

adaptive implementation approaches be adopted instead of viewing the CCMP as a static blueprint for an estuary's protection.

The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself.

George Bernard Shaw

INTRODUCTION

The National Estuary Program (NEP) emerged in part from the United States Environmental Protection Agency's (EPA's) participation and administration of the Great Lakes Program (GLP) and the Chesapeake Bay Program (CBP). The EPA's experiences with both of these programs illustrate the advantages of regional, co-operative approaches to the management of ecosystems. Because of the characteristics of ecosystems, governance institutions are required that are flexible and have the capacity to adapt and learn. This paper argues that the NEP is a promising approach to designing effective management systems for estuarine ecosystem problems.

This paper explores the development of the EPA's use of regional approaches to managing estuarine environments by examining both the GLP and the CBP. These two regional programs were the EPA's first experiments with ecosystem-based approaches to managing water quality and associated environmental problems. The innovations in ecosystem management that continue to be developed in the Great Lakes and Chesapeake Bay have been diffused and incorporated within the design of the National Estuary Program, as it too evolves.

The National Estuary Program (NEP) uses a Management Conference composed of different committees of affected resource users, the scientific community, the general public, and appropriate implementing authorities as the public choice mechanism for identifying both the environmental problems and the management actions necessary to manage the ecosystem.

The activities of the Management Conference ultimately lead to the preparation and implementation of a Comprehensive Conservation and Management Plan (CCMP) for an estuary. Given the requirements ecosystems impose upon the design of estuary management institutions, the NEP's use of the Management Conference is examined to determine if it is an appropriate mechanism to address the diverse range of environmental problems that typically affect estuaries. The implemen-

tation of the CCMPs at both the federal and state levels will become a major concern in the coming years as estuary programs begin to complete their management plans. Accordingly, this paper explores the feasibility of using adaptive implementation as the preferred approach. It also examines state 'ecological capacity' as a potential constraint on implementation of the CCMP.

ESTUARIES

Estuaries are coastal water bodies containing sea water diluted by fresh water from fluvial sources. They are among the most productive and complex types of ecosystems. Due to physical, chemical and biological characteristics, estuaries serve as an excellent environment for the growth of many plants and animals.¹ Besides serving as excellent wildlife habitats, estuarine regions are home to millions of people. Human interaction with the estuary and its associated watershed have had both direct and indirect impacts on these ecosystems. These impacts come from a wide array of human activities such as fishing, commercial shipping, recreational activities, waste disposal, industrial pollution, and coastal development. Accordingly, estuaries in the United States, particularly those adjacent to centers of urban concentration, have long been subjected to a great deal of environmental stress.

Because estuaries also serve as the drainage basins for vast areas of land situated around the estuary, they are particularly vulnerable to the cumulative impact of human activities. Therefore, it is important to have an effective mechanism for managing these human-induced perturbations to estuarine ecosystems. The challenge is to design a governance institution capable of managing a wide array of human activities on a very complex ecologic system. If these estuarine ecosystems are to be considered as a part of the human environment, and they are to be managed in order to attain recognized objectives, then an understanding of the dynamics of the ecosystem is essential in order to design these institutions and management systems.²

THE CHALLENGE OF MANAGING MARINE ECOSYSTEMS

Ecosystems represent the pattern of relationships between living and nonliving things within a prescribed boundary of space. Marine ecosystems are in a constant state of flux. They are open systems with

both the input and output of energy and materials. Marine ecosystems are also highly complex and subjected to an immense number of internal and external inter-relationships. As a consequence, the parameters which describe the internal behavior of the ecosystem are subject to change over time. It is clear that the dynamics of marine ecosystems make them highly important but very difficult to study and manage.²

The distinctive characteristics of each marine ecosystem present unique problems for the design and management of governance institutions.³ Some interrelated characteristics of marine ecosystems that have been identified are non-reducibility, interdependence, holism, complexity, diversity, and variability.^{3,4} These ecosystem characteristics create conditions of extreme uncertainty.⁵⁻⁸ It is this uncertainty which complicates the design of an effective governance system for estuaries.

It follows from these characteristics that a governance system for estuaries must recognize the holistic nature of marine ecosystems. This involves addressing the problem that 'everything is connected to everything else.'⁹ However, it is impractical to manage all of the impacts upon the ecosystem, especially when the relationships within the ecosystem are poorly understood. It should also be recognized that holistic, multimedia environmental management plans are often very difficult to implement.¹⁰ As Lindblom observes 'because everything is interconnected, the whole of the environmental problem is beyond our capacity to control in one unified policy.'¹¹ Therefore, it is incumbent to find critical points of intervention and focus management efforts on these points.

The interdependence of human uses and impacts on an ecosystem is perhaps the characteristic which most complicates the design and management of governance institutions. This problem is most pronounced in fisheries management and pollution control. In fisheries, the common property nature of the resource creates powerful incentives for individuals to overfish. The overall impact of large numbers of these individual decisions has the potential to destroy the resource and contributes to 'the tragedy of the commons.'^{12,13}

The problems in pollution control are related to the fact that estuaries have long been used as public 'sinks' into which pollution is deposited. This creates conditions which are 'public bads' where all who use the estuary are exposed to these negative effects, even though they may wish to avoid them. Unfortunately, there are weak incentives for polluters to bear the costs of clean-ups. Under these conditions, free-ridership may prevail and the environment and its users are the losers.¹⁴

The nature of the ecosystem and the incentive systems associated with human usage of these resources, presents a dual challenge to the design and management of ecosystems. These governance systems must not only manage individual human uses of the ecosystem, but must account for the interrelationships that exist between human uses.

