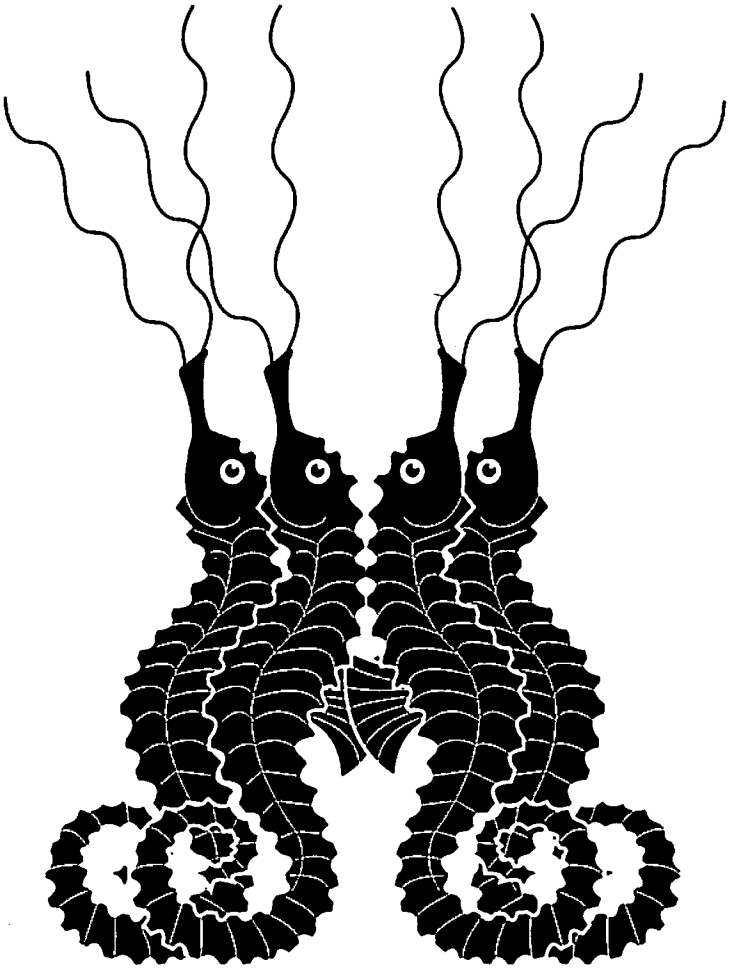
The Coastal Society
Fourteenth International Conference

CONFERENCE PROCEEDINGS

The Coast:
Organizing for the Future



APRIL 17-21, 1994

Sheraton Inn Charleston • Charleston, South Carolina

Proceedings

of the

Fourteenth International Conference

of

The Coastal Society

The Coast:

Organizing for the Future

17-21 April 1994
Sheraton Inn Charleston
Charleston, South Carolina

Thomas E. Bigford, Editor
Forsyth Kineon, Editorial Assistant
Robert Boyles, Editorial Assistant

Published by

The Coastal Society
P.O. Box 2081
Gloucester, MA 01931-2081

TCS 14 Conference Sponsors

National Oceanic and Atmospheric Administration
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Local Arrangements -- Elaine Knight, Rick DeVoe, and Leigh Handal (South Carolina Sea Grant Consortium)

Publicity -- Leigh Handal

Conference Planning Assistance -- entire TCS Board of Directors

Conference Editors -- Thomas E. Bigford (NOAA/National Marine Fisheries Service), Forsyth Kineon (University of Washington, School of Marine Affairs), and Robert Boyles (South Carolina Sea Grant Consortium)

Proceedings Publishers

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Madison, Wisconsin

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Foreward

The Coastal Society convened its 14th international conference in Charleston, South Carolina on April 17-21, 1994, with an emphasis on **"The Coast: Organizing for the Future."** That theme continued the timely debate initiated at TCS 13 in Washington, DC in April 1992. To succeed in this era of reduced resources, TCS and all others must focus attention on creative solutions to the coastal problems of the future.

The Coastal Society is proud to have hosted this conference. We are thankful to the many sponsors and supporting organizations who contributed financial or otherwise assisted Conference Coordinators Dave Smith and Margaret Davidson. Without their help TCS would not have convened such an exciting program. TCS has a 20-year tradition of information exchange. Our success depends on cooperative funding and collegial exchange. From planning through plenaries, this meeting typified the innovative organizational spirit sought by the Society's Board of Directors.

We are especially thankful to the South Carolina Sea Grant Consortium for their generous assistance. Rick DeVoe, Elaine Knight, and Leigh Handal orchestrated events, handled publicity, and assisted on the technical program. We are all indebted.

Finally, I thank the editorial and production team. Forsyth Kineon (University of Washington) and Robert Boyles (South Carolina Sea Grant Consortium) provided able editorial assistance. Bob Hamm and his colleagues at OmniPress in Madison, Wisconsin produced this volume.

Thomas E. Bigford
Proceedings Editor

March 15, 1994

Special Note on These Proceedings

This volume includes papers and abstracts for most of the individual presentations included in the final program. Not included are plenary session manuscripts and summaries of technical session that were presented as panel discussions. You may wish to refer to the final program for a capsule description of those sessions not included in these proceedings.

The manuscripts in these proceedings are presented in alphabetical order. Readers may find reference easier by referring to the final conference program and the Table of Contents for this volume (on the next pages) for sessions, topics, or papers of interest and then searching this volume by the last name of the lead author. To aid your search we have listed page numbers in the Table of Contents.

Thomas E. Bigford, NOAA/National Marine Fisheries Service

Forsyth Kineon, University of Washington, School of Marine Affairs

Robert Boyles, South Carolina Sea Grant Consortium

TABLE OF CONTENTS

The extended abstracts in this volume are presented in alphabetical order. However, the Table of Contents is patterned after the official conference program. Plenary sessions, technical sessions, and the poster session are listed below in the order scheduled in the conference, with a page reference to the author's proceedings contribution, if any. An asterisk indicates that the author did not submit an abstract prior to proceedings publication. Some of those authors prepared an abstract for distribution at the conference. Others participated in a panel discussions that was not amenable to abstracting for these proceedings.

Michael Orbach, School of the Environment,
Duke University

Panelists: Michael Orbach . . . . . *
Pam Pogue . . . . . *
Nina Petrovich . . . . . *

Technical Session -- Summary of Estuarine Research Federation Activities

Organized by: Joy Bartholomew, Estuarine Research Federation

Technical Session -- Partnerships for Coastal Education III: E-Map into the Classroom

Chair: Melva Okun, University of North Carolina

Technical Session -- Partnerships for Coastal Education IV: Satellites, Down-Links, Science and You

Chair: Debra Erickson, Sea World

Technical Session -- Marine Affairs and Policy as a Profession II

Organized by: Michael Orbach, Duke University
Nina Petrovich, Albemarle-Pamlico Estuarine
Study Program

Technical Session -- Coastal Community Partnerships

Chair: Tom Bigford, NOAA/National Marine Fisheries Service

Plenary II - Coastal Oceans Policy Roundtable Discussion on Rethinking Coastal Management

Moderator: Margaret A. Davidson, South Carolina Sea Grant Consortium

Speakers:
- Jeff Benoit . . . . . *
- Beth Milleman . . . . . *
- Marc Hershman . . . . . *

Respondents:
- Dana Beach . . . . . *
- Sarah Chasis . . . . . *
- Wayne Beam . . . . . *
- Robert Knecht . . . . . *

Plenary IIIA - Who Decides the Fate of the Coast?

Moderator: Rich Collins, University of Virginia

Public Regulatory Perspective
- John Humbach . . . . . *

Private Property Rights Perspective
- Roger J. Marzulla . . . . . *

Plenary IIIB -- Who Decides the Fate of the Coast?

Moderator: Rich Collins, University of Virginia

Panelists:
- Mark Permar . . . . . *
- Will Travis . . . . . *
- Fred Smith . . . . . *
- Jerry Schubel . . . . . *
- John Echeverria . . . . . *
- John Humbach . . . . . *
- Roger J. Marzulla . . . . . *

Technical Session -- When Does Regulation Go Too Far?

Moderator: Jack Smith, Nelson, Mullins, Riley and Scarborough

Panelists:
- John Humbach . . . . . *
- Bruce Yandle . . . . . *
- Walter Clark . . . . . *

Technical Session -- Sustainable Development Along the Coast

Chair: Jim London, Clemson University

Panelists:

Technical Session -- Controlling Coastal Nonpoint Pollution: Perspectives on the New Paradigm

Chair: Laurie McGilvary, NOAA/National Ocean Service

Technical Session -- Marine Affairs and Policy as a Profession III

Co-Chairs: Michael Orbach, Duke University
Nina Petrovich, Albemarle-Pamlico Estuarine Study Program

Panelists:

Technical Session -- Organizing for Watersheds

Chair: J. Glenn Eugster, Environmental Protection Agency

Panelists:

Technical Session -- Science and Policy in Coastal National Parks: Organizing for the Future

Chair: Suzette Kimball, DOI/National Parks Service

Technical Session -- Sustainable Sites

Chair: Truitt Rabun, American Society of Landscape Architects

Panelists: John A. Clark . . . . . *
John L. Knott . . . . . *
Truitt Rabun . . . . . *

Technical Session -- The New Property Rights Laws and Environmental Protection

Moderated by: Jack Smith, Nelson, Mullins, Riley and Scarborough

Panelists: Steve Spitz . . . . . *
Nancie Marzulla . . . . . *
John Echeverria . . . . . *

Technical Session -- Building Bridges in Integrated Coastal Ecosystem Management: Forging Public/Private Partners in Watershed Planning

Co-chairs: Pam Pogue, University of Rhode Island and
Leigh Johnson, University of California

Building State and Local Partnerships to Improve Integrated Resources Management within the Hunt/Potowomut Watershed: A Municipal Training Program for Volunteer Board Members and Town Staff
Pam Pogue . . . . . *
Fostering Public/Private Partnerships for Coastal Nonpoint Source Pollution Management: An Education and Interest-Based Approach
Leigh Johnson 145
Coastal Nonpoint Source Program: How to Promote Partnerships for Implementation
Don Weitman . . . . . *
The Boating Industry of CZARA Regulations
William W. Anderson . . . . . *

Technical Session -- Science and Governance in Estuarine Management

Chair: Baruch Boxer, Rutgers University

Institutional Arrangements for Water-Quality Governance in Puget Sound, Washington: A Collective Choice Perspective
Thomas M. Leschine, David Fluharty, and Eric Shott 191

Plenary IV -- The Changing Coast: Facing the Future

Moderator: David E. Smith, University of Virginia

Technical Session -- Marine Advisory Service Programs in Coastal Recreation and Tourism

Panelists:

Technical Session -- Establishing Environmental Values

Panelists:

Technical Session -- Coastal Zone Management: Evaluation and Enhancement

Chair: Lauriston King, Texas A&M University

Technical Session -- Building Partnerships "Conch" Style

Co-chairs: Bud Ehler and Dan Basta, NOAA/National Ocean Service

Panelists:

Technical Session -- Working Together to Conserve Coastal Ecosystems: Beyond Planning and Studies

Chair: Susan Essig, DOI/Fish and Wildlife Service

Technical Session -- International Partnerships II

Chair: Richard Delaney, University of Massachusetts

Technical Session -- Partnerships for Coastal Recreation and Tourism

Chair: Ray Tabata, Hawaii Sea Grant

Technical Session -- National Estuarine Research Reserve... A Look to the Future -

Co-chairs: Francesca Cava, NOAA/National Ocean Service and Maurice Lynch, Virginia Institute of Marine Science

Technical Session -- Understanding Coastal Processes

Chair: Asbury Sallenger, DOI/US Geological Survey

Technical Session -- Coastal Economics and Law

Chair: Rodney Weiher, NOAA

Technical Session -- Translating Scientific Knowledge into Environmental Policy: The Road to More Effective Policy Choices

Chair: Megan Bailiff, Washington Sea Grant Program

THE DETECTION AND PREDICTION OF SEA LEVEL CHANGES ON COASTAL WETLANDS USING SATELLITE IMAGERY AND A GEOGRAPHIC INFORMATION SYSTEM

John D. Althausen, University of South Carolina
John R. Jensen, University of South Carolina

This research summarizes the use of remote sensor data and high resolution digital elevation models (DEMs) to predict the effort of sea level rise on the Fort Moultrie coastal region near Charleston, South Carolina. In situ and remotely sensed data were used to construct and density the DEM. Landsat Thematic Mapper (TM) images obtained on multiply dates were used to inventory Spartina alterniflora and other land cover in the region. It was then possible to determine the effect of tidal stage on remotely sensed classification/change detection products, and to predict the impact of various sea level rise scenarios in the coastal region. This study used several geographic information system (GIS) functions to predict the effects of sea level rise. The research also demonstrates the utility of using remotely sensed data for detecting water level changes, using both visual interpretation and change detection techniques.

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PUBLIC INTEREST IN COASTAL NATURAL HAZARDS MITIGATION: LEGAL FOUNDATIONS FOR THE POLICY WORKING GROUP

Finlay M. Anderson, Oregon State University

Introduction

The potential for coastal earthquakes, tsunamis, and landslides has been emerging as an area of increasing concern for Oregon's coastal zone. Similarly, threats posed by coastal processes and hazards such as beach starvation and shoreline erosion continue to be pressing policy issues as coastal development accelerates the demand for shoreline protection measures. Policy issues needing an increased natural hazards emphasis range from infrastructure development, upland zoning, emergency preparedness and flood insurance. The Coastal Natural Hazards Working Group (PWG) was developed in response to section Coastal Zone Management Act (CZMA) section 309[1] to address these and other land-use policy issues in Oregon's ocean shore. If additional and more restrictive management measures are needed to address existing and potential coastal hazards in Oregon, they must be based on clearly articulated public interests in the coast and its resources. Secondly they must be legally defendable within the framework of the Supreme Court's guidelines concerning regulatory takings and Oregon's own common law regarding shoreline regulation. This paper identifies the public interest in shoreline management and delineates overlapping public and private interests which make may policy recommendations dealing with natural hazards prone to charges of regulatory takings. Recent Oregon Supreme Court decisions which have been handed down since Lucas v South Carolina Coastal Commission[2] are discussed in terms of their impact on coastal planning in Oregon.

Three statewide land use planning goals are used by local governments in Oregon to develop comprehensive planning documents. The State has used its police power to direct the Department of Land Conservation and Development to assist and coordinate development of Local Comprehensive Plans (LCPs)[3] and to develop the planning goals.[4] Goal 7, Natural Hazards, mandates that development not consistent with the potential for natural hazards not be located in those areas without appropriate safeguards.[5] Goal 17, Coastal Shorelands, requires that LCPs be developed around the geologic and hydrologic hazards along the ocean

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[1]CZMA § 309(a); 16 USCA § 1456b(a)

[2]*Lucas v South Carolina Coastal Commission.* 112 S.Ct. 2886. 1992

[3]ORS 197 *et. seq.*

[4]ORS 197.225

[5]OAR 660-15-000

shorelands. Preference is given to land use management practices and nonstructural erosion controls when problems of erosion and flooding arise.[6] Goal 18, Beaches and Dunes, prohibit development on hazardous dune and interdune lands and strictly prohibits the breaching of foredunes.[7]

In 1967, Oregon sought to influence land use decisions, particularly with regards to the beaches and shoreline, with the passing of the 1967 Beach Law[8]. The purpose of the Beach Law was to preserve and maintain the sovereignty of the state over the ocean shore so that the public may have uninterrupted use of the shore.[9] It was neither the intention nor was it the policy of the legislature to reserve rights for the public which did not previously exit. Rather, it was an attempt to clarify long existing ambiguities in the legal jurisdiction over the beaches.[10] A second state law - the Removal/Fill law was established at about the same time to protect Oregon shoreline from removal or filling of material along the shore.[11]

Customary Use Doctrine In Oregon's Shore

Less than two years after the passage of the 1969 Beach Law, the Oregon Supreme Court validated the basic legal premise of the new law in State ex rel Thorton v Hay.[12] The case revolved around a hotel owner building a barricade of pilings and steel cable in front of the Surfsand Motel in Cannon Beach. The Clatsop County Circuit Court had granted an injunction and the Oregon Supreme Court affirmed. The ruling -- that the public has rights in dry sand area contained within legal description of ocean front property and that the state can prevent landowners from enclosing such an area - used a unique approach that greatly strengthened the jurisdiction of the Beach Law.

The Oregon Supreme Court relied on requisites of custom as advanced by the early English legal writer, William Blackstone. The court found that the public had customary rights of access to the beach because their use was 1) ancient; 2) without interruption; 3) peaceable and free from dispute; 4) reasonable; 5) had clear

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[6]OAR 660-15-010

[7]*Ibid*

[8]ORS 390.605-390.770

[9]ORS 390-610(1)

[10]Oregon's Beaches: A Birthright Preserved. Oregon State Parks and Recreation Branch 1977. p 21.

[11]ORS 196.800-196.990

[12]*State ex rel Thorton v Hay* 462 P.2d 671 (1969)

limits and boundaries; 6) obligatory with respect to similarly situated lands in the state and; 7) not repugnant or inconsistent with other customs or laws in the state.

The significance of the courts use of custom is in the scope of lands affected. Strictly construed, prescription applies only to specific tracts at issue before the courts. Thus, the courts may well have been filled with tract-by-tract litigation for years while landowners argued the specifics of their property. The use of custom, according to the court's ruling "can be proven with reference to a larger region. Ocean-front lands from the northern to the southern border of the state ought to be treated uniformly."[13]

Twenty years after Hay the court issued a ruling in McDonald v. Halvorson[14] which suggested that the application of custom as a vehicle for asserting beach rights was not so universal as suggested by the original Hay ruling. The clarification advanced by the court was that custom applied only to lands that were similar to those settled in Hay. Areas potentially excluded from the customary use doctrine may include unique estuarine settings, and even headlands where a history of public use or outright public ownership is not clear.[15] It appears that the burden of proof lies with the landowner for proving that custom would not apply to their lands. The state stands in good position to use the Beach Law and recognized public interest in the ocean shore to show strong leadership in establishing public policy to prevent or plan for coastal natural hazards.

The Takings Issue: Private Property

Rights and Coastal Natural Hazards

While Nollan[16] and Lucas[17] have been received in the planning community with some misgivings, there are several reasons why opinions should not cause the PWG concern. On the contrary, the guidelines which the opinions lay out may be beneficial for the PWG in terms of structuring and expressing its policy options in such a way that will provide the least resistance from private property owners and the courts. Strong adherence to these decisions will be a positive factor in convincing private rights advocates that it is neither the mission nor intention of the PWG to regulate away all private property rights in the shoreline. Custom, as defined in Hay and to a lesser extent in McDonald, and public interest as advanced

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[13] *Ibid* at 676

[14] *MacDonald v. Halvorson* 308 Or. 780, 780 Pd 714 (1989)

[15] *Ibid* at 724

[16] *Nollan v. California Coastal Commission* 483 U.S. 825 (1987)

[17] See note 2, *Supra*

by the Beach Law seem to be have historically focused on "access" and "recreation." Using access and recreation as a paradigm for justifying regulation of natural hazards might be viewed by property rights advocates as lacking such a nexus. The PWG must clearly articulate the manner in which poor upland use impacts the public's ability to use and enjoy the beach in order to avoid running into the limits imposed by Nollan. Examples of such problems -- such as instances where revetments or headwalls limit access to or across a beach, or where poor siting creates a hazard to health and safety of the public on the beach -- should be documented for the public record.

While the emphasis on common law may be restrictive in many eastern seaboard states with strong private property jurisprudence, states such as Oregon which have a common law jurisprudence favoring public rights are not deprived of that tool for shoreline management. The emphasis on nuisance rather than noxious use in determining legitimate exercise of police power to regulate land is germane to the goals and issues which the PWG is addressing. To the extent that the state is limited to focusing on nuisance, the PWG's mission is not at odds with those limitations.

Oregon courts are in an excellent position to be supportive of land-use policies oriented towards natural hazard mitigation, given the strong common law backing for public interest in shoreline management through the Beach Law and custom doctrines. The PWG can make sure it does not conflict with the private property interests by heeding the standards of the Nollan and Lucas decisions and the suggestions of Hildreth[18] and others:

1) Acquiring all or part of a landowner's "bundle of rights" through such mechanisms as conservation easements. This approach could be emphasized in high hazard areas, especially where these areas coincide with intense public use or wildlife needs.

2) Awarding "density bonuses" and transferable development rights to affected property owners.[19]

3) Require bonds be posted to cover removal of facilities that are sited in hazard prone areas or replacement of infrastructure as a result of shoreline migration. It should be kept in mind, however, that because their property is generally more valuable than inland property, these

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[18]Hildreth, R. (1991) "Recent Legal Developments in Coastal Natural Hazards Policy" *in* Good and Riddlington (eds) Coastal Natural Hazards: Science, Engineering, and Public Policy *Oregon Sea Grant* ORESU-B-92-001 pp 121-126

[19]*Ibid*

coastal residents often pay proportionately more of the taxes supporting the services on which they rely.[20]

4) Require the information concerning shifts in shoreline patterns be recorded as part of the public record as a way of providing notice to potential purchasers.

5) Develop a thorough administrative review procedure in the event that natural hazards policies significantly impact the economic value of the property.[21] Such an administrative review infrastructure is already in place in Oregon with the Land Use Board of Appeals. This panel may be an important backstop to maintain equity in the policy process.

6) The PWG should take care to make a solid record of detailed and relevant findings in support of natural hazard policies that may sharply reduce property values. Care should be taken to distinguish health and safety concerns from aesthetic and social values.[22] Recreation and access -- as a justification for reducing property values through natural hazard policies should be approached gingerly -- though Oregon's jurisprudence is likely to be supportive of those arguments.

7) The PWG should, where possible, develop policies that accomplish hazard mitigation while simultaneously benefiting affected land-owners.[23] Density caps and shoreline preservation measures could not be viewed as a takings, if the cost to the landowner in unrealized development is completely or even partially offset by benefits which may accrue to the landowner because of the measure. Reciprocal benefits that offset costs should be inherent in well designed land-use policies.

A year after the Lucas decision, the Oregon Supreme Court issued its first coastal decision which incorporated the new takings guidelines. The court's opinion reconciled Hay and Lucas, leaving Oregon's doctrine of custom and common law property standards untouched in the ocean shore. Stevens v City of Cannon Beach[24] concerned a landowner who wished to put a seawall on two vacant lots as part of an eventual development of these lots for a hotel or motel. The lots, though

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[20] Skelton, H. (1990) "Houses on the Sand: Takings Issues Surrounding Statutory Restrictions On the Use of Oceanfront Property" 18 *Environmental Affairs* 125. at 153

[21] Coastal Law and Planning Panel (1992)"Lucus and its Aftermath", UNC-SG-92-10.

[22] Ibid

[23] See note 21, Skelton, *Supra* at 148

[24] 317 OR 131 (1993), US Supreme Court review sought Dec, 1993

zoned for residential or motel use, were determined to be unsuitable for development because they conflicted with the city's zoning ordinances and because part of the lots included significant portions of dry sand area reserved for the public under both the beach law and the Hay decision. The owners of the lot claimed that the permit denial amounted to a regulatory takings, since they owned their lots prior to the enactment of the Beach Law.

The Oregon Supreme Court affirmed a series of lower court rulings, confirming that Hay merely articulated a public interest which had always been present, rather than creating an new legal principle. Thus, under the states property law doctrine of custom, the proscribed uses in this case weren't part of the plaintiff's title even though they had bought the property before the court had articulated the doctrine of custom in Hay.

Conclusions

The legal foundations for natural hazard mitigation are strong, the public interests are relatively clear and well grounded in common law jurisprudence. Finally, the development and implementation of a comprehensive coastal natural hazards carries many other popular and necessary programs on its shoulders. Additional benefits from such programs include aesthetic and scenic values, habitat and wildlife conservation, water quality and fisheries enhancements, and infrastructure development and planning.

The PWG is in an excellent position to promote innovative hazard mitigation policies which enjoy broad-based support. Oregon's strong common law interests in shoreline conservation and established tools such as the Beach Law and the Removal/Fill Law which formalize customary use theories provide the legal framework for necessary new regulation of coastal lands in the public interest. Careful consideration of the lessons from Nollan and Lucas should enable the PWG and regulatory bodies enacting hazard mitigation policies to avoid conflict between private land-owners and the public interest.

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ADDRESSING COASTAL ISSUES THROUGH EDUCATIONAL COLLABORATIONS AND PARTNERSHIPS

Norman K. Bender, University of Connecticut

Society is facing coastal and marine issues whose solutions can often be addressed through informal educational programs. Issues which can be addressed in this manner include: fisheries resource conservation and management, aquacultural production and development, coastal habitat restoration, estuarine management, monitoring and control of non-indigenous aquatic species, ensuring access to coastal waters and waterfronts, and enhancing the viability of water-dependent coastal and marine resource activities. The current period can be viewed as one requiring increased collaborative efforts and partnerships designed to resolve a wide range of issues including those relating to society's interactions with coastal and marine resources.

Societal Trends

There are a variety of factors influencing the need for greater use of partnerships, collaborations, and collective efforts when influencing coastal resource utilization, conservation and management issues:

1) A combination of the strongest economic downturn since the Great Depression and a slow growth recovery;

2) Increased competition for limited resources;

3) Changing demographics and an increasingly diverse population; and

4) A growth of dissensus.

These create needs for people and organizations to identify common interests, and combine intellectual and financial resources when addressing mutual concerns.

While the United States economy emerged from the latest recession in late 1992 and 1993, the recovery has been much slower than previous post-World War Two economic upturns. Annual growth rates of 1.5% to almost 3.0% (on a quarterly basis) are much lower than those experienced during the initial stages of recovery from earlier recessions. It is possible that the United States, having experienced the deepest recession since the 1930s, will also experience a decade of slow economic growth during the 1990s.

Many northeastern states (New Jersey to Maine) continue to experience recessionary conditions. Connecticut continues in a recession with a net loss of over 200,000 jobs since the recession officially began in February of 1989. State economists forecast continued job losses during 1994.

These difficult economic conditions are creating extremely tight budgets for the public, private and non-profit sectors. Connecticut's "great recession" has resulted in tight state budgets, corporate "downsizing", municipal budget crises, and difficult times for the non-profit sector. The combination of a major recession stemming from the excesses of the 1980s speculative boom, corporate downsizing, and reduced defense expenditures resulting from the end of the Cold War have contributed to Connecticut's weak economy. The state's non-agricultural workforce may not reach its previous peak employment level until the late 1990s.

Difficult economic conditions result in increased competition for available financial resources in all economic sectors (public, private and non-profit). The need to obtain increased shares (or maintain existing levels) of public sector budgets, secure one's position in the marketplace or obtain donations can lead to increased competition among agencies and organizations with missions relating to coastal issues. The Sea Grant Marine Advisory Service Futures Report (Murray et al., 1990) reports "growing social, economic and environmental pressures will increase demands on our coastal resources as the allocation of these resources is sought by a myriad of competing interests."

Changing demographics and an increasingly diverse population creates a need for people to understand other cultures and viewpoints. The U.S. population is becoming grayer as the median age increases. By the year 2000, over 50% of the country's population will be over 40 years old. The large baby boom cohort is reaching middle age and will reach senior citizen status during the first two decades of the next century. The Sea Grant Marine Advisory Program report indicates over 60 per cent of total U.S. population growth since 1980 has been in coastal counties.

As an increasing percentage of the population comes from non-European backgrounds, it will be important for people to understand the diversity of values and outlooks including those pertaining to the conservation, utilization and management of coastal and marine resources. The combination of changes in the population's age patterns and ethnic backgrounds may result in different views toward coastal and marine resources. Educational partnerships and collaborations will be necessary if society is to address coastal and marine issues in ways that consider the perspectives and interests of an increasingly diverse population.

A final factor creating a need for increased forms of cooperation is a trend toward the growth of dissensus in the United States. Dissensus, the antithesis of consensus, reflects differences and clashes over opinions and values (Spear and Mocker, 1989). The information age may contribute to people having less of a common identity than has been the case in recent decades.

Factors Influencing Collaborations and Partnerships

These conditions which can cause competition, different perspectives, and at times conflicts, can also contribute to people deciding that cooperation and partnerships are appropriate methods when addressing coastal and marine issues facing society. It is possible that the consequences of dissensus and competition

will cause increasing numbers of people to consider cooperating with others to address coastal and marine resource issues.

Futurists and social commentators have identified a trend toward increased reliance upon collaboration, partnerships, teamwork and cooperative efforts when developing educational programs. Educational consortia result from a combination of factors including: major societal issues that can not be resolved by a single organization, tight budgets and the need for a variety of approaches.

To put it simply, organizations concerned about coastal and marine issues will consider working together because their individual efforts will not be sufficient to have the desired impacts. Those conditions common to the early 1990s which can lead to competition among organizations may also contribute to some people recognizing that the benefits of cooperation can outweigh those of competition.

Carol L. Anderson (1994) comments that partnerships involve common goals and "individuals contributing their specialization and expertise." She adds that "partnerships are created on strengths and specialties and result in win-win outcomes as complex societal issues are addressed." According to Anderson, "Partnerships are like a dance rather than a fixed relationship and this means there is a beginning and an end."

Barbara Gray (1989) has defined collaboration as "...a process in which those parties with a stake in the problem actively seek mutually determined solutions. They join forces, pool information, knock heads, construct alternative solutions, and forge an agreement." Gray identifies the growing turbulence of our environment (societal) as resulting in new problems and our inability to solve them. These turbulent conditions create needs for greater cooperation among individuals and organizations.

A major opportunity to form educational partnerships and collaborations comes from advancing shared visions that are "intended to advance the collective good of the stakeholders involved" (Gray). Collaboration can also contribute to bringing together expertise that would not normally be addressing a common problem. Individuals and organizations working together can also reduce project costs as well as spread costs among a larger number of stakeholders, resulting in reduced average costs per stakeholder.

Features critical to successful collaborative processes include (Gray):

"1. The stakeholders are interdependent,
2. Solutions emerge by dealing constructively with differences,
3. Joint ownership of decisions is involved,
4. Stakeholders assume collective responsibility for the future direction of the domain, and
5. Collaboration is an emergent process."

According to Gray, the three phases of collaborative efforts and their characteristics are:

Phase 1: Problem Setting

Common definition of problem
Commitment to collaborate
Identify stakeholders
Legitimacy of stakeholders
Convener characteristics
Identification of resources

Phase 2: Direction Setting

Establish ground rules
Agenda setting
Organizing subgroups
Joint information search
Exploring options
Reaching agreement and closing the deal

Phase 3: Implementation

Dealing with constituencies
Building external support
Structuring
Monitoring the agreement and ensuring compliance

Factors which provide positive influences on collaborative efforts include (Gray):

- Inclusion of all affected stakeholders and sufficient stakeholder incentives
- Appropriateness of issues and agreement on scope of collaboration
- Timing of collaborative efforts

In addition to opportunities, there are also obstacles to collaboration which can stall efforts to initiate a collaborative process or prevent successful implementation of a mutually developed project. Obstacles include: individualism which is a common value in the United States, collaboration can be time consuming, institutional values may not place a high regard upon collaborative efforts, and a real or perceived need to compete with other organizations may over-ride benefits from collaboration. Organizations may need to protect (and project) their identity through high levels of visibility and may not be willing to share the spotlight with others.

Coastal Educational Collaborations and Partnerships in Connecticut

A longstanding educational collaboration involves Connecticut's Sea Grant Marine Advisory Program (SGMAP) which has operated as a Sea Grant/Cooperative Extension partnership since 1974. SGMAP serves dual functions as the outreach area of the Connecticut Sea Grant College Program and the marine team of the Connecticut Cooperative Extension System (CES). Whaples describes examples of benefits resulting from this partnership:

1) The CES food and nutrition staff is targeting seafood issues.

2) The Public Policy Specialist and SGMAP Program Leader provide leadership in developing a successful proposal for a Long Island Sound Public Policy Education Project involving Connecticut Public Television.

3) Marine Advisory, land use, water quality and natural resources staff developed a research-based education program designed to educate municipal officials about the impacts of land use decisions on water quality, and

4) Marine Advisory projects have benefitted from University faculty representing a variety of disciplines.

Whaples describes the following problem areas in marine extension collaboration:

"(1) Sharing credit for program success and insuring that both collaborators receive the recognition that they deserve seems to be a problem that periodically appears.

(2) The issues of logos, letterheads, signature blocks and administrative egos sometimes gets in the way of programming.

(3) The Program leader serving as the boundary spanner between the partners can experience frustration and confusion. This is particularly true if either of the collaboration chief administrators are insensitive or lose sight of the importance of delivering programs related to critical issues to the client Groups."

The Long Island Sound Study (LISS) Public Participation and Education Project is definitively the most complex collaborative educational effort currently undertaken by the Connecticut Sea Grant Marine Advisory Program. It involves a collaborative approach which includes Sea Grant Extension staff in Connecticut and New York State, U.S. Environmental Protection Agency staff, a 37- member citizens advisory committee, management and technical committees, two state Environmental Protection Departments, and state and federal legislators. It exhibits a combination of the many strengths and weaknesses of collaborative enterprises

with a number of successful educational projects, some of which are considered models by National Estuary Program officials.

Imperial et al., identify a major characteristic of the National Estuary Program, "...is that it utilizes these partnerships and tools to emphasize action through systematic problem solving." The Public Participation and Education Project works to inform the general public and specific publics about the progress of LISS research conclusions and management directions while also providing opportunities for input to the overall process which theoretically utilizes a consensus building approach.

The Connecticut Zebra Mussel Task Force, formed in 1991, illustrates a new collaborative educational effort which involves 30 representatives of Sea Grant Extension and research, water supply utilities, power utilities, state and federal agencies, consulting firms, lake management agencies and sportfishing groups. Formed in response to the growing threat of Zebra mussel infestation, the task force is leading efforts in the state to train public and private sector personnel in monitoring, treatment and control methodologies, as well as influence public policies. Other educational projects developed by the Connecticut Sea Grant Marine Advisory Program in collaboration with other organizations include:

1. Nonpoint Source Education for Municipal Officials project,

2. Fenger Brook Watershed Management project,

3. Utilizing the Quinnipiac River Watershed as a Field Laboratory to Involve Inner City Youth in Marine Environmental Science Projects, and,

4. On-the-water Workshops for community leaders aboard the Project Oceanology Envirolab educational vessel.

Implications for Marine Collaborative Efforts

A combination of factors moving collaboration and partnerships toward the top of our agenda include: competition for limited resources, and turbulent economic, social and technological conditions.

Collaboration, partnerships and cooperative activities can help to reduce competition, share expertise, and create educational capabilities that are larger than the sum of the individual components.

Whaples indicates that collaborations work best when: the objectives are clear, collaborators have similar objectives, individual egos aren't too big, and collaborators bring different resources to the table that can be effectively combined.

It is possible that those conditions which are causing stress along our coastlines may also create an impetus for society to develop new ways for us to work together to address coastal and marine issues.

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REFOCUSING HOW STATE COASTAL PROGRAMS ARE EVALUATED

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Introduction

Under the federal Coastal Zone Management Act (CZMA), the periodic evaluation of state coastal management programs is a responsibility of the federal Office of Ocean and Coastal Resource Management (OCRM). The authors, along with other members of the Coastal Ocean Policy Roundtable (COPR), spent several months studying ways to improve the federal review of state coastal programs. In July 1993, the COPR submitted its report to OCRM. The COPR report, entitled "Recommended Improvements to the Federal 312 Performance Review of State Coastal Management Programs," covers 10 major issues and recommends actions for OCRM to refocus the federal evaluation process.

The Coastal Ocean Policy Roundtable (COPR), 14 individuals from outside federal government, serves as an informal sounding board on current and emerging coastal and ocean policy issues for the Office of Ocean and Coastal Resource Management (OCRM) in NOAA/DOC. One issue COPR was asked to study is the Section 312 evaluation process mandated by the CZMA.

This abstract, which is based on the COPR report, summarizes current requirements and operation of the Section 312 evaluation process for state coastal management programs. It also contains a series of recommendations for refocusing and improving the federal evaluation process. Recommendations address institutional deficiencies in OCRM; needed changes in CZM laws, policies, scientific information; and institutional mechanisms for establishing status and trends in coastal resources and management results.

Current Requirements and Operation of Federal Evaluation Process

Section 312 of the CZMA requires that OCRM conduct evaluations of state coastal management programs and produce detailed written findings on the extent to which each state has implemented and enforced its federally approved program, addressed the coastal management needs identified in CZMA Section 303 and adhered to the terms of any grant or cooperative agreement. Public meetings must be conducted as part of each evaluation and opportunity provided for oral and written comment by the public. Evaluation reports must be issued following each review of state performance. The findings are used by OCRM to make decisions relevant to a current award or to negotiate future financial assistance awards.

The 1990 CZMA Reauthorization changes the procedures for carrying out evaluations including a 45-day notice for public meetings, written response to all written comments on the evaluation, and completion of the final evaluation report within 120 days after the last public meeting held in the state. It also authorized

new interim sanctions which provide for suspension and/or redirection of any portion of a financial assistance award to a state coastal program if the state is failing to adhere to its approved program, or a portion of the program. Final sanction provisions now require the Secretary to withdraw program approval and financial assistance if the state fails to take the actions specified in the final findings document.

OCRM schedules and conducts an evaluation of each state coastal management program and prepares written findings at least once every three years. Programs are selected according to the date of the last findings or, if there is a continuing problem, upon the recommendation of the Coastal Programs Division. OCRM must formally notify a state of an upcoming site visit approximately 60 days in advance, but sets up information contacts prior to that time to initiate the evaluation process. There are other federal and state public meeting notice requirements.

An OCRM Evaluation Team conducts the program evaluation. The team consists of a program analyst from the Policy Coordination Division (PCD) who serves as the team leader, an individual from the Coastal Program Division (CPD), a representative of a state coastal program, and others as needed. As part of pre-site preparation, the team leader reviews grants, performance reports, previous Section 312 documents, and other publications, communications, and pertinent information to identify state program issues. This is done in coordination with other team members. Contacts and scheduled interviews are set at this time.

A site visit to the state is conducted, at which time meetings are held with state officials, federal, state and local government agencies, and other interested parties. In addition, one or more public meetings are held to solicit public comments on the program. An exit interview is conducted with state coastal program officials.

The team leader then prepares an OCRM briefing on the evaluation. With assistance of evaluation team members, the team leader prepares a set of findings (background, accomplishments, recommendations, response to written comments) for review within 45 days of the site visit. The final draft is sent to the state within 60 days of the site visit. The state has two weeks to review the draft, but may request additional time. If there is a preliminary finding of "not fully adhering," the state program will be given 30 days to respond. The team leader reviews the state's comments and incorporates relevant changes into the final findings document, which is signed by the OCRM Director within 120 days of the last public meeting. The final findings are announced in the Federal Register and sent to the state, evaluation participants and other interested parties.

Timelines cited are targets. OCRM has experienced difficulty meeting the 120-day target. Factors include staff shortages; added workload associated with tracking mandatory actions and interim sanctions; diversion to other assignments; increased complexity of reviews; increased interest and scrutiny of findings by other units in OCRM; and impacts on staff from executing multiple overlapping evaluations.

The "Necessary Actions in the Evaluation Findings" identify action(s) the state must take by the next regularly scheduled review or by the date(s) indicated to meet program requirements. Failure by a state to meet the terms of a Necessary Action may result in a finding of non-adherence and/or may lead to sanctions including withholding of financial assistance and ultimately withdrawal from the national program. Program Suggestions made to a state by OCRM are not mandatory, but may be elevated to a Necessary Action if warranted over time. The Policy Coordination Division (CPD) coordinates with the Coastal Programs Division (CPD) on follow-up to any Necessary Actions or sanctions imposed on a state.

Observations Regarding the 312 Requirements and State Program Reporting

In studying the requirements and operation of the federal Section 312 evaluation of state coastal programs, the Roundtable found that state coastal programs have extensive reporting requirements for participation in the nation program, but that the information prepared under 306 and 309 grants does not meet federal program evaluation needs and does not provide standardized measures of coastal management results. The Roundtable agreed that reporting requirements should be revised with many resultant benefits. Some states would be allowed to submit streamlined mini self-evaluation reports annually. Reports which document measures of CZM success through replicable data base would justify continued funding for sound coastal management programs. The result would be more efficient OCRM oversight and an improved state of our nation's coastal resources.

Recommended Actions to Refocus How State Coastal Programs are Evaluated

The Coastal Ocean Policy Roundtable Report recommends that OCRM implement several changes:

1) Streamline and refocus all state program information reporting requirement.

2) Adopt a two-tiered review process for abbreviated 312 reviews.

3) Give states the option to contract for independent 312 evaluations through new OCRM guidelines.

4) Limit the number of "necessary actions" a state must take to avoid sanctions or decertification and develop estimates for costs and/or level of effort required.

5) Establish a long-term monitoring and reporting system to track changing coastal resources and impacts of CZM activities.

6) Devise a tracking system to monitor state CZM program progress and compliance.

7) Seek CZM Act amendments to extend the deadline to complete 312 evaluations, reduce public meeting notice time requirements, streamline reporting requirements, and mandate with funds an ongoing CZMA assessment of on-the-ground impacts.

8) Request Congress increase OCRM staff assigned to program oversight and evaluations, strengthen internal program and policy staff coordination, and use state program managers and independent assessments to assist with 312 reviews.

9) Produce an annual report of the state-of-the-nations coasts that summarizes the benefits of CZMP.

10) Recommit and invest in the 312 evaluation process and implement COPR findings, with incentives to coastal states to participate in a streamlined process.

Conclusions

The goal is to adapt and refocus the 312 evaluation process to make it an effective tool to highlight coastal management successes, bring public and agency attention to unmet needs, and create the constituency for continued sound coastal management funding and implementation. Any actions OCRM takes to improve the federal evaluation process will be essential to the success of the federal/state coastal zone management program partnership.

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NOAAs EFFORTS IN WATERSHED AND ECOSYSTEM MANAGEMENT

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The National Oceanic and Atmospheric Administration (NOAA) is the primary federal steward of living marine resources and their habitats, with complex missions related to the public, industry, and decision makers. Successful conservation and management hinges on interagency cooperation and maximum efficiency. As its natural resource management programs mature and the Clinton Administration strives to reinvent government, NOAA is expanding beyond its historic efforts to manage species and special areas. This paper summarizes examples of NOAAs new directions, especially in watershed and coastal ecosystem management.

NOAAs Mandates

NOAAs natural resource mandates span the coasts and encompass all aspects of marine ecosystem management. Legislation passed since NOAA was created in 1970 has expanded the agency into marine sanctuaries, coastal zones, fishery resources, marine mammals, endangered species, and the environment. More recent mandates relate to hazardous materials and oil spills that can compromise those resources. Most of those efforts were undertaken from a narrower ecological context than is demanded by today's standards.

NOAAs programs and society's expectations have matured over the past 20 years. Since at least the late 1980s, NOAA has made a conscious effort to respond. It has redesigned its science, management, education, and outreach activities into interdisciplinary programs that reflect today's problems. The changes are evident in budget initiatives, research investigations, and management programs.

Why the New Approach?

One reason is obvious. Many natural resource populations are in significant decline, reflecting the effects of overharvest and insufficient understanding about complex marine systems. Marine fish stocks and coastal habitats are two examples. Those resources also are foremost among the trustee responsibilities addressed in NOAAs new plans.

Another reason is that resource management has evolved toward the broader approach. The 1970s witnessed water basin planning and glimpses of special area management planning. While water basin programs were decimated by budget cuts in the early 1980s, coastal management expanded.

One noteworthy effort was the Clean Water Act amendment establishing the National Estuary Program (NEP) and implemented by the Environmental Protection Agency and their state colleagues.

The NEP successfully gathered stakeholders to debate research, education, and management for nearly two dozen major waterbodies. While funding limitations restricted implementation, the NEP contributed greatly to enthusiasm over the watershed and ecosystem approaches of the 1990s. And the energy will encompass parallel efforts on biodiversity, sustainable development, and other initiatives.

NOAA had its own new program in the late 1980s. The Coastal Ocean Program was NOAAs first major budget initiative in years to receive approval by Congress and the White House. The program is already combining skills within the agency to provide new services and products. COP also convinced the agency that it could meet the challenges of the 1990s.

These approaches are essential to address the issues facing society and the coasts. For example, watershed and ecosystem management may be used as levers to address non-point source water pollution in the coastal zone that affects the habitat of valued fisheries and commercial fish harvests. Similarly, freshwater diversions that alter habitat health and ecosystem structure are now being factored into endangered species recovery plans.

These new efforts, both in NOAA and elsewhere, reflect a healthier relationship between natural resource management and the economy. The connection burst forth with the spotted owl debate, continues with reauthorization hearings on the Endangered Species Act, and has now broadened into fishery management.

NOAAs Newest Initiatives

These efforts are much more than simple repackaging. NOAA has new strategic goals, budget initiatives, research programs, management efforts, and multidisciplinary offices. Much of the work involves anthropologists, economists, foresters, and other new partners.

NOAA has grand plans for its new approaches to natural resource management. The agency is collaborating with others on watershed initiatives, is connecting its species and habitat mandates with Superfund and oil spill programs that could provide an essential treasury for implementation, and continuing to pursue creative approaches to natural resource management. Four examples reveal the breadth of these efforts.

Coastal Ecosystem Health -- This recent initiative is now ensconced in NOAAs Strategic Plan. The new program will shift effort from a fragmented to an integrated approach, and from a site-specific point in time to an ecosystem-wide effort sustained over time. The five primary components of this initiative promise to be preventive, not reactive:

1) Integrated management operations will support work on coastal zone management, estuarine research reserves, and marine sanctuaries.

Biodiversity demonstration projects will focus research on genetics, taxonomy, and ecology. Related efforts will seek to decrease habitat loss through projection and interagency assistance.

2) Assessments will define conditions and the extent of actions that threaten our nation's coastal resources. These efforts will be by watershed or receiving basin, and will have a cross-disciplinary focus.

3) Monitoring will be a joint effort with states, using the National Status and Trends Program to build a national coastal monitoring program.

4) Information will be synthesized so NOAA can understand and predict ecosystem functions. Regional watershed studies will compare unstressed with developed regions and model management approaches.

5) A Nonindigenous Aquatic Species Program will address problems associated with introduced species and with preventing new invasions.

These five components are captured in a major goal of NOAA's Strategic Plan, the agency's primary managerial tool. The intent is to enhance coordination among NOAA offices so coastal ecosystem health efforts throughout the agency can be more focused on watersheds.

A Center for Coastal Ecosystem Health will be established in 1994 at the Charleston Naval Shipyard. Programs at NOAAs new facility will reflect the priorities listed above and will be conducted with input from South Carolina and other collaborators.

NOAAs initiative owes its support from the December 1992 Economic Summit and its focus on economic growth and environmental responsibility. The mission is shared throughout the Clinton Administration, and specifically by the White House Office of Environmental Policy.

Sustainable Development -- NOAAs Office of Sustainable Development and Intergovernmental Affairs was established in 1993 to serve as a liaison to President Clinton's Council on Sustainable Development, which advises the administration on policies to encourage economic growth, create jobs, and protect the environment. The Council seeks to develop policies that will support a national strategy on sustainable development. One early task will be with the new Northeast Coastal Economic Advisory Committee, whose focus is economic issues related to the northeast seafood industry and harvests from the Georges Bank ecosystem.

Forest Ecosystem Management Assessment Team -- NOAA is deeply involved in FEMAT, the public-private partnership created to implement recommendations from President Clinton's Timber Summit of early 1993. The early focus on old growth forests and northern spotted owls has evolved into a broader ecosystem approach involving the entire Pacific Northwest. Agencies, the private

sector, tribes, and the public have expanded their plans to include anadromous fish and river corridors, with major implications to endangered salmon runs, freshwater flows, and other major issues.

The FEMAT effort includes an Aquatic Conservation Strategy with four basic components:

1) Riparian reserves to protect lands along streams and unstable areas where special standards and guidelines govern land use.

2) Key watershed designations for watersheds that include at-risk fish species and stocks and for high quality water.

3) Watershed analysis procedures to evaluate geomorphic and ecologic processes in specific watersheds. The analyses will form the basis for monitoring and restoration efforts and the foundation for delineating Riparian Reserves.

4) Watershed restoration through comprehensive, long-term programs.

Marine Biodiversity Initiative -- NOAAs Office of the Chief Scientist led an effort in 1993 to develop the agency's first Marine Biodiversity Action Plan. This initiative is now part of the NOAA Strategic Plan, and may soon culminate in an approved plan that will constitute NOAAs first step in developing a more detailed framework for participation in interagency and international programs. NOAAs goal is to work with other national and international leaders to advance concern about marine biodiversity research and conservation. NOAA is also providing staff to work with the Department of Interior's National Biological Survey to instill a marine biodiversity component.

Specific recommendations include developing new research and monitoring programs, creating a data and information network, establishing international protocols for data collection, focusing new management initiatives on ecosystems under immediate threats, and offering assistance on policy and technical matters.

NOAA's efforts on marine diversity now extend to President Clinton's National Science and Technology Council. NSTC consolidates and elevates key functions of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) and other programs of recent years. NSTC includes a Committee on Environment and Natural Resource Research, which is chaired by NOAA Administrator James Baker and will include a biodiversity and ecosystem research subcommittee.

Summary

NOAA is adjusting its approach to managing coastal and marine resources. Programs described above illustrate how the agency is shifting from species-by-species and resource-by-resource management into the broader arenas of

ecosystem and watershed management. The efforts will require redirecting existing efforts and strengthening interagency bonds. The work promises to be challenging. Early support for the approach is encouraging.

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TRANSLATION OF SCIENCE TO POLICY: NOTES FROM A GHOSTBUSTER

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An Interesting Calling

As a committee member, advisor or consultant I have been able to observe and analyze the conduct and translation of science to important coastal environmental policy issues in many parts of the U.S. Notably these include outer continental shelf oil and gas development, dredged material management in San Francisco Bay, integrated management of the Chesapeake Bay and its watershed, the Exxon Valdez oil spill, loss and restoration of Louisiana coastal wetlands, and the recent dramatic degradation of Florida Bay. My career as a coastal scientist "ghostbuster," coupled with my interest in human behavior and culture, has allowed me to offer some general observations about the difficulties of translation of science to policy and to propose some suggestions for improvements. In the presentation, I will illustrate these observations with examples from the aforementioned issues and regions.

Cultures and Coalitions

Much has been written about the differences in the subcultures of scientists and policy makers and implementors which limit effective translation. Valued actions, timeframes, goals, expectations, attention to detail and world views differ significantly. Effective bridgers of this cultural gap, be they scientists or policy makers/implementers, recognize these differences and accommodate them. A few such people can make a huge difference. But this bipolar cultural model of science and policy is over-simplified. Coalitions of interest group leaders, policy makers and implementors, scientists and even journalists, who share a set of beliefs in goals and causal relationships, may have substantial influence. However, such coalitions may diminish scientific objectivity in practice or perception.

Scientific Prophets

Although a common complaint of policy makers and managers is that it is hard to get an answer from scientists that is useful in decision making, in fact, most of the major shifts in how we perceive and deal with coastal environmental problems that I have observed have been as a result of one or more scientific "prophets" who offered evidence or arguments which ran contrary to conventional wisdom. Policy makers and managers were not very receptive, or were downright displeased, as these new ideas were floated. Scientists had difficulty in obtaining support for research to test their hypotheses. But eventually, the heresies became principles (to be protected from future heresies) on which subsequent management was based. Although the iconoclasts were sometimes, but not always, later recognized for their contributions, they were still kept at arm's length in implementing the very management strategies which they inspired. The challenge to the policy and management communities is to create a climate which tolerates, if not encourages,

scientific heresies, and keeps the critical talents of the prophets engaged in the process. On the other hand, the scientific community can do a much better job of assessing heresies and communicating their consequences and limits in knowledge.

Assessment and Priority Setting

The resolution of most coastal environmental issues with which I am experienced has suffered greatly because of the "blind describing the elephant" syndrome. This results not only from disparate interests and perspectives of pressure groups, agencies, and economic sectors, but also from diverse interests within the scientific community. Contaminant chemists are likely to emphasize potential toxic effects, wetland ecologists wetland loss, etc. For example, when scientists are asked to identify research needs, they nearly invariably produce all inclusive "shopping lists," which are quickly dismissed by the management community as unfocussed and unrealistic, and then lament that their recommendations go unheeded. We need better mechanisms which engage scientists and policy makers/implementors in sorting out the relative magnitude and risks of environmental threats and alternatives across disciplines and organizational sectors and focussing our attention on the most critical questions which science may realistically address.

Modeling, Monitoring, Research and Assessment

Managers are often drawn to support monitoring and modeling rather than research. Monitoring seems intuitively useful and action oriented, while modeling at least produces answers to questions posed. Scientists, on the other hand, prefer the freedom, excitement, and professional rewards of research and are in a perpetual funk about why there is not more support for research. In truth, research, monitoring and modeling are interdependent, but seldom effectively integrated through a rigorous scientific assessment process. If research is too weak to support incremental improvements in the models, the models will be unrealistic or unreliable. Limits in basic understanding of the environment will similarly diminish the interpretability of monitoring results. Better understanding of the codependence of and balance among these scientific approaches is needed among managers, scientists, and environmental advocates.

Communication

Scientific information is translated to the policy formulation and implementation process in a variety of ways beyond the types of formal linkages which may be drawn up in an organizational chart. One of the most important conduits is the popular and semi-popular press, which provides policy makers information directly and helps shape public opinion. Many scientists are leery of the press and its tendency for oversimplification and sensationalization. There is a great need for alternative, more direct mechanisms for infusion of information that fall between the newspaper clipping and full technical report in abstraction and approachability. We in the university community, as well as our colleagues in the management community, should nurture and support people who have the

knowledge and skills to assimilate and articulate coastal science through such intermediate mechanisms.

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ESTUARINE DILEMMAS: COMPARATIVE PERSPECTIVES ON THE USES OF SCIENCE IN MANAGEMENT

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Efforts in the U.S. and abroad over the past 20 years to use science more effectively in estuarine management are increasingly problematic. More sensitive investigations into diverse aspects of natural processes in marine and coastal systems challenge long - held assumptions as to the causes and effects of pollution and physical degradation on organisms and ecosystems. New research programs like marine biotechnology promise rich material benefits from science and technology, but give only lip service to "socioeconomic" implications. There is little evidence, moreover, that legislative and regulatory institutions can assimilate burgeoning scientific insights in the public interest.

Research increasingly sets its own agenda, even though much of it is funded by government agencies that are charged by statue with basing regulatory decisions on sound scientific information. The goals and limitations of science in cases since the early 1980s of "adaptive" strategies that frame management problems as scientific experiments.

On the policy side, publics are increasingly disenchanted with prospects for scientific enlightenment through policy. There is growing disparity between publics' faith in the potential for scientific guidance through regulatory thickets and the interests and capabilities of science to provide such guidance. With the exception of a few clear cause and effect cases like floatables on beaches and coliform counts and infection, estuarine science and management are poorly integrated.

How to improve the situation? What are the prospects for science- based estuarine management? Inexorable human pressures on estuaries seriously undermine natural processes and functions. United States, Mediterranean, and Chinese cases suggest that scientific insights are becoming less relevant in face of market-driven coastal and near shore development onslaughts. More worrisome, the guiding and supportive roles of national and international institutions that in recent decades have sustained policy-relevant science are weakening. In the U.S., EPA's failure to come to terms with inhouse and extramural science is disturbing. There are also demands by pro-development forces in Congress for unrealistic "scientific" assurance of regulatory benefits over costs in environmental cases. Degrading science for blatant political ends bodes ill for honest attempts to use science more effectively in marine policy.

False assumptions of scientific detachment deter prospects for creative solutions to policy dilemmas. Popular support for effective regulation is fragmented, and unrepresentative vocal groups representing small constituencies frequently dominate debate. EPA and NOAA-sponsored estuary programs often become vehicles for funding research projects for incestuously-favored scientific and publics constituencies.

Regional coalitions like those for Chesapeake Bay that fairly attempt to serve the broader public interest are rare. Early 1980s equity goals, moreover, are threatened by well-heeled property "takings" advocates whose goals, moreover, are threatened by well-heeled property "takings" advocates who stake out ever firmer legal grounds for compensation claims at public expense.

Complex policy processes in U.S. estuarine management reflect a unique blend of: legislative history; social, cultural, and political styles; and the structure function of scientific and technical institutions. Similar policy processes in the Mediterranean and China are driven by a different mix of institutional and sociocultural factors. In these cases, international organizations roles are more prominent in the evolution and modification of national perspectives and polices. The character and substance of development and conservation tradeoffs in specific cases, moreover, convey a quite different blend of cultural and economic policy determinants than in the U.S. The benefits of transnational "epistemic" sharing of scientific priority-setting assumptions is undermined by the fracturing effects of diverse, value, perceptual, and attitudinal factors in Mediterranean and Chinese cases.

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FROM PRACTICE TO POLICY: WORKING TOGETHER

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Working together to conserve coastal ecosystems is something all gathered at this meeting want to achieve. Ecosystems are so complex, societal pressures so great, responsibilities so diffuse, and our tools so piecemeal, that partnerships among federal, state and local stakeholders may be the only way for proper ecosystem management to be achieved. Banding together to share our expertise, leverage our meager resources, and reach consensus on our differences may also be the most efficient and effective approach to further the protection of vulnerable coastal environments.

Our practice of working together in a relatively formal way to tackle coastal ecosystem issues is not uncommon. And, in fact, many well established programs around the country have this concept at their core. Most of these partnerships have had some success over individual and competing efforts and have been able to focus collective effort on coastal ecosystem issues. For example, the National Estuary Program has over twenty coastal initiatives that bring federal, state and local interests together to develop strategies for coastal ecosystem protection. The Great Lakes Program and the Chesapeake Bay Program have developed extensive partnerships on much larger ecosystems involving their coastal waters. Elsewhere, there are countless agreements between federal, state and local groups formulated for the express purpose of working together on the protection and management of smaller coastal ecosystems.

Most of these cooperative efforts have evolved as a practical (and political) matter, and success varies: The Lakes and the Bay are under severe stress; local coastal ecosystems are threatened; site-specific ecological problems arise. The scientific, management, and political forces got together, overcame institutional and programmatic inertia, and responded in a manner that looks at ecosystem problems in a broader manner .

A National Policy for Ecosystem Partnerships

The Clinton Administration has based its whole approach toward the environment on two principals: ecosystem management and partnerships. The bits and pieces of what we now do -- large and small -- may be placed in a framework of federal policy. While the picture of what constitutes competent ecosystem management remains unclear, the next step down, watershed management, has a fewer uncertainties and is being pushed by both the administration and in Congress in reauthorization of the Clean Water Act. Not only have senior administration officials pushed these approaches in their public statements, but also serious efforts are underway to make ecosystem management and partnerships a part of administration policy and legislation.

The National Marine Fisheries Service is excited about this approach. The Assistant Secretary for Oceans and Atmosphere of the National Oceanic and Atmospheric Administration has put the Department of Commerce fully behind coastal ecosystem management. In testimony before Congress on Clean Water Act reauthorization he stated: "NOAA has long championed an approach to environmental management that recognizes the integrity of ecosystems as the logical focus for resource management decisions." NOAA` has recently developed a strategic plan to protect coastal ecosystem health with a strong emphasis on coastal ecosystem management and building partnerships.

The Administrator of the Environmental Protection Agency has endorsed ecosystem and watershed management numerous times since her confirmation. Specific emphasis was placed on aquatic ecosystems during her testimony on the Clean Water Act. At that time she stated, "The Clinton Administration envisions an approach to water resource protection that looks first to the ecosystem itself, evaluates its needs based on risk, and then tailors solutions to those needs through the participation of stakeholders in every phase of the process. ...Our focus is on the biological and physical, as well as the chemical, integrity of our Nation's waters." She prefaced her remarks with strong support for public and private partnerships.

The Secretary of the Department of the Interior has made the concept of ecosystem management a key approach for avoiding what he refers to as "environmental train wrecks" -- adversarial situations where vested interests bang heads over an issue. The National Biological Survey is part of his solution for gathering ecosystem information for a coordinated approach to managing natural resources and resolving conflicts between public and private interests. Inherent in the Secretary's approach is a policy of consensus building through partnerships as seen in the Timber Plan and the Everglades.

The Vice-President's National Performance Review called for a major government wide effort in cross-agency ecosystem planning and management. At this writing, there are indications that the White House Office of Environmental Policy and Office of Management and Budget plan to follow through with the Vice-President's recommendations. According to one respected watch-dog publication, these officials are "...seeking to boost ecosystem management as an integral part of government operations...[,] ... are examining ways to include ecosystem planning in the federal budget process and are discussing details of an executive order on ecosystem management that would boost interagency cooperation...."

Congress, meanwhile, has jumped on the ecosystem management bandwagon with strong provisions for watershed management in pending legislation to reauthorize the Clean Water Act.

Ecosystem Partnerships and The National Marine Fisheries Service

NOAA and the National Marine Fisheries Service is positioning itself to meet the challenges and take advantage of the opportunities by this new direction at the federal level.

The Chesapeake Bay Program

By involving local, state and federal partners working together, the Chesapeake Bay Program has become a model from both the ecosystem and partnership approach . First, essentially all of the watershed is included -- and it's a big watershed, 64,000 square miles, one-sixth of the Eastern Seaboard. Second, the key political units have bought in --Maryland, Pennsylvania, Virginia, and the District of Columbia -- as well as the relevant Federal agencies -- EPA, NOAA, Fish & Wildlife Service (F&WS) , Department of Agriculture, and others.

The historic 1983 Chesapeake Bay Agreement established the cooperative framework for the program and this agreement was expanded and strengthened in 1987 and 1992. These agreements followed studies on the Bay environment which found that the biggest risk to the Bay was increasing problems of oxygen depletion. These warning signs had significant implications to for sustaining the Bay's rich natural resources. Collaboration among Federal, state and private research groups identified nutrient over-enrichment as the primary causative factor and the political side of the partnership led to development of a unique agreement by the three States, the District of Columbia, and the Federal government to reduce nutrient input by 40%. Using good ecosystem logic, reductions are to be done on a tributary or watershed basis. Indeed, as of this writing, actual allocations of nitrogen and phosphorus compounds to be reduced by tributary have been agreed upon.

Collaboration in the Bay Program on the technical side has been extensive among all federal, state, and private research groups in the Bay watershed. The Bay program has an broad committee structure which allows full exchange of ideas and priorities among government officials, scientists, environmental groups, agriculture, business, industry, and the public at large. The EPA Administrator, the Governors and the Mayor meet once a year to update program priorities. This political event has led to major redirections on policy issues related to the Bay. A Commission of state legislators reviews, recommends solutions and communicates with their respective bodies that make things happen at the grass roots level. The Federal agencies meet regularly to coordinate their activities and share their expertise. Model programs on public outreach and communication with the concerned public exist.

The National Marine Fisheries Service's NOAA Chesapeake Bay Office coordinates NOAA activities related to the Chesapeake Bay Program. The office works closely with EPA, F&WS and other Chesapeake Bay Federal and state partners to strengthen and expand research and management activities related to NOAA authorities and expertise. A key focus is working in partnership with F&WS to protect and restore living marine and estuarine resources and the habitats they

depend upon. Activities include oversight of cooperative research on Bay fisheries stock dynamics, oyster disease, effects of toxicants and nutrients on estuarine structure and function, aircraft remote sensing, and atmospheric deposition of nitrogen. The office also cooperates with other state and federal partners in the Chesapeake Bay Program to restore key habitats including oyster bars, wetlands, Bay grasses and anadromous fish spawning runs. In addition the office works closely with Maryland and Virginia Sea Grant College Programs and with NOAA's Office of Coastal Zone Management to integrate the Maryland and Virginia coastal zone management programs into the Chesapeake Bay Program, especially with respect to nonpoint source control and growth management.

The Chesapeake Bay Program is a singular example of where NMFS is institutionally committed to a large-scale coastal ecosystem management program. In implementing a national policy toward large ecosystem management, the Chesapeake Bay Program is the best model available for putting together workable partnerships of all vested interests to produce solutions at the state and local level. Major factors making it successful have been:

- Stakeholder involvement --states in particular receive over one half of the Program's funds and have a direct role in managing the Program,
- Extraordinary public interest in saving the Bay that sustains political support for the program,
- A strong link between science and policy (effective use of computer modeling and exceptionally strong and well-funded scientific institutions), and
- A clear mission spelled out in the Bay agreements.

State and Local Partnerships

The National Marine Fisheries Service is very actively involved with federal and state partners in ecosystem and watershed programs around the country. Examples include:

- Coalitions associated with negotiations related to natural resources trust responsibilities under the Clean Water Act (wetlands), the Endangered Species Act, the Federal Power Act (anadromous fish), and the Fish and Wildlife Coordination Act,
- National Estuary Programs about the country such as the Santa Monica Bay Restoration Project and habitat restoration activities in Tampa Bay, Florida,
- The California Central Valley Anadromous Fish Restoration program which involves collaboration among stakeholders to address one of the most vexing watershed issues in the country,

- The Coastal Wetlands Conservation Plan for Louisiana involving Federal and state partners to set priorities to stop coastal wetlands loss, and

- Coastal America projects that include on-the-ground restoration activities involving federal, state and private sector partners at various locations around the country.

At times NMFS has not been as able to participate as it would like in working groups with other local, state and federal partners in many coastal ecosystem programs because of other priorities and limited resources.

Observations

Raising the concepts of ecosystem management, watershed management and "partnerships to address natural resources issues" to a national policy is very appealing. Several cautionary observations are, however, in order:

- No single person, group or assembly of groups in the near future is going to "manage" an ecosystem or watershed of any size, except perhaps (and hopefully) on wholly Federal or state-owned lands. While more "data" on ecosystem functions and biodiversity will certainly be useful (and seen by some as the solution to environmental conflicts), the complex of federal, state and local laws, regulations and customs will, for better or worse, manage ecosystems, including those in the coastal sphere. The challenge of ecosystem management will be to bring these diverse laws, regulations and customs together for a common purpose. It will not be easy.

- Ecosystem management is dead the minute it takes on the flavor of land use management. The "Wise Use Movement" has mobilized a substantial force in Congress and the states to weaken environmental regulations like the wetlands provisions of the Clean Water Act and the Endangered Species Act. Their almost paranoid concern about ecosystem management as a threat to property rights is best exemplified in the amendments constraining the establishment of the National Biological Survey.

- Watershed Management as being suggested by groups involved in reauthorization of the Clean Water Act may turn brush fires into forest fires. In the haste to devolve federal responsibility to the state and local level, national interests in common property resources that go beyond a watershed may be compromised under pressure to get the Feds out of the picture. Safeguards are needed.

- There is a legitimate tension that exists among parties with vested interests in what goes on within a watershed or ecosystem. Those responsible for public common property trust resources must defend their trust interests. Private interests have long had the upper hand, and those responsible for common property resources have been on the defensive.

A national policy of partnerships and coalition building should not compromise trust resource responsibilities. Environmental train wrecks should still be possible if the alternative is the unnecessary destruction of public natural resources for private interests.

