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**HIGH PRIORITY RESEARCH
AND DATA NEEDS**

**Interim
Functional Step Four**

Prepared for the
Marine Resources Council
Nassau-Suffolk Regional Planning Board
under
Sea Grant Project GH-63
National Science Foundation

November 1970
4047-422

Philip B. Cheney

The Center for the **ENVIRONMENT & MAN, Inc.**

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1.0 INTRODUCTION

The purpose of this report is to identify and describe those high priority needs for research and data collection which we (CEM) can state at this stage of progress are vital to the solution of Long Island's important coastal problems and to the management of its coastal zone.

We feel that it is important to state these needs as specifically as possible now, even though the state-of-the-art studies are not complete. In our judgement, based on our analysis and evaluation, they are of high priority and need not wait for further verification.

The continuing program of research and analysis to develop the methodology, knowledge and data for marine resource planning conducted by the Center for the Environment and Man, Inc., (CEM) has produced reports which describe the overall approach [1], the major coastal resource problems [1] [2], the categories of information and knowledge needed [3], and some of the background necessary for assessing the "state-of-the-art" in these categories [4] [5].

Presently a major effort is underway to determine the availability, reliability and applicability of existing knowledge and data. The New York Ocean Science Laboratory has reported on the availability of data and knowledge in several of the categories [6] and is continuing to investigate the "state-of-the-art" in the remaining categories. While the state-of-the-art research is incomplete at this time the priority needs are becoming evident through the implementation of the functional approach for the program. This approach has permitted a definition of the problems and the identification of decision areas faced by the Nassau-Suffolk Regional Marine Resources Council (MRC) and will aid their role of guidance and assistance in the wise use of Long Islands' marine

resources.

Section 2 of this report briefly describes how these needs were defined, based on problem analyses and preliminary state-of-the-art studies. Section 3 contains the list of specific high priority data collection and research that can be identified at this time.

2.0 DERIVATION OF DATA AND RESEARCH NEEDS

The overall approach being used in this program has been described in previous reports as a series of functional steps which will lead from a definition of problems through the specification of knowledge requirements, an evaluation of the state-of-the-art in these requirements and the resulting knowledge gaps and ultimately a design for research and data collection programs to fill the gaps on a priority basis.

In those reports we have identified and described 17 major coastal zone problems on Long Island [1]. Subsequently 14 of these were selected (on the basis of judgement relative to their importance) for more in-depth analysis [2]. From this a generalized set of knowledge and data requirements was established as a guide for the assessment of the state-of-the-art [5, 6].

For the purpose of providing the interim set of high priority data and research needs as reported in the next section we have gone back to identify the problems which we feel warrant the most significant effort toward resolution; to determine the knowledge and data which will advance our ability to resolve and manage them in an efficient and timely manner and; to identify those requirements which are lacking according to the preliminary state-of-the-art studies.

In selecting the problems several criteria were applied. They are:

- 1) intensity - a combination of factors consisting of the number of uses of coastal resources that are affected by the problem, the geographic extent of the occurrence of the problem,
- 2) trend - what is happening over time to the problem and associated uses of affected resources,
- 3) severity - the value of economic losses and other losses associated and the "degree" of effect upon other uses, and
- 4) irreversibility - changes caused by the problem related activities which would be impossible to overcome or which would be at least so costly as to be prohibitive.

With these criteria in mind a review of the problems isolated several which, in our judgement are high priority. Of the fourteen analyzed twelve problems have a direct relationship to the quality of coastal waters. Eight influence water quality, or are "causal" in nature. Four are affected by water quality. In fact, very few uses of coastal resource are not affected by water quality in some way.

Also, the trend in population growth and increase in economic activity eastward on Long Island indicate a continuing growth in waste disposal requirements and a continuing growth of pressure on the marine environment to accomodate these waters.