DESIGNING A GOVERNANCE SYSTEM FOR MARINE ECOSYSTEMS

Ecosystem management requires governance institutions which are adaptive to their task environment in much the same way that ecosystems adapt to changes in the environment. (For treatments of complexity in social choices, see Ref. 15.) It is essential to recognize the natural and physical demarcations of the ecosystem and 'fit' the management system accordingly.¹⁶ The interdependence of marine ecosystems makes the definition of boundaries for particular subsystems difficult but necessary for management purposes.¹⁷ A useful determining criterion is that, in addition to the physical linkages in the ecosystem, the boundaries of the management system should allow for the containment of strong common regional identities or conflicts and recognize appropriate social, economic, political, and institutional interests that are, more or less, coincidental with the boundaries of the basin itself.¹⁸ Typically, the watershed is the functional unit when managing estuarine environments.¹⁹

One effective approach to decision making for estuarine environments is an interactive learning process which combines appropriate scientists, political actors, and the public in a framework to make decisions that govern the management of resources. Opening up the decision-making process to various groups encourages views from diverse constituencies thereby broadening the parameters of policy debate. It also helps to incorporate non-economic values into the decision-making process and provides a framework in which to incorporate and utilize the best available scientific and technical information. This type of decision-making process has two important implications for institutional learning. First, if the parties concede that mistakes have been made in the past, they may make better decisions the next time. Second, they may learn extensively from perceived successes.²⁰

The use of an iterative and interactive decision-making process helps governance institutions arrive at decisions that are politically feasible and accessible to adaptive implementation approaches.²⁰ Evidence from the implementation literature underscores the importance of using an adaptive approach in policy settings characterized by complexity and uncertainty. For example, Berman²¹ argues that adaptive implementation is the 'establishment of a process that allows policy to be modified, specified, and revised—in a word adapted according to the unfolding interaction of the policy with its institutional setting.' Berman has also identified several characteristics of adaptive implementation: (1) active participation by relevant actors; (2) adjustment of policy to the constraints of the policy situation; (3) policy deliverers learn by doing rather than mechanically following a 'how to' procedure; (4) implementation is used as a means to clarify policy.²¹ The learning feature of implementation is also stressed by Browne and Wildavsky.²² They argue that an adaptive approach to implementation is exploratory and evolutionary. For them, as for Berman and others, policy evolves during implementation via mutual adaptation which uncovers weaknesses in policy design and execution. (For other treatments of implementation that support an adaptive approach, see Refs 22–33.)

In sum, a flexible social choice mechanism should exist that is capable of incorporating new information in order to respond to changing conditions and have the ability to establish new forms of co-ordination both across and within public choice units in order to cope with both persistent and emergent problems.³ In short, the system should have a capacity to learn.^{34,35} Any institutional structure resistant to change clearly does not meet these criteria and is inappropriate for managing dynamic ecosystems.

The next two sections on the Great Lakes Program and the Chesapeake Bay Program briefly examine the evolution of the EPA's approach to managing estuarine systems in the United States and the lessons that have been learned from these experiences. The concluding section of this paper assesses the National Estuary Program's (NEP's) suitability for managing ecosystems. Specifically, the flexibility of the NEP's management process is explored as well as the degree to which it has an identifiable learning capacity. It also briefly examines the degree to which the NEP utilizes an interactive and iterative management process and explores the feasibility of adaptive implementation as the preferred approach. Finally, this paper explores the limitations that a state's 'ecological capacity' may place upon implementation of an estuarine governance system.

EXPERIMENTS IN ESTUARY GOVERNANCE: PRECURSORS TO THE NEP

It has long been recognized that 'the problems in our estuaries are too big and too complex for any one agency, community, or interest group to address alone.'³⁶ In order to deal with the unique problems that are associated with estuaries, the US Congress has enacted various programs to foster estuary governance and manage coastal environmental quality. These actions have occurred over time, with each subsequent enactment building upon the experiences of the prior programs.

In a very real sense, estuary governance in the United States has been an experimental process. The approach taken by the EPA continues to evolve in response to: past experiences; new scientific advances in understanding ecosystems; the emergence of new technological approaches; changing sociocultural concerns; emerging political and economic concerns; and changing resource management approaches and institutions. The National Estuary Program (NEP) is the product of a long history of coastal environmental quality initiatives at both the federal and state levels.³⁷ However, the two most important precursors to the development of the NEP's approach to managing estuarine systems are the Great Lakes Program (GLP) and the Chesapeake Bay Program (CBP).³⁸

THE GREAT LAKES PROGRAM

The Great Lakes Program began around 1970. It has been a cooperative effort between the United States and Canada which addresses the environmental problems affecting the Great Lakes ecosystem. The GLP is a true inter-jurisdictional effort which encompasses the entire watershed of the Great Lakes. The jurisdictions effected by the program include eight State jurisdictions and two Canadian Provinces.

The United States and Canada base their respective management programs on a series of international agreements, the Great Lakes Water Quality Agreements (GLWQAs), the first of which was signed in 1972.³⁹ Based upon these agreements, the US and Canada set up programs to manage and protect the Great Lakes. The International Joint Commission plays an important role in guiding the efforts of these countries and monitoring the progress of implementation. (For information on the activities of the IJC, see Refs 40–42.)

The US portion of the program is administered by the Great Lakes National Program Office (GLNPO), which is a separate and distinct

office within the Environmental Protection Agency (EPA) and has operated on a series of 5-year plans.^{43,44} These work plans guide implementation efforts. As progress has been made, the program has moved on to deal with increasingly complex issues affecting the integrity of the Great Lakes environment.⁴⁵ Using this incremental approach, the GLP has been able to 'fine tune' its management programs based upon the acquisition of new information and past experience. It also has allowed the management system to respond to emergent environmental problems.

The objectives of the original Great Lakes Water Quality Agreement were general and addressed conventional pollutants. Accordingly, the early years of the program focused primarily on point sources of pollution in order to address the problems of oxygen depletion and eutrophication. As a result, major municipal treatment plants were required to reduce phosphorus in effluents, and phosphate detergents were banned in many of the Great Lake states. These efforts helped reduce nutrients, elevated oxygen levels, and helped restore fisheries in Lake Erie.

The GLWQA agreement was renegotiated in 1978 and added more specific and quantitative objectives including physical, microbiological, and radiological parameters. It also directed attention to managing non-point sources of pollution and controlling the input of persistent toxic substances. Finally, the agreement recognized the interconnections of ecosystem interactions and declared that both the United States and Canada shall manage the Great Lakes as an ecosystem.⁴⁶ The 1987 amendments to the GLWQA further defined the ecosystem management approach taken by the GLP. These amendments added ecosystem objectives for all of the Great Lakes as well as specific objectives to be applied to single chemical and physical parameters. It also required the preparation of remedial action plans for areas of concern and lakewide management plans (IJC, 1989). Thus, the GLP has begun to break the Great Lakes down into smaller and more manageable units for governance purposes. (For more information on the GLP and the GLNPO, see Refs 55-59.)

