4) How can we reconcile statistical significance with environmental significance?
(5) What additional information do we need to facilitate better monitoring decisions?

For example, analyses of power and precision for sediment and tissue contamination parameters have not been made for our region and would help guide decisions on replication, etc.

(6) Is it possible to define a balanced indigenous population?
(7) What if biological parameters are within compliance limits, but sediment parameters are not?

Some portion of the regional plan should be special studies to develop better approaches for determining which organism responses are best for use as early warning signals. Studies on sediment contaminants would be designed to develop better criteria for sediment impacts on biota.

SCCWRP hopes to assist in establishing a regional monitoring program by co-sponsoring a workshop to produce a consensus on the strategy for implementing such a program. Additional technical workshops will need to be held to work out details.

In anticipation of regional monitoring we have compiled a regional demonstration data base that includes permit monitoring data from the Hyperion Treatment Plant, Los Angeles County, Orange County, and Point Loma, as well as the 1985 Reference Site Survey data. It contains data from 93 sites at 30, 60, and 150 m sampled in the summer of 1985. This data base is available for use in addressing the numerous technical questions about regional monitoring, some of which are those listed above.

Most importantly, working together on the NRC case study produced a new spirit of cooperation and interest by southern California discharge agencies and regulatory agencies. That momentum should be carried forward towards a viable regional monitoring program.

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