- Working together in a natural resource partnership isn't necessarily easier or cheaper. If your responsibilities are to protect a natural resource and the missiles are coming in from all directions and you're the only one on duty, it's easier to keep firing back than to leave the firing line without a cease-fire and with the expectation of prolonged negotiations.

- Partnerships becomes geometrically more difficult as you add each additional stakeholder. At a certain level (between 5 to 7), the partnership becomes amoebae-like and starts to subdivide into subcoalitions and interest groups. The difficulty now grows exponentially.

- Large, cumbersome partnerships may be a fact of life in successful ecosystem and watershed management in the future. Our democratic form of government is neither efficient nor pretty. The talents needed will be political, social and educational as well as scientific. Unfortunately, those agencies responsible to protect trust resources are not yet geared up to fully meet this challenge.

Conclusions

Ecosystem management is the only way to go for the proper management of natural resources. How this is accomplished is still to be determined, but some points are becoming clear:

- Consensus-based decision making should strengthen the chances of successful resolution of controversial natural resource issues as witnessed in the 40% nutrient reduction plan in the Chesapeake Bay, the Timber Plan in the Pacific Northwest and the Everglades plan in South Florida.

- Partnership agreements on watershed or ecosystem management actions will likely be fragile -- consensus must be broad enough and strong enough to counter the ever-changing political mix.

- There must be sufficient and stable funding -- The availability of funding is a marvelous attractant to focus stakeholders on the issues.

- There needs to be both carrots and sticks, a balance between enforceable policies and flexible, voluntary actions. Getting the proper mix can be tricky.

A critical question will be whether the present Administration will have the political will and the leadership to firmly establish ecosystem management and

partnerships not only as policy but also basic approach to natural resources management.

THE NATIONAL COASTAL WETLANDS CONSERVATION GRANTS PROGRAM

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Section 305 of the Coastal Wetlands Planning, Protection, and Restoration Act of 1990 established the National Coastal Wetlands Conservation grants Program. This program, administered by the U.S. Fish and Wildlife Service, provides for matching grants to coastal States to carry out coastal wetlands conservation projects, including acquisition, enhancement, restoration, and management. Eligible applicants are State agencies of coastal States. Funds are made available from monies deposited in the Sport Fish Restoration Account of the Aquatic Resources Trust Fund. The Service solicits and evaluates project proposals annually by criteria that address project benefits, and contaminated wetlands. Priority consideration is given to projects involving the conservation of maritime forest on barrier islands. In 1992, thirteen projects received $5.7 million in Federal funding. Thirteen new projects and one carry-over project were funded in 1993 at a cost of $5.9 million. A similar level in available for 1994.

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UNDERSTANDING RECREATIONAL IMPACTS ON MASONBORO ISLAND

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The North Carolina National Estuarine Research Reserve (NCNERR) is 1 of 22 such designated programs in 18 coastal states and Puerto Rico. Federal legislation that created this national program was established as part of the 1972 Coastal Zone Management Act which recognized the need to protect selected coastal resources from pollution and the pressures of development.

The National Oceanic and Atmospheric Administration (NOAA) within the U.S. Department of Commerce administers the national system of reserves in partnership with participating states. Each state reserve program is eligible for federal matching funds for acquisition, development, monitoring, research, education and operations. The primary mission of the national reserve system is a federal, state and community partnership to protect areas and to promote informed management and stewardship of the nation's estuarine/coastal habitats through scientific understanding linked with public education.

In 1982, North Carolina applied to NOAA for matching funds to begin an estuarine reserve program. North Carolina's extensive (nearly 2.3 million acres) and diverse estuarine resources resulted in the formation of a multi-component reserve program. Following a decade of acquisition and program development, the NCNERR now consists of four designated components located along the outer coast: Currituck Banks (960 acres in Currituck County), Rachel Carson (2,600 acres in Carteret County), Masonboro Island (5,000 acres in New Hanover County) and Zeke's Island (1,600 acres in Brunswick/New Hanover counties). Among these four sites only a small portion of Masonboro Island remains to be acquired.

Management of the NCNERR is performed by the North Carolina Department of Environment, Health and Natural Resources/Division of Coastal Management. The four components are managed by the full-time reserve staff with assistance from a network of governmental agencies, local groups and private individuals to promote estuarine research and education while maintaining compatible traditional uses.

The Masonboro Island component is the largest remaining underdeveloped barrier island in southeastern North Carolina. Over 5,000 acres in area and eight miles in length, the island is situated between two extensively developed barrier island towns, Wrightsville Beach to the north and Carolina Beach to the south. The site is bounded by the Atlantic Ocean to the east and the Atlantic Intracoastal Waterway (sound side) to the west. The city of Wilmington lies approximately six miles to the northwest.

The island complex consists primarily of sound waters and intertidal salt marshes/mud flat (4,427 acres) while natural uplands (i.e., ocean beaches, dunes, shrub thicket and maritime forest) encompass 537 acres and dredge material areas along the waterway cover 166 acres. Loggerhead sea turtles (federal threatened status) nest on the ocean beaches during the spring and summer months. Sea beach amaranth (a federal threatened status plant) occurs sporadically in fore dune areas. Colonial waterbirds such as least terns and black skimmers use open, sandy upper beaches and overwash areas for their annual nesting activities during April through August.

Legal protection of Masonboro Island has been affected through various instruments; federal regulations, local zoning restrictions, state nature preserve designation and Outstanding Resource Water (sound areas of the island complex) designation. These safeguards will ensure that the island remains a pristine natural area. In addition, The Society for Masonboro Island, a local non-profit group, supports the reserve program through site surveillance and various volunteer efforts pertaining to island management.

Generations of local residents and visitors have used the island and its waters for fishing, camping, boating, sunbathing, hunting, nature study and hiking. Although these recreational activities are relatively low impact uses in more traditional coastal recreation settings, long-term unmanaged use may result in negative impacts to this fragile ecosystem. Since the state is close to completing acquisition of the entire complex (70 acres remain in private ownership), on-site management of the state-owned portion is being initiated by reserve staff and volunteers. However, data are needed to provide managers with the tools necessary to balance future recreation use with natural resource protection.

The purposes of this study were to:

1) Survey and document the physical impacts on the natural resources of Masonboro Island that were the direct result of recreational use.

2) Determine if the island's natural processes mitigate the impacts due to recreational use during the period of low recreational use (October - April).

Methodology

The initial process undertaken by the researchers to facilitate the study on Masonboro Island involved the formulation of a systematic and detailed methodology for examining the island. The methodology utilized divided the island into two distinct physical sections and four separate impact zones.

The physical sections identified were the Ocean Front and the Sound Side. The ocean front section began at the extreme northwest end of the Masonboro Island jetty and continued along the ocean front side of the island running the entire north-south distance of the island. The eastern boundary of the ocean front section was the Atlantic Ocean. The western boundary of the ocean front section was the

western most side of the dune line. Where no dune line existed on the island, the western boundary became the transition point at which the island vegetation changed from dune/ocean front vegetation to marsh/sound side vegetation. The sound side section included all area of the island west of the ocean front section boundary line.

The four impact zones identified were Ocean Front Sites (OFS), Ocean Front Trails (OFT), Sound Side Sites (SSS), and Sound Side Trails (SST). The ocean front sites were primarily the result of camping or picnicking activity. The sites were characterized by impacts such as compacted sand, loss of vegetation, damaged vegetation (cut branches and limbs on shrubs and trees), accumulated trash, fire rings, latrine areas and built structures (e.g., tables, awning supports, barbecue pits, etc.) Ocean front trails were identified as areas of visible compacted sand which are void of vegetation that connect the ocean front dry beach area with the interior of the island or with sound side trails.

Sound side sites were similar to those of the ocean front sites but also included areas where small recreational boats had been frequently pulled up on shore. The impact to these areas was in the form of lost estuarine grasses. The sound side trails were predominantly foot paths leading from the sound side dry beach area or sound side marsh/wetlands to the interior of the island and usually connected with ocean front trails.

Data collection began in October - November, 1992. The researchers traveled by boat to Masonboro Island from the mainland, a 15 to 30-minute trip depending on which section of the island was accessed. Masonboro Island contains only 10 to 12 adequate points of boat access on the sound side of the island. Once on the island, the researchers walked the circumference of the reserve (total walking distance approximately 16 to 18 miles) identifying areas which exhibited signs of physical impact due to recreational use.

Once identified by the researchers, each site was assigned an identification code and a Site Disturbance Record (SDR) was developed. Trails and sites on the ocean front were assigned identification codes numerically such as OFT #1 and OFS #1. Trails and sites on the sound side were assigned identification codes alphabetically such as SST A and SSS A. Beginning at the north end of Masonboro Island (northwest end of the jetty) the first ocean front trail and ocean front site identified were coded OFT #1 and OFS #1. Each successive ocean front trail or ocean front site, moving from north to south on the ocean front was then numbered sequentially. Moving north to south on the sound side (from the same starting point as the ocean front) the first sound side trail and sound side site identified were marked as SST A and SSS A. Each successive sound side trail or sound side site located was lettered sequentially.

At each identified recreation impact site, measurements documenting the magnitude of the physical disturbance were obtained as part of the SDR. Each SDR included:

1) Disturbance measurements.

2) A written narrative of the site describing the extent of the impact and all pertinent information identified at the site.

3) A photographic record of the site.

To further reference the location of each disturbance site on Masonboro Island, each SDR code (e.g., OFS #1 or SST C) was placed on both a blue line map and on an aerial photograph of the island.

The following spring (April 1993) the identified impact sites were revisited to determine any changes that may have occurred to the sites over time. This component of the data collection was based on the rationale that during the seasonal period of minimal recreational activity (October - April) some of the negative impacts due to recreational use may be mitigated due to the natural remedial processes (e.g., plant growth, blowing sand, storm overwash etc.) of the island. Similar to the fall data collection, an updated SDR was created for each revisited site.

Results

The fall 1992 data collection resulted in the identification of 75 sites that could be positively identified as having been impacted due to recreational use. Using the impact zones (OFT, SST, OFS, and SSS) developed in the methodology and geographic location (north end, center, and south end of the island) the data was examined based on both the type and location of the impact site.

Thirteen ocean front trails were identified during the fall data collection. Of these, 10 ocean front trails were located on the north end of the island, 2 were identified in the center section, and 1 ocean front trail was located on the south end of Masonboro. For sound side trails 9 trails were identified with 7 located on the north end of the island and 2 running across the center of the island.
The survey of ocean front sites indicated 16 sites located on the north end of the island, 12 ocean front sites identified in the center of the island and 1 site on the south end of Masonboro. For sound side sites, the final category used to classify recreational impact, 24 sound side sites were identified. Five sound side sites were located on the north end of the island, 11 sites were found in the center section of the island, and 8 sites were found on the south end of Masonboro.

In April 1993 all recreation impact sites that were identified on Masonboro Island during the fall of 1992 were revisited to determine if the natural processes of the island had mitigated any of the impacts caused by recreational use. The results of the spring 1993 data collection indicated that 33 of the 75 (44%) impact sites identified in the fall of 1992 had been significantly altered (50% or more of the original impact was no longer visible) or completely eliminated (no evidence of impact remained) by natural processes.

The zone (OFTs, SSSs etc.) of the impact and the location on Masonboro Island of the site were both important factors related to the amount of natural mitigation that occurred over time. Trails were the least dynamic impact on the island. Of the 13 ocean front trails 5 (38.5%) were significantly altered or completely eliminated over time while only 2 of the 9 (22.2%) sound side trails were significantly altered or completely eliminated between fall of 1992 and spring of 1993. Sound side sites were more dynamic with 11 of 24 (45.8%) impact sites having been significantly altered or completely eliminated during the observation period. Ocean front sites showed the greatest amount of mitigation to impact with 15 of the original 29 (51.7%) sites having been significantly altered or completely eliminated.

The location of the impact site on the island was also important in determining the degree of mitigation that occurred over time. Of the 38 sites located on the north end of the island 34.2% were significantly altered or completely eliminated due to natural processes. In the center section of the island 37% of 27 identified impact sites were significantly altered or completely eliminated. The most dramatic change on the island occurred on the south end where 100% of the sites (10) identified were significantly altered or completely eliminated over time.

Conclusions

The results of this study indicate that recreational use on Masonboro Island is having a long-term (more than six months) impact on the physical features of the resource base. However, recreational impacts on the island are neither uniformly distributed nor is there a consistent pattern of natural mitigation across the island. Both of these findings have important implications for the management of Masonboro Island.

In terms of the distribution of recreational impact on the island most sites were found to be highly associated with access onto the sound side of the island and trails leading from those access points to the ocean front beach. With the exception of four sites all sound side sites (excluding boat landing sites) and ocean front sites were located within fifty yards of the identified sound side trails and ocean front trails. Additionally all trails led from the sound side of the island to the ocean front (west to east), with no trails running laterally across the island (north to south). Since Masonboro Island is only accessible by private boat most of the sound side sites were those areas where boats could easily land passengers on shore or areas adjacent to the landing sites where recreators camped, picnicked, or sunbathed. Considering that the largest number of impact sites (29) was located on the ocean front the data suggests that if recreators did not choose to stay near their boat they were most likely to travel across the island to recreate on or near the ocean front beaches. Very little recreation impact was found on the interior section of the island (that area between the sound facing edge of the ocean front dune field and 50 yards in from the sound side shoreline. Only 4 sites were located in this zone and all of these sites were located within 50 yards of a trail leading to the ocean front beach.

The relationship between access onto the island and location of recreation impact sites was also graphically illustrated when the sites were placed on a map.

The resulting map revealed 8 identifiable clusters of recreation impact, all directly related to access points onto the island. One large cluster of sites (38) was located on the north end of the island, 5 smaller clusters (of 7, 6, 4, 2, and 8 sites respectively) were identified in the center section of the island and 2 clusters, both made up of 5 sites each were located on the south end of the island.

The location of the impact clusters was an important factor in understanding the island's ability to mitigate recreation impacts naturally. Those sites closest to the sound side or ocean front and those sites clustered at the north and south ends of the island were most likely to have impact mitigated over the five-month study period. The major factor that contributed to mitigation was high water and ocean overwash due to winter and early spring storms. In the north end cluster 12 ocean front sites were either significantly or completely changed due to overwash that erased visible impacts as far as the middle of the ocean front dune field, while on the sound side high water erosion resulted in 2 sites being significantly altered or completely eliminated. In the center clusters almost all of the natural mitigation was on the ocean front and due to storm overwash. Finally the south end clusters showed the greatest amount of mitigation. Due to the narrowness and low elevation at this end of the island storm surges completely overwashed (from ocean front to sound side) the southern 2 miles (approximate) of the island eliminating all evidence of recreation impact except for 2 sites that were significantly altered.

Management Implications

The findings of this study are based on only one year of data collection. Since natural mitigation on the island appears to be strongly related to storm surge some caution must be given in the interpretation of the results of this study due to the large number of severe storms that occurred along the North Carolina coast during the winter and early spring of 1993. However within the limitations of this study managers may wish to encourage recreation use on the north and center ocean front sections of the island, the sound side of the extreme north end of the island, and anywhere along the approximately two miles of the southern end of Masonboro.

The results also suggest that since there are only 10 - 12 boat access points onto the island managers (if they desire) can reduce impacts from recreation through the closure of access points for boat landings on the sound side of the island. This action would seem to be especially effective for application to the center section of the island where access is through narrow shallow channels that could be easily closed. Closure of such access would in essence reduce impact to entire clusters of sites located in the center of the island.

Recreation is an important use of Masonboro Island. However, it is apparent that recreational use is having a long-term impact on the physical features in some areas of the island. Only through understanding the relationship between recreational use and the island's natural ability to mitigate impact can managers make knowledgeable decisions that will allow for a satisfying recreational experience by users of the island and the protection of the valuable natural resources that comprise Masonboro Island.

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WATERSHED MANAGEMENT: A TOOL BUT NOT A PANACEA

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Watershed management and/or ecosystem management have become the current rage in the nation's capital to solve all the environmental problems under current Federal regulation including point source discharges, contaminated sediments, nonpoint source discharges, endangered species and wetland protection.

Unfortunately, this concept is being oversold as a substitute for permit-by-permit federal regulation, rather than a tool for providing a comprehensive view of competing needs (human and natural) and planning horizon to reduce permit-by-permit conflicts between preservation and development. The presentation will use current watershed management activities to document what this tool can provide, its limitations, and the problems that could occur if this tool is oversold as part of the Clean Water Act reauthorization.

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RESOURCE PROTECTION THROUGH PARTNERSHIPS

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In South Carolina we have begun to look at our potential role in protecting fish and wildlife resources and are exploring new avenues through which to achieve meaningful long-term habitat protection. The most promising opportunity we see is working through "Focus Areas" which have been established at nine different locations in South Carolina. The S.C. Wildlife and Marine Resources Department has taken the lead in establishing the focus areas, but other entities such as the Service, TNC, DU, Historic Ricefield Association, Conservation Districts and private citizens all cooperate to make these efforts successful. The primary goal of the focus areas is to foster long term habitat protection through conservation easements and management. Although the NAWMP is the umbrella under which the focus areas are established, the goals and objectives to far beyond waterfowl.

Each Focus Area is headed by a Task Group composed of five to seven individuals representing a cross section of the most resource oriented groups or individuals in the given area. The Focus Area concept is extremely "timely" and one that should be encouraged wherever possible. Each area is essentially a manageable sized "Area-wide Planning Unit" that brings together all or most of the entities that would be necessary to undertake a large scale Conservation effort. A key product of each Focus Area is the identification and delineation of all categories of resources that occur within its boundaries. When this information is mapped, it not only assists the focus area effort, but it is also an invaluable data base for Regulatory Review activities. With this resource map we are better able to prioritize our effort, identify highest priority resources, and to more clearly understand the need, or lack of need, for a project.

In addition to the resource information that is compiled and made available, the Focus Areas establish a forum for other benefits as well. The most important of these benefits is the opportunity to work closely with such a cross section of people. Many of these are the same people we traditionally deal with in an adversarial role through the regulatory program. Although our efforts through the Focus Areas have not centered around any specific regulatory actions, they have included many of the same people. Through this effort participants gather in a non-threatening and non-controversial setting. It has been encouraging to see such broad-based support for the long-term protection of fish and wildlife resources and to see the enthusiasm many of the people bring with them to our meetings.

The key point to keep in mind is that the habitats that are being protected now under long-term conservation easements will be protected forever. We need to maintain our regulatory presence because it keeps everyone honest, but we are truly missing an opportunity if we don't commit the time and resources to get involved in interdisciplinary partnerships that result in long-term habitat protection. We should not discourage this kind of participation, simply because of the long term personnel commitment and the subtle benefits that results.

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ASSESSMENT OF BARRIERS TO THE FULL IMPLEMENTATION OF THE CLEAN WATER ACT SECTION 403 PROGRAM

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Introduction

The passage of the Clean Water Act of 1972 (since amended in 1977 and 1987) established a permitting system to control the release of pollutant discharges into surface waters. Section 402 National Pollution Discharge Elimination System (NPDES) permits must be obtained by municipal and industrial facilities prior to any discharge into navigable waters of the U.S. The NPDES permit sets forth national technology-based standards for minimum wastewater treatment requirements and water quality-based standards to protect designated uses classified by the states.

Section 403 of the Clean Water Act (CWA) established additional regulatory requirements for wastewater discharges to the oceans. Section 403 ocean discharge criteria (40 CFR Part 125, subpart M) were developed to protect living marine resources and public health where the technology and water quality-based regulations of Section 402 are insufficient. For instance, if a pollutant not regulated by Section 402 is found to degrade the marine environment, then Section 403 can be used to set additional permit conditions for that pollutant. Regulations promulgated under Section 403 do not constitute an additional wastewater permit, but are guidelines which must be incorporated into the Section 402 permitting process. No ocean wastewater discharge will receive a Section 402 permit without first meeting the standards of Section 402 and the ocean discharge criteria of Section 403.

Section 403 requirements apply only to ocean wastewater discharges which occur seaward of the baseline. The baseline is defined in the Clean Water Act to be the:

> "[B]elt of the seas measured from the line of ordinary low water along that point of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland water." (EPA, 1990)

Therefore, industrial and municipal discharges into estuaries are currently not covered by 403 requirements.

If Section 403 applies to a discharge, then ten ocean discharge guidelines (Table 1) must be considered when issuing an NPDES permit in order to determine whether "unreasonable degradation" to the marine environment will occur. Considering these guidelines, if the EPA determines there will be "unreasonable degradation" based on the available information about the nature of the discharge and the impacted marine environment, then the Section 402 permit cannot be issued. If, however, there is insufficient information and the EPA is unable to make the ocean discharge criteria evaluation, then the EPA may issue an interim NPDES permit only if it can be determined the wastewater discharge will cause "no

irreparable harm". A discharge will be allowed under "no irreparable harm" provisions (section 125.123(a) and (b)) if:

1) It can be determined that no irreparable harm will result from the discharge.

2) There are no reasonable alternatives to the discharge.

3) The discharger will comply with necessary permit conditions (EPA, 1993b).

(1) Quantities, composition, and potential bioaccumulation or persistence of the pollutants to be discharged;
(2) Potential transport of the pollutants by biological, physical, or chemical processes;
(3) Composition and vulnerability of potentially exposed biological communities, including
- unique species or communities,
- endangered or threatened species,
- species critical to the structure or function of the ecosystem;

(4) Importance of the receiving water area to the surrounding biological community, e.g.,
- spawning sites,
- nursery/forage areas,
- migratory pathways,
- areas necessary for critical life stages/functions of an organism;

(5) The existence of special aquatic sites, including (but not limited to)
- marine sanctuaries/refuges,
- parks,
- monuments,
- national seashores,
- wilderness areas,
- coral reefs/seagrass beds;

(6) Potential direct or indirect impacts on human health;
(7) Existing or potential recreational and commercial fishing;
(8) Any applicable requirements of an approved Coastal Zone Management Plan (CZMP);
(9) Such other factors relating to the effects of the discharge as may be appropriate;
(10) Marine water quality criteria.

Table 1. Ocean Discharge Guidelines (EPA, 1993c).

"Irreparable harm" is broadly defined as "significant undesirable effects occurring after the date of permit issuance which will not be reversed after cessation or modification of the discharge."

A permit issued under a finding of "no irreparable harm" will also require a monitoring program to collect information to later make a more precise determination of "unreasonable degradation." A flow chart of this decision process is depicted in Figure 1.

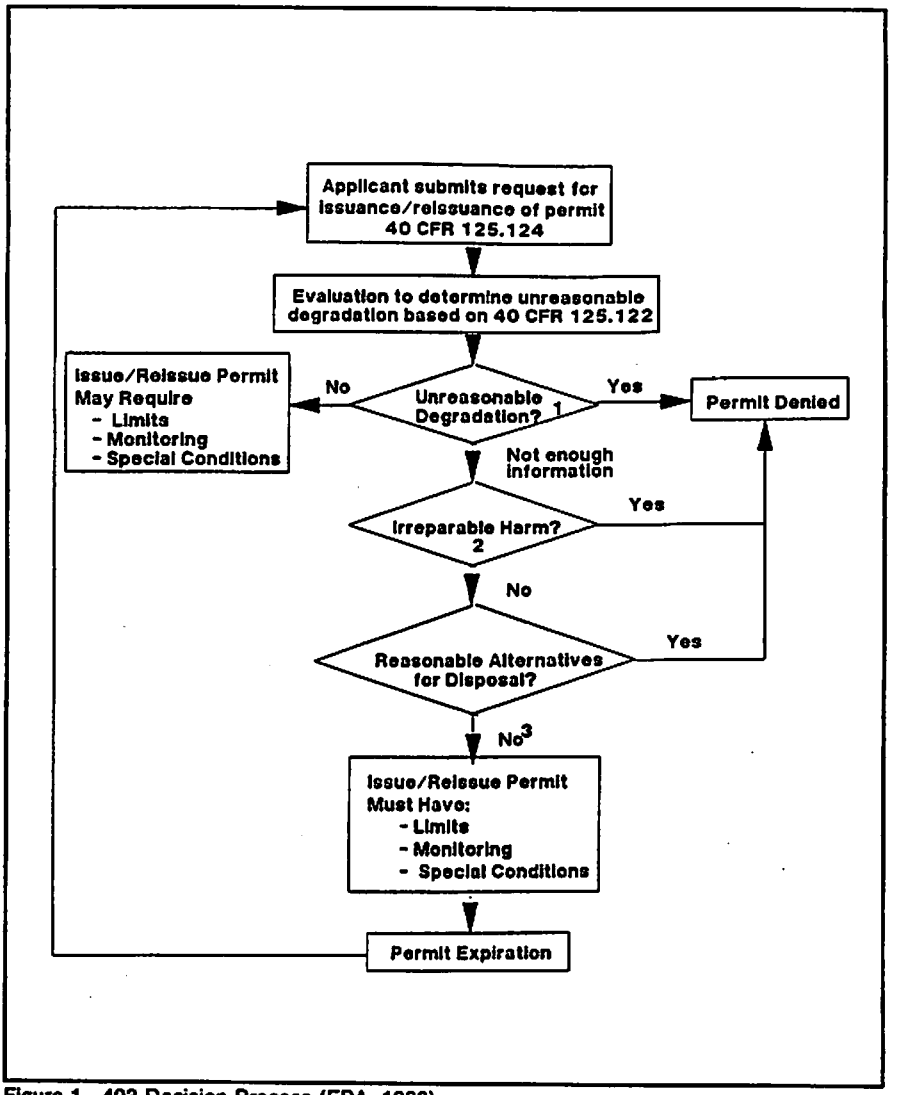

Figure 1. 403 Decision Process (EPA, 1990)

Discussion

The initial success and focus of the 403 program has been the supplemental regulation of several general NPDES permits covering thousands of oil and gas facilities in waters beyond the territorial seas where state water quality standards do not apply (EPA, 1993b). The regulations have also been useful for the protection of some sensitive aquatic habitats like the Flower Garden Banks where the discharge limits of the 402 permit alone would be inadequate. However, a full evaluation of the 403 program as it is administered by each region and authorized state reveals

the 403 program is poorly understood by many permit writers and is even completely neglected by some authorized states (EPA, 1993a). Of the facilities that are in compliance with Section 403, the detail of the review, the level of review, and the effectiveness of the monitoring vary (EPA, 1990). The implementation of the ocean discharge criteria lack consistency between regions and authorized states (EPA, 1990). This is due in large part because there is no nationally consistent technical guidance for permit writers. The flexibility in the regulations for determination of "unreasonable degradation" and "irreparable harm" allow issuing authorities to make these decisions based on their best professional judgement. Indeed, the ten ocean discharge guidelines are only required to be "considered" by the permitting authority. These judgements, therefore, could be expected to vary among different permit writers assessing the same site.

According to the EPA, the reason for this best professional judgement approach is due to the difficulty encountered in creating specific national standards or biocriteria for all wastewaters and ocean receiving environments. The limits of scientific information about these ocean environments is also cited as a barrier to the full implementation of the ocean discharge criteria (EPA, 1993c).

Consequently, in the next round of NPDES permitting there will be insufficient data to determine whether "unreasonable degradation" is occurring for many Section 403 marine discharges (EPA, 1993b). A recent survey of the regions by EPA headquarters revealed that a large number of 403 discharges were either permitted under interim "no irreparable harm" provisions or there simply had been no 403 evaluation at all (Table 2).

Permit Status	Number of Facilities
No Unreasonable Degradation	195
No Irreparable Harm	34
Determination is Pending an Ongoing Review	22
No 403 Determination/Information	89

Table 2. Permitting status of acknowledged section 403 marine wastewater discharges. (USEPA. Memorandum. July 16, 1993, status update on discharges currently subject to 403regulations. USEPA, Marine Pollution Control branch, Washington D.C.)

Apart from the scientific difficulties, some bureaucratic problems also impede an effective coordination of the 403 program. At USEPA headquarters the 403 program is in a completely separate office (Office of Wetlands Oceans and Watersheds) than the 402 program (Office of Wastewater Enforcement and Compliance). This positioning makes it difficult to integrate the programs. Furthermore, the Permit Writers Guide used as a handbook for Section 402 NPDES permitting in the field has no explanation or guidance for 403 ocean discharge criteria evaluations. Due to this lack of specific guidance, 403 responsibilities in Region IX, for instance, have diminished because the 402 staff doesn't know what the 403 program is (EPA, 1993a). The budget for the 403 program has also been scheduled for reductions (EPA, 1993a).

Conclusions

The CWA Section 403 program is a forward looking program which authorizes EPA to include habitat integrity controls and assessments of in situ biological community impacts for marine wastewater discharges. While there have been some notable successes with regulating oil and gas facilities in federal waters and protection of some sensitive aquatic habitats, the are numerous problems with the overall implementation of the program. These problems include variability amongst regions and authorized states implementing the program, poor integration of the 403 and 402 programs, the lack of specific technical guidance for permit writers implementing the program, a lack of scientific understanding of wastewater impacts to marine environments, and administrative problems which fail to give the 403 program a clear identity.

Possible developments which could improve the 403 program include:

1) Development of specific technical guidelines to address the ocean discharge criteria.

2) Improved integration of 402 and 403 staff and program responsibilities, perhaps joining these in one office in Washington, D.C.

3) Improved financial and administrative support within EPA.

4) Development of biocriteria used to make 403 determinations.

5) improvement in scientific understanding of wastewater impacts to marine environments.

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COASTAL LAND DEVELOPMENT AND ITS THREATS TO THE BARRIER ISLANDS OF SOUTH CAROLINA

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The overdevelopment of coastal barrier islands in recent years has led to a deterioration of these islands. Further, this development is threatening the natural flow of the maritime forest and its unique array of plant and animal species. Removal of maritime forests is jeopardizing the islands' ability to protect coastal areas from the effects of hurricanes and tropical storms. The compromise between privatization and public access of these areas must weigh heavily on government controls. A evaluation of laws and policies involving coastal development issues is needed to determine what further steps must be taken to stop overdevelopment.

As in case of Lucas v South Carolina Coastal Council, compensation for properties privately owned can be awarded in order to prevent development. In flood hazard areas and wetlands, government could reject the right of development by property owners under a program that transfers development rights, offering more tolerable sites in replacement of these government protected holdings. Further, the conservation of these islands can be achieved through private ownership as well. Individuals and organizations such as The Nature Conservancy can purchase coastal properties with plans of leaving then in their natural state. Requirements set by government forcing large, leasable lots to be developed into single-family dwelling, could prevent this problem of high-density development.
This study will consider the choices that society faces in dealing with scarce resources such as barrier islands.

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THE SOUTH CAROLINA COASTAL MANAGEMENT PROGRAM: AN EVALUATION

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Since the CZMA did not establish federal standards, it has been difficult to rigorously evaluate the federal program's national impact on the protection of the costal environment or on the rate of costal development. More importantly, there are no criteria established to evaluate the programs implemented by individual states. The CZMA gave the states considerable leeway in establishing not only the relative importance of particular environmental and development values but also in how the balance between them would be struck. Therefore, the states and territories participating in the federal CZM program differ greatly from one another in:

1) What tools are employed to allocate coastal resources among alternative uses.

2) Who actually makes which decisions.

3) Which parties, including developers, environmental organizations, local governments, and individual citizens, have standing to participate in the deliberations or otherwise to influence the decisions (Healy and Zinn 1985).

In implementing their programs, most states have used the same tools widely utilized in land use planning -- regulation by permit, zoning and subdivision laws, comprehensive and specific planning, acquisition of land, and formal and informal negotiation among affected parties (Healy and Zinn 1985; Archer 1988). By looking at a state's effort (the process) to implement a coastal management program -- the institutional arrangement, its policy objectives, and the mechanisms to achieve its objective -- perhaps, an objective method of evaluating the impact of management programs on coastal values will be found.

Specifically, this study will attempt to evaluate the South Carolina Coastal Management Program, focusing on its achievements in the nine area of national interest as listed in the CZMA: natural resource protection, living marine resource conservation, hazards management, major facility siting, public access for recreation, redevelopment of urban waterfronts and ports, simplification of decision procedures, coordination of affected federal agencies, and public participation. Moreover, this study will explore the decision-making process in the formation, implementation and evaluation of policies pertaining to the management of coastal resources in South Carolina. In this analysis an attempt will be made to identify the social forces -- political, economic, and technological -- which have most likely influenced the development and outcome of state coastal zone management polices and programs.

The objectives of this study are:

1) To develop a model of the current socio-political process for developing coastal resource management policies in South Carolina.

2) To determine how coastal values have been affected by technology advancement, fiscal policies, scientific, information and other applicable social phenomena.

3) To examine the methodology used by the state to evaluate the effect of policies and programs.

4) To examine the effort by the Coastal Council to address the nine rear of national interest.

5) To determine if the Coastal Council is achieving the goals and objectives of the SCCMP.

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ENVIRONMENTAL MONITORING OF COOK INLET, ALASKA, THROUGH A CITIZENS ADVISORY COUNCIL

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Summary

The Oil Pollution Act of 1990 (OPA90), passed by Congress in response to the *EXXON Valdez* disaster, mandates two citizens' councils to advise the oil industry and regulators on local environmental and safety concerns related to the operation of tankers, terminals and other facilities in Alaska. The two councils are modeled after the Sullom Voe oil terminal in the Shetland Islands, Scotland, and are designed as a demonstration program that could be utilized elsewhere in the United States. Both councils, Cook Inlet Regional Citizens Advisory Council (Cook Inlet RCAC) and Prince William Sound RCAC are funded by oil companies operating in each region.

Under Cook Inlet RCAC are two technical committees, the Prevention, Response, Operations and Safety (PROPS) Committee and the Environmental Monitoring Committee (EMC). The EMC is directed under OPA90 to "devise and manage a comprehensive program of monitoring the environmental impacts of [oil industry] operations . . . " in the Cook Inlet region. After consulting with experts, he EMC contracted for a consultant to devise a conceptual monitoring program, held a forum for discussion and comment on the conceptual plan, then did a pilot program for the field in the summer of 1993.

The pilot sampling program consisted of sediment and benthic tissue analyses, combined with toxicological testing of sediments gathered from 12 stations in four general areas of Cook Inlet. In addition, two "mussel watch" stations were moored in the Inlet, combining live mussels (*Mytilus edilus)* and lipophilic membrane devices for analysis and comparison.

Future challenges faced by the Environmental Monitoring Committee are to expand the pilot program into a long term monitoring program, and to seek cooperation within Federal, State, and private entities charged with marine environmental monitoring. The ultimate goal is to utilize the results of a final monitoring program to make sound and well-reasoned recommendations to the oil industry and its regulators in the management and protection of the Cook Inlet environment.

Growing Pains: The Mandate and Formation of the Oil Oversight Citizens Councils.

As the scientific characterization of the physical damage of the EXXON Valdez disaster continues to unfold, the human tragedy -- the failure of policy to avoid and prepare for the spill -- also continued to pose a challenge to lawmakers. The Oil Pollution Act of 1990 (OPA90) sought a remedy in battling the complacency of industry and its regulators that lead ultimately to the spill and its effects on society and the environment.

Along with a suite of reforms and new policies, OPA90 contained a provision for two "Demonstration Programs" in Alaska that would provide advice and recommendations to government and industry from the local citizens perspective. The belief stated in the OPA90 is that "only when local citizens are involved in the process will the trust develop that is necessary to change the present system from confrontation to consensus." Cook Inlet Regional Citizens Advisory Council (RCAC) is based in Alaska's first oil producing province, and a body of water surrounded by half the State's population. The other citizens' council, based in Prince William Sound, is funded at over $2 million a year and has oversight of the tanker port for the Trans-Alaska Pipeline. Cook Inlet RCAC oversees the area's 15 production platforms, two tanker terminals, and two refineries, and is funded at "up to" one million dollars by industry, according to OPA90.

The two Regional Citizen's Advisory Councils would have two primary foci: (1) to review and comment on oil spill prevention and response plans, prevention and response generally, and (2) to develop a "comprehensive" environmental monitoring program.

From 'Comprehensive" to a Workable Program: Defining the Monitoring Mission.

The challenge before the Environmental Monitoring Committee of Cook Inlet RCAC was to involve a group of citizens in the highly technical field of environmental monitoring. The group set out with a lofty set of goals and objectives, but by consulting with experts in the field, soon discovered that "comprehensive monitoring" was a contradiction in terms, and a goal that could not literally be attained.

Consulting began with the invitation of several public and private environmental professionals to the first committee meeting in 1991 to describe what form monitoring takes in practice, and the costs associated with it. The high cost of environmental monitoring became an issue in Cook Inlet RCACs long struggle to secure a funding agreement with the oil companies operating in the area. The committee also had new ideas to consider, such as distinctions between research and monitoring, resource monitoring, compliance monitoring, impact analysis, combinations of biological and chemical monitoring, and what media to monitor.

In early 1992, the committee set out to contract for the design of a conceptual monitoring program specific to Cook Inlet. Nine months in the development, by MBC Applied Environmental Sciences, the conceptual monitoring design became the focus of a second meeting of environmental interests and professionals for discussion and refinement. (These meetings have become a yearly event, known as "monitoring forums," where the committee presents its work and seeks broad input on it.) Immediately following "Monitoring Forum II," the committee scoped the work to be included in its Pilot Environmental Monitoring Program for Cook Inlet, to be conducted during the summer of 1993. With a limited budget, the EMC sought the most monitoring for its dollars.

Incorporating the recommendations and comments submitted for the EMC's second monitoring forum, the Committee published a request for proposals that

identified three major tasks: (1) To develop a work plan for the pilot program, (2) to carry out that program, and (3) based on the results, suggest a future long-range monitoring program for Cook Inlet. The Committee received seven proposals, all of which had budgets in excess of what the committee had to spend. Undeterred, the committee commenced reducing the list in a series of meetings in early 1993. The selection process ended with telephone interviews of representatives of the two finalists. It is interesting that, though each firm submitted equally good proposals, the final decision was partially the result of interviewees' skill in making impromptu presentations over the phone to the committee members. The committee responded favorably to clear, concise and understandable answers, not being burdened with jargon.

As noted above, the proposed budget for the contract was more than the committee had to spend. A fortunate combination of events allowed the EMC to go on with the work. For one, the U.S. Department of Interior Mineral Management Service (MMS) planned to conduct field studies in the Inlet pursuant to an upcoming oil and gas lease sale in the area. MMS agreed to lend the use of a 36' vessel in exchange for access to the data collected, saving about $15,000 in charter fees. Also, the contractor agreed to defer task three of the proposal (the data analysis and the long-range monitoring plan), in hopes that the committee could come up with more funding later. As it turned out, toward the end of the year, the RCAC committed unexpended funds to the remainder of the pilot program.

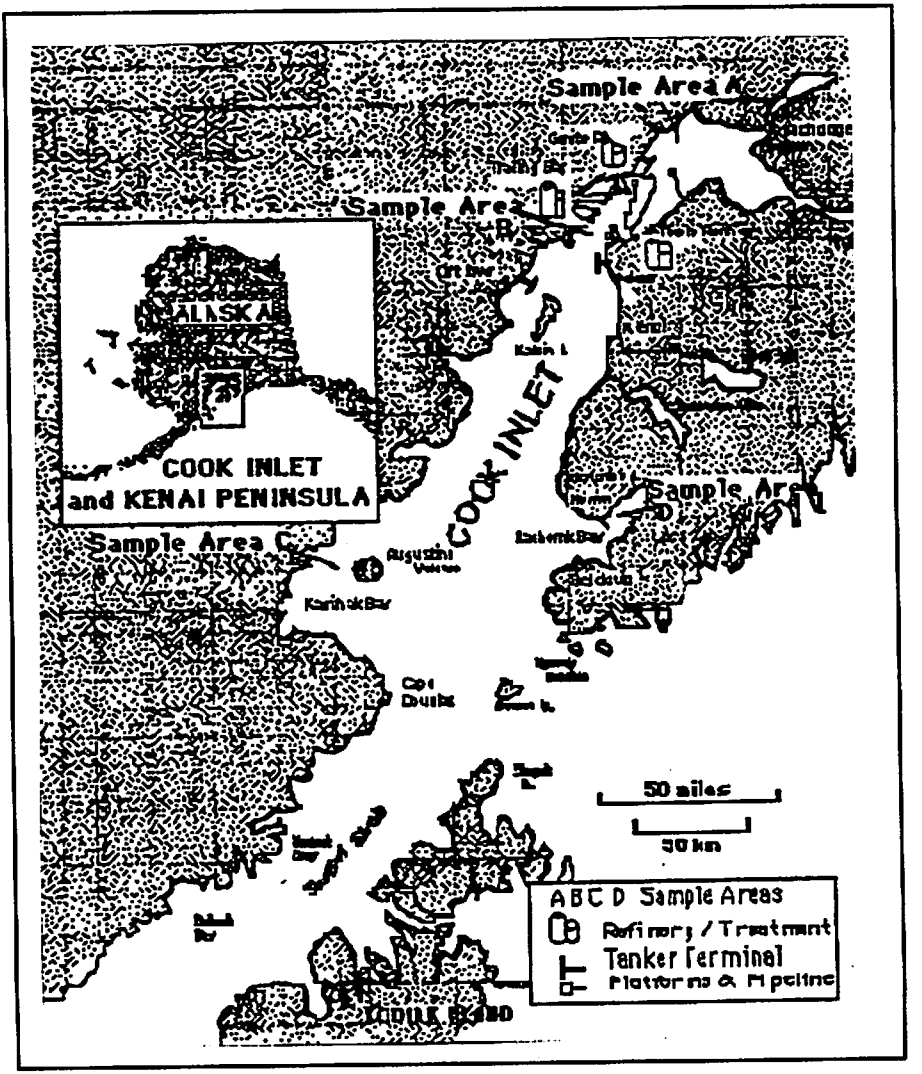
The Pilot Program Design, Implementation, and Results

The winning proposal was to sample at 12 stations within four general areas of Cook Inlet. Near-shore surface sediments were collected at each station along with *Macoma* bivalve clams, where available, living in those sediments. The study was to be based on the "Sediment Quality Triad," where correlations are examined among chemical analyses of tissues, sediments, and toxicological profiles of the sediments at each of the twelve stations.

In addition, moorings were placed at two of the stations in upper Cook Inlet, one near an oil treatment discharge, and the other in a suspected "clean" area upstream of industrial activities. Moorings each contained caged mussels (*Mytilus edilus*) and "Semi-Permeable Membrane Devices" (SPMDs), a new tool for simulating the uptake of hydrocarbons in the water column by living tissues. The SPMDs were incorporated in the moorings as an alternative to the traditional "mussel watch" design to test their feasibility as a method and because it was suspected that the mussels would not survive well in the harsh upper Cook Inlet environment.

The committee received the first draft of the final report at the end of 1993. The range of findings posed as many questions as answers. As expected, the live mussels took a beating after one month in upper Cook Inlet. The mortalities in the cages ranged from 23% to 61%. This apparently was due to the extreme currents, turbidity and lack of food, not industrial pollution.

The toxicity tests showed test animals, living for ten days in the sediments collected at each station, did significantly poorly in five of the twelve stations. Though one would expect to find hydrocarbon pollution levels higher in those five "toxic" stations, it in fact was not. Nor were the tissue levels of the collected *Macoma* any higher. In fact, all the tissue and sediment samples showed hydrocarbons at background levels for a clean, unpolluted area. The levels



found were 10 to 100-fold less than the levels known to have adverse effect on marine organisms.

As for the SPMDs, higher levels of hydrocarbons were extracted from the mooring deployed a quarter mile from the oil treatment outfall. However, due to the small number of samples (two), that result could not be made statistically significant.

So the EMC has no clear indication if any environmental harm has been caused by petroleum industry discharges in Cook Inlet. Some in the industry would argue that, therefore, there is no more cause for continued environmental monitoring. "No exposure, no harm." Such a claim can be countered by the idea that, to have true monitoring, one must make a series of measurements over time to detect a trend. Another argument is that a greater effort is needed to cover more of Cook Inlet. But all these arguments, pro and con, miss the point of citizen-managed monitoring.

Citizens, Science, and Future Directions

Regardless of the scientific or management value of the work, citizen-managed monitoring, post-EXXON Valdez, serves a vital role: that of empowerment. Too often, the public must take for granted the pronouncements of experts in technical fields. And, since the opinions of experts are often conflicting, the public is forced to choose among what are, in the end, competing scientific mythologies. Confronted with the conflicts between what government, industry, and activist organizations say, most people just tune out.

A healing alternative, for those who can't get directly involved in the process, is to know that someone besides the same old players is involved. Industry, government, and even activists, all with their attorneys, lobbyist and public relations people, often operate though an outmoded, bankrupt and damaging confrontational process.

Citizen-managed monitoring benefits the public and policy makers by providing environmental indicators that are immune to the taints of pro- or anti- development interests. It provides a forum in which, ideally, the realistic concerns of protecting the environment can supplant both unsubstantiated fears of degradation on one hand, and blind faith on the other that resource development can continue without some cost to the environment.

Citizen monitoring through OPA90 has the potential for great success. However, the Act provides only for monitoring of the oil industry. Environmental monitoring, by definition, defies such distinctions. The pressures on the Cook Inlet environment are not limited to the oil industry, but could includ riverside and coastal development, municipal and agricultural runoff, recreational and commercial fishing operations, and other stresses that are already apparent in more developed coastal regions.

For citizen monitoring to be a success in Alaska, a broader mandate is needed, with sharing of resources by the RCACs, State and federal agencies, and academia with a stake in the environment. It is hoped that the efforts of the RCACs

in Alaska will provide a viable model for constructive public participation in environmental decision-making elsewhere in the United States and the world.

COASTAL HAZARDS MANAGEMENT: THE STATE OF THE ART AND BEYOND

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An array of natural hazards continues to threaten lives, property, and public investment in coastal areas. These hazards include hurricanes and other coastal storms, tidal and riverine flooding, chronic and episodic shoreline erosion, landsliding, bluff retreat, sea level rise, earthquakes, and tsunamis.

This paper examines current coastal natural hazards management issues, initiatives, and challenges in states participating in the federal coastal zone management (CZM) program. First, a snapshot view of the current status of hazards management in the states will be presented to provide an overview of which states are using what techniques to manage coastal hazards. Then, using information recently developed by the states, problems or weaknesses being encountered in the present management regimes will be discussed, followed by discussion of ways in which states are trying to address the problems. Finally the paper will address possible changes to the federal Coastal Zone Management Act (CZMA) that might be used to encourage and better enable states to address successfully the problems presented by coastal natural hazards.

Under the Coastal Zone Enhancement Program, created by Congress as part of the 1990 reauthorization and amendment of the CZMA, states are being encouraged to improve their CZM programs through legislative or regulatory changes in eight national CZM objectives. One of these national objectives is to prevent or significantly reduce "threats to life and destruction of property by eliminating development and redevelopment in high hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level rise."

States began this Enhancement Program in 1991 by assessing the status of their coastal resources and their existing management programs. As a part of this process, states collected and analyzed information on the nature and extent of their coastal hazards problems and opportunities, the degree to which their current programs addressed hazards management problems, and the needs for new or improved techniques for managing the adverse effects of coastal hazards. Many states then developed strategies for addressing problems in their coastal hazards management regimes, and projects based upon those strategies were funded by NOAA beginning in 1992.

The information in the state assessments and the strategies developed to address hazards management issues will be useful in identifying issues of concern and common problems states are facing in management of coastal hazards. In addition, a review of state progress toward achieving their hazards management goals will shed further light on how states can cope with this coastal management challenge.

Assessments of existing state management programs reveal a variety of techniques currently being used to reduce threats posed by coastal natural hazards. These techniques include the following:

1) Setbacks (administered either locally or at the state level and established either as a fixed distance or based on erosion rates).

2) Prohibitions or restrictions on development in designated hazard areas (developed and implemented at the state level or locally, with minimum state guidelines).

3) Policies restricting reconstruction of storm-damaged structures.

4) Restrictions on septic tanks in flood hazard areas.

5) Restrictions on state-funded infrastructure development in designated hazard areas.

6) State-funded acquisition programs for hazardous areas or vulnerable structures.

7) Restrictions or prohibitions on shoreline armoring (implemented either at the state level or locally).

8) Landform alteration policies (e.g., restrictions on dune grading; dune management plans).

9) Special building codes for high hazard areas.

10) Required disclosure provisions for property transactions in coastal hazard areas.

11) Public education programs.

Concerns or shortcomings that states have identified in these programs include both technical and institutional issues. For instance, many states cite lack of data on erosion or bluff recession rates as a problem. Beyond a need for more data lies a need for new or improved methods for analyzing data and measuring beach and bluff recession rates. Such methodologies would enable more accurate, defensible determination of setbacks and better identification and inventory of hazardous areas. Such delineation and inventory are prerequisite to implementation of building restrictions or other management regimes. Another commonly identified technical need is for a better understanding of the cumulative effects of shoreline protective structures and other changes to coastal natural features.

A few states face newly emerging hazards issues. In the Pacific Northwest, for example, recent geologic evidence indicates the periodic occurrence of major subduction zone earthquakes, accompanied by groundshaking, liquefaction, and

tsunamis. This evidence has generated new categories of hazards in which more technical information is needed and new management issues are arising.

From an institutional perspective, problems that states have identified in coastal hazards management include the following: needs for new state authorities and standards; the need to upgrade existing state authorities and standards; the need to develop means to achieve consistency among state, regional, and local policies and decisions; a need for more consistent local decisionmaking, more restrictive local ordinances, and better local enforcement of existing shoreland development restrictions; the existence of overly liberal (or nonexistent) restrictions on reconstruction of storm-damaged structures; and a lack of data on the economic implications--including true public costs--of shoreline loss and property damage.

States have developed strategies to address all of these categories of problems. These are broadly categorized and summarized below and will be presented in more detail with the final paper, along with information on successes and problems encountered in trying to develop these new programs.

Strategies to create new state authorities: Projects proposed to create new state authorities include establishment of requirements for disclosure of potential coastal hazards to buyers in coastal areas; new flood hazard guidelines; a hazards mitigation plan, including setbacks and post-event recovery strategies; landform alteration policies; policies on groin construction; and a shift in state policy from an engineering approach to one based on siting standards, conserving natural protective features through acquisition, and other land use management solutions.

Strategies to upgrade or better utilize existing state authorities: Projects proposed in this category include development, adoption, and implementation of new standards for high hazard areas; encouraging and assisting local governments to restrict placement of septic systems in areas subject to erosion from coastal storms; amending setback ordinances to incorporate new erosion and recession rates; strengthening building code standards in high hazard areas; and amending state statutes to incorporate changes in objectives and policies related to beach management and setback provisions.

Improving capacity of local plans and ordinances to manage shoreline development: Several states have proposed development of model elements for local plans in areas such as erosion management, construction standards, setbacks, and other restrictions on development in designated areas. Other states have proposed establishing new or revised standards and mandatory guidelines for local land use plans. One state proposed legislation to provide dedicated funding for development and implementation of local plans. Another method proposed to improve local planning was development and implementation of criteria to ensure that local jurisdictions could accurately identify hazardous areas and assess the risks to proposed development.

Technical studies: Technical projects proposed to improve coastal hazards management included studies of the cumulative impacts of shoreline protective

structures and other development decisions; development of new or improved methodologies to determine appropriate oceanfront coastal construction setbacks; improved methods of monitoring and calculating erosion and recession rates; data analysis and mapping projects for hazardous areas, including projects for identification of areas of greatest risk; development of scenarios for the effects of sea level rise; support for efforts to refine understanding of subduction zone earthquakes; and development of littoral cell management plans.

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COOPERATIVE EFFORTS IN THE SOUTHERN NEW ENGLAND/NEW YORK BIGHT ECO-REGION

Joe Dowhan, U.S. Fish and Wildlife Service

The Fish and Wildlife Service's Southern New England/New York Bright Coastal and Estuary Project focuses on one of the most densely populated and urbanized substantial portions of seven northeastern states (Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont), several large bays and estuaries and the major watersheds of the Connecticut, Housatonic, Hudson, and Raritan Rivers. The Region supports a diverse and abundant array of natural resource features including hundreds of federal trust species populations, and ecological attributes, many of national significance. The Service through its Bay/Estuary Program is working closely with the States, other federal agencies, local governments and the private sector to identify, protect, and restore significant habitats and ecosystem features in this important coastal region.

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IS GOOD SCIENCE NECESSARY FOR GOOD POLICY?

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This paper is actually about posing two challenges to the proposition that a good science is a cornerstone for effective policy. The first challenge is to suggest that very often perfectly sensible policy choices can be made in the absence of compelling science.

The second challenge is to argue that good science is rarely sufficient to produce wise policy choices.

Two examples of recent coastal policy actions, or inactions, serve to illustrate the challenges set forth above.

Inadequate Science - Good Policy

Rockfish Moratorium - In the early nineteen eighties, declining juvenile indices for rockfish (striped bass) in the Chesapeake Bay suggested that more stringent management efforts might be appropriate. There was, however, little agreement in the scientific community about the severity of the problem or about the appropriate policy response. Discussion largely centered around further restrictions on gear, seasons, catch restrictions, and the need for more research.

In the face of continuing debate and discord, in 1985 the Maryland Department of Natural Resources decided to impose an absolute moratorium on the catching or possession of rockfish in the state of Maryland. This action was followed by either moratorium, or highly restrictive catch regulations, in the other northeastern U.S. states.

Remarkably, in a period of six years stocks recovered sufficiently to allow a return of a limited fishery and in 1993 the juvenile index exceeded the previous 40-year high by about 30%.

Nutrients in the Patuxent - A major debate about estuarine eutrophication has been whether it is more important to control the nutrient phosphorous or nitrogen. This debate had raged over a decade or more in the Chesapeake Bay without any resolution.

The focal point for the argument during the nineteen eighties was the Patuxent River, a major Maryland tributary to the process to try to chart a new course for the Patuxent. In spite of continuing debate over which nutrient was critical to the Patuxent, a strategy was devised which essentially allowed the Patuxent to become a large laboratory in which the experiment of nitrogen removal would be tested.

Chesapeake Bay Protection - The modern movement to protect Chesapeake Bay from pollution loads and resource abuse began in 1983. This new effort at protection followed an unprecedented $27 million study of the Bay's problems. There is little question that this study, together with the political support which engendered, was crucial to the development of important actions to save the Bay.

However, interestingly enough, much of what was scientifically discussed and identified as critical important during the course of the study had actually been relatively well understood by scientist nearly a decade earlier. This assertion is supported by a careful reading of the proceedings of a 1977 conference on bay issues which was held at the Patuxent Naval Air Station. Issues such as depleted oxygen levels, increasing levels of meats, declining stocks of rockfish and shad, and the decline of bay aquatic grasses were all clearly identified. The problems were clearly set forth.

However, this scientific knowledge about the growing problems of the Bay did not galvanize governments to action. In fact many officials continued to assert that the Bay was perfectly healthy. It was another seven years before action would begin to be taken.

The foregoing examples suggest the linkages between good science and good policy are tenuous at best. And, it is not certain that the latter depends upon the former. In order to consider other connections, if any, between good science and good policy, it is useful to understand a little bit about the characteristics of each. A thorough exploration of these characteristics is a lengthy task, beyond the scope of this abstract, but a few thoughts about the nature of each is important.

Good science rarely reveals the true answer to a problem or question nor does it often demonstrate in a compelling fashion what one ought to do if solutions to a problem are sought. Scientific analysis is often complex and frequently inaccessible in its finest nuances to the non-scientist. In spite of its complexity, science can often provide a clear picture of cause and effect relationships and suggest points for useful interventions.

Policy is much like law and sausage - one doesn't really want to know how they are made. That is, policy derives from a variety of influences which are combined in a unwieldy and often highly dense process. However, for the policy process to be thought of as successful it must at least be responsive to important public needs in a way which is so perceived by the public. In addition, successful policymaking results in effective and efficient actions directed at the identified important problems.

Of critical importance in understanding the policymaking process is the central fact that it is not a product solely based on good science. A number of other extremely important factors must be considered. These include:

1) Public expectations and values about the use and protection of environmental resources.

2) Technical, financial, and human resources available to address a particular problem.

3) Institutional strengths and capacity.

4) Cultural realities.

As indicated, science rarely provides certain guidance as to the right answer. Even if it did, the kinds of factors listed above might well suggest a policy response which differs from that which the science might suggest.

This discussion suggests that the role of science in policy making is limited and that science is merely one component in a very complex process. What then is the appropriate role for science, especially in the great majority of cases where it is not able to offer the "true" answer? At its most useful, science can offer:

1) Some assessment of the relative risks associated with various threats.

2) Equally importantly, comparative evaluations of the likely efficacy of proposed policy responses.

3) To the policymaker, a clear identification of the boundaries of (un)certainty around complicated choices.

4) A rational context within which to build a framework for risk taking.

Thus, science is rarely the sole source of the answer. It is merely one tool, admittedly an important one, to assist in policymaking. Unfortunately, the superficial certainty of science provides a seductive false sense that if only science were more heavily relied on, then policymaking would be wiser. One wonders if many who offer this panacea aren't simply seeking to reduce much of the policy made to assure protection of coastal marine resources.

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SCIENCE FOR MANAGEMENT: THE WAQUOIT BAY NATIONAL ESTUARINE RESEARCH RESERVE EXAMPLE

Christine Gault, Waquoit Bay, National Estuarine Research Reserve

Introduction

The Waquoit Bay National Estuarine Research Reserve (WBNERR), designated in 1988 and located in the towns of Falmouth and Mashpee on the southern shore of Cape Cod, Massachusetts, is one of 22 reserves in the National Estuarine Research Reserve System (NERRS). The primary function of the Reserve System, which was established in 1972 as part of the Coastal Zone Management Act, is to serve as a network of natural laboratories for research that fosters our understanding of estuarine ecosystems and to apply this research to coastal management issues. WBNERR is administered by the National Oceanic and Atmospheric Administration (NOAA) and the Massachusetts Department of Environmental Management (DEM).

To fulfill its objective of improving coastal management by translating research results to the public and policy makers, the Reserve integrates representatives from local, regional and state coastal management agencies into advisory and planning committees. The Waquoit Bay Advisory Committee is comprised of representatives of bay user groups, town, regional and state regulatory agencies with jurisdiction over the bay, citizens groups and the Wampanoag Tribe. The Research Advisory Committee is comprised of scientists from a number of the facilities, such as the Woods Hole Oceanographic Institute, that work within the Reserve. The Resource Protection Subcommittee includes town and state resource protection officials including shellfish wardens, conservation agents, health agents, planners, and environmental police officers, among others. The Outreach Advisory Committee includes representatives of the Woods Hole Sea Grant Program, the Massachusetts Coastal Zone Management (MCZM) Program, the Falmouth and Mashpee School Systems, etc. Periodically the chairpeople of all of the committees meet to coordinate efforts.

The staff structure is also designed to facilitate the transfer of research information. The Research Coordinator conducts Reserve research and coordinates the research being done by others at the Reserve. The Research Translator translates the research results to the policy makers and regulators, while the Education Coordinator translates the research results to the general public on a conceptual level. The Reserve Manager focuses on coastal policy issues, planning and land management. This core group meets weekly to coordinate efforts. In addition the entire staff meets weekly to discuss all aspects of reserve programs in recognition of the need to continuously transfer knowledge between staff as well as to policy makers.

Research

Approximately 50 people have been involved in research at the Waquoit Bay Reserve for the past few years. Funding for their work has come from a variety of sources including the National Science Foundation, the Environmental Protection Agency, universities, MCZM, U.S. Fish and Wildlife, the Cape Cod Commission, the NOAA Coastal Ocean Program's Estuarine Habitat Initiative, and NOAA/National Ocean Service/Office of Ocean and Coastal Resource Management's Sanctuaries and Reserves Division which has a competitive pot of money for research conducted within Reserves.

The Reserve also has its own in-house research program. Studies include: the impacts of docks, piers and recreational vehicles, barrier beach dynamics and the endangered bird project. There is also an on- going phased monitoring program which is encouraged at all reserve sites. One of the objectives of the monitoring program is the maintenance of a data base that records measurements of environmental variables which will provide long-term records that reflect seasonal and annual changes and trends of the coastal environment. Volunteer water quality monitors are adding to the data base.

The Land Margin Ecosystem Research Project

WBNERR is unique within the NERRS because it is a study site for a Land Margin Ecosystem Research (LMER) Project. This project is jointly funded by NOAA, the National Science Foundation (NSF) and the Environmental Protection Agency (EPA). The Waquoit Bay LMER (WBLMER) supports research that aims to increase understanding of the impact of non-point source pollution on estuaries.

The multidisciplinary project, one of five LMER studies in the U.S., is directed by Dr. Ivan VaLliela of the Marine Biological Laboratory (MBL) and the Boston University Marine Program (BUMP). WBNERR's association with the LMER project brings a large amount of intensive research to the Reserve which will greatly accelerate our understanding of how the Waquoit Bay ecosystem functions and responds to perturbations. This understanding can then be applied to similar shallow coastal embayments in the northeast. The Reserve contributes by serving as a research and logistics support facility, and perhaps of greater importance, as an interface between the WBLMER scientists and the policy makers who are responsible for determining the course of development within the region and subsequently the future health of coastal resources.

Much of the WBLMER research is based on the premise that land use in Waquoit Bay's watershed affects the ecosystems near and within the bay. WBLMER research takes advantage of the fact that there are subwatersheds within the Waquoit Bay drainage basin. These subwatersheds have experienced different rates of development. Therefore, researchers can study the impacts of development on the ecosystem.

Residential and commercial development combined with highly permeable sandy soils increases the amount of nitrogen in the groundwater. In Waquoit Bay, a shallow, moderately flushed coastal embayment, the nutrients lead to eutrophication as evidenced by increased growth of seaweed and phytoplankton, reduced concentration of dissolved oxygen during certain times of the year, reduced habitat quality and changes in community structure.

Although scientists agree on the general principles of "nitrogen loading" and eutrophication, they do not yet know the answers to such questions as: "How much nitrogen can we add to an estuary before we exceed its capacity to assimilate it?" or "What amounts of nitrogen are contributed from on-site waste water treatment systems? from agriculture, lawns or acid rain?

To address these questions WBLMER researchers study the nitrogen cycle in the Waquoit Bay watershed to learn how much nitrogen enters from different sources, where it goes, how much is removed at different stages, how fast it travels, and how rapidly different algae respond to various amounts of nitrogen. The Waquoit Bay Reserve channels this information to local, regional and state officials to better manage coastal watersheds and protect their resources.

Translating Research Results to Policy Makers

The Reserve acts as a bridge between the scientific community and coastal managers by promoting and conducting research and being knowledgeable about the informational needs of the coastal management community through our close working relationships with town, regional and state officials. The work that the Reserve has been doing on alternative denitrifying on-site wastewater treatment systems as a possible solution to nitrogen loading serves as an example.

Research at Waquoit Bay, Buzzards Bay and elsewhere has shown that one of the major sources of nitrogen in shallow coastal embayments surrounded by highly permeable soils is on-site wastewater treatment systems. When Reserve staff recounted this information during presentations to the public, people would invariably ask, "Well, what can we do about it?" A couple of years ago Reserve staff began examining ways to reduce nitrogen at the septic tank. We found that although the Massachusetts Title V, the code that regulates on-site waste water treatment systems, discouraged all but the conventional tank and leach field approach to on-site treatment, several other states were allowing alternative systems. In February 1992 the Reserve sponsored a conference called Nitrogen Removal Onsite Wastewater Treatment Systems: Technologies and Regulatory Strategies, funded by EPA, the Buzzards Bay Project and the MASS Bays Project. The goal was to provide Massachusetts regulators and citizens with information about denitrifying technologies, funding, land use and regulatory strategies. Invited speakers were from several states that were currently permitting these alternative systems. To foster interaction, education and cooperation among the various regional and state agencies, personnel from the Massachusetts Department of Environmental Protection Division of Water Pollution Control, the Cape Cod Commission, and

several local health boards were included in planning and implementing the conference.

More than 300 health agents, planners, regulators, concerned citizens and engineers from around the country and Canada attended the conference. WBNERR published and distributed a Position Paper from the conference in the fall of 92. Interest sparked by the event resulted in the formation in a committee co-chaired by the Reserve and the Association for the Preservation of Cape Cod (APCC), which brought together many of the people in the state interested in advanced on-site systems.

Because of its leadership on this issue, WBNERR was chosen in October 1992 as one of eight "communities" to participate in a National Small Flows Clearing House Demonstration Project to study the efficacy of advanced on-site treatment technologies. The Waquoit Bay Reserve will receive $110,000 through EPA to install and monitor several systems. A committee comprised of representatives from various local and regional government bodies, as well as members of the local scientific community has been formed to oversee this project.

Meanwhile, the Reserve also joined forces with APCC and the Citizens for the Protection of Waquoit Bay (CPWB), a not-for-profit group, to educate and galvanize the users of the Bay. A Citizens Action Committee, comprised of representatives of over 20 civic groups, was formed. The Committee developed a Waquoit Bay Watershed Action Plan which they presented to the regulatory boards of the three towns in the watershed -- Mashpee, Falmouth and Sandwich. An Intermunicipal Committee composed of representatives from all of the boards in the towns was formed to respond to the Action Plan. This Committee has met monthly at the Reserve.

One of the Committee's first actions was to apply for a Federal No-Discharge designation for Waquoit Bay. The No-Discharge Zone would prohibit all dumping of marine sanitation devices within Waquoit Bay. There are plans to have the formal designation ceremony in the spring, 1994.

Members of the Intermunicipal Committee are also exploring a possible nitrogen loading overlay district for the watershed. One possible tool for an overlay district is the ability of the Cape Cod Commission, the regional planning board, to declare an area a District of Critical Planning Concern (DCPC). This designation would require the towns in the watershed to develop regulations that would force all land use in the watershed to meet a critical nitrogen loading rate for the bay.

However, citizens, policy makers and regulators are ahead of the science of nitrogen control. Scientists have not yet established the critical loading rate for the bay. During the 1993 summer the Conservation Agent for Mashpee was working to enact a nitrogen loading by-law. Looking for a critical loading rate the Agent went to the LMER scientists, the Buzzards Bay Project and the Cape Cod Commission, all of whom are in various stages of developing models for nitrogen loading. No one was ready to provide a critical loading rate due to lack of sufficient information on

flushing rates and other uncertainties. Reserve staff helped him understand the complexity of attaining this rate, the different time scales of research and policy, and the various approaches to determining a critical nitrogen loading rate. Because the Agent felt, as do many citizens, that he couldn't afford to wait for the right number, he used the Cape Cod Commission's guideline for drinking water, 5 ppm, which is extremely conservative for the marine environment. The Reserve supported his attempts to initiate action to reduce nitrogen loading in public forums, but stressed that drinking water standards ultimately would prove inadequate for the health of the bay.

As mentioned the LMER project is developing several computer models to help understand the nitrogen loading dynamics of the Bay. After four years of study the group is still trying to determine proportional contributions from several sources. In the meantime, needing a management tool to address the issue, the Buzzards Bay Project and the Cape Cod Commission have developed their own nitrogen loading models which are currently being used. Reserve staff are working with the LMER scientists on a computer model using MacIntosh Hypercard which will help planners and others compare the two existing models with the LMER scientific model. Reserve staff have developed a primer and are insuring that the terminology and approach is "planner friendly."