The GLP has come a long way since the 1972 GLWQA. Some examples of the progress that has been made include: phosphorus loadings from point sources have been reduced by an estimated 80-90% through regulation and financial assistance; all major dischargers as a group are currently meeting the 1 mg/liter phosphorus goal; the GLP is now targeting the control of non-point sources of nutrients; support is being given to efforts to obtain information about sources, fates, and effects of pollutants to support a mass balance approach in

remedial action programs; point source loadings of almost all toxic substances have decreased in recent years; the GLP is working to assess and address contaminated bottom sediments; and evaluations are underway to determine whether additional controls are needed to control point and non-point sources of pollution in order to restore oxygen levels in Lake Erie.⁶⁰

Lessons learned from the GLP

A recent review of the Great Lakes Program identified several lessons that have been learned during the first 20 years of the program's experience.⁶⁰ Perhaps the most important of which is the importance of having clear goals and priorities. Without clearly articulated goals and priorities to drive the decisions and actions of the GLP, its efforts frequently have lacked focus.⁶⁰ This problem is exacerbated in a management system that is highly complex and involves many levels of government.

Another important lesson has been that it is important not to set the program's expectations too high; particularly given the financial resources that have been available. The GLP has realized from its experiences that it cannot do everything. Accordingly, it is very important to set risk-based goals and priorities and let the priorities drive the management decisions and actions.⁶⁰ In addition, because the GLP will never have the authority or the resources to address all of the problems in the Great Lakes, it is important that these resources be flexibly targeted and integrated in a manner that provides the greatest opportunity from the limited availability of resources.⁶⁰

A clear lesson that emerges from the experience of the Great Lakes Program was that pollution controls evolve in an adaptive phased pattern.⁶¹ In other words, pollution control programs build on the successes of past governance attempts (international agreements in this case) while trying to correct the weaknesses and avoid the failures of past regulatory programs. The process involves identifying pollution problems based on impaired uses; linking those impairments to pollutants; isolating the origin of the primary pollutants; developing corrective actions; and implementing those corrective actions.⁶¹

In order to employ this type of approach, it became clear that it was necessary to involve a broad range of scientists, political actors and concerned members of the public in order to assimilate and incorporate this information into management actions. In addition, the substance of the GLWQA demonstrates the evolution of the pollution controls

based upon the experiences of past management actions and new scientific information.

The GLP quickly realized that it was essential to have continuous monitoring of water quality and living resources. Such monitoring is essential so that future trends may be modeled and new scientific information can be assimilated. It also allows for the evaluation of past management actions in order to isolate the progress that has been made and can help identify what additional management strategies may be necessary.⁶¹ Without continuous monitoring, it would be impossible to know if new environmental problems are emerging or whether the ecosystem is responding favorably to management activities.

Finally, the GLP has realized the importance of communicating the successes of the program and the complexities of the environmental problems that remain.⁶² Communicating this progress is essential such that the program participants can learn from their past experiences and retain both enthusiasm and support for the continued implementation of the program and the provisions of the GLWQA.

THE CHESAPEAKE BAY PROGRAM

Another important precursor of the National Estuary Program has been the Chesapeake Bay Program (CBP). The CBP was created by Congress in 1975 to deal with an interstate body of water which failed to be adequately addressed by existing environmental legislation. Congress authorized a US\$25-million 5-year study to begin in fiscal year 1976 which required the Environmental Protection Agency to assess water quality problems in the Bay and make recommendations on ways to improve existing management mechanisms.¹

In 1983, the EPA published several reports which synthesized the results of the research.^{1,62,63} These scientific findings spurred the Chesapeake Bay states to action. The bordering states of Maryland, Virginia, the District of Columbia, Pennsylvania, and the EPA signed the broadly worded 1983 Chesapeake Bay Agreement.^{64,65}

The 1983 Chesapeake Bay Agreement (CBA) committed the states to prepare plans for the improvement and protection of the Bay's water quality and living resources and established the Chesapeake Executive Council. The CBA also provide a clear direction for the individual state actions to follow. Thus, the Chesapeake Bay Program did not make the same mistake that the GLP had made. Instead, the CBP focused its management efforts from the start on specific issues. However, the individual states were left significant flexibility to implement their own

corrective and protective measures and, in a sense, agreed to collectively work towards the improvement of the Bay's water quality.⁶⁵⁻⁷¹ Through a series of committees and subcommittees, the Chesapeake Executive Council monitored the implementation of state management actions.

Through special agreements with the EPA, six additional federal agencies joined the Chesapeake Bay partnership in 1984. In 1985, these four jurisdictions and the seven federal agencies examined their programs and produced a Chesapeake Bay Restoration and Protection Plan,⁷⁰ which cataloged their goals and illustrated the commitments that the signatory parties had made to the Chesapeake Bay effort. This plan, as well as future plans and strategies appended to it, form the basis of the interstate management plan for the Chesapeake Bay.⁷²

In 1987, the Governor of Virginia and the Chairman of the Executive Council called for a review of the 1983 CBA. The resulting 1987 Chesapeake Bay Agreement (CBA) considerably strengthened the substance of the original 1983 document. It contained recommendations for: governance; public access; public information, education and participation; population growth and development; living resources; and water quality. One of the ways these recommendations strengthened those found in the 1983 agreement was through the use of 29 numerical commitments. For example, the 1987 CBA commits the states and the District of Columbia to implement basin-wide strategies to achieve a 40% reduction in the amount of nitrogen and phosphorus entering the main stem of the Chesapeake Bay by the Year 2000 (see also Refs 73-77).

In 1991, the Chesapeake Executive Council began to re-evaluate the nutrient goal. While the final report is not yet complete, the work has brought new information to light. For example, it appears that phosphorus levels have declined by 19% in the Bay. However, it appears that nitrogen inputs have actually increased by about 8% overall with significant increases in the upper portions of the Bay. No clear trend has been detected for dissolved oxygen.⁷⁸

This re-evaluation has also brought to light some new information. Portions of the Chesapeake Bay's drainage basin in New York, West Virginia and Delaware, which were not originally part of the CBP, are now thought to be contributing nutrients at levels higher than thought. Airborne nutrients also are now thought to contribute a large portion of total nitrogen load.⁷⁸ Based on this preliminary research it now appears that when these two sources are factored out, the total level of 'controllable' nutrient inputs subject to the CBA is only about 54% of the total nitrogen and 79% of the total phosphorus input.⁷⁸ Based on

the results of this ongoing research effort, the Chesapeake Executive Council will be in a position to further refine the management strategies to provide for a greater control on these two pollutant inputs.