These, then indicate that answers to questions related to water quality and waste disposal are of a high priority on Long Island, which of course, is not unexpected nor particularly revealing in itself. However, when we attempt to concentrate our efforts where they will return the greatest benefits in the management of Long Island's coastal waters the answers are not so easily ascertained. There are some needs which would appear to have a widespread usefulness if filled.

A second high priority problem in the Long Island coastal zone (and in many other coastal areas) is the loss of coastal wetlands. Wetlands serve a number of purposes, and particularly fish and wildlife as a habitat, spawning ground, nursery and nutrient producing area. They also serve as buffers to absorb the energy of coastal storms.

The primary reason for placing wetlands on a high priority is the apparent irreversibility of an action which destroys such an area. The natural wetlands have evolved over a long period of time and probably cannot be restored to their naturally productive state by man. While this is itself may be a researchable question the losses are extensive and of sufficient

current concern to warrant some immediate concentrated effort.

The third high priority problem is the whole complex question of dredging. The reason why we consider this problem to be of high priority in the Long Island area is because of the extensive number of dredging projects carried out on a continuing basis. Although proposed projects are submitted for review by a number of interested agencies (including MRC) little is known about the actual effects of any particular project and even less is known about the cumulative effects of dredging.

There are specific items of knowledge and data which would improve the capability to make soundly based decisions for the management of the coastal zone to resolve, or minimize the effects of, these problems. These items fall within the eight categories described in the knowledge requirements report [3]. Essentially, each item relates to one or more of the following questions.

- 1) What is the present state:
of activities related to resource uses?
of the chemical, physical and biological conditions
of the coastal waters?
- 2) What is the desired state:
of proposed or planned activity?
of coastal waters (standards)?
- 3) What effects will the proposed activity have:
upon the conditions of the coastal waters? (standards)
upon the state of the marine biota?
- 4) How will these changes affect:
planned/desired uses of the coastal resources?

The questions are posed in different sequences depending upon the problem and depending upon the purpose of the analysis. For example, in the problem of water quality if one approaches the evaluation of the adequacy of existing standards or the establishment of new standards the sequence would ideally be:

- 2) What are the desired/planned uses of the coastal waters?
- 4) What water quality is needed to satisfy these uses?

This should result in standards designed to meet the needs. But once the standards are established, management of activities to enforce these standards might include sequences such as the following:

- 1) What are the present conditions of coastal waters?
- 1-2) How are they different than the standards?
- 1-3) What activities are significantly affecting the conditions which are not up to the standards?

or given a proposed activity:

- 1-3) What effect will the proposed activity have on the condition of coastal waters?
- 2) Will this violate the standards?
- 4) If so, what impact will it have on planned/desired activities?

It should become evident that data and knowledge which will contribute to the answers to these questions will have a major influence on the Council's ability to responsibly manage the problems of Long Island's coastal resources. It should also begin to become evident that many parts of the data and knowledge will be applicable to more than one problem.

In the development of high priority needs, once the high priority problems have been established, it is necessary to select and weight the research and data needs. Several criteria were again applied, using our best judgement. First, the importance of the need in terms of managing the problem was taken into account. Those items which are essential to even a first effort at problem resolution are ranked above those which would be "nice to have" but are not essential. Second, those items which have applicability to a large number of problems are ranked above those with a single problem applicability.

And third, ranked by the above two criteria, the items are evaluated in terms of their availability to select those which will provide the greatest improvement in our resource management ability. Having gone through this exercise those needs which:

- 1) are related primarily and importantly to the three selected problems,
- 2) are important in terms of the number of problems to which they are applicable,
- 3) have been evaluated in terms of their availability, and
- 4) the state-of-the-art study indicates are seriously deficient,

have been identified and selected for listing in the next section.