Other Projects

In response to concerns raised by citizens and local regulators, the Reserve has also begun a program to address the question of possible impacts from docks, piers and recreational boats. People were particularly concerned with cumulative impacts. A literature search has revealed very little research on the impacts of non-commercial docks and recreational boats.

The Massachusetts Coastal Zone Management (MCZM) Program has provided initial funding to the Reserve to begin looking at this question. The advisory group for this project includes the Conservation Agents for Falmouth and Mashpee, the Shellfish Warden for Mashpee, the Massachusetts Division of Marine Fisheries and the MCZM Program. Participants in the research include: the University of New Hampshire, the Woods Hole Oceanographic Institute, the Marine Biological Laboratory, NJ School of Medicine, the University of Massachusetts at Dartmouth and Rutgers. A proposal for continuing funding has been submitted which hopes to examine the effects of wake turbulence and water displacement, propeller scour, benthic shading and wood preservatives on submerged aquatic vegetation and infaunal macroinvertebrates.

As part of this project the Reserve conducted a boating survey to obtain data on boating and marine sanitation devise use. Of the 1,200 questionnaires distributed, nearly 700 were returned. The questionnaire and the research will provide important information for state, regional and local regulators who make dock and pier permit decisions.

Summary

The National Estuarine Research Reserve System provides an unique network of estuarine research sites that provide research information to the policy makers and the public to insure better management of the nations coastal zone. At Waquoit Bay NERR policy makers, regulators, researchers and coastal managers join the reserve staff on various projects, advisory committees and planning groups to insure the integration of program areas and efforts. Reserve staff work with others on research projects, an Annual Research Exchange Day, conferences, workshops, presentations, technical reports, the Science and Policy Bulletins, computer models, etc. to provide needed information. The "Evenings on the Bluff" series, the Coastal Watersheds at Bay Curriculum, interpretive walks, open houses and special events help inform the public about coastal issues. The efforts at Waquoit Bay NERR together with similar efforts at Reserve sites around the country are making important contributions to understanding the process of applying research information to policy decisions thereby improving the understanding and management of coastal resources.

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REVITALIZING TWO SMALL CITIES' WATERFRONTS: A NATIONAL DEMONSTRATION PROJECT

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Introduction

Many small coastal towns and cities in America have been hard hit by global and national economic restructuring and changes in patterns of natural resource utilization. The small resource industry-based communities along coastal rivers and bays in the Pacific Northwest are no exception. Timber-related dislocations associated with court-ordered cutbacks to protect spotted owl habitat have greatly reduced employment in the woods, and the high price being paid for a diminishing supply of raw logs by foreign customers has created a shortage of raw material for local sawmills. Declining harvests of fisheries, driven by many factors, including listings or proposed listings of several salmon species under the federal Endangered Species Act, affect other communities. At the same time population growth is occurring at record rates in the major metropolitan areas of Puget Sound and the Willamette Valley—areas whose populations traditionally look to coastal communities to satisfy many of their leisure, recreation, and retirement needs. But the industrial nature of bay and riverfront communities and their proximity to attractive ocean beach destinations combine to limit their appeal to tourists and recreationists. In short, they are places one drives through on the way to somewhere else.

Over the years these changes have affected the waterfront, leaving buildings, docks, rail facilities, storage yards, and other property abandoned, derelict, or run-down. Morale has declined with the economy. Waterfront revitalization in these and dozens of similar coastal communities is an unrealized opportunity. There are opportunities for improved public access and recreation for residents and visitors, for small-scale industrial or commercial operations such as boat-building or secondary processing, for commercial tourist facilities that take advantage of the natural amenities many of these communities have overlooked in the past. While this is an attractive alternative to some communities, they have few of the resources—human, financial, and technical—to successfully mount and carry out a revitalization program.

Two small coastal communities in the Pacific Northwest—Raymond, Washington and Warrenton, Oregon—serve as good examples of these trends. They were selected recently to participate in a national demonstration project, the goal of which is to demonstrate that small communities can, with very limited technical assistance, develop and begin to implement well-thought-out, community-based waterfront plans that expand local economies and improve quality of life.

The community-based process being used in the demonstration project is described in a waterfront revitalization guide published by the authors (Good and Goodwin 1990). Waterfront Revitalization for Small Cities is a practical "how to" publication written primarily for the kind of lay reader likely to play a leading role in

the revitalization of smaller communities' waterfronts. It is a composite of the actual experiences of eight northwest coastal cities and focuses on both plan development and implementation. The demonstration project is jointly funded by the National Coastal Resources Research and Development Institute (NCRI) and the Washington and Oregon Sea Grant Programs; the authors and several university and private sector colleagues serve as the "project assistance team."

The Demonstration Project Communities

The town of Raymond, Washington (population 2,900) lies at the confluence of the North and South Forks of the Willapa River, six miles upstream from Willapa Bay. The river at this point is tidal and navigable for shallow draft vessels. Private industrial and common use docking facilities have been developed by, or on land leased from the Port of Willapa Harbor, and are utilized by wood chip barges and fishing boats. The Port also leases waterfront industrial sites and promotes industrial development.

Between 1980 and 1990 the timber-dependent economy of the region experienced drastic decline; local forest products employment suffered a 40% loss. The secondary impacts of these losses have been seen in declining retail sales, business and personal services, and other economic sectors upon which community vitality depends. Population and housing declines have followed; downtown has been particularly hard hit.

Raymond's physical setting and natural resources endowment present real opportunities for waterfront revitalization. The downtown is "contained" on three sides by the river, and by extensive wetlands — some in a completely natural state — on the fourth. Forested bluffs have further limited urban sprawl and protected some fine natural viewsheds and skylines. Downtown business buildings are typically three-story masonry structures built during the first two decades of this century. But parts of the downtown riverfront resemble more of a barrier than a place; streets here dead-end at a low railroad embankment which parallels the river and defines its bank. Elsewhere the remaining Weyerhaeuser mill and log-yard occupy the inside of a strategic bend in the river.

US 101, which carries Puget Sound metropolitan traffic bound for beach destinations skirts the downtown. At present there are few inducements to travelers to break their trips and visit Raymond, let alone spend the night. A revitalized waterfront could become such an inducement, bringing visitors downtown to purchase food, gifts, entertainment, and lodging while they enjoy waterfront parks, trails, interpretive centers, and opportunities to boat, kayak, or fish on the river. Riverfront festivals, drawing perhaps on the rich timber industry heritage, could augment the flow of visitors to all Pacific County destinations if coordinated through regional tourism development boards.

A variety of projects and proposals affect future development of the riverfront; but the city and the port lack an over-arching framework to guide waterfront land acquisition, land use, and project development. The demonstration project is

devoted to developing such a framework through a community-based waterfront revitalization plan.

Warrenton, Oregon (1990 population: 3,325) is the northwestern-most city in the state of Oregon and at the mouth of the Columbia River. The city's traditional economic base has been forest products manufacturing and other resource-based industries; these sectors have experienced dramatic declines in the 1980s and the downward trends are continuing. In response, Warrenton has adopted an aggressive economic development stance in an attempt to forestall and reverse general economic decline. Some successes have been achieved, notably in attracting commercial shopping facilities and fishing businesses. Despite these successes, the 1991 Oregon State legislature, responding to the timber crisis, designated Warrenton as a "severely-affected community," thereby making the city eligible to compete for special financial assistance programs.

Warrenton is comprised largely of diked wetlands intermixed with dune ridges and other uplands. It is bordered on three sides by major waterbodies—the Pacific Ocean to the west, the Columbia River on the north, and Youngs Bay and the Lewis and Clark River on the east. Bisecting the city north to south is the Skipanon River waterway, a small but economically important tributary of the Columbia. The Skipanon is one of the principal industrial and commercial areas of the city and includes a lumber mill, a fish processor, the city-owned and operated boat basin, private moorage, a fish market, and charter fishing boat operations. The east bank of the Skipanon, with the exception of the boat basin and associated businesses, is mostly vacant land owned by city, the Port of Astoria, and Oregon. Downtown Warrenton, which consists of public buildings, a few businesses, and residential areas, is located on the west bank of the Skipanon just upstream from the boat basin. The highway running directly through the downtown is one of the two principal routes to Fort Stevens State Park (the busiest in the state) and the Hammond mooring basin, the principal launch point for thousands of recreational salmon fishers.

The Skipanon River waterfront is the focal point for the proposed demonstration project, though the Columbia River waterfront from the Hammond mooring basin east to the Skipanon will also be evaluated. There are opportunities for expansion of marine industrial and commercial enterprises, particularly commercial fishing moorage, vessel repair, and other support services. The distinctly "working waterfront" character of Skipanon River, its strategic location with respect to pass-through tourist traffic, the historic nature of the area, and its location adjacent to the small downtown center together create significant opportunities for expansion of visitor-serving businesses and facilities. Through carefully-planned public access improvements and stimulation of private commercial investment, Warrenton could expand and diversify its waterfront economy, create a new identity and role for the mostly-abandoned downtown commercial district, and physically link the community to its Skipanon waterway heritage. The demonstration project serves as the principal vehicle for the city and port to realize these opportunities.

While not a panacea, revitalizing the waterfront may prove to be another arrow in the quiver of communities seeking a way out of community decline. Successful waterfront planning and plan implementation in Raymond and Warrenton will show peer cities elsewhere some ways to help break the cycle of despair that typically accompanies economic decline.

The Planning Process

In summary form, the planning process in Waterfront Revitalization for Small Cities includes several stages:

1) Community Organization and Orientation -- form the planning team; adapt the planning model; design a public involvement program.

2) Waterfront Survey -- identify the study area; inventory and map cultural, physical, and natural characteristics; identify waterfront issues.

3) Waterfront Plan Development -- develop alternative visions for the waterfront based on overall goals and specific objectives; make cost estimates for carrying out plans.

4) Waterfront Plan Implementation -- form local implementation teams; pursue development opportunities in the plan.

Progress on Revitalization Plans

In both Raymond, Washington and Warrenton, Oregon, significant progress has been made in developing waterfront revitalization plans. It is fair to say that there are skeptics in both communities. But as awareness of the planning effort in each community grows, there has been a corresponding growth in expectations of what might actually be accomplished. Planning teams and community members are talking about possibilities for expanded or improved access, about nature-based tourism at the waterfront, and about new kinds of industries and jobs that take advantage of the unique character of each community. Progress in the planning process is outlined below, followed by a preliminary evaluation of progress as it relates to the overall goal of the demonstration project.

Community Organization and Orientation

Each of the communities quickly appointed local planning teams. Adapting the planning model has been a deliberate process in each community, with each step preceded by planning sessions with key staff and team members, followed up by "how-to" workshops for the planning team. This has been particularly effective in Raymond, but there was some initial resistance in Warrenton for having the university-based project assistance team work directly with the local planning team, resulting in delays and departures from the planning model. Both communities have developed and implemented successful public involvement programs, which culminated in "town hall" style meetings to brief the community on inventory/survey

results and get input on key issues and possible goals for the waterfront. Raymond has made particularly effective use of newspaper coverage of the project. The Warrenton team, in an effort to get ideas from young and old, put together a bus tour of the waterfront that paired senior citizens with high school seniors. Both teams used surveys to collect data from stakeholders, with Raymond using an interview approach and Warrenton a direct-mail approach. Both have yielded good ideas, confirmed some opinions, and refuted others. Both communities, with assistance, developed and carried out "visual preference surveys" using slides to see what kinds of waterfronts and projects people most liked or did not like.

Waterfront Survey

Study areas were identified early on in both communities, and basic data collected and mapped: land use and significant buildings, land and water ownership, zoning, public access-parks-recreation sites, wetlands, erosion areas and dredged material disposal sites, historic/archaeologic sites, and the diking systems. Associated "problems and unrealized opportunities" were also identified as part of the waterfront survey process. The local planning team members did not express a great deal of interest in gathering data, leaving most of the survey task up to city and port staff.

Waterfront Plan Development

Each of the communities have identified plan "elements" based in part on the natural breakout of problems and opportunities they have identified through the inventory and public involvement process. Similarly, both communities have identified broad goals under each plan element and objectives designed to help achieve those goals. For example, under their Public Access element, Warrenton has established a goal "to create links along the shore between various existing and other planned access points using trails along dikes or nearby roads." Using this and similar goals as a framework, the planning team have conducted design workshops, translating goals and objectives into specific proposals for improvements. These workshops are proving to be the key events in the waterfront planning process, providing the project-oriented planning teams with graphic representations of the specific actions they want to see happen.

Waterfront Plan Implementation

Though the implementation team is not scheduled to be appointed until the plan is completed, work has begun to identify potential funding sources for possible demonstration projects and on the phasing waterfront development. In Warrenton, a "design studio" through a local university's landscape architecture program is planned to provide detailed designs for a proposed waterfront park and a waterfront trails network along dikes that surround the city. Actual project construction should be underway by the end of the two-year demonstration project. Raymond has begun engineering design and cost estimates for a small boat facility on the downtown waterfront adjacent to a rails-to-trails bike/pedestrian trail that was recently acquired by the state parks system.

Preliminary Evaluation of the Planning Approach

The premise of the demonstration project—that small communities can, with very limited technical assistance, develop and begin to implement well-thought-out, community-based plans that expand local economies and improve quality of life—has been regularly reviewed and evaluated by the project assistance team. Some preliminary conclusions are offered:

1) Start-up time for a community-based planning process is more time-consuming than expected; actually, however, the discipline of the externally-imposed schedule probably made things move faster than they might have otherwise. Conclusion: an imposed schedule is good, but needs to be realistic.

2) The waterfront book may be too detailed to serve as a true community planning guide. Although many of the issues and questions arising about the process are addressed in the book, they are hard to find. Consequently, a shorter "workbook" version of the book with appropriate modifications, a good index, and more "how to" guides for each step, would be more useful to planning team members.

3) There needs to be a solid local staff—project assistance team relationship established early on to facilitate technical assistance transfer. A key staff member must be an enthusiastic champion of the process and be committed to its execution. This should be a prerequisite for developing a relationship.

4) While plan outcomes from the two communities are unclear, the need for local political commitment is certainly one of the critical factors in seeing the process through to implementation. One of the communities is on more solid footing than the other in this regard.

5) Involvement of a well-staffed regional planning agency in small city waterfront planning is a great asset, perhaps even a necessity for success. Generally, this suggests that professional support, whatever the source, is necessary to run a successful waterfront planning process.

6) The relatively conservative attitude about "property rights" in small communities makes it difficult to engage a planning team in speculation about what kinds of uses and activities might be desirable on privately-owned waterfront lands. An issue in both communities, this suggests that an "educational forum" approach aimed at local landowners might be more effective than a traditional planning process.

The second and final year of this national demonstration project will close in late 1994. Written plans for both communities should be in place and actual demonstration projects, probably related to waterfront interpretive trails and other access opportunities, underway. The communities will have established implementation teams to guide the various projects planned. The project assistance team will have evaluated the impact of the project and developed a plan for follow-up evaluation three years later. While some measure of "success" can be determined in the short run (new community-based planning skills, the start-up of projects, etc.), the true test of the process and its economic and community benefits will likely take several years or perhaps even a decade to realize. However, many of the lessons learned, including those above, will be transferrable at once.

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IMPROVING STATE COASTAL HAZARDS MANAGEMENT: PROGRESS ON OREGON'S CZMA SECTION 309 STRATEGY

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Introduction

The need for improvements in coastal natural hazards management policies and policy implementation in Oregon has been recognized for many years, but has been given new impetus by Congress' passage of the 1990 Coastal Zone Reauthorization Act. Section 309 of the act established a voluntary Coastal Zone Enhancement Grants Program to facilitate state coastal management program changes in several areas, including coastal hazards. Following an assessment of needs, the federal Office of Ocean and Coastal Resources Management (OCRM) concurred with Oregon officials that coastal hazards was a qualifying area. A five-year coastal hazards policy improvement strategy and funding proposal was prepared and approved by OCRM; work began in 1992.

This paper outlines Oregon's coastal hazards policy improvement strategy and progress, with emphasis on Oregon's Coastal Natural Hazards Policy Working Group (PWG). A brief overview of natural hazards along the Oregon coast is presented first, along with the present hazards management framework and some of its shortcomings. The contents of Oregon's strategy are then outlined, and the work of the PWG described, including the process being used, and preliminary policy recommendations and implementation measures.

Hazards, Existing Policies, and Problems

Natural hazards affecting the Oregon coast can be understood in terms of the regional tectonic setting, local geology, and global and regional oceanographic and atmospheric conditions. Just offshore is the 700-mile long Cascadia Subduction Zone (CSZ), the boundary between the westward-moving North American plate and the northeast-moving Juan de Fuca plate. The vulnerability of the coast to large earthquakes (M 8-9+) along this fault and locally-generated tsunamis has been established in recent years; recurrence intervals are estimated at 340 to 590 years (Madin, 1992). The most recent event was about 300 years ago and the probability of another large quake in the next 50 years is about 20-30%. The scenario for such an earthquake includes severe, sustained ground-shaking; liquefaction of unconsolidated, saturated soils; numerous and possibly massive landslides; and a series of large tsunamis arriving soon after the event. Loss of life and property could be significant.

Although hazards associated with potentially catastrophic earthquakes have garnered significant attention recently, Oregon has long been affected by more subtle, chronic natural hazards. These include episodic beach and dune erosion, gradual and episodic sea cliff recession, bluff slumping and landslides, and coastal

flooding. Excess sand buildup is a problem in some areas. These chronic hazards owe their severity to winter storms that generate significant wave heights of 20-30 feet; associated storm surge and wave setup along the beach and shoreland; strong nearshore currents, including devastating rip currents; high winds, rain, runoff, and associated lowland flooding; and elevated sea levels caused by seasonal effects and periodic El Niños (Komar and Good, 1989). Long term sea level rise (SLR) associated with global warming is also a problem along about 150 miles of the central coast, where uplift is minimal and, not coincidentally, where erosion problems are most severe (Komar, 1992).

Local, state, and federal agencies each have programs and policies related to natural hazards along the Oregon coast. The principal programs and policies include Oregon's statewide land use planning program and its hazard-related planning goals. Used by local governments to develop local comprehensive plans (LCPs), these goals include: Goal 7 — Natural Hazards, Goal 17 — Coastal Shorelands, and Goal 18 — Beaches and Dunes. Hazards information and mapping is the responsibility of the Department of Geology and Mineral Industries (DOGAMI). Shore protection structures (SPSs) along the oceanfront are regulated under a joint permit program by the State Parks and Recreation Department (SPRD) and the Division of State Lands (DSL).

Coastal hazards management problems have been identified in several recent studies (Good, 1992; Jones, 1993; ODLCD, 1993). They include inadequate hazard mapping, particularly for potentially catastrophic earthquakes and tsunamis; inconsistent quality in geotechnical reports prepared to evaluate sites and suggest mitigation measures; lack of coordination between local planning/development of uplands and state management of public beaches, particularly with respect to permitting of seawalls and revetments; jurisdictional gaps and overlaps in the SPRD/DSL permit process, and inadequate assessment of proposed SPSs; inadequate emergency shore protection procedures; inadequate public awareness of the threat of earthquakes and tsunamis; poor disaster preparedness for large earthquakes and tsunamis at all levels; and lack of procedures for factoring the threat of earthquakes and tsunamis into the local land use process, particularly for critical facilities. Significant population growth and development at the coast, particularly in recent years, is compounding these problems (Jones, 1993). A growing influx of retirees, second-home buyers, and visitors are creating demand for new construction along the oceanfront, including homes, condominiums, motels, and restaurants. More hazardous sites avoided earlier are now filling in with vulnerable development. Older structures built along the oceanfront are also increasingly at risk, owing to gradual sea cliff recession and episodic beach and dune erosion.

A Strategy for Improving Coastal Hazards Management

Oregon's five-year strategy for addressing these issues has three components: 1) hazard assessment, 2) hazard awareness, and 3) hazard policies and implementation. Hazard assessment projects have thus far included a pilot mapping program for chronic hazards and a project to improve geotechnical report content standards (Komar, 1993). A catastrophic hazards mapping project is underway.

These will be expanded in the future to other areas. Increased hazards awareness is being pursued as part of the mapping, geotechnical report, and policy improvement projects. Policy improvements are being identified by a Coastal Natural Hazards Policy Working Group (PWG).

The PWG was formed in early 1992 as an outgrowth of a 1991 Sea Grant coastal hazards conference held in Newport. The conference presented the results of recent research, examined engineering and regional planning strategies to mitigate hazards, and reviewed public policy issues. Participants expressed great interest in delving into the problems identified above to find acceptable solutions. A 20-member PWG was drawn from conference attendees; it includes people with a variety of coastal interests—oceanfront property owners, realtors, environmentalists, a consulting geologist, local planners, a school teacher, a county commissioner, an emergency manager, a fire chief, and managers from key state and federal agencies.

The PWG has no formal mandate. Consistent with the Section 309 program goals, however, it defined its "mission" as: Representing a broad range of public and private interests, the PWG is identifying important coastal natural hazard issues, evaluating existing management strategies, examining alternatives, and recommending and supporting needed policy improvements to decision-makers at all levels.

The PWG used an "all-hazards/all-decisions" approach to identify problems and generate alternative solutions (Ansevin and Good, 1993). In an "issues and options" report (CNHPWG, 1993), the PWG outlined 27 policy issues and more than 150 options for dealing with them. Issues were organized in four broad categories: Hazard Assessment, Disaster Preparedness and Response, Land Use, and Shore Protection; a feed-back evaluation form was also included as part of the report. The PWG conducted 10 public evaluation workshops for various stakeholders and the general public; more than 400 attended. The input from these workshops and the more than 60 evaluation forms that have been returned are being used to help develop final policy recommendations. Implementation of recommendations, currently in draft form, will require both legislative and administrative action by local, state, and federal government, as well as private sector actions.

Draft Policy Recommendations

Although it is not certain what recommendations will finally emerge, the PWG has largely completed a rough draft of its recommendations for hazard assessment, land use, and shore protection. Some draft final recommendations are outlined below, but the stress should be on "draft."

Hazard Assessment

A number of problems related to hazard assessment were identified in the PWG process: inadequate chronic and catastrophic hazard mapping and data for decisions about land use, shore protection, and disaster preparedness and

response; inconsistent and poor quality geotechnical reports prepared for site-specific developments; and poor dissemination or access to existing and newly released information. In response to these issues, the PWG is likely to recommend:

1) Development of criteria and standards for collection, reporting, and mapping coastal hazards (based on the earlier-referenced pilot projects).

2) Inventory of existing studies, maps, and digital data and evaluation for use in new hazard mapping, prior to new investments; improved access to this information through database development and a central depository.

3) Development of coastwide standard chronic and catastrophic hazards maps at a minimum scale of 1:4,800, with criteria for establishing mapping priorities.

4) Funding of other applied research on chronic and catastrophic hazards that contribute to hazard reduction and resource management.

5) Specific content standards for site-specific geotechnical report requirements, procedures for peer review, and coastal certification of geotechnical professionals.

Land Use

Land use issues identified by the PWG include poor coordination between land use decisions and management of beaches and shore protection (e.g., inadequate building construction setbacks); public subsidies of development in hazardous areas; lack of hazard awareness by buyers of real property; and lack of procedures for factoring the threat of earthquakes and tsunamis into the local land use decisions. Likely PWG recommendations include:

1) Establishing a new method for determining building construction setbacks, using a coastwide "formula" approach, but applied locally based on specific site characteristics.

2) A framework and process for special area management planning (SAMP) along the oceanfront, including mapping & inventory procedures, establishment of logical boundaries, means to deal with "unbuildable" lots and the influence of existing uses/past decisions on future development, advance determination of shore protection and dune management strategies, and evaluation of alternative shore protection techniques through pilot projects.

3) Elimination of certain classes of public subsidies in certain hazardous areas.

4) A local government notification process for proposed oceanfront development as it relates to the need for future shore protection.

5) Limits on development in earthquake/tsunami hazard areas, particularly for critical facilities, schools, etc.

Shore Protection

Problems related to shore protection management include jurisdictional gaps and overlaps, and inadequate assessment of proposed SPSs in the state permit process; lack of coordination with local government and state agencies, particularly in the review and evaluation process; and inadequate emergency shore protection procedures. Preliminary recommendations include:

1) Explicit goals for a revitalized shore protection program, including a basic policy discouraging hard SPSs.

2) Consolidation of the program within a single agency (SPRD) and a new mandated interagency review/evaluation process that takes advantage of existing expertise.

3) New jurisdictional boundaries to eliminate physical gaps in permit program coverage.

4) A new process and sequencing of decisions with respect to need for shore protection, threatened property, alternative shore protection methods evaluation, impact assessment, and compensation for unavoidable impacts, including cumulative impacts.

5) Explicit emergency shore protection procedures requiring removal once the emergency has passes.

6) Increased administrative/civil enforcement authority for the lead shore protection agency.

7) Establishment of a fee for costs of shore protection permit review and evaluation.

8) An education initiative to improve transition to the new program.

Disaster Preparedness and Response

Problems identified include: low public awareness of earthquake/tsunami hazards, inadequate disaster preparedness and response planning, and vulnerable communication systems, utilities, critical facilities, infrastructure, and buildings. The PWG is likely to recommend:

1) Development and implementation of an all-audience education program to increase awareness and preparedness for earthquakes and tsunamis along the Oregon coast.

2) Establishment of a coastwide Incident Command System for earthquake response.

3) Preparation of earthquake annexes to local and state emergency operations plans; assistance in preparation of plans for businesses and families.

4) Improved emergency communication systems.

5) Determination of coastal lifeline and infrastructure vulnerability and the effect on disaster plans.

6) Inventory of buildings for structural integrity and a plan for vulnerability retrofitting.

7) Post-disaster planning for reconstruction and land use.

Discussion and Conclusions

The draft recommendations outlined above, if fully implemented with adequate resources by appropriate agencies or private parties, would create a coastal hazards management framework for Oregon that integrates the full range of chronic and catastrophic hazards with all decisions affected by those hazards. It would incorporate the latest scientific findings and technical procedures, spur needed improvements in coordination, and reduce conflict through advance planning (SAMPs). Most important, it would help achieve the fundamental goals underlying existing and proposed policies:

1) To protect human life and property from natural hazards.

2) To protect the beach in perpetuity for public recreational use and enjoyment.

3) To conserve, protect, and where appropriate, develop or restore oceanfront lands consistent with protection of the beach and upland property.

The final recommendations of the PWG are expected in mid-1994. At that time the real work of seeking implementation of this new management regime begins. It is hoped that the groundwork laid by the PWG, the public nature of the process, and the attempts to keep policy-makers and others informed along the way will result in a favorable climate for implementation, whether through legislation, administrative rules, or other means.

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MANAGING CUMULATIVE AND SECONDARY IMPACTS IN THE COASTAL ZONE: A SURVEY OF CURRENT STATE APPROACHES

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In recent decades, most coastal areas have experienced unprecedented population growth. Cumulative and secondary impacts on natural resources in the coastal zone result from a wide-range of activities surrounding the current population growth and subsequent increase in development. These impacts include loss of sensitive habitats and resources, decrease in water quality, and decrease in public assess to the coast, among others. The diffuse causes of these impacts, and general lack of technical information identifying the effects of these causes, creates a complex coastal management problem that is difficult for most states to address through current management regimes.

This paper will examine the techniques and methodologies coastal states have developed, and are currently developing, to address cumulative and secondary impacts from growth and development in the coastal zone, and explore the challenges to their efforts. First, an overview of current coastal state management regimes, and the weaknesses in those regimes, to address cumulative and secondary impacts will be discussed. Second, an examination of current techniques and procedures states have proposed and are developing to address those weaknesses will be presented. Finally the paper will highlight the successes and challenges states have encountered while developing these new management regimes.

This examination will be limited to coastal states which have federally approved coastal zone management programs and which have projects funded through the Coastal Zone Enhancement Program to address cumulative and secondary impacts. In this Enhancement Program, which was created through the 1990 reauthorization and amendments to the Coastal Zone Management Act, states are encouraged to address eight national coastal resource management objectives through "enhancements" or changes to their coastal zone management programs by developing new legislation or regulations, or make improvements to existing laws or policies. One of these national objectives is to address cumulative and secondary impacts of population growth and development on coastal resources, such as wetlands and fishery resources.

States first assessed the status of their coastal resources and determined the potential for improving the management of those resources given the significance of the issue in the state and the existing institutional framework. This assessment provided the states with a factual basis to determine priorities and develop strategies for improving their coastal management programs. Most states, 27 out of the 29 coastal states and U.S. territories, listed cumulative and secondary impacts as a priority area to receive funding in order to develop improvements. States then developed strategies and proposed projects to address these issues, and other identified state priorities.

The state assessments that identified the existing management frameworks and techniques to address cumulative impacts recognized the inadequacy of those techniques. These techniques mostly include incremental regulatory practices, e.g., considering impacts on a case-by-case basis through permit review.

In many cases, states have the legal authority in their state coastal zone management program statutes for controlling development that potentially has cumulative impacts on coastal resources. Many states also have individual cumulative impact policies that may exist in local land use plans. However, the assessments of existing programs reveal no systematic methodology for applying those cumulative impact laws and policies. This creates the inability to develop information resources necessary for comprehensive control of cumulative impacts, and makes it difficult to quantify and qualify these impacts. Further, most states lack a sufficient coordination effort among the agencies responsible for the varying legislation. This makes it difficult to assess the effectiveness of the laws and regulations to evaluate whether areas are adequately protected from cumulative and secondary impacts.

Proposed in the states strategies are varying, many times overlapping, approaches to improving the management of cumulative and secondary impacts. A few of these approaches are discussed below.

Many states have proposed to utilize and improve upon existing planning frameworks--regional or comprehensive planning, state-wide growth management laws, critical area laws for the coastal zone -- to attempt to manage the effects of cumulative and secondary impacts of growth and development. Some of the proposals for improving these existing frameworks include: improve coordination between regulatory agencies to conduct better cross-media assessments of resources; expand the scope of state environmental impact review requirements; incorporate cumulative impacts language into existing environmental programs and regulations; modify permit procedures; and improve baseline data and monitoring capability with a greater emphasis on basin-wide and regional approaches.

For example, California proposed to develop a regional review process of local coastal plans which are used to implement the California Coastal Management Plan. The state is conducting a demonstration project in a designated region to review regional cumulative impacts to resources and make recommendations to the locals in the regions on any changes needed to better consider cumulative impacts in the local permitting process for coastal development. Drawing on the demonstration project, the new regulations may specify new monitoring, data collection and/or better coordination with other public agency to better consider cumulative impacts in the region. Memoranda of Agreements may be established with other agencies to help solidify the coordination processes.

Other states have proposed more science-based efforts by collecting and utilizing resource data on Geographical Information Systems (GIS) combined with a comprehensive planning and management approach to protect natural resources. For example, North Carolina is developing a complex network of information of

existing resources using GIS which will include the location of permitted activities and land use activities. and identify critical habitats on a watershed basis. The state is also developing population growth and natural resource coefficients in order to quantify the demands and pressures from projected population growth. This will help draw a more direct relationship between growth and environmental quality. The state will use this information to develop specific criteria and enforceable policies to assess and address cumulative effects through improved state policies and local land use plans. Likewise, Alaska is working to develop a methodology that will quantify the impacts to fisheries habitat on one of its rivers.

Many states are combining efforts towards managing cumulative impacts with other identified priority areas in their Enhancement Programs, such as the protection of wetlands, and the protection of property from coastal hazards. Other states are taking a less comprehensive approach than what has been described and have proposed to address the cumulative or secondary impacts from specific problems. Some of these proposals include: improve regulations for septic systems in flood prone areas and in sensitive habitat areas such as shellfish beds; improve specific stormwater management guidelines for developed areas; review mitigation banking alternatives for activities in wetlands; and revise siting and design guidelines for marinas and boast slips.

For most states, the Coastal Zone Enhancement Program has provided an opportunity to develop methodologies to assess cumulative and secondary impacts. From these methodologies, information will be gathered to provide a basis for new criteria, policies, and regulations that protect important habitats and coastal resources from adverse cumulative impacts. As mentioned above, the final paper will provide a more detailed examination of state efforts and examine the challenges and successes in trying to develop these new programs.

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THE FUTURE OF THE PACIFIC NORTHWEST OYSTER INDUSTRY

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Introduction

The commercial oyster industry in the Pacific Northwest is an integral part of many coastal communities. For over 100 years, it has created business opportunities, local employment, general economic development and has provided an important product the domestic market. In addition, the industry's colorful history has added to local character in an important way. Currently, hundreds of people are directly employed by the industry, which had 1989 sales of nearly $30 million, and a total economic impact much greater (Oregon Dept. of Agriculture, 1990). Over 10,000 acres of intertidal land in Oregon and Washington are utilized.

The industry saw its beginnings in the mid-1850s with the harvest of the small native oyster, Ostrea lurida. The industry flourished and soon, as much as 200,000 bushels were being harvested annually from Puget Sound alone (WA dept. of Natural Resources, 1990). By 1895, the stocks were seriously depleted. Oyster growers attempted to introduce the European oyster from the east coast, but were met with limited success. The industry was revived with the introduction of the Pacific oyster, Crassostrea gigas, from Japan. This oyster grows well in our waters and is relatively simple to cultivate. Originally, seed was purchased from Japan, but there are many hatcheries now in operation in the Pacific Northwest, so oyster seed is locally available.

The preferred method of oyster growing is bottom culture. In this system, cultch shells with spat attached are taken by boat or dredge to their destination, where they are shoveled over the side. Sometimes, these oysters are collected and moved to fattening grounds after two to three years. After four years, the oysters are harvested by dredge and prepared for market.

The industry currently faces new challenges that have already spelled doom for several commercial operations. The primary culprits are two species of burrowing shrimp. Mud shrimp, Upogebia pugettensis, and ghost shrimp, Callianassa californiensis burrow into the intertidal sediment, softening the substrate enough so that mature oysters cannot be supported. They sink in and suffocate in the sediment. Burrowing shrimp populations have apparently increased greatly in recent years, compounding the problem. The cause of this population increase is unclear, and will be discussed later. To combat the burrowing shrimp problem, the pesticide carbaryl (trade name Sevin) has been used for several years to rid the oyster beds of shrimp. The use of carbaryl has led to even more pressure from state agencies and environmental interests to discontinue its use. In fact, it has already been banned for use in Oregon due to its negative ecological impacts and improper application methods (Bakalian, 1985).

This paper will address the factors surrounding the volatile issue by first examining probable causes for increases in the shrimp population, then looking at

possible solutions. Other factors will also be explored that have led to the decline in the industry. These factors include falling prices, rising operational costs, and the environmental movement. Next, the paper will describe experiments with off-bottom culture and alternative delivery of pesticides that were completed in summer 1993. Finally, we will discuss the future of the industry, with emphasis placed on the need for innovative solutions to the numerous challenges the industry faces.

Shrimp Galore

Ask an oyster grower what the biggest challenge to growing oysters in the Pacific Northwest is, and he will undoubtedly tell you it's the shrimp. Not only does the soft sediment bury and kill oysters, but it is very difficult to walk on the beds when one's boots sink up to the thigh. Although there are no studies that document increasing shrimp populations, it is has been observed empirically by oyster growers and long-time residents that numbers have indeed increased significantly. Again, the exact cause of the ballooning shrimp population is not known. Many people believe that it may have to do with the changing ecology of the bay. For example, decades of poor logging practices have resulted in excessive siltation into the bay, may provide ideal habitat for burrowing shrimp. Predator-prey relationships have also been suggested. Cutthroat trout, Onchorrynchus clarkii, Pacific staghorn sculpin, Leptocottus armatus, and white sturgeon, Acipenser transmontanus are known to feed on burrowing shrimp, and historic declines in numbers of these fish may have also contributed to the increase in shrimp numbers (SEIS, 1989). Whatever the actual cause, helicopter spraying of carbaryl has at least partially alleviated the problem. However, as often occurs, the solution has brought with it a host of new problems.

Carbaryl is very effective at killing shrimp, with mortalities of 50% to 98% (SEIS, 1989). However, it also effectively kills many other species of marine organisms as well, including juvenile Dungeness crabs. The Dungeness crab fishery is very valuable in the Pacific Northwest, and the fact that carbaryl application is highly toxic to juvenile crabs is a matter of great concern to commercial crab fishermen. This in itself is a complicated issue because while carbaryl kills crabs, the presence of oyster shells has been shown to provide excellent habitat for larval and juvenile Dungeness crab (WRAC, 1993).

Solutions

A 1989 supplemental environmental impact statement (SEIS, 1989) addressed the greatest immediate threat, which was and still is perceived to be increasing numbers of shrimp in the estuaries. Oyster growers have long known that off-bottom culture methods are not economically feasible, and have pressed for experimentation with alternative pesticides or delivery systems. However, state agencies and environmental interests have been concerned about the adverse effects of carbaryl and have pressed for experimentation with alternative culture methods that might eliminate the need for pesticide use. The SEIS proposed four management alternatives, however, no long range plan has been adopted by the Departments of Fisheries and Ecology, which are the two state agencies most

involved with the issue. Alternative one eliminates carbaryl application and calls for the continuation of current ground culture methods. Alternative two also eliminates carbaryl application, and calls for implementation of alternative growout methods. Alternative three suggests shrimp control methods other than carbaryl application, including chemical treatment, mechanical control, biological control, and commercial harvest. Alternative four is status quo, i.e., carbaryl treatment at present scale. Some components of these alternatives have been explored already. Below is a brief summary of some of the most prominent methods that have been discussed.

Electrofishing, which involves passing an electric current through the substrate with the intention of forcing the shrimp out of their burrows has been informally experimented with, and some positive results have been observed (Langdon, pers. comm., 1994). However, more extensive experimentation must be completed to determine the feasibility of electrofishing as a means of shrimp control and/or commercial harvest of shrimp for bait.

Alternative three of the SEIS recommends alternative means of shrimp control. Efforts in this arena have focused on chemical and mechanical control methods. Chemical methods could mean using different types of pesticides that are more species-specific and less harmful to non-target species, or it could mean alternative delivery of carbaryl. Injection into the substrate may result in less incidental kill, while better targeting the burrowing shrimp. Mechanical methods might include ground compaction or disruption of the sediment. These types of shrimp control have not been explored extensively.

Alternative two of the SEIS suggests alternative grow-out methods. Some types of off-bottom culture methods are suitable for use in the Pacific Northwest. Long lines and rack-and-bag systems are the most predominant, but production costs are greater than for bottom culture, making it not feasible economically. Off-bottom culture can be financially successful for a small, family operation, but it does not scale up well to a larger operation. One possibility that could make off-bottom culture profitable is to raise a higher value crop such as scallops, native oysters, or abalone (SEIS, 1989).

Beginning in October, 1992, we designed and constructed three types of off-bottom culture methods to explore their feasibility. These were placed on intertidal areas in Willapa Bay, Washington. The site was selected because there had been no carbaryl spraying and there was a thriving shrimp population, so we would know if our methods would be able to stand up to winter conditions and a heavy shrimp presence. The three types of methods included long-lines, a "floating field" that consisted of plastic Vexar netting with pvc pipe attached for floatation, and a "flexible tray" trial that was adapted from a design developed by the Harbor Branch Oceanographic Institute. The labor-intensive nature of off-bottom culture was evident during our experiments. Simply attempting to walk around on the flat was a challenge, let alone trying to actually work. In addition, the severe winter winds and wave action in this region tended to either tear our experiments loose, or bury them with silt. The long-line trials were successful for the most part, but again, construction and labor costs are prohibitive. The floating field was the most

expensive to construct and suffered greatly from the adverse weather. It also tended to become fouled due to siltation and algal growth. The flexible tray system shows promise, but probably only for higher value product. This method was also susceptible to severe winter weather, fouling, and excessive siltation.

Conclusion

The future of the oyster industry in the Pacific Northwest is far from secure. Several businesses have been sold, or have filed for bankruptcy. The scary thing is that most or these are businesses that have been around for many years, such as Hayes Oyster Company in Tillamook Bay, OR and Coast Oyster Company in Puget Sound, WA. Oystermen, are typically difficult to convince to abandon traditional culture methods, but the industry is very concerned about its troubles and has been active in organizing and steering exploration toward solutions. By active involvement and innovative research the industry should be able to overcome its current problems and continue to produce oysters for many decades to come.

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TURBIDITY AND SUSPENDED SEDIMENT ASSOCIATED WITH BEACH NOURISHMENT DREDGING

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Turbidity, a measure of light scattering due to particles or impurities suspended in water, is important to underwater visibility, sedimentation, and light transmission. Periods of high turbidity significantly stress some underwater ecological communities such as coral. Suspended sediment contributes to turbidity and independently stresses corals through the deposition of sediment. Turbidity and suspended sediment concentration vary substantially in the nearshore region under natural conditions. Natural variations in these quantities may be significantly modified by engineering activities such as beach nourishment dredging.

An ongoing field observation program is being carried out to measure natural and man-induced fluctuations in turbidity and suspended sediment. A variety of observational techniques have been utilized including in-situ underwater electronic sensors, sedimentation traps, water sampling measurements of turbidity, and remote video imaging. Two field sites have been established: Hollywood Beach, on the southeast coast of Florida, and Longboat Key, on the west coast of Florida. Large scale beach nourishment projects were carried out at each site during the period of observations.

The findings to date cover a range of subjects. A few specific results follow: The two years of in-situ turbidity measurements at Hollywood Beach indicate that variations in turbidity are correlated with fluctuations in wave height with an r-squared of approximately 0.5. The remaining fluctuations in turbidity remain unexplained. Video images at Hollywood revealed the occasional presence of turbidity plumes. These plumes originate in the surf zone but appear to diffuse and advect far seaward of the surf zone.

At Longboat Key, a "100-year storm" occurred during spring 1993, just after the initiation of the beach nourishment dredging project. This storm resulted in significant erosion of the newly placed beach, and the formation of an offshore sand bar. Sedimentation traps located in water depth of approximately 5 meters indicated a substantial increase in sand sedimentation rates both at the project site and at nearby control sites.

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PARTNERSHIPS IN GALVESTON BAY, TEXAS

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The U.S. Fish and Wildlife Service (Service) Galveston Bay Program was formally initiated in 1992. The goal of the program is, in close cooperation with public and private partners, to conduct restoration, management, and education activities to ensure the biological diversity and productivity of the Galveston Bay system for generations to come. Program activities contribute directly to priorities identified in the Galveston Bay National Estuary Program, a broad-scale consensus building effort to develop a management plan for Galveston Bay and much of the lower portions of its watershed. Service efforts take place both on and off Service lands, often in cooperation with non-Service partners.

Specific Galveston Bay Program partnership efforts have been conducted with the Houston Audubon Society, Armand Bayou Nature Center, the Soil Conservation Service, the Galveston County Beach Park Board, Sea Grant, the Galveston Bay Foundation, U.S. Army Corps of Engineers, Texas Parks and Wildlife Department, Texas General Land Office, Texas Natural Resources Conservation Commission, and several private landowners. Joint projects include improvement and protection of a wetland/dune/lagoon complex, restoration of wetlands, protection and improvement of several bird rookeries, a shoreline erosion control project, development of a cordgrass (Spartina alterniflora) nursery to provide stock for wetland plantings, development of freshwater habitats, a short course on ecosystems for environmental educators, an ecosystem video, and numerous public education events. Discussions of some of the more prominent partnership activities follow.

The Service is presently working with the Galveston County Beach Park Board to protect and enhance a wetland/dune/lagoon complex known locally as Big Reef. The 210-acre site lies immediately adjacent to Bolivar Roads (the Houston Ship Channel) on the east end of Galveston Island. Migratory bird habitats (including endangered species) have been degraded by unrestricted vehicular traffic at the site. The Service approached the Galveston County with a proposal to create a barrier to prevent vehicles from disturbing and destroying feeding and nesting efforts of numerous shorebirds and wading birds. The Park Board was quite receptive as it would improve the bird watching opportunities, thus adding to a budding ecotourism industry in the Galveston area. Big Reef and nearby Bolivar Flats are very popular birding sites for national and international visitors. The biggest problem was associated with possible conflicts with state laws providing "open beaches" to the public. To compensate the public for this loss of vehicle access and to provide an educational opportunity, the Service agreed to provide interpretive signs and some materials for walkways to enhance public use. As of January 1994, the project is under construction.

In cooperation with the Armand Bayou Nature Center, the Texas General Land Office, and the Texas Parks and Wildlife Department, the Service is contributing to

several wetland restoration efforts. Armand Bayou is designated as a "Coastal Preserve" by the state of Texas, one of only three sites carrying such a designation. The Coastal Preserve Program is administered by both the Texas Parks and Wildlife Department and the Texas General Land Office. They are committed to take necessary actions within their jurisdictions to maintain the integrity of these sites. The Nature Center is a private 2,000-acre refuge adjacent to the Bayou. Armand Bayou has suffered from wetland loss due to erosion and land subsidence caused by groundwater extraction. The partnership effort is designed to pool resources to demonstrate the feasibility of restoring these wetlands, thus enhancing water quality, improving productivity, and restoring natural biological diversity within the preserve. Restoration at three sites along the bayou is underway or completed with five more sites in the planning stages.

A cost-share arrangement with the Houston Audubon Society and cooperative work with the Corps of Engineers and the Texas Parks and Wildlife Department is currently benefitting thousands of colonial nesting birds. The Society is enhancing nesting success through nest island management and with educational signage. The Corps and the Department have assisted in placing large signs on Little Pelican Island, the largest rookery on the Texas coast. The signs advise of the legal implications of harassing or taking migratory birds and endangered species. In addition to its unusually high number of nesting birds, the island holds great potential to substantially contribute to the recovery of the brown pelican, an endangered species. Annual nesting surveys will provide an indication of the effectiveness of the program.

Recent studies in coastal Texas indicate that freshwater habitats in close proximity to estuarine emergent marshes receive the highest use by shorebirds, waterfowl, and other waterbirds. Such habitats have had the greatest rate of decline in the Galveston Bay estuary. In the fall of 1993, the Service initiated a "winter water" program for migratory birds. The goal was to provide as much fresh water, either in a permanent wetland or temporarily flooded habitat, in as close proximity as possible to the coast. While a bit of a gamble biologically, and less desirable than permanent wetland restoration, the program is very inexpensive and easy to administer. During the 1993-94 wintering and migration period, 37 small, inexpensive, "stand-pipe" water control structures may provide as much as 1,100 acres of shallow freshwater environments. The structures can be moved from one year to the next, depending on effectiveness and landowner interest. Periodic monitoring will dictate the future of the program.

Urban non-point source pollution is one of the most significant problems in the Galveston Bay estuary. Sea Grant and the Service, working together, have undertaken a neighborhood environmental landscape program to promote the use of native vegetation in landscape planning, reduced pesticide use, water conservation, and pollution prevention. The program will include newsletters for education and advocacy purposes, as well as a demonstration planting in a highly visible location. To qualify for the program and its benefits, neighborhoods will have to guarantee a certain level of participation. An example of potential inducements to participate

could be discounts at local landscape nurseries also participating in the program. This program is similar to one already working in Florida.

The first product of the Galveston Bay Program was a cooperative effort with the Texas Natural Resources Conservation Commission (formally, the Texas Water Commission) to produce an educational video on the Galveston Bay ecosystem. The Service scripted the video and funded much of the photography. The state produced and edited the video. The video is designed for a senior high school level biology course and is also well suited for broadcast on public television.

As an agency, the Service is coming to the realization that it cannot achieve its mission by working in isolation. The vast majority of wildlife habitats are in private ownership and the activities of numerous state and federal agencies have significant effects on wildlife populations. The Service is also beginning to take a broader or more holistic view towards resource management and is now in the process of shifting its focus from the species to the ecosystem level. The Galveston Bay Program is one of a number of recent Service efforts that reflects this new approach.

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CONSENSUS BUILDING/CONFLICT RESOLUTION IN THE INDIAN RIVER LAGOON

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The Indian River Lagoon Region

The Indian River Lagoon region, located along Florida's east central coast, is one of the fastest growing areas in the country. It is home to more than 750,000 people, 35 identified estuarine user groups, and more than 120 government entities and non-profit organizations -- many of whom have divergent needs and interests.

Since the early 1900's the region has been noted for a renowned citrus industry and a significant boat and marine industry. But perhaps one of the greatest growth impacts on the region was initiated in 1950 when the one of the five counties in the region, Brevard County, was selected as the new site for the National Aeronautics Space Administration. This new identity transformed sleepy towns like Titusville, Cocoa and Satellite Beach into mini metropolitan areas overnight. Between 1950 and 1970, the tourism industry dramatically increased as well, spurring the construction of 130 new airports during the 1960's alone (Derr, 1989).

In retrospect, today many researchers and scientists alike attribute the decline in water quality and natural resources in the region to this unprecedented, rapid, largely unplanned settlement, as thousands of people relocated to the fragile environments along the shores of the Indian River Lagon (Luther 1976).

Since the pioneering years of the early 1900's, the region's population has rocketed. Many now refer to Florida as "a lost paradise," and "a place of shameful slaughter, as birds of air, fish of the sea and creatures between suffer" (Derr, 1989). During the last forty years the population in the watersheds bordering the Indian River Lagoon has jumped ten-fold from less than 70,000 in 1940 to more than 750,000 today. As man settled into the region, he changed the face of the natural landscape through clearing, draining, replanting, deforestation, reforestation, irrigation, and diking. Such changes were needed to allow human habitation of a hostile environment. For many years, the effects upon the estuarine system of the Indian River Lagoon by man and his activities went unnoticed. However, it has become apparent that the Lagoon is not thriving as it once did. Declining fisheries, decreased numbers of wading birds and other animals, including the eradication of some species and the overall visual decline of water quality have provided a warning beacon to those living along its shores. Furthermore, many of today's existing uses of the lagoon's natural resources appear to be competing and divergent lending little hope for support of future restoration activities.

The National Estuary Program

In 1990, the region which encompasses 40 percent of the state's east coast was designated by the U.S. Environmental Protection Agency "an Estuary of National Significance." Essentially, the region was recognized as (1) having a

significant diversity of both plant and animal species, (2) being threatened by a decline in habitat and water quality and suffering from an ever-increasing population and (3) benefiting from a significant amount of public interest for restoration of the water body.

Unlike past environmental efforts to clean up water pollution, the NEP program attempts to coordinate the efforts of federal, state and local governments in protecting and restoring the natural resources of Indian River Lagoon. Furthermore, the program stresses that "society (should) participate in planning rather than being manipulated by planning" (Chekki, 1979).

Unlike many of the 21 National Estuary Programs, the Indian River Lagoon has benefited from a considerable amount of preceding organized research on the decline of water quality in the region. Entering its third year of a five-year program, the Indian River Lagoon National Estuary Program (IRLNEP) has built on prior research and management efforts by identifying key issues of technical concern through characterization work.

Developing A Vision

In initiating the process of integrating public understanding and building public consensus in the planning process, the IRLNEP scheduled a visioning conference, "Visions For the Future: Lessons To Be Learned" 10 months after the commencement of the program. At this workshop, citizens, government agency representatives, non-profit leaders, private industry and community leaders gathered to gain a sense of vision for the Indian River Lagoon program. The conference sought (1) to gain insight from the experiences of other NEP programs throughout the country, and (2) offered the opportunity for participants to share their own impressions of the Indian River Lagoon program with the experiences of other estuary managers. Perhaps the most important opportunity provided by the visioning workshop was the chance for workshop participants to share their frustration with the difficult questions and issues raised in trying to accomplish the goals of planning for the restoration and maintenance of our nation's estuaries.

The visioning workshop offered an initial catalyst to the Indian River Lagoon program as it provided a spark for discussion and allowed some of the many user groups to voice their opinions on 'how to restore the Indian River Lagoon.'

Articulating This Vision

Six months after the initial visioning conference was held in January 1993, the program released its first draft of the Comprehensive Conservation and Management Plan (CCMP), offering a draft blueprint for coordinated action in restoring the estuary. In releasing the draft plan, two major events occurred: the program's mission to develop a blueprint for the clean up of the estuary was clarified and more evident to the public and program committee membership. Also, members of the public began to organize themselves in relation to issues addressed in the draft plan.

Within two weeks of release, the program's office began receiving public input through letters, telephone calls and attendance at meetings from members of various interest groups. During early February, program staff scheduled a follow up workshop on articulating the vision. At this workshop, members of the various interest groups, citizens, community, non-profit and industry leaders gathered to hammer out a strategy to integrating public input into the future drafts of the CCMP. This strategy essentially offered a business plan for gaining public consensus.

Developing A Framework For Action

During the fall of 1993, the program began implementing its strategy for public input by conducted three action planning forums in the northern, central and southern sub-regions of the lagoon. The groups utilized a variety of techniques including focus groups, planning "charettes" to design physical elements of the group's recommendations and straw poll votes. From the specific recommendations gained at the forums, staff is currently developing specific action plans for each major issue. These actions plans have been organized into 14 major categories including: education, advocacy, funding, land acquisition, coordinated regional impoundment management, marina pump outs, septic tanks, freshwater discharges, agricultural discharges, coordinated action planning, resource management, urban discharges, point source discharges, and water quality data coordination. Collectively these categories will provide the framework for action in the final draft of the CCMP, slated for release in 1996.

The framing of these corrective actions will be achieved through special task forces consisting of technical experts, resource managers, NEP committee members, interest group leaders and interested members of the public, who have expertise in one of the fourteen major categories. These task forces will present the final issue recommendations for restoration of the water body to the public at a lagoon-wide consensus building and conflict resolution forum. This forum will allow representatives from business, civic groups and government entities to negotiate and ultimately express their desire to develop a shared community vision for the restoration of the Indian River Lagoon.

The Consensus Approach: The Key to the Future

We have learned that long-term trends indicate that continued degradation of water quality around the population centers in the Indian River Lagoon will continue unless corrective actions are taken. The consensus approach is enabling the IRLNEP to clearly identify and resolve problems early, identify cost effective strategies, maintain flexibility, and most importantly provide for the appropriate involvement of affected and responsible parties. In utilizing the consensus approach during the planning process, the IRLNEP is able to bring together the many interests, define the issues, explore both mutual interests and those which may divide groups, generate options and reach acceptable solutions for implementation.

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THE ROLES OF SCIENCE IN U.S. MARINE POLICY: SOME REGIONAL APPLICATIONS

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Introduction

This comment tries to clarify the roles science and scientists do and should play in marine policymaking. It is a shortened version of one which will appear in the Coastal Management Journal and was supported in part by Oregon Sea Grant.

For purposes of this comment, policy is defined as public sector articulation of general principles for and specific decisions regarding the conservation and development of both privately and publicly owned marine resources. Thus, in the United States, the President, Congress, federal and state courts, state governors, state legislatures, coastal local governments, ports, and federal and state marine, environmental, and resource agencies all play important roles in establishing and implementing marine policy. The roles science plays in marine policymaking varies tremendously both with the particular issue and the institution making the policy decisions.

Science is defined broadly to include the methodologies of both the natural and social sciences. More succinctly, "[s]cience is a method, generally accepted at the core although disputed at the margins, designed to tell us what is right, or true, or correct. But science cannot tell us what is better" (Huffman, 1991). What is "better" is debated and decided in policymaking processes, including those focused on marine policy.

The Distinctions Between Science and Values in Policymaking

Most marine policy decisions are resource allocation decisions, either through direct allocation of publicly owned or controlled resources such as seabed minerals or fish or indirect allocation through regulation of private resource utilization. It hardly makes sense to proceed with such "allocative or distributive choices without first factoring in the contributions of the scientific community" (Young, 1989). But marine policy decisions also involve the personal values and beliefs of those making the decision and those affected by the decision, as well as scientific knowledge about natural and social processes. Thus "the distinction . . . between science and values . . . is fundamentally important to legitimate public decision making" (Huffman, 1991). A principle goal of any marine policymaking process that purports to be scientifically based should be to maintain as clear a separation of science from values as possible. The current Endangered Species Act process is a pretty good example of separating scientific truth (listing) from value (economic factors are taken into account in designating critical habitat and implementing recovery plans). If the respective roles of fact and value are obscure, decisionmakers cannot be held responsible either for their scientific errors, or for their policy judgments. (Graham et al., 1988).

On the other hand, "[s]cience when it is accepted as a justification for policy, becomes a tool for circumvention of the democratic process. . . . The tendency to justify policy decisions on the basis of science is pervasive in the U.S. regulatory system. . . . The challenge is to preserve the objectivity of the scientific process while avoiding scientific domination of the policymaking process" (Huffman, 1991). Otherwise, policymakers will not be politically responsible for the value choices they make.

Achieving Timely Scientific Input

Four norms of environmentally responsible conduct have emerged from the processes surrounding the June 1992 UN Conference on the Environment and Development. They emphasize sustainability, biodiversity, polluter pays, and a precautionary approach to resource use. Public ownership of most marine resources supports a thoughtful, go slow, or precautionary approach to marine resource use which reflects the latest scientific thinking. Even so, the timetables for marine policy decisions do not always mesh well with those of scientific research resulting in marine policy decisions without significant scientific input. The rates and processes of scientific discovery are not always predictable, so the amounts of time and money required to generate information relevant to a pending marine policy decision cannot always be known in advance.

Despite the legitimate concern for maintaining at least a conceptual separation between facts and values, in the end for the increased use of science in marine policy making, scientists themselves will have to be willing to accept more temporary or part-time involvements with the policymaking bodies. In other words, natural and social scientists must be willing to serve on boards and commissions and participate in other forums which make marine policy decisions. Non-scientists such as attorneys (Symposium, 1992) and politicians are willing to make policy decisions and exercise their judgment and influence based on whatever information is available; scientists should be willing to contribute their judgment to marine policy decisions even on issues where more research clearly is needed.

Lessons for Regional Action of Marine Environmental Issues

How can approaches to marine science and policy be usefully applied? Consider the case of regional action on marine environmental issues.

According to Trippier (1992), differing environmental sensitivities and resource uses mean that uniform global standards are not appropriate. Then the challenge is to identify the relevant marine regions, a task of both science and policy. Once regions have been identified at least tentatively, the next step can be an effective scientific analysis to consider the full range of activities in the region, to ascertain where the problems are greatest, to prioritize concerns and assess possible counter measures, again a mixture of science and policy. The next step is political commitment to the assessment and acting on its recommendations. Finally, there is the need for effective administrative mechanisms to translate, implement, monitor, and enforce the response measures agreed upon. Initially it appears that most

marine environmental problems are coastal in nature and often relate directly to development pressure but the priorities for action vary according to the scale of activities involved and local environmental characteristics. This underlines the need for a sound scientific assessment as the starting point for more effective regional action (Trippler, 1992).

In the United States, regional action on marine environmental issues has proceeded the furthest in the Gulf of Maine, Gulf of Mexico, and Pacific Northwest regions. The Mitchell bill, formally the South Carolina Fish Hatchery Act of 1990, Title IV, Regional Marine Research Programs (Public Law 101-593), established nine regional marine research programs for those three regions and six others. Considerations of both science and policy were used in defining the marine regions recognized by the legislation. Regional boards consisting of federal and state appointees, most with marine science backgrounds, were established.

For the Gulf of Maine, research is being carried out pursuant to the 1992 Gulf of Maine Research Plan prepared pursuant to the Mitchell bill (Gulf of Maine, 1992). Completion of the research and monitoring identified in the Gulf of Maine plan should provide the sound scientific assessment needed as a starting point for more effective regional action. The plan's 10-year goal is to work toward development of a suite of models that collectively simulate how the Gulf of Maine ecosystem and its interacting components function naturally, and under stress. The two overarching societal concerns to be addressed by the plan are:

1) Contamination of the Gulf of Maine either degrades living marine resources or alters ecosystem structure.

2) Physical changes to habitats in the Gulf of Maine alters ecosystem structure and functioning.

According to the plan, addressing these issues requires scientific information on:

1) The patterns of contaminants; their sources, transport, and cycling; and their biological effects.

2) The physical, chemical, and biological factors causing noxious and/or excessive phytoplankton concentrations, and the effects of these concentrations on the ecosystem.

3) The natural variability of the Gulf of Maine ecosystem in order to distinguish natural from human-induced changes.

4) The susceptibility of the Gulf to dissolved oxygen depletion.

Of these scientific informational needs, the highest priority for initial support are those concerning transport and cycling of contaminants and the causes of noxious or excessive phytoplankton concentrations (Gulf of Maine, 1992).

However, for full consideration of resource user activities in the Gulf of Maine region, ascertaining where problems are greatest, prioritizing concerns, and assessing possible public and private sector responses, the appropriate focal point would seem to be the Gulf of Maine Council on Marine Environment established by the states of Massachusetts, Maine, and New Hampshire and the provinces of Nova Scotia and New Brunswick (Hildreth, 1991). The Council has developed and begun implementation of a specific 10-year Gulf of Maine Action Plan the goal of which is "to maintain and enhance marine environmental quality in the Gulf of Maine and to allow for sustainable resource use by existing and future generations" (Gulf of Maine Council, 1991).

Under the Mitchell bill, regional marine research plans for the Gulf of Mexico and the Pacific Northwest also have been prepared (Gulf of Mexico, 1993; Pacific Northwest, 1993). The Pacific Northwest plan identifies regional marine environmental issues involving chemical contaminants, habitat alterations, declines in natural populations, and human health issues. Natural perturbations, catastrophic events, and anticipated trends in environmental conditions are evaluated based on existing data and research. Pacific Northwest regional marine research needs fall into three principal groups:

1) Investigating the natural system in order to detect and understand ecosystem change.

2) Alteration of marine and estuarine habitats due to anthropogenic activities and natural phenomena.

3) Fate, affects, and transport of contaminants in the marine ecosystem.

The needs were identified through an extensive survey of Pacific Northwest researchers and resource managers. The Pacific Northwest regional board consciously excluded from the plan resource management agency operational needs involving applied techniques such as methods for controlling ghost shrimp or cleaning oiled birds. The priority needs identified in the plan lean towards understanding basic processes and background conditions in the Pacific Northwest marine ecosystem. The relatively small but very important areas of that ecosystem which suffer from contamination and habitat degradation are well represented in the identified research needs.

Research priorities for funding under the Gulf of Mexico plan are:

1) Develop a comprehensive conceptual ecosystem model of the Gulf of Mexico.

2) Study the physical and chemical processes and ecosystem ecology of the nearshore zone from the shoreline seaward to a depth of approximately 25 m.

3) Study the offshore zone, seaward of the 25 m contour including the outer reaches of the continental shelf, the continental slope, and the abyssal plains.

As an effector of the coupling between the offshore and nearshore zone, the Loop Current and its impact upon the Gulf of Mexico is a priority topic of study (Gulf of Mexico, 1993).

Using a dichotomy developed by Tuohy based on prior work by Jasanoff, the Gulf of Maine, Gulf of Mexico, and Pacific Northwest Research plans are built around "research science" subjected to the traditional peer review and other standards of scientific research, rather than "regulatory science" performed principally to comply with legal requirements such as statutory timetables with the resulting studies often being unpublished (Tuohy, 1993). While the Gulf of Maine region has received federal research funds to begin carrying out its plan, no such funds have yet been appropriated for regional research in the Gulf of Mexico, Pacific Northwest or any of the other regions established by the Mitchell bill.

Furthermore, there is no regional political body for the Gulf of Mexico or the Pacific Northwest equivalent to the Gulf of Maine Council on the Marine Environment for coordinating state implementation of and management responses to the Gulf of Mexico or Pacific Northwest plans. The Pacific Northwest situation is complicated by the fact that two other regional boards established under Public Law 101-593, Alaska and Southern California, have overlapping interests in the ecosystems and resources covered by the Pacific Northwest Plan. The Pacific Northwest Regional Research Plan recognizes these issues as well as the challenge of coordinating with British Columbia on transboundary issues of mutual concern. The Gulf of Mexico plan recognizes an overlapping concern in the Florida Keys with the adjacent South Atlantic board established by Public Law 101-593.

A proposed interstate compact between the four west coast states, Hawaii, and British Columbia to support coordinated regional ocean resources management has not been adopted. Thus implementation of the Pacific Northwest regional research plan will depend upon the Pacific Northwest regional board's success in maintaining good communication with researchers and resource managers throughout the region. Fortunately, oil spill response among the four west coast states and British Columbia will continue to be coordinated by the States-British Columbia Oil Spill Task Force established in 1989.

For several years prior to the enactment of Public Law 101-593, through its Gulf of Mexico Program (GOMP) the federal Environmental Protection Agency has attempted to coordinate a regional response to Gulf of Mexico pollution problems. The Gulf of Mexico regional marine research plan (GOM RMRP) sees the two programs' roles as complementary:

> The GOMP and the GOM RMRP are complementary and supportive by design. The GOMP characterizes environmental challenges, and directs resources at assessments, demonstration efforts and implementation of

needed actions, abatement and control measures, and best management practices. Through its structure, the Gulf of Mexico Program solicits input from the general public and resource users groups. GOMP projects provide the opportunity for the general public to become involved in rectifying and mitigating environmental degradation. Because of the mechanism through which the GOMP is funded, basic research cannot be funded as a function of the GOMP (Gulf of Mexico, 1993).

No other regional programs have been proposed to carry out scientifically based marine policymaking in the Gulf of Mexico.

Thus, as Trippier (1992) recommends, in the Gulf of Maine, Gulf of Mexico, and the Pacific Northwest relevant marine regions have been identified and effective scientific analyses proposed to consider the full range of activities in the regions to ascertain where problems are greatest, prioritize concerns, and develop management responses. Through the Gulf of Maine Council there also appears to be some regional political commitment to the assessment and a will to act on recommendations that is so far missing in the Pacific Northwest and the Gulf of Mexico. Several studies useful for creating such political commitment in the Pacific Northwest are available (Cicin-Sain et al., 1990; Hildreth, 1991; Hildreth et al., 1989). The federal Environmental Protection Agency's Gulf of Mexico Program has yet to develop regional political commitment to implementing actions recommended in the Gulf of Mexico Regional Marine Research Plan. None of the three regions has yet developed effective administrative mechanisms to translate, implement, monitor, and enforce responses to the problems identified. An issue deserving further consideration by the Clinton Administration is how the federal government can best support and incorporate the results of regional efforts into federal marine policymaking.

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THE ROLE OF HYPERMEDIA IN ON-SITE DATA ANALYSIS: A CASE STUDY OF MASONBORO, NORTH CAROLINA

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Natural resource researchers on the southeastern Atlantic seaboard are blessed with not only an abundance of natural resources, but a wide diversity, as well. Yet, this plenitude also provides the impetus for conflicts in utilization of these natural resources. Nowhere are these conflicts more evident than Masonboro Island, a component of the North Carolina National Estuarine Research Reserve. Driven by forces ranging from preservation and conservation to outright despoliation, Masonboro Island is an area of particular concern. Far from being merely an academic interest, the island is an indicator, the health of which affects the region economically, ecologically, and spiritually. It is only through collaboration of concerned individuals, resource administrators, and legislators that Masonboro Island can be managed to accommodate divergent uses without grievous consequences. Yet, sound management must be based upon sound research, with data gathered and analyzed within the context of that most relevant laboratory, the island itself.