Lessons learned from the CBP

One of the principal lessons derived from this program was that success depends on a phased process of identifying pollution problems, evaluating alternative solutions, and recommending and implementing cost-effective actions to alleviate these problems.¹⁵ The management process needs to be an adaptive system which addresses increasingly complex issues while progressively integrating existing management and governance mechanisms. The reason for this phased process can be attributed to a limitation in our capacity to deal with complex ecosystem problems. This is especially true in multi-jurisdictional settings. Attacking problems at the simpler levels and then progressing on to tougher, more complex issues, can assure better utilization of problem solving resources. It may also be easier to gain political acceptance by focusing on progressively more complex issues after agreement is achieved at a simple conceptual level.¹⁶

A second important lesson from the Chesapeake Bay experience is the importance of joining federal, state and local officials in a co-operative decision-making process. This has allowed participants to learn from each other's experiences and provide for a high level of flexibility. The framework for the CBP's decision making and this intergovernmental participation has been an elaborate committee structure. The Chesapeake Executive Committee (CEC) is the high level policy committee which endorses major policy initiatives, while the Principals' Staff Committee reviews Chesapeake Bay issues and advises the CEC members on policy issues. The most important committee with respect to day-to-day operations is the Implementation Committee. This essentially is a management committee which coordinates the activities of federal and state agencies by monitoring the work of the CBP's subcommittees (e.g. non-point source, living resources, public access, growth and development, and public information and education).¹⁷

While the authority for regulatory and financial decisions remains in the hands of state legislatures, the CBP plays an important role in shaping Bay policy. Millions of dollars in federal and state funds are spent each year on Chesapeake Bay restoration and protection programs; most of which follows the policy lead set by CBP officials on the Chesapeake Executive Committee.¹⁸ This would not be possible if these

officials were not committed to implementing the provisions of the CBA. The CBP rejected a top-down command and control approach to implementation. Instead, the CBP has utilized an adaptive approach to implementing the provisions of the CBA. This approach has given states the flexibility necessary to implement the diverse array of the CBP's management actions within the existing state governmental systems. It has also allowed the states the flexibility to work new environmental initiatives into the CBP framework while utilizing a co-operative approach to solving the Chesapeake Bay's environmental problems which recognizes and works within a given state's political and financial limitations.

Another lesson that has been learned from the CBP is the importance of a sound monitoring program. With a solid monitoring program, managers and legislatures are able to determine whether the prescribed actions have been successful. A monitoring program therefore allows for the evaluation of implementation mechanisms and programs.¹⁹ Without this type of scientific information, it would be impossible to perform the type of re-evaluation work that is presently being done for the nutrient objectives. Accordingly, monitoring information identifies successes that have been achieved, directs future management actions, and helps evaluate the ecosystems response to present management approaches.

THE NATIONAL ESTUARY PROGRAM

Despite the tremendous investment in water pollution control programs pursuant to the 1972 Federal Water Pollution Control Act Amendments and the development of state coastal management programs under the 1972 Coastal Zone Management Act, estuaries have continued to degrade in the United States.²⁰ The experiences of the CBP and GLP supported the use of co-operative regional approaches to managing ecosystems and provided a useful model upon which to base a national program to protect and manage estuaries of national significance. Accordingly, many of the lessons of the Chesapeake Bay Program and the Great Lakes Program have become incorporated into the design of the National Estuary Program (NEP).

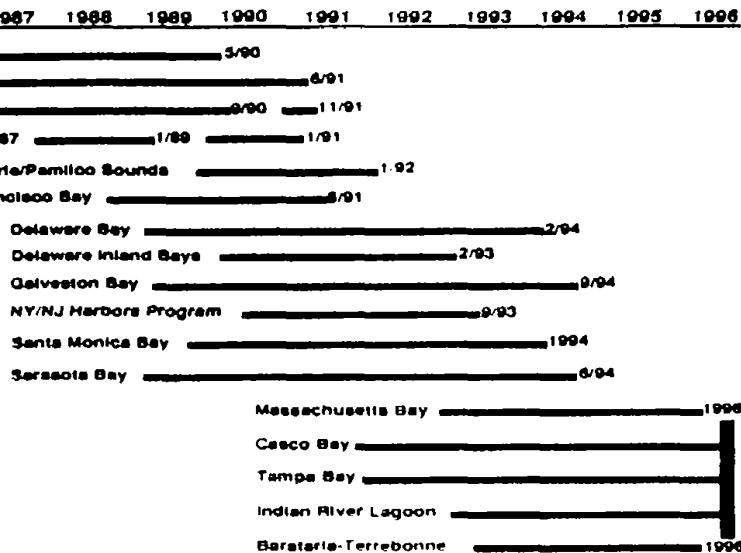
In 1985, Congress appropriated US\$4 million to study four estuaries, and two more estuaries received funding in 1986. This expanded the EPA's use of regional management strategies to protect coastal environments. The 1987 Water Quality Act (WQA) formally established the National Estuary Program and added six additional estuaries.

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NEP a truly national program with clear legislative It also established a formal mechanism for program : governors nomination.⁴² Using the governors nomina- ve more estuary programs entered the NEP in April of tion, up to three more estuaries are scheduled to enter Fiscal Year 1993 (Federal Register, 1992:6178). This each to adding estuaries to the program allows new earn and benefit from the experiences of the earlier ms.

ently are 17 estuaries in the NEP encompassing 14 state Fig. 1). These programs encompass a diverse set of systems including both heavily urbanized and rural water- tion, several of the watersheds span state boundaries and complex jurisdictional structure. However, while the ary programs may differ significantly with respect to racteristics, size, jurisdictional complexity, and causes of , they share many of the problems common to all of the ies.

administered by the Environmental Protection Agency



imate beginning of the 17 estuary programs and the scheduled dates for CCMP completion.

(EPA) through the Office of Wetlands, Oceans, and Watersheds (OWOW). However, the regional EPA offices have the lead role in supervising individual programs. The EPA is required to identify nationally significant estuaries which may be threatened due to pollution, development, or overuse and assist in the preparation of a Comprehensive Conservation and Management Plan (CCMP) using a Management Conference. The CCMP is to ensure and enhance the ecologic integrity of the estuarine ecosystem.⁶¹

The NEP is a voluntary program which offers the incentive of federal planning funds to elicit participation in the program. This funding lasts for the 5-year duration of the management process. Unlike the Coastal Zone Management Program, the NEP offers virtually no implementation funding. The program is designed to provide states with the technical and financial assistance necessary to identify an estuary's problems and to develop management actions using a standard but phased management approach which permits considerable local variation in problem selection, managerial design, and relies on state and local implementation funding.