3.0 HIGH PRIORITY RESEARCH AND DATA NEEDS

In the previous section we discussed the reasons for selecting certain problems as a starting point and the criteria for priority ranking problems and knowledge requirements. In this section the items which met the criteria and for which, we feel, sufficient justification exists are listed in hopes that actions to meet the needs may get underway. The needs are listed together with the problem(s) to which they apply and some indication of how they can be applied. There has been no attempt to rank these needs. Consequently, the sequence should not be construed as an indicator of priorities. They all are to be considered high priority. A "D" before the items indicated a data need while an "R" a research need.

Need D-1: Baseline physical data of Long Island's coastal and estuarine waters primarily currents, benthic characteristics and tidal flows. In addition to a data collection there is a need for monitoring of the essential variables, particularly currents and circulation on a continuous basis.

Reason: To develop the basic hydrographic patterns of these waters and observe their changes over time.

Use: This data will be useful in all problems where the movement of coastal waters has an influence. It is of particular relevance to the management of water quality and to evaluating the effects of dredging.

- In water quality management the data would form the basic input for predicting the transport and diffusion of effluents and the resulting concentrations of pollutants. It would aid in analyses to select the locations of outfalls and the degree of treatment required prior to discharge.
- In dredging evaluations the data is essential to the prediction of how physiographic changes caused by dredging will change the currents and circulation patterns, flushing rates and salinity.

Need D-2: Baseline water quality data of Long Island's coastal and estuarine waters primarily temperature, salinity, Do, turbidity, pH. Again, a systematic continuous monitoring program is required in addition to the baseline data.

Reason: To establish the quality baseline (existing) and monitor the changes over time.

Use: This data will have its primary usefulness in the management of the Island's coastal water quality, and will thus have an influence on all activities which have an interaction with water quality.

- In water quality management the data is essential to determine the existing water quality. A monitoring system will also provide the basis for surveillance and control to support management actions.

Need D-3: An inventory of Long Island's wetlands. While a number of studies describing some wetlands have been done, a more comprehensive description inventory is needed for management.

Reason: Particularly missing are inventories of wetlands in or near: [6]

- 1) Great and Little Peconic Bays
- 2) Noyack Bay
- 3) Shelter Island Sound
- 4) Gardiners Bay
- 5) Flanders and Reeves Bays
- 6) The shores of Riverhead and Southold Townships

Use: This data, coupled with procedures for evaluating and classifying wetlands (R-7), would enable the bi-county area to develop a wetlands plan to insure that the irreversible losses are under control. Due to the rate of loss experienced and the growth of conflicting uses this plan should be under development. (We assume here that selected wetlands should be preserved because of their beneficial characteristics, but that it is not feasible, practical or necessary to preserve all wetlands. Accordingly a balance approach is recommended to determine those selected for preservation).

Need R-4: Evaluation and refinement of water quality standards to meet the needs for water quality management in Long Island's coastal and estuarine waters. A study to investigate the potential value of establishing effluent standards for future management also appears to have a high usefulness.

Reason: Particularly needed because a more refined classification system for quality would be specifically related to the desired uses of coastal waters and, thus, more responsive to management needs.

Use: In all water quality management the standards are a "proxy" for all the planned desired uses which are influenced by water quality. As such once established they become the management "goal" or target used as a basis for deciding yea or nay on specific projects and associated water quality changes.

One of the major difficulties in the use of receiving water standards is determining how a specific activity will affect quality. A research program which resulted in sound effluent standards would overcome this difficulty.

Water quality standards are also of particular use in the evaluation of proposed dredging activities. Predicted changes in flushing currents, salinity, turbidity, etc. all can be related to standards to aid in estimating the effects and desirability of a project.

Need R-5: Institute a program to determine the effects of waste disposal practices on the ecology of the south shore bays and estuaries.

Reason: As population grows the use of cess pools for waste disposal is degrading the quality of underlying ground water. With collection, treatment and disposal in the ocean planned research is needed to estimate what the effects would be (on groundwater levels and flows and consequently) on salinity and other quality parameters and on the dependent marine organisms in these coastal waters.