The intent of this project was therefore three-fold. First, a hypermedia-based database of environmental and recreational impacts on Masonboro Island was developed based upon longitudinal photographic, graphic, and textual data. Second, this database will then be utilized for both continuing on-site longitudinal research concerning barrier island impacts. Finally, the system can then assist in the management of the these resources in order to mitigate such impacts.

The Role of Computers in Research

Computers have long been applied to analysis of data in natural resource research. Nonetheless, until recently, such analysis was limited by two primary constraints. First, the process of analysis was contextually removed in both time and space from the actual site in which the data were derived. Second, the data were rooted in a single medium, usually quantitatively and numerically oriented. Such a format often precluded managers, particularly those with limited computer skills, from utilizing them. However, recent technological innovations, as well as shifts in the paradigms underlying data gathering, analysis, and presentation have freed researchers and managers from these constraints.

Among the most notable of these innovations is the development of truly portable computing which possesses the power of many desktop and mini/mainframe systems. Most recent, and relevant, is the emergence of quality color displays on these notebook, or laptop systems. This mode of computing provides researchers with varying degrees of freedom from the constraints of the laboratory and office. Of critical importance, however, is the ability to analyze

voluminous and complex data on-site, rather than post hoc. In comparative studies, this allows an immediacy not previously available.

A second innovation which has proven not only to be a technological extension, but a conceptual one as well, is hypermedia. Hypermedia allows one to navigate a vast field of data consisting of varied formats, including text, graphics, photographs, and sounds. However, the distinguishing feature of hypermedia is that it allows the user to create linkages and cross references between data which assist him or her in more fully understanding and assimilating the "big picture" which the data encompasses. The critical issue in this method of data analysis is that it does not predispose the user to examine the data from a prescribed perspective. Rather, the user is free to "play" with the data in an intuitive manner, allowing him or her to create a "personal understanding" of it, and thereby apply it as is most appropriate. Combined with portable computing, a hypermedia-based system provides researchers and managers with a new mode of on-site data analysis.

A Day in the Life of a Resource Manager

It is a beautiful, sunny day with a slight salty breeze blowing through the live oaks, typical of a fall day in Wilmington, NC. Aboard the mighty research vessel Beluga, the resource managers of the Masonboro Island Reserve component, along with researchers from the University of North Carolina at Wilmington, motor toward the island. Upon landing, the team begins its examination of recreational impacts of the past season.

Having traveled not more than 50 meters, the team comes upon the first site: a campfire ring with a rustic shelter built of flotsam. "Is this a new site?" asks Lynn, the head of the management team. "Not sure, let's check and see," replies Jo, a research assistant. Opening her pack, she removes her portable computer. "Let's see where we are," she says, as the Global Positioning System transceiver downloads the coordinates to his computer, pinpointing their location on a map of the island.

While examining the displayed map, they recognize this site as having been previously logged into the database. "Let's have a look at the history of the site," says Lynn. Upon clicking its icon, photographs of the site taken over the past year's visits are displayed, along with notes and drawings which the researchers had entered. "Look how the site has begun to recover. See where the vegetation has begun to reappear? Let's make a note to ourselves to look at this next time we're here." Clicking on an icon once again, the computer records her as she says, "Note for the spring data gathering: keep track of the regrowth of vegetation surrounding site SSS 1."

"Let's make a few more notes about this site before moving on." Clicking on another icon, her personal notebook pops into view. While typing notes about the site, she decides a drawing would help to clarify her description. Another click, and graphics tools appear in her notebook. Finishing her entries, the final step to inventorying the site is to take a picture of its current state. Retrieving the digital

camera from her backpack, she takes a couple of shots which are downloaded into the database. "There, that ought to do it. Let's note that location from the GPS so we can specifically look at this site on the satellite image of the island. Ready to move on?"

Project Description

Far fetched? Not really. The technology to develop such a system exists. The integration of these components is the long-range goal of this project. Currently, the first stage of this project has focused upon development of the hypermedia database.

The initial opportunity to implement a hypermedia system on a portable computer presented itself in examination of the recreational impacts on Masonboro Island, through funding provided by the North Carolina Division of Coastal Management and the North Carolina Sea Grant program. Longitudinal data had been, and is continuing to be, derived in photographic, graphic, and textual formats. Utilizing MacroMedia Authorware Pro 2.0 and a Macintosh Powerbook Duo 210, a hypermedia system integrating these data was developed. This system, as it exists, allows researchers to gather, examine, manipulate, and perform comparative analysis upon this longitudinal data, in all available formats, on-site. Further, this system provides the functionality and ease of use which will allow managers of coastal resources to monitor and assess impacts, as well.

Upon entering into the system, the user is presented with a simplified map of Masonboro Island. Given the size of the island, as well as the intense clustering of many impact sites, the user is able to zoom into the map to better isolate individual sites. Once an site of interest has been located, the user clicks on that icon, which displays the longitudinal data which exists about the site. Photographic, graphic, textual, and verbal data relevant to the site are available at the click of a button. A user notebook pops up at the click of yet another button, as does a voice input system.

A unique adaptation of the hypermedia system focused upon its refinement in order to accommodate a wide variety of natural resource databases. Of particular interest was the modification of the database structure in order to accommodate a pictorial "data layering system" wherein identified recreational and environmental impacts can be displayed as an independent overlay, as can additional data, such as sea turtle nesting sites. Such an approach may be found to assist in the identification of multiple sources of impact and the resulting conflicts. However, most importantly, using this approach will allow the resource manager to focus upon proactively recognizing and attending to such impacts, rather than attempting to resolve them retroactively.

Future Directions

The primary short-term goal of this project is to test the efficacy of the hypermedia database through close collaboration with managers and researchers.

Once the system has been refined to accommodate input and evaluation from these groups, additional databases relevant to Masonboro Island will be integrated into the layering system, such as flora, fauna, and archeological sites. The intent will be to develop a comprehensive database focusing upon Masonboro Island.

To increase the functionality, relevant technologies, such as GPS and digital photography will be integrated into the system as funding becomes available. With the cost of such "high technology" dropping rapidly, such tools will soon prove to be indispensable to the resource manager.

It is also the intent of this project to apply this model to various diverse on-site research and management issues, particularly those involving resource management conflicts, such as grazing in arid lands and fragile ecosystems. In essence, this system will be able to be applied within a wide variety of disciplines, thereby diversifying the potential for additional research and collaborative opportunities.

Perhaps the most vital aspect of the intended development path is the utilization of the hypermedia paradigm. Due to the adaptability of the proposed system to individual use patterns, the system will be functional not only within research and management environments, but in instructional environments, as well. Within this context, the focus will turn toward the adaptive capabilities of the system provide for self-directed learning.

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RESPONDING TO COASTAL POLLUTION VIOLATIONS

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A passenger cruise line was recently fined approximately $500,000 under U.S. statutes on the basis of a videotape made by passengers showing vessel crew throwing bags of garbage overboard. As a private citizen enjoyed the beach or out on a cruise, or as an employee who happens to be conducting field work in the coastal or marine environment, you too may find yourself in the position of observing an activity or a situation that you think may be illegally polluting coastal waters. You may even be in the position of capturing such an activity on film, or of being able to talk to someone who knows something about what happened. In any case, you may feel that you should, or could, take some steps to report such incidents to "the proper authorities." Who are the appropriate authorities? What should you do to report a potential violation? What should you avoid doing? Whose responsibility is it to follow up on your report?

The U.S. statutes that govern coastal and ocean pollution are primarily enforced by the U.S. Coast Guard, although the Environmental Protection Agency (EPA), the Corps of Engineers (COE), the National Oceanic and Atmospheric Administration (NOAA), and other federal and state agencies also have an enforcement role, depending on the statute. This presentation is intended to familiarize audience members with principal marine and coastal pollution statutes, instruct them on the basics of recognizing and responding to violations under these statutes when appropriate, and documenting observations in a way that would be admissible in enforcement actions.

For the purposes of illustration, the presentation will focus on: the Marine Protection, Research and Sanctuaries Act (MPRSA); the Clean Water Act (CWA) Section 312; the Shore Protection Act (SPA); and the Act to Prevent Pollution from Ships (APPS). After a brief explanation of what constitutes violation under these Acts, several scenarios will be suggested for which it would be possible for an observer to respond. The safety and advisability of proceeding as a citizen will be addressed, and the basics will be covered on how to collect information that would be helpful and usable in any enforcement proceedings that may result. An overview of what agencies have primary enforcement responsibility will also be provided, along with information about contacting them to report possible violations of pollution statutes.

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LAW, RELIGION, AND ENVIRONMENT IN THE SOUTH

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It is no secret that the southern region of the United States takes its religion very seriously - it's not called the "Bible Belt" for nothing. Primarily fundamentalist in outlook, the region draws upon a strong heritage of Protestantism that calls for a literal interpretation of the Bible, individual access to the Divine, an ethical code based on personal morality, and an informal approach to worship.

The South's fundamentalist outlook can also be seen in its attitudes toward law and government. Traditionally, it is a region that is politically conservative, fiercely patriotic, and like its reading of the Bible, favors a literal interpretation of principles of separation of church and state, most religious southerners have had little problem using the legal system to promote their ideas of a Christian society.

Finally, one cannot talk about the region without talking about the environment. As a subculture, the South is a web of traditions, and many of those traditions are based on an almost physical link to the land. Indeed, since the beginning of settlement of the area, the bond between the southerner and the land has been a strong one. Thus, in attempting to understand the area one can ask: how have people living in the South affected the environment? How have environmental conditions affected the society living under its influence? Furthermore, what roles have religious belief and views about government played in forming and shaping this intense relationship between culture and nature?

I will look at the relationship of law, religion, and environment in the South. By focusing on a specific environmental issue or geographic area within the region, I intend to investigate how, both historically and currently, the southerner's relationship with the environment has been shaped by primarily fundamentalist attitude toward religion and government. An examination of southern views of the environment will be helpful to policymakers as they seek to develop policy that will take environmental protection into the 21st century.

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SECTION 6217: THE FEDERAL PERSPECTIVE

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In 1990, Congress passed section 6217 of the Coastal Zone Act Reauthorization Amendments, entitled "Protecting Coastal Waters." This statute directed a new effort by coastal states and territories to control nonpoint source pollution. The new coastal nonpoint program is administered jointly by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA).

Section 6217 requires the 29 states and territories which have federally-approved coastal management programs to develop and implement Coastal Nonpoint Pollution Control Programs. The approach taken by this new program is patterned, in part, after that taken over the past 20 years to control pollution from point sources. Specifically, the state coastal nonpoint programs are required to implement best available management measures for sources of nonpoint pollution generally in coastal watersheds, and after a period of monitoring the effect of these measures, to implement additional management measures where necessary to meet water quality standards. The state coastal nonpoint programs are not intended to be whole new programs, but are to build upon existing coastal management and nonpoint source control efforts already existing in the states.

The states and territories are required to submit their coastal nonpoint programs to NOAA and EPA for approval by July 1995. Failure to submit an approvable program will result in a loss of a portion of federal funding under section 306 of the Coastal Zone Management Act, which supports the basic state coastal management effort, and section 319 of the Clean Water Act, which supports states overall nonpoint program efforts.

The management measures which the coastal states and territories are expected to implement for the first tier of nonpoint source pollution control are found in guidance developed by EPA, in consultation with other federal agencies. This guidance, which was issued by EPA on January 19, 1993, contains economically achievable management measures that address five major categories of nonpoint pollution sources, i.e., agriculture, forestry, urban runoff, hydromodification (dams, channelization and erosion), and marinas. The guidance also contains measures for wetlands and vegetated treatment systems that are useful in dealing with runoff from all of these sources.

Two factors make the state coastal nonpoint program required under section 6217 different from other nonpoint pollution control efforts. The first is this two-tiered approach to pollution management which requires all sources to implement basic measures as part of regular operations without having to demonstrate a direct link between the sources and a water quality problem, and then to require additional actions by pollution sources where water quality standards are not being met. The second factor is that the states must implement these measures through enforceable policies and mechanisms.

Development and implementation of these programs presents major challenges to the states. The first challenge relates to the political sensitivity of developing enforceable policies for sources not traditionally subject to such management controls. While states are encouraged to seek voluntary compliance through incentives, disincentives, and education, the states must be able to ensure implementation of the management measures through enforceable policies and mechanisms. A second major challenge relates to the resources necessary to develop and implement such broad programs, e.g., having adequate resources to deal with large numbers of small nonpoint sources such as on-site disposal (septic) systems. A third challenge is to educate and inform citizens and public institutions about how their activities contribute to nonpoint source pollution, and the need for changes to individual attitudes and behavior to successfully control the problem. This includes the integration of the efforts of diverse state agencies and local governments.

NOAA and EPA are committed to helping the states meet these challenges. We have held regional workshops around the country to explain the various aspects of the program and to identify opportunities for providing technical assistance to the states. We have developed a threshold review process through which we review and comment on state proposals for aspects of their coastal nonpoint programs in order to assist the states in focussing their limited resources on areas needing changes in order to meet the program approval requirements. We have been working with other federal agencies to gain their cooperation and support for the state efforts. Finally, we are endeavoring to provide mechanisms and opportunities to enhance sharing of information among the states.

When section 6217 was passed in 1990 it was seen as a new paradigm for nonpoint pollution management, and its application in the coastal states a test that would foreshadow proposed changes to the Clean Water Act. We are now seeing this experiment played out in state development of their programs, and in the discussions on the reauthorization of the Clean Water Act which are still continuing. The outcome of these efforts and discussions will set the agenda for nonpoint pollution control for several years to come.

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ENVIRONMENTAL CONSIDERATIONS ON THE OUTER CONTINENTAL SHELF

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The Minerals Management Service (MMS) is the primary federal agency on the Outer Continental Shelf (OCS) responsible for ensuring that all aspects of oil, gas, and sulfur leasing, exploration, development, production, and abandonment activities on the OCS are conducted in a safe and clean manner. Safety, environmental protection, and conservation of resources are our highest priorities and every reasonable precaution is taken to minimize the risk of human injury, oil spills, and environmental degradation from operational discharges.

Production on the OCS accounts for 11 percent of the total oil and 28 percent of total natural gas produced in the United States. The OCS is thus a large contributor to our national energy needs. Since over 90 percent of ongoing OCS operations occur in the Gulf of Mexico, it is the principal area of offshore leasing, exploration, and production activity. As the most mature area, it is the primary focus of MMS's research, regulation, and monitoring effort with regard to the actual production of offshore oil and gas.

Environmental Impact Statements (EIS's) are prepared and available to the public for each 5-year leasing plan and again prior to each lease sale. "Scoping" is a very early step in the environmental analysis of potential offshore oil and gas activities. Scoping is the process where issues are identified, focused, and considered for inclusion in the EIS. The scoping effort is conducted to provide interested citizens with an opportunity to aid our agency in the identification of appropriate issues and alternatives.

Operational safety and environmental protection are of primary importance in all leasing and lease management decisions. This is accomplished by establishing environmental standards in regulations and lease stipulations, and by enforcing those standards through (1) review of exploration and development plans and permit applications, and (2) a rigorous program of inspections. To accomplish these, MMS depends upon an extensive environmental studies program, engineering studies, and a highly knowledgeable technical staff of engineers and scientists.

Once a lease sale is held, environmental evaluations become more specific. These functions include the operational reviews done by environmental specialists. Environmental evaluations are performed for every potential offshore operation. When a company has acquired a lease to operate on the OCS, MMS has the authority to control or change industry plans. If, for example, a biologically productive area might be adversely affected by offshore oil and gas activity, MMS can control offshore activity by prohibiting the activity in specific areas or require the transport of all drilling fluids and cuttings to shore for disposal.

Once a decision is made to allow offshore oil and gas activity, MMS has an additional role. The MMS inspects industry operations on a regular basis and maintains a staff of 60 professionally trained inspectors who are regularly flown by helicopter offshore to inspect as many as 160 separate items on the platforms throughout the Gulf. Each of these inspectors has in-depth knowledge of well-drilling processes, equipment, and methods used in offshore exploration and development.

The MMS also has a very active Environmental Studies Program (ESP), which has spent approximately one-half billion dollars in judging potential environmental problems associated with all levels of oil and gas activities. Each study produces information that is published by MMS and available to the public through the Regional Public Information Offices. The MMS uses information from the ESP to aid in judging the potential environmental problems associated with all levels of oil and gas activities. The staff of biologists, oceanographers, and related specialists in the Gulf of Mexico Region are currently monitoring 57 separate environmental studies, with an additional 13 in the planning and procurement cycle.

In the current fiscal year, approximately $9.1 million of the MMS Environmental Studies Program budget will be directed to Gulf studies. The shifting emphasis to increased funding of studies in the Gulf during the last 5 years ($37.55 million) is a direct response to the need identified by the National Academy of Sciences and other review and advisory groups for a better understanding of the long-term, chronic environmental impacts associated with offshore gas and oil development and production activities.

Since its inception in 1973, the MMS Environmental Studies Program has sponsored more than $125 million worth of environmental studies through 212 studies in the Gulf and over $550 million throughout the agency. These funds have supported studies in environmental mapping, physical oceanography, marine ecosystems, coastal studies, endangered species, cultural resources, socioeconomic studies, ecological effects of oil and gas activities, and environmental information management. The goals of the ESP are to obtain environmental and socioeconomic information that can be used to help assess the potential and real effects of the offshore gas and oil program. Currently, the Gulf of Mexico Environmental Studies Section is monitoring contracts with a value of $55 million. A number of additional studies are in the formative stages.

The following is a synopsis of some of the issues examined in detail by the Gulf of Mexico Region Environmental Studies Program.

Air Quality

The objectives of MMS air quality studies are to characterize and quantify emissions of air pollutants generated on the OCS to examine the transport and dispersion of these emissions in the atmosphere, and to evaluate their effects on air quality onshore.

Ozone is the pollutant of primary concern because emissions from the OCS have the potential for ozone formation, and some coastal areas adjacent to OCS activities exceed the federal ambient air quality ozone standard. Atmospheric concentrations of nitrogen dioxide and sulfur dioxide may also be important for platforms near the coastline.

Emissions are quantified by generating an inventory of equipment used and fuel consumption on each OCS facility and applying appropriate emission factors for each pollutant. The atmospheric processes acting on these emissions and the resulting effects on ambient air quality are simulated through air quality models. The models typically used for ozone and inert pollutants simulate wind fields, dispersion processes, complex chemical reactions, and deposition. These models require a fairly extensive amount of data on emissions, meteorology, and air quality. In many modeling applications, existing historical data are not sufficient for model use; therefore, a field program is conducted to obtain the additional data.

Biology

The biological studies include specific investigations of the following topics: benthic ecology, marine environmental monitoring, fisheries, protected species, marine mammals, birds, turtles, and fates and effects of contaminants associated with offshore natural gas and oil activities.

These studies may describe the distribution and interactions of benthic and pelagic communities and populations, as well as biological aspects of fishes, birds, mammals, and turtles. Unique protection of all marine mammals in U.S. waters is provided by the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Federal agencies are required to ensure that actions they conduct, fund, or authorize will not jeopardize the continued existence of listed species or destroy or adversely modify their critical habitats. These Acts require the MMS to meet special information needs, including the collection of data pertaining to the distribution and interrelationships of species protected under these Acts, and the determination of the potential effects of offshore natural gas and oil activities on these species.

Fates and effects investigations are primarily studies of the physical-chemical and biological processes that affect spilled oil, and the impacts of oil and gas drilling and production discharges and spilled oil on biological populations or communities.

Physical Oceanography

The broad objective of MMS-sponsored physical oceanography studies is to provide an understanding of the dynamic processes of the ocean and the features that control the motion of the coastal and oceanic waters of the continental shelf. In general, physical oceanography field studies are conducted by MMS to support modeling efforts for oil spill risk analysis, to provide information on coastal processes impacts useful for management of natural resources, and to provide information

important to the interpretation of processes affecting marine biological communities and populations.

The complexity of physical oceanographic processes is a result of interactions of the many spatial and temporal scales, as well as the surrounding boundary conditions. The boundary conditions affecting physical oceanographic processes include: land (coastal morphology); bottom topography (trench, channel, island, seamount, etc.); open-ocean features (front, eddy, under currents, jet, etc.); and free water surface with winds, waves, and thermal exchange.

Each OCS area possesses unique characteristics arising from the interactions of the physical oceanographic processes. For these reasons, it is important to identify the major processes and features in each region to improve oil spill risk analysis, management of natural resources, and interpretation of biological observations.

Social and Economic

Social and economic studies include the following:

1) Economic modeling efforts conducted to support the 5-year offshore natural gas and oil leasing plan.

2) Research to describe the economic and social systems of coastal residents.

3) Research to characterize and monitor the complex interactions between the economic and social systems and activities associated with the offshore natural gas and oil industry.

The Outer Continental Shelf Lands Act, as amended in 1978, emphasizes the need to assess effects on the human environment. Public concerns about the human environment have been a primary source of opposition to the offshore natural gas and oil leasing program. Experience of the MMS Environmental Studies Program in Alaska has demonstrated that many of these concerns can be effectively addressed through well-planned social and economic research.

Other

There are special studies and analyses designed to provide complete coverage of issues related to the offshore natural gas and oil leasing program that do not appropriately fall into the topics discussed above. These projects cover the following issues: information management; information transfer; support of scientific conferences; multidisciplinary information summaries and analyses; and reviews of the MMS Environmental Studies Program conducted by the National Research Council.

The MMS has placed increased emphasis on working cooperatively with state institutions and other federal agencies. Studies are being conducted through the Coastal Marine Institute (CMI) at Louisiana State University, a cooperative venture initiated in FY 1992 by MMS and the state of Louisiana. While Louisiana State University has the lead role, the University of New Orleans and the University of Southwestern Louisiana will also conduct research through the CMI. These studies are focused on environmental and socioeconomic aspects of OCS gas and oil and marine mineral development activities. The CMI program emphasizes building partnerships with state institutions and sharing costs for OCS-related research. In recognition of the mutual benefits of the research, matching funds are a prerequisite for such partnerships. The CMI with the state of Louisiana was signed in September 1992 and includes one-to-one matching funds (up to $1.8 million/year each from MMS and Louisiana) over a 5-year period.

The MMS conducts an active research program on oil spill response to develop better methods for detection and cleanup. This program has led to improvements in oil spill contingency plans.

The MMS is also developing the Environmental Studies Program Information System (ESPIS), a project to consolidate into an automated system the scientific information and data produced over the years by the ESP contracts. This automated system would allow MMS decisionmakers, other federal agencies, Congress, industry, academic researchers, and the public access to the vast collection of Environmental Studies Program marine science information and data. The ESPIS is being designed to allow full-text, conceptual, and contextual searching. This design will enable users full flexibility in retrieval and the ability to manipulate, compare, and contrast the information analytically.

A variety of mechanisms is used to disseminate the information accumulated through the ESP. An active publications programs is supplemented by the Information Transfer Meeting (ITM), an annual meeting designed to provide a forum for "scoping" topics of current interest or concern relative to environmental assessment. The ITM also serves to present the accomplishments of the Environmental Studies Program for the Gulf of Mexico and of other MMS research programs or study projects and to foster an exchange of information of regional interest among scientists, staff members, and decisionmakers. Attendance in recent years has been 500-600 persons, including scientists, managers, and laypersons from government, academia, industry, environmental groups, and the general public.

The MMS has the commitment, responsibility, and authority to ensure that offshore activities are conducted in as safe a manner as possible. Offshore exploration and production have occurred on the Gulf of Mexico OCS since 1954. The MMS as regulator and industry as operator have learned a great deal during the past 40 years about how offshore operations can safely coexist with the offshore and coastal environments.

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FOSTERING PUBLIC/PRIVATE PARTNERSHIPS FOR COASTAL NONPOINT SOURCE MANAGEMENT – AN EDUCATION AND INTEREST BASED APPROACH

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Introduction

The federal Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) recognized that nonpoint source pollution (NPS, or runoff), is a significant factor in degrading coastal water quality and that coastal resources requiring good water quality are economically important. For example, commercial and recreational fisheries support an industry worth $12 billion a year. These resources are experiencing increasing pressure from human activities that create runoff; more than half of the United States population lives in the coastal zone and this population is growing. Recognizing the link between land use and coastal water quality, CZARA required the U.S. Environmental Protection Agency (USEPA) and the National Oceanic and Atmospheric Administration (NOAA) to cooperate with state water quality and coastal zone management agencies in developing and implementing the coastal NPS program (USEPA, 1993a,b).

In January 1993 the USEPA published final versions of the (g) Guidance (management measures for controlling NPS mandated under CZARA Section 6217(g)) and the Program Development and Approval Guidance (instructions for states to use in developing programs). Five major areas were identified for pollution management:

1) Urban, construction, highways, airports/bridges and septic systems.

2) Agriculture.

3) Forestry.

4) Marinas and recreational boating.

5) Hydromodification and wetlands (USEPA, 1993 a,b).

NPS Challenges and Opportunities

The sweeping nature of the NPS program suggests that agencies' resources may be insufficient to implement it using traditional enforcement methods. In part this is because traditional methods frequently engender conflict, costs and delays. For example, San Diego County agricultural producers describe public hearings as "tellings," where their concerns are not addressed. Boatyards speak of costs and difficulties encountered in working with agencies to develop realistic monitoring requirements. Agencies tell of resistance experienced in communicating with groups they regulate. Environmental groups express frustration that regulatory programs bog down in appeals and court cases.

Nationally, government agencies and environmental interests perceive voluntary pollution management as ineffective (Hilgren, 1991). Such problems develop in part because environmental policy changes often place much of the cost on a few to provide benefits for all (Libby, 1991) and in part through lack of communication on ways to minimize burdens imposed by compliance while benefiting the environment. Clearly, new methods are needed to reduce conflicts and costs and to enable water quality and coastal zone agencies with finite resources to meet the considerable challenge of NPS management.

The coastal NPS program offers opportunities to employ new approaches. The Program Development and Approval Guidance requires that:

1) Management measures must be economically achievable.

2) There must be opportunities for public participation in all aspects of the program.

3) States are encouraged to provide assistance for implementing management measures specified in the (g) Guidance.

4) States must provide assistance for implementing additional management measures for land uses and critical coastal areas adjacent to impaired or threatened coastal waters.

5) Assistance is to be technical and educational and include information on how to participate in developing and implementing state programs (USEPA, 1993a).

The (g) Guidance states that it provides specific management practices for illustrative purposes and that EPA anticipates the broad management measures generally will be implemented by applying one or more management practices appropriate to the source of pollution, location and climate (USEPA, 1993b).

These elements of the coastal NPS program thus offer opportunities for new approaches to environmental management, including greater use of public participation and education. It also challenges environmental managers to develop them. The following sections of this report will outline new approaches to public participation and education and describe cases in which they are being applied successfully to agricultural and boating components of the coastal NPS program.

The Interest Based Approach

An effective method for conflict resolution has been developed by the Harvard Negotiation Project (Fisher and Ury, 1981) and expanded by practitioners across the country to form the basis of modern mediation (Community Mediation Program, 1991) in which a neutral facilitator guides parties in resolving a dispute. Mediation has successfully resolved numerous coastal resource conflicts (Knaster,

1985; Susskind and McCreary, 1985) and its techniques offer promise for NPS program development.

In Getting to Yes, Roger Fisher and William Ury explain four basic principles of interest based negotiation:

> "People: Separate the people from the problem Interests: Focus on interests, not positions
> Options: Generate a variety of possibilities before deciding what to do
> Criteria: Insist that the result be based on objective criteria."

Using interest based negotiation requires understanding how it differs from the familiar positional negotiation in which each "side" states a position, or what it wants to happen. The position is chosen to advance that side's interests, or needs. Problems arise when one side's position threatens the other's interests. In contrast interest based negotiation first helps disputing parties express and reach understanding of their interests. They come to terms with emotions that are part of every dispute, such as anger, frustration or need for acknowledgment. Then they work to understand each other's "nuts and bolts" interests, such as costs, loss of opportunity, reduction of pollutants and timetables. Next they propose actions that could satisfy their interests and develop objective criteria for evaluating the proposed actions. Finally, they negotiate to evaluate, revise and select actions that all agree will resolve part or all of the dispute.

The Educational Component

NPS management is complex; each major section of the (g) Guidance addresses a variety of parties, types of pollution and management practices. It overlaps with other regulatory programs. Wise decision making requires understanding the regulatory and technical contexts and the interests of the many concerned parties. Once decisions are made, management practices must be hammered out, needs for assistance must be assessed and educational programs conducted. Regulatory agencies need to establish working relationships with groups that can assist them in communicating, determining which management practices are economically achievable and suited to local situations, developing the practices and educating the public who will use them.

Agricultural and Boating Case Studies

In 1991 the United States Department of Agriculture - Extension Service funded the author and co-worker Dr. Valerie Mellano to develop a national model for empowering local agricultural producers, environmental interests and government agencies to work cooperatively in evaluating, selecting and implementing measures to reduce agricultural impacts on coastal water quality. The issue of agriculture and coastal nonpoint source pollution in San Diego County was chosen because economic achievability and public participation were required and project leaders' expertise was in marine and agricultural sciences (Johnson and Mellano, 1993).

The project leaders contacted leaders from each of these groups and local scientists to explain the NPS program and its requirements for public participation and economic achievability. Leaders of the three groups with a stake in the issue were invited to cooperate in recommending ways to develop such a program. They agreed to try it and encouraged others to participate. Scientists agreed to provide expertise.

Good decisions depend on good information. Background information was prepared, including a summary of the regulatory framework for the issue (Flynn and Tierney, 1992) and results of interviews of forty-nine participants representing the stakeholder groups and scientists (Rager et al., 1992). They were asked about their knowledge, concerns, responsibilities and anticipated actions regarding agriculture, coastal NPS and regulations. Information was provided by mail and at decision making forums, so that all worked from a common foundation of knowledge.

Forum participants representing all three groups then suggested alternatives for managing agricultural nonpoint source pollution in San Diego County. Next they discussed the proposed alternatives and their possible consequences in a deliberative fashion. The project leaders served as neutral facilitator using ground rules that stressed respect and an equal voice for all points of view. Forum participants selected the following priorities for action from among suggestions presented in the initial brainstorming session:

1) Technical, educational and economic assistance are needed for reducing agricultural NPS.

2) NPS programs should be developed on a watershed basis.

3) Liaison should be established with other NPS and stormwater management planning groups.

4) A steering committee should take the lead in implementing recommendations.

A steering committee representing all three stakeholder groups (agriculture, environmental and agency) was established. It developed liaison with other watershed and water quality management groups and the authors obtained USEPA Near Coastal Waters Program funding to provide technical and educational assistance on a watershed basis. Subcommittees are working with Dr. Mellano to develop educational materials on best management practices suited to local agricultural conditions and commodities and with the author to develop educational materials on the ecology, economic value and impacts of nonpoint source pollution on coastal waters.

A mail survey found participants had increased their understanding of NPS regulations, of agricultural practices affecting NPS and of each other's concerns about the issue. They expressed strong interest in taking advantage of a state voluntary period to cooperate in managing agricultural NPS. Survey respondents

and others strongly approved project methods and suggested using this type of process to address other environmental issues.

Following a presentation by the project leaders, Farm Bureaus from three neighboring counties formed a joint NPS management committee and began working with local regulatory agencies. San Diego Dockmasters requested a similar project related to NPS from marinas and recreational boating.

The USEPA Near Coastal Waters Program also funded a project to apply these methods to nonpoint source pollution from boat hull refinishing in San Diego Bay. Underwater hull cleaners, boatyards, marina managers, yacht clubs, government agencies and environmental interests have been identified as stakeholders in this issue. Group interviews are being used successfully to streamline the process of determining stakeholder concerns and recommendations.

Although the boating NPS project is in early stages, response has been enthusiastic. All stakeholder groups have offered to contribute information and participate in developing best management practices. Members of the boating community welcome it as an opportunity for "a seat at the table;" water quality and coastal zone agencies believe participation will improve communications with the boating community and reduce costs for developing the NPS program; environmental interests and scientists view participation as a means for enhancing their own outreach efforts.

Discussion and Conclusions

These projects were conceived in response to local and national concerns about the need to reduce pollution of coastal waters and about the increasing costs of environmental management. Project leaders believed a balanced, cooperative approach to managing NPS would provide a longer range solution than if one group dominated decision making. Background research and education developed mutual understanding of proposed regulatory programs and the perspectives of groups with a stake in the issue.

A context for success was established by:

1) Involving participants from all affected groups.

2) Emphasizing that all concerns were important in decision making.

3) Establishing a neutral, deliberative atmosphere for discussion.

4) Stressing that all could gain by working cooperatively.

5) Helping participants find common ground through understanding facts and the values that underlie concerns and influence decision making.

6) Providing educational and technical assistance for implementing participants' decisions.

Significant change occurred in attitudes and willingness of agriculture, agencies and environmental groups to work together. Thus, a strategy of establishing respect, trust, communication, education and cooperative effort early in NPS management programs can produce breakthroughs in understanding and commitment to cooperative action. Industries, as well as agencies and environmental interests, can increase the likelihood that NPS programs will be cost effective and benefit coastal water quality if they pursue opportunities to communicate and cooperate early in the process.

Acknowledgments

The author wishes to thank Dr. Valerie Mellano for her cooperation in the agricultural project described in this paper. The author also wishes to thank Bill Dickinson, Tim Wallace, Diane Wallace, Kathleen Rager, Patrick Flynn, Jennifer Tierney, Erika Andersen, Jovita Pajarillo, Suzanne Marr, and the many advisors, participants and reviewers for their encouragement, support and assistance in developing the projects and concepts described herein.

This paper is funded in part by grants no. NW009982-01-0 and no. X-009864-01-0 from the United States Environmental Protection Agency, in part by grant no. 91-EWQI-1-9032 from the Department of Agriculture - Extension Service, in part by grant no. NA36RG0537, project no. A/EA-1 from the National Sea Grant College Program, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, through the California Sea Grant College, and in part by the California State Resources Agency. The views expressed herein are those of the author and do not necessarily reflect the views of USEPA, USDA, NOAA, state of California or any of their sub-agencies. The U.S. Government is authorized to reproduce and distribute for governmental purposes.

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REGULATING COASTAL CONSTRUCTION AND RECONSTRUCTION: RESOLUTION OF TECHNICAL AND LEGAL CONFLICTS

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Most coastal states presently administer some form of regulatory program to control the siting and/or construction of coastal development, and to protect the beach/dune system. The federal government is likely to expend its current role in the area with adoption of erosion management legislation pending before Congress, or through reauthorization of the NFIP in 1995. Adoption and implementation of such regulatory programs, either or federal, require a clear understanding of technical and legal issues. Unfortunately, conflicts often arise between the science underlying these programs and the politics associated with land use regulation.

Recent court cases, especially Lucas vs South Carolina Coastal Council, have been cited by many as justification for relaxing or eliminating restrictions on coastal development, despite the fact that many that rely on Lucas do not understand the natural processes that affect the Lucas lots and other coastal areas. Unfortunately, such a course would undoubtedly lead to increased losses due to erosion, flooding and storm damage. A prudent approach, then, would be to accurately characterize coastal processes and hazards, and to incorporate this knowledge into coastal regulatory programs and post-storm reconstruction plans. Without a firm scientific foundation, planning and regulatory programs are more vulnerable to challenge and to the "politic" of coastal land use regulation.

This paper will review the physical setting and coastal processes relevant to Lucas, including a discussion of the impacts of hurricane Hugo and local-state-federal actions in the vicinity following the storm. Policy and regulatory aspects of the case will be discussed in light of this information. Pending federal erosion management legislation will also be reviewed, and recommendations will be made for the development and implementation of technically sound, legally defensible regulatory programs.

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STUDIES ON SEDIMENT CUTOFF STRUCTURE FOR OCEAN OUTFALL

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Hirofumi Kawamoto, Taiyo Kogyo Corporation

Silt protector sheets have been applied successfully to many working cite of underwater construction in order to prevent surrounding area from spreading of rolled up sediment by underwater earth works. Recently, it is requested to develop new type of silt protector sheets to deal with sediment containing runoff discharge. This type of silt protector sheets have to have high permeability and suitable sediment cutoff capacity. For this purpose, authors developed new type of silt protector sheet. Authors came across damages of cultured scallop and shellfish, and coral because of suffocation by discharged suspension load sediment from earth works of river basin. It is considered to construct settling just behind the outfall, but generally it is impossible to have sufficient land for such settling pond at coastal area. So that, some additional facilities become necessary in order to utilize limited dimension of settling pond effectively. Authors have carried out hydraulic model test for the sediment cutoff capacity of newly developed silt protector sheet. The new silt protector sheet is a composite sheet which consists of ordinary silt protector sheet and high permeable silt protector sheet in half, to generate meandering flow in the settling pond. Elongated path flow and stagnation behind the low permeable ordinary silt protector portions of new composite silt protector sheets could be expected to rise sediment cutoff capacity in settling pond, comparing with the case of no structure in the pond or high permeable silt protector sheet stretching.

Equipment for Hydraulic Model Tests

The tests were carried out in tank with a length of 200 cm. with a width of 70 cm, and with a height of 55 cm which made of vinyl chloride. Six silt protector sheets were stretched in the tank as shown in Figure 1. Small rectangles on the slit protector sheets are the unwoven portion of the silt protector sheets to rise permeability of the sheets. Figure 2 is a plane figure and rectangle thick line indicates wall of the tank. Thin lines in the tank indicate high permeable silt protector sheets and portion of it composite silt protector sheets. Arrangement of the sheets was also in Figure 2. The reason why two high permeable silt protector sheets were stretched at the upstream end is that these sheets have a function to make flow velocity from the point inflow uniform over cross section of the tank.

Situation should be same on actual settling pond and first and second sheets are expected additional function to deposit rather coarse sediment. Dotted lines in Figure 2 indicate the portion of ordinary silt protector sheets of composite silt protector sheets. The two portions of composite silt protector sheets, high permeable and ordinary, were stretched alternatively, left and right, as shown in Figure 2 in order to generate meandering in the tank Figure 3 indicates side view of the equipment including turbid water supply and outlet. Thin lines in the tank indicate the positions of the sheets being stretched. Water depth had been kept 40 cm

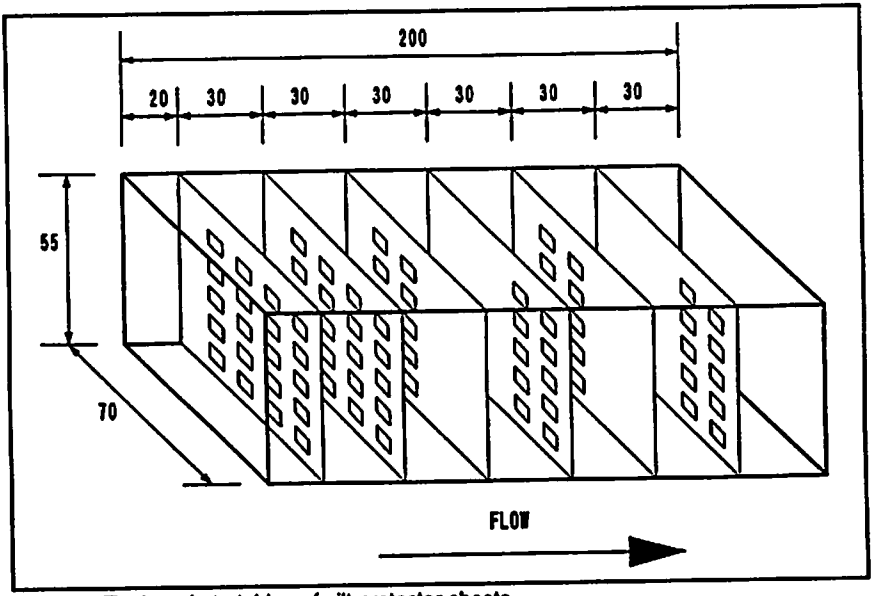

Figure 1. Tank and stretching of silt protector sheets.

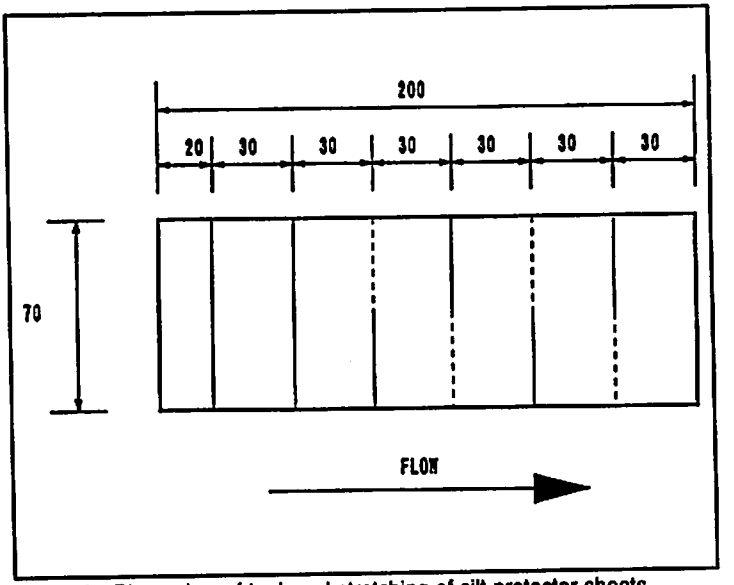

Figure 2. Plane view of tank and stretching of silt protector sheets.

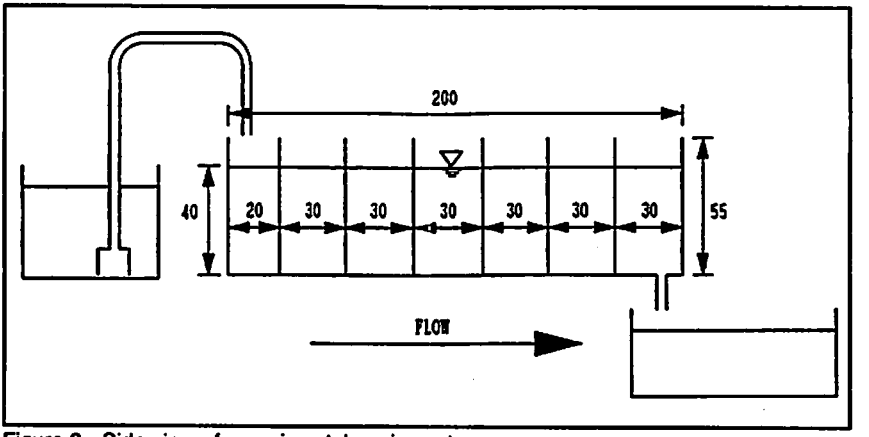

Figure 3. Side view of experimental equipment

through the test. Thirty-seven liters per second of concentration adjusted turbid water was supplied by pump at the upstream end of the tank. After flow velocity and water level in the tank become stationary, turbidities were measured at the point of inflow, out flow, and middle of every two silt protector sheets at half depth for each point by turbidity meter. Cross sectional measurements of the turbidities in between two silt protector sheets were done at trisectional points of the tank. Bentonite was used for turbid water. Adjusted concentration were 500mg/l, 1,000mg/l, 1,500mg/l, 2,000mg/l, 2,500mg/l and same test without any sheets and the test which all sheets be high permeable silt protector sheets for the comparison to 1,500mg/l of turbid concentration.

Considerations for the Similitude Law

Similitude law of hydraulic model test is a rule to convert hydraulic quantities which were obtained by hydraulic model test into the quantities which were obtained by hydraulic model test into the quantities which can be expected at the prototype. There are some kind of similitude laws depending on the predominant forces influence to hydraulic phenomena. Such as gravity force for Froude's law, as elasticity force for Mach's law, surface tension force for Weber's law. These are established to agree corresponding hydraulic nondimensional numbers such as Froude number, Reynolds number, Mach number, Weber number, presupposing geometrical similarity between model and prototype. There are some other similitude laws to agree coefficients included in governing equations such as diffusion coefficient of diffusion equation, besides them. Hydraulic quantities which supposed to be occurred to prototype would be converted the quantities which supposed to be occurred to prototype would be converted the quantities which obtained by hydraulic model test by means of similitude law using scale as a parameter.

Since this hydraulic model test is the test of sediment transport and setting, it is impossible to achieve complete geometrical similarity. Reasons are opening

and thickness of string silt protector sheets and size of fine sediment particles, that is, suspension sediment. These are quite difficult to make complete scale model with rather small scale, moreover, the phase of hydraulic phenomena would be different between model and prototype even if the complete similarity be achieved. That is, bed load sediment in the prototype may become suspension load sediment in the model, and Reynolds number of the flow passing through the silt protector sheets should be changed. Then, generation of eddy at downstream of the silt protector sheets should also be changed. So that, settling velocity of sediment be changed. Scale of the tank, water depth in the tank, flow rate of inflow, and opening of unwoven portions of composite silt protector sheets are set up the scale of 1/20 and applied similitude law of Froude. So that, this model is able to be considered as a kind of deformed similitude conversion rate is not determined precisely. Then, emphasis is put on the tendency of turbidity reduction by passing through silt protector sheets rather than the digit of turbidity of every measuring point.

Results of Hydraulic Model Tests

Tests were carried out three times for each turbidity concentration. Transition of measured turbidity concentration are shown in Figures 4 to 10. Figure 4 is the figure of 500mg/l of bentonite turbidity supply for two high permeability silt protector sheets and 5 composite type silt protector sheets. Center of the circles indicate the measuring point of turbidity normalized by supplied concentration but little bit deformed in order to emphasize the difference of the concentration. And digits under the circles indicate the readings of the turbidity meter. Figures 5, 6, 7, and 8 are for 1,000mg/l, 2,000mg/l, 2,500mg/l respectively. Vertical lines in the figures indicate silt protector sheets and single lines or single lined portion are high permeability silt protector sheet of opposite type of silt protector sheet. And double lined portion in the figures indicates the portion of ordinary silt protector sheet of opposite type of silt protector sheet.

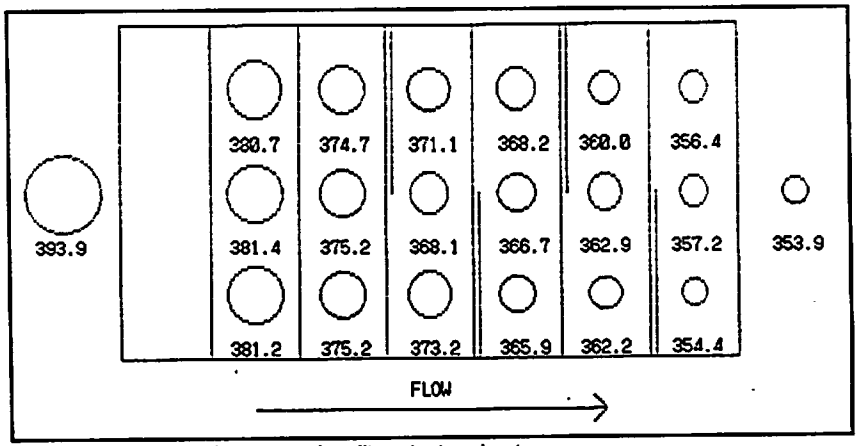

Figure 4. 1500mg/1 for composite silt protector sheets

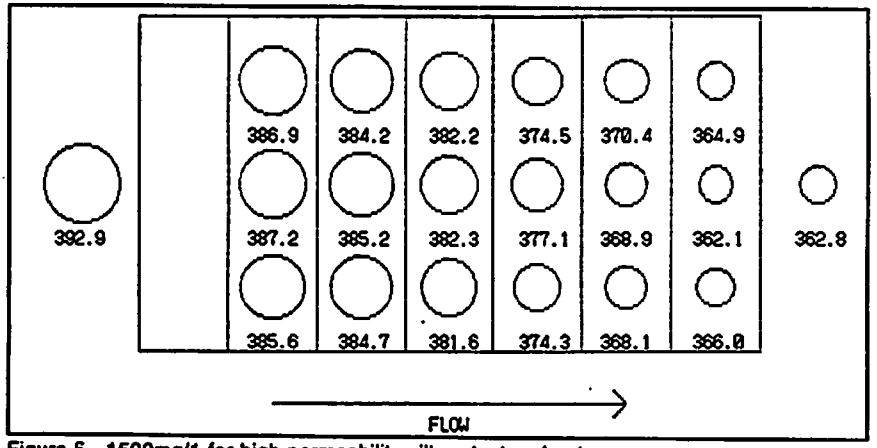

Figure 5. 1500mg/1 for high permeability silt protector sheets

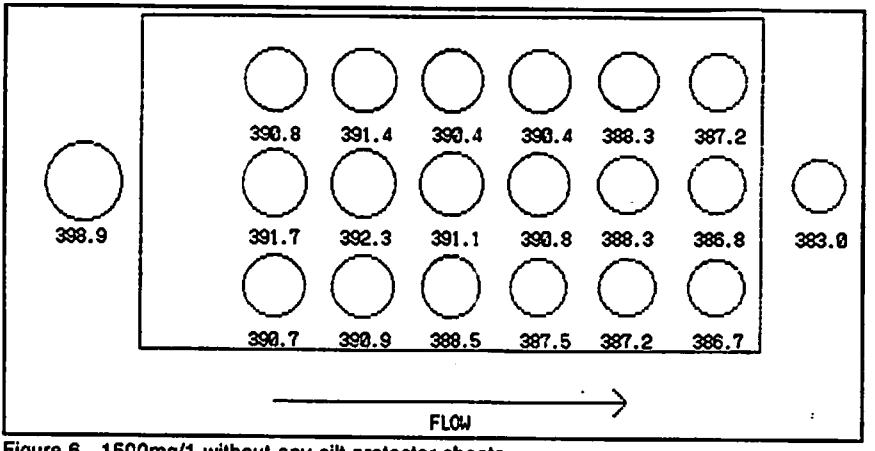

Figure 6. 1500mg/1 without any silt protector sheets

Flow velocities were measured at same points as turbidities were measured but since authors had no multi-directional flowmeter, the meandering in the tank could not be recognized by the digit of measured values. Meandering was recognized by observation of dye injected into the flow.

Spatial turbidity concentration of high permeability silt protector sheets and composite silt protector sheets for 1,500mg/l of supplied turbidity is given in Figure 4. It is recognized that the turbidity concentration behind the portion of low permeable ordinary silt protector sheets being low comparing with the portion behind the high permeable portion of the sheets by Figure 4. This would be stagnation behind the low permeable ordinary silt protector sheets settle much more than behind of high permeable silt protector sheets where no stagnation be generated at all. Figure 5 is the same condition as Figure 4 except all silt protector sheets. It is understandable that turbidity concentrations of every cross section is rather smooth

compare with the results of Figure 4. And Figure 6 is a result of same measurement as Figures 4 and 5 but all silt protector sheets were taken away. Figure 6 indicates turbidity concentration of every measuring point is almost same. And Figure 7 is the result of the same measurement as Figure 4 but supplying turbidity concentration being 2,500mg/l. The same tendency as Figure 4 also observed by Figure 7. The use of composite silt protector sheets can generate meandering flow in the tank or pond. And stagnation may be generated behind the portion of low permeable ordinary silt protector sheets. This stagnation accelerate to settle sediment there.

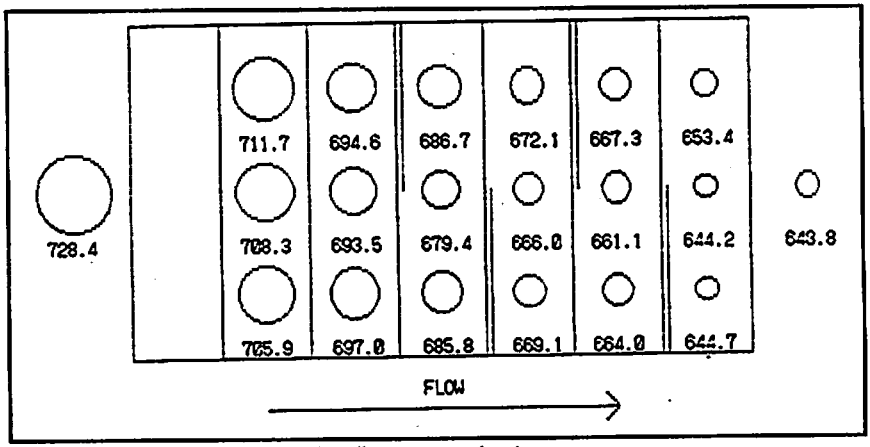

Figure 7. 2500mg/1 for composite silt protector sheets

Conclusions

By the comparison of Figures 4, 5, and 6 composite type of silt protector sheets may be effective as a membrane structure to settle sediment in rather small and limited dimension of settling pond. Actually, coarse sediment would be settled in front of first, uppermost, silt protector sheet in the settling pond. But suspension load sediment would be much more harmful to living resources of coastal area, and also for aquatic environments. Though further investigation and experiment should be necessary, utility and possibility of this composite type of silt protector sheets, especially for coastal area environments, would be considered to be shown.

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NATIONAL ESTUARY PROGRAM ACTION PLAN DEMONSTRATION PROJECT BAFFLE BOX CONSTRUCTION IN THE INDIAN RIVER LAGOON, FLORIDA

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The National Estuary Program (NEP) was established in 1987 under Section 320 of the Clean Water Act. The Act authorizes the Administrator of the Environmental Protection Agency (EPA) to convene Management Conferences to develop Comprehensive Conservation and Management Plans (CCMP) for estuaries of national significance that are threatened by pollution, development, or overuse. The Indian River Lagoon Management Conference was convened during April, 1990.

The Management Conference provided a forum for consensus building and problem solving among interested agencies and user groups. The end result of this process is the CCMP. This plan characterizes the lagoon, defines the problems, and identifies the costs and possible funding mechanisms for corrective actions.

Action Plan Demonstration Projects are pilot projects designed to test new and innovative methods for solving identified problems in the lagoon. Results from these projects are extrapolated for basin wide application, and inclusion in the CCMP.

A major problem in the IRL pertains to storm water runoff. This situation is especially difficult to deal with in urbanized areas, which lack available land for traditional storm water treatment techniques, such as retention ponds or grass swales.

A potential solution could be the use of constructed devices known as baffle boxes. Basically these contraptions are large cast concrete structures which function as sediment traps. Barriers inside the box slow down the flow of water, allowing time for the sediment to settle to the bottom of the box. Filter screens are also placed in the box to trap larger debris. When the water discharges through the pipe at the opposite end of the pipe, the sediment load is diminished, and the water quality is improved. Periodic cleaning of these boxes maintains their efficiency.

Specifics concerning the design and installation of baffle boxes are evolving. Therefore, EPA provided funds to Brevard County, Florida for five baffle box demonstration projects. Each project will deal with different watersheds, and baffle box configurations. The results obtained from this project will be incorporated into the CCMP.

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CONSTRAINTS AND OPPORTUNITIES FOR COMMUNITY MANAGEMENT OF COASTAL RESOURCES

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Rogelio N. Tagarino, University of the Philippines at Los Baños

Background

The authors undertook a case study of selected coastal communities in eastern Sorsogon, in the Bicol region at the southern end of the Philippines' main island of Luzon. This study was stimulated by the limited research into community-level management of natural resources.

The most important challenge to the human community over the next generation will be the management and allocation of ever-scarcer resources. Our present tools and systems for managing natural resources need to be revised to meet this demand. The (mostly absentee) stewards charged by present policy systems with preserving various resources have demonstrated limited capacity and less flexibility to meet this challenge.

National programs—usually absentee in design and management—tend to be commodity specific, while coastal resources are site-specific: Most coastal resources are affected by land-based activities -- siltation resulting from logging, chemical poisoning from factories, etc. Local communities can respond more immediately to perceived compatibilities, and can effectively manage the sustained exploitation of its resources; this is especially so when the "absentee" group provides them with research findings on new technologies, techniques, and policy regimes. Of course, neither resident nor absentee stewardship groups are homogeneous, implying that a policy system which places economic management responsibility with resident groups and training, research and monitoring with absentee groups, may be most appropriate. Self-regulating, self-reliant communities can help members deal more effectively with the competition and market pressures which lead to over-exploitation. This brings up the need to identify policies, and local community-level organizations, appropriate for resource exploitation that is sustainable and which enables communities, indeed nations, to become self-reliant.

Research Framework

A conceptual framework for addressing the needs of coastal resource users generally, is needed to help avoid basing resource management policies on too narrow a conception of those needs. As indicated earlier, the general topic of sustainable resource management policy is conceptually quite complex, with the result that "... policy analysis tends either to be restricted to a narrow angle in the hope of maintaining analytical rigor or is wide-ranging and fuzzy." Reasons for this include the wide variety of environmental and natural resource 'problems' and the large number of "actors" and their different interests.

As local participation is a continuing, iterative activity, the effective implementation of decentralization programs aimed at enabling these local organizations depends largely on the presence of appropriate behavioral, attitudinal and cultural conditions. The most important factors include the willingness of local officials to support and perform decentralized management functions, the quality of local leadership, the attitudes of rural people towards government, and the degrees to which traditional customs and behavior are compatible with decentralized planning, decision making and management. All of these are "soft" variables which are difficult to deal with in a policy or operational sense, but which are very important, if not paramount.

Since all of the variables indicated in the literature are included in the framework used, it should enable such a broad, general assessment. This framework does not include such short-hand measures of "better" resource management as increases in yield or increases in income. This exclusion results because of the study's focus on community capabilities for coastal resource management.

Information on these and related variables is generally not available. However, little has been done in the Philippines to describe a measure of a community's capabilities for having resource management devolved to it, so that there seems to be more interest in community involvement in resource management "at the top," than in the community. This study aims to provide part of this foundation data. It was undertaken in support of other efforts to develop comprehensive coastal resource conservation management policies that take into account the aspirations and conditions of the rural communities. This study will pursue the following specific tasks:

1) Describe the communities' awareness of, concern for and compliance with existing public policies for common use or conservation and management of seaweed resources.

2) Describe the quality of the community's leadership capabilities -- the skills, time devoted, understanding, organizations, etc. that the rural coastal community has and which of these might be developed and used for resource management.

3) Determine local communities' perceptions of present governmental structures.

4) Determine and examine the existence and perceived performance of seaweed exploitation-related institutional systems existing in the localities.

The Communities

The Bicol communities selected for this study are on the Philippine Sea-Pacific Ocean side of Sorsogon. Sorsogon's population is estimated to be

600,000. As of 1983, the average annual household income for the province was only P4,231 ($529) — P726 ($90) per person (this compares to the Bicol region's average annual household income of P20,221). Also as of 1983, Sorsogon had nearly 13,500 municipal fishermen using nearly 10,000 bancas, 2/3 of which were sail/oar powered. Fish production had tripled over the preceding three years—this increase was 8 times higher than increases over the preceding 5 years. During 1983-84, catches dropped, signalling overfishing.

There are a number of places in the Philippines where commercial seaweed species, especially Eucheuma, may be found growing naturally, although seaweed grows practically all around the country, with distribution affected only by the seasons. The Bureau of Fisheries and Aquatic Resources has identified good areas for its growth; the Bicol region is among the leaders. There is also a history of commercial production based on harvesting wild crops and seaweed culture research in the Bicol area. In the early 1980s Marine Colloids (Philippines), Inc. was founded. This center, operated by the Aquacultural Resources Development Project (ARDP), is linked with the University of Hawaii Professor Emeritus Maxwell Doty who is involved in a number of research efforts around the world related to seaweed biology and income-generating seaweed farming.

Data Collection and Analysis

This study follows the methodology of technology assessment, with the stipulations that this is only a beginning look, and that this study is intended to contribute to both a larger assessment and a continuing assessment process. As such, this study is primarily a case study; it is exploratory and categorizing-defining. In other words, it collected and analyzed:

1) Primary data on local situations.

2) Primary and secondary data to define the parties-at-interest and possible impact areas.

3) Primary data on the perceptions of parties-at-interest.

4) Areas of agreement and disagreement among the data and between the data and alternate practices for community management of coastal resources. The steps above are roughly in sequence with the objectives.

Four different respondents were sampled: General household residents (GHH); Seaweed Gatherers and Producers (PHH); Institutional Respondents (IR); and Organizational Respondents (OR). Each type of respondent was surveyed randomly, with smaller sampling frames having larger sampling rates. Data were analyzed using basic statistical descriptors. Comparisons among indicators and other descriptors, used similar tests.

Findings on Variables

Willingness

Participation in Social Organizations: The indicator was the average number of hours resource users (PHH respondents) spent on an organization's activities each month. The average number of hours spent was 4.22 was fairly small -- about one hour per week. This monthly average was greater than the average for the preceding month, possibly because of the holidays and harvest that occur around that time. The implication of this indicator is that local organizations which might become involved in resource management will need to attract increased participation from their members, and to attract more members. An organization's involvement in resource management would involve granting and regulating economic use rights; this is a very attractive incentive.

Self-Perceived Capacities to Manage Resources: The indicator was the percentage of GHH respondents who could identify resource management-related activities of the organizations existing in their barangay. The number of activities which could be identified is theoretically very large, hence the percentage of people with such knowledge rather than an average number of resource management projects known was selected. Fourteen percent of the GHH respondents who identified organizations existing in their community could identify resource management-related activities of organizations within their barangay. Thirty-seven percent of the GHH respondents identified other activities; and 49% could not identify any activities of the organizations existing in their barangay.

Confidence: The confidence indicator relates to local institutions. For this study, the indicator was the percentage of fishing households within the GHH population which indicated an intention and/or plan to engage in other livelihood activities in the future. Forty-six percent of these respondents had such intention/plan. Given the limited income provided by fisheries, it is perhaps not surprising that this many of the fishing households are considering other livelihood activities. Fifty-four percent of the fishing households had no plan or no opinion on plans for alternative livelihood activities.

Information: The indicator used was the average score of the practical result of seaweed producers' information sources. This score was obtained by ranking the three different harvesting methods from least sustainable to the most sustainable. Each source of information was then compared. The average score for all four sources of information was 1.26, indicating that seaweed gatherers' information sources did not tell them of the harm and decreased productivity that result from plucking whole plants. Relatives tended to give the "best" information (1.45), and having no advice (1.10), or advice from buyers (1.17) were the "worst" information sources.

Compatibility

Awareness of Programs: Respondents' awareness of the status of the project(s) they could identify was fairly good; all respondents were able to indicate the current status of the projects they mentioned. However, the respondents' awareness of future, planned projects was limited (6%), perhaps reflecting their organization's (or another's) limited planning and information dissemination capabilities. Admission of project "failures" was very limited (2.4%). Respondents were generally not well acquainted with financial aspects of project development, e.g., funding sources, implementing agency and sponsoring agency. This limited knowledge may reflect that local leaders were not involved in project development, and hence know little of the details. Most respondents scored fairly high on this indicator; the average score was 5.63.

Organizational Mandates: To gauge the compatibility between organizational mandates and their potential and capability for managing coastal resources, the mandates of the organizations surveyed were reviewed against criteria related to resource management, e.g.,:

1) Legal authority to manage resources.

2) Organizational charter providing for aspects of resource management.

3) Organizational capacity for training and information dissemination. Organizational development capacity.

4) Capital and equity systems to support resource management and members' resource exploitation.

5) Technical capacity related to resource management.

Out of a possible score of 29 (which is an arbitrary number and should not be considered an optimum), most organizations, as might be expected, did not even reach the halfway point of 14.5. None of the organizations had a distinct provision in their by-laws or elsewhere for them to undertake resource management. As might be expected, all of the organizations scored poorly in capital/equity and technical capabilities.

Organizational Budgets: Similar to the review of the organizations' mandates just described, the budgets of the organizations surveyed were reviewed against several criteria important for resource management. The criteria used were: availability, adequacy, source and control. Did the organization have a budget? Was the budget adequate for the organization's mandate? What was (were) the organization's source(s) of funds? Did the organization have a system of financial control? Out of a possible score of 20 (which is an arbitrary number and should not be considered an optimum), most organizations did not even reach the halfway point of 10. Most of the organizations had inadequate budgets for their basic activities and did not have an internal financial control system.

Perceived Performance: To gauge the public's perceptions of the performance of public officials, the indicator selected was the rating given by PHH respondents of the performance and capabilities of selected government officials. The data indicated that government officials performed between "little activity" and "some activity" (1.58) related to seaweeds. It is worth noting that those officials physically closest to the respondents received the highest rating -- a rating even higher than that given to the national level technical agency.

Attitudes

Perceived Benefits vs. Costs: Given that local residents had not, since pre-colonial days, had much responsibility for the management of their natural resources, there was no way for this study to directly measure the case communities perceptions of the benefits and costs of local management of coastal resources. The surrogate measure chosen for this study was the percentage of seaweed producer households which felt their present living conditions were better that they were in the years before they gathered seaweed. Clear majorities felt that their quality of life had improved since they began gathering seaweeds, and that seaweed production itself had helped improve their living conditions.

Knowledge/Awareness: For this study, the indicator used was the average percentage of the extent of awareness of Institutional Respondents of public policies on coastal resources. While the awareness level indicated (47%) is not very low, when compared with, i.e., driver's licenses, it is not at all high. Also, awareness of those general policies which affect most coastal resource users is much higher (61%) than is awareness of policies concerning seaweed exploitation.

Assistance Desired From Government: For this study, the indicator was the percentage of the 55 seaweed gatherers who expected assistance from government in order to begin seaweed culturing. Sixty percent of the seaweed gatherers expected assistance from the government, either local or national. No assistance was expected by the gatherers from non-governmental or other private organizations, although 25% of the seaweed buyers and buyer/gatherers did expect assistance from sources other than government).

Perceptions of Individual vs. Community Needs: The indicator used was the percentage of seaweed producer households who expressed consistent feelings of the importance of seaweeds to them personally and to the community. A sizeable majority (59%) of the PHH respondents' feelings were consistent for seaweeds.

Leadership Quality

Levels of Education: For this study, the indicator chosen was the average number of years of schooling successfully completed by the Institutional Respondents. This number (10.49) indicates that local leaders have completed high school. Analysis of the data indicates that, at the local level, educational attainment tends to be "completed primary school," while at "higher" levels, educational attainment tends to be "completed a baccalaureate course." Clearly, this data

indicates that specific training is needed for barangay councillors if they are to be participate in the local management of natural resources.

Salaries/Incomes: The average salary, P3,763/month is, for rural Philippines in 1990, a reasonable amount. However, salaries varied considerably, and, like the educational levels just discussed, the most local levels had the lowest salaries.

Perceptions of Leaders' Capabilities: The indicator used was the PHH respondents' assessment of the capabilities of various government officials' efforts to sustain seaweed exploitation. By scoring responses on a three-point scale, it was possible to obtain an average for each of the various officials and an aggregate average. The aggregated average score was 1.87.

Information: For this study, the indicator was the average score of Organizational Respondents for their feelings concerning the availability of information on coastal resources to users. Using a scale where 1 indicated that such information was not available, 2 indicated that its availability was very limited, 3 indicated that such information was sometimes available, and 4 indicated that the information was always available, the aggregate average score was 2.52.

Conclusions and Implications

The main objective of this study was to provide part of the foundation data for community resource development policy planning and implementation. The conclusions related to those objectives are summarized in the following Table.