The management strategy of the NEP

The 1987 Water Quality Act defines the NEP's primary goals to be the protection and improvement of water quality and the enhancement of living resources (33 USCS §1330 (a)(2)(A)). To meet these goals, the NEP utilizes a Management Conference to oversee estuary program activities leading to the completion and implementation of a Comprehensive Conservation and Management Plan (CCMP). Each CCMP should address three management areas: water and sediment quality management; living resources management; and land use and water resources management.⁶²

The management strategy of the National Estuary Program incorporates federal, state and local governments, the scientific community, and concerned members of the general public in an interactive and collaborative decision-making system called the Management Conference. The Management Conference stimulates the transfer of scientific, technical and management experience and knowledge among the estuary program participants. It also helps to enhance the general public's and the decision maker's awareness of the environmental problems affecting the estuarine ecosystem and serves as the means to discuss and propose solutions to these problems.⁶² Thus, the Management Conference is intended to be both interactive and collaborative, and is focused on building partnerships among the estuary program

participants. These partnerships are important in order to obtain the necessary commitments that are required for the effective implementation of a Comprehensive Conservation and Management Plan (CCMP).⁷⁹

The structure of the NEP: the Management Conference

The primary decision-making unit in an estuary program is the Management Conference. Each Management Conference is designed to work within the existing governmental framework and involves interaction and collaboration among estuary program participants. According to the 1987 WQA, the Management Conference structure must include representatives of the appropriate federal, state and regional agencies as well as local government officials and affected industries, public and private educational institutions, and the general public. Essentially, the members of the Management Conference represent all appropriate public and governmental actors in the coastal environmental management process.

It is essential to realize that this management structure is not put together for the sake of creating a structure; it is put together to create an audience for program findings and recommendations, and to take action.⁸⁰ In short, the Management Conference uses an iterative and interactive decision-making process that attempts to balance conflicting needs and uses while focusing on the environmental goals of maintenance and restoration of an estuary's ecologic integrity.

The EPA provides for flexibility in the construction of a Management Conference's structure because each estuary program differs with respect to its size, diversity of concerns, and jurisdictional complexity.⁸¹ This flexibility allows both the structure and management strategy to be modified in response to successes, failures, and political realities.

The Management Conference is typically headed by a high level Policy or Executive Committee. The members of this committee are the EPA representative(s), the Governor(s), and top agency officials. They are the ultimate signatories of the CCMPs. Basically, it is this high level policy committee which directs the activities of the Management Conference. Accordingly, this committee must try and balance the concerns of the Management Conference constituencies with the realities of time and fiscal constraints.⁸² It is important that this Policy Committee actively involves the relevant state agency officials, most notably the state's coastal zone management officials, early in the management process. Two of the first six estuary programs, the San Francisco Bay/Delta Estuary Program and the Narragansett Bay

Project, experienced problems due to the absence of these officials from the Policy committee early in the management process. Early involvement of the state coastal zone management officials is important if the efforts of these programs are to be mutually supportive.

While the Policy Committee oversees the Management Conference activities, it is the Management Committee which is the focal point of consensus building in an estuary program.⁸³ The members of the Management Committee represent state water quality and natural resource management agencies, members of the regulatory community, and others representing community and environmental interests. Some of the typical responsibilities of the Management Committee include: the development of the 5-year Management Conference Agreement; the identification and definition of environmental problems in the estuary; the production of estuary characterization reports; and the development of management strategies in the CCMP.⁸⁴ These activities are typically supported by an estuary program staff.

The Management Committee also supports and monitors activities of the other standing committees or work groups. The rest of the committee structure is determined by the individual programs and reflects local jurisdictional conditions and attitudes. Typically, the estuary programs will have standing committees such as a: science and technical advisory committee (STAC); citizens' advisory committee (CAC); local government committee (LGC); and a financial planning committee (FPC). These committees may remain standing throughout the 5-year process or they may be utilized during certain phases of the management process.⁸⁵ Thus, each estuary program has a distinct committee structure designed to facilitate activities necessary to produce a CCMP.

The NEP management process

The basic management process of the NEP consists of a series of federally mandated planning steps to promote basin-wide planning to control pollution and manage living resources.⁸⁶ The primary objective of this strategy is the identification of priority problems. Accordingly, each NEP is expected to fund both basic and applied research directed at linking causes to priority problems. The Management Conference then establishes program goals and objectives, and determines desirable and allowable uses for the estuary.⁸⁷ It is important to note that the NEP is not simply a sophisticated planning exercise but requires specific financial, institutional, and political commitments that address priority problems.⁸⁸

After creating the Management Conference structure, the first step in the management process is a 5-year State-EPA Management Conference Agreement. This Agreement is the product of negotiation among the EPA and the Management Conference state(s). It identifies program activities, work products, and sets major program milestones and work schedules for completing the CCMP.

Subsequent steps in the management process are directed towards meeting the seven statutory purposes of a Management Conference. These seven purposes are to:

- assess trends in water quality, natural resources, and uses of the estuary;
- collect, characterize, and assess data on toxins, nutrients, and natural resources within the estuarine zone in order to identify the causes of environmental problems;
- develop the relationship between the point and non-point loadings of pollutants to the estuarine zone and the potential uses of the zone, water quality, and natural resources;
- develop a CCMP that includes recommendations for priority corrective actions and compliance schedules addressing sources of pollution and restoration of the biological, chemical and physical integrity of the estuarine zone;
- develop plans for the co-ordinated implementation of the CCMP by states as well as the federal and local agencies participating in the conference;
- monitor the effectiveness of actions taken pursuant to the plan; and
- review Federal financial assistance programs and federal development programs for consistency with the CCMP (33 USCS §1330(b)).

To satisfy these seven purposes, the NEP employs a management process that is highly structured and synoptic. At the same time, the Management Conference encourages, and indeed requires, participation by diverse and varied constituencies at state and local levels. The Management Conference is expected to employ whatever forms of information gathering, public education, negotiation, and public participation are needed to develop consensus on management actions and ensure plan implementation.