Use: The results of this research could have a significant effect on the design of new waste treatment systems which are inevitable particularly in Suffolk County. It could help to answer the questions of discharge locations, degree of treatment, and the need for recharge. Consequently, it should not be delayed.

Need R-6: Research to determine the heat carrying capacity of Long Island Sound.

Reason: The Sound is looked to as a supply of cooling water for power generation facilities. The evaluation of each plant on an individual basis generally is concerned only with the local and marginal effect of that plant on the ecology. It appears that more emphasis should be placed on the total effects of heat additions to the Sound over a long period of time.

Use: This project would provide a scientific basis for the evaluation of future plants and could assist in providing the basis for more refined thermal standards for water quality management and particularly effluent standards (based on the BTU's discharged for example).

Need R-7: Research to develop procedures for classifying and evaluating coastal wetlands to assist in ranking and selecting wetlands for preservation.

Reason: Wetlands carry out certain functions and have certain characteristics (such as productivity, habitat characteristics, location, etc.) which should be included in a ranking procedure not now available.

Use: This project would form major input to development of a plan to protect, preserve and develop wetlands to accommodate the many pressures for coastal land while maintaining the natural functions to a great enough extent to insure the continuation of desirable species dependent upon wetlands.

Need R-8: Research to develop operationally useful mathematical simulation models for simulating the physical and chemical behavior of the coastal and estuarine waters of Long Island.

Reason: The key words in this need are operationally useful. Models should be useful for predicting how a certain proposed activity would affect the waters. Such models would provide a resource management and planning capability to the council and the Regional Planning Board for superior to anything available at this time and would provide a substantial advance in the resolution of many coastal resource problems.

Because of the cost associated with the development of such a model for a single area a substantial amount of effort should go into the development of generalized models with wider applicability.

Use: A simulation model should be available to predict estuarine circulation, salinity and flushing based upon inflow, physiographic characteristics, tides, etc. and also to predict the transport and diffusion of pollutants, and their concentration in time and space.

- In water quality management such models will provide a mechanism for determining the locations of outfalls and degree of treatment necessary to meet standards. They could also be useful in predicting the effects of thermal additions. Also, coupled with a monitoring program, such models could help to isolate trouble spots where standards are not being met.
- In dredging evaluations such models could provide an invaluable capability to predict how the physiographic changes would affect circulation, flushing, salinity and other quality parameters. (This will require the development of 3 dimensional models to be really effective).

4.0 SUMMARY OF HIGH PRIORITY NEEDS

In the preceding section the set of needs were described and their applicability to some of the problems was discussed. In summary these are:

- D-1 Baseline physical data and synoptic monitoring
- D-2 Baseline water quality data and synoptic monitoring
- D-3 Inventory of wetlands
- R-4 Evaluation and refinement of water quality standards
- R-5 Effects of waste disposal practices on the south shore ecology
- R-6 The heat carrying capacity of Long Island Sound
- R-7 The value of coastal wetlands
- R-8 The development of operational mathematical simulation models

At this point the reader is reminded that there are other data and knowledge requirements, but either they are available in a satisfactory form (and will be discussed in a state-of-the-art report) or their availability has not been assessed at this time.

The needs which have been identified focus upon the questions which will improve our ability to manage. Needless to say, the eight items described are no simple task to accomplish. For example, an extensive data collection and the development of synoptic monitoring systems to meet needs D-1 and D-2 require a knowledge and understanding of the physical, chemical and biological processes, development of monitoring instruments and data systems, and an analysis to depict the optimal deployment of instruments both for gathering baseline data and for long term monitoring.

As another example, R-8 infers a long term and costly research program. But engineering models are available now.

They should be used as available while improved models are developed. It is likely that the management use of such models will go through an evolutionary process of refinement as better models are developed.

In any event, the eight items listed coincide closely with national recommendations [7] [8] and are, in our judgement, of sufficient importance that they should be given consideration both by researchers on Long Island (and others in the case of R-4, R-7 and R-8) and by funding agencies as well.

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