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THE EVOLUTION OF COASTAL INTEREST GROUPS: A COMPARISON OF THE SPORT FISHING INSTITUTE AND THE COASTAL CONSERVATION ASSOCIATION

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Americans have historically formed associations and organizations to pursue public and private goals. Indeed, there has been a proliferation of groups since the 1960s, many of which focused their attention on Washington. Groups with coastal and ocean interests continue to form and join the burgeoning legions of environmental interests seeking to shape national policy. Although researchers have continued to refine estimates of the number and membership of these organizations, there have been few studies that examine their evolution and political roles. This paper compares and contrasts the life histories of two recreational fishing groups, the Sport Fishing Institute and the Coastal Conservation Association, particularly with respect to their evolution as political interest groups. Based on this comparison, the notion of distinctive developmental stages (nascent, developing, and mature), each characterized by distinctive variables, can contribute to understanding the actual and potential political role of these groups. By these criteria, the Sport Fishing Institute has evolved into a mature special interest organization, while the Coastal Conservation Association is in the developing phase of its life cycle. Identification of these developmental stages can provide strong indicators about the prospects for the style and intensity of a group's political behavior.

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COASTAL CONSERVATION AND THE U.S. FISH AND WILDLIFE SERVICE: AN OVERVIEW

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Introduction

U.S. coastal areas, although representing only 5-10 percent of the U.S. continental land area, are renowned for their significant living resources. Coastal ecosystems are highly dynamic, biologically diverse and, with sensitive stewardship, appear to be capable of meeting many human demands on a sustainable basis.

The exceptionally high ecological productivity and biological diversity of U.S. coastal regions is well recognized and documented (Odum, 1978; Whittaker and Likens, 1971; Bildstein et al., 1991). Coastal areas provide valuable nursery, breeding, staging and resting areas for numerous species of fish, shellfish, mammals and birds. For example, in the U.S., approximately 50 percent of the migratory song birds of management concern are associated with coastal habitats and 30 percent of North American waterfowl winter in coastal areas. Nearly 45 percent of the U.S. endangered and threatened species depend on coastal habitats (almost 75 percent of the listed birds and mammals). Wetlands comprise about 16 percent of the U.S. coastal zone. U.S. estuaries support fisheries whose economic values exceed an estimated $19 billion dollars annually. And nearly two-thirds of all fish caught world-wide depend upon estuaries at one or more critical stages in their life history.

Unfortunately, despite the high ecological significance of our coastlines, present trends indicate continued, even accelerating degradation of our coastal ecosystems. At present, over 50 percent of the U.S. population resides within 80 km of the coast (Southworth, 1989). Human population densities in these areas are now more than four times the national average. Growth projections for the next 20 years indicate that more than one-half of the population increase will be concentrated in coastal areas, and by the year 2010 some estimate that as much as 75 percent of the U.S. population will live within 50 miles of the coastline. Consequently, U.S. coastal and estuarine areas face some of the most intense pressures from expanding human populations and their developments.

Population growth and the corresponding expansion of human developments continue to place unsustainable demands and stresses on our fragile coastal ecosystems. Our coastlines are becoming increasingly crowded with waterfront homes, marinas, shopping centers and industrial developments. Intensive and extensive agricultural activities in the upstream watersheds increase soil erosion and sediment loadings, and produce toxic or nutrient-rich effluents that overload the natural assimilative capacity of the nation's estuaries and coastal waters. Volumes of sediments, nutrients and noxious chemicals from urban, agricultural and industrial developments drain into our coastal systems, poisoning food webs and water supplies, degrading ecosystem integrity, reducing biological diversity and significantly lowering the overall productivity of these living systems.

In the northeast, oyster harvests are a remnant of their historic abundance and many of the formerly productive Atlantic coast fisheries appear to be in severe, permanent decline. On the Pacific coast, the once uncountable runs of anadromous salmon and steelhead are now at a crossroad, with the majority of stocks in rapid decline, and several on the verge of extinction. Fisheries in many other coastal areas also appear greatly stressed or in rapid decline, and substantial numbers of nongame wildlife, shorebird, waterfowl, plant and invertebrate species indigenous to, or dependent upon coastal ecosystems also show similar trends. The numbers of endangered and threatened species in coastal areas continue to grow despite the many efforts of state and federal government conservation agencies and private conservation groups.

Coastal Activities of the U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (Service) has traditionally played an important role in the protection of coastal living resources through its many legislative authorities (Table 1), extensive on-the-ground presence and biological expertise. Service programs in fisheries, refuges, migratory bird and waterfowl management, habitat conservation, endangered species, and law enforcement are extensively involved in our nation's coastal regions. However, addressing the increasingly rapid pace with which our coastal areas are being altered, degraded and unwisely developed requires a renewed commitment to coastal conservation and more innovative and preventative approaches. It also requires recognition that no single agency alone can conserve our coastal ecosystems.

Table 1. Service Authorities (in part) that relate to coastal conservation

- Fish and Wildlife Act of 1956;
- Fish and Wildlife Coordination Act;
- Endangered Species Act;
- Marine Mammal Protection Act;
- Clean Water Act;
- Migratory Bird Conservation Act;
- Coastal Barrier Resources Act as amended by the Coastal Barrier Improvement Act of 1990;
- Coastal Wetlands Planning, Protection and Restoration Act;
- Emergency Wetlands Resources Act;
- Great Lakes Fish and Wildlife Restoration Act;
- Federal Power Act;
- Food Security Act of 1985 as amended by the Food Agriculture, Conservation, and Trade Act of 1990;
- National Environmental Policy Act.

The Service has made coastal conservation one of its top priorities, and is committed to do so, not alone, but in partnership with other federal, state and local governments and private efforts. This commitment embraces both the full array of traditional Service programs as well as several recent coast-specific legislative authorities and a new Service program, the Coastal Ecosystems Program (formerly Bay/Estuary Program). This paper provides a brief description of Service activities involved with coastal conservation and the actions they are taking.

Traditional Programs

Many of the Service's traditional programs include extensive authorities (Table 1), facilities, and expertise directed at conserving coastal ecosystems and their living resources.

Refuges and Wildlife - Nearly 40 percent of the Service's National Wildlife Refuges are coastal. In terms of coastal acreage more than 500 sites include about 10 million acres in coastal regions of the lower 48 states and about 57 million acres in Alaska. Consequently, a substantial amount of the Service's refuge and land management activities focus on coastal living resources. In addition, public environmental awareness programs on specific refuges provide readily available and a cost-effective sources of public information about coastal fish and wildlife and coastal ecology. In addition, National Wildlife Refuges provide significant opportunities to restore and rehabilitate coastal habitats and ecosystems.

The Refuge and Wildlife Program also includes the Service's Realty (new refuge acquisitions), Migratory Bird Management, and Law Enforcement Divisions, all of which play significant roles in the management and protection of coastal ecosystems. Coastal areas consistently rank among the highest priorities for new refuges acquisitions or as additions to existing management units. The Migratory Bird Management Program is intensively involved in coastal areas because of the high numbers of migratory birds dependent on coastal wetlands, estuaries and associated habitats. Habitat joint ventures which represent regional partnerships between the Service and a number of public and private interests concerned with conservation of wetland habitats for migratory waterfowl under the North American Waterfowl Management Plan are also important coastal players since four of them cover nearly 75 percent of the U.S. continental coastline.

Ecological Services - This broad Service program area, which leads and coordinates the Coastal Ecosystems Program (discussed below), encompasses Service efforts in endangered species, environmental contaminants, habitat conservation, private lands, federal project and permit reviews, and national wetlands inventory and wetlands conservation activities. Within the Service's 6 coastal regional offices and nearly 40 coastal field offices, Ecological Services personnel conduct extensive on-the-ground activities throughout the U.S. coastal regions. Ecological Services activities include conducting fish and wildlife trend and impact assessments, mapping of wetlands in the U.S., providing a variety of technical assistance functions to prevent or minimize the impacts of land and water development projects on fish and wildlife and their ecosystems or to assist in the restoration, enhancement and general conservation of habitats, ecosystems and fish and wildlife populations.

About 65 percent of the more than 10,000 Corps of Engineers wetland and dredging permits reviewed annually by Ecological Service's personnel are coastal and nearly 45 percent of the hundreds of federal land and water development projects are reviewed. With regard to endangered and threatened species, nearly

half of the several thousand Endangered Species Act consultations conducted involve coastal habitats and species.

Fisheries - The Fisheries program is an integral part of the Service's coastal emphasis. The program goal is to provide leadership to conserve, restore, enhance, and manage fishery resources and their supporting aquatic ecosystems to maintain their benefits for future generations. The Fisheries Program focuses on nationally significant fishery resources through a combination of habitat restoration, mitigation, fish stock assessment, and hatchery propagation. The Program focuses on interjurisdictional fisheries such as anadromous, estuarine, large river fish, and endangered species. These efforts are undertaken in cooperation with other federal agencies, state cooperators and Tribal governments. Pacific salmon, Atlantic salmon, lake trout, and striped bass are some of the more prominent species emphasized by the Fisheries Program. These fisheries provide valuable, long-term benefits to the economy of many coastal states, local communities, and businesses.

The Service's Pacific salmon restoration and mitigation efforts consist of a combination of hatchery propagation, wild stock management, and habitat rehabilitation. These measures are necessary to halt the decline of salmon stocks as a result of federal power and water development projects, changing land use practices and pollution. Restoration programs are being implemented in the Klamath, Trinity, and Chehalis River Basins. Restoration activities in the Columbia River Basin include efforts to recover three stocks of Snake River salmon and attempts to prevent future declines of other stocks at risk.

The Service has been involved in restoring Atlantic salmon to New England rivers for more than 100 years. Current activities include protection and restoration of spawning and rearing habitat, reductions of high seas harvest, hatchery propagation, and providing adequate upstream and downstream fish passage to ensure successful completion of the life cycle. Efforts to reduce fishing mortality were boosted by an agreement with Greenland to significantly reduce harvest of Atlantic salmon of North American origin. Agreements negotiated among the Service, Federal Energy Regulatory Commission, NOAA/National Marine Fisheries Service and hydro-power operators to increase instream flow releases have enhanced spawning and rearing habitat. Production of hatchery fish plays a significant role in the restoration effort. Increased hatchery production in recent years stems largely from a shift to stocking fry rather than parr or smolts.

Striped bass have supported important commercial and recreational fisheries along the Atlantic coast for many years. Serious declines occurred in the 1970 and 1980's that lead to significant reductions in allowable catch and increased stocking programs by the states and the Service. High juvenile numbers were measured along the Atlantic coast in 1993 because of favorable ocean conditions and an increase in spawning stock. The striped bass stocks on the Atlantic coast appear to be recovering.

Restoration of naturally reproducing lake trout in all five Great Lakes is a Service goal. An aggressive stocking program has been combined with effort to

control sea lamprey, improve water quality, and regulate harvest. Service National Fish Hatcheries stock several indigenous strains of lake trout on historical spawning reefs to maximize adult returns. Many of the fish are stocked on offshore reefs where lake trout are known to spawn and survival is thought to be the highest. Ongoing studies by Fishery Resource Offices determine survival and growth of hatchery lake trout and identify critical spawning habitat have contributed to the general recovery of native Great Lakes fish. The Great Lakes Fish and Wildlife Restoration Act, discussed below, will greatly assist in these efforts.

New Coastal Authorities

Great Lakes Fish and Wildlife Restoration Act - The Great Lakes provide an immense natural resource to the people of the U.S. and Canada. The freshwater in the five lakes combined make up 18 percent of the world's freshwater supply, the largest inland freshwater body in the world. Sixty percent of all Canadians and 20 percent of all U.S. citizens live within the Great Lakes drainage basin and over 25 million people depend on the freshwater from the lakes basin for drinking water.

Recognizing the great significance of the living resources of the Great lakes and the enormous threats facing the lakes from over development, pollution, invasion by exotic species and habitat loss, Congress passed the Great Lakes Fish and Wildlife Restoration Act in 1990. The goals of the Act are to:

1) Restore self-sustaining fish and wildlife populations in the Great Lakes basin.

2) Minimize the impacts of contaminants on fish, wildlife and their habitats.

3) Protect, maintain, and where degraded or destroyed, restore fish and wildlife habitat, including the enhancement and creation of wetlands.

4) Stop illegal activities adversely affecting fish and wildlife and their habitats.

5) Restore threatened and endangered species to viable, self-sustaining levels.

The Act authorizes the Service in conjunction with the states, Canadian government, other federal agencies, Indian Tribes and other interested parties, to conduct a study to identify the problems and specific actions needed to restore the Great Lakes ecosystem. The Act also established five new Service offices around the Great Lakes region and expanded one existing office to carryout the provisions of the law. Although authorized for up to $10 million dollars annually, only $1 million has been appropriated each year since 1992. The estimated need to carry out the provisions of the act may well exceed the authorized limit.

The Service is now in the process of completing the study in conjunction with the partners. The Environmental Protection Agency, Corps of Engineers, and National Oceanic and Atmospheric Administration are the major federal partners.

Coastal Barrier Improvement Act of 1990 - Coastal barriers are unique landforms which support and provide protection for diverse aquatic habitats and serve as the mainland's first line of defense against the impacts of coastal storms and erosion. Examples of coastal barriers include bay barriers, barrier spits, barrier islands, tombolos, dune or beach barriers, and fringing mangroves (U.S. Dept of the Interior, 1988). Most barriers are highly unstable areas on which to build, however many of these areas have undergone increased development in recent years. Some of this development has been encouraged by the availability of national flood insurance and other types of federal financial assistance.

Congress recognized the vulnerability of coastal barriers to development by passing the Coastal Barrier Resources Act of 1982 (CBRA). The purpose of this legislation is to minimize the loss of human life, the wasteful expenditure of federal revenues, and damage to the natural resources associated with coastal barriers by establishing a Coastal Barrier Resources System (System). Within each congressionally designated barrier unit, certain types of new federal expenditures and financial assistance which have the effect of encouraging development of coastal barriers, are prohibited. By restricting these types of federal expenditures and financial assistance Congress aimed to eliminate or greatly reduce these problems. The CBRA, however, does not prohibit non-federal and privately financed development, and under section 6 of CBRA, certain federal expenditures and activities are permitted after consultation with the Service.

The System is comprised of units which encompass undeveloped coastal barriers and their associated aquatic habitats. Undeveloped coastal barriers along the Atlantic and Gulf of Mexico coasts were identified and mapped by the Department of the Interior (Department) and designated by Congress as units of the System in 1982. The System originally consisted of 186 individual coastal barrier units totaling 666 miles of shoreline and 452,834 acres of undeveloped, unprotected coastal barriers on the Atlantic and Gulf of Mexico coasts.

The CBRA is unique in that it does not define the specific areas included in the System. Instead, the law references a series of maps on file with the Secretary which depict the specific boundaries of the individual units.

Congress specifically excluded undeveloped coastal barriers which are considered to be otherwise protected" from the System. As defined by the CBRA, otherwise protected areas are barriers which are "included within the boundaries of an area established under federal, state, or local law, or held by a qualified organization as defined in section 170(h)(3) of the Internal Revenue Code of 1954, primarily for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes." Examples of these areas include National Wildlife Refuges, National Parks and Seashores, state parks and conservation lands, and local parks and recreation areas.

In 1990, the CBRA was amended by the Coastal Barrier Improvement Act (CBIA). The CBIA tripled the size of the System by adding coastal barriers of the Great Lakes, as well as additional areas along the Atlantic and Gulf of Mexico coasts. The System currently includes 560 units, comprising almost 1.3 million acres and about 1,200 shoreline miles. CBIA also amended section 1321 of the National Flood Insurance Act of 1968 to prohibit the issuance of new federal flood insurance within "otherwise protected areas." These areas were also identified for the first time on the maps referred to in the CBIA.

The CBIA also directed that a study be undertaken to examine the need for protecting undeveloped coastal barriers along the Pacific coast of the United States and to prepare maps identifying undeveloped coastal barriers bordering the Pacific Ocean south of 49 degrees north latitude which the Service and the appropriate governor consider to be appropriate for inclusion in the System. Specifically, the study was to examine:

A) The potential for loss of human life and damage to fish, wildlife, and other natural resources, and the potential for the wasteful expenditure of federal revenues given the geologic differences of the coastal barriers along the Pacific coast as opposed to those found along the Atlantic and Gulf coasts.

B) The differences in extreme weather conditions which exist along the Pacific coast as opposed to those found along the Atlantic and Gulf coasts.

The areas to be studied and mapped included: the states of California, Oregon, Washington, and Hawaii; American Samoa; Guam; the Northern Marianas; and all other territories and possessions of the United States in the Pacific Ocean. During the initial identification and mapping of coastal barrier units on the Pacific coast, the Service found no units which fit the definition of an undeveloped coastal barrier in the territories or possessions of the United States in the Pacific Ocean. Therefore, maps were prepared only for the states. The results of this study were made available to the public in December 1993 and comments from the governors of the affected states, other government agencies and the public have been solicited. After review and evaluation of the comments, final recommendations of the Service and the governors for those Pacific coastal barriers appropriate for inclusion in the system will be sent to Congress for their consideration.

Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) of 1990 - This legislation (Public Law 101-646) provides several new ways to fund coastal conservation projects. Funding for the CWPPRA is made available by allocating 18 percent of the sport fish restoration account which comes from taxes on the sale of fishing equipment and small motor fuels.

The first provision includes about $33 million in funding for development and implementation of coastal wetland restoration plans to help stem the dramatic loss of coastal wetlands in Louisiana, which leads the nation in acres of coastal

wetlands lost. The agencies involved include the Corps of Engineers, Environmental Protection Agency, NOAA/National Marine Fisheries Service, and U.S. Fish and Wildlife Service, who participate with the Governor of Louisiana in designing and implementing restoration projects.

Second, CWPPRA provides additional funding to the North American Wetlands Conservation Act for implementing coastal wetland acquisition and restoration projects in coastal states other than Louisiana. This program is administered by the Service's North American Waterfowl and Wetlands Office in Washington D.C. Each year since fiscal year 1992 (the first year funding was made available under the CWPPRA) about $7 million dollars in grants have been provided to a wide array of recipients to restore and protect coastal wetlands.

The third provision is the National Coastal Wetlands Conservation Grant Program administered by the Service which provides for competitive 1:1 matching grants to all coastal states, except Louisiana, for coastal wetland conservation projects. Specific criteria have been established for evaluating the state proposals. Priority is given to state proposals that are consistent with the National Wetlands Priority Conservation Plan and those involving coastal maritime forests on coastal barriers. In addition, states with dedicated trust fund programs for acquiring wetlands, natural areas, and open spaces can receive a higher federal match.

Again, each year since 1992, about $7 million dollars have been made available for this grant program for restoration, acquisition or combination restoration/acquisition of coastal wetland habitats. Table 2 shows the federal funding available and wetland acreages affected for the three years the program has existed.

TABLE 2. CWPPRA FUNDING AND WETLAND ACRES CONSERVED
FISCAL YEARS (FY) 1992 - 1994

	FY 1992	FY 1993	Fy 1994
Federal Funding	$5,659,205	$5,905,991	$7,601,100
Acres conserved[1]	59,793	3,917	17,873

Coastal Ecosystems Program

The Service's Coastal Ecosystems Program was initiated to place greater Service emphasis on the nation's most significant coastal watersheds and ecosystems. The Program was specifically designed to function as an integrator and focal point for the Service's broad capabilities, authorities and resources. A key

[1]Funded actions include land acquisition, as well as specific on-the-ground projects to restore and enhance coastal wetland habitats

part of the effort is to establish working partnerships with other federal, state and local agencies and the private sector to address the priority resource problems in the nation's most ecologically-important coastal areas.

The goal of the Coastal Ecosystems Program is to conserve the nation's coastal biological diversity and achieve a net gain of fish and wildlife and the natural ecosystems that support them by:

1) Integrating all Service activities and capabilities in high priority coastal watersheds to identify the most important natural resource problems and solutions.

2) Carrying comprehensive living resource needs, problems and solutions to the planning and decision-making processes of other agencies.

3) Forming partnerships to implement projects to restore and enhance important coastal habitats.

4) Conducting outreach activities to instill a stewardship ethic and educate and catalyze the public and private sector to get involved, change behaviors, help conserve coastal habitats, and promote ecologically sound decisions.

Present (fiscal year 1994) funding is about $5 million, which allows individual projects in nine high priority coastal watersheds or watershed complexes (Table 3). It thus relies on the extensive local field presence and capabilities of the Service to provide timely, comprehensive information on federal trust resources and their habitats, information on hydrology (watershed conditions, flow volumes, and timing), contaminant problems, nutrient enrichment, and habitat alterations and their effects on living resources and their ecosystems.

TABLE 3. EXISTING FY 1993-1994 COASTAL ECOSYSTEMS PROGRAMS, FUNDING LEVELS AND ESTIMATED NEEDS ($ thousands)

Existing Programs	FY 93	FY 94	Total est. need
Chesapeake Bay	2,037	2,026	2,500
Puget Sound	346	502	1,400
Delaware Bay	370	370	850
Albemarle-Pamlico	340	340	800
Southern New England/New England Bight	246	346	1,050
San Francisco Bay	273	293	1,200
Galveston Bay/Texas coast	247	244	2,400
Gulf of Maine	247	247	900
Southern California Coast/San Diego Bay	297	293	1,000
Total	4,403	4,661	12,100

Although the nine coastal watersheds/ecosystems encompassed by these efforts are among the highest priority in the nation from a living resources standpoint, clearly many more of the nation's coastal ecosystems are threatened or in need of additional attention. Based on available information the Service has identified 13 additional high priority coastal watersheds that require immediate attention (Table 4). These additional coastal ecosystems have been identified and prioritized based on the resource values and threats present within each area (Table 5). This priority system is also used to help guide our efforts in implementing the program. Although only 9 areas are funded at present, we hope that eventually all 22 identified coastal ecosystems will be funded.

Establishing Coastal Ecosystems Programs in all of these high priority coastal areas will enable the Service not only to address and resolve existing problems, but also provide significant opportunities to avert potential problems in the future.

TABLE 5. ESTIMATED FUNDING NEEDS FOR PROPOSED COASTAL ECOSYSTEMS PROGRAMS

Proposed Coastal Ecosystems Programs (in priority order)	Estimated Need ($ thousands)
Florida Bays/Florida	2,000
Eastern Florida/Indian River (FL)	900
Cook Inlet (AK)	310
South Carolina Focus Areas (SC)	1,200
Barataria-Terrebone (LA)	720
Green Bay (WI/MI)	600
Columbia River Estuary (OR/WA)	1,000
Tampa/Sarasota Bays (FL)	800
Sabine Lake/Calcasiew Lake (TX/LA)	1,100
Alabama/NW Florida (AL/FL)	800
Caribbean Islands (PR)	1,200
Central California Bays & Estuaries (CA)	800
Oregon Bays & Estuaries/Coos Bay (OR)	600
Total	12,030

In addition to intra-Service integration, the Coastal Ecosystem Program provides a watershed/ecosystem-focused framework for interaction with other federal and state agencies, international cooperators, Tribal representatives, private individuals and groups to involve as broad a segment of our society as possible. By placing Coastal Ecosystems Programs in priority coastal watersheds, opportunities for cooperation and leveraging of Service capabilities with others is increased. This has the added benefit of being more cost-effective, fostering increased trust in our public institutions, and hopefully will ultimately contribute to an improved stewardship ethic on the part of a wider segment of our society.

The living resources (ecological) focus of the Coastal Ecosystems Program is an important complement to other federal coastal efforts. Consequently, strong emphasis is placed on establishing working partnerships with federal, state and local agencies, non-governmental organizations, and the private sector to carry out on-the-ground actions to restore and enhance habitats, fish and wildlife populations and the natural character, function and productivity of the target ecosystems.

EPA Coastal Programs - EPA's National Estuary Program (NEP) and Near Coastal Waters Program, largely emphasize water quality because the authority is derived from the Clean Water Act. The Service's Coastal Ecosystems Program brings an ecological perspective to these important EPA Programs and thus helps ensure adequate consideration of the biodiversity and ecosystem aspects in the development and implementation of the Comprehensive Conservation and Management Plan (CCMP). At present the 9 funded Coastal Ecosystems Programs cover about 14 of the 21 National Estuary Programs presently established by EPA as well as the EPA Chesapeake Bay Program. Six of the 15 proposed Service Coastal Ecosystems programs correspond to the remaining 7 NEP's.

Table 5. Criteria used to evaluate and prioritize Coastal Ecosystems Programs:

1)	**Coastal watersheds/ecosystems with high living resource value.**
2)	**Areas with high biological diversity.**
3)	**Areas threatened with significant resource loss or degradation, or where substantial losses or degradation have already occurred.**
4)	**Areas with high potential for problem prevention, restoration or remediation.**

Programs of the National Oceanic and Atmospheric Administration - The Service's Coastal Ecosystems Program also complements the programs and activities of NOAA. These include implementation of the Coastal Zone Management Act (CZMA), the National Marine Sanctuary and Estuarine Research Reserve Programs (Sanctuaries and Reserves Programs), and the National Marine Fisheries Service's living resource and habitat programs. Like the EPA programs there is high complementarity between the Service's Coastal Ecosystem Program and NOAA's Coastal Zone Management Program and Sanctuaries and Reserves Programs. In addition, the Service has been working with NOAA/National Ocean Service's Office of Ocean and Coastal Resource Management (OCRM) to develop a Memorandum of Understanding to leverage specific capabilities of the two agencies at the national level. It is hoped that this will help facilitate specific subagreements at the state and local levels to increase joint collaboration between the Service and OCRM programs on specific coastal conservation actions.

National Biological Survey - At present, about 50 percent of the Service's research is directed at coastal fish and wildlife and their habitats. Service research has provided some of the most comprehensive information and data on coastal living resources in the world. As a consequence, integration of these research efforts will remain an important aspect of the Coastal Ecosystem Program. However, with the establishment of the National Biological Survey the Service's research function will transfer to the new agency. The Service's Coastal Ecosystems Program will work closely with the NBS as it develops its capabilities to insure timely access to research information for management and operational purposes.

Other federal, state and non-governmental programs - The watershed-ecosystem focus of the Service's Coastal Ecosystems Program permits more effective coordination with the Corps of Engineers navigation and environmental programs, Soil Conservation Service and many other agencies and interests that carry out activities in the nation's coastal ecosystems.

Conclusion

Through increased on-the-ground actions supported by several new coastal authorities and increased commitment to coastal conservation on the part of its many traditional programs and its newly established Coastal Ecosystems Program, the Service, in cooperation with a wide array of partners, has begun to make significant progress in the conservation of the nation's coastal ecosystems. An important part of this is the building of trust and a renewed stewardship ethic on the part of the public. The ultimate goal is increased sensitivity and commitment on the part of the American people to protect and restore our fragile coastal areas.

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CHANGING LAND USES, ENVIRONMENTAL EFFECTS, AND INSTITUTIONAL RESPONSES IN THE LONG POINT AREA, LAKE ERIE

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A key objective in the development of an Environmental Folio for the Long Point World Biosphere Reserve is to determine significant land cover changes and institutional responses. The Long Point Biosphere Reserve is located along the north shore of Lake Erie and is an important natural habitat for wildlife and migratory birds and a focus for human use and development in the forms of agriculture, recreation, fishing, and rural, urban and industrial development. Land cover analysis was completed for the study area from 1955 and 1990 aerial photography. Seven main classes were defined: forest, wetland, parkland/savanna, agricultural land, built-up area, coastal deposits, and open water.

During the 35 years since 1955, it is apparent that major changes in land cove have occurred with Long Point Study area. Clearly the main land cover change issue is the loss of wetlands/marshes, a decrease of 6.7% of the total land cover in the study area since 1955. With currently only 15.1% coverage in the study area, a continued loss of these wetlands at the rate since 1955, would result in rapid destruction of these important natural features. The main treats appear to consist of marina and cottage development along the Inner Bay shoreline. Protection of the wetland/marsh areas should be a management priority.

Although these trends are not significant at the level of the study area mapping and analysis, examination of detailed study sites clearly illustrates that important shifts in land cover types have developed. This indicates the nature of land cover change in the Long Point area which are characterized by very site specific and often rapid changes at important locations along the Inner Bay shoreline. Increased expansion of cottage and marina developments have come at the expense of natural ares at the community of Long Point, along the north shore, and at Turkey Point. Shoreline wetland and marsh areas have suffered the greatest impact. Urban growth at Port Rowan and other interior communities have reduced local agricultural land but in other locations expansion of agricultural activity in marginal lands, forest areas and wetlands had offset this loss. The results indicate the nature and magnitude if shifts in activities, development, and general utilization of the land area over the last 35 years.

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INSTITUTIONAL ARRANGEMENTS FOR WATER QUALITY GOVERNANCE IN PUGET SOUND, WASHINGTON: A COLLECTIVE CHOICE PERSPECTIVE

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This paper describes the evolution of institutional arrangements to enhance water quality in Puget Sound. The analytical framework we employ connects the collective goods character of resource management problems like water quality provision to the institutional arrangements that determine who may do what, how actions are monitored, and how rewards and sanctions are administered.

Three emergent programmatic areas are examined: the rural nonpoint pollution control program, sediment management standards, and a program which resulted in standards and site identification for dredged material disposal. Each involved multi-agency participation in its development and attention over an extended period of time. Public conflict varied over time and across programs.

The programs are examined with respect to decision-making strategies employed, functional and geographic scope of institutional arrangements and authority, and the size of the implementing administrative units. In each case the path of program development showed substantial variation along at least one of these dimensions between initial problem identification and the emergence of operational rules. The rural nonpoint pollution problem in particular saw significant variation in all of the factors before control program coalesced.

The variation observed suggests that the Puget Sound Water Quality Authority has served to catalyze organizational learning about water quality program development. Problems remain that are likely to require further adjustments in institutional arrangements, however, particularly in the nonpoint pollution program.

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A COMPARATIVE ANALYSIS OF MARICULTURE POLICY IN WESTERN NATIONS

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Global per capita seafood consumption is currently 43 pounds annually. By the year 2000 the production of seafood will have to increase from 100 million to 140 million metric tons per year to maintain today's consumption levels given present population projections. World fisheries are producing at near capacity, therefore the increase must necessarily come from aquaculture (2). Aquaculture is the process of growing, farming or cultivating plants and animals in a marine or freshwater environment. This method of farming produces yields far greater than those found within the natural aquatic environment (2).

Aquaculture is not a new enterprise. What is new is the recent recognition of the enormous success and expansion of aquaculture occurring in the world (2).

The growth of aquaculture and mariculture (aquaculture in the marine environment) has with few exceptions been constrained in western nations by public skepticism and inhibiting policy. As mariculture has expanded, becoming an industry rather than a novelty, it has sparked opposition from groups concerned with coastal pollution, the purity of wild stocks and other ecological issues. Local fishermen sometimes object to the waste generated by farms, or sites that block access to traditional fishing grounds. Landowners and tourist organizations have objected to the installation of farms on scenic stretches of coast which are important for tourism. Sportfishermen fear that fish farms are responsible for killing off wild gamefish. Scientists are concerned about the long term impact of fish farming on the marine environment. Ecologists are concerned about the use of toxic chemicals or antibiotics which are introduced to the ocean. Environmentalists are worried about marine mammals becoming attracted to pens as a source of food and then becoming entangled in the netting. Even bird lovers are upset when they hear stories of herons, egrets, or osprey being killed to keep them from feeding at grow out pens (1).

Fears about potential problems generate strong opposition to fish farms. This is especially true when new or exotic species are being introduced into non native waters. Many of these concerns are legitimate The potential for environmental damage, however is sometimes exaggerated or is no longer a significant problem, thanks to advances in technology, medicine and fish farming techniques (1).

Mariculture thrives in many parts of the world. It provides both jobs and regional income. It requires maintenance of a high quality environment. It meets the need for a good source of high quality protein and represents an expanding market opportunity(2). Until recent times temperate mariculture has been almost exclusively dominated by the culture of salmon. Salmon was the species for which technology was successfully developed first and continues to be the major species in

mariculture. Salmon mariculture is climate-limited to temperate and subarctic areas of the globe. These regions are also occupied by the developed countries of the world. Therefore a discussion of salmon culture is consistent with the objective of this paper; to compare mariculture policies among western nations.

In this abstract salmon mariculture excludes salmon ranching which is an activity which raises questions which are outside the scope of this study to address. (Salmon ranching is the process of releasing juvenile salmon which have been raised artificially for the freshwater stage of their life, to the wild, where they survive on their own, until they return to the place of their release, when they are harvested.) Mariculture, therefore, refers to the practice of raising fish in cages at sea. The development of salmon mariculture is one of the most significant mariculture success stories to date. During the last two decades production techniques for rearing salmon in pens or cages located in marine or coastal areas have been developed. Norway was the nation which was largely responsible for the development of salmon mariculture in the 1970s and still leads the world in production volume, technology, research and development. Today other nations endowed with appropriate resources are actively engaged in salmon farming on commercial scales, including, in order of production volumes: UK, Chile, Japan, Canada, Faeroe, Ireland, US, Australia, New Zealand, France, Turkey, Korea, and Russia (3),(1).

When a comparison is made between the appropriate coastal resources which the above countries have at their disposal and their production volumes in mariculture, it is apparent that the level of mariculture production carried on by a country is a function of other factors than the availability of the right kind of geography. Of the countries engaged in salmon farming only a very few are producing at or near potential as limited by coastal geography.

It is outside the scope of this paper to examine the technical inputs and market processes impinging on mariculture production and therefore it will be assumed that all the countries mentioned above may competitively produce salmon by mariculture at comparable levels of efficiency and profitability.

So what is it that makes the difference between those countries that are operating at or near their salmon mariculture production capacity and those that are not?

Although the husbandry of aquatic organisms has a long history of development, dating back to 4000 BC in China and 1600 AD in Europe, only in the last quarter century have foods derived from aquacultural practices become a significant share of the world supply of aquatic foods (3).

Increases in general aquacultural production are due to the following factors:

1) Improvement in aquaculture production technologies.

2) Increased demand for seafood products due to an increase in population growth, disposable income, and a growing awareness of seafood related health benefits.

3) Reduced or limited wild caught fish supplies.

4) Globalization of fish marketing.

5) Improvements in fish preservation techniques (3).

When focussing on mariculture and salmon farming in particular all of the above factors apply, but the most important reason that salmon farming has grown at such a fast pace is that it is a new form of profitable economic activity that has been developed over the last two decades, primarily pioneered by Norwegian entrepreneurs.

Due to this fact, it may be viewed as an opportunity which has only recently become available to countries with the right climate and geography. Different countries have shown different levels of commitment to the development of salmon mariculture. Some nations have been more inclined than others to capitalise on this opportunity and this is reflected in how much production individual countries engage in, and how much of their capacity for production they exploit.

This argument may be countered with the view that countries with production near capacity have been in the mariculture business longer than those operating further from capacity. This would be consistent with the fact that Norway has the longest production history and the largest production (154,000 tons in 1991) (1). However the example of the United States, a country endowed with an immensely long and suitable coastline, where salmon farming has been practiced since the late 1970s, nearly as long as Norway,and yet only produced 9,538 tons in 1991 (1) shows that the issue is more complex. Indeed the discrepancy between the level of production between these countries is even greater that might appear from the tonnage figures. This is reflected in the fact that many Norwegian fish farming companies are international, with a large proportion of Chilean production owned and operated by Norwegian firms.

Why are some countries more committed to mariculture than others?

The sociological issues which must be faced by individual countries' administrations is of utmost importance in deciding how best to allocate scarce resources. A case can be made that the northern maritime nations of Europe which have experienced great success in the establishment of salmon mariculture recognized that salmon farming represented a viable opportunity to generate economic activity in isolated coastal areas where little other opportunity existed. Countries such as Norway, Scotland (UK), Faeroe (Denmark), and Ireland have provided and continue to provide great assistance to the development of salmon farming on their territories in the form of flexible legislation, active research, and

funding. Other nations that have actively encouraged the development of mariculture are Canada, Australia, and Chile.

Other nations have not provided the same level of assistance to the development of mariculture. Political pressure in these countries to invest in the future of isolated coastal regions is not so important, where the proportion of population inhabiting such areas may be negligible compared to that in the Northern European Maritimes. The cultural importance of preserving a viable economic base founded on maritime tradition may also be less in some countries than in the Northern European Maritimes.

Regardless of the underlying reasons for governmental commitment to salmon mariculture development, the basic tool of government, the law, is a much greater obstacle to salmon farming in some countries than in others. The political processes involved in adapting policy and redefining legislation vary from country to country. In some countries legislation has proved flexible and dynamic. In others, statutes incompatible with the development of new forms of coastal economic activity have presented insurmountable obstacles to those who would wish to develop mariculture industry.

Concluding Remarks

The development of salmonid or any form of mariculture for a nation is no small undertaking. It would appear that today, after twenty years of rapid growth during which time growth has not yet been limited by market forces, the benefits accruing to those nations that have met the challenge far outweigh the costs incurred. This trend seems set to continue. Therefore it is not unreasonable to infer that as the benefits gained by a country engaged in mariculture become more apparent, other countries will attempt to develop their own mariculture industry. This is already the case with South Korea, Russia, and Turkey all becoming involved in the salmon farming business, with visible interest and flexibility being shown by their governments.

However, some countries, such as the United States, where government has shown a high degree of unwillingness to facilitate the development of mariculture, as evidenced by the 1990 ban on all mariculture in Alaska, do not appear likely to be major players in mariculture in the foreseeable future.

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THE IMPACT OF LEGALIZED DOCKSIDE GAMING ON MISSISSIPPI COASTAL MANAGEMENT AGENCIES

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In 1991, legislation was enacted that permits dockside gaming in waters of the State of Mississippi south of the three coastal counties and along the Mississippi (Miss. Code Ann. Section 75-76-1 et seq.) There are currently eleven dockside casino boats operating in the state. Seven are located on the Gulf coast, two in Tunica County, and one each in Vicksburg and Natchez. It has been estimated that 20 boats will be in operation by the end of 1994. In the first eight months of 1993, gross gaming revenues topped $450 million and state officials estimate that tax proceeds for the fiscal year will be at least $70 million.

Hand-in-hand with optimistic forecasts of increasing tax revenues and employment has been a recognition that dockside gaming has the potential to adversely affect the environment and to strain existing infrastructure such as roads, airports, and sewerage systems. In an effort to mitigate these effects, state and local agencies have been required to devote an increasing large amount of their time and resources to address problems related to new casino development.

I propose to conduct a survey of state and local coastal management agencies to determine how dockside gaming is affecting their ability to carry out their ongoing regulatory responsibilities. Results from this proposed survey will assist Mississippi in its planning efforts for future casino development sites. It will also provide important information to other states that already either allow dockside gaming or are considering it for the future.

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ENVIRONMENTAL IMPACTS IN PARANÁ DELTA, ARGENTINA

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Introduction

Paraná delta is located in the tropical coast of Buenos Aires state, ending at the Rio de La Plata estuary in the northern margin of the largest city of Argentina (Figure 1). It represents a lobulate delta with a high rate of front progradation, of about 70 m per year (Iriondo and Scotta, 1979; Codignotto and Marcomini, 1993).

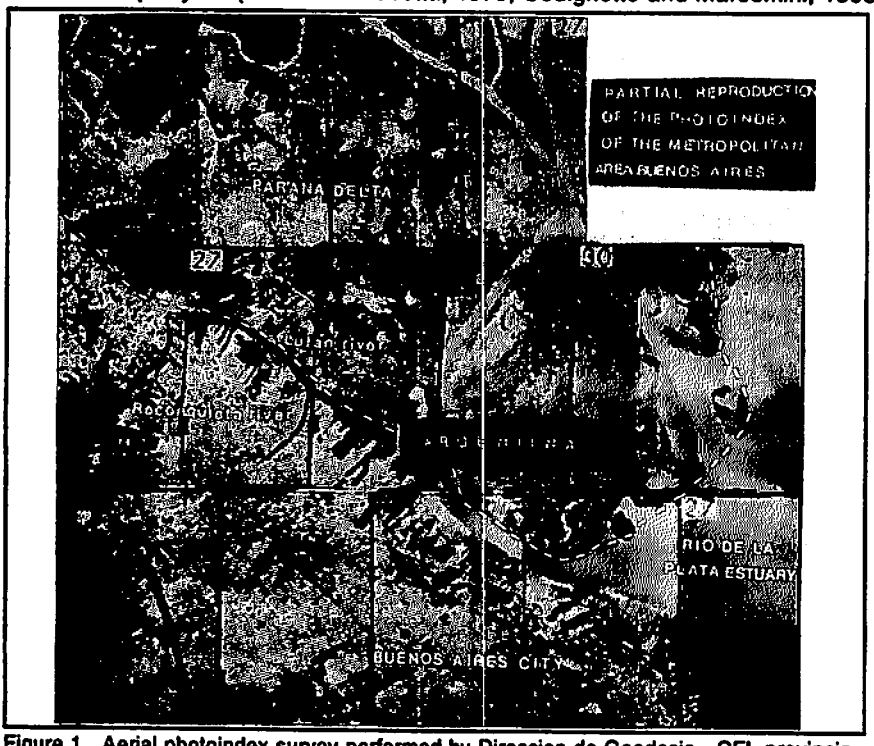

Figure 1. Aerial photoindex survey performed by Direccion de Geodesia - CFI, provincia de Buenos Aires, 1991.

Although it reflects an accretional environment with a constant progradation toward the Rio de La Plata estuary, serious erosional problems are affecting the human population of the delta. The delta complex is thickly populated. The chief occupations of the people relate to silviculture, fruticulture, and agriculture.

The delta is prone to natural hazards like riverine floods and wind-induced waves that increase estuarine water levels in the lower delta.

Uncontrol anthropogenic activities have generated environmental impacts such as pollution and erosion, which are drastically affecting the natural ecosystem.

Hydrodynamic Conditions

Parana delta ends at an estuary with dynamic conditions that affect the lower delta. Tides and winds continuously change estuarine and delta channel water levels. Tides are semidiurnal. Mean amplitudes are 0.64 m for spring tides and 0.46 m for neap tide. Variations in levels due to tide action range from 0.92 to 1.24 m.

Winds change channel levels depending on speeds and directions. Winds coming from south, southeast, and east provoke an increase in level if they blow out for a long time at speeds over 48 km/h north, northeast and southwest winds induced a decreasing on its level. South and southeast storms usually occurred between June and October, they raise the level up to 2.8 m during ordinary floods, and more than 2.8 during extraordinary floods (Figure 2).

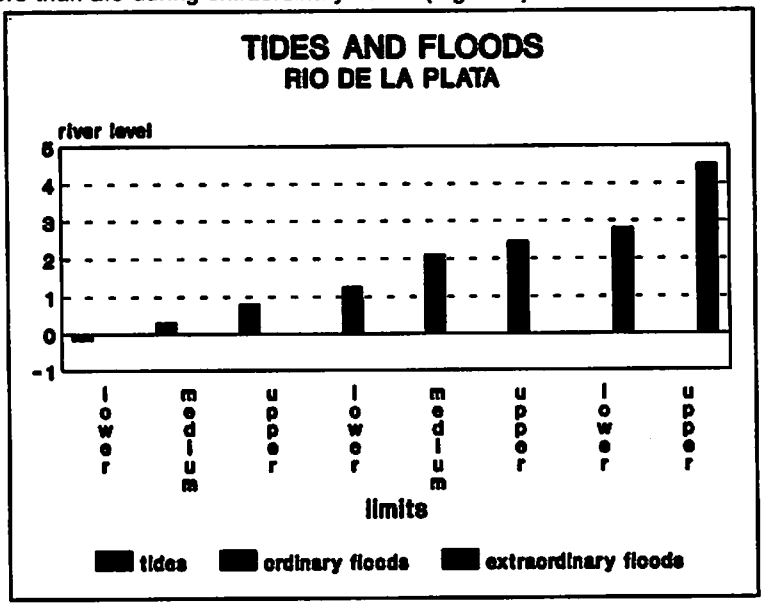

Figure 2.

Environmental Problems

The delta plain is a lowland with distributary pattern and sinuous channels of permanent regime. In their margins extended levee are developed. The approaching levee zones are swamps and marshes. The houses are constructed over the levee near the channels margins because they have higher high and are not covered during ordinary floods (Figure 3).

The erosional sectors are associated with the margins of natural and artificial channels, where are built most of the human assessments.
The three principal causes of erosion are described below.

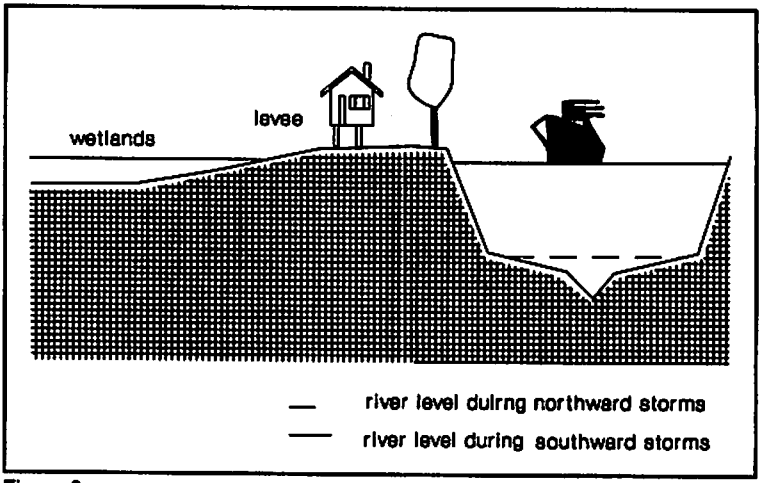

Figure 3.

First is dredging from the bottom of the channels for filling of coastal areas, navigation and construction of protection structures. It changes the transversal profile of the rivers and generates marginal erosion of the channels that destroys houses and human settlements.

Figure 4 shows three stages of river channelization: "A" represents the natural profile; "B" reflects the profile after dredging; and "C" is the recovery profile. The lateral channels move backward to reach the new equilibrium profile adapted to the new dredging depth.

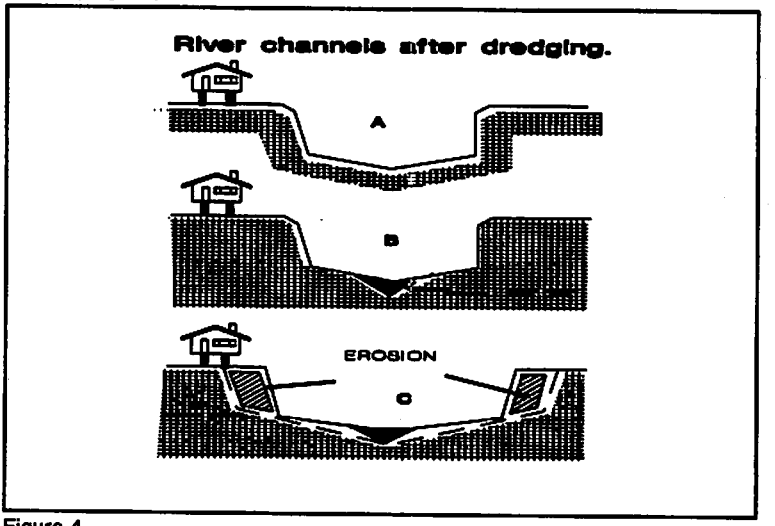

Figure 4.

Induced waves associated with small boat navigation, that regarding vessels operation induced erosion on the margins of the channels and increases in ambient turbidity. The boat traffic is high in the main channels, especially during week-ends. Vessel and passengers ships raised sediment particles from the bed by shear and lift forces, and generate resuspension of silt and clay of the bottom. Similar responses were described by (Garrad and Hey, 1987), in a Broadland river. The resuspension effect is higher during low river levels (northward winds), because the channels depth decreased. High divergent and tangential are propagated as the vessel passes. Usually, the fist of these vessels waves contains the greatest energy (Garrad and Hey, 1988). This kinds of waves, brake over the margins of the channels and erode the waterways banks.

The more practical solution would be reduce boat speeds to a level below that likely to reduce tangential wave height.

Vertical coastal protection structures: This kind of structure promote the reflection of the incoming waves, increasing the wave high and consequently increasing the erosion on the margins channels.

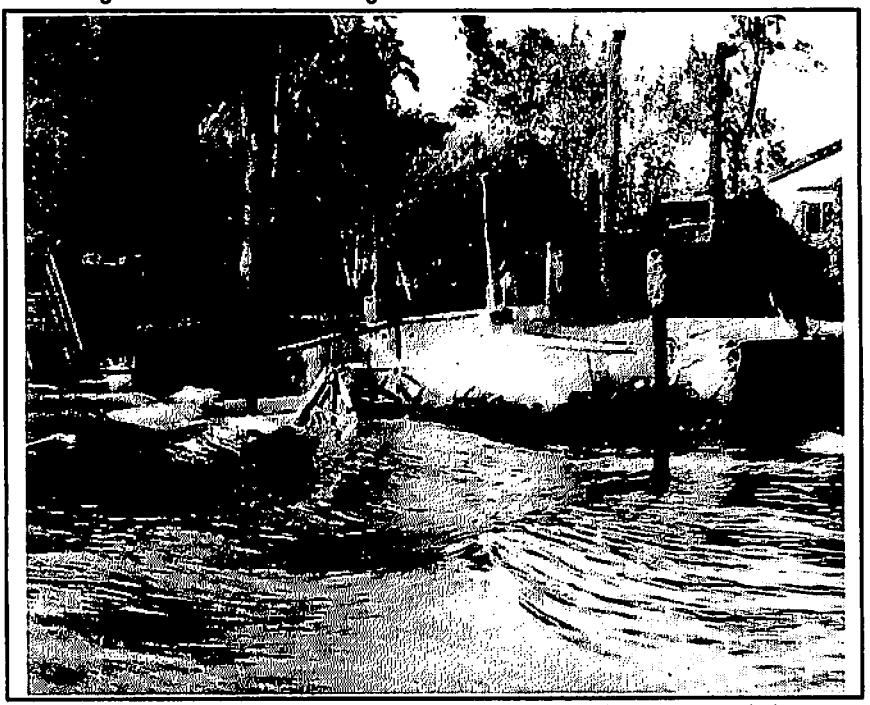

Figure 5. Erosive effect of tangential vessels waves on protection structures during a northward wind day

Water pollution is an important matter that must be taken into account. Great quantities of industrial residue are pulled into the principals rivers every day. Along the Parana river several industrial cities are emplaced and the residue

materials are spread over the lower delta. In Figure 1 it is observed a contaminant plume of the Reconquista river which collect the residue of the northern area of Buenos Aires city and are pulled into the southern delta. Several episodes of fisheries mortality are observed frequently. It must be considered seriously because the habitants of the islands use an aquifers which is fed by the river water.

The fast advance of the delta front over the rio de La Plata estuary, could generate international conflicts. Codignotto (1990), estimated that is reasonable to guess that in 50 years the delta will advance over the international limits.

Final Considerations

The Parana delta is a natural and scenic recourse, of ecological, economic and scientific value, and constitute the area of recreation of the Buenos Aires city. The sustainable development of the delta resources must be based on an integrated approach to management. A national policy environmental is very much needed in delta. It has become imperative to protect the environment, by establishing a program of continuous monitoring with strict control of contaminant and erosional agents.

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POLICY CHANGE AND THE REVIVAL OF TEXAS COASTAL MANAGEMENT

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Texas experienced a revival in coastal management between 1981, when the governor of Texas declined to submit the state's coastal management program plan to NOAA for review, and 1991, when the state legislature passed legislation to develop a plan once again. This revival of state coastal policy resulted from a variety of factors, including the demise in political influence of the oil and gas industry, the altered demographics of the coastal region, and the continuing impact of such chronic change processes as coastal erosion and wetlands loss. This paper will examine the evolution of Texas coastal management policy as a case study of policy change in which the roles of advocacy coalitions, policy entrepreneurs, and institutional learning are described and explored. In light of the sharply different strategies pursued by Texas to develop its former and current coastal management programs, the issues addressed should be useful to all states, coastal and noncoastal, that are subjected to a contentious policy environment.

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CASINO GAMBLING ON THE MISSISSIPPI COAST: LANDSCAPE CHANGE AND COASTAL MANAGEMENT ISSUES

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Synopsis

Since the first modern dockside casino opened in Biloxi in August 1992, a total of ten casinos have opened along the coast of Mississippi. This creation of a gambling destination in the Southeast, perhaps a natural modern outgrowth of a historic pattern, had led to a variety of problems of interest to coastal geographers and coastal managers. These include landscape changes, landuse zonation conflicts, and changes in urban (resort) morphology--all of which are important for urban planning and proper guidance of casino development. Biloxi, with six of the present ten coastal casinos, serves as an excellent setting for evaluating casino development and its impacts.

The Mississippi Gaming Control Act of 1990

In 1990, the Mississippi Gaming Control Act was passed. This act paved the way for legalized gambling as long as certain provisions were met: 1) no gambling was permitted on Mississippi soil but only on "vessels" which could be docked along a shoreline, and 2) these dockside sites were restricted to counties along the Mississippi River and along the coast of Mississippi Sound, provided a majority of county residents approved.

The 1990 Gaming Act specified that coastal gambling sites were restricted to "south of the three (3) most southern counties....", the intent being to augment beach tourism with beachfront casinos. Voters in Jackson County rejected dockside casino gambling, so only Hancock and Harrison Counties were affected. The shores of those two counties which faced south onto Mississippi sound contained mostly public artificial beaches (including the famous "longest man-made beach in the world" fronting Harrison County for 25 miles). As jurisdiction over Mississippi's "tidelands" fell under the office of the Secretary of State, that office advised limiting casino sites to non-sand beach portions of the shorefront. This severely restricted potential sites to existing ports and harbors and a few areas where (often illegal) nearshore reclamation activity had occurred in the past. More liberal interpretations of 1990 Gaming Act included bay areas of the coastal counties (e.g. St. Louis Bay, Back Bay of Biloxi) and--in the opinions of some--navigable tributaries thereof so long as tidal influence existed.

Casino Development and Its Impacts

Mississippi's first casino opened in August 1992 (Biloxi's Isle of Capri), and as of early February 1994, a total of twenty casinos have opened and applications for about 50 more are on file. Ten of these are along the Mississippi River (five near Tunica, a 35-mile drive from Memphis), and ten are along the coast. Eight of

the ten coastal casinos are in Harrison County, and six of those eight are within the city limits of Biloxi (Figure 1). With at least five more casinos scheduled to open in Biloxi in 1994 (not including two across Back Bay in D'Iberville), Biloxi and Tunica are already sharing the distinction of being the two major casino gambling centers in the state (Figure 2).

The impacts of casino gambling have been tremendous. In addition to the economic impacts, the change in landscape is the most visible of the various impacts as casinos are being developed in both empty lands (such as the soybean farms of Tunica County) and also occupied lands (as along the built up coastal region). Probably nowhere has casino development had more impacts than in Harrison County, especially in Biloxi, where 30% of the state's casinos are located. In Biloxi, casino-related development is encroaching upon and displacing seafood canning businesses and also residential neighborhoods. Several of the "floating" casinos are built on barges and may not be able to be easily evacuated during hurricane events. The implications for landuse planning and coastal management are tremendous.

This research, which builds upon previous work along the Mississippi coast (Meyer-Arendt 1992a, 1992b, 1993) examines the following aspects of landscape modification in Biloxi: 1) overall changes in landscape appearance as casino infrastructure replaces older artifacts of the built environment, 2) landuse conflicts as recreational zones encroach upon residential and industrial zones, 3) changes in urban morphology, especially in regard to the recreational business district (RBD), which is fragmenting into several zones including a "Casino Row" strip five miles east of the existing RBD, and 4) implications of landuse changes for urban planning and coastal management in Biloxi.

1. Landscape Change

The introduction of casinos has led to many changes in the landscape of Biloxi since 1992, a trend that will surely continue into the near future. Casino sites are restricted to certain "commercial" and "waterfront" landuse zones, in which there has existed relatively vacant land or a built environment that has been degrading over the years. Although landscape change associated with an economic boom stimulated by casino gambling may well affect many sectors of the city of Biloxi, the most visible impacts are (obviously) in the vicinity of the specific sites of casino development. The three most important sites to date--"Casino Row", the Biloxi Waterfront, and West Beach--all occupy the Biloxi shorefront.

The most important of these changes has been in the region increasingly called "Casino Row" once known as "front beach of Point Cadet". Point Cadet has been the core area of Biloxi's seafood industry for over a century, and "front beach" has come to consist of over 60 acres of oyster shells deposited in the nearshore waters of Biloxi Bay (Meyer-Arendt et al. 1994). Except for some public facilities at the far eastern end, seafood canning factories and ice houses occupied most of this reclaimed land. Over the decades, however, the seafood industry has declined and many of the near-derelict structures became abandoned or converted to other uses

(including nightclubs). After the legalization of gambling, the combination of large, non-sand-beach properties coupled with boat docking facilities proved attractive to casino developers. By early 1994, four casinos had opened, one more was under construction, and plans existed for a possible sixth. In addition to actual "floating" gambling establishments--which range from pseudo-steamboats to the 250,000-sq.-ft. barge-mounted Grand Casino ("largest floating casino in the world"), the casino developers have built (or are building) parking facilities and, in some cases, hotels. One hotel will be, at thirteen stories, the highest structure in Biloxi, and even the parking garages are high-rise. The Grand Casino has built its parking garage north of U.S. Highway 90 (Beach Blvd.), connected to the casino complex by a wide overpass. The potential for coastal landscape change at Casino Row is great.

A second major site of landscape change is along the Biloxi waterfront, a region that includes the traditional commercial harbor area for Biloxi and a mixed-commercial area built on reclaimed land extending westward to the terminus of Interstate-110. One casino--the Biloxi Belle--has bought up the leases to several businesses and created an extensive casino complex. A second casino--Gold Coast--has plans for building closer to the harbor area, between an office building and a condominium. Although zoning laws allow casino development, there is some local opposition, especially to the 90-foot-high glittery sign the casino wants to erect on the side of Beach Blvd.

The third major site of significant changes in landscape is along West Beach, the traditional tourist strip formerly west of the former city limits. Although zoned "waterfront", most of the strip is fronted by sand beach, thus precluding easy gaining of casino site permits. Two sites of non-sand beach exist, and at one--the Broadwater Marina--a casino has been brought in. Similar casino/convention complexes are planned for the second (and nearby) site, but lease disputes have delayed construction of the Treasure Bay and Lone Star Casinos. In general, however, there has been an "intensification" as well as modernization of the West Beach recreational landscape. Chain restaurant franchises are replacing mom-and-pop hamburger shops and souvenir stores.

Plans also exist for casino construction along Point Cadet and the Back Bay of Biloxi shoreline east of the I-110 bridge. The Palace Casino, nearing completion at the foot of Howard Ave., had plans for incorporating the old Hwy. 90 bridge--now used as a fishing pier--into its complex. Although this was rejected, the potential of landscape change in areas traditionally oriented towards shrimping, dry-docking, and ship-building--but never tourism--remains.

2. Landuse Conflicts

A second major area of research entails the implications of landuse conflicts. First, the establishment of casinos in multi-purpose landuse categories (notably the "waterfront" designations) has led to changes in types of businesses. Second, low-density, low-volume-of-traffic-flow types of businesses are being replaced by casino complexes which are large, employ thousands of people, and

attract hundreds of thousands of people. Increased traffic and demand for parking spaces has spilled over into residential and limited commercial landuse zones, and some residents are not anxiously awaiting corollary increases in certain categories of crime. At Casino Row, St. Michael's Catholic Church has leased out parking spaces to the Casino Magic across the street. As the spillover of employees and casino customers threatens to disrupt the serenity of historic ethnic neighborhoods (such as the multicultural residential enclaves that housed the seafood industry workers), there will be increasing requests to rezone. The city of Biloxi, through its planning department and architectural review board, may well successfully restrict the gambling infrastructure. But since the city has already designated all of the "waterfront" zoning categories as potential casino sites, the demand for increased commercial and high-density residential land surely will rise as (and if) casinos move into the Back Bay region.

3. Resort Morphology

A third research theme entails the "fitting" of Biloxi's casino development into existing models of resort morphology. In a typical seaside city, tourism development takes place along the waterfront closest to the central business district (CBD) and then gradually expands laterally along the waterfront if tourist demand is sustained (Meyer-Arendt 1990). In Biloxi, the waterfront did develop as the earliest nucleus of tourism, and one antebellum hotel has been preserved as a museum. In the 1920s, three hotels were built at both shorefront flanks of the CBD, and landuse conflicts arose at that time. With the World War II building of Keesler Air Force Base and a postwar boom in tourism (stimulated in large part by construction of the 25-mile-long artificial sand beach in 1951), tourism and entertainment facilities became located along West Beach because of more liberal zoning policies outside the city limits. This strip of beachfront quickly became the core area of Biloxi's RBD. Until casino gambling, most visitors to Biloxi came to the RBD strip. Now that Casino Row is evolving to the east of Biloxi, quite distant from the RBD, the big question is: how much of a "secondary RBD" will develop at Casino Row. Will recreational facilities be "all-inclusive", i.e. will tourists stay within the casino complexes? Or will tourists spill out looking for other attractions in Biloxi? Probably West Beach will not decline as an RBD, especially with three operating casinos in the near future. But, will multiple RBDs develop at the other sites of casino development, including Back Bay?

4. Implications for Urban Planning and Coastal Management

Casino gambling has stimulated a rejuvenation of the tourist industry along the Mississippi coast, but uncontrolled growth and irresponsible planning could both disrupt neighborhoods and lifestyles and also lower the overall economic benefits of casino revenues. Architectural disruptions in a region that boasts of an antebellum resort landscape could easily degrade the cultural landscape. Landuse plans should encourage discrete landuse zones and function to minimize "casino spillover" and preserve pre-existing landuse patterns. Models of resort morphology offer insights into landuse patterns at other seaside resorts, and communities such as Biloxi, Gulfport, and Bay St. Louis would benefit from them. Related coastal management

issues, such as hurricane evacuation plans, need to be reevaluated in view of the increasing number of casinos and vehicles. The degradation of the sand beach has been a problem in the past, and recent efforts at improving the beach should not be negated by casino development. In addition to proper guidance of casino development, the monitoring of casino impacts is important. One tool which is proving useful in that regard is Geographical Information Systems (GIS) technology (Abusalih 1994). Biloxi planners are regularly updating their GIS "layers" of traffic flows, real estate values, and other aspects of community development impacted by the proliferation of casinos. Laissez-faire planning, prevalent along the Mississippi coast in days gone by, will not ensure sustainable levels of qualtiy-of-life nor of tourism very far into the future.

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DISPATCH FROM THE FRONT: A HUGO LESSON

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Abstract

These findings and recommendations are from a research project on the experiences of residents of Sullivan's Island during and after Hurricane Hugo, which stuck the South Carolina coast near midnight on September 21, 1989. The community of some 437 families and 1,603 people, located on a barrier island immediately north of Charleston harbor, was crossed by the hurricane's eye, battered by winds in excess of 125 miles an hour, and submerged by a 15-foot tidal surge. None of the 923 buildings on the island escaped damage and more than 60 were totally destroyed. Normative and some narrative data were obtained from a 12-page questionnaire mailed to Sullivan's Island residents in June, 1990, and narrative data from follow-up structured interviews with residents and public officials.

Municipal Preparations

Sullivan's Island's elected officials and municipal employees in 1989 could fairly be described as well informed and, in view of past hurricane experiences along the Carolina coast, prepared. The mayor and police and fire chiefs all had experienced hurricanes. The township had a disaster plan and it had been reviewed in early September, 1989, well before Hurricane Hugo formed. Pre-disaster emergency routines were activated in the Lowcountry counties several days before the hurricane struck. Representatives from all municipalities had met at the Charleston County Disaster Center on September 21st, the day the hurricane hit, to review disaster preparations. On Sullivan's Island that morning, the fire chief, the town's three paid firemen, and members of the Sullivan's Island volunteer fire and rescue team began implementing contingency plans. The entire police force, the chief and four officers, stayed busy seeing that everyone evacuated. A disaster command post was established in a private residence built inside and atop a former coast defense structure, a one-time ammunition bunker, constructed of steel-reinforced concrete, with a floor 17 feet above sea level.

The Emergency

Based on past experiences, the plan to have municipal employees and their equipment ready moment the hurricane had passed was sound. But the command post on Sullivan's Island had to be abandoned abruptly during the night of September 21-22 in the face of reports that a 21-foot storm surge was bearing down on the coast. Just as people made it off the island, the Ben Sawyer drawbridge broke loose into the water, severing the road connection to the mainland. When officials got to the island by boat the next day, what they saw appalled them. Debris was everywhere. Houses blown off their foundations blocked roads. There were so many nails and so much glass on the streets that the few vehicles that survived the tidal surge were quickly disabled by flat tires. Communications were difficult.

Practically no emergency assistance was immediately available from County, State, or Federal sources. In an informal meeting on the island with his police and fire chiefs, town attorney, and other officials, the mayor decided that conditions on the island were too dangerous, and barred residents from returning to the island by boat.

Prevented from coming back to their homes by boat to see the damage to their property and get things they needed, and learning there were no immediate plans to assist them, many island residents reacted angrily. At two town meetings held in neighboring Mt. Pleasant residents eventually succeeded in establishing ad hoc citizens groups to organize and run the boat lifts that would be the transportation system to the island until the bridge was temporarily repaired, two weeks after the storm. But people generally were unable to take emergency actions to prevent further damage to their homes and property.

Stress

A major natural disaster is a very sharp blow to individual well being. Hurricane Hugo was no exception. Sullivan's Islanders rated Hurricane Hugo as more stressful than life events such as the loss of one's job or the death of a friend where great stress effects have been observed previously. Those who had major household disruptions in particular viewed the impact of the hurricane as more stressful than other life events, irrespective of the dollar amount of damage or loss they experienced. For those who perceived an increase in stress, important factors were the amount of physical damage to property, the need to miss work to take care of family and property, marital status, dual career membership, and experience with insurance companies. One of the most important changes that people noted was an enhanced level of apprehension at the beginning of a new hurricane season.

Insurance

Hurricane Hugo confronted insurance companies with the greatest property loss from any natural disaster in American history to that time. Company routines, geared to dealing only with moderate-sized disasters, had to be mobilized to deal with the unexpected. In what a state chief insurance commissioner called "the insurance industry's finest hour," companies sent some 3,600 claims adjusters into damaged areas to deal with some 340,000 claims. On Sullivan's Island, as elsewhere, three sets of interests met at ground zero: The insurance companies desired to meet, but not exceed, their financial obligations to pay the losses covered in the policies they had issued. Companies also desired to live up to, and hopefully exceed, their carefully cultivated and continuously advertised reputations for taking care of policyholders. Claims adjusters had to apply their best judgments in balancing these sometimes conflicting interests. Policyholders came to the post-storm meetings with insurance adjusters under stress and with a perspective that was often personal and emotional. Theirs was the sudden realization that of all the service sector purchases one makes, few can be as important as the insurance bought to guard against the unexpected tragedy.