The legislation requires the different estuary programs to follow a similar managerial process while allowing them to emphasize and address different issues. Even when the issues appear to be similar across programs, they are not always the same in terms of local

importance, scope and complexity. The varying degrees of attention that an issue receives by different programs is the direct result of differing public perceptions, causes, and jurisdictional complexity. This flexibility in issue selection allows estuary programs to avoid issues that are beyond the scope of a state's capacity to implement. If estuary programs are to develop CCMPs that have a strong state commitment for implementation, they must recognize appropriate political, economic and social constraints.

While the substance of individual CCMPs will differ significantly in response to this flexibility in issue selection, each estuary program essentially follows the same management process: (1) problem identification; (2) problem characterization; (3) development of CCMP; and (4) CCMP implementation.^{61,85}

The first phase of the management process creates the Management Conference structure of the estuary program and identifies the problems to be addressed in the CCMP. The identification and continual re-evaluation of the estuary's environmental problems is one of the primary focuses of the NEP. As an estuary program evolves, the range of environmental problems and associated management actions can be administered in light of information from ongoing research and changes in political, social, economic and environmental conditions. In some cases, the environmental problems that are identified have known causes and easily identifiable management actions. In these cases, programs have implemented 'action now agendas' and demonstration projects. These are priority actions that can be achieved early in the Management Conference process without significant scientific inquiry. The implementation of these 'action now agendas' and demonstration projects allows management approaches to be tested and helps to generate support for estuary program activities.

Once the priority environmental problems have been identified, the estuary program can then focus its efforts on the characterization phase of the decision-making process. Frequently, the product of this phase of the management process is a status and trends report which identifies probable causes of the identified environmental concerns and documents the relationships between pollution loads and potential uses. At this stage, applied science and basic research are directed towards linking specific causes to environmental problems. Because the NEP only provides modest funding for scientific studies, it is important that the programs use these resources to synthesize the existing base of scientific knowledge and to supplement areas of limited information with basic and applied research.

The third phase of the management process is the production of the

Comprehensive Conservation and Management Plan (CCMP). The CCMP contains action plans to address the problems identified in the status and trends report. It is intended to address the critical problems and outline corrective actions to attain/maintain uses of the resource that are threatened due to human interactions with the environment. It also contains an implementation plan, federal consistency review, and a monitoring program to track the effectiveness of implementation activities.

To provide technical assistance and help estuary programs develop their CCMPs, the EPA funds demonstration projects. Action plan demonstration projects test, on a small scale, the effectiveness of strategies and technologies that may become part of the CCMP. Projects must relate to problems identified as priorities and contribute significantly to the development of a CCMP. These projects provide additional assistance to individual programs as well as provide a pool of experience that other estuary projects can utilize.⁶⁰⁻⁶⁸

Thus far, the estuary programs have had a great deal of flexibility in the design of their Management Conference structure and in the process employed to complete each of the first three phases of the planning process. This has created subtle differences in the management process across the programs. Some estuary programs, such as the Narragansett Bay Project, have focused heavily on scientific research. In some cases, the CCMP has been prepared in several stages. For example, in the Puget Sound Estuary Program, the final CCMP approved by the EPA in 1991 built upon earlier management plans approved by the Puget Sound Water Quality Authority in 1987 and 1989.⁶⁹ The Massachusetts Bay Program (MBP), by way of contrast, drafted a CCMP in its first program year in order to limit the scope of issues that the program will address and orient public officials at state and local levels with respect to the substance and institutional requirements of the final plan.⁷⁰

The flexibility in issue selection has also led to substantial differences in the content of CCMPs. The focus of the Long Island Sound Study (LISS) has primarily been on managing to improve low oxygen levels, hypoxia, in Long Island Sound. While a limited range of issues has been addressed, the management activities addressing this one issue are extensive.⁷¹ The Puget Sound Estuary Program (PSEP) and the Narragansett Bay Project (NBP) by contrast have chosen to address numerous environmental problems primarily at the state level. At the other end of the spectrum are the activities of the Buzzards Bay Project (BBP) which utilizes broad policy statements but emphasizes improving existing authorities and local government implementation.⁷² In many

ways, the BBP is similar to a special area management plan. If the first four estuary programs are any indication of the diversity that can be expected in CCMP content, it is reasonable to expect each of these plans to be unique and have individualized requirements for implementation.

Implementing CCMPs at the federal level

Despite program requirements for the preparation of implementation plans and financing strategies, serious questions remain regarding the implementability of these CCMPs. The legislation contains no promise of significant implementation funding and removes a large portion of the implementation responsibility from the federal government and places it directly with state governments. This is quite a different approach from other coastal programs such as the Coastal Zone Management Program which typically promised significant implementation funding for approved programs. At this point in time, it does not appear that any of the first four estuary programs will be able to fully implement the provisions of their CCMPs without significant federal funding. Accordingly, this element of the NEP's program structure is open to significant discussion and will surely be addressed in some fashion by the 1992 reauthorization of the Clean Water Act.

Moreover, many of the issues identified by the CCMP's are far broader than the EPA's water quality protection responsibilities and involve issues of fisheries and coastal zone management; both of which are under National Oceanographic and Atmospheric Administration (NOAA) jurisdiction. A necessary condition for implementation at the federal level would appear to be the creation of a mechanism between the EPA and NOAA for managing estuarine ecosystems in a well informed, well financed manner.

First steps in this direction were taken when the EPA and NOAA (1988) signed a memorandum of understanding (MOU) in 1988 that addressed the question of a CCMP's implementation. According to this MOU, elements of each CCMP which contain enforceable policies are to be submitted to states for incorporation into their approved Coastal Zone Management Programs and NOAA will continue to provide scientific and technical support in the implementation of approved CCMPs. This would make these elements of a CCMP subject to the CZMA's federal consistency provisions and biennial evaluation process.

However, questions regarding the co-ordination between NOAA's Coastal Zone Management Programs (CZMPs) and the EPA's National Estuary Programs (NEPs) remain. Many of these questions will

inevitably be answered as more estuary programs enter the implementation phase. However, the one issue which remains a potential barrier to successful co-ordination between these programs is the absence of consistent federal mandates for coastal zone pollution control.

Unlike NOAA's CZMPs which must balance the demands of both conservation and development, estuary programs are charged with developing Comprehensive Conservation and Management Plans that protect and improve estuary water quality and living resources. The absence of a requirement to balance the needs of conservation with those of development could create problems in the co-ordination of these programs. It could even create a situation where a CCMP contains policies which are inconsistent with the 'enforceable policies' of an approved state CZMP. Thus, in the absence of additional MOUs or changes to the legislative mandates, it is incumbent upon individual estuary programs to work closely with state coastal zone management programs such that the CCMP is not only consistent, but also furthers the objectives of both programs. It is also advantageous to incorporate as much of the CCMP policies as possible into a state CZMP in order to subject those policies to Section 307 federal consistency review.

NESTING THE NEP PROGRAM IN STATE GOVERNANCE SYSTEMS

Without a significant amount of estuary program experience with the implementation of CCMPs, the question of a state's capacity to implement a CCMP remains unanswered. The diversity in the issues addressed and the size and scope of remedial actions could present problems in the implementation of the more ambitious CCMPs at the state and local level. In many cases, the issues addressed by estuary programs are those which the current regulatory system has failed to deal with. Accordingly, institutions and policies may need significant modification at state and local levels.

It is important to realize that the Comprehensive Conservation Management Plans (CCMPs) are not, in and of themselves, state public policy. In order to achieve policy status, the issues in the plans must move from the problem definition stage to the political agendas of state government. Public policy status requires an authoritative choice among the specified alternatives developed in the CCMP and the implementation of that decision.

John Kingdon,²² an authority on the agenda setting process, found the specification of alternatives, authoritative choices among these alternatives, and the implementation of these decisions to be largely

independent of one another, with each developing according to its own dynamics and rules. Kingdon discovered that the chances of issues rising on the decision-agenda (a list of items for actual action) 'is more likely if problems, policy proposals and politics are coupled into a package.'²² Kingdon also found that policy proposals are more likely to become public policy if they meet the following conditions: (1) technical feasibility, (2) fit with dominant values and current public mood, (3) budgetary workability, and (4) political support.²²

Assuming that estuary problems and management actions identified in the CCMPs get on the state agenda, the next challenge for program managers is to design an effective implementation program. Due to the variety of actors and the multi-organizational settings, estuary program managers should not be expected to encounter situations of straightforward policy execution.

The realities of the policy task environment will require estuary program managers to mobilize and co-ordinate the resources controlled by key actors at different levels in order to put the overall program into operation. Such organizational conditions indicate that an adaptive approach to implementation is the preferred alternative. This perspective sees implementers being influenced to accept and co-operate in the program and explicitly recognizes the importance of 'effective bargaining arenas.'²³ As Elmore²⁴ concludes:

Unless the initiators of a policy can galvanize the energy, attention and skills of those affected by it, thereby bringing these resources into a loosely structured bargaining arena, the effects of a policy are unlikely to be anything but weak and diffuse. Once bargaining is recognized as a key element of implementation . . . sufficient flexibility must exist in the outlines of a policy to allow the local bargaining process to work.²⁶

Moreover, there is considerable evidence that the implementation process shapes policy.^{25,26} Given these conditions, it is incumbent upon state policy managers and National Estuary Program participants to design and utilize institutions which have the capacity for learning required to implement management programs for dynamic estuarine ecosystems.

RECOGNIZING STATE 'ECOLOGICAL CAPACITY'

Perhaps the major constraint on the success of individual estuary programs is the 'ecological capacity' of the states themselves. They

must have the will, imagination, and financial resources to implement the program. If they do not, the program will fail. In addition, managers charged with implementing CCMPs must contend with an already structured social and physical environment which may either hinder or facilitate their efforts.

Scholars concerned with policy implementation have introduced the concept of ecological capacity in order to define the political, economic and social context with respect to state environmental management efforts.⁹⁵ For example, one major study⁹⁶ examined the relationship between ecological capacity and the implementation of the Resource Conservation and Recovery Act of 1976. The study used five sets of variables to operationalize the concept of ecologic capacity which were related to implementation success. These were:

- (1) state wealth (e.g. personal income, per-capita spending, average family income, and percentage poor)
- (2) problem severity (e.g. industrialization and pollution potential)
- (3) political conditions (e.g. inter-party co-operation and professionalization of the state legislature)
- (4) administrative and organizational factors (e.g. bureaucratic consolidation)
- (5) economic factors (e.g. business dominance)

This study found that problem severity and administrative-organizational capabilities exerted significant influence on state implementation of a federal program. Moreover, several other studies have demonstrated a significant relationship between state ecological capacity and implementation success.^{97,98}

The experiences of the first four estuary programs give some indication of the role that state 'ecological capacity' may play in the implementation of CCMPs. The first CCMP to be completed was the 1991 Puget Sound Water Quality Management Plan (PSWQMP).⁹⁹ The plan revises and amends the two previous Puget Sound Water Quality Management Plans (1989 and 1987) and includes 15 new action plans and reorganizes many of the state's environmental management agencies. It has been estimated that annual funding needed to support the plan will exceed US\$54 million by 1994.¹⁰⁰ It is still unclear how successful this plan has been with respect to ensuring the long-term commitments that are necessary to implement the PSWQMP's provisions.

The Buzzards Bay Project (BBP) was the second National Estuary Program to produce a final CCMP. Unlike the Puget Sound Estuary Program's CCMP, it is much more locally oriented. It relies heavily on

voluntary local government implementation of the plan.¹⁰⁰ This has caused concerns. While there has been strong local support of the plan produced, there are significant financial limitations on the local financing of implementation activities; particularly those recommendations relating to combined sewer overflows in New Bedford Harbor. In addition, Massachusetts has had problems with state budget deficits. These budgetary shortfalls have limited the availability of state funding to implement plan provisions. Thus, the Buzzards Bay Project staff and local government officials have expressed concerns regarding the abolishment of its Management Conference and the lack of substantial sources of federal level implementation funding.¹⁰² Both of these actions are considered to be barriers to successful implementation of the Buzzard Bay Project's CCMP.

The next two estuary programs to finish their CCMPs will be the Narragansett Bay Project (NBP) and the Long Island Sound Study (LISS). The Narragansett Bay Project released its draft CCMP in early 1992. It addressed many different sources of pollution to Narragansett Bay and contained over 500 recommendations. In addition, the draft CCMP has cost estimates for the 5-year implementation schedule of over US\$650 million, mostly for combined sewer overflows. Given the current condition of both Rhode Island's and Massachusetts' budgetary problems, it is unlikely that these two states will have the financial capacity to implement many of the Narragansett Bay Project's CCMP without significant federal financial assistance. The Long Island Sound Study's CCMP may be the most challenging of these four to implement. While a draft has not yet been completed, preliminary estimates for the implementation of the CCMP's hypoxia recommendations total approximately US\$6 billion.¹⁰¹ Clearly, successful implementation of the Long Island Sound Study's CCMP will require substantial political and financial commitments at all levels of government.