Dealing with insurance companies proved difficult for many and an important stressor. Nine of every ten islanders had wind or homeowners insurance coverage and nearly two-thirds carried flood insurance on buildings before the storm, but fewer than half the people had their personal property insured against flood damage. Though three claims out of every four were settled within four months after the storm, only half the people said they were satisfied or extremely satisfied with their settlements. A majority of policyholders experienced at least some problems with the insurance companies, and nearly one policyholder in six had a bad insurance experience. In general, people with higher levels of damage and loss and greater uninsured losses were confronted by more problems, had to battle harder to obtain settlements, and reported more dissatisfaction. One-third of all policyholders changed companies after the hurricane, compelling evidence that questions of insurance coverage and difficulty in obtaining settlements were major post-disaster problems. For them, the insurance experience after Hurricane Hugo did not represent the industry's finest hour.

Emergency Decrees

Mainland residents who stayed through the hurricane or took shelter in nearby communities were able to get back to their homes, camp out, and take advantage of the intervals between hard rains to make makeshift repairs to protect their homes against further damage. At worst, they were home. Barred from returning immediately to Sullivan's Island by emergency decrees, mistakenly but commonly referred to as "martial law," many island residents did not know for days whether or not their homes still stood. Others watched in frustration as hard rains further damaged their property. The immediate resentment at the decision to bar residents deepened in the long months of recovery and rebuilding that followed the storm. According to survey data, slightly more half the people felt that bringing in the national guard was necessary; a third did not. More than half the people said that the use of the guard to keep residents off the island interfered with their rights to return and examine property damage. Nine months after the storm, slightly over half were still frustrated by the fact they had been prohibited from returning after the storm. Many were quite angry, with just under half reporting some measure of resentment about not having voice in decisions impacting their lives. These and other responses reveal a population polarized about the declaration of martial law and the presence of the military on the islands after the hurricane.

Recommendations

The following recommendations are based on the Sullivan's Island experience.

1. Make Pre-Disaster Warnings More Explicit. Governments must continue to remind people that the coastal flood plain is a hazard area. Programs to encourage early evacuation in case of an emergency can be supplemented with plans to place permanent markers on buildings and at prominent points in low-lying areas and along evacuation routes. For example, a highway sign could read: "This road would be xx feet under water in a Category 4 or 5 hurricane striking the coast

at high tide. The practice of visually reminding people they live on a flood plain was introduced successfully in the 1950s in the Tennessee Valley Authority Community Flood Damage Mitigation Assistance Program.

2. Harness Public Energy Instead of Treating People as Victims. Post-disaster stress is also post-disaster energy. Depending on individuals and circumstances, stress has both positive and negative effects. The readily measurable increase in stress after a natural disaster will affect a large proportion of the population. Based on this study of Sullivan's Island residents, most evacuees and others were victims only to the extent that they experienced a major problem. As a group, they were not frightened, not incapacitated, and certainly not helpless. They were energized, concerned about their property and possessions, and intended intend to take care of their own affairs. They required assistance, resisted restrictions. Pre-disaster planning offers an opportunity to identify local residents with useful expertise or skills and devise ways to mobilize volunteers to assist government in advance of a disaster.

3. Make Informing the Public the First Item in a Disaster Plan. Public business gets overloaded rapidly in natural disasters. Decisions made under emergency conditions, like the "martial law" decisions on the barrier islands, can divide government from citizens. Clear channels of two-way communication are a necessity because disaster victims and evacuees need information and emergency assistance quickly but they don't intend to have their lives controlled. More sophisticated ways for obtaining accurate information rapidly and disseminating it to people are required to deal with the high level of public energy that exists after a disaster. The 1990 Sullivan's Island Disaster Plan correctly focuses on mechanisms for acquiring this information and maintaining communication channels between government and people. There is more to this aspect of post-disaster planning than just reducing friction. The post disaster experience of victims and, possibly, the vicarious experience of television viewers, may affect how people respond in the future. Volunteered one Sullivan's Island resident angry about being kept off the island after the storm, "I will never evacuate again, but I will have ammunition." The hard edged statement reflects an intensity typical of many residents. After Hurricanes Hugo and Andrew, we can expect people to hurry to get out of the path of Category 4 and 5 storms. There may be some danger, however, that a few coastal residents might be tempted to try to ride out storms predicted to be less intensive or to strike a short distance away.

4. Emphasize Appropriate Insurance Coverage in Disaster Planning. No lives were lost on the barrier islands during Hurricane Hugo because people heeded advance warnings and cleared the coast. Because the federal government invests time and money to track storms and predict where they might strike and because state and local governments invest in plans to warn and evacuate populations, we do not experience the great losses of life that hurricanes earlier in the century cost. A similar government effort and planning can mitigate property loss, speed recovery, and hold down reconstruction and recovery costs. People with higher levels of uninsured loss or who experienced problems with insurance companies revealed greater stress and higher levels of dissatisfaction with post-storm government

operations. Post Hugo experiences on Sullivan's Island revealed individual problems in the areas of inadequate insurance coverage, inappropriate insurance coverage, and inadequate preparations to document losses. Governments at all levels have a vested interest in informing the public about insurance because dealing with an economically crippled population complicates post disaster recovery efforts.

5. Strengthen Construction Codes for Hazard Zones and Enforce the Codes. The best time to lower hurricane damage is well before the storm hits. Insurance companies, taxpayers, and potential hurricane victims have a common interest in moderating future costs. In a hurricane there is immediate destruction and damage from wind, water damage from surges and tidal flooding, water damage to standing structures and contents after roof coverings and vents are blown away, and further damage from post-storm rains that may continue for some time. Coupling incentives for state and local governments to promote stronger construction to the percentage of the disaster cost the federal government will bear can lower damages in all three areas. One model is the National Flood Insurance Program, which leaves responsibility for managing flood plain development at the local level but requires communities to comply with federal construction and development standards to be eligible for participation. In a federal hurricane disaster program, a federally supported mapping program would identify potential hurricane disaster areas. As a condition for a designated percentage federal participation in emergency disaster recovery costs, state and local governments in the zones would be required to enact building codes to federal standards to minimize wind and flood damage, and also to maintain the necessary strict inspection systems to insure that builders complied. As in the flood insurance program, structures now standing in the hurricane hazard zones could be grandfathered in, but not their replacements.

6. Broaden Municipal Pre-Disaster Planning. Pre-disaster warnings should be more explicit and targeted to individuals, not mass marketed. Disaster preparation drills should occur more frequently and incorporate worst-case scenarios. Planners could borrow such usable concepts from peacetime military planning as the war game, the staff ride, and command improvositation; i.e., disaster planning that does more than just inventory equipment and test communications.

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ST. LAWRENCE RIVER: PUBLIC OR PRIVATE

Daniel J. Palm, St. Lawrence-Eastern Ontario Commission

Introduction

This presentation will detail how a major coastal land use conflict was resolved. It will focus on the process, not the particulars of the specific conflict, with the intent of setting forth a series of lessons learned. These hopefully are applicable to resolving other such conflicts. It is necessary that a brief discussion of the specific conflict be provided as background prior to discussing the process and lessons learned.

Background

In the early 1950's, the New York Power Authority purchased about 25,000 acres along 37 miles of shoreline on the St. Lawrence River. Similar action on the Canadian side occurred in order to construct the Moses-Saunders Power Dam and portions of the St. Lawrence Seaway. Little of the promised economic prosperity occurred locally as a result of the project leaving the local population resentful of the "taking" of their land. The fact that land that wasn't flooded, about 12,000 acres, was removed from the tax rolls has also been a major issue.

In an effort to address this issue, the New York Power Authority unilaterally declared 5,100 acres of this land "surplus to the needs of the project" and offered to sell it for private development.

Conflict

As one might expect, the selling of 5,100 acres of public shoreline property for private development ran contrary to several Federal and State public policies. Thus, the agencies responsible for enforcing these policies were placed in the unenviable position of having to object to the New York Power Authority proposal. The basic issue being should the shoreline be held in public or private ownership.

Process

Realizing that Federal Energy Regulatory Commission (FERC) approval was required to divest of any surplus lands, and that FERC was considerably influenced by agency positions, NYPA formed a task force of the involved State agencies -- Department of Environmental Conservation, Office of Parks, Recreation and Historic Preservation, Department of State, and the St. Lawrence-Eastern Ontario Commission. The county planning office was also asked to participate to provide insight into local views. All agencies involved agreed to serve given New York Power Authority acceptance of certain conditions. The Task Force's charge was to prepare a land use plan for the 37-mile corridor.

The following steps were included in preparing this comprehensive land use plan:

1) Development of objectives for resource protection, corridor planning, development and tax policy.

2) Resource inventory.

3) Determination of constraints to development.

4) Application of constraints and resulting proposed land uses.

5) Development of recreationway.

6) Delineation of national estuarine research reserve.

7) Identification of implementation techniques.

8) Environmental review process.

9) Public involvement.

The comprehensive planning process followed was fairly standard and incorporated the requirements for relicensing of hydropower facilities.

Within the task force there were varying views regarding public involvement. The timing of the creation of a Citizen's Advisory Committee (CAC) was a particular issue. A CAC was finally created late in the process. It was given the charge of reviewing the draft plan and helping prepare the recreation plan.

Outcomes

The four-year process resulted in a land use and recreation plan for the area agreed upon by all agencies involved, as well as three of the four towns and most other interest groups. Of primary importance is the fact that state coastal policies were upheld. This resulted in a 37-mile recreationway funded with $1.7M for capital improvements and $230,000 per year for maintenance; request for designation of a 5,900-acre National Estuarine Research Reserve; continued protection for 3,000 acres of wetland; recognition of the scenic quality of the shoreline and standards for its protection; and, protection of other significant habitats. On the other hand, 900 acres were identified as suitable for development by the private sector under standards that ensure resource values will be maintained. These acres will be turned over to the towns for sale following the completion of all reviews and approvals.

This plan has entered the State Environmental Quality Review (SEQRA) process and will, upon completion, be forwarded to the Federal Energy Regulatory Commission for approval. For the task force, the planning and review process has

begun to end. However, implementation has just started. It is here that the results of four years of conflict resolution will be tested.

Lessons Learned

Although there were many "lessons" resulting from this effort, I will enumerate only a few that I believe are applicable to similar efforts in other areas:

1) At the onset, step back from the issue(s), take time to construct a "vision", put it in writing and then pursue it -- don't compromise this vision for the simple sake of reaching agreement.

2) As the varying interests address the issues, agree that it is okay to disagree and provide a mechanism for dealing with such disagreement.

3) Ensure close coordination of strategy between task force members prior to making public pronouncements.

4) Keep legislators at appropriate levels of government informed. Let them know the issues and the varying interest groups positions. Ensure they are familiar with the vision.

5) Be consistent in your decisions. Base them to the greatest extent possible on objective decision making criteria.

6) Deal with your opponents in an effort to resolve conflicts while you cultivate supporters.

7) Provide for citizen input early in the process.

8) Bring the process to an end. At some point, look your opponent in the eye and say - Unless something significant occurs, discussion is over. You do what you have to do and I'll do what I have to do to achieve our desired outcome.

9) Most important, but actually the hardest, keep the interactions non personal by respecting all involved parties. Each has the right to have their own positions; to use different tactics; and, to respond to influences you may not understand.

Postscript

Although the review process has not ended, I believe the plan, as drafted, will withstand the test of these reviews. Looking back on the past four years, I will agree that the process could have been shortened, less controversial, more efficient, or certainly resulted in a different plan. However, given the intensity of disagreement, unwillingness by some parties to consider compromise, and the significance of the issues, I believe a coalition of support was developed for a plan

that is reasonable and reflective of most local, state and federal interests. As a Task Force member who represents a Commission that had a vision for the area; spearheaded several of the most controversial parts of the plan, and thus was the lightning rod for opposition, I believe New York's St. Lawrence River coastal area will be provided improved long term management as a result of these efforts. The resulting public-private mix of ownership and accompanying uses responds fully to the goals of the federal and state coastal management programs. Hopefully, the lessons learned set forth above can be used by you, with less pain, to achieve similar results in other areas of the coast.

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CREATING MORE PROBLEMS THAN IT SOLVES: URBAN SOURCES IN THE 6217 PROGRAM

Sam Passmore, South Carolina Coastal Conservation League

Too often, environmental regulations that seek to control a specific form of pollution through technological means create as many problems as they solve. We all know, for instance, of situations in which an industrial discharger has shifted its waste stream to one media (e.g., air) to meet discharge limitations for another (e.g., water). Environmental regulations of this type fail because they do not take into account the pattern of problems in which a single pollution source is embedded. This certainly seems to be the case with the Urban Sources element of the 6217 Program. The Program's emphasis on structural Best Management Practices (BMPs) at the site level may very well do more harm than good.

The EPA document, "Guidance Specifying Management Measures for Sources on Nonpoint Pollution in Coastal Waters" (hereafter, the Blue Book), discusses in great detail three separate management measures for solving the problem of urban runoff:

1) New development management measures.

2) Watershed protection management measures.

3) Site development management measures.

Of the three, only the first establishes a quantifiable performance standard -- 80% reduction of the average annual total suspended solids (TSS) loadings off of a newly developed site. The Blue Book suggests that states consider a wide range of BMPs, like detention ponds and constructed wetlands, to achieve this 80% removal rate.

Because this is the only specific goal for urban runoff sources, most of the coastal states are likely to adopt 6217 programs that are exclusively oriented around achieving the 80% removal rate at the site level. This is the case in South Carolina, since the Stormwater Management and Sediment Reduction Act (which the state hopes will satisfy the urban runoff requirements of the federal program) is geared toward achieving precisely the same goal.

This single-minded focus on the use of BMPs at the site level would be a serious mistake. Relying solely on BMPs to protect water quality will be expensive and may ultimately fail for one simple reason -- BMPs are "end of pipe" solutions. Just as with any other type of pollution, the best place to reduce nonpoint source pollution is at the beginning of the process so there will be less to treat at the end. Researchers in Maryland, for instance, found that five years after that state enacted an aggressive program of stormwater BMPs, pollution in the Chesapeake Bay actually increased because of "poorly planned, low density growth."

Implemented in isolation of other approaches, the 80% rule will actually have the perverse effect of encouraging low density residential sprawl. If the size of your universe is a house site, the best way to limit nonpoint source pollution leaving the site is to put the house in the middle of a very large lot.

But large lot zoning creates as many problems as it solves. Large lot subdivisions convert vast expanses of natural vegetation into the ubiquitous suburban lawn, leading to an increased use of lawn chemicals. In addition, families who live in large lot subdivisions are entirely dependent on their cars for all the trips they make. This dependence on the car contributes to road runoff, air pollution, and airborne deposition of pollutants in our waterways.

Large lot subdivisions also have profound fiscal, economic and social consequences. Because the distances between homes are great, the cost of providing many services (sewer, water, police, fire) increases unnecessarily, which drives up taxes. Prime farmland and timber land is needlessly converted to suburban uses, which reduces the size of the rural economy. And large lot subdivisions have the effect of segregating society along economic lines.

To the extent that the 80% rule encourages large lot subdivisions, it is a classic example of how a technology based, media specific regulatory program fails to see the forest for the trees.

This is where the second and third management measures recommended by EPA -- Watershed Management and Site Development -- should, but probably will not, enter the picture.

The watershed management approach utilizes land use and infrastructure planning (i.e., water, sewer, roads) to direct new development, at reasonably high densities, into areas that are least susceptible to erosion and sediment loss. Similarly, new development is limited in areas that are erosion prone or provide important water quality benefits.

Like watershed management, the site development approach is concerned with the appropriate location of different land uses, but at the site level. Using site design techniques like clustering and vegetative buffers, the amount of total impervious surface is kept down while sensitive areas are protected.

The benefits of using these two measures in tandem are immense. An EPA funded study of the Chesapeake Bay basin found that land use controls were as effective as BMPs in controlling nonpoint source pollution. More importantly, only land use controls and BMPs in combination would maintain future nonpoint source loadings at 1980 levels.

These two approaches are also extremely cost- effective. Using site development techniques, the Woodlands New Community, a town north of Houston, saved $14 million by making use of the natural drainage system rather than taking the conventional BMP approach.

Even within its discussion of the 80% rule, the EPA urges states to cut costs by using watershed management and site development approaches.

Sound watershed management requires that both structural and nonstructural measures be employed to mitigate the adverse impacts of storm water. Nonstructural Management Measures II.B and II.C [Watershed Management Measures and Site Development Measures] can be effectively used in conjunction with Management Measure II.A [80% rule] to reduce both the short and long- term costs of meeting the treatment goals of this management Measure.

The South Carolina Coastal Conservation League (SCCCL) concurs with this EPA guidance, and believes that the federal agencies should be more aggressive in promoting it.

Watershed Management and Site Development Management Measures should be an integral component of every state's 6217 program to control urban runoff. Ideally, these "non-structural" measures should be the backbone of the program, with BMPs serving as a secondary measure in particularly sensitive areas. As it is, the Program is likely to be implemented in precisely the reverse order.

In South Carolina, the Stormwater Management and Sediment Reduction Act allows local governments to implement the Act on a watershed basis. Final regulations promulgated under the Act note that "the comprehensive approach to implementing the program on the watershed basis will allow for planned, orderly development in a watershed." But the state does not provide any inducements to local governments to select this approach, and there are no circumstances under which the state requires this approach. While implementation of the Act is still in the early stages, it appears that no local government is likely to adopt the watershed management approach.

Given that the watershed management and site development approaches are critical to a truly effective and fiscally responsible 6217 program, SCCCL believes that South Carolina should seek ways to activate the watershed management provisions that lie dormant within the Stormwater Management and Sediment Reduction Act. In particular, the state should develop incentives for local governments to take this approach. Equally important, the state should require these "non-structural" approaches in areas where available evidence indicates that BMPs alone have not, or will not, adequately control nonpoint source pollution.

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RESTORATION PLANNING: PITFALLS AND PEAKS

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The New Bedford Harbor area was impacted by polychlorinated biphenyls (PCB) discharged from two electronic manufacturing plants from the 1940s through 1978. The site was designated a Superfund site in 1986 and after years of litigation, an out-of-court settlement included recovered money for injured natural resources.

Restoration planning began several years ago. primarily at the request of legal counsel, involving state and federal agencies, but not the public because of the on-going litigation. Furthermore, the early discussions did not have the benefit of knowing the proposed target clean-up levels in the sediments which, in turn, impact the water column and tissue residue concentrations. In this context, restoration planning becomes more difficult because of the many resources which are impacted and will remain so, unless clean-up of sediment PCB reaches ambient concentrations. The target clean-up levels are higher throughout the site.

The process for involving the public, reaching consensus, and developing a plan is challenging to all participants. The steps in the process involve identifying the key players, defining the bounds on the lost resources in specific terms, adopting a consensus building process, drafting a plan based on that input, and implementing the plan. These steps are discussed in the context of what is successful in leading towards the acceptance of a New Bedford Restoration plan and what has inhibited moving forward its development in a timely fashion.

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THE ROLE OF GENDER IN INTEGRATED COASTAL MANAGEMENT FOR DEVELOPING COUNTRIES: THE CASE OF BARBADOS

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Introduction

Coastal management as a concept is growing in importance as nations at all levels of development recognize the value the coast represents in a nation's economic development. Sustainability is now considered a critical component of coastal management planning in most nations. Rich resources of the coast (including space) are limited and must be allocated to meet the needs of individuals in the present as well as across generations. For developing countries in particular, the issue may be more pressing when development of the coast means economic survival. The objective of this study is to integrate the role of gender with coastal management and demonstrate the importance of the connection. The significance of gender analysis to coastal management can be best demonstrated by focusing on a sustainable development perspective.

The role of gender has been extensively researched in terms of sustainable development and natural resource use in many sectors of environmental policy. It has been narrowly examined, however, in the marine sector. Barbados has been chosen to demonstrate the connection between gender and coastal management because of its social and geographical context. Two factors were important in the determination of location for this case study:

1) A nation with a strong coastal orientation.

2) A nation with readily accessible information about gender issues.

An empirical study was not conducted to confirm conclusions made about coastal management in Barbados. Therefore, this study represents a framework for analysis, the principles of which should be addressed through further studies.

A gender analysis may be approached through the planning process by including women and men at all phases or by analyzing the target society in terms of the differentiation of labor by gender and other important social indicators. Gender analysis reveals important information about the way people manage and use resources and thus provides valuable insights into development planning. Incorporating this information into integrated coastal management plans may be the key to making them more sustainable.

Coastal Management to Integrated Coastal Management

Coastal management embodies an effort to coordinate human activities with coastal resources and processes, such as hurricanes and beach erosion, in the region in which the land meets the sea. Activities on land which affect any part of the sea may be considered to be included within the jurisdiction of coastal

management. Coastal management in the context of this research represents development planning. For small island nations, threats of global warming and sea level rise compounded with economic insecurity and environmental degradation emphasize the need for sound, sustainable development planning. Small island nations can use integrated coastal management as an organizing principle, both in relation to other island nations and within national policy, due to their dependence on the coast for survival and economic strength.

Attention to sustainable development has illustrated the utility of traditional practices, respect for social customs and concern for long-term solutions ... all of which have provided a forum for the discussion of gender analysis. In other natural resource use areas, such as agriculture and forestry, gender analysis has revealed inequities in the creation of sustainable development plans, in approaches to development assistance and in the ability of planning to benefit all members of society. Attention to gender issues will humanize the planning process and will broaden it to be more equitable and sustainable for the long term.

Gender Analysis as an Approach to Integrating Coastal Management with Social Considerations

Gender may be defined as the social, historical or cultural construction of masculinity and femininity in a society, irrespective of biological sex. "Gender" then plays a distinctive role in the operation of a society from the education and care of children to the governance of nations.

Gender analysis can be applied to coastal management two ways:

1) Through an analysis of differences in the way women and men use resources and how these differences should be addressed in development.

2) From a management standpoint through an analysis of differences in the way women and men perceive problems and find solutions.

It is important to note that both perspectives are relevant for coastal management. Women should be included in the construction of coastal management plans to introduce perspectives and ideas which may not arise from men alone. In addition, any management plan should address the specific needs and concerns of user groups which are otherwise excluded from the development process. According to this perspective, planners would not approach women individually, per se, but instead approach the standpoint that women have in society (i.e., informally employed single mothers).

A great deal of development planning has been conducted by men, from both ends of the planning process. Men often hold leadership positions in organizations which conduct development planing, and those organizations often direct their efforts towards governments and businesses, also led by men in many cases. Women need not just be involved in the planning process; the societal roles

that different groups of women maintain needs to be targeted to examine their needs. Including all user groups is the only way that sustainable development can be achieved, and some user groups may be unintentionally excluded if a gender analysis is not applied.

How is one to apply a gender analysis to the construction of a development process such as integrated coastal management (ICM)? A gender analysis begins as an intellectual exercise, identifying trends in development practices. In order to target differences on the basis of gender, one must understand the construction of feminine and masculine roles in the society. These roles would serve as a reference through which specific analyses would be made. In this case, the history of Barbados was examined to determine historical events that contributed to the formation of cultural, traditional and societal norms. These norms, such as the relatively high percentage of female-headed households due in part to the practice of slavery, have direct influences on the roles that men and women play in society. Some of these roles materialize in social structures such as the division of labor by gender, the differential status of women and men and familial relationships in Barbados.

Examining the family structure in particular reveals how men and women are socialized in society and illustrates the formation of gender roles. In Barbados, the structure of society (including the division of labor by gender) is heavily influenced by the family. Women are responsible for the maintenance of the household. A significant number of families in Barbados, although not the majority, are headed by women. Familial relationships influence the types of jobs that both women and men will take.

Through the analysis of other natural resource uses, seven important issues can be identified in which development planning priorities differ between women and men:

1) Women often maintain traditional and sustainable uses of natural resources. Culturally speaking, modern technologies and practices are targeted mainly toward men, those formally employed, while women continue to use traditional practices. Often times, these practices are more sustainable.

2) If women's use of a resource is ignored, the real depletion of that resource will be underestimated.

3) Many women are employed informally, i.e., earn an income through the production of crafts or the sale of goods on a market. These activities are often ignored in economic accounting efforts for development planning because they are harder to measure.

4) Women, being primarily responsible for the maintenance of the household, suffer a triple burden of work. Majority world women in particular perform unpaid household labor, are employed for family

maintenance (either formally or informally) and perform unpaid community labor. Legal and political status is usually not uniform between women and men.

5) Women may be denied access to legal and political channels due to cultural traditions.

6) Because of few legal rights, women may also have limited access to financial capital and credit.

7) Finally, women and men have different perspectives on the use of the environment and on development. Some of these differences have materialized in the proliferation of women's self-help organizations or cooperatives. These different perspectives are significant for the planning side of development.

Why are the above issues important? Primarily, they highlight areas which development planners ought to target specifically. Since every nation has different social customs and traditional practices, these general issue areas should identify problem areas which may otherwise be overlooked. For example, in an area where access to legal and political channels may exist for women, economic activities in the informal sphere may be ignored. Experiences among women and among majority world nations in general must not be universalized.

Gender and Integrated Coastal Management in Barbados

To demonstrate the connection between gender and ICM in Barbados, the issues relating to development planing discussed above will be used due to the absence of empirical data about the special needs of Barbadians in coastal management. Generally, a gender analysis can contribute to the development of an integrated coastal management plan in the following ways: by involving all affected user groups, by identifying traditional and sustainable uses of resources and by suggesting policies which could lead to the modification of existing coastal industries which might make their practices more equitable. The ICM plan itself may be different in form if it included more anthropological inputs.

In a National Report to UNCED, 1992, the Environment Unit outlined several goals for a national integrated coastal management program. Those which may have gender implications will be discussed here. Although examples will be made in the context of Barbados, it is important to note that they are suppositions which have not been verified through direct contact with Barbadians. Any strategy used to incorporate women's (or any other marginalized group's) concerns would be best determined by the society itself.

Reviewing the following goal statement for example, "Develop a national policy on coastal and ocean resource management supported with legislation and regulation:" a national policy statement would ideally be formulated by a combination of groups, both governmental and non-governmental, who have an

interest in coastal management. The policy itself should specifically address anthropological issues. A gender analysis (that which evaluates the perspectives and inputs of both women and men) could highlight some important anthropological issues to be included in the national policy. A national policy may naturally include measures to control nonpoint sources of marine pollution. However, only through a gender analysis involving a survey of user groups to determine their needs and priorities, may it also include the establishment of a cost share program to help small businesses implement pollution control measures. If the needs of women are distinctively important and formerly ignored by governmental policy, a national policy might, for example, establish an advisory council of women on ocean and coastal management.

Developing an "inventory of living and non-living resources" may be accomplished by approaching smaller user groups, some of which may only be identified through an anthropological approach, such as gender analysis. For example, while a fishery exists for the collection of oysters, perhaps a small group of women and children collect a specialty species on another part of the island which is sold only locally. Fishery managers responsible for the inventory may not be aware of this effort. Initiating a gender analysis of the fishing industry would require planners to approach fishermen's wives, individual households in coastal areas and other smaller groups which might be involved in the fishing industry but normally overlooked. This approach also applies to any other research or monitoring effort. Fishery management as a whole could be greatly enhanced with a gender analysis to determine a more accurate accounting of fishing effort and distribution of assistance to the industry.

The siting or level of use restriction of "marine protected areas" may be affected by the extent to which otherwise invisible user groups are active in the area. These user groups may not necessarily be women ... gender analysis can lead to the discovery of other marginalized groups whether based on gender, age or social status. "Strengthening action" with regards to coastal management requires mobilization of society at all levels. Gender analysis in this context represents a methodology, an approach to a broader anthropological analysis which can be used as a tool for approaching the relevant user groups. A truly integrated management plan would mobilize the public, offer support for regional and international initiatives and provide the impetus for effective implementation of management recommendations.

Concluding Remarks

A critical component of ICM to emphasize again here is the notion of sustainability. A sustainable plan must account for scarcity of resources, environmental protection, economic development and the maintenance of a certain level of quality of life into the future. Integrated management plans incorporate anthropological components, such as the traditional use of resources. Traditional uses, those before mechanization, often were sustainable. The cotton industry is a perfect example in Barbados. Before mechanization, crops were fertilized naturally and rotated so as not to exhaust the land. In addition, mangroves and other land-

stabilizing plants were not cleared for planting cash crops on a large scale. Due to conclusions made in other natural resource use areas, groups of women often continue these traditional practices on a subsistence level. Integrating traditional practices on a regular basis could lead to greater sustainability. A gender analysis could better identify these practices and contribute to the development of a truly integrated coastal management plan.

Ultimately, "gender analysis" is about equity and attention to the social aspects of integrated coastal management. That is not to say that the social aspects of coastal management efforts are incomplete without a gender analysis; instead, it has become evident through this research that some social groups, practices and traditions are commonly overlooked through the planning process. Probably the best way to make development planning (or integrated coastal management planning) more sustainable is by including a more accurate cross representation of society in the planning process. Public participation representing more diverse life experiences and cultures is more likely to identify societal concerns more comprehensively. By addressing the status of women and men in society, gender analysis is the best way to identify and involve all user groups in the planning process.

In order for a gender analysis to be effective in this manner, it must consider all other social divisions in a society. It is envisioned here as an approach to a planning process, an approach through which all members of society may be included. A plan may easily be developed without a gender analysis, but based on the conclusions drawn in this study, it may be incomplete. Integrated coastal management plans purport to incorporate human uses of marine and coastal resources and space as well as planning issues, such as fragmented government jurisdiction and user conflicts. Many of these uses or planning issues may remain invisible without assessing the society through a cultural lens. Assessing masculine and feminine roles across a society -- in all economic, racial, political and cultural subdivisions of that society -- will yield valuable information and may help to include groups into the process which may have been otherwise excluded. Integrated coastal management plans would be much more effective (successful) in a society where all groups were able to participate and have their needs addressed. Gender analysis may be considered a tool for addressing social and cultural aspects of development planning and integrated coastal management can hardly be considered "integrated" without it.

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VEGETATIVE BUFFERS ALONG COASTAL WATERS: PROVIDING INCENTIVES TO LOCATE DEVELOPMENT OUTSIDE BUFFERS

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Functions of Vegetative Buffers

Vegetative buffers are upland areas adjacent to wetlands that are left intentionally in a natural state. Buffers separate wetland areas from adjacent land uses, thereby reducing the impact of land uses upon wetland areas. Buffers also remove/reduce nonpoint source pollutants, minimize human impacts, maintain natural shoreline environment, provide riparian wildlife habitat, and preserve scenic views.

Buffer widths can be determined by several methods. Phillips (1989) has developed a mathematical model, the "riparian buffer delineation equation," to determine buffer effectiveness and includes two versions: hydraulic and detention. The hydraulic equation addresses pollutants that are transported by surface flow energy. The detention equation addresses dissolved pollutants, incorporating both subsurface and surface flows.

Another method of buffer delineation uses a qualitative evaluation process. Roman and Good (1983) developed a three-step process. First, the wetland's relative value is evaluated. Second, the proposed development's potential impacts are determined. Third, depending upon which management area the proposed development is located, a buffer distance is assigned, ranging from 50 to 300 feet.

Wildlife buffers are determined in a different manner. Delineation is based upon wildlife needs. The width should be determined by the species with the widest home range. Schaefer and Brown (1992) provide guidelines to "help provide the basis for informed, rational decisions concerning the protection of viable natural systems."

Often a general buffer width is determined for a management area. For instance, the Chesapeake Bay Critical Area requires a 100- foot buffer, which is expanded if certain conditions exist like steep slopes or highly erodible soils. The Pinelands Area of New Jersey has a 300-foot buffer along wetlands. The Adirondack Park buffer width ranges from 50 to 100 feet depending upon land use classification. Virginia's Chesapeake Bay Preservation Area Program requires a 100-foot buffer.

Development within Buffers

The challenge in administering buffer programs arises from the provision of allowing development on grandfathered lots. Development on grandfathered lots is usually single family dwellings. Accessory structures such as garages and additions to the principal structures can be considered as normal uses associated with single

family dwellings and are usually permitted. The main questions concerning development within buffers are what development is allowed and where is it located.

Guidelines for allowing development in the buffer could be based upon the type of structure. A list could state what types of structures are acceptable and which are not. However, guidelines based upon type of structures may result in providing less direction for allowing development and more concern for interpreting a property owner's purpose for proposed structures in the buffer.

Buffer management guidelines which address disturbance to the buffer are more appropriate. Criteria for development in the buffer should provide incentives to stay out of the buffer. Incentive could be based upon the area of disturbance of the development activity. The incentive to stay out of the buffer is the cost of developing in the buffer.

Two types of guidelines for buffer management on grandfathered lots are described below. The guidelines encompass mitigation based upon imperviousness and a buffer strip based upon encroachment. The positive and negative implications of the guidelines are explored.

Mitigation Based upon Degrees of Imperviousness

Development activities in the buffer vary in imperviousness. Some types of development surfaces have a lesser impact than others based upon the amount of stormwater generated; for instance, less stormwater runoff is generated from a wooden deck than a garage roof. On a continuum of pervious to completely impervious, a wooden deck could be considered somewhat impervious (depending upon design and construction materials) and a roofed structure or concrete patio as completely impervious. To address water quality impacts from varying degrees of imperviousness, a sliding scale ratio could be used for development activities in the buffer.

Types of impervious surfaces could be scaled from 1 to 3, with the lower number having less of an impact. If a surface was determined to be a 1, then mitigation would be required on a 1:1 ratio for the square footage disturbed. If a surface was categorized as somewhat impervious, a 2:1 ratio would be required. For surfaces that were completely impervious, a 3:1 ratio for mitigation would be required. A ratio based upon the degree of imperviousness would address a development activity's impact. The goal of this method is to provide an incentive to reduce the amount of impervious surfaces in the buffer.

If development does occur, there is an incentive to use more pervious types of construction materials since mitigation costs would be less. Requiring mitigation for the degree of a development activity's imperviousness addresses water quality concerns. A weakness of this method is determining the number assigned to a type of impervious surface. The determination that a type of impervious surface was a 2 rather than a 1 would require a scientific basis and site specific review. Implementation costs could be high.

Buffer Strip Based upon Encroachment

Another approach that provides incentives to locate development activities outside the buffer is based upon encroachment distance and area of physical disturbance. The distance development encroaches into the buffer is the distance that a buffer strip of natural vegetation would be established landward of the shoreline. In addition, the square footage of the disturbance would be mitigated at a 1:1 ratio and added to the buffer strip width. The square footage of offset vegetation is divided by the lot length, and then added to the encroachment buffer strip. If some of the buffer area is already established as natural vegetation, then a buffer strip equal to the encroachment distance must be established in natural vegetation landward of the edge of the existing natural vegetation. The incentive to locate development activities outside the buffer is the costs of planting vegetation.

As an example of the encroachment concept, if a house encroaches 25 feet into a 100-foot buffer, then a 25-foot strip from the shoreline must be established in natural vegetation, if none exists. Furthermore, the area of the disturbance would be required to be added to the buffer strip. If this hypothetical house disturbed 1,250 square feet of the buffer on a 150-feet long lot, then 1,250 square feet of offset vegetation would be required. Dividing 1,250 square feet by 150 feet equals approximately 8.3 feet. Thus the total distance of a required buffer strip would be 25' + 8.3' = 33.3 feet.

Most development activities on grandfathered lots within the buffer are for structures such as decks or sheds and are designed and constructed by property owners (or are prefabricated) and usually do not require the expertise of an engineer or an architect. It is likely that buffer management plans will be prepared by property owners with assistance from local staff. There is a trade-off between the exactness of determining a development's impact and the expertise needed in making those determinations.

In instances where development would encroach greater than half of the distance of a buffer, the establishment of a vegetated strip of equal distance would be impossible. Where mitigation could not be located shoreward of the disturbance, a property owner would be required to establish a natural vegetation area of equal square footage. The natural vegetation area must be established on site in the buffer, either along side or landward of the development activity. If location within the buffer is not practical, then vegetation must be established on site in the management area. If on-site mitigation is not feasible, only as a last resort, then a fee-in-lieu of planting would be required as an offset. Fees-in-lieu would be maintained by the jurisdiction in a designated fund for mitigation.

Requiring mitigation for both the encroachment distance and area of disturbance would discourage property owners from constructing elongated structures. To limit the encroachment distance into a buffer, a house could be designed longer than normal, perhaps as long as the maximum distance allowed by side yard setbacks in the zoning ordinance. The encroachment distance might be small, but the overall square footage disturbance might be great. For example, a

single family house may encroach only 5 feet into the buffer, but is 50 feet in length, an encroachment area of 250 square feet. Merely requiring a 5-foot buffer strip would not seem to mitigate the area extent of the encroachment. To discourage this situation, the requirements for mitigating both distance and area are necessary.

These guidelines locate the natural vegetation at the water's edge to mitigate the negative impacts of development activities. In contrast, some local programs only require that mitigation be located, in order of preference, in the buffer, in the management area or off site as a fee-in-lieu of planting. Vegetation should be adjacent to the shoreline, otherwise instances can occur where a property owner locates vegetation within the buffer, but far from the shoreline, thus not allowing the vegetation to function as a filter to stormwater runoff or as wildlife habitat.

A buffer strip based upon encroachment distance and area of disturbance would reestablish or enhance wildlife corridors along the shoreline and provide water quality improvement. This method provides an incentive to locate development outside the buffer. A management plan based upon these guidelines would directly address the buffer's functions in removing stormwater pollutants, minimizing adverse effects of human activity, and establishing a transitional habitat area between aquatic and upland communities.

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LAPPING AT THE FRONT DOOR: IMPLICATIONS OF SOUTH CAROLINA'S BEACHFRONT MANAGEMENT ACT

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Beachfront Management Options

Beachfront management options in their simplest form are armor, nourish, or retreat. Armoring the shoreline with seawalls, bulkheads, and revetments has been shown to result in increased erosion. Of the total 90 miles of developed shoreline in South Carolina, approximately 20 miles are armored (Kana, 1990). Armoring the shoreline with hard erosion control structures is no longer an option in South Carolina since their use is restricted by beachfront management regulations.

The second beachfront management option, nourishment, uses the natural beach/dune system, augmented by additional sand placed on the beach by artificial means. For areas in South Carolina experiencing erosion, estimates indicate that 16 million cubic yards of sand will be required to restore and maintain a dry beach at a cost of $65 million over the next decade (Kana, 1990). Accomplishing such nourishment varies according to the different shorelines of the state. Costs estimates range from $500/linear foot for unstable beaches to less than $100/linear foot for stable ones (Kana, 1990). Public access to the shoreline is a criterion that South Carolina uses to determine state beach nourishment funding. Thus, money collected from state tax payers is used to protect areas which the state's citizens and out-of-state visitors can access.

The third beachfront management option is retreat. South Carolina has implemented a gradual retreat policy based upon the average yearly erosion rate over the past forty years. However, this policy does not account for the prospect of sea level rise. A corollary policy is to discourage new construction near the beachfront.

Establishment of the S.C. Beachfront Management Act

The South Carolina Coastal Zone Management Act, passed in 1977, established the S.C. Coastal Council to protect and enhance the state's coastal resources. The South Carolina Beachfront Management Act was passed in 1988 based on recommendations from the Blue Ribbon Committee on Beachfront Management. The committee found that many miles of the state's beaches were eroding and that the "erosion is threatening the continued existence of our beach/dune system and thereby threatening life, property, the tourist industry, vital State and local revenue, marine habitat, and a national treasure" (SCCC, 1991). This Act was amended in 1990.

Policies of the Beachfront Management Act

The General Assembly set forth policies for beachfront management. The primary policy is to "protect, preserve, restore, and enhance the beach/dune system" (SC, 1990). Another policy sets forth the responsibility of creating a comprehensive long-range beach management plan which "must promote wise use of the state's beachfront to include a gradual retreat from the system over a forty-year period" (SC, 1990). Hard erosion control devices such as groins or sea walls are restricted while soft, non-structural methods like dune formation are promoted. Furthermore, beach nourishment is promoted "as a means of beach preservation and restoration where economically feasible" (SC, 1990).

The Act describes two types of erosion zones: a standard erosion zone and an inlet erosion zone. The standard erosion zone is influenced by similar coastal processes, not influenced by inlets, and exhibits similar profiles which are relatively constant over time. In contrast, inlet erosion zones are directly influenced by inlets, and thus are more unstable.

The Act establishes a setback line and baseline to implement the gradual retreat policy. The best information available from scientific methods and historical data were used to establish these lines. The standard erosion zone baseline was established at the crest of the primary dune, or where the crest of the primary dune would have been if the beach had not been altered. The inlet erosion zone baseline was established as the most landward extent of erosion over the past forty years. From the baseline, a setback line was determined. The setback line was calculated by multiplying the average erosion rate over the past forty years by forty. The minimum distance between setback line and baseline was set at 20 feet.

The baseline and setback line establish areas where development is closely regulated. Development activities between the baseline and the ocean are restricted. The Act explicitly states "(n)o new construction or reconstruction is allowed seaward of the baseline..." (SC, 1990) with seven exemptions. These exceptions include wooden walkways, small decks, public fishing piers, golf courses, landscaping, reconstructed pools if landward of a functioning erosion control device, and structures with a special permit. Development activities between the setback line and baseline are also regulated.

New construction of habitable structures is allowed as long as certain requirements are followed. These requirements involve siting the structure as far landward as practicable (in regard to local zoning and parking requirements), restricting the heated space to 5,000 square feet, and not incorporating erosion control devices as part of the structure. No structure seaward of the setback line may be located on the primary dune.

The Act specifies how structures are to be rebuilt if damaged, either by natural or human causes. The Act governs pools and restricts the use of hard erosion control structures. The only new erosion control structures allowed seaward of the setback line are those which protect existing public highways.

For activities that are otherwise not allowed by the Act, the Coastal Council may issue a special permit. A special permit may be issued as long as a structure is not located on the primary dune or on the active beach or is not "detrimental to the public health, safety, or welfare" (SC, 1990). Furthermore, if "the permitted structure becomes situated on the active beach" it is required to be removed. The special permit provision was incorporated in the 1990 revision of the Act. Previously, no construction was allowed seaward of the baseline. This prohibition lead to the Lucas v. South Carolina Coastal Council case.

Structures Encroaching the Baseline and Setback Line

Seventeen communities in five counties have approximately 1,451 structures located seaward of South Carolina's setback line and baseline, see Table 1. Each community has its own development pattern, for instance, North Myrtle Beach ranks first with 276 structures encroaching the lines while Daufaskie has the fewest structures with only 4.

While the number of structures encroaching the setback and baselines convey an idea of the extent of development, a community's percentage of the state's total presents another insight. Three of the seventeen beach communities contribute more than 57% of the total number of encroaching structures. In contrast, ten communities each contribute 3% or less of encroaching structures.

When appraisal value is considered, a different pattern emerges, see Table 2. The appraised value of encroaching structures totals $1.1 billion. Myrtle Beach has the highest appraisal value of encroaching structures. Note that Daufuskie has a zero appraisal value, although some value does exist.

Another pattern is the type of structures located within the setback or baselines. The majority of encroaching structures are houses, specifically, single family detached houses. Of the 1,451 structures, 829 were houses, 307 pools, and 248 multi-family structures (i.e., condominiums and hotels; the number represents discrete buildings, not the number of units). Seven piers were documented along with 40 other structures, such as club houses, commercial buildings, and gazebos.

Implications of the Beachfront Management Act on Coastal Development

A comparison between the number of structures and appraisal value of structures reveals an interesting distinction. A community's percentage of the state total for encroaching structures differs from the percentage of state total appraisal value. For instance, Myrtle Beach contains only 8.27% of the total number of encroaching structures, yet Myrtle Beach's structures comprise 38.53% of the total appraisal value.

The percentage of structures or the percentage of appraisal value could be a factor for nourishment. A policy could be developed to favor number of structures over the value, or vice versa. The state policy for nourishment funding is based upon public access, but other factors might need to be considered if two

communities competing for the same funding provide the same amount of public access. Whether that criterion is number or value of structures would significantly affect a community's opportunity to obtain funding.

Usually public benefit is used which is a combination of use/visitation and property value benefits. The still more important issue is who pays for erosion control projects and what combination of taxes and fees are assessed to recoup user benefits.

Description of Database

The data for this paper was obtained from the South Carolina Coastal Council and from appraiser's offices in five counties. Data collected included type of structure, location, name and mailing address of property owner, appraisal (not including land value), and if available, square footage of structure and year built. It is assumed that database will be updated by the Coastal Council periodically.

COMMUNITY	# of Structures	% of State Total
Daufuskie	4	0.28
Debidue Beach	36	2.48
Edisto Beach	103	7.10
Fripp Is.	40	2.76
Garden City	246	16.95
Harbor Is.	35	2.41
Hilton Head Is.	310	21.36
Horry Co. N.	22	1.52
Horry Co. S.	19	1.31
Isle of Palms	26	1.79
Litchfield	13	0.90
Myrtle Beach	120	8.27
N. Myrtle Beach	276	19.02
Pawley's Is.	75	5.17
Seabrook Is.	25	1.72
Sullivan's Is.	12	0.83
Surfside Beach	89	6.13
TOTAL	1451	

Table 1. Structures Encroaching in the Setback and Baselines

COMMUNITY	Appraisal in Dollars	% of State Total Appraisal
Daufuskie *	$ 0	0.00
Debidue Beach	10,650,311	0.93
Edisto Beach	5,378,168	0.47
Fripp Is.	3,262,603	0.28
Garden City	145,168,308	12.68
Harbor Is.	2,843,779	0.25
Hilton Head Is.	119,996,870	10.48
Horry Co. N.	118,501,200	10.35
Horry Co. S.	1,012,313	0.09
Isle of Palms	10,725,000	0.94
Litchfield	3,749,045	0.33
Myrtle Beach	441,167,421	38.53
N. Myrtle Beach	216,828,005	18.93
Pawley's Is.	12,544,284	1.10
Seabrook Is.	11,217,200	0.98
Sullivan's Is.	1,019,500	0.09
Surfside Beach	41,081,452	3.59
TOTAL	$1,145,145,459	

* Appraisal value not available.

Table 2. Appraisal Value for Structures Encroaching the Setback and Baselines

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PUBLIC TRUST DOCTRINE

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New Jersey's version of the public trust doctrine, developed in a line of cases beginning with Borough of Nepture City v. Borough of Avon-by-the-Sea, 294 A.2d 47 (N.J. 1972), requires municipalities to provide equal access to the beach regardless of the beachgoer's residence. The most far-reaching of these cases indicates, perhaps in dictum, that private property owners' right to exclude from the dry sand area might have to be curtailed to provide easement-type access to the beach. Mattews v. Bay Head Improvement Association, 471 A.2d 355 (N.J. 1984).

Accounts of these cases, particularly in legal casebooks and treatises, obscure the origins of the public trust doctrine in a class- and to some extent race-based conflict over beach use. The cases were brought (and continue to be brought) by the New Jersey Public Advocate's Office at least in part out of a concern to combat private and local efforts to exclude relatively undesirable types -- poor folk, college students, and blacks -- from the beaches.

The paper will develop this submerged background of the New Jersey public trust doctrine, relying on oral interviews with the litigants, review of litigation materials, and contemporaneous historical documents. The paper will then expand, connecting the historical background of the development of the New Jersey public trust doctrine to contemporary concerns about environmental racism/justice/equity. It may also speculate on how and why abstract legal doctrine has obscured the specific historical background of this development.

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WHO SHOULD PAY FOR BEACH NOURISHMENT PROJECTS?

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Both natural and manmade causes can lead to beach erosion. Coastal storms and development projects that change ocean currents provide examples of such causes. A popular means to counteract the harm to property from shoreline erosion is beach nourishment. This process involves replacing the lost sand with sand from inland sites or from nearby ocean locations.

Beach nourishment projects are expensive and often short-lived. A project for Folly Beach, South Carolina is expected to cost $116 million over the next 50 years. Ocean City, Maryland nourished 9 miles of beach during the past 4 years at a cost of $51.2 million, only to see most of it washed away during heavy storms in the fall of 1992.

Many beach nourishment projects are largely funded by the federal government. For example, the federal government will provide $98 million for the Folly Beach project. For a 1995 proposed nourishment project for Myrtle Beach the federal government will cover 65% of the construction costs, with local and state governments covering the remainder. Beach nourishment projects create value for property owners, local residents and tourists. Property owners near the ocean receive recreational and storm protection benefits. Local governments enjoy increased revenues from property taxes as a result of increased property values. Wider beaches also attract more tourists creating benefits for them as well as jobs and revenue for local citizens and government.

The objective of this study is to examine questions pertaining to equity in the distribution of costs and benefits. We use a case study to identify recipients of some of the benefits in an effort to ascertain the degree of funding equity. For example, is it equitable to tax a Kansas citizen for a beach nourishment project in South Carolina, or tax a citizen in Greenville, South Carolina as much as a citizen living in Garden City, South Carolina? The closer the correlation between beneficiaries and payers the more equitable the project. The Army Corps of Engineers currently is required by law to calculate benefits-cost ratios for all nourishment projects, but their methods are inaccurate and incomplete. In fact, the Corps presently justifies a project solely on storm reduction benefits.

The benefits from beach nourishment are often difficult to estimate since they are not sold directly in the marketplace. However, there are various indirect techniques available to measure nonmarket benefits. We use an hedonic model to calculate the increments in property value from beach nourishment. The general form of the model is:

(1) $P_i = a_0 + B_1 S_i + B_2 L_i + B_3 N_i + B_4 A_i + E_i$

where:

a_o = a scaler
B_1, B_2, B_3, B_4 = vectors of parameters
P_i = the price of house i
S_i = a vector of structural characteristics
L_i = a vector of locational characteristics
N_i = a vector of neighborhood characteristics
A_i = a vector of amenities offered
E_i = a stochastic disturbance term, assumed to be normally distributed

The hedonic technique describes the supply and demand conditions necessary to calculate a particular attribute's contributions to the total value of a property. A wider beach presumably provides a combination of recreational benefits and property protection from storms, benefits that are captured by the market price of property. Flooding due to storms and high tides can cause significant damage, not only to oceanfront property but also to homes farther removed from the beach. Consequently, other things being constant, the value of a wider beach should be captured by the price of the land.

Data Set and Results

Our study focuses on a sample of 385 single- family homes that were sold between 1983 and 1991 in the two communities of Surfside and Garden City just south of Myrtle Beach, South Carolina. Selling price, location, and information, such as square footage, number of rooms and structural age, were obtained from multiple listing catalogs and county tax records. Distance variables were derived from various area maps. A series of 32 survey markers spaced along the shorelines of these two towns provided the beach width
measurements. The nearest survey marker to a particular house indicates the width of beach for that house.

Variables that may be correlated with beach distance and width, such as view of water and oceanfront location, were also included.

The double-log form was determined to be the appropriate functional form by using the Box-Cox transformation process. All signs are as expected, and most variables are significant at the 1 percent level. The adjusted R^2 of .81 indicates that the model predicts a substantial amount of the variation in housing prices.

Using the mean values of attributes for oceanfront homes, our study shows that an additional foot of sand, an increase from 79 to 80 feet, increases market value of an average house and lot by approximately $525. However, there are diminishing returns to beach width. Increasing the width of beach from 119 to 120 raises market value by only $389. Additionally, the value of wider beaches is less for homes farther removed from the beach. Using the mean values for houses 1/3 of a mile from the beach, the increase in value is $234 as the beach is widened from 79 to 80 feet, and an additional $174 for an incremental widening from 119 to 120 feet.

Gains in Property Values from Beach Nourishment

Our model provides an estimation of storm damage protection benefits. Since the value of a wider beach is capitalized in housing prices, the benefits can be seen as a stream of benefits over the years in the form of less property value loss. The beach nourishment project, which adds 107 feet of beach width in SB, increases the value of the average oceanfront home by $27,410. For GC the addition of 96 feet would increase the value of the average oceanfront home by $41,246. The model indicates that the nourishment project adds substantial value to houses removed from the oceanfront, benefits not calculated by the ACE methods.

The aggregate benefits to Surfside Beach and Garden City in terms of private residential property protection can be estimated by summing the increased benefits to all single family homes in the area. There are approximately 2,300 single family homes in Surfside Beach and 1,000 single family homes in Garden City. We then estimate the number of houses at different distances from the beach. Multiplying these values by the number of houses at different distances shows estimated cumulative benefits of the nourishment project for single family homes to be $63,779,417, which produces a benefit/cost ratio of 1.96.

In contrast to the Army Corps of Engineers computes the benefit ration to be 4.2. This figure includes residential and commercial property, as well as public infrastructure such as roads. Also, since housing market prices are used in their estimations, property values capture the enhanced recreational benefits as well as storm protection gains.

Our estimates of damage reduction benefits is superior to the one currently used by the ACE in several respects. The hedonic model used in our study controls for recreational benefits by using the interaction between distance to beach and beach width, which allows the beach width variable to measure only storm damage benefits. Also, while there is protection value from nourishment to property near the ocean, there is also storm protection for property farther removed from the sea, a benefit not currently measured by the ACE. The hedonic model allows this value to be calculated. Additionally, the hedonic model is based on more realistic assumptions. The ACE analysis assumes, that if the beach is not nourished, all property value will be lost. However, it is unlikely that property owners would allow property to be completely destroyed. It is more likely that affected parties would practice damage avoidance, for example by strengthening and elevating buildings.

A further advantage of our model is that the value of an additional unit of sand can be determined, which in turn can be compared to the additional cost of an incremental unit of sand. This type of marginal analysis allows us to estimate the optimal level of nourishment. It can be shown that net benefits to society are maximized when marginal benefits are equal to marginal costs.

The SB\GC nourishment project, as well as numerous other projects handled by the U.S. Army Corps of Engineers, is to be paid for by federal, state, and local governments. Our model illustrates that ocean area property owners enjoy

significant benefits from beach nourishment, paid for with public dollars, and much of that coming from taxpayers living in other parts of the state and country. Of course, some of the benefits accruing to property owners are passed on to the government in the form of higher taxes. The benefit principle of taxation would suggest that those who benefit from a project should bear the costs. Black, et al. (1990) suggest a special assessment on beach properties since much of the benefits of nourishment accrues to those property owners. Our study provides a basis for determining the value to a specific property from beach nourishment, and therefore could provide a method for estimating the appropriate tax to be charged. Clearly, an oceanfront house should be assessed more than an identical house 1/2 mile from the beach, or one 500 miles from the ocean.

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Florence, SC 29501
PH 803/661-1438

CRITICAL EVALUATION OF THE STATUS OF THE LAW REGARDING WETLANDS, INVERSE CONDEMNATION AND TRANSFER OF DEVELOPMENT RIGHTS

Alfred A. Porro, Jr., Porro and Porro, Attorneys at Law

This paper will address and weigh the public rights in conservation and preservation of wetlands with the rights of private property owners. A review of the various laws protecting wetlands, including laws and regulations of EPA, U.S. Army Corps of Engineers, U.S. Fish and Wildlife, and various State Laws will be set forth for laying the basis of the present status of the scene. Thereafter, a review of the series of the United States Supreme Court and various other federal and state decisions protecting the rights of private property owners will be critiqued.

In conclusion, this paper will analyze the present available vehicles to the next horizon, i.e. an amicable resolution of an apparent conflict between the public and private rights. The vehicle of mitigation, high-density upland development and transfer of development rights will be urged.

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DESIGNING EFFECTIVE BASELINE MONITORING PROGRAMS FOR THE GREAT BARRIER REEF MARINE PARK, QUEENSLAND, AUSTRALIA

Marjetta Lee Puotinen, Duke University

Abstract

Rising interest in and support for both the protection and expanded use of coastal and marine resources worldwide underscores the need for effective management of these dynamic and often poorly understood environments. However, long-term data on which to base management decisions is often lacking. This data deficiency is particularly evident for the management of large ecosystems such as the Great Barrier Reef Marine Park, Australia. Given the tremendous size of the Park and limited funding available, effective monitoring programs must generate the most information value possible. To do so requires understanding the management process the data will support and the use of decision tools that work within that context.

Introduction

The Great Barrier Reef, the largest system of corals and associated life forms in the world, warrants an immense amount of research and monitoring to explore, utilize, and protect its complex, intricate ecosystems and their components. The Great Barrier Reef Marine Park Authority (the Authority)[1], the federal statutory body responsible for the protection and sustainable use of the Reef, develops and coordinates baseline monitoring programs within the Marine Park. The Research and Monitoring Section (R&M) of the Authority is currently evaluating how to most effectively design these programs. This paper discusses the importance of monitoring to Marine Park management, describes how the decision-making context of the Authority determines how program effectiveness is defined, explores the worth of various program designs, and introduces a spatial decision support tool, the Reef Research Allocation Model (RRAM), under development for use in selecting monitoring sites.

Importance of Baseline Monitoring

Effective management of the Reef, a resource of proven national and international significance, depends on the availability of long term data relevant to the decisions facing the Authority. Limited funding for long term monitoring necessitates careful program design.

[1] "The Authority" will refer to both the Authority and its staff unless otherwise noted.

The Value of the Reef

Extending over 2,000 kilometers along the northeast coast of Queensland, Australia, the Reef supports a tremendous array of life including 1,500 species of fish, 350 species of hard corals, over 4,000 mollusks species, and more than 400 species of sponges (Kelleher, 1986). In addition to its potential for scientific research and spectacular and singular beauty, the Reef supports a growing Queensland tourist industry, two fisheries generating close to $400 million of output per year and a major shipping lane (Craik, 1992). The Marine Park was established in 1975 in response to widespread national and international recognition of the value of the Reef and the need to protect it from potentially damage from oil and mineral recovery. The Park includes most of the Reef, covering an area of over 340,000 square kilometers. In October 1981, the entire Reef region was designated as a World Heritage Area.

Need for Long-Term Data

To achieve its primary goal ("to provide for the protection, wise use, appreciation, and enjoyment of the Reef in perpetuity through the care and development of the Marine Park,") the Authority manages the Park as a "multiple use protected area," developing zoning plans restricting access to sensitive areas, separating conflicting uses, and maintaining sustainable levels of use (Craik, 1992; GBRMPA, 1992; Kelleher, 1986). Establishing and implementing effective zoning plans requires research and monitoring to gain scientific understanding of the Reef and its processes, estimate trends in use (Craik et al, 1990), to measure damage, and assess the effectiveness of zoning plans in meeting the Authority's goals over time. Despite its vital importance, very little scientifically valid biological or socioeconomic information is currently available, particularly over the time periods necessary to make decisions based on the sustainability of ecosystem use (Kelleher, 1986).

Funding Constraints

Limited funding requires the development of a highly prioritized, goal-oriented research and monitoring program to generate maximum results for minimal cost. The Authority's research and monitoring program, implemented by R&M, addresses specific concerns (e.g., water quality, crown-of-thorns starfish) through research initiatives and gathers long term data through broad-based, multi-purpose monitoring. The size of the Marine Park limits the number of monitoring sites, highlighting the need for a system to determine where baseline monitoring efforts would be most productively concentrated.

The Decision-Making Context of the Authority

The context within which decisions are made determines what constitutes an effective baseline monitoring program design. This context, or "cultural ecology" is established by the legal mandates that empower the Authority and consists of the legislative sectors with interest in Reef issues or general procedural oversight,

administrative bodies with authority and/or responsibility for the Marine Park (e.g., the Authority), and private sector constituencies involved in the policy process.

Legal Mandates

The Australian government is a federal system with separation of powers between the Commonwealth and the State and Territories much like the United States. The balance of power between the legislative, executive, and judicial branches of governments at local, state, and federal levels is not distinct, however. While the Constitution represents the highest legal authority as interpreted by the High Court of Australia and implemented by the Executive, the powers of the Parliament and the Executive overlap (Figure 1). Members of Parliament are selected in popular elections that are held every six years.[2] The majority party in the House of Representatives elects the Prime Minister at least every three years from the House,[3] and the Cabinet and Governor General from either the House or Senate. Thus, the Executive remains a part of Parliament, and is controlled by the majority party. The Senate Bills Committee may recommend that proposed legislation is unconstitutional, but generally any bill able to win a majority vote passes. As a member of Parliament, the Prime Minister has no veto power. Regulations for each new law are written by the Office of Legislative Drafting for approval by the Governor General. Agencies granted responsibility and authority by the law cooperate with the Office and the Governor General to generate acceptable

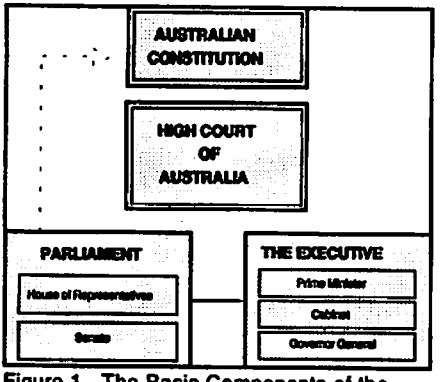

Figure 1. The Basic Components of the Commonwealth Government in Australia

regulations. The Senate Rules and Ordinance Committee and the Senate Estimates Committee review agency adherence to procedural requirements and budget expenditure (Honchin, 1993).

[2]The composition of each House is similar to that in the US.
[3]Elections can be called at any time by a majority vote of the House.

Within this context, the Great Barrier Reef Marine Park Act of 1975 (the Act) established a Commonwealth statutory body (the Authority) to act as "the principle advisor to the Commonwealth government on the care and development of the Marine Park" as seen on Figure 2 (GBRMPA, 1992; Kenchington, 1990). Subsequent Act amendments, regulations, and zoning plans have the force of law and priority over Queensland State laws in conflicts. The Act does not require reauthorization and remains in force until amended or overturned by the High Court of Australia.[4] In addition, a significant body of Commonwealth and Queensland legislation (Appendix 1) provides a legal background for Marine Park issues such as endangered species protection, pollution prevention, and over fishing.[5]

Cultural Ecology: Organization

While the Act granted primary responsibility for the care and development of the Marine Park to the Authority, final authority over Marine Park management rests at the federal ministerial level. The Governor General is responsible for approving regulations to implement the Act with the advice of the Authority. Amendments to the Act must be proposed as new legislation by Commonwealth Ministers (Honchin, 1993). In practice, ministerial involvement in actual Marine Park decision-making is minimal, limited to the approval of the annual budget or particularly sensitive or controversial issues.

In addition, the Commonwealth government has jurisdiction only over areas it controls. This includes all areas on the continental shelf beyond the three mile territorial sea and all intertidal lands. Islands and subtidal lands, a significant part of the Reef Region, are controlled by the Queensland government and are not part of the Marine Park (Kenchington, 1990). Hence, the Act provides for "complimentary management" of the Marine Park and adjacent Queensland lands, most of which have been declared as parks. The Great Barrier Reef Ministerial Council was established in 1979 by the Emerald Agreement between the Prime Minister of Australia and the Premier of Queensland to "coordinate policy between the Commonwealth and Queensland governments at the Ministerial level" (GBRMPA, 1992). The Ministerial Council consists of two Ministers each from the Commonwealth and Queensland governments (Appendix 2). The chairman of the Council (The Minister) advises the Authority consistent with the Act as in Figure 2 (Kenchington, 1990).[6] Therefore, while the Authority and its staff are responsible for developing "management policy, planning, and guidelines" for the Marine Park (e.g., zoning plans, issuing permits, oil spill planning, coordinating research efforts), Queensland is responsible for its day to day management (GBRMPA Glossary,

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[4]Undeclaring sections of the Marine Park requires a two-thirds majority in both houses of Parliament. Amendments require passing amendment bills by majority vote. (Honchin, Per. Comm.)

[5]Any legislation pertaining to State or Commonwealth jurisdiction of marine and coastal areas is also relevant. Only areas controlled by the Commonwealth can be declared part of the Great Barrier Reef Marine Park.

[6]Note that "the Minister" represents the Commonwealth and that Commonwealth law (within the Constitution) overrides Queensland law. (Kenchington, 126-130.)

1993). Major agreements affecting the operation of the Marine Park are listed in Appendix 3. While the Queensland Department of Environment and Heritage (QDEH) has primary responsibility for day to day management, other state and Commonwealth agencies are involved (Appendix 4).

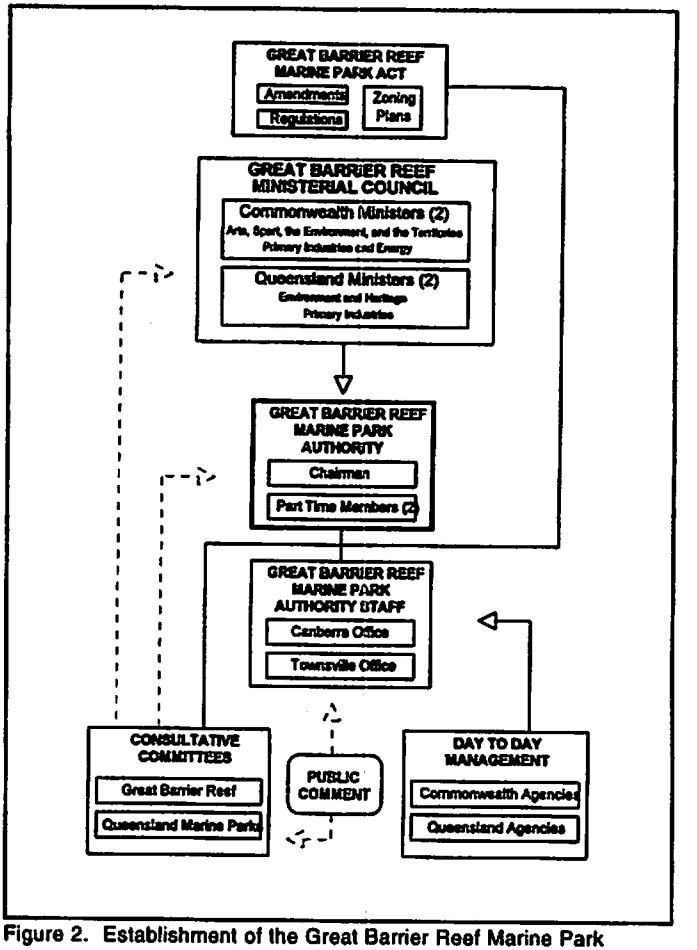

Figure 2. Establishment of the Great Barrier Reef Marine Park management structure

To incorporate the views of the wide range of individuals, organizations, and groups with interests in the Reef, the Great Barrier Reef Consultative Committee was established by the Act as "an independent advisory body for both the Minister and the Authority" (GBRMPA, 1992). The Committee is appointed by the Minister and consists of one member from the Authority with an unlimited term and at least twelve additional members for three year terms of whom at least one third must be appointed by the Queensland government (Kenchington, 1990). To allow Queensland Marine Parks issues and Marine Park issues to be addressed

separately if necessary, the Queensland Marine Parks Consultative Committee was created by the Queensland government in 1991. Membership, structure, and role of both committees is generally the same although the latter is not backed by legislation and reports to the Minister of QDEH. Committee membership, representative of the wide range of groups with interests in the Marine Park, is listed in Appendix 5 (GBRMPA, 1992). Additional advisory committees are listed in Appendix 6. The Act also mandates periods of public comment for proposed zoning plans and other major management decisions (Kenchington, 1990), although the public has far less influence than in the United States (Honchin, 1993).