Given the limitations of state ecological capacity, EPA managers and their state counterparts should take state ecological capacity into account when formulating CCMP policies, negotiating implementation commitments and calculating the probability of an estuary program's success.

SUMMARY AND CONCLUSIONS

Achieving the wise use of America's estuaries requires both understanding these complex, dynamic systems, and creating a governance approach that can effectively focus the diverse interests, authorities,

and institutional capacity of society to protect and restore their productivity and functioning. This is perhaps one of the most demanding challenges in the field of environmental management.

The conditions of tremendous environmental and social uncertainty and change do not support the idea of creating a master plan for estuary repair and maintenance which can be mechanically implemented by impartial government officials. The technical basis for such an approach does not exist and it is naive to expect that the vast economic and organizational resources needed to put a master plan into action will readily emerge without great effort and sacrifice.¹⁰³ Indeed, the political and social struggle to create good estuary governance from a human perspective mirrors the ceaseless cycles of life and death in the marine environment itself.

Out of the experience in water pollution control and environmental management in the 1970s and the 1980s are some promising approaches to creating governance systems that match the complexity and uncertainty that they were created to manage. The Great Lakes Program and the Chesapeake Bay Program are two such approaches. Both of these programs have created decision-making systems that were needed to implement policies and programs to protect these ecologic systems.

These are many lessons that have emerged from the experiences of the Great Lakes Program and the Chesapeake Bay Program. Thus, it is not surprising that the National Estuary Program represents an interesting 'diffusion of innovation' of estuarine management experience. In particular, is the use of management, technical and citizen advisory committees in the CBP which formed the basis of the Management Conference Structure in the NEP. Moreover, the phased approach to adding estuaries also permits the NEP to make improvements in the management process in an incremental fashion which permits the NEP to diffuse innovations among its individual programs. This incremental approach encourages lessons to be learned as the program progresses and allows for diffusion of innovations within the NEP itself.

On the basis of this analysis, it appears that the NEP's structure seems to be flexible enough to stimulate the selection of diverse issues and remedial actions that are required to address environmental concerns appropriate for each estuary. The NEP also allows for the flexible construction of individual state programs such that they can adapt to the local political, economic, and socio-cultural constraints of the task environment. The Management Conference also uses a management process that is both interactive and iterative and involves all relevant political actors.

While it appears that the Management Conference process is appropriate for managing complex estuarine ecosystems, the success of the National Estuary Program remains uncertain. At the federal level, it may be necessary to provide a greater level of financial support for the implementation of the CCMPs that are produced. This could help to offset limited state ecological capacities which present significant barriers to the implementation of these management plans. In addition, as more estuary programs move into the implementation phase, further co-ordination between the NOAA's Coastal Zone Management Program and the EPA's NEP may be necessary. While the initial 1988 MOU has been very useful, it deals with implementation in a limited manner. Accordingly, an update in the MOU to account for issues related to program implementation and integration may be appropriate.

At the individual estuary program level, the future of the NEP is also uncertain. It remains to be seen how successfully the individual CCMPs will be implemented. Because these CCMPs will be substantively different due to the flexibility in individual state approaches, issues selected, and state ecological capacity, it is reasonable to expect a variety of success with CCMP implementation. Accordingly, while the Management Conference process may be an appropriate mechanism for managing complex estuarine systems, it is the proper use of this process that will dictate an estuary program's success.

In order to be successful, estuary programs must involve all of the appropriate political actors. Individual estuary programs must also ensure that consensus among estuary program participants is maintained throughout the management process, particularly during the development of the CCMP. Estuary programs officials are advised to structure estuary program activities in a manner which is both interactive and iterative such that a learning process can develop among Management Conference participants.

Because the NEP allows for significant flexibility in issue selection, it is important for the estuary programs to avoid the temptation of producing complex master plans for the estuary that soon lose sight of the priority environmental problems. Focusing on many different issues or treating all of the issues as if they are of equal importance makes it very easy to lose what should be a focus on the priority environmental problems of the estuary. If there is no focus on priority problems, it becomes much more difficult to focus implementation activities, and solicit political support, especially in times of limited financial resources.

At this point in time, it would be inappropriate to assess the success or failure of any estuary program's approach to implementation.

However, estuary program managers are strongly advised to consider utilizing implementation approaches which are adaptive and have the ability to learn from past experience and new information. Estuary program managers are also strongly advised to recognize and work within the political, financial, and social constraints that pervade a state's ecological capacity in order to ensure that a CCMP is produced that is implementable. Indeed, a major criterion for the success of an individual estuary program may be the degree to which the CCMP is 'fine tuned' over time to incorporate new information about the estuarine ecosystem and make the implementation of the CCMP's goals, strategies and actions more successful.

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85. The management process of the NEP has become more structured with time. The first tier of estuary programs conducted activities in a manner slightly different to the subsequent two tiers of programs. This description of the management process is based upon the process followed by the second and third tier programs.
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89. Anon., Massachusetts Bay Program slates early 'first version' of CCMP. *Coastlines*, 1 (5) (April-May 1991) 2.
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91. Anon., Buzzards Bay CCMP looks to town boards to take cleanup lead. *Coastlines*, 1 (2) (Oct.-Nov. 1990) 10-13.
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100. This is evidenced by such activities as: the creation of the first ever coastal nitrogen protection overlay district between the towns of Plymouth, Wareham, and Bourne;¹⁰⁰ and the voluntary creation of the Buzzards Bay Action Compact which creates a regional organization of local governments to oversee the implementation of the CCMP
101. Anon., Towns vote on regional plan to protect bay. *Bay Watch*, 6 (1) (May 1991).
102. Concerns over sources of federal implementation funding and the benefits of extending the duration of Management Conferences were voiced at a Congressional hearing of the House Subcommittee on Fisheries and the Environment and the Subcommittee on Oceanography in Marion Massachusetts on 20 May 1991. These hearings discussed the provisions of bill H. R. 2029 introduced by Rep. Gerry Studds, and the activities of the Buzzards Bay Program.