The Authority itself consists of one full time member appointed by the Governor General as Chairman and Chief Executive, and two part time members, one of whom must be appointed by the Queensland government (Figure 3). The Chairman interacts with the Commonwealth and Queensland governments at the ministerial level assisted by the staff of the Canberra Office. He often serves as the Authority representative to national and international organizations (Appendix 7) and committees relevant to the Reef (e.g., Great Barrier Reef Consultative Committee). The Executive Officer (EO) controls the day-to-day operation of the Authority's Townsville Office, consulting with the Chairman when necessary. The Secretariat sits on relevant committees and provides administrative support. The remaining staff are organized within seven sections based on function and responsibility. Each section is led by a section head, subject to the EO except for the Planning & Management Section which has a direct link to the Chairman as well as the EO (Honchin, 1993). The Chairman, staff of the Canberra Office, Secretariat, EO, and section heads form the senior corporate staff of the Authority (Appendix 8). Coordination and cooperation across sections varies with the issues and personalities involved.

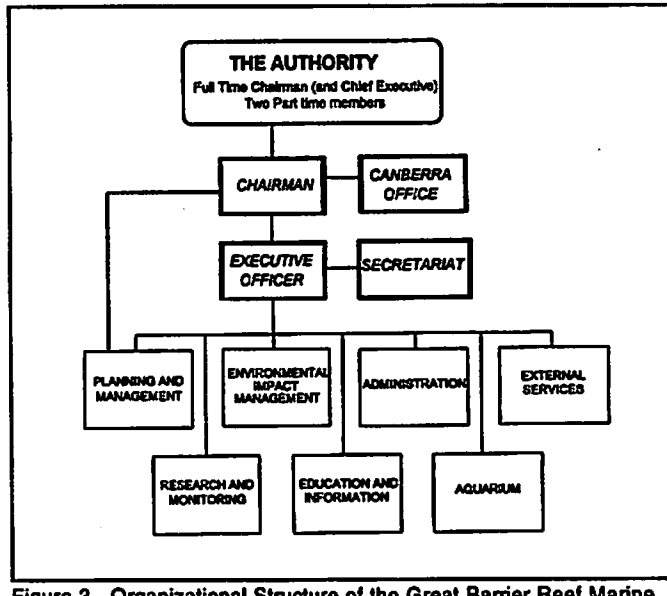

Figure 3. Organizational Structure of the Great Barrier Reef Marine Park Authority and Staff

Marine Park Authority and Staff
Cultural Ecology: the Funding Process

The annual funding process illustrates the interactions between the Authority, its staff and other Queensland and Commonwealth agencies and bodies (Figure 4). Each section of the Authority's staff prepares a yearly budget which is reviewed by the EO, who drafts a budget for final approval by the Chairman. This budget and a similar budget for the day to day management of the Park prepared by the staff of QDEH[7] are submitted to the Authority for approval as the Authority's "Annual Programme." The Great Barrier Reef Ministerial Council reviews the plan and recommends its inclusion as a single line appropriation in the budget bill to be prepared by the Commonwealth Department of Finance and Treasury.[8] The Authority's budget may be cut back at this stage or when the bill is passed, based on the advice of the Senate Estimates Committee and Senate Bills Committee. In fact, the funding obtained is rarely the full amount requested (Honchin, 1993).

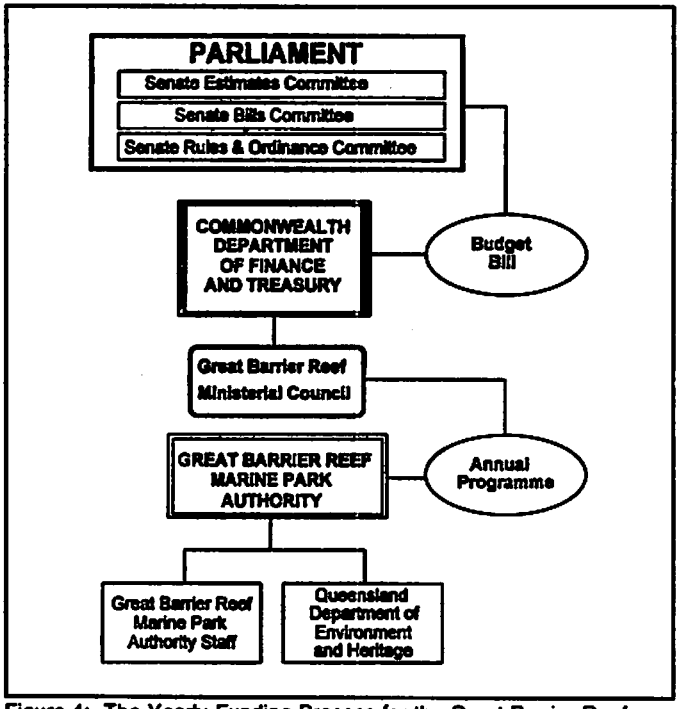

Figure 4: The Yearly Funding Process for the Great Barrier Reef Marine Park Authority

[7]The Queensland government receives no direct funding from Parliament for the day to day management of the Marine Park.

[8]The Ministerial Council rarely objects as the Chairman ensures that the Programme will be acceptable to its members. (Per. Comm., Darin Honchin.)

The Authority has some flexibility in allocating its limited funding since the individual section budgets within the Authority are not subject to approval by Parliament, and the Ministerial Council rarely objects to the Annual Programme. However, the Minister has a significant influence on what the Chairman deems acceptable in the Programme. Therefore, as the EO and section heads will try to submit budgets likely to be accepted by the Chairman, Parliament influences the Authority's program. Through this process, the individual sections of the Authority compete with each other and QDEH for a share of the limited budget. Hence, each section must demonstrate effective use of funds each year to maintain or increase their share of the budget. This is particularly necessary for R&M, which receives a relatively large appropriation (Figure 5).[9] The effectiveness of R&M baseline monitoring programs depends, then, on their relevance to the goals of the Authority, as established in the Act and interpreted by the Ministerial Council, Chairman, EO and R&M section head, given their relative cost.

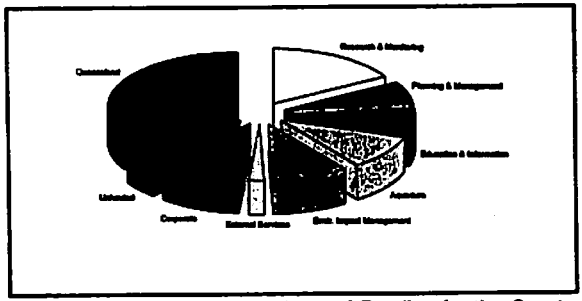

Figure 5. Percentage Breakdown of Funding for the Great Barrier Reef Marine Park Authority, 1991-1992

Evaluation of Selection Alternatives

Before monitoring can take place, the reefs to monitor must be identified, the data to gather determined, and the methods and equipment selected. R&M determines what data is most relevant to the Authority's needs, and selects methods and equipment based on the latest scientific information. How sites are selected is currently determined by no set method. The worth of each potential selection method is based on whether:

1) The sites chosen cover the full range of conditions of interest to the Authority.

2) Are cost effective given their information value.

3) Are logistically feasible to monitor.

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[9]R&M must demonstrate that research and monitoring activities are vital enough to the management of the Marine Park to justify receiving almost three times more money that the Planning and Management Section (GBRMPA, 128).

Site selection alternatives include monitoring all reefs, a random selection of reefs, those reefs associated with current research projects, and a biased selection of reefs.

Monitoring All Reefs

While the only way to ensure that the sites chosen represent the full range of conditions of interest to the Authority is to monitor all reefs, the enormous resources and time this would require does not exist. Further, the information value gained from monitoring over 3000 reefs may not be cost effective even if possible. Finally, monitoring of many reefs in the Marine Park is not logistically feasible due to military activities, prohibitive distances from the nearest port, and lack of facilities within a reasonable distance.

Monitoring a Random Sample of Reefs

The number of reefs needed for a random sample covering the full range of conditions of interest is not feasible given limited time and resources. The information value gained from a random sample may not be cost effective. Further, this method does not consider the logistical constraints noted above. While random sampling would select a statistically independent set of reefs, the high variability of reef characteristics across space precludes deriving missing data from the sample.

Monitoring Researched Reefs

While monitoring at reefs currently being researched is obviously logistically feasible and of interest, the type of information sought from research initiatives differs from that of baseline monitoring. Research projects are developed in response to specific questions, while monitoring efforts address broader data needs. Thus, monitoring only at research sites may not cover the full range of conditions of interest. In addition, most research projects are conducted by outside organizations and are often supported by other sources as well as the Authority. Hence, reefs that are cost effective as research project sites may be prohibitively expensive to monitor solely with Authority resources.

Monitoring a Biased Sample of Reefs

Since all reefs cannot be monitored, the best way to ensure that the full range of conditions of interest are represented by a logistically feasible set of cost effective sites is to select a biased sample of reefs. The Reef Research Allocation Model (RRAM) is being developed as a spatial decision support tool to provide a method of biased sampling for use by R&M.

The Reef Research Allocation Model (RRAM)

RRAM provides a logical framework to identify an "optimal" number and distribution of baseline monitoring project sites across the Marine Park for a given average yearly budget and set of research priorities. The model ranks each reef in

the Marine Park by its value as an information source for an Authority-defined research agenda, adjusts this ranking for the logistical constraints of monitoring each reef, ranks the reefs by information value per unit cost of monitoring, and selects the set of reefs fundable within the average yearly budget that represents a high total information value per unit cost while maintaining diversity of representation of reef and community types.

Thus, RRAM would be used by R&M as a biased sampling tool to help decide how many and which reefs to monitor for a set of parameters of interest during a given time period. R&M staff determine current issues of interest to the Authority, influenced by their perception of the "cultural ecology" noted above, scientific knowledge and personal experience, and design monitoring programs of varying duration to address them. The set of reefs to monitor for each program would be chosen using the allocation generated by RRAM as a guide, subject to the direct approval of the head of the section, and the indirect approval of the EO and the Chairman.

To ensure its utility as a tool for managers, RRAM is:

1) Simple, to allow use by users with varying backgrounds, needs, and technical abilities.

2) Flexible, to allow easy updates as data becomes available or priorities change.

3) Adaptable, to use data of many types (e.g., highly quantitative statistics and qualitative knowledge of experts), qualities, and scales.

4) Applicable, for use with other spatial allocation questions.

RRAM also contains an error tracking model, providing managers with an approximation of the reliability of the results given the quality of the data. In addition to improving the implementation of the decision process, RRAM provides a detailed record of the process used to make each allocation decision, allowing managers to assess the effectiveness of the decision process itself in selecting appropriate sites over time. The model runs in Arc-Info Geographic Information Systems (GIS) software on Unix-based Sun Sparcstations.

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Appendix 1: Relevant Legislation

Commonwealth Acts

Continental Shelf (Living Natural Resources) Act, 1968
Environmental Protection (Impact of Proposals) Act, 1975
Environmental Protection (Sea Dumping) Act, 1981
Fishing Industry Research and Development Act, 1987
National Parks and Wildlife Conservation Act, 1975
Protection of the Sea (Civil Liability) Act, 1981
Protection of the Sea (Discharge of Oil from Ships) Act, 1981
Protection of the Sea (Powers of Intervention) Act, 1981
Protection of the Sea (Prevention of Pollution from Ships) Act, 1981
Wildlife Protection (Regulation of Imports and Exports) Act, 1982
World Heritage Properties Conservation Act, 1983
Australian Heritage Commission Act, 1975
Coastal Waters (State Titles) Act, 1980
Fisheries Act, 1952
Pollution of the Sea by Oil Act, 1981
Coastal Waters (State Powers) Act, 1980
Conservation Legislation Amendment Act, 1988
Historic Shipwrecks Act, 1976
Sea Installations Act, 1987

Queensland Acts

Beach Protection Act, 1968-1989
Clean Waters Act, 1971-1988
Constitutional Powers (Coastal Waters) Act, 1980
Fauna Conservation Act, 1974-1989
Fisheries Act, 1976-1989
Harbours Act, 1955-1989
Marine Parks Act, 1982-1988
National Parks and Wildlife Act, 1975-1989
Off-Shore Facilities Act, 1986

Appendix 2: The Great Barrier Reef Ministerial Council

Commonwealth Members

Honourable Ros Kelly, MP, Minister for the Arts, Sport, the Environment and the Territories
Honourable Simon Crean, MP, Minister for Primary Industries and Energy

Queensland Members

Honourable Pat Comben, MLA, Queensland Minister for the Environment and Heritage
Honourable Ed Casey, MLA, Queensland Minister for Primary Industries
Secretariat
Staff member of Canberra Office of the Great Barrier Reef Marine Park Authority

Appendix 3: Major Agreements Concerning the Great Barrier Reef Marine Park

1979 - Emerald Agreement: Reached between the Prime Minister of Australia and the Premier of Queensland. Established the Great Barrier Reef Ministerial Council and the principle of "complimentary management" of the Marine Park.

1980 - Basis of Agreement between the Commonwealth and Queensland governments on how to manage the Capricornia Section of the Great Barrier Reef Marine Park. Set
guidelines for the role of agencies in day to day management and determined how costs would be met. Extended for use in the other sections of the Park.

1987 - Draft memorandum of understanding with the Department of Defence hoping to establish that military activities will avoid sensitive environments within the Marine Park if at all possible.

1987 - Memorandum of Understanding with the Commonwealth Department of the Arts, Sport, the Environment, and the Territories on the operation of the Environmental Protection (Impact of Proposals) Act of 1975.

1988 - An agreement between the Commonwealth and Queensland governments and the Authority confirming the legitimacy of existing day to day management policies already in place.

Appendix 4: Commonwealth and Queensland Agencies Involved in Marine Park Management

Commonwealth Agencies

Department of the Arts, Sport, the Environment, & Territories Australian
Maritime Safety Authority
Coastwatch
Australian Federal Police
Department of Primary Industries
Bureau of Tourism Research
Australian Institute of Marine Science
Commonwealth Scientific & Industrial Research Organization
Department of Finance and Treasury

Queensland Agencies

Department of Environment and Heritage
Boating and Fishing Patrol
Water Police
Department of the Premier, Economic and Trade Development
Port Authorities Association
Department of Primary Industries
Department of Business, Industry and Regional Development
Boating and Fishing Patrol Offices

Appendix 5: Membership of the Great Barrier Reef & Queensland Marine Parks Consultative Committees, 1991-1992

Helene Marsh, James Cook University of North Queensland

Tony Fontes, Barrier Reef Diving Services

Denis Griffith, Queensland Sport and Recreational Fishing Council

Eddie Hegerl, Australian Littoral Society and Queensland Conservation Council

Tor Hundloe, Industry Commission

Alan Jeffreys, Australian Conservation Foundation Inc.

Harley Juffs, Queensland Department of Primary Industries

Bill Kehoe, Queensland Commercial Fisherman's Organisation

Graeme Kelleher AM*, Great Barrier Reef Marine Park Authority

Gordon McKauge, Far North Queensland Promotions Bureau Tourism Task Force

Andre Maestracci MBE, Ansett Transport Industries Limited

David Mazitelli, Commonwealth Department of Tourism

Dave Perkins, Queensland Department of Environment and Heritage

Jim Wallace, Association of Marine Park Tourism Operators and Quicksilver Connections

Wally Ziegelbauer, Aboriginal and Torres Strait Islander interests

Ald John Cleland, Cairns City Council

Ted Loveday**, Queensland Commercial Fishermen's Organisation

*Unlimited membership as the Authority's representative
**Member only of the Queensland Marine Parks Consultative Committee

Appendix 6: Advisory Committees to the Great Barrier Reef Marine Park Authority

Great Barrier Reef Consultative Committees

Queensland Marine Parks Consultative Committee
Crown-of-Thorns Starfish Research Committee
Advisory Committee on Research into the Effects of Fishing on the Great Barrier Reef Region
Torres Strait Baseline Study Advisory Committee
Water Quality Technical Advisory Panel
The Great Barrier Reef Aquarium Advisory Board

Appendix 7: National and International Organizations with Authority Representation

International Tropical Marine Resource Centre (INTROMARC) - Includes the Authority, the Australian Institute of Marine Science, and James Cook University of North Queensland. Provides expertise to foreign countries on a commercial basis.

Australian Marine Science and Technology Limited (AMSAT) - Includes the Authority and all Commonwealth government agencies with major marine science responsibilities. Provides expertise internationally on a commercial basis.

International Marine Parks Project - Includes the Authority, the International Union for the Conservation of Nature (IUCN): Commission on National Parks and Protected Areas, and the World Bank. Program to identify areas worldwide for conservation as Marine Parks.

Ocean Rescue 2000 Project - Includes the Authority, the Commonwealth Department of Art, Sport, the Environment, and Territories, and all state and territory governments. Program to improve the state of the Australian Marine Environment.

Strategic Plan for the Great Barrier Reef World Heritage Area - Includes more than 60 Australian and international organizations. Working group to draft a plan for the protection and management of the Great Barrier Reef World Heritage Area.

Appendix 8: Senior Staff of the Great Barrier Reef Marine Park Authority, 1991-1992

Full Time

Chairman, Graeme Kelleher, AM
Head, Canberra Office, Peter Ottesen
Executive Officer, Wendy Craik
Secretariat, Chris Smalley
Head, Planning & Management Section, Peter McGinnity
Head, Environmental Impact Management Section, Kate Shurcliff
Head, Administration Section, Ross Hebblewhite
Head, External Services Section, Daniel van R. Claasen
Head, Research & Monitoring Section, Simon Woodley
Head, Education & Information Section, Ray Neale
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Part Time

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WORKING TOGETHER IN PUGET SOUND

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The Puget Sound Program, formed in 1991, is one of the cornerstones of the ecosystem protection and watershed restoration activities of the U.S. Fish and Wildlife Service's Olympia, Washington State Office. The program is designed to provide the catalyst for partnerships among U.S. Fish and Wildlife Service programs and between the U.S. Fish and Wildlife Service and other federal, state, local and tribal entities, businesses, and organizations.

The Puget Sound Program has a mission of protecting and restoring the natural resources of the greater Puget Sound basin, which includes Hood Canal and portions of the Straits of Juan de Fuca and Georgia to the Canadian border, and many tributary watersheds. The basin is bounded by the Olympic mountains on the west and the Cascade Range on the east. Puget Sound is a deep fjord-like estuary supporting a wide diversity of terrestrial, riverine, estuarine, and marine creatures.

The 3.4 million people now living in the Puget Sound basin are expected to be joined by another 1.1 million by the year 2010. Agricultural and forestry activities, and urban, suburban, and industrial development have resulted in substantial habitat loss and degradation, as well as declines of many economically and culturally important fish and wildlife species.

Recognizing the value of, and threats to, Puget Sound, the Environmental Protection Agency (EPA) designated Puget Sound as part of the National Estuary Program in 1988, formalizing the activities of a state-federal partnership which had already begun development of a management plan for the Sound. The resulting 1991 Puget Sound Water Quality Management Plan was the first Comprehensive Conservation and Management Plan adopted by the EPA Administrator under the National Estuary Program. The Plan, while focusing on water quality issues, also addresses habitat protection and restoration and public education.

In cooperation with many partners, the U.S. Fish and Wildlife Service, through the Puget Sound Program, is helping to implement elements in the Management Plan. The Management Plan was used as the starting framework for the development of the Puget Sound Program, as a way to both identify the appropriate roles the U.S. Fish and Wildlife Service could fill with the Program when it was formed in 1991, as well as to help identify appropriate partner agencies. The wetlands restoration and contaminants monitoring elements in the Management Plan have been the initial focus areas for the Puget Sound Program's efforts to implement the Plan.

Habitat Restoration

The Puget Sound Program has identified three estuaries and one watershed in which habitat restoration efforts are currently focused: the Snohomish River estuary near Everett, the Elliott Bay/Duwamish River estuary in Seattle, the

Commencement Bay/Puyallup River estuary in Tacoma, and the Skokomish River watershed, draining into Hood Canal, a natural waterbody in the west side of the Puget Sound basin.

The Puget Sound Management Plan tasks the U.S. Fish and Wildlife Service, Washington Department of Ecology, and Environmental Protection Agency with leading the implementation of pilot wetlands restoration projects and developing an interagency strategy for long-term wetlands restoration. These three agencies, in cooperation with the Washington Department of Wildlife and Snohomish County are restoring tidal connections to a wetland that was diked off for agricultural uses early in this century. This project in the Snohomish River estuary will serve as the pilot for a 450-acre dike-breaching project being planned for another location in the same estuary.

Contrasting restoration efforts in the rural Snohomish River estuary, pilot restoration projects are also underway in the urban Duwamish River estuary in a port/industrial area of Seattle. Partners brought together through the Coastal America process include the Environmental Protection Agency, U.S. Army Corps of Engineers, NOAA/National Marine Fisheries Service, General Services Administration, and Port of Seattle. Three small sites along the tidal Duwamish River shoreline are being restored to provide intertidal beach and marsh habitat, with riparian buffers. Each project includes different features demonstrating possible methods of restoring habitat in developed, constricted river corridors. These include removal of shading and derelict structures, removal of fill material, and recontouring ditches to create off-channel tidal sloughs.

The involved agencies are committed to at least 10 years of follow-up monitoring for all of these pilot projects, although the intensity of each monitoring effort may vary depending on the availability of funds. Based on many of the lessons learned from these pilot projects, the involved agencies are developing a strategy for continued interagency efforts to restore lost wetland resources in the Puget Sound basin.

The Puget Sound Program provides habitat restoration expertise to other Fish and Wildlife Service programs, most notably supporting the Natural Resource Damage Assessment and Restoration process of the Service's Contaminants Program. In both the Seattle and Tacoma harbor areas, the Puget Sound Program is helping to lead habitat restoration planning and implementation efforts which are being funded by Natural Resource Damage Assessment settlements. These efforts involve close partnerships between the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, state agencies, local governments, native American tribes, businesses, and citizens. The lessons learned from the pilot Coastal America projects in the Duwamish River estuary have been very helpful to these planning efforts. The Puget Sound Program helped to produce a cumulative impacts analysis and inventory of potential restoration sites to assist the restoration planning process for Tacoma's Commencement Bay and lower Puyallup River.

The Puget Sound Program has joined with the Skokomish Indian Tribe, the U.S. Forest Service, Mason County, and several other agencies and groups to restore habitat in the Skokomish River Watershed. The Forest Service has already begun repairing slope failures caused by road construction and logging in the upper, federally-managed portion of the watershed. The Puget Sound Program has prepared a summary of available fish and wildlife information for use in a watershed assessment, and is helping to identify needed habitat restoration projects in the middle and lower reaches of the watershed below the National Forest boundary.

Implementation of the President's Forest Plan is solidifying the relationships of many entities to restore ecosystem health in watersheds damaged by timber harvest and related activities. The Fish and Wildlife Service is working closely with the Forest Service and others to select target watersheds and implement joint restoration efforts. The Puget Sound Program is one of the key Fish and Wildlife Service programs which will be working to restore habitat in these target watersheds.

Contaminants Monitoring

Another key element of the Puget Sound Management Plan is the Puget Sound Ambient Monitoring Program, a long-term, interagency program to evaluate the health of Puget Sound. Puget Sound's sediments, fish, shellfish, and water column are sampled on a regular basis to evaluate contaminant levels and trends, and to identify areas needing special attention for protection or clean-up. In cooperation with the Washington Department of Wildlife, the Puget Sound Program developed the monitoring plan for evaluating Puget Sound's seabird populations and their contaminant levels. The Washington Department of Wildlife leads the population monitoring, and the Fish and Wildlife Service, through the Puget Sound Program, is responsible for the seabird contaminants monitoring. Currently studies are underway with surf scoters and pigeon guillemots to evaluate their suitability as long term contaminants monitoring species. Contaminants evaluations of surf scoters is expected to begin in winter 1994-1995.

The Puget Sound Program has also worked with the Washington Department of Wildlife and U.S. Navy to investigate whether contaminants might be the cause of reproductive failures in bald eagles in the Hood Canal area of Puget Sound. Preliminary results indicate that elevated levels of polychlorinated biphenols (PCBs) may be at least one cause of the reproductive problems. Further evaluation will be conducted to better define the problem and identify solutions.

Education and Outreach

The Puget Sound Program's education and outreach efforts have included sponsoring agency and public restoration information workshops, organizing annual Coastweeks events to highlight ongoing restoration activities and the values of Puget Sound's natural resources, and working with schools. An outreach strategy is currently being developed to target teachers, schoolchildren and their parents in watersheds which are priority habitat restoration areas for the Puget Sound Program

and partners. Restoration activities and follow-up monitoring are planned to be integrated into local school curricula to both educate students and build community stewardship. The Service is a partner in the Northwest Watersheds Education Alliance, which protects and restores watersheds using students and communities. This program links globally through the highly acclaimed Global Rivers Environmental Education Network (Project GREEN). The Puget Sound Program is also participating in a citizen-agency coalition to help build a common vision for the protection of the Green River watershed, which flows into Seattle's Duwamish River estuary and Elliott Bay.

Partnerships Are the Key

All Puget Sound Program activities involve working with partners both inside and outside the U.S. Fish and Wildlife Service, with several advantageous results. Duplication of effort is minimized, financial and technical capabilities are maximized by sharing effort among participants, information is more easily exchanged about problems and opportunities, and increasingly, priorities for action can be jointly set. In the Pacific Northwest, with spotted owls and salmon serving only as the first of possibly many endangered species crises, combined efforts of agencies and private partners are the only way to muster sufficient resources to protect remaining intact ecosystems and restore the damaged ones.

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TRACKING PROGRESS IN PROTECTING ESTUARIES

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The authors present procedures that individual estuary-protection programs can use to track progress in achieving protection objectives and targets. The focus of the procedures is on obtaining regular (e.g., quarterly) information on the outcomes of a variety of estuary protection programs.

The major purpose of outcome information is to assist program managers in improving their programs. With information on estuary protection outcomes, program personnel will be better able to identify where program activities are achieving desired results and where they are not. The information presented, however, will not by itself, indicate why progress, or the lack of progress, has occurred.

A second major purpose of outcome information is to increase estuary program accountability to elected officials and the public for the resources applied to these programs -- by indicating the extent to which estuary --protection programs are achieving results.

For national purposes, to the extent that many estuary programs use similar procedures, such information can be accumulated and reported to provide a national perspective on progress in estuary protection. With over 100 estuaries around the nation, this comprises an important measurement of national environmental protection.

Thus, the information obtained by these procedures should be useful to federal, as well as state and local officials.

Coverage and Scope

The procedures described track progress in the following categories of estuary protection activities:

1) Progress of individual local governments in implementing estuary protection actions and activities.

2) Progress in encouraging households and boaters to undertake actions that reduce potential estuary pollution.

3) Progress in encouraging key industries to alter their practices and to reduce their release of polluting substances.

4) Finally, and ultimately the most important, progress in achieving overall improved water quality, improved condition of living resources, and

increased ability of the estuary to support desired public and business uses of the estuary waters.

The paper lists a set of basic indicators of estuary protection outcomes, and describes procedures that can be used by estuary protection programs to obtain regular, e.g., annual or quarterly, data on these indicators. The paper includes illustrative data collection instruments (such as questionnaires) that can be adapted for use by individual estuary programs. Estimates are provided as to the extent to which an estuary is likely to need special resources to utilize these procedures.

The paper also describes steps (the process) that estuary programs can take to develop their own version of the outcome indicators and data collection procedures.

Basis for These Procedures

The Urban Institute examined numerous materials relating to performance indicators and held numerous interviews with EPA and estuary protection personnel. During 1992 and 1993, two estuaries participated as pilots and helped develop and test these outcome monitoring procedures: Buzzards Bay (Massachusetts), which had recently completed development of its Comprehensive Conservation and Management Plan (CCMP), and Tampa Bay (Florida), which was just beginning its program and has not yet completed its CCMP. National Estuary Program (NEP) personnel from each of these two estuaries and The Urban Institute team worked together over 14 months to identify appropriate indicators of estuary protection outcomes and low-cost data collection procedures. Most of the procedures reported here have been tested by one, and sometimes both, of the estuary programs, or are in the final stages of testing as of this writing.

The principal tests conducted have been the following:

1) Both estuaries pilot tested "Government Action Checklist" procedures. The joint estuary-Urban Institute team worked with public officials, citizen groups, and other professionals in each estuary to develop a checklist of government actions that the officials believe are important for governments in each estuary to implement. Procedures for assessing the extent to which each item on the checklist has been achieved by each local community were developed. (In Buzzards Bay, the progress ratings are being assessed by an existing citizen's coalition. In Tampa Bay, the assessments are being conducted by the Regional Planning Council). Repeating this process annually will provide officials and the public with an indication of progress over time. The information generated is also expected to be useful to the individual communities to help them identify gaps that need to be corrected.

2) Tampa Bay conducted a pilot test of a random sample of households throughout the area and, separately, a survey of residents in two

neighborhoods who were given special guidance in ways households can protect estuary waters. In both surveys, the purpose is to assess the extent to which activities being conducted by the estuary are achieving results in the form of improved bay protection activity by households and to provide baselines for measuring progress in future years when the surveys are repeated by the estuary.

3) Buzzards Bay piloted a survey of boaters to identify the extent to which boaters are properly handling wastes. Subsequent repeat surveys will indicate progress achieved after efforts have been made to inform boaters on recommended waste-handling procedures.

4) Buzzards Bay undertook an initial test of a survey of industries that generate hazardous/toxic waste. The purpose is to provide a baseline for future periodic surveys to help identify whether programs to reduce hazardous waste (and to improve waste handling) are achieving desired results and to what extent.

5) Both sites developed and tested procedures for "Bay Quality Indices." The indices combine key available indicators of water quality, condition of living resources, such as fish and shellfish, and the ability of the waters to support public and business uses such as shellfishing and swimming. These indices can also be broken out by major embayments of the estuary. The indices are based on available data and do not represent the ideal composition of such indices. The indices, however, reflect the practical cost limitations on data collection. A key feature is that the indices are understandable to public officials and the public.

The Process of Developing Estuary Protection Outcome Monitoring Procedures

The candidate procedures presented in this paper are not intended to be mandatory for estuary programs. Each estuary program will likely want to develop its own version of such procedures. The procedures identified here are intended to be starting points for other estuaries that are not already monitoring the outcomes of their estuary protection programs. Some suggestions contained here may also be useful to estuaries with existing outcome monitoring procedures -- for improving their efforts.

We recommend that estuary programs use these procedures as a starting point and identify which data elements and which data collection procedures are appropriate for their own estuary. For examples, what items should be included in their own "Government Action Checklist?" Which topics should be covered by the various household and industry survey instruments? Which elements are practical for inclusion in their own Bay Quality Index?

The paper recommends that the process for developing outcome monitoring procedures should involve existing policy and management committees to review the

overall set of performance indicators and the various procedures. The section of the paper that describes each procedure also describes a process that a local estuary program can use to develop its own version of those procedures.

Cost of the Procedures

Each survey procedure described here requires annual activity by the estuary to track progress. Surveys of households or organizations (the Household Survey, Boater Survey, and Toxic/Hazardous Waste Industry Surveys) can use mail survey procedures (if ample follow-ups of non-respondents are used to obtain reasonably credible response rates). Random samples can also be used to reduce collection costs, rather than attempting to survey all households or all organizations. Mailing costs are likely to be small, but the administration of the survey requires staff time to process the mailings, do the tabulations, and prepare the reports. Clerical staff and, perhaps, volunteers can be used on these activities so such surveys should be feasible, even for small estuary-protection programs.

The cost of regular Bay Quality Index preparation depends on how much data collection is done regularly on the various components of the Bay Quality Index. An ideal bay quality index would likely require major resources for regular collection of a large number of, often complex, water quality and living-resource condition measurements. The use of volunteer citizen monitoring of some data elements (such as used by Buzzards Bay and other estuaries) will increase the feasibility of collection of some Index components for those estuary programs with highly limited resources.

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THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM: A LOOK TO THE FUTURE

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Background

Estuaries are areas traditionally noted not only for the habitat they afford various fish, shellfish, migratory bird, and wildlife populations, but also for their inherent recreational, commercial, and aesthetic value. Unfortunately, these areas have come under increasing anthropogenic pressure during the past few decades. As one means of dealing with this problem, Congress established the National Estuarine Sanctuary Program as part of the Coastal Zone Management Act of 1972. Over the past two decades the program has undergone two name changes and the addition of approximately one designated Reserve per year, but has still adhered to its original mission -- to protect designated estuarine resources to allow for the development of effective research and education programs.

As specified in the CZMA, NERRS has a five-part mission:

1) To ensure long-term protection of Reserve sites to allow for thorough study.

2) To promote Reserves as effective study sites for use by various public and private organizations

3) To coordinate research at Reserve sites to allow for more informed coastal management decisions.

4) To gather and make available estuarine research to improve understanding and management of estuarine areas.

5) To further public education on and understanding of estuarine areas.[1]

Over the first two decades of NERRS, significant progress has been made in acquiring resources and designating Reserves. More recently, attention has been focused on fulfilling the five "missions" of the program, with several success stories to show for it.

Long-term Protection

The purpose of protection of Reserve sites is to encourage the use of the sites for long-term studies. Therefore the goal of long-term protection is not necessarily restoration, but simply the establishment of appropriate field laboratories, including both the natural environment and research facilities. The establishment of "control" sites for estuarine research has been accomplished at each Reserve

through coordinated efforts of property acquisition, facility construction, and site operation at the federal, state, and local levels.

The first Reserve was established at South Slough, Oregon in 1974. Since that time twenty-one others have been designated in seventeen states and the Commonwealth of Puerto Rico. At this time, nearly 450,000 acres of estuarine waters, wetlands, and uplands are managed as part of NERRS.[2]

To ensure diversity among areas designated as Reserves, the site selection process has a built-in geographical aspect in that the CZMA established biogeographical classes of ecosystems and placed emphasis on designating Reserve sites in each class. The biogeographic classification scheme has divided the nation's coastal regions into 13 regions and 29 subregions. To date, NERRS has established Reserves in each of the regions and 17 of the 29 subregions, and has begun the designation process for Reserves in 3 others (Figure 1).

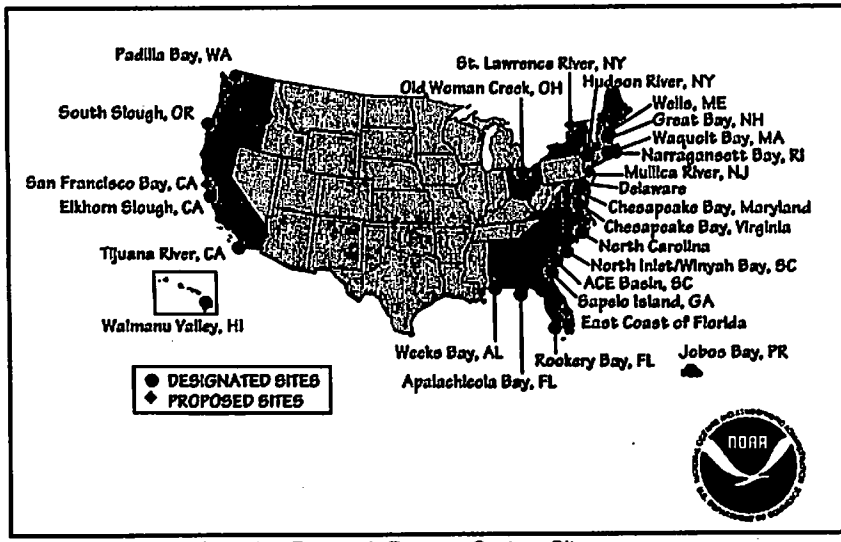

Figure 1. National Estuarine Research Reserve System Sites

Acquisitions of estuarine property rely on a combination of local, state, and federal funds, and are generally phased in over a number of years. Funds collected from states and local entities have often far exceeded the required match. A second method of enlarging the boundaries of Reserves is by reliance on conservation easements, which allow states to manage private lands within Research Reserves. Additionally pre-existing state and federal lands are often incorporated into the Reserve boundaries.

Once Reserve lands are acquired, there remains the task of maintaining the sites as appropriate long-term research facilities. An important requirement of this is monitoring the uses of the Reserve grounds and surrounding areas. Although

Reserve managers do not have regulatory authority over the land use permitting process, they are often sought out for input into the process where Reserve areas are potentially affected.

The construction of adequate research facilities has become a priority for many Reserves throughout the system. As part of this effort, laboratory facilities, research vessels, and visiting researcher quarters have been constructed on many sites in the past few years. Each of these improvements facilitates the use of Reserves as proper research facilities.

Encouraging Research at Reserve Sites

Within the United States, several different federal agencies are involved in estuarine research in one form or another. Among them are the Environmental Protection Agency (EPA), National Science Foundation, and the U. S. Fish and Wildlife Service. Within each of these agencies are a number of programs dealing specifically with estuaries, such as the National Estuary Program, Long-term Ecological Research, and Land Margin Ecosystem Research.[3] The unique resources of NERRS make the Reserve sites ideal, although sometimes underutilized, study sites for estuarine research.

The Elkhorn Slough National Estuarine Research Reserve (ESNERR) has done a particularly good job of attracting research by organizations and individuals not specifically linked to NOAA or the California Department of Fish and Game, the two administering agencies. The research conducted at ESNERR has benefitted from not only the dynamic environment on the Reserve grounds, but also the relatively large number of academic institutions in the area. Colleges and universities that have been associated with past projects include Cabrillo College, Moss Landing Marine Laboratories, Santa Clara University, Stanford's Hopkins Marine Station, and the University of California at Santa Cruz.

Research at the ESNERR is not limited to academic institutions, however. Among other institutions involved in one-time or ongoing research projects here are the Nature Conservancy, Coastal Conservancy, U. S. Geological Survey, Moss Landing Harbor District, Smithsonian National Museum of Natural History, and the Point Reyes Bird Observatory. Within NOAA itself, the Monterey Bay National Marine Sanctuary has cooperated on tidal scouring research taking place at ESNERR. Funding for research projects has come from such varied sources as the EPA, Monterey County Water Resources, Santa Clara Valley Audubon Society, and the California Rod and Gun Club.[4]

A second Reserve, Weeks Bay National Estuarine Research Reserve (WBNERR), has been successful in luring over $900,000 worth of EPA research funds to the site, beginning FY 94.[5] One of the EPA studies, a $440,000, three-year project, will study how pesticides are processed by salt marsh plant and animal communities. Samples of sediments, biota, and the water column will be studied to determine if salt marsh organisms have any ameliorating effects on pesticides. The Weeks Bay Pollution Prevention Project, a $300,000 demonstration project, contains

both prevention and restoration functions. The prevention aspect involves no-till farming incentives, designed to reduce runoff of both sediments and pesticides. The restoration aspect involves conversion of agricultural lands to their original wetland conditions. A third project falls under Section 319 of the Clean Water Act. The basis of this project deals with installation of on-site wastewater disposal systems and monitoring of their effects.

Coordination of Research

The goal of the NERRS Research Program is to encourage research at Reserves that will further the field of coastal zone management. Despite a relatively constant level of federal funding for NERRS research being divided among researchers at an ever-increasing number of sites, significant progress toward understanding of estuarine processes has been made at many Reserve locations.

Over its history NERRS has funded two overall categories of research, monitoring and competitive research. The monitoring component of the program concerns gaining basic knowledge of the biological, chemical, and physical processes occurring at each site. The NERRS program office has separated the process into three sections as part of the National Three-Phase Monitoring Program. Phase I, Environmental Characterizations, involves analysis of existing literature and limited field assessments in order to establish a "baseline" of information about the Reserve. Phase II of the program requires a compilation and publication of a "Site Profile," detailing the history and current scientific knowledge of the Reserve. In the third and final stage of the program, Long-Term Monitoring, the Reserve identifies data needs and initiates a sampling program to track changes in ecosystem parameters. As established, the Three-Phase Monitoring Program allows great leeway for the local entities in operating site-specific monitoring programs within the national guidelines.

The Tijuana River National Estuarine Research Reserve (TJNERR) serves as the model site for establishing a monitoring program. The initial studies conducted by the primary researcher at the Tijuana River site began in 1976, well before TJNERR's designation in 1982.[6] The site profile was completed in 1992, and details such attributes as the Reserve's environmental history, ecological communities, ecosystem functioning, and environmental concerns.[7] Since the publication of the profile, researchers have continued sampling as part of the long-term monitoring process.

Competitive research topics are also of great interest to the NERR system. The purpose of such studies is to generate information on specific coastal zone management questions. Independent researchers submit proposals to the NERRS program office for review. Federal funding is then allocated based upon budgetary constraints, merits of research, and compatibility with the overall NERRS research goals. Most studies occurring at Reserve sites are funded by some combination of federal, state, and private funds.

Over the first 11 years of the Research Program (1982-1992), 190 separate research projects were funded as part of the program.[8] Research topics included such diverse subjects as wastewater discharge, nutrient processing, fish recruitment, water budgets, erosional and depositional processes, and the impacts of human activities.

Dissemination of Information

An issue closely related to that of determining research priorities and conducting studies is that of application of the findings. Reserves have traditionally cooperated with both the national office and with other individual Reserves in pulling together information from throughout the system and distributing the results to interested parties.

Although Old Woman Creek National Estuarine Research Reserve (OWCNERR) is the smallest Reserve in size, it has played a significant role in expanding the knowledge base of coastal resource managers on many subjects. In one instance, the OWCNERR hosted a 1989 conference entitled "Priorities for Great Lakes Coastal Wetlands Research" for invited U.S. and Canadian wetland scientists and decision makers. The published proceedings of this conference included the current information base on Great Lakes and coastal wetlands along with priorities for future studies.

In the academic realm, the Reserve offered a graduate course in conjunction with Bowling Green State University entitled "The Ecology of Lake Erie Wetlands." OWCNERR has also been the site for EPA and U.S. Army Corps of Engineers Wetlands Delineation Training Courses. Finally, the Reserve brought together researchers from the U.S. and Canada for the Great Lakes Algal Foray.[9]

An excellent example of a Reserve's focusing its resources on one particular environmental problem is given by Waquoit Bay National Estuarine Research Reserve (WBNERR). The WBNERR used its resources to disseminate information to the public about potential solutions to poor estuarine water quality. Waquoit Bay and areas similar to it in the New England area have suffered substantial degradation in the recent past, largely due to anthropogenic additions of nitrogen released as septic tank effluent.[10] WBNERR sponsored a 1992 conference entitled "Nitrogen Removal Onsite Wastewater Treatment Systems: Technologies and Regulatory Strategies." The purpose of the conference was to provide Massachusetts decision makers and citizens with information detailing how other states more advanced in these technologies have dealt with similar problems.

One reason for the effectiveness of WBNERR's wastewater treatment project was that it offered useful information for individuals with varying levels of understanding of the problem. For the individual interested in the technological aspects, it offered the presentation of the latest scientific research along with accompanying bibliography. For the decision makers, it offered an opportunity for discussion of feasible alternatives. For the interested layperson, it offered an easy-to-follow explanation of the problem along with potential solutions.

Education/Community Involvement

The issues of community involvement and educational outreach are perhaps the issues where NERRS has achieved its greatest successes. In most cases, the two issues are complimentary as community organizations play a major role in the educational function of the Reserves, and increased exposure by educational outreach leads to greater community involvement with the Reserves.

The Laudholm Trust serves as a prime example of community involvement in the NERRS program. This grassroots organization was incorporated in 1982 as a not-for-profit organization charged with the mission of purchasing the 250-acre Laudholm Farm property in southern Maine that was for sale at the time. This potentially developable property was one of the last remaining stretches of undeveloped land in southern Maine. Through an active campaign of fundraising ($6 million over the first eight years) and lobbying, the Trust helped arrange the purchase of the property and the joining of surrounding protected lands to form the 1,600-acre Wells National Estuarine Research Reserve.

The Laudholm Trust, however, did not end with the completion of its mission. The Trust is still active today with more than 3,200 members and 300 active volunteers. Funds raised today, approximately $800,000 per year,[11] continue to support the Reserve's on-going mission.

The mission of the NERRS Education Program is to design and implement "a comprehensive program of education and interpretation (natural, historical, and cultural) to strengthen understanding, appreciation, and stewardship of estuaries, coastal habitats, and associated watersheds."[12] Many of the twenty-two Reserves make use of educational coordinators to put the goals of the program into practice.

Although a large degree of autonomy is afforded each of the Reserves in regards to developing education programs, each site offers programs for people of all ages. Informal educational programs used at individual Reserves include bird walks, fish counts, beach clean-ups, and nature trails. Publications, videos, teacher training, and outreach education programs have also been relied upon to reach a wider audience.

Rookery Bay National Estuarine Research Reserve (RBNERR) has been especially successful in offering education programs to a diverse audience.[13] For the younger visitors there are school group tours, boat trips, and nature talks. RBNERR also offers a publication, Keep It Clean, that not only presents a well-received introduction to the estuarine environment, but also informs coastal residents on topics such as wastewater treatment and the proper use of lawn and cleaning chemicals. Some of Rookery Bay's most effective programs are its workshops for environmental professionals. The workshops are offered six to eight times per year to capacity audiences that consist of local, regional, and state decision-makers.

Future of the Program

The future of the National Estuarine Research Reserve System holds much promise, both in tangible and intangible assets. The system is set to expand to four new sites in the near future, San Francisco Bay; St. Lawrence River, New York; east coast of Florida; and Mullica River, New Jersey. These additions will raise the holdings of the NERR system to over 550,000 acres.

The focus of the early years of NERRS was, quite understandably, concerned with developing the infrastructure of the Reserve system. Emphasis was therefore placed on acquisition and construction of Reserve sites and facilities, with less attention paid to the Research Program in general. While NERRS is positioned to expand again, beginning in the summer of 1994, more emphasis is now being placed on the areas of research and education.

Prior to 1991, NERRS research funds were used to support a vast array of research topics with little national scope. A subsequent review of the NERRS research program lead to a rethinking of strategy for research funding. A new system for awarding grants based on long-term research priorities was implemented in FY 1993. What had previously been a self-professed "shotgun" approach to allocating research funds was now focused by implementation of two-year research priorities. Along with the establishment of research priorities also came new emphasis on long-term studies. No longer are research grants allocated on the basis of single-year studies, opening the door for completion of the Reserve system's goal of long-term research projects.

The NERRS Education Program has also undergone a revision of its scope. To make the program more national in focus, NERRS has recently hired a system-wide education coordinator and developed a strategic plan for revamping the education program. As part of the education program development, new emphasis will be placed on functioning as a "system of sites" to share resources and expertise.

The federal/state/local interactions relied upon to perform the many functions of NERRS will become even more important over the following decades. As research and education programs take center stage, an even greater emphasis upon the NERR "System" bodes well for completion of the division's program goals.

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ICM AND NORTH CAROLINA'S COASTAL PROGRAM: WHERE THE PARADIGM MEETS THE ROAD

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Considerable attention and interest has been generated lately regarding the "New paradigm" of Integrated Coastal Management (ICM). The paradigm is articulated by its creators, Eichbaum and Schubel, in the recently published report "Managing Wastewater in Coastal Urban Waters" (NRC, 1993). While various terms have been developed (and have waned?) to describe the planning/management process (holistic, multidisciplinary, interdisciplinary, comprehensive, to name a few), ICM does seem at present to apply principles in a unique manner. As the paradigm and resulting principles develop, it is interesting to review an existing and evolving organizational structure at the coastal-state level as a primary mechanism for achieving the potentials of ICM.

North Carolina's Coastal Management Program was among the first, federally approved programs under the 1972 Coastal Zone Management Act. Through the authority of the N.C. Coastal Area Management Act of 1974, the Coastal Resources Commission and the Division of Coastal Management were charged with "establishing a comprehensive plan" for "coordinated management" of the state's coastal area. Using the Eichbaum/Schubel construct of ICM as "a three-part process", this paper will briefly review the evolution of the N.C. Coastal Management Program. The principles and elements of the ICM process will provide background for assessing the program's current strategic planning effort as a premier example of ICM involving interaction among government, academia, citizens and interest groups. The North Carolina example will outline the integration of local land use planning, state and federal regulatory programs, joint state agency efforts (non-point source, wetlands, oceans management, cumulative and secondary impacts) in the context of the basic elements of the ongoing ICM process.

Observations will be provided on missing elements, and the practical realities of a rigid application of an academic ICM paradigm "in the field." Recommendations will be outlined for potential program improvements to realize ICM, primarily involving the "federal, state partnership."

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GEOMORPHOLOGICAL SHORELINE CLASSIFICATION AND HABITAT SENSITIVITY ANALYSIS FOR KATMAI NATIONAL PARK AND PRESERVE, ALASKA

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On March 24, 1989, the tanker Exxon Valdez grounded on Bligh Reef and discharged approximately 11 million gallons of Prudhoe Bay crude oil into Prince William Sound, Alaska. Coastal winds and currents transported the oil slick southwest into Blying Sound and westward along the north shore of the Gulf of Alaska. The storm-tossed crude oil degraded and weathered into an oil-and-water emulsion called mousse. Viscous mousse rafts occasionally stranded along the Kenai Peninsula but primarily remained offshore, engulfing the Barren Islands north of Kodiak Island, and continued southwest through Shelikof Strait. Exxon Valdez oil sporadically stranded in various concentrations along the entire length of Katmai National Park and Preserve. This event highlighted the risk of anthropogenic disturbance on pristine ecosystems even hundreds of miles from the origin. The National Park Service, recognizing that the lack of baseline data for this remote coast was detrimental to effective shoreline management, initiated the development of a digital coastal resource information system. Vertically differentiated geomorphological shoreline classifications and habitat sensitivity analyses, based on low altitude aerial photography will augment existing sensitivity indexes to facilitate park management and oil spill decision making.

Katmai National Park and Preserve is located on the Alaska Peninsula, bounded on the north by Cook Inlet and on the southeast by Shelikof Strait and the outlying Kodiak Island Archipelago. The Aleutian Mountain Range runs southwest through the park and includes volcanic peaks of over 2,500 meters in elevation within 30 km of the coast. The park lies within the Alaska-Aleutian Range physiographic province and the adjacent coastal trough of Shelikof Strait. This ridge and trough accretionary complex results from tectonic convergence of the Pacific and the North American Plates. The coastal zone is subject to multiple and complex geological processes that include isostatic rebound from glacial retreat, eustatic sea level changes from mass balance adjustments of the global water regime, and tectonic warping strongly evident by periodic volcanic eruptions and earthquakes. The coastal geomorphology is affected by these and other processes including: the combined wave energy regime of Shelikof Strait, Cook Inlet and the Gulf of Alaska; sediment supplied by glacial and fluvial erosion of sedimentary rock from the adjacent Aleutian and Chigmit Mountains; currents; wind; snow and ice accumulation; and the extreme temperature range of this sub-polar maritime climate.

The shoreline geomorphology of the Katmai coast was classified by Research Planning Institute, Inc (RPI), (Hayes, 1980, and Domeracki et al., 1981). This project was contracted by the National Oceanic and Atmospheric Administration (NOAA) in conjunction with the Outer Continental Shelf Environmental Assessment Program, encompassing much of Alaska's coastline. The Environmental Sensitivity Index (ESI) maps provide shoreline classifications for most of the southcentral Alaskan coast based on geomorphological indicators relating shoreline type and

energy regime to retention time (persistence) of stranded oil. The maps also include information and locations for marine mammal concentrations, seabird colonies, anadromous fish streams and significant shellfish beds.

Interpretation of geomorphological indicators can define the prevailing shoreline processes that control the longevity of stranded oil. For example, a wave-cut platform, an erosional feature, generally indicates a horizontal or low slope angle impermeable bedrock surface with high wave energy. Stranded oil would not persist there for more than a few weeks. On a well sorted, rounded cobble beach, oil would seep into interstitial spaces and reside until the high energy waves of winter storms roll the cobbles, transporting them vertically and horizontally along the beach face. Trapped interstitial oil could then be exposed and released into the water or redistributed along the beach. On rocky shorelines with relatively stable, large angular boulders and deep interstitial voids, trapped oil could persist for many years.

Geomorphological classifications and oil spill sensitivity indices aid in the forecasting of stranded oil persistence on various shoreline types. The ESI rates shoreline types on a scale from 1 to 10, with 1 being the least sensitive to long lasting effects from stranded oil. This index, used in conjunction with the locations and sensitivity of other biological and cultural resources, provides a basis for decision-making relative to prioritizing sites for oil spill response activities.

Oil spill assessment teams found the ESI shoreline classifications limited by the scale and intertidal area represented on the basemap, standard U.S. Geological Survey (USGS) 1:63,360 scale quadrangles. The RPI classification of the shoreline was primarily based on aerial surveys with groundtruthing, which were adequate for identifying general geomorphological trends, but failed to delineate the subtle variances in beach structure that ultimately controlled the persistence of stranded Exxon Valdez mousse on the Katmai shorelines. The coastal configuration, energy regime and shoreline type can change dramatically at different stages of the tide in areas of extensive wave-cut platforms, tidal flats, and reefs. The USGS topographic maps depict a coast outlined by the approximate mean high tide. In many areas of the parks where the tidal flux reaches 7.3 meters, the low tide may expose an additional kilometer of middle to lower intertidal shoreline not shown on USGS topographic maps. It is not clear at what tide level the ESI shoreline classifications were defined. For example, many areas on the ESI maps are classified as exposed wave-cut platforms. On the Katmai shore these are usually lower intertidal features, often fringed by middle intertidal veneers of boulders and cobbles, and upper intertidal beaches of cobbles and pebbles. On many Katmai beaches, the stranded oil was observed thrown to higher elevations by high tide waves or spray. These upper and supra intertidal strandings are often not subsequently inundated by tides on a daily basis. Despite the generally exposed location, these perched beaches have retained stranded oil longer than the bedrock platforms. This may be due to the locally sheltered environment of interstitial spaces, the absence of attached algae in the upper intertidal zone (when observed in lower zones, algae seemed to preclude the adhesion of oil mousse), and/or the retarded microbial degradation rate due to shorter periods of tidal inundation at higher shoreline elevations.

A shoreline may appear to be generally exposed to high energy waves but closer site inspection often revealed that upper and middle intertidal beaches are relatively protected by lower intertidal shoals, reefs, terraces, etc., particularly in the summer when wave energy is generally lower. The outlying lower and middle intertidal features may cause higher energy waves to break and dissipate energy before striking the upper intertidal beaches. Beach assessments in 1990, 1991 (Schoch, 1991) and transect data in 1992 (Schoch, 1993) along the Katmai coast documented stranded oil persisting primarily along the high tide line on stable beaches of moderate to high permeability. Therefore, for purposes of evaluating sensitivity to oil spills on shorelines with great tidal range, shoreline information should include a vertically differentiated description of intertidal zone geomorphology. Classifications should emphasize the characteristics of the zone most susceptible to long term oil retention (i.e., upper intertidal zone) and not necessarily the most prominent feature.

During the summer of 1990, for purposes of developing a prototype coastal atlas, the ESI maps for Katmai National Park were refined. The entire 430 kilometer shoreline of the park was reclassified horizontally to include intertidal zonation (supra, upper, middle and lower intertidal zones) based on ground surveys that annotated 1:12,000 vertical aerial photograph base maps. Local energy exposure, substrate size, substrate angularity, and permeability were qualitatively described to provide additional parameters for shoreline descriptions.

The refined classification scheme and detailed mapping of shoreline types on the Katmai coast will facilitate the decision-making process regarding oil spill response in areas of extreme tidal range where large areas of relatively sensitive habitats may be exposed at low tide levels.

With further refinement, this classification scheme could be applied to other shorelines where a two dimensional scheme provides insufficient accuracy.

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HOW ONE MORE "C" COULD RAISE OUR SCIENCE-TO-POLICY GPA TO AN "A"

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Introduction

The theme of the session is enhancing the use of science -- of scientific information -- in policy making and in environmental management. At present, I would assign a grade of "C" to our efforts in this arena and to their effectiveness. Given the widespread "grade inflation" practices and "dumbing down" of the curriculum, it's clear that, at least in my opinion, the effectiveness and the timeliness with which we incorporate advances in scientific understanding into environmental policy and management leaves much to be desired.

We hear and read a great deal of the virtue and value of communication and cooperation in maintaining partnerships ranging from business to marriage. These two "Cs" -- communication and cooperation -- are necessary, but not sufficient to significantly enhance partnerships among scientists, policy makers and environmental managers. Another "C" is needed. If we can add it and sustain it, our grade point average (GPA) in utilizing science in environmental policy and management could be raised to an "A." The "C" that needs to be added is "COLLABORATION." Collaboration is the basis for effective partnerships. Collaboration requires frequent and open communication. It requires cooperation among the participants. And, collaboration requires a shared vision, a commitment to common goals and objectives, and an integration of well defined roles and responsibilities into a team pursuit of those goals and objectives. In the remainder of this abstract I outline the elements of a new paradigm for science as a tool in coastal management. The concepts were developed initially in two workshops conducted by Stony Brook's Marine Sciences Research Center for the Hudson River Foundation and the New York Department of Environmental Conservation. The conceptual model which was described in two reports (Schubel 1990, 1991) was called the "Estuarine Science-Management Paradigm," (ES-MP).

The creation and maintenance of partnerships is at the core of the proposed strategy. It was during the second of the two workshops that Dr. Gene Likens brought to our attention the statement adopted about five years earlier at a Cary Conference on "Sustained Ecological Research: A Critical Need." This statement is reproduced as Exhibit A.

EXHIBIT A

On the Need for Partnerships of Scientists and Resource Managers

Because they have common long-term goals, we propose a new partnership between scientists and resource managers. Elements of this partnership include:

"1. Agreement by scientists to answer the questions put to them by managers, while making clear the level of uncertainty that exists and what additional research needs to be done.

2. Agreement by managers to give serious consideration to these answers and to support the continuing research toward better answers:"

Statement adopted at the Cary Conference on "Sustained Ecological Research: A Critical Need" in Millbrook, New York, on May 13, 1987: revised July 4, 1987.

The Estuarine Science-Management Paradigm (ES-MP)

The "Estuarine Science-Management Paradigm" has the following elements: research; monitoring; education; analysis, synthesis, interpretation of data for decision makers; and partnerships among scientists, environmentalists, managers, and other decision makers, and management. In the sections that follow I treat each of these very briefly.

The steps in applying the paradigm are outlined below.

Step 1. Identify through public consultation the assets/values/uses which society wants to protect or enhance.

This initial step should involve broad consultation to assess the public's desires. It should be achieved through workshops, conferences and other public forums. The results should be distributed widely for comment. A consensus should be achieved.

Step 2. Identify significant management issues related to the assets/values/uses identified by society.

This step should be carried out by key managers, a few carefully selected scientists and a few representatives of the public.

Step 3. Determine whether or not each management issue identified in Step 2 can be addressed adequately with existing data and information; determine how well it can be addressed -- to what levels of accuracy and depth.

For each major management issue there should be one or more carefully orchestrated vertical integration efforts targeted at specific themes. Each should be done by a group of experts no larger than is needed to cover the essential elements of that issue. Each team should involve the best minds possible in all required areas of expertise. Each also should make a first cut at defining the research needs, short-term and long-term, to address the management issues.

Step 4. Formulation of a Research Program responsive to management issues.

The management issues will change with time, but in all cases the scientific program should be responsive to them. One of the primary objectives of the ES-MP is to achieve and sustain a good match between management issues and the research program, and to retain enough flexibility and autonomy so that the research programs takes a relatively long view. The difference between the research program of the ES-MP and the more conventional research initiative is that, indeed, it is a program, a Program with a capital "P." The elements of the program should be identified by a group of outstanding scientists and a small number of key managers.

Mechanisms should be put in place to ensure that the projects are integrated into a program. The RFPs should state clearly what the management issues are and what information the managers believe they need, but they should be less prescriptive than the typical RFPs for coastal programs. The choice of specific questions to be asked, or hypotheses to be tested, and the approaches to be used should be left to the scientists.

All principal investigators supported by the research program must have an obligation to be part of a science-management team with managers who are actively involved with responsibility for the specific management issue. The team should meet periodically -- at least quarterly -- to review progress on the research and to explore how the results relate to the management issue.

Each of these teams of scientists and managers should meet in a more formal setting on an annual basis to prepare a "white paper" on the research and management issue. These will be evolving, dynamic reports that chronicle the ways in which the scientific program has been responsive to management needs and how research results have actually been incorporated into management strategies -- management policies and practices. The interactions between managers and scientists will lead to new research initiatives as the program evolves.

Step 5. Formulate management strategies to achieve societal goals utilizing the best scientific information.

Management of the system to ensure the assets, values and uses desired by society (Step 1) is the raison d'etre of the ES-MP. The goals and objectives of the program should be stated explicitly and in terms of assets/values/uses important

to society now and in the future. Ecosystem integrity should not be overlooked as an important value.

Step 6. Implement the management strategies.

Without action nothing of importance will happen.

Step 7. Design and implement an environmental monitoring program to assess the efficacy of the management strategies adopted

A monitoring program should be carefully crafted to meet the goals and objectives of the ES-MP. It should exploit the best of existing monitoring programs and should add observations only if needed. It should focus on generating important data of high quality and on transforming those data into information needed for the ES-MP. The importance of monitoring uses and values, and of involving the public should not be overlooked. The program should be given a rigorous check-up on a periodic basis.

Step 8. Create a science/management/ education/environmental roundtable

A permanent roundtable should be created which brings together, on a periodic basis, leaders from all the different constituencies critical to the success of the ES-MP. The number of permanent seats at the roundtable should be limited to a maximum of 25. The roundtable should provide a forum to develop and articulate a vision, to clarify goals and objectives and to undertake important projects that cut across ES-MP program elements.

Conclusions

The components of the ES-MP -- research, monitoring, education, analysis, and management are inextricably interconnected and should perhaps be portrayed like the arrows in the often used recycling logo: each activity feeds the others. The partnerships are the energy sources that fuel and sustain the cycle and give the proposed science-management model its unique character. They are the key to enhancing the timeliness and the effectiveness of incorporating advances in science and technology in environmental policy and management programs.

One activity only touched upon lightly in the previous sections is education. It is critical. Education is the mechanism for keeping the public informed and supportive. It is also the mechanism for training the next generation of scientists, managers and informed and concerned citizens -- citizens who elect our decision makers. A variety of educational materials should be developed which are suitable for different age groups, for individuals of different educational levels and backgrounds and for delivery through different media. But all must share several features in common. They must be accurate, balanced, informative and interesting. They must pose the environmental issues accurately and richly. They must identify the full range of management alternatives and assess the advantages and disadvantages of the alternatives individually and in different combinations. They

must make the factual basis of each issue clear so that important environmental problems -- problems that deserve attention -- can be differentiated from those that may be perceived to be important, but for which scientific evidence indicates otherwise. The goal is to move the technical diagnoses of environmental problems and the prescriptions for their treatment out of the arena of opinion and into the arena of specialized knowledge with proper educational vehicles.

A new paradigm is needed if we are to significantly increase the value -- real and perceived -- of science as a tool in coastal environmental management. The proposed paradigm is designed to create and sustain partnerships among scientists, environmentalists, policy makers, managers, and the public. It is designed to foster development of shared goals and objectives in a collaborative search for the most effective and creative combination of solutions. These may change as knowledge increases, as technology evolves and as societal priorities change. The partnerships can accommodate to change as long as they are powered by shared goals and objectives and not by posturing and positions. The proposed paradigm can be used effectively in combination with Integrated Coastal Management.

One more "C" -- collaboration -- could improve our science-to-policy GPA to an "A."

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THE DISNEY WILDERNESS PRESERVE: A CASE STUDY IN ENVIRONMENTAL MITIGATION

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In 1991, the Disney Development Corporation initiated plans to expand the Disney World theme park which would culminate in the destruction of approximately 560 acres of wetlands. Under the Clean Water Act, Disney was obligated to minimize the damage as much as possible and provide for the mitigation of the environmental impact. Disney, in cooperation with state regulatory agencies, federal regulatory agencies, and several environmental non-government organizations, participated in processes and decisions which led to the creation of a unique and innovative mitigation plan. The Florida Department of Environmental Regulation (DER) collaborated with Disney, the EPA, The Nature Conservancy and other agencies and groups to develop a plan which differed from traditional approaches to environmental mitigation. According to this plan, Disney would finance the restoration and management of an 8,500- acre preserve which includes 2,550 acres of wetlands and is inhabited by 4 threatened species, 6 species of special concern, and the highest concentration of breeding bald eagles in the southeast. The area, named the Disney Wilderness Preserve, will be owned and managed by The Nature Conservancy. A landmark case of environmental mitigation, the plan for the Disney Wilderness Preserve signifies the importance for cooperation between private industry, government, and public-interest groups in seeking successful alternatives to conventional mitigation.

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PACIFIC OCEANWIDE ECOSYSTEMS MANAGEMENT: THE COASTAL ECOSYSTEMS PROGRAM IN THE U.S. PACIFIC ISLANDS

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Coastal habitats are vital parts of marine and terrestrial ecosystems, and this is demonstrated nowhere better than on islands. In the Pacific, coastal aquatic habitats include: wetlands; reef flats; embayments; sheltered coves; sand, rubble, and cobble beaches; and coral reefs, while dryland habitats include savannahs, forests, and lava flows. These features provide important breeding, foraging, and loafing habitat for terrestrial and aquatic wildlife, natural buffers against damaging storm waters, natural laboratories for scientific and biological research, recreational opportunities for people, and the basis for both subsistence and commercial fisheries.

Pacific Island ecosystems have the richest biological diversity of any lands under U.S. Fish and Wildlife Service jurisdiction. Unfortunately, key habitats have been lost or have deteriorated, and more than 20 species may have become extinct as a result of the rapidly increasing demands being placed on these fragile areas. Like the State of Hawaii, the Territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands, the Republics of Palau and the Marshall Islands, and the Federated States of Micronesia are experiencing rapidly increasing human populations and associated development, with corresponding loss of native habitat and other environmental degradation.

In response to these problems, the U.S. Fish and Wildlife Service's Pacific Islands Office has initiated several new efforts to protect entire watersheds or important habitats within these island ecosystems. As our staff is increasing, additional emphasis is being placed on coastal ecosystems and the vital role they play in island environments.

Coastal ecosystem management on an island is generally quite different from similar management on the mainland. Compared with the slow changes of continental land masses, the emergence, erosion, subsidence, and disappearance of a volcanic Pacific Island is a rapid geological process. The island of Hawaii -- better known as the Big Island -- continues to grow as the eruptions of Kilauea volcano pour new lava onto its shores. Southeast of the Big Island lies Loihi seamount, which is slowly raising its summit from the ocean's depths toward the water's surface. Eventually Loihi may emerge as the newest Hawaiian island. At the same time, the forces of erosion are steadily carving into the basaltic rocks of the older islands, creating features such as Waimea Canyon and the Na Pali coast on the island of Kauai. The subtropical and tropical climates of the Pacific Islands also distinguish the islands from the mainland.

An excellent example of the differences between Pacific islands and the mainland is illustrated by the recent Pacific Coastal Barriers study, in which criteria developed to identify coastal barriers for potential protection on the east and Gulf coasts were applied not only to the west coast, but also to the Pacific islands. This

evaluation resulted in the identification of only 35 potential coastal barrier units on the Hawaiian Islands, and none on the other Pacific islands. Coral reefs were considered to be barriers only if associated with mangroves. In Hawaii, mangroves are alien species that are generally considered to be a problem rather than a resource to be protected. Public comments voiced during informational public meetings on the draft coastal barriers study in Hawaii focused on these differences.

With their relatively small land masses, the Pacific islands have no extensive bay-estuary systems such as Puget Sound in the Pacific northwest and Chesapeake Bay on the east coast. But bays, beaches, wetlands, and coral reefs are still critical to the environmental health of the islands. Since almost every place on an island is near the ocean, coastal ecosystems play a vital role in the culture and economy of its residents. Increasing pressures on these ecosystems throughout the Pacific can: deplete nearshore fish and other marine life resources; destroy coral reefs, wetlands, and nearshore upland areas; interfere with natural sand movements; reduce groundwater and aquifer recharge areas; and pollute coastal waters.

To illustrate our Pacific focus, we are highlighting two proposed bay/estuary projects that will assess baseline resource values, identify potential contaminant and water quality problems, and develop and implement strategies to resolve conflicts between resource protection and developmental interests. We continue to seek funding for these projects that are designed to help ensure protection of both endangered species habitat and important nursery habitat for fish and invertebrate species of subsistence and commercial value. The third project described is in its infancy and has the potential to protect not only the coastal resources but the entire island's ecosystem while still allowing development and appropriate use of its resources.

Hanalei Bay and Estuary, Kauai, Hawaii

One of the least disturbed large bay/estuary systems in the State of Hawaii, Hanalei Bay is also one of its most scenic treasures. A portion of the estuary is bounded by the Hanalei Valley National Wildlife Refuge, created to provide nesting, feeding, and loafing habitat for four species of endangered Hawaiian waterbirds: the Hawaiian coot (Fulica americana alai), the Hawaiian duck or koloa (Anas wyvilliana), the Hawaiian moorhen (Gallinula chloropus sandvicensis), and the Hawaiian stilt (Himantopus mexicanus knudseni). The valley also is culturally important to the native Hawaiian community and produces most of the taro (a staple in the Hawaiian diet) available in the State. The Hanalei River, the primary stream flowing into the estuary, is within a forest reserve managed by Hawaii, and Hanalei Bay has been recommended for marine conservation district status on the basis of its high biological quality.

In addition to providing habitat for the Hawaiian coot, duck, and moorhen, the estuary provides habitat for several species of native fishes, including the endemic goby (Awaous stamineus) and recreationally valuable fish species including mullet (Mugil spp.) and flagtail (Kuhlia sandvicensis). A massive patch reef with total

coral coverage ranging from 30 to 60 percent is located in western Hanalei Bay. Between 20 and 50 species of fish, including important food fishes, inhabit the reef. Green sea turtles (Chelonia mydas), a federally threatened species, also venture into the bay. A sand beach barrier on the eastern side of the bay protects Puu Poa Marsh, a significant wetland area on privately owned land adjacent to a major resort development.

Developmental pressures continue to threaten Hanalei Bay and estuary. Permits for a proposed marina in the lower reach of the estuary recently were denied. Nonpoint source pollution from a ranch and homes along a portion of the estuary are among the most significant threats to water quality within the bay and estuary system. Increased recreational pressures may affect the coral reefs and the habitat they provide for marine species, as well as the beach barrier that protects the adjacent wetland habitat.

Program funding would allow the U.S. Fish and Wildlife Service to coordinate efforts of the state and other federal agencies to identify threats to these significant natural areas and to provide technical assistance to develop and implement resource management plans for Hanalei Bay and estuary. Baseline resource values would be assessed, potential contaminant and water quality problems would be identified, and strategies to resolve conflicts between resource protection and developmental interests would be developed and implemented. Additional funding from other Service programs could enhance the Hanalei Bay/estuary project by clearing Puu Poa Marsh of alien grass species and restoring its usefulness as a functioning wetland.

Ngeremeduu Bay, Republic of Palau

Ngeremeduu Bay, along the west coast of Babeldaob Island in the Republic of Palau, is the largest and best developed bay/estuary system in Micronesia. The margins of the estuary and the lower reaches of the stream are dominated by mangroves that support 14 species of indigenous birds. In addition, two endemic species of bats, the fruit bat (Pteropus pelewensis) and the sheath-tailed bat (Emballonura palauensis), roost and feed within these mangrove forests.

The mangrove estuary provides important nursery habitat for numerous species of fishes and invertebrates of subsistence and commercial value in Palau. The endangered saltwater crocodile (Crocodylus porosus) currently is found in low numbers in the estuary. However, Ngeremeduu Bay provides the most extensive habitat in Palau for saltwater crocodiles, capable of supporting hundreds of these animals. The primary breeding and feeding habitats for the crocodiles are in the upper tidal reaches of the five main rivers and tributaries including associated riverbanks and mangrove swamp forests, which drain into the bay.

The dugong (Dugong dugong) is the only herbivorous mammal that is strictly marine, and is the only surviving member of the order Sirenia (sea cows). In Micronesia, dugongs occur only in Palau, and they are totally absent from Polynesia. The resident population in Palau is the most isolated in the world and is probably not

being supplemented by adjacent yet depleted populations in Irian Jaya and the Philippines. Palau's dugongs occur in muddy waters and are known to feed on sea grasses. Ngeremeduu Bay sea grass beds may be among the most important foraging areas for this species.

Rapidly increasing development pressures in Palau seriously threaten the resources of Ngeremeduu Bay. The extensive watershed that drains into the bay is threatened by impacts from the construction of new access roads and a proposed international airport. Sedimentation from these activities poses a significant threat to the health of existing habitats within the bay. Unauthorized clear-cutting of mangrove forests and filling of adjacent reef-flat habitats has occurred within the vicinity of the Bay.

Bay/estuary program funding would allow the Service to coordinate with the Palauan government and other federal agencies to identify threats to this significant natural area and to provide technical assistance to develop and implement resource management plans for Ngeremeduu Bay. As in Hanalei Bay, baseline resource values need to be evaluated, potential contaminant and water quality problems must be identified, and strategies to resolve conflicts between resource protection and development interests must be devised and implemented if Ngeremeduu Bay is to remain functional for Palau's wildlife and beneficial to its people.

Rota Habitat Conservation Plan, Commonwealth of the Northern Mariana Islands

Unlike many other Pacific islands, the Island of Rota (located about 40 miles northeast of Guam) still retains most of its natural resources, including an intact tropical rainforest. However, the island's ecosystem is threatened by the planned development of four major golf resorts, other piecemeal development, and the distribution of public lands as agricultural homesteads.

Unlike the Hawaiian Islands, the Island of Rota exhibits only a core of volcanic material that comprises about two percent of the island's surface. The remainder of the island is composed of successively younger emergent limestone reefs. These reefs have been exposed by uplift and sea level changes over millions of years as the forces of plate tectonics shaped the Northern Mariana Islands.

High rainfall and shallow soils cause the land to be highly erodible, even in areas with minimum levels of slope. The resultant sedimentation in the streams and marine coastal areas threatens the diversity and vigor of native freshwater species and the diverse coral reef community. Uncontrolled use of a dump and use of leaching fields at beach restrooms could seriously endangered water quality in coastal areas.

Coastal ecosystems play an important role in supporting island economics on Rota. Subsistence fishing is a historic activity that is expanding to recreational activities, including an annual cliff fishing tournament. An increasing interest in tourism is placing greater pressure on beaches used for snorkeling, swimming, and picnicking. A recent tourism-related development is a park created at the site of the

only seabird colony of its kind in the southern half of the Marianas. The steep sea cliffs protect a terrace that provides ideal nesting habitat for the brown booby and red-footed booby. Brown noddies, white-tailed tropicbirds, and great frigatebirds also use the area.

Based on a request from the Governor of the Commonwealth of the Northern Mariana Islands, the U.S. Fish and Wildlife Service has entered into a pre-application consultation with the intent of providing technical assistance for the development of a Habitat Conservation Plan and a section 10(a)(1)(B) permit for the island of Rota. The purpose of the plan is to not only protect the island's native wildlife, but also to develop a comprehensive islandwide master plan that integrates local needs in maintaining island cultural values and traditions, natural landscapes, soil erosion control, and watershed protection with the establishment of wildlife conservation areas.

A wildlife biologist recently has been detailed to Rota for one year to conduct biological field studies and to help facilitate and implement the habitat conservation planning process. A number of status, distribution, and abundance surveys on sensitive native species will be conducted either by Service personnel or experts under contract to the Service. A wide variety of data are being digitized for use in a Geographical Information System. And a significant public outreach effort is being developed and implemented to involve local residents in the development of the plan.

The Pacific Islands Office strongly supports such broadbased, cooperative planning efforts as a primary means of protecting not only fragile coastal ecosystems, but entire islandwide environments.

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CHEMICAL CONTAMINATION IN THE COASTAL ENVIRONMENT: RESULTS FROM THE NOAA NATIONAL STATUS AND TRENDS PROGRAM

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Introduction

Concerned about the quality of the marine environment and the absence of any long-term national monitoring program in the United States, the National Oceanic and Atmospheric Administration (NOAA) created the National Status and Trends (NS&T) Program in 1984 to monitor spatial and temporal trends of chemical contamination and to determine biological responses to that contamination. Since 1984 annual analyses for trace metals and organic contaminants (e.g., pesticides) have been made on surface sediments, livers of benthic fish, and whole soft-parts of mussels and oysters collected from about 350 sites located throughout the coastal United States. Samples and data have been gathered under two NS&T Programs. The Benthic Surveillance Program began sampling fish and sediments in 1984. Since 1986 the NOAA Mussel Watch Project, a major component of the NS&T Program, has been measuring the same chemicals in surface sediments and whole soft-parts of mussels and oysters.

Sampling Sites and Species

The need for large-scale and long-term monitoring was emphasized by a U.S. National Research Council report (NRC, 1990) indicating that more than $130 million is being spent every year on domestic marine environmental monitoring, but that most of it is devoted to compliance monitoring, i.e., testing wastewaters and other materials prior to discharge, or making measurements near discharge points, as prescribed by regulation. Since compliance monitoring, by design, covers very small spatial scales, national programs such as the NS&T Program are the only ones that focus on wider public concerns. It is on this wider scale that national benefits should be derived from expending billions of dollars to control direct and indirect chemical discharges to coastal and marine waters.

The Mussel Watch Project was designed to describe chemical distributions over national and regional scales. Therefore, it is important for sampling sites to be representative of rather large areas rather than the small-scale patches of contamination commonly referred to as "hot spots." To this end, no sites were knowingly selected near waste discharge points. Furthermore, because the Mussel Watch Project is based on analyzing indigenous mussels and oysters, a site must support a sufficient population of these mollusks to provide annual samples.

No single species of mollusk is common to all coasts. As a result, it has been necessary to collect four different ones: the mussel, Mytilus edulis, on the East Coast from Maine to Cape May, NJ; the oyster, Crassostrea virginica, from Delaware Bay southward and throughout the Gulf of Mexico; the mussels, M. edulis

and M. californianus, on the West Coast; and the oyster, Ostrea sandvicensis,in Hawaii. The list of fish species is longer but those most commonly collected and analyzed have been winter flounder, Pseudopleuronectes americanus in the Northeast, Atlantic croaker, Micropogonias undulatus, in the Southeast and Gulf of Mexico, and white croaker, Genyonemus lineatus, starry flounder, Platichthys stellatus, and English sole, Parophyrs vetulus, on the West Coast.

Chemicals Measured

The NS&T program monitors concentrations of chlorinated hydrocarbons, polycyclic aromatic hydrocarbons, and the trace metals (silver, arsenic, cadmium, copper, chromium, mercury, nickel, selenium, tin, and zinc). Concentrations of each of these chemicals can serve as indicators of human activity. While the metals all have different uses, they can be categorized as chemicals that have been increasingly discharged to the environment as a result of industrialization. Among the chlorinated pesticides are such chemicals as DDT and chlordane. Use of DDT was banned in the United States in 1972. Chlordane use on U.S. crops ended in 1983; its use for termite control effectively ended in 1988. Another group, polychlorinated biphenyls (PCBs) is a mixture of chlorinated compounds first used in the 1920s for a number of industrial purposes. Their high heat capacities and low dielectric constants were exploited for use in electrical transformers and capacitors. Phase-out of PCB use in the United States began in 1971; a ban on new uses took effect in 1976. The three butyltin compounds are found in tissues and sediments because the parent compound, tributyltin (TBT), has been used as an antifouling agent in paint commonly used on ships and some underwater marine facilities. Its use on vessels less than 75 feet long was banned in 1988. The last organic group, polycyclic aromatic hydrocarbons (PAH), is similar to metals in the sense that PAHs occur naturally. They are found in fossil fuels such as coal and oil. Their existence, however, is also attributable to humans because they are produced when organic matter is burned. A multitude of human activities, from coal and wood burning to waste incineration, create PAH compounds in excess of those that would exist naturally.

Data Availability

A number of reports describe the spatial extent and severity of chemical contamination and changes in concentrations of contaminants over the last decade (NOAA, 1989; NOAA, 1991; O'Connor 1990; Lauenstein et al., 1990; O'Connor and Ehler, 1991; O'Connor, 1992; and O'Connor, 1993). All data used in these reports are available in electronic format from the NS&T Program. Other reports (Varanasi et al., 1989; Zdanowicz and Gadbois, 1990; Hanson and Evans, 1991; Johnson et al., 1992 a and b; McCain et al., 1992; and Myers et al., 1993), stemming primarily from the Benthic Surveillance Project, have quantified the connection between contamination and the occurrence of tumors in livers of fish.

National Distribution of Sediment Contamination

Two simple but important conclusions from analysis of sediment are that: a) high levels are found in association with cities; and b) even the high levels at representative sites are not the extreme concentrations of typical "hot spots" of contamination. The NS&T data on chemical contamination in sediments led O'Connor (1990) and O'Connor and Ehler (1991) to conclude that contamination is primarily a concern on local scales and, particularly, in urban areas rather than a being general characteristic of coastal environments.

National Trends in Contamination

While chemical concentrations in mussels and oysters can, with some important precautions, also be used to describe national distributions of contamination, data are collected primarily to monitor trends in chemical concentrations over time. Temporal trends in molluscan concentrations have been sought through two non-parametric statistical tests on data from 1986 through 1991. One, the sign test, is based on the fact that there are many sites for which year-to-year changes can be examined. The other, Spearman rank correlation, examines the correlation between the ranks of concentration and year at each site.

The basis of the sign test is identification of pairs of years between which concentrations of a given chemical at all sites show a statistically significant tendency to change in the same direction. For example, between 1989 and 1990, total butyltin concentrations decreased at 103 of 152 sites. The chances of that being a random split between increases and decreases is much less than 5% (0.05 level of significance); therefore it is concluded that, on a national scale, total butyltin decreased between those two years. For total butyltin concentrations between 1990 and 1991, on the other hand there were 80 decreases and 71 decreases and no conclusion can be drawn about national trends. Between 1989 and 1991, though, there were 115 decreases among 152 sites, indicating that total butyltin concentrations have decreased over the time they have been measured by the NS&T Program.

Year-to-year and 1986-to-1991 differences have been tabulated for other measured chemicals. When viewed on a national scale, there was usually no particular direction of change between years in the concentrations of any chemical. Where changes have occurred between consecutive years, they were most often decreases. Over the six years, from 1986 to 1991, the changes were also mostly decreases. There were increases in concentrations of silver, chromium, and lead between 1990 and 1991 that showed, as well, increases for 1991 over 1986. These increases bear watching as they are the sole indications of progressive increases in any contaminant. The organic contaminants all show decreases since the NS&T Program began.

The sign test identifies common behavior between any two years among many sites. On the other hand, the Spearman test, based on correlations between concentration and time, searches for a statistically significant linear pattern among

all years at each site. With only six years of data (n=6) a Spearman correlation coefficient must be at least 0.886 to be significant (at the 0.05 level), and only very strong trends are evident. Nevertheless, out of 2,130 tests (15 chemicals x 142 sites), there were 248 chemical/site combinations with such strong trends, 168 decreasing, and 80 increasing.

At the 0.05 level of significance, about 106 (0.05 x 2,130) of the apparently strong trends may be only random juxtapositions of concentrations and years. One way to assess which of the trends are most likely to be real is to find strong correlations at each site among groups of neighboring sites. For example, with five years of data O'Connor (1992) noted that all sites in Long Island Sound showed decreasing trends for cadmium. That correlation also applied over six years. The important point, however, is that when trends are found, they are much more likely to be decreases than increases.

Longer-term Trends

Lauenstein et al. (1990) found decadal trends in lead concentrations by comparing NS&T data from 1986 through 1988 with data from analyses of mussels and oysters collected in 1976 through 1978 under a previous "mussel watch" program (Goldberg et al., 1983) sponsored by the U.S. Environmental Protection Agency (EPA). Fifty sites are common to both programs and, at 39 of them, concentrations of lead were higher in the 1970s. The preponderance of change in the decreasing direction was attributed to the phaseout of leaded gasoline.

It is possible, under certain circumstances, to find sediment that can be specially examined so that layers in vertical sections can be associated with a sequence of years. Generally, the objective is to apply radiological dating techniques to sediments that are little disturbed by biological activity and that have sufficiently rapid rates of sedimentation (Valette-Silver, 1993). The common observation is that contamination began to increase in the 1940s, to plateau in the 1960s, and began to decrease in the 1980s. This last point is being examined through collection and analysis of cores that will allow chronologies of contamination into, at least, the late 1980s.

Conclusions

The national distribution of chemical contamination, as manifest through the nation data set of the NS&T Program, is that high levels are usually found in urban areas and that extreme levels associated with "hot spots" occur only over very small spatial scales. Annual sampling and chemical analysis of mussels and oysters reveal temporal trends in chemical contamination of the environment. The main conclusions with regard to the coastal United States are that, usually trends have not been detected, but when they are they are predominantly decreases. Since trend detection will improve as time passes (and the "n" in the correlations increases) it is expected that trends that are now obscured by uncontrollable natural factors will emerge.

Acknowledgments

NS&T Benthic Surveillance samples have been gathered and analyzed by scientists of the NOAA/National Marine Fisheries Service laboratories in Gloucester, Massachusetts; Sandy Hook, New Jersey; Charleston, South Carolina; Beaufort, North Carolina; and Seattle, Washington. NS&T Mussel Watch samples have been gathered and analyzed by: the Battelle laboratories in Duxbury, Massachusetts and in Sequim, Washington; the Texas A&M University Geochemical and Environmental Research Group in College Station, Texas; and the La Jolla, California, laboratory of Scientific Applications International Corporation.

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DAY OF THE DOLPHIN: CITIZEN PARTICIPATION IN RESEARCH OF COASTAL BOTTLENOSE DOLPHINS IN NORTH CAROLINA WATERS

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Cetacean Awareness Programs (CAP) is an organization interested in the education, research and preservation of marine mammals and their environment. "Day of the Dolphin" is an event of Cetacean Awareness Programs.

"Day of the Dolphin" is the project name for an education/research project that involves public volunteers in an effort to learn more about the biology, population, location and movements of bottlenose dolphins that inhabit areas of the North Carolina coast. "Day of the Dolphin" is an opportunity for people to become involved in a research effort that monitors dolphin activity within a projected study area. It is an opportunity to educate the public and heighten "awareness" and sensitivity toward dolphins and their costal habitats. Since 1989, citizen-volunteers have provided needed data on the neighboring bottlenose dolphins that visit or live along the North Carolina coast.

Cetacean Awareness Programs have conducted 20 "Day of the Dolphin" sighting events along the N.C. coast during the last five years. More than 800 citizen-volunteers have occupied 325 shore-based observation stations along the beaches from Kitty Hawk to Fort Fisher. Information on costal dolphins has resulted from more than 1,500 dolphin sightings recorded during these observation periods.

This paper talks about the vital role public-volunteers play by participating in a research project. It is an example of how to utilize citizens in acquiring needed information on dolphins or other subject matters. It will discuss "Day of the Dolphin" methodology and the importance and advantages of involving public-volunteers. I will summarize the results of our studies and emphasize the strategies of data collection and marine education.

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THE DEVELOPMENT OF A COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN, THE ALBEMARLE-PAMLICO ESTUARY STUDY, NORTH CAROLINA

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Abstract

The Albemarle-Pamlico Estuarine Study (APES) is an $11 million cooperative research and management program sponsored by the North Carolina Department of Environment, Health and Natural Resources and the U.S. Environmental Protection Agency (EPA). It is one of 21 estuarine systems designated for study under the EPA's National Estuary Program. The study has been guided by representatives from nearly every interest group in the region; including farmers, fishermen, foresters, environmentalists, developers, business and industry leaders, university researchers, government agencies, and local elected officials. Their goals were to study the environmental conditions of the estuary, identify problems and trends and their likely causes, and develop action-oriented management plans to address high-priority problems. The culmination of this six-year collaboration is the Comprehensive Conservation and Management Plan (CCMP).

Introduction

The Albemarle-Pamlico (A/P) Sounds of North Carolina represent the second largest estuarine system in the United States, second only to Chesapeake Bay. The A/P estuarine system is made up of Albemarle Sound (including Currituck and Croatan Sounds), and Pamlico Sound (including Core, Roanoke, and Bogue Sounds), with their many tributaries, marshes, swamps, and wetlands. These sounds are influenced by saltwater from the Atlantic Ocean and by freshwater discharges from numerous river systems. The drainage area includes all or portions of 36 counties in North Carolina, one-third of the state's total, and 16 counties in Virginia, one-sixth of the state. It is a key nursery area for east coast fisheries and supports an abundant array of plant and animal life. The natural resources of this region offer significant economic opportunities related to agriculture, fishing, forestry, tourism, and recreation.

Signs of Environmental Stress

However, like many of the nation's critical coastal ecosystems, the A/P estuarine system is showing signs of environmental stress. While the area does not have graphic environmental problems, such as the toxic wastes in Boston Harbor or Puget Sound, there are disturbing trends. Extensive new development combined with historic farming activities have led to deteriorating environmental conditions. Portions of the freshwater rivers and streams in the A/P region are unfit for fish propagation or recreation. Algal blooms have choked several river and estuarine systems. More than 26,000 acres of prime shellfish habitat are closed because of bacterial pollution. Unsafe levels of mercury and dioxin have been found in fish

tissue. Declines in fisheries are occurring annually, while disease epidemics have been reported in several species of fish and crabs. Throughout the region, draining and filling of wetlands has contributed to the destruction of vital fish, plant, and wildlife habitats. One of the greatest challenges facing the region is how to deal with population growth. In the last decade, the population in the A/P region has grown by 19 percent, double the rate of the nation as a whole. In addition, tens of thousands of tourists visit North Carolina's beaches and sounds each season, increasing demand for roads, resorts, restaurants, and recreational facilities. These symptoms are the early indication of an estuarine system in trouble.

The National Estuary Program

In response to the decline in both water quality and natural resources of the nation's most important estuarine systems, Congress established the National Estuary Program. Its principal purpose is to "promote comprehensive planning for, and conservation and management of, nationally significant estuaries." The Clean Water Act authorizes the governor of a state to request that the EPA designate an estuary to convene a management conference. Section 320 of the act states that the primary objective of a management conference is to "develop a comprehensive conservation and management plan (CCMP) that recommends priority corrective actions and compliance schedules addressing point and nonpoint sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary."

The Albemarle-Pamlico Estuarine Study (APES)

In 1987, the Albemarle-Pamlico Sounds estuary was designated under the Clean Water Act as one of the nation's first five National Estuary Programs. Important components of the National Estuary Program and APES are the consideration of water quality, fisheries resources, land and water habitats, and the interaction of humans with the natural resource of the estuarine system as a whole.

Four committees were established to guide the estuary's management conference: (1) Policy Committee, (2) Technical Committee, (3) Albemarle Citizen's Advisory Committee, and (4) Pamlico Citizen's Advisory Committee. The policy and technical committees include federal, state, and local government members and representatives of both citizen advisory groups. This structure provided a forum for consensus building and problem solving among interested agencies and user groups.

The goals of the APES Management Conference were to identify problems in the estuarine system, generate research where gaps in knowledge existed, increase public awareness of environmental issues, and find solutions to address those issues. The culmination of this six-year collaboration is the Comprehensive Conservation Management Plan (CCMP).

Development of the CCMP

Upon formation of the APES Management Conference in 1987, efforts to better understand the Albemarle-Pamlico Sounds estuary began immediately. For the Albemarle-Pamlico program to be successful, it was important to develop the technical knowledge and public understanding necessary to protect the ecological integrity of the region. In unprecedented fashion, the combined expertise of existing federal, state, and local programs sought to characterize the environmental conditions of the estuary. Estuarine health, reasons for decline, and future trends were assessed to determine the highest priority problems addressed in the CCMP. As a result, more than 100 research projects were supported through the APES program.

Successful management of the estuarine resources of the A/P region depended upon the active cooperation of citizens and local governments. The APES Management Conference sought public outreach as one of its top priorities. Public input was generated through numerous workshops and pubic meetings involving all major interest groups.

To address the priority problems identified through characterization and public input, specific action plans were developed as the CCMP began to unfold. During the planning process, three public drafts were revised through enormous government and public input to produce the final version of the CCMP. The document evolved from a series of disconnected recommendations to a well-coordinated approach to managing environmental protection and economic growth.

The recommended actions presented in the CCMP are believed to be the most effective, most feasible, and most immediately necessary to protect the health of the Albemarle-Pamlico estuarine system. The CCMP contains general management plans to address regional concerns: water quality plan, vital habitats plan, fisheries plan, stewardship plan, and implementation plan. Each plan contains goals and objectives and specific "critical steps" describing the measures necessary to implement a management action. The potential economic costs and considerations of management actions are also described.

The plan must be approved by the Governor of North Carolina and the Administrator of the U.S. Environmental Protection Agency. Once approved, the state legislature, appropriate state and federal commissions and agencies, and others will begin to examine ways in which to integrate the plan's recommendations into management programs.

Conclusion

Many people rely on the Albemarle-Pamlico estuary for their livelihood and quality of life. If current trends persist, we may lose the unique resources of this region. As a result of APES, more is known about the Albemarle-Pamlico Sounds than ever before. The Comprehensive Conservation and Management Plan

provides the necessary tools for continued management, coordination, and cooperation for environmental stewardship.

ECONOMIC INCENTIVES AND SEA TURTLE EXPLOITATION

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The high market values of sea turtle shells, meat, cartilage, oil, skin, and eggs, in conjunction with habitat loss and incidental take, are driving all seven known species to extinction. This paper will examine the economic incentives surrounding the exploitation of sea turtle eggs in developing countries, with specific reference to the Olive ridley (Lepidochelys olivacea) and the leatherback (Dermochelys coriacea) in Guatemala, El Salvador, and Costa Rica. Conservation strategies, which focus on enforcement, education, and direct manipulation of economic incentives, will be evaluated as to their effectiveness, economic sustainability, and ethical integrity. The ecological effectiveness of conservation initiatives and their ability to financially sustain themselves are of the utmost importance in developing countries where financial resources are limited. Developing countries face the additional problem that acute exploitation pressures resulting from poverty and over-population often tempt conservationists to initiate programs without questioning their ethical foundations.

Rather than simply treating the symptoms of sea turtle exploitation, the most forward-looking conservation strategies combat the economic forces which drive exploitation. Eco-tourism in Costa Rica is becoming more profitable than collecting eggs, while El Salvador's "Turtle Barter Market" program is encouraging donation of eggs to local hatcheries by giving egg collectors one point for each egg that they donate to a hatchery. These points can then be "spent" at selected stores to buy food, clothing, and tools. However, does this program amount to more than buying eggs? And does it encourage exploitation?

The ecological and financial success of conservation strategies which directly target the economic structure surrounding the exploitation of sea turtle eggs has implications foe future sea turtle conservation and management. For example, a Guatemalan non-governmental organization, which has had limited success with the enforcement and educational strategies which worked so well in North America, is considering shifting its education programs to target the market. The goal is to stimulate donations to Guatemala's network of sea turtle hatcheries by creating a demand for the eggs of collectors who collaborate with sea turtle hatcheries as opposed to the eggs of collectors who do not donate eggs to hatcheries. This increased demand for the eggs of collaborators would drive their price up, encouraging more people to collaborate with hatcheries. Although the program is appealing because it supports itself by passing the costs of conservation on the consumer, its foundations should be examined prior to implementation. Is it right to be creating a demand for the eggs of an endangered species?

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ECOSYSTEM MANAGEMENT IN THE NORTHEAST REGION

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The Fish and Wildlife Service's resource management programs in the northeastern United States is undergoing a major change. Focusing on ecosystems and embodying total quality management, team building, empowerment of employees, partnerships, and results-oriented decision making, the Fish and Wildlife Service is taking a new approach to natural resource issues in the northeastern United States.

In late June 1993, a 10-member Ecosystem/Watershed Management Team, representing all Fish and Wildlife Service programs was established to develop a watershed/ecosystem approach to protecting and enhancing fish and wildlife resources throughout the northeast. Guidance to the Team contained no restrictions relating to existing programmatic or organizational boundaries within the Region (i.e., "No existing paradigms will be left untouched.") The idea is that all program ares would work together on teams to solve fish and wildlife resource issues from an ecosystems perspective within defined watersheds.

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THE MARINE RECREATIONAL SERVICES INDUSTRY IN THE U.S. VIRGIN ISLANDS: EMERGING ECOTOURISM INDUSTRY OR JUST TOYS FOR THE RICH BOYS?

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Introduction

The U.S. Virgin Islands (USVI), with its splendid variety of islands and cays, tranquil bays and colorful reefs, boasts some of the finest marine recreation resources in the world. These help draw almost 2 million visitors to the territory each year, and provide both residents and tourists with unique opportunities for leisurely recreation and marine-related enterprise. As the tourist industry has developed in the USVI over the past two decades, marine-related businesses catering to the recreational needs of the industry have multiplied in number and variety. While boat chartering remains perhaps the most visible, high profile recreational activity within the territory, other activities relying upon the marine setting include diving, sport fishing, water sports, ferry and water tour operations. Additionally, secondary services catering to the needs of such marine recreation activities include marinas, marine-supply retailers, food and beverage provisioners, and boat service and repair shops. A host of ancillary enterprises providing on-shore goods and services include lodging, dining, shopping, entertainment, transportation, laundry, maintenance, fuel, financial and communications services. Thus the marine recreation industry plays a substantial role in the territorial economy.

Yet there has been surprisingly little documentation of the industry itself, aside from a survey done by the recreational boat industry (Marine Center Development Company, 1988), a listing of addresses in the "U.S. Virgin Islands Marine Recreation Services and Facilities Directory" (Peter, 1989), and several pages in a Caribbean study (Poon, 1990). There is little documentation recording employment in marine recreation or the amount of government revenue derived from the sector. This gap in information was made increasingly apparent as the industry itself began to witness a decline in activity dating from the disastrous effects of Hurricane Hugo in 1989, exacerbated by the onset of the national recession in 1990 and the Gulf War in 1991. The marine recreation services industry (MRSI), so reliant upon tourist arrivals for its own prosperity, has suffered lowered levels of business activity and the destruction or exodus of charter boats and marine recreation firms. While remaining members of the industry have endured this decline, expressions of government concern have been limited by the common misconception of the industry as confined to the high profile yachting sector providing "toys for rich boys" who supposedly have ready sums of money even during recession. In this paper, we examine what the marine recreation service industry encompasses, how it is regarded in relation to the environment, and how the industry contributes to the economy and commercial vitality of the USVI.

What is the USVI Marine Recreational Services Industry?

In early 1992, we distributed a self-reporting survey to all identified businesses engaged in various aspects of marine recreation. Excluded were cargo transportation, military services, commercial fishing, and support facilities judged to be outside the realm of recreation. Of the 300 forms distributed, 98 completed forms were returned; 55 other targeted firms were determined to have gone out of business or been incorporated into other enterprises. The return rate of the questionnaires approximates that experienced by Jennings (1992). The following information is in part based on this survey, which is available from Sea Grant University of Puerto Rico (Strickland and Quinn, 1992). The data in this paper largely relates to the situation of the marine industry in 1992.

A large portion of the industry comprises services other than boating activities which may be overlooked in popular perceptions of the industry. Firms offering boating activities (including charters, sport fishing and ferries) only encompass 35% of all firms providing MRSI activities; this compares to 40% in 1989. Such comparison obscures, however, the dramatic 50% decline in charter boats based in the USVI since 1988 (Marine Center Development Company, 1988). While some marine activities have expanded (or diversified) to fill some of the vacuum, other segments of the MRSI have suffered a similar contraction in overall business activity.

Despite the common notion that many businesses are fly-by-night operations managed by people similar to the shiftless, incompetent charter boat captain in the movie "Captain Ron," the sector has an enduring business record. More than a quarter of the responding firms were established prior to 1975; 59% had begun business since 1980 and about one-third since 1986. Almost half of all businesses had at least ten years experience, underscoring the continuing contribution of the industry to the broader economy. The fact that 18% of respondents began business in the somewhat lackluster years following Hurricane Hugo suggests promise for the industry's future. Contrary to popular perception that marine recreation services are consumed mainly by tourists, local residents were the single most frequently cited source of business. While not reflecting actual total client numbers or gross revenue associated with each customer group, these figures underscore links between the industry and the local community that are often overlooked.

About 70% of the businesses grossed less than $500,000 per year, most had fewer than seven employees, and were generally owned and operated by people living in the territory. Many businesses operated entirely with only one or two employees. Through professional organizations such as the Virgin Islands Marine Industries Association (VIMI), collective efforts like the annual yacht show have been organized. Despite the average limited size of individual firms, the combined volume of the 92 reporting businesses was estimated to total $32.5 million. This figure might arguably represent roughly half of the estimated total business volume of marine recreation services, assuming that the survey respondents represent roughly half of the total sector. Therefore, total business volume might approach $65 million;

if an expenditure multiplier of 1.5 is applied (as done in previous studies examining the industry in other parts of the Caribbean), business volume might approach $100 million. This would represent as much as 12-13% of total tourism expenditure and about 7% of gross territorial product.

Total full-time employment in the industry is estimated at 1,300 employees representing 4% of total private sector employment in the territory. On-the-water activities only account for 20% of total MRSI employment. Other MRSI employment opportunities tend to be ignored by common local perceptions of the industry despite the fact that mechanics and skilled repair workers receive the highest hourly wage in the sector. Annual wages and salaries for full-time MRSI employees of responding businesses totaled $30 million. If including earnings in ancillary businesses, the sum would represent 7-8% of total private sector gross pay for the territory (Department of Labor, unpublished data). These figures exclude additional wages paid to part-time or seasonal employees.

Since the responding businesses foresee a 50% expansion in marine recreation employment in coming years, it is important to consider what kinds of skills will be demanded by such jobs. This would allow better planning among potential candidates and improved program design by trainers and educators seeking to develop and place individuals interested in MRSI work. Often it was expressed that the industry fails to engage the interests and talents of local residents, despite significant efforts of some businesses to recruit and train local youths in a variety of MRSI skills. The industry, working with governmental departments and educational institutions, urgently needs to identify and publicize future employment opportunities for which young people might train, and to establish programs providing the skills specifically required by marine recreation activities.

Environmental Attitudes and Cost to Coastal Habitats

The output of MRSI activity is not free of direct environmental cost. The development of safe sheltered boat marinas has resulted in destruction of mangrove swamps and protected bays, dredging and/or filling of salt ponds and harbors, and construction of jetties. Marine communities immediately juxtaposed to, but not damaged directly by such destruction suffer from sewage discharge, trash, waste hydrocarbons, and anti-fouling chemicals leaching from boat hulls. Many of these habitats are important nurseries for both fish and lobsters. Destruction of these coastal habitats reduces the potential sustainability of the Virgin Islands' traditional small-scale fisheries, contributing to the impoverishment of a sector of society not readily retrained for work in the tourist economy.

Other deleterious effects of boat-related MRSI activities include: anchor damage to coral reefs, sea grass beds and other benthic habitats; trash thrown from boats; and pollution from bilges, toilets and anti-fouling paints. However, with the cooperation of tourists, MRSI workers and government agencies, such effects can be managed and impacts minimized more easily than those associated with the degradation of coastal habitats for the construction of a beachfront hotel. Indeed, environmental attitudes within the industry are changing: the majority of the MRSI

respondents acknowledged a positive linkage between the state of the marine environment and the state of their business. As one surveyed member of the industry said, "Should the environmental quality of the shores and waters of the USVI in particular deteriorate, my business would suffer in direct proportion to such deterioration."

This environmental awareness is also present within the recreational fishing industry in many regions of the world. While only 10 years ago most billfish boats would land their catch of marlin and other fish, most billfish today are tagged and released for scientific research. Many captains of fishing boats recognize that their livelihood depends upon the maintenance of a rapidly dwindling resource. However, sport fishers cannot yet be called "ecotourists." On the contrary, in the USVI they have recently exhibited regressive ecological thinking through the organization of a "Monster Shark Tournament" in 1993. Sharks are not a threat to bathers in the USVI and are very rarely seen by divers. However, a small segment of the MRSI evidently chooses to perceive itself as a sector of "toys for rich boys" and views the slaughter of sharks as sport. We strongly urge members of the MRSI to seek detailed information about the social and environmental effects of the contest. While it may be harsh and unfair to judge an entire industry by the activities of a few boats over three days, the international publicity associated with such an event unfortunately leaves a lasting impression with the public. Sensational headlines are also generated by the annual winter residency of 10 or more mega-yachts in the waters around St. Thomas. As the ultimate "toys for rich boys", these vessels ranging 75-200 feet are said to contribute thousands of dollars apiece to the local economy each week through the goods and services they consume; however, little is still known about their environmental impact. Other non-ecotourist activities (e.g., parasailing, jet skiing) may contribute more to the economy, without the attendant environmental cost of activities such as the shark tournament.

With the above exceptions, the appreciation of the environment and its contribution to the vitality of the MRSI can generally be found across the spectrum of activities and may serve to unify the otherwise disparate service providers. Conservation of marine resources and promotion of environmental awareness might therefore be seen to have wide-ranging benefits for many different actors within the business community, in addition to the positive effects of such upon the environment itself and the popular enjoyment of its resources. The survey responses refute the assumption that people operating on-the-water activities (notably boats for charter, diving and water sports) are environmentally unaware and unwilling to help preserve the ecosystem.

In fact, some of the most ardent supporters of environmental protection and careful conservation practices are found among the boating sector of the industry. The Virgin Islands Diving Association has been campaigning to implement a mooring system at its preferred dive sites. Similarly, many boats would willingly utilize sewage pump-out facilities and waste oil disposal systems if there were assurances that the waste would be treated or removed from the island. Presently, not all of St. Thomas' sewage treatment plants meet EPA standards, discharging thousands of gallons of minimally treated sewage daily into the sea. Many in the MRSI believe

that they are being singled out. They argue that the environmental impact of the territory's population (currently over 101,000) through both non-point source pollution (e.g., septic tank leaching and oil runoff from roads) and point source pollution (e.g., sewage outfalls) is much greater than the discharge of some 2,000 people on boats. While exceptions can always be found, most of the MRSI businesses realize that their survival depends upon drawing customers to a healthy and vibrant marine environment and generally exercise great care to prevent spoiling the beauty and quality of the natural resources; to do otherwise would be to foul their own nest, discouraging future visitors and effectively reducing their levels of business. Many are sensitive to allegations that marine recreation services are a source of pollution and cause of environmental degradation, charges which they strongly refute. Given that many marine recreation businesses are small, they often feel disadvantaged in terms of available incentives and economic or political clout when compared to larger enterprises in the broader tourist industry.

The Potential for Sustainable Development in the Industry

While marine recreation in the waters around the USVI attracts hordes of visitors, their very numbers and their impacts while in, on or around the water will have serious implications for the quality of the marine environment. Its degradation would mean the demise of one of the leading attractions for visitors to the territory, with profound and self-evident negative consequences. For the most part, marine recreation businesses are among the first to recognize the importance of environmental conservation, and work actively to encourage their customers to respect the delicate balance of the marine ecosystem. Generally, clients in the term and bare boat sectors of the industry readily abide by such principles, having chosen to forego the comforts of a hotel in search of a more "natural" holiday dependent upon a pristine marine environment. Despite the decline after Hurricane Hugo in 1989, most people in the industry anticipate significant expansion and increased employment opportunities. At this juncture, the industry and the territory at large have the opportunity to incorporate evolving principles of sustainable development in promoting the MRSI, addressing ecological, economic and social concerns which support the integrity of the natural, economic and cultural resources of the USVI.

For the community to fully benefit from such expansion, it is imperative that better facilities and training programs be established which can help interested youth identify openings in the industry and develop essential skills. Past efforts to increase the awareness and participation of local youth in different kinds of marine activities have met with notable success. The "Kids and the Sea" (KATS) program, supported through the various efforts of VIMI, Virgin Islands Marine Advisory Service (VIMAS) and Rotary members, has trained dozens of youths in water safety and boat navigation skills. Gold Coast Yachts on St. Croix has established a successful apprenticeship program recruiting local youths to learn and profit from valuable boat-building skills. As successful as such programs are, their output in terms of trained marine recreation employees still fails to satisfy the territorial demand for such skilled labor. The number of future openings anticipated requires more, not less, energy and determination to help local youths identify and train for new jobs in marine recreation services.

Perhaps most fundamentally, there is an urgent call from many in the industry for careful consideration of the exploitation and conservation of the territory's marine environment. Regrettably, the industry is commonly underrepresented on committees entrusted to protect the environment, which often meet during day-time working hours unsuitable for many working in the marine industry; MRSI representation is scant and participation irregular even on those committees which meet in the evening (e.g., the Fisheries Advisory Committee). In such a climate with minimal inter-group communication, an attitude of "us versus them" develops. Consequently, the people with a real financial interest in the sustainable development and management of coastal resources (i.e., the MRSI) find themselves disenfranchised and powerless. In a pluralistic, democratic society, we must work together to empower people with the ability to comply with and subscribe to practices which result in sustainable development. It is unrealistic to think that the development of facilities and the passing of laws will effect change in the absence of agreement and cooperation. Making the transition to sustainable development requires the practice of the politics of inclusion (rather than exclusion). Given the industry's self-acclaimed experience in conserving marine resources and encouraging sound recreational practices among its customers, it could assist in promoting greater environmental awareness throughout the community, thereby helping to dispel negative popular judgments against the industry while increasing appreciation of the greatest natural resources of the USVI.

In January 1993, 20 members of the MRSI and selected government representatives met for focused roundtable discussions, at which it was acknowledged that the government had only recently become aware of the importance of the MRSI and that the industry and the government needed to work together in areas of mutual concern. It was agreed that issues requiring further attention included: fostering a dialogue between MRSI members and representatives of government offices associated with marine recreation and marine resources; training and developing skilled employees to fill new posts within the industry; and increasing environmental awareness to protect and conserve the natural resources of the marine environment as the basis of the MRSI. The latter observation was grounded in both environmental awareness and sound business sense. We view this meeting and its recommendations as a positive step towards managing the coastal resources of the USVI for sustainable development.

Acknowledgments

We gratefully acknowledge B.L. Kojis, R. Sherwood, and C. Galimore for their constructive comments.

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EXTERNALITIES OF COASTAL DEVELOPMENT: THE BREVARD COUNTY CASE STUDY

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This paper examines the social, economic, and environmental externalities that influence the use of waterfront property in Brevard County, Florida. Externalities can be defined as the environmental costs which are not reflected in market prices. Because externalities do not have a direct market value, they are often overlooked as having a direct value to a community. It is these externalities and their impacts on the community that will be reviewed.

In the case of Brevard County, such externalities could include alteration of biological, chemical and physical coastal properties of the beach's natural habitat. It is the impact of these externalities that contribute to the conflict between commercial coastal development and environmental degradation in Brevard County. For example, Brevard County's high density development adjacent to the surf zone not only place those inhabiting individuals at high risk but subjects these coastal lands to increased frequency of flooding, accelerated coastal erosion, progressive siltation, and an overall degraded ecosystem.

In reviewing the externalities of Brevard County, environmental strategies should not only shift perspective from society's short- term needs to considering long-term beachside construction in terms of integrating externalities within future development.

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COASTAL AMERICA: A PARTNERSHIP FOR ACTION

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Introduction

Coastal America is a collaborative partnership initiative to restore, preserve, and protect the nation's coastal ecosystems. The partnership includes the federal agencies with coastal stewardship responsibilities: Commerce, EPA, Interior; the Defense agencies (Army, Navy, Air Force); and the infrastructure agencies: Agriculture, HUD and Transportation. In addition, state and local agencies and non-governmental organizations are partners in specific projects.

This innovative, action-oriented multi-agency effort was initiated in response to a growing realization that our piece-meal approach to addressing the coastal crisis has been inadequate. Although media or activity specific laws and programs have helped protect selected resources, coastal ecosystems continue to be degraded. The Coastal America partnership approach combines the resources, authorities and expertise of the federal agencies to provide a comprehensive response to our coastal problems. By building coalitions among federal agencies, state and local governments, the private sector and concerned citizens, the partnership can accomplish big tasks which no agency or program could do alone.

The Coastal America process has shown that by joining the forces of federal agencies with state, local, and private alliances we can more effectively address environmental problems along our nation's shorelines. The challenge has been to break down the barriers between the federal agencies, establish trust and develop a process that integrates federal capabilities and existing resources with state, local, and nongovernmental efforts to address specific problems. The leveraging of resources, authorities, and expertise by the partnership is helping government work better and cost less - a major goal of the Clinton Administration. Specifically, this collaborative problem-solving process has encouraged national policy formulation, regional planning and local project implementation.

National -- Policy Formulation

Coastal America is governed by a multi-agency Memorandum of Understanding which provides a national operational framework for the initiative. The management structure for this national initiative cuts horizontally across the agencies and extends vertically from the policy level to the field level (Figure 1). National policy guidance is provided by the Principals Group which is comprised of Assistant Secretaries from the partner agencies. The Under Secretary of Commerce currently chairs the Principals Group. A national interagency team of senior level national program managers provides program guidance. Nine regional interagency teams of senior level regional managers coordinate activities, develop regional strategies and implement projects. The national partnership is facilitated by a Coastal America office which is staffed by employees from the partnership agencies.

The organizational structure enables early identification of policy issues and conflicts at the local, regional and national level and encourages timely resolution of these issues by senior level policy-makers.

Since the purpose of the partnership is to encourage collaborative action to restore and protect coastal environments, policy and program directives that prevent or inhibit collaborative projects are identified by the Regional Teams and elevated to the national level for resolution. For example, a policy preventing the beneficial use of dredged material for wetland restoration was noted by a Regional Implementation Team and quickly resolved by the National Implementation Team and Principals. The resolution of this issue not only enabled the project to move forward but encouraged the development of a legislative solution for the broader national problem. Specifically, Section 204 of the Water Resources Development Act of 1992 was modified to significantly reduce the non-federal share of incremental cost for the beneficial use of dredged material.

Recognizing that the implementation of any coastal policy requires public awareness and support, the national partnership also supports projects that encourage or enable regional/local action such as educational products and outreach efforts. The partnership has developed consensus reports on coastal wetlands "The Fragile Fringe", and watersheds "Toward a Watershed Approach: A Framework for Aquatic Ecosystem Restoration, Protection and Management." In addition, educational brochures and posters on such topics as clean water and wetlands, and a "Reporters Guide to Oceans and Coastal Issues" have also been developed. Coastal America media events and progress reports also highlight the coastal crisis and describe the partnership efforts. Future projects will include electronic media products that inform the public about specific coastal problems and solutions.

Regional – Planning Process

Planning occurs at the regional level, where interagency Regional Implementation Teams (RITs) develop strategies to address specific regional problems. These strategies provide a region specific framework for program implementation and project selection. This collaborative planning approach encourages the incorporation of environmental objectives in major development plans such as the reuse of military bases targeted for closure, water resources projects and transportation system improvements. The process of comparing and evaluating specific agency plans also encourages the early identification of collaborative opportunities to restore the environment while moving forward with vital economic development. Although all of the regions are currently refining their strategies, the northeast, southeast and Gulf of Mexico have already initiated comprehensive region-wide efforts to address specific problem areas.

The northeast strategy focuses on restoration of coastal habitat affected by infrastructure development. A specific example of this theme is a major effort to evaluate priority opportunities for restoration of coastal marshes constricted by rail and road systems along the northeast corridor. Sources of funding for this restoration strategy include the Intermodal Surface Transportation Efficiency Act of

1991. Resolutions to commit resources to accomplish the restoration efforts have already been signed among the Coastal America federal partners and the states of Connecticut and Rhode Island and an agreement is pending with Massachusetts.

The southeast strategy emphasizes activities that will maximize the formation of successful alliances with non-federal and non-governmental partners to address critical coastal problems in that region. A priority problem identified by the region has been obstructions to fish migration and an aggressive effort is underway to identify and restore access to historic fish spawning habitat in the Albermarle-Pamlico Sound Watershed. In harmony with the regional strategy to maximize the abilities, resources and authorities of a full range of responsible parties, federal and state stewardship agencies such as EPA, Interior and NOAA are providing scientific expertise and identifying priority streams for restoration while infrastructure agencies, such as the U.S. Army Corps of Engineers, Transportation and the U.S. Marine Corps are providing engineering, construction and demolition services.

The Gulf of Mexico strategy is to aggressively implement the consensus action plans developed by the multi-agency Gulf of Mexico Program. The Gulf team has pooled resources from the partner agencies to initiate projects throughout the region. These projects address 5 of the 10 areas of emphasis under consideration by the working scientific subcommittees of the Gulf Program. These five areas are habitat degradation, coastal and shoreline erosion, nutrient enrichment, toxic substances and pesticides, and living aquatic resources. The regional team continues to aggressively target consensus projects consistent with these themes for rapid implementation.

The other regions are actively seeking opportunities to leverage their resources and are strengthening their partnerships with non-federal agencies to address specific problems. For example, the Northwest team is emphasizing watershed restoration efforts that benefit anadromous fish; migratory birds; threatened, endangered, or candidate species; or marine mammals. The Great Lakes strategy focuses the partners efforts on habitat protection/restoration and nonpoint source pollution problems. The recently established Mid-Atlantic Team and Pacific Islands Team are getting organized and beginning to identify their priority issues.

Local -- Project Implementation

Project implementation occurs at the local level. Within each region site-specific coastal problems are identified and a working list of priority projects which include federal, state, local, private, and public participants is maintained. True interagency collaboration by the partners has encouraged the pooling of resources and fostered numerous administrative efficiencies that allow the expeditious implementation of projects. The teams have often been able to identify an agency which can provide federal resources most efficiently where they are needed. In addition, the permit process is expedited because the active participation by all affected federal and nonfederal stake-holders in project design encourages the early resolution of potential issues.

Although the partnership is still in its "infancy" it has already proven to be a very cost-effective way of assuring action at the local level. In its first year, 1992, it generated 24 partnership projects in 15 states valued at over $12 million, with more than half of the funds contributed by non-federal partners. In 1993, the partnership initiated an additional 40 projects in 17 states, valued at over $15 million. More than 20 federal agencies and 150 non-federal organizations participated in project efforts which will result in the restoration of thousands of acres of wetlands, the re-establishment of hundreds of miles of spawning stream, and the protection of critical habitat for endangered coastal birds, anadromous fish and marine mammals. Project examples from the southeast, Gulf, and northwest are highlighted in the text that follows.

The southeast region's Mitigation of Obstructions to Anadromous Fish Migrations project will restore access to historic anadromous fish spawning habitat in the Albemarle-Pamlico Sound watershed through the removal of dams and the construction of fish passages. Led by EPA, this effort includes FWS (for major assistance in dam retrofitting and identification of historic and current fish distributions, site selection, and cost estimates for mitigation); COE (for technical analysis and permit review support); NOAA (for assistance in the identification of historic and current fish distributions and monitoring of sites for anadromous fish presence); and U.S. Marine Corps (for demolition services). Nonfederal participants include the State of North Carolina's Transportation Department and Environment, Health and Natural Resources Department, the North Carolina Wildlife Resources Commission, the Virginia Division of Game and Inland Fisheries, and the Virginia Council on the Environment. The unique combination of partners and their respective "in-kind" contributions has enabled an extensive effort with minimal cost.

In Cockroach Bay, off Tampa Bay in Florida, a Coastal America project is underway to restore habitat in a 651-acre site. EPA is working with NOAA (for the review of the biological monitoring program); USGS (for advice and potential modeling of tidal channels); FWS (for technical expertise); COE (for permitting, construction review and technical assistance) and the Surface Water Improvement and Management (SWIM) program of the Southwest Florida Water Management District. Although coordinated by SWIM, the project is being designed and implemented under the auspices of a 16-member advisory committee the Cockroach Bay Restoration Alliance (COBRA). COBRA members include representatives from private firms and federal, state, and local governments. The extensive involvement and contribution from numerous non-governmental groups and volunteers, more than 85% of the project cost, make this project a good example of the true value of a broad partnership.

The Duwamish River project in the state of Washington will increase intertidal habitat quality and quantity for juvenile salmonids and other estuarine-dependent fish and wildlife species in a highly urbanized estuary. Under the leadership of FWS, federal participants include NOAA/National Marine Fisheries Service (for contaminant sampling and evaluation, and review and analysis of monitoring data); EPA (for overall federal coordination, baseline sediment sampling, and development and facilitation of monitoring and sampling plans for project

evaluation); COE (for technical assistance in engineering, design, and construction, baseline sediment sampling and analysis, and administration of permit requirements) and GSA, (for facilities management and facilitation of the "Federal Center South" Project Site). The Port of Seattle is also playing a major role, as the lead nonfederal sponsor. This project effectively illustrates the fact that economic development and environmental restoration can go hand-in-hand.

Summary

Coastal America provides a nationally coordinated multi-agency partnership with a regional collaborative approach and a local action-oriented project focus. It represents a new approach to addressing complex environmental problems in a time of limited resources - a new way of doing business that goes beyond conventional roles and demonstrates innovative aggressive action at all levels. The value of the process is that it provides:

1) A mechanism for leveraging resources, expertise and authorities.

2) A collaborative problem-solving focus that expedites efforts.

3) An action oriented approach which achieves results.

4) A consensus building process that avoids conflicts.

5) A partnership philosophy that encourages cost-efficient, innovative solutions.

In summary, this innovative partnership better serves the public and the environment.

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COORDINATION AMONG STATE AND FEDERAL AGENCIES TO SUPPORT ECOSYSTEM MANAGEMENT: THE EXPERIENCE OF THE U.S. FISH AND WILDLIFE SERVICE AND THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Effective, comprehensive protection and management of coastal and ocean resources of the United States requires the cooperation of federal, state and local agencies because of the division of responsibilities and authorities resulting from the federal nature of government in the United States. One effort to improve cooperation in this respect is the recent development of a Memorandum of Understanding (MOU) between the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration's (NOAA), National Ocean Service (NOS), Office of Ocean and Coastal Resource Management (OCRM). FWS programs have direct federal management responsibilities. OCRM has some direct federal regulatory authority through its National Marine Sanctuary Program. However, significant portions of OCRM's coastal and ocean management mandate are addressed through federally approved state Coastal Zone Management Programs and state National Estuarine Research Reserves, authorized by the Coastal Zone Management Act. The FWS-NOAA (NOS/OCRM) MOU provides a framework for common action between these two organizations at the national, state, regional and site/area-specific levels.

Work on the MOU began as a result of contacts between FWS and NOAA through Coastal America, a federal inter-agency partnership to protect, preserve and restore the nation's coastal ecosystems through existing federal capabilities and authorities. The early concept, proposed by FWS' Bay/Estuary Program, was a linkage between that program and OCRM's programs. The intent was to develop a framework for coordination at the national level, that would also support field level activities in resource planning, stewardship, education and outreach, interpretation, research and monitoring. While there was some knowledge of both formal and informal coordination between the agencies' programs at the state and site-specific level. The parties believed cooperation in the field could be strengthened with national support and encouragement.

As work progressed, consideration was given to expansion of the MOU to other parties within the agencies and to other federal agencies, however. Discussions with additional parties continued to complicate the MOU and increased the difficulty in reaching general agreement across parties for action. Finally, the initiators, FWS and NOAA/NOS/OCRM agreed to complete and sign a more focused agreement first. This would enable these two parties to begin planning and undertaking cooperative projects while further pursuing an expanded agreement with other parties over time.

The final MOU provides three levels of coordination: nationally-based activities; comprehensive coastal zone management; and special areas coordination. Categories of cooperation within these levels focuses on some or all of the following

functional areas: mechanisms for communication, education and outreach, comprehensive planning, site identification, management, research and monitoring.

Nationally-Based Activities

This section identifies the national point of contact for each federal agency and calls for at least bi-annual meetings to develop work plans, specific plans for education and research, and to review process on joint actions. Education and outreach staff will conduct at least one joint conference on a resource management issue, prepare briefing materials, and produce at least one publication. Research staff will meet for joint planning and action identification purposes.

Comprehensive Coastal Zone Management

Activities within specific states, including the establishment of formal state-service agreements, under this section are identified as the responsibility of the state CZM agency and the Service regional or state office. The national role under this section is to facilitate such agreements and serve as the focal point for coordination, planning, monitoring and annual reporting of cooperative activities nationally between the Service and the states.

During the first year the Service and OCRM, in consultation with its state partners, agree to identify and initiate at least one prototype project with national application. To facilitate preparation of state-CZM/FWS MOUs, OCRM and FWS will draft a model MOU that can be used as a starting point.

Special Areas Coordination

Activities in this area will take place at the national program, state, regional and area/site-specific level. Establishment of FWS agreements with National Estuarine Research Reserves are the responsibility of a state's reserve agency and the Service's regional or state office.

At the national program level the parties have agreed to cooperation in the identification of potential sites for designation as protected areas as well as the drafting of a model state-estuarine reserve/FWS MOU to facilitate the establishment of FWS/reserve agreements. A comparable National Marine Sanctuary/FWS MOU also will be drafted.

The expectation is that ongoing site-level cooperative work will continue. The national parties will recognize and support these actions and work with their respective field activities to identify and pursue additional actions for resource improvement, education, and research. Specific research cooperation will include development, implementation and evaluation of sampling and monitoring methodologies, continuation of site characterization work, and collaboration on establishment of complementary long-term monitoring programs.

While much of this work is still a promise at the national level since the agreement has just been signed, there is a significant base of ongoing cooperation at the state and site-specific level to build upon. OCRM recently completed a survey of its 22 designated National Estuarine Research Reserves and found that more than half of them (14) are already working with some element of the FWS. These are summarized in the table below. The findings of this survey will be used to help define and target areas of agreement and action under the new MOU.

National Estuarine Research Reserves Reporting Cooperative Activities with the FWS

FWS UNIT	TYPE OF ACTIVITY					
	# of Reserves	Stewardship	Research	Monitoring	Education	Interpretation
General	14	13	7	6	6	4
Refuge	10	8	4	2	6	5

While no comparable survey exists at present of cooperation between the FWS and state-CZM programs and national marine sanctuaries, there is anecdotal evidence. For example, the FWS and Florida are directly involved with OCRM in developing a management plan, regulations, and environmental impact statement for the Florida Keys National Marine Sanctuary (NMS); similar cooperative efforts have been involved in the development of the Olympic Coast NMS in Washington. On-going cooperation between the FWS' Farallone Islands Refuge and the Gulf of the Farallones NMS off California has been long standing.

Both parties are enthusiastic about signing this agreement. This, coupled with the good will demonstrated during its development and the long-term record of cooperation on the ground bodes well for expanded cooperation to improve the health of the nation's coastal, estuarine and oceanic ecosystems.

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BALANCING PRIVATE AND PUBLIC PROPERTY RIGHTS: CREATING INCENTIVES FOR EFFECTIVE COASTAL EROSION MANAGEMENT

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Marine shoreline erosion is a concern of both costal property owners and the user and mangers of costal public resources. Costal property owners are naturally concerned with protecting their investments in land and buildings. Unfortunately, houses and other buildings are often built dangerously close to the shoreline. Most property owners react to incidents of erosion by erecting erosion control structures such as concrete bulkheads. If properly constructed, these shoreline armoring structures can slow or halt most forms of localized wave-induced shoreline erosion for a period of time, but may have adverse impacts on unprotected properties.

Resource managers are, or course, concerned about any adverse effects on the habitats that support biological resource such as fish and shellfish. In addition, the scientific literature appears to indicate that shoreline armoring (and the associated vegetative clearing) typically results in the starvation of beaches, reflection of wave energy leading to exacerbated beach erosion, scouring of beaches, and elimination of vegetation.

Exploring policy solutions to the balancing of private and public property rights in costal erosion management is the objective of this paper. This paper (1) addresses the use of economic and market strategies (as opposed to command and control practices) to reduce inappropriate residential shoreline development and encourage relocation or removal of threatened structure; and (2) describes possible education and outreach programs as effective means of implementing policy options.

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A NATIONAL MONITORING PROGRAM FOR THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

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The National Estuarine Research Reserve System (NERRS) is a state-federal cooperative program established by the federal Coastal Zone Management Act of 1972. Federal matching grants from the NOAA/National Ocean Service's Office of Coastal Resource Management, Sanctuaries and Reserves Division are available to states for development and management of estuarine research reserves which are representative of various biogeographic regions and estuarine types in the United States. The goal of the program is to protect areas of representative estuaries, including valuable wetland habitat, for use as natural field laboratories and outdoor classrooms. The 22 existing Reserves fulfill the following goals:

1) To provide opportunities for long-term research and monitoring.

2) To provide opportunities for estuarine education and interpretation.

3) To provide a basis for more informed coastal management decisions.

4) To promote public awareness, understanding, and appreciation of estuarine ecosystems and their relationships to the environment as a whole.

In 1992, a recommendation from research coordinators attending the National Estuarine Research Reserve Association meeting was that a national coordinated monitoring program needed to be established for the reserves. Estuaries and coastal embayments are dynamic ecosystems that are subject to large-scale changes from both natural and anthropogenic sources. Critical baseline and integrated monitoring data are often not available to coastal zone managers in a format that allows them to readily evaluate large- and small- scale changes in environmental variables. Existing nationwide monitoring programs currently focus on short-term measurements taken annually or bi-annually over periods of three to four days to provide reference data for estuarine systems. A nationally coordinated system of monitoring and data management is needed in order to track variability in selected variables over a range of spatial (local, regional, national) and temporal scales (minutes, hours, days, months, years). In the past, each reserve developed a site-specific monitoring program revolving around issues pertinent to a particular reserve. Although this element will remain an integral part of the Reserve system, the development of a comprehensive monitoring program at the national level will be of benefit in addressing management and research issues on broad geographic scales.

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[1]Representing input from the other research coordinators in the National Estuarine Research Reserve System

In February 1994, research coordinators from the reserves, representatives from OCRM/SRD and various state (Delaware, New York, South Carolina) and federal monitoring programs (EPA-EMAP, NOAA National Status and Trends, National Biological Survey) met to develop a monitoring goal and strategy for the NERRS. It was agreed that the program goal would be:

> To identify and track short-term variability and long-term changes in the integrity (including biodiversity) of representative estuarine ecosystems and coastal watersheds, for the purpose of contributing to effective national, regional and site-specific coastal zone management.

This goal would be accomplished through phased monitoring of three major categories:

1) Abiotic (physical-chemical) factors.

2) Biological communities.

3) Land/water use.

Phase I of the program involves water quality and atmospheric data collection, as well as initiation of data management protocols and a centralized data center for the NERRS. As funding becomes available, additional phases of the program will be initiated.

During the first phase, technical requirements will focus on the need for long-term, fine-scale data on estuarine hypoxia and nutrient enrichment. Deteriorating water quality has been linked with adjacent land-use patterns. Water quality conditions can deteriorate rapidly over time in response to poor management practices, and non-point source impacts are often pulsed through estuarine systems by short-term episodic storm events. Dissolved oxygen levels and measurements of aqueous ammonia are sensitive indicators of estuarine water quality that can provide reliable assessments of the efficacy of management efforts to control non-point discharges and improve downstream habitat conditions. Long-term, continuous measurements of water quality are clearly required to more accurately track baseline conditions and to monitor improvements in water quality following implementation of best management practices.

The phase I monitoring program is designed to compare water quality conditions at a reference site and a site impacted by NPS pollution within each Reserve. Representatives of the NERRS and CZM programs will work together to select at least two locations to establish appropriate stations for automated water quality monitoring. Should additional monies become available, priority will be given to sample a third site within each Reserve where remedial steps have been taken to correct a recognized non-point source pollution problem.

This cooperative program builds on the strengths and responsibilities of two program elements administered by the NOAA/NOS Office of Coastal Resource

Management. The NERRS will coordinate with the state coastal zone management program to take future measurements of water quality variables in a manner that will evaluate non-point source pollution practices. Simultaneous records of changing weather conditions will also be collected from ongoing NOAA/National Weather Service efforts nearby the existing system of reserves. The coordinated systemwide assessment program will allow resource agencies and academic researchers to address:

1) Local, short-term impacts of land use change and weather on water quality.

2) Larger-scale regional differences between watersheds and adjacent estuarine systems.

3) Nationwide responses and trends in habitat deterioration.

Workshops, targeting coastal resource managers, regulators, and planners will be conducted at each site to address local issues related to water quality, non-point source pollution and storm water management.

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EIS -- A CITIZEN EMPOWERMENT TOOL IN NEPA

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The paper discusses the principles on which the Environmental Impact Assessment (EIA) is based, and how these principles are adopted as a model for environmental management programs at the international level. It begins with a brief discussion of the National Environmental Protection Act of 1969 (NEPA) and the provisions of the NEPA that relate to Environmental Impact Analysis and Statements and the empowerment of citizens in the enforcement and execution of NEPA. In subsequent sections, the EIA as found in NEPA is discussed in greater detail with emphasis in the principles behind it. The fundamental principles of EIA include:

1) Full and open disclosure of environmental consequences prior to any action by government agencies or developers.

2) The promotion of interdisciplinary approach to project evaluation.

3) Encouraging focus on key issues relating to an agencies decision.

4) Requiring an objective consideration of all reasonable alternatives.

5) Application of measures to avoid or reduce adverse impacts on the environment.

6) Encouragement of public participation.

7) Inter-agency consolation and coordination among agencies involved in environmental decision making.

The paper also examines Environmental Impact Statements (EIS), the scope of citizen participation, and the extent of public involvement possible in environmental matters. The historical development of citizen empowerment in the United States, its present implications in local, Regional, national and international settings, and its future progress in the enforcement of NEPA have a section by themselves. The worldwide adoption of the EIA model in preparing environmental impact statements, and the application of the above seven principles in past and present environmental cases is also discussed. The bulk of the paper also investigates the range of citizen empowerment in other related environmental legislation including but not limited to the Clean Air Act, Clean Water Act and the Solid and Hazardous Waste Disposal Act. It will discuss the logic of the landmark cases that have initiated and concluded by citizens advocates of environmental concerns on land, water and air. After a comparison of experiences in citizen participation between the developed and developing countries with focus on events in Africa, the paper concludes with a look into the future trend in applying these seven principles towards a better coordinated environmental protection and environmental management efforts worldwide.

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